IBM

3174 Establishment Controller

GA23-0218-08

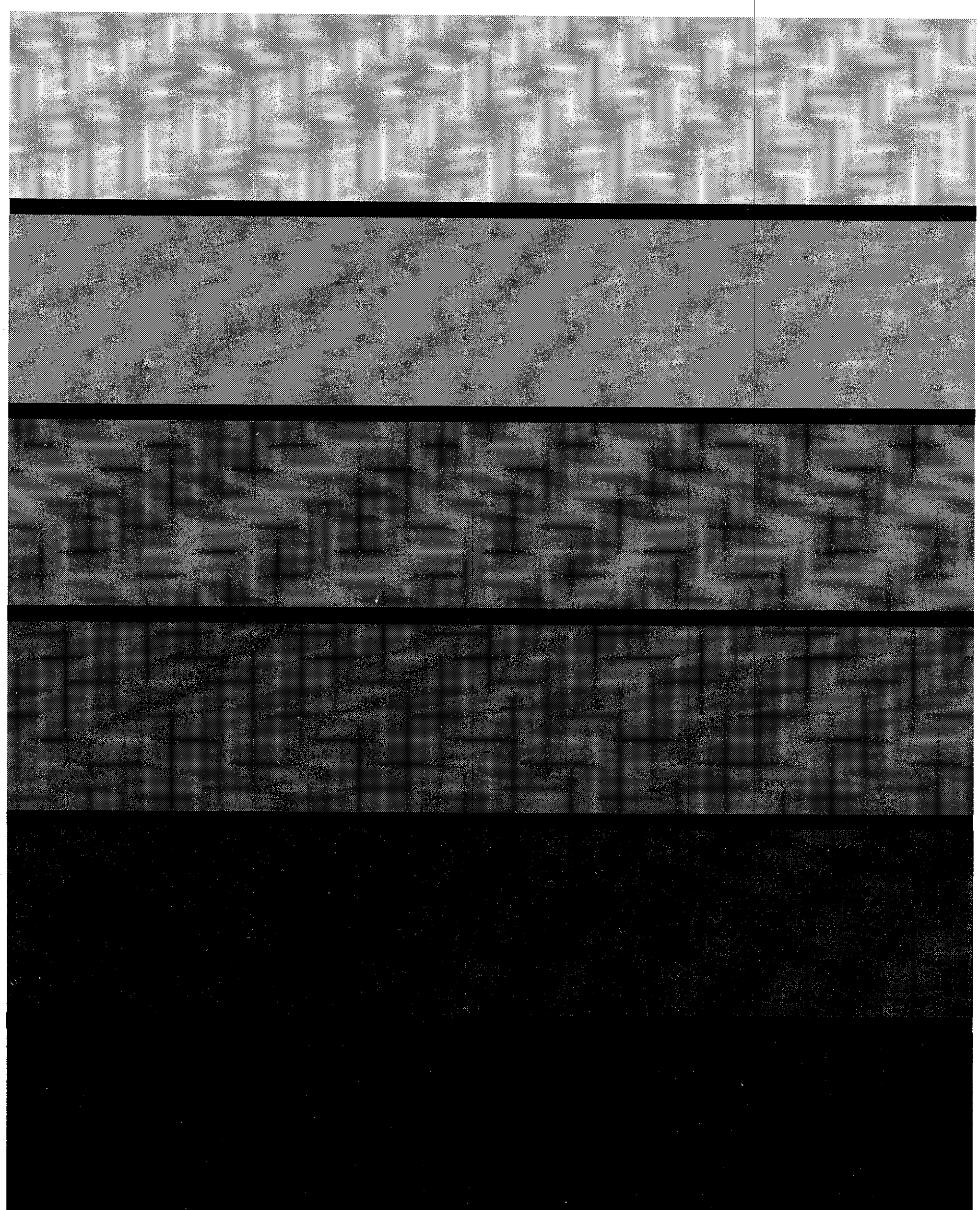
Functional Description

3270 Information Display System

3174 Establishment Controller

GA23-0218-08

Functional Description



3270 Information Display System

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Ninth Edition (June 1991)

This major revision obsoletes and replaces GA23-0218-07. See the "Summary of Changes" on page xxxiii for the changes made in this edition. Changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

Changes are made periodically to the information herein; before using this publication in connection with the operation of the IBM 3270 Information Display System, consult your IBM sales representative or the latest *IBM System/370, 30xx, and 4300 Processors Bibliography*, GC20-0001, for the editions that are applicable and current.

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Choosing the Right Book from the 3174 Library

The 3174 library contains information for installing, customizing, operating, maintaining, and programming the data stream for the 3174 controller. The list below shows the manuals you need to perform these tasks.

To Find Translations of Safety Notices:

Safety Notices, GA27-3824

To Organize Library Materials:

Binders and Inserts, SBOF-0089
Binder, SX23-0331
Inserts, SX23-0332

To Become Familiar with the 3174:

Master Index, GC30-3515
3174 Introduction, GA27-3850

To Prepare Your Site for the 3174:

Site Planning, GA23-0213
Physical Planning Template, GX27-2999

To Set Up and Operate the 3174:

Models 1L, 1R, 2R, 3R, 11L, 11R, 12L, 12R, and 13R User's Guide, GA23-0337
Models 21L, 21R, 22L, and 23R User's Guide, GA27-3874
Models 51R, 52R, 53R, 61R, 62R, and 63R User's Guide, GA23-0333
Models 81R, 82R, 90R, 91R, and 92R User's Guide, GA23-0313

To Plan for and Customize the 3174:

Configuration Support A and S

Planning Guide, GA27-3844
Utilities Guide, GA27-3853
Central Site Customizing User's Guide, GA23-0342
Asynchronous Emulation Adapter Description and Reference, GA27-3872

Configuration Support B

Planning Guide, GA27-3862
Model 90R Tokenway Planning, GD21-0036
Utilities Guide, GA27-3863
Central Site Customizing User's Guide, GA27-3868
Asynchronous Emulation Adapter Description and Reference, GA27-3872

Configuration Support C

Planning Guide, GA27-3918
Utilities Guide, GA27-3920
Central Site Customizing User's Guide, GA27-3919
Asynchronous Emulation Adapter Description and Reference, GA27-3872

To Perform Problem Determination:

Customer Problem Determination, GA23-0217
Status Codes, GA27-3832

To Install Features or Convert Models on the 3174:

Fixed Disk Installation and Removal Instructions, GA27-3864
Diskette Drive Installation and Removal Instructions, GA23-0263
Device Control Adapters Installation and Removal Instructions, GA23-0265
Model Conversion Instructions, GA23-0295
Token-Ring Network Feature Installation and Removal Instructions, GA23-0329
Storage Expansion Feature Installation and Removal Instructions, GA23-0330
Communication Adapter Installation and Removal Instructions, GA27-3830
Asynchronous Emulation Adapter Installation and Removal Instructions, GA23-0341
Concurrent Communication Adapter and Integrated Services Digital Network Adapter Installation and Removal Instructions, GA27-3851
Models 21L, 21R, 22L, and 23R Feature Installation and Removal Instructions , GA27-3875

To Use the Asynchronous Emulation Adapter Feature:

Asynchronous Emulation Adapter Description and Reference, GA27-3872
Terminal User's Reference for Expanded Functions, GA23-0332

To Use the Multiple Logical Terminals Function:

Terminal User's Reference for Expanded Functions, GA23-0332

To Obtain Data Stream Programming and Reference Information:

Functional Description, GA23-0218
Data Stream Programmer's Reference, GA23-0059
Asynchronous Emulation Adapter Description and Reference, GA27-3872
3174 Reference Summary, GX27-3872
3174 Character Set Reference, GA27-3831
3270 X.25 Operation, GA23-0204

To Perform Maintenance (Service Personnel):

Models 1L, 1R, 2R, 3R, 11L, 11R, 12L, 12R, 13R Maintenance Information, SY27-2572
Models 21L, 21R, 22L, and 23R Maintenance Information, SY27-0323
Models 51R, 52R, 53R, 61R, 62R, and 63R Maintenance Information, SY27-2573
Models 81R, 82R, 90R, 91R, and 92R Maintenance Information, SY27-2584
CE Reference Summary, SX27-3873
Status Codes, GA27-3832

Other Publications

The following publications are available for the 3174. They are developed by the International Technical Support Center. The intended audience for these books are IBM System Engineers and Customer Network Planners.

IBM 3174 Establishment Controller Installation Guide, GG24-3061.

NetView Distribution Manager Release 2 and 3174 Central Site Change Management Implementation Guide, GG24-3424.

IBM 3174 CECP Migration Issues, GG24-3380.

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ES/9000 * **Users:** The 3174 Model 21H used with the ES/9000 Models 120, 130, 150, and 170 is the same as a 3174 Model 21L throughout this publication.

Preface

This book describes how the IBM 3174 Establishment Controller interprets and executes the 3270 data stream and communicates with the host and terminals. You can use this book as a reference book by locating information quickly, or as an educational tool by reading the overview and selected chapters.

The 3174 Establishment Controller can also process the American National Standard Code for Information Interchange (ASCII) data stream. Refer to the *3174 AEA Description and Reference* for information on the data stream.

Who Should Read This Book

This book is for anyone who needs data stream level information about 3174 functions for writing programs for the 3270 data stream or researching network problems.

How This Book is Organized

The first chapter describes the whole book, and the remaining chapters contain reference information.

This book is organized so you can retrieve information quickly. It contains the following seven parts:

Part 1, "The 3174 Overview," introduces you to the 3174 Establishment Controller.

Part 2, "The 3270 Data Stream," contains 3270 commands, orders, attributes, and the functions the 3174 provides for Control Unit Terminals.

Part 3, "Host Attachment," describes 3174 local and remote attachment, X.21 operation, and communication over an X.25 network.

Part 4, "SNA Protocol," describes the System Network Architecture (SNA) protocol used by the 3174 SNA units to communicate with the host.

Part 5, "Network Management Tools," contains Response Time Monitor functions, Network Asset Management functions, SNA alert functions, and Common Management Information Protocol Event Reports.

Part 6, "3174 Features," describes 3174 Token-Ring and ISDN support, the Asynchronous Emulation Adapter feature, Multi-Host support, Local Format Storage, Advanced Peer-to-Peer Networking, and 3174 Peer Communication.

Part 7, " Appendixes," describes the operations of selector light pen and magnetic-stripe reading devices, the Extended Function feature for CUT devices, 3174 support of Intelligent Printer Data Stream, Country Extended Code Page, Operator Information Area symbols and indicators, Device Self-Description Data, 3174 Generic Alerts, and the SNA Sense Codes.

If you want information on specific topics, such as the 3270 data stream, the host attachment (local and remote), SNA protocols, or network asset management, see the Table of Contents, the divider pages for each part, or the Index.

Related Publications

References have been made in this manual to the following publications:

3270 Color and Programmed Symbols, GA33-3056
3270 Entry Assist User's Guide, GA23-0119
General Information—Binary Synchronous Communications, GA27-3004
2701 Data Adapter Unit Component Description, GA22-6864
2703 Transmission Control Components Description, GA27-2703
Introduction to the IBM 3704 and 3705 Communications Controller, GA27-3051
Introduction to the IBM 3725 Communications Controller, GA33-0010
Introduction to the IBM 3745 Communications Controller, GA33-0092
Synchronous Data Link Control General Information, GA27-3093
The X.25 Interface for Attaching SNA Nodes to Packet-Switched Data Networks General Information Manual, GA27-3345
X.25 Keyboard Labels, GX23-0285
Systems Network Architecture Format and Protocol Reference Manual: Architecture Logic, SC30-3112
SNA Formats Reference Summary, GA27-3136
Network Program Products—General Information, GC27-0657
Token-Ring Network Architecture Reference, SC30-3374
NetView Installation and Administration Guide, SC30-3360
NetView Administration Reference, SC30-3361
NetView Operations Primer, SC30-3363
NetView Operations, SC30-3364
NetView Messages, SC30-3365
NetView Hardware Problem Determination Reference, SC30-3366
NetView Customization Guide, SC30-3462
NetView Operation, SC31-6019
NetView Operation Primer, SC31-6020
Learning About NetView: Network Concepts, SK2T-0292
Network Problem Determination Application:
- *User's Guide*, SC34-2112
- *Installation*, SC34-2117
- *Messages and Codes*, SC34-2115
- *Recommended Action Guide*, SC34-2113
- *How to Use This Guide*, SC34-2108

Contents

Part 1. The 3174 Overview

Part 2. The 3270 Data Stream

Part 3. Host Attachment

Part 4. SNA Protocol

Part 5. Network Management Tools

Part 6. 3174 Features

Figures

Tables

Summary of Changes

Ninth Edition (June 1991)

This manual supports Configuration Support A Release 5, Configuration Support S Release 5, Configuration Support B Release 4, and Configuration Support C Release 1.

Where applicable, information has been added for:

- Advanced Peer-to-Peer Networking (APPN)
- 3174 Peer Communication
- Integrated Services Digital Network (ISDN)
- Common Management Information Protocol (CMIP) Event Reports
- 3174 Generic Alerts.

Technical changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

Part 1. The 3174 Overview

This part contains Chapter 1, "3174 Overview," which provides an overview of the entire book and describes the IBM 3174 Establishment Controller, one of the basic components of the IBM 3270 Information Display System.

Chapter 1. 3174 Overview

Introduction

This chapter provides an overview of the entire book and describes the IBM 3174 Establishment Controller.

The 3174 is one of the basic components of the IBM 3270 Information Display System, a family of products that can be customized to meet the needs of a wide range of display applications. (In this book, the IBM 3174 Establishment Controller is referred to as the 3174. The 3174 and the devices attached to it are referred to as the 3174 subsystem.)

The controller is available in both local (channel-attached) and remote (telecommunication-attached) models. It provides a broad range of connectivity options, workstation and host attachment possibilities, network asset management capabilities, and networking solutions. (Refer to the *3174 Introduction* for possible system combinations and controller/device combinations.)

The 3174 models can operate in *local* (channel-attached) or *remote* (telecommunications-attached) configurations:

- The 3174 *L* units operate as local units using SNA protocols or the host processor channel program (non-SNA) protocols (see Chapter 5, "Local Operation").
- The 3174 *R* units operate as remote units using binary synchronous communication (BSC) protocol, synchronous data link control (SDLC) protocol, Token-Ring or X.25 protocol (see Chapter 6, "Remote Operation").

The Different Models Available

The different 3174 models have varying levels of device attachment support:

- Models 1L, 1R, 2R, and 3R support up to thirty-two 3270 devices, and up to twenty-four ASCII devices.
- Models 11L, 11R, 12L, 12R, 13R, 21L, 21R, 22L, and 23R support up to sixty-four 3270 devices, and up to twenty-four ASCII devices.
- Models 51R, 52R, 53R, 61R, 62R, and 63R support up to sixteen 3270 terminals and up to eight ASCII devices.
- Models 81R, 82R, 90R, 91R, and 92R support up to eight 3270 terminals.

Note: Model 52R does not support Configuration Support B. Models 52R, 81R, 82R, 90R, 91R, and 92R do not support Configuration Support C.

The following list describes host attachments of the 3174:

- Models 1L, 11L, and 21L provide a System/370-architecture channel interface for SNA and non-SNA attachment to a host processor.
- Models 1R, 11R, 21R, 51R, 61R, 81R, 90R, and 91R provide EIA 232D/CCITT V.24/V.28 and CCITT V.35 interfaces for SDLC, BSC, or X.25 remote (telecommunications) attachment.
- Models 2R, 12R, 52R, 62R, 82R, and 92R provide an X.21 interface (CCITT V.11) for SDLC or X.25 remote (telecommunications) attachment.

- Models 3R, 13R, 23R, 53R, and 63R attach to an IBM Token-Ring Network. Devices attached to Models 3R, 13R, 23R, 53R, and 63R can communicate with up to eight SNA host processors through the network. The Token-Ring Network communicates with the host processor through a gateway. The gateway could be a 3174 Model 1L, 1R, 2R, 11L, 11R, 12L, 12R, 21L, 21R, 22L, 51R, 52R, 61R, 62R, or 90R with the 3270 Token-Ring Gateway feature. The hosts might also be attached to the Token-Ring Network by a 3720/37x5 Communication Controller with NCP Token-Ring interconnection.
- Models 12L and 22L have an Enterprise Systems Connection (ESCON*) Adapter that allows for SNA and non-SNA attachment to the IBM Enterprise Systems Connection Architecture optical I/O interface with fiber optic cables.

The Different Types of Terminals

This section describes some of the 3270-type terminals and ASCII devices that can be attached to the 3174. The 3270-type terminals fall into two categories: Control Unit Terminals and Distributed Function Terminals.

Control Unit Terminals (CUTs)

CUTs are display stations or printers that require the 3174 to interpret the data stream and execute functions on their behalf. Following are examples of CUTs:

- 3178 Display Station
- 3179 Display Station
- 3180 Display Station
- 3191 Display Station
- 3192 Display Station
- 3471 Display Station
- 3472F Display Station
- 4224 Printer.

For a list of the CUTs available, refer to the *3174 Introduction* or ask your IBM marketing representative.

Distributed Function Terminals (DFTs)

DFTs (including DFT-E, an extension of DFT) are terminals that do not require the 3174 to interpret the data stream and execute requested functions on their behalf. The 3174 provides communication services to DFTs; it receives transmissions from and sends transmissions to the host. DFTs can interpret the data stream because of a control program that is sent to the DFTs from the 3174 in a downstream load (DSL) or that is present in the DFT itself. Following are examples of DFTs:

- 3179G Graphics Display Station
- 3192G Graphics Display Station
- 3193 Display Station
- 3290 Information Panel Display Station
- 3472G Graphics Display Station (DFT-E)
- Personal System/2* (all models).

For a list of the DFTs available, refer to the *3174 Introduction* or ask your IBM marketing representative.

ASCII Devices

ASCII devices are display stations or printers that are attached to the 3174 through the Asynchronous Emulation Adapter (AEA). Following are examples of ASCII devices:

- 3101 Display Station
- 3151 Display Station
- 3161 Display Station
- 3162 Display Station
- 3163 Display Station
- 3164 Display Station
- PC/FTTERM Display Station*
- 4201 Proprinter*
- 4201 Proprinter II*
- 4202 Proprinter XL*
- 4207 Proprinter X24*
- 4208 Proprinter XL24.*

For a complete list of ASCII devices and 3270 devices that can emulate ASCII devices, see the *3174 AEA Description and Reference*.

Additional Communication Capabilities

The following features/functions allow the 3174 to communicate with the host or other terminals:

- 3174 Gateway (Token-Ring/ISDN)
- Asynchronous Emulation Adapter (AEA)
- Concurrent Communication Adapter (CCA)
- Single link multi-host support (SLMHS)
- Advanced Peer-to-Peer Networking
- 3174 Peer Communication.

IBM Token-Ring Network 3270 Gateway

Models 1L, 1R, 2R, 11L, 11R, 12L, 12R, 21L, 21R, 22L, 51R, 52R, 61R, 62R, and 90R with the IBM Token-Ring Network 3270 Gateway provide IBM Token-Ring Network attachment to an SNA host. The gateway feature on these models provides for data passage between a host processor and the work stations and 3174s attached to the IBM Token-Ring Network.

An example of possible connections to the IBM Token-Ring Network and the relationships involved in 3174 Token-Ring support is illustrated in Figure 14-1 on page 14-4.

The gateway feature does not interfere with the ability of ring-attached devices to communicate with each other on the ring. Also, it does not affect devices directly attached to the 3174.

With Configuration Support S, the gateway feature can support up to 140 work stations or 3174s. With Configuration Support B and C, all models (except Model 1L) that support the 3270 Gateway feature and have the 16/4 Mbps Token-Ring Adapter installed, can support up to 250 workstations or 3174s. The Token-Ring addresses of the workstations are mapped to unique host subchannel or SDLC addresses. One subchannel or SDLC address is also required for the 3174 in which the gateway feature is installed.

Integrated Services Digital Network Gateway

The Integrated Services Digital Network (ISDN) Gateway provides for data passage between an SNA host and workstations attached to an ISDN network. Each workstation is mapped to a unique host subchannel or SDLC address. One subchannel or SDLC address is also required for the 3174 customized as the gateway.

The ISDN Adapter provides the ISDN Gateway access to several different ISDN Networks. Each adapter has four Basic Rate Interface ports and up to four adapters (depending on the model) can be installed in a controller. Each port provides one D-Channel for signaling and two B-Channels for data, with each B-Channel supporting one workstation. This provides connectivity for up to 32 workstations.

The ISDN Gateway is supported on Models 1L, 1R, 2R, 11L, 11R, 12L, 12R, 21L, 21R, 22L, 61L, and 62R. It can coexist with the Token-Ring Network 3270 Gateway feature, and does not affect devices directly attached to the 3174.

See Chapter 14, 3174 Token-Ring and ISDN Support and the *3174 Planning Guide* for more information.

AEA Feature

The AEA feature provides support for ASCII devices and hosts. Each AEA provides eight ports, and up to three AEAs can be installed in Models 1L, 1R, 2R, 3R, 11L, 11R, 12L, 12R, 13R, 21L, 21R, 22L, and 23R. One AEA can be installed in Models 51R, 52R, 61R, 62R, and 63R. The AEA ports are in addition to the 3270-type ports that are available on the 3174s.

For more information on AEA, see Chapter 15, "Asynchronous Emulation Adapter (AEA)." For detailed information on AEA and ASCII devices, see the *3174 AEA Description and Reference*.

Multi-Host Support

There are two types of multi-host support: Concurrent Communication Adapter and Single Link Multi-Host Support. The CCA provides a teleprocessing host-attachment interface in addition to the primary host-attachment interface that is provided in the base controller. See Chapter 16, Multi-Host Support for more information. Each adapter allows you to access one or more additional IBM host. The host attachment can use BSC, SDLC, or X.25 protocol.

The Single Link Multi-Host Support feature allows terminals attached to a controller to access multiple 3270 hosts on a single physical link. Up to eight hosts can be configured if the link is primary; up to four hosts, if the link is secondary.

Advanced Peer-to-Peer Networking

Advanced Peer-to-Peer Networking (APPN) is an enhancement to IBM's Systems Network Architecture (SNA) and type 2.1 (T2.1) node architecture. It allows inter-connection of systems of widely differing sizes into networks of a dynamic topology. An APPN network is easier to use, is more reliable, and provides more flexibility than existing networks. APPN is supported on 3174 Models 1L, 1R, 2R, 3R, 11L, 11R, 12R, 13R, 21L, 21R, 23R, 51R, 53R, 61R, 62R, and 63R.

For more information, see Chapter 18, "Advanced Peer-to-Peer Networking (APPN)." For information on the parameters used in customizing for APPN, see the *3174 Planning Guide*.

3174 Peer Communication

3174 Peer Communication allows existing intelligent devices attached to a 3174 to form a star-wired LAN segment that may be bridged to an IBM Token-Ring through the 3174 Establishment Controller. 3174 Peer Communication extends the support on your 3174 to create a 3174-Peer segment, which is analogous to a LAN segment. 3174 Peer Communication supports reporting links with up to four LAN Network Managers. Support for 3174 Peer Communication is provided on 3174 Models 1L, 1R, 2R, 3R, 11L, 11R, 12L, 12R, 13R, 21L, 21R, 22L, 23R, 51R, 53R, 61R, and 62R.

For more information, see Chapter 19, "3174 Peer Communication." The *3174 Planning Guide* contains information on the customization parameters for 3174 Peer Communication.

Logical Unit Types Assigned to Displays and Printers

In the SNA environment, attached displays function as logical unit (LU) type 2. The data stream chain for a write-type command, for example, consists of the command code, buffer orders, and display data.

When operating in SNA, printers function as LU type 3 or, if capable of processing SNA Character String (SCS) or Intelligent Printer data streams, as LU type 1. Printers can also operate as local-copy devices. Data can be sent to printers from display stations attached to the same 3174.

Display Host Addressable Printer (HAP) allows a printer, attached to a 3270 or ASCII display's auxiliary port, to communicate with the 3174/host over the same communication link as the display. If the printer is attached to an ASCII display, the display must be communicating with an IBM/3270 host, which means the ASCII display must be operating in 3270 terminal emulation mode. The printer is recognized by the host as a distinct LU, and communication with the printer is independent of communication with the display. The display operates as an LU type 2, while the printer operates as either an LU type 1 or type 3. Host-initiated and operator-initiated local copy are not supported on display-attached printers. Screen copy (a function of the workstation independent of the controller), is supported on display-attached printers.

Addressing Terminals

SNA default addressing begins at address 02 and non-SNA default addressing begins at 00. Refer to the *3174 Planning Guide* for details about addressing terminals.

The Rate at Which Data is Transferred

The instantaneous rate at which data is transferred between the main storage of the host and an attached device depends on:

- Capability of the channel
- Transfer of either data or command codes
- Whether the device is locally or remotely attached.

In a local configuration, the 3174 provides information to the channel, and accepts information from the channel, at an instantaneous byte rate established by the channel or the controller, whichever is slower.

In a remote configuration, the rate at which data is transferred between the host and the 3174 depends on the type of transmission control unit and on the modems and communication facilities used. The 3270 system accepts data from and sends data to the transmission control unit/communication facility at the byte rate established by the transmission control unit/communication facility.

For CUT and DFT devices, all command operations that control movement of data to and from the 3270 system transfer data between the 3174 and a device buffer. When commands are not being performed, the 3174 and the device buffer interact asynchronously, and the last image displayed by a previous command is continuously regenerated.

The Codes Used to Transmit Data

Data, commands, and orders transmitted between the controller and the host are in the form of interface codes. Two different codes are used: Extended Binary-Coded Decimal Interchange Code (EBCDIC) and American National Standard Code for Information Interchange (ASCII). EBCDIC and ASCII explicitly define an information interchange code and implicitly specify unique character sets.

SNA Interface Code

With SNA, the 3174 operates with EBCDIC or an alternate (usually ASCII in the United States).

You can select an alternate code during customizing. The 3174 physical unit (PU) cannot support multiple alternate codes concurrently. The alternate code:

- Defines the available alternate interchange code
- Defines the character set for all associated LU type 2 devices
- Allows only typewriter keyboards.

It should not be used with an LU using the SNA character string.

The characteristics of LU-LU sessions are established by the SNA Bind request unit (RU). The Bind indicates which, if any, alternate code is allowed for the interchange code. The LUs must agree on an alternate code before one can be used.

The request header code select indicator (RH CSI) indicates the alternate code or EBCDIC for the function management data (FMD) RU. All host-bound FMD RUs use alternate code when permitted by the Bind, and have their RH CSIs set.

The alternate code character set is supported only for typewriter keyboards. The differences between the EBCDIC and ASCII keyboard layouts are noted below; four functions are involved, and the code points associated with each are in parentheses:

	Keytop Symbol	
Function Shift	**EBCDIC**	**ASCII**
Up	Bar (X'4F')	Exclamation point (X'21')
Up	Not sign (X'5F')	Circumflex (X'5E')
Up	Exclamation point (X'5A')	Right bracket (X'5D')
Down	Cent sign (X'4A')	Left bracket (X'5B')

Code structures pertain only to the data portion of information in a SNA data stream. All but the SNA LU-LU FMD RU is considered bit-significant control information and is not subject to graphic representation.

BSC Interface Code

The binary synchronous communication (BSC) interface code can be either EBCDIC or ASCII. For system compatibility, all units on a particular communication line must use the same code.

Understanding the 3270 Data Stream

The 3270 data stream consists of information transmitted between the controller and an IBM host system.

When an IBM host is transmitting information to the 3174 (outbound), the 3270 data stream can consist of commands, structured fields, orders, application data, and control command parameters. When the 3174 is transmitting information to an IBM host (inbound), the 3270 data stream can consist of attention identification (AID) bytes, orders, application data, sense information, and control information.

This section provides information about the 3174 commands, structured fields, orders, and attributes available with the 3270 data stream.

Commands

The 3270 data stream uses two types of commands: *data transfer* commands and *control* commands. Data transfer commands are issued to initiate such operations as the total or partial writing, reading, and erasing of data in a selected device character buffer. Control commands initiate controller and/or device operations not involved with data transfer (except for status information).

The command type code defines the operation to be performed. The operations that can be specified through a command include:

- Write to the character buffer
- Erase and then write to the character buffer
- Erase and then write to the alternate size character buffer
- Write structured field
- Read the entire character buffer
- Read only the modified data from the character buffer (some exceptions)
- Read all the modified data from the character buffer (no exceptions)
- Erase all the unprotected data from the character buffer
- Copy the contents of character buffer A to character buffer B (3174 remote attachments, BSC only)
- Select a device and initiate device-character-buffer to control-unit-buffer transfer of all data, modified data only, or data from position in preparation for a read buffer, read modified, or write operation (3174 local attachments, non-SNA only)

- Perform no functional operation; retrieve pending status (3174 local attachments)
- Sense further definition of the unit-check condition (3174 local attachments)
- Sense the controller identification (3174 local attachments).

Structured Fields

Structured field functions (data transfer or control) are used for such operations as loading a programmed symbol set and querying a device as to its characteristics, for example, character buffer capacity. Orders can be included in write data streams either alone or intermixed with display and print data.

Structured fields are discussed along with their formats in Chapter 3, "3270 Structured Fields."

Orders

Buffer control orders are interpreted and executed as they are received by the 3174. They are used to position, define, modify, and assign attributes on a field and character basis and to format data being written to a display character buffer. They can also erase selected unprotected data in the buffer and reposition the cursor. The outbound data stream can contain orders directing the formatting of a display device buffer or of a printer operation. The following sections describe the orders that can be included in the 3270 data stream.

The following attribute types can be specified in the orders included in the 3270 data stream:

Field Assigned to fields only

Color Assigned to fields and characters

Extended highlighting Assigned to fields and characters

Character set Assigned to fields and characters.

Values accompany the attribute type designation, for example, *red* for the color attribute or *protected*, *numeric* for the field attribute.

See "Attributes" on page 2-29, for more details on attributes.

Part 2. The 3270 Data Stream

This part contains the following chapters:

Chapter 2. 3270 Commands, Orders, and Attributes

Introduction

The 3270 data stream contains addresses, commands, orders, attributes, and structured fields. This chapter describes addressing and the commands, orders, and attributes listed below. The various structured fields are described in Chapter 3, "3270 Structured Fields."

Write commands[1]

- Write
- Erase/Write
- Erase/Write Alternate
- Erase All Unprotected
- Write Commands on LU Type 3 Printers
- Write Structured Field.

Read commands

- Read Buffer
- Read Modified
- Read Modified All.

Orders

- Start Field
- Set Buffer Address
- Insert Cursor
- Program Tab
- Repeat to Address
- Erase Unprotected to Address
- Start Field Extended
- Modify Field
- Set Attribute
- Graphic Escape.

Attributes

- **Field Attribute Character**
  - Protected/Unprotected Fields
  - Alphanumeric/Numeric Fields
  - Nondisplay/Display/Intensified Fields
  - Detectable/Nondetectable Fields.
- **Automatic Skip**
- **Base Color Mode**
- **Extended Field Attributes**
  - 3270 Field Attributes
  - Extended Highlighting
  - Foreground Color
  - Background Color
  - Character Set
  - Transparency.

[1] The Copy command is discussed in Chapter 6, "Remote Operation."

- **Character Attributes**
  - Character Set
  - Foreground Color
  - Background Color
  - Extended Highlighting
  - Transparency.

Addressing

Outbound data streams normally use 12-bit or 14-bit buffer addressing. When a terminal, such as the 3180 or 3290, is put in explicit partition state by a Create Partition structured field, 16-bit addressing is allowed, outbound and inbound.

Inbound data streams use 12-bit buffer addressing except when 16-bit addressing has been specified in a Create Partition structured field.

For 12- and 14-bit buffer addresses, bits 0 and 1 of the first address byte following an SBA, RA, or EUA order are called *flag bits*. The flag bits can have the following values:

00 14-bit binary address follows. The next 14 bits (the remainder of the current byte [6 bits] and 8 bits of the next byte) contain a buffer address in binary form. Address translation is not necessary.

01 12-bit coded address follows.

10 Reserved. Receipt of a buffer address beginning with the flag bits 10 causes a negative response (X'1001') or an Op Chk.

11 12-bit coded address follows.

Write Commands

The commands, Write, Erase/Write, Erase/Write Alternate, and Erase All Unprotected are used to load, format, and selectively erase device buffer data. These commands can also initiate certain device operations, such as starting the printer, resetting the keyboard, and sounding the audible alarm.

- Write can be used to modify existing buffer data.
- Erase/Write is used to load the buffer with completely new data.
- Erase/Write Alternate is identical with the Erase/Write command except it is also used to switch the display or printer into an alternate screen or print-capacity mode.
- Erase All Unprotected sets all unprotected buffer character locations to nulls.

Table 2-1 on page 2-4 shows the command codes, including the Write Structured Field (WSF) command.

Table 2-1. Write and Erase Command Codes				
Command	**Local Attachment EBCDIC (Hex)**	**Remote Attachment EBCDIC (Hex)**	**ASCII (Hex)**	**Graphic**
Write	01	F1	31	1
Erase/Write	05	F5	35	5
Erase/Write Alternate	0D	7E	3D	=
Erase All Unprotected	0F	6F	3F	?
Write Structured Field	11	F3	NA	3

Write Command

The bytes received by the 3174 for a Write command operation consist of a command code, a write control character (WCC), and orders or data. Remote 3174s also receive appropriate data link control framing. The sequence of bytes is shown in Table 2-2.

Table 2-2. Write Command Byte Sequence	
Byte	**Content**
XXX	Data link framing characters (remote only)
Any write command	
WCC	See Table 2-3 on page 2-5.
Orders and/or data	

The minimum data stream following a Write command must be at least a one-byte WCC. The byte count field of the write channel control word (CCW) must be at least 1 when attached to the 3174 L (non-SNA) controllers, or the command code is not sent. The minimum Write command data stream to a remote 3174 consists of framing characters (for example, in BSC, Start of Text [STX], Escape [ESC], and End of Text [ETX]) and the command code. To be meaningful, a WCC byte should follow the command code. If the BSC data link control character ETX follows the command code, an all-zero default WCC byte is generated by the controller, and command execution is ended normally. An order or display/print data byte that immediately follows the command code is interpreted as a WCC by the controller.

Table 2-3 on page 2-5 describes the WCC byte format and the function of each WCC bit. When the WCC specifies an operation that does not apply to the selected device, the specified operation is ignored. For example, if the sound-alarm bit is set and the selected device does not have the audible-alarm feature, the sound-alarm bit is ignored. When the WCC byte is followed by an order or display/print data bytes, only the reset Modified Data Tag (MDT) bits function, if specified, is performed before the write operation. Any other WCC function is deferred until all data is written and all orders are performed.

Table 2-3. Write Control Character (WCC)		
Bit	**Content**	**Explanation**
0	Determined by the configuration of bits 2–7	If the reset function is not supported, the only function of bits 0 and 1 is to make the WCC byte an EBCDIC/ASCII-translatable character. If the reset function is supported, bit 1 controls reset/no reset and bit 0 has no function. When bit 1 is used for the reset function, the WCC is no longer always EBCDIC/ASCII-translatable; therefore, the reset function cannot always be supported in an ASCII environment.
1	Reset bit	WCC reset bit. When set to 1, resets the functions denoted in Table 2-4 on page 2-7.
2,3		Printout formats:
	B'00'	The New Line (NL), End of Message (EM), and Carriage Return (CR) characters in the data stream determine print line length. Provides a maximum 132-print-position line when the orders are not present.
	B'01'	Specifies 40-character print line.
	B'10'	Specifies 64-character print line.
	B'11'	Specifies 80-character print line.
4	Start Print	Start print bit. When set to 1, at completion of the write operation, initiates an operation as follows: • Starts PRINT if device is a printer. • Starts LOCAL COPY if an SNA display. • Is a no-op if a non-SNA display.
5	Sound Alarm	The sound-alarm bit. When set to 1, sounds the audible alarm at the selected device when the operation ends if that device has an audible alarm.
6	Keyboard Restore	The keyboard-restore bit. When set to 1, restores operation of the keyboard by resetting the System Lock symbol. It also resets the AID byte at the termination of the I/O command.
7	Reset MDT Bits	Reset MDT bits. When set to 1, all MDT bits in the selected devices' existing buffer data are reset before any data is written or orders are executed.

Orders and buffer data can follow the WCC. (Orders are described later in this chapter.) Buffer data can be written into any specified location of the buffer without erasing or modifying data in the other buffer locations. Data characters are stored in successive buffer locations until an order is encountered in the data stream that alters the buffer address or until all the data has been entered. During the write operation, the buffer address is advanced one location as each character or field attribute is stored.

The buffer location where data entry starts depends on the following conditions:

- The starting location can be specified by an SBA order that follows the WCC. (This order is described later in this chapter under "Orders.")
- The starting location is the buffer address containing the cursor if the Write command is unchained or if it is chained from a CHAINED COMMAND SEQUENCE that does not modify the current buffer address.
- The starting location is the current buffer address if the Write command is chained from a CHAINED COMMAND SEQUENCE that does modify the current buffer address.

The formatting and placement of write data and the modification of existing buffer data are described under "Orders."

Programming Notes:

1. If the commands are being chained, the Write, Erase/Write, or Erase/Write Alternate command with the WCC start-print bit set must be the last command in the chain. If it is not, the controller does the following:

Local controller	Terminates the Write or Erase/Write command that specifies Start Print.
Remote controller	Performs the print operation and terminates the next command.

2. The printout-format bits are honored only if the start-print bit is set in the same WCC and directed to a printer. This is ignored if directed to a display.
3. If a Write command that includes data is chained from a previous Write command during remote operations, an SBA order should immediately follow the WCC to define the starting location for data entry. The SBA order permits recovery if an error condition requires retransmitting of that data.

Table 2-4 shows how the WCC reset bit resets functions.

Table 2-4. Reset Matrix

Keyboard Action or Data Stream State	Partitions	Reply Mode	Selection	Indicator	INOP	Symbol Set ID and Content Bit	Base Color Override
Clear function (SSCP)	R	R	R	1	R	NC	R
Clear function (unowned)	R	R	R	1	R	NC	R
Clear function (LU-LU)	R	R	R	1	R	NC	R
System request function SSCP (unowned)	R	R	R	1	R	NC	R
System request function SSCP (LU-LU)	R	R	R	1	R	NC	R
System request function unowned (SSCP)	R	R	R	1	R	NC	R
Receipt of RU (SSCP)	R	R	R	1	R	NC	R
System request function LU-LU (SSCP)	R	R	R	1	R	NC	R
Test function Enter	R	4	R	1	R	NC	R
Test function Exit	R	R	R	1	R	NC	R
WCC Reset in EW/EWA	R	R	R	1	R	NC	R
WCC Reset in 3270 DS EW/EWA only	NC	R	R	R	NC	NC	R
Power on	R	R	R	R	R	R	R
SNA Clear (LU-LU)	NC	3	NC	NC	NC	NC	NC
SNA ACTLU (SSCP-owned)	NC	NC	NC	NC	NC	NC	NC
SNA DACTLU	NC	NC	NC	NC	NC	NC	NC
SNA ACTLU (unowned)	NC	NC	NC	NC	NC	NC	NC
Unbind	NC	NC	NC	NC	NC	NC	NC
Bind	R	R	R	R	R	NC	R
Set Reply Mode	NC	3	NC	1	NC	NC	4
SA, SFE, MF	NC	NC	NC	NC	NC	NC	5
082B (external viewpoint)	R	R	R	R	R	NC	R
CD/EB Write acknowledgment	NC	NC	NC	NC	R	NC	NC
Create Partition	6	R	R	R	R	NC	R
Erase Reset	R	R	R	R	R	NC	R

Legend:

R = Reset (to default value)
NC = No change

Notes:

1. Display exactly those attribute indicators that are honored as a result of the reply mode.
2. Allow all attribute function selections during test.
3. Inbound reply mode is changed to the mode described in the structured field.
4. If the reply mode indicates color as an acceptable operator selection, then the color-override bit is set.
5. If SA, SFE, or MF reference color, then the color-override bit is set.
6. Add partition name.

Erase/Write Command

The Erase/Write command performs two operations: erase and write. The erase operation clears the entire device buffer to nulls, positions the cursor to character location 0, resets the Current Buffer Address (CBA) to 0, and sets all character attributes to their default value (X'00').

Erase/Write then performs the write and WCC operations in the same manner as a Write command. If no WCC is sent, the Erase/Write command does not erase the buffer, and the controller responds with a negative reply.

An Erase/Write command returns a display or printer to the default implicit size or character print capacity if the alternate size was selected by means of the Erase/Write Alternate command.

Erase/Write Alternate Command

For the 3174 non-SNA L controllers and the 3174 non-SNA R controllers, a unique instruction is required from the application program to enable a display or printer to function at greater-than-1920-default-character capacity. (CUTs with a capacity of 1920, 2560, 3440, and 3564 characters can function as 1920-character terminals.) The Erase/Write Alternate command is used to switch display screen size or printer capacity to the alternate size indicated by the display model number or specified for the printer as shown in Table 2-5.

Table 2-5. Default and Alternate Character Capacities

Device	Model (if applicable)	Character Capacity: Default	Character Capacity: Alternate
3178	C1, C2, C3, C4	1920	1920
3179	1	1920	1920
3180	1	1920	1920
	2	1920	2560
	3	1920	3440
	4	1920	3564 (note 1)
3278	2	1920	1920
	3	1920	2560
	4	1920	3440
	5	1920	3564
3279	2A, 2B, S2A, S2B, 02X	1920	1920
	3A, 3B, 03X, S3G	1920	2560
Other (note 2)		1920	2400
3287, 3289		1920	1920
		1920	2560
		1920	3440
		1920	3564

Notes:

1. With explicit partitioning, the 3180 capacity can expand to approximately 8K.
2. The 3174 supports the Tektronix 4205**, which has an alternate screen size of 2400 characters.

The Erase/Write Alternate command also operates as an Erase/Write command. Once the display or printer is placed in alternate mode, operation continues in alternate mode until one of the following happens:

- The operator invokes the Clear, Sys Req (SNA only), or TEST function.
- An Erase/Write command is received.
- The SNA session is unbound.
- Power fails at the controller, display, or printer.
- A system-reset sequence occurs (in channel-attached 3270 units).

Only these conditions return the display or printer to the default value screen size or character print capacity. For the local SNA controllers or R controllers, the Erase/Write Alternate and Erase/Write commands are used to switch a display screen size or a print capacity to alternate size, or vice versa, according to Bind parameter definition.

When in emulation mode and with the display not in an LU-LU session, the operator can set the display to its maximum size by pressing the Clear function.

A display station operating as an LU type 2 requires the format shown in Table 2-6 on page 2-10 as part of the Bind operation. Row values outside the ranges shown and column values other than those listed cause the Bind to be rejected with X'0835'.

Table 2-6. LU Type 2 Screen Size Bind Format

Byte	Bit	Model	Content	Description
20				Default number of rows:
		2	X'01' – X'18'	1 – 24
		3	X'01' – X'20'	1 – 32
		4	X'01' – X'2B'	1 – 43
		5	X'01' – X'1B'	1 – 27
		Other *	X'01' – X'1E'	1 – 30
21				Default number of columns:
		2 – 5 *	X'50'	80
		5	X'84'	132
22				Alternate number of rows:
		2	X'01' – X'18'	1 – 24
		3	X'01' – X'20'	1 – 32
		4	X'01' – X'2B'	1 – 43
		5	X'01' – X'1B'	1 – 27
		Other *	X'01' – X'1E'	1 – 30
23				Alternate number of columns:
		2 – 5 *	X'50'	80
		5	X'84'	132
24				Session screen size:
	0	All	B'0'	Reserved
	1 – 7	2 – 5	B'000 0000'	Default screen size
		2 – 5	B'000 0010'	Base Model 2 default (24 × 80)
		2 – 5	B'000 0011'	Unspecified screen size
		2 – 5	B'011 1111'	Dynamic screen size (specified in bytes 20 - 23)
		2 – 5	B'111 1110'	Extended default (size specified in bytes 20 and 21)
		2 – 5	B'111 1111'	Extended alternate (size specified in bytes 22 and 23)
25		All	Reserved	

* The 3174 supports the Tektronix 4205, which has a screen size of 30 x 80.

Byte 24 determines the screen size for both the base and the extended LU type 2. 1920-character displays are supported in the base LU type 2. The Bind format must specify the extended LU type 2 for larger screen sizes. The base LU type 2 screen size is in effect during the entire session when coded in byte 24. Bytes 20 through 23 are ignored in this case. Any I/O device that has base LU type 2 Bind format can accept an Erase/Write Alternate command, but it is executed as an Erase/Write command.

When bits 1 through 7 of byte 24 are coded B'000 0000', the device assumes the default size defined for that model display. If an Erase/Write Alternate command is received while bound, it is processed as a normal Erase/Write command. No state change occurs within the display.

If bits 1 through 7 of byte 24 of the Bind are set to B'000 0011', unspecified screen size, the 3174 will set the default screen size of the display being bound to 24 rows by 80 columns (1920 characters), and the alternate screen size as indicated by the display. A Query Reply (Implicit Partition) structured field response to a query from the host will return the alternate screen size as indicated by the display.

Some examples of alternate screen sizes are:

24 by 80 for a 3278 Model 2 (or equivalent) or a 3180/3192 Model ID 6
30 by 80 for a Tektronix 4205
32 by 80 for a 3278 Model 3 (or equivalent) or a 3180/3192 Model ID 7
43 by 80 for a 3278 Model 4 (or equivalent) or a 3180/3192 Model ID 8
27 by 132 for a 3278 Model 5 or a 3180/3192 Model ID 9.

If bits 1 through 7 of byte 24 are set to B'000 0010', a display station is bound as a base LU type 2 with a 24 × 80 character screen.

Byte 24 must be coded X'7E' or X'7F' to use displays in large-screen mode (2400, 2560, 3440, and 3564 characters) during the LU-LU session.

Sequential buffer addresses map to the defined screen format in row major order.

When byte 24 is coded X'7E', the screen size of the device is defined in bytes 20 and 21 of the Bind image, and bytes 22 and 23 are ignored. The device operates with the defined screen size during the entire session. An Erase/Write Alternate command is accepted by the device but is interpreted as an Erase/Write command. No state change occurs, and the screen size remains as defined in bytes 20 and 21 of the Bind image. Valid coding of bytes 20 and 21 is shown in Table 2-7.

Table 2-7. Bytes 20 and 21 of Bind Image

		Model				
Byte		**2**	**3**	**4**	**5**	**Other ***
20	Hex Row	≤ X'18' ≤ 24	≤ X'20' ≤ 32	≤ X'2B' ≤ 43	≤ X'1B' ≤ 27	≤ X'1E' ≤ 30
21	Hex Column	X'50' 80	X'50' 80	X'50' 80	X'50' X'84' 80 132	X'50' 80

* The 3174 supports the Tektronix 4205, which has a screen size of 30 x 80.

If the Bind specifies an invalid number of columns or if the number of rows is greater than the maximum row specified (above) for each model, the Bind is rejected. Buffer wrap occurs at the end of the row specified in byte 20.

When bits 1 through 7 of byte 24 are coded B'111 1111', a dynamic switch can be made during the session between a default screen size and an alternate screen size. When byte 24 is coded in this way, bytes 20 through 23 define the default and alternate screen sizes.

Valid coding of bytes 22 and 23 is shown in Table 2-8.

Table 2-8. Bytes 22 and 23 of Bind Image

		Model					
Byte		**2**	**3**	**4**	**5**		**Other ***
22	Hex Row	≤ X'18' ≤ 24	≤ X'20' ≤ 32	≤ X'2B' ≤ 43	≤ X'1B' ≤ 27		≤ X'1E' ≤ 30
23	Hex Column	X'50' 80	X'50' 80	X'50' 80	X'50' 80	X'84' 132	X'50' 80

* The 3174 supports the Tektronix 4205, which has a screen size of 30 x 80.

The Bind is rejected if an invalid number of columns is coded in the Bind image or if the number of rows is greater than the maximum row value shown for each model (above). When in alternate-size mode, the display wraps at the end of the row specified in byte 22 of the Bind image. When in default-size mode, the screen wraps at the end of the row specified in byte 20 of the Bind image.

Once the Bind has taken place, the display is cleared and set to the default screen size and format. RUs that contain SBA, RA, or EUA orders with addresses out of the range of the default screen size are rejected with negative response 1001 (address out of range). Data wraps at the default screen boundary whether entered by the operator or from the outbound data stream, and wrapping occurs at the default screen boundary as defined for all other 3270 operations (for example, Erase All Unprotected, Read Buffer).

The Erase/Write Alternate command dynamically switches the display to the specified alternate screen size.

If bound to dynamically switch, the device assumes the characteristics of a display with the alternate screen size, upon receipt of an Erase/Write Alternate command. RUs that contain SBA, RA, or EUA orders that have addresses out of the range of the valid alternate screen size are rejected with negative response 1001 (address out of range).

Erase All Unprotected Command

This command performs the following functions at the addressed device:

- Clears all unprotected buffer character locations to nulls.
- Resets to 0 the MDT bit for each unprotected field.
- Unlocks the keyboard when either the System Lock or the Wait symbol is displayed in the Operator Information Area.
- Resets the AID byte.
- Repositions the cursor to the first character location in the first unprotected field of the buffer. If no unprotected fields exist, the cursor is positioned to buffer location 0.
- Sets all character attributes to their default value (X'00').

In local non-SNA operation, Erase All Unprotected is executed immediately. Upon acceptance of this command, the 3174 local unit becomes *busy* and sends channel end (CE) status to the channel. Upon successful completion of this command, the controller sends device end (DE) status asynchronously to the channel and becomes *not busy*.

Programming Restriction: Erase All Unprotected should not be chained to a Write, Erase/Write, Erase/Write Alternate, Copy, or another Erase All Unprotected command. If it is chained to any of these commands, the resulting operation is not defined.

Write Commands on LU Type 3 Printers

Printers can operate as LU type 3 and extended LU type 3. Commands and orders used by LU type 2 are applicable to LU type 3 and extended LU type 3 except for the read-type commands: Read Buffer, Read Modified, and Read Modified All. Read-type commands are rejected with negative response 1001.

LU type 3 operations are directed by write-type commands. As specified in the Bind, printers that function as base LU type 3 operate as 1920-character devices, and printers that function as extended LU type 3 operate with alternate buffer sizes of 1920, 2560, 3440, or 3564 characters, or the full physical buffer. The alternate size is established by an Erase/Write Alternate command, and the default size is established by an Erase/Write command. Loss of power at the printer or the 3174 or unbinding the session returns the printer to the default buffer size.

The WCC for LU type 3 and extended LU type 3 is shown in Table 2-3 on page 2-5, which defines WCC bits.

When bit 4 (start print) is set to 1, the printer buffer content is printed after completion of the data transfer. Otherwise, printing does not occur after completion of the data transfer.

Buffered printers that operate as LU type 3 use the format shown in Table 2-9 on page 2-14 as part of the bind operation.

Table 2-9. LU Type 3 Buffer Size Bind Format

Byte	Bit	Content	Description
20			Default number of rows
		X'18'	24
		X'1B'	27
		X'20'	32
		X'2B'	43
21			Default number of columns
		X'50'	80
		X'84'	132
22			Alternate number of rows
		X'18'	24
		X'1B'	27
		X'20'	32
		X'2B'	43
23			Alternate number of columns
		X'50'	80
		X'84'	132
24			Session buffer size:
	0	B'0'	Reserved
	1−7	B'000 0000'	Default size. Extended LU 3 uses all available buffer space.
		B'000 0010'	Base LU 3 (24 × 80)
		B'111 1110'	Extended LU 3 (static buffer size is specified in bytes 20 and 21)
		B'111 1111'	Extended LU 3 (alternate size is specified in bytes 22 and 23)
25		X'00'	Reserved

Note: All other values are reserved and cause the Bind to be rejected with X'0835'.

Byte 24 establishes the buffer size for both base and extended LU type 3 operations. The base LU type 3 operation supports only 1920-character buffer, using the Erase/Write command. To use larger printer buffer sizes, the Bind must specify extended LU type 3 operation.

When bits 1 through 7 of byte 24 are coded B'000 0001' or B'000 0010', the printer is bound as a base LU type 3 with a 12×40 or 24×80 character buffer, respectively. An Erase/Write Alternate command is accepted, but it is processed as an Erase/Write command. A state change does not occur.

When bits 1 through 7 of byte 24 are coded B'000 0000', the printer assumes the default buffer size defined for that printer model. An Erase/Write Alternate command is processed as a normal Erase/Write command. A state change does not occur. For extended LU type 3 operation, the entire print buffer can be used, regardless of size. Buffer wrap occurs at the end of the physical buffer.

When coded B'111 1110', byte 24 indicates extended LU type 3 operation with the buffer size coded in bytes 20 and 21. Buffer size switching is not allowed. Bytes 22 and 23 are ignored. When an Erase/Write Alternate command is encountered in the data stream, it is interpreted as a normal Erase/Write command.

When byte 24 is coded B'111 1111', bytes 22 and 23 are inspected to determine the maximum alternate buffer size to be used during the session; for example, a Bind for 32 rows of 80 characters each permits the use of programs written for 960-, 1920-, and 2560-character buffer sizes. (If programs written for 132-character columns are used, byte 22 must be interpreted differently.) The operation of coding byte 24 depends upon buffer address wrap during write operations.

If the printer cannot support the required buffer size, the Bind is rejected with a negative response (0835) response parameter error. A 3287 with a basic 2K (K equals 1024) buffer cannot, for example, accept an LU type 3 Bind specifying a 2560-character buffer. The 3174 supports any column count within the constraints of the above row/column product. The row/column product determines the print buffer wrap point. Print formats are managed by the WCC and not by the Bind parameter values.

Write Structured Field (WSF) Command

The WSF command must be the first byte in any outbound structured field transmission. The length field of the first structured field follows immediately. An exception is the non-SNA local unit, where the length field is the first byte.

Command chaining involving the WSF command is not allowed, except after a Select Write (WRT) command.

In processing an outbound structured field transmission, the 3174, except for the Read Partition – Query structured field, does not check for multiple transmissions of a specific structured field type.

Read Commands

The read-type commands executed by the 3174 are Read Buffer, Read Modified, and Read Modified All. These commands work as follows:

- Read Buffer causes the entire buffer contents of the addressed terminal to be read into main storage.
- The operation initiated by Read Modified is determined by display station operator actions.
- The information read during execution of Read Modified or Read Modified All could consist of:
  - Fields of data modified by keyboard operations
  - Data entered by magnetic reading devices
  - Buffer addresses
  - Data in selector light pen or Cursr Sel fields
  - The code of a program function (PF) or program access (PA) function
  - Data sent in an outbound message that turned on MDT bits.

In remote BSC configurations, reading is normally accomplished by a General or Specific Poll sequence. In local configurations, an operator action that requires program interaction causes an attention interruption; the program would respond to this attention interruption with a read command. In remote configurations, the 3174 cannot generate attention interruption. Instead, the host program should issue poll sequences periodically. Upon receipt of a poll sequence, the 3174 BSC controller initiates one of the following three operations:

- If status and sense information is pending, this information is sent to the Transmission Control Unit (TCU).
- If an operator action has occurred that requires reading by the program, and status and sense information is not pending, a controller-generated Read Modified command operation is performed.
- If no operator action has occurred and status and sense information is not pending, the controller sends End of Transmission (EOT) to the TCU, terminating the operation.

Note: Unsolicited read commands are not recommended, because the information read by these commands may be incomplete.

During a read-buffer or read-modified operation, when BSC line discipline is used, a SUB character (X'3F' in EBCDIC, X'1A' in ASCII) is sent in place of any byte that has bad parity. Also, a data check sense condition is recorded. Normal transmission of the read data then continues until the usual ending point. At that time, the operation ends as follows:

- In a local configuration, Unit Check is sent in the ending status byte.
- In a remote configuration, the transmission is terminated with Enquiry (ENQ) in place of ETX or ETB.

Table 2-10 shows the read command codes.

Table 2-10. Read Command Codes

Command	L Units EBCDIC (Hex)	R Units EBCDIC (Hex)	ASCII (Hex)	Graphic
Read Buffer	02	F2	32	2
Read Modified	06	F6	36	6
Read Modified All (SNA only)	6E	6E	3E	:

Read Buffer Command

Execution of the Read Buffer command causes all data in the addressed device buffer, from the buffer location at which reading starts through the last buffer location, to be transferred to main storage. This command is provided primarily for diagnostic purposes. The transfer of data begins as follows:

- From buffer address 0 if the Read Buffer command is unchained.
- From the current buffer address if the Read Buffer command is chained. Certain 3270 emulators only begin data transfer from the current buffer address if the Read Buffer command is chained from a Write, Erase/Write, Read Modified, or another Read Buffer command. Regardless of where the transfer of data begins, data transfer from the buffer terminates when the last character location in the buffer has been transferred, or before the last character location has been transferred as follows:
  - In local (channel-attached) configurations, when the channel byte count reaches 0 (in this case, the buffer address after termination is undefined)
  - In remote (telecommunications-attached) configurations, when the last character of a text block has been transferred (described in Chapter 6, "Remote Operation").

The transferred data stream begins with a three-character read heading consisting of the AID character followed by a two-character cursor address. The contents of all buffer locations are transferred, including nulls. SF or SFE orders are inserted by the 3174 to identify the beginning of each field. The possible AID byte configurations are shown in Table 2-11 on page 2-18. An AID configuration other than 60 or E8 is set when the operator at the selected display station has performed an operation that requires program intervention. These operations are:

- Pressing a PF or PA function
- Reading a magnetic stripe
- Detecting on an attention field with the selector light pen or Cursr Sel function.

The attribute character is shown in Table 2-16 on page 2-30.

Read Modified Command

Read Modified initiates one of the following three operations, as determined by operator actions at the display station:

- Read Modified
- Short Read
- Test or System Request Read.

Table 2-11 on page 2-18 lists the operator actions and the resulting Read Modified command operation initiated by each action. Read Modified commands normally are not used for remote configurations, because polling initiates a controller-generated read-modified operation if AID is generated and if status is not pending. A major feature of Read Modified command operations is null suppression. The device buffer is cleared to all nulls when the operator turns on power, invokes the Clear function, or when the erase portion of an Erase/Write command is executed at the selected device. Also, selected portions of a buffer can be cleared to nulls by the Erase All Unprotected command and certain orders. During Read Modified command operations, null codes are not sent.

Read Modified Operation

If an AID other than selector light pen attention, the Cursr Sel, the PA, or the Clear function is generated during a Read Modified command, all fields that have been modified by a keyboard, selector light pen, Cursr Sel function, or by reading of a magnetic stripe are transferred to the program. All nulls are suppressed during data transfer and thus are not included in the read data stream. As a field is modified by the operator, the MDT bit is set in the attribute byte for that field. Then, when a read-modified operation is performed, successive attribute bytes are examined for a set MDT bit. When the bit is found, the data in the associated field is read (with nulls suppressed) before the next attribute byte is examined.

The first three bytes of the read data stream are always the AID code (Table 2-11 on page 2-18) and the two-byte cursor address. These bytes are called the *read heading.*

Table 2-11. Attention ID (AID) Configuration

AID	Hex Character (EBCDIC)	Hex Character (ASCII)	Graphic Character	Read Modified Command Operation	Resultant Transfer to CPU
No AID generated (Display or Display Station)	60	2D	-	Rd Mod (Unsolicited Read or Read Modified from Host)	If performing a remote polling operation, no read operation occurs; otherwise, field addresses and text in the modified fields are transferred.
No AID generated (Printer)	E8	59	Y	Rd Mod	
Enter function (and Selector Pen Attention)	7D	27		Rd Mod	See note 1
PF1	F1	31	1	Rd Mod	See note 1
PF2	F2	32	2	Rd Mod	See note 1
PF3	F3	33	3	Rd Mod	See note 1
PF4	F4	34	4	Rd Mod	See note 1
PF5	F5	35	5	Rd Mod	See note 1
PF6	F6	36	6	Rd Mod	See note 1
PF7	F7	37	7	Rd Mod	See note 1
PF8	F8	38	8	Rd Mod	See note 1
PF9	F9	39	9	Rd Mod	See note 1
PF10	7A	3A	:	Rd Mod	See note 1
PF11	7B (note 2)	23	#	Rd Mod	See note 1
PF12	7C (note 2)	40	@	Rd Mod	See note 1
PF13	C1	41	A	Rd Mod	See note 1
PF14	C2	42	B	Rd Mod	See note 1
PF15	C3	43	C	Rd Mod	See note 1
PF16	C4	44	D	Rd Mod	See note 1
PF17	C5	45	E	Rd Mod	See note 1
PF18	C6	46	F	Rd Mod	See note 1
PF19	C7	47	G	Rd Mod	See note 1
PF20	C8	48	H	Rd Mod	See note 1
PF21	C9	49	I	Rd Mod	See note 1
PF22	4A	5B	¢	Rd Mod	See note 1
PF23	4B	2E	.	Rd Mod	See note 1
PF24	4C	3C	<	Rd Mod	See note 1
					See note 1
Card Reader	E6	57	W	Rd Mod	See note 1
Alphanumeric MSR/MHS	E7	58	X	Rd Mod	See note 1
Selector Pen Attention, Light pen selection, or Cursor Select function	7E	3D	=	Rd Mod	AID code, cursor address, and field addresses only; no data.
PA1	6C	25	%	Short Rd	AID code only
PA2 (CNCL)	6E	3E	>	Short Rd	AID code only
PA3	6B	2C	,	Short Rd	AID code only
Clear function	6D	5F	_	Short Rd	AID code only
Test Req and Sys Req functions	F0	30	0	Tst Req Rd	A test request message. AID transferred on Read Buffer only.

Notes:

1 AID code and cursor address, followed by an SBA order, attributes address + 1, and text for each modified field. Nulls are suppressed.

2 Graphic characters for the United States I/O interface codes are shown. If a World Trade I/O interface code is used, refer to the *3270 Character Set Reference* for possible graphic character differences.

Following the read heading is the alphanumeric data of each modified field. The data for each field is preceded in the data stream by a SBA order code followed by the two-byte buffer address of the first character position in that field (the attribute address + 1). Thus, the read data stream when data has been modified is as shown in Table 2-12.

Table 2-12. Read Data Stream

Content	Meaning
AID	Read heading
Cursor address	Read heading
SBA	First modified field (nulls suppressed)
Attribute address + 1	First modified field (nulls suppressed)
Alphanumeric data	First modified field (nulls suppressed)
SBA	Second modified field (nulls suppressed)
Attribute address + 1	Second modified field (nulls suppressed)
Alphanumeric data	Second modified field (nulls suppressed)

If fields are modified by the keyboard, but completion of the modification is signaled by a selector light pen attention operation on other than ampersand character designator fields, a resulting read-modified operation reads only the address of the modified fields, not the modified data. A Read Modified All command can be used to obtain both the address of and the data in each field that has the MDT bit set to 1.

The buffer location at which the search begins for attribute bytes that define modified fields is a function of command chaining. This location is determined as follows:

- Buffer address 0 if the Read Modified command is unchained or is chained from a Copy, Select, Sense, or No Operation command
- The current address if the Read Modified command is chained from a Write, Erase/Write, Read Modified, Read Modified All, or Read Buffer command.

The search for modified-field attribute bytes ends when the last buffer location is checked.

The transfer of read data is terminated as follows:

- If the last modified field is wrapped from the last buffer (for example, 1919) to the first location, the operation is terminated after all data in the field is transferred (nulls are suppressed). The buffer address at the end of the operation is the address of the next attribute byte in the buffer. For example, if a modified field extends from address 1900 (the attribute byte) to address 79 (wrapped field), the data from addresses 1901 through 79 is transferred (nulls are suppressed). In this case, the read operation is terminated with the buffer address set to 80 (the attribute byte of the next field).

- If the buffer does not contain a wrapped modified field, and if the channel byte count has not reached zero (local operation only), the modified data stream is terminated when the last modified field is transferred. At the end of the operation, the buffer address is set to 0.
- For non-SNA L controller operations, if the channel byte count reaches zero before all modified data is transferred, read operations are terminated and the remaining modified data is not transferred. The buffer address after termination is undefined.

If the buffer is formatted (contains fields) but none of the fields have been modified, the read data stream consists of the 3-byte read heading only.

If the buffer is unformatted (contains no fields), the read data stream consists of the 3-byte read heading followed by all alphanumeric data in the buffer (nulls are suppressed), even when part or all of the data has not been modified. Since an unformatted buffer contains no attribute bytes, no SBA codes with associated addresses or address characters are included in the data stream, and the modification of data cannot be determined. Data transfer starts at address 0, regardless of command chaining, and continues to the end of the buffer. At the end of the operation, the buffer address is set to 0. This read operation can also be terminated by the channel byte count's reaching zero before all data is read; in this case, the buffer address after termination is undefined.

Short Read

The Read Modified command causes a short-read operation if the Clear, or PA function has been pressed at the selected device. During the short-read operation, only an AID byte is transferred to main storage. This AID byte identifies the function that was invoked.

Test Request Read

This description applies only to units not using SNA protocol. The Read Modified command causes a test-request-read operation if the Sys Req function has been pressed at the selected device. The test-request-read data stream sent to main storage is shown in Table 2-13.

Table 2-13. Test Request Read Data Stream

Content	Meaning
SOH	Test Request Read heading
%	Test Request Read heading
/	Test Request Read heading
STX	Start of text
Input Data	
ETX	End of text

The Test Request Read heading is generated by the 3174. The remainder of the data stream is the same as described previously for read-modified operations, excluding the 3-byte read heading (AID and cursor address). If the buffer is unformatted, all alphanumeric data in the buffer is included in the data stream (nulls are suppressed), starting at address 0. If the buffer is formatted, each attribute byte is examined for a set MDT bit. Each time a set MDT bit is found, the alphanumeric data in the field associated with that bit is sent to main storage (nulls are suppressed); if no MDT bits are set, the read data stream consists of the Test Request Read heading only. The buffer location at which the search for MDT bits begins and the transfer of data ends is the same as described for read-modified operations.

Test Request Read function usage is determined by the access method. Normally, the operator would do the following:

1. Clear the display.
2. Enter test request data in a predefined format.
3. Press the Sys Req function.

Read Modified All Command

The Read Modified All command is used with the local and remote attachments operating in SNA protocol. This command operates like a Read Modified command except that both addresses and data from all modified fields are sent to the host, regardless of the AID byte generated. The Read Modified All command is not generated by the controller in response to a poll sequence. It must be sent by the host.

Device Characteristics: Inbound Operation (INOP)

INOP determines the operation to be performed when data is transmitted inbound. It is set by any of the following:

- Setting INPID to zero sets INOP to Read Modified (with the exception of a Read Partition structured field directed to partition zero).
- An operator enter action, including a trigger action, sets INOP to Read Modified.
- A Read Partition structured field sets INOP to Query.
- Acknowledgment of an inbound transmission sets INOP to Read Modified.

Device Characteristics: Inbound Partition Identity (INPID)

INPID determines the partition from which data is transmitted inbound. It is set by any of the following:

- Creating an implicit partition sets INPID to zero.
- An operator enter action, including a trigger action, sets INPID to the PID of the active partition.
- A Read Partition structured field sets INPID to the specified value unless INPID=X'FF' (query operation), in which case INPID is unchanged.
- Destruction of the inbound partition sets INPID to zero.
- Acknowledgment of an inbound transmission sets INPID to zero.

Processing of Read Commands

Read commands (Read Modified, Read Modified All, Read Buffer) are processed as described in the following sections.

SNA Environment

The read command is rejected if any of the following are true:

- The SLU is not in SNA receive (RCV) or contention (CONT) state.
- The chain that contains the RU does not specify Change Direction (CD).
- The chain that contains the RU specifies End Bracket (EB).

When the command is not rejected, it is processed as follows:

- If the device is in normal read state, then data is transmitted inbound as defined by:

  1. The command
  2. The AID (Read Modified command only)
  3. The reply mode (see "Set Reply Mode" on page 3-28).

  A Read, Read Buffer, or Read Modified All command from the host does not change the read state. The device is placed in retry state if the transmission is generated by an *enter* action or reception of a Read Partition Query structured field.

- If the device is in a retry state, then a *retry* is performed as follows:

  – If the command is Read Modified and INOP specifies Query, then the appropriate query replies are transmitted.

  – If the command is Read Modified and INOP specifies Read Modified, then data is retransmitted as specified by:

    1. The Read Modified command
    2. The AID
    3. The reply mode.

  – If the command is Read Modified All or Read Buffer, then data is transmitted as defined by:

    1. The command
    2. The reply mode.

  The device remains in the retry state until a host acknowledgment causes a transition to the normal read state.

BSC or Non-SNA Local Attachment Environment

If the device is in normal read state in a BSC or non-SNA local attachment environment, then data is transmitted inbound as defined by:

1. The command (Read Modified, Read Buffer)
2. The AID (Read Modified command only)
3. The reply mode.

The device remains in normal read state.

If the device is in a data-pending state in a BSC environment, then data is transmitted as defined by:

1. The command
2. The AID (Read Modified command only)
3. The reply mode.

The device is placed in normal read state.

If the device is in a data-pending state in a local attachment environment, then:

- If the command is Read Modified and INOP specifies Query, the appropriate query replies are transmitted.
- If the command is Read Modified and INOP specifies Read Modified, then data is transmitted as defined by:
  1. The Read Modified command
  2. The AID
  3. The reply mode.
- If the command is Read Buffer, then data is transmitted as defined by:
  1. The command
  2. The reply mode.

The device is placed in the corresponding retry state (Enter, Read, Stacked Enter). The enter inhibit condition remains in effect.

If the device is in a retry state in a BSC or local attachment environment, then a *retry* is performed as follows:

- If the command is Read Modified and INOP specifies Query, then the appropriate query replies are transmitted inbound.
- If the command is Read Modified and INOP specifies Read Modified, then data is transmitted as defined by:
  1. The Read Modified command
  2. The AID
  3. The reply mode.
- If the command is Read Buffer, then data is transmitted as defined by:
  1. The command
  2. The reply mode.

  The device remains in the retry state. The enter inhibit condition remains in effect.

Orders

Orders can be included in Write, Erase/Write, or Erase/Write Alternate command data streams, either alone or intermixed with display or print data. Two types of orders are available: printout format orders and buffer control orders. Printout format orders are initially stored in the buffer as data and are subsequently executed only during a print operation. See Chapter 4, "Control Unit Terminal (CUT) Functions," for more information about print operations.

The following paragraphs describe buffer control orders, which are executed as they are received in the write data stream by the 3174. These orders are not stored in the buffer. Seven buffer control orders (see Table 2-14 on page 2-24) are provided to position, define, and format data being written into the buffer, to erase selected unprotected data in the buffer, and to reposition the cursor. Three buffer control orders are provided for managing the Color, Extended Highlighting, and Character Set attributes for fields and characters.

Start Field Extended (SFE), Modify Field (MF), and Set Attribute (SA) orders are used to manage the Color, Extended Highlighting, and Character Set attributes for fields and individual characters. (Field attributes, protection, display, character type, and so on, can also be controlled by SFE and MF.) The SFE and MF orders are used to define and alter attributes as they apply to whole fields. The SA order sets the Color, Extended Highlighting, and Character Set attributes as they apply to individual characters. All three orders make use of a *type value* pair (two bytes) to define the type of attribute (field, Color, Extended Highlighting, and Character Set) and the setting. (Attribute types and values are discussed later in this chapter.) These orders can be included in Write, Erase/Write, or Erase/Write Alternate command data streams, alone or mixed with display and print data.

Table 2-14. Buffer Control Orders and Order Codes

Order	Byte 1 (Order Code) (Hex) EBCDIC	ASCII	Byte 2	Byte 3	Byte 4
Start Field (SF)	1D	1D	Attribute character[1]		
Set Buffer Address (SBA)	11	11	1st address byte[2]	2nd address byte[2]	
Insert Cursor (IC)	13	13			
Program Tab (PT)	05	09			
Repeat to Address (RA)	3C	14	1st address byte[2]	2nd address byte[2]	Character to be repeated[3]
Erase Unprotected to Address (EUA)	12	12	1st address byte[2]	2nd address byte[2]	
Start Field Extended (SFE)	29	—	Count	Type[1]	Value[1]
Modify Field (MF)	2C	—	Count	Type[1]	Value[1]
Set Attribute (SA)	28	—	Type[1]	Value[1]	
Graphic Escape (GE)	08	—	Character code		

Notes:

[1] Table 2-16 on page 2-30 shows the field attribute byte.

[2] To be a valid address:

- If the default size is used in BSC mode, the maximum buffer address size is 1919 for the following models:

  3178-C1, -C2, -C3, -C4
  3278-2, -3, -4, -5
  3279-2, -3

- If the alternate size is used in BSC mode, the maximum buffer addresses are specified by the device model number:

  Model 2: 1919
  Model 3: 2559
  Model 4: 3439
  Model 5: 3563

- If the SNA/SDLC mode is used, the maximum default size and the alternate size are the display size − 1. The display size is defined in the bind parameter.

[3] Two bytes are required if an APL character is repeated.

Start Field (SF)

The SF order notifies the 3174 that the next byte in the write data stream is a field attribute character. (The field attribute character is described in Table 2-16 on page 2-30.) The 3174 stores the next byte (the field attribute character) at the current buffer address. As the field attribute character is stored, the 3174 sets a control bit at that address; this bit identifies the byte as an attribute character during subsequent program or device operations with the buffer data.

When received by controllers and terminals supporting the extended field attributes, the SF order causes the default value (X'00') for the Color, Extended Highlighting, and Character Set attribute types to be set in the extended field attribute buffer.

Note: The byte immediately following the SF order in the data stream is always stored as an attribute character, even when the byte is intended as an order or an alphanumeric data character.

During execution of a Read Buffer command, the 3174 may automatically insert SF, SFE, SA, or GE order codes in the read data stream immediately before each attribute character, depending on the inbound reply mode. (See "Set Reply Mode" on page 3-28.) This permits identification of the attribute characters by the program and also permits correct storage of attribute characters in the buffer if the read data is used for subsequent write operations.

Set Buffer Address (SBA)

The 3-byte SBA order specifies a new buffer address from which write operations are to start or continue. SBA orders can be used to write data into various areas of the buffer. An SBA order can also precede another order in the data stream to specify the following:

- The starting address for a PT, RA, SA, or EUA order
- The address at which an attribute byte is to be stored by an SF or SFE order or modified by an MF order
- The address at which the cursor is to be repositioned by an IC order.

If the SBA order specifies an invalid address, the write operation is terminated.

When a Read Modified command is executed and an attribute character (initially sent to the device by writing an SF order) is detected with the MDT bit set, the controller inserts, in place of the attribute, an SBA code followed by the 2-byte buffer address of the first character in the modified field (attribute address +1). The SBA code permits identification by the 3174 of fields that are modified. When a Read Modified command is executed in a remote unit, this 3-byte sequence is always sent in the same text block. Remote units do not split this sequence between two successive blocks.

Insert Cursor (IC)

The IC order repositions the cursor to the location specified by the CBA. Execution of the IC order does not change the Current Buffer Address (CBA). For example, if IC is issued when the CBA is 160 and the cursor is at location 80, the cursor is moved from location 80 and inserted at location 160. The CBA at the end of this operation would remain 160.

Program Tab (PT)

The PT order advances the CBA to the address of the first buffer location following the next unprotected attribute byte. If the PT is issued when the CBA is the location of an attribute byte of an unprotected field, the buffer address advances to the first location following the field attribute character. In addition, if the PT order in the write data stream does not follow a control command, order, or order sequence such as WCC, IC, or RA (three-character sequence), nulls are inserted in the buffer from the CBA to the end of the field, regardless of the value of bit 2 (protected/unprotected) of the attribute character for the field. Note that the field attribute character cannot be replaced by nulls. Whenever a character position is set to null by the PT order, the default value (X'00') for the Color, Extended Highlighting, and Character Set attribute types is set in the character attribute buffer. When the PT order follows a control command, order, or order sequence, the buffer content is not modified for that field.

The PT order stops its search at the last location in the buffer. If an attribute character for an unprotected field is not found by this point, the buffer address is set to location 0. (If the PT order finds an attribute character for an unprotected field in the last buffer location, the buffer address is also set to zero.)

To continue the search for an unprotected field, a second PT order must be issued immediately following the first one. Because the CBA was reset to 0 by the first PT order, the second PT order begins its search at buffer location 0. If the previous PT order inserted a null in the last buffer location, the new PT order continues to insert nulls from buffer location 0 to the end of the current field. However, it will not insert nulls if the last buffer location contained a field attribute.

Repeat to Address (RA)

The RA order stores a specified alphanumeric or null character in all buffer locations, starting at the CBA and ending at (but not including) the specified stop address. This stop address and the character to be repeated are identified by the three bytes immediately following the RA order in the write data stream, as shown in Table 2-15.

Table 2-15. RA Order Data Stream

Byte	Content
0	RA order
1,2	Stop address
3	Character to be repeated
3,4	GE order followed by another character

The third character following the RA order is always interpreted as the character that will be repeated. If an invalid stop address is specified, the write operation is terminated without storing the character, and error status is generated. When Color, Extended Highlighting, or Character Set attributes are specified for the character, the attribute values are entered into the character attribute buffer as each repeated character is written in the data buffer.

When the stop address is lower than the CBA, the RA operation wraps from the bottom row of the buffer to the top row. When the stop address equals the current address, the specified character is stored in all buffer locations.

Attribute characters are overwritten by the RA order if they occur before the RA order stop address.

Erase Unprotected to Address (EUA)

The EUA order inserts nulls in all unprotected buffer character locations, starting at the current buffer address and ending at, but not including, the specified stop address. This stop address is specified by two address bytes immediately following the EUA order in the write data stream. If an invalid address is specified, the write operation is terminated, and error status is generated. Whenever a character position is set to null by the EUA order, the default value (X'00') for the Color, Extended Highlighting, and Character Set attribute types is set in the character attribute buffer.

When the stop address is lower than the CBA, the EUA operation wraps from the bottom row of the buffer to the top row. When the stop address equals the current address, all unprotected character locations in the buffer are erased. Attribute characters are not affected by the EUA order.

Start Field Extended (SFE)

The SFE order (X'29') is used to define the start of a field and to assign field, Color, Extended Highlighting, and Character Set attributes to the field.

The format of the order is *X'29'—number-of-type/value-pairs type value type value . . . type value*. The first byte after the order specifies the number of type/value pairs following. *Type* is any of the four attribute types that can be specified, and *value* is the setting for the type.

Any permissible attribute type not specifically defined in the order has its value set to binary zeros, which selects the default value for that attribute type. When specified more than once in the SFE order, the last occurrence of an attribute type and value determines the setting. If the number of type/value pairs is specified as zero, all attribute types are set to their default values. (See "Attribute Types and Values" on page 2-34 for more information.)

Attribute values that are unknown or cannot be maintained and returned inbound are rejected. For non-SNA protocol, the value is rejected with an Op Chk.

The SFE order causes a field attribute byte to be generated at the current buffer position.

Modify Field (MF)

The MF order (X'2C') is used to selectively change field, Color, Extended Highlighting, and Character Set attributes at the CBA. The CBA must be that of a field attribute byte; otherwise, the order is rejected with an Op Chk in non-SNA protocol, or with a negative response of X'1001' for SNA protocol. Only the attribute types specified in the order are changed.

The format of the order is *X'2C'—number-of-type /value pairs type value type value . . . type value*. The first byte after the order specifies the number of type/value pairs following. *Type* is one of the four attribute types that can be specified in the MF order, and *value* is the setting for the type. (See "Attribute Types and Values" on page 2-34 for more information.)

At the completion of order processing, the CBA is increased by one.

If the number of type/value pairs is specified as zero, no change is made to any of the attributes and the CBA is increased by 1. The CBA must still, however, be that of a field attribute.

When specified more than once in an MF order, the last occurrence of an attribute type and value determines the setting.

Attribute values that are unknown or cannot be maintained and returned inbound are rejected. For Color and Extended Highlighting in SNA protocol, the value is rejected with a negative response of X'1001' or, for Character Sets, X'0863'.

Set Attribute (SA)

The SA order (X'28') is used to change the Color, Extended Highlighting, or Character Set attributes applicable to the character at the CBA or to set these attribute types to their default value. Attributes set for the character at the CBA are applied to the current and subsequent characters in the data stream until another SA order is encountered or the attributes are reset by a write-type command or power-on reset. Color, Extended Highlighting, and Character Set attributes that are set at the character level override the same attributes that are set at the field level.

The format of the order is *X'28' type value* (3 bytes). *Type* is one of the four attribute types that can be specified in the SA order, and *value* is the setting for the type. (See "Attribute Types and Values" on page 2-34 for additional information.) If more than one attribute type is to be changed, more than one SA order can precede the character in the data stream.

An Erase/Write or Erase/Write Alternate command resets the data buffer to nulls and each attribute associated with the null characters to its default value.

An SA order is generated and inserted in the inbound data stream only when the attribute value of an attribute type that has been specified in the Set Reply Mode structured field changes. The assumption is made that the Color, Extended Highlighting, and Character Set attribute types are all set to their default values at the beginning of the inbound transmission. The first SA order generated will be for the first attribute not equal to its default value. (See "Set Reply Mode" on page 3-28 for additional information.)

Attribute values that are unknown or cannot be maintained and returned inbound are rejected. For Character Set, the value is rejected with a negative response of X'0863'.

Attributes

All display stations for the 3270 system may be programmed with formatted fields. The control character at the start of each field contains the field attributes. Attributes contained in this character apply to all the data contained in the field.

Display stations that support the Structured Field and Attribute Processing option, such as the 3279 Models 2B and 3B, are capable of handling extended attributes. The extended attributes increase the number of characteristics that can be defined. Extended attributes may be applied to a field and to individual characters within the field. Extended attributes may also be applied to individual characters in an unformatted display.

Extended attributes do not occupy positions in the display buffer. Conceptually, three additional buffers are provided for the extended attributes. Each buffer has the same number of locations and the same address map as the display buffer. Figure 2-1 shows the concept of four parallel buffers.

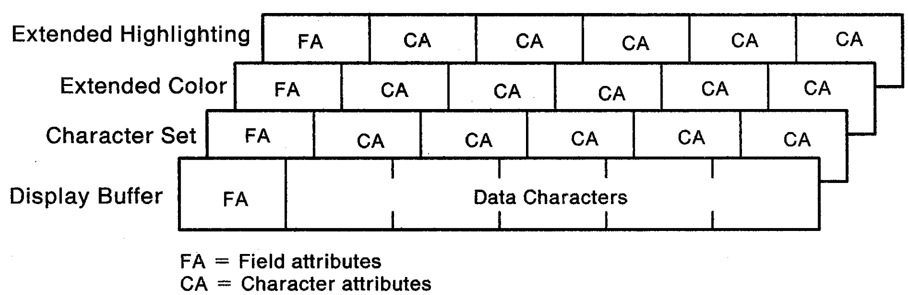


Figure 2-1. Relationship Between Extended Attributes

Field Attributes

The field attribute character occupies the first character position of each display field in a formatted display. The corresponding character position on the display screen is always blank. This 8-bit attribute character is loaded by a SF or SFE (attribute type X'CO') order to do the following:

- Define the start of a field
- Assign characteristics to the field.

Bit positions in the character are significant to the display. The value assigned to each bit or group of bits determines whether a specific attribute is applied.

Field Attribute Character

Table 2-16 on page 2-30 shows the significance of bits in the field attribute character. The field attribute character sets the following characteristics:

Protected/Unprotected: An operator cannot enter data into or modify the contents of a protected field. Input fields that require data from the operator must be unprotected.

Alphanumeric/Numeric: In an unprotected input field, alphanumeric/numeric defines the type of data that an operator can enter into the field. This attribute has special meaning for protected fields, Data Entry keyboards, and the Numeric Lock feature.

Nondisplay/Display/Intensified: Data contained in the field is either not displayed, displayed at normal intensity, or displayed at high intensity. The 3279 does not support two levels of intensity. If no extended attribute is defined, nonintensified fields and intensified fields are displayed in different colors. (The actual colors are determined by the position of the Base Color switch and by the value of the protected/unprotected attribute.)

Detectable/Nondetectable: Displayed data in a detectable field can be detected by the selector light pen. (The detectable field must contain a designator character as described in Appendix A, "Selector Light Pen and Magnetic-Stripe Reading Devices.")

Table 2-16 shows field attribute character bit assignment.

Table 2-16. Field Attribute Character Bit Assignment

EBCDIC Bit	Field Description
0,1	Value determined by contents of bits 2–7. Not significant.
2	0 – Unprotected 1 – Protected
3	0 – Alphanumeric 1 – Numeric (cause automatic upshift of Data Entry keyboard) **Note:** Bits 2 and 3 equal to 11 causes an automatic skip. (See "Automatic Skip.")
4,5	00 – Display/not selector light pen detectable. 01 – Display/selector light pen detectable. 10 – Intensified display/selector light pen detectable. 11 – Nondisplay, nonprint, nondetectable.
6	Reserved
7	MDT identifies modified fields during Read Modified command operations. 0 – Field has not been modified. 1 – Field has been modified by the operator. Can also be set by program in data stream.

Refer to Appendix A, "Selector Light Pen and Magnetic-Stripe Reading Devices," for the use of intensified field attributes when formatting selector light pen detectable fields.

Field attributes are protected against input from the keyboard. However, bit 7 (MDT) is set to 1 when the operator enters data into the field defined by the attributes. Attribute characters are not protected against operation of the Clear function. The Clear function erases all locations in the display buffer.

Automatic Skip

Upon entry of a character into the last character location of an unprotected data field, the cursor is repositioned according to the attribute character describing the next field. However, if the field attribute character describing the next field defines the field as numeric and protected, the cursor automatically skips that field and is positioned to the first character location of the next unprotected field.

Base Color Mode

Color display stations, such as the 3279, use the field attributes for the additional purpose of controlling color.

Some color display stations always decode the field attributes to assign a color to each display field. If the operator sets the Base Color switch to base color (oooo), then the fields are colored in one of four colors — red, blue, green, or white - depending on the protect and intensify bits. If the operator sets the Base Color switch to monochrome (oo), all data is displayed in green except for intensified fields; intensified data is displayed in white. The particular attributes examined are the protect and intensify attributes. Table 2-17 shows how the value of these attributes determines the color of characters displayed in a field.

The base color switch defined in Table 2-17 results when the proper attribute bit is set.

Table 2-17. Colors Derived from Field Attributes

Field Attribute	Attribute Bit 2 3 4 5	Base Color Switch oo	oooo
Unprotected, normal intensity	0 X 0 X	Green	Green
Unprotected, intensified	0 X 1 0	White	Red
Protected, normal intensity	1 X 0 X	Green	Blue
Protected, intensified	1 X 1 0	White	White

Some color displays support extended color. When extended color is used, the Base Color switch is disabled. If extended colors are not used by the application program, these models display base color or monochrome mode. See "Extended Color (Attribute Type X'42')" on page 2-32 for more information.

Note: The integrity of the unprotected/protected attribute is preserved; the operator can enter data only into an unprotected field.

Extended Attributes

Additional characteristics can be assigned to display fields and to individual character positions within the fields when the display station supports the 3270 Structured Field and Attribute Processing option. The extensions to the field attributes are:

- Extended Highlighting (blink, reverse video, underscore)
- Color (blue, red, pink, green, turquoise, yellow, white)
- Character Sets (the character code in the display buffer is used to address a character set)
- Transparency.

Note: Extended attributes are ignored if the field attribute is *nondisplay.*

When a character is displayed in a formatted field, the character attributes corresponding to the display buffer location are examined to determine the extended attributes of the character. If any of the character attributes contains X'00', that particular attribute is inherited from the extended field attribute.

The application program can assign character attributes to an unformatted display. Because there are no extended field attributes, the defaults for Extended Highlighting and Character Set are *none* and *base character set*. Setting the extended color character attribute to X'00' in an unformatted display causes the color to default to green.

Extended field attributes are protected against input from the keyboard. Input data from the keyboard is always assigned character attributes of X'00' if the operator does not select specific attributes. Enabling operator selection is a function of the reply mode set by a Write Structured Field command. (See "Set Reply Mode" on page 3-28 for additional information.)

The orders used by the program to load or change extended attributes are SFE, MF, and SA.

Extended Highlighting (Attribute Type X'41')

Extended Highlighting offers three ways in which a character or a field can be highlighted: blink, reverse video, and underscore. The valid codes for Extended Highlighting are:

X'00' — Select default (see note 1)
X'F1' — Blink
X'F2' — Reverse video (see note 2)
X'F4' — Underscore.

Notes:

1. Default depends on whether the display is formatted or unformatted:
   a. Formatted: X'00' in the character attribute causes that attribute to be inherited from the extended field attribute. X'00' in both the character attribute and the extended field attribute causes display without highlighting.
   b. Unformatted: X'00' in the character attribute causes display without highlighting.
2. See "Triple-Plane Symbol Sets" on page 3-12 for the effect of reverse video on characters defined with more than one color in a single-character position.
3. If the operator selects *cursor blink* or *reverse cursor*, the cursor characteristics interact with the Extended Highlighting attribute (see "Cursor Blink (Cursr Blink) Function" on page 4-18 and "Alternate Cursor (Alt Cursr) Function" on page 4-18).

Extended Color (Attribute Type X'42')

Extended Color is available only on certain color displays. For compatibility of programming between color and monochrome, this attribute can be sent to a 3278 Model 2, 3, 4, or 5 when the 3278 is equipped with the Extended Character Set Adapter feature.

Extended Color offers seven colors that can be defined for individual characters within a field or for complete fields. The valid codes for the Extended Color attribute are:

X'00' — Select default (see note 1)
X'F1' — Blue
X'F2' — Red
X'F3' — Pink
X'F4' — Green
X'F5' — Turquoise
X'F6' — Yellow
X'F7' — Neutral – white (see note 2).

Notes:

1. Default for an unformatted display is always green. On a formatted display, a character attribute of X'00' causes a default to the extended field attribute. When the extended field attribute also contains X'00', the display of base colors by such color display stations as the 3279 is suppressed if attribute type X'42' (Extended Color attribute) is used in the data stream following the Erase/Write or Erase/Write Alternate command or the Set Reply Mode structured field.

   When the display of base colors is suppressed, default is white for data in an intensified field and green for all other data. (See the descriptions in this chapter for details of commands and orders.)

   Base color is re-enabled by either of the following:

   - An Erase/Write or Erase/Write Alternate command with bit 1 of the WCC set to one
   - The operator pressing the Clear, Sys Req, or Test function.

   Colors displayed when base color is enabled depend on the field attributes and on the setting of the Base Color switch. (See "Base Color Mode" on page 2-31 for more information.)

2. X'F7' as a character attribute or inherited from the extended field attribute causes the character to be displayed white except when a triple-plane symbol set is used. (See "Triple-Plane Symbol Sets" on page 3-12.)

Character Set (Attribute Type X'43')

The Character Set features PS-2 and PS-4 use the character code from the display buffer as an address to access a symbol set. (For details, see "Programmed Symbols" on page 3-10.) Symbol sets are selected by the Character Set attribute. Valid codes for this attribute are:

X'00'	Select default (see note 1)
X'40' – X'EE'	Range of valid identities for symbol sets (see note 2)
X'F1'	Select APL/Text character set (see note 3).

Notes:

1. Default depends on whether the display is formatted or unformatted:
   a. Formatted: X'00' in the character attribute causes that attribute to be inherited from the extended field attribute. X'00' in both the character attribute and the extended field attribute selects the base character set.
   b. Unformatted: X'00' in the character attribute selects the base character set.
2. The identity assigned to a character set is determined by the programmer; it is a valid identity only when the symbols have been loaded using the Load Programmed Symbol Sets structured field.
3. X'F1' cannot be used in the extended field attribute. This value is supported only if the APL/Text character set is present. If used, it is rejected.

Transparency (Attribute Type X'46')

Transparency is the only extended attribute supported by the 3174 for the Tektronix 4205 or a device using a User-Defined Terminal (UDT) Table with a defined outbound background transparency sequence. It indicates that the 3174 uses an EAB for this device to define transparent areas of the screen where both the graphics and alphanumeric data are seen.

Attribute Types and Values

The following attribute types and values are used in the SFE, MF, and SA orders. Type codes other than those given in Table 2-18 are rejected with an Op Chk (non-SNA) or a negative response of X'1001' (SNA).

In Table 2-18, an x indicates that the type code is valid when used in the order.

Table 2-18. Attribute Type Codes

Attribute Type	Code	SFE,MF Orders	SA Order
Character attribute reset	X'00'		x
Field attribute	X'C0'	x	
Extended Highlighting	X'41'	x	x
Color	X'42'	x	x
Character Set	X'43'	x	x
Transparency	X'46'	x	x

Field attributes, extended field attributes, and character attributes are used in the 3270 data stream.

Table 2-19 shows valid attribute values for each code.

Table 2-19. Valid Attribute Code Values

Type Code	Value	Result
X'00'	X'00'	This is the only valid setting for this attribute type. This type/value pair is used only with the SA order. All character attributes specifiable in the SA order are set to default value.
X'C0'		The codes appearing here are determined by the field attributes desired. See Table 2-16 on page 2-30 for a breakdown of the field attribute byte.
X'41'	X'00' X'F1' X'F2' X'F4'	Default. See Table 2-20 on page 2-36. Blink Reverse video Underscore
X'42'	X'00' X'F1' X'F2' X'F3' X'F4' X'F5' X'F6' X'F7'	Default. See Table 2-20 on page 2-36. Blue Red Pink Green Turquoise Yellow White for 3279, black for 3287, multicolor for triple-plane symbol.
X'43'	X'00' X'40' to X'EF' X'F1'	Default. See Table 2-20 on page 2-36. Valid range for symbol-set IDs assigned in the Load Programmed Symbols structured field. Symbol-set ID for the APL/Text symbol set in terminal storage ID X'01'. This attribute value can be used only in the SA order. If X'F1' is received in an SFE or MF order, an Op Chk or a negative response of X'1001' is returned.
X'46'		Transparency

Attribute Defaults

Table 2-20 describes default conditions for the attribute types field (Color, Extended Highlighting, and Character Sets).

Table 2-20. Attribute Defaults

Attribute Type	Field Attribute	Character Attribute	
		Formatted Screen	Unformatted Screen
Field	Unprotected, A/N, display, nondetectable, MDT bit off.	Not applicable	Not applicable
Color	3279[1] 3278 – green 3287 – black[2]	Inherit field color	3279[1] – green 3278 – green 3287 – black[2]
Extended Highlighting	None	Inherit field highlight	None
Character Set	Nonloadable character set in read-only storage	Inherit field specified character set	Nonloadable character set in read-only storage

Notes:

[1] If the base color switch is set to color and the data stream contains any attribute type-color (X'42') specification or if the Set Reply Mode (SRM) function has set character mode with color as the reply mode, the base color switch setting is overridden, and the field default display color is green (white if the field is intensified). (See the reset matrix in Table 2-4 on page 2-7 for the actions that cancel the override of the base color switch.)

[2] Green if feature 9136 is installed.

The Color, Highlighting, and Character Set attributes always assume the default condition with attribute code X'00'. Character attributes assume the field setting (if defined); otherwise, the character attributes are as noted above for field attribute default.

Chapter 3. 3270 Structured Fields

Introduction

This chapter describes the structured fields used with the WSF command described in Chapter 2, "3270 Commands, Orders, and Attributes." This chapter also describes the outbound, outbound/inbound, and inbound structured fields. Appendix C, "3174 Support of Intelligent Printer Data Stream (IPDS)," discusses the Select IPDS Mode and Query Reply (3270 IPDS) structured fields and use of the Function Management Header Type 1 in supporting the intelligent printer data stream.

Structured fields can be sent to all types of devices. They have the following general format: *length type parameters data.*

The *length* field value includes the 2 bytes of the length field. A length field value of zero causes the structured field to be treated as the last structured field in the transmission.

The *type* field identifies the purpose of the structured field.

The *parameters* and *data* that follow are variable, depending on the structured field type.

Outbound Structured Fields

This section describes outbound structured fields. Outbound structured fields are sent from the host to the 3174.

Create Partition

The function of this structured field is to create a new partition. The entire structured field is not required to be present; parameters can be omitted.

Table 3-1 (Page 1 of 2). Format of Create Partition Field

Byte	Bit	Content	Meaning
0,1			Length of structured field (see Note 1)
2		X'0C'	Create Partition structured field ID
3			PID (Partition Identifier)
4	0–3		Unit of Measure:
		X'0'	Character cells
		X'1'	Addressable points – The number of points, in the vertical direction, in a character cell in a presentation space.
		X'2'	Addressable points – The row and column origin of the viewport relative to the usable area.
		Other	Reserved
	4–7		Address Mode:
		X'0'	12/14-bit addressing mode
		X'1'	16-bit addressing mode
		X'2'	Text
		Other	Reserved

Table 3-1 (Page 2 of 2). Format of Create Partition Field

Byte	Bit	Content	Meaning
5	0	B'0'	Reserved
	1	B'0'	Unprotected partition
		B'1'	Protected partition
	2		Type of Host-Initiated Local Copy:
		B'0'	Viewport
		B'1'	Presentation space
	3,4	B'00'	Reserved
	5−7		Base Character Set Index − Established from the list returned in the Character Sets query reply.
6,7			Height of presentation space (rows) (see Note 2)
8,9			Width of presentation space (columns) (see Note 2)
10,11			Row origin of the viewport relative to the usable area
12,13			Column origin of the viewport relative to the usable area
14,15			Height of viewport (rows)
16,17			Width of viewport; must equal width of presentation space
18,19			Window origin (row); must be equal to or less than the height of the presentation space minus the height of the viewport
20,21		X'0000'	Window origin (column); no offset allowed − must be X'0000'
22,23			Number of vertical scroll units; must be less than or equal to the viewport height and less than or equal to the presentation space height minus the viewport height (see note 3)
24,25			Horizontal windowing is not allowed. X'0000', X'0001', or X'FFFF' will be accepted by the controller
26,27			Number of horizontal points in cell; must equal value from query reply (usable area)
		X'0A'	27 × 132
		X'0C'	24 × 80
		X'0C'	32 × 80
		X'0C'	43 × 80
28,29			Number of vertical points in cell; must equal value from query reply (usable area)
		X'0C'	43 × 80
		X'10'	27 × 132
		X'10'	32 × 80
		X'12'	24 × 80

Notes:

1. The number of bytes in this structured field can vary from 3 bytes (0—2) to 30 bytes (0—29). Valid lengths are 0, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, and 30. Defaults for omitted parameters follow.
2. Height × width of presentation space cannot exceed 7680.
3. If the value is X'FFFF', then the scroll unit becomes 1 if the viewport height is not equal to the presentation space height, or the scroll unit becomes 0 if the viewport height is equal to the presentation space height.

The default values, if the parameter is omitted in the Create Partition structured field, are as follows:

Parameter	Default Value If Parameter Is Omitted
Byte 3	0
Byte 4	0
Byte 5	0
Bytes 6,7	Default screen height specified in Bind
Bytes 8,9	Default screen width specified in Bind
Bytes 10,11	0 (top screen row)
Bytes 12,13	0
Bytes 14,15	Smaller of 6 and 7 and height of usable area
Bytes 16,17	Smaller of 8 and 9 and width of usable area
Bytes 18,19	0 (top presentation space row)
Bytes 20,21	0 (leftmost presentation space column)
Bytes 22,23	1 if 14, 15 < 6, 7; 0 if 14, 15 = 6, 7
Bytes 24,25	0
Bytes 26,27	Usable area cell width from query reply
Bytes 28,29	Usable area cell height from query reply.

Erase/Reset

The Erase/Reset structured field can be used to set the buffers of devices capable of default or alternate buffer size operation to either the default or alternate size; for example, a 3278 display (Model 4) can be set to 1920-character capacity or 3440-character capacity.

Execution of the function sets the buffer to the specified size and leaves the device in its base or power-on state.

Table 3-2 shows the format of the Erase/Reset structured field.

Table 3-2. Format of Erase/Reset Structured Field

Byte	Bit	Content	Meaning
0,1		X'0004'	Length of structured field
2		X'03'	Erase/Reset identifier.
3	0	B'0'	Set buffer to default size.
		B'1'	Set buffer to alternate size.
	1−7	B'000 0000'	If not B'000 0000', a negative response of X'1001' (SNA) or an Op Chk (BSC) results.

Load Format Storage

This structured field allows the distribution of 3270 Data Stream display formats to the Format Storage Auxiliary Device and the requesting of reports of Format Storage Auxiliary Device storage utilization. The formats are in controller storage and are accessed by the Select Format Group, Present Absolute Format, and Present Relative Format structured fields.

Table 3-3. Format of Load Format Storage Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2,3		X'0F24'	Load Format Storage identifier
4	0,1	B'11'	Reserved – Must be B'11'
	2		Local Format Selection:
		B'0'	Format can be selected only by the host.
		B'1'	Format can be selected by the host or the operator.
	3		Screen size for operator-selected format:
		B'0'	Default screen size
		B'1'	Alternate screen size
	4–7	B'0000'	Reserved – Must be zeros
5		X'00'	Reserved – Must be zeros
6			Operand (see the description for each operand following the table):
		X'01'	Add Format (see note 1)
		X'02'	Delete Format
		X'03'	Delete Format Group
		X'04'	Reset Format Storage
		X'05'	Request Summary Status
		X'06'	Request Group Status
7–14			Local name for operator-selected format (see note 2)
15–30			Format Group name (see note 3)
31–46			Format name (see note 3)
47–nn			Format data (see note 4)

Notes:

1. An add format operand of this structured field is rejected if the local format selection flag is set and the first character of the local name field is an EBCDIC null character (X'00').
2. The local name is applicable only when byte 4 bit 2 is set to 1. Otherwise, the local name must be zeros.
3. The Local Format Storage feature ignores periods in all format names and format group names. The periods are deleted and the remainder of the name is concatenated (for example, ABC.12 becomes ABC12).
4. If no format data is included when the add format operand is selected, the request is rejected. It is also rejected if format data is included and the operand is other than add.

The following paragraphs describe the operands used in byte 6 of the Load Format structured field:

- Add Format – Adds the format data to the specified group directory.
  - If the group directory does not exist, it is created.
  - If the format name already exists, it is replaced.
  - If the add is successful, available status is returned.
  - If a local name is specified for operator-selected formats, it is cataloged in the local directory for the specified group.
  - If the group name or format name is omitted, or the 3174 has insufficient storage, exception status is returned.
  - If the local name already exists in the local directory for the specified group, the existing local name entry is changed to point to the new local name data (logical replace).
- Delete Format – Deletes the specified format.
  - If the delete is successful or the specified format is not found, available status is returned.
  - If a local name exists for the deleted format, it is removed from the local name directory of the specified group.
  - If the group name or format name is omitted, exception status is returned.
- Delete Format Group – Deletes all formats within the specified group directory and deletes the group directory.
  - If the delete is successful or the specified group name is not found, available status is returned.
  - If no group name is specified, exception status is returned.
  - Formats are removed from the group directory, and format storage space is returned to the format storage available pool.
- Reset Format Storage – Deletes all formats in all group directories and deletes all group directories.
  - All format storage space is marked as available.
  - Available status is always returned.
- Request Summary Status – Causes an Exception/Status structured field with self-defining parameter to be returned with the following information:
  - Number of groups assigned
  - Number of local names used
  - Total number of formats loaded
  - Amount of format storage space available.
- Request Group Status – Causes an Exception/Status structured field with self-defining parameter to be returned containing the following information:
  - Currently specified group name
  - Number of formats in specified group.

Load Programmed Symbols

The Load Programmed Symbols structured field is used to load symbol definition data into loadable terminal storage. (The *3270 Color and Programmed Symbols* manual describes Programmed Symbols capability, applications, and programming support.)

Terminals configured to support Programmed Symbols can have a maximum of six loadable storages (IDs of X'02' to X'07', correlating to the attribute selection functions PS-A to PS-F).

To accommodate multiple colors within a single-character location, some of the loadable terminal storages are provided with three primary color planes. For example, storage X'05' on the 3287 and storages X'04', X'05', and X'07' (PS-C, PS-D, and PS-F) on the 3279 are triple-plane storages.

The storage ID and a unique symbol-set ID (Local Coded Graphic Character Set Identifier [LCID]) are specified in the structured field, and the controller logic keeps track of the association. When the symbol set ID shows up in SA, SFE, or MF orders as a Character Set attribute value, the symbol set is accessed in the specified storage.

A Programmed Symbol set contains a maximum of 190 symbol definitions and a space code point (X'40'). Code points X'41' to X'FE' correlate to the 190 possible symbols. Not all code points can be invoked from a keyboard, only those permitted by the keyboard/language combination installed.

The skip suppression facility (specified in byte 3, bit 2) provides for suppression of the vertical spacing between character cells. If specified, skip suppression is applied any time the symbol set ID appears as an attribute value, effective with the next row of cells. Suppression is by row. That is, the ID of the symbol set specifying suppression must appear as an attribute value in each row if skip suppression is desired. Specification of another symbol set with skip suppression off, or default to the base character set, normally stops skip suppression with the next row. When the base character set is selected by default, however, and the change occurs when the field attribute and the extended field attribute are associated with the first character position in a row, skip suppression will not turn off until the next line plus one.

Note: Examples of devices on which skip suppression is available are the 3278 Model 2, the 3279 Model 2B, and the 3287 Models 1C and 2C.

This structured field has a basic and an extended form, shown in Table 3-4 on page 3-8. The basic form consists of a 7-byte header (bytes 0–6) and *n* bytes of symbol definition data. The extended form contains an extension to the basic header of a maximum of 6 bytes (bytes 7–12). The extension contains additional information associated with copy operations and color and *n* bytes of symbol definition data.

Table 3-4 (Page 1 of 3). Format of Load Programmed Symbols Structured Field			
Byte	**Bit**	**Content**	**Meaning**
0,1			Length of structured field, including extension if present.
2		X'06'	Load PS structured field identifier.
3	0	B'0'	Basic format. No extension present.
		B'1'	Format extension present (bytes 7–12).
	1	B'0'	Do not clear the specified terminal storage (byte 6) prior to loading, so that symbol definitions can be added to an existing set.
		B'1'	Clear the specified terminal storage (byte 6) before loading the symbol definitions in this structured field. The entire storage is cleared of any existing symbol definitions. If this PS set is part of a triple-plane set, only the plane(s) indicated in byte 12 (extension) is (are) cleared.
	2	B'0'	Skip suppression off. Normal row spacing (vertical) in effect.
		B'1'	Skip suppression on. The next row is positioned adjacent to the current row, with no spacing (vertical) between rows.
	3	B'0'	Must be B'0'. Other values are rejected with negative response (X'1001') or Op Chk.
	4–7	X'1'	Symbol definition data is display type 1. Each symbol definition specifies the dot pattern to be displayed in a 9-dot-wide-by-16-dot-deep block matrix. The definition consists of 18 bytes of data, the first two bytes defining a 16-bit vertical slice of the matrix (left side) and the last 16 bytes representing sixteen 8-bit horizontal slices (top to bottom) of the matrix. Definitions for the 9 × 16 block matrix are always assumed. When the display uses only a 9 × 12 block matrix, the last four bits of the 16-bit vertical slice and the last four 8-bit slices are ignored.
		X'2'	Display type 2, which is the display type 1 definitions in compressed form. See page 3-15.
		X'5'	The symbol definition data is printer type 5. Each symbol definition specifies the dot pattern to be displayed in a 10-dot-wide-by-8-dot-deep block matrix. The definition consists of 10 bytes of data, each representing an 8-bit vertical slice of the matrix. Bit 1 of byte 1 represents the upper-left dot in the matrix. Byte 10 represents the right-hand side of the matrix.
		X'6'	Printer type 6, which is the printer type 5 definitions in compressed form. The 3174 decompresses the data for LU type 3 devices. See page 3-15. Values other than X'1', X'2', X'5', or X'6' in bits 4–7 are not accepted. A negative response (X'1001') or Op Chk results.
4			LCID. Valid values are X'40' to X'EF'. The 3174 associates this ID with the terminal storage ID specified in byte 6. This ID is used in SFE, MF, and SA orders as a character set attribute value. An X'FF' in this byte causes the controller to mark the storage specified in byte 6 as *free* and to block any further reference to the symbol set. Invalid values cause a negative response (X'1001') or an Op Chk.

Table 3-4 (Page 2 of 3). Format of Load Programmed Symbols Structured Field

Byte	Bit	Content	Meaning
5		X'nn'	X'nn' is an EBCDIC I/O interface code point in the range X'41' to X'FE'. Invalid code points cause a negative response (X'1001') or an Op Chk. The code point correlates with a symbol-definition data slot in the loadable terminal storage, and the symbol definitions are loaded into slots correlated with contiguous EBCDIC code points, starting with the slot pointed to by X'nn'. Loading continues until one of the following happens: • A positive response indicates that loading ended on a matrix boundary. • A negative response indicates the following: – Loading did not end on a matrix boundary – Code point X'FE' has been overrun – Algorithm conditions for decompression were not met.
6			Loadable character set ID in the range X'02' to X'07'. These values equate with the PS attribute selection functions PS-A through PS-F, respectively. Invalid IDs or a valid ID not loaded causes a negative response (X'084C') or an Op Chk. Symbol definition data follows this byte unless extended form LPS.
7		X'nn'	Length specification for extended form, including this length parameter itself. If X'nn' is X'00' or a value greater than X'06', a negative response (X'1001') or an Op Chk is returned. Bytes 7 through 12 compose the LPS extension, and the parameters can be progressively included by specifying the appropriate length. Omitted parameters are equated to X'00', and the effect is the same as receiving a byte containing X'00'.
8	0	B'0'	All points available for display or printing.
		B'1'	Fewer than all dots may be displayed or printed.
	1	B'0'	For a local copy operation, the ID of this symbol set (byte 4) is compared with symbol-set IDs in the printer. If there is a match, the copy is performed using the corresponding symbol set in the printer. If there is no match, the characters of the interface code in the printer's read-only storage are used.
		B'1'	Symbol set IDs are not compared. Characters from the interface code in the printer's read-only storage are used.
	2	B'0'	This symbol set is keyboard-selectable. The PS function corresponding to the storage specified in byte 6 is enabled.
		B'1'	This symbol set is not keyboard-selectable. It is intended only for output. The PS selection function cannot be enabled while this storage and the specified symbol set (byte 4) are associated.
	3–7	B'0 0000'	If bits 3–7 are not zero, a negative response (X'1001') or Op Chk is returned.
9,10		X'nn'	Bytes 9 and 10 are the horizontal (9) and vertical (10) dot specification for the block matrix size of symbols in the set. If specified, byte 9 must be X'0A' for printers and X'09' for displays, and byte 10 must be X'08' for printers and X'10' for displays. These values are assumed if bytes 9 and 10 are not specified or are set to zero. A negative response (X'1001') or an Op Chk is returned for values other than the above.
11		X'00'	If not X'00', a negative response (X'1001') or an Op Chk is returned.

Table 3-4 (Page 3 of 3). Format of Load Programmed Symbols Structured Field			
Byte	**Bit**	**Content**	**Meaning**
12	0–4	B'0000 0'	Must be zeros. Other values cause a negative response (X'1001') or an Op Chk.
	5–7	B'000'	When triple-plane terminal storages are loaded, B'000' causes the symbol definitions for each code point to be loaded in all three planes.
		B'001'	Load the symbol definitions in the blue plane.
		B'010'	Load the symbol definitions in the red plane.
		B'100'	Load the symbol definitions in the green plane.
			Any other values in bits 5–7 cause a negative response (X'084C') or an Op Chk. Symbol definition data follows this byte.

Programmed Symbols

A programmed symbol (PS) is a special character or graphic component that is loaded by the application program into a symbol set in the device. Each symbol set contains 190 symbol locations. Each location contains a pattern of binary bits equivalent to the dot pattern contained in each character position on the display screen. To define a symbol, the application program sets only those bits in a location that relate to the active dots needed to display the symbol.

Symbol sets are either single-plane or triple-plane. Triple-plane sets are not available on monochrome displays. The advantage of a triple-plane set is that it allows more than one color to be used in a single character position. The symbol sets available at each PS address are as follows:

PS Address	3278 Models 2, 3, and 4	3279 Models 2B and 3B
A	Single-plane	Single-plane
B	Single-plane	Single-plane
C	Single-plane	Triple-plane
D	Single-plane	Triple-plane
E	Single-plane	Single-plane
F	Single-plane	Triple-plane

Characters are displayed as a pattern of active dots. Each character position on the screen is addressed by the display as a matrix of dots. Characters of the base character set are defined within the display station as a pattern of active dots in this matrix. The number of dots in the matrix and the size of the matrix vary between display stations. Table 3-5 on page 3-11 shows the matrix as defined for the 3279 and lists the parameters used by the 3278 Models 2, 3, and 4.

When displaying a character from the base character set, the display station reads an EBCDIC code from the display buffer. This EBCDIC code is used to address the base character set, and the addressed location contains the pattern of points needed to display the character. If the character attributes define or inherit a symbol set, however, then the character code addresses a location in the symbol set.

Table 3-5. Size of Character Position

```
* * * * * * * * *
* * * * * * * * *
* * * * * * * * *
* * * * * * * * *
* * * * * * * * *
* * * * * * * * *
* * * * * * * * *
* * * * * * * * *
* * * * * * * * *
* * * * * * * * *
* * * * * * * * *
* * * * * * * * *
```

Element	**3278-2**	**3278-4**	**3179, 3279**
Width, dots	9	9	9
Height, dots	16	16	16
Spacing between dots:			
Vertical	0.38 mm (0.015 in.)	0.38 mm (0.015 in.)	0.46 mm (0.018 in.)
Horizontal	0.37 mm (0.0145 in.)	0.37 mm (0.0145 in.)	0.34 mm (0.0135 in.)

Example: An application that displays a histogram would require a symbol set containing fill patterns. Location X'81' in the symbol set might contain a crosshatch fill pattern. X'81' in two locations in the display buffer might produce two different patterns of active dots:

1. From the base character set, X'81' would produce the character *a*.
2. From the symbol set, X'81' would produce the crosshatch pattern.

Table 3-6 illustrates this example. The figure assumes that symbol set Y has been loaded.

Table 3-6. Example of a Programmed Symbol Set

```
Display Buffer   | X'81' | X'81' |

Symbol Set       | base  |  Y    |

Base Character Set        Symbol Set Y

- - - - - - - - -         * - - * - - * - -
- - - - - - - - -         - * - - * - - * -
- - - - - - - - -         - - * - - * - - *
- - - - - - - - -         * - - * - - * - -
- - * * * * - - -         - * - - * - - * -
- - - - - - * - -         - - * - - * - - *
- - * * * * * - -         * - - * - - * - -
- * - - - - * - -         - * - - * - - * -
- - * * * * * - -         - - * - - * - - *
- - - - - - - * -         * - - * - - * - -
- - - - - - - - -         - * - - * - - * -
- - - - - - - - -         - - * - - * - - *
```

Symbol sets are loaded by the program issuing a WSF command. Data sent to the display by the WSF command includes:

- The number of the set being loaded
- The one-character identity assigned to the set
- A starting address for the load
- The data that defines the required symbol or set of symbols.

Valid addresses for location in each symbol set range from X'41' through X'FE'. Loading of a set starts at the location specified in the WSF command and progresses sequentially until all data has been transferred to the set. For details, see "Write Structured Field (WSF) Command" on page 2-15.

Single-Plane Symbol Sets: A single-plane symbol set has no inherent color characteristic and is available for both monochrome and color displays. On color displays, symbols from a single-plane set are displayed in the color defined in the character attribute or the extended field attribute. If the extended color attribute is X'00' in both the character attribute and the extended field attribute, the symbol is displayed in the default color (white for data or symbols in an intensified field and green for all other data and symbols).

Triple-Plane Symbol Sets: In certain applications, it may be necessary to display more than one color within a single character position. For example, the Programmed Symbols feature can be used to display three lines: one red, one blue, and one yellow. These lines may cross at certain points, and the area of the crossing point is significantly smaller than the area of a single character position. If multiple colors could not be displayed within a character position, the point of intersection might appear as follows:

```
- - - - - - - - - - - - - r - - - - - - - - - - - - -
- - - - - - - - - - - - - r - - - - - - - - - - - - -
- - - - - - - - - - - - - r - - - - - - - - - - - - -
b b b b b b b b b r r r r r r r r r b b b b b b b b b
- - - - - - - - - - - - - r - - - - - - - - - - - - -
- - - - - - - - - - - - - r - - - - - - - - - - - - -
- - - - - - - - - - - - - r - - - - - - - - - - - - -
- - - - - - - - - - - - - r - - - - - - - - - - - - -
y y y y y y y y y r r r r r r r r r y y y y y y y y y
- - - - - - - - - - - - - r - - - - - - - - - - - - -
- - - - - - - - - - - - - r - - - - - - - - - - - - -
- - - - - - - - - - - - - r - - - - - - - - - - - - -
```

Legend:
r = Red
b = Blue
y = Yellow
\- = Blank

The Programmed Symbols feature overcomes this difficulty by allowing the user to define symbols that contain more than one color. These symbols are stored in a triple-plane symbol set. Triple-plane symbol sets contain a separate plane for each primary color (red, blue, and green). Corresponding locations in each plane may be loaded with a different pattern of active bits. Addressing a location in a triple-plane symbol set produces the bit patterns from each plane at that location; the three patterns form the symbol displayed. The symbol is displayed in the character position related to the display buffer location that contains the code used to address the symbol set.

If the extended color attribute is X'F7' when a triple-plane set is addressed for a symbol, the pattern from each plane is displayed in the primary color for the plane, that is, red, blue, or green. To obtain pink, yellow, turquoise, and white, the same dot is made active in more than one plane. The combinations of the primary colors are described below under "Secondary Colors" on page 3-13.

If a color is defined in the character attribute or inherited from the extended field attribute, all three patterns are displayed in the defined color. If no extended color attribute is defined, the default is white for symbols in intensified fields and green for symbols in all other fields.

Triple-plane sets may be used as single-plane sets. If the program loads a triple-plane set without defining it as such, the same symbol is loaded into each plane. Loading a triple-plane set as a single-plane set causes the symbol to take on the color characteristics of a single-plane set.

Secondary Colors: Secondary colors are obtained by mixing red, blue, and green. The secondary colors are pink, yellow, turquoise, and white. When a pattern of bits from a triple-plane symbol set is displayed with the extended color attribute of X'F7', the active primary colors combine to produce secondary colors if the same bit is active in more than one plane. See Table 3-7 for the combinations of primary colors.

Table 3-7. Color Combinations

Red	Blue	Green	Video
No	No	No	No display
No	No	Yes	Green
No	Yes	No	Blue
No	Yes	Yes	Turquoise
Yes	No	No	Red
Yes	No	Yes	Yellow
Yes	Yes	No	Pink
Yes	Yes	Yes	White

Defining a Triple-Plane Symbol: A typical example of a symbol that requires a triple-plane occurs where the application program displays a graph with lines in different colors. At the point where two or more lines cross, each line needs to hold its color in the same character position as another line. The application programmer should also be aware of color mixing that might occur at the point common to several lines.

For example, suppose that two horizontal lines, one blue and one yellow, are cut by a red vertical line. The active dots at the character position might appear as shown in Table 3-8 on page 3-14.

Table 3-8. A Triple-Plane Symbol

```
- - - - r - - - -
- - - - r - - - -
- - - - r - - - -
b b b b r b b b b
- - - - r - - - -
- - - - r - - - -
- - - - r - - - -
- - - - r - - - -
y y y y r y y y y
- - - - r - - - -
- - - - r - - - -
- - - - r - - - -
```

Red Plane

```
- - - - r - - - -
- - - - r - - - -
- - - - r - - - -
- - - - r - - - -
- - - - r - - - -
- - - - r - - - -
- - - - r - - - -
- - - - r - - - -
r r r r r r r r r
- - - - r - - - -
- - - - r - - - -
- - - - r - - - -
```

Blue Plane

```
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
b b b b - b b b b
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
```

Green Plane

```
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
g g g g - g g g g
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
```

Legend:
b = Active blue bit
g = Active green bit
r = Active red bit
y = Yellow (red = green)

Note: The symbol extends to the edges of the character position, thus allowing the lines to continue without interruption into the adjacent character positions.

If the triple-plane example shown in Table 3-8 were displayed with any color attribute other than X'F7' (neutral), the three planes would be displayed in one character position using the defined color; an attribute of X'00' for a triple-plane set always defaults to white for symbols in an intensified field and to green for symbols in all other fields. For example, if the symbol previously described were displayed with a color attribute of X'F5' (turquoise), the symbol would be displayed as:

```
- - - - t - - - -
- - - - t - - - -
- - - - t - - - -
t t t t t t t t t
- - - - t - - - -
- - - - t - - - -
- - - - t - - - -
- - - - t - - - -
t t t t t t t t t
- - - - t - - - -
- - - - t - - - -
- - - - t - - - -
```

Legend:
t = Turquoise

Reverse Video and Triple-Plane Symbols: When reverse video is the Extended Highlighting attribute for a triple-plane symbol, the inactive primary colors for each point are made active and the active primary colors are made inactive. Table 3-9 on page 3-15 shows the effect of reversing the primary colors.

Table 3-9. Reverse-Video Highlighting of Triple-Plane Symbols

Red	Blue	Green	Normal Video	Reverse Video
No	No	No	No display	White
No	No	Yes	Green	Pink
No	Yes	No	Blue	Yellow
No	Yes	Yes	Turquoise	Red
Yes	No	No	Red	Turquoise
Yes	No	Yes	Yellow	Blue
Yes	Yes	No	Pink	Green
Yes	Yes	Yes	White	No Display

For example, specifying reverse video for the triple-plane symbol used in this chapter has the following result:

Normal Video	Reverse Video
- - - - r - - - -	w w w w t w w w w
- - - - r - - - -	w w w w t w w w w
- - - - r - - - -	w w w w t w w w w
b b b b r b b b b	y y y y t y y y y
- - - - r - - - -	w w w w t w w w w
- - - - r - - - -	w w w w t w w w w
- - - - r - - - -	w w w w t w w w w
- - - - r - - - -	w w w w t w w w w
y y y y r y y y y	b b b b t b b b b
- - - - r - - - -	w w w w t w w w w
- - - - r - - - -	w w w w t w w w w
- - - - r - - - -	w w w w t w w w w

Legend:

b = Blue	t = Turquoise
g = Green	w = White
r = Red	y = Yellow

Compression of Symbol Definition Bit Strings

Symbol definition bit strings can be transmitted by the Load Programmed Symbols structured field in uncompressed or compressed form. The 3174 can expand the compressed symbol definitions into the full dot pattern required by the display or printer.

An uncompressed symbol definition requires either 18 bytes of data (display) or 10 bytes of data (printer) to be transmitted. Compression, as described in this chapter, is a method for reducing the number of bytes (bits) transmitted.

An uncompressed symbol definition is created by dividing the character cell within which a symbol is formed into bytes (slices) as shown below. The symbol is defined by encoding the bits (dots) in each byte (slice) as a B'1' if the dot is to be *on*, and a B'0' if *off*. The dot pattern representing the symbol is thus formed. Byte (slice) 1 is understood to represent the leftmost upper 8 dots in the display matrix or the leftmost 8 dots in the printer matrix. The string of 144 bits (display) or 80 bits (printer) thus encoded represents the uncompressed symbol definition. A comparison process, which compares digits (4 bits) in the uncompressed bit string with reference digits selected from the same bit string, is used to compress the data.

Character Cell Division: The character cell for a display or printer character position is divided into slices as shown. A slice corresponds to a byte; the bits correspond to dots.

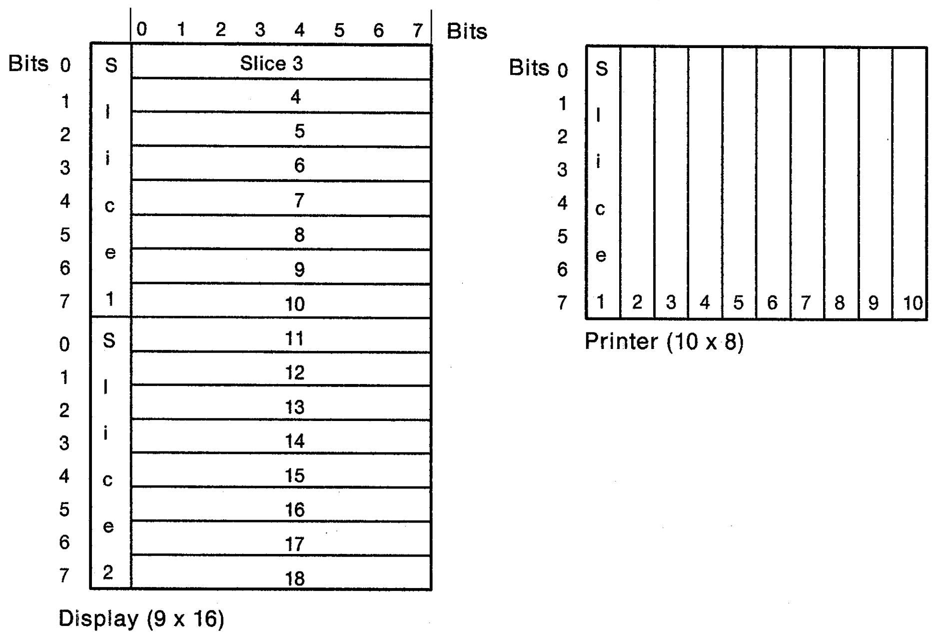


Figure 3-1. Character Cell Division

Once the character cell has been sliced in an appropriate manner, the slices can be thought of as forming a data string, beginning with slice 1, the zero bit in each slice at the left.

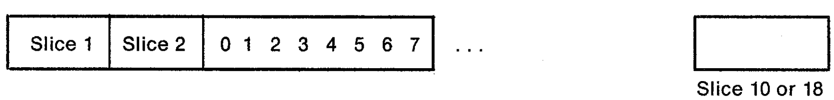


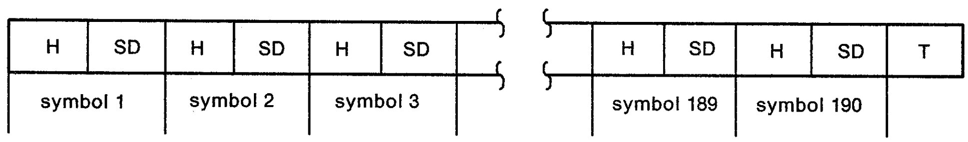
Figure 3-2. Character Cell Slices

Each group of 4 bits is termed a *digit*. The bit string that forms the symbol definition is compressed through the comparison process. Each digit is compared with the corresponding digit in a preceding slice, or zero, and the compressed bit string is generated according to the matches and mismatches that occur in the comparison process.

The Compression Process: In creating a type 2 (display) or type 6 (printer) compressed bit string for an individual symbol, an algorithm based on one of four comparison rules is used. So the 3174 can subsequently expand the compressed string, a header (of 1 to 4 bits) is used at the start of each symbol definition to signal which of the four comparison rules was used in the compression.

The compressed bit strings for all the symbols being defined are concatenated without regard for byte boundaries, and then terminator bits are added to make the total bit string fit into an integral number of bytes.

To summarize, type 2 or type 6 data that define a full set of symbols in a Load Programmed Symbols structured field appears as follows:

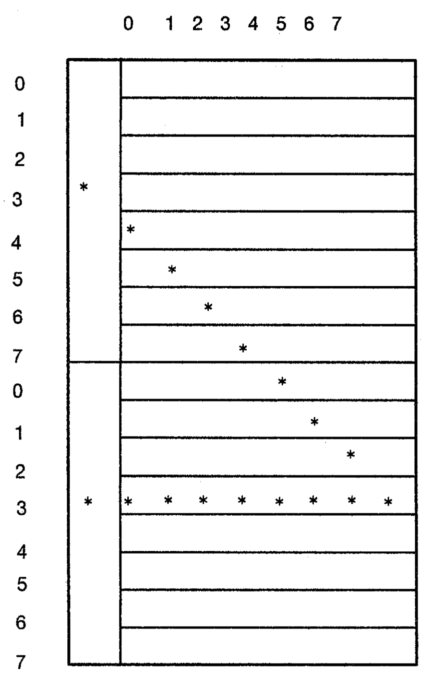


H = header bit(s)
SD = symbol-definition bits
T = terminator bits

Figure 3-3. Type 2 or Type 6 Data Compression

Figure 3-4 shows an example of a symbol in type 1 data format. The material following Figure 3-4 describes:

- The comparison rules and header bits
- Creation of the compressed bit string
- Examples of the compression algorithm.




```
In type 1 data format, the dot
pattern for this example symbol
would be transmitted in 18 bytes
having the following values:

Slice 1:   B'00010000' =   X'10'
Slice 2:   B'00010000' =   X'10'
Slice 3:   B'00000000' =   X'00'
Slice 4:   B'00000000' =   X'00'
Slice 5:   B'00000000' =   X'00'
Slice 6:   B'00000000' =   X'00'
Slice 7:   B'10000000' =   X'80'
Slice 8:   B'01000000' =   X'40'
Slice 9:   B'00100000' =   X'20'
Slice 10:  B'00010000' =   X'10'
Slice 11:  B'00001000' =   X'08'
Slice 12:  B'00000100' =   X'04'
Slice 13:  B'00000010' =   X'02'
Slice 14:  B'11111111' =   X'FF'
Slice 15:  B'00000000' =   X'00'
Slice 16:  B'00000000' =   X'00'
Slice 17:  B'00000000' =   X'00'
Slice 18:  B'00000000' =   X'00'
```

Figure 3-4. Type 1 Data Format—An Example Dot Pattern Encoded

The Comparison Rules and Header Bits: The four comparison rules that follow are used to create a compressed symbol definition bit string from a type 1 (display) or 5 (printer) uncompressed symbol definition bit string. Encoding the results of the comparison is discussed under "Creating the Compressed Bit String."

- Comparison Rule 1 (Header bit = B'0')

  Each digit is compared with a digit consisting of zero bits.

- Comparison Rule 2 (Header bits = B'10')

  Each digit is compared with the corresponding digit in the previous slice; for example, the first digit of slice 2 is compared with the first digit of slice 1, the second digit of slice 2 with the second digit of slice 1, the first digit of slice 3 with the first digit of slice 2, and so on. Since slice 1 has no previous slice, each digit of slice 1 is compared with a zero digit.

- Comparison Rule 3 (Header bits = B'110')

  Each digit is compared with the corresponding digit in the next-to-previous slice; for example, the first digit of slice 3 is compared with the first digit of slice 1, the second digit of slice 3 with the second digit of slice 1, the first digit of slice 4 with the first digit of slice 2, and so on. Since slices 1 and 2 have no next-to-previous slice, each digit of slices 1 and 2 is compared with a zero digit.

- Comparison Rule 4 (Header bits = B'1110')

  Comparison is not required. A blank symbol. The symbol definition consists only of zero bits.

Creating the Compressed Bit String: The digit comparisons are encoded by taking the digits four at a time (two slices—the slice pair referred to in following discussions) and comparing them with their corresponding digits in a reference slice pair that you have created (following the comparison rules). Because the digits are compared four at a time, it is convenient to regard the 18 slices of the type 1 data string or the 10 slices of a type 5 data string symbol definition as being made up of nine or five slice pairs. The digits of the slice pairs are compressed as follows:

1. Compare the first type 1 or 5 slice pair with the reference slice pair.
   a. When the two slice pairs are identical, put a *0* bit in the symbol-definition bit string, and repeat step 1 above for the next slice pair.
   b. When the two slice pairs are not identical, put a *1* bit in the symbol-definition bit string, and proceed to step 2.
2. Compare, in turn, each digit in the type 1 or 5 slice pair with the corresponding digit in the reference slice pair.
   a. For each digit that matches (that is, the digits being compared are the same), put a *0* bit in the symbol-definition bit string.
   b. For each digit that does not match (that is, the digits being compared are not the same), put a *1* bit in the symbol-definition bit string *followed by a copy of the 4 bits of the nonmatching digit from the type 1 or 5 slice pair.*
3. Repeat steps 1 and 2 in a similar manner through to the ninth slice pair of a type 1 string or the fifth slice pair of a type 5 string.

When the bit strings for all the symbols have been created and concatenated, the type 2 or type 6 data string is completed with 1 bits to make up an integral number of bytes. There must be at least four of these terminator 1 bits— even if they spill over into a further byte. The number of 1 bits required thus ranges from 4 (minimum) to 11 (maximum).

Examples of the Compression Algorithm: The following three examples show how a type 1 data string for a particular symbol is compressed into a type 2 data string. In these examples, the symbol whose type 1 data string is being compressed is the one shown in Figure 3-4. Here is the data string for that symbol, presented as nine slice pairs:

Slice-pair 1: X'1010'	Slice-pair 6: X'0804'
Slice-pair 2: X'0000'	Slice-pair 7: X'02FF'
Slice-pair 3: X'0000'	Slice-pair 8: X'0000'
Slice-pair 4: X'8040'	Slice-pair 9: X'0000'
Slice-pair 5: X'2010'	

For the particular symbol used in these examples, comparison rule 1 yields the shortest bit string; for any other symbol, however, the comparison rule that yields the shortest bit string depends on the symbol's particular dot pattern.

Using Comparison Rule 1: With Comparison Rule 1, the header is B'0' and the symbol-definition bit string is created by comparing each type 1 slice pair with an all-zeros reference slice pair as shown in Figure 3-5. The resultant bit string, including the header, is thus:

```
0110 0010 1000 1000 1110 0001 0100 0110 0100 1000 1010 1100
0010 1001 0100 1011 1111 1111 00
```

The original type 1 bit string of 144 bits is compressed to 74 bits.

Slice-pairs being compared according to rule 1:		Step 1: Compare slice-pairs. For a match, generate B'0'. For a mismatch, generate B'1', and do step 2.	Step 2: Compare digits. For a match, generate B'0'. For a mismatch, generate B'1' followed by a copy of the bits in the nonmatching Type 1 digit.			
Reference slice-pair	Type 1 slice-pair		Digit 1	Digit 2	Digit 3	Digit 4
X'0000'	X'1010'	1	1 0001	0	1 0001	0
X'0000'	X'0000'	0				
X'0000'	X'0000'	0				
X'0000'	X'8040'	1	1 1000	0	1 0100	0
X'0000'	X'2010'	1	1 0010	0	1 0001	0
X'0000'	X'0804'	1	0	1 1000	0	1 0100
X'0000'	X'02FF'	1	0	1 0010	1 1111	1 1111
X'0000'	X'0000'	0				
X'0000'	X'0000'	0				

Figure 3-5. Example of Compression Algorithm Using Comparison Rule 1

Using Comparison Rule 2: With Comparison Rule 2, the header is B'10', and the symbol-definition bit string is created by comparing each type 1 slice pair with a reference slice pair composed of the previous slices as shown in Figure 3-6. The resultant bit string, including the header, is thus:

```
1011 0001 0001 1000 0000 0111 0000 1010 0011 0010 0100 0101
1000 0110 0001 0100 1010 0101 1111 1111 1110 0001 0000 000
```

The original type 1 bit string of 144 bits is compressed to 95 bits.

Step 1: Compare slice-pairs.
For a match, generate B'0'.
For a mismatch, generate B'1', and do step 2.

Step 2: Compare digits.
For a match, generate B'0'.
For a mismatch, generate B'1' followed by a copy of the bits in the nonmatching Type 1 digit.

Slice-pairs being compared according to rule 2:						
Reference slice-pair	Type 1 slice-pair	Step 1	Digit 1	Digit 2	Digit 3	Digit 4
X'0010'	X'1010'	1	1 0001	0	0	0
X'1000'	X'0000'	1	1 0000	0	0	0
X'0000'	X'0000'	0				
X'0080'	X'8040'	1	1 1000	0	1 0100	0
X'4020'	X'2010'	1	1 0010	0	1 0001	0
X'1008'	X'0804'	1	1 0000	1 1000	0	1 0100
X'0402'	X'02FF'	1	0	1 0010	1 1111	1 1111
X'FF00'	X'0000'	1	1 0000	1 0000	0	0
X'0000'	X'0000'	0				

Figure 3-6. Example of Compression Algorithm Using Comparison Rule 2

Using Comparison Rule 3: With Comparison Rule 3, the header is B'110' and the symbol-definition bit string is created by comparing each type 1 slice pair with a reference slice pair composed of the next-to-previous slices as shown in Figure 3-7. The resultant bit string, including the header, is as follows:

```
1101 1000 1010 0010 1100 0001 0000 0011 1000 0101 0001 1001
0010 0010 1100 0011 0001 0000 1010 0101 0010 1111 1111 1110
1000 0100 0010 0000
```

The original type 1 bit string of 144 bits is compressed to 112 bits.

Step 1: Compare slice-pairs.
For a match, generate B′0′.
For a mismatch, generate B′1′, and do step 2.

Step 2: Compare digits.
For a match, generate B′0′.
For a mismatch, generate B′1′ followed by a copy of the bits in the nonmatching Type 1 digit.

Slice-pairs being compared according to rule 3:						
Reference slice-pair	Type 1 slice-pair		Digit 1	Digit 2	Digit 3	Digit 4
X′0000′	X′1010′	1	1 0001	0	1 0001	0
X′1010′	X′0000′	1	1 0000	0	1 0000	0
X′0000′	X′0000′	0				
X′0000′	X′8040′	1	1 1000	0	1 0100	0
X′8040′	X′2010′	1	1 0010	0	1 0001	0
X′2010′	X′0804′	1	1 0000	1 1000	1 0000	1 0100
X′0804′	X′02FF′	1	0	1 0010	1 1111	1 1111
X′02FF′	X′0000′	1	0	1 0000	1 0000	1 0000
X′0000′	X′0000′	0				

Figure 3-7. Example of Compression Algorithm Using Comparison Rule 3

Outbound 3270DS

This structured field is used to transmit Write, Erase/Write, Erase/Write Alternate, Erase All Unprotected, or BSC Copy commands as part of a 3270 data stream structured field containing other structured field functions (for example, the Load Programmed Symbols structured field).

Each Outbound 3270DS structured field encountered in the data stream is processed before operations are started on a succeeding structured field.

Table 3-10 shows the format of the Outbound 3270DS structured field.

Table 3-10 (Page 1 of 2). Format of Outbound 3270DS Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2		X'40'	Outbound 3270DS identifier
3		X'00'	Mandatory and checked. Any other value is rejected with SNA sense code X'1001' or non-SNA Op Chk.

Table 3-10 (Page 2 of 2). Format of Outbound 3270DS Structured Field

Byte	Bit	Content	Meaning
4			3270 command codes. Byte 4 values are checked. Any value other than those shown results in rejection with SNA sense code X'1001' or non-SNA Op Chk. Error checking for the 3270 command specified is the same as for the command when not enclosed in a structured field.
		X'F1'	Write
		X'F5'	Erase/Write
		X'7E'	Erase/Write Alternate
		X'6F'	Erase All Unprotected
		X'F7'	Copy (BSC)
5			Byte 5 contains the WCC for the Write command (X'F1', X'F5', X'7E'), or the copy control character (CCC) for the BSC Copy command (X'F7').
6			The *From* address for the BSC Copy command, or the start of a 3270 data stream order and data associated with the Write commands.
7−*n*			Orders and data continued (Write commands)

Notes:

1. If bytes 3 and 4 are missing, a SNA sense code of X'1001' or a non-SNA Op Chk is returned.
2. If no WCC is defined, no erasing or resetting occurs.
3. Erase/Write and Erase/Write Alternate do not change the screen size. Use the Erase/Reset structured field to do this.

The BSC Copy command must meet the following requirements to be valid in an Outbound 3270DS structured field. An Op Chk will be returned if they are not met.

- The communication must be BSC.
- The Outbound 3270DS structured field carrying the BSC Copy command must be the last structured field in the transmission.

The same rules apply to the BSC Copy command in the Outbound 3270DS structured field as cited for the command when used in a non-structured field 3270 data stream.

If the Outbound 3270DS structured field carrying the BSC Copy command is sent to an SNA controller, SNA sense code X'1001' results. When an outbound data stream contains multiple Outbound 3270DS structured fields, and thereby multiple WCCs, the WCC functions will be executed as follows:

Function	Description
Reset	Ignored
Start Print	Executed at the end of the transmission, after the write operation has been completed. Only the last structured field in the transmission may have a WCC that specifies Start Print. If the Start Print bit is set in any of the other structured fields, the WSF is rejected with SNA sense code X'1001' (RU data error) or non-SNA Op Chk.

Sound Alarm	Executed for each structured field at the end of the operation specified for the structured field.
Keyboard Restore	Examined for each structured field and noted if set to restore. The keyboard is unlocked if the WCC byte in one of the Outbound 3270DS structured fields is set to unlock. The keyboard is unlocked until the end of transmission is processed.
Reset MDT	Executed for each structured field containing a Write command, prior to writing any data or executing any orders in the data stream. The bit is ignored on an Erase/Write or Erase/Write Alternate command.

Present Absolute Format

The currently assigned group directory is searched for the format name specified in this structured field. If the specified format name is found, the stored format data is passed to outbound data stream processing for presentation on the display screen.

Table 3-11. Format of Present Absolute Format Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2		X'4B'	Present absolute format identifier
3		X'00'	Partition ID — Must be zeros
4			Format Presentation Command:
		X'F1'	Write — The data associated with the named format is written to the buffer of the specified partition.
		X'F5'	Erase/Write — The buffer of the specified partition is cleared, and the data associated with the named format is written to the buffer of the specified partition (see note 1).
		X'7E'	Erase/Write Alternate — Same action as an Erase/Write (see note 1).
5			WCC byte
6 – nn			Format name (see note 2)

Notes:

1. Neither the Erase/Write nor Erase/Write Alternate command alters the screen size when sent within a Present Absolute Format Structured Field. To alter the screen size, the host application must send an Erase/Write or Erase/Write Alternate command before it sends Present Absolute Format.
2. The Local Format Storage feature ignores periods in all format names. The periods are deleted and the remainder of the name is concatenated (for example, ABC.12 becomes ABC12).

Present Relative Format

The Present Relative Format Structured Field invokes the named format as does the Present Absolute Format structured field. The difference is that the Present Relative Format increments the buffer addresses in the format data by the value specified in the Format Offset Value field (bytes 4 and 5) before presenting the format on the display screen.

Byte	Bit	Content	Meaning
0,1			Length of structured field
2		X'4C'	Present relative format identifier
3		X'00'	Partition ID — Must be zeros
4,5			Format Offset Value
6			Format Presentation Command:
		X'F1'	Write — The data associated with the named format is written to the buffer of the specified partition.
		X'F5'	Erase/Write — The buffer of the specified partition is cleared and the data associated with the named format is written to the buffer of the specified partition (see note 1).
		X'7E'	Erase/Write Alternate — Same action as an Erase/Write (see note 1).
7			WCC byte
8–nn			Format name (see note 2)

Table 3-12. Format of Present Relative Format Structured Field

Notes:

1. Neither the Erase/Write nor Erase/Write Alternate command alters the screen size when sent within a Present Relative Format Structured Field. To alter the screen size, the host application must send an Erase/Write or Erase/Write Alternate command before it sends Present Relative Format.
2. The Local Format Storage feature ignores periods in all format names. The periods are deleted and the remainder of the name is concatenated (for example, ABC.12 becomes ABC12).

Read Partition (Query/Query List)

This structured field provides the mechanism for a host application program to inquire as to the color, highlighting, usable area, reply modes, and symbol-set characteristics of a terminal and to receive a reply. This field is valid only in outbound data streams and must be the only or last structured field in a WSF transmission. The format of the Read Partition (Query/Query List) structured field is shown in Table 3-13.

Table 3-13 (Page 1 of 2). Format of Read Partition (Query/Query List) Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2		X'01'	Structured field type
3		X'FF'	Identifies this partition as a Query
4		X'02'	Query
		X'03'	Query List — Bytes 5 and 6–n must be present.
5	0,1		Request Type — Present when byte 4=X'03'.
		B'00'	Only list (see note 1)
		B'01'	Query Equivalent + List (see note 2)
		B'10'	All Query replies (see note 3)
		B'11'	Reserved
	2–7	B'00 0000'	Reserved

Table 3-13 (Page 2 of 2). Format of Read Partition (Query/Query List) Structured Field

Byte	Bit	Content	Meaning
6 − *n*		QCODE(s)	QCODE(s) identifies the type(s) of Query Reply requested. The QCODE is found in byte 3 of each Query Reply.

Notes:

1. B'00' – Indicates that the only replies being requested are those specified in bytes 6 − n. If bytes 6 − *n* are not present, then a Null Query Reply is returned.
2. B'01' – Indicates that all the replies that would be sent, are in addition to those (if any) specified in bytes 6 − *n*.
3. B'10' – Indicates that all the replies supported will be sent.

If bytes 3 and 4 do not exist or bytes exist after byte 4 for Query, an Op Chk or sense code X'1001' is returned. If byte 3 does not contain X'FF' or byte 4 does not contain X'02' or X'03', an Op Chk or sense code X'1001' is returned. If the SNA outbound chain does not contain a change direction (CD) indicator or does contain an end bracket (EB) indicator, the chain is rejected with negative response X'0829'.

Processing in an SNA Environment

For an SNA environment, Read Partition (Query and the Query Reply) is processed as follows.

The Read Partition (Query) is rejected if any of the following is true:

- The SLU is in a retry state.
- The SLU is not in SNA receive (RCV) or contention (CONT) state.
- The Read Partition is not the last structured field in the RU chain.
- The chain containing the RU does not specify CD or specifies EB.
- Byte 3 of the query is not X'FF'.

When the Read Partition is not rejected, it is processed as follows:

- The time indicator is displayed.
- INOP is set to Query.
- The data is transmitted inbound.
- The SLU is placed in RCV state.
- The SLU is placed in retry-read state.

Processing in a BSC or Local Attachment Environment

If the device is in normal-read state, the Read Partition (Query and Query Reply) is processed as follows:

1. The time indicator is displayed.
2. INOP is set to Query.
3. For BSC:
   a. The device prepares to generate the required inbound data stream.
   b. The device is placed in data-pending-read state.
   c. A later poll causes the data to be transmitted and the device to be placed in retry-read state.
4. For local attachment (non-SNA):
   a. A channel attention occurs.
   b. The device is placed in data-pending-read state.

c. A later read command causes the data to be transmitted and the device to be placed in retry-read state.

If the device is in data-pending-enter state or retry-enter state, then:

1. The outstanding enter data is stacked.
2. The X-clock condition remains in effect.
3. INOP is set to Query.
4. For BSC:
   a. The device prepares to generate the required inbound data stream.
   b. The device is placed in data-pending-stacked-enter state.
   c. A later poll causes the query reply data to be transmitted inbound and the device to be placed in retry-stacked-enter state.
5. For local attachment (non-SNA):
   a. A channel attention occurs.
   b. The device is placed in data-pending-stacked-enter state.
   c. A later Read Modified command causes the data to be transmitted and the device to be placed in retry-stacked-enter state.

Select Format Group

This structured field specifies the name of the group directory that is to be searched by subsequent Present Absolute Format and Present Relative Format requests.

Table 3-14. Format of Select Format Group Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2		X'4A'	Select format group identifier
3		X'00'	Partition ID — Must be zeros
4–nn			Format group name (see Note)

Note: This group name remains in effect until reset or replaced by a later Select Format Group structured field. If a Present Absolute Format or Present Relative Format request is made before a format group is selected, the request is rejected with a negative response containing sense code X'1009'.

Select Intelligent Printer Data Stream (IPDS) Mode

This structured field is used to select IPDS mode in the non-SNA environment. When used with the data chain structured field, the Select IPDS Mode must immediately follow it.

Table 3-15. Format of Select IPDS Mode Structured Field

Byte	Bit	Content	Meaning
0,1		X'0006'	Length of structured field
2,3		X'0F83'	Identifies this structured field as Select IPDS Mode
4,5		Flags	Reserved; must be zero

Set Partition Characteristics

This structured field with the appended self-defining parameter is used by the host to enable or disable the operator call-up function of the Local Format Storage feature.

Table 3-16. Format of Set Partition Characteristics Structured Field

Byte	Bit	Content	Meaning
0,1		X'000A'	Length of structured field
2,3		X'0F08'	Set partition characteristics identifier
4		X'FF'	Partition ID — Must be X'FF'
5,6		X'0000'	Flags — Must be zeros

Table 3-17. Format of Set Partition Characteristics Self-Defining Parameter

Byte	Bit	Content	Meaning
0 (7)		X'03'	Length of parameter
1 (8)		X'04'	Operator call-up identifier
2 (9)			Flags:
	0	B'0'	Disable operator-selected formats.
		B'1'	Enable operator-selected formats.
	1	B'0'	Execute the local name search globally.
		B'1'	Execute the local name search qualified by the currently selected group name.
	2–7	B'00 0000'	Reserved — Must be zeros

Set Printer Characteristics

The Set Printer Characteristics (SPC) structured field and the Early Print Complete appendable parameter, allows an application to control the setting and resetting of certain functions within a CUT printer.

Table 3-18 shows the format of the SPC structured field.

Table 3-18. Format of Set Printer Characteristics Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2,3		X'0F84'	Set Printer Characteristics
4	0		Reset All Characteristics (RSTALL)
		B'0'	Off (No reset all)
		B'1'	On (Reset all)
	1–7	B'000 0000'	Reserved — must be zeros
5		X'00'	Reserved — must be zeros

The base can be sent without any self-defining parameters appended when a *reset* of all previously set functions is desired without setting any new ones (RSTALL=ON). If the base is sent without any self-defining parameters appended with *no reset all* indicated (RSTALL = OFF), it is treated as a NOP by the printer and a normal response will be returned.

Note: The base plus any appended self-defining parameters cannot exceed 128 bytes.

The Early Print Complete parameter can be appended to the base portion of this structured field. Early Print Complete allows the loading of the printer buffer and the printing operation to overlap, thereby improving throughput to high-speed printers. Early Print Complete is supported only in non-SNA environments on 3174 Models 1L, 1R, 11L, 11R, 12L, 21L, 21R, 22L, 51R, 61R, 81R, and 91R.

Table 3-19 shows the format of the Early Print Complete Self-Defining Parameter for Set Printer Characteristic structured field.

Table 3-19. Format of Early Print Complete Self-Defining Parameter for SPC Structured Field

Byte	Bit	Content	Meaning
0 (6)		X'03'	Length of parameter
1 (7)		X'01'	Early Print Complete
2 (8)	0,1		SREPC (Set/Reset Early Print Complete)
		B'00'	Enable operator control
		B'01'	EPC Off – Disable operator control
		B'10'	EPC On – Disable operator control
		B'11'	Reserved
	2–7	B'00 0000'	Reserved – must be zeros

Set Reply Mode

The Set Reply Mode structured field defines the format of inbound data streams generated in response to Read commands and specifies the character attributes (Color, Extended Highlighting, Character Sets, and Transparency) that the operator can select for keyed data. Three inbound data stream formats can be set: field mode, extended field mode, and character mode. Character mode also controls operator selection of character attributes.

SF, SBA orders, field attributes, characters, and the graphic escape code (X'08') can be included in inbound field mode transmissions.

SFE, SBA orders, field attributes, extended field attributes, characters, and the graphic escape code (X'08') can be included in inbound extended field mode transmissions.

SFE, SBA, SA orders, field attributes, extended field attributes, characters, character attributes, and the graphic escape code (X'08') can be included in inbound character mode transmissions.

The graphic escape code (X'08') is returned with a character (all modes) when the character attribute value indicates that the APL/Text storage contains the definition of the character.

The Set Reply Mode structured field consists of a length specification, an identifier, a reply mode specification, and, if character mode is specified, attribute type specifications. The length is a minimum of 5 bytes.

Table 3-20 on page 3-29 shows byte and bit content and meaning.

Table 3-20. Format of Set Reply Mode Structured Field			
Byte	**Bit**	**Content**	**Meaning**
0,1			Length of structured field
2		X'09'	Set Reply Mode identifier
3			PID (Partition Identifier)
4		X'00' X'01' X'02'	Field mode Extended field mode Character mode Other values result in negative response (X'1001') or Op Chk.
5−n			Attribute list for character mode (present only if byte 4=X'02'). Any, or all, of the character attribute types − Color, Extended Highlighting, Character Set, and Transparency − may be listed. Values are: X'41' − Extended Highlighting X'42' − Foreground Color X'43' − Character Set X'45' − Background Color X'46' − Transparency Other values result in negative response (X'1001') or Op Chk.

Set Window Origin

The format of the Set Window Origin structured field is as follows:

Table 3-21. Format of Set Window Origin Structured Field			
Byte	**Bit**	**Content**	**Meaning**
0,1		X'0008'	Length of structured field
2		X'0B'	Identifier − Set Window Origin
3			PID (Partition Identifier)
4,5			Row offset of the window origin
6,7			Column offset of the window origin

The Set Window Origin structured field changes the position of the window origin within the presentation space. Only row offset (from the beginning of the presentation space) is allowed.

SNA Character String (SCS) Data

This structured field allows an SCS printer data stream to be included in the same chain of RUs as the other structured fields (Read Partition−Query, Load Programmed Symbols) that can be directed to a printer in an LU type 1 session.

The SCS print stream must be sent via SCS data if any of the other structured fields are included in the transmission.

Note: This structured field is not processed by the controller. It is passed through to the printer.

The syntax is shown in Table 3-22 on page 3-30.

Table 3-22. Format of SCS Data Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2		X'41'	SCS Data identifier
3			PID (Partition Identifier)
4−n		data	The SCS printer data stream

SCS Control Codes

SCS control codes are honored by the 3262, 3287, and 3289 printers when operating as an LU type 1 attached to the 3174. These printers, using SCS support, can perform a variety of page-editing functions. The SCS control codes are:

Code	EBCDIC (Hex)	Name
BS	16	Back Space
BEL	2F	Bell Function
CR	0D	Carriage Return
ENP	14	Enable Presentation
FF	0C	Forms Feed
GE	08	Graphic Escape
HT	05	Horizontal Tab
INP	24	Inhibit Presentation
IRS	1E	Interchange-Record Separator
LF	25	Line Feed
NL	15	New Line
SA	28	Set Attribute
SHF	2BC1	Set Horizontal Format
SLD	2BC6	Set Line Density
SVF	2BC2	Set Vertical Format
TRN	35	Transparent
VCS	04XX	Vertical Channel Select
VT	0B	Vertical Tab

Note: To ensure format integrity, any change in print format should be followed by the appropriate synchronizing event (for example, CR, NL, FF).

The SCS control codes are defined as follows:

Back Space (BS): A format control that moves the print position horizontally one position to the left. If the print position is at column 1, the function is inoperative. Left margin settings are ignored.

Carriage Return (CR): A format control that moves the print position horizontally to the left margin on the same line. If the print position is already at the left margin, the function is inoperative.

Enable Presentation (ENP): A formatting control character used to enable the printing of keyboard input data on the presentation space. This code performs no function on the LU type 1 device, but it is accepted without error response and without affecting format.

Form Feed (FF): A format control that moves the print position to the top and left margin of the next form. If the maximum presentation line (MPL) value has not been set and there is no default value, the MPL defaults to 1, and the print position moves to the left margin of the next line.

Horizontal Tab (HT): A format control that moves the print position horizontally to the next tab stop setting. Horizontal tab stop values are set by using the Set Horizontal Format (SHF) function. If there are no horizontal tab stops set to the right of the current print position, the horizontal tab function results in a space.

Programming Note: Horizontal tab placed after the maximum presentation position (MPP) will cause a space in the first print position on the next line.

Inhibit Presentation (INP): A format control character used to inhibit the printing of keyboard input data. This code performs no function on the LU type 1 device, but it is accepted without error response and without affecting format.

Interrecord Separator (IRS): A separator character, normally used on the LU-SSCP session. If received on an LU-LU session, the IRS defaults to a New Line (NL) function.

Line Feed (LF): A format control that moves the print position vertically down to the next line.

New Line (NL): A format control that moves the print position to the left margin and vertically down to the next line. NL is functionally equivalent to CR followed by LF.

Set Horizontal Format (SHF): A data-defining control used to set the horizontal format controls. These include left and right margins and horizontal tab stops. A 1-byte binary count follows the SHF code that indicates the number of bytes to the end of the SHF string, including the count byte. The first 3 bytes following the count byte define the MPP, the left margin (LM), and the right margin (RM), respectively. Tab stop settings follow the right margin position. All values are expressed as 1-byte binary numbers.

The minimum SHF sequence is 1 byte long, which sets the horizontal format controls to their default conditions. The SHF sequence is:

(SHF)(cnt)(MPP)(LM)(RM)(T1)(T2)...(Tn)

This value is used to define a line length less than, or equal to, the maximum print position. The MPP default value is the maximum print position (132) or the value set up by the printer operator (3262 and 3289).

Programming Note: If the MPP is set to a value greater than the physical page width, data may be lost (for example, printing on the platen or the print head jams at the right margin).

LM specifies the column value of the leftmost print position. The LM also serves as the first horizontal tab stop. Valid LM values are less than, or equal to, the MPP. The LM default value is 1.

RM is not used in printing operations.

T1...Tn are horizontal tab stop settings. The tab stops do not have to be in order. Valid tab stop values are less than, or equal to, the MPP.

Set Line Density (SLD): Specifies the distance to be moved for single-line vertical spacing, as in LF or NL. A 2-byte parameter follows the SLD control code. The first byte, a count field, can be either X'01' or X'02'. A count field of X'01' with no parameter byte will set default print density. The sequence can also be '1BC60200', which will set default value to 6 lines per inch. The second byte specifies the distance in standard typographic points (one point = 1/72 inch). For example, a value of 12 points indicates 6 lines per inch. LPI/Point Values are as follows:

LPI	3[1]	4[1]	6	8
Point Values	24[1]	18[1]	12	9

Programming Note: If the SLD is changed without a corresponding change in the MPL (and vice versa), printing may occur on the form fold.

When the logical unit controlling a 3287 or 3289 receives an LU type 1 Bind, the 3287 or 3289 will default to a line density of 6 lines per inch.

Density values not implemented are rejected with a negative response of X'1005', parameter error. Line densities defined for the 3287 and 3289 printers are as follows:

LPI	6	8	4[1]	3[1]
SLD	12	9	18[1]	24[1]

Set Line Density (SLD) - 3262: SLD sets the number of print lines per inch by specifying the distance to be moved for single-line vertical spacing, as in LF or NL. This function changes values that were previously set during printer initialization or by pressing the CHANGE LPI key of the operator's panel.

A 2-byte parameter follows the SLD control code. The first byte, a count field, may be either X'01' or X'02'. The second byte, a line density parameter (lpi), specifies the distance to be moved for single-line vertical spacing. The value may be:

X'18' For 3 lpi
X'12' For 4 lpi
X'0C' For 6 lpi
X'09' For 8 lpi.

A count field of X'01' with no following line density parameter byte sets the default print line density to the current operator panel setting (either 6 or 8 lpi). A count field of X'11' (host system default) sets the line density to 6 lpi.

The following examples show how to use the SLD function:

2BC60218 = 3 lpi
2BC60212 = 4 lpi
2BC60209 = 8 lpi
2BC6020C = 6 lpi
2BC601 = default to op panel setting.

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1 3289 only

If no SLD value is specified, the printer uses the operator-selected value.

Set Vertical Format (SVF): Sets vertical format controls, including the MPL, top margin (TM), bottom margin (BM), and vertical tab stops. A 1-byte count field follows the SVF character to indicate the number of bytes, including the count byte, in the SVF string.

The first three values following the count in an SVF string are the MPL, the TM, and the BM, in that order. A zero for any of these values results in the function assuming the default value. Vertical tab stop values follow the bottom margin. All values are expressed as 1-byte binary numbers. The SVF sequence is:

(SVF)(cnt)(MPL)(TM)(BM)(T1)...(Tn)

MPL defines the page depth. All values between 0 and 102 (3287) or 0 and 127 (3289) are valid. A page depth defined by the SVF takes precedence over the device default value. The MPL default value for the 3287 is 1; the MPL default value for the 3289 is either 1 or the contents of the Selector switch. If the Selector switch is set to 00 and power is turned on, the MPL defaults to 1; if the Selector switch is set to 00 and the Reset switch is pressed, the MPL remains unchanged.

Programming Note: If the MPL is set to a value greater than the physical page length, printing may occur on the form fold.

TM specifies the line value used as the top representation line on the page. The top margin is also the first vertical tab stop. Valid TMs are less than, or equal to, the MPL. The default TM value is 1.

After the TM is initialized, it should not be changed because a TM change requires operator intervention to align the physical page. The printer cannot detect physical line 1; therefore, it is assumed that the operator has aligned physical line 1 to the printer's logical line 1. If a printer must be used in an intermixed SCS/non-SCS environment, the operator should always set the physical page line 1 at the first line to be printed, and the TM should always be set to a value of 1.

BM specifies the line value that, if exceeded, causes an automatic skip to a new page. BM must be greater than, or equal to, TM, and less than, or equal to, the MPL. The default BM value is the MPL value.

Transparent (TRN): A data-definition character which provides for the transmission of data in transparent mode. A 1-byte binary value follows the TRN code which specifies the number of bytes of transparent data to follow. The length does not include the length byte. Transparent data is user-defined and is not scanned for SCS control. Valid graphics are printed. Invalid graphics are printed as hyphens (-).

Vertical Channel Select (VCS): A device control code that allows selection of one of 12 vertical channels to control vertical format. The first character of the code is the select code, followed by a function value which selects the appropriate channel. When necessary, printers default the VCS code to an LF function. The 3287 always executes LF. The 3262 or 3289 skips to the channel, as specified by VCS.

Vertical Tab (VT): A format control that moves the print position vertically down to the next vertical tab stop setting. Vertical tab stops are set by using the Set Vertical Format (SVF) function. If there are no vertical tab stops below the current position, the VT function results in an LF function.

Graphic Escape (GE): A character selection code that immediately precedes a code point and is used to indicate that the character to be displayed or printed is to be selected from the character set stored in Read Only Storage (ROS) 1. (The base character set for the machine is stored in ROS 0.)

Set Attribute (SA): An attribute-defining code used to associate the color, extended highlighting, and programmed symbols attribute types with a character or string of characters. The SA code can also reset the attributes defined for a character or string of characters to those of the field in which the character(s) appear.

Outbound/Inbound Structured Fields

The following structured fields can be transmitted either from the host to the 3174 or from the 3174 to the host. The structured field is the same format in either direction.

Data Chain

This section describes the Data Chain structured field and the sequence that transmissions follow when using this field. It also discusses SNA protocols and their relationship to data chaining.

The SNA protocols provide a chaining function that allows a long message to be divided into small transmissions to match the capability of a device. The division can be done without regard to structured field or control-sequence boundaries. Non-SNA protocols do not provide this function. However, a chaining-like function is provided at the data stream level by 3174 support of the Data Chain and Query Reply (Data Chaining) structured fields. The data chaining is provided by the Data Chain structured field; the Query Reply provides the way for an application to inquire as to support of data chaining.

The Data Chain structured field uses the group parameter to provide the chaining control. The data to be sent (which must be in structured field form) can be divided without regard to structured field or control-sequence boundaries, with the following exceptions:

- The Data Chain structured field itself
- The Select IPDS structured field
- The Read Partition structured field
- The 3270DS structured field carrying a BSC Copy command
- The 3270DS structured field carrying a Write, Erase Write, or Erase Write/Alternate command with start print.

The length value, X'06', of Data Chain covers only the Data Chain structured field; that is, it does not include the rest of the data in the transmission.

When chaining, the Data Chain structured field starting the first transmission in the chain has its group parameter set = *Begin*. In the next transmission through the next-to-last transmission, the group parameter is set = *Continue*. In the last transmission of the chain, the group parameter is set = *End*. In the first transmission, a structured field must start immediately following the Data Chain structured field. In subsequent transmissions, however, the data following the Data Chain structured field may be a continuation of a structured field started in a previous transmission. That is, the length count of a structured field may span transmissions. If the length count of a structured field is not satisfied at the end of a transmission (excluding the last transmission of a data chain), the remainder of the data needed to satisfy the count starts immediately after the Data Chain structured field in the next transmission. The length count of a structured field could, if needed, carry across a number of transmissions.

Any of the following cause termination of the data chain and rejection of the transmission:

- Receiving a Data Chain structured field with the group parameter set to *Continue* or *End* when not in the in-chain state
- Receiving a Data Chain structured field with the group parameter set to *Begin* or *Only* when not in the between-chains state
- Receiving a transmission, when in the in-chain state, that starts with any 3270 command except a Copy (BSC only), a WSF (followed by a valid Data Chain structured field), or an Erase Write or Erase Write Alternate command (with WCC = Reset)
- Any Op Chk.

The format of a data chain structured field is used to provide a data chaining function in the non-SNA environment. Data Chain flows outbound only and is valid under the following conditions:

- A data chain structured field must be the first structured field in a WSF transmission.
- If *Begin* or *Only* is indicated, the chain state must be between chains.
- If *Continue* or *End* is indicated, the chain state must be in chain.

Table 3-23 shows the format of the data chain structured field.

Table 3-23. Format of Data Chain Structured Field

Byte	Bit	Content	Meaning
0,1		X'0006'	Length of structured field
2,3		X'0F21'	Data chain
4	0	B'0'	Reserved – must be zero
	1,2		Group parameter:
		B'00'	Continue
		B'01'	End
		B'10'	Begin
		B'11'	Only
	3,4		Inbound Control:
		B'00'	No change
		B'01'	Enable inbound data chaining
		B'10'	Disable inbound data chaining
		B'11'	Reserved
	5–7	B'000'	Reserved – Must be zeros
5		X'00'	Reserved – Must be zeros

Destination/Origin

This structured field is used to identify the destination (outbound data stream) or origin (inbound data stream) of structured fields that follow in a multi-device workstation implementation. The Destination/Origin ID in bytes 6,7 identifies the auxiliary device.

Table 3-24. Format of Destination/Origin Structured Field

Byte	Bit	Content	Meaning
0,1		X'0008'	Length of structured field
2,3		X'0F02'	Destination/Origin identifier
4			Flags
	0,1	B'00'	Enables input mode
		B'01'	No change to input mode
		B'10'	Disables input mode
		B'11'	Reserved
	2–7	B'00 0000'	Reserved – Must be zeros
5		X'00'	Flags – Must be zeros
6,7			Destination/Origin ID (DOID) – This value is the DOID reported in the self-defining parameter (bytes 2 and 3) of the auxiliary device query reply. See "Query Reply (Format Storage Auxiliary Device)" on page 3-46 or "Query Reply (OEM Auxiliary Device)" on page 3-51.

OEM Data

This structured field is used for both inbound and outbound data flows. The OEM data structured field must be preceded by the destination/origin structured field.

Table 3-25. Format of OEM Data Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2,3		X'0F1F'	OEM Data identifier
4		X'00'	Reserved – Must be zeros
5			Spanning Flags
	0,1	B'00'	Continue Span
		B'01'	End Span
		B'10'	Begin Span
		B'11'	Only in Span
	2–7	B'00 0000'	Reserved – Must be zeros
6		X'00'	Reserved – Must be zeros
7-n			Data (OEM formatted)

OEM data can be sent as Begin, Continue, End, or Only in Span. During spanning, the AEA does not accept 3270 keystrokes from the device, and only the OEM data is written to the device. Begin Span also empties the AEA receive queue. See the *3174 AEA Description and Reference* for more details.

Inbound Structured Fields

This section describes the inbound structured fields, which are structured fields sent from the 3174 to the host. Most of the inbound structured fields are solicited and take the form of a Query Reply, explained on page 3-39. Others are replies to specific outbound structured fields from the host, and do not take the form of the Query Reply. This section shows the structured fields for both.

Exception/Status

This structured field (Table 3-26) with one of four possible appended self-defining parameters, allows the 3174 to report exception/status information. This structured field is returned after each Load Format Storage structured field is processed to report the success or failure of the transmission.

Table 3-26. Format of Exception/Status Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2,3		X'0F22'	Exception/Status identifier
4		X'00'	Partition ID — Always zeros
5	0	B'0'	Status not available — This bit is always set to zero.
	1–7	B'000 0000'	Reserved — Always zeros
6		X'00'	Flags — Always zeros

Table 3-27 shows the self-defining parameter that is appended to report a failure of the format load.

Table 3-27. Format of Auxiliary Device Exception Self-Defining Parameter

Byte	Bit	Content	Meaning
0 (7)		X'06'	Length of parameter
1 (8)		X'01'	Auxiliary device exception identifier
2,3 (9,10)		X'0000'	Reserved — Always zeros
4,5 (11,12)			Exception condition:
		X'0801'	Invalid/unrecognized DOID in the Destination/Origin structured field
		X'0805'	Insufficient storage to complete load
		X'0806'	Format/Group Name not specified
		X'0807'	Data error

Table 3-28 shows the self-defining parameter that is appended to report the success of the format load.

Table 3-28. Format of Auxiliary Device Status Self-Defining Parameter

Byte	Bit	Content	Meaning
0 (7)		X'04'	Length of parameter
1 (8)		X'02'	Auxiliary device status identifier
2,3 (9,10)		X'0000'	Format successfully loaded

Table 3-29 shows the self-defining parameter that is appended in response to the Request Status Summary operand (byte 6) of the Load Format Storage structured field.

Table 3-29. Format of Request Summary Status Self-Defining Parameter

Byte	Bit	Content	Meaning
0 (7)		X'0C'	Length of parameter
1 (8)		X'04'	Summary status identifier
2,3 (9,10)			Number of groups currently defined
4,5 (11,12)			Total number of formats currently loaded
6,7 (13,14)			Total number of local names currently used
8−11 (15−18)			Amount of format storage space available

Table 3-30 shows the self-defining parameter that is appended in response to the Request Group Status operand (byte 6) of the Load Format Storage structured field.

Table 3-30. Format of Request Group Status Self-Defining Parameter

Byte	Bit	Content	Meaning
0 (7)		X'14'	Length of parameter
1 (8)		X'05'	Group status identifier
2−17 (9−24)			Group name
18,19 (25,26)			Number of formats in this group

Query Reply

For some terminals, the controller sends a series of query replies on behalf of the terminal as shown in Table 3-31. For other terminals that can operate in 3270 mode, the controller also sends the series of query replies shown in the following table. However, when those other terminals operate in LU-1 mode or are DFTs, the terminal provides its own series of query replies. Newer terminals provide all the query replies for the 3174 (although the controller does some limited modification before sending).

The response by the 3174 to the Read Partition – Query function is the transmission of a series of structured fields indicating the field and character attributes, the screen or page size and characteristics, the symbol sets, the reply modes, or features available on the addressed terminal. Since each structured field contains its own unique identification, the order in which the fields are transmitted is not important. An example follows. After the example, the individual structured fields are discussed.

Table 3-31 shows the reply to a Read Partition – Query structured field for a controller with a terminal having an Extended Attribute Buffer (EAB).

Table 3-31. Query Reply Response for Terminals with EAB

Query Reply	Function
X'88' or X'0601008B6000'	AID (X'88' is used for non-SNA, LU-2, and LU-3 sessions. A Function Management Header Type1 [FMH1], X'0601008B6000', is required to transmit the Query Reply structured field inbound from a printer in an LU type 1 session. The FMH1 is prepared by the printer.)
X'00168186z008 (16 z bytes)'	Color
X'000F818704 (8 z bytes)'	Highlighting
X'00178181z100 (17 z bytes)'	Usable area
X'00078188000102'	Reply mode
X'00008185B000 (7 z bytes)'	Character sets
X'03'	Number of bytes in descriptor
X'000000'	ROS 0 (ROS = Read-only storage)
X'0100F1' (if present)	ROS 1
X'02zztt' (if present)	RWS 2-PSA (RWS = Read/write storage)
X'03zztt' (if present)	RWS 3-PSB
X'04zztt' (if present)	RWS 4-PSC
X'05zztt' (if present)	RWS 5-PSD
X'06zztt' (if present)	RWS 6-PSE
X'07zztt' (if present)	RWS 7-PSF
X'001181A60000 (11 z bytes)'	Implicit partition

Where:

z is a variable of the structured field that depends on the terminal that is attached to the controller.

tt is the symbol set ID for sets that have been host-loaded. It is returned as X'FF' if the set is not loaded.

If a terminal has an Extended Character Set Adapter (ECSA) and ROS, or if RWS is not present in an ROS or RWS location, the descriptor for that location is not returned.

See Table 3-32 for an example of the data sent in response to a Read Partition – Query structured field for a 3174 with an attached terminal without an EAB.

Table 3-32. Query Reply Response for Terminals without EAB

Query Reply	Function
X'88'	Attention Identifier
X'00178181z100 (17 z bytes)'	Usable area
X'001181A60000 (11 z bytes)'	Implicit partition

Where:

z is a variable of the structured field that depends on the device that is attached to the controller.

A Query Reply inbound data stream consists of AID byte X'88', or the FMH1 noted above, defining what follows as an inbound-structured field data stream, followed by the structured fields. Each structured field is of the general format: *length type data*.

Note: Query Reply is the only structured field transmission sent inbound from a printer in LU type 3 session. The inbound-structured field types from a printer in an LU type 1 session is dependent on the data stream profile that has been selected. Consult the appropriate printer publications for additional information.

The following query reply structured fields are generated by the attached terminal and are passed to the controller for transmission to the host system:

- Alphanumeric Partition
- Auxiliary Device
- Begin/End of File
- Character Sets
- Color
- Data Chaining
- Data Streams
- Device Characteristics
- IBM Auxiliary Device
- Highlighting
- Null
- OEM Auxiliary Device
- Paper Feed Technique
- Save/Restore Format
- Settable Printer Characteristics
- Summary
- Useable Area
- 3270 IPDS.

Refer to the appropriate display or printer publication for descriptions of these structured fields.

Query Reply (Alphanumeric Partition)

This query reply and self-defining parameter define the characteristics of partition support for devices with the Extended Function feature. Table 3-33 shows the format for the Query Reply and Table 3-34 shows the format for the self-defining parameter.

Table 3-33. Format of Query Reply (Alphanumeric Partition) Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field.
2		X'81'	Query reply identifier.
3		X'84'	Partitions identifier.
4[1]		X'00'	The number of partitions supported.
5,6		X'1E00'	Total available partition storage in bytes.
7[2]	0	B'1'	Vertical windowing supported.
	1	B'0'	Horizontal windowing *not* supported.
	2	B'0'	Reserved.
	3	B'0'	All-points addressability *not* supported.
	4	B'0'	Reserved.
	5	B'0'	Presentation space local copy *not* supported.
	6	B'0'	Modify partition *not* supported.
	7	B'0'	Reserved.

[1]For the 3174, this byte will always be X'00'. This indicates that only 1 partition is supported and the partition's PID (defined in the Create Partition Structured field) must be 0.

[2]For byte 7, the controller performs a logical AND operation on the data returned by the terminal, using the mask indicated in byte 7. Both the controller and the terminal must support the functions listed for the query reply to be able to indicate to the host program that the function is supported.

Table 3-34. Format of Query Reply (Alphanumeric Partition) Self-Defining Parameter

Byte	Bit	Content	Meaning
0 (8)		X'07'	Length of parameter
1 (9)		X'02'	Buffer allocation parameter
2 (10)		X'01'	Character multiplier
3 (11)		X'00'	Row overhead
4 (12)		X'00'	Column overhead
5,6 (13,14)		X'0000'	Fixed overhead

Query Reply (Auxiliary Device)

This query reply (Table 3-35) indicates support of one or more auxiliary devices on the respective LU/device address. It is returned for LU address 1.

Table 3-35. Format of Query Reply (Auxiliary Device) Structured Field

Byte	Bit	Content	Meaning
0,1		X'0006'	Length of structured field
2		X'81'	Query Reply
3		X'99'	Auxiliary device (AUXDA) identifier
4,5		X'0000'	Reserved — Always zeros

Query Reply (Character Sets)

This query reply indicates the number and kind of symbol sets (both user-defined and IBM-defined Programmed Symbol sets) present in the terminal. The terminal storage ID is given with an indication of whether it is associated with a symbol set.

The structured field consists of a 12-byte base and up to eight 3-byte storage descriptors, one for each storage area present in the terminal. A descriptor defines one terminal storage and symbol-set characteristics. One or more descriptors follow byte 12 of the structured field.

The format of the Query Reply (Character Sets) structured field is shown in Table 3-36. Table 3-37 on page 3-44 shows the descriptors.

Table 3-36 (Page 1 of 2). Format of Query Reply (Character Sets) Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2		X'81'	Query reply identifier
3		X'85'	Identifies this query reply as Character Sets.
4	0	B'0'	Graphic escape not supported
		B'1'	Graphic escape supported
	1	B'0'	Multiple LCIDs are not supported
		B'1'	Multiple LCIDs are supported
	2	B'0'	Load Programmed Symbols structured field not supported
		B'1'	Load Programmed Symbols structured field supported
	3	B'0'	Load Programmed Symbols structured field extension not supported
		B'1'	Load Programmed Symbols structured field extension supported
	4	B'0'	Multiple character slot sizes are not supported
		B'1'	Multiple character slot sizes are supported
	5	B'0'	2-byte character sets are not supported
		B'1'	2-byte character sets are supported
	6	B'0'	CGCSGID not present
		B'1'	CGCSGID present
	7	B'0'	Reserved

Table 3-36 (Page 2 of 2). Format of Query Reply (Character Sets) Structured Field			
Byte	**Bit**	**Content**	**Meaning**
5	0	B'0'	Reserved – Must be zero
	1	B'0'	Character size specified in the Load Programmed Symbol Sets structured field must match the character slot size specified in the query reply.
		B'1'	Character size specified in the Load Programmed Symbol Sets structured field need not match the character slot size specified in the query reply.
	2	B'0'	Reserved – Must be zero
	3–7		Reserved
6			Default dot matrix block width
		X'00'	3262
		X'0A'	3268, 3287
		X'09'	Display
7			Default dot matrix block height
		X'00'	3262
		X'08'	3268, 3287
		X'10'	Display
8–11		X'40000000'	Display supports Load PS data format type 1. (Value will be X'60000000' if the 3174 has been customized to support decompression.)
		X'04000000'	Printer supports Load PS data format type 5. (Value will be X'06000000' if the 3174 has been customized to support decompression.)
12			Length of each symbol set descriptor shown in Table 3-37 on page 3-44.

Table 3-37. Descriptors for Query Reply (Character Sets) Structured Field

Byte	Bit	Content	Meaning
0			Terminal storage identification: X'00' to X'07':
		X'00'	Read-only storage containing I/O interface code symbol set.
		X'01'	Read-only storage containing APL/Text symbol set if feature present.
		X'02' to X'07'	Host-loadable terminal storages for Programmed Symbol sets. These storages are specified in the Load PS structured field. If a terminal is configured for MLT, the Programmed Symbol set is owned only by the primary session.
1	0	B'0'	Read-only storage
		B'1'	Loadable terminal storage
	1	B'0'	Single-plane storage
		B'1'	Triple-plane storage
	2	B'0'	Symbols are accessed using a 1-byte code.
	3	B'0'	Comparison of the symbol set ID of the symbol set loaded in this storage with the symbol set ID(s) of sets loaded in the printer is allowed (copy operations).
		B'1'	Comparison is not allowed.
	4−7	B'0000'	Reserved
2			Symbol set ID. The ID is associated with the terminal storage ID contained in byte 0. Value range is X'40' through X'EF' for valid symbol ID. A value of X'FF' indicates that the storage is not associated with any symbol set.
3−6			CGCSGID − Present only if byte 4, bit 6 in the base query reply is set to 1. See note.

Note: The CGCSGID (Coded Graphic Character Set Global Identifier) is made up of the 2-byte character set number and the 2-byte code page number. For example, a CGCSGID of X'02B90025' represents CECP character set 697 and code page number 037 for the English (US) Code Page.

For a list of the CGCSGIDs, see the *3174 Character Set Reference*.

Query Reply (Color)

This query reply indicates the color attribute values recognized by the addressed terminal and returned in an inbound data stream. Eight pairs of bytes, one pair for each of the possible color attribute values, are returned to the host. The first byte of a pair contains the color attribute value accepted; the second byte contains the same value if that color is supported by the terminal, or the default color attribute value (X'00') if it is not. There is one exception: the second byte of the pair defining the default color attribute for the terminal indicates the default color that will be supported.

Tables 3-38 and 3-39 show the format of the Query Reply (Color) structured field.

Table 3-38 (Page 1 of 2). Format of Query Reply (Color) Structured Field

Byte	Bit	Content	Meaning
0,1		X'0016'	Length of structured field
2		X'81'	Query Reply structured field ID

Table 3-38 (Page 2 of 2). Format of Query Reply (Color) Structured Field			
Byte	**Bit**	**Content**	**Meaning**
3		X'86'	Identifies this query reply as color
4	0	B'0'	Reserved
	1	B'0'	Printer only — Black ribbon not loaded
		B'1'	Printer only — Black ribbon loaded
	2−7	B'00 0000'	Reserved
5		X'08'	Number of color pairs
6−21			Terminal-dependent (see Table 3-39 on page 3-45)

Table 3-39. Examples of the Format of Bytes 6—21 of Query Reply (Color) Structured Field

	1st Byte	2nd Byte			
Byte	**Possible Attribute Value**	**3178, 3278**	**3262, 3268, 3287-1, -2**	**3287-1C, -2C**	**Full Color 3279**
6,7	X'00'	X'F4'	X'F7'	X'F7'	X'F4'
8,9	X'F1'	X'00'	X'00'	X'F1'	X'F1'
10,11	X'F2'	X'00'	X'00'	X'F2'	X'F2'
12,13	X'F3'	X'00'	X'00'	X'00'	X'F3'
14,15	X'F4'	X'00'	X'00'	X'F4'	X'F4'
16,17	X'F5'	X'00'	X'00'	X'00'	X'F5'
18,19	X'F6'	X'00'	X'00'	X'00'	X'F6'
20,21	X'F7'	X'00'	X'00'	X'F7'	X'F7'

As an example, the following Query Reply (Color) structured field might be transmitted for a 3287 Model 1C and 2C printer:

```
X'00168186000800F7F1F1F2F2F300F4F4F500F600F7F7'
```

Query Reply (Data Chaining)

This query reply indicates that data chaining is supported in the non-SNA environment. Table 3-40 shows the format of this structured field.

Table 3-40. Format of Query Reply (Data Chaining) Structured Field			
Byte	**Bit**	**Content**	**Meaning**
0,1		X'0006'	Length of structured field
2		X'81'	Query Reply
3		X'98'	Data chaining identifier
4		X'80'	Only value supported
5		X'00'	Reserved — must be zeros

Query Reply (Data Streams)

This query reply is used in the SNA LU-1 environment to inquire as to what data streams are supported by the addressed device. Table 3-41 shows the format of this structured field.

Table 3-41. Format of Query Reply (Data Streams) Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structure field (>4)
2		X'81'	Query Reply
3		X'A2'	Data streams
4−n			List of data stream identifiers. The first identifier (byte 4) is the default data stream:
		X'00'	SCS data stream (default)
		X'02'	IPDS

Query Reply (Format Presentation)

This query reply (Table 3-42) indicates that the LU/device supports format presentation. It is returned for all CUT-mode terminals.

Table 3-42. Format of Query Reply (Format Presentation) Structured Field

Byte	Bit	Content	Meaning
0,1		X'0004'	Length of structured field
2		X'81'	Query Reply
3		X'90'	Format presentation identifier

Query Reply (Format Storage Auxiliary Device)

This query reply (Table 3-43) and self-defining parameter indicate support of the Format Storage Auxiliary Device (storage area that can be loaded with 3270 data stream display formats via the Load Format Storage Structured Field). It is returned for LU address 1.

Table 3-43 (Page 1 of 2). Format of Query Reply (Format Storage Auxiliary Device) Structured Field

Byte	Bit	Content	Meaning
0,1		X'0010'	Length of structured field
2		X'81'	Query Reply
3		X'94'	Format storage auxiliary device identifier

Table 3-43 (Page 2 of 2). Format of Query Reply (Format Storage Auxiliary Device) Structured Field

Byte	Bit	Content	Meaning
4			Flags:
	0	B'0'	Only one format is allowed per transmission.
	1		Format Storage Utilization (see note 1):
		B'0'	No formats are loaded in storage.
		B'1'	Formats are loaded in storage.
	2		Operator-Selected Formats Default — Represents the value entered for customizing question 179:
		B'0'	Disabled
		B'1'	Enabled
	3		Format Storage Format Management (see note 2):
		B'0'	Formats presented by this host are managed only by this host.
		B'1'	Formats presented by this host may be managed by other applications or hosts.
	4–7	B'0000'	Reserved — Always zeros
5		X'00'	Flags — Always zeros
6,7		X'0000'	Reserved — Always zeros
8,9		X'4000'	LIMOUT (see note 3)

Notes:

1. If formats for this host are managed by a different host or application (bit 3 set to 1), this bit is always set to 1.
2. If this host is configured to load over-riding formats (see "LFS Feature with Multi-Host Support" on page 17-9), this bit is set to 1, and the size of the format storage space reported in bytes 4 and 5 of the self-defining parameter is the amount of format storage allocated to this host.

   If this host is configured to only present formats that are managed by another host or application, this bit is set to 1, and the size of the format storage space reported in bytes 4 and 5 of the self-defining parameter is 0.
3. This value represents the maximum number of bytes that can be contained in the Load Format Storage structured fields in a single transmission. The value of X'4000' imposes a 16K byte maximum.

The self-defining parameter (Table 3-44) is appended to show the amount of storage allocated for format storage.

Table 3-44 (Page 1 of 2). Format of Query Reply (Format Storage Auxiliary Device) Self-Defining Parameter

Byte	Bit	Content	Meaning
0 (10)		X'06'	Length of parameter
1 (11)		X'01'	Direct access
2,3 (12,13)			This value should be used as the Format Storage Auxiliary Device DOID in the Destination/Origin structured field on page 3-36 to identify Format Storage.

Table 3-44 (Page 2 of 2). Format of Query Reply (Format Storage Auxiliary Device) Self-Defining Parameter			
Byte	**Bit**	**Content**	**Meaning**
4,5 (14,15)		 X'0040' X'0080' X'0100' X'0200' X'0400' X'0600'	Space in the 3174 allocated for format storage: 64K 128K 256K 512K 1024K 1536K

Query Reply (Highlighting)

This query reply indicates the highlighting attribute values recognized by the addressed terminal and returned in an inbound data stream. Four pairs of bytes, one pair for each of the possible highlighting attribute values, are returned to the host. The first byte of a pair contains the highlighting attribute value accepted; the second byte contains the same value if that highlighting attribute is supported by the terminal or the default highlighting attribute value (X'00') if it is not. There is one exception: the second byte of the pair defining the default highlighting attribute support indicates the default highlighting that will be supported.

The format of the Query Reply (Highlighting) structured field is shown in Table 3-45. Table 3-46 shows the terminal dependencies of the Query Reply (Highlighting).

Table 3-45. Format of Query Reply (Highlighting) Structured Field			
Byte	**Bit**	**Content**	**Meaning**
0,1		X'000D'	Length of structured field
2		X'81'	Query reply identifier
3		X'87'	Identifies this query reply as highlighting
4		X'04'	Number of highlighting pairs
5–12			Terminal-dependent (see Table 3-46). Possible highlighting attribute values are: X'00' Default X'F0' Normal X'F1' Blink X'F2' Reverse video X'F4' Underscore

Table 3-46. Format of Bytes 5–12 of Query Reply (Highlighting) Structured Field					
	1st Byte	**2nd Byte**			
Byte	**Possible Attribute Value**	**3178**	**3278**	**3262, 3268, 3287-1, -1C, -2, -2C**	**3279**
5,6	X'00'	X'F0'	X'F0'	X'F0'	X'F0'
7,8	X'F1'	X'00'	X'F1'	X'00'	X'F1'
9,10	X'F2'	X'00'	X'F2'	X'00'	X'F2'
11,12	X'F4'	X'00'	X'F4'	X'F4'	X'F4'

Query Reply (Implicit Partition)

This query reply defines unique implicit partition characteristics.

The default and alternate sizes returned in the Implicit Partition Query Reply are:

- For SNA, those established at Bind
- For non-SNA, those in effect at the time the reply is generated.

Table 3-47 shows the format of the Query Reply (Implicit Partition) structured field. The self-defining parameters are shown in Tables 3-48 and 3-49. The elements in Table 3-48 are generated and sent inbound in reply to a query directed to any display station. The elements in Table 3-49 are generated and sent inbound in reply to a query directed to any SNA LU type 3 or any non-SNA printer.

Table 3-47. Format of Query Reply (Implicit Partition) Structured Field

Byte	Bit	Content	Meaning
0,1		X'0011'	Length of structured field
2		X'81'	Query reply
3		X'A6'	Implicit partition identifier
4,5		X'0000'	Reserved

Table 3-48. Implicit Partition Sizes for Display Stations (3278 and 3279)

Byte	Bit	Content	Meaning
0 (6)		X'0B'	Parameter length
1 (7)		X'01'	Implicit partition sizes
2 (8)		X'00'	Reserved
3,4 (9,10)		WD	Width of default implicit partition size in cells
5,6 (11,12)		HD	Height of default implicit partition size in cells
7,8 (13,14)		WA	Width of alternate implicit partition size in cells
9,10 (15,16)		HA	Height of alternate implicit partition size in cells

Table 3-49. Implicit Partition Sizes for Printers

Byte	Bit	Content	Meaning
0 (6)		X'0B'	Parameter length
1 (7)		X'03'	Implicit partition sizes
2 (8)		X'00'	Reserved
3 – 6 (9 – 12)		DPBS	Default printer buffer size in cells
7 – 10 (13 – 16)		APBS	Alternate printer buffer size in cells

The buffer size defines the following printer buffer restrictions:

1. The maximum linear character buffer address that can be explicitly specified in 3270 orders. (This maximum buffer address is 1 less than the buffer size in character cells.)
2. The wrapping point for the transmitted data. If the implied address for data being loaded into the character buffer exceeds the maximum address allowed by buffer size, then the implied address is reset to zero and loading continues from the first buffer location.

Note: For a Bind command with byte 24=0, the buffer sizes are decreased by 256 bytes if the printer has the PS feature.

Query Reply (Null)

This query reply informs the host that the device does not support any of the features or functions that the host inquired about with the Read Partition structured field specifying Query List (QCODE List). If the host queries the device, and the device supports at least one feature or function about which the host queried, then the Null Query Reply is *not* sent to the host.

This query reply must always be sent inbound in reply to a Read Partition structured field specifying Query List.

Table 3-50. Format of Query Reply (Null) Structured Field

Byte	Bit	Content	Meaning
0,1		X'0004'	Length of structured field
2		X'81'	Query Reply identifier
3		X'FF'	Null

Example 1

- A device supports features A, B, and C.
- The host queries for features A, X, and Z.

The device does not send the Null Query Reply. It sends the query reply only for feature A. Thus, the host recognizes that the device does not support features X and Z.

Example 2

- A device supports features A, B, and C.
- The host queries for features X, Y, and Z.

The device sends the Null Query Reply, because the device does not support any of the requested features.

Query Reply (OEM Auxiliary Device)

The OEM auxiliary device query reply has the following format:

Table 3-51. Format of Query Reply (OEM Auxiliary Device) Structured Field

Byte	Bit	Content	Meaning
0,1		X'0024'	Length of structured field
2		X'81'	Query Reply
3		X'8F'	OEM Auxiliary Device identifier
4		X'00'	Reserved – Must be zeros
5			Device recognized data stream
6–13		X'E3C5D2F4 F2F0F540' X'C4C5C3F2 F4F04040'	Device Type (see Note): Tektronix 4205 DEC VT240/1**
14–21		X'E3C5D2F4 F2F0F540' X'C4C5C3F2 F4F04040'	User Assigned Name (see Note): Tektronix 4205 DEC VT240/1

Note: The device type and user assigned name are the same and are not changeable for the supported devices.

The direct access self-defining parameter provides the ID for use in the Destination/Origin structured field in the direct access of the OEM Auxiliary Device. This parameter is required with each OEM Auxiliary Device query reply.

Table 3-52. Format of Query Reply (OEM Auxiliary Device) Self-Defining Parameter

Byte	Bit	Content	Meaning
0		X'04'	Length of parameter
1		X'01'	Direct access
2,3			DOID – This value should be used as the auxiliary device ID in the Destination/Origin structured field on page 3-36.

Two additional self-defining parameters are defined for this query reply. They identify whether the device is running with a 7- or 8-bit character set, and they limit the amount of data the host can send in an OEM data structured field. The LIMIN/LIMOUT fields prevent the depletion of host buffers that might occur from large host data streams and slow ASCII devices. The LIMIN/LIMOUT self-defining parameter for the OEM auxiliary device query reply indicates the maximum number of bytes allowed in the OEM data structured field to or from the OEM auxiliary device.

Table 3-53. Format of LIMIN/LIMOUT Self-Defining Parameter			
Byte	**Bit**	**Content**	**Meaning**
0		X'06'	Length of parameter
1		X'02'	LIMIN/LIMOUT OEM auxiliary device identifier
2,3			Maximum inbound OEM structured field bytes allowed per transmission (128 for ASCII graphics).
4,5			Maximum outbound OEM structured field bytes allowed per transmission (2000 for ASCII Graphics). Structured fields other than OEM (such as WSF) are not included in this maximum outbound value.

The Coded Character Set ID (CCSID) self-defining parameter is used to identify whether the device is operating with a 7-bit or 8-bit character set. Because ASCII graphics is going to support devices that the AEA does not specifically support, a specific character set identification cannot be sent. The AEA can identify whether the port is configured for 7- or 8-bit data.

Table 3-54. Format of CCSID Self-Defining Parameter			
Byte	**Bit**	**Content**	**Meaning**
0		X'04'	Length of parameter
1		X'04'	CCSID identifier
2,3		 X'F103' X'F104'	CCSID Number: 8-bit character set 7-bit character set

Query Reply (Partition Characteristics)

This query reply (Table 3-55) indicates that Set Partition Characteristics is supported.

Table 3-55. Format of Query Reply (Partition Characteristics)			
Byte	**Bit**	**Content**	**Meaning**
0,1		X'0006'	Length of structured field
2		X'81'	Query Reply
3		X'8E'	Partition characteristics identifier

The self-defining parameter (Table 3-56) indicates that the Enable Operator Call-Up self-defining parameter of the Set Partition Characteristics structured field is supported.

Table 3-56. Format of Query Reply (Partition Characteristics) Self-Defining Parameter			
Byte	**Bit**	**Content**	**Meaning**
0 (4)		X'02'	Length of structured field
1 (5)		X'03'	Operator call-up

Query Reply (Reply Mode)

This query reply indicates the form of inbound data stream that the addressed terminal supports. Table 3-57 shows the format.

Table 3-57. Format of Query Reply (Reply Mode) Structured Field

Byte	Bit	Content	Meaning
0,1		X'0007'	Length of structured field
2		X'81'	Query reply identifier
3		X'88'	Identifies this query reply as *reply mode*.
4		X'00'	Indicates that the terminal supports field-mode inbound data streams.
5		X'01'	Indicates that the terminal supports extended-field-mode data streams.
6		X'02'	Indicates that the terminal supports character-mode data streams.

Query Reply (RPQ NAMES)

The query reply (RPQ NAMES) structured field tells the application which RPQs are initialized for use in the display. If appropriate, RPQ-dependent information is supplied for each.

When the function is supported, this query reply is transmitted inbound in reply to a Read Partition structured field specifying Query or Query List (QCODE List =X'A1', Equivalent or All).

The following table shows the format of this structured field:

Table 3-58. Format of Query Reply (RPQ NAMES) Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2		X'81'	Query Reply
3		X'A1'	Identifies this query reply as RPQ Names
4-7			Device type identifier
8-11			Model type identifier (X'00000000' = all models)
12			RPQ length (length of RPQ Name + RPQ)
13-n			RPQ name

For example, the following table describes the RPQ Query Reply sent by device type 8775 supporting RPQ SU0183 only.

Table 3-59. Example of a Query Reply (RPQ)			
Byte	**Bit**	**Content**	**Meaning**
0,1		X'0013'	Length of structured field
2		X'81'	Query Reply
3		X'A1'	Identifies this query as RPQ Names
4-7		X'8775'	Device type identifier
8-11		X'AL4(0)'	Model type identifier (X'00000000' = all models)
12		X'07'	Length of RPQ name (including this byte)
13-18		X'SU0183'	RPQ name

Query Reply (Settable Printer Characteristics)

Within a WSF transmission, the Settable Printer Characteristics field must be sent as the first structured field in the transmission. However, if the Settable Printer Characteristics structured field is used with the Data Chain structured field, it must be sent immediately following a Data Chain (Begin or Only) structured field. If used following a Data Chain (Begin) structured field, and a recoverable error occurs prior to completion of the end-of-chain, the unit of recovery is the chain; for example, retry the chain from the beginning.

Table 3-60 shows the format of the Settable Printer Characteristics Query Reply, which indicates support of one or more printer functions or modes that can be set or reset by use of the Settable Printer Characteristics structured field. Self-defining parameters are used to describe each characteristic supported. This structured field is generated by the printer and flows inbound in reply to a Read Partition – Query List (QCODE = X'A9' or "ALL").

Table 3-60. Format of Query Reply – Settable Printer Characteristics			
Byte	**Bit**	**Content**	**Meaning**
0,1			Length of structured field
2		X'81'	Query Reply
3		X'A9'	Settable Printer Characteristics
4,5		X'0000'	Reserved – must be zeros

Table 3-61 shows the format of the Early Print Complete Self-Defining Parameter Query Reply.

Table 3-61 (Page 1 of 2). Format of Query Reply – Early Print Complete Self-Defining Parameter			
Byte	**Bit**	**Content**	**Meaning**
0 (6)		X'03'	Length of parameter
1 (7)		X'01'	Early Print Complete (EPC)

Table 3-61 (Page 2 of 2). Format of Query Reply – Early Print Complete Self-Defining Parameter

Byte	Bit	Content	Meaning
2 (8)	0,1		Printer Operator Control
		B'00'	No printer operator control
		B'01'	Printer operator control – EPC set OFF
		B'10'	Printer operator control – EPC set ON
		B'11'	Reserved
	2–7	B'00 0000'	Reserved – must be zeros

Prior to use of this structured field, an application should determine the set printer characteristics of the printer by issuing a Read Partition (Query List) structured field. The Query List structured field must either contain a QCODE of X'A9' or indicate ALL.

Printers supporting the Settable Printer Characteristics structured field must indicate support of both Data Stream Compatibility/Data Stream Emulation Query and the Load Structured Field order in the Printer Communication Information Area. The 3174 sends a Load Structured Field order (X'07') with the information received from the application. If a Settable Printer Characteristics structured field is received for a printer that does not indicate that both are supported, the 3174 rejects it by sending an Op Check sense code to the host.

When Early Print Complete is on, the printer returns a positive completion status for the print information received after it is verified, but before it is printed. If an error occurs while this information is printing, the error is reported and associated with print information received later. Because the error is not properly synchronized with print information to which it pertains, error handling may be affected.

If a Settable Printer Characteristics structured field is detected out of sequence, it is rejected with an Op Check sense code sent to the host.

All Set Printer Characteristics are reset to default by any of the following:

- Receipt of an Erase Write or Erase Write Alternate command with WCC = Reset
- Power on reset (POR)
- RSTALL=B'1' in the Set Printer Characteristics structured field.

If a system performs its error handling by reprinting the job, it is recommended that Early Print Complete be turned on at the beginning of the job, and turned off with the last piece of print information for the job. This requires the code that manages Early Print Complete to recognize job boundaries.

The Set Printer Characteristics structured field is valid only in non-SNA environments. In the SNA environment, LU1 may be used to overlap the loading of a printer's buffer with the print operation if the serial load and print required by LU3 results in performance problems.

Query Reply (Summary)

This query reply provides a list of the device-supported query replies (QCODEs) that can be used by the host in a Read Partition Query List (QCODE List). All the QCODEs that are supported by the device are included in the Summary Query Reply except the Null query reply QCODE.

The Summary Query Reply must always be sent inbound in reply to a Read Partition structured field specifying Query, or Query List (List, Equivalent, or All).

Table 3-62. Format of Query Reply (Summary) Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2		X'81'	Query Reply identifier
3		X'80'	Summary Query Reply
4−n		LIST	List of supported QCODEs

Query Reply (Transparency)

This query reply is sent only if the device is a Tektronix 4205 or a device using a User-Defined Terminal (UDT) Table with a defined outbound background transparency sequence. It then indicates that the 3174 uses an EAB for this device to define transparent areas of the screen where both the graphics and alphanumeric data are seen. Transparency is the only extended attribute supported by the 3174 for this device type.

Table 3-63. Format of Query (Transparency) Structured Field

Byte	Bit	Content	Meaning
0,1		X'0009'	Length of structured field
2		X'81'	Query Reply
3		X'A8'	Transparency identifier
4		X'02'	Number of pairs
5		X'00'	Data stream attribute value accepted
6		X'F0'	Device action (default background - transparent)
7		X'FF'	Data Stream attribute value accepted
8		X'FF'	Device action (background opaque)

Query Reply (Usable Area)

This query reply indicates the size and characteristics of the screen or page of the addressed terminal. Screen or page size is expressed as width of usable area in characters (columns or print positions) and depth of usable area in characters (rows or print lines). (For a printer, the values returned correspond to the maximum print position [MPP] and maximum print line supported by the hardware, not to the current settings if operator-specifiable.)

The default size of the dot matrix block within which a character is presented is also defined.

If a printer is a page printer, the following should be considered:

- Because print data is not immediately placed on the paper, but instead resides in a volatile internal storage area, unexpected power downs may result in the loss of printed data that would otherwise have been printed on non-page printers.
- Page printers may have recovery resources that eliminate the need to resend print data after an intervention-required condition.

The format of the Query Reply (Usable Area) structured field is shown in Table 3-64, and the format of the self-defining parameter is shown in Table 3-65 on page 3-59.

Notes:

1. The only devices listed in Table 3-64 are those for which the 3174 supplies the query reply.
2. Some devices that normally supply their own query reply but are emulating a device, may have their equivalent values shown in Table 3-64.
3. For devices that supply their own query reply, see the device documentation for the correct values.

Table 3-64 (Page 1 of 3). Format of Query Reply (Usable Area) Structured Field

Byte	Bit	Content	Meaning
0,1			Length of structured field
2		X'81'	Query reply identifier
3		X'81'	Identifies this query reply as Usable Area
4	0	B'0'	Reserved
	1	B'0'	Not a page printer
		B'1'	Page printer
	2	B'0'	Outbound 3270DS structured field supported
		B'1'	Outbound 3270DS structured field not supported
	3	B'0'	Not a hard-copy device
		B'1'	A hard-copy device
	4−7	B'0001'	12/14-bit addressing allowed
		B'0011'	12/14/16-bit addressing allowed
		B'1111'	Unmapped (no explicit address)
5	0	B'0'	Variable cells are not supported
		B'1'	Variable cells are supported
	1	B'0'	Matrix-type characters are supported
		B'1'	Non-matrix-type characters are supported (bytes 10−20 are not applicable and must be zeros)
	2	B'0'	Values in bytes 6,7 and 8,9 are specified in cells
		B'1'	Values in bytes 6,7 and 8,9 are specified in PELs
	3−7	B'0 0000'	Reserved − Will be set to zeros
6,7			Width of usable area (cells/PELs):
		X'50'	3178-C1, -C2, -C3, -C4; 3278-2, -3, -4; 3279-2, -3; Tektronix 4205
		X'84'	3262, 3268, 3278-5, 3287

Table 3-64 (Page 2 of 3). Format of Query Reply (Usable Area) Structured Field

Byte	Bit	Content	Meaning
8,9			Height of usable area (cells/PELs):
		X'0018'	3178-C1, -C2, -C3, -C4; 3180; 3278-2; 3279-2
		X'001B'	3278-5
		X'001E'	Tektronix 4205
		X'0020'	3278-3; 3279-3
		X'002B'	3278-4
		X'0066'	3287
		X'007F'	3262, 3268
10			Unit of measure used to represent the distance between dots given for X and Y directions in bytes 11 – 14 and 15 – 18:
		X'00'	Inches
		X'01'	Millimeters
11 – 14			Dot spacing in the X (horizontal) direction, expressed as a fraction with a 2-byte numerator and 2-byte denominator, and measured in the units defined in byte 10.
		X'00000000'	3262
		X'00010064'	3268, 3287
		X'00010071'	3278-5
		X'00020089'	3178-C1, -C2, -C3, -C4; 3278-2, -3, -4; Tektronix 4205
		X'000A02E5'	3279-2, -3
15 – 18			Dot spacing in the Y (vertical) direction, expressed as a fraction with a 2-byte numerator and 2-byte denominator, and measured in the units defined in byte 10.
		X'00000000'	3262
		X'00010040'	3268
		X'0002006F'	3279-2, -3
		X'00020085'	3178-C1, -C2, -C3, -C4; 3278-2, -3, -4, -5; Tektronix 4205
		X'0002008C'	3287
19			Number of X-units in default cell:
		X'00'	3262
		X'09'	3178-C1, -C2, -C3, -C4; 3278-2, -3, -4, -5; 3279-2, -3; Tektronix 4205
		X'0A'	3268; 3287
20			Number of Y-units in default cell:
		X'00'	3262
		X'08'	3268; 3287
		X'0C'	3278-4, -5; 3279-2, -3
		X'10'	3178-C1, -C2, -C3, -C4; 3278-2, -3; Tektronix 4205

Table 3-64 (Page 3 of 3). Format of Query Reply (Usable Area) Structured Field			
Byte	**Bit**	**Content**	**Meaning**
21,22			Character buffer size, in bytes. Buffer size is not reported for devices operating in LU type 1 mode.
		X'0780'	3178-C1, -C2, -C3, -C4; 3278-2; 3279-2 (1920)
		X'0960'	Tektronix 4205 (2400)
		X'0A00'	3278-3; 3279-3 (2560)
		X'0D70'	3278-4 (3440)
		X'0DEC'	3278-5 (3564)
		X'nnnn'	3262, 3268, 3287 – Dependent on installed buffer size (2K or 4K). Equivalent to display sizes except when byte 24 of an LU type 3 Bind command is set to X'00'. Wrap points for the physical buffer are then given as follows: 2K buffer – X'07B0' (1968) 4K buffer – X'0EB0' (3760) with PS feature 4K buffer – X'0FB0' (4016) without PS feature.
23			Minimum number of x units in variable cell.
24			Minimum number of y units in variable cell.
25			Maximum number of x units in variable cell.
26			Maximum number of y units in variable cell.

Notes:

1. For CUT displays without the Extended Function feature and the 3180, 3191 (Models D, E, and L), and 3192 only bytes 0—22 of the base Usable Area query reply are returned.
2. For CUT displays 3472 and 3471 Model B, bytes 0—26 will be returned.
3. For CUT displays with the Extended Function feature that support a Model 5 screen size, and Alternate Usable Area Self-Defining Parameter will also be included in the structured field. (Its format is shown in Table 3-65 on page 3-59.)

Table 3-65 (Page 1 of 2). Format of Alternate Usable Area Self-Defining Parameter			
Byte	**Bit**	**Content**	**Meaning**
0		X'08' or X'13'	Length of parameter
1		X'02'	Identifies this field as an alternate usable area extension.
2		X'00'	Reserved – Will be set to zeros
3		X'01'	Identifier for this alternate usable area definition
4,5			Alternate usable area width:
		X'0084'	If bytes 6 and 7 of base query reply are X'0050'
		X'0050'	If bytes 6 and 7 of base query reply are X'0084'.

Table 3-65 (Page 2 of 2). Format of Alternate Usable Area Self-Defining Parameter			
Byte	**Bit**	**Content**	**Meaning**
6,7		 X'001B' X'002B'	Alternate usable area height: If bytes 8 and 9 of base query reply are X'002B' If bytes 8 and 9 of base query reply are X'001B'.
8		 X'00' X'01'	Unit of Measure: Inches Millimeters
9–12			Dot spacing in the X (horizontal) direction, expressed as a fraction with a 2-byte numerator and 2-byte denominator, and measured in the units defined in byte 8.
13–16			Dot spacing in the Y (horizontal) direction, expressed as a fraction with a 2-byte numerator and 2-byte denominator, and measured in the units defined in byte 8.
17			Number of X-units in default cell
18			Number of Y-units in default cell
Note: Bytes 8–18 must be present for those devices that support the Load Programmed Symbols structured field.			

Query Reply (3270 IPDS)

The query reply (3270 IPDS) structured field indicates support of the Intelligent Printer Data Stream (IPDS) through the 3270 data stream (non-SNA).

When this function is supported, the query reply is transmitted inbound in reply to a Read Partition structured field specifying Query or Query List (QCODE = X'9A', Equivalent or All).

The following table shows the format of this structured field:

Table 3-66. Format of Query Reply (3270 IPDS) Structured Field			
Byte	**Bit**	**Content**	**Meaning**
0,1		X'0008'	Length of structured field
2		X'81'	Query Reply
3		X'9A'	Identifies this query reply as 3270 IPDS
4,5			Reserved
6,7			Maximum transmission size allowed outbound. It specifies the maximum number of bytes of IPDS data allowed in an outbound transmission. A value of X'0000' indicates no limit specified.

Chapter 4. Control Unit Terminal (CUT) Functions

Introduction

This chapter describes the functions that the 3174 provides for attached CUTs. It does not attempt to describe the functions and capabilities of each terminal that can attach to the 3174. For such terminal-specific information, refer to the individual display station and printer descriptions. The functions described in this chapter include local keyboard functions for display stations and the local copy function for printers.

Two types of 3270 display stations can be attached to the 3174:

Control Unit Terminals (CUTs) rely on the 3174 to interpret the data stream. Keyboards attached to 3270 displays enable the operator to change, edit, or create character displays except within fields defined by attribute characters as protected from local functions by the program. As messages are being composed or modified by local function, the changes are inserted in the buffer and then displayed. When the operator completes an operation and uses the Enter function or an AID generating function, an I/O pending interruption occurs.

Note: How the 3174 carries out the local functions for CUTs is described under "Local Functions" on page 4-7.

Distributed Function Terminals (DFTs) interpret the data stream because they have a control program downstream-loaded to them from the 3174 (the 3290, for example) or because of a control program loaded in their diskette drive or fixed disk (the 3270PC, for example). As a result, the 3174 simply passes the data stream between the host and the DFT without modification. Thus, the responsibility for data stream interpretation is distributed to these terminals. How the DFTs interpret the 3270 data stream is described in their individual description books.

Also available is an extension to the DFT terminal called a DFT-E. A DFT-E supports a CUT interface and a DFT interface on the same controller port at the same time. Sessions through the CUT interface of a DFT-E display can access ASCII hosts, perform online tests, and perform X.21 and X.25 dialing. Sessions through the DFT interface operate as normal DFTs.

For DFTs, such as the 3290, the 3174 merely passes the data stream because the DFT can interpret the data stream independently. But for CUTs, such as the 3278, that are communicating with the 3270 host, the 3174 interprets every keystroke that is entered at the display stations. For ASCII devices communicating with a 3270 host, the 3174 also interprets every keystroke that is entered since they are emulating CUT devices.

When a CUT device is using the AEA feature to communicate with an ASCII host, most keystrokes are passed on to the ASCII host for processing. Therefore, most of the information in this chapter does not apply for ASCII Emulation. See the *3174 Asynchronous Emulation Adapter Description and Reference* and the *3174 Terminal User's Reference for Expanded Functions* for more information on the functions available in ASCII Emulation. The following functions are performed by the 3174 for a CUT display in ASCII Emulation mode:

- Alternate Shift
- Shift Lock
- Up-shift
- Caps Lock
- Alternate Cursor
- Cursor Blink
- Reset
- Change Screen
- Click
- Device Cancel
- Extension Mode
- Test Mode
- Local Copy
- Extended Graphics Mode.

For printers, the 3174 manages the Printer Authorization Matrix (PAM), which allows a display station to use the local copy function to print documents on a printer attached to the same 3174.

For information on the types of keyboards and the locations of the keys for the functions described in this chapter, refer to the *3174 Character Set Reference*. For information on keyboard languages supported and the Country Extended Code Page function, see Appendix D, "Country Extended Code Page (CECP)," and the *3174 Character Set Reference*. The 3270 data stream is discussed in the *3270 Data Stream Programmer's Reference*.

Most of the functions described in this chapter have corresponding indicators that are displayed in the OIA of the display screen. See Appendix E, "Operator Information Area Symbols" for the indicator that is displayed, its location, and description.

Extended Graphics Mode

Extended Graphics mode is a function of the 3174 that extends the number of characters that can be obtained from a keyboard. This function is available on 3270-type display stations when running ASCII terminal emulation; it is also available on 3270-type display stations when running 3270 mode (communicating with a 3270 host). When running ASCII terminal emulation, all styles of keyboards are supported. However, the display stations with keyboards emulating a Base keyboard must send the keystroke sequence that is used to enter Extended Graphics mode to the 3174 before Extended Graphics mode is available to the user in ASCII terminal emulation. When running 3270 mode, the controller must be customized for CECP (question 123=1) and the display station must be CECP-capable.

When you hold the ALT function and press either Shift function, the keyboard goes into Extended Graphics mode or the extended graphics layer of the keyboard. A plus sign is displayed in the OIA to indicate Extended Graphics mode. In this mode, the section of keys on the keyboard that includes all of the graphic functions, the number functions, the alphabetic functions, and the space bar are redefined. After an extended graphics character is selected, the keyboard returns to its normal mode of operation, and the plus sign is removed from the OIA. You can exit Extended Graphics mode by using the ALT and Shift functions again.

These functions do not take you out of Extended Graphics mode:

- Cursor Blink
- Alternate Cursor
- Click
- Up/Down Shift
- Alternate Shift
- Caps Lock
- Shift Lock
- Numeric Shift Lock.

Refer to the *3174 Character Set Reference* for the keyboard layouts and function reassignments when in Extended Graphics mode.

Type Ahead Function

Type Ahead is a function of the 3174 that allows keystroke entry when the keyboard is locked during an I/O operation with the 3270 host or during a printer busy condition with a 3270 host session. The I/O operation is represented by the Time or System Lock indicator in the Operator Information Area (OIA). The printer busy condition is represented by the Printer Busy or Printer Very Busy indicator. The Type Ahead function is enabled by default during 3174 customization, and is available for both 3270 and ASCII terminals.

When Type Ahead is enabled, the 3174 queues keystrokes in stack mode (that is, when the keyboard is locked during an I/O operation with the 3270 host). For ASCII terminals, more keystrokes can be queued because an additional receive buffer is used. When the Type Ahead queue is full, the Keystroke Queue Full indicator is displayed. This indicator is automatically cleared when the I/O operation with the 3270 host is complete or the printer busy condition has cleared and the 3174 starts processing the Type Ahead queue. Pressing the Reset function also clears the indicator, but it can **purge** all the keystrokes in the Type Ahead queue. See the "Reset Function" on page 4-11 for more details.

While in stack mode, the OIA is updated immediately for most functions that display an indicator (such as Upshift). These types of functions or keystrokes are referred to as indicator-related keystrokes. By displaying an indicator, the terminal user knows how any subsequent keystrokes are to be handled. Note that the function represented by the indicator applies only to those keystrokes that follow the display of the indicator. The indicator-related keystrokes are also processed while the Keystroke Queue Full indicator is displayed.

While in stack mode, these indicator-related keystrokes do not provide an immediate indicator in the OIA:

- Non-escaping keys, such as accent keys
- Print ID function
- Entry Assist cursor position sequence.

These indicator-related keystrokes are not allowed in stack mode and cause the Minus Function indicator to be displayed:

- Entry Assist Enable/Disable function
- Entry Assist Change Format Mode function
- Program Symbol Set Selection function.

Under certain conditions, the Reset function can purge the Type Ahead queue as mentioned above. Other procedures or functions also purge the queue. The display of and subsequent selection from the Connection Menu purges the Type Ahead queue. (That is, Type Ahead cannot be used while you are waiting for an

ASCII host connection request to complete.) Other functions, although processed immediately, purge the queue, and they are:

- Attention
- System Request
- Test Request.

When the security key is in effect, the Type Ahead queue continues to be processed. However, while the terminal is disabled, any keystrokes are discarded except for the indicator-related keystrokes.

When customized for MLT, a keystroke queue exists for each session or LT for that terminal. It is unnecessary for the Type Ahead queue to be processed before changing sessions. The queue can be processed in the background sessions. There are, however, some keystrokes that cannot be processed in the background sessions (such as Insert, Delete, and Erase EOF). When any of these keystrokes are encountered, processing halts for that session only, until that session again becomes the active session.

Null/Space Processing

Both nulls (X'00') and space characters (X'40') appear as blanks on a display screen. Space characters are transmitted to the host, but nulls are not transmitted as part of the 3270 data stream when modified screen data is sent to the host. Because nulls are not sent to the host, graphic characters may shift positions on the display when the screen is updated by the host.

With null/space processing, nulls are converted to space characters before the data is transmitted. When doing null-to-space conversion, the space will inherit the null's character attribute. Thus, the converted data appears at the host the same as it does on the display.

Null/space processing is a 3174 function available for both 3270 and ASCII terminals when communicating with a 3270 host. The function is toggled on and off for each session (LT) by the terminal user with the use of the Extension/Extended Select function followed by the Null/Space Processing function (refer to the *3174 Character Set Reference* for the location of this function). The null/space indicator appears in the OIA when the function is active. Once null/space processing is toggled on, it remains active for that session until toggled off or until the 3174 completes an IML. This holds true for each assigned LT on a 3270 terminal, even when the power to the terminal is turned off and back on. The null/space processing state is reset, however, when the power to an ASCII terminal is turned off and then back on.

Note: Null/space processing is not available for sessions communicating with an ASCII host.

Null/Space Processing on Formatted Screens

Null-to-space conversions are performed only on fields modified by the user. Positioning the cursor within a field does not cause conversions to be performed unless the field is modified by the user. In order to reduce transmission time to the host, nulls that follow the last graphic character in a field are not converted to space characters.

If null/space processing is not active at the time a field is actually modified, conversions can still be performed if the function is toggled on before the next AID function is used or before the cursor is positioned outside the modified field. Once the conversions are performed, they are not lost, even after the function is toggled off.

Null/Space Processing on Unformatted Screens

Null-to-space conversions are performed only if data on the screen is modified by the user. In order to reduce transmission time to the host, nulls that follow the last graphic character on the screen are not converted to space characters.

If null/space processing is not active at the time a modification is made, conversions can still be performed if the function is toggled on before the next AID function is used. Once the conversions are performed, they are not lost, even after the function is toggled off.

Using Insert Mode with Null/Space Processing

Null/space processing has a feature that is especially useful in Insert mode. Without null/space processing, when a character string is followed by blanks to the end of a field, characters could be inserted only if those blanks were actually nulls. Spaces at the end of a field had to be changed to nulls before Insert could be used. With null/space processing, those blanks at the end of a field can be either nulls or spaces. Insert mode works with either.

When null/space processing is active and a character is inserted on an unformatted screen, only the characters between the cursor and the end of the screen are shifted to the right. Characters cannot be wrapped past the end of the screen because null-to-space conversions have already been performed on all nulls prior to the cursor. In fact, with null/space processing active, all leading nulls and embedded nulls within the text are actually converted to spaces before Insert mode is activated.

Local Functions

The following descriptions of local functions are applicable to all keyboards attached to local function terminals, except where noted. In some cases, descriptions of local functions contain SNA protocol terms and references to local copy operations. For a detailed description of these topics, refer to "Local Copy Function" on page 4-24, Chapter 6, "Remote Operation," and Chapter 9, "SNA PU 2.0 Protocol."

Cursor

The cursor can appear as an underscore, a blinking underscore, a reverse image of the character, or a blinking reverse image of the character. The operator can change the cursor from an underscore to a reverse image of the character, or vice versa, by using the Alternate Cursor (Alt Cursr) function. (The normal cursor is an underscore, and the alternate cursor is a reverse image of the character.) The same operator can cause either type of cursor to blink by using the Cursor Blink (Cursr Blink) function. Alternate cursor and cursor blink can interact with the extended highlighting attributes.

When the cursor is displayed under one character in a line of characters, that character can be changed or deleted by local functions. Also, if the cursor is displayed under (or within) a position without a display character, a character can be inserted in that position by a local function.

When the display is turned on, the cursor is automatically generated and displayed in the first location on the screen. The cursor can be repositioned by the keyboard operator and by the program. The cursor is not affected by field attributes or by the Security Keylock feature. It is displayed even when positioned in a nondisplayed/nonprint field and when the Security Keylock feature, if installed, is turned off.

Alternate Function

The Alternate function is used to activate functions usually mapped on the front of keys; for example, to activate the Alternate Cursor function discussed in the previous section, the Alt function and the key with Alt Cursr on the front are pressed. Using the Alt function with a key that has no function mapped to it produces no effect.

Extension/Extended Select Function

The Extension (Base keyboards) and Extended Select (Enhanced and Converged keyboards) function provides a keyboard mode in which additional functions required by such features as the X.21 or X.25 interfaces can be activated. The keyboard is placed in extension/extended select mode by use of the Extension or Extended Select function on the keyboard. Then the keys that have been assigned the additional functions required by the feature become active. Refer to the *3174 Terminal User's Reference for Expanded Functions* for keyboard layouts and the location of the Extension/Extended Selected function as well as the additional functions.

Alphabetic Characters

Alphabetic characters can be entered into the display buffer in either uppercase or lowercase code, depending on the use of the Shift function and/or Caps Lock function. Alphabetic characters are displayed as all uppercase or upper and lowercase characters, as determined by the setting of the Dual Case/Mono Case switch on the display. The shift functions on the Katakana keyboards operate differently from the functions described here.

Keyboard entry of an alphanumeric character into the display buffer occurs at the cursor location, provided the cursor is located in an alphanumeric character location within an unprotected data field. (An attempt to enter an alphanumeric character into a protected data field or into an attribute character location is blocked.)

On displays that support extended attributes, the character attributes for each character position are normally set to X'00' when entering data into that position. If the program allows attribute selection, the character attributes for each character position are set to X'00' if a specific attribute for the input data is not selected.

Successful keyboard entry of the alphanumeric character causes the cursor to advance to the next character location within the unprotected data field.

Character-Oriented Functions

The Up, Down, Right, and Left functions move the cursor one position in the direction indicated on the keytop. The Backspace function performs the same function as the Left function. The cursor can be moved into any character location, including unprotected and protected alphanumeric character and field attribute character locations, through the use of these functions. Operation of these functions does not affect the MDT bit. When the Alternate function is used with the Right and Left functions, the cursor moves two locations at a time, except when the 3270 Entry Assist function is active. (Refer to the *3270 Entry Assist User's Guide* for those functions.)

These functions are all capable of causing the cursor to wrap. Horizontal wrap always involves a vertical movement. The cursor repositions to the next or preceding row of characters. Vertical wrap due to operation of the Up or Down functions involves no horizontal movement. The cursor stays in the same character column.

These functions all have typematic operation at a repeat rate of approximately 10 operations per second. A *typematic* function is a function that repeats as long as the function is pressed.

Field-Oriented Functions

Any of four functions moves the cursor to the first position in a field on a formatted screen. All four functions can cause the cursor to wrap from the end of the last line on the display and to continue at the beginning of the top line. The following functions do not affect the MDT bit:

Tab Moves the cursor to the first character location of the next unprotected data field. In a display with no unprotected fields, the cursor is repositioned to character location 0. The Tab function has typematic capability at a repeat rate of approximately 10 operations per second.

Backtab When the cursor is located in the field attribute character position or the first alphanumeric character location of an unprotected data field or in any character location of a protected data field, this function moves the cursor to the first alphanumeric character location of the first preceding unprotected data field. When the cursor is located in any alphanumeric character location of an unprotected data field other than the first location, this function moves the cursor to the first alphanumeric character location of that field. In a display with no unprotected fields, the cursor is repositioned to character location 0. The Backtab function has typematic capability.

New Line Moves the cursor to the first unprotected character location of the next line. If the display has no unprotected data fields, the cursor is repositioned to character location 0. If the display contains no fields, the cursor is repositioned to the first character position of the next line. The New Line function has typematic capability at a rate of approximately 10 operations per second.

Home Moves the cursor to the first unprotected character position on the screen.

Erase to End of Field Function

If the cursor is located in an alphanumeric character location in an unprotected data field, the Erase EOF function clears the character location occupied by the cursor and all remaining character locations to the right in that field to nulls. The character attributes for all the erased characters are set to X'00'. The operation can wrap from the end of the last line on the display to the end of the field. The cursor does not move as a result of this function, and the MDT bit is set to 1.

The Erase to End of Field function disables the keyboard when the cursor is located in a field attribute character location or is within a protected data field. No character locations are cleared, the cursor is not moved, and the MDT bit is not set.

Erase Input Function

This function clears all unprotected character locations to nulls, resets the MDT bit to 0 in unprotected fields, and repositions the cursor to the first unprotected character location on the screen. The character attributes for all the erased characters are set to X'00'.

In a buffer with only protected data fields, no character locations are cleared and the cursor is repositioned to character location 0.

If the display is unformatted, the entire buffer is cleared to nulls and the cursor is repositioned to location 0.

Insert Mode Function

The Insert mode function places the keyboard in an insert mode of operation. The Insert symbol is displayed in the Operator Information Area (OIA).

Insert mode works differently with null/space processing or 3270 Entry Assist than what is described below. See "Using Insert Mode with Null/Space Processing" on page 4-7 or *3270 Entry Assist User's Guide* for details.

If the cursor is located in an unprotected data field having a null character either in the character location identified by the cursor or in any character location in the field beyond the cursor, operation of an alphanumeric function causes that alphanumeric character to be entered at the cursor and the MDT bit to be set to 1. The character formerly occupying the cursor location and all remaining characters within the field (except for null characters or characters to the right of null characters) are shifted one character location to the right. If the location identified by the cursor location at the time of the insert operation is a null, no character shifting occurs.

After all null characters at or beyond the cursor location in the field have been overwritten, or if there were no null characters, operation of an alphanumeric function disables the keyboard. Field attribute characters and extended field attributes are not shifted as part of the insert operation. On displays that support extended attributes, the character attributes are shifted with the characters. The character attributes for inserted characters are set to X'00', except where the application program allows attribute-selection and the operator has selected specific attributes.

If more than one row of characters is contained within the field, a character occupying the last character location in the row is shifted into the first character location of the next row.

Operation of an alphanumeric function in Insert mode, when the cursor is located in a field attribute character location or is within a protected data field, disables the keyboard. No character locations are cleared, the cursor is not moved, and the MDT bit is not set.

Operation of the Reset, Enter, Test, System Request, or Attention function, or any other function (AID) that causes host communication returns the keyboard to normal mode. Operation of the Cursor Select (Cursr Sel) function, selector light pen, magnetic slot reader (MSR), or magnetic hand scanner (MHS) also returns the keyboard to normal mode.

With the Type Ahead function, the keyboard is only returned to normal mode by the Reset, Test, System Request, and Attention functions.

Delete (Del) Function

If the cursor is located in an alphanumeric character location in an unprotected field, the Delete function deletes the character from the character location identified by the cursor and sets the MDT bit to 1 (if not previously set). The cursor does not move. All remaining characters in the unprotected field, to the right of the cursor and on the same row, shift one character location to the left. If the display supports extended attributes, the character attributes for the deleted character are deleted and the other character attributes are shifted left. Vacated character locations at the end of the row are filled with nulls. The character attributes of vacated character positions are set to X'00'. If the unprotected field encompasses more than one row, characters in rows other than the row identified by the cursor are not affected.

The Delete function disables the keyboard when the cursor is located in a field attribute character location or is within a protected data field. No character locations are cleared, the cursor is not moved, and the MDT bit is not set. (Use the Reset function to enable the keyboard.)

Reset Function

The Reset function is used to recover from an inhibited local function that has resulted in a disabled keyboard. When a keyboard is disabled, only certain local functions (those that cause an indicator to display) are allowed. The Reset function does not reset a disabled keyboard when a command is being executed for the device to which the keyboard is attached.

When a keyboard is disabled, symbols are displayed in the Input Inhibited area of the Operator Information Area (OIA) of the display screen. The Reset function does not restore the keyboard or other input devices for the following input inhibited conditions:

- Printer Busy
- Printer Very Busy
- Printer Not Working
- Time (see note below)
- Non-resettable Machine Check
- Security Key.

Note: The Time indicator can be reset under certain conditions: in SNA while in SSCP mode; in BSC, before a poll.

Using the Reset function:

- Resets all input inhibited conditions except those listed above.
- Resets Insert mode.
- Resets a Non-Escaping Key operation.
- Removes the Host Descriptor from the OIA, provided there are no other input inhibit conditions or an Insert mode to reset.
- Terminates Print ID mode (the cursor then reappears, and the old printer ID appears in the OIA).
- Resets the AID code if the Time indicator was reset or was not displayed.
- May purge keystrokes that have been queued in Type Ahead mode.

In Type Ahead mode, the Reset function purges the Type Ahead queue if a keyboard inhibit condition exists, unless that condition is:

- Because of the security key being in effect.
- Created by keystrokes that are processed immediately even if the session is in stack mode.
- Time or System Lock and when in insert mode.

If no input inhibit condition exists, the Reset function purges the Type Ahead queue unless the session is in Insert mode or the Host Descriptor is displayed. In that case, the Reset function resets the Insert mode or removes the Host Descriptor, and does not purge the queue.

Duplicate (Dup) Function

The Duplicate function enters a unique character code into the display buffer, performs a Tab function, and sets the MDT bit to 1. The Duplicate character informs the application program that a *duplicate* operation is indicated for the rest of the field. The Duplicate character is transferred as a Duplicate code when the data is read from the display to the program. The Duplicate character, when stored in a device buffer, appears as an asterisk (*) on displays using mono case mode, and is printed as an asterisk (*) on a printer. On displays using dual case mode, the Duplicate character appears as an asterisk with an overscore.

The Duplicate function does not affect the current status of extended attributes, and programmed symbols selection does not affect the Duplicate character.

Using the Duplicate function when the cursor is located in a field attribute character location or is within a protected data field disables the keyboard. No character locations are cleared, the cursor is not moved, and the MDT bit is not set. (Use the Reset function to enable the keyboard.)

Field Mark (FM) Function

The Field Mark function enters a unique character code into the display buffer and sets the MDT bit to 1. Field Mark informs the application program of the end of a field in an unformatted buffer or a subfield in a formatted buffer. The field mark character is transferred as a Field Mark code when the data is read from the display to the program. The Field Mark character, when stored in a device buffer, appears as a semicolon (;) on displays using mono case mode, and is printed as an asterisk (*) on a printer. On displays using dual case mode, the Field Mark character appears as a semicolon with an overscore.

The Field Mark function does not affect the current status of extended attributes, and the programmed symbols selection has no effect on the Field Mark character.

Using the Field Mark function when the cursor is located in a field attribute character location or within a protected data field disables the keyboard. No character locations are cleared, the cursor is not moved, and the MDT bit is not set.

Program Attention (PA) Functions

The Program Attention functions solicit program action by causing an I/O pending to occur at the display station. The program is notified of the interruption by an Attention status indication in local (channel-attached) units and by responding to a poll in remote (telecommunication-attached) units. An AID character is generated at the time of the interruption to identify which function caused the interruption, but the MDT bit is not affected.

The program attention functions are Clear, Enter, the PF functions, and the PA functions. Using PA or PF during a System Services Control Point (SSCP) session results in an input inhibited condition. Using the Clear function clears the display screen of all data to nulls (except the indicator row), sets all extended attributes to X'00', and positions the cursor at location 0,0 on the display.

Note: Refer to the warning in the *3174 Planning Guide* regarding the accidental or intentional use of the PA3 function.

The Clear function removes the numeric shift indicator if displayed, but does not change shift status. It does not perform a reset function. If an alternate screen size has been selected, Clear resets the screen to the default size. In 3270 BSC, the Clear function AID code is sent to the host. When SDLC is used, the Clear function AID code is sent to the host when Clear is used during an PLU-SLU session. While in test mode, the Clear function does not cause an AID to be sent to the host.

Using the Clear function when a terminal is in explicit partition state places the terminal back in implicit partition state. (The explicit partition is destroyed.)

System Request (Sys Req) Function

When the 3174 operates in SNA, the operator can use the System Request function for SSCP-SLU and PLU-SLU session switch procedures. The System Request function also simultaneously initiates Reset and Clear functions despite the presence of most input inhibited conditions. System Request results in no response for the following input inhibited conditions:

- Printer Busy
- Printer Very Busy
- Printer Not Working
- Security key in effect.

System Request is allowed only if the LU is active. If the LU is not active, the Minus Function indicator is displayed.

When using the Type Ahead function, System Request purges the Type Ahead queue.

On controllers with host attachments using BSC or non-SNA protocol, the System Request function performs the test-request function. The automatic reset function is not available. See "Test Request Read" on page 2-20 for more information.

Device Cancel (Dev Cncl) Function

The Device Cancel function cancels a current outstanding print request to a printer if input is inhibited because of a Printer Busy or Printer Very Busy condition. A request initiated by the print function is dequeued, and the keyboard is restored. The Device Cancel function has no effect on a host-initiated local copy.

The Device Cancel function is also used to remove Device Not Functional conditions (Printer Failure, Printer Not Working). Any coexisting printer error symbol is also removed. If an input inhibited condition of higher priority than Device Not Functional is displayed, then the Device Cancel function is not performed.

Following use of the print function, the keyboard is restored. After a host-initiated print, the Printer Not Working symbol is replaced by the Time symbol.

Use of the Device Cancel function during a print ID operation at the 3174 terminates the operation. The cursor reappears, and the previous printer ID appears in the OIA near the bottom of the screen.

When using the Type Ahead function, Device Cancel cancels only the print job in process or a print job that was queued because of a printer busy condition. It does not cancel a print request that was stacked in the Type Ahead queue.

Shift Function

The Shift function performs the upshift function. When the keyboard becomes ready initially, only characters located on the bottom position of the keytops can be entered from the keyboard. By pressing and holding the Shift function, characters shown on the top position of the keytops can be entered. The up shift state is indicated in the OIA on the display screen. Using Shift resets the Shift Lock function.

Shift Lock Function

The Shift Lock function fixes upshift character selection. The Shift Lock function is deactivated by the Shift function. The shift state is indicated in the OIA on the display screen.

Numeric Shift Lock Function

The Numeric Shift Lock function is available on displays with Base Data Entry and Base Data Entry Keypunch keyboards. The function is a toggle that takes the input device in and out of Numeric Shift mode (upshift). Numeric Shift mode can be temporarily overridden by the Alpha Shift function.

Caps Lock Function

The Caps Lock function causes a character in a specified set of characters, normally lowercase alphabetic characters (for example, English a–z) to be translated into another specified character, normally the corresponding uppercase alphabetic character (for example, English A–Z), based on the keyboard language being used.

The Caps Lock function alternately turns the function on and off. An indicator is displayed in the OIA when the function is active.

All Shift local functions are processed before the Caps Lock function is applied. This allows the function to be applied against the shifted code point.

When the Caps Lock function is on during non-escaping key processing, verification of the combined lowercase character is done before the translation takes place.

APL Shift Function

APL Shift is a function that, when toggled off, makes the normal characters of the keyboard available (that is, the typewriter layer). When toggled on, the keyboard is now in the APL layer and all APL characters are now available instead of the typewriter characters.

An indicator is displayed in the OIA of the display screen to show when APL Shift is on (active).

TEXT Shift Function

TEXT Shift is a function that, when toggled off, makes the normal characters of the keyboard available (that is, the typewriter layer). When toggled on, the keyboard is now in the TEXT layer and all TEXT characters are now available instead of the typewriter characters. An indicator is displayed in the OIA of the display screen to show when TEXT Shift is on (active).

The ALT Shift is identical between the two layers. In ALT Shift, both TEXT and non-TEXT characters are available.

Language Shift Function

Some terminals have special keyboards that can support two different character sets, such as Latin and Greek.

You can select either language and change case within that language. A shift function on these keyboards allows you to shift between character sets and maintain a shift up or shift down state. For pictures of keyboard support, refer to the *3174 Character Set Reference*.

Keyboards with shift functions and Alt functions can provide multiple levels of shifting.

In the following paragraphs concerning language shift methods, *key* refers to the key or key sequence for your keyboard that performs the specified function. *Alt* is a shift function which, when selected, supersedes the other shift functions. There are three methods of shifting languages:

- Some keyboards have four shift functions, such as Latin Lower, Latin Upper, National Language (such as Greek) Lower, and National Language Upper. The keyboard remains in the shift selected until you select one of the other shift functions.
- Some keyboards have the standard upper shift functions that put the keyboard in upper shift when you press and hold these keys. There is also a language shifting function in the Alt shift of the two shift functions. Selecting one Alt shift function puts the keyboard in Latin language. Selecting the other Alt shift function puts the keyboard in the national language.
- Some keyboards have a language toggle function. When the language toggle function is pressed, the keyboard changes languages. These keyboards have upper shift functions that put the keyboard in upper shift when held pressed.

Numeric Lock Feature Operation

When the Numeric Lock feature is installed, the characters 0–9, decimal sign, minus sign (-), and Duplicate can be entered by the operator in a field identified in the field attribute byte as numeric and unprotected. Magnetic Slot Reader(MSR)/Magnetic Hand Scanner (MHS) input is also accepted. When the cursor enters such a numeric field, the Numeric indicator is displayed. While the cursor is in this field, operating any other function that can enter a displayable character disables the keyboard and displays the Numeric input inhibit indicator.

When entering a numeric field, the keyboard is automatically upshifted or downshifted depending on the keyboard type:

- On Data Entry and Data Entry Keypunch keyboards, the keyboard is put into upper shift.
- On Typewriter keyboards, the keyboard is put into lower shift.
- On APL and Text keyboards (with APL OFF and TEXT OFF respectively), the keyboard is put into lower shift.
- On APL keyboards (with APL ON), the keyboard is put into lower APL shift.
- On Text keyboards (with TEXT ON), the keyboard is put into lower Text shift.

When entering a numeric field on a terminal that has the numeric lock feature installed, do not rely on the automatic upshift or downshift when entering the following functions: Insert, Dup, Change Screen, Attention, System Request, Test Request, Device Cancel, Reset, Cursor Blink, Alternate Cursor, Click, Extended Select, or Programmed Symbols Set Selection. Also, you should not rely on the automatic shift to use the function that appears on the same key as one of these functions. Instead, when using one of these functions, place the keyboard into the appropriate shift by using the Shift, Alpha Shift, or ALT function. The reason is that some preliminary processing is done on the functions before the automatic upshift or downshift is recognized by the controller. For example, on a Typewriter Enhanced keyboard, the Insert function is the lower shift of a key, and the Dup function is the upper shift of the same key. Shift Lock is active when you enter a numeric field. So, when the Insert/Dup function is pressed, the preliminary processing that is done on the key recognizes the upper shift function, or Dup. And not until after the processing of the automatic downshift is the function recognized as Insert and the terminal placed in Insert mode. However, the Insert indicator does not appear in the OIA. If the Shift Lock is removed before pressing the function, the preliminary processing recognizes the lower shift function of the key, or Insert, the terminal is placed in Insert mode, and the Insert indicator is displayed in the OIA.

You can temporarily override the Numeric Lock feature by holding down certain shift functions while keystroking non-numeric displayable characters. While these shift functions are being held down, they provide their normal shifting function as well as providing the override.

The types of keyboards and the shift functions that provide the override are:

Keyboard Type	Override Function
Typewriter	Shift
Data Entry	Shift
	Alpha
APL	Shift
	Alt (for APL characters only)
Text	Shift
	Alt

Alpha Function

When the Data Entry or Data Entry Keypunch layout keyboards have been programmed for nonalpha shift, you can select the characters shown on the bottom of the keytops by using the Alpha function and entering the desired characters. When power is applied, the keyboard is in lower shift alpha mode.

Cursor Select (Cursr Sel) Function

The Cursor Select function allows the selector light pen detection function to be performed from the keyboard. The Cursor Select function can be used on any field defined as a selector light pen detectable field (as described in Appendix A, "Selector Light Pen and Magnetic-Stripe Reading Devices"). However, a Cursor Select field does not require the space or null character padding constraints associated with the selector light pen detectable field. The Cursor Select function can occur within the field on a line different from that of the attribute that describes the field.

Cursor Select operations can be immediate or deferred (as defined for selector light pen fields). The field used for cursor select operation can also be defined in the following format:

- Basic attribute character as defined for selector light pen
- Designator character as defined for selector light pen
- Data character(s) optional
- Basic attribute character next field.

This format is not applicable when the selector light pen is used. When a Cursor Select field is being defined, the attribute character can not be located in the last line of the display with the designator character in the first line.

Attention (Attn) Function

The Attention function is operable with SNA protocol in a SNA PLU-SLU session only, and is processed despite any input inhibited conditions, except for security key in effect. It allows the terminal user to request Change Direction, except when the controller is in shutdown or data-traffic-reset state. With host attachments using BSC or non-SNA protocol, or if the SNA session is not PLU-SLU, the Attention function causes a Minus Function indicator to be displayed in the OIA.

A second or successive Attention that occurs prior to completion of processing for the first Attention is ignored (with no indication). When you are using the Type Ahead function, Attention purges the Type Ahead queue.

Cursor Blink (Cursr Blink) Function

The Cursor Blink function causes the cursor (either the underscore or the reverse image) to blink. Using the Cursor Blink function again causes the blinking to stop.

Alternate Cursor (Alt Cursr) Function

Using the Alternate Cursor function changes the cursor display. The underscore type of cursor is changed to a reverse image. Conversely, the reverse image is changed to the underscore type cursor by the alternate cursor function.

Test (TEST) Function

Test invokes test functions resident in the 3174. Test clears and resets the display screen, and the Test indicator is displayed in the OIA, despite any input inhibited conditions. The controller places the device to be tested in test mode, and the operator identifies the test function desired. Test mode terminates when the Test function is used again.

The Test function results in no response with one of the following conditions present:

- Printer Busy
- Printer Very Busy
- Printer Not Working
- Security key locked
- Certain non-resettable machine checks
- Host-initiated local copy in progress
- I/O operation in progress with a 3270 host.

When the 3174 uses SNA, the controller enters test ownership state.

When the 3174 operates in BSC mode, Intervention Required is generated if a command is received for the display when in test mode. With non-SNA channel, the Test function generates a Control Check and Intervention Required. When test mode terminates normally, status with Device End is generated, and the terminal is put in its power-on state. When you are using the Type Ahead function, Test purges the Type Ahead queue.

Click Function

A clicking sound can be produced as keys are pressed on keyboards. The clicking sound is controlled by operating conditions such as input inhibit. For example, if the clicking sound is enabled and an input inhibited condition occurs, the Click function is then disabled, and vice versa. The Click function activates the clicking sound if it has been turned off or prevents clicking if it has been activated.

Print Function

The Print function initiates a local copy function. Local copy is described under "Local Copy Function" on page 4-24.

Ident Function

The Ident function assigns a printer or printer class for the purpose of performing a local copy function. The Printer Authorization Matrix (PAM) defines which printers are available for the local copy function. (See "Local Copy Function" on page 4-24 for more information.) When the Ident function is used, the cursor disappears from the screen, and the Assign Printer symbol appears with two underlined characters in the *nn* position. Enter the ID in the *nn* position. (Display stations with one of the PS features always select the base character set for the printer ID. If a symbol set is active when Ident is used, it is suppressed and then made active again at the end of the printer ID sequence.)

If the ID is for a printer class, it will be in the range 70—85. If the ID is for a specific printer, it will either be the printer's port number or the printer's PAM entry number. (The answer to customization question 800 determines which type of number should be used). When the ID is a printer port number, the range is 01—55, where:

- 01—31 is HG26-01 through HG26-31,
- 32—39 is HG21-00 through HG21-07,
- 40—47 is HG22-00 through HG22-07, and
- 48—55 is HG23-00 through HG23-07.

The PAM entry number can range from 01—47.

Note: Selecting a printer port number of 00 or the PAM entry number for port 26-00 is not allowed. Local copies are not authorized for a printer on port 26-00.

If the specified printer is not authorized (that is, the PAM does not permit the display to copy to the selected device or class of devices), the keyboard is locked and the Input Inhibited Operator Unauthorized symbol is displayed. If the *nn* is outside the valid range, the keyboard is locked and the Input Inhibited What Number symbol is displayed. Once the input inhibit condition is reset, the previous contents of the printer status field of the Operator Information Area (OIA) are displayed, the cursor reappears, and the print ID sequence can be retried.

If the selected print class or printer is valid and authorized for this display, the Printer Assignment symbol appears to indicate the logical connection, and print ID mode is exited. The cursor reappears, and the keyboard remains unlocked. The printer assignment change applies to all LTs associated with the same communication link.

In print ID mode, the following rules apply:

- Numeric information is displayed at the *nn* position in the indicator row. Each character is then checked for validity.
- Reset and other functions that cause a reset operate normally and cause print ID mode to be terminated. The cursor reappears, and the contents of the printer status area of the OIA are displayed.
- The following functions, operations, and actions terminate print ID mode:
  - Program Attention function
  - Device Cancel function
  - Security Key function
  - Unsolicited host read operation
  - Unsolicited host write operation
  - Any action that generates an input inhibited condition other than those keystrokes that cause a Keystroke Queue Full or those keystrokes that are processed immediately even if the session is in stack mode. See "Type Ahead Function" on page 4-5 for more information.
  - Change screen sequence works normally, but when the session again becomes the foreground session the What indicator is displayed to indicate that print ID mode has been exited.

  The cursor reappears, and the previous contents of the printer status area of the OIA are displayed in the indicator row.
- Other functions that work during a keyboard-inhibit condition also work while in print ID mode without causing termination.
- All other functions that are not honored during keyboard-inhibit conditions cause the Input Inhibit What symbol to be displayed and terminate print ID mode. In this case, the cursor reappears and the contents of the printer status area of the OIA are displayed in the indicator row.

Non-Escaping Keys

On some keyboards, use of the Accent characters causes no cursor movement. These Accent functions are referred to as *non-escaping keys* or *dead keys*. A subsequent character that receives the accent must be keyed next. If the subsequent character is valid, a unique composite character is formed on the screen at the cursor location.

Accent characters are also valid non-escaping keys from the Extended Graphics layer of the keyboard, except on a Converged Data Entry keyboard.

Note: Non-escaping keys vary from language to language and type of keyboard used.

Non-Escaping Key Mode

The Accent character places the keyboard in Non-Escaping Key mode. For Configuration Support A and S, the accent character is displayed at the cursor location and the cursor does not move. For Configuration Support B and C, the Enhanced Dead Key indicator is displayed in the OIA, the cursor does not move, and the contents of the screen are not changed.

Non-Escaping Key mode is normally exited with the keying of a valid character and the accent/character combination being displayed on the screen in the cursor location. Other conditions cause this mode to be exited, and if displayed, the Enhanced Dead Key indicator is erased from the OIA:

- An invalid character is combined with the Accent and causes the Invalid Dead Key indicator to be displayed.
- The Reset, Test, or System Request function is used.
- The Extended Graphics layer of the keyboard is entered.
- The Change Screen sequence is performed. When the session is again returned to the foreground session, the Invalid Dead Key indicator is displayed.

  Note: With Configuration Support A and S, the Change Screen sequence is not valid in Non-Escaping Key mode. It causes the Invalid Dead Key indicator to be displayed in the OIA.
- Keystrokes or functions, other than those just mentioned, cause the Invalid Dead Key indicator to be displayed.
- A selector light pen, MSR, or unsolicited host write operation causes the What indicator to be displayed.
- Any function that causes the Type Ahead queue to be purged.

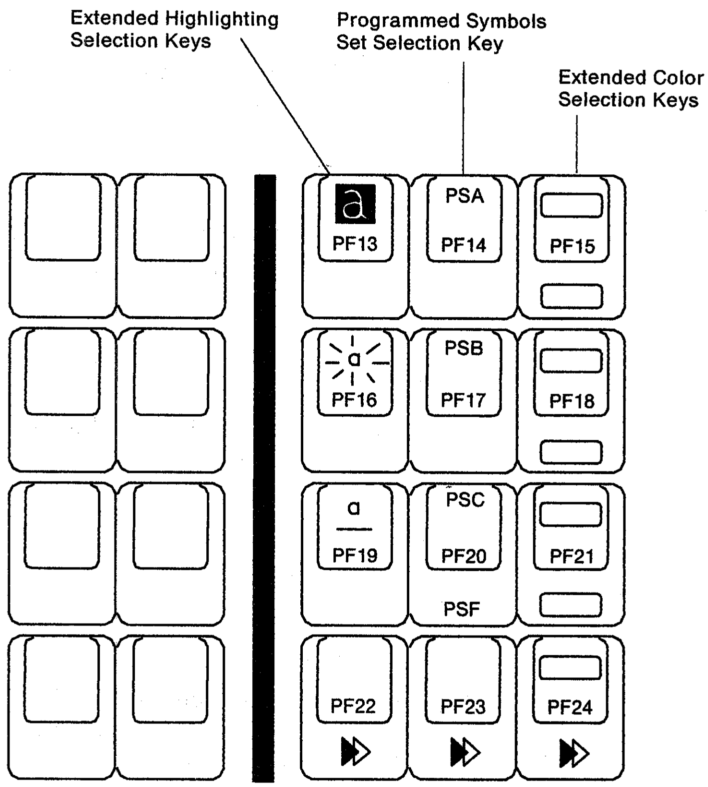
The following keystrokes do not cause Non-Escaping Key mode to be exited:

- Up/Down Shift
- Shift Lock
- Numeric Shift Lock
- Caps Lock
- Alternate
- Device Cancel
- Click
- Alternate Cursor
- Cursor Blink
- Attention.

During Non-Escaping Key mode, when the keyboard is selecting code points in a Programmed Symbol set in loadable storage, a composite character is not displayed. Instead, the character at a third code point is selected.

Attribute-Select Functions

The 12 PF keys at the right of some keyboards, in conjunction with the shift and alternate functions, are used to select extended character attributes that are to be assigned to each character entered from the keyboard. These keys are shown in Figure 4-1, and their actions are explained following the figure.



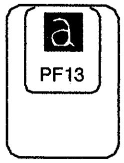
Note: The APL/text keyboard has PF designation as PF1-PF12.

Figure 4-1. Attribute Select Keys

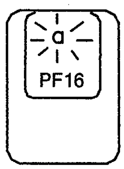
Operator selection of extended attributes is restricted to character attributes. Extended field attributes are protected against operator input. Character attributes of X'00' are assigned to characters entered, except when the program allows the operator to select attributes and the operator has made a selection. Where a selection has been made, the same attribute assignment is made for each character entered from the keyboard until the operator makes another selection for that attribute-type or until the set reply mode is changed to disable selection. The types of attributes that the operator is allowed to select must be explicitly defined by the application program in the Set Reply Mode function of a Write Structured Field command. If the operator is to select symbol sets, then the Load Programmed Symbols function must also define the set as operator selectable. When attribute selection is allowed, the OIA shows which extended attribute is valid for selection and the current status of that attribute. A field inherit function is provided for each type of extended attribute. Use this function to cancel a selected attribute and to cause default to the extended field attribute.

When data is entered from the keyboard, the character attributes related to the location of the data entered into the buffer are updated. If attribute selection is allowed and specific attributes are selected, the code of each selected attribute is loaded into the character attributes. For each type of extended attribute, if selection is not allowed and canceled, the character attribute is set to X'00'.

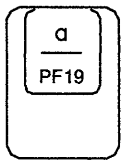
Extended Highlighting



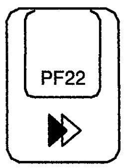
With upper shift, the Extended Highlighting function selects reverse video as the extended highlighting character attribute.



With upper shift, the Extended Highlighting function selects character blink as the extended highlighting character attribute.

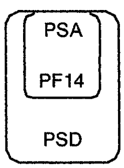


With upper shift, the Extended Highlighting function selects character underscore as the extended highlighting character attribute.

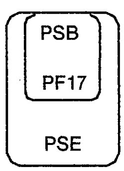


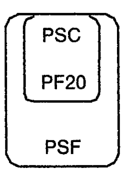
With Alt shift, the Extended Highlighting function sets field inherit as the extended highlighting character attribute.

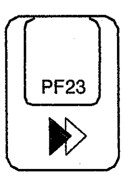
Symbol Set



Programmed Symbol Set A (PSA) through Programmed Symbol Set F (PSF), with the required shift (upper or alternate, depending on the position of the legend on the key), select the symbol set character attribute.

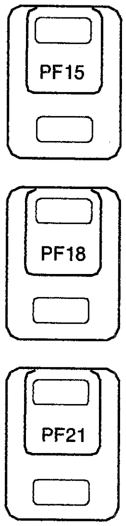




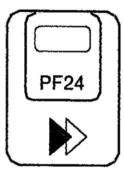


With Alt shift, the Set Symbol function sets field inherit as the symbol set attribute.

Extended Color



The color codes, with the required shift (uppercase or alternate, depending on the position of the code on the key), select the extended color character attribute.



With Alt shift, the Extended Color function sets field inherit as the extended color character attribute.

Local Copy Function

In addition to processing the BSC Copy command in BSC units, the 3174 provides a local copy function that allows direct data transfer from a display station to a printer(s) attached to the same 3174. The local copy function is directed by the 3174 *Printer Authorization Matrix (PAM)*. The PAM must be loaded into the controller.

The local copy function can be initiated by the operator or the host. For operator-initiated copy, use the Print function on a keyboard to initiate a local copy request. The local copy request is serviced by a printer selected under control of the PAM.

In SNA attachments, host-initiated local copy requests are initiated through a write type command with the WCC print bit set to 1 to a display.

The printer used for the request is the one that has been assigned to the display under control of the PAM. The local copy function and host-initiated local copy requests cannot be used to print a copy of a display screen on a Host Addressable Printer (HAP). Displays with a HAP, provide a local screen capture function that allows the display to send a copy of its screen to the printer that is attached to it. Refer to the display station's documentation to determine how to perform the screen capture function.

Do not attempt to copy graphics dependent on more than one character position for their presentation. If the graphic data cannot be accessed by a single code point, the printout is inaccurate because of the differing block matrix sizes and dot densities between display and printer. Also, attempting to copy to a printer not configured for programmed symbol operation or not containing a matching symbol set (with the one in the display station) results in default to the I/O interface character set installed in the printer.

Printer Authorization Matrix (PAM)

The 3174 PAM is sent from the host at your request (in conjunction with a host application) or specified during 3174 customizing. The matrix defines the operating modes of the printers attached to the 3174. (See the *3174 Planning Guide* for more information.) The PAM:

- Identifies the port number for the printer. The following restrictions apply:
  - 26-00 cannot be used for local copies.
  - HG27 port numbers can only be specified if customization question 800=11.
- Establishes printer mode. A printer can be reserved for the exclusive use of either the host or the Local Copy function. A third mode allows a sharing between these two functions.
- Assigns print classes. A print class is a way of grouping printers for use by local copy. A local copy request directed to a class is then serviced by one of the printers assigned to that group.
- Defines source displays. The display port list specifies which display stations can use the printers that have been defined for local copy support.

Printer Modes

A printer can be in one of three modes, specified in the PAM as local, system, or shared mode. Each printer on the 3174 is defaulted to system mode until a matrix is loaded. Printers that are specified as being in shared or local mode then become available for local copy use.

Local Mode: A printer in local mode can be used for Local Copy functions regardless of host attachment or communication protocol. Thus, display stations within the cluster can contend for use of printers but the host can not. The printer is not available for direct print operations from the host.

A local copy operation involves the transfer of data from the display buffer to the printer buffer and the subsequent printing of the data. A local copy can be initiated by using the Print function on a display station attached to a 3174 or by the host when the display station is operating in SNA. (The start-print bit in the WCC of a Write command to the source display station initiates the host copy operation.)

The response to a BSC Copy command or a direct print request(s) from the host to a printer when in local mode is Intervention Required (IR). Also, a printer in local (channel-attached) mode cannot validly be specified as a *from* BSC device in a Copy command. An I/O operation addressed to a printer in local mode when attached to a non-SNA channel results in Control Check (CC). Subsequent operations cause Intervention Required. The controller sends Device End (DE) when the printer is returned to either shared or system mode.

In SNA, an LU type 1 or 3 Bind request to a printer is rejected with a negative response of X'0801' (printer not assigned) when the printer has been put into local mode.

System Mode: A printer in system mode is entirely under host (system) control. System mode is the default mode each printer assumes when no PAM has been loaded, or when a printer has not been defined in the PAM during customizing. The printer cannot be used for operator-initiated local copy requests. The printer is likewise not available for host-initiated copy operations when using SNA. However, when operating with BSC protocol, the printer can honor a BSC Copy command when it is in system mode. The BSC Copy command, directed to the *to* device, specifies the *from* device as a command parameter and does not use the PAM.

Shared Mode: In shared mode, both host-directed printing operations and local copy operations are permitted on the same printer. In system mode, the printer is protected from local copies. In local mode, the printer is protected from host-initiated operations. When in shared mode, however, the subsystem does not guarantee this type of integrity. Users must assume the responsibility for integrity of their printed data by "installation rules" and proper programming practices when using a printer in shared mode. In BSC, an operator-initiated local copy operation to a printer in shared mode is not executed if the printer has status pending from a previous host-directed print operation. General or specific polling clears the printer status and frees the printer for local copy usage. See "Shared Printers Assigned to a Non-SNA Host" on page 4-42 for conditions that cause a printer that is on a shared port to be freed from the host allocation.

In SNA, a printer designated as being in shared mode in the PAM can be used for local copy under the following conditions:

- When the printer is not in session with a PLU in the host
- When Between Bracket Printer Sharing has been specified in the customizing procedure (sequence number 213) and the printer is not in bracket state with a PLU in the host.

Printer Class Structure

The PAM provides the ability to assign a printer to a class. The definition of a class of printers is made by the customer and can be based on type, character subset, type of forms mounted, location, etc. For example, in a particular installation class, *72* may be defined as referring to all printers with yellow paper. Thus, an operator can select an authorized printer on the basis of these characteristics rather than by address. When multiple printers are assigned to a class, improved copy throughput can be obtained.

The PAM allows a maximum of 16 printer classes to be defined in each subsystem. In any configuration, a single printer can be in one or several classes or not in a class. Several printers can be members of a single class.

Source Device Lists

Each printer can be restricted as to which display stations it can accept local copies from. When a local copy is directed to a print class, the printer selected is one that is authorized to accept copies from the requesting display station. Not all printers assigned to a particular class will be authorized for the same subset of display terminals.

When Multi-Host Support is used, a CUT display can perform local copy to an authorized printer only if both the display session and the printer are associated with the same communications link. DFT displays can only use printers on the primary communication link.

Loading a Host-Defined PAM

The 3174 PAM is required if you plan to perform local copy operations. If no matrix is loaded, the default condition for the cluster is that all printers are in system mode, and local copy operations are not possible except with the BSC Copy command. You can load a host-defined PAM while the 3174 is on-line. To initiate the loading of a PAM:

1. The display operator (on port 0 of HG26) initiates a transaction with a host program responsible for defining, managing, and loading the PAM. This transaction can, through appropriate interaction with the operator, define a new PAM, retrieve a previously defined matrix from host storage, or redefine an existing matrix.
2. The host program transmits the matrix data to the display attached to port 0 of HG26 as normal application data in a data stream. At this time the operator can add or alter data.
3. The operator invokes Extension/Extended Select mode, then presses the Host Load Matrix function. This causes the buffer to be scanned one row at a time from top to bottom. As each row is processed, the configuration data is stored in internal form in the controller.

Note: If the 3174 has CCA features or if configuration question 800 = 11 (HG27 printers allowed on PAM and Print ID is PAM entry number), then you cannot load a host-defined PAM.

During the loading process, the Time symbol is displayed in the OIA and the keyboard is locked. If the load is successful, the Time symbol is turned off and the keyboard unlocks. The cursor appears in column 1 of the row containing the end-of-matrix attribute sequence. The operator can then return to normal activity. Local printing can take place according to the authorization established in the PAM. When the load process is completed, configuration data cannot be retrieved from the controller for presentation back to the operator or the host, until you perform a re-IML.

If the loading process is unsuccessful, the Program Check symbol is displayed and the keyboard remains locked. The cursor appears in column 1 of the row containing the error. The operator can reset the keyboard and resume operation. Only those device descriptors that have been processed take effect. Recovery procedures are the responsibility of the application program. It is a host program responsibility to ensure that correct matrix data is loaded. If invalid data is loaded, unexpected results can occur when the matrix is used by the subsystem. Loading of the matrix terminates abnormally only when there is a program check. A display must be operating in 80-column format to properly load a PAM.

Screen Format

When the operator initiates the load operation from the keyboard, the PAM must appear in the buffer as follows:

Rows 1, 2	Reserved
Row 3	Header
Rows 4-N	Destination Device Descriptors
Row N+1	Trailer.

The first two lines of the display are reserved for the host program to display descriptive information to the display operator. These positions are not scanned during the load process.

Header: There must be a sequential string of 4 attribute characters, beginning at the first character position on the third row of the display, as follows:

Hex			
EBCDIC	**ASCII**	**Graphic**	**Definition**
60	2D	—	Protected
C1	41	A	Unprotected, MDT = 1
D4	4D	M	Unprotected, numeric, detectable
60	2D	—	Protected

This 4-byte sequence uniquely identifies the buffer data that follows as print authorization data. If the sequence does not appear exactly as shown, a program check occurs and the loading process is terminated. The remainder of the third row is not scanned.

Device Descriptors: Subsequent rows of the display contain the destination device descriptors. One descriptor is contained in a row. The format of each descriptor is as follows:

Col 1	Cols 2, 3	Col 4	Cols 5—20	Cols 21—52
Protected attribute – 1 byte	Address of printer – 2 bytes	Printer mode – 1 byte	Print class – 16 bytes	Source device list – 32 bytes

The protected attribute (EBCDIC X'60' or ASCII X'2D') defines the next 51 bytes as a destination device descriptor. If it does not appear in the first column of the row, a program check occurs and the loading process is terminated at this point. The two bytes immediately following the attribute character provide the character-coded decimal port address of the printer being described. For example, the printer at port 03 is identified by the character data 03 (X'F0F3'). Addresses are validated at the time the matrix is loaded to ensure that addresses are within the range of the number of HG26 devices supported on the controller. (Printers attached via the AEA feature and to HG27 ports are not supported in a host-defined PAM.) A program check is indicated if an invalid device address is specified.

Printer mode is expressed as follows, as a one character field:

Mode	Hex		Graphic
	EBCDIC	ASCII	
Local	D3	4C	L
System	E2	53	S
Shared	D1	4A	J

Any other coding of this byte results in the printer being defined to be in system mode. There is no validation of this byte during loading of the matrix. If there is a conflict between the mode definition and the coding of the source device list, the mode byte takes precedence.

The next 16 characters define the printer classes that are applicable to the device. By appropriate coding of this field, a device can be defined for multiple classes. Each character in this field is defined to be a character-coded digit, representing one entry in the class field of the device descriptor:

Display Column:	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Class:	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85

The character 1, X'F1', in one of these character positions defines the device as a member of the class associated with the corresponding position in the class field of the device descriptor. The character 0, X'F0', or any other character in this position, means that the device is not in the associated class.

The source device list is a 32-byte field. Source devices authorized for printers are character-coded. The character 1, X'F1', in any character location, specifies the associated device as an authorized source device for the destination device being defined. The character 0, X'F0', or any other value in this location, indicates that the associated device is not a valid source device:

Display Column:	21	22	23	24	25	26	27	28	29	30	31	32	. . .	52
Device Address:	00	01	02	03	04	05	06	07	08	09	10	11	. . .	31

Each descriptor takes 52 bytes, including the attribute byte; thus, each row contains 52 bytes of significant information. Other data on the row is not scanned during the load process. The first descriptor begins at row 4 column 2, the second at row 5 column 1, and so on.

Note: The source device list only applies to displays attached to HG26. With Configuration Support B Release 4 or later, displays attached to the AEA feature and to HG27 will not be able to perform a local copy function to a HG26 printer that has been modified by a host-defined PAM.

Trailer: The end of the matrix is signaled by the following sequence of 4 attribute bytes, beginning in the first column of the row following the last valid destination device descriptor:

Hex		Graphic	Definition
EBCDIC	ASCII		
60	2D	—	Protected
C5	45	E	Unprotected, MDT = 1, detectable
D5	4E	N	Unprotected, numeric, MDT = 1, detectable
C4	44	D	Unprotected, detectable

Scanning the buffer terminates at this point; the configuration data and each device descriptor are stored in the 3174. If a descriptor was previously loaded for a particular destination device, it is replaced by the one being loaded. An existing descriptor, not replaced, is still in effect for local copy operations. There is no global reset, other than power off, on the 3174. Only a program check causes termination of the load process prior to completion. If the configuration data is not valid, for example, if a display is selected as a destination device, there is no notification of this condition to either the operator or the application program. However, when a local copy operation is attempted, it is rejected accordingly.

Note: If a PAM is constructed using multiple Write commands, the WCC bit setting must not specify reset MDT bit 7 = 1.

Mode Transitions

When a new PAM is loaded into the 3174, unsatisfied print requests can still be queued. These print requests can have been made using destination device descriptors that were modified by the loading process. When new device descriptors are loaded into the subsystem, outstanding print requests are satisfied (if possible) based on the new configuration matrix. If the print requests cannot be satisfied, they are purged from the queue and the operator notified via indicator.

If a destination device changes from local to system mode, a bind to the printer LU is allowed, and any local copy requests queued for the printer are purged from the queue. When initiated by an operator using the Print function, the Busy symbol on the requesting display changes to Operator Unauthorized. When initiated by the host using the start-print bit in the WCC, a negative response of X'0801', printer not available, is sent to the PLU. Any printing actually in process is completed. If a device changes from system to local mode, subsequent transmissions to the SLU are responded to with X'0801' (Printer Not Available). If the printer is not in session, the transition to local mode is immediate. When a printer is changed from shared to system mode, the transition is immediate if the printer is in session with a host PLU. If the printer LU is not in session when the change is made, a session can be bound to the printer LU. However, any outstanding print requests are purged from the print queue. When initiated by the operator with the Print function, the Printer Busy symbol is replaced with the Operator Unauthorized symbol. When initiated by the host with the start-print bit in the WCC, a negative response of X'0801' is generated to the host request. When changing from local to shared mode, and from system to shared mode, the transition is immediate.

3174 Printer Status Symbols

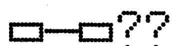
The following conditions determine the printer status symbols that appear in the OIA when the printer authorization matrix is loaded from the host:

- After the PAM is updated, the 3174 checks the Printer Assignment symbol on each display station. If the current assignment symbol is still valid, that is, the printer or printer class is authorized for use by the display operator, the symbol is not changed. If the assignment is not valid, but the display operator is authorized to use other printers, the Printer Assignment symbol is changed to What Printer symbol. If there are no printers in the system authorized for use by the display station, the Printer Assignment symbol does not appear.

- If the Printer Assignment symbol is not displayed when the matrix is loaded, and there are printers authorized for the display station, the Printer Assignment symbol then appears. The *nn* value is assigned as the first (lowest port number) printer authorized for the display station. If the printer is in a class, then the class number will be the *nn* value. If there are no authorized printers for the display station, the symbol does not appear.

- The priority of the printer status symbols, from lowest to highest, is:

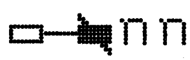
  a. Blank (no symbol displayed)

  b.  What Printer

  c.  Printer Assignment

  d.  Assign Printer

  e.  Printer Printing

  f.  Printer Failure

  Thus, if Printer Assignment or Printer Failure is displayed while the matrix is loaded, the symbol does not change until the condition causing the current indication is cleared, as, for example, when the printing operation is completed. The new printer status symbol is then displayed.

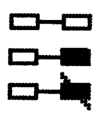
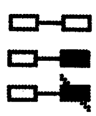
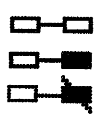
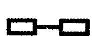
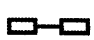
- Writing the What Printer symbol to a display station, or removing the Printer Assignment symbol, terminates the print ID sequence if the operator has been entering a print ID during the load process. The cursor is visible, and there are no inhibit conditions.

- If operator-initiated print requests are queued and a new matrix is loaded, the symbols change (as previously described). If there is no change in assignment, the queued requests are processed normally. However, if the Printer Assignment symbol is not displayed or is changed to the What Printer symbol by the load process, the Operator Unauthorized symbol is displayed, the print request is removed from the queue, and the keyboard is locked. Pressing the Reset function unlocks the keyboard. If the queued request was host-initiated, the keyboard remains locked, the Time symbol is displayed, the request is removed from the queue, and a negative response of X'0801', printer not assigned, is sent to the PLU.

- If the Print function is pressed while the What Printer symbol is displayed or while no Printer Assignment symbol is displayed, the Operator Unauthorized symbol is displayed and the keyboard is locked. Pressing the Reset function unlocks the keyboard.

- If the Ident function is pressed while the What Printer symbol is displayed, the Printer Assignment symbol appears. The first printer (printer with the lowest port number) authorized for use by the display is indicated by *nn*. If the printer is in a class, then the class number will be the *nn* value.
- If the Ident function is pressed while no Printer Assignment symbol is displayed, the Operator Unauthorized symbol is displayed and the keyboard is locked. Pressing the Reset function unlocks the keyboard.
- If power is removed from a display station after the matrix is loaded, and there are printers authorized for use by the display station, the Printer Assignment symbol is displayed as described previously in condition 2.

Changes that can occur to the printer status symbols are summarized as follows:

If the Current Printer Status Symbol is:	**And the New Matrix Specifies:**	**Then the New Symbol Is:**
 nn nn nn	nn is still authorized.	 nn
 nn nn nn	nn is no longer authorized, but there are authorized printers for the display station.	 ??
 nn nn nn	nn is no longer authorized, and there are no authorized printers for the display station.	blank
 ??	An authorized printer exists for this display station.	 ??
blank	An authorized printer exists for this display station.	 nn
 ?? or blank	No authorized printers exist for the display station.	blank

Print and Ident function operations are summarized as follows:

If the Current Printer Status Symbol Is:	And the Following Key Is Operated:	Then:
□—□ ?? or blank	**Print**	Operator Unauthorized is displayed, and the keyboard is locked.
□—□ ??	**IDENT**	The control unit will make assignment and display □—□ nn
blank	**IDENT**	Operator Unauthorized is displayed, and the keyboard is locked.
□—□ nn	**Print**	Print request is processed as described under "Operator-Initiated Copy."
□—□ nn	**IDENT**	□—□ _ _ is displayed and print ID mode is enabled.

3174 Local Copy Operation

The operator initiates a local copy function using the Print function on the keyboard of a display station attached to a 3174; or, in SNA, the PLU initiates a local copy operation by sending a write-type command to the display with the start print bit turned on in the WCC. Another type of host-initiated local copy function is described under "Copy Command" on page 6-24.

The responses to local print requests are discussed in the following paragraphs. These responses depend on the availability of printers within a selected print class. When a selected print class contains two or more printers, and no printers are immediately available, the system response to the print request is based on the most available printer(s) in the selected print class. Categories of unavailability, in order from most to least available, are:

- Busy executing a display printout for another SLU
- An intervention-required condition exists
- Allocated as LU1 or LU3, in session with a PLU
- A permanent error situation.

Printer Assignment

With the exception of the BSC Copy command, the PAM is used to direct local copy data from a display to an associated printer.

The Printer Assignment indicator's *nn* value identifies the printer or class of printers to which the local copy will be directed.

- A printer class is indicated by a number in the range of 70—85.
- If configuration question 800=10, then a specific printer is indicated by its port number, where:
  - 01—31 is ports 26-01 through 26-31,
  - 32—39 is ports 21-00 through 21-07,
  - 40—47 is ports 22-00 through 22-07, and
  - 48—55 is ports 23-00 through 23-07.
- If configuration question 800=11, then a specific printer is indicated by its PAM entry number (01—47).

Note: HG27 printers can only be defined in the PAM if configuration question 800=11.

When the controller is IMLed, the PAM is used to determine the default printer assignment indicator for each display port. If the user wishes to change the default assignment, the Ident function can be used. See "Ident Function" on page 4-19 for more information.

The default printer assignment is determined by the printer port (with the lowest port number), that the display is authorized to use. If this printer is a member of one or more classes then the default printer assignment indicator will indicate the lowest class number to which the printer belongs. Otherwise, the default printer assignment will indicate either the printer port number or PAM entry number depending on the answer to configuration question 800. If the display has multiple sessions, the default printer assignment is the same for all LTs.

The following list shows the printer ports in order from lowest to highest:

26-01 to 26-31,
21-00 to 21-07,
22-00 to 22-07,
23-00 to 23-07,
27-00 to 27-31.

The following tables show an example of the default printer assignment scheme. Table 4-1 on page 4-35 describes the definition of each printer in this example. Table 4-2 on page 4-35 lists each of the displays, the printers that they can local copy to, and what the default printer assignment value is.

Table 4-1. Example Default Printer Assignment Scheme			
PAM Entry Number	**Printer Port**	**Printer Mode**	**Class The Printer Belongs To**
1	26-02	Local	None
2	26-03	Local	70, 72
3	21-01	Local	71
4	21-02	Local	None
5*	27-03	Local	None
*This PAM entry is only valid if customization question 800 = 11.			

Table 4-2. Example of Printer Authorization for Local Copy				
			Printer Assignment Value	
Display Port	**Authorized Printers**	**Authorized Printers With Lowest Port Number**	**When Q800 = 10**	**When Q800 = 11**
26-00	26-02 21-02	26-02	02	01
26-01	26-03	26-03	70	70
21-00	None	N/A	N/A	N/A
21-03	21-02 27-03*	21-02	34	04
27-00	26-02 21-01	26-02	02	01
27-01	26-03 21-01	26-03	70	70
27-02	21-01 21-02	21-01	71	71
*This printer can only be authorized if configuration question 800 = 11.				

Operator-Initiated Copy

With the PAM loaded in the 3174, the operator can initiate a local copy operation by pressing the Print function on the display keyboard. The Print function is active in an SNA environment under the following conditions:

- No session has been established (prior to receipt of ACTLU, or after receipt of DACTLU).
- Session owner is *unowned.*
- The terminal is in test mode, and the keyboard is unlocked.
- Session owner is the SSCP, and the keyboard is unlocked.
- Session owner is the PLU, the keyboard is unlocked, and the SLU is not in receive state.

The Print function is active in a non-SNA environment if an Input Inhibit symbol is not displayed.

If the specified print class or specific printer is valid, but the printer or all printers in the print class are busy doing local copy operations for other displays, the Input Inhibited Printer Busy (short term) symbol is displayed. If the printer or all printers in the class are busy because they are *in brackets* (SNA) or *have status pending* (BSC) with a host application, which is possible only when the printer is in shared mode, the Printer Very Busy (long term) symbol is displayed. In either case, the request is then queued, and the keyboard is locked until the copy can be performed or the operator cancels the print request. Note that the Printer Busy (short term) symbol is displayed if the operator presses Print while the Printer Printing symbol is displayed, even if other printers in the assigned print class are available. The operator can wait until a printer becomes available to perform the copy function. The Reset function has no effect while a print request is on the queue; however, the operator can cancel the local copy request by pressing the Device Cancel function (while the request is on the queue). This turns off the Input Inhibited symbol, unlocks the keyboard, and dequeues the print request. The operator is then free to perform another task.

If the print class or specific printer is valid but the printer or all printers in the selected class are not functional, then the Input Inhibited Printer Not Working symbol is displayed and the keyboard is locked. The operator must press the Device Cancel function to continue. This action turns off the Input Inhibited symbol and unlocks the keyboard. The print request is not queued. The operator can then choose an alternate action. When the Printer Not Working symbol has been turned on as a result of an operator-initiated copy request, this symbol, and an associated Printer Failure symbol, if displayed, is turned off by receipt of any outbound FM data request.

If the operator attempts to print again, and the selected print class is still not operational, the Input Inhibited Printer Not Working symbol reappears. Some operator action, for example, loading paper in the printer, can be required to clear a not-functional condition. If no valid print class or printer is defined for this display (no printer status symbol) and the Print function is pressed, the Input Inhibited Operator Unauthorized symbol is displayed and the keyboard is locked. The indicators remain on until the operator presses the Reset function.

When a valid printer is selected, and the display-to-printer buffer transfer begins, the display keyboard is locked and the Printer Busy symbol remains displayed. This symbol remains on and the keyboard remains locked until the buffer transfer is completed successfully. When this occurs, the keyboard unlocks, and the Printer Printing symbol replaces the printer status symbol during the print operation. The Printer Printing symbol always indicates the actual port number or PAM entry number of the selected printer. Once the actual printing operation is completed, the Printer Printing symbol is replaced by the original Printer Assignment symbol.

If the printer stops during a local copy operation (out of paper or paper jam; a data check on the printer does not fall in this category), the Printer Failure symbol replaces the Printer Printing symbol and the print is terminated. The keyboard locks and the Printer Not Working symbol is also displayed, calling the operator's attention to the failure. The Printer Failure symbol always specifies the failing printer (port number or PAM entry number), not the print class. In this state, the Device Cancel function removes both symbols from the display.

Operator-Unauthorized Condition (Example): If the display station cannot perform the copy operation because the most available printer does not have a large enough buffer, the operator is alerted by an inhibit condition with the Operator Unauthorized symbol. This can occur, for example, when the operator attempts to copy to a 1920-character buffer printer from a 3440-character display.

The Operator Unauthorized symbol is also displayed if the indicated selection turns out to be a display station rather than a printer. This can occur when an invalid device descriptor gets loaded in the matrix. When Multi-Host support is used, the Operator Unauthorized symbol is displayed if:

- A CUT display user tries to print to a printer associated with another communication link, or
- A DFT display user tries to print to a printer that is not associated with the primary communication link.

Host Interference with Operator Copy (SNA): Once the display operator has initiated a local copy operation, any outbound FM data request is rejected with a busy indication, X'082D', during the time that the operator request is queued or the buffer is being transferred, and an outbound FM data request is received for display. Once the buffer transfer has been completed, the display is free to receive outbound FM data requests. If a negative response has been sent because of this condition, an LUSTAT of X'0001D000' is sent at the completion of the buffer transfer to notify the host that the busy condition no longer exists. FM data can be written into the display buffer as soon as the buffer transfer is completed.

If the host is in session with the printer, the local copy operation does not change the selected size of the printer buffer as set by the host session.

Host-Initiated Local Copy Using SNA

The host application program can initiate a local copy function in a SNA environment by sending to the display station a write-type command with the start-print bit in the WCC turned on. (The Copy function under SNA ignores WCC bits 2 and 3.) The controller performs the local copy function as required, using the print class or printer assigned to the display station and displayed in the OIA. When a write-type command is sent to the display station with the start-print bit on, the display station first interprets the orders and data in the write data stream and updates the display buffer. During this time, the Time symbol is displayed. Once the buffer write is completed, the 3174 attempts to use the printer(s) that it assigned to the display. The Time symbol remains on while the copy operation takes place. Once the buffer transfer is completed, the Printer Printing symbol replaces the Printer Assignment symbol. The Printer Printing symbol always shows either the port number or PAM entry number of the printer actually doing the print operation.

The keyboard remains locked, regardless of keyboard restore, until the print operation is completed. When the print operation is completed, the keyboard unlocks according to the keyboard restore in the WCC. The Time symbol is removed, and the Printer Assignment symbol replaces the Printer Printing symbol.

To perform the host-initiated local copy described above, the host program must send a write-type command with the start-print bit turned on in the WCC as an RQD chain or an RQE, CD, EB chain. Otherwise, the synchronization can be lost or the request rejected with response X'0843'.

Printer Busy Condition

If, after performing the display buffer update operation, the 3174 finds that the connected printer or all printers in the selected print class are busy with other local copy operations, the print request is queued; the Time symbol remains on; the Printer Busy symbol is not displayed. The Device Cancel function is inoperative under queued host-initiated requests.

On a 3174 configured for between-bracket printer sharing, if the selected printer or all printers in the selected class are found to be *in* brackets with the PLU, the copy operation is refused as follows: after the write operation is completed, the controller responds negatively to the print request with X'0807', Printer Busy. When between bracket printer sharing, the 3174 does not hold the printer if a release condition occurs after the 0807 or 082E response and before the LUSTAT is sent.

Once a print request has been refused with Printer Busy, the SLU sends an LUSTAT of X'0001B000' to the PLU when a printer becomes available. (Only one LUSTAT is returned per SLU, regardless of the number of times the PLU can have requested a local print operation.)

The PLU can choose not to wait for the LUSTAT but to continue with other display work. Even though the SLU is taken out of the ERP.1 state by the PLU, it is still bound to send in the LUSTAT when the printer becomes available.

If between bracket printer sharing is selected, the 3174 broadcasts LUSTATs for all displays that it can service. The printer is then held until each of those displays has provided a release by one of the following:

- Receiving an FM data request. If start print is specified, it is processed prior to releasing the printer.
- The display is powered off or a permanent error is detected on the display.
- Clear, Unbind, DACTLU, or ACTLU is received.
- DACTPU/ACTPU is received.

The 3174 does not hold the printer after sending an X'0001B000' LUSTAT when configured for between session printer sharing.

Printer Not Assigned Condition

If a printer is not assigned to the SLU at the time it is selected, the controller responds to the Write type command with negative response (0801) Printer Not Assigned.

On a 3174 configured for between session printer sharing, if the selected printer or all printers in the selected class are busy because they are in session with a host application, the print request is refused as follows: after the write operation is completed, the 3174 responds negatively to the print request with X'0801', Printer Not Assigned.

Printer not assigned is also sent to the PLU when a copy request is made and the selected printer cannot perform the copy because of a feature mismatch between the display device and the printer.

In all cases mentioned above, after the negative response has been sent to the host, the 3174 enters the ERP.1 state.

Printer Not Functional Condition

If the most available printer is not functional at the time that the printer is selected, the Printer Not Working symbol replaces the Time symbol. The Write command receives negative response X'082E', intervention required, or negative response X'082F', permanent printer error. The display LU goes into the ERP.1 state as defined for printer busy. When intervention-required is returned, recovery can require operator action, for example, loading forms. When the intervention-required condition is cleared, the 3174 generates an LUSTAT 0001B000 to the PLU in session with the display. After receiving the LUSTAT, the PLU can reinitiate the copy request by sending a Write command with the start-print bit in the WCC and with no data.

If the operator uses the Device Cancel function while the Printer Not Working symbol is displayed, the Printer Not Working symbol is replaced by the Time symbol.

If the PLU transmits any FM data request to the display and the Printer Not Working symbol has not been cleared, the FM data request removes the Printer Not Working symbol and, if displayed, an associated Printer Failure symbol, and can take the SLU out of the ERP.1 state.

No LUSTAT is required when X'082F' (permanent error) is sent as a response to the Write command.

If the printer malfunctions during the print operation, both the Printer Not Working and the Printer Failure symbols are displayed. The print operation terminates, and the Write command receives negative response X'082E', or negative response X'082F'. The keyboard remains locked, and the system waits for some recovery action as defined above. If another device is available in the same printer class, the 3174 can generate the LUSTAT immediately.

Note: Any FM data requests from the PLU clear a Printer Not Working symbol. This requires careful planning by an installation in the use of host and operator-initiated printing.

Local Copy Performed without SNA Protocol

In a BSC environment, host-initiated local copy is initiated through use of the Copy command (remote only). The description of operator indicators under "Host-Initiated Local Copy Using SNA" on page 4-37 does not apply to the Copy command. Operator-initiated copy in a non-SNA subsystem is the same as defined under "Operator-Initiated Copy" on page 4-35.

When a printer or class of printers is in shared mode, the contention between host and local copy use of the printers is resolved according to the following procedure:

- If, during processing of an operator-initiated copy operation, the host sends a selection addressing sequence to the printer, the controller responds with a Reverse Interrupt condition and set Intervention Required condition. When the local copy queue no longer exists and the printer becomes available, Device End is sent in response to a poll (remote) or as asynchronous sense/status (local) to signal that the printer is available.
- To provide security in subsystems, the printer buffer is cleared after successful operator-initiated local copy operations are completed. A read buffer or read modified operation does not return the contents of a printer buffer just used in a local copy operation by another display operator.

- The host application program can use the printer when there are no operator-initiated local copy requests outstanding. If the host must have sole ownership of the printer for data integrity or performance considerations, the printer should be designated as a system mode printer in the PAM.
- If the PAM is changed during normal operation, the transitions are made as described under "Mode Transitions" on page 4-30.
- If a host transmission to the display is received while an operator-initiated copy request is queued, the host transmission is accepted and written to the display. No change is made to the status of the operator-initiated copy. If the copy is queued and buffer transfer has not taken place, the new screen is copied. If buffer transfer has started before arrival of the host transmission to the display, the transfer is completed before writing to the display. In this case, the old screen is copied.
- Each time the local copy queue is completed, a Device End is transmitted to the CPU by the 3174, thereby signaling that the printer is available. The printer buffer is set to the default size after each copy queue is completed.

Mono/Dual Case Control

When power is applied, the 3262 and the 3289 are automatically activated to print the dual case character set; the 3287 is activated to print mono case.

In dual case operation, the alphabetic character codes sent by the host determine whether uppercase or lowercase characters are printed, provided that the print belt has the dual case character set. In mono case operation, the lowercase alphabetic character codes print equivalent uppercase characters.

The Change Case switch can be pressed to change the print case on the 3262, 3287, and 3289. However, when operating with LU1 printers in SNA, the data character codes and the print belt character set determine whether mono or dual case characters are printed, regardless of the Change Case switch setting.

In a BSC environment, when using the Copy command to transfer data from a display to a printer, the setting of the Change Case switch on the *from* display determines mono or dual case in the *to* printer. (This is also true for local Copy.) When the Copy command transfers data from a display or a printer to a display, the Change Case switch on the *to* display determines whether mono or dual case is displayed.

Format Control During Shared Printer Operations

When shared printers respond to uncoordinated print requests, control of the horizontal and vertical print position format is governed by the operating mode(s) and the format selected.

In BSC or non-SNA channel printer operations, sharing occurs on a buffer load basis, between local copy requests and host-initiated printer output, by means of write-type or Copy commands. When using SNA protocol, local copy requests for display buffer data originating from an LU2 session can share a printer with either LU3 or LU1 host output. Sharing of LU2 and LU3 devices is comparable to BSC or non-SNA channel operation.

When performing local copy in BSC, non-SNA channel, and SNA printer operations, the entire buffer contents, including nulls, attribute, and buffer control characters of a *from* display or a *from* printer (non-SNA only), can be transferred to a printer buffer.

During formatted print operations, the data is scanned a line at a time. If a line contains one or more data characters (including Space, New Line (NL), End of Message (EM), Forms Feed (FF), or Command Reject (CR)) in a display/print field, the line is printed and a line feed is performed. At least one Space character must be present to produce a blank line.

A valid FF character is executed regardless of the attribute of the field, except for the 3262 and 3289-1 and 3289-2. These printers do not execute or print any characters in a nonprint field, including the FF character. If the FF character is invalid, it is not executed and prints as a blank in a field that is not defined as nondisplay/nonprint.

If a line contains only nulls, attribute characters, or alphanumeric characters (including Space, NL, EM, FF, or CR) in a nonprint/nondisplay field, no line is printed and no line feed is performed. A screen facsimile can be obtained only by inserting at least one space character in the blank lines.

When directly printing from the host in BSC, non-SNA channel, and SNA LU3 printer operations, the identical procedure is followed as described previously, once data has been loaded in the buffer and the print operation is started. Thus, when a print operation is completed, a line feed is automatically performed after printing of the last line (blank or not). Therefore, the next buffer load of data, regardless of the source, starts printing on the next line, ignores the previous horizontal position, and is contiguous with the previous output except for blank lines as provided in either or both buffer data.

A valid FF control character in the data at either the beginning or the end of a form (one or more buffer loads) ensures synchronization of the forms with the data. Interleaving a local copy operation within a host output print operation using Vertical Forms Control (VFC) usually causes local copy to be printed on part of a completed form or cause at least one form to be misprinted. This can best be averted by configuring the printer in system mode, thus excluding its use for local copy.

In BSC, and non-SNA channel unformatted print operations, the completed print operation terminates at a new line position. Thus, the next print operation is also contiguous with the previous output except for possible blank lines as specified in the data. (SNA LU type 1 devices do not perform unformatted printouts.)

When operating as an SNA LU type 1 device, commands such as automatic Line Feed (LF) and New Line (NL) are not sent at the end of a bracket or a session. Therefore, the print position can be one position to the right of the last printed character. The first printed line resulting from a local copy operation performed with an LU2 device is printed on the line that is currently available. Overprinting can occur if the first line is not specified as a blank line. When the local copy operation is completed, the LU1 session resumes with a new bracket at the horizontal print established by the preceding LU1 bracket.

Shared Printers Assigned to a Non-SNA Host

A shared printer that is allocated to a non-SNA host is disconnected from this allocation when one of the following is received:

In BSC

- Power on reset (POR).
- Print Complete.
  - If data chaining is not in effect, the printer is released when *Print Complete* is received.
  - If data chaining is in effect, the printer is released when a *Print Complete* is received for the transmission containing a data chaining *only* or *end*, or when either a Write type command or an outbound structured field that contains a WCC with the Reset = On is received.
- BSC Copy that contains a Copy Control Character (CCC) with Start Print = On
  - A *from* printer is released after the data is retrieved by the 3174.
  - A *to* printer is released on print complete (if CCC = Start Print).
- After the data is retrieved by the controller for one of the following read operations (when the data is retrieved, the printer is no longer in *retry* read state):
  - Read Modified
  - Read Modified All
  - Read Buffer
  - WSF command followed by a Read Partition (Query/Query List) structured field.
- A Write type command or an outbound 3270 Data Stream structured field that contains a WCC with the Reset = On (if data chaining is active, a WCC with the Reset = On causes a data chaining *end*).
- Controller or printer operation error.

In Non-SNA Channel

- POR.
- Print Complete.
  - If data chaining is not in effect, the printer is released when *Print Complete* is received.
  - If data chaining is in effect, the printer is released when a *Print Complete* is received for the transmission containing a data chaining *only* or *end*.
- When not in *retry* read state (not waiting for a write type command to acknowledge inbound data) and one of the following read operations is received:
  - Read Modified
  - Read Modified All
  - Read Buffer
  - WSF command followed by a Read Partition (Query/Query List) structured field.
- A Write type command or an outbound 3270 Data Stream structured field that contains a WCC with the Reset = On (if data chaining is active, a WCC with the Reset = On causes a data chaining *end*).

- System or selective reset.
- Controller or printer operation error.

Host Addressable Print

The printer attached to a 3472 can be used as a host addressable printer (HAP). In this case, the host system recognizes the printer as if it were directly attached to the 3174. However, the 3174 does not recognize the printer as a subsystem printer. Thus, the other display stations attached to the controller cannot submit a local copy print request to the printer. However, the display to which the printer is attached, can use a local screen capture function to copy the screen contents to the printer.

To enable Host Addressable Print, the 3174 Release A/S 5.0 or higher is needed. Refer to the *IBM InfoWindow 3472 User's Guide* and the *IBM InfoWindow 3471 and 3472 Introduction and Installation Planning Guide* for details.

Multiple Logical Terminal (MLT) Function

The MLT function enables IBM 3270 CUTs and ASCII devices in 3270 emulation mode to interact with as many as five host sessions. Each session can be connected to a 3270 host or an ASCII host. The display station screen and keyboard are owned by a single session at a time. This session is the *active session*. The other sessions are maintained in the 3174 and are called *background sessions.*

Each session that connects to a 3270 host requires that the 3174 host session address be known to the 3270 host. The host connections and associated host session address are defined during 3174 customizing procedures. The number of host sessions is limited to the type of host connection (SNA or non-SNA) and to controller storage. A session connected to an ASCII host does not require that a 3270 host address be assigned to it. (A connection to an ASCII host requires the AEA feature.) Access to the ASCII host is defined through 3174 customizing procedures described in the *3174 Planning Guide*.

For Configuration Support B and C

3270 CUTs:

The Logical Terminal Assignment (LTA) determines the number of LTs, the 3270 host with which each LT communicates, and which host address from the Port Assignment Table is to be used for each LT. When the AEA feature is customized, the Default Destination Panel determines with which host the LT communicates when it is accessed for the first time. The host from the Default Destination Panel can be the 3270 host that was designated in the LTA, an ASCII host, or the Connection Menu. Default Destination is overridden if the LT is assigned to a CCA host.

- Storage is allocated only for LTs in the assignment list.
- Host notification signals are sent only for LTs in the assignment list. When you turn on an MLT CUT display, a power-on signal is sent to the host for LT-1. Host notification signals are sent for other LTs when they are first accessed as part of the change screen sequence.

- Programmed symbols (PS) can be assigned to the session on LT-1 (any 3270 host). Does not apply to the CUT interface of the DFT-E.
- When customized for Multi-Host Support, sessions can be assigned for any host on the controller. The CUT interface of the DFT-E cannot communicate with a 3270 host.

ASCII Devices:

- The AEA Session Limit determines the number of display LTs, the Port Assignment Table determines which host address is used for each LT, and the Default Destination Panel determines with which host each LT communicates when it is accessed for the first time. The host from the Default Destination Panel can be the 3270 host (Host ID 1A), an ASCII host, or the Connection Menu.
- Storage is allocated for the number of sessions specified in the AEA Session Limit.
- When you turn on an MLT ASCII device, a power-on signal is sent to the host for LT-1. Host notification signals are sent for other LTs when they are first accessed as part of the change screen sequence.
- When customized for Multi-Host Support, LTs can be assigned for any ASCII host and the 3270 host designated as 1A.

For Configuration Support A and S

- The Port Assignment Table (PAST) determines the sessions that are assigned to each LT.
- Storage is allocated for all LTs in the port assignment.
- Host notification signals are sent for all LTs when you turn on an MLT CUT display (ASCII MLT is not supported by Configuration Support A or S).
- Programmed symbols can be assigned to LT-1.

See Chapter 16, "Multi-Host Support" for additional information.

Error Messages

If an LT is specified in the LTA or AEA Session Limit but is not supported, an appropriate error indication appears when the LT is first accessed. The LT is unusable until the controller can support it. The following types of errors cause an LT to be unusable:

- Insufficient storage (2%%)
- CCA not present (399)
- CCA not customized (399)
- CCA failure (325).

Change Screen (ChgSc) Function

The Change Screen function allows the terminal user to access the sessions defined during controller customization. The terminal user accesses each session in round-robin fashion by using the Change Screen function. (Refer to the *3174 Terminal User's Reference for Expanded Functions* for the location of the Change Screen function.) The current session is maintained in the background and the next (background) session becomes active. All host level processing occurs in both foreground and background sessions; the display screen is not changed by updates to the background sessions.

When controller resources do not support an LT, an insufficient storage error (2%%) is displayed in the OIA of a blank screen. Press Reset to continue using your active session. You will not be able to use the change screen sequence to access other sessions.

Note: For Configuration Support B and C, insufficient storage to support an LT causes only that LT to be skipped. The Change Screen, Skip This LT, and Restore All Skipped LTs functions remain active. On subsequent cycles through change screen sequence, the LT is bypassed until sufficient storage is available to support it. If storage becomes available, the change screen sequence restores bypassed LTs. If you choose to skip an LT with insufficient storage using the Skip This LT function, you must later restore it using the Restore All Skipped LTs function if sufficient storage becomes available.

Skipping and Restoring LTs

The Skip This LT function and Restore All Skipped LTs function are defined in extension mode (extended select mode on enhanced and converged keyboards). Refer to the *3174 Character Set Reference* for the locations of these functions.

For CUT and ASCII displays, LTs can be marked as skipped and removed from the change screen sequence by invoking the Skip This LT function. Invoking the Skip This LT function causes the current LT to be skipped, and a change screen for the next LT.

The skipped LTs are removed from the change screen sequence until the Restore All Skipped LTs function is invoked or until the controller is reloaded. If a session is in progress on a skipped LT when the display is powered off, the host is notified. When the power to an ASCII display is turned on, the skipped LTs are added back into the change screen sequence.

Note: The Skip This LT and Restore All Skipped LTs functions are supported only by Configuration Support B and C.

Session Indicators

Each time you use the Change Screen function, the LT identifier shows which session is active. Table 4-3 lists the possible LT identifiers:

Table 4-3. LT identifiers

Session	For Non-X.21/X.25 Systems	For X.21/X.25 Systems
First (primary)	LT-1	-1
Second	LT-2	-2
Third	LT-3	-3
Fourth	LT-4	-4
Fifth	LT-5	-5

The LT identifier is not displayed if only one session is defined for the port. If multiple sessions are defined for the port, but there are insufficient resources to support multiple sessions, the LT identifier is displayed as LT-X when the display is turned on. LT-X indicates that you have a configuration error, and you should notify your system administrator.

Note: For X.21 systems, see Figure 7-1 on page 7-4 for indicator symbols. For X.25 systems, see Table 8-2 on page 8-18 for indicator symbols.

For Configuration Support B and C, the Host Identifier (ID) is displayed in column 18 of the OIA and gives additional information about your session. The Host ID is updated each time you press the Change Screen function. Depending on the type of host (ASCII or IBM) the session is communicating with, the Host ID differs as follows:

ASCII Host — The host ID is the Station Set number of that ASCII host; the two-character number can be from 1 to 30.

IBM Host — The host ID specifies which link, host, and session index are defined for this session. The Host ID is three characters long and has the following format:

Column	Name	Description
18, 19	Host ID	A two-character identifier for each of the hosts. The first character is numeric and identifies the specific host link. The second character is alphabetic and identifies multiple hosts on a link.
20	Session Index	Identifies the session on the host designated by the Host ID.

The Host Descriptor is a 20-character name displayed in columns 30-49 of the OIA. Columns 30-49 are updated with the Host Descriptor each time you use the Change Screen function. Depending on the type of host (ASCII or IBM) the session is communicating with, the Host Descriptor varies as follows:

ASCII Host — The Host Descriptor is the Station Set Name of that ASCII host. If the Station Set Name has more than 20 characters, only the first 20 characters are displayed.

IBM Host — The Host Descriptor has a maximum of 20 characters.

If no Host Descriptor is defined, the indicators normally displayed in the OIA appear. If an update to any of the overlayed areas occurs while the Host Descriptor is displayed, the Host Descriptor is erased and the original indicators appear in the OIA. The Host Descriptor can also be removed by using the Reset function, if there is no input inhibit or insert indicator to be removed with the Reset function.

Note: The Host Descriptor is not displayed during test mode, during change format mode, when the Connection Menu is displayed, or when an LT identifier of LT-X appears in the OIA.

Operational Characteristics

The characteristics and limitations of MLT operation are:

- All shift states, except APL, Text, and the language shift, are maintained across sessions. The shift state is updated for the active session and transferred to the next session when you use the Change Screen function.

  Insert mode is maintained on an individual session basis.
- Entry Assist parameters (such as margins and tabs) are maintained on an individual session basis.
- Security key operations apply only to the active or foreground session.
- Programmed Symbol Set is supported only for LT-1.
- Device attachment, MSR, and selector pen operations are applied to the active session and maintained on an individual session basis.
- The display switches, Mono/Dual, 2/4 Color, and Test/Normal, apply to all sessions.
- The actions of the Test function are applied only to the active session.
- Only one LT associated with each 3270 communications link can be in test mode.
- Cursor mode, Print ID, and the Clicker function apply across all sessions associated with a particular host link on a device basis.
- The Change Screen function is not always valid to use. You cannot use it when:
  - The controller microcode[1] does not support MLT.
  - The controller is not customized to support MLT on the terminal.
  - The security key is off.

[1] Microcode may be classified as IBM Licensed Internal Code. See the "3174 Licensed Internal Code" notice on page ii.

- The color convergence RAS test is in effect.
- An MSR or Selector Light Pen operation has been stacked while in Type Ahead mode.

Local Copy Considerations

The change screen operation is valid during the local copy procedure. The print operations, from the host and keyboard, are handled on a session basis. The session can be the active session or a background. For host-loadable PAM operations, printer assignment changes initiated while a local copy operation is printing are delayed until printing is completed. If any print operations are in progress, the printer assignment is updated for the affected sessions at the completion of the operation.

Data Stream Handling

The following paragraphs describe data stream handling considerations of the 3174 for the MLT function.

Load Programmed Symbols (PS)

Ownership of the Program Symbol set is assigned only to LT-1. While LT-1 is in the background, the Program Symbol set updates can occur. During the Load Programmed Symbols operation, the display screen flashes or is blank. The session currently being displayed is not affected, except for visual disruption during the operation.

The Write Structured Field Query Reply data stream generated for the secondary sessions reports that Load Programmed Symbols are not supported. A Load Program Symbol Set structured field directed to a secondary session is rejected. Character Set selection from the keyboard is not allowed for secondary sessions.

Explicit Partition

Explicit partitions are not supported for displays with power on and with more than one session. For displays that support the Extended Function feature, for example, 3180s and 3192s, the Query data stream is modified to indicate that explicit partition is not supported. This modification is accomplished by inhibiting the generation of the Alphanumerics Partitions structured field and modifying the Usable Area structured field as follows:

- Byte 4 bits 4–7 are modified to indicate that 12/14 bit addressing is allowed.
- Bytes 21 and 22 are modified to indicate the maximum screen size of the display. The size is based on the width and height of the Usable Area.
- Prior to Configuration Support B4.0, the Alternate Usable Self-Defining Parameter is omitted by adjusting the structured field length in bytes 0 and 1. With microcode release B4.0, the Alternate Usable Area Self-Defining Parameter is only omitted if customization question 126 digit 5 is equal to 1.

Refer to "Query Reply (Usable Area)" on page 3-56 for more information.

File Transfer

Using the Change Screen function during file transfer operations can cause unpredictable results.

Note: To avoid losing data, only the active session should receive data and the alarm sounding for the background session should be inhibited.

Part 3. Host Attachment

This part contains the following chapters:

Chapter 5, "Local Operation," describes general channel interface operations of the 3174 when it is locally attached to a host through a channel.

Chapter 6, "Remote Operation," describes how the 3174 operates when it is remotely attached (telecommunication-attached) using BSC and SDLC.

Chapter 7, "X.21 Operation," describes how the 3174 uses the functions, keys, and indicators for X.21 interface and the modes and states of X.21 operation.

Chapter 8, "X.25 Operation," describes the steps required for designated terminals that are attached to a 3174 to communicate over an X.25 network.

Chapter 5. Local Operation

Introduction

The first part of this chapter describes how the 3174 operates when locally attached to a host through a channel.

The following general channel interface operations apply to SNA and non-SNA locally-attached units:

- Command initiation
- Chaining
- High-speed transfer
- Command retry
- DFT operations
- Attention delay.

The second part of this chapter describes the commands, status and sense definitions, and error-recovery procedures for non-SNA locally attached units.

The third part of this chapter describes the commands, status and sense definitions, and error recovery procedures for SNA locally attached units.

Refer to the *3270 Information Display System Introduction* for information about the host systems, controller models, and attached terminal combinations that support local operations.

See Chapter 14, "3174 Token-Ring and ISDN Support," for information concerning 3174s with a Gateway feature and the 3174 Models 3R, 13R, 23R, 53R, and 63R, attached to an IBM Token-Ring Network.

General Channel Interface Operations

The local (channel-attached) 3174 can be customized to operate as either a non-SNA or SNA controller. This section summarizes local operation for both the non-SNA and SNA 3174s. Refer to the *IBM System/370 Principles of Operation*, GA23-7000, and the *IBM System/360 and System/370 I/O Interface Channel to Control Unit Original Equipment Manufacturers' Information*, GA22-6974, for more detailed descriptions.

The host initiates channel operations with a Start I/O instruction, which identifies the address of the controller and terminal to the channel. The Start I/O instruction also causes the channel to produce a channel address word (CAW). The CAW designates the storage protection function and the location in main storage of the first CCW, which the channel uses in command initiation. The channel then produces the CCW, which specifies the command to be executed and number and address, in main storage, of any bytes to be transmitted.

Selection

The channel selects a 3174 by sending an address byte to all attached 3174s. The address byte is part of the Start I/O instruction sent by the host to start channel operations. When the addressed 3174 recognizes its address, it connects to the channel and responds to the selection by returning the address to the channel.

Addressing of non-SNA units is different from that for SNA units. See the following sections for more information.

Non-SNA Unit Addressing

Table 5-1 shows the address byte when 16 or fewer terminals are attached to the 3174. The table reflects the total number of addresses available when the AEA feature and the MLT function are being used. The first four bits of the address byte specify the controller address, and the last four specify the terminal address.

Table 5-1. Non-SNA 3174 Terminal Addressing, 16 or Fewer Terminals per Controller

	8-Bit Channel Address Byte			
Controller No.	**Controller 0123**	**Terminal 4567**	**Terminal No.**	**4567 (xxxx)**
0	0000	xxxx	0	0000
1	0001	xxxx	1	0001
2	0010	xxxx	2	0010
3	0011	xxxx	3	0011
4	0100	xxxx	4	0100
5	0101	xxxx	5	0101
6	0110	xxxx	6	0110
7	0111	xxxx	7	0111
8	1000	xxxx	8	1000
9	1001	xxxx	9	1001
10	1010	xxxx	10	1010
11	1011	xxxx	11	1011
12	1100	xxxx	12	1100
13	1101	xxxx	13	1101
14	1110	xxxx	14	1110
15	1111	xxxx	15	1111

Table 5-2 on page 5-4 shows the address byte when as many as 32 terminals are attached to the 3174. The first 3 bits of the address byte specify the controller address, which must be even, and the last 5 bits specify the terminal address. No more than 16 terminals can be attached to a 3174 with an odd-numbered address.

Table 5-2. Non-SNA 3174 Terminal Addressing, 17 or More Terminals per Controller

	8-Bit Channel Address Byte					
Controller No.	**Controller 0 1 2**	**Terminal 3 4 5 6 7**	**Terminal No.**	**3 4 5 6 7 (x x x x x)**	**Terminal No.**	**3 4 5 6 7 (x x x x x)**
0	0 0 0	x x x x x	0	0 0 0 0 0	16	1 0 0 0 0
2	0 0 1	x x x x x	1	0 0 0 0 1	17	1 0 0 0 1
4	0 1 0	x x x x x	2	0 0 0 1 0	18	1 0 0 1 0
6	0 1 1	x x x x x	3	0 0 0 1 1	19	1 0 0 1 1
8	1 0 0	x x x x x	4	0 0 1 0 0	20	1 0 1 0 0
10	1 0 1	x x x x x	5	0 0 1 0 1	21	1 0 1 0 1
12	1 1 0	x x x x x	6	0 0 1 1 0	22	1 0 1 1 0
14	1 1 1	x x x x x	7	0 0 1 1 1	23	1 0 1 1 1
			8	0 1 0 0 0	24	1 1 0 0 0
			9	0 1 0 0 1	25	1 1 0 0 1
			10	0 1 0 1 0	26	1 1 0 1 0
			11	0 1 0 1 1	27	1 1 0 1 1
			12	0 1 1 0 0	28	1 1 1 0 0
			13	0 1 1 0 1	29	1 1 1 0 1
			14	0 1 1 1 0	30	1 1 1 1 0
			15	0 1 1 1 1	31	1 1 1 1 1

Note: Controllers 1, 3, 5, 7, 9, 11, 13, and 15 cannot be assigned when attached devices are assigned Terminal No. 16 or greater.

Terminal addresses must always be assigned sequentially, starting with address 0. However, no priority is given to a particular terminal address. When the 3174 recognizes both the controller and terminal addresses, it logically connects to the channel and returns the address byte to the channel.

SNA Unit Addressing

The 3174 SNA units are single-address 3174s. Any one of 253 addresses (2 – 254) can be assigned to a controller.

Command Initiation

Command operations start when a 3174 is successfully selected. When a command is to be executed by the 3174 (not by the channel alone), the channel sends the command code (CCW bits 0—7) to the 3174 unit.

When execution of the command involves a transfer of data (such as a write or read operation), the 3174 responds to the command with a status byte called *initial* status, which indicates when it can execute the command. If the command can be executed, the channel responds automatically to service requests from the controller, and the controller assumes further control of the operation. Command operation can be terminated by the controller or by the channel when the channel byte count reaches zero. At this time, the controller sends the channel another status byte, called *first ending* status, which indicates whether the command operation was successfully performed up to this point. If the *first ending* status byte also indicates that the command operation is completed, then it is the only ending status sent. If the command operation is not completed at this point, a *second ending* status byte is sent to indicate that the operation is completed.

Chaining

When the channel has completed the operations specified by a CCW, it can continue the activity initiated by the Start I/O by fetching a new CCW, thereby starting execution of another command. Producing the new CCW is called *command chaining,* and the CCWs that belong to such a sequence are said to be *chained.* All CCWs in a chain apply to the controller specified by the Start I/O instruction. Multiple devices can be specified through SNA protocol.

Either of two types of chaining can be specified by the current CCW (bits 32 and 33): data chaining or command chaining. During data chaining (current CCW bit 32=1), the new CCW fetched by the channel defines a new main storage area, the data address, for the current command. Data chaining is transparent to the controller. During command chaining (current CCW bit 33=1), the new CCW specifies a new command and a data address for the new command. The controller is dedicated to one CCW string until final channel-end time or until operations are abnormally terminated.

Programming restrictions that must be observed when command chaining is used are described in "Write Structured Field (WSF) Command" on page 2-15.

High-Speed Transfer Mode

High-speed transfer is a mode of operation that uses an interlocked or data streaming method of transferring all data, except sense data, between the channel and the 3174. Sense data is still sent using the single-tag interlocked method. High-speed transfer gives higher data transfer rates by alternating Data In with Service In and Data Out with Service Out. The high-speed transfer option should be selected only when connected to a channel with the High-Speed Transfer feature installed.

High-speed transfer is enabled through 3174 customization (question 224). The interlocked mode allows data transfer rates of up to 1.25Mbps; data streaming mode allows rates of up to 2.5Mbps.

Command Retry Function

When the 3174 detects certain error conditions, it can request the channel to retry a command. This Command Retry request consists of a combination of status bits and the use of the 'mark 0 in' line. If the retry request is not successful (the channel does not execute it), the status is passed to the host.

After three consecutive successful command retry attempts, the command retry counter is reset, and the command retry function is disabled. After the 3174 receives the next command from the host, the command retry function is enabled.

To use the command retry function, the 3174 must be attached to a channel equipped with the Command Retry feature.

Attention Delay Function (Only SNA Units)

The attention delay function increases the probability of including more than one Path Information Unit (PIU) per read channel program, and reduces the number of unsolicited attentions presented to the channel. Inbound data (PIUs) are queued during the delay period, and one attention is presented at the end of the delay period. The attention is presented before the end of the delay period if the number and size of the PIUs on the inbound queue satisfy the maximum receive capacity of the read channel program.

The delay period timer is reset and restarted when either attention is presented or a status modifier is included with the normal ending status for a Write Break command. The only exception is when the inbound queue is empty. If the inbound queue is empty, the delay period timer is started whenever a PIU is added to the empty queue.

The attention delay function is available only on SNA locally attached units.

Non-SNA Operations

The non-SNA 3174 units can attach to an IBM System/370* using a selector channel, a byte multiplexer channel, or a block multiplexer channel through the standard I/O interface. When the units are attached to a byte multiplexer channel, data can be transferred in bursts of 2 to 512 bytes, selectable by 3174 microcode customization. The channel, in turn, is attached to main storage and to the processing unit.

The channel program controls all controller operations by transmitting information across the I/O interface. This information consists of the following:

- An address byte, which selects one 3174 and one terminal (display station or printer) attached to the 3174
- Command bytes, which specify the type of operation to be performed by the controller for the terminal
- Data bytes, which are either stored in the controller buffer for ultimate use by the selected terminal as display or printout data or decoded as orders and used by the controller for formatting the buffer
- Various control signals.

Status bytes, which are automatically generated by the controller, inform the channel program about:

- The general condition of the controller and selected terminal at various stages of command operations
- Any unique conditions of the controller and any attached terminal when command operations are not in progress.

Commands

Non-SNA units receive the following control commands from the channel:

- Select Read Modified (RM)
- Select Read Buffer (RB)
- Select Read Modified from Position (RMP)
- Select Read Buffer from Position (RBP)
- Select WRT
- Erase All Unprotected
- No Operation
- Sense
- Sense ID.

Note: Non-SNA units also receive all the 3270 data stream commands described in Chapter 2, "3270 Commands, Orders, and Attributes." These commands are received in the form of CCW command codes.

Table 5-3 shows the codes for each of the commands listed above.

Table 5-3. Non-SNA Command Codes

Command	EBCDIC (Hex)	ASCII (Hex)	Graphic
Select RM	0B	NA	NA
Select RB	1B	NA	NA
Select RMP	2B	NA	NA
Select RBP	3B	NA	NA
Select WRT	4B	NA	NA
Erase All Unprotected	0F	3F	?
No Operation	03	NA	NA
Sense	04	NA	NA
Sense ID	E4	NA	NA

Select Read Modified (RM) Command

Select RM is an immediate command. After the non-SNA unit receives the Select RM command, it sends Channel End to the host.

The non-SNA unit executes a Select RM command by preparing for a read-modified operation and then returning Device End to the host; that is, the terminal buffer is searched for any modified fields, and the input data stream is built. This could result in an AID only (Short Read), test-request-read, or a read-modified data stream. If the command following the Select RM command (chained) is a Write command, the input data is not used. The write data stream is received by the non-SNA unit and processed to the terminal. If the Write command is a WCC, SBA xx only, and then is chained to an RB or RM command, the input data stream that has been prepared is not used, and the appropriate data stream is prepared on receipt of the RB or RM command. If the command following the Select RM is the RB command, the input data is not used, an RB operation is performed, and the data is sent to the host.

The Select RM command is used to separate the device-to-non-SNA-unit read-modified preparation from the channel operation to decrease channel use by the non-SNA unit.

Note: The successful use of the Prepare to Read select commands on the non-SNA unit requires that appropriate code be included in the access methods of the host operating system. Host operating system SYSGEN manuals indicate the operating system SYSGEN macros that are a prerequisite.

Select Read Buffer (RB) Command

Select RB is an immediate command. After the non-SNA unit receives the Select RB command, it sends Channel End to the host.

The non-SNA unit executes a Select RB command by preparing for an RB operation; that is, a device-to-control-unit buffer transfer is performed and an RB data stream is built. When the data stream is completed, Device End is sent to the host. If the command chained to the select RB command is not an RB command, the command is not accepted, and Channel End, Device End, Unit Check, and Operation Check are sent to the host.

Select Read Modified from Position (RMP) Command

Select RMP is an immediate command. After the controller receives the Select RMP command, it sends Channel End to the host. A Select RMP command is executed by recording the RM condition and returning Device End.

The commands following the Select RMP command should be a chained Write command followed by a chained RM command. (The Write command contains only four bytes [WCC, SBA xx] to set the buffer address.) If the sequence is other than as described, the command is not accepted, and Channel End, Device End, and Unit Check (Operation Check) are sent to the host.

Upon receipt of the Write command, the non-SNA unit performs the RM operation from position preparation and returns Device End to the host when the data stream is completed. The RM command is then executed.

Select Read Buffer from Position (RBP) Command

Select RBP is an immediate command. After the controller receives the Select RBP command, it sends channel end to the host. A Select RBP command is executed by recording the read-buffer condition and returning Device End.

The commands following the Select RBP command should be a chained Write command followed by a chained RB command. (The Write command contains only four bytes [WCC, SBA xx] to set the buffer address.) If the sequence is other than as described, the command is not accepted, and Channel End, Device End, Unit Check, and Operation Check are sent to the host.

Upon receipt of the Write command, the non-SNA unit performs the RB from position preparation and returns Device End to the host when the data stream is completed. The Read Buffer command is then executed.

Select Write (WRT) Command

Select WRT is an immediate command. After the controller receives the Select WRT command, it sends Channel End to the host. A Select WRT command is executed by inhibiting execution of the *prepare to read* functions, returning Device End to the host. If the chained command following the Select WRT is not a Write or WSF command, Channel End, Device End, and Unit Check (Operation Check) are sent to the host.

Erase All Unprotected Command

This command performs the following functions at the addressed device:

- Clears all unprotected buffer character locations to nulls.
- Resets the MDT bit to 0 for each unprotected field.
- Unlocks the keyboard when either the System Lock or the Wait symbol is displayed on a CUT.
- Resets the AID byte.
- Repositions the cursor to the first character location in the first unprotected field of the buffer. If no unprotected fields exist, the cursor is positioned to buffer location 0.

In local configurations, Erase All Unprotected is an immediate type command. Upon acceptance of this command, the non-SNA unit is *busy* and sends Channel End initial status to the channel. Upon successful completion of this command, the controller sends Device End status to the channel and then is *not busy.*

Programming Restriction: Erase All Unprotected should not be chained to a Write, Erase/Write, Erase/Write Alternate, Copy, or another Erase All Unprotected command. If it is, the resulting operation is not defined.

No Operation Command

The No Operation command performs no function operation in the controller but can be used to retrieve pending status. No Operation is an immediate command. Therefore, Channel End and Device End normally are presented as initial status unless pending status or a busy condition exists.

Sense Command

The Sense command should be issued in response to Unit Check status for further definition of the unit check condition. The controller responds to a Sense command by sending one byte (two bytes for Models 12L and 22L), of sense data to the channel. The sense register is then reset.

All other commands to the same address, except a No Operation or a Test I/O command (command code of X'00'), reset the sense register immediately when the command is issued. The controller responds to Sense commands issued to an address other than the one for which sense data is pending with a Busy and Status Modifier initial status indication, and the sense register is not reset. A Sense command should be issued following receipt of Unit Check status to ensure that valid sense information is retrieved.

Table 5-4 on page 5-11 summarizes the significance of each sense bit. The various sense and status bit combinations are described in Tables 5-5 through 5-9.

Sense ID Command

Sense ID command requests data transfer to the host. Either four or seven bytes of data are sent as follows:

- Four bytes of data, which contain the controller type and model, are transferred to the host for all device addresses except those to which Serial Original Equipment Manufacturer Interface (SOEMI) is attached.

- For SOEMI addresses, 7 bytes of data are transferred with bytes 4–6 containing X'BA0001'.

Byte	Value
0	X'FF'
1,2	X'3174'
3	X'1D'
4—6	X'DDDDMM'

- For Models 12L and 22L, twelve bytes of data are sent with bytes 4–6 containing X'BA0001' for all device addresses to which the SOEMI is attached, as follows:

Byte	Value
0	X'FF'
1,2	X'3174'
3	X'1D'
4—6	X'DDDDMM' Where: DDDDMM=X'BA0001' for SOEMI attached devices DDDDMM=X'000000' for non-SOEMI attached devices
7	X'00'
8–11	X'40720060'

The Sense ID command is honored only when the non-SNA local controller is online, not busy, and has no outstanding status to be presented.

Read Configuration Data (RCD) – Models 12L and 22L Only

This command retrieves a unique network node identifier and 3174 port configuration information. See Appendix F, "Device Self-Description Data" for more information.

Status and Sense Definitions

The 3174 generates a status byte to inform the channel of certain controller conditions. The status byte can be solicited, reporting conditions relating to channel-initiated operation, or unsolicited, reporting conditions unrelated to channel-initiated operation.

Sense Byte Description

The 3174 returns one sense byte (two sense bytes for Models 12L and 22L) in response to a sense command. This byte is used to identify the error condition and to determine the Error Recovery Procedures (ERP) action.

Table 5-4 on page 5-11 describes each bit of the status byte. Status is reset by the controller once it has been accepted by the channel. Tables 5-5 through 5-9 list the status bit usage and, where applicable, the accompanying sense bit combinations.

Table 5-4. Sense Bit Assignments for Non-SNA Locally Attached 3174s		
Byte	**Bit**	**Name**
0	0	Command Reject (CR)
	1	Intervention Required (IR)
	2	Bus Out Check (BOC)
	3	Equipment Check (EC)
	4	Data Check (DC)
	5	Unit Specify (US)
	6	Control Check (CC)
	7	Operation Check (OC)
1[1]	0	–
	1	–
	2	Resetting Event (RE)
	3	–
	4	–
	5	Overrun (OV)
	6	–
	7	–
Note: [1] Applies to Models 12L and 22L only.		

Solicited Status

Solicited status is sent to the channel by the 3174 as a result of host-initiated action, such as the execution of a channel program. Categories of solicited status are defined as *initial status* and *ending status* as follows:

Initial Status: Initial status is sent by the 3174 to the channel when the 3174 recognizes the initial-selection address and receives the channel command. If a busy condition exists during the initial selection, the 3174 can report either a short-busy sequence (Table 5-5) or an initial status (Table 5-6) to the channel.

If the 3174 reports a short busy sequence, it sends the status after recognizing the initial-selection address, but before receiving the command. However, the 3174 does not report the short busy sequence in response to initial selection if there is chaining.

When the 3174 uses initial status to report the busy condition, it sends the status after recognizing the initial selection address and receiving the channel command.

Tables 5-5 and 5-6 show various combinations of solicited status that the 3174 can send to the channel in response to initial selection. The recovery procedures are described under “ERP Actions” on page 5-16. Pending or stacked status is indicated by *x*.

Table 5-5. Short-Busy Sequence Conditions (Non-SNA)					
Status	**Sense**	**Display**	**Printer**	**ERP**	**Condition**
B, SM	—	X	X	—	The controller has not completed a previously initiated operation.

Table 5-6. Initial Status Conditions (Non-SNA)

Status	Sense	Display	Printer	ERP	Condition
All-zero	—	X	X	—	Normal status for any command other than Erase All Unprotected, No Operation, or any Select command.
B	—	X	X	—	Response to a command addressed to a device that is being serviced by the controller or that is completing a previously issued command.
B, 'x'	—	X	X	—	Response to a command addressed to a device other than the device whose status is pending or the device being serviced by the controller.
CE	—	X	X	—	Normal status for a Select or Erase All Unprotected command.
CE, DE	—	X	X	—	Normal status for a No Operation command.
UC	BOC	X	X	1	A parity check was detected on the command byte.
UC	IR	X	X	2	A command other than Sense or Sense ID was addressed to a device that the controller has recorded as "unavailable" or "not ready."
UC	CR	X	X	3	An invalid command was issued to the controller.
UC	RE	X	X	11	A Resetting Event condition has been detected by the controller.

Ending Status: Tables 5-7 and 5-8 show the various combinations of solicited ending statuses that the 3174 can send in response to a channel-initiated operation. Depending on the command, and the conditions met during execution of the command, either one or two ending status sequences are sent. See "ERP Actions" on page 5-16 for the recommended actions.

Note: Control Unit End (CUE) could be generated and combined with the first-ending or second-ending status before it is accepted by the channel.

Status	Sense	Display	Printer	Error Recovery Procedures
CUE	—	X	X	The remaining status bits, exclusive of CUE, define whether an error has occurred and, if so, the Error Recovery Procedures action that should be taken.

The condition that caused the controller to return *controller busy* status to a previous selection attempt has now been cleared. The controller is now free to accept a new command. CUE status can occur by itself or in combination with any of the documented status conditions.

Table 5-7 (Page 1 of 2). First (or Only) Ending Status Conditions (Non-SNA)					
Status	**Sense**	**Display**	**Printer**	**ERP**	**Condition**
CE	—	X	X	—	Sent at end of data stream on Write, Erase/Write, Erase/Write Alternate, or Write Structured Field command.
CE, DE	—	X	X	—	Sent at end of data stream on an RB, RM, Sense, or Sense ID command or when channel byte count goes to zero on an RB or RM command.
CE, DE, UC	BOC	X	X	10	The controller detected a parity error on a character in data stream of a Write, Erase/Write, Erase/Write Alternate, or Write Structured Field command.
CE, DE, UC	DC, US	X	X	1	Addressed device detected a parity or cursor check during a Write, Write Structured Field, RB, or RM command. Also, the controller can disable the device because of error. Unit Check (Intervention Required) is reported on the retry because the device requires a power-on reset to be reenabled.
CE, DE, UC	DC	X	X	1	The controller detected a cursor or parity check during receipt of data stream on a Write, Erase/Write, Erase/Write Alternate, or Write Structured Field command.
CE, DE, UC	DC	X	X	10	The controller detected a cursor or parity check during transmission of data stream on an RB or an RM command.
CE, DE, UC	CC	X	X	10	Addressed device failed to respond in a specified period of time to an Erase/Write or Erase/Write Alternate command, or an unchained Write, Write Structured Field, RB, or RM command, or the device security key was in the off position. When attached to a 3174, the addressed device was found to be in test mode or assigned as a local copy device. (Unit Check, Intervention Required are reported on a subsequent operation.) The addressed DFT is not available or is doing local copy.
CE, DE, UC	OC	X	X	3	An incorrect Select command chain sequence was received.
CE, DE, UE	—	X	X	9	The controller attempted to perform an RB or RM command but found, after returning initial status, that the addressed device was "busy."
CE, DE, UC, SM	ssss	X	X	n	Sent to request a channel command retry when the controller is prepared to accept an immediate retry of the failing command. (To request a command retry, the 'mark 0 in' line is raised in conjunction with this combination of status.) This status should not be seen by the host program unless the channel does not have the command retry feature. In this case, the recommended ERP for the accompanying sense (ssss) should be executed.
DE, UE	—	X	X	9	The controller attempted to perform a Select or Erase All Unprotected command, but found, after returning initial status, that the addressed device was busy.

Table 5-7 (Page 2 of 2). First (or Only) Ending Status Conditions (Non-SNA)

Status	Sense	Display	Printer	ERP	Condition
DE	—	X	X	—	The device becomes *not busy* after completing an Erase All Unprotected command. The device-to-controller buffer transfer is completed on a Select command, or the DFT has completed preparation of an RM data stream in response to a Select command.
CE, DE, UC	OV	X	X	1	An Overrun condition has been detected on the channel.

Table 5-8 (Page 1 of 2). Second Ending Status Conditions (Non-SNA)

Status	Sense	Display	Printer	ERP	Condition
DE	—	X	X	—	The controller-to-device buffer transfer is completed on a Write, Erase/Write, Erase/Write Alternate, or Write Structured Field command that did not start a printer, or the DFT has completed processing a Write-type command. The printer becomes *not busy* after completing a printout.
A, DE, UC	IR	-	-	6	The addressed printer became Not Ready (out of paper or cover open) before completion of a print operation.
DE, UC	IR	-	-	6	A command attempting to start a printer found it Not Ready.
A, DE, UC	IR, EC, US	—	X	6	A printer became mechanically disabled during a printout, and an automatic recovery was not successful.
DE, UC	IR, EC, US	—	X	6	A command attempted to start a print operation, but the printer CARRIAGE MOTOR POWER switch was off.
A, DE, UC	EC, US	—	X	7	A printer character generator or sync check error occurred, or the printer became mechanically disabled during printout but restored itself.
DE, UC	DC	X	X	10	During an Erase/Write, Erase/Write Alternate, or Select command the controller (1) detected a parity or cursor error or (2) detected a parity check on data received from the addressed device in response to an internal poll during a command.
DE, UC	DC	X	X	1	During a Write or Write Structured Field command the controller (1) detected a parity or cursor error or (2) detected a parity check on data received from the addressed device in response to an internal poll during a command.
DE, UC	DC, US	X	X	1	The addressed device detected a parity or cursor check while executing a Write, Erase/Write, Erase/Write Alternate, Write Structured Field, Select, or Erase All Unprotected command. Also, the controller can disable the device because of error. Unit Check (Intervention Required) is reported on the retry because the device requires a power-on reset to be reenabled.

Table 5-8 (Page 2 of 2). Second Ending Status Conditions (Non-SNA)					
Status	**Sense**	**Display**	**Printer**	**ERP**	**Condition**
DE, UC	OC	X	X	3	A Write, Erase/Write, Erase/Write Alternate, or Write Structured Field command containing a WCC with a start-print bit is chained to a subsequent command, or a WSF command was chained to a subsequent command. The 3174 or DFT received an invalid buffer address in data stream of Write-type command, or data stream ended before providing all characters required for an SBA, RA, SF, or EUA order on a Write-type command. A portion of the device buffer can have been changed. The 3174 or DFT received an incorrect Select command chain sequence.
DE, UC	CC	X	X	10	The addressed device failed to respond in a specified time to a Write, Erase/Write, Erase/Write Alternate, Select, or Erase All Unprotected, a display was in test mode, the device security key was off, or a printer was assigned as a local copy device. (Unit Check, Intervention Required are reported on a subsequent operation.) The addressed DFT was not available for a control command or was performing a local copy operation.
DE, UE	—	X	X	9	The 3174 tried to perform a Write, Erase/Write, Erase/Write Alternate, or Write Structured Field but, after returning initial and first ending status, found the addressed device busy.
DE, UC	OV	X	X	1	An Overrun condition has been detected on the channel.

Unsolicited Status

The 3174 reports unsolicited status in response to conditions unrelated to any host-initiated function. Table 5-9 shows the various combinations of unsolicited status that the 3174 can send to the channel. See "ERP Actions" on page 5-16 for the recommended actions.

Table 5-9 (Page 1 of 2). Unsolicited Status Conditions (Non-SNA)					
Status	**Sense**	**Display**	**Printer**	**ERP**	**Condition**
A	—	X	X	—	An attention-generating action (for example, the PA function was pressed) was performed by the operator, or an inbound data stream has been prepared by the attached device and is ready for transmission.
A, DE	—	X	X	—	An attention-generating action (for example, a PA function was pressed) occurred after a unit exception, or busy, condition had been reported to the host.

Table 5-9 (Page 2 of 2). Unsolicited Status Conditions (Non-SNA)					
Status	**Sense**	**Display**	**Printer**	**ERP**	**Condition**
DE	—	X	X	—	A device changes from *not available* to *available* or from *not ready* to *ready*. A device becomes *not busy* after having previously sent Unit Exception when the controller attempted to execute a command with the device when it was *busy*. Bringing up power on the 3174 causes each active DFT logical terminal to present DE to the channel. Bringing up power on the DFT or exiting from test or setup mode while the 3174 is on causes each active logical terminal to present DE to the channel.
A, UC	DC, US	X	X	1	An idle device detected a parity or cursor check in its buffer, or an idle device on a 3174 was disabled by 3174 detected errors. (Unit Check, Intervention Required can be reported on the next retry because the device requires a power-on reset.)

Error-Recovery Procedures (ERP)

The following paragraphs discuss the ERP as they relate to the 3174 or attached devices. The ERP actions are also presented to assist in correcting system problems.

3174 Device-Detected Errors: Error conditions detected by the 3174 or attached device are indicated to the program by Unit Check status. The program must respond by using a Sense command to further define the condition. If a Sense command is not performed and the sense conditions still exist, the 3174 does not honor other interrupts from the devices. The combined configurations of Unit Check status bits and associated sense bits determine subsequent recovery operations.

ERP Actions: The recovery actions recommended in the ERP column of Tables 5-5 through 5-9 are:

1. Rebuild the entire buffer image and re-enter the failing chain of commands. The sequence of commands used to reconstruct this image should start with an Erase/Write command (or Erase/Write Alternate on a 3174). However, if the failing command is a Write Structured Field command, do not issue Erase/Write; just retry the Write Structured Field command. If after two retries the problem is not corrected, follow procedure 4.
2. If the error indicates the device is *unavailable*, request and wait for operator intervention to *ready* the device. Upon receipt of DE status, retry the chain of commands.
3. If a nonrecoverable program error has occurred, examine the data stream to locate the problem.
4. Request maintenance for the device that is giving trouble. After the repair, the buffer image can be reconstructed, starting with an Erase/Write command (or Erase/Write Alternate).
5. Record the error for future reference, and continue with the program. The error occurred while the controller was *idle* and is not indicative of a data error.

6. The error indicates that the printer is out of paper, has the cover open, or has a disabled print mechanism. Request operator intervention to *ready* the printer. Then, on receipt of DE status, retry the print operation by issuing a Write command with the proper WCC and no data stream. (There is no data error. The data is still intact in the device buffer and can be reused.) If this procedure is unsuccessful, follow procedure 1.
7. The error occurred during a printout and indicates either a character generator or sync check error or a disabled print mechanism. There is no buffer data error. The proper error recovery procedure is application-dependent, since the user might or might not want a new printout. Because the buffer contents are still good, follow procedure 6.
8. A data error occurred at the device during a printout. This indicates a data error at the device. Follow procedure 1.
9. A device is busy, but the controller was not informed of the busy status in time to respond with busy status in the initial-status byte. A Device End or Attention, Device End status are generated asynchronously when the device becomes not busy. After the DE or A,DE is received, retry the chain of commands that was being executed when the Unit Exception (UE) status was received.
10. Retry the failing chain of commands. If, after two retries, the problem is not corrected, follow procedure 1. A Write command to a non-SNA unit can be retried if new fields have not been created in the buffer portion that has been cleared by a Program Tab or Erase Unprotected to Address order.
11. Identify the device by performing a Sense ID command followed by a Read Configuration Data command.

Channel-Detected Errors: Errors detected by the channel are indicated to the program by the channel status byte in the channel status word (CSW). If the channel status byte indicates a Channel Control Check, an Interface Control Check, or a Channel Data Check, retry the chain of commands. If the problem is not corrected after three retries, request maintenance for the channel in error.

SNA PU 2.0 Operations

This section discusses the SNA operations for a PU 2.0 node. Some of these discussions are relevant to a T2.1 node; however, there are some differences. See Chapter 18, "Advanced Peer-to-Peer Networking (APPN)" for more information.

The SNA 3174 controllers are attached to an IBM System/370 architecture compatible channel using a selector byte multiplexer or a block multiplexer channel through the standard I/O interface. When the controllers are attached to a byte multiplexer channel, operation is in 2-byte multiplex mode, the default mode, unless another value is selected during customization.

The channel program controls all SNA unit operations by transmitting information across the I/O interface. This information consists of the following:

- An address byte, which selects one controller
- A command byte, which specifies the type of operation to be performed
- A link header
- SNA data
- Various control signals.

Status bytes, which are automatically generated, inform the channel of the general and unique conditions of the SNA units when command operations are not in progress.

Commands

The commands and orders discussed in Chapter 2, "3270 Commands, Orders, and Attributes," are contained in the SNA data stream. The control commands listed in Table 5-10 are the command codes (CCW bits 0–7) that the channel sends to the controller.

Table 5-10. SNA Unit Command Codes

Command	Code	Command	Code
Write	01	Read Start 0	32
Read	02	Write Start 1	51
No Operation (NOP)	03	Read Start 1	52
Sense	04	Restart Reset	93
Control	05	Sense ID	E4
Write Break	09	Test I/O (see note)	00
Write Start 0	31		

Note: Test I/O is an IBM System/370 instruction, not a CCW command code. It clears outstanding status in the 3174 SNA unit, but it does not transfer data.

Write Command

The Write command requests data transfer from the host. It consists of a *Link Header,* and SNA data, as follows:

- The Link Header consists of:
  - Data count field (2 bytes)
  - Bytes 0 and 1 contain the total byte count of the record that is being transferred
  - Byte 2 is reserved
  - Byte 3 contains the function code. X'00' is used for normal data transfer.
- The SNA data contains:
  - Transmission Header (FID2)
  - Request Header (RH)
  - Request/Response Unit (RU).

Read Command

The Read command requests data transfer to the host. The data must be transmitted in the following specific format:

- The Link Header consists of:
  - Data count field (2 bytes)
  - Bytes 0 and 1 contain the total byte count of the record that is being transferred
  - Byte 2 is reserved
  - Byte 3 contains the function code. X'00' is used for normal data transfer.
  - Pad characters (*n* bytes).

- The SNA data contains:
  - TH (FID2)
  - RH
  - RU.

Note: The size of the Link Header is determined by the Connect function (refer to "Control Command").

No Operation Command

The No Operation (NOP) command does not transfer data. Ending status to this command does not reflect any change within the controller. Normal IBM System/370 usage inserts the NOP command in a CCW string for possible later dynamic program modification, or as a standalone command for checking availability of the channel path to the controller. Additionally, the NOP command can be used as the ending command in the Read CCW, Write CCW, and the Write-Read CCW sequences.

Sense Command

The Sense command is normally issued after Unit Check status has been presented to the host and requests 2 bytes of sense data. The sense bits are retained for reading until a command other than Sense, Test I/O, or NOP is accepted.

Control Command

The Control command provides two functions to the SNA unit: Connect and Disconnect.

Connect Function: The Host Physical Unit Services issues a Control command (05) to send initialization parameters to the 3174 LUs. The data stream consists of the 10 bytes shown in Table 5-11.

Table 5-11. SNA Unit Control Command Connect Function Byte Descriptions

Byte	Bit	Content	Meaning
0,1		X'000A'	Total number of bytes (including length)
2		X'00'	Reserved – Not used
3		X'01'	Connect function code
4,5			The number of buffers contained in each host Read Channel program. Used to determine the maximum number of basic transmission units (BTUs) that can be sent to the host with the CCW string.
6,7			The total number of bytes that can be sent with each Read CCW (buffer). The total length is the sum of the path information unit and Secondary-to-Primary Link Header, including pad characters.
8,9			Specifies the total length of the Secondary-to-Primary Link Header. This length consists of the 4-byte fixed portion of the Link Header plus *n* pad characters. All Secondary-to-Primary PIUs are preceded by 4 + *n* bytes.

The SNA unit determines that these parameters are acceptable under the following conditions:

- The size of the host buffer, multiplied by the number of host buffers, is large enough to accommodate the following:
  - Link Header: (4 bytes minimum, 78 bytes maximum)
  - Transmission Header: (6 bytes)
  - Request Header: (3 bytes)
  - At least 256 bytes of data (RU).
- The host buffer is an even number of bytes.
- The host buffer is not less than 78 bytes.
- The Secondary-to-Primary Link Header Size does not exceed 78 bytes and is an even number of bytes.

Rejection of the Connect function code is a status of Device End, Unit Check to the next command received by the controller. The NI (not initialized) sense byte is set. Sense Command Reject (CR) can also be set according to the type of command received.

Receipt of a Connect function code while the controller is already connected causes the controller to disconnect and then reconnect using the new initialization parameters.

Disconnect Function: The host physical unit services issues a Control command (05) that sends a Disconnect function. The NI sense bit is set.

The contents of the 4-byte data stream are shown in Table 5-12. The data stream can be larger than 4 bytes, but only 4 bytes are used and the rest ignored. The number of bytes sent must agree with the length in the data count field.

Table 5-12. SNA Unit Control Command Disconnect Function Byte Descriptions

Byte	Bit	Content	Meaning
0,1		X'0004'	Total number of bytes
2		X'00'	Reserved – Not used
3		X'02'	Disconnect function code

Write Break Command

This command must be used as the last Write command in all Write CCW sequences. If only one Write CCW is to be issued, it must be the Write Break command. This command includes all the functions shown for the Write command.

Write Start 0 Command

All SNA data from the host is sent by a Write CCW sequence. A Write Start command initializes the sequence. No data is transferred for this command. It attempts to set the Write Start indicator, which is used as a reference for data sent from the host.

All data from the host in a chained command CCW string is under the envelope of a preceding Write Start 0 command. The data is considered valid (that is, no need for retransmission) when the controller receives a Write Start 1 command. New data is transmitted only when the Write Start 1 command is accepted by the controller.

Note that new data is transmitted when a Restart Reset command immediately precedes a Write Start 0. The Write Start command attempts to change the Write Start indicator state. The indicator is not changed if the command is not accepted or if UE is part of the ending status.

Read Start 0 Command

All SNA data is received by the host via a Read CCW sequence, which is initialized by a Read Start command. This sequence is considered fully complete by the SNA unit on receipt of a subsequent alternate Read Start command. New data is transmitted when a Restart Reset command immediately precedes a Read Start 0 command. Data is not transferred for this command.

Write Start 1 Command

The Write Start 1 command is similar to the Write Start 0 command. It attempts to change the Write Start indicator from the alternate setting of the Write Start 0 command. In other respects, the two commands are the same. Note that "previous" data is retransmitted when a Restart Reset command immediately precedes a Write Start 1 command.

Read Start 1 Command

The Read Start 1 command complements the Read Start 0 command. Previous (old) data is retransmitted when this command follows a Restart Reset command.

Restart Reset Command

Data is not transferred with this command. The Restart Reset command is used to reset the Read Start and Write Start indicators to logical zero. Previously transmitted data is subject to retry if the Restart Reset command is followed by a Read Start 1 command or a Write Start 1 command (improper usage can result in duplicate or lost data). Ending status does not reflect the inability to transfer data to or from the controller.

Sense ID Command

The Sense ID command requests data transfer to the host. Twelve bytes of data are sent as follows:

Byte	Value
0	X'FF'
1, 2	X'3174'
3	X'1A'
4–7	X'00000000'
8–11	X'407200A0'

The Sense ID command is honored only when the SNA local controller is online, not busy, and has no outstanding status to be presented.

Test I/O Command

This command transfers no data. It is never coded in a CCW. It originates from a Test I/O instruction or from channel hardware not under program control. A Test I/O command clears outstanding status in the 3174 SNA unit.

Read Configuration Data (RCD) – Models 12L and 22L Only

This command retrieves a unique network node identifier and 3174 port configuration information. See Appendix F, "Device Self-Description Data" for more information.

Status and Sense Definitions

The 3174 generates a status byte to inform the channel of certain controller conditions. The status byte can be solicited, reporting conditions relating to channel-initiated operation, or unsolicited, reporting conditions unrelated to channel-initiated operation.

Sense Byte Description

The 3174 returns two sense bytes in response to a Sense command. These bytes are used to identify the error condition and to determine the ERP action.

Table 5-13 describes each bit of the status byte. Status is reset by the controller once it has been accepted by the channel.

Tables 5-14 through 5-18 list the status bit usage and, where applicable, the accompanying sense bit combinations.

Table 5-13. Sense Bit Assignments for SNA Locally Attached 3174s

Byte	Bit	Name
0	0	Command Reject (CR)
	1	Intervention Required (IR)
	2	Bus Out Check (BOC)
	3	Equipment Check (EC)
	4	Data Check (DC)
	5	Overrun (OV)
	6	Not Initialized (NI)
	7	Abort (AB)
1	0	Data Length Check (DLC)
	1	—
	2	Resetting Event (RE)
	3	—
	4	Parity Check Modifier (PCM)
	5	Parity Check-1 (PC1)
	6	Parity Check-2 (PC2)
	7	Machine Check (MC)

Solicited Status

Solicited status is sent to the channel by the 3174 as a result of host-initiated action, such as the execution of a channel program. Categories of solicited status are defined as *initial status* and *ending status*. Ending status can consist of either one or two ending sequences.

Initial Status: Initial status is sent by the 3174 to the channel when the 3174 recognizes the initial selection address and receives the channel command. If a busy condition exists during the initial selection, the 3174 can report either a short busy sequence or an initial status to the channel.

If the 3174 reports a short busy sequence, it sends the status after recognizing the initial selection address, but before receiving the command. However, the 3174 does not report the short busy sequence in response to initial selection if there is chaining.

When the 3174 uses initial status to report the busy condition, it sends the status after recognizing the initial selection address and receiving the channel command.

Tables 5-14 and 5-15 show various combinations of solicited status that the 3174 can send to the channel in response to initial selection. The recovery procedures are described under "ERP Actions" on page 5-16. Pending or stacked status is indicated by *x*.

Table 5-14. Short-Busy Sequence Conditions (SNA)

Status	Sense	ERP	Condition
B, SM	—	—	The controller has not completed a previously initiated operation.

Table 5-15 (Page 1 of 2). Initial Status Conditions (SNA)

Status	Sense	ERP	Condition
All-zero	—	—	Normal status for all valid commands except immediate operation commands. (Immediate operation commands include NOP, Write Start 0/1, Read Start 0/1, and Restart Reset.)
B	—	—	The controller has not completed a previously initiated operation.
B, 'x'	—	—	The controller has pending or stacked status available and has not completed a previously initiated operation.
CE	—	—	Sent in response to a Write Start 0/1, Read Start 0/1, or Restart Reset command.
CE, DE	—	—	Sent in response to a NOP command.
UE[,A]	—	—	Sent in response to: • A Write, Control, Write Break, or Write Start 0/1 command because of insufficient buffer space to receive data from the host. The command and its associated data transfer (if any) are rejected. Optionally, a read channel program can also be requested. • A Read Start 0/1 command to notify the host that an unsolicited read channel program has been received or that no data is available for transfer to the host.
UC	BOC, PC2	1	A parity error was detected on the command received from the host.
UC	CR	1	An invalid command was received from the host.
UC	CR, NI	2	Sent in response to a Write, Read, Write Break, Write Start 0/1, Read Start 0/1, or Restart Reset command if the controller is in the not-initialized state.
UC	CR, NI, AB	3	Sent in response to a Write, Read, Write Break, Write Start 0/1, Read Start 0/1, or Restart Reset command if Abort sense had previously been reported and the conditions that caused the Abort have not been cleared.

Table 5-15 (Page 2 of 2). Initial Status Conditions (SNA)			
Status	**Sense**	**ERP**	**Condition**
UC	RE	4	A Resetting Event condition has been detected by the controller.

Ending Status: Tables 5-16 and 5-17 show the various combinations of solicited ending status that the 3174 can send in response to a channel-initiated operation. Depending on the command, and the conditions met during execution of the command, one or two ending status sequences are sent. See "ERP Actions" on page 5-16 for a description of the recommended actions.

Note: CUE can be generated and combined with the first-ending or second-ending status before it is accepted by the channel.

Table 5-16 (Page 1 of 2). First (or Only) Ending Status Conditions (SNA)			
Status	**Sense**	**ERP**	**Condition**
CE	—	—	Sent at the end of data transfer for Write, Read, Control, or Write Break commands when the controller remains busy and is not prepared to execute the next command.
DE	—	—	Sent in response to a Write Start 0/1, Read Start 0/1, or Restart Reset command when the controller is prepared to execute the next command.
CE, DE	—	—	Sent at the end of data transfer for Sense or Sense ID commands.
DE, UE[,A]	—	—	Sent in response to: • A Read Start 0/1 command to indicate that an unsolicited read channel program has been received, or that no data is available for transfer to the host, or that "old" data was requested and it is not available. Optionally, a new read channel program can also be requested. • A Write Start 0/1 command to indicate that there is insufficient buffer space to receive data from the host. Optionally, a read channel program can also be requested.
CE, DE, UE[,A]	—	—	Sent in response to a Write, Control, or Write Break command to indicate that there is insufficient buffer space to receive data from the host. Optionally, a read channel program can also be requested.
CE, DE, UC	BOC, PC1, PC2	1	A parity error was detected on the data being received from the host during a Write, Control, or Write Break command.
CE, DE, UC	EC, PC1	1	A parity error was detected during processing of the data for a Write, Control, or Write Break command.
CE, DE, UC	EC, PC1, PCM	1	A parity error was detected during processing of the data for a Read, Sense, or Sense ID command.

Table 5-16 (Page 2 of 2). First (or Only) Ending Status Conditions (SNA)			
Status	**Sense**	**ERP**	**Condition**
CE, DE, UC	EC, PC2	1	A parity error was detected on the data being sent to the host during a Read, Sense, or Sense ID command.
CE, DE, UC	EC, MC	1	An internal error was detected during a channel operation.
CE, DE, UC	DC, DLC	1	Sent at the end of data transfer for Write, Control, or Write Break commands when fewer than four bytes have been received with the command, or the value contained in the Link Header's data count field does not equal the total number of bytes received.
CE, DE, UC	DC	1	Sent at the end of data transfer for a Read command if the value specified in the Read CCW's count field did not match the value specified at initialization.
CE, DE, UC, SM	ssss	1	Sent to request a channel command retry when the controller is prepared to accept an immediate retry of the failing command. (To request a command retry, the 'mark 0 in' line is raised in conjunction with this combination of status.) This status should not be seen by the host program unless the channel does not have the command retry feature. In this case, the recommended ERP for the accompanying sense (ssss) should be performed.
CE, DE, UC	OV	1	An Overrun condition has been detected on the channel.

Table 5-17 (Page 1 of 2). Second Ending Status Conditions (SNA)			
Status	**Sense**	**ERP**	**Condition**
DE	—	—	Sent in response to a Write, Read, Control, or Write Break command when the controller is no longer busy and is able to accept the next command.
DE, UE[,A]	—	—	Sent in response to a Read command when no additional data is available to be sent with the current read channel program. Optionally, a new read channel program can also be requested.
DE, SM	—	—	Can be sent in response to a Write Break command when the controller is no longer busy and has data available for transfer to the host. This status, which should not be seen by the host program, causes the channel to skip a CCW in the channel program. (See "Write CCW Sequence" on page 5-28.)
DE, UC	DC, DLC	1	Sent at the end of data transfer for Write, Control, or Write Break commands when fewer than four bytes have been received with the command, or the value contained in the Link Header's data count field does not equal the total number of bytes received.

Table 5-17 (Page 2 of 2). Second Ending Status Conditions (SNA)

Status	Sense	ERP	Condition
DE, UC	DC	1	Sent at the end of data transfer for a Read command if the value specified in the Read CCW's count field did not match the value specified at initialization.
DE, UC	NI	2	Sent if invalid initialization parameters are received with the Control command.
DE, UC	NI, AB	3	Sent in response to a Control command with a function code of *connect* when the controller is not initialized and conditions within the controller do not allow acceptance of a *connect* request at this time.
DE, UC	OV	1	An Overrun condition has been detected on the channel.

Unsolicited Status

The 3174 reports unsolicited status in response to conditions unrelated to any host-initiated function. Table 5-18 shows the various combinations of unsolicited status that the 3174 can send to the channel. See "ERP Actions" on page 5-16 for a description of the recommended actions.

Table 5-18. Unsolicited Status Conditions (SNA)

Status	Sense	ERP	Condition
A	—	—	Sent as a controller request for a read channel program.
DE	—	—	Sent when the controller has gone from the offline to the online state and has remained initialized (that is, the connect parameters are still valid).
DE, SM[,A]	—	—	Sent to indicate a buffer-available condition. This is a signal to the host that it can resume sending data to the controller. Optionally, a read channel program can also be requested.
DE, UC	NI	2	• If sent when the controller has gone from the offline to the online state and is not initialized, it is a request that the host send an initialization (Control) channel program. • If sent when the controller is already online and initialized, it indicates that all SNA sessions should be terminated and that the host should reconnect by sending an initialization (Control) channel program.
UC	NI, RE	5	A Resetting Event condition has been detected by the controller; the 3174 has not yet received a *connect* command.

Error Recovery Procedures

The error recovery procedures that follow are recommended for support of SNA units and assistance in correcting CCW sequences with errors.

The recovery procedures recommended in the ERP column of Tables 5-15 through 5-18 are as follows:

1. Issue a message containing the address of the channel and unit, the CSW, the sense data, and the CCW executed. If the first CCW of the chain is a valid Start command, begin retry from that point. If the failure is continuous, notify the operator.
2. Issue an initializing control command.
3. Wait for an unsolicited DE, UC, then perform recovery procedure 2.
4. Identify the device by performing a Sense ID command followed by a Read Configuration Data command. Then, issue an initializing control command.

SNA-Unit-Detected Errors: Error conditions detected by the SNA units are indicated to the program by Unit Check status. The program must respond to this status by using a Sense command for further definition of the condition.

Device-detected errors are reported via SNA. See Appendix H, "SNA Sense Codes" on page H-1.

Channel-Detected Errors: Errors detected by the channel are indicated to the program by the channel status byte in the CSW. If the channel status byte indicates a channel control check, an interface control check, or a channel data check, the recommended error recovery procedure is to retry the chain of commands. If the channel status byte indicates a channel program check, a protection check, or an incorrect length (should not occur), the recommended error recovery procedure is to terminate the task. A program error has probably occurred.

Typical CCW Sequences

The following CCW sequence is recommended for support of the SNA units.

Read CCW Sequence: The commands used in the Read CCW sequence are Read Start 0/1, Read, and NOP. All Read CCW sequences must start with a Read Start 0/1 command and are initiated only on the request of SNA units.

Command chaining is expected out of the Read Start command through the subsequent Read commands; that is, the Read CCW sequence must start with the Read Start command, which is followed by chained Read CCWs until the final command. Insertion of CCWs such as Transfer-in-Channel (TIC) and NOP is permissible.

An example of a possible Read CCW sequence is:

Read Start 0	CC,SLI
Read	CC,SLI
Read	CC,SLI
Read	CC,SLI
Read	CC,SLI
NOP	SLI

Where:

CC = Chain Command flag
SLI = Suppress Length Indication

Note: The number of Read CCWs should equal the number of buffers specified in the Connect function.

The NOP as shown above is recommended. The controller signals Channel End, Device End as ending status to the NOP. Normally, the data should be depleted before the NOP command is reached. Second-ending status to the last Read CCW used is Device End, Unit Exception (Attention).

Whenever the host issues the next Read CCW sequence, it must start with the alternate Read Start command, which in this case is Read Start 1. However, if the sequence is restarted with its original Read Start command, in this case Read Start 0, the controller interprets this to mean that an error has occurred and presents the data again.

The number of Read CCW's should equal the number of buffers specified in the Connect function.

Write CCW Sequence: When the host has been notified that the controller has buffers available, it can at any time issue a Write CCW sequence.

The commands used in Write CCW sequences are Write Start 0/1, Write, Write Break, and NOP.

Every Write CCW sequence must start with a Write Start 0/1 command. Command chaining into a Write Start command should only be from a NOP or Restart Reset command. The last write command should be a Write Break command, which in turn should be followed by two NOP commands or by an NOP and a Read CCW sequence.

An example of a possible Write CCW sequence is:

Write Start 0	CC,SLI
Write	CC,SLI
Write	CC,SLI
Write	CC,SLI
Write Break	CC,SLI
NOP	SLI
NOP	SLI

Where:

CC = Chain Command flag
SLI = Suppress Length Indication

Two NOP commands are necessary at the end of this CCW chain because the ending sequence depends on the availability of data for transmission to the host. If no data is to be transmitted, Device End is signaled to the Write Break command. As a result, the channel command-chains into the first NOP command. If data is to be transmitted, however, the ending status signaled to the Write Break command is Device End, Status Modifier. The channel then skips the first NOP command and command-chain to the second NOP command, thereby ending the CCW sequence. If this skip to the second NOP command occurs, the host must recognize that a Read CCW sequence is *owed* to the controller, and that the unit does not request the Read with an unsolicited attention interrupt. However, the unit responds with Device End, Status Modifier to all Write Break commands until all data has been correctly transmitted.

Note: If the host issues a Write CCW sequence starting with the original Write Start command, in this example Write Start 0, the controller interprets this to mean that an error has occurred. The controller starts taking in the data, discarding it, and counting the Write commands received until the count matches its saved CCW counter. Any data subsequently received is then treated as new data.

Write-Read Sequence: This sequence is used for reducing host activity and clearing buffers in the controller as rapidly as possible. It consists of the previous two sequences combined. It is a Write CCW sequence, which at the option of the controller can continue into a Read CCW sequence if data is available for transmission to the host. The method used is to signal the Status Modifier with the DE for the Write Break command. The Status Modifier causes the channel to skip the NOP CCW and to continue into the Read CCW sequence.

If no data is available to transmit to the host, the Status Modifier is not signaled in the ending status. The channel then command-chains from the Write Break command into the NOP command, thereby ending the CCW sequence.

An example of a possible Write-Read CCW sequence is:

Write Start 0	CC,SLI
Write	CC,SLI
Write	CC,SLI
Write	CC,SLI
Write Break	CC,SLI
NOP	SLI
Read Start 0	CC,SLI
Read	CC,SLI
Read	CC,SLI
Read	CC,SLI
Read	CC,SLI
Read	CC,SLI
NOP	SLI

Where:

CC = Chain Command flag
SLI = Suppress Length Indication

If, because of error, the CCW chain is broken in the section containing the Write CCWs, then the host must re-send the entire CCW chain. If an error occurs in the read portion of the CCWs, only the Read CCW sequence should be re-sent.

CCW—Error Recovery Procedure: The following paragraphs describe the error recovery procedures in detail.

Commands involved are those shown in the Write, Read, and Write-Read CCW sequences. The actual retry must be from the first CCW in the write or read sequence, which must be a Write Start or a Read Start command or can be reinitialized by a Restart Reset command.

After an SNA unit has received the Control command containing a valid Connect function, it expects the first host Write CCW sequence to begin with a Write Start 0, and the first host Read CCW sequence to begin with a Read Start 0. Upon receipt of a new Write Start or Read Start command, the controller complements its appropriate switch. The switch retains what Write or Read Start command is due next. In error situations, the CCW sequences reissued by the host must not be changed, and retry must be from the appropriate Read or Write Start command or from a Restart Reset command.

In error-free operation, Read CCW sequences should not be issued by the host unless solicited by Attention or by Status Modifier in response to the Write Break command.

When an error occurs in the data transfer, recovery is controlled by appropriate use in a Read or Write CCW sequence of the following five commands:

Read Start 0
Read Start 1
Write Start 0
Write Start 1
Restart Reset.

Read Start 0/1: Initialize the Read CCW sequence. It reads old or new data. To read new data, Attention or Status Modifier must have been presented or the Read Start command ends with Channel End, Device End, Unit Exception. The normal ending status is Channel End, Device End, which allows the Read Start to be command-chained to a Read command(s).

Reissuing a Read CCW sequence without changing the Read Start command results in rereading previously transmitted data, whether or not an error occurred. The read operation need not have been solicited by the controller.

The expected Read Start indicator in the controller is changed only if the response to the Read Start command was Channel End, Device End and if the Read Start command received was the expected one. Thus, the host should change its Read Start CCW only after successful completion of its Read CCW sequence. Successful completion is signaled by Device End, Unit Exception to one of the Read CCWs.

Write Start 0/1: Initialize the Write CCW sequence. It indicates whether the host is transmitting old or new data. The normal ending status is Channel End, Device End, which allows the Write Start command to be command-chained to a Write or Write Break command. The ending status of Channel End, Device End, Unit End indicates a buffer-depletion condition (no buffers available to receive the data from the host). The host must stop sending data and await a buffer available signal (Device End, Status Modifier).

When the host receives the Buffer Available signal, it can resume data transmission, starting with the CCW that was rejected with the Unit End status.

However, the CCW chain can be handled as if an error has occurred and the host can re-send the complete Write CCW sequence, starting with the unmodified Write Start command initially used. Whenever the host does start a Write CCW sequence with the same Write Start command as previously used, the controller then discards the data from a number of Write commands until the count of discarded records equals its previous count of the number of records accepted. Subsequent data is then treated as new data.

The expected Write Start indicator in the controller is changed only if the response to the Write Start command was Channel End, Device End and if the Write Start command received was the expected one. Thus, the host should change its Write Start indicator only after completion is signaled with Device End or Device End, Status Modifier as ending status to the Write Break command.

Restart Reset: Resynchronizes channel transfers after any host failure, provided the controller has not been reinitialized. This command sets the indicators to expect Write Start 0 and Read Start 0 as the next starting CCW for transmitting new data. Thus, Write Start 1 and Read Start 1 can be used to retry the last transmitted records. The host can then continue normal transmission by using the Write Start 0 and Read Start 0 commands for all new transmissions.

If Read Start 0 is used first, then any old data is destroyed, and only new data, if available, can be read. If Read Start 1 is used first, then the last data transmitted to the host should be retried. Therefore, any portion of data already processed by the host should be skipped after a reread, and any portion of data not processed before the error is lost if Read Start 0 is used first.

To continue write data transfers after a Restart Reset command is issued, the host can use either Write Start command. If Write Start 1 is used, the last Write CCW sequence as its associated data should be used. The controller skips any record that is successfully processed under the last accepted Write Start command. If Write Start 0 is used first, then the accepted record count in the controller is reset and all records now sent by the host are processed as new data.

The host must be aware of these possibilities and use the proper Read Start and Write Start command to prevent lost or duplicate data.

Chapter 6. Remote Operation

Introduction

This chapter describes how the 3174 operates when it is remotely attached (telecommunication) using one of the following:

- Binary Synchronous Communication (BSC)
- Synchronous Data Link Control (SDLC).

This chapter contains the following sections:

- BSC operation, which discusses modes of operation, redundancy checking, and data link control characters used with multipoint (nonswitched line) data link control
- SDLC operation, which discusses nonsequenced commands and responses, physical unit identification, SDLC station address, Gateway operation, error recovery procedures, and auto-disconnection.

Readers who are unfamiliar with the binary synchronous method of communication should review the following publications, as applicable:

- *General Information—Binary Synchronous Communications*
- *IBM 2701 Data Adapter Unit Component Description*, (especially the section that describes Synchronous Data Adapter—Type II)
- *IBM 2703 Transmission Control Components Description*, (especially the section on BSC capabilities)
- *Introduction to the IBM 3704 and 3705 Communications Controller*
- *Introduction to the IBM 3725 Communications Controller*
- *Introduction to the IBM 3745 Communications Controller*.

Refer to Chapter 14, "3174 Token-Ring and ISDN Support," for information concerning 3174s with the Gateway feature and the 3174 models that attach to an IBM Token-Ring Network.

BSC Operation

When using BSC operating mode, the 3174 communicates with the host program via an IBM Transmission Control Unit (2701, 2703, 3704, 3705, 3725, 3745, or equivalent Integrated Communication Adapter), and with appropriate data sets as specified for the controller.

Note: In the BSC section of this chapter, the term *3174* also refers to the 3174 remote attachments in BSC mode.

The 3174 uses BSC procedures over duplex or half-duplex facilities (nonswitched or privately owned) at line speeds up to 19 200 bps. These communications use the Multipoint Data Link mode of operation only.

The switched network backup (SNBU)[1] facility allows you to specify a switched line to be used as an alternative path should your primary line become unavailable or unusable.

Code Structures

Each 3174 can operate with one of two code structures: EBCDIC or ASCII. The choice of code depends on the application, but, for system compatibility, the code must be the same for all units on a particular communication line.

Channel Program Concepts

In telecommunication-attached configurations, the Transmission Control Unit (TCU) becomes the intermediary between the 3174 and the channel program. As such, the TCU, not the 3174, executes channel commands and initiates I/O interrupts. At the start of each I/O operation involving the TCU, the Start I/O instruction addresses the TCU and a communication line attached to that TCU. The Start I/O instruction does not address an individual remote controller on that line. Subsequent CCWs in the channel program initiate TCU operations. CCWs specify TCU commands, not 3174 commands.

Selection of a 3174 and all subsequent command operations are specified by character sequences in TCU Write CCW data streams. Write CCW data to the TCU communication line selected by Start I/O can contain the following:

- Address bytes to select a controller on the communication line
- The code of a command (such as Erase/Write or Write) to initiate a controller operation
- Orders and/or display/print data for the controller buffer.

In addition, this write data contains the appropriate data link control characters. Thus, all characters sent by the TCU to a 3174, with the exception of synchronous idle (SYN), pad, and block check characters, originate from the data stream of a Write CCW addressed to the TCU.

Note: All Write commands should be set for CCW chaining to a Read command when a response is expected. (This prevents a loss of data received by the TCU in response to Write command operations.) An exception to this requirement is when the Write command is used to issue EOT to the 3174.

Text Blocking

The 3174 performs inbound text blocking. Each block of data can contain a maximum of 256 text characters. Of that total, each block contains the Start of Text (STX) and End of Transmission Block (ETB) (or End of Text [ETX]) data-link control characters. Two address bytes (CU poll address and device address) precede the read heading in the first block only and are included in the 256-character total. The last block of a message is terminated with ETX, which is also included in the 256-character total.

Note: If the automatic polling facility (Auto Poll) is used by the TCU, the Auto Poll index byte adds one byte to the text block created by the 3174.

[1] Models 11R, 12R, 13R, 21R, 23R, 61R, 62R, 63R, 90R, 91R, and 92R, when attached to IBM 3872 and 3875 modems, do not support half-duplex SNBU.

BCCs are transmitted as the last characters of a data stream. (See "Redundancy Checking" on page 6-8.) BCCs are not counted as text, because they follow the ETX and ETB data link characters. Upon successful comparison of the received BCCs with the accumulated BCCs, the program should respond with Acknowledge (ACK) to read the next block of text. Each subsequent block is preceded by STX to initiate BCC accumulation by the TCU.

Text blocking does not disjoin the 3-byte SBA order sequence (SBA code and 2-byte field address) generated during execution of an RM command. Therefore, the last characters of a block ending with an SBA sequence is ... SBA, Address, Address, ETB (or ETX).

Multipoint (Nonswitched Line) Data Link Control

Each 3174 can operate on a nonswitched communication line with multiple stations. Time-sharing of the line is accomplished by interleaving transmissions between the TCU and all units on the line. A 3174 operates multidropped on the same line with other properly featured units, such as other 3270 units, IBM 2770s, and IBM 2780s.

The TCU is the *control station* of the multipoint, centralized network. All units attached by communication line to the TCU are called *tributary stations.* The control station is the focal point of the network and maintains, under program control, an orderly flow of network traffic by initiating all data transfers. The control station is either the transmitter or the receiver of every communication.

3174 Modes of Operation

In a multipoint environment, the 3174 is always in one of the following modes of operation:

- Control
- Text
- Transparent-monitor
- Transparent.

Control Mode: The 3174 enters control mode whenever it transmits or receives a valid EOT sequence. While in control mode, the unselected 3174 monitors the communication line for:

- A valid selection or poll addressing sequence, by which the 3174 is selected for entry into text mode.
- A Data Link Escape (DLE)-STX sequence, placing the 3174 in transparent-monitor mode.

Text Mode: Once a 3174 is successfully selected, it enters text mode. In text mode, the 3174 is either a master station or a slave station, as is the TCU. This status depends on the operation being performed. The station that is transmitting a message is called the *master station*. The station that is receiving and acknowledging the message is called the *slave station.*

The 3174 becomes the master station (and the TCU the slave station) once it sends STX to the TCU while executing a Read command or a poll operation. As the master station, it can transmit the following:

- Text messages
- Enquiries (ENQ) to request a reply or retransmission from the TCU.

After transmission of the message is completed, the 3174 returns to control mode.

The 3174 becomes the slave station (and the TCU the master station) when executing a write type command. As a slave station, it responds appropriately to master station (TCU) transmissions.

Transparent-Monitor Mode: Transparent-monitor mode is provided only with EBCDIC 3174s. It permits the transmission of data in any of the 256 possible EBCDIC bit patterns between the TCU and another unit on the same communication line with the 3174. This data can be independent of the selected transmission code (EBCDIC). Examples of such format-independent data are packed-decimal data, programs (both source and object), core images, and other binary data. Thus, link control characters within this data does not inadvertently initiate a 3174 operation.

When an EBCDIC 3174 decodes a DLE STX sequence while in control mode, it enters transparent-monitor mode. While in this mode, the 3174 disregards all data configurations that can appear on the communication line except for the following:

- A transparent text sync sequence (DLE SYN)
- A transparent text-terminating sequence (DLE ITB, DLE ETX, DLE ETB, or DLE ENQ).

The 3174 leaves transparent-monitor mode and returns to control mode if one of the following occurs:

- A transparent text sync sequence is not received within any 3-second period
- A transparent text-terminating sequence is decoded.

Transparent Mode: The 3174 provides transparent-mode transmission support (inbound and outbound) for the displays and printers that use the Extended Highlighting, Color, or Programmed Symbols function. Any data link control characters transmitted while the controller is in transparent mode must be preceded by a DLE to be recognized as control functions. The control functions used are:

DLE STX Initiates transparent mode for the following text.

DLE ETB Terminates a block of transparent text, returns the link to normal mode, and calls for a reply.

DLE ETX Terminates the transparent text, returns the link to normal mode, and calls for a reply.

DLE SYN Used to maintain synchronization or used as a time-fill sequence for transparent mode.

DLE ENQ Indicates *disregard this block of transparent data* and returns the link to normal mode.

DLE DLE Used to transmit Data Link Escape as data when a bit pattern equivalent to DLE appears in the transparent text. One DLE is disregarded; the other is treated as data.

DLE ITB Terminates an intermediate block of transparent text, returns the data link to normal mode, and does not call for a reply. The BCC character follows DLE End of ITB.

The boundaries of transparent data are determined by the DLE STX and by the DLE ITB, DLE ETB, or DLE ETX control functions, which initiate and terminate the transparent mode of operation. The controller and the displays or printers that support the Extended Highlighting, Color, and Programmed Symbols functions can accept data in transparent mode at any time; acceptance is not related to the use of the Extended Highlighting, Color, or Programmed Symbols functions.

For outbound transparent text transmissions the following occurs:

- Order splitting is permitted with a DLE ETB, meaning that the next block is a continuation of the text.
- DLE ETX processing is the same as in nontransparent mode; each block must start with a command sequence.
- On a teleprocessing line error, after the return of a Negative Acknowledgment (NAK) by the 3174, either a retransmission of the block or an EOT is expected from the sender.
- When a program error is found in the data, or a device error occurs during the processing of a block, the 3174 returns an EOT.
- NAK is returned by the 3174 when a transmission has DLE ETX or DLE ETB missing.

Note: Block size should be limited to 3000 bytes in a WSF transmission containing the LPS structured field. In addition, the maximum number of LPS structured fields that can safely fit in the 3174 buffer space is 90. This applies to displays and printers. Exceeding this limit can cause the 3174 to overflow its checkpoint buffers. When this overflow is detected by the controller, an op-check results.

In a WSF transmission to an IBM 3270 Personal Computer Attachment, the total length of one transmission should be held to 2048 bytes or less.

For DFTs, such as the 3290 Information Panel, the block size is limited to 3584 bytes or less.

Inbound Transparent Transmissions: The 3174s with remote attachments transmit inbound data in transparent mode only if the following occurs:

- The inbound reply mode is extended field
- The inbound reply mode is character
- The inbound data stream includes structured fields.

Transparent Text Blocking (Outbound): The following example illustrates the sequence expected during outbound blocking:

TCU	Device
.	
.	
.	
EOT	
(PAD and SYN characters)	
3270 CU address	
3270 CU address	
Device address	
Device address	
ENQ	
	ACK0
DLE STX	
ESC	
WRITE COMMAND	
TEXT 1	
DLE ETB (BCC)	
	ACK1
DLE STX	
TEXT 2	
DLE ETB (BCC)	
	ACK0
DLE STX	
TEXT 3	
DLE ETX (BCC)	
	ACK1
EOT	

Order sequences can be split in the blocking process. For example, one block can end with:

SBA
DLE ETB (BCC)

and the next block continue with:

DLE STX
ADDRESS
ADDRESS

Outside of transparent mode, ETB is treated as an ETX function. If the transmission for TEXT 2 in the example had omitted the DLE prefix, ETB would have been treated as ETX and the transmission acknowledged, but the transmission for TEXT 3—not beginning with a command—would have been treated as an error.

If the outbound blocked transmission contains a Read command, the ETB is treated as ETX. The read data stream is transmitted.

If a text block other than the first in the transmission contains a command, the second command sequence (ESC, CMMD) is treated as data. The device is in transparent mode, expecting a text block, and is not checking for a command sequence in the incoming transmission.

When a text block is expected, and another BSC control sequence, such as Reverse Interrupt (RVI) or Wait Before Transmit (WACK), is received, the device ignores it. The effect is a timeout at the TCU.

Redundancy Checking

A redundancy check is performed on the following communication line data:

- 3174 command-sequence characters (including the write data of a Write, Erase/Write, or Erase/Write Alternate command)
- Data transmitted to the TCU in response to a read type command or to a polling sequence.

A BCC is accumulated for each block of data at both the TCU and the 3174. If EBCDIC code is used, a 2-byte BCC is generated (cyclic redundancy check accumulation). If ASCII code is used, a 1-byte BCC is generated (longitudinal redundancy check accumulation).

BCC accumulation is initiated by, but does not include, the first STX or Start of Header (SOH) framing character. All characters following this STX or SOH, up to and including the ETB or ETX characters are part of the accumulation. Following the ETB or ETX character, the transmitting unit transmits its BCCs. The receiving unit then compares the character(s) with the BCCs it has accumulated. If the redundancy accumulations are different, a transmission error has occurred.

When the 3174 is the receiving unit and detects a BCC error, it responds to the transmission by sending NAK to the TCU. When the TCU is the receiving unit, it sets Unit Check in the ending status for the TCU command being executed when the BCC error was detected. Also, the TCU sets Data Check in the sense byte.

Note: BCC characters are removed from the data stream when received for comparison by the TCU or by the 3174. These characters are not stored in main storage or in the 3174 buffer.

In both EBCDIC and ASCII, transmission formats (data link controls) are rigidly screened so that communication is orderly and accurate. Improper transmissions are ignored or rejected to avoid the acceptance of faulty messages. Received or transmitted data blocks are counted odd-even-odd-even, and so on, by both the transmitter and the receiver (by means of ACK 0's and ACK 1's), and their counts must agree at each block-check point.

Data Link Control Characters

Two types of characters are transmitted between the TCU and the 3174: CU data link control characters and 3174 message data.

Data link control characters are used for such purposes as message framing, acknowledgment that received message data was valid or invalid, and identification of the start- or end-of-text transmission. Data link control characters are used (singly or in sequences) by the TCU (under program control) and by the 3174 to establish and control all data link operations in an orderly fashion.

The 3174 message data consists of all address, command, order, and display/print characters sent to the 3174 and of all buffer data, AID bytes, and status/sense bytes read from the 3174. Data link control characters are described individually in the following paragraphs and are described with 3174 message data in "Operational Sequences (Nonswitched Line)" on page 6-13.

The data link control characters, with their EBCDIC or ASCII codes, are:

Data Link Control Character	EBCDIC (Hex)	ASCII (Hex)
ACK 0 (2 bytes)	1070	1030
ACK 1 (2 bytes)	1061	1031
DLE	10	10
ENQ	2D	05
EOT	37	04
ESC	27	1B
ETB	26	17
ETX	03	03
ITB	1F	1F
NAK	3D	15
RVI (2 bytes)	107C	103C
SOH	01	01
STX	02	02
SYN	32	16
TTD (2 bytes)	022D	0205
WACK (2 bytes)	106B	103B

All control characters transmitted by the TCU (except pad and SYN) are issued by the channel program as part of a TCU Write CCW data stream. All control characters transmitted to the TCU are generated by the controller. A Read command to the TCU is used to store these characters (except pad and SYN) into main storage for subsequent analysis by the access method.

Pad: TCU or 3174 hardware generates pad characters, leading and trailing, to ensure complete transmission or reception of the first and last significant characters of each transmission.

SYN (Synchronous Idle): TCU or 3174 hardware generates two consecutive SYN characters to establish character synchronization. The TCU can also embed SYN characters in text for time-fill to maintain synchronization. The 3174 discards these SYN characters (does not store them in the buffer).

DLE (Data Link Escape): DLE is always the first byte in the following 2-byte control characters: ACK 0, ACK 1, WACK, and RVI. DLE is also used as the first character in several 2-character sequences that are used in transparent-monitor mode (see "Transparent-Monitor Mode" on page 6-5).

ACK 0 (Even Acknowledge): ACK 0 is a 2-byte character, as follows:

EBCDIC: X'1070'
ASCII: X'1030'

The 3174 transmits an ACK 0 after a successful selection addressing (not poll) sequence to indicate to the TCU that the 3174 is ready to accept transmission. The 3174 or TCU also transmits an ACK 0 upon receipt and validation of an even numbered (second, fourth, etc.) text block.

ACK 1 (Odd Acknowledge): ACK 1 is a 2-byte character, as follows:

EBCDIC: X'1061'
ASCII: X'1031'

The 3174 or TCU transmits an ACK 1 upon receipt and validation of an odd numbered (first, third, etc.) text block.

NAK (Negative Acknowledgment): The 3174 transmits a NAK in response to a TCU text transmission that:

- Terminates with ENQ
- Contains an ENQ embedded in text
- Contains an invalid BCC
- Contains a TTD sequence (STX ENQ)
- Contains no ETX.

The TCU can also send a NAK when a timeout occurs to a General Poll of a 3270 device.

When the 3174 receives a NAK in response to a text transmission, the 3174 retransmits the last block of text.

Note: The TCU should be programmed to respond with NAK to an ENQ (that ends a text block) from the 3174. This NAK causes the 3174 to send EOT and retain the status for error recovery.

ENQ (Enquiry): The 3174 transmits ENQ to:

- Request a reply from the TCU following a three-second timeout
- Request retransmission of the previous reply from the TCU
- Form the last character of a text message in which a data check was detected by the 3174. (See the note above.)

When the 3174 receives ENQ in response to a transmission, the last 3174 transmission to the TCU is repeated. The 3174 responds with NAK when ENQ is received as follows:

- As the last character of a TCU-aborted text transmission
- As part of the text
- As part of a Temporary Text Delay sequence (STX ENQ).

To be addressed successfully, the 3174 must receive ENQ as the last character of a polling or selection addressing sequence.

WACK (Wait before Transmit): WACK is a 2-byte character, as follows:

EBCDIC: X'106B'
ASCII: X'103B'

With CUTs: The 3174 generates WACK in response to the following:

- A selection addressing (not poll) sequence when a device attached to the 3174 is busy
- Write or Copy command text transmission when the start-printer bit is set in the WCC or CCC. The 3174 responds with ENQ to a WACK from the TCU (printers only).

With DFTs: If the 3174 was configured for DFT BSC WACK support (configuration question 176), the 3174 generates WACK when:

- The 3174 is responding to data from the host
- The DFT has not finished processing a previous block of information
- Any block of information ends with ETX.

The host receives a positive acknowledgment by way of a status message DE, indicating that the data stream was processed correctly. Any other status received is an indication that the data stream was not processed correctly.

The host answers the WACK with ENQ; the 3174 continues to send WACKs at two-second intervals until the DFT has completed processing.

RVI (Reverse Interrupt): RVI is a 2-byte character, as follows:

EBCDIC: X'107C'
ASCII: X'103C'

The 3174 generates RVI in response to an attempted selection (not poll) by the TCU when the 3174 has a status and sense message to be transmitted. Whenever the 3174 accepts RVI from the TCU, the 3174 responds with EOT and resets all pending status and sense information. The 3174 accepts RVI in place of ACK 0 or ACK 1 and then only when they would have been valid. If the 3174 receives RVI in response to an RVI, a timeout occurs at the 3174.

STX (Start of Text): The 3174 receives STX as the first character of a command or TTD sequence. The STX causes the 3174 to clear its BCC and start accumulating a new BCC (STX is not included in the accumulation). Subsequent STX (and SOH) characters are included in the BCC accumulation. STX is transmitted by the 3174 to the TCU as the first character of a read-data text block except in a status or test-request message. This STX causes the TCU to start accumulating a new BCC (STX is not included in the accumulation).

The first character in status and test-request messages is SOH, with STX following two header characters. With a message of this type, the TCU starts BCC accumulation on receipt of the first SOH. The subsequent STX character is included in the BCC accumulation.

SOH (Start of Heading): The 3174 generates SOH in a 3-character heading sequence that identifies the accompanying data as a status message (SOH, %, R, STX, ---) or as a test-request message (SOH, %, /, STX, data ---). The TCU starts BCC accumulation on receipt of SOH (SOH is not included in the accumulation).

ETB (End of Transmission Block): During a message transfer operation, ETB informs the receiving unit that BCC follows. The 3174 treats ETB as though it were ETX if the block was not sent in transparency mode. The 3174 does not accept conventionally blocked outbound text.

ETX (End of Text): During a message transfer operation, ETX informs the receiving unit that BCC follows. The 3174 transmits ETX at the end of the last (or only) block of a text message. Then, on successful comparison of the received BCC with the accumulated BCC, the program should respond with ACK to the 3174. If the BCC comparison is unsuccessful, the TCU interrupts the program (Channel End, Device End, and Unit Check status, with Data Check set in the sense byte); the program should respond with NAK to the 3174. Receipt of ETX by the 3174 initiates a BCC comparison, causes a line turnaround, and causes generation of an appropriate response to the TCU.

EOT (End of Transmission): EOT is transmitted by the 3174 when:

- The 3174 is a slave station and is unable to perform an operation requested by the TCU
- The 3174 is a master station, as normal termination of a read operation.
- The 3174 has completed General Poll operations with each attached device
- The 3174 responds to the RVI sent by the TCU.

Line synchronization is dropped, and the 3174 is returned to control mode. Note that the program can also issue EOT to the 3174 in order to drop line synchronization and return the 3174 to control mode. EOT does not reset status and sense in the 3174. Therefore, EOT should not be sent as a response to a status message.

If an error occurs during buffer transfer, following receipt of a valid selection addressing sequence, the 3174 provides a positive response to the selection sequence and internally set Data Check (DC) and Unit Specify (US) status. EOT is sent in response to the following 3270 command or poll.

ITB (End of Intermediate Transmission Block): The 3174 does not accept conventionally blocked text. However, to coexist on a BSC multipoint line on which ITB can be used, the 3174 includes the ITB and associated BCC in its own BCC accumulation but then removes them from the data stream so that they are not stored in the buffer. The 3174 does not perform a BCC comparison at that time, but continues the receive operations until ETB or ETX is decoded.

ESC (Escape): ESC must precede the command code in each command-sequence data stream transmitted to the 3174, as follows: STX, ESC, CMD, ---. The 3174 does not generate ESC.

TTD (Temporary Text Delay): TTD is a 2-byte character sequence: STX ENQ. The 3174 responds to TTD by transmitting NAK to the TCU. The 3174 does not generate TTD. TTD can also be used by the master station to terminate an operation (that is, initiate a forward abort). The 3174 (slave station) always responds with a NAK, expecting the master station to transmit EOT. In this case, the slave station interprets this sequence as a controlled forward abort rather than an end of transmission.

Operational Sequences (Nonswitched Line)

The following paragraphs describe the various data and control sequences that can be performed with the 3174 operating on a nonswitched line. These sequences are divided into the following four categories:

- General and Specific Poll
- Selection addressing
- Write and control type commands
- Read type commands.

The description of each category is associated with a sequence/response diagram, which shows:

- All 3174 responses to program-generated transmissions by the TCU
- Normal program-handling of 3174 transmission.

These diagrams show the I/O supervisor/access method as examining each 3174 response to determine which operation to initiate next. For specific applications, however, additional use of command chaining in the channel programs can be desirable.

A selection addressing sequence selects a 3174 and an attached device for subsequent command operations. Polling sequences are selection sequences used specifically to obtain pending status at a device. Either a Specific Poll sequence requesting status from a particular device or a General Poll sequence sent to all devices can be executed.

Remote Chaining of 3270 Commands

For remote (telecommunication-attached) operations, 3270 command codes are included in the data stream of a Write CCW to the TCU. Remote chaining of 3270 commands is defined as the transmission of more than one command sequence to a 3174 following a single selection addressing or poll sequence. This chaining is normally accomplished with separate Write CCWs in the channel program. For example, the channel program could:

1. Write a selection addressing sequence and read the response for evaluation by the I/O supervisor/access method
2. Write a 3270 Write command and text block and read the 3174 response for evaluation
3. Write a 3270 Write command followed by a second text block and read the 3174 response for evaluation.

The program can chain 3270 commands following a selection addressing sequence, provided that the BSC rules governing limited conversational mode are observed. (Refer to *General Information Binary Synchronous Communications*.) The 3174 permits any valid command to be chained following a poll sequence. However, RB or RM commands should not be chained, because the BSC rules for limited conversational mode (a maximum of two consecutive data transfers without an intervening ACK) would be violated.

Any 3270 command (except Erase All Unprotected) can be chained from a Write, Erase/Write, Erase/Write Alternate, or Copy command. However, if the Write, Erase/Write, Erase/Write Alternate, or Copy command has started a print operation, the 3174 aborts the subsequent chained command (the print operation is completed normally).

General and Specific Poll Sequences

When a General or Specific Poll sequence is issued (see Figure 6-1 on page 6-16), one of the following possible results occurs:

- If status and sense information is pending with or without an AID present, a status and sense message is generated.
- If status and sense information is not pending and an AID is present, a Read Modified command is executed.
- If there is no status or sense information or no AID pending, an EOT response is generated.

Figure 6-1 on page 6-16 lists the conditions under which status and sense messages are transmitted.

The controller and device address bytes transmitted for the General and Specific Poll sequences are:

1. General Poll Address byte sequence:
```
3174 Poll Address
3174 Poll Address  (See Table 6-1 on page 6-18)
7F (EBCDIC) or 22 (ASCII)  Used in place of the two
7F (EBCDIC) or 22 (ASCII)  device-address bytes.
```

2. Specific Poll address byte sequence:
```
3174 Poll Address
3174 Poll Address  (See Table 6-1 on page 6-18)
Device Address
Device Address
```

The selected 3174 remains selected at the completion of a poll operation so the program can issue a Write, Erase/Write, Erase/ Write Alternate, Copy, or EAU command without reselecting the 3174 and the device; command operations are with one of the following:

- The device that was selected by a Specific Poll
- The device from which a response was last received during the General Poll operation.

Selection is dropped when the 3174 transmits EOT. The 3174 transmits EOT when the 3174 has no pending status or messages or after it receives NAK from the TCU in response to a message that ends with ENQ.

Specific Poll addresses the 3174 and one device to determine whether status and sense information or a manually entered message is awaiting transfer to the TCU. The pending status and sense information or message is transferred automatically by the 3174 on receipt of the Specific Poll addressing sequence.

When a General Poll addresses the 3174, each attached device is examined in the order in which the Enter function was pressed. If a message is present, it is transferred to the TCU. Each message is accompanied by the address of the device from which it originated.

Upon completion of this transfer, an ACK response from the program causes the 3174 to continue the General Poll operation, either by transferring another block of a text message or by examining other attached devices for pending messages. The program could issue a command rather than ACK to the device from which the message was just received only after inbound blocks that end with ETX. The 3174 ignores any commands that are sent in response to a block of data that ends with ETB. Once the 3174 has examined all attached devices and has successfully transferred all pending messages, it generates EOT and returns to control mode. If the program wishes to terminate the General Poll, an RVI can be issued to the 3174, forcing an EOT response. A command issued rather than the ACK (after blocks that end with ETX) also terminates the General Poll.

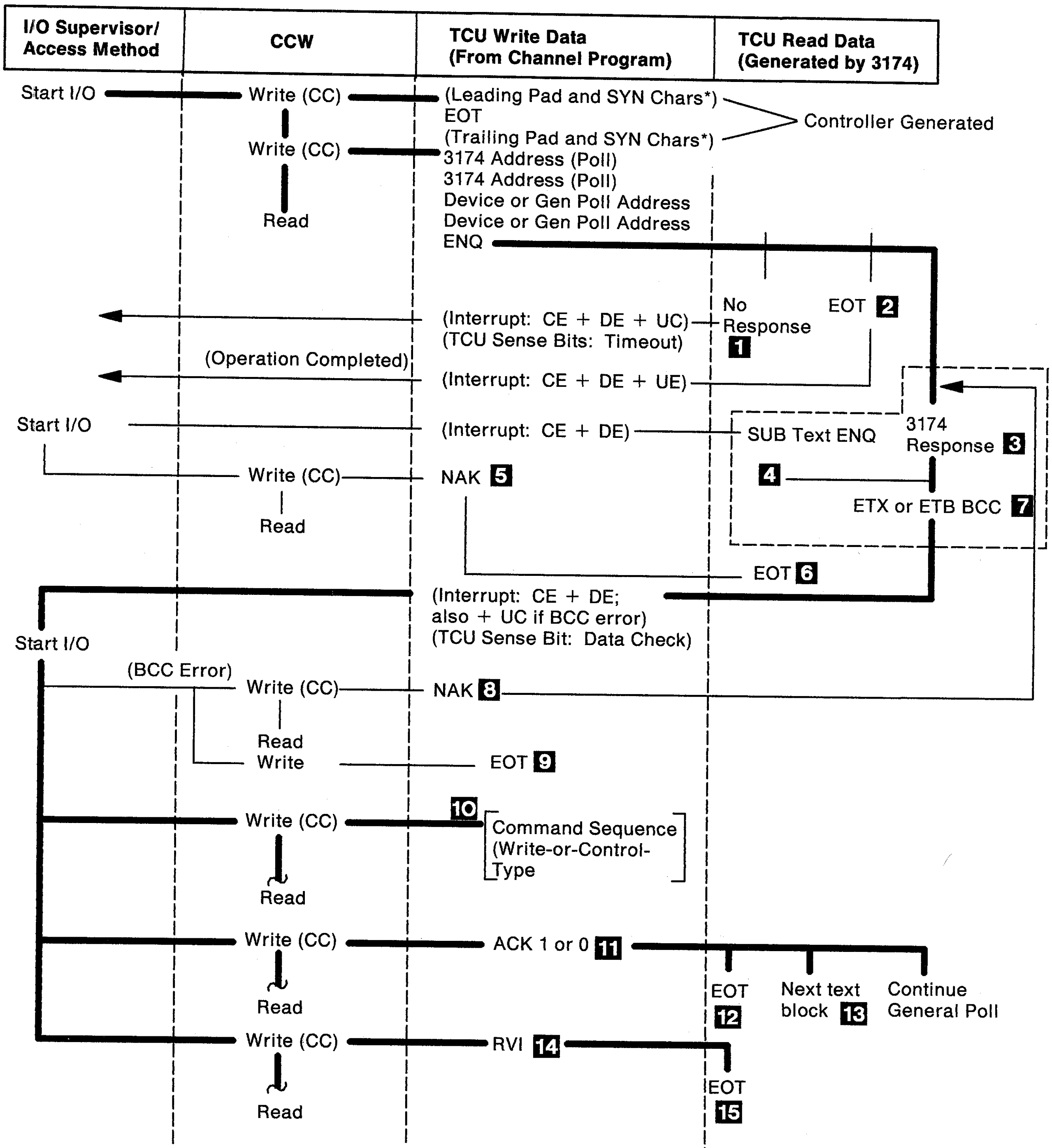
Figure 6-2 shows the message formats. Note that a device address is not provided in the heading of a Test Request message. An address must be manually entered by the operator as part of the text, because the operator can specify the address of another device for test operations with the program.

The status and sense bits are described later in this chapter under "Status and Sense (S/S) Bytes" on page 6-27.

Selection Addressing Sequence

The selection addressing sequence (Figure 6-3 on page 6-20) specifies a 3174 and an attached device in preparation for write, control, or read type command sequences. It is similar in format to a Specific Poll sequence in that a 3174 address is sent, followed by a device address, but different I/O characters and hex codes are used to represent the 3174 address bytes. Column 1 in Table 6-1 on page 6-18 lists the characters and hex codes used to complete the selection addressing sequence. Comparative examples of 3174 and device address codes for General Poll, Specific Poll, and selection addressing sequences are shown in the examples following that table.

For the 3174, the selection addressing sequence performs a function similar to a local Select command in that it causes a device-to-controller buffer transfer. The 3174 provides a positive response to a selection sequence before transfer of a device buffer to the 3174. If an error occurs during buffer transfer, after receiving a valid selection addressing sequence, a positive response to the selection sequence is provided by the 3174, and DC and US status are internally set. EOT is sent in response to the next command.



* Only the critical framing characters (sync pattern and pad) are shown. All other framing characters are also hardware-generated as required. See *General Information — Binary Synchronous Communications* for a complete description.

Legend:

CC	= Chain Command (CC) Flag in CCW is set to 1.
Interrupt	= TCU-generated interrupt
CE	= Channel End,
DE	= Device End
UE	= Unit Exception
UC	= Unit Check

Figure 6-1 (Part 1 of 2). General Poll and Specific Poll, Sequence/Response Diagram

Notes:

1 The 3174 will fail to respond to the addressing or polling sequence, causing a TCU timeout, for any of the following reasons:

- The 3174 is unavailable (has power off, is offline, or is not attached).
- Any character in the polling sequence is invalid.
- The characters in the polling sequence are out of order.
- The polling sequence is incomplete (less than seven characters).
- The 3174 address is incorrect in the write data stream.
- The addressed 3174 was left selected from the previous transmission.

2 There is no I/O pending or pending status. For General Poll, the CU sends EOT only after polling all devices.

3 The device response is a function of the kind of device and its status. Types of responses include Text, Status, and Test Request messages.

For General Poll, the search for a response starts at some random device address and continues sequentially (as long as ACKs are received in response to text transmissions) until all devices are given the opportunity to respond.

4 Upon detection of an internal parity check or a cursor check, the 3174 (1) substitutes the SUB character for the character in error, (2) records Data Check status, and (3) transmits an ENQ in place of ETX (or ETB) and BCC at the end of the text block. The general poll process is stopped.

5 Mandatory program response to a text block terminated in ENQ.

6 Terminates the operation. The nature of the error (parity or cursor check) does not warrant a retry. This response indicates that status and sense information is stored.

7 ETB is used to frame each block of a blocked text message, except the last block. ETX is used to frame the last block of a blocked text message.

8 BCC error has been detected. The program issues NAK to cause the 3174 to repeat its last transmission.

9 Response issued by the program to terminate the operation if the TCU is unsuccessful in receiving a valid BCC following *n* attempts by the 3174 to transmit the message. This response does not cause the 3174 to reset its sense/status information. Therefore, the same status message is transmitted if a Specific Poll is immediately issued to the same device.

10 This transmission must be a write or control type command sequence. A read type command violates BSC standards on Limited Conversational mode.

For General Poll, this transmission stops the polling operation. The General Poll must be reinitiated to ensure receipt of all pending device messages.

11 Positive acknowledgment. The text block has been successfully received by the TCU. The program issues ACK 1 in response to the first and all odd numbered text blocks and issues ACK 0 in response to the second and all even numbered text blocks.

12 Normal termination of a Specific Poll.

Normal termination of a General Poll.

13 The second and all succeeding text blocks are framed as the first except they do not include the 3174/device address sequence.

14 RVI to terminate polling sequence.

15 Termination of polling sequence on receipt of RVI.

Figure 6-1 (Part 2 of 2). General Poll and Specific Poll, Sequence/Response Diagram

Table 6-1. Remote (Telecommunications-Attached) Controller and Device Addressing

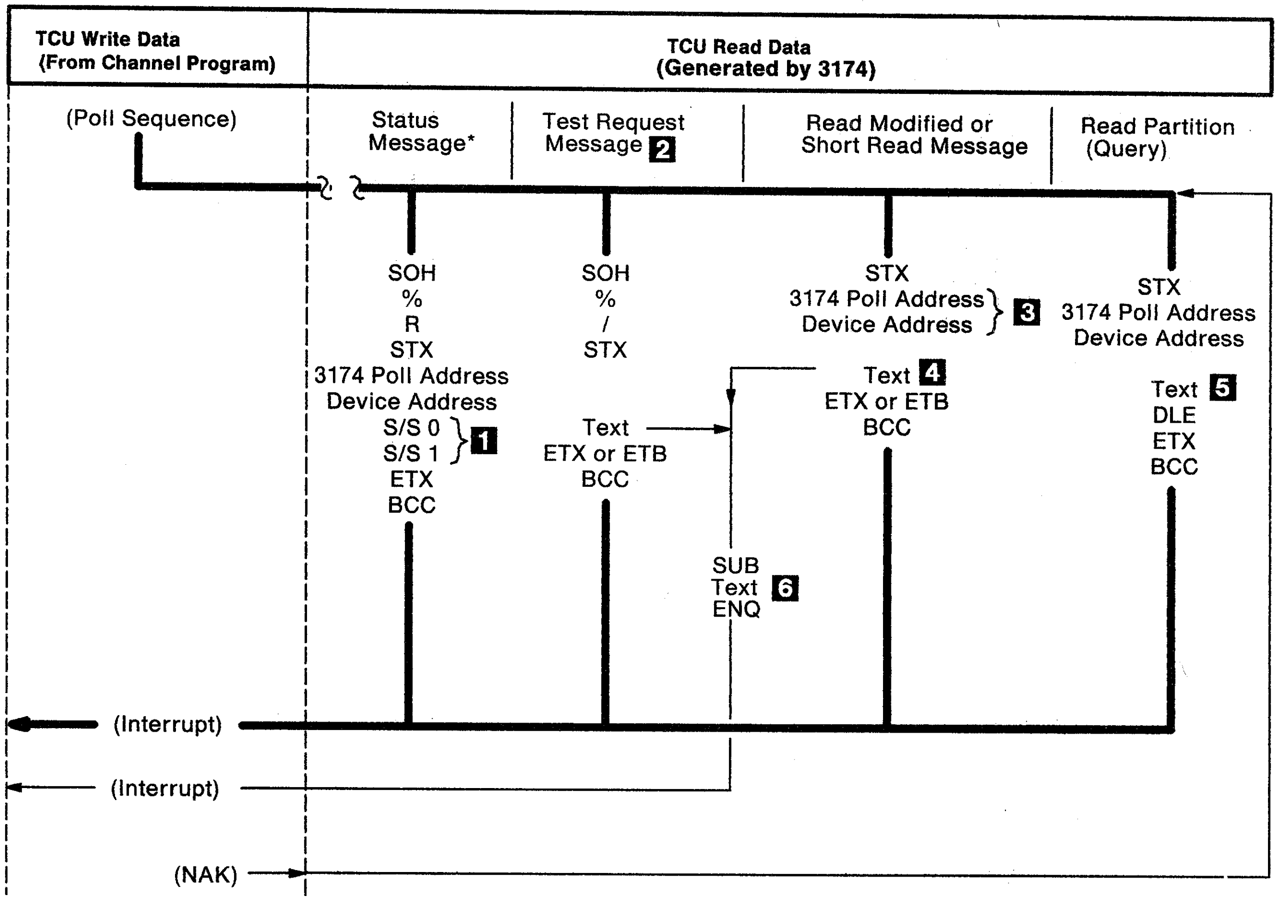
Column 1 Use this column for: • Device Selection • General Poll • Specific Poll • Fixed Return Addresses					Column 2 Use this column for: • 3174 Selection Addresses • Test Requests				
3174 or Device No.	EBCDIC I/O Character	EBCDIC Hex (Note 1)	ASCII I/O Character	ASCII Hex	3174 No.	EBCDIC I/O Character	EBCDIC Hex (Note 1)	ASCII I/O Character	ASCII Hex
0	SP	40	SP	20	0	-	60	-	2D
1	A	C1	A	41	1	/	61	/	2F
2	B	C2	B	42	2	S	E2	S	53
3	C	C3	C	43	3	T	E3	T	54
4	D	C4	D	44	4	U	E4	U	55
5	E	C5	E	45	5	V	E5	V	56
6	F	C6	F	46	6	W	E6	W	57
7	G	C7	G	47	7	X	E7	X	58
8	H	C8	H	48	8	Y	E8	Y	59
9	I	C9	I	49	9	Z	E9	Z	5A
10	¢	4A	[	5B	10	¦	6A	¦	7C
11	839dh	4B	839dh	2E	11	,	6B	,	2C
12	<	4C	<	3C	12	%	6C	%	25
13	(	4D	(	28	13	_	6D	_	5F
14	+	4E	+	2B	14	>	6E	>	3E
15	|	4F	!	21	15	?	6F	?	3F
16	&	50	&	26	16	0	F0	0	30
17	J	D1	J	4A	17	1	F1	1	31
18	K	D2	K	4B	18	2	F2	2	32
19	L	D3	L	4C	19	3	F3	3	33
20	M	D4	M	4D	20	4	F4	4	34
21	N	D5	N	4E	21	5	F5	5	35
22	O	D6	O	4F	22	6	F6	6	36
23	P	D7	P	50	23	7	F7	7	37
24	Q	D8	Q	51	24	8	F8	8	38
25	R	D9	R	52	25	9	F9	9	39
26	!	5A	]	5D	26	:	7A	:	3A
27	$	5B	$	24	27	#	7B	#	23
28	*	5C	*	2A	28	@	7C	@	40
29	)	5D	)	29	29	'	7D	'	27
30	;	5E	;	3B	30	=	7E	=	3D
31	¬	5F	^	5E	31	" (Note 2)	7F	"	22

Notes:

1. Graphic characters for the United States I/O interface codes are shown. Graphic characters for EBCDIC 4A, 5A, 5B, 7B, 7C, and 7F might differ for particular World Trade I/O Interface Codes. Refer to the *3270 Character Set Reference*, for possible graphic differences when these codes are used.
2. I/O character address (") is used as the device address to specify a General Poll operation.

Table 6-2. Examples of Controller and Device Addressing

		EBCDIC	ASCII
General Poll CU5	CU Address	C5	45
	CU Address	C5	45
	Device Address	7F	22
	Device Address	7F	22
Specific Poll Device 4 on CU5	CU Address	C5	45
	CU Address	C5	45
	Device Address	C4	44
	Device Address	C4	44
Select Device 4 on CU5	CU Address	E5	56
	CU Address	E5	56
	Device Address	C4	44
	Device Address	C4	44



* Response to General Poll or Specific Poll only (*not* program-generated Read Modified command)

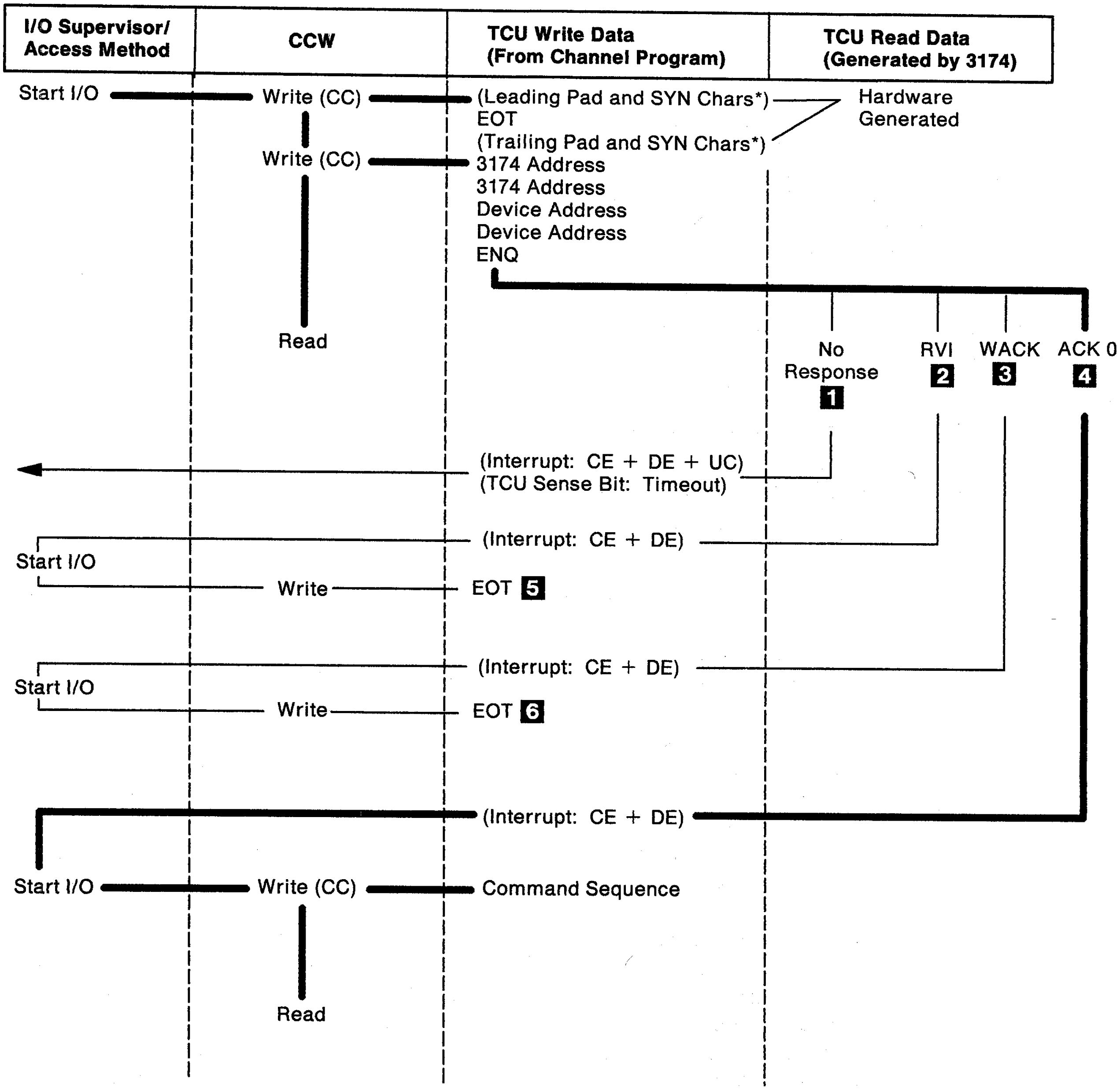
Legend:

Interrupt = TCU-generated interrupt

Notes:

1. A status message response is issued to a General or Specific Poll if (1) the 3174 has pending status (General Poll Ignores Device Busy and device unavailable and, if the 3174 continues polling of the next device), or (2) if error status develops during execution of the poll.
2. A Test Request Message response is issued to a General or Specific Poll if a Sys Req function is pressed at a Category A display attached to a 3174.
3. This address is included only in the first block of a blocked text message.
4. The text portion of this message is the result of either a Read Modified or Short Read operation by the 3174.
5. The text portion of this message is the result of a Read Partition (Query) structured field.
6. Inbound abort error occurred on device after first block sent to host.

Figure 6-2. 3174 Message Response to Polling or Read Modified Command



* Only the critical framing characters (sync pattern and pad) are shown. All other framing characters are also hardware-generated as required. See *General Information — Binary Synchronous Communications* for a complete description.

Legend:

CC = Chain Command (CC) Flag in CCW is set to 1.
Interrupt = TCU-generated interrupt
CE = Channel End
DE = Device End
UC = Unit Check

Figure 6-3 (Part 1 of 2). Selection Addressing, Sequence/Response Diagram

Notes:

1 The 3174 fails to respond to the addressing or polling sequence causing a TCU timeout for any of the following reasons:

- The 3174 is unavailable (has power off, is offline, or is not attached).
- Any character in the polling sequence is invalid.
- The characters in the polling sequence are out of order.
- The polling sequence is incomplete (less then seven characters).
- The 3174 address is incorrect in the write data stream.
- The addressed 3174 was left selected from the previous transmission.

2 The addressed device has pending status (excluding Device Busy or Device End).

3 The addressed 3174 is busy. No S/S information is stored. An RVI response takes precedence over a WACK response.

4 The address has been successfully received and no status is pending.

5 Termination of attempted addressing sequence:

Availability of valid status and sense information cannot be ensured unless a Specific Poll is issued to the responding device as the next addressing sequence issued to this 3174.

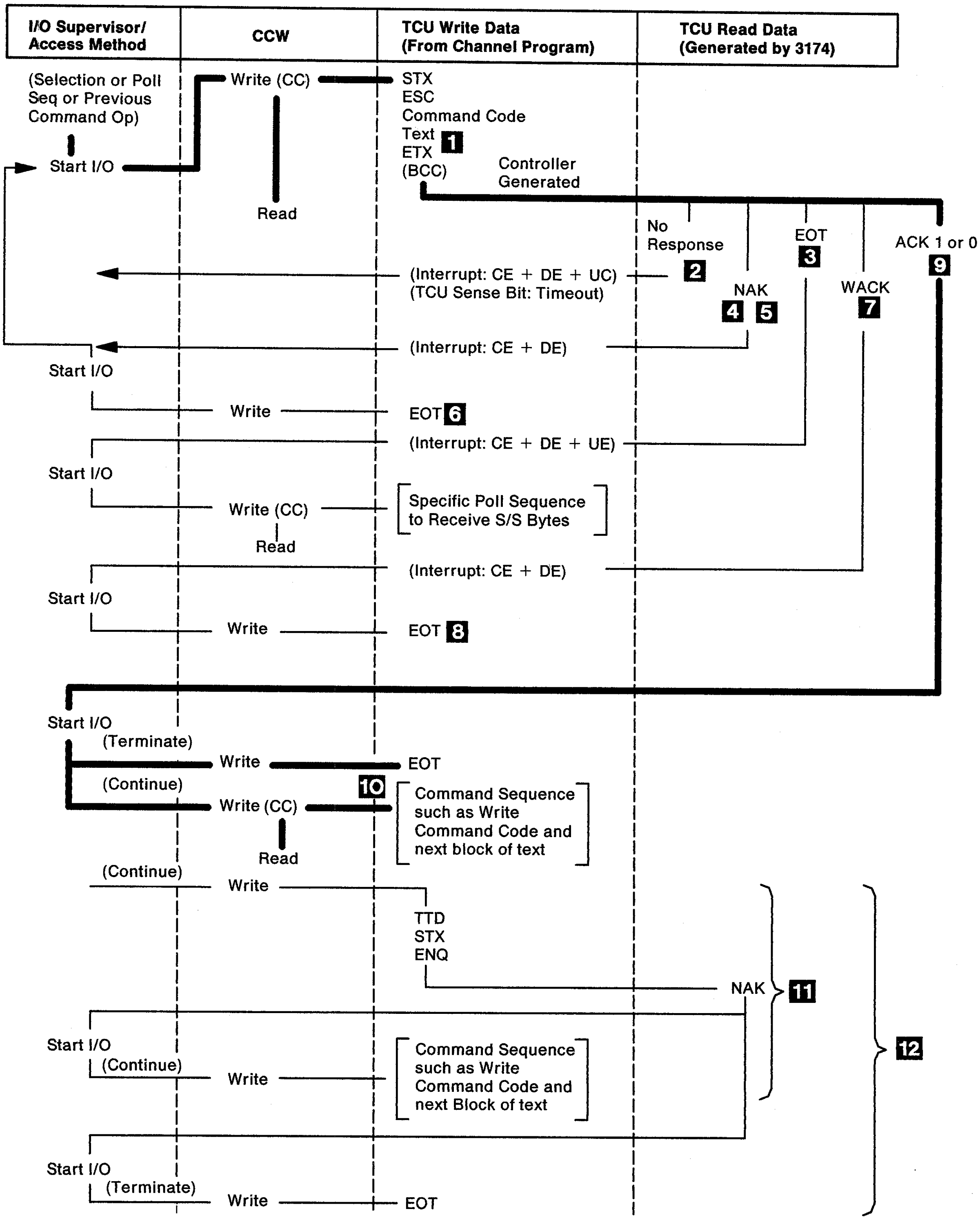
6 Termination of attempted addressing sequence.

Figure 6-3 (Part 2 of 2). Selection Addressing, Sequence/Response Diagram

Write Type and Control Type Command Sequences

The program initiates a Write, Erase/Write, Erase/Write Alternate, Copy, or EAU operation (Figure 6-4 on page 6-22) by first writing a command and, except for EAU, a data sequence to the selected 3174 and then reading the response. All write type commands and Copy commands must be followed by a minimum of one data byte (the WCC or CCC byte). If the program reads a positive response (ACK) from the 3174, it can terminate the operation or continue with another command. The program can write blocks of text to the 3174 by initiating, after receipt of each ACK, a Write command sequence for each block to be written.

Write data is blocked to devices attached to a 3174 as follows: Each time the 3174 receives a selection addressing sequence, it begins to transfer the device buffer contents to the controller buffer. As the Write command data is received by the controller, updating occurs, and the result is asynchronously transferred to the buffer of the addressed device. The device buffer contents not affected by the write data stream remain unaltered in the device buffer. If the transmission of a block of data to the controller is successful (ACK reply), a device-to-control-unit-buffer transfer is begun. If the transmission of a block of write data to the controller is unsuccessful (for example, NAK reply), the buffer contents previously stored in the controller buffer are immediately transferred to the device buffer before another Write command is received. These contents include any previous text blocks that were written successfully. Thus, the 3174 can receive retransmission of the block that was unsuccessfully received.



Legend:

CC = Chain Command (CC) Flag in CCW is set to 1.
Interrupt = TCU-generated interrupt
CE = Channel End
DE = Device End
UE = Unit Exception
UC = Unit Check

Figure 6-4 (Part 1 of 2). Write Type and Control Type Commands, Sequence/Response Diagram

Notes:

1 No text is transmitted on an EAU command transmission.

2 Command transmission was not successfully received because of invalid framing (STX missing). Causes a timeout at TCU.

3 The controller is unable to perform the operation indicated in the command transmission because of a busy/unavailable/not ready device or one of the following:

a. Receipt of an illegal command/order sequence
b. Failure to decode a valid command
c. An I/O interface overrun
d. A parity/cursor check
e. An illegal buffer address
f. A locked buffer.

In the case of the Copy command, the *from* device is busy or has a locked buffer, or CCC is missing.

The EOT response to a command transmission indicates that status information is stored in the controller. To ensure retrieval of valid status, the program must issue a Specific Poll (addressing the device that was selected when EOT was generated) as the next addressing sequence to this controller. Successful completion of a Specific Poll addressed to the responding device, a device selection addressed to any other device on the same controller, or a General Poll addressed to the same controller, is required to restart the internal controller device polling operation.

4 If a transmission problem causes both a 3174-detected check condition and a BCC error, the BCC error takes precedence over all other check conditions, and a NAK is transmitted to the TCU.

5 BCC error or missing ETX has been detected. The NAK response requests the program to repeat its last transmission.

6 Response issued by the program to terminate the operation if the 3174 is unsuccessful in receiving a valid BCC following *n* attempts by the program to transmit the message.

7

CUT: chained	If the Start Printer bit is set in the WCC or CCC, a WACK response indicates that the text transmission was successfully received, but that the printer is now busy and an additional command cannot be accepted.
DFT: distributed	If the controller has been customized with the BSC communication option and has function terminals, the DFT can function as a printer type device.

If any of the conditions cited in Note 3 prevail, the EOT response takes precedence over the WACK response.

8 Normal termination of the operation by the program.

9 Command execution has been successfully completed.

10 Repeat the operation shown in this figure for the next command sequence.

11 Example of a TTD sequence.

12 Example of terminating an operation using TTD (a forward abort sequence).

Figure 6-4 (Part 2 of 2). Write Type and Control Type Commands, Sequence/Response Diagram

Copy Command

The 3174s with remote attachments support the Copy command when operating with BSC protocol. These units do not support the Copy command when operating with SNA protocol. However, a Local Copy function is provided. See Chapter 4, "Control Unit Terminal (CUT) Functions" for more information.

Note: The Copy command is not recognized by the 3290 Information Panel display station. To obtain a printed copy of information displayed on the 3290 screen, *Local Copy* must have been specified at 3174 customization and the appropriate entries made in the PAM.

Copy is used to transfer buffer data from one device to another device attached to the same controller. The selected device is the *to* device, the one to which buffer data is transferred. The *from* device, the source of the buffer data to be copied, is identified in the second of two bytes that follow the Copy command code. The first byte, called the CCC, identifies the type of data to be copied. The CCC can also, at the *to* device, start print operations, specify the printout format for those operations, and, when the device is a display station, sound the audible alarm.

The bytes of the Copy data stream are defined as follows:

Byte	**Content**
0	STX
1	ESC
2	Copy Command Code
3	CCC (See Table 6-3.)
4	*From* Device Address (See Table 6-4 on page 6-26.)
5	ETX

Table 6-3 describes the function of each CCC bit. A CCC and an address byte must always follow the command code. If they do not, the controller aborts the command and generates error status.

Table 6-3 (Page 1 of 2). Copy Control Character (CCC)

Bit	Content	Explanation
0,1		Determined by the contents of bits 2 through 7 as shown in Table 2-3 on page 2-5.
2,3		Define the printout format as follows:
	B'00'	The NL, EM, and CR orders in the data stream determine print line length. Provides a 132-print position line when the orders are not present.
	B'01'	Specifies a 40-character print line
	B'10'	Specifies a 64-character print line
	B'11'	Specifies an 80-character print line.
4		The Start Print bit. When set to 1, this bit initiates a printout operation at the *to* device after buffer transfers are completed.
5		The Sound Alarm bit. When set to 1, this bit sounds the audible alarm at the *to* device after buffer transfers are completed (if that device has an audible alarm).

Table 6-3 (Page 2 of 2). Copy Control Character (CCC)		
Bit	**Content**	**Explanation**
6,7		Define the type of data to be copied as follows:
	B'00'	Only attribute characters are copied.
	B'01'	Attribute characters and unprotected alphanumeric fields (including nulls) are copied. Nulls are transferred for the alphanumeric characters not copied from the protected fields.
	B'10'	All attribute characters and protected alphanumeric fields (including nulls) are copied. Nulls are transferred for the alphanumeric characters not copied from the protected fields.
	B'11'	The entire contents of the storage buffer (including nulls) are copied.

Copy command operations are similar to Write command operations. After the controller, for example, accepts the Copy data stream, it initiates the transfer of all bytes from the *from* device buffer to the controller buffer. Upon completion of this transfer, the controller inserts nulls in all character locations that do *not* contain the type of data specified by CCC bits 6 and 7. The updated controller buffer contents are then transferred to the selected *to* device. At the completion of Copy command operations, the cursor is in the same character location at the *to* device as it was at the *from* device at the start of operations.

The *from* device buffer can be locked (made incapable of being copied) by writing a protected/alphanumeric attribute byte (bits 2=1 and 3=0) in address 0 (with BSC only).

The Copy command can specify as the *from* device the same device that is selected (the *to* device). This procedure provides a means of programming selective device buffer erase operations as specified by CCC bits 6 and 7. In this case, the device buffer contents are transferred to the controller, nulls are inserted as determined by the CCC, and the resulting buffer contents are transferred back to the same device buffer.

When the buffer size of the *from* device is smaller than, or equal to, the buffer size of the *to* device, screen size switching occurs as listed in Table 6-4 on page 6-26. Invalid transfers are also indicated. The buffer of the *to* device is, in effect, cleared before the copy is performed. The same rules apply for copy-operation transfers to printer buffers.

Programming Notes:

1. Copy should not be chained from a Write, Erase/Write Alternate, Erase/Write Unprotected, or Erase All Unprotected command, because it copies the data as modified by the Write or Erase command.

2. If the CC Start Print bit is set and commands are being chained, Copy should be the last command of the chain. If not, the controller aborts the subsequent command.

3. Copy can be executed from a smaller buffer size to a larger buffer size, but an attempt to copy from a larger to a smaller buffer size causes an Operation Check.

4. An Operation Check occurs if copying from an APL device in APL mode to a device that does not have the APL feature installed.

To	3278-2 3279 1920	3278-2 3279 2560	3278-3 1920	3278-4 3440	3278-4 1920	3278-5 3564	3278-5 1920
3278-2 3279 1920	o	v	o	v	o	v	o
3278-2 3279 2560	-	o	A	•	A[1]	•	A[2]
3278-3 1920	o	v	o	v	o	v	o
3278-4 3440	-	-	-	o	A	•	A[3]
3278-4 1920	o	v	o	v	o	v	o
3278-5 3564	-	-	-	-	-	o	A
3278-5 1920	o	v	o	v	o	v	o

Table 6-4. Buffer Transfers for 3174 Model R Copy Command Operations

Legend:

o Transfer allowed, no change in screen state required.
- Transfer not allowed, Operation Check returned to host.
• Transfer allowed, no change in screen state (appearance on *from* and *to* device can differ).
A Transfer allowed, screen state changes to alternate size.
v Transfer allowed, screen state changes to default size.

1 The 3440 screen does not have a 2560 mode; therefore, the screen size is set to 3440.
2 The 3564 screen does not have a 2560 mode; therefore, the screen size is set to 3564. The format is changed from 80 to 132 columns.
3 The 3564 screen does not have a 3440 mode; therefore, the screen size is set to 3564. The format is changed from 80 to 132 columns.

Read-Type Command Sequences

Note: Read Buffer is used primarily for diagnostic purposes, and Poll (General and Specific) is normally used in place of Read Modified for link-attached read operations.

The program initiates a read operation (Figure 6-5 on page 6-28) by first writing a command sequence to the selected 3174 and then reading the response. If the 3174 responds with text followed by ETB, and if BCC comparison at the TCU is successful, the program should write ACK to retrieve the next block. This should continue until an error is detected or until a text block is followed by ETX.

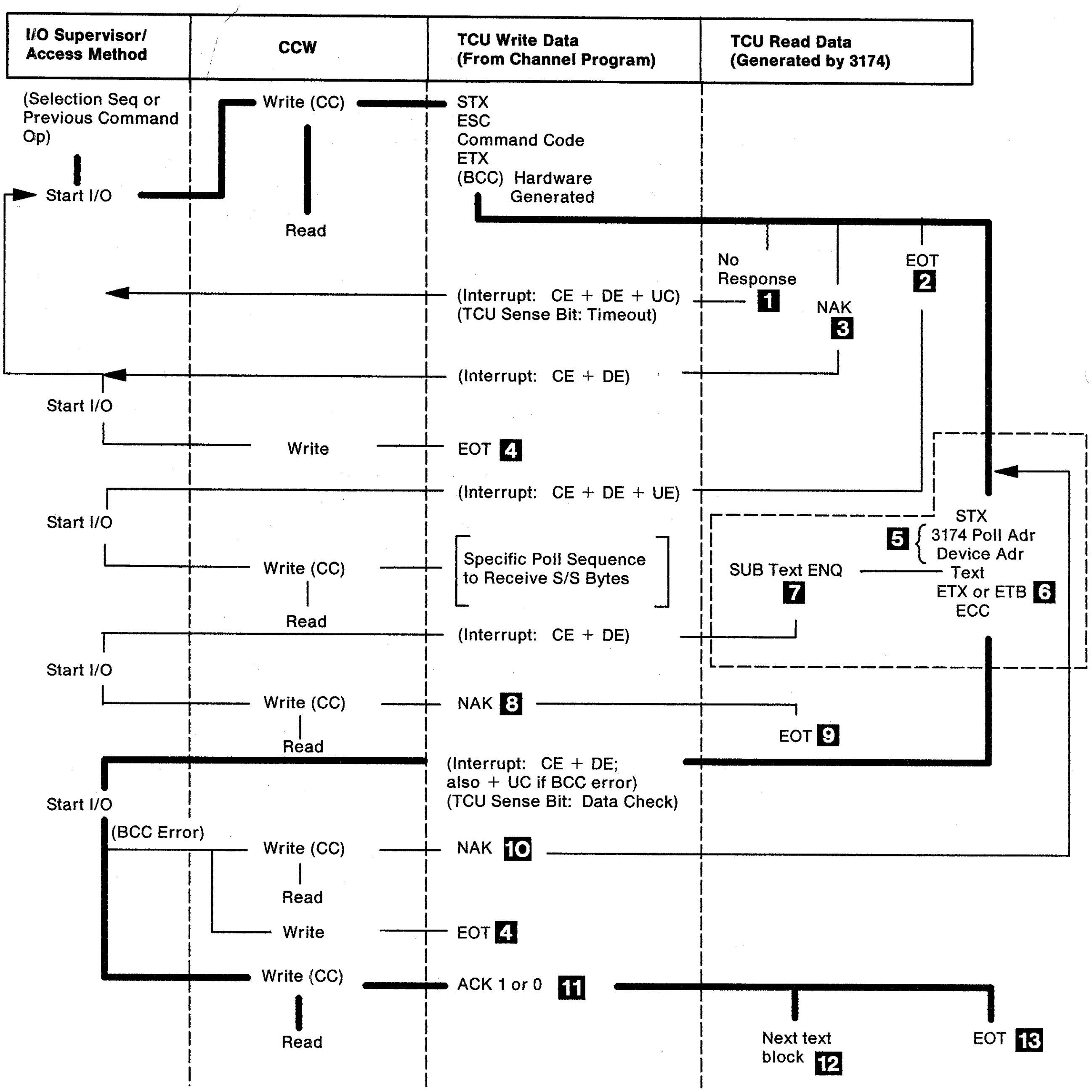
After ETX is received, the program should write ACK to the 3174 and then read the EOT reply. The three types of Read Modified message responses are shown in Figure 6-2 on page 6-19.

The 3174 retransmits text up to 15 times when NAK or an incorrect ACK is received or when ENQ is received in response to a conversational text reply to a Read command. The 3174 supports limited-conversational-text mode. If the host transmits a text block following receipt of a text transmission that ends in ETB, a timeout occurs at the 3174 and ENQ is sent to the host.

Status and Sense (S/S) Bytes

All link-attached status and sense conditions are combined into two bytes. These two bytes are always sent in a status message. In EBCDIC code, the bits are transmitted as indicated in Table 6-5 on page 6-30. If the sense bytes are transmitted in ASCII code, the EBCDIC code defined below is translated to ASCII before transmission.

Status and sense conditions are recorded by the 3174 for each device. These conditions can include busy or ready status or detected errors. Table 6-6 on page 6-32 shows how these status and sense conditions are interpreted for each error response transmitted by the 3174 in response to a poll sequence from the TCU.



Legend:

CC = Chain Command (CC) Flag in CCW is set to 1.
Interrupt = TCU-generated interrupt
CE = Channel End
DE = Device End
UE = Unit Exception
UC = Unit Check

Figure 6-5 (Part 1 of 2). Read Type Command, Sequence/Response Diagram

Notes:

1 Command transmission was not successfully received because of invalid framing (STX missing). Causes timeout at TCU.

2 The 3174 is unable to perform the operation indicated in the command transmission because of a busy/unavailable/not ready device or a 3174-detected check condition (receipt of an illegal command/order sequence, failure to decode a valid command, or an I/O interface overrun). The EOT response to a command transmission indicates that status information is stored in the 3174. To ensure retrieval of valid status, a Specific Poll must be issued to the device-responding EOT as the next addressing sequence issued to this 3174.

3 If a transmission problem causes both a 3174-detected check condition and a BCC error, the BCC error takes precedence over all other check conditions, and a NAK is transmitted to the TCU.

4 Response issued by the program to terminate the operation if the 3174 is unsuccessful in receiving a valid BCC following *n* attempts by the program to transmit the message.

5 This address sequence is included only in the first block of a blocked text message.

6 ETB is used to frame each block of a blocked text message, except for the last block. ETX is used to frame the last block of a blocked text message.

7 Upon detection of an internal parity check, the 3174 automatically substitutes the SUB character for the character in error. If a parity or cursor is detected, ENQ is transmitted in place of ETX (or ETB) and BCC at the end of the text block and appropriate status and sense information is stored. This is used by the 3174 if, after the first block has been transmitted, the transmission cannot be completed because of power being off at the terminal.

8 Mandatory program response to a text block terminated in ENQ.

9 Response to terminate the operation. The nature of the error (parity or cursor check) does not warrant a retry. This response indicates that appropriate status and sense information is stored. The status retrieval information included in Note 2 applies.

10 BCC error has been detected. The program issues NAK to cause the 3174 to repeat its last transmission.

11 Positive acknowledgment. The text block has been successfully received by the TCU. The program issues ACK 1 in response to the first and all odd-numbered text blocks and issues ACK 0 in response to the second and all even-numbered text blocks. This response to a text block terminated in ETX turns on the device SYSTEM AVAILABLE indicator.

12 The second and all succeeding text blocks are framed as the first except that they do not include the 3174/device address sequence.

13 Normal termination of the operation following transmission of the last text block.

Figure 6-5 (Part 2 of 2). Read Type Command, Sequence/Response Diagram

Bit	Definition
	S/S Byte 0:
0	Dependent on setting of bits 2-7.
1	Always a 1
2	Reserved
3	Reserved
4	**Device Busy (DB)** - This bit indicates that the addressed device (except the 3278 or 3279) is busy executing an operation or that a busy detection was previously made by a command or Specific Poll. The device is busy when it is executing an Erase All Unprotected command or a print & operation, accepting data from the operator identification card reader, or performing various keyboard operations (Erase Input, Backtab, and Clear). This bit is set with Operation Check when a Copy command is received that specifies a *busy* device with its *from* address. This bit is set with Unit Specify when a command is addressed to a busy device. This can occur by chaining a command to a Write, Erase/Write, Erase/Write Alternate, or Copy command that started a printer or by chaining a command to a Specific Poll addressed to a busy device. **Note:** Device Busy is not returned for the 3278 or 3279 when executing an Erase All Unprotected command, accepting data from the MSR or MHS, or performing Erase Input, Backtab, or Clear keyboard operations.
5	**Unit Specify (US)** - This bit is set if any S/S bit is set as a result of a device-detected error or if a command is addressed to a busy device.
6	**Device End (DE)** - This bit indicates that the addressed device has changed from unavailable to available and not ready to ready, or busy to not busy. This bit is included during a Specific or General Poll but is not considered pending status by a selection-addressing sequence. If a selection-addressing sequence detects that the addressed device has pending status and also detects one of the above status changes that warrants a DE, then the DE bit is set and preserved along with the other pending status, and an RVI response is made.
7	Reserved

Table 6-5 (Page 1 of 2). Remote Status and Sense Byte Definitions – BSC

Table 6-5 (Page 2 of 2). Remote Status and Sense Byte Definitions – BSC

Bit	Definition
	S/S Byte 1:
0	Dependent on setting of bits 2-7.
1	Always a 1
2	**Command Reject (CR)** - This bit is set when an invalid 3270 command is received.
3	**Intervention Required (IR)** - This bit is set if: • A Copy command contains a *from* address in its data stream that specifies an unavailable device. • A command attempted to start a printer but found it not ready. The printout is suppressed. • The 3174 receives a selection-addressing sequence or a Specific Poll sequence for a device that is unavailable or that became not ready during a printout. A General Poll sequence does not respond to the unavailable/not ready indication and proceeds to determine the state of the next device. • The 3174 receives a command for a device that has been logged as unavailable or not ready.
4	**Equipment Check (EC)** - This bit indicates a printer character generator or sync check error occurred, the printer became mechanically disabled, or a 3174 detected bad parity from the device.
5	**Data Check (DC)** - This bit indicates a 3174 operation to a device was unsuccessful (that is, the device was disabled with DC returned to the host; IR is returned on a subsequent retry by the host).
6	Reserved
7	**Operation Check (OC)** - This bit, when set alone, indicates one of the following: • Receipt of an illegal buffer address or of an incomplete order sequence on a Write, Erase/Write, or Erase/Write Alternate command. • The device did not receive a CCC or a *from* address on a Copy command. • Receipt of an invalid command sequence. (ESC is not received in the second data character position of the sequence.) • The internal buffering capability is exceeded on a 3174. This bit is set with Unit Specify to indicate that the *from* address on a Copy command specified a device with a locked buffer (the device data is secure).

Table 6-6 (Page 1 of 3). Remote Status and Sense Responses – BSC			
Device Response	**Command**	**S/S**	**Explanation**
RVI	Selection	Outstanding Status	Pending information from a previous operation with the same device.(If the addressed device is busy, WACK is sent to the TCU instead of RVI, and no S/S bit is set.) **Note:** A selection-addressing sequence does not recognize a DE as pending status. If there is no other pending status, it resets this bit and proceeds with the selection. If the addressed device has other pending status, DE remains set with it, and the RVI response is made as usual. The addressed device is unavailable.
		IR	A character generator or sync check error has occurred, or the printer was mechanically disabled but the condition has been corrected. DE, EC, US is not sent by the 3287 or 3289.
		DE, EC, US	The addressed printer is out of paper, its power has been turned off, or its cover is open.
		DE, IR	The addressed printer is mechanically disabled and cannot recover.
		DE, IR, EC, US	A parity error is detected at the printer.
		DE, DC, US	A parity check or cursor check is detected by the addressed device on the data it is sending to the controller. For a 3174, an operation to a terminal was unsuccessful. The terminal was disabled and DC US returned to the host. On subsequent retry by the host, IR is returned to the host.
		DC, US	
EOT	Read Commands	CR	Invalid 3174 command is received.
		OC	Invalid command sequence (ESC is not in the second data character position), or data follows the command in the data stream received at the device.
		DB, US	The addressed device is busy. The command was chained to a Write, Erase/Write, Erase/Write Alternate, or Copy command which started a print, or it was chained to a Specific Poll.
		IR	A command is addressed to an unavailable device.
		DC	The 3174 is unable to complete a Read command operation after the first block has been sent to the host, because either there was an error in the terminal or the terminal power goes off after the first block was sent. A SUB character and an ENQ character are placed in the buffer. When the TCU responds NAK, the 3174 responds EOT.
		DC, US	A parity check or cursor check is detected by the addressed device on the data it is sending to the controller. An operation to a terminal was unsuccessful. The terminal was disabled and DC US returned to the host. On a subsequent retry by the host, IR is returned to the host.
EOT	Write Commands	CR	An invalid or illegal 3174 command is received.
		OC	An invalid command sequence (ESC is not in the second data position), an illegal buffer address or an incomplete order sequence is received, or a data byte was sent to the device during the Write command before the operation required by the previous data byte was completed.
		DC, US	The device detects a parity or cursor check on its buffer during the command operation. For a 3174, an operation to a terminal was unsuccessful. The terminal was disabled and DC US returned to the host. On a subsequent retry by the host, IR is returned to the host.
		DB, US	The addressed device is busy. The message is accepted but not stored in the 3174 buffer. The command is aborted.

Table 6-6 (Page 2 of 3). Remote Status and Sense Responses – BSC			
Device Response	**Command**	**S/S**	**Explanation**
EOT	Copy Command	DB, OC	The *from* device is busy. (The device is busy executing an operation, a printout, reading data from the operator identification card reader, or performing a keyboard operation.) The Copy command is aborted.
		IR, OC	The *from* device is not available.
		OC, US	The *from* device has a locked buffer.
		OC	The data stream contains other than 2 bytes (the CCC and the *from* address). The command is aborted.
		OC	The *from* device buffer is larger than the *to* device buffer.
			The buffer of the *from* device (has APL/Text feature) contains APL/Text characters (entered since an Erase/Write or Erase/Write Alternate command or a Clear function operation) and the *to* device does not have the APL/Text feature.
		DC, OC, US	Set when *from* device detects an internal parity or cursor check. For a 3174, an operation to a terminal was unsuccessful. The terminal was disabled, and DC US returned to the host. On a subsequent retry by the host, IR is returned to the host.
		DB, US	The addressed *to* device is busy.
		DB, US, OC, DE	The addressed device becomes not busy before a Specific Poll is issued to retrieve the DB, US, OC status (described above).
EOT	Write Erase/Write, Erase/Write Alternate, Copy Commands	IR	Addressed device is not available, or addressed printer is not ready.
EOT	Erase All Unprotected Command	OC	One or more data bytes followed the command (buffer overrun).
	Specific and General Poll	DE, IR, EC, US	All unrecoverable mechanical failure is detected at the printer.
		DC, US	A parity check or cursor check is detected by the addressed device on the data it is sending to the controller. For a 3174, an operation to a terminal was unsuccessful. The terminal was disabled and DC US returned to the host. On subsequent retry by the host, IR is returned to the host.
		DC	The 3174 is unable to complete a Read command operation after the first block has been sent to the host, because either there was an error in the terminal or the terminal was powered off after the first block was sent. A SUB character and an ENQ character are placed in the buffer. When the TCU responds NAK, the 3174 responds EOT.
		DE	The poll finds a device (1) previously recorded as busy or now not busy or (2) previously recorded as unavailable or not ready, now available and ready.
		IR, DE	The poll finds a device, previously recorded as ready, available, and busy, now not ready and not busy, or the printer went not ready during a printout.
			A parity error is detected at printer.
		DC, US, DE	The addressed device is busy.
	Specific Poll	DB	

Table 6-6 (Page 3 of 3). Remote Status and Sense Responses – BSC			
Device Response	**Command**	**S/S**	**Explanation**
NAK	Read and Write Commands		NAK is transmitted by the 3174 when it detects a BCC error on the TCU transmission. A BCC error has priority over all detectable error conditions. If, for example, a BCC error and a parity error are detected during the same command transmission, the parity error condition is reset, and a NAK response is sent by the 3174.

Error Recovery Procedures

Errors detected at the 3174 are indicated to the system processor by the following responses: RVI, NAK, EOT, or sense/status information. The meaning of the responses depends on their sequences, as defined in Figure 6-1 and Figures 6-2 through 6-5.

An error in the 3178, 3278, or 3279 is reported once to a General Poll. The 3174 allows parts of messages to be transmitted to the host before all data is transferred from the 3178, 3278, or 3279 to the 3174. If a terminating condition prevents completion of data transfer from the 3178, 3278, or 3279 to the 3174 after inbound link transmission has started, the 3174 sends STX......SUB ENQ.

The 3174 responds to a Specific Poll with DC status. Following a selection addressing sequence, a write type command is accepted but a read type command is rejected and DC status is returned by the 3174.

When the host selects the 3174 and issues an RM command, the 3174 transmits a single block of text followed by ETX. If the host makes an error by starting a new command sequence with STX, the 3174 responds with ENQ. If more than one text block is transmitted to the host, with ACK received from the host after each ETB, the host can respond to ETX on the last block, with a new command sequence beginning with STX, ESC.

Table 6-7 on page 6-35 lists the various error combinations of sense/status bits (except DB, which is not an error) and the recommended error recovery procedure for each combination. Supplementary procedures are also recommended. Although there are 256 possible combinations of status and sense bits, only a portion of this total is normally used. Combinations other than those listed can occur. For example, an unpredictable catastrophic hardware failure could induce an undefined combination of status and sense bits. Errors that occur at the *from* device during a Copy command are identified by an Operation Check (OC) sense bit in addition to the sense bit representing the detected error.

Table 6-7. Remote 3174 BSC Status and Sense Conditions

	Detected during 3174 Operation						Transmitted in Response to:		Error Recovery Procedure
Sense/Status Bits	**Hex EBCDIC**	**Hex ASCII**	**Selection Addressing Sequence**	**Specific Poll Sequence**	**General Poll Sequence**	**A 3270 Command**	**Specific Poll**	**General Poll**	**3174**
CR	40 60	20 2D				D, P	D, P		6
OC	40 C1	20 41				D, P	D, P		6
OC, US	C4 C1	44 41				D, P	D, P		12
IR	40 50	20 26	D, P	D, P		D, P	D, P		4
IR, OC	40 D1	20 4A				D, P	D, P		5
DC	40 C4	20 44	D, P	D, P	D, P	D, P	D, P	D, P	1
DC, US	C4 C4	44 44	D, P	D, P	D, P	D, P	D, P	D, P	2
DC, OC, US	C4 C5	44 45				D, P	D, P		3
DC, OC, DE	C6 C4	46 44		P	P		P	P	8
IR, DE	C2 50	42 26		P	P		P	P	4
IR, EC, US, DE	C6 D8	46 51		P	P		P	P	7
DB	C8 40	48 20	D, P	D, P			D, P		9
DB, US*	4C 40	3C 20				D, P	D, P		10
OC, DB*	C8 C1	48 41				D, P	D, P		11
DE	C2 40	42 20		D, P	D, P		D, P	D, P	None

Legend:

D - Display Station
P - Printer

* The DB, US, and OC S/S bits are combined if a Copy command is addressed to a busy *to* device and the command also specifies the *from* device the same as the *to* device.

Note: The attached device errors that are detected asynchronously do not cause a sense bit to set until the device is polled for status during a selection-addressing, Specific Poll, or General Poll sequence. Those error S/S bit combinations that contain DE were detected during a printout.

The error recovery procedures recommended in Table 6-7 are:

1. Execute a new address selection addressing sequence and retransmit the message, starting with the command sequence that was being executed when the error occurred. If, after two retries, the operation is not successful, this should be considered a nonrecoverable error. Follow supplementary procedure B after two retries.

2. Reconstruct the entire device buffer, if possible, and retry the failing chain of commands (within the BSC sequence of operations). The sequence of commands used to reconstruct the buffer should start with an Erase/Write or Erase/Write Alternate command. If the information in the screen buffer is such that it cannot, or need not, be reconstructed, the operation can still be retried. If an unrecoverable 3178, 3278, or 3279 buffer error is detected, the entire buffer is cleared and the host system is informed of the error by receiving DC, US status but is not informed of the clear operation. If, after three retries, the operation is not successful, this should be considered a nonrecoverable error. Follow supplementary procedure A.

3. The error occurred during execution of a Copy command. Execute procedure 2, except that it is the buffer of the *from* device specified by the Copy command that should be reconstructed. After three retries, follow supplementary procedure B.

4. The error indicates that the printer is out of paper, has its cover open, or has a disabled print mechanism, or it indicates that the device is unavailable. Request (or wait for) either the display or system operator to ready the device. Then, retry the printout by issuing a Write command with the proper WCC and no data stream. (There is no data error, and the data is still intact in the device buffer and can be reused.) Or, follow procedure 2.

5. The error indicates that the *from* device specified by a Copy command is unavailable. Note that the device address associated with the error status and sense information does not indicate the device that actually required *readying*. The device that requires the corrective action is the device specified by the *from* address in the Copy command. When the device is determined and made ready, follow procedure 1.
6. The operation should be tried up to six times. Continued failure implies an application programming problem, which can be detected by analyzing the failing write data stream.
7. The error occurred during a printout operation and indicates either a character-generator error or a disabled print mechanism. There is no data error. The proper error recovery procedure is application-dependent, because you may or may not want a new printout. If a new printout is required, follow procedure 4.
8. A data error occurred in the device buffer during a printout, and procedure 2 should be followed.
9. A Specific Poll detected that the addressed device is busy. Periodically issue a Specific Poll to pick up the Device End sense/status bit sent by the device when it becomes not-ready (unless this status change is detected on a selection addressing sequence).
10. Indicates that a command was erroneously addressed to a busy device. Periodically issue a General or Specific Poll to pick up the DE sense/status bit sent by the device when it becomes not busy. Then follow procedure 1.
11. Indicates that, in attempting to execute a Copy command, the *from* device was found to be busy. Follow procedure 1 when the *from* device becomes not busy. Note that the device address associated with the status and sense message is the address of the *to* device and not that of the busy *from* device. The *from* device transmits Device End via a Specific or General Poll when it becomes not busy.
12. An attempt was made to execute a Copy command, but access to the *from* device data was not authorized. The device address associated with the error sense/status bits is that of the copy *to* device.

Supplementary Procedures

A. Request maintenance for the device that is giving trouble. After repair, reconstruct the screen buffer image. The sequence of commands used to reconstruct this image should start with an Erase/Write command. Retry the failing chain of commands according to the procedure that referred you to this supplementary procedure.

B. The *from* device specified by the Copy command in the failing chain of commands (CCWs) is malfunctioning. The *from* device should be determined from the data-stream information, and maintenance should be requested for the device. After the repair, reconstruct the buffer image. The sequence of commands used to reconstruct this image should start with an Erase/Write command. Retry the failing chain of commands according to the procedure that referred you to this supplementary procedure.

C. Same as procedure 1, except a new selection addressing sequence is not performed, and this message is transmitted as part of the present device selection.

D. Same as procedure 1, except retransmit the entire failing chain of commands.

EOT to a Text Block

The recommended recovery procedure depends on the type of detected error. A Specific Poll must be issued immediately following the EOT to obtain the error sense/status information. Then, the recovery procedures recommended in Table 6-7 on page 6-35 should be performed.

Errors Detected during a Specific or General Poll Sequence

Any errors that result from execution of the poll sequence itself are contained in Table 6-7 on page 6-35, and those recovery procedures apply. The detected error bits are transmitted to the TCU in a status message during the poll sequence.

RVI to Selection Addressing Sequence

A Specific Poll must be issued immediately following the RVI to a selection addressing sequence to obtain the error sense/status information. Then the recovery procedures defined in Table 6-7 on page 6-35 should be followed.

SDLC Operation

The 3174 operates as a secondary SDLC station as described in the *IBM Synchronous Data Link Control Concepts*, GA27-3093. Support of the frame sequence, flag byte, address byte, control byte, and frame check sequence bytes conforms to that document. This section describes how the 3174 operates as a secondary SDLC station. When the 3174 performs the Gateway function, it appears to the host as multiple SDLC secondary stations.

The switched network backup (SNBU)[2] facility allows you to specify a switched line to be used as an alternative path should your primary line become unavailable or unusable.

Nonsequenced Commands and Responses

Table 6-8 on page 6-38 contains the nonsequenced commands and responses supported by the 3174.

[2] Models 11R, 12R, 13R, 21R, 23R, 61R, 62R, 63R, 90R, 91R, and 92R, when attached to IBM 3872 and 3875 modems, do not support half-duplex SNBU.

Table 6-8. Nonsequenced Commands and Responses

Command/Response	Hex Code, with poll/final bit=1
Set Normal Response Mode (SNRM) Command	93
Disconnect (DISC) Command	53
Unnumbered Acknowledgment (UA) Response	73
Disconnect Mode (DM) Response	1F
Frame Reject (FRMR) Response	97
Test Command/Response	F3
Unsequenced Poll Command/Response	33
Exchange Station ID Command/Response	BF

The Set Normal Response Mode (SNRM) command sets the physical unit for the 3174 in Normal Response Mode (NRM) and causes the 3174 to deactivate the physical unit if it is in active state. The On-Line and Ownership symbols are turned off. For Gateway physical units, the SNRM causes the Gateway to respond with a Disconnect Mode (DM) response until a link to the downstream physical unit (DSPU) exists. Once the downstream link exists, the Gateway responds with a UA response to the next SNRM and places the station in NRM. See Chapter 14, 3174 Token-Ring and ISDN Support for detailed physical unit activation flows.

The DISC command sets the 3174 or Gateway in Normal Disconnect Mode (NDM).

The UA response is sent by the 3174 to acknowledge receipt and acceptance of the SNRM and DISC commands.

The DM response is sent by the 3174 in NDM to request on-line status. DM is sent in response to any command except Test and XID. DM is sent in response to the SNRM command when the 3174 cannot enter NRM. For Gateway stations, DM is sent in response to SNRM if a link to the DSPU does not exist.

The FRMR response is implemented by the 3174 as described in the *IBM Synchronous Data Link Control Concepts*. The FRMR will be sent in response to any poll until an SNRM or DISC is received to reset the controller.

The Test command is used to initiate one round-trip transmission of test data in both NRM and NDM. The 3174 will return the Test response without data if buffering is not available to hold the complete test data, or with data if buffering is available. When Test is sent for a Gateway station, the Gateway returns the Test response immediately; nothing is sent to the corresponding DSPU.

The Unsequenced Poll command and response allows the 3174 to provide the group poll function when operating as a Gateway. When the Gateway receives an Unsequenced Poll command, it is allowed to respond with data from any station. The Gateway will respond with an Unsequenced Poll response if there is no data to send.

The XID command and response contains additional data beyond the C byte. The 3174 responds to the XID command in NRM or NDM, except when an FRMR condition exists, in which case the FRMR response takes precedence over the XID. For Gateway stations, the same XID response is returned as for the 3174's physical unit; the actual XID from the DSPU device is not used. The additional data of the XID response consists of 20 bytes, defined as follows:

Table 6-9. XID response

Byte	Bit	Content	Meaning
0	0−3 4−7	X'1' X'2'	Format PU type 2
1		X'14'	Length of XID I-field: 20 bytes
2−5	0−11 12−31	X'017' X'nnnnn'	Block Number ID number − PUID configuration question 215
6,7		X'0000'	Reserved
8		X'00'	Secondary link station (nonnegotiable); two-way alternating
9		X'10'	Link station segment assembly
10,11		X'0209'	Maximum receive I-field length: 521 bytes
12		X'00'	SNA link profile
13		X'00'	SIM and RIM not supported
14,15		X'0000'	Reserved
16		X'07'	Maximum number of received I-frames before acknowledgment: 7 frames (modulo 8)
17		X'00'	Reserved
18		X'01'	Length of SDLC address to be assigned
19		X'aa'	SDLC controller address: configuration question 104

For XID used in APPN on T2.1 SDLC links, refer to Chapter 18, "Advanced Peer-to-Peer Networking (APPN)" on page 18-1.

Physical Unit Identification (PUID)

The 3174 has a unique physical unit identification (PUID). The PUID is a 5-character hexadecimal code; the only valid characters are A—F and 0—9. Each PUID in a network should be unique. It identifies the controller to the host in response to an SDLC XID command. The PUID is required if the 3174 operates on a switched data link.

SDLC Station Address

The SDLC station address is a 1-byte address that is specified during customization of the controller. See the *3174 Planning Guide* for more information.

When the 3174 Gateway feature is used, an SDLC station address is also used for each workstation attached to the Token-Ring and ISDN networks.

Gateway Operation

When the 3174 performs the Gateway function, it appears to the host as multiple SDLC secondary stations.

Group Address

If the 3174 Gateway (Token-Ring/ISDN) feature is active and Group Poll is customized, a Group Address is required. This is a 1-byte address that is used in the unsequenced poll command.

Multipoint Operation

When operating as a Gateway with SDLC, the 3174 makes the stations on the Token-Ring and ISDN networks appear to the host as stations on a multipoint line. The following diagram shows a sample Token-Ring Gateway configuration: a multipoint line with NCP as the primary station controlling the line and each station as an SDLC secondary. Each station represents a PU and has a unique SDLC address.

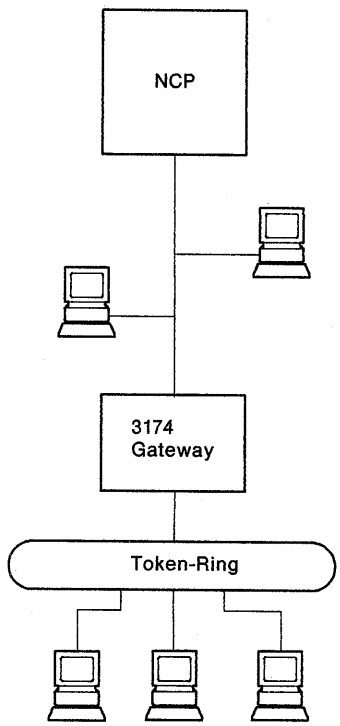


Figure 6-6. Sample Token-Ring Gateway Configuration

In microcode releases prior to B3.0, the 3174 multipoint support allowed it to operate only on a line operating in half-duplex multipoint mode. In this mode, only one station on the line (including the host station) can transmit at a time. Typically, the host transmits frames to one of the stations, then requests a response. When the 3174 receives this request for a response (often called a "poll"), it enters a transmit state, and sends the response to the host. While in the transmit state, the 3174 cannot receive anything from the host, for that station or any other. If any frames are sent by the host during that time, the 3174 discards them. After responding, the 3174 returns to receive state, and can accept frames from the host for any station.

Starting with release B3.0, the 3174 multipoint support allows it to operate on a line that is using Duplex Multipoint mode. In this mode, the host may send frames to another station. Release B3.0 microcode causes the 3174 to stay in receive state, while it is also in transmit state. Therefore, it can receive frames for one of the Token-Ring stations or ISDN stations (Configuration Support C), while it is transmitting a response for another of the stations.

Error Recovery Procedures

The following sections describe the error recovery procedures used by the controller.

Abort Function

The Abort function is used by the communication controller or by the 3174 when a frame being transmitted is to be discarded. The Abort function is performed by transmitting eight contiguous 1 bits without zero insertion at the earliest possible time following recognition of an abort situation. No FCS is transmitted. When, for example, the 3174 receives seven contiguous 1 bits, it discards the aborted frame. The 3174 employs the Abort function when an equipment malfunction occurs that causes an erroneous transmission.

Timeout Controls

When the 3174 is attached point to point or multipoint and does not recognize any valid outbound frame for 20 to 25 seconds, a nonproductive timeout occurs. The timeout causes the 3174 to set the Communication Check symbol on all attached display stations. The timer is reset to zero every time the 3174 detects a valid outbound frame. The Communication Check symbol is turned off when a valid frame is received by the station.

If a condition of no line activity is detected by the 3174 for 20 to 25 seconds, the Communication Check symbol is set on all attached display stations. The indicator is turned off when a valid frame is received.

Auto-Disconnection

Auto-disconnection is a result of the controller's detecting the absence of any communication for 60 seconds. 3174 support is as follows:

Configuration	Auto-Disconnection
Switched	Yes[1,2]
Leased	No

Notes:

[1] When the controller is operating with an SNBU modem, receipt of an SDLC DISC command does not cause automatic disconnection from the line. The command causes the controller to shut down and all active sessions to be deactivated.

[2] Automatic disconnection is supported, but the line is not physically disconnected when a CDT coupler, or its equivalent, is used between the modem and the line.

Chapter 7. X.21 Operation

Introduction

This chapter describes how the 3174 uses the X.21 interface. The functions, keys, and indicators used for X.21 are described, as well as the modes and states of X.21 operation. See the appropriate display terminal operator's guide for additional information.

The X.21 Interface

The X.21 interface enables a display operator, using a display keyboard, to connect the 3174 to a host through data-circuit terminating equipment (DCE) in the public switched network. To use the X.21 interface, you need:

- A 3174 with a Type 2 Communication Adapter installed or a Type 2 CCA (9267) installed
- The properly customized diskette.

The 3174 uses X.21 interface to communicate with the host, using SDLC protocol, and line speeds of 24 0, 4800, 9600, 19 200, 48 000, and 64 000 bps in a digital switched network.

X.21 Functions

The 3174 supports the following X.21 functions:

Address Call: A host system can be *dialed* using the keyboard to enter its public switched network address.

Abbreviated Address Call: A host system can be dialed using an abbreviated network address.

Closed User Group Call: The number of 3270 systems and host systems that can connect to each other can be limited. Dialing of a network number not included in the dialer's user group results in an access-barred condition.

Direct Call: A host system connection is established without entering its network address. The address must have been predefined to the network.

Automatic Answering: An incoming call from a host system is automatically *answered* by the controller. Operator action is not required to complete the connection.

Autocall/Autodisconnect:

1. Autocall: When a display LT associated with the host achieves a power-on state, the 3174 automatically initiates a connection to the host.
2. Autodisconnect: When the last display LT associated with the host achieves the power-off state, the 3174 automatically performs a DISC function to that host.

An incoming call from a host system is automatically *answered* by the controller. Operator action is not required to complete the connection.

Call Progress Signals: The 3174 interprets and displays Call Progress signals from the network. These signals give the status of outgoing calls (and also indicate results of operations with the Registration/Cancellation Facility).

Controlled Not-Ready State: In this state, the 3174 is disconnected from the network. Incoming calls are rejected, and a Call Progress signal to this effect is returned to the caller. Outgoing calls, dialed or direct, cannot be initiated.

Registration/Cancellation Facility: Abbreviated network addresses, and IDs for members of a closed user group, are registered and canceled (with the network) using this facility.

X.21 Functions and Indicators

You use the following keys and indicators:

- The X.21 keys on the display keyboard for X.21 functions and incoming calls
- The X.21 indicators in the Operator Information Area of the display to determine the status of the 3174.

You can use all supported X.21 functions from the keyboard/display that are attached to port 0 of HG26 and HG27 on the 3174. The other terminals (as a group) are authorized to use none, some or all of the X.21 functions when the 3174 is customized. See the *3174 Planning Guide* for more information.

Note: If CCAs are used for multi-host support, the X.21 functions and indicators apply to the X.21 host of the active LT. To perform an X.21 function for a different host, use the Change Screen function to access an LT for that host, then perform the X.21 function you need.

Control Functions

The following control functions are enabled after invoking Extension/Extended Select mode on display stations operating in CUT mode. Place the X.21 labels (P/N 1743595) on the keytop (Extension key) or on the keyboard cover above the affected keys.

- ► DIRECT, the Direct Call function
- ► DIAL, the Dial Call function
- ► LOCAL, the Local function
- ► COMM, the Communication function
- ► DISC, the Disconnect function.

Indicators

Certain indicators identify the state of the 3174 during X.21 operation. These indicators can appear alone or with other operator information area indicators. When the X.21 indicators are accompanied by a Call Progress signal (Nnn), the signal is conveying information about a network operation. For the rest of the chapter, these indicators are referred to by their name only; refer to Figure 7-1 on page 7-4 for the symbol of each indicator and where it appears in the operator information area.

Indicator	Symbol	Location
Call Ready		Reminder area
Call Ready with 'call progress' signal	Nnn	Reminder area
Dial In (Dialing terminal)	# ?	Reminder area
Dial In (other terminals, same 3174)	##	Reminder area
Disconnect in Process	@	Reminder area
Extension mode	▸	Shifts and Modes area
Incoming Call in Process		Reminder area
In-use	N	Readiness and System Connection area
Local (Communication Reminder with status code 599)	599	Reminder area
Operator Communication Check	X	Do Not Enter area
Outgoing Call in Process		Reminder area
Outgoing Call in Process with 'call progress' signal	Nnn	Reminder area

Figure 7-1. X.21 Indicators

X.21 Modes and States

You use the X.21 functions and indicators to initiate and track switched network operations. The state of the 3174 controls the functions that apply at a given time. The keyboard must be in extension mode for any X.21 control function to be active.

Call-Ready State

When the 3174 is in X.21 ready state, the Call Ready indicator is displayed, and the ► (extension), ► DIAL, ► DIRECT, and ► LOCAL functions are enabled. An incoming call can be accepted.

The 3174 enters ready state when:

- You bring up power on the 3174.
- You press the ► COMM function while the 3174 is in local mode.
- You use the ► DISC function to end a Dial-In state.
- You use the ► DISC function or ► DISC command to disconnect the line.
- The network rejects an outgoing call.

The Call Ready indicator with Call Progress signals is displayed. The ► DISC function or ► COMM function clears the Call Progress signal.

- An error disconnects the line, or an error occurs in the connection process.

  The Communication Error indicator is displayed (overrides the Call Ready indicator). Pressing the ► COMM function restores the Call Ready indicator.

Dial-In State

The 3174 accepts call requests (Dial Call function or Direct Call function pressed) from the terminals on a first-come, first-served basis. Once a given terminal enters a dial request, an attempt to enter a dial request or to change the Dial-In state (except for ► DISC) by another terminal is rejected. (The keyboard is inhibited, and the Operator Communication Check indicator is displayed.)

If Autocall is customized, an automatic call may be initiated when a different LT becomes active. This has precedence over the Dialing terminal and changes the X.21 state to Outgoing Call-in-Process.

When you press the ► DIAL function, the following occurs:

- The 3174 exits the ready state.
- The Call Ready and Extension mode indicators disappear.
- The Dial-In (dialing terminal) indicator is displayed at the dialing terminal.
- The Dial-In (other terminal) indicator is displayed at the other terminals.
- The 3174 initiates a keyboard reset and screen-clear operation.
- The DIAL function displays the current dial digits (either customized [Q371] or the values entered the last time the DIAL function was used for this host).
- The 3174 positions the cursor at the home position.
- The 3174 selects the base character set.
- The 3174 resets the Highlighting Color (3279) and Character Sets indicators to the default indications.

Note: If the terminal is in a Wait, Device Busy, Device Very Busy, Device Not Functional, or Security Key off condition, the Dial Call function has no effect and the keyboard exits extension mode.
While in Dial-In state, the following functions are accepted, rejected, and ignored:

- At the dialing terminal:
  - The ► DIAL, ► DIRECT, ► LOCAL, ► DISC, Test, Clear, Enter, and other functions are accepted.
  - The ► COMM function is ignored.
  - AID-producing functions (except for Clear and Enter) are rejected with the minus function indicator displayed.
- At the other terminals:
  - The ► DIAL, ► DIRECT, and ► LOCAL functions are rejected with an operator communication check displayed.
  - The ► DISC, TEST, and other functions are accepted.
  - The ► COMM function is ignored, the AID-producing functions are rejected, and the minus function indicator is displayed.

To dial, do the following:

1. Press ► DIAL.
2. Type the address digits in the Dial-In area. Address digits will be displayed for you. You may change them if necessary.

   The Dial-In area is an unprotected area of the screen extending from the home position to column 31. Null and blank characters in the Dial-In area are ignored.

   To clear the Dial-In area, press the Clear function. (No AID signal is sent.)

   If you attempt to enter a digit in the remainder of the screen, which is protected, the Go Elsewhere indicator is displayed.
3. Press the Enter function.

   The Outgoing Call-in-Process indicator replaces the Dial-In indicator. The ► DIAL, ► DIRECT, and ► LOCAL functions are disabled.

   If the dial digits are incorrect or invalid, the What indicator is displayed and Dial-In state is reset to the Call Ready state.

   If you pressed the Enter function before you typed any digits, the Enter function is rejected and the What and Call Ready indicators are displayed.

To abort the Dial-In state, use the ► DISC function at the dial-originating terminal. Using the Test function at another terminal does not affect the Dial-In state.

When you press the ► DISC function in Dial-In state, the 3174:

1. Clears the screen.
2. Resets the Dial-In state to Call Ready state, where:
   a. The ► DISC, Test, and other functions are accepted.
   b. The ► COMM function is ignored.
   c. All AID-producing functions are rejected with the minus function indicator displayed.

See Figure 7-2 on page 7-7 for a Dial-In state summary.

Action Taken	Resultant State	Response and Operator Information Area Indicator Displayed: Dialing Terminal	Response and Operator Information Area Indicator Displayed: Other Terminal
Dial Call (► DIAL key)	Dial-In	Accepted -z- #?	Rejected X ⚲ -z- -z- ##
Direct Call (► DIRECT key)	Outgoing Call-In-Process	Accepted → -z-	Rejected X ⚲ -z- -z- ##
Take offline (► LOCAL key)	Controlled-Not-Ready	Accepted -z- 599	Rejected X ⚲ -z- -z- ##
Cancel Controlled not ready state (► COMM key)	Dial-In	Ignored -z- #?	Ignored -z- #?
Disconnect Line (► DISC key)	Call Ready	Accepted -z-	Accepted -z-
Test mode	Call Ready	Accepted TEST Abort Dial-In	Accepted TEST -z- ##
Enter key	Outgoing Call-In-Process	Accepted → -z-	Rejected X - f -z- ##
Clear key	Dial-In	Accepted clears Dial-In area -z- #?	Accepted clears screen -z- ##
PA, PF, Attn, Sys Req keys	Dial-In	Rejected X - f -z- #?	Rejected X - f -z- ##

Figure 7-2. Controller/Terminal Responses in Dial-In State

Outgoing Call-in-Process State

The 3174 enters Outgoing Call-in-Process state directly from Ready state when you press ► DIRECT. The 3174 enters the Outgoing Call-in-Process state from Dial-In state when you press Enter after you enter the dial digits. This state is also entered if Autocall is customized and the first LT becomes active. The Call Ready indicator is replaced with the Outgoing Call-in-Process indicator. The ► DIAL, ► DIRECT, and ► LOCAL functions are disabled.

Call Progress signals can be displayed along with the Outgoing Call-in-Process indicator. (See "Call Progress Signals" on page 7-9.)

Ready-for-Data and Data Transfer States

After line connection has been made but before any sessions with the host have been established (SNA ACTPU/ACTLU sequence), the Outgoing Call-in-Process indicator is turned off and the In Use indicator is displayed in the Readiness and System Connection area. After session(s) have been established, the Online indicator is also displayed in the same area.

While in the Ready for Data and Data Transfer states:

- The AID-producing functions, TEST, ► DISC, and other functions are accepted.
- The ► DIAL, ► DIRECT, and ► LOCAL functions are rejected with the Operator Communication Check indicator displayed.
- The ► COMM function is ignored.

Disconnection-in-Process State

The 3174 enters Disconnection in Process state when you press the ► DISC function, when a disconnect command or timeout condition causes the line connection to be broken, or when the last LT becomes inactive and Autodisconnect is customized. The Disconnection in Process indicator is displayed until disconnection is completed, when the Call Ready indicator is displayed, and the 3174 returns to Ready state.

While in the Disconnection in Process state the following occurs:

- Test and other functions are accepted.
- The ► DIAL, ► DIRECT, and ► LOCAL functions are rejected with the Operator Communication Check indicator displayed.
- The AID-producing functions are rejected and the minus function indicator is displayed.

The screen is not cleared. All session-related indicators, including Online Ownership, and System Lock, are cleared.

Incoming Call State

The 3174 enters Incoming Call state from Ready state. The Call Ready indicator is replaced with the Incoming Call-in-Process indicator, and, when the connection is completed, the In Use indicator is displayed. After session establishment, the Online indicator is also displayed.

While in Incoming Call state, the following occurs:

- The ► DISC, TEST, and other functions are accepted.
- The ► DIAL, ► DIRECT, and ► LOCAL functions are rejected with the Operator Communication Check indicator displayed.
- The ► COMM function is ignored.
- AID-producing functions are rejected with the minus function indicator displayed.

Controlled-Not-Ready State

The 3174 enters Controlled-Not-Ready state from the Ready state when you press the ► LOCAL function. All incoming calls and outgoing call requests are rejected. The Call Ready indicator is replaced with the Communication Reminder indicator accompanied by a status code of 599.

You use the ► COMM function to restore the 3174 to Ready state.

While in Controlled-Not-Ready state:

- The ► COMM, TEST, and other functions are accepted.
- The ► DIAL, ► DIRECT, ► DISC functions are rejected with the Operator Communication Check indicator displayed.
- The AID-producing functions are rejected with the minus function indicator displayed.

Call Progress Signals

The Call Progress signals, two-digit codes displayed with the Call Ready and Outgoing Call-in-Process indicators, originate from the public switched network. They provide information about outgoing call requests and registration/cancellation operations.

When displayed with the Call Ready indicator, Call Progress signals indicate:

- The call request just made has failed and the line is disconnected. The network reason for the failure is specified by the signal.
- The registration/cancellation operation just attempted succeeded or failed.

When displayed with the Outgoing Call-in-Process indicator, Call Progress signals indicate the network status of the call. No operator action should be taken until either the In Use indicator appears (call successful) or the Call Ready indicator with Call Progress signals appears (call unsuccessful).

Following are the CCITT-defined Call Progress signals for public switched networks:

01 Terminal called
02 Redirected call
03 Connect when free
20 No connection
21 Number busy
22 Procedure error
23 Transmission error
41 Access barred
42 Changed number
43 Not obtainable
44 Out of order
45 Controlled-not-ready
46 Uncontrolled-not-ready
47 DCE power off
48 Invalid facility request
49 Network fault in local loop
51 Call information service
52 Incompatible user
61 Network congestion
71 LT Network congestion
72 RPOA out of order
81 Registration/cancellation confirmed

The 3174 handles Call Progress signals according to their category, as follows:

Category 1: 0x signals — Wait for one minute; return to Call Ready state if not successful.

Category 2: 44, 45, 49 (when customized for Short-Hold Mold [SHM]), 2x, 6x signals and any Call Progress signals received with parity errors – Retry. The number of retries and the time interval (3 to 20 seconds) between retries is specified at 3174 customization.

Category 3: 4x (except 44, 45, and 49 when customized for SHM), 5x, 7x, 8x signals – Go to Call Ready state immediately.

The Call Progress signal value is also logged in the PD data area of the 3174 error log. If one of the received digits contains a parity error, the affected digit is displayed as an '_' character in the Operator Information Area, and displayed as an 'F' in the error log. Receipt of any Call Progress signal containing a parity error causes the 3174 to retry the call.

Call Progress signals displayed with the Call Ready indicator are cleared by use of the ► DIAL, ► DIRECT, ► DISC, ► LOCAL, or ► COMM functions or by receipt of an incoming call.

Registration/Cancellation Facility

This facility does the following:

- Registers abbreviated address call sequences with the network
- Cancels abbreviated address call sequences
- Registers the addresses that make up the closed user group
- Cancels the addresses that make up the closed user group.

To use the Registration/Cancellation Facility, do the following:

1. Press the ► DIAL function to put the 3174 in Dial-In state.
2. Type in a sequence of numbers or a slash, comma, dash, period, or plus sign, indicating the desired type of registration/cancellation wanted and the specifics. The exact sequence and content vary between public switched networks.

After completion of a registration/cancellation request, the Call Ready indicator is displayed with a Call Progress signal indicating success or failure of the request.

Autocall/Autodisconnect

The Autocall/Autodisconnect functions eliminate the need for any terminal user to use the X.21 function. Each X.21 Switched host can be customized for Autocall and/or Autodisconnect.

Autocall

If a host is customized for Autocall, the 3174 makes a call to the host when the host is disconnected and a display LT associated with that host becomes active. LTs become active as follows:

- DFT: LTs associated with a DFT become active when the 3174 receives AEDV "online" from the DFT for the LT.
- CUT and ASCII displays: each LT becomes active the first time the user toggles to it, and the LT is routed (via the Default Destination, if AEA is in use) to this 3270 host. If the LT is routed to an ASCII host, or to the Connection Menu, it

becomes active for this X.21 host when the user selects the 3270 host from the Connection Menu.

- Printers: printer LTs will not trigger the Autocall function.
- DFT-E displays: DFT-Es invoke Autocall the same as the DFTs, for the 5 DFT LTs. Accessing the CUT sessions of the DFT-E does not trigger an Autocall.

The 3174 makes either an Addressed Call or a Direct Call, depending on the type of call that was selected during customizing:

1. If the Autocall option (Q372) has a value of 1, the 3174 will initiate a DIAL function, using the customized dial digits (Q371). The customized digits will be used even if the X.21 Dial function had been used previously to enter different digits. This is equivalent to a DIAL function requested from the terminal, with no changes to the DIAL screen.

   Note: When X.21 dial digits are entered from the DIAL screen, several special characters are allowed: plus, comma, dash, period, and slash. However, because the customization program supports only alphanumeric characters, the special characters cannot be supplied in the answer to Q371. Therefore, selection of Q372 = 1 is only useful for attachments that do not require any of these special characters in the dial digit sequence.

2. If the Autocall option (Q372) has a value of 2, the 3174 will initiate a DIRECT function, where no dial digits are used. This is equivalent to a DIRECT function requested from the terminal.

If the call fails for any reason, normal OIA indicators and SSC information provide the reason for the failure. The call is attempted again only when another LT becomes active, or when someone uses the Dial or Direct function from a keyboard. (A terminal user could turn his terminal off and back on to cause the 3174 to try the call again.)

Autocall overrides an outstanding Dial process for that host; the terminal with the Dial screen displayed will be cleared.

Autodisconnect

When Autodisconnect is customized for a host, the 3174 will monitor display sessions associated with that host, and when the last such LT becomes inactive, the 3174 will disconnect the call for that host. Active printer LTs do not prevent the Autodisconnect from occurring. LTs become inactive as follows:

- DFTs: LTs associated with a DFT become inactive when the device is turned off or when the 3174 receives AEDV "offline" from the DFT for the LT.
- CUTs and ASCII displays: an LT assigned to a CUT or ASCII display becomes inactive when the device is turned off or when the Connection Menu is used to
  - replace the 3270 host session with an ASCII host session
  - disconnect the 3270 host session (PF12).
- Printers: printers do not trigger Autodisconnect.

The Disc function can be used from a keyboard, even if Autodisconnect is customized for the host. If the host is also customized for Autocall, the next display LT that becomes active will cause the 3174 to re-initiate the connection.

LTs that have been marked as "skipped" by the operator are not considered inactive.

Error Conditions and Status Information

When the Communication Reminder indicator with 3174 error status code is displayed during X.21 operations, the In Use indicator tells you the state of the connection. If the call is to be retried, the ► COMM function resets the Communication Reminder indicator. Refer to the *3174 Status Codes* manual for status code information.

When the X.21 interface is installed on the 3174, concurrent test 3 of the subsystem log and test facility provides X.21-related information. For more information about the status testing, refer to *3174 Customer Problem Determination.*

X.21 Switched Short-Hold Mode

Short-Hold Mode (SHM) is an automatic facility that disconnects the X.21 switched link between two stations (a primary station and a secondary station) whenever there is a break in the data traffic. It reconnects the link as soon as there is more data to send. SHM support is made possible by the fast connect/disconnect times of the X.21 networks.

The SHM process does not interrupt SNA sessions between the two stations, and users of the 3174 are unaware of the disconnect/reconnect activity, because SHM is an automatic facility.

During establishment of the initial call, both the 3174 and the Communication Controller 3720/37*x*5 sense whether SHM is to be used. If SHM is to be used, then the 3720/37*x*5 is responsible for disconnecting the link when a suitable break in the data traffic occurs. When either the 3174 or the 3720/37*x*5 has more data to send, it performs an auto-call, and the receiving station recognizes this call as the resumption of the current session.

Note: In this chapter, the following equipment is referred to by the number in parentheses:

IBM 3178 Display Station (3178)
IBM 3278 Display Station (3278)
IBM 3279 Color Display Station (3279)
IBM 3705 Communications Controller (3705)
IBM 3720 Communications Controller (3720)
IBM 3725 Communications Controller (3725)
IBM 3745 Communications Controller (3745).

37*x*5 includes 3705, 3725, and 3745.

Related Support

SHM on the 3174 requires corresponding support in the 3720/37*x*5. For a description of SHM, refer to the documentation for the 3720/37*x*5 controller.

Refer to the *3174 Planning Guide* for detailed 3174 customizing information and procedures.

SHM Communication Checks

In the event of errors unique to X.21 Switched SHM, the users at terminals attached to the 3174 are first informed of the problem via a specific Communication Check number in the indicator row. That number is also logged in the 3174 error log with a qualifier giving the exact reason of the error.

Communication Check number 563 informs the user that an XID error has occurred and cannot be retried.

Communication Check number 504 with qualifier 09 (which can be viewed by the /1 test or at the operator display panel) indicates that a Write Halt error occurred.

In the case of X.21 timeout, the timeout value is logged in the PD data area of the error log.

In the case of Call Progress Signal (CPS) received, the CPS value is also logged in the PD data area of the 3174 error log. If a parity error occurs on a CPS digit, the affected digit is displayed as an 'F' in the error log. CPSs containing parity errors cause the 3174 to retry the call. When the 3174 establishes an SHM call again, actual CPS values are not shown in the OIA. For a description of these CPS values, see the list on 7-9.

Test Modes (SHM)

The following information describes the 3174 tests /3,4 and /6,3, which contain unique information for SHM (each described in the *3174 Customer Problem Determination*).

Test /3,4

This test is invoked at any non-DFT terminal connected to the 3174 by pressing the Alt and Test functions to enter Test mode, then entering /3,4 to show the dial number used for an outgoing call.

Note: Test /3,4 is supported by Configuration Support B and C only. The outgoing call information is displayed using Test /3,1 for Configuration Support A.

Test /6,3

This test is invoked at any operating non-DFT terminal connected to the 3174 by pressing the Alt and Test functions to enter Test mode, then entering /6,3 to display the X.21 SHM Control Data panel.

On lines 00, 10, and 20, bytes 00 through 23 are the 34-byte (maximum) buffer that is used to store the XID1 of the 3174.

On lines 30, 40, 50, and 60, bytes 30 through 61 are the 50-byte buffer that is used to store the XID1 from the Primary.

Notes:

1. Byte 01 of the XID1 is the length in hexadecimal of the XID1. This number of bytes defines the boundary of the XID1. All bytes after this boundary should be ignored.
2. Where byte 19 or m + 1 is '00', the following field is omitted.
3. The content of the XID1 buffer of the 3174 can differ from the content of the XID1 last sent from the 3174. (Typically, byte 9 can differ.)

Table 7-1 contains the XID1 summary.

Table 7-1 (Page 1 of 2). XID1 Summary

Byte	Bit	Content	Meaning
0			Format of XID and PU-type of sender
	0−3	X'0'	Fixed format; bytes 0−5 only
		X'1'	Variable format; bytes 0−p
	4−7		PU type of the XID−sending node:
		X'1'	PU-T1
		X'2'	PU-T2
		X'3'	Reserved
		X'4'	PU-T4
		X'5'	PU-T5
			Note: Byte 0 = X'12' in 3174 variable-format XID.
1			Length in hexadecimal of the variable-format XID I-field. Reserved in fixed-format XID.
2−5		X'017n nnnn'	017 is the 3174 block number; nnnnn is the answer to configuration question 215 (PUID)
6,7			Reserved
8			Link-station and connection protocol flags
	0,1		Reserved
	2		Link-station role of XID sender:
		B'0'	Sender is a secondary link station
		B'1'	Sender is a primary link station
	3		Reserved
	4−7		Link station transmit/receive capability:
		X'0'	Two-way alternating
		X'1'	Two-way simultaneous
9			Node characteristics of the XID sender
	0		PU capability to receive FMD requests:
		B'0'	PU cannot receive FMD requests from SSCP
		B'1'	PU can receive FMD requests from SSCP
	1		Reserved
	2,3		Segment assembly capability of the node's PC element:
		B'00'	The mapping field is ignored, and PIUs are forwarded unchanged.
		B'01'	Segments are assembled on a link-station basis.
		B'10'	Segments are assembled on a session basis.
		B'11'	Only whole PIUs are allowed.
	4,5		Reserved
	6		Short Hold status indicator:
		B'0'	Not already engaged in an SHM session.
		B'1'	Already engaged in an SHM session.
			Note: This bit has no meaning when the next bit (7) is off.
	7		Short Hold indicator − Gives the short-hold capability of the XID sender:
		B'0'	Short-hold mode not supported
		B'1'	Short-hold mode supported
10,11			Maximum I-field length the XID sender can receive
	0	B'0'	Format flag (always 0)
	1−15		Maximum I-field length

Table 7-1 (Page 2 of 2). XID1 Summary

Byte	Bit	Content	Meaning
12	0−3		Reserved
	4−7	X'0'	SNA link profile (only value)
13	0,1		Reserved
	2		SDLC initialization mode options:
		B'0'	SIM and RIM not supported
		B'1'	SIM and RIM supported
	3−7		Reserved
14,15			Reserved
16	0		Reserved
	1−7		Maximum number of I-frames that can be received by the XID sender before an ACK is sent.
17			Reserved
18		X'00'	
19			Number of dial digits of the XID sender (hex)
20−m			Dial digits of the XID sender (hex)
m + 1			Alternate dial digit length (hex)
m + 2−p			Dial digits of an alternative free 3720/37x5 port

Chapter 8. X.25 Operation

Introduction

This chapter describes how the 3174 provides X.25 attachment. It also describes the steps required for terminals attached to a 3174 to control communication over an X.25 network. Use this chapter to plan X.25 procedures for terminal operators and to plan for customizing the 3174. The topics covered include:

- Setting up X.25 operation
- Overview of X.25 support in the 3174
- Operating the 3174 in an X.25 network
- Using the dial screen
- X.25 status indicators
- Understanding X.25 facilities
- Understanding X.25 packet types.

Setting Up X.25 Operation

Before you begin, you may need:

- Information about the X.25 network subscription
- *The X.25 Interface for Attaching SNA Nodes to Packet-Switched Data Networks General Information Manual*
- *3174 Planning Guide*
- *X.25 Keyboard Labels*.

To set up your 3174-attached terminals for X.25 operation, do the following:

1. **Understand X.25 concepts and your network subscription.**

   You might have been introduced to X.25 concepts and operation by the X.25 network servicer. The X.25 interface is described in *The X.25 Interface for Attaching SNA Nodes to Packet-Switched Data Networks General Information Manual*.

   The X.25 facilities supported by the 3174 are described later in this chapter.

   How much you need to understand of X.25 concepts and the detailed interface probably depends on how much planning the network servicer has already done for you. In any case, you need information from the network subscription to complete the following steps.

2. **Plan for customizing the 3174s.**

   Use this chapter and the *3174 Planning Guide* to fill out the form that is used to customize each 3174.

   To fill out the forms in the planning guide, you may need information recorded during the last 3174 customization as well as information from the X.25 network subscription.

3. **Plan your local operating procedures.**

   Use "Operating the 3174 in an X.25 Network" on page 8-8 to determine and write the procedures for terminal operators to use to connect to and disconnect from the X.25 network. You may want to write these procedures separately or to integrate them into the application procedures for terminal operators to use.

4. **Put the X.25 labels on the terminal keyboards.**

   At each terminal that is able to connect to the X.25 network, affix the specific IBM-provided X.25 labels for the functions that you want operational at that terminal.

5. **Customize the 3174s.**

   Using the form filled out when planning customization in step 2, customize each 3174 that is to be connected to the X.25 network.

6. **Validate the connection to the X.25 network.**

   After the 3174 has been customized, you should now be able to follow, at any of the terminals that have X.25 function support, the dial procedure for connecting to a host on a Switched Virtual Circuit (SVC). When you have done this successfully, you are ready for normal operation. No procedures are necessary for connecting to a host on a Permanent Virtual Circuit (PVC).

Note: If Multi-Host Support is used, the X.25 functions and indicators apply to the X.25 host of the active LT. To perform an X.25 function for a different host, you use the Change Screen function to access an LT for that host, then perform the X.25 function you need.

Overview of X.25 Support in the 3174

CCITT Recommendation X.25 defines the procedures that a network DCE uses to attach DTEs to an X.25 Packet Switched Network. (The 3174 acts as a DTE; the network node that it attaches to is the DCE.) 3174 microcode releases before B3.0 conform to the 1980 version of the CCITT Recommendation. Release B3.0 conforms to the 1988 version. Release B3.0 also conforms to ISO standards 7776 and 8208.

The X.25 Recommendation defines 3 levels of interface to the network: physical, link and packet. The physical and link levels allow data to be passed to and from the DTE and DCE; they define how to access the actual network. The packet level defines how to establish communications to and exchange data with another DTE attached to the network. A virtual circuit is the name of the connection that exists in the packet level between 2 DTEs. In IBM SNA environments, a virtual circuit is mapped to the DLC layer of SNA. A DTE may have multiple virtual circuits at a time, communicating with multiple remote DTEs, or multiple circuits with the same remote DTE, or a mixture of both.

IBM X.25 architecture defines a 4th protocol layer called LLC (Logical Link Control). This provides mapping of certain SNA functions, like XID and TEST, that are not provided by the packet level protocols. The 3174 supports the type of LLC called QLLC (Qualified Logical Link Control).

3174 Physical and Link Levels

The 3174 supports the following leased physical interfaces to X.25 networks:

- EIA 232D
- CCITT V.24/V.28 or CCITT V.35
- X.21 (CCITT V.11).

For the X.25 link level, the 3174 uses LAPB (Link Access Procedure Balanced) protocols. The 3174 provides modulo 8 link level sequence numbering.

3174 Packet Level

The X.25 packet layer includes the concept of a virtual circuit between two DTEs, and the protocols to establish, maintain and break that connection. In an SNA configuration, each X.25 virtual circuit can be thought of as a point-to-point SDLC switched or leased line, connecting two DTEs. (Therefore, a virtual circuit carries the traffic for a single PU.) Protocols for the packet level allow multiple circuits to share one physical interface to the network. With microcode releases before B3.0, the 3174 supports a single virtual circuit. Starting with release B3.0, up to 8 virtual circuits on the primary X.25 link can be used for SNA host attachment, and up to 4 virtual circuits can be used for SNA host attachment through a CCA.

The 3174 provides the following packet level functions:

- Modulo 8 or modulo 128 packet level sequence numbers
- Data packet sizes of 64, 128, 256 or 512 bytes
- Packet windows of 1-7 for modulo 8, or 1-11 for modulo 128
- Permanent Virtual Circuits (PVCs)
- Switched Virtual Circuits (SVCs), both outgoing and incoming calls
- User Facilities (see "Understanding X.25 Packet Types" on page 8-6.)

Packets

An X.25 packet is a piece of information transferred to and from the network, and carried in the information field of the LAPB I-frame. There are several types of packets:

- virtual circuit management packets — packets in this group (like an "Incoming Call" packet) set up and clear calls on virtual circuits.
- data packets — these packets carry user messages to and from the DCE. (In an SNA configuration, these messages are PIUs.) Depending on the data packet size in use for the virtual circuit, a message may be split into many data packets as it travels through the network. The packet layer of X.25 describes how this "packetizing" is done, and how such messages are reassembled by the receiver.
- flow control packets — RR and RNR packets acknowledge data from the DCE and regulate the flow of data packets.
- others — there are other types of packets that the 3174 X.25 implementation does not use (for example, Interrupt packets and Registration packets).

A complete description of how the 3174 uses each type of packet is contained in "Understanding X.25 Packet Types" on page 8-6.

DTE addresses and Logical Channel Numbers

In the X.25 Recommendation, there are 2 important addresses:

1. DTE address - this is the address by which the network identifies each DTE. It is similar to a phone number. Each DTE has only one DTE address.
2. Logical Channel Number (LCN) - a logical channel is a path between a DTE and its network DCE, over which traffic for a virtual circuit may travel. The LCN is an address that the network and a DTE use to identify a particular virtual circuit. Each packet associated with a particular circuit will contain its LCN. The LCN is a 12-bit number which makes it possible to have 4096 virtual circuits per DTE. However, most DTEs have a much smaller number of virtual circuits.

Each DTE address is unique within the network. The LCN has only local significance, between the DCE and DTE. Therefore, there are 2 LCNs associated with any virtual circuit: an LCN between the local DTE and the network DCE, and an LCN between the remote DTE and its network DCE. The DTEs do NOT know the LCN used at the remote DTE's interface. When you subscribe to an X.25 network service, the network administration will assign specific LCNs to be used for Permanent Virtual Circuits (PVCs) and ranges of LCNs to be used for Switched Virtual Circuits (SVCs).

Permanent and Switched Virtual Circuits

The X.25 Recommendation defines two types of virtual circuits: Permanent and Switched (PVC and SVC). A PVC is similar to a leased phone line; no circuit establishment is required, other than initializing the packet interface between the DTE and its DCE. Each network subscriber determines the number of PVCs and the remote DTEs to which they should connect, so the identity of the remote DTE always correlates with the LCN at the local interface.

For an SVC, however, a DTE chooses from a pool of LCNs, when it initiates a connection. The local DTE calls the remote DTE by choosing an unused LCN, and sending a Call Request packet containing that LCN. The Call Request packet also contains the DTE address of the desired remote DTE. The network will select an unused LCN at the remote DTE's interface, and send an Incoming Call Packet, containing the DTE address of the caller. From then until the call is cleared, each DTE will associate the virtual circuit with the LCN selected at its own interface.

Note: For SNA host connections on SVCs, the 3174 does not support the reset procedure. If the 3174 receives a Reset Indication packet on an SVC, it sends a Reset Confirmation packet, and then sends a Clear Request packet to end the call.

The 3174 can be customized to use either a PVC or an SVC for each host connection. For SVC host connections, the 3174 can make outgoing calls and/or accept incoming calls. When incoming calls are to be used, the 3174 may use the remote DTE's address to determine who is calling. It may also be necessary for the 3174 to use a Connection Identifier to verify the calling host. A Connection Identifier can be customized for each host connection of the 3174, and is passed in the call user data field of call establishment packets. The *3174 Planning Guide* explains when Connection Identifiers must be customized and how they are used.

Virtual Circuit Establishment: For SNA host connections on SVCs, the 3174 provides 2 ways to make and break the X.25 call.

1. Terminal users can manage the call using the X.25 functions, DIAL, DISC, LOCAL and COMM. "Operating the 3174 in an X.25 Network" on page 8-8 describes how to use these functions, and how they affect the X.25 host connections. When these keys are used, their functions apply only to the host connection associated with the active LT.

2. The 3174 can be customized to automatically call and/or clear the host connection, through the Autocall/Autodisconnect function. This is described in "Autocall/Autodisconnect" on page 8-8.

For PVC host connections, the host connection should be available as soon as the 3174 IML has completed, and the X.25 link and packet level interfaces have been initialized. Data traffic can flow immediately, as no call set-up procedures are used. However, terminal users can use the LOCAL and COMM functions to suspend and resume the flow of traffic for the PVC. These key functions are described in "Using the X.25 Keyboard Functions" on page 8-10.

Understanding X.25 Facilities

Table 8-1 lists the X.25 Network facilities supported by the 3174.

Table 8-1. X.25 Network Facilities

Facility Name	Support	Comment
Extended packet sequence numbering	S	Modulo 8 or 128 numbering.
Nonstandard default window size	S	Modulo 8: 1-7. Modulo 128: 1-11.
Nonstandard default packet size	S	User selects 64, 128, 256, or 512.
Incoming calls barred	S	Network-assigned.
Outgoing calls barred	S	Network-assigned.
One-way logical channel out	S	Uses only one channel.
One-way logical channel in	S	Uses only one channel.
CUG	C	
CUG with outgoing access	S	Network-assigned.
CUG with incoming access	S	Network-assigned.
Incoming calls barred in CUG	S	Network-assigned.
Outgoing calls barred in CUG	S	Network-assigned.
Reverse charging	C	
Reverse-charging acceptance	C	User determines acceptance.
RPOA selection	C	
Flow control parameter negotiation	C	Calling DTE to request window and packet size.
Throughput class negotiation	C	3174 negotiates throughput class (75-64000 bps).

Legend:

C Facilities for which the 3174 supplies unique codes in the Call Request packet.
S Facilities that are requested via paperwork negotiation with the network administration.

Understanding X.25 Packet Types

The following X.25 packet types are supported by the 3174. The cause and diagnostic codes mentioned in the descriptions are described in *3174 Status Codes*.

Call Request (SVC): The Call Request packet is transmitted by the 3174 when an X.25 dial operation is performed by the operator or when an Autocall is configured and the first LT is powered on. This packet contains the called number and optional information which matches the user's subscription. The optional information is based on operator input or the options selected while configuring.

Incoming Call (SVC): The Incoming Call packet is received by the 3174 as a result of a remote DTE transmitting a Call Request Packet. The 3174 examines the data in the packet (based on options selected during configuration) to ensure that it conforms to the information configured or as specified by the display operator through a dial operation.

Call Accepted (SVC): The Call Accepted packet is sent by the 3174 after an Incoming Call packet has been accepted.

Call Connected (SVC): The Call Connected packet is received by the 3174 as confirmation that the remote DTE has accepted the 3174's Call Request. The circuit is now in the data-ready state, and SNA protocols may begin.

Clear Request (SVC): The Clear Request packet is sent by the 3174 as a result of an X.25 disconnect operation by the operator (when the DISC function is pressed) or the network (normal circuit termination), when Autodisc is configured and the last LT powers off, or as a result of certain errors detected by the 3174. Cause and diagnostic codes are included. If caused by a 3174-detected error, the codes are logged and displayed.

Clear Indication (SVC): The Clear Indication packet is received by the 3174 as a result of a normal clearing sequence, or as a result of problems detected by the network or the remote DTE. The circuit is stopped, a Clear Confirmation packet is sent, and cause and diagnostic codes are logged and displayed.

Clear Confirmation (SVC): The Clear Confirmation Packet is sent by the 3174 to acknowledge the receipt of a Clear Indication packet or may be received by the 3174 in a network response to Clear Request packet.

Reset Request (PVC): The Reset Request packet is sent when the 3174 detects certain X.25 errors. Cause and Diagnostic codes are included and logged. The 3174 then attempts to reopen the circuit. The SNA layers must be reactivated through a QSM (SNRM), ACTPU, ACTLU sequence. Reset Request is also sent when you press the LOCAL function for a PVC.

Reset Indication (PVC/SVC): The Reset Indication packet is received by the 3174 as a result of problems detected by the network or the remote DTE. The circuit is stopped, and the error condition is logged with cause and diagnostic codes. The SNA layers must be reactivated through a QSM (SNRM), ACTPU, ACTLU sequence.

Reset Confirmation (PVC/SVC): The Reset Confirmation packet is transmitted by the 3174 to acknowledge receipt of a Reset Indication packet, or the Reset Confirmation packet may be received by the 3174 in confirmation of a Reset Request packet.

Restart Request (PVC/SVC): The Restart Request packet is sent when the 3174 is resetting the link due to detecting certain X.25 errors. The Restart Request packet is also sent when an open-link operation is performed. Open-link operations are performed when:

- A 3174 IML is performed.
- The link has been closed because of an error condition. In this event, the 3174 immediately attempts to re-open the link. Cause and diagnostic codes are included and logged.

When the link is reset because of error conditions, the cause and diagnostic codes are logged.

Restart Indication (PVC/SVC): When the Restart Indication packet is received, the 3174 responds with a Restart Confirmation packet, and shuts down the link. The cause and diagnostic codes are logged.

Restart Confirmation (PVC/SVC): When the 3174 has sent a Restart Request packet as a result of attempting to initialize packet level operation, receipt of a Restart Confirmation packet signals the completion of initialization. The 3174 sends a Restart Confirmation packet to acknowledge receipt of a Restart Indication packet.

Data (PVC/SVC): The Data packet is used to transmit and receive data once a circuit has been established.

Receiver Not Ready (PVC/SVC): When the 3174 receives a Receiver Not Ready packet, the 3174 stops transmission until a Receiver Ready is received. The 3174 does not send a Receiver Not Ready packet.

Receiver Ready (PVC/SVC): The Receiver Ready packet is sent by the 3174 in response to any data packet that is received unless an outgoing data packet is ready for transmission. Receipt of a Receiver Ready packet indicates that transmission by the 3174 may continue.

Diagnostic (PVC/SVC): The Diagnostic packet contains diagnostic information and is received when a reset, clear, or restart packet is not appropriate. The cause and diagnostic information is logged, and no further action is taken.

Operating the 3174 in an X.25 Network

When the 3174 is connected to an X.25 network, you can customize host connections of the 3174 to operate on permanent virtual circuits (PVCs) or on switched virtual circuits (SVCs). A PVC is similar to a point-to-point SDLC leased line, while an SVC is similar to a point-to-point switched line. More X.25 keyboard functions and operating procedures might be required with an SVC. When Single Link Multi-Host Support is used, you may have SVC and PVC hosts on the the same link.

Autocall/Autodisconnect

The Autocall/Autodisconnect functions eliminate the need for any terminal user to use the X.25 functions. Each X.25 SVC host can be customized for Autocall and/or Autodisconnect.

Autocall

If an X.25 host is customized for Autocall, the 3174 attempts a connection to the host when the host is disconnected and a display LT associated with that host becomes active. An LT becomes active as follows:

- DFT: LTs associated with a DFT become active when the 3174 receives AEDV "online" from the DFT for the LT.
- CUT and ASCII displays: each LT becomes active the first time the user toggles to it, and the LT is routed (via the Default Destination, if AEA is in use) to the 3270 host. If the LT is not routed to a 3270 host, it becomes active when the user selects a 3270 host from the Connection Menu.
- Printers: printer LTs will not trigger the Autocall function.
- DFT-E displays: DFT-Es invoke Autocall the same as the DFTs, for the 5 DFT LTs. Accessing the CUT sessions of the DFT-E does not trigger an Autocall.

The 3174 sets all call parameters to the customized values, and attempts the connection using those values. This is true even if the X.25 Dial function had been previously used and different values for the call parameters were entered on the X.25 dial screen. ("Call parameters" are the values displayed on the dial screen. See Figure 8-1 on page 8-14 for an example).

If the call fails for any reason, normal OIA indicators and SSC information provide the reason for the failure. The call is attempted again only when another LT becomes active, or when someone uses the X.25 Dial function from a keyboard. (A terminal user could turn his terminal off and back on to cause the 3174 to try the call again.)

Autocall overrides an outstanding Dial process for that host; the terminal with the Dial screen displayed will be cleared.

Autodisconnect

When Autodisconnect is customized for an X.25 host, the 3174 will monitor display sessions associated with that host, and when the last such LT becomes inactive, the 3174 will clear the call for that host. Active printer LTs do not prevent the Autodisconnect from occurring. LTs become inactive as follows:

- DFTs: LTs associated with a DFT become inactive when the device is turned off or when the 3174 receives AEDV "offline" from the DFT for the LT
- CUTs and ASCII displays: an LT assigned to a CUT or ASCII display is powered-off when the device is turned off or when the Connection Menu is used to:
  - replace the 3270 host session with an ASCII host session
  - disconnect the 3270 host session (PF12)
- Printers: printers do not trigger Autodisconnect.

The 3174 allows DISC to be initiated from a keyboard, even if Autodisconnect is customized for the host. If the host is also customized for Autocall, the next power-on of an appropriate LT will cause the 3174 to re-initiate the connection.

LTs that have been marked as "skipped" by the operator are not considered inactive.

Using the X.25 Keyboard Functions

Additional keyboard functions are provided to support X.25. These functions are available for both CUT and AEA-attached displays. The X.25 functions described below are enabled after you invoke Extension/Extended Select mode.

► **DIAL:** Used for SVC operation. When the function is pressed in the call-ready state, the controller goes into dial mode for the host assigned to the LT, initiates a keyboard reset and clear function, and displays the dial screen. The screen displays the dial number previously selected and (if so customized) other X.25 control field defaults selected during customizing or by a previous dial mode operation. Values requiring change can be updated.

► **DISC (Disconnect):** Used for SVC operations. Pressing the function causes the controller to clear the call to the host and to go into the call-ready state. The 3174 can be customized so that if the controller has no active LU-LU sessions for that host, the clear occurs immediately; otherwise, you must press ► DISC a second time to cause the disconnect, or you can press Reset to reset the disconnect sequence.

► **LOCAL:** Used for SVC and PVC operations. For SVC operations, the function is used in the call-ready state to go into the local state for the host assigned to the LT. For PVC operations, the function can be pressed while in In Use state, and causes the controller to reset the PVC, and to go into the local state. The 3174 can be customized so that if the controller has no active LU-LU sessions for that host, the state change occurs immediately; otherwise, you must press ► LOCAL a second time.

► **COMM (Communication):** Used for SVC and PVC operations. For SVC operations, the Communication function is used to change the host state from local to call-ready. For PVC operations, the COMM function is used to get back to the In Use state.

Customizing for Keyboard Support

During the 3174 customizing procedure, you can define which X.25 control functions will be operational from port 0 (HG26 or HG27) and which control functions will be operational from all other ports. See the *3174 Planning Guide* for additional information.

Using the X.25 Keyboard Labels

To identify the functions assigned to specific keys, a set of X.21/X.25 stick-on labels (P/N 1743595) can be applied to the keytops and keyboard cover.

X.25 States

Different X.25 operational states can be part of PVC and/or SVC operations.

Call-Ready The circuit is not open. A connection can be attempted.

Local The circuit is disconnected. A connecting operation cannot be performed.

In use The circuit is connected and ready for data.

Incoming call or outgoing call-in-process The connection operation is in progress.

Disconnect-in-process The disconnection operation is in progress.

Error Error states are displayed by the Machine Check and Communication Check indicators.

The operational states are represented by status indicators in the Operator Information Area. These indicators are only displayed on CUT and AEA-attached displays. For an illustration and description of the indicators, see "X.25 Status Indicators" on page 8-18.

Permanent Virtual Circuit (PVC) Operations

The 3174 attempts to activate the X.25 link as soon as the IML completes. Once the link is active, X.25 PVC operation is possible, and the In Use indicator is displayed on all LTs reporting to that host.

In PVC operations, use the ► LOCAL and ► COMM functions for disconnect and reconnect operations, respectively. During customization, however, you can specify that the function of the ► LOCAL and ► COMM functions be deleted. Then, you cannot use these functions to intervene with PVC connections.

Disconnect Operation

The ► LOCAL function allows you to disconnect the PVC host connection. When you press ► LOCAL, the 3174 determines whether any SNA sessions are active. If no sessions are active, the 3174 immediately resets the PVC. This places the host connection in LOCAL state. If SNA sessions are active and the 3174 is so customized, the Operator Communication Check and Input Inhibited indicators are displayed and no action is taken. To disconnect when an active SNA session exists, press ► LOCAL a second time. To cancel the disconnect operation, press Reset to restore the keyboard and to reset the Operator Communication Check and Input Inhibited indicators.

While in LOCAL state, if data packets are received from the host, the 3174 sends a Reset Request packet with diagnostic code C5. Also, while in LOCAL state, the Local Mode indication is displayed on all associated LTs.

Reconnect Operation

When the host connection is in the PVC local state, pressing ► COMM causes the 3174 to return to In Use state. PVC operation is possible and the In Use indicator is displayed.

Switched Virtual Circuit (SVC) Operations

For SVC host connections, the Call Ready indicator is displayed at LTs assigned to those hosts after the X.25 link is initialized.

Call Ready/Incoming Call Operation

In the call ready state, the ► DIAL and ► LOCAL functions are active and an incoming call (from the host) can be processed. No further action is required for incoming-call operations unless you wish to change the incoming-call parameters. These parameters were initially set during customization or subsequently modified by a dial-mode operation. Incoming Call packets are accepted in the call-ready state, and the Incoming Call-in-Process indicator is displayed. This indicator is reset when the circuit is connected.

Dial In Operation

To initiate an outgoing call or to modify the operating parameters for an incoming call, you execute a dial mode operation using the ► DIAL function. When you press ► DIAL in the call ready state, the ► Dial indicator replaces the Call Ready indicator. Pressing ► DIAL initiates keyboard reset and clear functions simultaneously.

The dial screen is then displayed. See "Using the Dial Screen" on page 8-14 for information on filling in the dial mode information.

After keying in the dial mode information, press Enter. If the data is successfully validated by the 3174, the data is stored for future reference. An additional step is executed for outgoing-call operations; a Call Request packet is assembled and transmitted by the 3174, and the Outgoing Call in Process indicator replaces the Dial indicator. When the circuit is connected, the Outgoing Call in Process indicator is reset and the In-Use indicator is displayed in the operator information area.

If you did not press the Enter function or if you entered invalid data, you can retrieve the information stored by the last successful DIAL/Enter function operation by pressing ► DIAL again.

When dial mode has been entered at an LT, an attempted entry of dial mode for the same host at any other LT is inhibited and the Operator Communication Check indicator is displayed.

When one LT is in dial mode, the ► DISC function on LTs assigned to that host forces the first LT out of dial mode.

Pressing the Clear function while in dial mode causes the input fields on the screen to be restored to the previously stored values.

Disconnect Operation

To disconnect an SVC host connection from the X.25 network, press ► DISC. If there are no active SNA LU-LU sessions for that host, pressing ► DISC initiates an immediate disconnect. If SNA sessions are active (bound) and if the 3174 is so customized, the first disconnect sequence does not initiate a disconnect sequence but sets the Operator Communication Check indicator, indicating that there are sessions active. You can disconnect regardless of the status of the SNA sessions by pressing ► DISC a second time. This action causes a Clear Request packet to be sent. If you do not want to terminate the active SNA sessions, press Reset to clear the Operator Communication Check indicator.

A customizing option is provided that allows the DISC function to initiate a disconnection immediately, regardless of the status of the LU sessions.

A disconnect sequence can also be initiated by the receipt of a Clear Indication packet. The cause and diagnostic codes from the Clear Indication packet are displayed in the Operator Information Area.

The disconnect-in-process state is entered when the ► DISC function operation is accepted, when a QDISC packet is received, or when an autodisconnect occurs. It may also be entered because of error conditions that cause the 3174 or the network to clear the SVC.

If not in dial mode, the screen is unchanged. If in dial mode, the dialing terminal's screen is cleared and the disconnect-in-process state is entered. Sessions are reset if they exist, and all session-related indicators, including Online, Ownership, and System Wait, are reset.

The Call Ready indicator replaces the Disconnect in Process indicator when the circuit is successfully disconnected. The In Use indicator is turned off. A new Dial operation or autocall is required to reestablish the connection.

Local State Operation

In the local state, all incoming calls and dial operations for this host are rejected.

To place an SVC host connection in the local state, press the ► LOCAL function while in the call-ready state. The Local state indicator is displayed.

To exit the local state, press ► COMM. The call-ready state is entered.

Using the Dial Screen

On an SVC host connection, when you press ► DIAL, the dial screen (shown below) appears on the display terminal screen. The dial screen always displays the host network address (HNAD). You can customize so the other control fields are displayed as well. These control fields show the values that you selected during customization or the values that you changed during the previous dial operation.

You can update any of the displayed field values. When the screen contains the desired values, you press the Enter function to initiate 3174 action. If an invalid field has been specified, the Input Inhibited and Wrong Number indicators are displayed. The cursor is automatically positioned in the first character location of the invalid field so you can correct it.

Figure 8-1 shows the dial screen, and the material following it describes the various control fields of the dial screen.

```
HNAD  = 123 123 789

CID   = 12345678
NPKT  = 1
NWND  = 04
RPOA  = 1898
CUG   = 32
TCLS  = 9
OOPT  = 00000000
IOPT  = 00000000
COPT  = 00000000
I/O   = 0
```

Figure 8-1. The X.25 Dial Screen

Dial screen check: When Single Link Multi-Host Support is being used, and more than one host is customized for incoming call support, certain changes to the DIAL screen parameters are not allowed. If there is more than one host on the link defined with circuit type= two-way or incoming and the host being DIALed is defined as two-way or incoming, the following conditions are checked:

1. The "DTE address" digit of the incoming call options (digit 1) for this host must be 1.
2. If the "Verify CID" digit of the incoming call options (digit 6) for this host is 0, then no other host on that link that is defined with circuit type = two-way or incoming may have the same DTE address as the host being DIALed.
3. If the "Verify CID" digit of the incoming call options (digit 6) for this host is 1, then no other hosts on that link having the same DTE address and defined with circuit type = two-way or incoming may have the same CID value as the host being DIALed.

Host Network Address (HNAD)

This 15-character field is the network address of the host data terminal equipment (DTE). The controller places the HNAD in an Outgoing Call packet, or, if so customized, validates the HNAD in an Incoming Call packet.

You can enter numbers 0 through 9. Blanks or nulls can be entered for visual clarity, but are ignored by the controller.

For an incoming call, if digit 1 of the incoming call options (IOPT) is 1, the value of this field is compared with the calling DTE address of the Incoming Call packet. If they match, a Call Accepted packet is sent. If there is no match, a Clear Request packet with a diagnostic code is sent.

Connection Identifier (CID)

You can preset this 8-character field during customizing. With microcode releases before B3.0, the data in this field is not displayed.

For an incoming call, if you selected CID validation in the incoming call options (IOPT digit 6=1), the 3174 compares the entire field (padded to the right with blanks) with bytes 4–11 of the call user data field. If there is no CID, or if the CID does not match, a Clear Request packet is issued with a diagnostic code included. The Call Ready indicator is displayed with the diagnostic code.

For an outgoing call, if the outgoing call options (OOPT digit 6=1) indicate that the CID is to be included, the complete CID field (padded to the right with blanks) is included in bytes 4–11 of the call user data field.

If you did not set the call options to validate or supply a CID, the value of this field is ignored.

Negotiation Packet Size (NPKT)

On incoming calls, this one-character field sets the limit to which the 3174 can negotiate packet size. On outgoing calls, the value in this field serves as the indicated (requested) value when packet size negotiation is selected in the outgoing call options (OOPT digit 4=1).

Allowable values in this field are 0 (64-byte limit), 1 (128-byte limit), 2 (256-byte limit), and 3 (512-byte limit).

Negotiation Window Size (NWND)

This 2-character field is used for window size negotiation. On incoming calls, the value in this field sets the limit to which the 3174 can negotiate. On outgoing calls, the value in this field serves as the indicated (requested) value when window size negotiation is selected in the outgoing call options (OOPT digit 5=1).

Allowable values in this field are:

01–07 If you are using modulo 8 packet sequence numbering
01–11 If you are using modulo 128 packet sequence numbering.

Recognized Private Operating Agency (RPOA)

This 4-decimal-digit field contains the RPOA facility ID that is to be used to select between two public networks.

The four decimal digits entered are inserted in the facilities field of the Call Request packet. If the field is all blanks and/or nulls, the RPOA facility is not included.

Closed User Group (CUG)

This 2-decimal-digit field permits the CUG facility to be included in a Call Request packet or validated on an Incoming Call packet.

If an incoming call is received that contains CUG, the call is validated against this value.

Throughput Class Negotiation (TCLS)

This 1-character field defines the throughput class value for the 3174 to use in class negotiation. If the incoming and outgoing call options (IOPT digit 7=0, OOPT digit 7=0) indicate that Throughput Class Negotiation is not used, this field is ignored.

Allowable values in this field are 3 (75 bps), 4 (150 bps), 5 (300 bps), 6 (600 bps), 7 (1200 bps), 8 (2400 bps), 9 (4800 bps), A (9600 bps), B (19 200 bps), C (48 000 bps), and D (64 000 bps).

If OOPT digit 7 is 1, the 3174 uses the Throughput Class Negotiation facility in an Outgoing Call packet to request the customized class.

If IOPT digit 7 is 1, the 3174 accepts the throughput class that is requested in an Incoming Call packet, if it is less than the customized value. If not, the 3174 returns the customized value in the Call Accepted packet.

Outgoing Call Options (OOPT)

This 8-digit field defines outgoing call options as follows:

Digit	Content	Meaning
1	0	Do not supply the 3174 (calling) DTE address.
	1	Supply the 3174 DTE address in the Call Request packet.
2,3	00	Do not include the reverse-charge facility field in the Call Request packet.
	01	Request reverse charge via the reverse-charge facility field.
	10	Request *no* reverse charge via the reverse-charge facility field.
	11	Invalid
4	0	Do not include packet size negotiation in the Call Request packet.
	1	Include packet size negotiation in the Call Request packet. The value inserted for both transmission directions is the same and is the value specified in NPKT.
5	0	Do not include window size negotiation in the Call Request packet.
	1	Include window size negotiation in the Call Request packet. The value inserted for both transmission directions is the same and is the value specified by NWND.

Digit	Content	Meaning
6	0 1	Do not include the CID in the Call Request packet. Include the CID (password) in the call user data field of the Call Request packet.
7	0 1	Do not include throughput class negotiation in the Call Request packet. Include throughput class negotiation in the Call Request packet, using the value in TCLS.
8		Reserved

Incoming Call Options (IOPT)

This eight-digit field defines incoming call options as follows:

Digit	Content	Meaning
1	0 1	Do not validate the host (calling) DTE address. Validate the host DTE address.
2,3	00 01 10 11	Do not accept calls with the reverse-charge facility included. Accept calls with the reverse-charge facility equal to the reverse charge requested. Accept calls with the reverse-charge facility *not* requested. Accept calls with the reverse-charge facility whether or not reverse charges are requested.
4	0 1	Do not accept calls that include packet size negotiation. Accept calls that include packet size negotiation.
5	0 1	Do not accept calls that include window size negotiation. Accept calls that include window size negotiation.
6	0. 1	Do not validate the CID (password). Validate the CID on the Incoming Call packet.
7	0 1	Do not accept calls that include throughput class negotiation. Negotiate the throughput class. If the throughput class in the Incoming Call packet is less than or equal to the customized throughput class value (TCLS), the requested value is accepted. If the requested value is greater than the customized value, the customized value is returned in the Call Accepted packet.
8		Reserved

Connection Options (COPT)

Digit	Content	Meaning
1	0 1	1980 CCITT Recommendation X.25 supported by remote DTE 1984 CCITT Recommendation X.25 supported by remote DTE
2	0 1	The 3174 should use SNA diagnostic codes. The 3174 should use ISO (CCITT) diagnostic codes.
3-8		Reserved

Incoming/Outgoing Call Control

This 1-digit field defines the control to be exercised if this SVC host connection is configured for two-way calls.

If 0 is specified, the information on the dial mode screen is used when an outgoing call is initiated. If 1 is specified, the information on the screen is stored. If an incoming call is received, the 3174 uses the stored information to decide whether to accept the call.

If the circuit type specified during customizing is an incoming call or an outgoing call, this field is not displayed.

X.25 Status Indicators

You check the status of your X.25 host connection by looking at the indicators in the Operator Information Area of your LT. These indicators are shown in Table 8-2.

Table 8-2. X.25 Operator Information Area Status Indicators

OIA Symbol	Meaning
N	Network In Use
─z─	Call Ready
─z─ *xccdd*	Call Ready (with cause and diagnostic codes)
─z─ # ?	Dial-In (dialing terminal)
─z─ ##	Dial-In (other terminals)
→z─	Outgoing Call In Process
←z─	Incoming Call In Process
─z─ ☼	Disconnect In Process
⤫z─599	Local Mode
⤫z─ *xccdd*	X.25 Communication Reminder (with cause and diagnostic codes)
X 웃─z─	Operator Communication Check

For the indicators that are common to other types of networks as well as X.25, see Appendix E, "Operator Information Area Symbols."

Cause and Diagnostic Indicators

Cause and Diagnostic indicators are displayed in the operator information area to aid in user problem determination for abnormal disconnection. They are displayed with the Call Ready indicator when cause and/or diagnostic codes are received by or transmitted from the 3174 because of an error condition. They are not displayed when the 3174 operator causes a normal disconnect through the DISC function. Cause and diagnostic codes are also displayed with the X.25 Communication Reminder indicator and indicate the cause and diagnostic codes from a Restart/Reset/Clear packet transmitted or received from the 3174.

Function Operation

This section defines how a function is treated when it is pressed in X.25-specific states. Figure 8-2 and Figure 8-3 on page 8-20 summarize these function operations.

Status	DIAL Key Pressed	ENTER Key Pressed	DISC Key Pressed
	Operation		
Call Ready	Accepted. [1] # ? or # #	Accepted. Dial in complete.	Ignored.
Call Ready with C&D Codes	Accepted. [1] # ? or # #	Accepted. Dial in complete.	Accepted. [2]
Outgoing Call in Process	Rejected.	Rejected. X-f	Accepted.
Incoming Call in Process	Rejected.	Rejected. X-f	Accepted.
Data Ready	Rejected.	Rejected. Treated as AID key.	Accepted.
Disconnect in Process	Rejected.	Rejected. X-f	Ignored.
Local	Rejected. 599	Rejected. X-f 599	Ignored. 599
X.25 Communication Reminder	Rejected. XCCDD	Rejected. X-f XCCDD	Ignored. XCCDD

[1] *See Figure C-2 for indicators displayed by Dialing terminal and Other terminals.*
[2] *Reset cause and diagnostic (C&D) codes.*

Status	LOCAL Key Pressed	AID Key Pressed	COMM Key Pressed
	Operation		
Call Ready	Accepted.	Rejected. X-f	Ignored.
Call Ready with C&D Codes	Accepted.	Rejected. X-f	Accepted. [4]
Outgoing Call in Process	Rejected.	Rejected. X-f	Ignored.
Incoming Call in Process	Rejected.	Rejected. X-f	Ignored.
Data Ready	Rejected.	Same as base machine. X-f	Rejected.
Disconnect in Process	Rejected.	Rejected. X-f	Rejected.
Local	Ignored. 599	Rejected. X-f 599	Accepted. (SVC) or 505-01 (PVC)
X.25 Communication Reminder	Rejected.	Rejected. X-f XCCDD	Rejected. XCCDD

[3] *Reset Operator Communication Check indicator*
[4] *Reset C&D codes.*

Figure 8-2. Function Operations during X.25 States

Action Taken	Symbol	Dialing Terminal	Symbol	Other Terminals
DIAL key	—Z— # ?	Accepted. Display Dial screen with saved parameters	X 옷 —Z— and —Z— # #	Rejected.
LOCAL key	X 옷 —Z—	Rejected.	X 옷 —Z— and —Z— # #	Rejected.
COMM key	X 옷 —Z—	Rejected.	—Z— # #	Ignored.
DISC key	—Z—	Accepted. (See Note.)	—Z—	Accepted. (See Note)
TEST key	TEST	Accepted. Abort Dial-In.	TEST	Accepted.
ENTER key	—옷—Z— (if ok) X 옷 # ? (if not ok)	Validate input. If OK, accept ENTER key, update parameters, initiate out-going call. (See Note.)	X — f and —Z— # #	Rejected.
CLEAR key	—Z— # ?	Accepted. Display Dial screen with saved parameters.	—Z— # #	Accepted. Clear screen.
PA,PF, ATTN, SYS REQ keys	X — f	Rejected.	X — f and —Z— # #	Rejected.

Note: This indicator is broadcast to all powered terminals.

Figure 8-3. Function Operation in Dial-In State

Part 4. SNA Protocol

This part contains Chapter 9, "SNA PU 2.0 Protocol," which describes the System Network Architecture (SNA) protocol used by the 3174 to communicate with the host.

Functional Description

Chapter 9. SNA PU 2.0 Protocol

Introduction

A dependent LU resides in a type 2 node and requires assistance from the System Services Control Point (SSCP) in VTAM to be operational. The dependent LU cannot send a Bind and uses the SSCP-LU session to request that the primary LU initiate the session.

An independent LU resides in a type 2.1 node and does not require assistance to activate an LU-LU session. There is no SSCP-LU session for an independent LU. The independent LU can send a Bind or receive a Bind to activate a session. Only an LU type 6.2 can be an independent LU. For additional information regarding independent LU 6.2 sessions, see Chapter 18, "Advanced Peer-to-Peer Networking (APPN)."

This chapter describes the following SNA protocol used by 3174 SNA units to communicate with the host over dependent sessions:

- SNA sessions
- SNA commands
- Session processing states
- RU lengths
- Segments
- 3174 errors
- Sessions
- Screen size
- Operation in SSCP-SLU session
- SNA print control
- SNA referral data.

This information helps the system analyst and system programmer in establishing the host-to-3174 communication using SNA protocols. A knowledge of the Network Control Program (NCP) and IBM access methods that support SNA (VTAM, VTAME, TCAM) is assumed.

Additional information on SNA is contained in the *Systems Network Architecture Format and Protocol Reference Manual: Architecture Logic*. Information to help the host programmer plan the use of SNA commands and access method macros is contained in the appropriate access method publications.

See Chapter 14, "3174 Token-Ring and ISDN Support," for information concerning SNA protocol as used by 3174s supporting gateway operations.

Transmission Formats

The host program and the 3174 communicate using half-duplex, flip-flop, send-receive protocols. When the host program or the 3174 is transmitting data, it assumes the role of the sending LU. The LU to which the transmission is directed is the receiving LU. An LU is the logical entity that communicates on behalf of an end user (such as a terminal or application program). The term *outbound* refers to transmissions from the host to the 3174. The term *inbound* refers to transmissions from the 3174 to the host.

The portions of a transmission between the host and the 3174 that are discussed in this chapter are as follows:

Transmission Header (TH)
This header contains format identification, mapping fields, an expedited flow indicator, an origin and destination LU address, and a sequence number.

Request/Response Header (RH)
This header describes the type of message being transmitted and contains indicators that control SNA protocols.

Request/Response Unit (RU)
The RU contains the data or commands that flow in the transmission. (Occasional reference is made to a null RU, that is, an RU that contains no data.)

The 3174 can communicate with the host system by means of a teleprocessing network that uses the SDLC, X.21, X.25, or Token-Ring transmission format. The 3174 may also communicate using channel attachment to a host system. A description of SDLC transmission format is found in *IBM Synchronous Data Link Control General Information*.

Session Components

Within SNA, communication takes place between LUs. For 3174 dependent sessions, the host always contains the primary logical unit (PLU), and the 3174 contains the secondary logical unit (SLU). A maximum of 253 device-oriented SLU addresses can be configured, and the range of those addresses is 2 to 254. Address 0 is associated with the SSCP-PU session, address 1 is a non-device-oriented service SLU, and address 255 is reserved.

A set of logical connections, called *sessions,* is required to control the exchange of data and control information between the host program and a 3174 SLU. At the host system, the access method provides the SSCP function for all sessions that are established with the 3174. The SSCP maintains information that allows a PLU to establish and maintain an LU-LU session with a specific 3174 LU.

SNA Sessions

The sessions that must exist between the host system and the 3174, for an access method application program and the 3174 to exchange information, are as follows:

SSCP-PU (access method— 3174 PU)
SSCP-PLU (access method—host program)
SSCP-SLU (access method— 3174 SLU)
PLU-SLU (host program— 3174 SLU) (referred to as *LU-LU*).

The following topics discuss the sessions individually and identify how they are established and terminated. The SNA commands that establish and terminate the sessions are identified. SNA commands are discussed in detail under "SNA Commands" on page 9-11.

SSCP-PU Session

Before beginning the SSCP-PU (access method— 3174) session, the physical transmission or channel connection to the host must be established. In locally attached systems, the Online/Offline switch must be placed in the Online position before communication can begin between the 3174 and the host.

The SSCP-PU session must be established before the SSCP-SLU or LU-LU sessions can begin. When the access method network operator activates a specific 3174, the access method issues the Activate Physical Unit (ACTPU) command to the controller. The ACTPU command should indicate that FM profile 0 and TS profile 1 session rules are being used on the SSCP-PU session. The SSCP-PU session is the first session established between the host system and the 3174.

The SSCP-PU session is terminated when the access method network operator deactivates the 3174. When all SSCP-LU sessions for the controller have been terminated, the access method issues the Deactivate Physical Unit (DACTPU) command. When the 3174 returns a positive response to the DACTPU command, the SSCP-PU session is terminated.

In locally attached systems, the Online/Offline switch may be placed in the Offline position when the host communication function is terminated.

SSCP-SLU Session

When the SSCP-PU session is established, an activate command may be issued to the access method to establish the SSCP-SLU session. The access method will issue an Activate Logical Unit (ACTLU) for the appropriate SLU or SLUs in the 3174. The ACTLU command should indicate that FM profile 0 and TS profile 1 session rules are being used on the SSCP-LU session. The SSCP-SLU session must be established before the LU-LU session can begin.

The SSCP-SLU session is terminated when the access method sends a Deactivate Logical Unit (DACTLU) command to the specified SLU. When the controller returns a positive response to the DACTLU command, the SSCP-SLU session is terminated.

LU-LU Session

An LU-LU session occurs between two LUs in a SNA network. It provides communication between two end users or between an end user and an LU services component.

Initiating an LU-LU Session

Four types of dependent LU-LU sessions are supported by the 3174. Further description of these sessions is provided later in this section. The LU-LU session types are:

Type 1 The device attached to the 3174 SLU is a printer, and the data stream is either the SCS or is specified by the Data Stream Profile (DSP) of a Function Management Header Type 1 (FMH-1).

Type 2 The device attached to the 3174 SLU is a keyboard/display, and the data stream is in the 3270 data stream compatibility (DSC) mode format.

Type 3 The device attached to the 3174 SLU is a printer, and the data stream is in the 3270 DSC mode format.

Type 6.2 This LU supports the Central Site Change Management (CSCM) function. No devices are supported on this LU type. For details on CSCM, refer to the *3174 Central Site Customizing User's Guide*. An independent LU 6.2 session may also be used for CSCM when APPN is customized. See Chapter 18, "Advanced Peer-to-Peer Networking (APPN)" for further details.

The SNA Bind command is used to differentiate these types of sessions.

The command flow sequence required to establish a session is summarized in Figure 9-1 on page 9-7. The command flow nomenclature is generalized, and access method specific macro names are not used. The example assumes that no sessions are active between the host and the 3174. The access method sends the ACTPU command to establish the SSCP-PU session **1**. ACTLU commands **2** are then sent to establish SSCP-PLU and SSCP-SLU sessions. The SSCP-PLU session can be established with the host application any time before logon. The network is now ready for LU-LU sessions to be established.

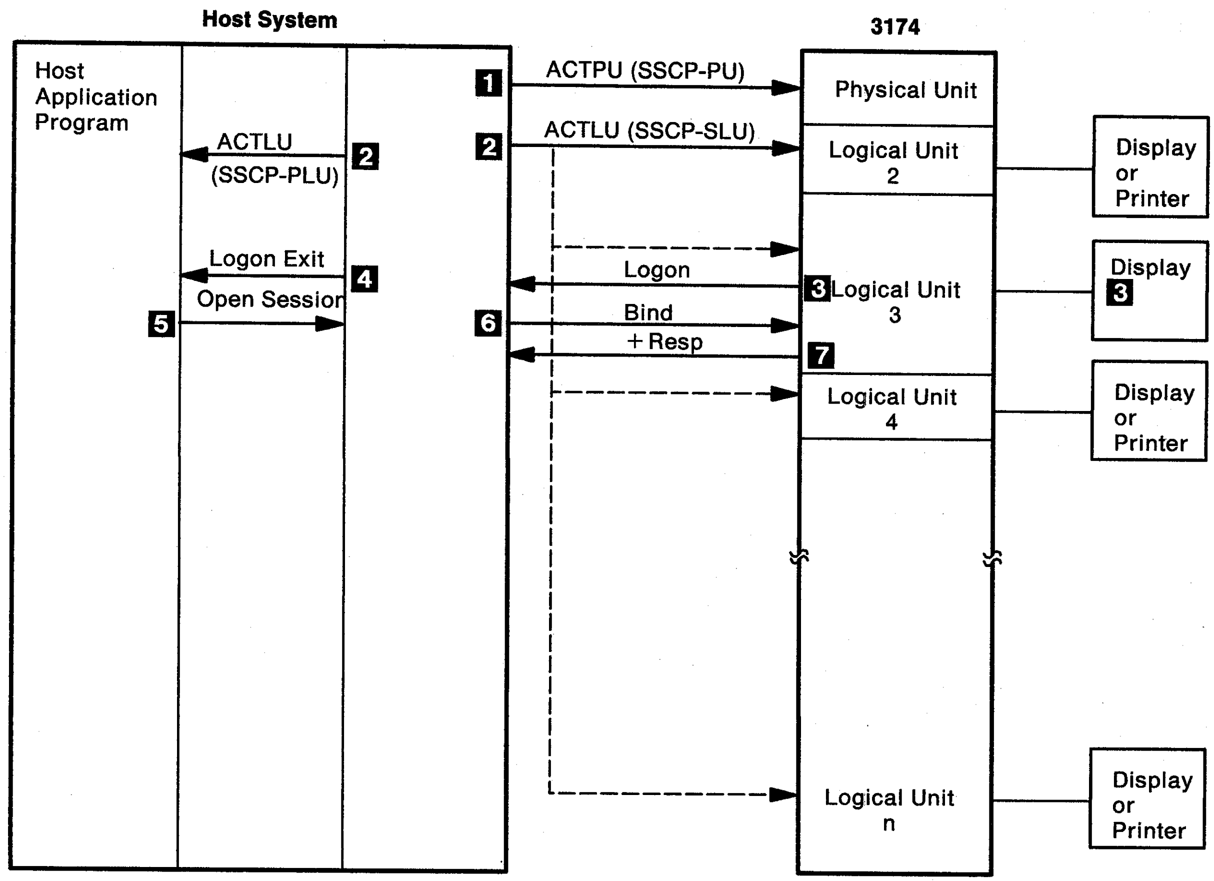


Figure 9-1. Establishing a Session with a 3174

An LU-LU session is started by the host application program when it issues the Bind request. The LU-LU session can be initiated by the host application program (for example, acquiring the terminal or by a simulated logon) or by the display terminal operator 3 (a character-coded logon). If a character-coded logon is received by the access method, the access method translates the logon request and schedules a logon exit 4 for the PLU. After the PLU receives control at the logon exit or when the PLU acquires a terminal, the PLU passes an open session request to the access method 5 which causes an SNA Bind 6 to be passed to the SLU. The 3174 LU examines the session parameters of the Bind. If they are acceptable, it allows the session to be established by sending a positive response 7 to the Bind command. The response to unacceptable or invalid session parameters depends on the LU type. For LU types 1, 2, and 3, the 3174 rejects the Bind command by returning a negative response with a sense code of X'0835'. Also, if power is not on at the device, a negative sense code of X'080A' or X'0845' is returned to the Bind. For LU type 6.2, some session parameters can be negotiated if not acceptable. It is not until after this negotiation fails that the 3174 LU sends a negative response to the Bind command with a sense code of X'0835'. See "Bind Command" on page 9-14 for more details.

For LU types 1, 2, and 3, after the Bind command has been accepted with a positive response, the host program can issue the Start Data Traffic command to allow data traffic to flow for the session.

The manner in which an LU-LU session can be initiated depends on the type of session being started. A type 1, 3, or 6.2 session must be initiated by the PLU. A type 2 session can be initiated by either the PLU or the SLU.

Terminating an LU-LU Session

The PLU can terminate an LU-LU session by requesting that the SSCP close the session. The SSCP then sends an Unbind command to the SLU, and the LU-LU session is terminated.

Type 2 sessions can also be terminated by the display operator in either of two ways. First, the display operator notifies the PLU by entering a logoff message (where supported) on the LU-LU session; the PLU then terminates the session. Second, the display operator changes from an LU-LU session to an SSCP-SLU session by using the SYS REQ function and enters a logoff message. The SSCP then passes the logoff request to the PLU. If the logoff message is conditional, the Unbind may be deferred; if unconditional, the Unbind is issued by the access method on the PLU's behalf.

The SLU terminates an LU-LU session when the following occurs:

- The 3174 detects a segmenting error. The 3174 sends an Unbind request, type X'FE', to the PLU indicating a session protocol error.
- A DFT or an ASCII device loses power. If there is an active LU-LU session, the 3174 terminates the session and sends an Unbind request, type X'0F', indicating session cleanup to the PLU.

  For ASCII devices, a Termself can be sent instead of Unbind if configuration question 711 digit 1 is 1.
- A printer powers up on a port that previously used a CUT device. An Unbind request is sent for the CUT.
- The 3174 passes through an Unbind request from a DFT.
- A pacing overrun occurs on an LU type 1 or an incomplete RH was received for any LU type. The Unbind type is X'FE' indicating a format or protocol error, and sense data is given.

Transmission Header

The 3174 supports FID2 transmission headers (TH). The transmission header consists of 6 bytes:

TH0:	FID (bits 0–3) MPF (bits 4, 5) RES (bit 6) EFI (bit 7)	Format identification Mapping field Reserved Expedited flow indicator
TH1:	RES (bits 0–7)	Reserved
TH2:	DAF (bits 0–7)	Destination address field (See Table 9-1 on page 9-9 and "Addressing Terminals" on page 1-6.)
TH3:	OAF (bits 0–7)	Origin address field
TH4,5:		Sequence number on normal flow requests and responses, ID number on expedited flow requests and responses.

The 3174 handles transmission headers received on outbound requests as follows:

- All reserved parameters are ignored on requests.
- Mapping Field (MPF)—The 3174 supports segmenting for FM data.
- Expedited Flow Indicator (EFI)—The expedited flow indicator identifies normal (0) or expedited (1) flow requests.

Table 9-1 shows the default device addressing scheme for SNA terminals. Device addresses can be specified at customization if the default addressing scheme is not desired.

Table 9-1. Device Addressing for SNA Terminals

Device Number	Device Address	Device Number	Device Address
PU	0	15	17
*	1	16	18
0	2	17	19
1	3	18	20
2	4	19	21
3	5	20	22
4	6	21	23
5	7	22	24
6	8	23	25
7	9	24	26
8	10	25	27
9	11	26	28
10	12	27	29
11	13	28	30
12	14	29	31
13	15	30	32
14	16	31	33

Note: A maximum of 253 logical terminals are addressable with MIS/MLT support.
* Non-device-oriented service SLU

Expedited Flow Requests (EFI = 1)

The 3174 supports the following requests as outbound expedited flow requests:

RU Category	Request
SC	ACTPU, DACTPU, ACTLU, DACTLU, Bind, Unbind, Clear, SDT, CRV
NC	Not supported
DFC	Signal, Shutdown
FMD	Not supported.

When the 3174 receives any requests listed above with correct categories and EFI = 1, they are passed through for further processing.

Normal Flow Requests (EFI = 0)

The 3174 supports the following requests as outbound normal flow requests:

RU Category	Normal Request
SC	Not supported
NC	Not supported
DFC	Cancel, Bid, Chase, RTR, LUSTAT
FMD on PLU-SLU	Any request
FMD on SSCP-SLU	Any in SCS format
FMD on SSCP-PU	REQMS/NMVT.

When the 3174 receives any of the requests listed above associated with the correct categories and EFI = 0, they are passed through for further processing.

Function Management Header Type 1 (FMH-1)

For LU type 1 sessions, a Function Management Header type 1 (FMH-1) may be used to identify the data stream being sent to, or being received from, a printer. The DSP field contained within the FMH-1 is used for this purpose.

A DSP value of X'B' identifies a structured field data stream; X'C' identifies a DCA-L2 data stream; X'D' identifies an IPDS data stream. Not all printers attached to the 3174 may support all DSP values; therefore, refer to the appropriate printer publication for usage.

Sessions on which an FMH-1 may be used must be established with a Bind whose byte 6 bit 1 is set to 1. If the session is being established to a printer not equipped to handle an FMH-1, the Bind is rejected with a sense code of X'0835'.

If an FMH-1 is sent to a printer that is equipped to handle an FMH-1, but the FMH-1 contains invalid parameters, the FMH-1 is rejected with a sense code of X'1008'.

Null RUs, whose RH indicates *formatted,* sent by the host to a printer bound as LU1 which supports FM headers, will be rejected with a sense code of X'1008' (invalid FM header).

If an FMH-1 is sent to a printer whose session was established with a Bind whose byte 6 bit 1 is set to 0, the FMH-1 is rejected with a sense code of X'400F'.

Function Management Header Type 5 (FMH-5) (LU Type 6.2 Only)

LU type 6.2 uses this header to carry a request for a conversation to be established between two transaction programs. This header, commonly referred to as an *Attach,* identifies the transaction program that is to be put into execution and connected to the receiving half-session. When a transaction program issues an Allocate verb naming a transaction program to be run at the other end of the conversation, an Attach FMH-5 carries the transaction program name (TPN) to the receiving LU.

Function Management Header Type 7 (FMH-7) (LU Type 6.2 Only)

LU type 6.2 uses this header, following a negative response with sense X'0846', to carry specific information that relates to the error on the session or conversation. For example, an FMH-7 is sent when an FMH-5 Attach specifies a nonexistent transaction program name.

Refer to the *SNA Formats Reference Summary* for specific byte layouts and detailed descriptions of all the FM header formats.

SNA Commands

SNA commands define a set of controls to establish and terminate sessions and to assist in the management of host-to-3174 data flow and sessions.

The three types of SNA commands are as follows:

- Session Control (SC) commands, which establish and terminate sessions in the network.
- Data Flow Control (DFC) commands, which control the flow of data in an LU-LU session.
- Function Management Data (FMD) commands, which are used to transfer data in the LU-LU session, SSCP-LU session, and SSCP-PU session.

Description of Commands Supported

The SNA commands supported by the 3174 are listed in Table 9-2 on page 9-12. The letter X under the session types indicates the originator of the command. Descriptions of the supported commands follow the table.

Table 9-2. SNA Commands Supported by the 3174

SNA Command		Session Type					
Name	Type	SSCP -	PU	SSCP -	SLU	PLU -	SLU
ACTPU	SC	X					
DACTPU	SC	X					
ACTLU	SC			X			
DACTLU	SC			X			
Bind	SC					X	
Unbind	SC					X	X
SDT	SC					X[3]	
CRV	SC					X[3]	
Clear	SC					X[3]	
Cancel	DFC					X[3]	X[3]
Chase	DFC					X[3]	
LUSTAT	DFC					X[4]	X
SHUTD	DFC					X[3]	
SHUTC	DFC						X[3]
RTR	DFC						X[1]
Bid	DFC					X[3]	
Signal	DFC					X[3]	X[2]
BIS	DFC					X[4]	
Data	FMD					X	X
REQMS	FMD	X					
RECFMS	FMD		X				
Notify	FMD				X[3]		
NMVT (Alert)	FMD		X				
NMVT (RTM)	FMD	X	X				
NMVT (PSID)	FMD	X	X				
NMVT (CMIP)[5]	FMD		X				
TERMSELF	FMD				X		

Notes:

[1] SLU types 1 and 3 3174 configured for between-bracket printer sharing, and LU type 6.2 sessions.
[2] Only SLU types 1 and 2
[3] Only SLU types 1, 2, and 3
[4] Only SLU type 6.2
[5] NMVT (CMIP) will only be sent when the 3174 is customized as an ISDN Gateway.

Session Control (SC) Commands

This section describes the Session Control commands and the Bind Command session parameters that are used with various LUs.

Activate Physical Unit (ACTPU) Command

The ACTPU command is sent by the access method to establish the SSCP-PU session with a 3174. The SSCP-PU session is established when the 3174 returns a positive response to the ACTPU command.

The ACTPU command can be transmitted when the SSCP-SLU and LU-LU sessions are active, for example, when an NCP restart procedure occurs. When the 3174 receives the ACTPU command, it is processed differently depending on the type of ACTPU command and the status of the SSCP-PU session. When an ACTPU ERP is received with no SSCP-PU session active, or when an ACTPU¬ERP is received, all active SSCP-LU and LU-LU sessions are terminated immediately.

Note: Once an SSCP-PU or SSCP-LU session is established, the 3174 considers these sessions active until it receives a DACTPU, DACTLU, or link level

DISCONNECT. For example, if the owning VTAM goes away, there are no SSCP sessions because there is no SSCP. But, if the network does not explicitly tell the 3174 that it no longer has an owner, the 3174 still believes that it has SSCP-PU and SSCP-LU sessions. When and ACTPU ERP is received with the SSCP-PU session already active, the SSCP-LU and LU-LU sessions are not affected. Regardless of the type of ACTPU command received, the 3174 returns a positive response and the SSCP-PU session is re-established.

Deactivate Physical Unit (DACTPU) Command

When the 3174 receives the DACTPU command, all active LU-LU and SSCP-SLU sessions and the SSCP-PU session are terminated. If a command other than ACTPU or DACTPU is received after a positive response has been returned for the DACTPU command, the 3174 returns a negative response with sense data indicating PU not active (sense code X'8008').

Activate Logical Unit (ACTLU) Command

The ACTLU command is sent by the access method to establish the SSCP-SLU session with a 3174 controller LU. The SSCP-SLU session is established when the 3174 returns a positive response to the ACTLU command. The SSCP-PU session must be established prior to the receipt of ACTLU to allow the 3174 to return a positive response to this command. If the 3174 receives a command other than ACTPU, ACTLU, DACTPU, DACTLU, or Unbind before the SSCP-LU session is established, a negative response code of X'8009' is returned indicating LU not active. A positive response is returned to an ACTLU, DACTLU, or Unbind command only if the SSCP-PU session is active. Note that the SLU is in the 3174 and that the session can be activated without a display or printer being powered on or attached.

When the 3174 receives the ACTLU command, it is processed differently depending on the type of ACTLU command and the status of the SSCP-LU session. When an ACTLU ERP is received with no SSCP-LU session active, or when an ACTLU¬ERP is received, the active LU-LU session is terminated immediately. When an ACTLU ERP is received with the SSCP-LU session already active, the SSCP-LU session is put into contention state and any active LU-LU session is not affected. Regardless of the type of ACTLU command received, the 3174 returns a positive response and the SSCP-LU session is established again.

Note: Once an SSCP-PU or SSCP-LU session is established, the 3174 considers these sessions active until it receives a DACTPU, DACTLU, or link level DISCONNECT. For example, if the owning VTAM goes away, there are no SSCP sessions because there is no SSCP. But, if the network does not explicitly tell the 3174 that it no longer has an owner, the 3174 still believes that it has SSCP-PU and SSCP-LU sessions. The ACTLU positive response will include the X'0C' vector. For the format of the X'0C' vector, see “Notify Command (LU Types 1, 2, and 3)” on page 9-29.

Deactivate Logical Unit (DACTLU) Command

Receipt of this command terminates the SSCP-SLU session. If an LU-LU session is established when the DACTLU command is received, the session is terminated. When the 3174 receives a command other than ACTPU, ACTLU, DACTPU, DACTLU, or Unbind after a positive response has been returned for the DACTLU command, a negative response of X'8009' is returned indicating SLU not active.

Bind Command

This command is sent by the access method to request an LU-LU session between an application program and a 3174 SLU. The 3174 returns a positive response to establish the LU-LU session. When the session cannot be established, the 3174 returns a negative response with sense data that describes the reason the session was rejected.

The 3174 examines session parameters that are received with the Bind command. The required values depend on the type of session established. Table 9-3 on page 9-15 provides a detailed description of the session parameters that are sent with the Bind command for LU types 1, 2, and 3. Table 9-4 on page 9-17 provides a detailed description of the session parameters that are sent with the Bind command for LU Type 6.2, and Table 9-5 on page 9-20 shows the 3174's response to the LU type 6.2 Bind command.

When the SSCP-SLU session is established and the 3174 receives a command that flows on the LU-LU session other than Bind or Unbind, a negative response is returned with sense data indicating no session established (sense code X'8005').

For LU types 1, 2, and 3, if the device attached does not have power or is physically detached from the 3174 port, a negative response is returned with sense data indicating power off (sense code X'0845' or X'080A').

When an LU-LU session exists (a Bind command has been accepted), and the 3174 receives a subsequent Bind command for the LU, a negative response is returned with sense code X'0805' that indicates that the session limit has been exceeded.

Session parameters included in the Bind command RU define the protocols that govern the session. The following tables describe the contents of the Bind command RU that are supported by the 3174 and explain how the session parameters are used. A generalized setting for the access method logmode table is listed under "Bind Default" on page 9-57. Also listed (under "Bind Check" on page 9-59) are the checks that the 3174 makes when the Bind command is received. Specific customer optimization or device features may require changes for each installation.

The 3174 checks certain bytes of the Bind command to make sure they contain valid parameters. For LU types 1, 2, and 3, if the controller finds a parameter invalid, it returns a negative response containing sense code X'0835'. For LU type 6.2, the Bind command is not necessarily rejected when certain session parameters are unacceptable. LU type 6.2 supports Bind negotiation, which means it will alter those unacceptable session parameters and return the new negotiated values with a positive response to the Bind. If the Bind sender does not accept these negotiated values, it will send an Unbind command.

For the session parameters that cannot be negotiated, the LU type 6.2 Bind is rejected by the controller with a negative response containing sense code X'0835DDDD', where DDDD indicates the offset value of the Bind byte in error. An exception to this is when the Bind is rejected with sense code X'080F6051', which means the controller detected a random data or enciphered data subfield in the user data field.

Table 9-3 (Page 1 of 3). Bind Command Session Parameters for LU Types 1 – 3			
Byte	**Bit**	**Content**	**Meaning**
0		X'31'	Identifies this RU as a Bind command.
1		X'01'	Bind type and format.
2		X'03'	FM profile. Specifies that the data flow control commands and the request/response protocols that are to be used for this session conform to FM Profile 3.
3		X'03'	TS profile. Specifies that the 3174 conforms to TS Profile 3; that is, pacing and sequence numbers are used with normal flow transmission and that data traffic is controlled by the Clear and Start Data Traffic commands.
4			Primary LU Protocols:
	0	B'0'	The PLU can send only single-element chains.
		B'1'	The PLU can send single- or multiple-element chains.
	1	B'0'	Immediate request mode is used. Only one definite response can be outstanding at a time. That response must be received before the PLU can send another RU.
	2,3	B'01'	The PLU can request only exception-only responses.
		B'10'	The PLU can request only definite responses.
		B'11'	The PLU can request definite or exception-only responses.
	4,5	B'00'	Reserved
	6	B'0'	The PLU cannot send compressed data (LU Types 1, 2, and 3).
		B'1'	The PLU can send compressed data (LU Type 1 only).
	7	B'1'	The PLU can send End Bracket.
5			Secondary LU Protocols:
	0	B'0'	The 3174 can send only single-element chains (LU types 1 and 3).
		B'1'	The 3174 can send single- or multiple-element chains (LU types 1, 2, and 3).
	1	B'0'	Immediate request mode is used. The 3174 can issue a request for a definite response. No further transmissions are sent until the 3174 receives the requested response.
	2,3	B'01'	The 3174 can request only exception-only responses.
		B'10'	The 3174 can request only definite responses.
		B'11'	The 3174 can request either definite or exception-only responses.
	4,5	B'00'	Reserved
	6	B'0'	The 3174 cannot send compressed data.
	7	B'0'	The 3174 cannot send End Bracket.
6			Common Protocols:
	0		Ignored
	1	B'0'	The PLU and the 3174 cannot exchange FM headers.
		B'1'	The PLU and the 3174 can exchange FM headers.
	2	B'1'	Bracketed session is used. Both the PLU and the 3174 must use bracket protocols.
	3	B'1'	Bracket termination rule 1 is used (refer to "Bracket Protocol (LU Types 1, 2 and 3)" on page 9-26 for a description of bracket termination rule 1).
	4	B'0'	Both the PLU and the 3174 must use EBCDIC.
		B'1'	Both the host program and the 3174 can use an alternate code (for example, ASCII).
	5,6	B'00'	Reserved
	7		Ignored

Table 9-3 (Page 2 of 3). Bind Command Session Parameters for LU Types 1 – 3			
Byte	**Bit**	**Content**	**Meaning**
7			Common Protocols:
	0,1	B'10'	This session uses half-duplex, flip-flop (HDX FF) transmissions. Refer to "Session Processing States (LU Types 1, 2, and 3)" on page 9-41.
	2	B'0'	The PLU is responsible for error recovery.
	3	B'0'	The 3174 is always the first speaker.
	4,5		Ignored
	6	B'0'	Reserved
	7	B'0'	Contention (simultaneous transmissions from the host program and the 3174) is resolved in favor of the 3174.
8	0		Ignored
	1	B'0'	Reserved
	2 – 7		Secondary-to-primary LU pacing count. If set to zeros, pacing is not used.
9	0,1	B'00'	Reserved
	2 – 7		The primary-to-secondary pacing value defines the number of RUs that may be received by the 3174 before a pacing response must be returned to indicate readiness for another block of RUs. If set to zeros, pacing is not used. See "Pacing" on page 9-31 for recommendations of pacing values.
10			Maximum RU size sent by the secondary LU. This value represents the largest RU that can be sent by the 3174. It is expressed as a mantissa (8 through F) and an exponent value of 2 by which the mantissa is multiplied. For example, when the mantissa is specified as 8 and the exponent of 2 is 5 (hex 85), the RU size represented is 256 bytes. Examples of mantissa and exponent values used by the 3174 are shown below with the RU size they represent: 85 = 256 86 = 512 C6 = 768 87 = 1024 A7 = 1280 C7 = 1536 E7 = 1792 88 = 2048 See "Request/Response Unit (RU) Size Restrictions" on page 9-44 for detailed information about values supported by the 3174.
11			Maximum RU size sent by the primary LU. This value represents the largest RU that can be sent by the PLU and is specified in the same format as for the secondary LU (byte 10). See "Request/Response Unit (RU) Size Restrictions" on page 9-44 for detailed information about values supported by the 3174.
12,13			Ignored by the 3174
For SLU Type 1:			
14		X'01'	Session type 1
15,16			Ignored
17	7	B'1'	The Read Partition-Query and Query Reply structured fields are supported by the secondary logical unit. Not checked by the 3174, but is accepted.
18		X'E1'	Sent but not checked by the 3174 for LU type 1.
19			Ignored
20 – 25			Not supported for LU type 1.

Table 9-3 (Page 3 of 3). Bind Command Session Parameters for LU Types 1−3			
Byte	**Bit**	**Content**	**Meaning**
For SLU Types 2 and 3:			
14		X'02'	Session type 2
		X'03'	Session type 3
15	0	B'1'	The Read Partition-Query and Query Reply structured fields are supported by the secondary logical unit. Not checked by the 3174, but is accepted.
16−19		X'0000 0000'	Reserved
20−25			See Table 2-6 on page 2-10 for LU Type 2; Table 2-9 on page 2-14 for LU type 3.
For all SLU Types:			
26—K			Cryptography Options (Encrypt/Decrypt)
K+			Ignored

Table 9-4 shows the parameters for the dependent LU type 6.2 Bind command. No devices are supported by LU type 6.2. It supports only the Central Site Change Management (CSCM) function. For more information on CSCM, refer to the *3174 Central Site Customizing User's Guide.*

Table 9-4 (Page 1 of 4). Bind Command Session Parameters for LU Type 6.2			
Byte	**Bit**	**Content**	**Meaning**
0		X'31'	Identifies this RU as a Bind command.
1	0−3	X'0'	Format 0000
	4−7	X'0'	Type negotiable
2		X'13'	Function Management (FM) profile 19
3		X'07'	Transmission Services (TS) profile 7
4			Primary LU Protocols:
	0	B'1'	The PLU can send single- or multiple-element chains.
	1	B'0'	Immediate request mode is used. Only one definite response can be outstanding at a time. That response must be received before the PLU can send another RU.
	2,3	B'11'	The PLU can request definite or exception-only responses.
	4−6	B'000'	Reserved
	7	B'0'	The PLU cannot send End Bracket.
5			Secondary LU Protocols:
	0	B'1'	The 3174 can send single- or multiple-element chains.
	1	B'0'	Immediate request mode is used. The 3174 can issue a request for a definite response. No further transmissions are sent until the 3174 receives the requested response.
	2,3	B'11'	The 3174 can request either definite or exception-only responses.
	4−6	B'000'	Reserved
	7	B'0'	The 3174 cannot send End Bracket.

Table 9-4 (Page 2 of 4). Bind Command Session Parameters for LU Type 6.2

Byte	Bit	Content	Meaning
6			Common Protocols:
	0	B'0'	The PLU supports receiving segmented RUs.
		B'1'	The PLU does not support receiving segmented RUs.
	1	B'1'	The PLU and the 3174 can exchange FM headers.
	2	B'0'	Brackets are used and reset states are in-bracket.
	3	B'1'	Bracket termination rule 1 is used.
	4 *	B'0'	Both the PLU and the 3174 must use EBCDIC.
		B'1'	Both the host program and the 3174 can use an alternate code (for example, ASCII).
	5,6	B'00'	Reserved
	7	B'0'	The 3174 is not permitted to queue the Bind response.
		B'1'	The 3174 is permitted to queue the Bind response for an indefinite period.
7			Common Protocols:
	0,1	B'10'	This session uses HDX FF transmissions.
	2	B'1'	The PLU and 3174 are both responsible for error recovery (see note 1).
	3 *	B'0'	The 3174 is contention winner.
		B'1'	The PLU is contention winner.
	4,5	B'00'	Reserved if EBCDIC is used.
		B'01'	If alternate code is used, B'01' indicates ASCII-8 as the alternate code.
	6	B'0'	Reserved
	7	B'1'	HDX FF reset state is *send* for the PLU and *receive* for the 3174.
8	0		Staging indicator for the 3174 to PLU:
		B'0'	One-stage pacing
		B'1'	Multiple-stage pacing
	1	B'0'	Reserved
	2−7		The 3174's send pacing window size
9	0,1	B'00'	Reserved
	2−7 *		The 3174's receive pacing window size (see note 2).
10	0	B'1'	Indicates a maximum RU size is specified.
	1−7		Maximum RU size sent on normal flow by the 3174. See "Request/Response Unit (RU) Size Restrictions" on page 9-44 for detailed information about values supported by the 3174.
11	0	B'1'	Indicates a maximum RU size is specified.
	1−7 *		Maximum RU size sent on normal flow by the PLU (see note 3). See "Request/Response Unit (RU) Size Restrictions" on page 9-44 for detailed information about values supported by the 3174.
12	0		Staging indicator for the PLU to 3174:
		B'0'	Multiple-stage pacing
		B'1'	One-stage pacing
	1	B'0'	Reserved
	2−7 *		The PLU's send pacing window size.
13	0,1	B'00'	Reserved
	2−7		The PLU's receive pacing window size.
14	0	B'0'	Basic PS usage format
	1−7	B'000 0110'	LU type 6
15		X'02'	Level 2 of LU type 6
16—22			Reserved

Table 9-4 (Page 3 of 4). Bind Command Session Parameters for LU Type 6.2			
Byte	**Bit**	**Content**	**Meaning**
23	0−2	B'000'	Retired
	3	B'0'	Access Security Information field is not accepted on incoming FMH-5s.
		B'1'	Access Security Information field is accepted on incoming FMH-5s.
	4 *	B'0'	Validation of RU integrity checking is not supported.
		B'1'	Validation of RU integrity checking is supported.
	5	B'0'	Reserved
	6	B'0'	Already Verified indicator is not accepted on incoming FMH-5s.
		B'1'	Already Verified indicator is accepted on incoming FMH-5s.
	7	B'0'	Persistent verification capability is not supported.
		B'1'	Persistent verification capability is supported.
24	0	B'0'	Reserved
	1,2 *	B'01'	Confirm synchronization level is supported.
		B'10'	Confirm, sync point, and backout synchronization levels are supported.
	3 *	B'0'	Reconnect is not supported.
		B'1'	Reconnect is supported.
	4,5 *		Responsible for reinitializing a session following a session outage:
		B'00'	Operator
		B'01'	PLU
		B'10'	3174
		B'11'	Either PLU or 3174.
	6 *	B'0'	Parallel sessions are not supported between the PLU and 3174.
		B'1'	Parallel sessions are supported between the PLU and 3174.
	7 *	B'0'	Change number of sessions is not supported.
		B'1'	Change number of sessions is supported.
25	0	B'0'	Priority session allocation for resynchronization is not supported.
		B'1'	Priority session allocation for resynchronization is supported.
	1−7	B'000 0000'	Reserved
26	0,1	B'00'	Reserved
	2,3	B'00'	Session-level cryptography is not supported.
	4−7	B'0000'	Session-level cryptography is not specified. The following cryptography option fields are omitted.
27−m			Length and Primary LU name
m+1 − n			Length and User data (see note 4)
n+1 − p			Length and User Request Correlation value

Table 9-4 (Page 4 of 4). Bind Command Session Parameters for LU Type 6.2			
Byte	**Bit**	**Content**	**Meaning**
p+1 − r			Length and Secondary LU name

* Indicates a negotiated field.

Notes:

1. Recovery − Byte 7 bit 2 should be set for symmetric responsibility for recovery. However, the Bind request must come from the PLU since no dependent Bind request can be sent by the 3174.
2. 3174's receive pacing window size − If a value of zero is received in the Bind request, the Bind will be rejected with a X'0835' sense code.
3. PLU send maximum RU size − If a value is received in the Bind request for an RU size of less than 256 bytes, the Bind will be rejected with a X'0835' sense code.
4. User data:

Mode name	Prior to release C1.0, if a mode name of SNASVCMG is received in the Bind request, the Bind is rejected with a X'0835' sense code. Starting with release C1.0, the Bind will be rejected with a X'0835' sense code if the mode name is anything but BATCH or #BATCH.
Random data	If the random data subfield is present in the Bind request, the Bind is rejected with a X'080F6051' sense code.
Enciphered data	If the enciphered data subfield is present in the Bind request, the Bind is rejected with a X'080F6051' sense code.

Table 9-5 shows the 3174 response to the dependent Bind command for LU type 6.2.

Table 9-5 (Page 1 of 3). 3174 Response to the LU Type 6.2 Bind Command			
Byte	**Bit**	**Content**	**Meaning**
0		X'31'	Identifies this RU as a response to a Bind command.
1	0−3	X'0'	Format 0000
	4−7	X'0'	Type negotiable
2		X'13'	FM profile 19
3		X'07'	TS profile 7
4			Primary LU Protocols:
	0	B'1'	The PLU can send single- or multiple-element chains.
	1	B'0'	Immediate request mode is used. Only one definite response can be outstanding at a time. That response must be received before the PLU can send another RU.
	2,3	B'11'	The PLU can request definite or exception-only responses.
	4−6	B'000'	Reserved
	7	B'0'	The PLU cannot send End Bracket.
5			Secondary LU Protocols:
	0	B'1'	The 3174 can send single- or multiple-element chains.
	1	B'0'	Immediate request mode is used. The 3174 can issue a request for a single definite response. No further transmissions are sent until the 3174 receives the requested response.
	2,3	B'11'	The 3174 can request either definite or exception-only responses.
	4−6	B'000'	Reserved
	7	B'0'	The 3174 cannot send End Bracket.

Table 9-5 (Page 2 of 3). 3174 Response to the LU Type 6.2 Bind Command

Byte	Bit	Content	Meaning
6			Common Protocols:
	0	B'0'	The 3174 supports receiving segmented RUs.
	1	B'1'	The PLU and the 3174 can exchange FM headers.
	2	B'0'	Brackets are used and reset states are in-bracket.
	3	B'1'	Bracket termination rule 1 is used.
	4	B'0'	Both the PLU and the 3174 must use EBCDIC.
	5,6	B'00'	Reserved
	7	B'0'	The 3174 will not queue the Bind response.
7			Common Protocols:
	0,1	B'10'	This session uses HDX FF transmissions.
	2	B'1'	The PLU and 3174 are both responsible for error recovery (see note 1).
	3	B'0'	The 3174 is contention winner.
	4–6	B'000'	Reserved
	7	B'1'	HDX FF reset state is *send* for the PLU and *receive* for the 3174.
8	0		Staging indicator for the 3174 to PLU (see note 2):
		B'0'	One-stage pacing
		B'1'	Multiple-stage pacing
	1	B'0'	Reserved
	2–7		The 3174's send pacing window size (see note 3).
9	0,1	B'00'	Reserved
	2–7		The 3174's receive pacing window size (see note 4).
10	0	B'1'	Indicates a maximum RU size is specified.
	1–7		Maximum RU size sent on normal flow by the 3174 (see note 5). See "Request/Response Unit (RU) Size Restrictions" on page 9-44 for detailed information about values supported by the 3174.
11	0	B'1'	Indicates a maximum RU size is specified.
	1–7		Maximum RU size sent on normal flow by the PLU (see note 5). See "Request/Response Unit (RU) Size Restrictions" on page 9-44 for detailed information about values supported by the 3174.
12	0		Staging indicator for the PLU to 3174 (see note 2):
		B'0'	Multiple-stage pacing
		B'1'	One-stage pacing
	1	B'0'	Reserved
	2–7		The PLU's send pacing window size (see note 6).
13	0,1	B'00'	Reserved
	2–7		The PLU's receive pacing window size (see note 7).
14	0	B'0'	Basic PS usage format
	1–7	B'000 0110'	LU type 6
15		X'02'	Level 2 of LU type 6
16–22			Reserved
23	0–2	B'000'	Retired
	3	B'0'	Access Security Information field is not accepted on incoming FMH-5s.
	4	B'0'	Validation of RU integrity checking is not supported.
	5	B'0'	Reserved
	6	B'0'	Already Verified indicator is not accepted on incoming FMH-5s.
	7	B'0'	Persistent verification capability is not supported.

Table 9-5 (Page 3 of 3). 3174 Response to the LU Type 6.2 Bind Command			
Byte	**Bit**	**Content**	**Meaning**
24	0	B'0'	Reserved
	1,2	B'01'	Confirm synchronization level is supported.
	3	B'0'	Reconnect is not supported.
	4,5	B'01'	The PLU is responsible for reinitializing a session following a session outage.
	6	B'0'	Parallel sessions are not supported between the PLU and 3174
	7	B'0'	Change number of sessions is not supported.
25	0	B'0'	Priority session allocation for resynchronization is not supported.
	1−7	B'000 0000'	Reserved
26	0,1	B'00'	Reserved
	2,3	B'00'	Session-level cryptography is not supported.
	4−7	B'0000'	Session-level cryptography is not specified. The following cryptography option fields are omitted.
27		X'00'	Length of Primary LU name (none)
28−n			Length and User data (see note 8)

Notes:

1. Recovery − Byte 7 bit 2 should be set for symmetric responsibility for recovery. However, the Bind request must come from the PLU since no dependent Bind request can be sent by the 3174.
2. Staging indicators − These values are copied from the Bind request.
3. 3174's send pacing window size − This value is copied from the Bind request.
4. 3174's receive pacing window size − This value, *n*, is chosen according to the algorithm (2n-1) * RUSIZE ≤ 4K (8K for Models 12L and 22L), where RUSIZE is the PLU send maximum RU size returned in the Bind response. It is not negotiated up in value. If a value of zero is received in the Bind request, the Bind is rejected with an X'0835' sense code.
5. Maximum RU size:

   3174 send — This value is copied from the Bind request.

   PLU send — This value is the smaller of the value in the Bind request and the value which indicates an RU size of 4096 bytes (8192 bytes for Models 12L and 22L). This value must indicate an RU size of at least 256 bytes. Otherwise, the Bind is rejected with a X'0835' sense code.
6. PLU's send pacing window size − This value is set to equal the 3174's receive pacing window size if one-stage pacing is specified. Otherwise, the window size is copied from the Bind request.
7. PLU's receive pacing window size − This value will be copied from the Bind request.
8. User Data:

   Unformatted data — If this subfield is present in the Bind request, an unformatted data subfield of length X'01' is returned in the Bind response.

   Mode name — If this subfield is present in the Bind request, it will be copied into the Bind response.

   Session instance identifier — If this subfield is present in the Bind request, it will be copied into the Bind response and the high-order byte of the identifier will be set if necessary.

   Fully-qualified SLU network name — This subfield is returned in the Bind response. The value returned in this subfield corresponds to the values entered for 3174 customizing questions 501 and 502.

Unbind Command

Receipt of this command directs the 3174 to terminate the LU-LU session between a host program and a 3174 SLU. The LU-LU session is terminated when the 3174 returns a positive response to the Unbind command. This command can be sent by the 3174. (See "Terminating an LU-LU Session" on page 9-8 for more information.)

Start Data Traffic (SDT) Command (LU Types 1, 2, and 3)

This command allows data traffic to flow during an LU-LU session. The SDT command must be issued after a Bind command has established the LU-LU session. This command is also sent after the Clear command to complete a session resynchronization sequence with the 3174. SDT is valid only when the data-traffic-reset state is active for an LU-LU session.

To complete a session resynchronization sequence, the host program must request transmission of the SDT command from the access method.

Cryptographic Request Verification (CRV) Command (LU Types 1, 2, and 3)

This command verifies session level cryptography between the PLU and SLU. This command is supported by Configuration Support A and S only on Models 1R and 2R.

Clear Command (LU Types 1, 2, and 3)

Receipt of the Clear command causes the 3174 to enforce the data-traffic-reset state upon the LU-LU session. The Clear command also causes the 3174 to initialize all inbound and outbound transmission buffers. When data-traffic-reset state is activated for an LU-LU session, only the following commands are valid for that session: Clear, Unbind, and SDT.

Data Flow Control (DFC) Commands

This section describes the 3174 data flow control commands.

Cancel Command (LU Types 1, 2, and 3)

Normal SNA use of this command directs the receiver to discard all elements of the chained transmission being received. However, the 3174 processes data RUs to the display or printer as they are received without waiting until end-of-chain. Therefore, the Cancel command only serves to provide a proper termination for an otherwise incomplete chain. A Cancel command received between chains does not affect the chain state. However, it may affect the bracket or direction states depending on the presence of an end bracket (EB) or change direction (CD) in the RH. Processing of a chained transmission is terminated when the Cancel command is received. EB or CD may be sent with the command.

When a chained transmission is in progress and the 3174 returns a negative response to an element of that chain, the PLU should terminate that chained transmission by issuing the Cancel command if the last chain element has not already been sent to the 3174.

When sent by the 3174 type 2 SLU, the Cancel command directs the PLU to stop processing a chained transmission and to discard all elements of the chain that are currently being received. The Cancel command is substituted for the end of the chain if a 3178, 3278, or 3279 failure or operator action prevents transfer of all data from the display to the 3174.

When the PLU returns a negative response for an element of a chain, the following will happen:

- *For a 3174 when inbound pacing is not used,* the entire chain is transmitted before the PLU response is examined. The Cancel command is not sent.
- *For a 3174 when inbound pacing is used,* the negative response from the PLU will be examined only if the 3174 must look for a pacing response. If the negative response is examined, the 3174 sends the Cancel command and does not transmit the remaining elements in the chain. If the negative response is not examined, the entire chain is transmitted and the Cancel command is not sent.

In either case, the PLU should discard all elements of a chained transmission after sending a negative response.

Chase Command (LU Types 1, 2, and 3)

Chase is used to confirm that all preceding requests have passed through the network and have been processed. When this command is received, the 3174 returns a positive response to the PLU, indicating all previous chains have been processed.

The PLU should complete or cancel the current chained transmission before issuing the Chase command. When a chained transmission is sent with exception-only responses requested, the Chase command can be used to verify that all responses for that chain have been received. The EB or CD indicators can be issued with the Chase command.

LU Status Command (LUSTAT)

For LU types 1, 2, and 3, the 3174 SLU sends the LUSTAT command to notify the PLU that a processing error has been detected or that a change in the operational status of a device has occurred. A 4-byte status code is sent by the 3174 SLU to describe the error condition or the device status change.

For LUSTAT codes and conditions that determine which LUSTAT is sent, see "Logical Unit Status (LUSTAT) (LU Types 1, 2, and 3)" on page 9-61.

For LU type 6.2, LUSTAT is used to accompany RH bits. It is sent by the PLU or 3174 SLU when a transmission is between chains and RH bits need to be sent but there is no data to be sent.

Shutdown Command (LU Types 1, 2, and 3)

The PLU sends the Shutdown command. Receipt of this command directs the 3174 SLU to prepare for a session termination sequence. The 3174 returns a positive response to the PLU, but data-transfer sequences are not inhibited.

The Shutdown command causes the session to enter shutdown-complete-pending state. The pending state is maintained until the SLU completes normal flow processing and goes between bracket (BETB). The SLU then sends the Shutdown Complete command to the PLU.

Shutdown Complete Command (LU Types 1, 2, and 3)

This command is sent by the 3174 after the Shutdown command has been received from the host program and an EB has caused the SLU to go to BETB state.

When the Shutdown Complete command is sent to the PLU, the session enters Shutdown Complete state. When Shutdown Complete state is active, no data transmissions can be sent to the PLU. The PLU, however, may continue to send data to the 3174.

The PLU may either terminate the session using the Unbind command when the Shutdown Complete command is received from the 3174 or use Shutdown as a means of stopping traffic. Exit from Shutdown Complete state requires a Clear and SDT if the command is used to stop traffic.

Ready to Receive (RTR) Command

A 3174 type 1, 3, or 6.2 SLU sends this command to indicate when a previously rejected bracket (with sense code X'0814') can be reinitiated by the host program. The RTR command is allowed only when the session is ready to receive a new bracket. For LU types 1 and 3, this applies to the 3174 only when it is configured for BETB printer sharing.

When the RTR command is sent and a positive response is received from the host program, the LU enters begin-bracket-pending state and expects the host program to begin a bracket.

Bid Command (LU Types 1, 2, and 3)

The Bid command is sent by the PLU to a 3174 SLU to request permission to begin a bracket. The use of Bid avoids long chains of data that use transmission time and then are discarded because the SLU won bracket contention. If the Bid is accepted by the SLU, a positive response is returned and the SLU goes to begin-bracket-pending state and waits for the request containing begin bracket (BB).

A 3174 SLU that is configured for BETB printer sharing can reject a Bid command by winning bracket contention for the following reasons:

LU type 2

- The 3174 is already in Bracket (INB), and a PLU protocol error exists. The sense code returned is X'0813'.
- The operator has initiated an inbound data stream carrying BB. The sense code returned is X'0813'.
- An operator has started to enter data on the screen but has not initiated an inbound data stream. The sense code returned is X'081B'.

LU type 1 or 3

- The SLU is already INB, and a host program protocol error exists. The sense code is X'0813'.
- A printer attached to the 3174 is busy doing a local copy operation. The sense code returned is X'0814'. The 3174 will send the RTR command to the host program when the printer becomes not-busy and a BB can be accepted by the secondary LU. This applies to the 3174 only when it is configured for BETB printer sharing.

Signal Command (LU Types 1, 2, and 3)

The PLU can send the Signal command to the 3174 SLU to request the CD indicator. The SLU will complete any chained transmissions in progress and send the CD to the PLU. A request with CD but no data (a null RU) will be sent if the SLU is in send state but has not started transmitting. If the SLU is already in receive, BETB, or ERP1 state (see "Session Processing States (LU Types 1, 2, and 3)" on page 9-41), the Signal command is positively responded to but no SLU action is taken.

The 3174 sends the Signal command (X'00010000') when the terminal operator presses the keyboard Attn function or, for an LU Type 1, either of the printer PA switches. The command is expedited and has no effect on SLU states. After Signal has been sent by an SLU, pressing the Attn or PA functions does not cause a second Signal until the 3174 receives a response to the first Signal.

Bracket Initiation Stopped (BIS) Command (LU Type 6.2)

This command is sent from the PLU to a 3174 type 6.2 SLU to indicate that the PLU will not attempt to begin any more brackets. The 3174 returns a BIS reply after processing all transaction programs currently waiting to begin a bracket. When the PLU receives the BIS reply, the PLU sends an Unbind command to terminate the session.

Function Management Data (FMD) Commands

This section describes the function management data commands that relate to 3174 transmissions.

Data Protocols

For all LU types, this command is used to transfer data in the LU-LU or SSCP-LU session. For LU types 1, 2, and 3, it may only be sent in LU-LU session when data traffic is allowed (SDT has been issued and a positive response has been received).

When communicating with a 3174 SLU, the following FM data protocols are used:

Bracket — Bracket Protocol is used to delimit a series of related inbound and outbound FM data RUs, for example, all the RUs required to complete a transaction.

Chaining — Chaining protocol logically connects one or more RUs from a single LU, for example, all RUs required to complete a display image.

Change direction — Change direction (CD) protocol informs the receiving LU that the sending LU has completed transmission and expects the next transmission to be from the receiving LU; for example, the PLU has transmitted a complete form image and expects the next transmission to be from the display operator when the blank fields in the form image are filled in.

Bracket Protocol (LU Types 1, 2 and 3): The 3174 provides a bracket protocol to delimit a series of related inbound and outbound requests. A bracket may consist of one input and one output, many sets of inputs and outputs, or a series of requests flowing in a single direction. The BB and EB indicators are used to delimit a bracket. References are made to bracket states (BETB and INB); these states are described under "Bracket States (LU Types 1, 2, and 3)" on page 9-43.

A bracket is initiated when the BB indicator is accepted by the primary or secondary LU. The bracket is usually ended when the End Bracket indicator (EB) is received by the secondary LU. The specific conditions that end a bracket are defined by SNA bracket termination restriction 1 (see "Restrictions" on page 9-27). Two commands, Bid and RTR, are implemented to further define the initiation of a bracketed session. These commands are described under the headings "Bid Command (LU Types 1, 2, and 3)" on page 9-25 and "Ready to Receive (RTR) Command" on page 9-25.

The following protocols apply for 3174 bracket processing:

- For sessions with type 2 SLUs, the SLU may begin a bracket any time the session is between brackets. The PLU may request permission to begin a bracket using Bid. If the SLU returns a positive response, the PLU may begin a bracket. If the SLU returns a negative response, the PLU must wait for the next BB from the SLU.
- For type 1 and 3 sessions, the PLU may begin a bracket any time the session is between brackets (the only time the SLU will begin a bracket is when the operator presses the PA function). The PLU may start a bracket by sending a transmission that contains BB or by sending Bid, waiting for a positive response, and then sending a transmission that contains BB.
- The PLU may attempt to initiate a bracket by simply sending a transmission with BB. If a contention situation exists (the SLU begins a bracket before receiving BB from the PLU), the SLU returns a negative response to the PLU's transmission and then discards all portions of the chain from the PLU. Since the SLU is first speaker, the SLU assumes that its transmission will be accepted by the PLU.

If a Bid or BB from the PLU is rejected, the 3174 will do the following:

- For a session with a type 2 SLU, the SLU sends BB when it next has data to send. The PLU may return its data when it receives CD protocol
- For a type 1 or 3 session with a 3174 configured for between-session printer sharing, the SLU will not reject the PLU's Bid or BB unless a protocol error is detected. The PLU should restart the transaction.
- For a type 1 or 3 session with a 3174 configured for BETB printer sharing, the SLU will reject the PLU's Bid or BB only if the printer is performing a local print function or when a protocol error is detected. When the local print is completed, the SLU will send RTR.

Restrictions: The host program can end a bracket. The 3174 cannot end a bracket. Bracket protocol establishes the following restrictions on beginning and ending brackets:

1. BB and EB cannot be sent with response RUs.
2. BB can only be sent with FM Data requests.
3. EB can only be sent with the Chase and Cancel DFC commands and FM Data requests.

The 3174 supports bracket termination restriction 1 as follows:

- When EB is received and the last element of a chain requires definite response, the 3174 will enter BETB state from INB state after +RSP to the chain or stay INB after a negative response.
- When EB is received and the last element of a chain requires exception response, the 3174 will enter BETB from INB immediately.

The 3174 ignores the BB bit on all outbound requests except FM data, and ignores EB on all outbound requests except FM data and DFC commands Cancel and Chase.

Chaining Protocol: A data chain is a complete unit of data that originates at a single LU. Data RU chaining provides a method of logically defining a complete unit of data regardless of whether the data is transmitted as a single RU or as a series of consecutive RUs. Each RU is associated with only one chain. An individual RU may be the beginning, middle, ending, or only (both beginning and ending) RU in the chain; the chaining indicators, Begin Chain (BC) and End Chain (EC), are contained in the request header. The following are definitions of each type of RU in a chain:

First in Chain (FIC)	Identifies an RU that begins a chained transmission (RH=BC¬EC).
Middle in Chain (MIC)	Is transmitted with all RUs following the BC transmission, except the last RU in that chain (RH=¬BC¬EC).
Last in Chain (LIC)	Identifies the RU that completes a chained transmission (RH=EC¬BC).
Only in Chain (OIC)	Both the BC and EC indicators are included to indicate a transmission that consists of a single RU. The RU is termed a single-element chain (RH=BCEC).

A chain is correct if the RUs consist of the following:

- FIC, LIC; or
- FIC, MIC, ..., LIC; or
- OIC.

Any other sequence of chaining indicators causes a chaining error.

Chaining Operations: When the 3174 receives a chain with chaining indicators in an improper sequence (for example, FIC, MIC, FIC), a negative response with sense data indicating a chaining error (sense code X'2002'), is returned to the host program. The 3174 purges the chain, ignoring subsequent elements of that chain until a data RU with the LIC or a Cancel command is received. Receipt of an OIC data RU terminates the purging of a chain; the OIC message is also purged. Sending RUs with chaining indicators in the sequence FIC, MIC, OIC is a violation of chaining protocol. In this case, when the 3174 receives the OIC transmission, the chaining error is detected, the OIC transmission is purged, purging of chain elements is stopped, and a negative response is sent for the OIC transmission. The 3174 is now ready to process the next chain normally.

CD: The 3174 uses a HDX-FF mode to transfer normal flow data. Only one of the two LUs in the session may send at a given time. The flip-flop protocol demands that when one LU is sending, the other must be prepared to receive. Therefore, the two states of send and receive (RCV) exist on each end of the session.

A bit in the request header, called the CD indicator, is used to keep the two end-point LUs in synchronization. Each time an LU accepts this CD in a request, it means it is that LU's turn to send. Each time an LU sends the CD in a request, that LU must then be prepared to receive. The 3174 always sends CD with LIC or OIC in an FMD RH. Exceptions may occur following negative responses (see "ERP1 State (LU Types 1, 2, and 3)" on page 9-43).

Request Maintenance Statistics (REQMS) Command

The Request Maintenance Statistics (REQMS) command is sent by the SSCP to a 3174 when the Network Problem Determination Application (NPDA) requests PU performance statistics. The following four types of requests can be made:

- Type 1 - Link test statistics
- Type 2 - Summary counters
- Type 3 - Communication adapter data error counts
- Type 5 - 3174 configuration information.

The state of the Reset/NO-Reset indicator in the REQMS request determines whether the log area where the transmitted maintenance statistics are stored is cleared.

An REQMS request that cannot be executed by the 3174 is rejected with a negative response; an accepted REQMS request receives a positive response and the requested statistics (formatted as Record Formatted Maintenance Statistics [RECFMS]) as an inbound message.

Record Formatted Maintenance Statistics (RECFMS)

The Record Formatted Maintenance Statistics (RECFMS) command is sent by the 3174 to the SSCP in response to an REQMS command (the 3174 will not send unsolicited RECFMS requests to the host). The RECFMS maintenance statistics are recorded at the host by the Network Communications Control Facility (NCCF).

When the 3174 accepts an REQMS request, it transmits the maintenance statistics requested. If the REQMS specified *Reset,* the error log area referenced by the REQMS is reset by the 3174 after the RECFMS is transmitted; otherwise, the error log area is not reset. For a description of the RECFMS responses, refer to the *3174 Customer Problem Determination*.

Notify Command (LU Types 1, 2, and 3)

The 3174 supports the Notify command, when it flows from the secondary LU in the 3174 to the SSCP, for purposes of advising the SSCP of power on or off conditions at the device. The Notify command uses the same protocols and state changes, including keyboard control if device ownership is SSCP-SLU, as the character-coded requests.

The request is sent as follows:

TH0:	X'2C'	(Secondary--> Primary, normal)
TH1:	X'00'	
DAF:	X'00'	
OAF:	Address of LU sending Notify	
SNF:	X'0000'	
RH0:	X'0B'	(Request FMD, formatted, Only In Chain)
RH1:	X'80'	(DR1)
RH2:	X'00'	
RU0:	X'81'	Network services
RU1:	X'06'	Session service
RU2:	X'20'	Notify
RU3:	X'0C'	Vector function
RU4:	X'06'	Length
RU5:	B'0000 00xy'	
RU6,7:	X'0000'	LU-LU session limit
RU8,9:	X'0000'	LU-LU session count
RU10:	X'00'	Reserved

The following xy values are used for ASCII devices when customization question 711 digit 2 is 0, and for non-ASCII devices:

01 - Cannot currently act as secondary LU.
11 - Can now act as secondary LU.

The following xy values are used for ASCII devices when customization question 711 digit 2 is 1:

00 - SLU capability is inhibited—sessions cannot be queued or started.
11 - SLU capability is enabled—sessions can be queued or started.

The vector X'0C' is also contained in the ACTLU positive response to notify the SSCP of device power on or off status at ACTLU time. If power on or off status by a device is detected during an SSCP-SLU session, the Notify request is sent to the SSCP only if the Notify command is supported. If power on or off status by a device is detected during an LU-LU session, a negative response or LUSTAT is sent to the PLU, and the Notify request is sent to the SSCP if Notify is supported.

Support for the Notify command differs for Configuration Support A, B, and C. For Configuration Support A, a negative response to a test notify with sense code X'10030000' indicates that notifies are not supported by the host. No additional notifies are sent by the 3174 until a new ACTPU is received. Also, a negative response with sense code X'10030000' to a power on/off notify turns off notify support. A negative response other than X'10030000' does not turn off notify support. For Configuration Support B and C, test notifies are not sent, and a negative response with sense code X'10030000' to a power on/off notify turns off notify support. Negative responses received with any other sense code do not turn off notify support.

The response received to a Notify request determines which sense code the 3174 sends when rejecting a Bind command received for an LU whose device is turned off. If a positive response was received to any Notify request, the 3174 sends sense code X'0845' to reject the Bind. The X'0845' indicates that another Notify command is sent to the SSCP when the device powers on and that a Bind may now be accepted. If a negative response with sense code X'10030000' is received to the Test Notify request, the 3174 sends sense code X'080A' to reject the Bind. The

X'080A' indicates that no Notify command is sent to the SSCP when the device powers on.

For unformatted data flow on the SSCP-SLU session, a negative response from the SSCP leaves the SLU in receive state. This causes a hang condition if a negative response (Notify) leaves the SLU in receive state. Therefore, the SLU returns to contention state regardless of the value of the response.

Pacing

Inbound and outbound pacing is supported by the 3174. Pacing is used as a tuning parameter for the system. Usage comments are included here; control, however, is under the user's discretion at NCP or equivalent definition time.

The pacing count *N* determines the number of normal flow request RUs that can flow before a pacing response is required to allow the next group of N RUs to continue. A special response designated as Isolated Pacing Response (IPR) is used to return the pacing response if a response to the outbound request is not required at the time that the pacing response is required. The 3174 indicates readiness with a pacing response as soon as buffers become available after receiving the pacing request. Thus, the number of normal flow RUs allowed in the network due to pacing is up to 2*N*-1. RUs may vary in length as specified in the Bind parameter.

Pacing (LU Type 1)

For the 3174, device dependencies exist because the printer is slower than the displays. Be careful when using pacing protocol so that waiting RUs and/or chains are not stacked in the 3174 link buffers.

Within a chain, the 3174 transfers RUs from the link buffer pool to the printer buffer as they are received. The pacing parameter is then used to ensure that there is adequate printer buffer space so that the link buffer pool does not fill and restrict data flow to the keyboard displays or other printers.

During the transmission of multiple chains, interaction occurs between pacing and the type of response requested. When a definite response is requested, a response for a chain must be received by the PLU before it can send the next chain. When exception response is requested, the PLU may send any number (up to the pacing count) of consecutive chains without waiting for a response.

When OIC RUs are used that are less than, or equal to, 256 bytes, it is redundant to specify both pacing and definite response; unnecessary network traffic will occur if both are specified. The 3174 does not accept a pacing count of zero. When chains with multiple RUs are used, pacing is necessary even though definite response is requested.

During the transmission of multiple chains, the 3174 uses printer buffers as an extension of the link buffer pool.

If the 3174 SLU type 1 receives more normal flow requests than it is guaranteed by using the outbound pacing mechanism, a negative response (sense code X'0801') and an Unbind command generated by the SLU will be returned. The 3174 will respond to the chain in process of being printed and clear any remaining unprocessed chains from the printer, including the chain causing the error.

Pacing (LU Types 2 and 3)

For LU type 2 (CUTs), the 3174 generally operates faster than the link, and pacing is not required for the controllers.

For LU type 3, the definite response required when the WCC start-print bit is set is an effective alternative to pacing.

In telecommunication networks where RUs are processed through more than one communication controller (for example, a 3704 and a 3790 or two 3705s), outbound pacing may be required for type 2 and 3 LUs to prevent data traffic congestion in these controllers.

Inbound pacing is supported by the 3174. Usage in a tree-structured network may not be required. Usage in large telecommunication networks may require inbound pacing to prevent congestion at communication controllers in the network.

Pacing (LU Type 6.2)

This section describes fixed pacing, which is used on a dependent LU 6.2 session. For information regarding adaptive pacing, used on independent LU 6.2 sessions, see Chapter 18, "Advanced Peer-to-Peer Networking (APPN)."

Pacing is supported on the LU type 6.2 session, both inbound and outbound. The SLU send window size (inbound pacing) is accepted directly from the Bind command. A value of zero indicates that no inbound pacing will be used on the session.

If the SLU receive window size (outbound pacing) is acceptable, it is returned in the positive Bind response. However, if the specified value is unacceptable, it is negotiated *down* only and returned in the positive Bind response.[1]

The SLU receive window size is considered acceptable when the window size *n* satisfies the following algorithm:

$$(2n\text{-}1) \leq \frac{\text{3174 Resource Limit}}{\text{PLU send max RU size}}$$

Where:

2n-1 = Maximum number of outbound requests allowed in the network at any given time, and
3174 Resource Limit = 4096 (8192 for Models 12L and 22L).

If the SLU receive window size received in the Bind command is unacceptable, the maximum value of *n* which satisfies the above algorithm is returned in the positive Bind response.

Finally, if outbound pacing is not requested in the Bind command, the 3174 does not negotiate for pacing. Instead, it will reject the Bind command with a negative response containing sense code X'08350009'.

1 The value is not negotiated *up* because the Bind may pass through boundary function nodes in the network that do not support the LU type 6.2 concept of Bind parameter negotiation.

SNA Responses

The RH contains indicators that describe the following types of responses:

- Definite Response 1 (DR1)
- Definite Response 2 (DR2)
- Definite Response 3 (DR1 DR2).

The RH also contains an Exception Response Indicator (ERI) that is used when describing the response protocol. Definite response protocol (DR1, DR2, or DR3) specifies that a response, either positive or negative, must be given. Exception response protocol (DR1, DR2, or DR3 with ERI) specifies that only a negative response may need to be returned.

The only definite response type requested by the 3174 is DR1. The response protocol requested by the 3174 (definite response and/or exception response) is defined in the Bind.

The 3174 LU types 1, 2, and 3 will respond to a message from the host with any requested response type (DR1, DR2, or both). The 3174 LU type 6.2 will respond only to a DR1. The 3174 supports definite response or exception response protocols.

No distinction is made (within this chapter) between the specific response types. The term *positive response* indicates successful receipt of a command or data RU. The term *negative response* indicates that the receiving LU detected an error, which is reported to the sending LU.

Summary of SNA Commands (LU Types 1, 2, and 3)

Table 9-6 summarizes the validity of SNA commands received by the 3174 relative to the SSCP-PU, SSCP-LU, and LU-LU sessions and to two LU-LU session processing states (data traffic reset and in brackets). Table 9-7 on page 9-34 shows the same for SNA commands sent by the 3174.

Table 9-6 (Page 1 of 2). Summary of SNA Commands Received

SNA Command Received	SSCP-PU Session Active	SSCP-LU Session Active	LU-LU Session Active	LU-LU Session Processing States: Data Traffic Reset On	Data Traffic Reset Off	In Bracket On	In Bracket Off
ACTLU ERP	R	E					
ACTLU¬ERP	R	E	T				
ACTPU ERP	E						
ACTPU¬ERP	E	T	T				
DACTLU	R	T	T				
DACTPU	T	T	T				
Bind	R	R	E	X			X
Unbind	R		T	X			X
Cancel	R	R	R		R		
Chase	R	R	R		R	R	

Table 9-6 (Page 2 of 2). Summary of SNA Commands Received							
				LU-LU Session Processing States			
				Data Traffic Reset		In Bracket	
SNA Command Received	SSCP-PU Session Active	SSCP-LU Session Active	LU-LU Session Active	On	Off	On	Off
Clear	R	R	R	X			X
SDT	R	R	R	R	X		X
CRV	R	R	R				
Signal	R	R	R		R		
Shutdown	R	R	R		R		
FM Data	R	R	R		R	R	
REQMS	R						
NMVT	R						

Legend:

R - Required state for this command to be valid.
E - Command establishes this session.
T - Command terminates this session.
X - Command sets the processing state to the indicated status.

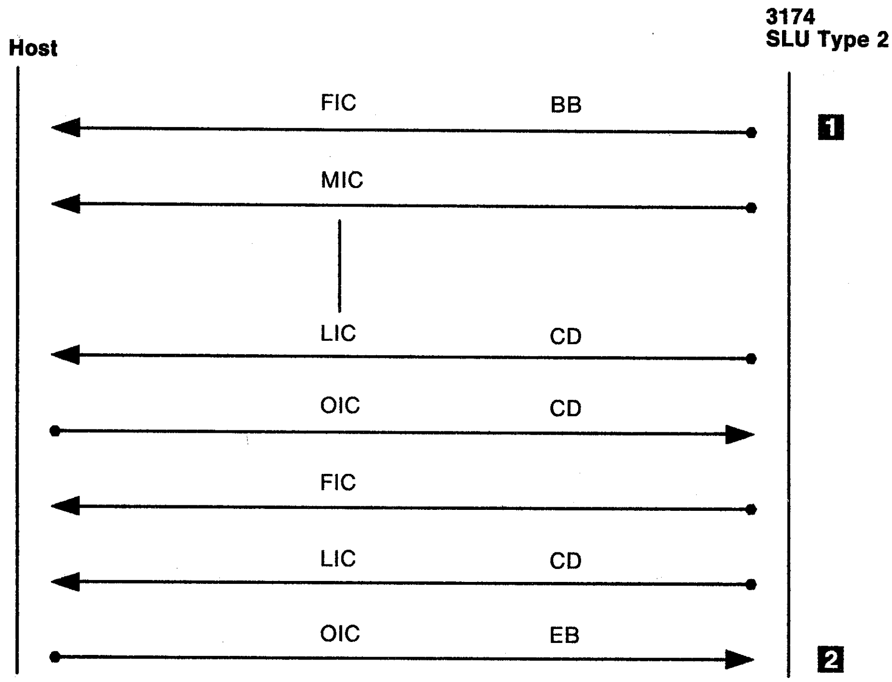
Table 9-7. Summary of SNA Commands Sent							
				LU-LU Session Processing States			
				Data Traffic Reset		In Bracket	
SNA Command Sent	SSCP-PU Session Active	SSCP-LU Session Active	LU-LU Session Active	On	Off	On	Off
LUSTAT	R	R	R		R		
Signal	R	R	R		R		
Cancel	R	R	R		R	R	
Unbind *							
Ready to Receive	R	R	R		R		R
Shutdown Complete	R	R	R		R		R
FM Data	R	R	R		R		
RECFMS	R	R	R				
Notify	R	R					
NMVT	R						
TERMSELF		R	R				

Legend:

R — Required state for this command to be valid.
* — See "Terminating an LU-LU Session" on page 9-8 for the conditions under which a 3174 issues an Unbind command.

Sample SNA Command Sequences (LU Types 1, 2, and 3)

Figures 9-2 through 9-8 illustrate the use of SNA commands. Responses to commands are not shown unless the response is a necessary part of the example.

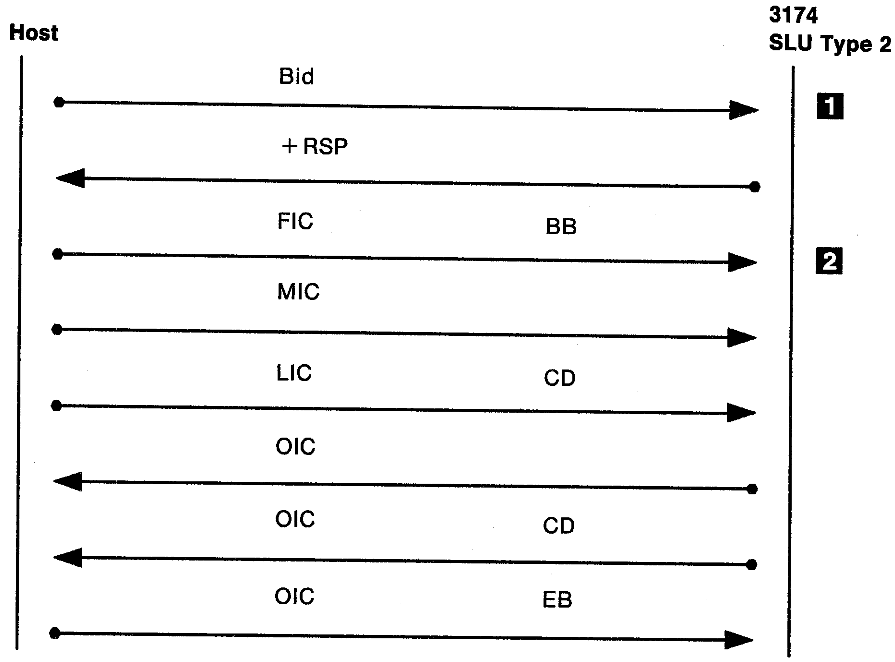


Notes:

1 Initial conditions: Session established and both ends in contention and BETB. The 3174 sends a chain as a result, for example, of pressing the Enter function.

2 After the required exchange of chains is completed, the host ends the unit of work by sending EB (the 3174 cannot send EB). The EB chain may contain data: for example, a write to the screen; or it may be a Null RU chain, that is only RHs.

Figure 9-2. Bracket/Chain: Initiated by LU Type 2 (without Contention)



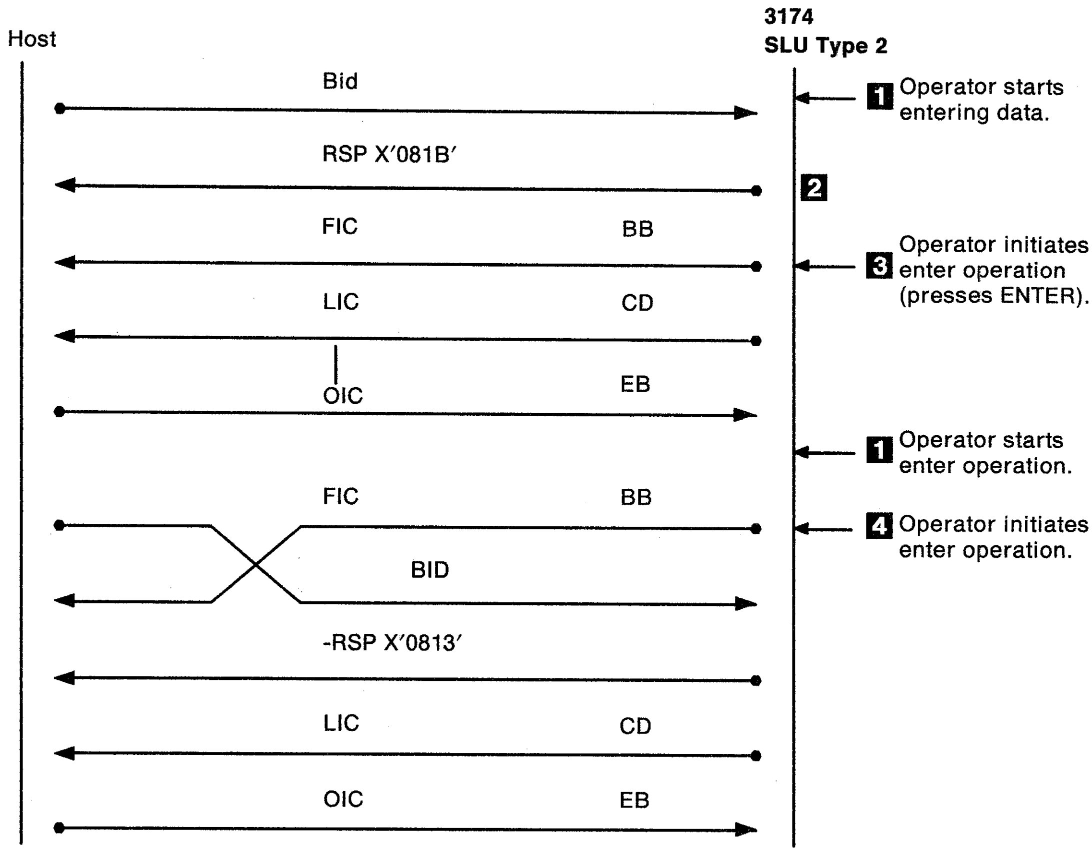
Notes:

1 Initial conditions: Session established and both ends are in contention and BETB. Host sends Bid to indicate intention to begin a bracket.

2 The Bid was accepted, so the host initiated the unit of work with BB.

Note: The host has the option of going directly to **2**, that is, skipping the Bid. However, there is a possibility of Bid rejection (Figure 9-4 on page 9-37), which would result in resending the data associated with **2**.

Figure 9-3. Bracket/Chain: Host-Initiated (without Contention)



Notes:

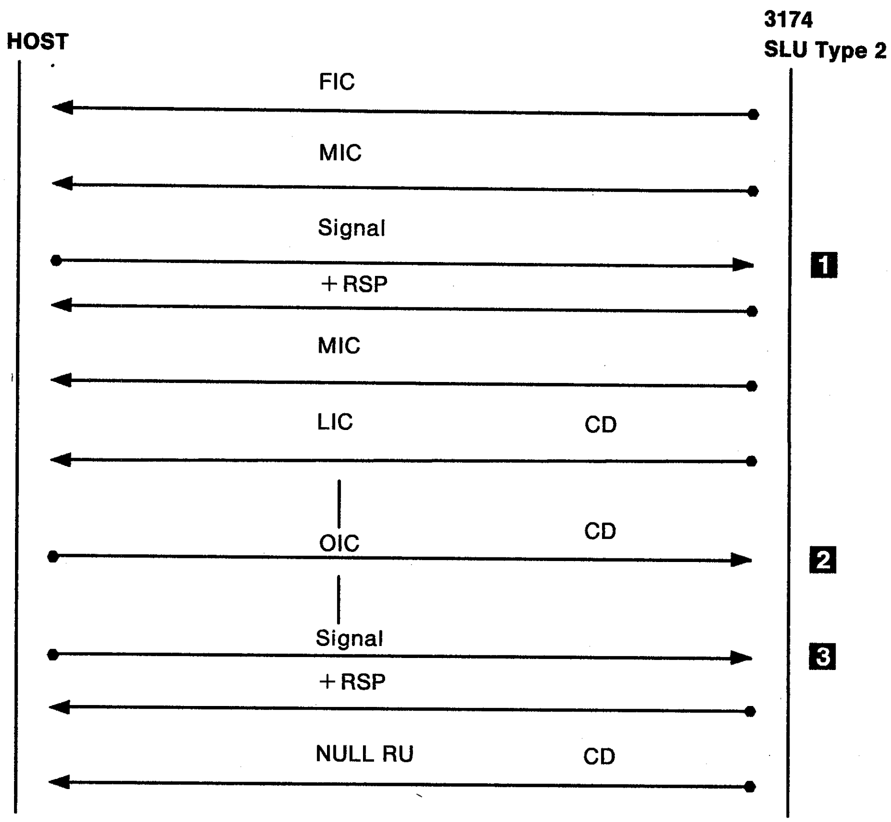
1 Initial conditions: Session established and both ends are in contention and BETB state. The first operator keystroke puts the type 2 SLU in the send (but not transmitting) state. The type 2 SLU remains in BETB state.

2 The type 2 SLU will reject a Bid (or BB) with X'081B', Receiver in transmit mode.

3 The operator initiates an enter operation; for example, presses the Enter function. The type 2 SLU begins a bracket and transmits the operator-entered data.

4 When the operator presses the Enter function, type 2 SLU goes to INB state. Type 2 SLU begins a bracket and starts sending data. The host has sent a Bid (or BB) before the type 2 SLU first chain element was received. The type 2 SLU rejects the Bid (or BB) with X'0813'. The sense code differs from 2 because the bracket check is made before the HDX state check. In 2, the bracket check was good.

Figure 9-4. Bracket/Chain: Host-SLU Contention



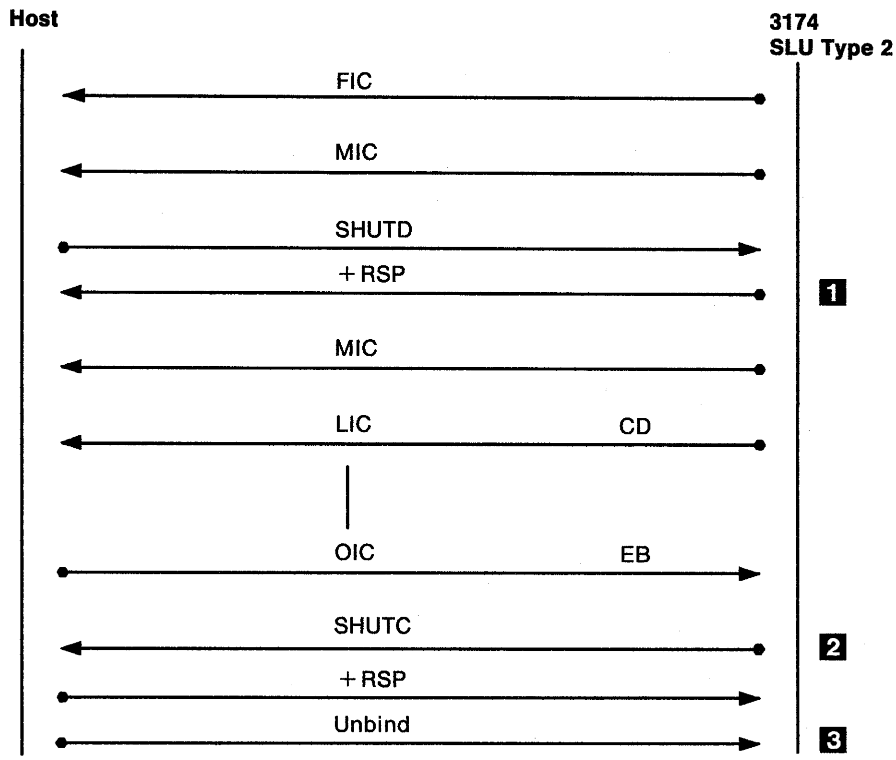
Notes:

1. The SLU type 2 receives Signal while sending. The +RSP is returned to acknowledge receipt of Signal. Signal is effectively treated as a NOP, and the SLU completes sending of the chain. The SLU type 2 always sends CD on Last In Chain.

2. CD allows the SLU to send. The operator starts keying in data.

3. Before the operator initiates sending of data; for example, presses the Enter function, the host sends the Signal. The SLU sends +RSP to Signal, locks the keyboard, and sends CD.

Figure 9-5. Signal from Host



Notes:

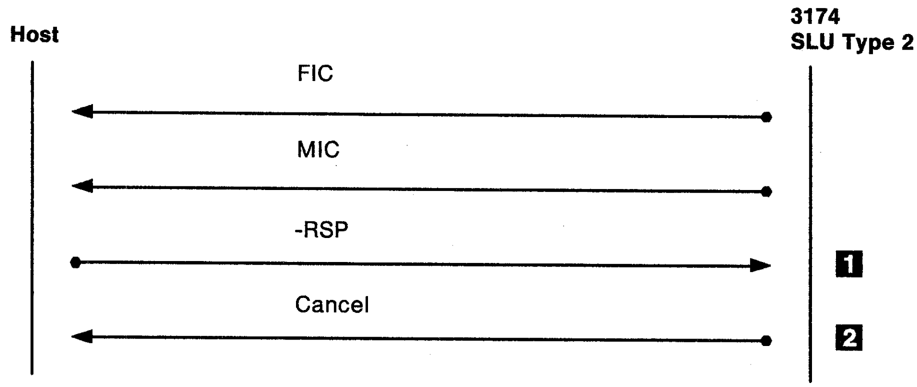
1 The SLU type 2 is alerted that the host wants to shut down. However, a synchronizing EB must be received before effecting shutdown.

2 The SLU goes into shutdown; that is, inbound data flow (and Signal) is inhibited.

3 The host terminated the session.

Note: The host could clear the condition and continue by sending Clear, SDT instead of terminating the session.

Figure 9-6. Shutdown/Shutdown Complete



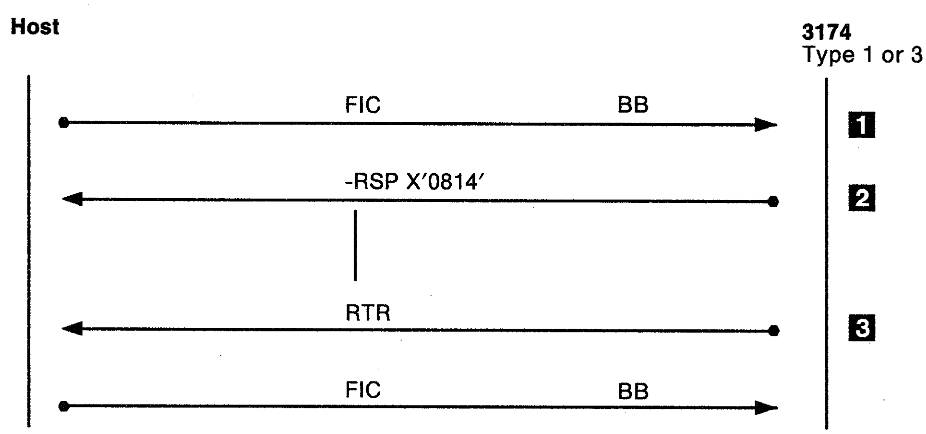
Notes:

1 The type 2 SLU receives negative response to a chain element.

Note: Normally, the 3174 will not examine any response until the entire chain has been sent and will therefore not send Cancel as the result of receiving a negative response. However, when inbound pacing is in effect, responses are examined when the SLU must receive a pacing response before continuing transmission. A negative response will then be detected and cause Cancel to be sent.

2 The type 2 SLU sends Cancel to direct the host to discard the chain elements already received. The SLU goes to receive state, waiting for host recovery action.

Figure 9-7. Cancel: SLU Type 2 Sending



Notes:

1 The printer associated with SLU type 1 or 3 is not available, because a local copy is being done. Consequently, the SLU type 1 or 3 cannot honor the host BB (or Bid).

2 The SLU type 1 or 3 rejects BB (or Bid) with negative response X'0814' (Bracket Reject, RTR to follow).

3 The printer becomes available, and SLU type 1 or 3 sends RTR to indicate to the host that a bracket may be started.

Figure 9-8. RTR: LU Type 1 or LU Type 3 Sending

Session Processing States (LU Types 1, 2, and 3)

The 3174 controls the processing of SNA commands, responses, and user data transmissions with a set of session states. Some of these states are defined by SNA, and others are unique 3174 definitions that cause SNA state transitions. When the 3174 receives the Clear or Bind command, all 3174 session states are reset.

This section describes the processing states used by the 3174. When several states relate to a common processing function, such as bracket or chain processing, they are described under a common heading. The remaining processing states are described individually.

Data Traffic (Reset/Active) State (LU Types 1, 2, and 3)

Reset of all SNA LU-LU states in the 3174 is assured by entering the data-traffic-reset state. This state is entered when a Bind or Clear command is received from the PLU. When the data traffic reset state is turned off by SDT, the state is referred to as *data traffic active.*

When in the data traffic reset state for any LU-LU session, the 3174 SLU cannot transmit data or commands to the host program, and the host can send only session-recovery and session-termination commands. The 3174 accepts data RUs for an LU-LU session only during data traffic active state.

When in the data traffic reset state and a data RU or a command other than SDT, Clear, or Unbind is received from the host program, the 3174 returns a negative response with sense data indicating that data traffic is inactive (sense code X'2005'). No other state, except contention, can exist when the SLU is in the data traffic reset state.

Contention (CONT) State (LU Types 1, 2, and 3)

The contention state on the LU-LU session exists only between brackets. In this state, the LU resources are not allocated. All associated I/O devices are enabled, and the SLU can accept data from either the terminal or the host, whichever occurs first. The first arrival triggers a change to the send or receive state.

Send (SEND) State (LU Types 1, 2, and 3)

The send state is common to both contention and HDX FF modes of operation.

In the send state, the 3174 LU resources are allocated for inbound (to the primary) operations. Internally, there are two subdivisions of the send state. These are referred to as send-not-transmit (send¬xmit) and send-transmit (send-xmit). Send¬xmit exists while the controller is entering data from a keyboard, MSR, or selector light pen into the device buffers. The state is entered from the contention state by the first keystroke capable of changing data on the display or by initial input from the type 2 SLU MSR, selector light pen, or the type 1 SLU PA function. The state is maintained until exited to send-xmit by an action that causes the data to be sent inbound, generally by pressing the Enter function. The transition from send¬xmit to send-xmit also causes the transition to INB state when leaving the contention state. The transition always causes the keyboard to be locked and the Input Inhibited and Time indicators to be turned on. When in the IB state, send¬xmit is entered from receive state or ERP1 state after successfully processing an outbound chain carrying CD but not EB.

The type 2 SLU keyboard does not automatically unlock when the send state is entered from either the receive state or the ERP1 state. The keyboard is unlocked only if the last command received was not a 3270 Read command and one of the following occurs:

- A previous WCC specified keyboard restore
- The previous command was an Erase All Unprotected command
- The SLU is in send state and the terminal operator presses the Reset function.

After going from the contention state to the send¬xmit state, any normal outbound requests received on that session will be discarded and a negative response *Receiver in Transmit Mode* with sense code X'081B' will be sent. Once in the INB state, any normal outbound requests received on the session (FMD with BB or Bid) while in send state will be discarded and a negative response Bracket Bid Reject with sense code X'0813' will be sent. Neither of these responses causes any state change in the 3174 SLU. If in the INB state and in the send state, a request received will be rejected by the 3174 with sense code X'2004'.

During the send-xmit state, the data is being transferred from the device buffer to the PLU. Except for a possible LUSTAT, all normal flow chains on the LU-LU session will carry the CD. The transition out of the send-xmit state depends upon the response type carried with the inbound request. If a definite response is requested, the transition from the send-xmit state to receive takes place after the response to the inbound request is returned to the 3174. If an exception response is requested, the transition from the send state to the receive state takes place as soon as the end of chain has been successfully transferred to the transmission link.

Receive (RCV) State (LU Types 1, 2, and 3)

The receive state is common to both contention and HDX-FF modes of operation. In this state, the 3174 LU resources are allocated for outbound (from the PLU) operations.

When the RCV state is active, inbound normal flow requests cannot be sent. Responses, as requested, and control commands on the expedited flow can be sent inbound.

Input devices may be activated by a WCC character that specifies Keyboard Restore. However, using the selector light pen or MSR or pressing the Enter, PA, PF, or Clear functions to send data to the PLU by an operator will not be allowed.

Normal flow traffic from the PLU is passed to the device when it is in the receive state. A request with a WCC containing the keyboard-restore bit set to zero is treated as a NOP for the keyboard states. For example, if the keyboard was unlocked before the write operation, it will remain unlocked after a successful write operation. If the keyboard was locked before the write operation, it will remain locked after the write operation.

For the LU-LU session, the receive state is entered from the contention state if an outbound normal flow message is accepted for processing. It is entered from the send-xmit state after receiving a response from an inbound request carrying CD and definite response or after successfully transferring the chain to the data link when the request carries CD and exception response.

For the LU-LU session, the receive state is changed to the send-xmit after successfully processing a last-of-chain carrying the CD. The receive state is changed to the contention state after successfully processing and responding to a chain carrying EB or after receiving a chain carrying EB, which carries exception response requested. Receive state is changed to ERP1 state if any negative response except X'0813', X'0814', or X'081B' is returned to the outbound request.

ERP1 State (LU Types 1, 2, and 3)

The ERP1 state allows for error recovery protocols. The PLU is always responsible for error recovery; therefore, the SLU state structure generally is awaiting an outbound request to correct the error condition. However, there are times when the SLU must first recover and notify the PLU of its recovery by use of an LUSTAT command before the PLU can take action. Thus, the SLU ERP1 state allows a form of contention mode within brackets. This state is able to receive any request but can only send LUSTATs.

When an LUSTAT flows inbound the SLU remains in ERP1 state. By remaining in ERP1 state, successive LUSTATs flow without requiring the general exchange of CD between LUSTATs. LUSTAT does not request CD when sent while in ERP1 state.

All SLUs enter the ERP1 state after responding with any negative response except X'0813', X'0814', and X'081B'. If the negative response does not change the state to BETB, the transition to ERP1 takes place at end-of-chain.

The SLU remains in the ERP1 state until it is changed by accepting an outbound chain carrying CD/EB. Following processing of the CD bit, the transition is made to the send state. Following processing of the EB bit, the transition is made to the contention state.

When in the ERP1 state, the keyboard is locked, except for the Sys Req and Attn functions.

Bracket States (LU Types 1, 2, and 3)

The 3174 has three major states associated with bracket protocols: BETB, INB, and pending begin bracket (PEND.BB). These states are used to ensure synchronization of traffic between the PLU and the SLU. Transitions between these states are controlled by the BB and EB bits and by the Bid command.

Between Bracket (BETB) State (LU Types 1, 2, 3)

The BETB state exists when the PLU and the SLU are in contention to begin a bracket. This is the state entered after the SDT command is accepted. When the Bid command or the BB state is accepted from the PLU or when the BB state is sent by the SLU, the BETB state ends. If the host program cancels the chain containing the BB or if the SLU sends negative response for the chain containing the Bid or BB, the 3174 returns to BETB state. BETB state is normally assumed when an EB has been processed successfully.

When a chain carrying both BB and EB is being processed, BETB state is not changed.

The 3174 sets BB on the first RU transmitted when the controller enters INB from BETB.

BETB is terminated and INB is entered when the first (or only) element of a chain with BB bit on is ready to be transmitted; that is, when an Enter, PA, PF, or other attention function is pressed.

Pending Begin Bracket (PEND.BB) State (LU Types 1, 2, and 3)

In the PEND.BB state, the 3174 is waiting for the host system to begin a bracket. The 3174 has either returned a positive response to a Bid command or received a positive response to a Ready to Receive command. When the host program attempts to begin a bracket and the 3174 is in PEND.BB state, the 3174 will not reject the bracket with sense code X'0813' or X'0814'.

In Bracket (INB) State (LU Types 1, 2, and 3)

The INB state is entered when the 3174 receives a BB without the EB or when the 3174 begins a bracket. The INB state is maintained by the 3174 until the positive definite response to the EB chain is returned to the host or until the 3174 receives the last element of the EB chain when exception response is requested.

3174 Bracket State Errors (LU Types 1, 2, and 3)

Error codes generated for bracket error conditions are as follows. The bracket state conditions remain unchanged after sending the error code.

	Command						
State	**Chase and EB**	**Chase and ¬EB**	**Bid**	**Cancel and EB**	**Cancel and ¬EB**	**FMD and BB**	**FMD and ¬BB**
BETB	2003	—	—	2003	—	—	2003
INB	—	—	0813	—	—	0813	—
PEND.BB	2003	—	—	2003	—	—	2003

Request/Response Unit (RU) Size Restrictions

This section describes the RU size restrictions that exist between inbound and outbound operations and between local and remote models.

Outbound to the 3174

The maximum RU length that a PLU is permitted to send is defined in byte 11 of Bind. The 3174 accepts a maximum RU size within the following constraints. Where multiple constraints apply, the maximum RU size is limited to the smallest size calculated by applying each constraint.

Local Models

The maximum RU size received must be less than or equal to 4096 bytes (or 8192 bytes for Models 12L and 22L).

For Type 1 SLUs: The following formula applies:

$$MRU \leq \left(\frac{BUFF\text{-}336}{PC}\right) - 13$$

Where:

MRU Is the smallest multiple of 256, more than or equal to the maximum RU size specified in byte 11 of the Bind.

PC Is the pacing count specified in byte 9 of the Bind.

BUFF Is the device buffer size.

A Bind reject with sense code X'0835' will occur if the Bind specifications do not meet these limits.

For Type 2 and 3 SLUs: Byte 11 of Bind (PLU maximum send RU size) is not checked. A negative response with sense code X'1002' (RU length error) will occur if the PLU transmits an FM data RU greater than 4096 bytes (or 8192 bytes for Models 12L and 22L).

For Type 6.2 SLUs: The PLU maximum send RU size allowed is the lesser of the value in byte 11 of the Bind command and 4096 bytes. If the value received in the Bind command is less than 256 bytes, the Bind command is rejected with sense code X'0835'.

Remote Models

For Type 1 SLUs: The following formula applies:

$$MRU \leq \left(\frac{BUFF\text{-}336}{PC}\right) - 13$$

Where:

MRU Is the smallest multiple of 256, more than or equal to the maximum RU size specified in byte 11 of the Bind.

PC Is the pacing count specified in byte 9 of the Bind.

BUFF Is the device buffer size.

A Bind reject with sense code X'0835' will occur if the Bind specifications do not meet these limits.

For Type 2 and 3 SLUs: There are no restrictions.

For Type 6.2 SLUs: The PLU maximum send RU size allowed is the lesser of the value in byte 11 of the Bind command and 4096 bytes. If the value received in the Bind command is less than 256 bytes, the Bind command is rejected with sense code X'0835'.

Inbound from the 3174

The maximum RU that the 3174 sends is determined by the following constraints.

Local Models

The maximum inbound RU that the 3174 sends is determined as follows:

For Type 1, 2 and 3 SLUs:

1. If the read channel program size = (S/2) + (RH + TH + LH),

   Where:

   S Is either the lesser value in byte 10 of the Bind or 2048
   RH Is the length of the Request/Response Header (3 bytes)
   TH Is the length of the Transmission Header (6 bytes)
   LH Is the length of the Link Header (varies from 4-byte minimum to 32-byte maximum).

   then the RU maximum is either the lesser value in byte 10 of the Bind or 2048.

   Note: If the value in byte 10 of the Bind is greater than 2048 bytes, the value is ignored, and 2048 is used.

   The *read channel program size* is the data count of a Read CCW multiplied by the number of Read CCWs in the channel program. In terms of the connect parameters, this size is the number of host buffers multiplied by the size of the host buffers. In terms of ACF/VTAM system definition, this size is the value of bufsize for the I/O buffer pool (a VTAM parameter) multiplied by the value of the MAXBFRU on the PU statement defining the 3174.

2. If the read channel program size < (S/2) + (RH + TH + LH), then the RU maximum = (Read Channel Program Size - (RH + TH + LH)) x 2.

For Type LU 6.2 SLUs:

The 3174 max send RU size is copied from the Bind request.

Remote Models

For Type 1, 2, and 3 SLUs:

The maximum RU length is either the lesser value in byte 10 of the Bind or 2048.

For X.25 attachments in B4.0, the maximum RU size for CUT devices might be further adjusted, depending on the selected packet size and segment size, in order to optimize packet utilization. For an example, refer to "Remote Attachments" on page 9-48 and consult the discussion on X.25.

For Type LU 6.2 SLUs:

The 3174 max send RU size is copied from the Bind request.

Segmenting Description

RUs sent to network terminals are often larger than acceptable for optimum transfer of data by the link connecting the terminal to the network. Therefore, a basic information unit (BIU) that consists of RH and RU may be divided into smaller elements, called *segments,* that are transmitted over the link. The 3174 supports inbound and outbound segmenting on the LU-LU session except when attached to a local channel. The local (channel-attached) 3174 supports inbound segmenting only.

The segment elements are defined as follows. The First in Segment (FIS) element is equated to Begin-BIU, not End-BIU. The Last in Segment (LIS) element equates to End-BIU, not Begin BIU. The Middle in Segment (MIS) equates to not Begin-BIU, not End-BIU. An Only in Segment (OIS) contains the entire BIU.

Sequencing of segments is in the correct order if the sequence consists of one of the following:

1. FIS, LIS
2. FIS, MIS,..., LIS
3. OIS.

Segmenting Outbound to the 3174

The 3174 supports outbound segmenting only for remote attachments, which include host attachments through a Concurrent Communication Adapter.

Local Attachments

Segmenting outbound is not supported on local attachments.

Remote Attachments

Errors caused by improper sequencing of the segment elements cause termination of the existing LU-LU session (by the SLU) and an Unbind request to be sent to inform the host. See "Terminating an LU-LU Session" on page 9-8.

The maximum size for segment elements (the NCP MAXDATA parameter) delivered to the 3174 is 521. (This would include 512 bytes of RU data, 6 TH bytes, and 3 RH bytes.)

If the segment elements exceed 521 bytes in length on an SDLC attachment, the 3174 will reject the segment element by discarding the frame information and not incrementing the link count. Continuous rejection of a segment element that is too long is expected to cause a retry failure in the communication controller, and result in an inoperative station disconnect by that node.

For an X.25 attachment, a segment longer than 521 bytes causes the 3174 to clear a SVC or reset a PVC.

Local Attachments

If a BIU can be contained in one 3174 I/O buffer, it is sent in a PIU containing an OIS element.

If a BIU cannot be contained in one 3174 I/O buffer, and a second buffer is available, the amount of data that can be contained in the first I/O buffer is sent in a PIU containing an FIS element. The amount of data that can be contained in the second I/O buffer is sent in a PIU containing an LIS element. Depending on the size of the read channel program, the two PIUs are sent in either one channel program or two.

If a second I/O buffer is not available, the RU length of the BIU is truncated to the amount that can be contained in one I/O buffer, and the data is sent in a PIU containing an OIS element.

Notes:

1. A locally attached 3174 never sends a PIU containing an MIS element.
2. Although the amount of inbound data to be sent may exceed the capacity of the two I/O buffers, the 3174 never allocates more than two I/O buffers at a time for sending a chain element (BIU) of a multi-element chain.
3. Segments from different LUs may be intermixed within a read channel program.

Remote Attachments

SDLC: Segmenting inbound is supported by the 3174 on the LU-LU session under the following conditions:

- When maximum RU size is specified as 256 bytes or less and accepted at Bind time, no inbound segmenting is performed.
- When maximum RU size is specified as greater than 256 bytes, inbound segmenting is performed as follows:

  A PIU with an OIS element will contain a maximum of 256 bytes of RU data plus 6 bytes of TH data plus 3 bytes of RH data.

  The size of other elements depends on the response entered for customizing question 370. The response indicates the maximum inbound PIU size as either 265 or 521 bytes.

  If 265 is specified:

    A PIU with an FIS element will contain a maximum of 256 bytes of RU data plus 6 bytes of TH data plus 3 bytes of RH data.

    A PIU with a MIS or LIS element will contain a maximum of 256 bytes of RU data plus 6 bytes of TH data.

  If 521 is specified:

    A PIU with an FIS element will contain a maximum of 512 bytes of RU data plus 6 bytes of TH plus 3 bytes of RH data.

    A PIU with a MIS or LIS element will contain a maximum of 512 bytes of RU data plus 6 bytes of TH data.

  When the Bind maximum RU size is greater than 256 bytes, considerations other than maximum RU size and amount of data to be transmitted may determine the actual RU length ($\leq$ Max RU size) that is sent. The 3174 will never send an RU having more than 2048 bytes.

  Note: The 3174 may interleave a response between the inbound segment elements of an RU.

X.25: Segmenting inbound is supported by the 3174 on the LU-LU session as follows:

- When maximum RU size from the Bind is 256 bytes or less, the 3174 does not do inbound segmenting.
- For release B3.0 and later, if the maximum RU size from the Bind is greater than 256, the maximum size of inbound segments is determined by the response to customizing question 370. The response indicates the maximum inbound PIU or segment size as either 265 or 521 bytes (up to 256 or 512 bytes of RU data plus 6 bytes of TH data plus 3 bytes of RH data.)

For release B4.0 and later, the maximum segment size is adjusted to 256 (customizing question 370=0) or 512 bytes (customization question 370=1) in order to optimize packet utilization. The only exception is the case where the packet size is 512, and customization question 370=0. In such a case, the maximum segment size remains at 265 bytes since no further optimization is needed.

Example:

Assume customization question 370 indicates a segment size of 521, and the packet size is 512. A CUT session is bound with an RU size of 2048, and a complete 2048 byte RU is ready to go to the host. Release B3.0 microcode would segment this into 4 PIUs:

```
First-in-segment  (FIS)   TH+RH+512 bytes of RU data = 521
Middle-in-segment (MIS)   TH+512 bytes of RU data    = 518
Middle-in-segment (MIS)   TH+512 bytes of RU data    = 518
Last-in-segment   (LIS)   TH+512 bytes of RU data    = 518
```

Each of these PIUs would be fragmented further into packets as follows:

```
PIU1, FIS:     Packet header + 512 bytes of PIU
               Packet header + 9   bytes of PIU

PIU2, MIS:     Packet header + 512 bytes of PIU
               Packet header + 6   bytes of PIU

PIU3, MIS:     Packet header + 512 bytes of PIU
               Packet header + 6   bytes of PIU

PIU4, LIS:     Packet header + 512 bytes of PIU
               Packet header + 6   bytes of PIU
```

It takes 8 packets to send this data. However 4 of those packets are not full.

Release B4 and later, adjusts the maximum segment size and maximum RU size so that the 2048 byte message would actually be sent as 2 chain elements:

```
First-in-chain  -- TH+RH+2012 bytes of RU data
Last-in-chain   -- TH+RH+36 bytes of RU data
```

These would be split into segments as follows:

```
First-in-chain, FIS  -- TH+RH+503       (512 total)
                MIS  -- TH +  503
                MIS  -- TH +  503
                LIS  -- TH +  503
Last-in-chain,  OIS  -- TH+RH+36
```

These would not have to be further fragmented for packet generation, as each one contains up to a maximum of 512 bytes of message data.

Note: PIUs may not be filled to capacity depending on the data stream being sent to the host.

3174 Errors

The following paragraphs describe data link control and the protocol for reporting errors during sessions.

Data Link

For data link control, action is as discussed in *IBM Synchronous Data Link Control General Information*. Unique action is that the Set Normal Response Mode command causes the 3174 to reset from an Activated Physical Unit to a Deactivated Physical Unit. All sessions must be restarted by the sequence starting with ACTPU.

LU-LU Session Error Reporting

A protocol has been established for the reporting of transmission and processing errors during sessions. When the host program or the 3174 SLU is the receiving LU, errors are reported by returning a negative response to the sending LU, with descriptive sense data included.

During a dependent LU 6.2 session, the host or the 3174 SLU may also choose to send an Unbind of type X'FE' (format or protocol error), with descriptive sense data included, to terminate the session.

The format of the 4-byte sense data sent with a negative response or in an Unbind request of type X'FE' or in an FMH-7, is as follows:

Byte	Contents
0	Category
1	Modifier
2 and 3	Sense code specific information

Byte 0 of the sense data RU is bit-encoded to reflect one of six transmission error categories as follows:

Byte 0	Category
X'80'	Path error
X'40'	RH usage error
X'20'	State error
X'10'	Request error
X'08'	Request reject

Byte 1 of the sense data RU is a binary modifier that further defines the error condition. The modifier encoding is unique to each category code. Appendix H, SNA Sense Codes defines the modifier encoding for each major code of system sense data that is issued by the 3174.

For LU types 1, 2, and 3, the 3174 will not examine the sense data in a negative response from the host. All negative responses on the LU-LU session cause the 3174 to enter RCV state and await further action by the host.

Sessions (LU Types 1, 2, and 3)

Three sessions exist for the 3174 when it is operating with SNA protocols: SSCP-PU, SSCP-SLU, and LU-LU (PLU-SLU). The three sessions can exist simultaneously. The SSCP-SLU and LU-LU sessions may wish to use the display simultaneously.

An interactive protocol is used with the 3174, in which, at any given time, only one of the sessions is defined as the device (display screen, keyboard, and data buffer) owner. During ownership, any attempts by the nonowner session to send FM data is rejected.

Figure 9-9 shows the transfer of device ownership between the SSCP-SLU and the LU-LU session. Prior to ACTLU, or following DACTLU, no session can own a device. Local operations initiated by the Test function are not defined as sessions.

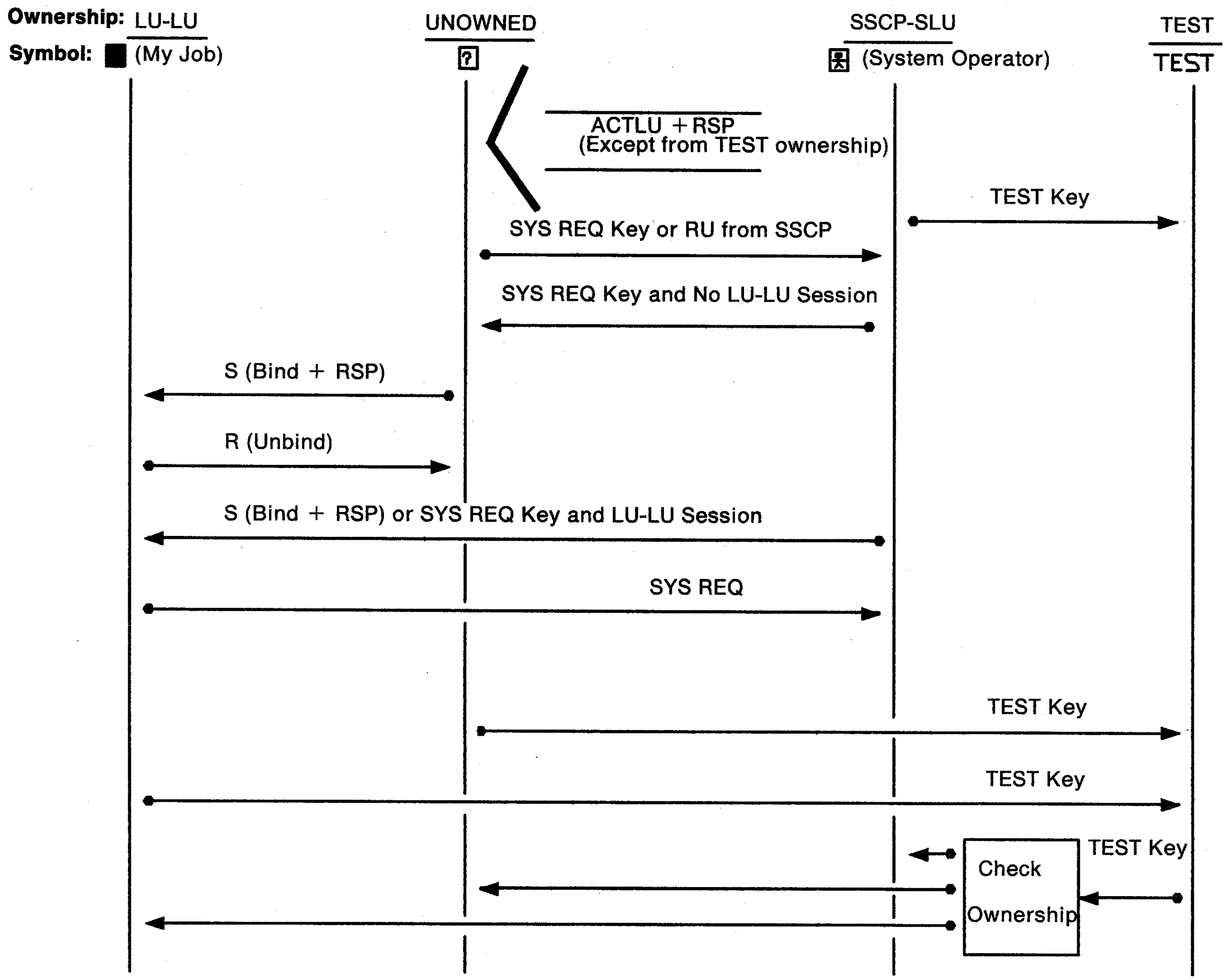


Figure 9-9. State Diagram for Session Ownership of Device

Device ownership is indicated to the operator by symbols in column 3 of the OIA. Prior to ACTLU or following DACTLU, this column is blank. ACTLU causes the Unowned symbol to appear.

After ACTLU is received, the Sys Req function may be used by the operator to control which session owns the device. When the LU-LU session is not bound and the Unowned symbol appears in column 3, the Sys Req function, or an RU from the SSCP, transfers device ownership to the SSCP-SLU session. At this time the System Operator symbol appears in column 3. The operator can then communicate with the SSCP.

If the attached device is a printer or a display station without a keyboard, an FM data request to the SLU from the SSCP while in the unowned state will be rejected with category not supported sense code X'1007'.

When a Bind command is received and positively responded to, ownership is transferred immediately from the SSCP-SLU session, or the unowned state, to the LU-LU session, and the My Job symbol appears in column three. Bind commands may be PLU-initiated without operator logon.

The Sys Req function is also used to transfer ownership from the LU-LU session to the SSCP-SLU session. This transfer of ownership interrupts communication taking place during the LU-LU session without waiting for completion of outbound chains. Inbound chains will be completed unless a test is made for a pacing response. As long as the LU-LU session remains bound, another pressing of the Sys Req function will cause ownership transfer back to the LU-LU session. If the LU-LU session is not bound, the Sys Req function will cause ownership transfer to the unowned state.

Pressing the Test function causes the device to go into or leave the test ownership state. This state removes the device from the SLU and makes it unavailable to either the SSCP or the PLU. If the PLU sends an FM request, the SLU sends RSP X'082D'. If the SSCP sends an FM request, the SLU sends RSP X'081B'. These responses assume that all other requirements for an active session have been met. When leaving the test state, a check is made for SSCP or PLU device ownership. Return will be to the session whose ownership is indicated by the check or to the unowned state if neither the PLU nor the SSCP is the owner.

Setting the Screen Size

When ownership changes, the screen size may change. When changing from the unowned state to SSCP-SLU ownership, the screen size is set to the maximum physical size. When the screen enters the unowned or test state, the initial screen size is the size set by the previous owner; pressing the Clear function will set the screen to the maximum physical size. Operation and control of the screen size when the owner is the LU-LU session is discussed in "Erase/Write Alternate Command" on page 2-8.

Pressing the Sys Req function clears the screen. The screen also is cleared by the transfer of ownership from unowned to SSCP-owned when this state transfer is caused by an outbound RU from the SSCP.

Operation in SSCP-SLU Session

The following paragraphs describe the operational characteristics of the 3174 during the exchanging of display data on the SSCP-SLU session.

SSCP-SLU Contention Operation

The 3174 supports FM profile 0. Immediate control and immediate response modes are followed, and all requests are treated as definite response requests.

HDX-contention is implemented, and a normal flow request must be processed and acknowledged by a response before an opposite-direction normal flow request can be accepted or processed.

The 3174 SLU is in contention state whenever SSCP-SLU session ownership mode is entered by use of the Sys Req function.

Nonerror Operation

For nonerror operation, the receipt of an FMD request or the receipt of a positive response initiates the transition to contention state. The transition from contention to send-not-xmit state is made when the first data key pressed is accepted. The transition to receive state is made when the Enter function is accepted.

The keyboard is controlled by state conditions. It is unlocked when in contention or send-not-xmit, and locked when in receive. The operative keys that are locked or unlocked are the same as for the LU-LU session.

There is no send-xmit state associated with the SSCP-SLU session.

Error Operation

When a normal flow request has been transmitted inbound and a negative response is received, the SLU remains in receive state and waits for an outbound request from the SSCP.

When a normal flow request is received but cannot be accepted because of an error or a not-available condition (that is, the terminal is in test mode, or the operator has started to type), the SLU remains in contention state following the negative response.

Outbound Message Handling

The SSCP may send messages to a display when the SSCP-SLU session owns the display. The messages are byte strings consisting of SCS control codes and SSCP-supported graphic codes. The only valid SCS control codes are NL and, when the APL/Text feature is installed, the Graphic Escape character. Null, IFS, and IRS are treated as graphics and displayed as blank, *, and ; respectively. Any other binary combination in the SCS data stream will be treated as if it is a graphic. The characters appearing on the screen for code points other than supported graphics are unpredictable.

Each message from the SSCP is displayed at the current cursor address. When the 3174 receives an NL control code in the SSCP message, it will insert nulls in the character positions remaining in the display line being written and position the cursor at the leftmost position of the next line. Characters following the NL code are displayed beginning at the new cursor position. The message wraps to the top of the screen if the last line on the screen is written and additional characters remain in the message.

After displaying the data in the received chain, the 3174 places the cursor in the position next to the last character if NL does not follow. If the message is ended by NL, the remainder of the line is set to nulls, and the cursor appears in the first character position of the next line. This cursor position address is called the *initial cursor address* and is stored to identify the starting position of the operator's display input data.

Inbound Message Handling

When the System Operator symbol is displayed, an operator can enter the message bound for the SSCP from the character position occupied by the cursor.

After entering a message, the operator must press the Enter function to initiate transmission of the inbound message to the SSCP. Pressing other AID functions has no effect, except for the Clear function. Data transmission does not occur. If other PA or PF functions are pressed, Input Inhibited and Minus Function symbols are turned on. Pressing the Clear function clears the display screen, and the initial cursor address is reset. The Erase Input and Erase EOF functions operate as defined under "Local Functions" on page 4-7.

Chains sent on the SSCP-SLU session are OIC and have a maximum RU length of 256 bytes. The 3174 will send the data (excluding nulls) contained in the first 256 screen character positions including and following the cursor address, or to the end of the screen, whichever occurs first.

System Logon

By means of the logon sequences, the terminal operator requests that a session be established with a PLU. The logon sequence is as follows:

1. The terminal operator checks the symbol displayed in column 3 of the OIA. If the My Job symbol is displayed, the terminal is already connected to a PLU, and system logon is not required.
2. The operator does one of the following:
   a. If the Unowned symbol is displayed, the terminal operator presses the Sys Req function to enter the SSCP-SLU owned session and then keys in a character-coded logon request in a syntax defined by the installation. The operator presses the Enter function, and the logon message is sent to SSCP.
   b. If the System Operator symbol is displayed, the display station is already owned by the SSCP-SLU session. In this case, the operator performs step 2a, except the Sys Req function is not pressed.
3. SSCP receives the logon request and sends a positive response (the Input Inhibit and Wait indicators disappear).
4. SSCP may send a message, such as a prompting or error message, if necessary. When the 3174 receives this message, it sends a +RSP if accepted for display, or RSP X'081B' if device ownership has been transferred to the LU-LU session.

5. A successful logon causes the My Job symbol to appear. An error message leaves the System Operator symbol displayed; the operator may retry, starting with step 2b.

   Note: An SSCP-SLU message confirming LOGON should not be used, because this may arrive after the Bind command and confuse the operator by displaying the Message Received symbol.

System Logoff

By performing the logoff sequence, the terminal operator requests the SSCP to terminate a session with the PLU. The logoff sequence is as follows:

1. The terminal operator presses the Sys Req function to enter the SSCP-SLU owned session and keys in a character-coded logoff request in a syntax defined by the installation. When the operator presses the Enter function, the logoff message is sent to SSCP.
2. SSCP receives the logoff request and sends a definite response.
3. SSCP may send a message. When the 3174 receives the message, it sends a +RSP if accepted for display, or RSP X'081B' if device ownership has been transferred.

SNA Printer Control

The following paragraphs describe the structure of the SNA session and the SNA control for printer operations. Details and constraints of subsystem operation are described under "3174 Local Copy Operation" on page 4-33.

Figure 9-10 on page 9-56 shows a typical example of a logical subsystem and the point at which contention for the printer occurs.

Printers attached to the 3174 can be configured to operate in one of the following modes:

System Mode: The printer is logically coupled with a type 1 or 3 SLU as the principal device; the SLU is in direct session with the PLU. The SLU type is selected at the time the session is bound (the Bind command) and remains the same throughout the session. In this mode, the printer cannot be used for Local Copy functions.

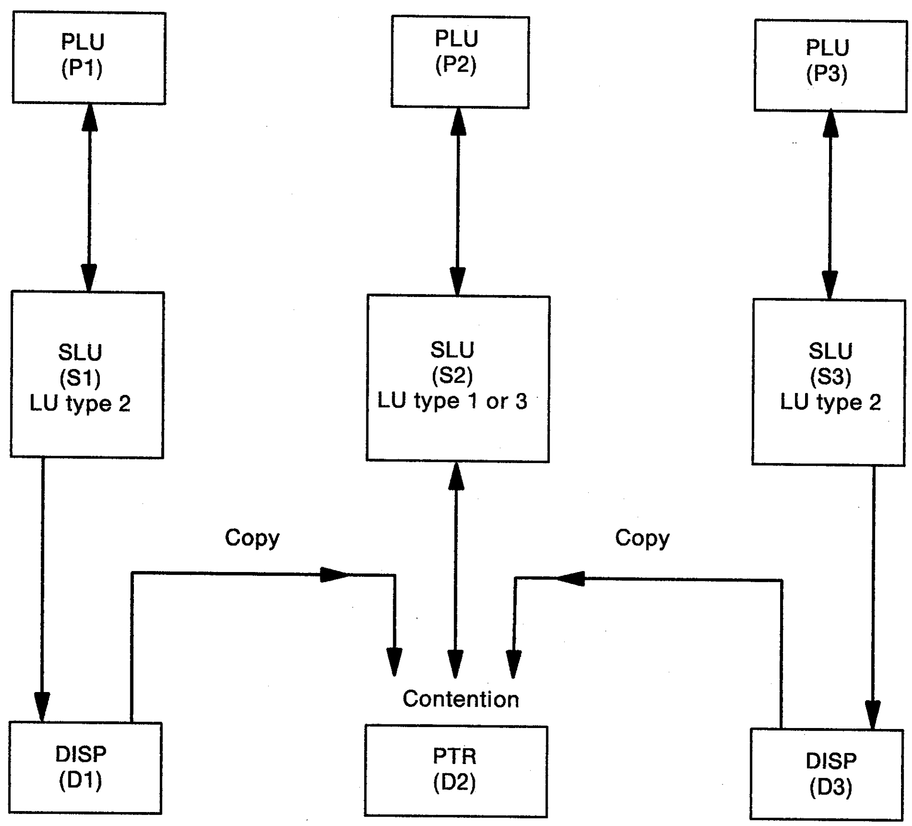
Local Mode: The printer may be used by one or more type 2 SLUs as a subsidiary device for Local Copy functions. A copy request may be initiated by the SLU's PLU (WCC with Start Print=1), or the operator may initiate the copy request by using the Print function. In this mode, the printer cannot be used as a type 1 or 3 SLU; a Bind request for the SLU associated with the printer will be rejected with sense code X'0801'.

Shared Mode: Both the SLU type 2 and the SLU type 1 or 3 may compete for use of the printer. The printer is used by the SLU type 1 or 3 as a principal device and by the SLU type 2 as a subsidiary device. Depending upon proper customizing, sharing may be done between brackets or between sessions.

> **BETB Printer Sharing:** In shared mode, printer contention is allowed to occur between brackets. When the printer's SLU enters BETB state (or if a session does not exist), the printer is available for either a Local Copy from an SLU Type 2 or an SLU type 1 or 3 bracket, whichever occurs first. If a local copy

function is being performed for either a single SLU type 2 or a queue of SLU type 2 requests, a BB request for the type 1 or 3 SLU will be rejected with sense code X'0814' (Bracket Reject, RTR to Follow). When all local copies are completed, the type 1 or 3 SLU acquires the printer and sends RTR to the PLU. If the type 1 or 3 SLU is INB, the printer is not available for Local Copy functions. (For details, see the description of the function under "Local Copy Function" on page 4-24.)

Between Session Sharing: When in shared mode, the 3174 allows a printer to be used for local copy only when the printer is not being used in an SLU type 1 or 3 session. If a printer is being used for local copy and a Bind is received to initiate a type 1 or 3 session, the 3174 allows completion of the local copy in progress and then sends a positive response to the PLU. All queued local copy requests will either be processed by an alternate printer or rejected with sense code X'0801' (no printer configured – host-initiated local copy only). This type of sharing biases the printer availability in favor of the type 1 or 3 SLU session.



P1,P2,P3	:PLUs at the host.
S1,S3	:SLUs in the 3174 operating as LU type 2.
S2	:SLU in the 3174 operating as LU type 1 or LU type 3.
D1,D3	:Display devices controlled by S1 and S3, respectively.
D2	:Printer device controlled by S2 or copied to from D1 or D3.

Figure 9-10. 3174 Logical Subsystem

SNA Reference Data

The following sections describe Bind command settings, Bind parameters, and SLU Logical Unit Status.

Bind Default

The following Bind command settings are suggested for the specified LU types:

For LU Type 1:

Byte	Content	Byte	Content
0	X'31'	9	X'01'
1	X'01'	10	X'85'
2	X'03'	11	X'87'
3	X'03'	12,13	X'0000'
4	X'B1'	14	X'01'
5	X'90'	15−17	X'00−00'
6	X'30'	18	X'E1'
7	X'80'	19−26	X'00−00'
8	X'00'		

For LU Type 2:

Byte	Content	Session Screen Size	Display Model
0	X'31'		
1	X'01'		
2	X'03'		
3	X'03'		
4	X'B1'		
5	X'90'		
6	X'30'		
7	X'80'		
8,9	X'0000'		
10	X'87'		
11	X'87'		
12,13	X'0000'		
14	X'02'		
15−23	X'00−00'		
24	X'00'	Base default (12 × 40 or 24 × 80)	1−5
	X'01'	Base Model 1 default (12 × 40)	1
	X'02'	Base Model 2 default (24 × 80)	2−5
	X'03'	Unspecified screen size	2−5
	X'7E'	Extended default size is specified in bytes 20 and 21.	1−5
	X'7F'	Extended alternate size is specified in bytes 22 and 23.	1−5
25		Reserved	
26	X'00'		

For LU Type 3:

Byte	Content	Session Buffer Size
0	X'31'	
1	X'01'	
2	X'03'	
3	X'03'	
4	X'B1'	
5	X'90'	
6	X'30'	
7	X'80'	
8,9	X'0000'	
10	X'85'	
11	X'87'	
12,13	X'0000'	
14	X'03'	
15–23	X'00–00'	
24	X'00'	Extended LU3 uses all available buffer space. No size is specified.
	X'01'	Base LU3, 12 × 40
	X'02'	Base LU3, 24 × 80
	X'7E'	Extended LU3 static buffer is defined in bytes 20 and 21.
	X'7F'	Extended LU alternate sizes are indicated in bytes 22 and 23.
25		Reserved
26	X'00'	

For Dependent LU Type 6.2:

Byte	Content	Byte	Content
0	X'31'	10	X'88'
1	X'00'	11	X'89' (see note 1)
2	X'13'	12	X'01' (see note 1)
3	X'07'	13	X'00'
4	X'B0'	14	X'06'
5	X'B0'	15	X'02'
6	X'50'	16–23	X'00–00'
7	X'A1'	24	X'24'
8	X'00'	25,26	X'0000'
9	X'01' (see note 1)	27—r	See note 2

Notes:

1. These settings are suggested for 3174 Models 1L, 11L, and 21L and for 3174 Models 3R, 13R, 23R, 53R, and 63R when Token-Ring-Attached to Models 1L, 11L and 21L with the gateway feature. For all other models, the suggested settings are X'02' for bytes 9 and 12, and X'87' for byte 11.

2. Bytes 27 – *r* are optional. If these bytes are included in the Bind request, the 3174 will validate their format. If a mode name is specified in the user data field, it is recommended that the mode name be BATCH or #BATCH. For Configuration C, the mode name must be BATCH or #BATCH.

Bind Check

Tables 9-8 and 9-9 (for LU types 1, 2, and 3, and for LU type 6.2) show the bytes of the Bind parameters and whether they are checked.

Table 9-8. Bind Parameter Checking for LU Types 1, 2, and 3

		LU Type 1		LU Type 2		LU Type 3	
Byte	**Bit**	**Check**	**Reject If**	**Check**	**Reject If**	**Check**	**Reject If**
1	0−3	C	not X'0'	C	not X'0'	C	not X'0'
	4−7	C	not X'1'	C	not X'1'	C	not X'1'
2,3		C	not X'03'	C	not X'03'	C	not X'03'
4	0	NC		NC		NC	
	1	C	B'1'	C	B'1'	C	B'1'
	2,3	C	B'00'	C	B'00'	C	B'00' or B'01'
	4,5	NC		NC		NC	
	6	NC		C	B'1'	C	B'1'
	7	C	B'0'	C	B'0'	C	B'0'
5	0	NC		C	B'0'	NC	
	1	NC		NC		NC	
	2,3	C save	B'00'	C save	B'00'	C save	B'00'
	4−7	NC		NC		NC	
6	0	NC		NC		NC	
	1	NC		C	B'1'	C	B'1'
	2	C	B'0'	C	B'0'	C	B'0'
	3	C	B'0'	C	B'0'	C	B'0'
	4	C	Note 1	C	Note 1	C	Note 1
	5−7	NC		NC		NC	
7	0,1	C	not B'10'	C	not B'10'	C	not B'10'
	2	C	B'1'	C	B'1'	C	B'1'
	3	C	B'1'	C	B'1'	C	B'1'
	4−7	NC		NC		NC	
8		NC		NC		NC	
9	0,1	NC		NC		NC	
	2−7	C	B'00 0000'	NC		NC	
10	0−7	NC		C		NC	
11		C		NC		NC	
12,13		NC		NC		NC	
14		C	not correct device	C	not correct device	C	not correct device
15−19		NC		NC		NC	
20−23		NC		C (note 2)		C (note 2)	
24		NC		C save		C save Device Dep	
25		NC		NC		NC	
26 (Note 3)		C	not X'00'	C	not X'00'	C	not X'00'
27−35	All bytes ignored (see note 3)						

Legend: C = Check NC = No check B = Bit

Notes:

1. Feature-dependent.
2. If byte 24 bits 4-7 have X'E' or X'F', these bytes are checked.
3. Bytes 26-35 are reserved for the Encrypt/Decrypt feature.

Table 9-9. Bind Parameter Checking for LU Type 6.2

Byte	Bit	LU Type 6.2	
		Check	Reject If
1	0−3 4−7	C C	X'0' X'0'
2		NC	
3		NC	
4		NC	
5		NC	
6		NC	
7		NC	
8		NC	
9	0,1 2−7	NC C	 B'00 0000'
10	0 1−7	C NC	B'0'
11	0 1−7	NC C	 < 256
12		NC	
13		NC	
14		NC	
15		NC	
16−22		NC	
23	0−2 3 4,5 6 7	NC C NC C NC	 B'0' and bit 6=B'1' B'1' and bit 3=B'0'
24	0 1,2 3−7	NC C NC	 Not B'01' or B'10'
25		NC	
26	0,1 2,3 4−7	NC C C	 Not B'00' Not X'0'
27−m		NC	
m+1 − n		C*	
n+1 − p		NC	
p+1 − r		NC	

* The bytes being checked depend on the type of subfield:

Subfield	Action
Unformatted data	Ignored
Modename	Reject if length > 9 or modename specified is not BATCH or #BATCH
Session ID	Reject if 3 > length > 9
Fully-qualified PLUNAME	Reject if length > 18, NETID length > 8, or LUNAME length > 8
Fully-qualified SLUNAME	Reject if present
Random or enciphered data	Reject if present.

Logical Unit Status (LUSTAT) (LU Types 1, 2, and 3)

LUSTAT provides a means for the SLU to report exception conditions or status when the SLU is not in receive state (a negative response is used when the SLU is in receive state). The following are the CD settings that accompany LUSTAT and the state changes, if any, that occur:

SLU State When LUSTAT Sent	CD Setting	State Change
BETB	May be set	None
ERP1	Not set	None
Send	Set for principal device	To Receive
	Not set for subsidiary device	None

Inbound LUSTATs are sent with exception response by the 3174.

Note: An LUSTAT showing power off sent while in send state carries CD. An LUSTAT that shows power on cannot be sent until the PLU causes an SLU state change to Send state, ERP1 state, or LU state (S, *R) — not receive state.

The following status codes will be used by the 3174 to send information to the PLU, on the PLU-SLU session:

Value	Explanation
X'0001z000'	Device now available; presentation space not destroyed.
X'00020000'	Device has received CD, but has no input mechanism.
X'081C2000'	Component failure; permanent error.
X'082B0000'	Device available; presentation space integrity lost.
X'08310000'	Principal device is powered off or disconnected.
X'0801z000'	Printer has been removed from configured status.

Where:

z Specifies whether the status refers to the principal or subsidiary device, as follows:
- 0 LU type 1 Principal (printer)
- D LU type 2 Principal (display)
- B LU type 2 Subsidiary (printer)
- 0 LU type 3 Principal (printer).

(See "SNA Printer Control" on page 9-55 for a description of principal and subsidiary devices.)

The priority of these status codes, in low to high order, is assigned as follows:

X'0002', X'0001', X'082B', X'0831', X'0801', X'081C'.

The 3174 will send the highest level of priority status when an opportunity allows its transmission.

Table 9-10 on page 9-62 shows the LUSTAT codes that are returned to clear the negative response condition listed in the left column. Table 9-11 on page 9-62 lists the LUSTAT codes that are used to report an SLU error condition instead of a negative response. The X's show the sessions that use the code points.

Table 9-10. LUSTAT Codes to Clear Negative Responses				
	LU STATUS Code			
Negative Response Code	LU type			SSCP
	T1	T2	T3	
0802	00010000 082B0000 081C0000 08310000	0001D000 082B0000 081CD000 08310000	00010000 082B0000 081C0000 08310000	NA
0807	NA	0001B000 0801B000 081CB000 081CD000	NA	NA
082D	NA	0001D000 082B0000 081CD000	NA	NA
082E	NA	0001B000 0801B000 081CB000 081CD000	NA	NA
0831	082B0000 081C0000	082B0000 081CD000	082B0000 081C0000	NA NA

Table 9-11. LUSTAT Codes to Report SLU Error Condition			
	Sent By LU type		
LUSTAT	T1	T2	T3
SEND			
BETB			
ERP.1			
00020000	X	X	X
081C0000	X		X
081CB000		X	
081CD000		X	
082B0000	X	X	X
08310000	X	X	X
0801B000		X	

LUSTAT is used as follows.

For all LU types, when the 3174 has sent negative response with X'0802' or X'082E' and this condition is reset, LUSTAT with X'0001P000' will be sent, where the value P is X'0' for LU type 1 or 3, X'D' for LU type 2 principal (display), and X'B' for LU type 2 subsidiary device (printer).

If the presentation integrity is lost while an X'0802' condition exists, LUSTAT with X'082B0000' will be sent instead of X'0001P000' when the X'0802' condition is reset.

For LU type 2, when the 3174 SLU has sent negative response with secondary component not available (X'0807') and this condition is reset, LUSTAT with X'0001B000' will be sent.

For all LU types supported by the 3174, the LUSTAT X'00020000' will be sent to the PLU when the 3174 accepts a normal flow request carrying CD, but no input components (keyboard, light pen, MSR, etc.) are attached to the device.

For all LU types, LUSTAT with X'082B0000' will be sent to the PLU when the 3174 SLU detects presentation integrity lost (for example, regeneration buffer parity error) and is in (S, *R) state for the 3174.

For LU type 2, when the 3174 has sent negative response (Device Busy) (X'082D') to a PLU request because of session ownership change from PLU to SSCP or TEST, LUSTAT with X'082B0000' will be sent to the PLU when returning to the PLU-SLU session.

For LU type 2, when the negative response (Device Busy) (X'082D') has been returned from the 3174 for a Back Tab busy condition, the LUSTAT X'0001D000' component now available to the PLU will be sent when the busy condition clears.

For LU type 2, when the 3174 has sent negative response (Device Busy) (X'082D') to a PLU because the SLU is busy executing a local copy, the 3174 sends LUSTAT X'0001D000' component now available to the PLU when the busy condition clears.

For all LU types, if a principal device is powered off or unplugged from the controller port and a session exists that is in (S, *R) state, LUSTAT X'08310000' will be sent to the PLU.

For all LU types, when a principal device has sent negative response or LUSTAT X'08310000' and then power is restored, LUSTAT with X'082B0000' will be sent to the PLU.

For all LU types, if the 3174 finds a permanent error in the principal device and is in (S, *R) state, LUSTAT with X'081CP000' will be sent to the PLU. The value of P is the same as previously defined.

For LU type 2, if the 3174 finds a permanent error in the subsidiary device and is in (S, *R) state, the worsening of the previous condition will not be reported. Instead, LUSTAT X'0001B000' will be sent, and the next outbound request will be rejected with the proper sense code.

For LU type 2, if the 3174 finds the subsidiary device has been configured from local or shared mode to system mode, LUSTAT X'0001B000' will be sent if an LUSTAT is owed. The next outbound request will be rejected with the proper sense code.

Error Recovery Procedures

The following sense codes are returned by a negative response, an LUSTAT, an Unbind request, or an FMH-7. Suggested recovery procedures are indicated for each error code and must be evaluated for the needs of each user.

Negative Response Codes

Error Code	Recovery Procedure (See notes on page 9-65) LU Types 1, 2, and 3	LU Type 6.2
Path errors: X'80xx'	1	1
RH errors: X'40xx'	2	1, 20
State errors: X'20xx'	2, 3	1, 20
Request errors: X'10xx'	2, 21	1, 20
Request Reject: X'08xx'	See the following table for the sense code and LU type, then go to the recovery note(s) specified.	

Hex 'xx'	LU Type 1	LU Type 2	LU Type 3	LU Type 6.2	PU
01	5	5 or 6	5	NA	
02	8	7	8	NA	
05	4	4	4	24	
07	NA	7	NA	NA	
09	2	2	2	NA	
0A	4	4	4	NA	
0C	NA	NA	NA	NA	1, 4
0F	NA	NA	NA	1	
11	9	NA	NA	NA	
13	10, 11	10, 11	10, 11	NA	
14	12	NA	12	24	
15	4	4	4	24	19
1B	NA	13	NA	NA	
1C	3, 4	3, 4	3, 4	NA	
21	1	1	1	NA	
29	3, 4	3, 4	3, 4	NA	
2B	14	14	14	NA	
2D	NA	7	NA	NA	
2E	NA	7	NA	NA	
2F	NA	15	NA	NA	
31	7	7, 16	7	NA	
35	1	1	1	1	1
43	NA	7, 17	7, 17	NA	
45	1	1	1	NA	
46	NA	NA	NA	21	
4B	NA	NA	NA	22	
4C	4	4	4	23	
63	NA	4	4	NA	
64	NA	NA	NA	24	
71	NA	4	4	NA	
89	NA	NA	NA	23,25	

LUSTAT Sense Codes

Hex Code	Recovery Procedure (See Recovery Notes)
0001 0000	9a
0001 B000	9a
0001 D000	9a
0002 0000	18
0801 B000	6, 15
081C 0000	3
081C B000	15
081C D000	3
082B 0000	14
0831 0000	7, 16

Recovery Notes:

1. No recovery action can be taken until the error condition reported is corrected.
2. Unbind and correct the program code.
3. Retry the operation up to three times by sending Clear, SDT, and starting traffic at a program check-point restart. Terminate the operation if the retries are not successful.
4. No recovery; look for an alternate terminal, or terminate the operation.
5. Unbind and look for an alternate terminal, or terminate the operation.
6. Read the display, and save for later printout.
7. Wait for LUSTAT; recovery based on LUSTAT code.
8. Wait for LUSTAT; retransmit chain.
9. User options:
   a. Resend chain.
   b. Send next chain.
   c. Send query to printer operator for PA function response.
10. Check the input queue for inbound data with BB and CD.
11. Protocol error occurred. Retry without BID or BB.
12. Wait for RTR to begin bracket.
13. User options:
    a. Check the input queue, and wait for data.
    b. Send SIGNAL to get CD.
14. Reformat display or printer from check-point restart.
15. Retry the operation up to three times by use of Write command and WCC with start-print bit set to 1. An alternate printer may become available.
16. Unbind to force user identification by entering new logon.

17. Retry with correct bit settings.
18. Program-dependent:
    a. If input is required from the terminal, unbind and select an alternate terminal.
    b. If input is not required, data output may continue. CD should be suppressed.
19. Retry after response to the previous request.
20. Correct the reported condition, rebind the session, and retry the operation.
21. Wait for FMH-7; recovery is based on the sense code in FMH-7.
22. Retry the operation.
23. Display the 3174 error log to determine the cause of the error and the appropriate recovery procedure.
24. Host software error.
25. Additional SNA sense code data is contained in the data that follows the FMH-7. Refer to the *3174 Central Site Customizing User's Guide* for a description of SNA registered sense codes.

Part 5. Network Management Tools

This part contains the following chapters:

Chapter 10, "Response Time Monitor (RTM) Function," describes Response Time Monitor (RTM) definitions, logs, interfaces, and operating procedures.

Chapter 11, "Network Asset Management Function," describes the Network Asset Management function which supplies status of a controller and its attached devices to the host.

Chapter 12, "SNA Alert Function," describes the SNA Alert function, which is a problem determination function you can select when customizing 3174 SNA units.

Chapter 13, "Common Management Information Protocol Event Reports," describes the CMIP Event Report function which is a problem/performance determination tool that is available on the 3174 when customized as an ISDN Gateway.

Chapter 10. Response Time Monitor (RTM) Function

Introduction

This chapter describes the Response Time Monitor (RTM), a network management tool that measures response time. This chapter contains specific information about the following topics:

- Response time
- RTM logs
- RTM host interfaces
- Host request and 3174 reply formats
- Operating procedures.

As networks become larger and more complex, many installations are having more and more difficulty managing them effectively. When components within networks change because new functions are installed, such as automatic switching from a telephone line to a satellite link, a new routing table, or a new version of software in one of the nodes, you may notice a significant improvement or degradation in response time. When response time increases and the network management desk at the host receives complaints, the network manager has no way of verifying the problem.

The RTM function allows the network manager to differentiate between a good and a bad response time as well as a questionable response time. The RTM function accurately measures and records the transaction times of inbound host attention (AID) operations from display stations that communicate with the host.

3174 and Host Requirements

The RTM function is available on all 3174 models, but you must customize in order to use it.

A timer in the 3174 provides a time-base generator that increments a 16-bit counter every 25 milliseconds. The timer furnishes the microcode with an approximately 27-minute interval with which to measure the host's response to AID-generating functions and other actions, such as a selector-pen-immediate detect or an MSR/MHS auto-enter operation.

No host programming is required to use the RTM function for 3270 subsystem display of response times. However, the RTM function has a host interface for SNA communication. Host programming support (Network Logical Data Manager, Release 2) is available to set RTM parameters from a host and to collect and display RTM information at an NCCF operator station. No host interface is available for BSC-linked or non-SNA local-attached 3174s. Refer to *Network Program Products—General Information* for more information.

Supported Devices

The RTM function measures response times for all attached controller terminals. Because printers are output devices only, RTM statistics are not kept for them. Also, RTM statistics are not available for DFT sessions on hosts connected through CCAs.

Customization

Customizing support is required for the RTM feature. During customizing, panels are displayed to permit the customizer to specify various RTM feature parameters, such as the configuration and boundaries. See customizing questions 127 and 128 in the *3174 Planning Guide* for more information.

Response Time

When you customize the 3174 for the RTM, each configured device or logical terminal is allocated a series of five counters, as shown in Figure 10-1. These counters represent intervals of time into which the various response times are mapped.

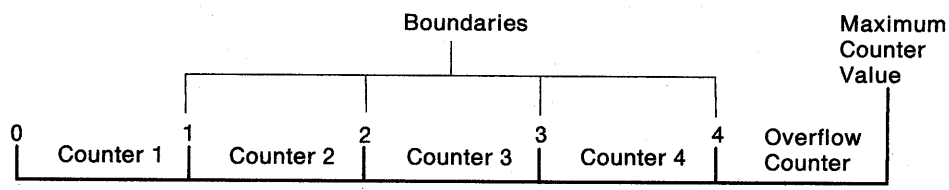


Figure 10-1. Counters and Boundaries

When you customize the 3174, you can set as many as four counters by specifying the maximum times, or boundaries, associated with each counter. If a response time is less than or equal to a particular boundary, the counter associated with that boundary is incremented at the end of the transaction. If not, the next boundary value is checked. If the response time does not fit within any of the boundaries, then it is mapped into the fifth, or *overflow*, counter.

If you specify any one of the four boundaries as the maximum, the counter associated with that boundary becomes the overflow counter and subsequent counters are ignored. By specifying boundary values properly, you can obtain a distribution of network responses for each logical terminal.

You must specify boundaries in order of increasing magnitude. The maximum boundary value is 27 minutes, 18.3 seconds, while the maximum counter value is 65535. The counter does not wrap around when it reaches this value. If any of the boundaries is set to the maximum boundary value, the counter associated with it becomes the overflow counter. The customizing default boundaries are 1, 2, 5, and 10 seconds.

The RTM function also keeps the total response time for each logical terminal. Each time a counter (including the overflow counter) is incremented, the corresponding transaction time is added to a total-time register for that terminal. By dividing this total time by the total number of transactions, the average response time is calculated. This average response time is available only through the host application, so you cannot display it by the 3174.

RTM measures response time from recognition of the inbound AID request in the 3174 until the end of the transaction. The end-of-transaction parameter is defined for all devices when the 3174 is customized. When the 3174 is attached via an SNA protocol, response time is measured on the LU-LU flow only. None is measured for the SSCP-LU session.

The following paragraphs describe how the end-of-transaction parameter may be defined.

First Character

The measurement is terminated when the first character of the next outbound message is written to the terminal.

With SNA Protocol: The *first character* is the first character of *First in Segment*. This character can be any of the following:

- A Write, Erase/Write, Erase/Write Alternate, or Erase All Unprotected command
- A Load Programmed Symbols, Erase Reset, Set Window Origin, Activate Partition, Create Partition, Destroy Partition, or Reset Partition structured field.

A write with or without data terminates the RTM measurement. These commands and structured fields are examples of outbound communication that might modify the contents of the presentation space.

With Non-SNA Protocol: The *first character* is the first character placed on the screen or a BSC Copy command.

Keyboard Unlocked

With SNA protocol, the measurement is terminated when the next outbound operation (other than a read) to the terminal contains one or more of the following items:

- A CD indicator
- An EB indicator
- A keyboard restore request (either a WCC with the keyboard restore bit set or an Erase All Unprotected command [implicit keyboard restore]).

The timer stops after *Last in Segment* of *LIC* is processed. The correlation between the items listed above and the action taken by the 3174 is as follows (0=off, 1=on):

Keyboard Restore Request	EB	CD	3174 Action
0	0	0	Timer not stopped
0	0	1	Timer stopped
0	1	0	Timer stopped
0	1	1	Timer stopped
1	0	0	Timer stopped
1	0	1	Timer stopped
1	1	0	Timer stopped
1	1	1	Timer stopped

With non-SNA protocols:

- For CUTs, measurement is terminated as follows:
  - On EOT for BSC.

    However, upon receipt of a BSC Copy command, the measurement is terminated on the *from* terminal once the screen image is stored in the 3174. At this point, the *from* terminal is available for you to use. Measurement is terminated at the *to* terminal designated in the BSC Copy command on receipt of EOT.
  - On End of Command Chain (local models).
- For DFTs, measurement is terminated on receipt of a Terminate Chained Command Sequence (TCCS).

CD/EB

This definition is valid only in an SNA environment. The measurement is terminated upon receipt of a CD or EB indicator, which puts the device into send or contention state, respectively. The timer stops after the last character of *Last in Segment* of *LIC* is processed.

The correlation between keyboard restore and the two indicators is as follows (0=off, 1=on):

Keyboard Restore Request	EB	CD	3174 Action
0	0	0	Timer not stopped
0	0	1	Timer stopped
0	1	0	Timer stopped
0	1	1	Timer stopped
1	0	0	Timer not stopped
1	0	1	Timer stopped
1	1	0	Timer stopped
1	1	1	Timer stopped

Notes:

1. EB and CD received in an exception response request, or in a definite response, cause measurement to be terminated on LIC.
2. CD accompanying a read command does not stop the timer.

Last Character

This definition accurately measures the total elapsed time for transactions with host applications that unlock the keyboard before the actual data requested by the terminal operator is provided by the application. It measures from the time an AID function is pressed to receipt of the last character of the last message before the next AID function is pressed. The definition of *last character* is as follows:

With SNA protocol: On receipt of CD/EB (change direction or end bracket).

With non-SNA protocol: For terminals such as the 3278 and 3279 display stations, measurement is terminated by the following:

- On EOT for BSC. However, upon receipt of a BSC Copy command, the measurement is terminated on the *from* device, once the screen image has been stored in the controller. Then, the *from* device is available for the operator to use. The *to* device in the BSC Copy will still have the measurement terminated at EOT.
- On End of Command Chain.

The last character definition is not supported on DFTs. RTM support is disabled for DFT devices if this definition is selected by the host or 3174 customization.

RTM Logs

Display stations that may display RTM logs are the 3178, 3179, 3180, 3278, and 3279 display stations, and the 3270 Personal Computer in CUT mode (not DFT).

Through customizing, you can specify which ports may be used to view the RTM logs:

- No ports
- Port 0 only (HG26 or HG27)
- All ports.

You can view the entire RTM log when an authorized display station is in test mode. Refer to Chapter 16, "Multi-Host Support" on page 16-1 for restrictions on displays.

If you are using an authorized display station, you can retrieve and display the RTM logs of all configured devices. See "Operating Procedures" on page 10-19 for a description of the procedure.

A hard copy of the display may be obtained by use of the Local Copy function.

When you do not customize the 3174 for the host RTM interface and you are using an authorized display station, you can reset the RTM logs of all configured devices. See "Operating Procedures" on page 10-19 for a description of the procedure. All log information is reset except the customized boundaries, the customized RTM definitions, any pending transaction status, and the last transaction time. (If the RTM-started flag is set, the response time for that transaction is still measured.) The RTM logs can be reset at any time during their display.

When you customize the 3174 for host RTM support, you cannot set the RTM logs.

RTM Log Display Format

For Configuration Support A and S, the RTM log information is displayed as shown in 10-2. For Configuration Support B and C, the RTM log information is displayed as shown in 10-3. The entire screen is protected, and the second line is displayed in high intensity.

```
A4/1                                   @ = 000
@     DEF  CTR#1  BDY#1   CTR#2  BDY#2  CTR#3  BDY#3  CTR#4   BDY#4   OV
00     1      10    0.5  11,415    1.0    316    5.0     21  1:00.0       6
01p    1       0    0.5       0    1.0      0    5.0      0  1:00.0       0
02 ?   1     651    0.5       0    1.0      0    5.0      0  1:00.0  14,458
03   * 2     215    0.5     512    1.0     56    5.0      0  1:00.0       1
04i    1 *    31    1.0      11    2.0  4,371    5.0      4    10.0       2
05    .1       0    0.5       0    1.0      0    5.0      0  1:00.0       0
06    *3 *     1    1.0      61    2.0      4    3.0      0     4.0      45
07     1   1,415    0.5     890    1.0    323    5.0      0  1:00.0   1,381
```

Note: The example shows representative information for the first eight logical terminals. Each time the Enter (or PA1) function is pressed, the next group of eight terminals is displayed. The heading, @ = XXX, in the top center of the display, corresponds to the first logical terminal number in the group currently being displayed (000, 008, etc.).

An asterisk (*) is displayed in the DEF column when the host changes a definition. In the example, the definitions of logical terminals 03 and 06 were changed.

Also, an * is displayed in the CTR#1 column if any of the boundaries are changed by the host. In the example, one or more boundaries were changed for logical terminals 04 and 06.

Abbreviations and Definitions of Symbols

CTR = Counter
BDY = Boundary
@ = Device or logical terminal
OV = Overflow
p = Printer (no statistics are kept for printers)
i = Distributed function device
- = Never powered on (no statistics are kept)
* = Parameter set by the host. An * preceding the response time definition indicates that the host has changed the definition.
An * following the definition indicates that the host has changed boundary values.
? = RTM disabled by host, or by customizing, for this device
DEF = Response time definition:
1 = Time to first character on screen
2 = Time to keyboard usable by operator
3 = Time to CD/EB
CTR#1 = First counter (response time = 0 up to BDY#1 value)
BDY#1 = First boundary in minutes and seconds
CTR#2 = Second counter (response time greater than BDY#1 up to BDY#2 value)
BDY#2 = Second boundary in minutes and seconds
CTR#3 = Third counter (response time greater than BDY#2 up to BDY#3 value)
BDY#3 = Third boundary in minutes and seconds
CTR#4 = Fourth counter (response time greater than BDY#3 to BDY#4 value)
BDY#4 = Fourth boundary in minutes and seconds
OV = Overflow (response exceeds last boundary value)

Figure 10-2. RTM Display Panel for Configuration Support A and S

Displayed boundaries are rounded to the nearest tenth of a second.

```
                 ____ Response Time Log - Host ID 1E ____

Host DEFINITION CTR#1   BDY#1 CTR#2   BDY#2 CTR#3   BDY#3 CTR#4   BDY#4  OVER
Addr
001    i b d3   00000 11:01.0 00000 10:12.0 00000 11:15.0 00000 11:10.0 00000
002    _ b d3   00000     0.5 00000     2.0 00000     5.0 00000    10.0 00000
003    p    3   00000     1.0 00000     2.0 00000     5.0 00000    10.0 00000
004    v b d1   00000     1.0 00000 11:01.0 00000     5.0 00000    10.0 00000
005    i b d2   00000     1.0 00000     2.0 00000     5.0 00000    10.0 00000
006    v    3   00000     0.5 00000     2.0 00000 11:01.0 00000    10.0 00000
007    v b d3   00000     1.0 00000     2.0 00000     5.0 00000    10.0 00000
008    i b ?3   00000     1.0 00000     2.0 00000     5.0 00000 11:01.0 00000

                               DEFINITION

p = Printer             b = BDYs set by host       1 = Time to First Character
i = Intelligent device  d = DEF set by host        2 = Time to Keyboard Unlocked
_ = Never powered on    ? = DEF disabled by host   3 = Time to CD/EB
v = Video display                                  4 = Time to Last Character

 To go directly to other tests, enter: /Test,Option
 Select test; press Enter ===> _

 PF: 3=Quit   7=Back    8=Fwd     12=Test menu
```

Figure 10-3. RTM Display Panel for Configuration Support B and C

Last Transaction Time Indicator

Display stations that can display the Last Transaction Time Indicator (LTTI) are the 3178, 3179, 3180, 3278, 3279, and 3290 display stations, and the 3270 Personal Computer.

You display the Last Transaction Time Indicator at an authorized display station by performing the procedure in "Operating Procedures" on page 10-19. (A display station can be authorized by customizing or by the host.)

For each transaction, the LTTI is displayed in one of two formats. The format depends on the transaction time measured: less than 1 minute or more than 1 minute. The LTTI is displayed in locations 21 – 27 of the operator information area and appears as either:

clock: ss.s	—	:00.0	—	when the transaction time is less than 1 minute.
clock mm:ss	—	00:00	—	when the transaction time is 1 minute or more.
clock: 00.0	—	:00.0	—	when no last transaction time is available.

Where: ss = seconds, .s = tenths of a second, mm = minutes.

Once enabled, the Last Transaction Time Indicator is updated each time you perform a host attention (AID) operation. Updating continues until the Last Transaction Time Indicator is erased by one of the following actions:

- The device (or controller) is powered off.
- You repeat the steps described in "Displaying the Last Transaction Time Indicator" on page 10-21.

If the host revokes authorization of the last transaction time indicator after you enabled it, the indicator continues to be displayed until the next host attention operation from that logical terminal. At that point, the clock symbol remains displayed but the time is erased from the screen. The Last Transaction Time Indicator (the clock symbol and time) is again displayed when authorized by the host.

If the host revokes authority and then reinstates it before a host attention operation is performed from that logical terminal, the indicator remains active.

When the host revokes the ability to display the last transaction time indicator, and you perform the sequence described in "Operating Procedures" on page 10-19, the clock symbol is erased. If you perform the sequence while unauthorized, only the clock and the colon are displayed in the Operator Information Area.

If the host reauthorizes the Last Transaction Time Indicator after you erased it, there is no indication at the display station that authority has been reinstated.

If a communication check occurs, the last transaction time indicator is replaced by the communication reminder indicator. When communication is again established, the communication reminder indicator is erased, and the Last Transaction Time Indicator is again displayed.

RTM Host Interface

Using the RU formats provided at the end of this section, an SNA host application program can communicate with the RTM function in the 3174 and can solicit RTM information from the following:

- One logical unit (LU)
- All LUs with nonzero RTM data.

The host application program can reset the RTM logs. Also, the host application program may change the parameters affecting collection of RTM information by updating the following parameters on a one-or-all-LU basis:

- Activate/deactivate RTM for one or all LUs
- Set RTM boundaries
- Set RTM definition code
- Enable/disable controller display of RTM logs and last transaction time indicator
- Return unsolicited data when a session ends
- Return unsolicited data when a counter overflows.

An ACTPU/DACTPU sets the potential lost data flag in the 3174 reply RU but does not cause the controller to revert to the customizing defaults for RTM parameters.

Solicited RTM Information

When the 3174 is customized to support the host interface for RTM information and a request is made to the 3174 on an SSCP-PU session via a host request containing an RTM major vector, the 3174 examines the request. If the request is accepted, a positive response is returned to the host. If the host request does not solicit any data, the 3174 considers the request completed after sending the positive response and updating the appropriate RTM logs.

If the host request is soliciting information, one or more 3174 replies are then returned to the host as solicited replies. Each of these replies contains data pertinent to a specific LU attached to the 3174. If the reset bit is included in the request, the RTM data for that LU is reset upon transmission of the record. The Reset function includes the RTM counters (including overflow) and the total transaction time. It excludes the last transaction time and any pending transaction time. If the host gives a negative response, the counter information is lost.

If an outbound request is intended for a specific LU, it must contain an SNA address list with one element that provides the 3174 with the local address of the LU. Each inbound request contains an SNA address list with two elements: the first element provides the local address of the SLU; the second element provides the local address of the associated PLU. Inclusion of local addresses in the inbound RUs allows the host RTM application program to correlate response time data with the associated PLU and SLU session pair. Translation of the addresses into 8-byte EBCDIC names is the responsibility of one or more upstream nodes.

A session correlation vector is also returned with the RTM data that is unique to each session pertaining to a specific 3174. Thus, a host application program can determine the appropriate session pair after the session has been unbound, provided that the application program was able to determine the session identity previously.

The RTM data is collected only when a device is in an LU-LU session. When unsolicited RTM transmission on Unbind command is not supported, the data associated with each logical terminal may pertain to multiple LU-LU sessions. If multiple-session data is present, a flag is set in the appropriate RTM log. The flag is reset when the RTM data is sent inbound. The session correlation number is updated upon acceptance of each Bind request for that LU.

If a counter overflow occurs, collection of RTM data for the logical terminal is suspended until the RTM data is reset. The data is reset when one of the following occurs:

- A request is received from the host for the terminal (or all terminals) containing a reset indication in the Request Vector
- A request is received that changes the boundaries or definition for that LU, or when data is sent unsolicited to the host.

When the host requests only nonzero RTM data from all LUs, only those LUs with nonzero RTM data respond, or the last LU configured responds if no LUs have nonzero data.

The SSCP-PU session operates in duplex mode. REQMS, RTM, or Product Set ID (PSID) requests will be stacked, if storage exists, and a transmitted positive response returned. The stacked request will be processed once any current activity, that is, previous REQMS/RTM/PSID requests, has received host acknowledgment. If no storage exists to stack the request, the request is rejected (0815 0003 — Queue Limit Exceeded).

Unsolicited RTM Information

Besides allowing solicited information to flow on the SSCP-PU session, the 3174 may be customized, or enabled by the host, to transmit unsolicited RTM information when an LU-LU session is terminated or when an RTM counter overflows. When one of these conditions occurs, the associated RTM information is scheduled within the 3174 for transmission to the host RTM application program on the SSCP-PU flow. Once transmitted, the data for that logical terminal is reset.

If the transmission was caused by an RTM counter overflow, a flag is set in the RTM data to indicate the potential loss of data. If the transmission was caused by session termination and another Bind command is accepted for the logical terminal before the RTM information can be transmitted, additional responses are discarded until the RTM data is transmitted. The session correlation vector is updated after the RTM information is transmitted. A potential loss of data because of the new Bind command is indicated in the next RTM transmission (not the transmission just sent).

Should a solicited response be pending when a session unbinds or a counter overflows, flags are set in the RU to indicate the multiple reasons for returning data, and only one RU flows. Data is reset upon transmission, regardless of whether the reset bit was included in the host RTM request.

Sense Codes

Sense codes are returned with a negative response to an REQMS or Network Management Vector Transmit (NMVT) request. Sense codes are described in Appendix H.

Only certain checks are performed by the 3174. Others are considered sender checks, and indeterminate results occur if they are received. See Table 10-2 on page 10-15, for the bytes that the 3174 checks.

Distributed Function Terminal (DFT) Interface

The 3174 provides an interface for DFTs to support the RTM function. However, since such devices are responsible for their own keystroke and data stream processing, RTM support is also required in these devices.

Note: RTM support is disabled for DFT devices if the transaction-end definition is selected by the host or during 3174 customization and for DFT sessions on CCAs.

When a DFT indicates that one or more of its logical terminals is online to the host, the 3174 issues a command indicating the RTM definition and the authorization to display the Last Transaction Time Indicator to each of these active logical terminals.

When you initiate a host attention operation on one of these logical terminals, the DFT sends status to the 3174, indicating that the 3174 should start an RTM measurement. After processing the resulting data stream, the device sends additional status to the 3174, indicating that the RTM measurement should be completed. The 3174 then updates its RTM log for that logical terminal and responds with the last transaction time for the operation, if so authorized. If you enabled the Last Transaction Time Indicator for the logical terminal, the DFT then displays this time.

Each time a host request is received from the host application program that alters the definition or authority to display the Last Transaction Time Indicator for a particular logical terminal, the 3174 notifies the DFT of the change. The 3174 also provides status to each DFT.

Host Request and 3174 Reply Formats

This section contains the SNA TH, RH, and RU formats for the host request and the solicited and unsolicited 3174 replies.

Host Request Format

The basic format of the host request is as follows:

TH
RH
RU
- NMVT Header
- Length to End of RU
- Request RTM Major Vector
  - SNA Address List (if required)
    - Target LU (if required)
  - RTM Request Vector
  - RTM Control Vector (if required).

Table 10-1 (Page 1 of 4). TH, RH, and RU Definitions for the Host Request

Byte	Bit	Value	Meaning
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0 RH1 RH2		X'0B' X'80' X'00'	Formatted Function Management Data (FMD); Only in chain Definite response only Not applicable **Note:** No other bits in this request header are applicable to this session.
RU0 RU1 RU2		X'41' X'03' X'8D'	NMVT header
RU3,4		X'0000'	Ignored (may be nonzero but not to be used)

Table 10-1 (Page 2 of 4). TH, RH, and RU Definitions for the Host Request

Byte	Bit	Value	Meaning
RU5	0,1	B'00'	Reserved
	2,3	B'00'	Ignored
	4—7		Procedure-related identifier (PRID)
RU6			Procedure-related identifier (PRID)
RU7	0	B'0'	Reserved
	1	B'0'	Last RU
	2	B'0'	First RU
	3	B'1'	SNA address included
	4—7	B'0000'	Reserved
RU8	0	B'0'	No concatenation
	1—7	B'000 0000'	Remaining length of this RU
RU9			
RU10,11		X'8080'	Code point for RTM major vector
RU12		X'0A'	Length of SNA address list
RU13		X'04'	Code point SNA address list
RU14		X'01'	Number of TAFs
RU15 through RU21		X'0000 0000 0000 aa'	Target address: 7 bytes aa = Local destination address (DAF)
RU22		X'04'	Length of RTM request vector
RU23		X'92'	RTM request vector function
RU24	0	B'0'	No reset
		B'1'	Reset data upon reply transmission (or immediately if no reply is expected)
	1	B'0'	No RTM data is retrieved
		B'1'	Retrieve data/status for all specified LUs with nonzero counts
	2	B'0'	Retired
	3	B'0'	Retrieve data/status for all LUs with nonzero data
		B'1'	Retrieve data/status for a specified LU in the SNA address list
	4	B'0'	Apply RTM control vectors to LU specified in the SNA address vector (if present)
		B'1'	Apply RTM control vectors to all LUs
	5,6	B'00'	Retired
	7	B'0'	Reserved
RU25		X'00'	Reserved
RU26			Length of RTM control vector
RU27		X'94'	RTM control vector function

Table 10-1 (Page 3 of 4). TH, RH, and RU Definitions for the Host Request			
Byte	**Bit**	**Value**	**Meaning**
			STATUS/PARAMETER CHANGE (RU28 used in conjunction with RU30). Any bit setting of B'0' will cause the corresponding bit in RU30 to be ignored. Any bit setting of B'1' will cause the corresponding bit in RU30 to be read and acted on.
RU28	0	B'1'	RTM status (activate/deactivate)
	1	B'1'	Session end (solicited/unsolicited)
	2	B'1'	Counter overflow (solicited/unsolicited)
	3	B'0'	Retired
	4	B'1'	RTM definition code
	5	B'1'	RTM boundaries
	6	B'0'	Retired
	7	B'1'	Subsystem display (enable/disable)
RU29	0	B'0'	Retired
	1—7	B'000 0000'	Reserved
			STATUS INDICATORS (see the description above for RU28)
RU30	0	B'0'	Deactivate RTM
		B'1'	Activate RTM
	1	B'0'	Reset unsolicited on session end
		B'1'	Unsolicited on session end
	2	B'0'	Reset unsolicited on counter overflow
		B'1'	Unsolicited on counter overflow
	3	B'0'	Retired
	4	B'0'	No RTM definition to be set
		B'1'	RTM definition to be set
	5	B'0'	No RTM boundaries to be set
		B'1'	RTM boundaries to be set
	6	B'0'	Retired
	7	B'0'	Disable subsystem display
		B'1'	Enable subsystem display
RU31	0	B'0'	Retired
	1—7	B'000 0000'	Reserved
RU32		X'00'	Reserved
RU33			Ignore (Unsol in time interval)
RU34			RTM DEFINITION
		X'00'	Reserved
		X'01'	First character on screen
		X'02'	Keyboard usable
		X'03'	CD/EB
		X'04'	Last character
			All other code points reserved
RU35		X'00'	RTM time increment = 100 (ms)
RU36 through RU41		X'0000 0000 0000'	Reserved
RU42	0—3	B'0000'	Reserved
	4—7	B'0---'	Number of boundaries (1—4)
RU43,44			Boundary, if appropriate (must be in increasing value)
RU45,46			Boundary, if appropriate

Table 10-1 (Page 4 of 4). TH, RH, and RU Definitions for the Host Request

Byte	Bit	Value	Meaning
RU47,48			Boundary, if appropriate
RU49,50			Boundary, if appropriate

When the 3174 receives an RTM request, SNA protocol and RU checks are performed. If any one of the checks fails, the RTM request processing is terminated and a negative response is returned to the host. Table 10-2 shows the RTM receiver checks performed.

Table 10-2. RTM Receiver Checks

RU Byte/Bit(s)	Check Performed	Sense
NMVT HEADER		
00—02 / all	Must be the NMVT ID – X'41038D'	1007 0001
03,04 / all	Ignored	—
05 / 0—3	Ignored	—
07 / 0—3	Ignored	—
08,09 / all	RU length error	086F 0001
10,11 / all	Must be RTM Major Vector: X'8080'	080C 0005
SNA Address List		
00 / all	Length error	086F 0405
01 / all	X'04' qualifies this as an SNA Address List	—
02 / 5—7	Ignored	—
03 – 10 / all	Ignored	—
RTM REQUEST VECTOR		
00 / all	Length error	086F 9205
01 / all	X'92' qualifies this as an RTM Request Vector	—
02,03 / all	Ignored	—
RTM CONTROL VECTOR		
00 / all	Length error	086F 9405
01 / all	X'94' qualifies this as an RTM Control Vector	—
02 / 3,6	Ignored	—
03 / 1—7	Ignored	—
04 / 3,6	Ignored	—
05 / all	Ignored	—
06,07 / all	Ignored	—
08 / all	Must be X'01'—X'04'	0870 9408
09 / all	Time increment must = 100 ms	0870 9409
10—15 / all	Ignored	—
16 / all	Must be X'01'—X'04' when RU28 bit 5 and RU30 bit 5 are set	0870 9410
17—24	Highest boundary value is X'03FF' Boundaries must be in ascending order.	See "SNA Sense Codes" on page H-1.

Notes:

1. The 3174 SSCP-PU session is defined as FM profile 0 and TS profile 1 (duplex definite response). Should the 3174 transmit an inbound message, it waits for a response (positive or negative) before transmitting or receiving additional messages on that session. If a response is somehow lost by the network, no other SSCP-PU activity is possible without first receiving an ACTPU. Data may be lost during recovery.
2. All other bytes are considered *sender checks,* and indeterminate results occur if there are problems within them.
3. RTM statistics are accumulated for devices only while they are in LU-LU sessions (SNA only).
4. The RTM control vector function (X'94') and RTM request vector function (X'92') are applied immediately if no inbound RUs are to flow. Otherwise, they are applied after the requested data for each LU has been transmitted, not after the response has been received. The current data is reset if RU24 bit 0=1 in the request vector function. In addition, if boundaries or the definitions are changed without requesting the current data, the data is reset.
5. If unsolicited-on-Unbind or counter-overflow is enabled either by the host RTM application program or as a 3174 customizing option, the RTM data for each LU is reset upon transmission.
6. If unsolicited-on-Unbind is not enabled, the RTM counters are not reset upon receipt of a Bind. It is a host RTM program responsibility to solicit the RTM data before the counters overflow.

3174 Reply Format

The basic format of the 3174 solicited and unsolicited reply is as follows:

- TH
- RH
- RU
  - NMVT Header
  - Length to End of RU
  - RTM Data Reply Major Vector
    - SNA Address List
      - Target LU
      - PLU Associated with Target LU
    - RTM Status Response Vector
    - Relative Time Vector
    - RTM Data Vector (if required)
    - Data Reset Flag Vector (if required).

Table 10-3 shows the SNA TH, RH, and RU definitions for the solicited and unsolicited 3174 reply.

Table 10-3 (Page 1 of 4). TH, RH, and RU Definitions for the 3174 Reply (Solicited and Unsolicited)

Byte	Bit	Value	Meaning
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)

Table 10-3 (Page 2 of 4). TH, RH, and RU Definitions for the 3174 Reply (Solicited and Unsolicited)

Byte	Bit	Value	Meaning
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0		X'0B'	Formatted Function Management Data (FMD); Only in chain
RH1		X'80'	Definite response only
RH2		X'00'	Not applicable
			Note: No other bits in this request header are applicable to this session.
RU0		X'41'	NMVT header
RU1		X'03'	
RU2		X'8D'	
RU3,4		X'0000'	Ignored
RU5	0,1	B'00'	Reserved
	2,3	B'00'	Ignored
	4−7		PRID from request (0000 if unsolicited)
RU6			PRID from request
RU7	0	B'0'	Unsolicited
		B'1'	Solicited
	1	B'0'	Last
		B'1'	Not last
	2	B'0'	First
		B'1'	Not first
	3	B'1'	SNA address list included
	4−7	B'0000'	Reserved
RU8	0	B'0'	No concatenation
	1−7	B'000 0000'	Remaining length of this RU
RU9		X'25'	No DATA or Reset vectors
		X'27'	Reset vector but no DATA vector
		X'46'	DATA vector but no Reset vector
		X'48'	DATA and Reset vectors
RU10,11		X'0080'	Code point for RTM data reply
RU12		X'11'	Length of SNA address list
RU13		X'04'	Code point SNA address list
RU14		X'02'	Number of TAFs
			TARGET ADDRESSES
RU15 through RU21		X'4000 0000 0000 aa'	SLU local address: 7 bytes (40 = PLU follows) aa = Local destination address (DAF)
RU22 through RU28		X'0000 0000 0000 pp'	PLU local 7-byte address associated with above SLU address (OAF) pp = OAF
RU29		X'09'	Length RTM status response vector
RU30		X'91'	RTM status response vector function

Table 10-3 (Page 3 of 4). TH, RH, and RU Definitions for the 3174 Reply (Solicited and Unsolicited)

Byte	Bit	Value	Meaning
RU31			RESPONSE CODES
	0	B'0'	Reserved
	1	B'1'	Data not included
	2	B'1'	Specific RTM request for this LU, but RTM for this LU is not active
	3	B'1'	First response for current LU-LU session
	4	B'1'	Bind for new session received while in solicited mode only. Session data is combined.
	5−7	B'000'	Reserved
RU32			REASON FOR UNSOLICITED RESPONSE
	0	B'1'	Session end
	1	B'1'	Counter overflow
	2	B'0'	Retired
	3−7	B'0 0000'	Reserved
RU33			RESP CODE - POTENTIAL DATA LOSS
	0	B'0'	Reserved
	1	B'1'	Counter overflowed. All counters for LU frozen
	2	B'1'	Controller IMLed/ACTPU-Cold
	3	B'1'	New session before data sent. Potential loss of new data
	4	B'1'	RTM definition/boundaries set without soliciting data; all old data lost.
	5−7	B'000'	Reserved
RU34			STATUS INDICATORS
	0	B'0'	RTM inactive
		B'1'	RTM active
	1	B'1'	Unsol on session end
	2	B'1'	Unsol on counter overflow
	3	B'0'	Retired
	4	B'1'	RTM definition set by host
	5	B'1'	RTM boundaries set by host
	6	B'0'	Retired
	7	B'1'	Subsystem display of logs enabled
RU35	0	B'0'	Retired
	1−7	B'000 0000'	Reserved
RU36,37		X'rraa'	Session correlation number rr = Number assigned at Bind by 3174 and incremented for each subsequent Bind for that LU: 00-FF with wrap. aa = LU subsystem address
RU38		X'07'	Length of relative time vector
RU39		X'42'	Code point for relative time vector
RU40		X'EF'	Sequence number; not time
RU41 through RU44			Sequence number Starts at 0000 0000 at IML; incremented for each record sent indicating order of transmission
RU45		X'21'	Length of RTM data vector

Table 10-3 (Page 4 of 4). TH, RH, and RU Definitions for the 3174 Reply (Solicited and Unsolicited)

Byte	Bit	Value	Meaning
RU46		X'93'	RTM data vector
RU47			RTM DEFINITION
		X'00'	Reserved
		X'01'	First character on screen
		X'02'	Keyboard usable
		X'03'	CD/EB
		X'04'	Last character
			Other code points reserved
RU48		X'00'	RTM time increment = 100 ms.
RU49,50		X'0000'	Reserved
RU51,52		X'0000'	Time interval from last data in seconds
RU53	0−3	X'4'	Number of boundaries returned
	4−7		Number of valid boundaries: 1—4
RU54,55			Boundary 1
RU56,57			Boundary 2
RU58,59			Boundary 3
RU60,61			Boundary 4
RU62,63			Counter 1
RU64,65			Counter 2
RU66,67			Counter 3
RU68,69			Counter 4
RU70,71			Overflow counter
RU72 through RU75			Total response time Includes time for all counters including overflow
RU76,77			Last transaction time
RU78		X'02'	Length of data reset flag
RU79		X'45'	Data reset flag vector function

Operating Procedures

This section provides the step-by-step procedures for displaying the RTM logs and LTTI for sending operator-generated alert messages.

Displaying RTM Data

Authorized display stations can display two kinds of RTM data— the RTM log and the RTM LTTI. Display stations are authorized at customization time, or, if host support is present, display station authorization may be set by the host program. Also, when a host interface is not present, an authorized display station can be used to reset the RTM log data.

Note: A DFT (for example, a 3290 Information Panel) cannot display or reset the RTM log.

See Table 10-4 on page 10-20 for the indicator names and symbols that may be displayed by the RTM log. (Representative panels are shown in Figure 10-2 on page 10-7 and Figure 10-3 on page 10-8).

Table 10-4. RTM Log Indicator Names and Symbols

Indicator Name	Symbol
What number	X 웃 # ?
Input inhibited, minus function, and operator unauthorized	X -f 웃 X
Input inhibited and minus function	X -f
Input inhibited and What	X ? +

Displaying the RTM Log

If you are using multi-host support in Configuration Support B or C, you can display and reset the RTM log for each host. To do this, you must enter test mode from an LT defined to the same communications link as the host whose RTM log you wish to view. For example, from an LT defined to host 1C, you can display RTM logs for hosts 1A through 1H, but not for host 2A or 3A.

To display the RTM log, do the following:

1. If using multi-host support, use the Change Screen function to switch to an appropriate LT as described above.
2. Press the Test function to place the display station in test mode.
3. Press PF12 to display the 3174 Test Menu.
4. For Configuration Support A or S, type **/1,1** and press the Enter function. A panel is displayed (see Figure 10-2 on page 10-7) that shows the first 8 logical terminals.

   - If the host is not customized for RTM, when you enter **/1,1**, the minus function symbol is displayed in the OIA.
   - If you enter **/1,1** at an unauthorized display station, the input-inhibited, minus-function, and operator-unauthorized symbols are displayed in the OIA.

   For Configuration Support B or C, type **/1,1,*n*** where *n* is the host ID, and press the Enter function. A panel is displayed (see Figure 10-3 on page 10-8) that shows the first 8 host addresses that are in use for that host. An address is *in use* if it represents a session that is in the LTA.

   If the host is not customized for RTM when you enter **/1,1,*n*** or if you enter **/1,1,*n*** at an unauthorized display station, an error message is displayed in the message area.
5. Press PF8 to scroll forward. Eight more host addresses are displayed. Use the PF8 function to continue paging through the RTM log. For Configuration Support B and C, you can use PF7 to scroll backward.
6. Pressing PF8 after the last group of logs has been displayed causes the input-inhibited minus-function indicator to be displayed in the OIA.

   To page through the log again, you can repeat steps 3, 4, and 5.

You can generate a printed copy of any of the RTM log panels by using the 3174 Local Copy function.

Resetting the RTM Log

The RTM log can be reset from an authorized display station only when no host interface is defined for the RTM function. (When host support for the RTM function is present, only the host can reset the RTM log.) The individual logs for all configured logical terminals are reset, except for the following:

- The information entered at customization time (time boundaries, display authorization, measurement definition).
- Any pending transaction status. (If the RTM-started flag is set, the response time for the transaction is still measured.)

To reset the RTM log, do the following:

1. If using multi-host support, use the Change Screen function to switch to an appropriate LT.
2. Press and hold Alt, then press the Test function to place the display station in test mode.
3. Press PF12 to display the main menu.
4. For Configuration Support A and S, type **/4,1** and press the Enter function. For Configuration Support B and C, type **/4,1,*n*** where n is the host ID, and press the Enter function.
   - If the controller is not customized for RTM when you enter **/4,1** on the selection line, the minus function symbol is displayed in the OIA.
   - If you enter **/4,1** at an unauthorized display station, the input-inhibited, minus-function, and operator-unauthorized symbols are displayed in the OIA.
5. When the logs have been reset, a message will appear in the message area that will indicate that the RTM log has been reset.
6. Press PF3 to exit test mode.

If you are displaying the RTM log and want to reset the log, you must do the following:

1. Clear the screen by pressing the Clear function. The cursor appears in the upper left corner of the screen.
2. Type **/4,1** or **/4,1,*n*** starting at the cursor position. Press the Enter function.
3. Press the Test function or PF3 to exit test mode.

Displaying the Last Transaction Time Indicator

The LTTI is displayed in the OIA of an authorized display station. The LTTI is displayed as a clock symbol followed by numbers representing minutes and seconds, or as a clock symbol followed by numbers representing seconds and tenths of a second:

Numbers	**Represent**
`10:02`	ten minutes and two seconds
`:11.3`	eleven and three-tenths seconds

The colon separates minutes and seconds; the period separates seconds and tenths of a second.

To display the LTTI , do the following:

1. Invoke extension/extended select mode. See "Extension/Extended Select Function" on page 4-8 for additional information.
2. Press the LTTI trigger function. The LTTI appears in the OIA in one of the formats previously discussed.
   a. If the controller is not customized for RTM when the LTTI trigger function is pressed, the input-inhibited and What symbols are displayed in the OIA.
   b. If the display station is unauthorized, the clock symbol and colon are displayed in the OIA with no time indicated.

To erase the LTTI from the OIA, place the display in extension mode and press the LTTI trigger function again.

Chapter 11. Network Asset Management Function

Introduction

This chapter describes Network Asset Management, which is a function of the 3174 and NetView. Network Asset Management provides product identification information for a controller and its attached devices. Included here is a list of the NetView publications that have information on Network Asset Management and how to invoke it:

- *NetView Operation*, SC31-6019
- *NetView Customization Guide*, SC30-3462
- *NetView Installation and Administration Guide*, SC30-3360
- *NetView Administration Reference*, SC30-3361.

With the Network Asset Management function, a host application sends an NMVT request called Request Product Set ID (PSID), requesting vital product data from a controller, or a controller and its attached devices. The controller responds by sending to the host application a Reply PSID containing the vital product data. This vital product data includes such things as model number, serial number, plant of manufacture, type of product, and power-on status.

The Request PSID and Reply PSID flow on the SSCP-PU session. If information about all devices is requested, the controller builds a reply for itself, and upon receiving a host acknowledgment, loops until all attached device information has been sent.

When the 3174 receives a Request PSID, the request is queued in SNA outbound line buffers, if available. The 3174 queues any subsequent requests until the queue limit has been reached. This limit is based on the availability of line buffers. Once the limit is reached, further requests are rejected until the queue has been diminished.

For each request it is able to queue, the controller sends a positive response to the host. The controller then processes each request in the queue in sequential order and sends its reply to the host. As with the RTM function, once the controller sends the reply to an outstanding request, it must receive a response from the host before it can process the next request in its queue. If for some reason, the response is lost in the network, transmission on the session is deadlocked until the SSCP-PU session is reinitialized.

In the event an ACTPU cold/ERP is processed while Reply PSID RUs are being generated for all devices, no further replies are generated for the outstanding request. The replies are not generated because ACTPU is a reset of the SSCP-PU session on which the information flows.

Host Request and 3174 Reply Formats

This section describes the SNA TH, RH, and RU formats for the host request and the solicited 3174 replies.

Host Request Format

The host request may solicit information on the controller only, or the controller and all attached devices. The basic format of the host request is as follows:

TH
RH
RU
- NMVT Header
- Length to End of RU
- PSID Major Vector
  - Length of subvector
  - Request subvector.

Table 11-1 shows the TH, RH, and RU definitions for the host request format.

Table 11-1. TH, RH, and RU Definitions for the PSID Host Request

Byte	Bit	Value	Meaning
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0		X'0B'	Formatted Function Management Data (FMD); Only in chain
RH1		X'80'	Definite response only
RH2		X'00'	Not applicable
			Note: No other bits in this request header are applicable to this session.
RU0		X'41'	NMVT header
RU1		X'03'	
RU2		X'8D'	
RU3,4		X'0000'	Retired
RU5,6		X'0nnn'	PRID
RU7		X'00'	Flags not applicable for this request
RU8,9		X'0006'	Length field of Request PSID major vector
RU10,11		X'8090'	Code point for Request PSID major vector
RU12		X'02'	Length of subvector
RU13		X'81'	Request information on controller only
		X'83'	Request information on controller and all attached devices.

The Request PSID will be verified by the 3174 upon receipt. If the contents are invalid, a negative response will be generated and the buffer will be deallocated. This will terminate the processing for that message. Table 11-2 shows the bytes that are checked for valid data.

Table 11-2. PSID Receiver Checks

RU Byte/Bit(s)	Check Performed	Sense
NMVT HEADER		
00,01 / all	Must be the NMVT Id – X'4103'	1007 0001
02 / all	Must be the NMVT Id – X'8D'	1003 0001
03,04 / all	Ignored	—
05,06 / 0—3	Ignored	—
07 / all	Ignored	—
08,09 / all	Length field – Must be X'0006'	086F 0001
10,11 / all	Must be Major Vector: X'8090'	080C 0005
REQUEST VECTOR		
01 / all	Length field of subvector – Must be X'02'	086F nn05
02 / all	Must be subvector request X'81' or X'83'	080C 0006

Note:

nn = subvector request (X'81' or X'83')

Note: The 3174 SSCP-PU session is defined as FM profile 0 and TS profile 1 (duplex definite response). If the 3174 transmits an inbound message, it waits for a response (positive or negative) before transmitting or receiving additional messages on the session. If a response is somehow lost by the network, no other SSCP-PU activity is possible until the 3174 receives an ACTPU. Data may be lost during recovery.

3174 Reply Formats

The controller sends one response to either form of Request PSID (controller only, or controller and its attached devices). This response will be a positive acknowledgment of the validity of the request, or will be a negative SNA sense code. Positive response will be followed by a reply for the controller only (if the request subvector was X'81'), or a reply for the controller and a reply for each attached device (if the request subvector was X'83'). Following transmission of a reply, a response must be received from the host before any more replies will be sent. The response can be either positive or negative.

The basic format of the 3174 solicited reply is as follows:

TH
RH
RU
- NMVT Header
- Length to End of RU
- PSID Major Vector
  - PSID Subvector Data
  - Port Information (reply to X'83' only)
  - Device Power-On Status (reply to X'83' only)
  - Relative Time Vector
  - Product Set Attributes Subvector
  - Physical Location Subfield
  - Additional Product Set Attributes Subvector (reply to X'83' only)

Label Subfield (reply to X'83' only)
Data Subfield (reply to X'83' only)
Additional Product Set Attributes Subvector (reply to X'83' only)
Label Subfield (reply to X'83' only)
Data Subfield (reply to X'83' only).

Table 11-3 shows the SNA TH, RH, and RU definitions for the solicited 3174 reply only for controller vital product data; Table 11-4 on page 11-7 shows the SNA TH, RH, and RU definitions for the solicited 3174 reply for vital product data on the controller and all attached devices.

The X'11' subvector in Table 11-3 contains vital product data that was entered during controller customization and that always appears in the Reply PSID. The X'84' subvector contains vital product data that was entered using online test 5 (/5,2) and appears only if the data was entered.

Table 11-3 (Page 1 of 2). TH, RH, and RU Definitions for the 3174 Reply for Controller Information

Byte	Bit	Value	Meaning
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0		X'0B'	Formatted Function Management Data (FMD); Only in chain
RH1		X'80'	Definite response only
RH2		X'00'	Not applicable
			Note: No other bits in this request header are applicable to this session.
RU0		X'41'	NMVT header
RU1		X'03'	
RU2		X'8D'	
RU3,4		X'0000'	Retired
RU5,6		X'0nnn'	PRID (echoed from request)
RU7			Miscellaneous flags
	0	B'1'	Reply was solicited
	1,2	B'00'	Only reply
		B'10'	First reply for this PRID
	3	B'0'	No SNA address list included
	4−7	B'0000'	Reserved
RU8,9			Length field of Reply PSID major vector
RU10,11		X'0090'	Code point for Reply PSID major vector
RU12		X'19'	Length of Reply PSID subvector
RU13		X'10'	Key for Reply PSID subvector
RU14		X'00'	Retired
RU15		X'16'	Length of Product Identifier subvector
RU16		X'11'	Key for Product Identifier subvector

Table 11-3 (Page 2 of 2). TH, RH, and RU Definitions for the 3174 Reply for Controller Information

Byte	Bit	Value	Meaning
RU17		X'01'	IBM product
RU18		X'13'	Length of Hardware Identifier subfield
RU19		X'00'	Key for Hardware Identifier subfield
RU20		X'12'	Format type
RU21 RU22 RU23 RU24		X'F3' X'F1' X'F7' X'F4'	Machine type
RU25 through RU27			Model number in EBCDIC (response entered for customizing question 100)
RU28,29 RU30 through RU36			Serial Number: Plant of manufacture (response entered for customizing question 108; default is zeros) Sequence number in EBCDIC padded with X'F0F0' (response entered for customizing question 108; default is zeros).
RU37		X'07'	Length of relative time vector
RU38		X'42'	Key for relative time vector
RU39		X'EF'	Indicates a time value that shows relative order only.
RU40 through RU43			Value starting at 0000 0000 at IML; incremented for each record sent indicating order of transmission.
RU44		X'36'	Length of Product Set Attributes subvector
RU45		X'84'	Key for Product Set Attributes subvector
RU46		X'34'	Length of Physical Location subfield
RU47		X'00'	Key for Physical Location subfield
RU48 through RU97			Physical Location (coded graphic characters)

Table 11-4 on page 11-7 shows the SNA TH, RH, and RU definitions for the solicited 3174 reply for vital product data on the attached devices. One reply flows for each port on the controller.

The X'84' subvector and X'86' subvectors shown in Table 11-4 on page 11-7 may or may not be present in the Reply PSID. Their appearance depends on different conditions. For example, the X'84' subvector (bytes RU67 through RU120) is present only if the physical location (bytes RU71 through RU120) is entered for the device using online test 5 (/5,4). If this subvector is not present, any subsequent X'86' subvectors, if present, start with byte RU67.

In Table 11-4 on page 11-7, at the beginning of these subvectors, notes explain the conditions under which the subvector appears.

Table 11-4 (Page 1 of 4). TH, RH, and RU Definitions for the 3174 Reply for Attached Devices

Byte	Bit	Value	Meaning
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0 RH1 RH2		X'0B' X'80' X'00'	Formatted Function Management Data (FMD); Only in chain Definite response only Not applicable **Note:** No other bits in this request header are applicable to this session.
RU0 RU1 RU2		X'41' X'03' X'8D'	NMVT header
RU3,4		X'0000'	Retired
RU5,6		X'0nnn'	PRID (echoed from request)
RU7	 0 1,2 3 4−7	 B'1' B'01' B'11' B'1' B'0000'	Miscellaneous flags Reply was solicited Last reply for this PRID Middle reply for this PRID SNA Address List included Reserved
RU8,9			Length field of Reply PSID major vector
RU10,11		X'0090'	Code point for Reply PSID major vector
RU12		X'0A'	Length of SNA Address List subvector
RU13		X'04'	Key for SNA Address List subvector
RU14		X'01'	Number of addresses in SNA Address List
RU15		X'00'	Address Format − 00 means one or more single local addresses
RU16 through RU20			Reserved
RU21			Represents the first entry from the Port Assignment panel for the given port.
RU22		X'0D'	Length of attached device configuration description
RU23		X'82'	Key for attached device configuration description. See "Power-On Indicators" on page 11-10.
RU24		X'05'	Length of port number subfield
RU25		X'10'	Key for port number subfield
RU26 through RU28			Port number (in EBCDIC). See "Port Numbering Scheme" on page 11-10.

Table 11-4 (Page 2 of 4). TH, RH, and RU Definitions for the 3174 Reply for Attached Devices

Byte	Bit	Value	Meaning
RU29		X'03'	Length of power-on status subfield
RU30		X'20'	Key for power-on status subfield
RU31		 X'01' X'02'	Power-on status: Powered on Powered off
RU32		X'03'	Length of subfield for power-on status since last solicitation
RU33		X'30'	Key for subfield for power-on status since last solicitation
RU34		X'01' X'02'	Powered on since last solicitation Not powered on since last solicitation
RU35		X'19'	Length of PSID subvector
RU36		X'10'	Key for PSID subvector
RU37		X'00'	Retired
RU38		X'16'	Length of Product Identifier subvector
RU39		X'11'	Key for Product Identifier subvector
RU40		 X'01' X'03' X'09'	Product class: IBM product Unknown Non-IBM product
RU41		X'13'	Length of Hardware Identifier subfield
RU42		X'00'	Key for Hardware Identifier subfield
RU43		X'12'	Format type
RU44 RU45 RU46 RU47		X'F-' X'F-' X'F-' X'F-'	Machine type in EBCDIC (X'F0F0F0F0' if unknown)
RU48 through RU50			Model number in EBCDIC (zeros if unknown)
 RU51,52 RU53 through RU59			Serial Number: Plant of manufacture (zeros if unknown) Sequence number in EBCDIC (zeros if unknown)
RU60		X'07'	Length of relative time vector
RU61		X'42'	Key for relative time vector
RU62		X'EF'	Indicates a time value that shows relative order only.
RU63 through RU66			Value starting at 0000 0000 at IML; incremented for each record sent indicating order of transmission.

Note: The following X'84' subvector (RU67 through RU120) is present only if the physical location is entered for the device using online test 5 (/5,4).

Table 11-4 (Page 3 of 4). TH, RH, and RU Definitions for the 3174 Reply for Attached Devices

Byte	Bit	Value	Meaning
RU67		X'36'	Length of Product Set Attributes subvector
RU68		X'84'	Key for Product Set Attributes subvector
RU69		X'34'	Length of Physical Location subfield
RU70		X'00'	Key for Physical Location subfield
RU71 through RU120			Physical Location (coded graphic characters)
Note: The following X'86' subvector (RU121 through RU164) is not present if the sequence number (RU53 through RU59) is supplied by the device.			
RU121		X'2C'	Length of Additional Product Set Attributes subvector
RU122		X'86'	Key for Additional Product Set Attributes subvector
RU123		X'1B'	Length of Label subfield
RU124		X'00'	Key for Label subfield
RU125 through RU149		X'SOURCE OF SEQUENCE NUMBER'	Label subfield (coded graphic characters)
RU150		X'0F'	Length of Data subfield
RU151		X'10'	Key for Data subfield
RU152 through RU164		X'USER SUPPLIED'	Data subfield (coded graphic characters)
Note: The following X'86' subvector (RU165 through RU208) is not present if the device type, model number, or manufacturing plant is supplied by the device.			
RU165		X'2C'	Length of Additional Product Set Attributes subvector
RU166		X'86'	Key for Additional Product Set Attributes subvector
RU167		X'1B'	Length of Label subfield
RU168		X'00'	Key for Label subfield
RU169 through RU193		X'SRC OF DEVTP MODL MFGPLNT'	Label subfield (coded graphic characters)
RU194		X'0F'	Length of Data subfield
RU195		X'10'	Key for Data subfield
RU196 through RU208		X'USER SUPPLIED'	Data subfield (coded graphic characters)

Table 11-4 (Page 4 of 4). TH, RH, and RU Definitions for the 3174 Reply for Attached Devices

Byte	Bit	Value	Meaning
Note: The following X'86' subvector (RU209 through RU245) is present for those devices, such as an IBM 3472, that allow the reporting of extended vital product data either through terminal setup mode or online test 5. If this subvector is present, up to seven similar X'86' subvectors may follow to include the eight label and data subfields that are allowed. See "Extended Vital Product Data" on page 11-12 for more information.			
RU209		X'2F'	Length of Additional Product Set Attributes subvector
RU210		X'86'	Key for Additional Product Set Attributes subvector
RU211		X'11'	Length of Label subfield
RU212		X'00'	Key for Label subfield
RU213 through RU227			Label subfield (coded graphic characters) represents the label information entered during 3174 customization.
RU228		X'1C'	Length of Data subfield
RU229		X'10'	Key for Data subfield
RU230			Mismatch Field:
		X'00'	Data in the next 15 bytes is current.
		X'5C'	Data in the next 15 bytes may not be current. Use online test 5 (/5,6) to update.
RU231 through RU245			Data subfield (coded graphic characters) represents the extended vital product data that was entered using online test 5, or entered during device setup.

Power-On Indicators

Two power-on indicators are maintained for each port and sent in the X'82' subvector. One indicator reflects the current power-on/power-off status of the device. The other indicator is set when the device powers on and is reset when the reply for the Request PSID is built for the device. This indicator reflects whether the device has been powered on since the last solicitation of data.

Port Numbering Scheme

A unique number identifies each port in the 3174's reply to a host Request PSID. These numbers appear in the reply for each port that is physically installed in the controller. The numbers range from 0 to 87 and are divided into hardware groups according to the adapter in the controller, as follows:

0 — 31 Terminal Adapter ports 0 — 31 (hardware group 26)

32 — 39 AEA 1, ports 0—7 (hardware group 21)

40 — 47 AEA 2, ports 0—7 (hardware group 22)

48 — 55 AEA 3, ports 0—7 (hardware group 23)

56 — 87 Terminal Adapter ports 0 — 31 (hardware group 27).

Note: If 3270-type terminals are attached through a multiplexer (TMA or 3299), then the Terminal Adapter that the multiplexer is attached to will determine the hardware group that the 3270 terminal is associated with.

The maximum number of ports available depends on the controller model, but the numbers for those ports physically installed still fall within the above range of numbers designated for that hardware group. For example, if sixteen 3270-type ports and eight AEA ports are available in the controller, the port numbers that appear in the controller's reply are 0—15 and 32—39.

Vital Product Data

Some terminals report their own vital product data (sequence number, device type, model number, and plant of manufacture) to the controller. The controller then includes this data in its Reply PSID.

Vital product data, for other terminals, is not supplied by the terminal, but is instead supplied by a terminal user through online test 5 (/5,4). Refer to *3174 Customer Problem Determination* for online test information. In these cases, the controller includes the user-supplied data in its Reply PSID. The user-supplied data is represented in bytes 44 – 52 for device type, model number, and plant of manufacture, bytes 53 – 59 for sequence number, and bytes 71 – 120 for the physical location.

If the sequence number sent in the Reply PSID was supplied by the user, then the Reply PSID contains a X'86' subvector (bytes 121 – 164) indicating that the user supplied the sequence number. If the device type, model number, and plant of manufacture were supplied by the user, a second X'86' subvector (bytes 165 – 208) is included in the Reply PSID indicating that the user supplied the data. When the data is supplied by the terminal rather than the user, these X'86' subvectors are not present in the Reply PSID.

If the 3174 is re-IMLed, the vital product data supplied by the terminal is lost. The vital product data supplied by the user is saved, because it is stored on the control diskette or fixed disk. If there is a fixed disk available, the vital product data is always stored there. If there are two fixed disks, the vital product data will be stored on fixed disk number three. If there is no fixed disk available, the vital product data will be stored on the diskette that was used to IML the 3174.

Source of Vital Product Data

Vital product data can be entered for a terminal even if that terminal supplies all or part of its own data. The data is entered using online test 5 (/5,4). After the data is entered and the user invokes /5,3 to display it, both the "device-defined" and "user-defined" data is displayed. However, when the data is sent in the Reply PSID to NetView, only the device-defined data is included. The device-defined data overrides the user-defined data and is always included in the Reply PSID.

If the terminal does not supply the serial number, the user-supplied serial number is sent in the Reply PSID. When the terminal supplies any one of the three fields (device type, model number, or plant of manufacture), the controller sends only the device-supplied data for these three fields, even if the remaining fields are supplied by the user. In this case, none of the user-supplied data in these three fields is sent to NetView.

NetView indicates when the data has been supplied by the user. If no indicator is present at NetView, then the data has been supplied by the terminal.

Moving Terminals

When moving terminals to different ports on the same controller, the vital product data that was reported for the original terminal is still saved by the controller. If the terminal user does not update the data and the terminal does not supply its own data, the original data is reported to NetView in the Reply PSID. The original data is also displayed during online test 5 (/5,3).

If the terminal supplies its own data, the original data is then replaced in the controller with the new data, and this new data is sent in the Reply PSID and is displayed during online test 5.

Security

If desired, a password can be required for the terminal user before entering vital product data for a terminal. The password is entered during 3174 customization (question 098). The terminal user must then enter this password before being able to invoke the vital product data update panels using online test 5 (/5,2 and /5,4).

Extended Vital Product Data

Extended vital product data is information, such as terminal location, building number, and office, and is provided by a terminal user. Some terminals provide a facility for the user to enter the data through terminal setup mode, while other terminals do not provide this facility and the user must enter the data using online test 5 (/5,6). The data for a particular terminal can be entered **only** from that terminal. The data cannot be entered through the Central Site Control Facility (CSCF). Both the 3472 (all models) and the 3471 Model B support Extended Vital Product Data. In order to get this function on CUT devices, the Extended Function feature must be enabled (see Appendix B, Extended Function Feature for CUT Devices, for information on how to enable this feature).

Extended vital product data consists of label and data fields. The label fields are entered during 3174 customization (question 802 of the Device Definition Utility); the data fields are entered by the terminal user. Once entered, the 3174 includes these label/data pairs in the Reply PSID (bytes 121 – 164).

If the 3174 is IMLed or the power is turned off, the data fields stored in the controller are erased. However, the labels that were entered during 3174 customization are saved on the Control disk that was used for IML. If the 3174 power is turned off, the extended vital product data is saved in the terminal, even if the power to the terminal itself is turned off.

Moving Terminals

When moving terminals that support extended vital product data to different ports on the same controller, the data moves with the terminal. If that same terminal is moved to another controller that uses different labels, the extended vital product data for that terminal is no longer current and should be updated.

When the power for the terminal is turned on, the 3174 compares the labels stored in the 3174 with those in the terminal. Whenever a match is found, the terminal's data associated with that label is copied to the 3174 and stored. If all the labels match, the new terminal's extended vital product data replaces the original terminal's data in the 3174.

If a label does not match, an asterisk (*), X'5C', is placed in the first position of the data field. It indicates that the data may not be current for the terminal on the port being reported. The user of that terminal should invoke the "Update Extended VPD" option (either through online test 5 or terminal setup mode), and update the data, if necessary.

Chapter 12. SNA Alert Function

Introduction

This chapter describes the SNA Alert function, which is a problem determination function you can select when customizing SNA controllers. It answers the following questions:

- What is the SNA Alert function?
- What is the SNA Alert operation?
- What is the Alert Message format?
- What is the Token-Ring Alert, Link Event, and Problem-Determination Message format?

What Is the SNA Alert Function?

The 3174 SNA alert function sends problem determination information, collected by the 3174 or entered by an operator, to the hardware monitor component of the NetView* program.

The 3174 sends problem determination information (alert messages) to the host NetView program in response to the following events:

- Controller errors
- Attached-terminal errors
- Application program checks
- Operator-generated alerts (for situations not normally encountered)
- Token-Ring errors
- Integrated Services Digital Network (ISDN) errors
- Advanced Peer-to-Peer Networking (APPN) errors
- 3174-Peer errors.

With Configuration Support C Release 1, the following alerts are generic in format:

- Advanced Peer-to-Peer Networking
- 3174 Peer Communication
- Integrated Services Digital Network
- Token-Ring errors.

For the format of the Generic Alerts, see "Generic Alert Message Format" on page 12-45. See Appendix G for a listing of the Generic Alerts.

What Is the NetView Program?

The NetView program is an enhanced network management licensed program that provides a cohesive set of SNA host network-management services in a single product. It includes the functions of the Network Communication Control Facility (NCCF), Network Logical Data Manager (NLDM), and Network Problem Determination Application (NPDA) network management products, and functions of the VTAM Node Control Application (VNCA) and Network Management Productivity Facility (NMPF) program offerings.

The NetView program functions provide a command facility (NCCF), session monitor (NLDM), and a hardware monitor (NetView) including status monitor, online help facility, online help desk, and browse capabilities. For the purposes of this chapter, when operating in an environment where NPDA is used (the NetView program has not been installed), NetView can be read as NPDA.

The hardware monitor component of the NetView program provides the network user with problem determination information, which is generated at resources (for example, programs and devices such as the 3174) that are both local (channel-attached) and remote (telecommunications-attached) to the host system. The problem determination information sent to the host consists of statistics, events, and alerts.

Statistics are records of traffic and recoverable error counts that have been collected at certain resources and reported to the host system.

Events are unusual situations detected at the resource and reported to the host system. These reported situations are not errors or other undesirable incidents but indicate the need for some form of attention or intervention. The event data is sent to the host system for the NetView program both to store in its data base and to analyze in order to determine whether to issue and record an alert.

Alerts are high-priority events that need immediate attention. They are sent to the NetView operator.

Note: The host alert support does not identify the source of alert messages below the PU level. Therefore, all alert messages for a 3174 and attached terminals will be stored in the hardware monitor data base under the 3174 name.

The hardware monitor collects and displays the alerts, events, and statistical data to help you identify failing network resources and determine a probable cause and recommended action for specific alert or event-related problems. The NetView program includes all NPDA, Version 3, Release 2 support, including (except for VM) the IBM 3600/4700 Threshold Analysis and Remote Access feature. Alerts, events, and statistics collected in other domains that are running NPDA, Version 3, or the NetView program in a multiple-domain network or in an interconnected SNA network environment may be displayed. NPDA cannot view data collected by the NetView program.

Alert generation is depicted in Figure 12-1 on page 12-5, which shows the data flow through the NetView statistical and alert processing functions. Statistics received by the NetView program is sent to a statistical processor and compared with a user-established error-to-traffic ratio. If the statistical data is found to be greater than the established threshold value, a performance event record is created, provided that the comparison process has been enabled by the user. The original statistical record is entered in the data base.

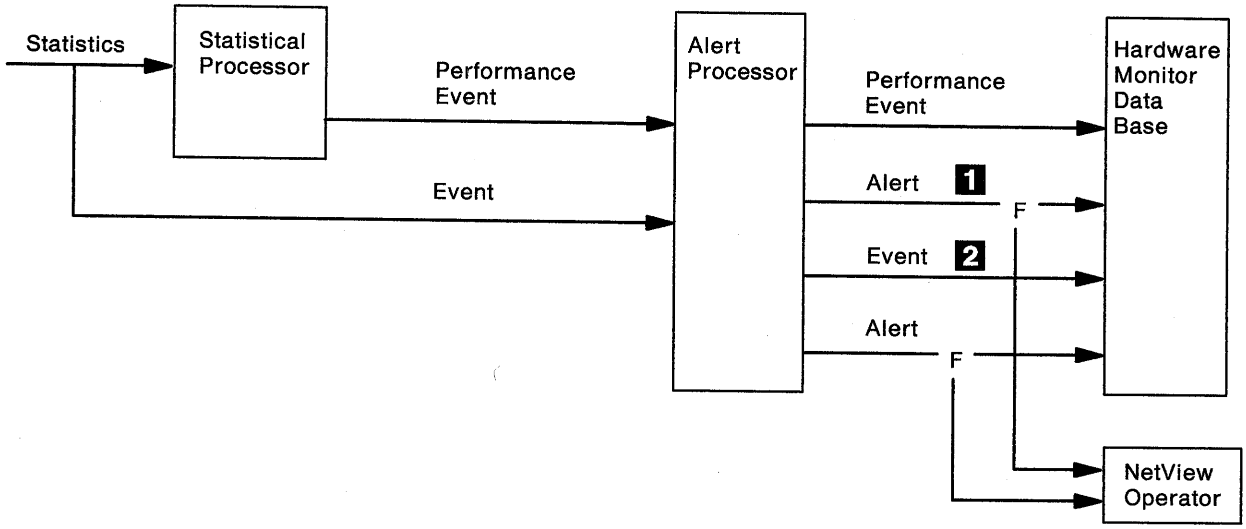


Figure 12-1. Concepts of Alert Generation

The performance event record is then processed by the alert processor (before entry into the data base), and an alert record **1** is formatted. This newly generated alert record is directed to the NetView operator and is also entered into the data base, provided that user-defined criteria (filters) have been met. (A *filter* is a NetView facility that allows the user to prevent certain data from being recorded or from being viewed on a display station. A filter can also be used to generate alert data from an event.)

Alerts are also generated from selected event data records. Figure 12-1 shows an event being processed by the alert processor (before entry into the data base) and the creation of an alert record **2** to be directed to the NetView operator and entered into the data base.

The statistical records that supply error-to-traffic data and the event records that become alerts remain in the data base in their original form.

Alerts are stored in the hardware monitor data base and displayed (at the host) to the user in a reverse chronological listing that may be viewed on several display stations. Alert data is not organized by resource; records are presented only in reverse chronological order.

Alert data can be retrieved from the data base for display by doing the following:

- Entering commands that retrieve specific types of alert displays
- Following an alert/event tracking sequence of displays that finally leads to a single event on the resource that caused the alert.

Alert data may be displayed in various presentations. The presentations pertinent to the 3174 Alert function are described in "How the NetView Program Uses SNA Alert" on page 12-8. The alert data that is displayed to the NetView operator is determined by the filters specified by the display operator. Filters allow control of the flow of data from the resources to the data base and from the data base to the display. A NetView user may not want to view all the data stored in the NetView data base. By selective filtering, only alert data about specific terminals may be passed on to the display operator.

For more detailed background information on NetView and NPDA functions, see the following manuals:

- *NetView Installation and Administration Guide*
- *NetView Hardware Problem Determination Reference* (The successor to the *NPDA User Reference* and includes RECFMS and NMVT layouts)
- *NetView Messages*
- *NetView Operation Primer*
- *Learning About NetView: Network Concepts* (A diskette for a PC that explains SNA concepts and includes a simulation of the NetView program)
- *Network Problem Determination Application:*

  User's Guide
  Installation
  Messages and Codes
  Recommended Action Guide
  How to Use This Guide.

3174 and Host Requirements

The Alert function is available on all SNA host attachments. All current terminal configurations are supported, except that DFTs (such as the 3290 Information Panel) do not support operator-generated alerts. (These terminals do not support controller RAS tests.)

The NetView program or Version 3, Release 1 or later, of the NPDA program is required at the host.

NetView Version 2 Release 2 is required in order to display subvector information for ISDN Generic Alerts.

Gateway Considerations

When the 3174 is customized as a Gateway to a Token-Ring or an ISDN network, each of its downstream PUs (DSPUs) will have its own SSCP-PU session with the host. The 3174 will also have an SSCP-PU session with the host through its local PU. Alerts pertaining to events in the 3174 will be reported on the local SSCP-PU session. DSPUs will report their own alerts on their own SSCP-PU sessions.

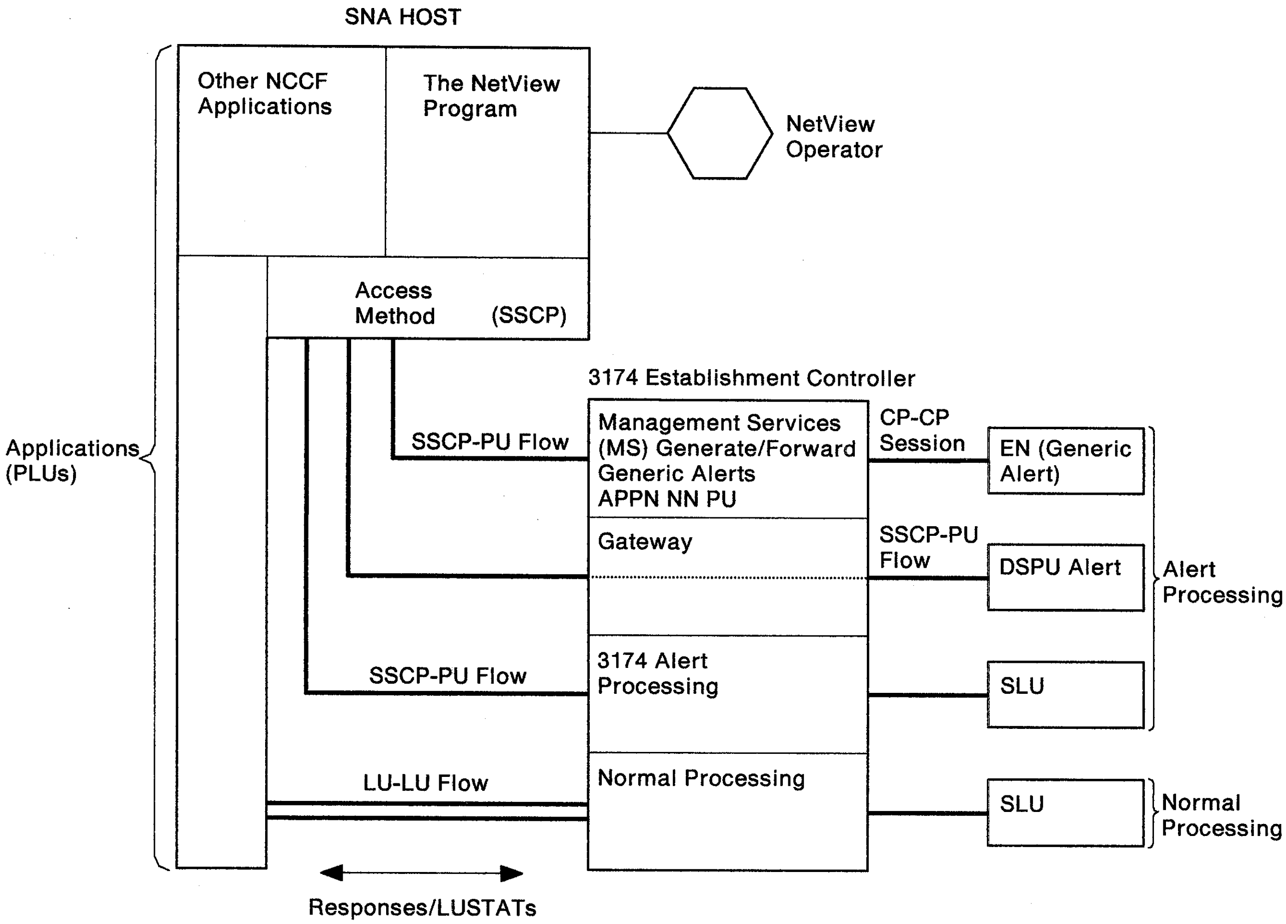
APPN Considerations

When the 3174 is customized as an APPN node, it acts as a pseudo alert focal point for the end nodes it serves. In this configuration, an end node builds an alert and sends it to the 3174 over a CP-CP session. Acting as a network node in the APPN network, the 3174 uses its Management Services (MS) function to parse the alert.

The alert arrives at the network node in a Control Point Management Services Unit (CPMSU) format using Multiple Domain Support (MDS) transport. The 3174 network node converts these APPN alerts into Network Management Vector Transport (NMVT) format and sends them to the NetView focal point on the PU-SSCP session of the 3174 network node.

SNA Host Support

The SSCP-PU session is used to send alert data to the host (Figure 12-2). The alert information flows through the network to the access method and to the NetView program. The NetView program maintains a data base of alert information based on filters currently in effect for devices throughout the network and allows customers to perform problem determination and failure isolation.



Legend

SSCP = System Services Control Point
LU = Logical Unit
PU = Physical Unit
PLU = Primary Logical Unit
SLU = Secondary Logical Unit
DSPU = Downstream Physical Unit
EN = End Node
APPN = Advanced Peer-to-Peer Networking
NN = Network Node

Figure 12-2. SNA Host Connection

How the NetView Program Uses SNA Alert

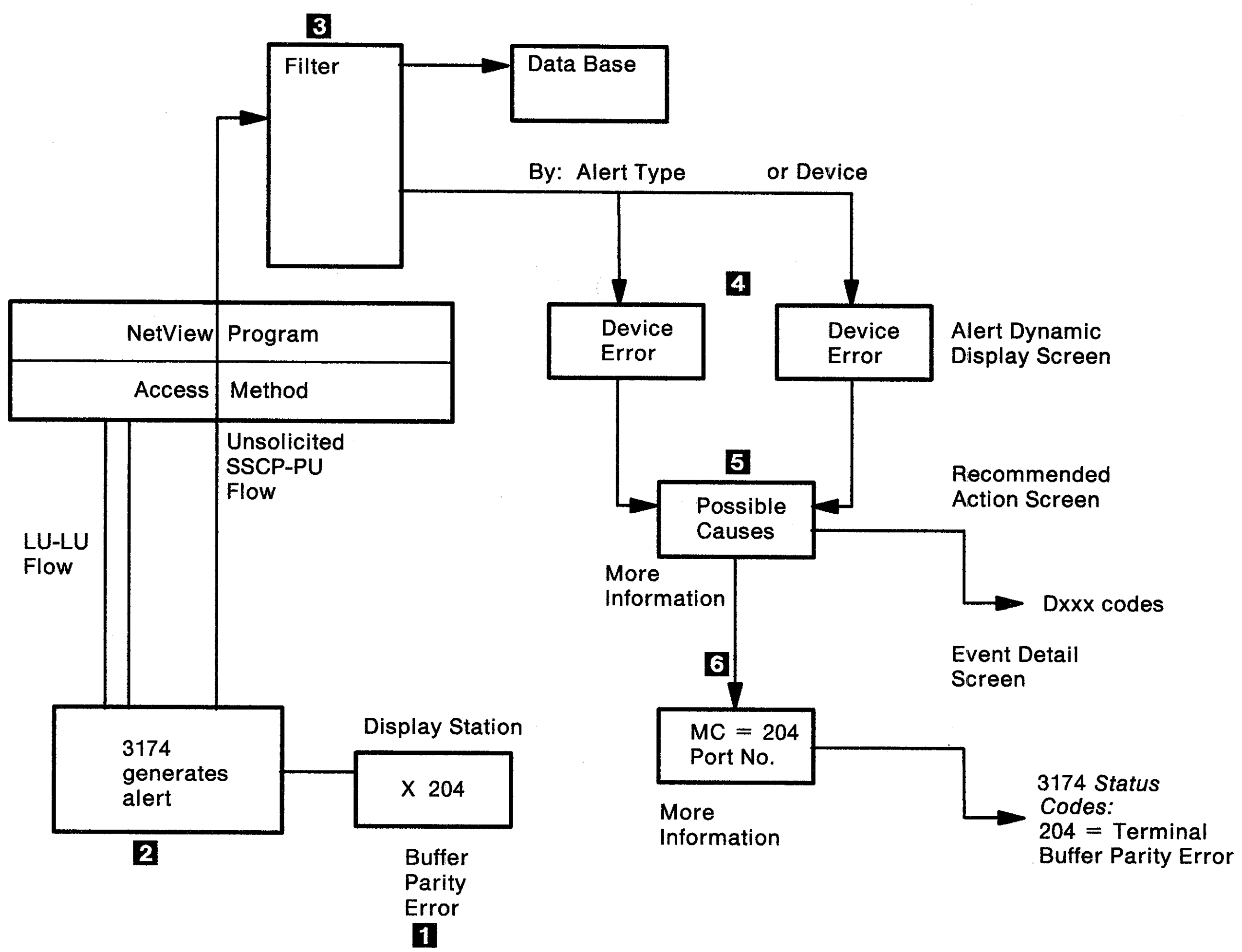
Alert messages transmitted by 3174s are added to the NetView data base or are displayed to a NetView operator, depending on the filters specified by the operator. Some of the information provided in the alert message can be used by a service representative to help determine field replaceable unit (FRU) isolation.

The NetView program permits multiple display operators to view alert data. In addition, the NetView program permits each operator to specify, using filters, the alert data he wishes to monitor. Thus, a large network can have several people who monitor selected portions of the network.

The example in Figure 12-3 on page 12-9 shows that the NetView program uses three basic screen presentations to aid the customer and the service representative in problem determination: alert dynamic, recommended action, and event detail. In addition, the NetView program provides Hexadecimal Display of Data Record and Link Configuration/Detail screens to aid in Token-Ring problem determination.

Alert Dynamic Display

The Alert Dynamic display shows a reverse chronological history of the alerts (the latest alert is at the top) of all elements or of a specific node that have been received most recently by the NetView program and have met the filter requirements designated by a particular operator. Each alert occupies a line entry and specifies the date and time the alert was received and recorded in the data base, the originator's name and type, and a canned alert description of the potential problem. Included in the description is a probable-cause statement. Other screens are selected from an input line on this display.



Notes:

1. The 3174 detects a buffer parity error in the display.
2. The 3174 generates an alert and sends it to the host.
3. The Netview program filters the alert by alert type:
   - What the operator sees
   - What is recorded in the data base.
4. Alerts are displayed on the Netview operator's display in reverse chronological order on the dynamic display screen.
5. For more information, the operator calls out the recommended action screen. To find the meaning of the Dxxx code, type ACTION Dxxx and press Enter.
6. For even more information, the operator calls out the detail screen and consults *3174 Status Codes* to find the meaning of X 204.

Figure 12-3. An Example of Alert Generation and Display

Recommended Action Display

The Recommended Action display lists the possible reasons for a specific error condition. The most likely causes of the error condition are listed under three major categories: user-caused, install-caused, and failure-caused. Within each category, the actions are shown in the most practical sequence of execution from the user's viewpoint. Each recommended user action in the display is preceded by a reference in the form Dxxx, where D indicates documentation and xxx is an identifying number. For an online description of these Dxxx numbers, type ACTION Dxxx and press Enter. For more information on this command, see *NetView Operation*, or *NetView Operation Primer*.

Event Detail Display

The Event Detail display shows a detailed description of the alert message. It shows a hierarchy of resource names and types showing the path through the network to the alert originator. It also shows several modifiers provided by the originator explaining the type, general and specific causes, a user-action code, and the device block ID. The display also provides for a maximum of three 8-character qualifiers that can be used by the originator to further explain the problem. Finally, the display provides the ability to transmit a three-line text message from the originating PU to the NetView operator.

Specific recommended action and event detail displays are selected for display to the NetView operator on the basis of device type (for example, 3174) and the user-action code contained within the alert.

Hexadecimal Display of Data Record Display

The NetView program operator can call up the hexadecimal display when the hardware monitor component of the NetView program receives an alert from the 3174. A hexadecimal presentation of the message received by the hardware monitor is provided.

The subvector data displayed can be used for problem determination. Subvectors are described in "Alert Message Format" on page 12-20. Subvector descriptions are also contained in the *NetView Hardware Problem Determination Reference*.

Subvector A0 (not present in a Generic Alert) in the Alert message and subvector 59 in the Link Event and PD Statistics messages contain the status code and qualifier data which provide important problem determination information. *3174 Status Codes* contains problem descriptions and recovery actions associated with the various status codes and qualifiers.

An example of subvector A0 in an Alert message follows:

```
    SUBVECTOR A0
11A0F8F8F06BF0F8F3F16BC9C2D4D3C1D5
     8 8 0 , 0 8 3 1 , I B M L A N
    \___ ___/ \___ ___/ \_____ _____/
        V         V           V
       SSC      QAHG   Link Subsystem Name
```

Link Configuration/Detail Display

The Link Configuration/Detail display presents (along with other Token-Ring information) the qualifiers from an Alert, Link Event, or PD Statistics message. See "Alert Detail Screens" on page 12-15.

What is the SNA Alert Operation?

If you have customized for the SNA Alert function, the host will receive machine, program, and communication error information. The SNA alert operation requires specific error codes to be generated by the 3174 and the attached terminals.

Reportable Errors

In normal operation, the 3174 causes three-digit error codes (*nnn*) to be displayed in the operator information area of the display screen. These codes follow the machine check, program check, and communication check symbols and describe the conditions indicated by the error symbols.

The first digit of the *nnn* error code indicates the type of error that occurred, as follows:

Error Code	Type of Error
2*nn*	Terminal
3*nn*	Controller
4*nn*	SNA Protocol and data stream
5*nn*	Communication check and Token-Ring
6*nn*	DFT
7*nn*	DFT
8*nn*	Features (for example, AEA, APPN, Gateway, 3174-Peer).

For example, a communication check symbol followed by an *nnn* code of 505 indicates a host connection condition.

When using multi-host support, alerts caused by hardware errors are sent to the host that is customized as the Alert Control Point. Other alerts are sent to the host associated with the affected session.

The 3174 will try to send alerts for all errors that have not affected the integrity of the host adapter, the controller, the storage, or the microcode itself. A *permanent* error disables a device or causes the loss of a critical resource. A *temporary* error is one that is recoverable with some loss in productivity and one that may cause the loss of a noncritical resource. A *performance* alert is one that exceeds a predetermined threshold but does not disable a device. Mismatches between the hardware and the microcode are considered installation problems. Certain 5*nn* communication check numbers are returned after the communication line is re-established and are considered delay-recovered. Response time alerts are sent when an RTM counter overflows and the device is allowed to send RTM alerts.

The intent is to send alerts based on the error codes generated by the 3174 and attached terminals and to let NetView-filtering decide which alerts are significant.

The NetView program supports the following alert parameters: alert type, general cause, specific cause, and the accompanying description/user-action and detail text reference codes from the 3174.

Alert Type

X'01'	Permanent error
X'02'	Temporary error
X'03'	Performance
X'04'	Operator intervention required
X'0A'	Terminal operator input
X'0C'	Not used
X'0D'	Not used
X'0F'	Delayed-recovered
X'10'	Not used

General Cause

X'01'	Hardware or microcode
X'06'	Media (diskette or fixed disk)
X'07'	Hardware or software
X'0D'	SNA-level protocol
X'0F'	Unknown
X'12'	Customizing
X'13'	Component offline

Specific Cause

X'0001'	Base processor (microcode)
X'0004'	Main storage
X'0006'	Printer
X'0009'	Keyboard
X'000A'	Selector pen
X'000C'	Display or printer
X'000D'	Display
X'000E'	Remote product
X'0012'	Communication line adapter
X'0014'	Local-channel adapter
X'0016'	Direct-attached adapter
X'001B'	Link-customer equipment (coaxial cable)
X'004D'	controller (other than storage controller)
X'0056'	Application program check
X'0062'	Disk device with removable media
X'006E'	Encryption/decryption adapter
X'0080'	Token-Ring network error
X'00FF'	Unknown

Description/User-Action Code

X'FE01'	Customizing error
X'FE02'	Permanent device error
X'FE03'	Temporary device error
X'FE04'	Permanent error (device or coaxial cable)
X'FE05'	Temporary device error (keyboard)
X'FE06'	Temporary device error (selector pen)
X'FE08'	Permanent device-controller interface sync error
X'FE09'	RPQ error (undetermined)
X'FE0E'	Permanent error disk media
X'FE0F'	Application program check
X'FE10'	Temporary error, device-reported
X'FE11'	Permanent error, device-reported
X'FE12'	Permanent device-reported application program check
X'FE13'	Customizing error (controller)
X'FE14'	Permanent error. Device failed to report operation completed
X'FE1D'	Permanent intelligent device interface error
X'FE20'	Operator-generated alert screen 01
X'FE21'	Operator-generated alert screen 02
X'FE22'	Operator-generated alert screen 03
X'FE23'	Operator-generated alert screen 04
X'FE24'	Operator-generated alert screen 05
X'FE25'	Operator-generated alert screen 06
X'FE26'	Operator-generated alert screen 07
X'FE27'	Operator-generated alert screen 08
X'FE28'	Operator-generated alert screen 09
X'FE29'	Operator-generated alert screen 10
X'FE2A'	Operator-generated alert screen 11

X'FE2B'	Operator-generated alert screen 12
X'FE2C'	Operator-generated alert screen 13
X'FE2D'	Operator-generated alert screen 14
X'FE2E'	Operator-generated alert screen 15
X'FE2F'	Operator-generated alert screen 16
X'FE30'	Operator-generated alert screen 17
X'FE31'	Operator-generated alert screen 18
X'FE32'	Operator-generated alert screen 19
X'FE33'	Operator-generated alert screen 20
X'FE39'	Response time monitor counter overflow
X'FE3A'	Delayed alert 5*nn* (nonchannel-attached)
X'FE3D'	Delayed alert 5*nn* (channel-attached channel)
X'FE40'	Permanent controller hardware failure (1 FRU)
X'FE41'	Permanent controller hardware failure (2 FRU)
X'FE42'	Delayed controller hardware failure (1 FRU)
X'FE43'	Delayed controller hardware failure (2 FRU)
X'FE44'	Temporary controller hardware failure (1 FRU)
X'FE45'	Temporary controller hardware failure (2 FRU)
X'FE46'	controller error—Battery
X'FE47'	Terminal multiplexer error
X'FE48'	controller error, threshold exceeded (1 FRU)
X'FE49'	controller error, threshold exceeded (2 FRU)
X'FE4A'	SNA data stream error
X'FE4B'	controller error—DASD media
X'FE4C'	Device attachment error
X'FE4D'	Host link communication error
X'FE4E'	Delayed controller hardware failures (0 FRU)
X'FE4F'	Host link communication error
X'FE60'	Initialization failure; Token-Ring adapter
X'FE61'	Open failure; Token-Ring lobe
X'FE62'	Open failure; Token-Ring lobe/network
X'FE63'	Open failure; Token-Ring fault domain
X'FE64'	Open failure; Token-Ring duplicate station address
X'FE65'	Open failure; Token-Ring remove command received
X'FE66'	Lobe wire fault; Token-Ring lobe
X'FE67'	Auto removal; Token-Ring lobe
X'FE68'	Token-Ring remove command received; user
X'FE69'	Token-Ring inoperative; fault domain
X'FE6A'	Token-Ring temporary error recovered; fault domain
X'FE6B'	Adapter check; Token-Ring adapter
X'FE6C'	Excessive Token-Ring errors; fault domain
X'FE6D'	Connect failure; Token-Ring remote device
X'FE73'	Link timeout: Token-Ring network/remote device
X'FE75'	Link timeout: Token-Ring network/remote device
X'FE91'	Reject received: Token-Ring remote device
X'FE92'	DM/DISC received: Token-Ring remote device
X'FE94'	SABME received: Token-Ring remote device
X'FE99'	FRMR sent: Token-Ring remote device
X'FEA4'	FRMR response received: Token-Ring remote device

Detail Text Reference Code

The Detail Text Reference Codes are presented in this section.

Note: The NetView program and NPDA, Version 3, Release 1 and later, generate 3174 alert messages using the 3174 description/user-action code only. The 3174 also includes a detail text reference code. There is no correlation between these two codes.

X'FE01'	Q1: SC,QAHG	Q2: (not used)	Q3: (not used)
X'FE02'	Q1: SC,QAHG	Q2: Port number	Q3: (not used)
X'FE03'	Q1: SC,QAHG	Q2: LU number	Q3: (not used)
X'FE04'	Q1: SC,QAHG	Q2: Port number	Q3: Terminal ID
X'FE05'	Q1: SC,QAHG	Q2: LU number	Q3: Terminal ID
X'FE06'	Reserved		
X'FE08'	Q1: (not used)	Q2: Port number	Q3: (not used)
X'FE09'	Reserved		
X'FE0A'	Q1: (not used)	Q2: LU number	Q3: (not used)
X'FE0B'	Q1: SC,QAHG	Q2: TYPE,LOC	Q3: (not used)
X'FE0C'	Q1: SC,QAHG	Q2: TYPE,LOC	Q3: TYPE,LOC
X'FE0D'	Q1: SC,QAHG	Q2: LU number	Q3: Error detail
X'FE0E'	Q1: Reserved	Q2: Reserved	Q3: Reserved
X'FE0F'	Q1: SC,QAHG	Q2: Error detail	Q3: (not used)
X'FE20' through X'FE33'	Q1: Customer-defined	Q2: Customer-defined	Q3: Customer-defined
X'FE60'	Q1: SC,QAHG, Link subsystem name	Q2: Initialization interrupt register	Q3: (not used)
X'FE61' through X'FE65'	Q1: SC,QAHG, Link subsystem name	Q2: Open error code	Q3: (not used)
X'FE66' through X'FE6A'	Q1: SC,QAHG, Link subsystem name	Q2: Ring status	Q3: (not used)
X'FE6B'	Q1: SC,QAHG, Link subsystem name	Q2: Adapter check status	Q3: (not used)
X'FE6C'	Q1: SC,QAHG, Link subsystem name	Q2: (not used)	Q3: (not used)
X'FE6D'			

Q1, Q2, Q3	Alert code qualifiers
SC,QAHG	
SC	Status (error) code
QA	Status code qualifier
HG	Hardware group (For a list of HGs, see *3174 Customer Problem Determination*.)
Port number	Controller port number in hex (00—1F).
LU number	Secondary logical unit ID in hex (local address).
TYPE,LOC	xxx,yyy where xxx is the type of failing FRU and yyy is the location of the failing FRU.
Error detail	Additional information about the error. For a description of this information, see the status codes in *3174 Status Codes* where this error detail appears in the Extended Data column.
Terminal ID	Terminal identification code (for example, the 3290).

Alert Detail Screens

The qualifier fields displayed on detail screens are as follows:

SC	Qualifiers Supplied on Event Detail Screen and Link Configuration/Detail Screen		
2xx	Q1: SC,QAHG	Q2: Port number	Q3:* Terminal ID
3xx	Q1: SC,QAHG	Q2:* TYPE, LOC	
4xx	Q1: SC,QAHG	Q2: LU number	Q3:* Error detail
5xx	Q1: SC,QAHG	Q2:* Error detail	
6xx	Q1: SC,QAHG	Q2: Port number	Q3: Terminal ID
7xx	Q1: SC,QAHG	Q2: LU number	Q3: Terminal ID

* Not always present

Token-Ring-Related:			
341,01	Q1: SC,QAHG	Q2: Initialization interrupt register	Q3: (not used)
341,02	Q1: SC,QAHG	Q2: Adapter check status	Q3: (not used)
880,01—04	Q1: SC,QAHG	Q2: Open error code	Q3: (not used)
880,05—08	Q1: SC,QAHG	Q2: Ring status	Q3: (not used)
880,58	Q1: SC,QAHG	Q2: Ring status	Q3: (not used)
881,01	Q1: SC,QAHG	Q2: Open error code	Q3: (not used)
883,01	Q1: SC,QAHG	Q2: (not used)	Q3: (not used)
890,01	Q1: SC,QAHG	Q2: (not used)	Q3: (not used)

Q1, Q2, Q3	Alert code qualifiers.
SC,QAHG	
SC	Status code
QA	Status code qualifier
HG	Hardware group (For a list of HGs, see *3174 Customer Problem Determination*.)
Port number	Controller port number in hex (00—1F).
LU number	Secondary logical unit ID in hex (local address).
Terminal ID	Terminal identification code (for example, the 3290).
TYPE,LOC	xxx,yy where xxx is the type of failing FRU and yy is the location of the failing FRU.
Error detail	Additional information about the error. For a description of this information, see the list of status codes in *3174 Status Codes* where this error detail appears in the Extended Data column.

Operator-Generated Alert Messages

Note: The procedure for sending an alert message to the host is presented in "Sending Operator-Generated Alert Messages" on page 12-17.

Operator-generated alert messages can be sent from any CUTs or any DFTs in CUT mode.

Through a customizing parameter, all display station operators, the operator on port 0 of HG26 or HG27 only, or no operators may be authorized to request an alert message panel while the display is in 3174 test mode. When properly filled in, the information on the panel is transmitted as part of an alert NMVT inbound request to the host.

Included in these alert messages are the installation-specified user-action code, a 120-character (maximum length) text message, and a maximum of three 8-digit qualifiers.

The user-action code (01—20 decimal, required) correlates with one of the product-unique panels that can be defined in the NetView data base as part of the host SYSGEN process.

Once the alert message is received by the NetView program, the user-action code is used to correlate the message with one of the product-unique panels defined in the NetView program, and the message is mapped into the panel. The text message and qualifiers allow the operator to pass such things as a 3174 *nnn* code, a port number, a telephone number, etc., as well as a text message to the NetView operator.

When an authorized display station operator enters test mode, the panel shown in Figure 12-4 is displayed.

Blank areas on the screen are protected.

```
/A
XX
----------------------------
nnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnn
nnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnn --------------
Q1 mmmmmmmm Q2 mmmmmmmm Q3 mmmmmmmm
```

Legend:

/A	Indicates the alert screen is ready for transmission when the Enter function is pressed.
XX	Is a two-character field for the user-action code (01-20 decimal required).
nnnn...	Is a 120-character field filled with nulls, ready for entry of the text message (optional).
mmmm...	Are three 8-character fields filled with nulls, ready for entry of the qualifiers (optional). Blank areas on the screen are protected.

Figure 12-4. Skeleton Alert Message Panel

When the Enter or PA1 function is pressed, a check is performed to ensure that the user-action code is a number between 01 and 20 (decimal). If the number is between 01 and 20, the 3174 translates the number into the appropriate user-action code and an alert is sent. If an invalid user-action code is entered, the wrong number symbol is displayed in the Operator Information Area.

After an operator-generated alert is sent, the display screen is cleared to prevent accidental retransmission of the message. Only one operator-generated alert may be pending within the 3174 at one time. For example, several authorized display station operators may request an alert screen simultaneously. Once an operator fills his screen with the required user-action codes (and any optional text and qualifiers) and presses the Enter function, the entry is queued for transmission, provided there is no operator-generated alert already pending. If a second authorized operator attempts to enter an alert before the first operator-generated alert is transmitted to the host, and responded to, the second operator's entry is inhibited, the screen is not cleared, and the Input Inhibited and Minus Function symbols are displayed in the OIA. The second operator must press the Reset function and try again. If the first operator's screen has been transmitted and no other operator has entered an alert, the second operator's entry is honored.

Regardless of the upstream response, the screen is cleared. If a link-level error occurs, the hardware will try retransmission of the alert. If the data has been lost because of an error above the link level (DACTPU), the information will be retransmitted after a subsequent ACTPU.

If an attempt is made to request an operator-generated alert screen from an unauthorized display station, the Input Inhibited, Minus Function, and Operator Unauthorized symbols are displayed in the Operator Information Area.

Sending Operator-Generated Alert Messages

For Configuration Support A and S, requests can be made from authorized display stations for the display of an operator-generated alert message in skeleton form. When filled in with installation-developed information (a 3174 error code, a port number, etc.) and an installation-specified user-action code, the message is then transmitted inbound to the host. See Figure 12-4 on page 12-16.

For Configuration Support B and C, you can send an alert to any host on the same link as the active LT. For example, when you are using an LT assigned to host 1D, you can send an alert to any host 1A through 1H. For more information, refer to the *3174 Planning Guide*.

The steps you follow to send operator-generated alert messages differ depending on the configuration you have installed. To send operator-generated alert messages, do the following:

1. Follow the instructions for the configuration you have installed:

Configuration	Instructions
A and S	Press and hold Alt, then press the Test function to place the display in test mode. Then press PF12 to display the 3174 Test Menu.
B and C	Use the Change Screen function to switch to the appropriate LT. Press and hold Alt, then press the Test function to place the display in test mode. Then press PF12 to display the 3174 Test Menu.

2. Display the Skeleton Alert Message panel by following the instructions for the configuration you have installed:

Configuration	Instructions
A and S	Enter /A on the selection line and press the Enter function.
B and C	Enter /A,n (where n = the Host ID) on the selection line and press the Enter function.

   The panel shown in Figure 12-4 on page 12-16 appears on the screen.

   If the display station is unauthorized, the Input Inhibited, Minus Function, and Operator Unauthorized symbols are displayed in the OIA.

3. Fill in the message with the information specified by your installation. *The user-action code is required.* See Figure 12-4 on page 12-16.

   - Use only characters from the base character set (do not enter message information while the keyboard is in APL mode, TEXT mode, etc.) *and* do not enter characters with extended attributes.

- If other than characters from the base character set have been entered from the keyboard, the Input Inhibited and What symbols are displayed in the Operator Information Area. To re-enter the information, you must clear the screen (Clear) and request the operator-generated message panel again by keying in /A (or /A,n for Configuration Support B and C) and pressing the Enter function.

4. Press the Enter function to initiate transmission of the message.

   - The user-action code is checked after the message is presented for transmission. If invalid, the Wrong Number symbol is displayed. To enter a correct code, you must follow the procedure given in step 3 concerning the re-entering of information.
   - After transmission, the display screen is cleared.
   - If a communication check is detected, the Input Inhibited and Communication Reminder symbols, followed by a 5*nn*, are displayed.
   - Transmission of only one operator-generated alert message can be pending at one time. For example, several users at authorized display stations may request an alert screen concurrently. Once one user fills the panel with the required user-action code and any optional information, and presses the Enter function, that message is queued for transmission. If a second user attempts to enter an alert message before the first message has been transmitted to the host, and responded to, entry of the second message is inhibited, and the Input Inhibited and Minus Function symbols are displayed. The second user's panel is not cleared from the screen, and, by pressing the Reset function and re-entering the message, the second user may try again.

Priority Queuing of Alerts within the 3174 (Display Alerts Only)

The 3174 queues one alert for each attached device. If an error occurs in a device that causes an alert to be queued and a second and more serious error (one of higher priority) occurs in the device, the second error will replace the first error in the queue and the first error will be lost. However, if the second error is of equal or lower priority, the second error will be lost. See Table 12-4 on page 12-29 for a tabulation of alert priorities.

Except for temporary errors, as soon as an alert for a specific device is transmitted to the host, additional alerts for that device may be queued. The rate of acceptance of errors into the queue is determined primarily by the host response time on the SSCP-PU flow. When a condition occurs that causes a temporary alert, an attempt is made to queue that alert according to the above algorithm. However, if a subsequent temporary error occurs, an alert will not be generated until the operator has reset the input inhibited condition caused by the previous alert. Thus, the frequency of temporary alerts is restricted by keying the alert generation to the rate at which the operator can reset the keyboard.

For Generic Alerts, the 3174 will queue up to 8 alerts per upstream host connection (only for hosts that are customized to receive alerts). If this queue is full and another error occurs, the new alert will replace on the queue any alert of lower priority. If all alerts on the queue are of higher priority, then the new alert will be lost. Of these 8 alerts for upstream host connection, a maximum of 5 received End Node (EN) alerts can be queued. Unlike internal Generic Alerts, however, these EN alerts are not prioritized or replaced in any way.

Negative Responses

The following inbound negative responses from the 3174 may be returned in response to an REQMS or NMVT request. These responses are not unique to alert but are included here for reference.

1003 0001 Negative Response. An NS header was received, but it was neither REQMS nor NMVT, or it was NMVT, but RTM is not supported. The request is rejected, and error recovery is the responsibility of the sender.

1007 0001 Negative Response. An invalid NS header was received. The request is rejected, and error recovery is the responsibility of the sender.

080C 0005/0000 Negative Response. A valid REQMS or NMVT request was received, but the REQMS or NMVT type parameter is not supported by the 3174. The request is rejected, and error recovery is the responsibility of the sender. A modifier of 0005 indicates an NMVT major vector function received that is not supported; a modifier of 0000 indicates an invalid or unsupported RECFM request was received.

0815 0003 RTM/REQMS in Progress. The number of outstanding NMVT/RTM requests to process has exceeded the limit. As processing of these queued requests is completed, the controller will be able to handle more.

Product-Instance ID Vector Support

As shown in Tables 12-1 through 12-4, the 3174 supports the following fields in the NMVT product-instance ID vector:

For the 3174:

- Machine type: 3174 in EBCDIC
- Model: xxx in EBCDIC
- Plant of manufacture: xx as specified during customization (zero if unknown)
- Serial number: 00xxxxx in EBCDIC, where xxxxx is the response to customizing question 108, Unique Machine Identifier, which is supposed to be a unique number within the network and may consist only of alphanumeric characters 0 through 9 and A through F. (These are the only valid alphanumeric characters that may be entered during the customizing procedure.)

For attached devices:

- Machine type: xxxx in EBCDIC (if known)
- Plant of manufacture: zeros if unknown
- Sequence number: zeros if unknown.

It is the responsibility of the attaching terminals to provide the above information to the 3174 when the terminals are powered on. The 3174 includes this information in the alert RU.

Customizing

You must customize for the alert function in order to have it available on your 3174. See customizing question 220 in the *3174 Planning Guide* for more information.

Alert Message Format

There are several conditions that result in the generation of alert messages:

- Controller error
- Device hardware error
- Application program check
- Operator-generated alert
- Token-Ring error
- Token-Ring link events
- Token-Ring problem-determination statistics
- Generic Alert (For Release C1 only).

Each category requires the generation of an alert message in a specific NMVT format. The first four message categories are itemized below, followed by notes about alert messages on page 12-31 and a quick-reference table on page 12-32. The Token-Ring-based messages are given in "Gateway Alert Message Format" on page 12-33. The format of the Generic Alerts are discussed in "Generic Alert Message Format" on page 12-45.

The ID for the subvector or subfield follows the name.

Controller Error

The specific NMVT format for controller error messages follows. See Table 12-1 for details.

TH
RH
RU
    NMVT Header
    Length to End of RU
    Alert Vector (X'0000')
        Product-Set ID Vector (X'10')
            PU Product Vector (X'F1')
            PID Subvector (X'11')
    Basic Alert Vector (X'91')
    Detail Qualifier Vector (SSC, QAHG) (X'A0')
    Detail Qualifier Vector (type, location) (X'A0')
    Detail Qualifier Vector (type, location/blanks) (X'A0')
    Relative Time Vector (X'42')
    Hierarchy Name List * (X'03').

* Subvector included for disk media errors

Table 12-1 (Page 1 of 4). TH, RH, and RU Definitions for Controller Errors

Byte	Bit	Value	Meaning
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)

Table 12-1 (Page 2 of 4). TH, RH, and RU Definitions for Controller Errors			
Byte	**Bit**	**Value**	**Meaning**
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0		X'0B'	Formatted Function Management Data (FMD); Only in chain
RH1		X'80'	Definite response only
RH2		X'00'	Not applicable
			Note: No other bits in this request header are applicable to this session.
RU0		X'41'	NMVT
RU1		X'03'	
RU2		X'8D'	
RU3,4		X'0000'	Reserved (may be nonzero but not to be used)
RU5,6		X'0000'	PRID when solicited
RU7	0	B'0'	Unsolicited
	1	B'0'	Last or only
	2	B'0'	First or only
	3	B'0'	Not used
	4−7	B'0000'	Reserved
RU8	0	B'0'	No concatenation
	1−7	B'000 0000'	Remaining length of this RU
RU9		X'4F'	(X'5D' if hierarchy name list is included)
RU10,11		X'0000'	Code point for alert
RU12		X'19'	Length of product-set ID vector
RU13		X'10'	Product-set ID vector − PU
RU14		X'F1'	PU product vector
RU15		X'16'	Length of subvector
RU16		X'11'	Product Identifier subvector
RU17		X'01'	IBM machine
RU18		X'13'	Length of product-instance ID vector
RU19		X'00'	Product-instance ID vector
RU20		X'12'	Format of product-instance ID vector
RU21		X'F-'	Machine type
RU22		X'F-'	
RU23		X'F-'	
RU24		X'F-'	
RU25 through RU27			Model number in EBCDIC (zero if unknown)
RU28,29			Plant of manufacture (zero if unknown)
RU30		X'F0'	Customization-specified sequence number in EBCDIC.
RU31		X'F0'	
RU32 through RU36			
RU37		X'0E'	Length of basic alert vector
RU38		X'91'	Basic alert vector

Byte	Bit	Value	Meaning
RU39			Alert classification:
	0		Initiation indicator:
		B'0'	Alert not initiated by operator action.
		B'1'	Alert initiated by operator action.
	1		Held-alert indicator:
		B'0'	Alert sent when problem was detected.
		B'1'	Alert detected earlier but not sent then, because no session was available to send it on.
	2−7	B'00 0000'	
RU40			Alert type
RU41			General cause code
RU42,43		X'00--'	Specific component code
RU44,45		X'FE--'	Alert description code
RU46,47		X'FE--'	User-action code
RU48,49		X'FE--'	Detail text reference code
RU50		X'00'	Not used
RU51		X'0A'	Length of detail qualifier 1
RU52		X'A0'	Detail qualifier 1 − EBCDIC
RU53		X'F-'	S 3nn, 5nn, or 8nn status code
RU54		X'F-'	S
RU55		X'F-'	C
RU56		X'6B'	, Comma delimiter
RU57		X'F-'	Q Status code qualifier
RU58		X'F-'	A
RU59		X'F-'	H Hardware group
RU60		X'F-'	G
RU61		X'09'	Length of detail qualifier 2
RU62		X'A0'	Detail qualifier 2 − EBCDIC
RU63		X'F-'	Type — 4 digits (or blanks, if not applicable)
RU64		X'F-'	
RU65		X'F-'	
RU66		X'F-'	
RU67		X'6B'	, Comma delimiter
RU68		X'F-'	Location — 2 digits (or blanks, if not applicable)
RU69		X'F-'	
RU70		X'0A'	Length of detail qualifier 3
RU71		X'A0'	Detail qualifier 3 — EBCDIC
RU72			Padding: X'40' if EBCDIC; X'00', if hex.
RU73		X'F-'	Type − 4 digits for 2 FRU SCs (else all blanks)
RU74		X'F-'	
RU75		X'F-'	
RU76		X'F-'	
RU77		X'6B'	, Comma delimiter
RU78		X'F-'	Location − 2 digits for 2 FRU SCs, (else blanks)
RU79		X'F-'	
RU80		X'07'	Length of relative-time vector
RU81		X'42'	Code point for relative-time vector
RU82		X'EF'	Sequence number; not time
RU83 through RU86			Sequential number: Starts at 0000 0000 at IML. Incremented for each record sent.

Table 12-1 (Page 3 of 4). TH, RH, and RU Definitions for Controller Errors

Table 12-1 (Page 4 of 4). TH, RH, and RU Definitions for Controller Errors			
Byte	**Bit**	**Value**	**Meaning**
			Diskette Media Errors:
RU87		X'0E'	Length
RU88		X'03'	Hierarchy name list subvector
RU89		X'00'	Reserved
RU90		X'01'	Number of entries
RU91		X'06'	Length
RU92 through RU96		C'-----'	DSKT1 or DSKT2 — Resource name
RU97 through RU100		C'DSKT'	Resource type

Device Hardware Error

The specific NMVT format for device hardware error messages follows. See Table 12-2 for details.

TH
RH
RU
  NMVT Header
  Length to End of RU
  Alert Vector (X'0000')
    SNA Address List (X'04')
    Product-Set ID Vector (X'10')
      PU Product Vector (X'F1')
      PID Subvector (X'11')
    Product-Set ID Vector (X'10')
      LU Product Vector (X'F3')
      PID Subvector (X'11')
    Basic Alert Vector (X'91')
    Detail Qualifier Vector (SSC, QAHG) (X'A0')
    Detail Qualifier Vector (port) (X'A0')
    Detail Qualifier Vector (device type/blanks) (X'A0')
    Relative Time Vector (X'42').

Table 12-2 (Page 1 of 4). TH, RH, and RU Definitions for Device Hardware Errors			
Byte	**Bit**	**Value**	**Meaning**
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0		X'0B'	Formatted Function Management Data (FMD); Only in chain
RH1		X'80'	Definite response only
RH2		X'00'	Not applicable
			Note: No other bits in this request header are applicable to this session.
RU0		X'41'	NMVT
RU1		X'03'	
RU2		X'8D'	
RU3,4		X'0000'	Ignored

Table 12-2 (Page 2 of 4). TH, RH, and RU Definitions for Device Hardware Errors			
Byte	**Bit**	**Value**	**Meaning**
RU5,6		X'0000'	PRID when solicited
RU7	0 1 2 3 4−7	B'0' B'0' B'0' B'1' B'0000'	Unsolicited Last or only First or only SNA address list included Reserved
RU8 RU9	0 1−7	B'0' B'000 0000' X'72'	No concatenation Remaining length of this RU
RU10,11		X'0000'	Code point for alert
RU12		X'0A'	Length of SNA address list
RU13		X'04'	Code point SNA address list
RU14		X'01'	Number of TAFs
RU15 through RU21		X'0000 0000 0000 aa'	Target address (source): SLU local address: 7 bytes aa = LU local address
RU22		X'19'	Length of product-set ID vector
RU23		X'10'	Product-set ID vector − PU
RU24		X'F1'	PU product vector
RU25		X'16'	Length of subvector
RU26		X'11'	PID subvector
RU27		X'01'	IBM machine
RU28		X'13'	Length of product-instance ID vector
RU29		X'00'	Product-instance ID vector
RU30		X'12'	Format of product-instance ID vector
RU31 RU32 RU33 RU34		X'Fn' X'Fn' X'Fn' X'Fn'	Machine type: nnnn
RU35 through RU37			Model number in EBCDIC (left-justified and padded with blanks)
RU38,39			Plant of manufacture (zero if unknown)
RU40 RU41 RU42 through RU46		X'F0' X'F0'	Customization-specified machine Sequence number in EBCDIC
RU47		X'16'	Length of product-set ID vector
RU48		X'10'	Product-set ID vector − LU
RU49		X'F3'	LU product vector
RU50		X'13'	Length of subvector
RU51		X'11'	PID subvector
RU52		X'01' X'03' X'09'	IBM machine Unknown Non-IBM machine
RU53		X'13'	Length of product-instance ID vector
RU54		X'00'	Product-instance ID vector
RU55		X'12'	Format of product-instance ID vector

Table 12-2 (Page 3 of 4). TH, RH, and RU Definitions for Device Hardware Errors			
Byte	**Bit**	**Value**	**Meaning**
RU56		X'F-'	Machine type of attached device (zero if unknown)
RU57		X'F-'	
RU58		X'F-'	
RU59		X'F-'	
RU60			Model number in EBCDIC (zero if unknown)
RU61			
RU62			
RU63,64			Plant of manufacture (zero if unknown)
RU65 through RU71			Sequence number (zero if unknown)
RU72		X'0E'	Length of basic alert vector
RU73		X'91'	Basic alert vector
RU74			Alert classification:
	0		Initiation indicator:
		B'0'	Alert not initiated by operator action.
		B'1'	Alert initiated by operator action.
	1		Held-alert indicator:
		B'0'	Alert sent when problem was detected.
		B'1'	Alert detected earlier but not sent then, because no session was available to send it on.
	2–7	B'00 0000'	
RU75			Alert type
RU76			General cause code
RU77,78		X'00--'	Specific component code
RU79,80		X'FE--'	Alert description code
RU81,82		X'FE--'	User-action code
RU83,84		X'FE--'	Detail text reference code
RU85		X'00'	Not used
RU86		X'0A'	Length of detail qualifier 1
RU87		X'A0'	Detail qualifier 1 – EBCDIC
RU88		X'F-'	S 2nn, 6nn, or 8nn SSC
RU89		X'F-'	S
RU90		X'F-'	C
RU91		X'6B'	, Comma delimiter
RU92		X'F-'	Q SSC qualifier
RU93		X'F-'	A
RU94		X'F-'	H Hardware group
RU95		X'F-'	G
RU96		X'09'	Length of detail qualifier 2
RU97		X'A0'	Detail qualifier 2 – EBCDIC
RU98 through RU104		X'F-------'	Port number 00–1F
RU105		X'0A'	Length of detail qualifier 3
RU106		X'A0'	Detail qualifier 3 – EBCDIC
RU107 through RU114			Device type If not applicable: X'40404040' If device does not supply: X'F0F0F0F0' (padded on left with X'40404040')
RU115		X'07'	Length of relative-time vector
RU116		X'42'	Code point for relative-time vector

Table 12-2 (Page 4 of 4). TH, RH, and RU Definitions for Device Hardware Errors			
Byte	**Bit**	**Value**	**Meaning**
RU117		X'EF'	Sequence number; not time
RU118 through RU121			Sequential number: Starts at 0000 0000 at IML. Incremented for each record sent.

Application Program Check

The specific NMVT format for application program check messages follows. See Table 12-3 for details.

TH
RH
RU
  NMVT Header
  Length to End of RU
  Alert Vector (X'0000')
    SNA Address List (X'04')
    Product-Set ID Vector (X'10')
      PU Product Vector (X'F1')
      PID Subvector (X'11')
    Product-Set ID Vector (X'10')
      LU Product Vector (X'F3')
      PID Subvector (X'11')
    Basic Alert Vector (X'91')
    Detail Qualifier Vector (SSC, QAHG) (X'A0')
    Detail Qualifier Vector (LU) (X'A0')
    Detail Qualifier Vector (device type for DFTs, error detail, or blanks) (X'A0')
    Relative Time Vector (X'42').

Table 12-3 (Page 1 of 4). TH, RH, and RU Definitions for Application Program Checks			
Byte	**Bit**	**Value**	**Meaning**
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0 RH1 RH2		X'0B' X'80' X'00'	Formatted Function Management Data (FMD); Only in chain Definite response only Not applicable **Note:** No other bits in this request header are applicable to this session.
RU0 RU1 RU2		X'41' X'03' X'8D'	NMVT
RU3,4		X'0000'	Not used
RU5,6		X'0000'	PRID when solicited

Table 12-3 (Page 2 of 4). TH, RH, and RU Definitions for Application Program Checks

Byte	Bit	Value	Meaning
RU7	0	B'0'	Unsolicited
	1	B'0'	Last or only
	2	B'0'	First or only
	3	B'1'	SNA address list included
	4−7	B'0000'	Reserved
RU8	0	B'0'	No concatenation
	1−7	B'000 0000'	Remaining length of this RU
RU9		X'79'	
RU10,11		X'0000'	Code point for alert
RU12		X'11'	Length of SNA address list
RU13		X'04'	Code point SNA address list
RU14		X'02'	Number of TAFs
			Target address:
RU15		X'4000	SLU local address: 7 bytes
through		0000	(40=PLU follows)
RU20		0000	
RU21		aa'	aa = 02, LU local address
RU22		X'0000	PLU local address: 7 bytes
through		0000	
RU27		0000	
RU28		pp'	pp = OAF from LU Bind
RU29		X'19'	Length of product-set ID vector
RU30		X'10'	Product-set ID vector − PU
RU31		X'F1'	PU product vector
RU32		X'16'	Length of subvector
RU33		X'11'	PID subvector
RU34		X'01'	IBM machine
RU35		X'13'	Length of product-instance ID vector
RU36		X'00'	Product-instance ID vector
RU37		X'12'	Format of product-instance ID vector
RU38		X'F-'	Machine type
RU39		X'F-'	
RU40		X'F-'	
RU41		X'F-'	
RU42 through RU44			Model number in EBCDIC (zero if unknown)
RU45,46		X'0000'	Plant of manufacture (zero if unknown)
RU47		X'F0'	Operator-customized sequence number in EBCDIC.
RU48		X'F0'	
RU49 through RU53			
RU54		X'19'	Length of product-set ID vector
RU55		X'10'	Product-set ID vector − LU
RU56		X'F3'	LU product vector
RU57		X'13'	Length of subvector
RU58		X'11'	PID subvector
RU59		X'01'	IBM machine
		X'03'	Unknown
		X'09'	Non-IBM machine
RU60		X'13'	Length of product-instance ID vector

Table 12-3 (Page 3 of 4). TH, RH, and RU Definitions for Application Program Checks

Byte	Bit	Value	Meaning
RU61		X'00'	Product-instance ID vector
RU62		X'12'	Format of product-instance ID vector
RU63 RU64 RU65 RU66		X'F-' X'F-' X'F-' X'F-'	Machine type of attached device (zero if unknown)
RU67 through RU69			Model number in EBCDIC (zero if unknown)
RU70,71			Plant of manufacture (zero if unknown)
RU72 through RU78			Sequence number (zero if unknown)
RU79 RU80		X'0E' X'91'	Length of basic alert vector Basic alert vector
RU81			Alert classification:
	0		Initiation indicator:
		B'0'	Alert not initiated by operator action.
		B'1'	Alert initiated by operator action.
	1		Held-alert indicator:
		B'0'	Alert sent when problem was detected.
		B'1'	Alert detected earlier but not sent then, because no session was available to send it on.
	2−7	B'00 0000'	
RU82			Alert type
RU83			General cause code
RU84,85		X'00--'	Specific component code
RU86,87		X'FE--'	Alert description code
RU88,89		X'FE--'	User-action code
RU90,91		X'FE--'	Detail text reference code
RU92		X'00'	Reserved
RU93		X'0A'	Length of detail qualifier 1
RU94		X'A0'	Detail qualifier 1 − EBCDIC
RU95 RU96 RU97		X'F-' X'F-' X'F-'	4nn or 7nn SSC
RU98		X'6B'	Comma delimiter
RU99 RU100		X'F-' X'F-'	SSC qualifier
RU101 RU102		X'F-' X'F-'	Hardware group
RU103		X'04'	Length of detail qualifier 2
RU104		X'A0'	Detail qualifier 2 − EBCDIC
RU105 through RU111			LU number hex 02-81
RU112		X'0A'	Length of detail qualifier 3
RU113		X'A0'	Detail qualifier 3 − EBCDIC

Table 12-3 (Page 4 of 4). TH, RH, and RU Definitions for Application Program Checks

Byte	Bit	Value	Meaning
RU114 through RU121			Device type or error detail: Device type: If not applicable, X'4040404040404040' (padded with X'40404040'). If device does not supply, X'40404040F0F0F0F0'. Error detail: X'nnnnnnnn' (padded on right with 0's)
RU122		X'07'	Length of relative-time vector
RU123		X'42'	Code point for relative-time vector
RU124		X'EF'	Sequence number: not time
RU125 through RU128			Sequential number: Starts at 0000 0000 at IML. Incremented for each record sent.

Operator-Generated Alert

The specific NMVT format for operator-generated alert messages follows. See Table 12-4 for details.

TH
RH
RU
  NMVT Header
  Length to End of RU
  Alert Vector (X'0000')
    SNA Address List (X'04')
    Product-Set ID Vector (X'10')
      PU Product Vector (X'F1')
      PID Subvector (X'11')
    Basic Alert Vector (X'91')
    Text Vector (X'00')
    Detail Qualifier Vector (X'A0')
    Detail Qualifier Vector (X'A0')
    Detail Qualifier Vector (X'A0')
    Relative Time Vector (X'42').

Table 12-4 (Page 1 of 3). TH, RH, and RU Definitions for Operator-Generated Alerts

Byte	Bit	Value	Meaning
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0 RH1 RH2		X'0B' X'80' X'00'	Formatted Function Management Data (FMD); Only in chain Definite response only Not applicable **Note:** No other bits in this request header are applicable to this session.

Table 12-4 (Page 2 of 3). TH, RH, and RU Definitions for Operator-Generated Alerts			
Byte	**Bit**	**Value**	**Meaning**
RU0		X'41'	NMVT
RU1		X'03'	
RU2		X'8D'	
RU3,4		X'0000'	Ignored
RU5,6		X'0000'	PRID when solicited
RU7	0	B'0'	Unsolicited
	1	B'0'	Last or only
	2	B'0'	First or only
	3	B'1'	SNA address list included
	4−7	B'0000'	Reserved
RU8	0	B'0'	No concatenation
	1−7	B'000 0000'	Remaining length of this RU
RU9		X'D4'	
RU10,11		X'0000'	Code point for alert
RU12		X'0A'	Length of SNA address list
RU13		X'04'	Code point SNA address list
RU14		X'01'	Number of TAFs
			Target address:
RU15		X'0000	SLU local address: 7 bytes
through		0000	
RU20		0000	
RU21		aa'	aa=LU local address
RU22		X'19'	Length of product-set ID vector
RU23		X'10'	Product-set ID vector − PU
RU24		X'F1'	PU product vector
RU25		X'16'	Length of subvector
RU26		X'11'	PID subvector
RU27		X'01'	IBM machine
RU28		X'13'	Length of product-instance ID vector
RU29		X'00'	Product-instance ID vector
RU30		X'12'	Format of product-instance ID vector
RU31		X'F-'	Machine type
RU32		X'F-'	
RU33		X'F-'	
RU34		X'F-'	
RU35 through RU37			Model number in EBCDIC (zero if unknown)
RU38,39			Plant of manufacture (zero if unknown)
RU40 through RU46			Operator-customized sequence number in EBCDIC.
RU47		X'0E'	Length of basic alert vector
RU48		X'91'	Basic alert vector
RU49			Alert classification:
	0		Initiation indicator:
		B'0'	Alert not initiated by operator action.
		B'1'	Alert initiated by operator action.
	1		Held-alert indicator:
		B'0'	Alert sent when problem was detected.
		B'1'	Alert detected earlier but not sent then, because no session was available to send it on.
	2−7	B'00 0000'	

Table 12-4 (Page 3 of 3). TH, RH, and RU Definitions for Operator-Generated Alerts			
Byte	**Bit**	**Value**	**Meaning**
RU50			Alert type
RU51			General cause code
RU52,53		X'00--'	Specific component code
RU54,55		X'FE--'	Alert description code
RU56,57		X'FE--'	User-action code
RU58,59		X'FE--'	Detail text reference code
RU60		X'00'	Not used
RU61		X'7A'	Length of text vector
RU62		X'00'	Text vector ID
RU63 through RU182			120-byte operator input (text message in EBCDIC format)
RU183		X'0A'	Length of detail qualifier 1
RU184		X'A0'	Detail qualifier 1 – EBCDIC
RU185 through RU192			8-byte operator input (text message in EBCDIC format)
RU193		X'0A'	Length of detail qualifier 2
RU194		X'A0'	Detail qualifier 2 – EBCDIC
RU195 through RU202			8-byte operator input (text message in EBCDIC format)
RU203		X'0A'	Length of detail qualifier 3
RU204		X'A0'	Detail qualifier 3 – EBCDIC
RU205 through RU212			8-byte operator input (text message in EBCDIC format)
RU213		X'07'	Length of relative-time vector
RU214		X'42'	Code point for relative-time vector
RU215		X'EF'	Sequence number; not time
RU216 through RU219			Sequential number: Starts at 0000 0000 at IML. Incremented for each record sent.

Notes for Tables 12-1 through 12-4:

1. The 3174 SSCP-PU session is defined as FM profile 0 and TS profile 1 (duplex definite response). If the 3174 transmits a message inbound, it will wait for a response (positive or negative) before transmitting or receiving additional messages on the session. If a response is somehow lost by the network, no other SSCP-PU activity will be possible without first receiving an ACTPU. Data may be lost during recovery.

2. When an alert condition is detected by the 3174, that event will be scheduled to be sent inbound to the NetView program. Only one such event at a time can be scheduled for the controller or for each physical device attached to the controller. If a second event occurs from an already scheduled device, the more serious event will be sent. For example, if a temporary error is queued for transmission and a permanent error occurs, the permanent error will replace the temporary error in the queue and the latter error will be lost. If a

permanent error is queued and another permanent error occurs, the second permanent error is lost.

3. The SNA address list will be included with all device hardware, application program checks, and operator-generated alerts. If the address list cannot be translated by the appropriate network components, it is a host responsibility to handle the data.
4. With operator-generated alerts, the LU originating the message will not be in LU-LU session. As stated above, it is the responsibility of the appropriate network components to handle the SNA address list and ensure that the message is received by the NetView program.
5. Only one operator-generated alert can be scheduled in the 3174 at a time. If a second operator attempts to send an alert, that request will be denied. Once an alert is scheduled for inbound transmission and the RU is built, that operator's screen will be cleared. Note that if a communication check occurs while the operator-generated alert is being transmitted, all or part of that message may be lost, depending on network recovery procedures. The operator will not be notified about the success or failure of the message, because it is beyond the capabilities of the 3174. Once an operator-generated alert is transmitted to the NetView program and a host response received, another authorized operator may send an alert message.
6. With operator-generated alerts, RUs 63 through 182 contain an operator-keyed text message. This message may contain nulls, and the NetView program must be capable of including the nulls in the message displayed on the detail screen.

Quick Reference of Alert Message Formats

Table 12-5 is a quick-reference table to help you find the RUs in Tables 12-1 through 12-4 that are associated with specific alert information in each problem category.

Table 12-5. RU Quick-Reference Table

Alert Information	**Controller Error (Table 12-1)**	**Device Hardware Error (Table 12-2)**	**Application Program Check (Table 12-3)**	**Operator-Generated Alert (Table 12-4)**
Alert Type	40	75	82	50
General Cause Code	41	76	83	51
Specific Component Code	42, 43	77, 78	84, 85	52, 53
Alert Description/ User-Action Code	44, 45/ 46, 47	79, 80/ 81, 82	86, 87/ 88, 89	54, 55/ 56, 57
Detail Text Reference Code	48, 49	83, 84	90, 91	58, 59
Qualifier 1	53 – 60	88 – 95	95 – 102	185 – 192
Qualifier 2	63 – 69	98 – 104	105 – 111	195 – 202
Qualifier 3	72 – 79	107 – 114	114 – 121	205 – 212

Gateway Alert Message Format

Three categories of messages are generated by the 3174 gateway controllers during Token-Ring operations. The format and content for these messages follow. These messages are only valid for releases prior to C1. Not all subvectors and subfields are present in each generated message. The ID for each subvector or subfield is in parentheses following the name.

Token-Ring Alert

The specific format for Token-Ring alert messages follows. See Table 12-6 for details.

TH
RH
RU
- NMVT Header
- Length to End of RU
- Alert Vector (X'0000')
  - Product-Set ID Vector (X'10')
  - Relative Time Vector (X'42')
  - Basic Alert Vector (X'91')
  - Hierarchy/Resource List (X'05')
  - Token-Ring Link Connection Subsystem Data (X'51')
  - Link Connection Subsystem Configuration Data (X'52')
  - SDLC Link Station Counters (X'53')
  - Token-Ring Physical Link Station Counters (X'57')
  - Detail Qualifier Vector (SSC, QAHG, Link Subsystem Name) (X'A0')
  - Detail Qualifier Vector (error detail, or blanks) (X'A1').

Table 12-6 (Page 1 of 5). TH, RH, and RU Definitions for Token-Ring Alerts

Byte	Bit	Value	Meaning
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0		X'0B'	Formatted Function Management Data (FMD); Only in chain
RH1		X'80'	Definite response only
RH2		X'00'	Not applicable
			Note: No other bits in this request header are applicable to this session.
RU0		X'41'	NMVT
RU1		X'03'	
RU2		X'8D'	
RU3,4		X'0000'	Not used
RU5,6		X'0000'	PRID when solicited
RU7	0	B'0'	Unsolicited
	1	B'0'	Last or only
	2	B'0'	First or only
	3	B'0'	Not used
	4−7	B'0000'	Not used

Table 12-6 (Page 2 of 5). TH, RH, and RU Definitions for Token-Ring Alerts			
Byte	**Bit**	**Value**	**Meaning**
RU8	0	B'0'	No concatenation
	1−7		Remaining length of this RU
RU9			
RU10,11		X'0000'	Code point for alert
RU12		X'19'	Length of product-set ID Vector
RU13		X'10'	Product-set ID vector - PU
RU14		X'F1'	Reserved
RU15		X'16'	Length of subvector
RU16		X'11'	PID subvector
RU17		X'01'	IBM machine
RU18		X'13'	Length of product-instance ID vector
RU19		X'00'	Product-instance ID vector
RU20		X'12'	Format of product-instance ID vector
RU21 RU22 RU23 RU24		X'F-' X'F-' X'F-' X'F-'	Machine Type
RU25 through RU27			Model number in EBCDIC (zero if unknown)
RU28,29			Customization-specified plant of manufacture (zero if unknown)
RU30 RU31 RU32 through RU36		X'F0' X'F0'	Customization-specified sequence number in EBCDIC.
RU37		X'07'	Length of relative-time vector
RU38		X'42'	Code point for relative-time vector
RU39		X'EF'	Sequence number; not time
RU40 through RU43			Sequential number: Starts at 0000 0000 at IML. Incremented for each record sent.
RU44		X'0E'	Length of basic alert vector
RU45		X'91'	Basic alert vector
RU46			Alert Classification:
	0		Initiation indicator:
		B'0'	Alert not initiated by operator action.
		B'1'	Alert initiated by operator action.
	1		Held-alert indicator:
		B'0'	Alert sent when problem was detected.
		B'1'	Alert detected earlier but not sent then, because no session was available to send it on.
	2−7	B'00 0000'	
RU47			Alert type
RU48			General cause code
RU49,50		X'00--'	Specific component code
RU51,52		X'FE--'	Alert description code
RU53,54		X'FE--'	User-action code
RU55,56		X'FE--'	Detail text reference code
RU57		X'00'	Not used

Table 12-6 (Page 3 of 5). TH, RH, and RU Definitions for Token-Ring Alerts			
Byte	**Bit**	**Value**	**Meaning**
RU58		X'0E'	Length
RU59		X'05'	Hierarchy/resource list subvector
RU60		X'0E'	Subfield length
RU61		X'10'	Hierarchy name list
RU62		X'80'	Hierarchy Complete indicator
RU63		X'07'	Length
RU64 through RU71			
RU72		X'40'	DSP 1
RU73		X'2E'	Resource type identifier: Token-Ring
RU74		X'05'	Length (This byte and the next 6 bytes are present only when there is no fault domain.)
RU75 through RU78			Local area network address (EBCDIC)
RU79		X'00'	DSP 2
RU80		X'F1'	Physical unit type
RU81			Length (changes with subfields included)
RU82		X'51'	Token-Ring link connection subsystem data
RU83		X'04'	Length of subfield 1
RU84		X'02'	Subfield 1 ID
RU85,86		X'0000'	Ring/segment ID
RU87		X'08'	Length of subfield 2
RU88		X'03'	Subfield 2 ID
RU89 through RU94			Local Individual MAC address
RU95		X'08'	Length of subfield 3
RU96		X'04'	Subfield 3 ID
RU97 through RU102			Remote Individual MAC address
RU103		X'03'	Length of subfield 4
RU104		X'07'	Subfield 4 ID
RU105			Beaconing data
RU106		X'08'	Length of subfield 5
RU107		X'08'	Subfield 5 ID
RU108 through RU113			Single MAC address
RU114		X'0E'	Length of subfield 6
RU115		X'06'	Subfield 6 ID
RU116 through RU127			Local area network fault domain description
RU128		X'14'	Length of subfield 7
RU129		X'05'	Subfield 7 ID

Table 12-6 (Page 4 of 5). TH, RH, and RU Definitions for Token-Ring Alerts			
Byte	**Bit**	**Value**	**Meaning**
RU130 through RU147			MAC routing information
RU148		X'08'	Length
RU149		X'52'	Link connection subsystem configuration data ID
RU150		X'03'	Length of subfield 1
RU151		X'02'	Subfield 1 ID
RU152			Remote device DLC address
RU153		X'03'	Length of subfield 2
RU154		X'04'	Subfield 2 ID
RU155			Local device DLC address
RU156		X'13'	Length
RU157		X'53'	SDLC link station counters ID
RU158		X'03'	Length of subfield 1
RU159		X'01'	Subfield 1 ID
RU160			Cause code
RU161		X'04'	Length of subfield 2
RU162		X'02'	Subfield 2 ID
RU163,164			Transmit counter
RU165		X'03'	Length of subfield 3
RU166		X'03'	Subfield 3 ID
RU167			Transmit error counter
RU168		X'04'	Length of subfield 4
RU169		X'04'	Subfield 4 ID
RU170,171			Receive counter
RU172		X'03'	Length of subfield 5
RU173		X'05'	Subfield 5 ID
RU174			Receive error counter
RU175		X'08'	Length
RU176		X'57'	Local area network physical link station counters ID
RU177		X'03'	Length of subfield 1
RU178		X'01'	Subfield 1 ID
RU179			Cause code
RU180		X'03'	Length of subfield 2
RU181		X'02'	Subfield 2 ID
RU182			Receive congestion counter
RU183		X'11'	Length of detail qualifier 1
RU184		X'A0'	Detail qualifier 1 — EBCDIC

Table 12-6 (Page 5 of 5). TH, RH, and RU Definitions for Token-Ring Alerts			
Byte	**Bit**	**Value**	**Meaning**
RU185		X'F-'	S nnn SSC
RU186		X'F-'	S
RU187		X'F-'	C
RU188		X'6B'	, Comma delimiter
RU189		X'F-'	Q SSC qualifier
RU190		X'F-'	A
RU191		X'F-'	H Hardware group
RU192		X'F-'	G
RU193		X'6B'	, Comma delimiter
RU194 through RU199			Link subsystem name
RU200		X'12'	Length of detail qualifier 2
RU201		X'A1'	Detail qualifier 2 — Hex
RU202 through RU217			Error detail or blanks

Token-Ring Link Event Message

The specific format for Token-Ring link event messages follows. See Table 12-7 for details.

TH
RH
RU
- NMVT Header
- Length to End of RU
- Link Event Vector (X'0001')
  - Product Set ID (X'10')
  - Relative Time Vector (X'42')
  - Hierarchy/Resource List (X'05')
  - Link Event Status Subvector (X'8A')
  - SDLC Link Station Data Subvector (X'8C')
  - Token-Ring Link Connection Subsystem Data (X'51')
  - Link Connection Subsystem Configuration Data (X'52')
  - SDLC Link Station Counters (X'53')
  - LCS Product Specific Data (optional)(X'59').

Table 12-7 (Page 1 of 5). TH, RH, and RU Definitions for Token-Ring Link Events			
Byte	**Bit**	**Value**	**Meaning**
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0		X'0B'	Formatted Function Management Data (FMD); Only in chain
RH1		X'80'	Definite response only
RH2		X'00'	Not applicable
			Note: No other bits in this request header are applicable to this session.

Table 12-7 (Page 2 of 5). TH, RH, and RU Definitions for Token-Ring Link Events			
Byte	**Bit**	**Value**	**Meaning**
RU0 RU1 RU2		X'41' X'03' X'8D'	NMVT
RU3,4		X'0000'	Not used
RU5,6		X'0000'	PRID when solicited
RU7	0 1 2 3 4−7	B'0' B'0' B'0' B'0' B'0000'	Unsolicited Last or only First or only Not used Not used
RU8 RU9	0 1−7	B'0' B'000 0000'	No concatenation Remaining length of this RU
RU10,11		X'0001'	Code point for link event
RU12		X'19'	Length of product-set ID vector
RU13		X'10'	Product-set ID vector - PU
RU14		X'F1'	Reserved
RU15		X'16'	Length of subvector
RU16		X'11'	Product Identifier subvector
RU17		X'01'	IBM machine
RU18		X'13'	Length of product-instance ID vector
RU19		X'00'	Product-instance ID vector
RU20		X'12'	Format of product-instance ID vector
RU21 RU22 RU23 RU24		X'F-' X'F-' X'F-' X'F-'	Machine type
RU25 through RU27			Model number in EBCDIC (zero if unknown)
RU28,29			Customization-specified plant of manufacture (zero if unknown)
RU30 RU31 RU32 through RU36		X'F0' X'F0'	Customization-specified sequence number in EBCDIC.
RU37		X'07'	Length of relative-time vector
RU38		X'42'	Code point for relative-time vector
RU39		X'EF'	Sequence number; not time
RU40 through RU43			Sequential number: Starts at 0000 0000 at IML. Incremented for each record sent.
RU44		X'15'	Length
RU45		X'05'	Hierarchy/resource list subvector
RU46		X'15'	Subfield length
RU47		X'10'	Hierarchy name list
RU48		X'80'	Hierarchy Complete indicator
RU49		X'09'	Length

Table 12-7 (Page 3 of 5). TH, RH, and RU Definitions for Token-Ring Link Events

Byte	Bit	Value	Meaning
RU50 through RU57			
RU58		X'40'	DSP 1
RU59		X'2E'	Resource type identifier: Token-Ring
RU60		X'05'	Length
RU61 through RU64			Token-Ring network address
RU65		X'00'	DSP 2
RU66		X'F1'	Physical unit type
RU67		X'0B'	Length
RU68		X'8A'	Link event status ID
RU69		X'02'	Length of link station failure link event subfield
RU70		X'02'	ID of link station failure link event subfield
RU71		X'07'	Length of link event error description subfield
RU72		X'03'	ID of link event error description subfield
RU73 through RU77			Remaining link event status
RU78		X'1F'	Length
RU79		X'8C'	DLC link station data ID
RU80		X'04'	Length of subfield 1
RU81		X'01'	Subfield 1 ID
RU82,83			N(s)/N(r) counts
RU84		X'03'	Length of subfield 2
RU85		X'02'	Subfield 2 ID
RU86			Outstanding frame count
RU87		X'04'	Length of subfield 3
RU88		X'03'	Subfield 3 ID
RU89,90			Last DLC control field received
RU91		X'04'	Length of subfield 4
RU92		X'04'	Subfield 4 ID
RU93,94			Last DLC control field sent
RU95		X'03'	Length of subfield 5
RU96		X'05'	Subfield 5 ID
RU97			Sequence number modulus
RU98		X'03'	Length of subfield 6
RU99		X'06'	Subfield 6 ID
RU100			Link station state
RU101		X'04'	Length of subfield 7
RU102		X'07'	Subfield 7 ID
RU103,104			LLC reply timer (T1) expiration count
RU105		X'04'	Length of subfield 8
RU106		X'08'	Subfield 8 ID
RU107,108			Last received N(r) count

Table 12-7 (Page 4 of 5). TH, RH, and RU Definitions for Token-Ring Link Events

Byte	Bit	Value	Meaning
RU109		X'43'	Length
RU110		X'51'	Token-Ring link connection subsystem data
RU111		X'04'	Length of subfield 1
RU112		X'02'	Subfield 1 ID
RU112,113		X'0000'	Ring/segment ID
RU114		X'08'	Length of subfield 2
RU115		X'03'	Subfield 2 ID
RU116 through RU122			Local Individual MAC address
RU123		X'08'	Length of subfield 3
RU124		X'04'	Subfield 3 ID
RU125 through RU130			Remote individual MAC address
RU131		X'03'	Length of subfield 4
RU132		X'07'	Subfield 4 ID
RU133			Beaconing data
RU134		X'08'	Length of subfield 5
RU135		X'08'	Subfield 5 ID
RU136 through RU141			Single MAC address
RU142		X'14'	Length of subfield 6
RU143		X'05'	Subfield 6 ID
RU144 through RU161			MAC routing information
RU162		X'0E'	Length of subfield 7
RU163		X'06'	Subfield 7 ID
RU164 through RU175			Token-Ring network fault domain description
RU176		X'08'	Length
RU177		X'52'	Link connection subsystem configuration data ID
RU178		X'03'	Length of subfield 1
RU179		X'02'	Subfield 1 ID
RU180			Remote device DCL address
RU181		X'03'	Length of subfield 2
RU182		X'04'	Subfield 2 ID
RU183			Local device DLC address
RU184		X'13'	Length
RU185		X'53'	DLC link station counters ID
RU186		X'03'	Length of subfield 1
RU187		X'01'	Subfield 1 ID
RU188			Cause code
RU189		X'04'	Length of subfield 2

Table 12-7 (Page 5 of 5). TH, RH, and RU Definitions for Token-Ring Link Events				
Byte	**Bit**	**Value**	**Meaning**	
RU190		X'02'	Subfield 2 ID	
RU191,192			Transmit counter	
RU193		X'03'	Length of subfield 3	
RU194		X'03'	Subfield 3 ID	
RU195			Transmit error counter	
RU196		X'04'	Length of subfield 4	
RU197		X'04'	Subfield 4 ID	
RU198,199			Receive counter	
RU200		X'03'	Length of subfield 5	
RU201		X'05'	Subfield 5 ID	
RU202			Receive error counter	
RU203		X'11'	Length	
RU204		X'59'	LCS product-specific data	
RU205		X'F-'	S	nnn SSC
RU206		X'F-'	S	
RU207		X'F-'	C	
RU208		X'6B'	,	Comma delimiter
RU209		X'F-'	Q	SSC qualifier
RU210		X'F-'	A	
RU211		X'F-'	H	Hardware group
RU212		X'F-'	G	
RU213		X'6B'	,	Comma delimiter
RU214 through RU219				Link subsystem name

Token-Ring Problem-Determination Statistics

This specific format for Token-Ring problem determination statistics messages follows. See Table 12-8 on page 12-42 for details.

TH
RH
RU
- NMVT Header
- Length to End of RU
- PD Statistics Vector (X'0025')
  - Product Set ID (X'10')
  - Relative Time Vector (X'42')
  - Hierarchy/Resource List (X'05')
  - Token-Ring Link Connection Subsystem Data (X'51')
  - Link Connection Subsystem Configuration Data (X'52')
  - SDLC Link Station Counters (X'53'):
    - For a DLC counter overflow: present
    - For an adapter error log overflow: not present
  - Token-Ring Physical Link Station Counters (X'57'):
    - For a DLC counter overflow: not present
    - For an adapter error log overflow: present
  - LCS Product Specific Data (optional).

Table 12-8 (Page 1 of 4). TH, RH, and RU Definitions for Token-Ring PD Statistics			
Byte	**Bit**	**Value**	**Meaning**
TH0		X'2C'	Format ID 2; Only in segment
TH1		X'00'	Reserved
TH2		X'00'	Destination Address Field (DAF)
TH3		X'00'	Origination Address Field (OAF)
TH4,5		X'0000'	Sequence Number Field (SNF)
RH0		X'0B'	Formatted Function Management Data (FMD); Only in chain
RH1		X'80'	Definite response only
RH2		X'00'	Not applicable
			Note: No other bits in this request header are applicable to this session.
RU0		X'41'	NMVT
RU1		X'03'	
RU2		X'8D'	
RU3,4		X'0000'	Not used
RU5,6		X'0000'	PRID when solicited
RU7	0	B'0'	Unsolicited
	1	B'0'	Last or only
	2	B'0'	First or only
	3−7	B'0 0000'	Not used
RU8	0	B'0'	No concatenation
	1−7	B'000 0000'	Remaining length of this RU
RU9			
RU10,11		X'0025'	Code point for PD Statistics
RU12		X'19'	Length of product-set ID vector
RU13		X'10'	Product-set ID vector - PU
RU14		X'F1'	Reserved
RU15		X'16'	Length of subvector
RU16		X'11'	Product Identifier subvector
RU17		X'01'	IBM machine
RU18		X'13'	Length of product-instance ID vector
RU19		X'00'	Product-instance ID vector
RU20		X'12'	Format of product-instance ID vector
RU21		X'F-'	Machine type
RU22		X'F-'	
RU23		X'F-'	
RU24		X'F-'	
RU25 through RU27			Model number in EBCDIC (zero if unknown)
RU28,29			Customization-specified plant of manufacture (zero if unknown)
RU30		X'F0'	Customization-specified sequence number in EBCDIC.
RU31		X'F0'	
RU32 through RU36			
RU37		X'07'	Length of relative-time vector
RU38		X'42'	Code point for relative-time vector
RU39		X'EF'	Sequence number; not time

Table 12-8 (Page 2 of 4). TH, RH, and RU Definitions for Token-Ring PD Statistics			
Byte	**Bit**	**Value**	**Meaning**
RU40 through RU43			Sequential number: Starts at 0000 0000 at IML. Incremented for each record sent.
RU44 RU45		X'15' X'05'	Length variable Hierarchy/resource list subvector
RU46		X'15'	Subfield length
RU47		X'10'	Hierarchy name List
RU48		X'80'	Hierarchy Complete Indicator
RU49		X'09'	Length
RU50 through RU57			
RU58		X'40'	DSP 1
RU59		X'2E'	Resource type identifier: Token-Ring
RU60		X'07'	Length
RU61 through RU64			Token-Ring network address
RU65		X'00'	DSP 2
RU66		X'F1'	Physical unit type
RU67		X'43'	Length
RU68		X'51'	Token-Ring link connection subsystem data
RU69		X'04'	Length of subfield 1
RU70		X'02'	Subfield 1 ID
RU71,72		X'0000'	Ring/segment ID
RU73		X'08'	Length of subfield 2
RU74		X'03'	Subfield 2 ID
RU75 through RU80			Local individual MAC address
RU81		X'08'	Length of subfield 3
RU82		X'04'	Subfield 3 ID
RU83 through RU88			Remote individual MAC address
RU89		X'03'	Length of subfield 4
RU90		X'07'	Subfield 4 ID
RU91			Beaconing data
RU92		X'08'	Length of subfield 5
RU93		X'08'	Subfield 5 ID
RU94 through RU99			Single MAC address
RU100		X'0E'	Length of subfield 6
RU101		X'06'	Subfield 6 ID
RU102 through RU114			Token-Ring network fault domain description
RU115		X'14'	Length of subfield 7

Table 12-8 (Page 3 of 4). TH, RH, and RU Definitions for Token-Ring PD Statistics			
Byte	**Bit**	**Value**	**Meaning**
RU116		X'05'	Subfield 7 ID
RU117 through RU134			MAC routing information
RU135		X'08'	Length
RU136		X'52'	Link connection subsystem configuration data ID
RU137		X'03'	Length of subfield 1
RU138		X'02'	Subfield 1 ID
RU139			Remote device DLC address
RU140		X'03'	Length of subfield 2
RU141		X'04'	Subfield 2 ID
RU142			Local device DLC address
RU143		X'13'	Length
RU144		X'53'	DLC link station counters ID (present for DLC counter overflow, but not for adapter error log overflow)
RU145		X'03'	Length of subfield 1
RU146		X'01'	Subfield 1 ID
RU147			Cause code
RU148		X'04'	Length of subfield 2
RU149		X'02'	Subfield 2 ID
RU150,151			Transmit counter
RU152		X'03'	Length of subfield 3
RU153		X'03'	Subfield 3 ID
RU154			Transmit error counter
RU155		X'04'	Length of subfield 4
RU156		X'04'	Subfield 4 ID
RU157,158			Receive counter
RU159		X'03'	Length of subfield 5
RU160		X'05'	Subfield 5 ID
RU161			Receive error counter
RU162		X'08'	Length
RU163		X'57'	Token-Ring network physical link station counters I (present for adapter error log overflow, but not for DLC counter overflow)
RU164		X'03'	Length of subfield 1
RU165		X'01'	Subfield 1 ID
RU166			Cause code
RU167		X'03'	Length of subfield 2
RU168		X'02'	Subfield 2 ID
RU169			Receive congestion counter
RU170		X'11'	Length
RU171		X'59'	LCS product-specific data

Table 12-8 (Page 4 of 4). TH, RH, and RU Definitions for Token-Ring PD Statistics

Byte	Bit	Value	Meaning	
RU172		X'F-'	S	nnn SSC
RU173		X'F-'	S	
RU174		X'F-'	C	
RU175		X'6B'	,	Comma delimiter
RU176		X'F-'	Q	SSC qualifier -
RU177		X'F-'	A	
RU178		X'F-'	H	Hardware group
RU179		X'F-'	G	
RU180		X'6B'	,	Comma delimiter
RU181 through RU186				Link subsystem name

Generic Alert Message Format

All alerts for Advanced Peer-to-Peer Networking, Integrated Services Digital Network, 3174 Peer Communication, and Token-Ring are generic in format. Token-Ring alerts are generic for Release C1 only. This section describes the byte format of a Generic Alert RU that is generated by the 3174 Establishment Controller. Each Generic Alert is sent in an NMVT RU. This RU contains an Alert Major Vector and a series of subvectors and subfields. The subvectors and subfields that make up each alert are listed in Appendix G, "Generic Alerts."

A Generic Alert is built from subvectors and subfields in the following order (note that not all subvectors or subfields are present in each alert):

NMVT Generic Alert

- Alert MV
  - Product Set Identifier SV (X'10')
  - Remote Product Set Identifier SV (X'10')
  - Generic Alert Data SV (X'92')
  - Probable Causes SV (X'93')
  - User Causes SV (X'94')
    - User Causes SF (X'01')
    - Recommended Actions SF (X'81')
    - Detailed Data SF (X'82')
  - Install Causes SV (X'95')
    - Install Causes SF (X'01')
    - Recommended Actions SF (X'81')
    - Detailed Data SF (X'82')
  - Failure Causes SV (X'96')
    - Failure Causes SF (X'01')
    - Recommended Actions SF (X'81')
    - Detailed Data SF (X'82')
  - Supporting Data Correlation SV (X'48')
    - Fully-qualified Session PCID SF (X'60')
  - LAN LCS Data SV (X'51')
    - Ring ID SF (X'02')
    - Local individual MAC address SF (X'03')
    - Remote individual MAC address SF (X'04')
    - LAN routine information SF (X'05')
    - Fault domain description SF (X'06')
    - Beacon data description SF (X'07')
    - Single MAC address SF (X'08')

Fault domain error weight pair SF (X'09')
Bridge identifier SF (X'0A')
Link Connection Subsystem Configuration Data SV (X'52')
Port Address SF (X'01')
Remote Device Address SF (X'02')
Local Device Address SF (X'04')
LCS Link Station Attributes SF (X'06')
LCS Link Attributes SF (X'07')
Remote Telephone Number SF (X'09')
Local Telephone Number SF (X'0A')
Adapter Address SF (X'0B')
Channel Address SF (X'0C')
Link Station Data SV (X'8C')
Current N(s)/N(r) counts SF (X'01')
Outstanding Frame Counts SF (X'02')
Last data link control field received SF (X'03')
Last data link control field sent SF (X'04')
Sequence Number Modulus SF (X'05')
Link Station State SF (X'06')
Data Link Timer Expiration Count SF (X'07')
Last received N(r) count SF (X'08')
Relative Time SV (X'42')
Hierarchy Name List SV (X'05')
Hierarchy Name List SF (X'10')
Associated Resource SF (X'11').

Format of NMVT Generic Alert

Table 12-9. NMVT Generic Alert

Byte	Bit	Content	Meaning
0-2		X'41038D'	NMVT RU
3,4		X'0000'	Retired
5,6		X'0000'	Procedure Related Identifier (PRID)
7	0	B'0'	Unsolicited
	1,2	B'00'	Only NMVT
	3	B'0'	SNA Address list SV not included
	4-7	B'0000'	Reserved
8-m			Alert Major Vector

Format of Alert Major Vector

Table 12-10. Alert Major Vector

Byte	Bit	Content	Meaning
0,1		n+1	Length of major vector
2,3		X'0000'	Key
4-n			Contents of Alert MV

Produce Set Identifier (PSID) Subvector X'10'

Table 12-11. Format of PSID Subvector X'10'

Byte	Bit	Content	Meaning
0		X'19'	Length of SV
1		X'10'	Subvector Key
2		X'00'	Retired
3		X'16'	Length of Product Identifier Subvector
4		X'11'	Product Identifier Subvector Key
5	0-3	B'0000'	Reserved
	4-7	B'0001'	Product Class – IBM Hardware
6		X'13'	Length of Hardware ID Subfield
7		X'00'	Hardware ID Subfield Key
8		X'12'	Format Type
9-12			Machine Type in EBCDIC
13-15			Machine Model Number in EBCDIC
16,17			Plant of Manufacture (Zero if unknown)
18-24			Customization specific sequence number in EBCDIC (right justified with X'F0' fill bytes on the left)

Format of Generic Alert Data Subvector X'92'

Table 12-12. Generic Alert Data SV X'92'

Byte	Bit	Content	Meaning
0		X'0B'	Length of subvector
1		X'92'	Key
2,3			Flags
	0	B'0'	Not directly initiated by an operator action.
	1		Held Alert Indicator: • B'0' Alert sent when problem was detected • B'1' Alert detected earlier but not sent because no session was available to send it on.
	2		Delayed Alert Indicator: • B'0' Sender is not reporting a previously detected alert condition that prevented reporting when detected • B'1' Sender is reporting a previously detected alert condition that prevented reporting when detected.
	3-15	0	Reserved
4			Alert Type
5,6			Alert Description
7-10			Alert ID

Format of Probable Causes Subvector X'93'

Table 12-13. Probable Causes SV X'93'			
Byte	**Bit**	**Content**	**Meaning**
0		p+1	Length of subvector
1		X'93'	Key
2-p			One or more probable cause code points

Format of User Causes Subvector X'94'

Table 12-14. User Causes SV X'94'			
Byte	**Bit**	**Content**	**Meaning**
0		p+1	Length of subvector
1		X'94'	Key
2-p			Two or more subfields containing user cause data: • X'01' User Causes • X'81' Recommended Actions • X'82' Detailed Data.

Format of User Causes Subfield X'01'

Table 12-15. User Causes SF X'01'			
Byte	**Bit**	**Content**	**Meaning**
0		q+1	Length of subfield
1		X'01'	Key
2-q			2 byte user causes code points
Note: The third byte of each user cause code point indicates the number of succeeding X'82' subfields that are associated with the code point as follows: X'xx0x' − X'xx9x' = No X'82' subfields X'xxAx' − X'xxBx' = One X'82' subfields X'xxCx' = Two X'82' subfields X'xxDx' = Three X'82' subfields.			

Format of Install Causes Subvector X'95'

Table 12-16. Install Causes SV X'95'			
Byte	**Bit**	**Content**	**Meaning**
0		p+1	Length of subvector
1		X'95'	Key
2-p			Two or more subfields containing install cause data: • X'01' Install Causes • X'81' Recommended Actions • X'82' Detailed Data.

Format of Install Causes Subfield X'01'

Table 12-17. Install Causes SF X'01'

Byte	Bit	Content	Meaning
0		q+1	Length of subfield
1		X'01'	Key
2-q			2 byte install cause code points

Note: The third byte of each install cause code point indicates the number of succeeding X'82' subfields that are associated with the code point as follows:

X'xx0x' – X'xx9x' = No X'82' subfields
X'xxAx' – X'xxBx' = One X'82' subfields
X'xxCx' = Two X'82' subfields
X'xxDx' = Three X'82' subfields.

Format of Failure Causes Subvector X'96'

Table 12-18. Failure Causes SV X'96'

Byte	Bit	Content	Meaning
0		p+1	Length of subvector
1		X'96'	Failure Causes SV code point
2-p			Two or more subfields containing failure cause data: • X'01' Failure Causes • X'81' Recommended Actions • X'82' Detailed Data.

Format of Failure Causes Subfield X'01'

Table 12-19. Failure Causes SF X'01'

Byte	Bit	Content	Meaning
0		q+1	Length of subfield
1		X'01'	Key
2-q			2 byte failure cause code points

Note: The third byte of each failure cause code point indicates the number of succeeding X'82' subfields that are associated with the code point as follows:

X'xx0x' – X'xx9x' = No X'82' subfields
X'xxAx' – X'xxBx' = One X'82' subfields
X'xxCx' = Two X'82' subfields
X'xxDx' = Three X'82' subfields.

Format of Recommended Actions Subfield X'81'

Table 12-20 (Page 1 of 2). Recommended Actions SF X'81'

Byte	Bit	Content	Meaning
0		q+1	Length of subfield
1		X'81'	Key

Table 12-20 (Page 2 of 2). Recommended Actions SF X'81'			
Byte	**Bit**	**Content**	**Meaning**
2-q			2 byte Recommended Action code points
Note: The third byte of each recommended action code point indicates the number of succeeding X'82' subfields that are associated with the code point as follows: X'xx0x' – X'xx9x' = No X'82' subfields X'xxAx' – X'xxBx' = One X'82' subfields X'xxCx' = Two X'82' subfields X'xxDx' = Three X'82' subfields.			

Format of Detailed Data Subfield X'82'

Table 12-21. Detailed Data SF X'82'			
Byte	**Bit**	**Content**	**Meaning**
0		q+1	Length of subfield
1		X'82'	Key
2		X'00'	No product identification data is to be displayed
3			Data ID: • X'03' Adapter return code • X'07' Error Code • X'15' SNA Sense data • X'17' Ring Status Code • X'30' Reference Code • X'60' Port • X'61' Adapter • X'82' CP Name • X'85' Transaction Program • X'A7' Resource • X'A8' Maximum Number of Node Table Entries • X'C0' Counter Name • X'D5' Calling Telephone Number • X'D6' Telephone Number called • X'F0' Product Alert Reference Code.
4			Data encoding: • X'00' Hexadecimal • X'11' EBCDIC.
5-q			Detailed Data

Format of Supporting Data Correlation Subvector X'48'

Table 12-22. Supporting Data Correlation SV X'48'			
Byte	**Bit**	**Content**	**Meaning**
0		p+1	Length of subvector
1		X'48'	Key
2-p			One or more subfields, each containing one correlation token: • X'60' Fully-qualified Session PCID • X'82' Detailed Data.

Format of Fully-qualified Session PCID Subfield X'60'

Table 12-23. Fully-qualified Session PCID SF X'60'

Byte	Bit	Content	Meaning
0		p+1	Length of subvector
1		X'60'	Key
2-9			PCID
10			Length of CP name (3-17)
11-p			Network-qualified CP name

Format of LAN Link Connection Subsystem (LCS) Data Subvector X'51'

Table 12-24. LAN LCS Data SV X'51'

Byte	Bit	Content	Meaning
0		p+1	Length of subvector
1		X'51'	Key
2-p			Subfields containing LAN LCS data: Ring ID Local individual MAC address Remote individual MAC address LAN routine information Fault domain description Beacon data description Single MAC address Fault domain error weight pair Bridge identifier.

Format of Ring ID Subfield X'02'

Table 12-25. Ring ID SF X'02'

Byte	Bit	Content	Meaning
0		4	Length of subfield
1		X'02'	Key
2,3			Ring ID, in hexadecimal

Format of Local Individual MAC Address Subfield X'03'

Table 12-26. Local Individual MAC Address SF X'03'

Byte	Bit	Content	Meaning
0		8	Length of subfield
1		X'03'	Key
2-7			Local individual MAC address

Format of Remote Individual MAC Address Subfield X'04'

Table 12-27. Remote Individual MAC Address SF X'04'

Byte	Bit	Content	Meaning
0		8	Length of subfield
1		X'04'	Key
2-7			Remote individual MAC address

Format of LAN Routing Information Subfield X'05'

Table 12-28. LAN Routing Information SF X'05'

Byte	Bit	Content	Meaning
0		q+1	Length of subfield
1		X'05'	Key
2-q			Routing information

Format of Fault Domain Description Subfield X'06'

Table 12-29. Fault Domain Description SF X'06'

Byte	Bit	Content	Meaning
0		14	Length of subfield
1		X'06'	Key
2-7			Individual MAC address of downstream station
8-13			Individual MAC address of upstream station

Format of Beaconing Data Subfield X'07'

Table 12-30. Beaconing Data SF X'07'

Byte	Bit	Content	Meaning
0		3	Length of subfield
1		X'07'	Key
2			Beaconing type

Format of Single MAC address Subfield X'08'

Table 12-31. Single MAC address SF X'08'

Byte	Bit	Content	Meaning
0		8	Length of subfield
1		X'08'	Key
2-7			Single MAC address

Format of Fault Domain Error Weight Pair Subfield X'09'

Table 12-32 (Page 1 of 2). Fault Domain Error Weight Pair SF X'09'

Byte	Bit	Content	Meaning
0		6	Length of subfield
1		X'09'	Key

Table 12-32 (Page 2 of 2). Fault Domain Error Weight Pair SF X'09'			
Byte	**Bit**	**Content**	**Meaning**
2,3			Downstream severity weight
4,5			Upstream severity weight

Format of Bridge Identifier Subfield X'0A'

Table 12-33. Bridge Identifier SF X'0A'			
Byte	**Bit**	**Content**	**Meaning**
0		6	Length of subfield
1		X'0A'	Key
2-5			Bridge Identifier

Format of LCS Configuration Data Subvector X'52'

Table 12-34. Link Connection Subsystem (LCS) Configuration Data SV X'52'			
Byte	**Bit**	**Content**	**Meaning**
0		p+1	Length of subvector
1		X'52'	Key
2-p			Subfields containing LCS configuration data: Port Address Remote Device Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Adapter Address Channel Address.

Format of Port Address Subfield X'01'

Table 12-35. Port Address SF X'01'			
Byte	**Bit**	**Content**	**Meaning**
0		4	Length of subfield
1		X'01'	Key
2,3			Port Address in hexadecimal

Format of Remote Device Address Subfield X'02'

Table 12-36. Remote Device Address SF X'02'			
Byte	**Bit**	**Content**	**Meaning**
0		3	Length of subfield
1		X'04'	Key
2			Remote SAP

Format of Local Device Address Subfield X'04'

Table 12-37. Local Device Address SF X'04'

Byte	Bit	Content	Meaning
0		q+1	Length of subfield
1		X'04'	Key
2-q			Local Link Station DLC address: For ISDN, the data link control identifier (DLCI) for LAPE, or the service access point identifier (SAPI) and terminal equipment identifier (TEI) for LAPD. For Token-Ring, the local SAP value.

Format of LCS Link Station Attributes Subfield X'06'

Table 12-38. LCS Link Station Attributes SF X'06'

Byte	Bit	Content	Meaning
0		4	Length of subfield
1		X'06'	Key
2			Link Station Role: • X'01' Primary • X'02' Secondary • X'03' Negotiable.
3			Node Type for remote station: • X'01' Type 1 • X'02' Type 2.0 • X'03' Type 4 • X'04' Type 2.1 • X'80' non-SNA.

Format of LCS Link Attributes Subfield X'07'

Table 12-39 (Page 1 of 2). LCS Link Attributes SF X'07'

Byte	Bit	Content	Meaning
0		6	Length of subfield
1		X'07'	Key
2			Link Connection Type used: • X'01' nonswitched • X'02' switched • X'03' packet switched.
3			Half or Full Duplex: • X'01' half-duplex • X'02' full-duplex.
4			DLC Protocol type: • X'01' SDLC • X'02' BSC • X'03' Start-Stop • X'04' LAPB • X'05' LAPD • X'06' LAPE • X'07' LAN LLC.

Table 12-39 (Page 2 of 2). LCS Link Attributes SF X'07'			
Byte	**Bit**	**Content**	**Meaning**
5			Point-to-Point or Multipoint: • X'01' Point-to-point • X'02' Multipoint.

Format of Remote Telephone Number SF X'09'

Table 12-40. Remote Telephone Number SF X'09'			
Byte	**Bit**	**Content**	**Meaning**
0		q+1	Length of subfield
1		X'09'	Key
2		X'01'	EBCDIC encoding used
3-q			Remote Telephone Number

Format of Local Telephone Number SF X'0A'

Table 12-41. Local Telephone Number SF X'0A'			
Byte	**Bit**	**Content**	**Meaning**
0		q+1	Length of subfield
1		X'0A'	Key
2		X'01'	EBCDIC encoding used
3-q			Local Telephone Number

Format of Adapter Address SF X'0B'

Table 12-42. Adapter Address SF X'0B'			
Byte	**Bit**	**Content**	**Meaning**
0		4	Length of subfield
1		X'0B'	Key
2,3			Adapter Address

Format of Channel Address SF X'0C'

Table 12-43. Channel Address SF X'0C'			
Byte	**Bit**	**Content**	**Meaning**
0		4	Length of subfield
1		X'0C'	Key
2,3			Channel Address

Format of Link Station Data Subvector X'8C'

Table 12-44 (Page 1 of 2). Link Station Data SV X'8C'			
Byte	**Bit**	**Content**	**Meaning**
0		p+1	Length of subvector
1		X'8C'	Key

Table 12-44 (Page 2 of 2). Link Station Data SV X'8C'			
Byte	**Bit**	**Content**	**Meaning**
2-p			Subfields containing link station data: Current N(s)/N(r) Counts Outstanding Frame Counts Last data link control field received Last data link control field sent Sequence Number Modulus Link station state Data Link Timer Expiration Count Last Received N(r) count.

Format of Current N(s)/N(r) Count Subfield X'01'

Table 12-45. Current N(s)/N(r) Count SF X'01'			
Byte	**Bit**	**Content**	**Meaning**
0		4	Length of subfield
1		X'01'	Key
2			N(s) count, in binary
3			N(r) count, in binary

Format of Outstanding Frame Count Subfield X'02'

Table 12-46. Outstanding Frame Count SF X'02'			
Byte	**Bit**	**Content**	**Meaning**
0		3	Length of subfield
1		X'02'	Key
2			Outstanding Frame count in binary

Format of Last Control Field Received Subfield X'03'

Table 12-47. Last Control Field Received SF X'03'			
Byte	**Bit**	**Content**	**Meaning**
0		4	Length of subfield
1		X'03'	Key
2,3			Last control field received

Format of Last Control Field Sent Subfield X'04'

Table 12-48. Last Control Field Sent SF X'04'			
Byte	**Bit**	**Content**	**Meaning**
0		4	Length of subfield
1		X'04'	Key
2,3			Last control field sent

Format of Sequence Number Module Subfield X'05'

Table 12-49. Sequence Number Module SF X'05'

Byte	Bit	Content	Meaning
0		3	Length of subfield
1		X'05'	Key
2			Modulus, in binary

Format of Link Station State X'06'

Table 12-50. Link Station State SF X'06'

Byte	Bit	Content	Meaning
0		3	Length of subfield
1		X'06'	Key
2			Link Station State
	0		Local Link Station State: • B'0' Local Link station not busy • B'1' Local Link station busy.
	1		Remote Link Station State: • B'0' Remote link station not busy • B'1' Remote link station busy.
	2-7		Reserved

Format of Data Link Timer Expiration Count Subfield X'07'

Table 12-51. Data Link Timer Expiration Count SF X'07'

Byte	Bit	Content	Meaning
0		3	Length of subfield
1		X'07'	Key
2			Data Link Timer Expiration Count in binary

Format of Last Received N(r) Count Subfield X'08'

Table 12-52. Last Received N(r) Count SF X'08'

Byte	Bit	Content	Meaning
0		3	Length of subfield
1		X'08'	Key
2			Last Received N(r) count in binary

Format of Relative Time Subvector X'42'

Table 12-53 (Page 1 of 2). Relative Time SV X'42'

Byte	Bit	Content	Meaning
0		X'07'	Length of subvector
1		X'42'	Key
3		X'EF'	Sequence Number – not time

Table 12-53 (Page 2 of 2). Relative Time SV X'42'			
Byte	**Bit**	**Content**	**Meaning**
4-6			Sequence Number – starts at 0 at IML and is incremented for each record sent

Hierarchy Name List Subvector X'05'

Table 12-54. Format of Subvector X'05'			
Byte	**Bit**	**Content**	**Meaning**
0		n+1	Total Length of subvector
1		X'05'	Subvector Key
2-n			Subfields X'10' and conditionally present X'11'

Hierarchy Name List Subfield X'10'

Table 12-55. Format of Subfield X'10'			
Byte	**Bit**	**Content**	**Meaning**
0		p+1	Length of subfield
1		X'10'	Subfield Key
2	0		Hierarchy Complete Indicator: • B'0' Hierarchy is complete • B'1' Hierarchy is incomplete.
	1-7	B'0000000'	Reserved
3-p			Hierarchy name list entries
Note: The format of each hierarchy name list is shown below.			
0		s+1	Length of hierarchy name
1-s			Resource Name
s+1	0	B'0'	Reserved
	1		Display Resource Indicator: • B'0' Name should be displayed • B'1' Name should not be displayed.
	2	B'0'	Do not count this entry for resource list indexing
	3-7	B'00000'	Reserved
s+2			Resource Type: • X'21' – Adapter • X'2C' – Transmission Group number • X'2E' – Token-Ring • X'39' – LAN • X'3A' – Bridge • X'F1' – PU • X'F4' – Control Point • X'FA' – D-Channel.

Associated Resource Subfield X'11'

Table 12-56. Format of Subfield X'11'

Byte	Bit	Content	Meaning
0		q+1	Length of subfield
1		X'11'	Subfield Key
2		X'00'	Reserved
3-q			Associated Resource Entries
Note: The format of each Associated Resource entry is shown below.			
0		r+1	Length of name field
1-r			Resource Name
r+1	0-1	B'00'	Reserved
	2	B'0'	Do not count this entry for resource list indexing.
	3-7	B'00000'	Reserved
r+2			Resource type identifier • X'F4' for CP Name • X'FA' for D-Channel • X'FB' for B-Channel.

X'82' SF Contents

Within each X'82' SF, a specific code point describes the detailed information that is contained within that subfield. This section explains the information the 3174 sends within the X'82' SF for each code point.

Code Point:

- Adapter Number—The 3174 will send a 6 byte field consisting of the adapter's type (4 bytes) and its location (2 bytes). This field will be in EBCDIC.
- Reference Code—The reference code is an 8 byte field consisting of the SSC (3 bytes), Qualifier (2 bytes), and Hardware Group (2 bytes). A comma will occur between the SSC and the Qualifier, and the entire field will be in EBCDIC.
- Error Code—The Error code is a 2 byte field in hexadecimal which describes the type of error that caused the alert.
- Ring Status—The 3174 will send a 2 byte hexadecimal number depicting the status of the ring which caused the alert.
- SNA sense code—This is an architected 4 byte hexadecimal number describing the type of SNA error which has just occurred.
- CP Name—An 8 byte field containing a network CP Name, padded on the right with blanks.
- Transaction Program—An 8 byte hexadecimal number identifying the indicated transaction program.

- Name of resource causing error – An 8 byte field containing a network resource name, padded on the right with blanks.
- Maximum number of node table entries – A 2 byte hexadecimal number giving the maximum size of the 3174 node table.
- Adapter Return Code – See Error Code.
- Adapter Check Status – See Error Code.
- Product Alert Reference Code – See Reference Code.
- Port Number – A 1 byte hexadecimal number indicating the port on which the channel is active.
- Counter Name – A 2 byte hexadecimal counter name, indicating the counter that reaches threshold.
- Calling Phone Number – Up to 40 EBCDIC bytes indicating the phone number of the ISDN that has called the 3174.
- Telephone Number Called – Up to 40 EBCDIC bytes indicating the phone number the ISDN device called at the 3174.

Chapter 13. Common Management Information Protocol Event Reports

Introduction

This chapter describes the Common Management Information Protocol (CMIP) Event Report function which is a problem/performance determination function that is available on the 3174 when an ISDN Adapter is installed and customized. This chapter answers the following questions:

- What is the CMIP Event Report Function?
- How does the CMIP Event Report Function operate?
- What is the format of a CMIP Event Report?

What Is the CMIP Event Report Function?

Common Management Information Protocol (CMIP) Event Reports are an Open Systems Interconnect (OSI) network management function that is available on the 3174 when an ISDN Adapter is installed and customized. The information in CMIP event reports consists of error and performance counter statistics that are maintained by the ISDN Adapter. These reports are sent to the hardware monitor component of NetView where the network operator can view the report information. NetView Version 2 Release 2 is required at the host in order to view CMIP event reports. For information on NetView operation, refer to Chapter 12, "SNA Alert Function."

The CMIP event reports are sent as a result of the following events:

- A counter has reached its threshold
- A counter value has wrapped
- An ISDN Layer has terminated.

The counter values are maintained through time intervals, thereby allowing an ISDN network management performance expert to use the reports as an aid in determining network performance problems.

How Does the CMIP Event Report Function Operate?

The CMIP Event Report function is enabled through customization question 220. This question will also enable the SNA Alert function. Any non-zero response to customization question 220 enables the CMIP Event Report function.

What Causes a CMIP Event Report to be Sent?

Counter sets are maintained by the ISDN Adapter for each ISDN layer on each active channel. When the adapter detects that a counter event has occurred for which an event report must be sent to the host, a status code may be logged in the 3174 error log and a CMIP event report will be built and sent into the NetView host. The status code will be in the form of 83*n*, if logged. Refer to the *3174 Status Codes* for details on which status codes are accompanied by a CMIP event report.

For some counter events, an alert will be sent to the NetView host in addition to a CMIP event report. When the ISDN Adapter detects that a counter event has occurred, a CMIP event report will be built and sent to the Netview host. A status code may also be logged in the 3174 error log. For problem determination, when an alert/event report combination is sent to the host, the alert will indicate that an error condition has been detected through the counter set values. You can then use the information from the CMIP event report as an aid in determining what types of errors are occurring on the channel.

What Is a Counter Set?

Counter sets are maintained by the ISDN Adapter for each ISDN layer on an active channel. Each counter in a set is either an error counter or a performance counter. An error counter, as its name implies, counts error events on the channel. A performance counter counts events on the channel that can be used to evaluate the performance of the channel. The counters sets for each layer are described below.

Each counter has a hexadecimal name that is used by CMIP event reports. These names are shown in Tables 13-1 through 13-4.

Layer 1 Counters

The Layer 1 counters count events that occur in the lowest or physical layer of the model.

The performance counters are:

Errored Seconds: The number of seconds in which at least one transmission error has occurred.

Severely Errored Seconds: The number of seconds in which at least three transmission errors have occurred.

Collision Detect: The number of unsuccessful signaling attempts by the Terminal Equipment (TE) on a shared access medium. The 3174 functions as a TE.

The error counters are:

Loss of Frame Alignment: The number of times that the hardware has lost physical layer frame synchronization.

Detected Access Transmission System Errors – In: The number of Cyclic Redundancy Check (CRC) errors detected by the Network Termination 1 (NT1) in physical layer frames received from the network.

Detected Access Transmission System Errors – Out: The number of CRC errors in physical layer frames transmitted by the NT1 to the network.

Local End Code Violations: The number of unexpected line code violations that were detected at the TE's receiver.

Far End Code Violations: The number of unexpected line code violations that were transmitted by the TE and detected by the ISDN TE's receiver.

Table 13-1. Layer 1 Counter Set Names

Type of Counter	Counter	Hexadecimal Value
Performance Counters	Errored Seconds	X'0008'
	Severely Errored Seconds	X'0009'
	Collision Detect	X'000A'
Error Counters	Loss of Frame Alignment	X'0001'
	Detected Access	X'0002'
	Transmission Errors – In	
	Detected Access	X'0003'
	Transmission Errors – Out	
	Local End Code Violations	X'0004'
	Far End Code Violations	X'0005'

Layer 2 Link Counters

The Layer 2 counters count events occurring in the data link control layer. The Layer 2 Link specific counters track activity and performance of Layer 2 as a whole.

The performance counters are:

Total Frames Transmitted: The sum of the number of Information (I) frames, Unnumbered Information (UI) frames, and Supervisory (S) frames transmitted.

Total Frames Received: The sum of the number of I-frames, UI-frames, and S-frames received.

The error counters are:

CRC Errors Received: The number of received frames containing a CRC error.

Short Frames Received: The number of short frames received.

Buffer Overrun: The number of attempts made to write to a receive line buffer when it is full.

Buffer Underrun: The number of attempts made to read from a transmit line buffer when it is empty.

Aborted Frames Received: The number of incomplete Data Link Control (DLC) frames received.

Aborted Frames Transmitted: The number of incomplete DLC frames transmitted.

Misaddressed Frames Received: The number of frames received correctly, but for which no active station exists; therefore, these frames cannot be routed.

Unbounded Frames Received: The number of frames received that are not correctly bounded by starting or ending delimiters.

Non-Integral Frames Received: The number of frames received that are not composed of an integral number of octets prior to zero bit insertion or following zero bit extraction by Layer 2.

Table 13-2. Layer 2 Link Counter Set Names

Type of Counter	Counter	Hexadecimal Value
Performance Counters	Total Frames Transmitted	X'0015'
	Total Frames Received	X'0016'
Error Counters	CRC Errors Received	X'0006'
	Short Frames Received	X'000B'
	Buffer Overrun	X'000C'
	Buffer Underrun	X'000D'
	Aborted Frames Received	X'0010'
	Aborted Frames Transmitted	X'0011'
	Misaddressed Frames Received	X'0012'
	Unbounded Frames Received	X'0013'
	Non-Integral Frames Received	X'0014'

Layer 2 Station Counters

The Layer 2 Station specific counters track activity and performance of each link station.

The performance counters are:

Total Frames Transmitted: The sum of the number of I-frames, UI-frames, and S-frames transmitted.

Total Frames Received: The sum of the number of I-frames, UI-frames, and S-frames received.

Total Bytes Transmitted: The total number of bytes transmitted.

Total Bytes Received: The total number of bytes received.

Total Bytes Retransmitted: The total number of bytes retransmitted due to transmission errors.

The error counters are:

Frames Retransmitted: The number of protocol data units retransmitted as a result of timeout on the link or any other protocol errors, such as sequence errors.

Receive Sequence Errors: The number of received frames containing sequence errors. Sequence errors can be detected only in frames that contain send or receive counts; such frames are I-frames and S-frames (RR, RNR, and REJ).

Table 13-3. Layer 2 Station Counter Set Names		
Type of Counter	**Counter**	**Hexadecimal Value**
Performance Counters	Total Frames Transmitted	X'0015'
	Total Frames Received	X'0016'
	Total Bytes Transmitted	X'0019'
	Total Bytes Received	X'001A'
	Total Bytes Retransmitted	X'001B'
Error Counters	Frames Retransmitted	X'0017'
	Receive Sequence Errors	X'0018'

Layer 3 Counters

Layer 3 counters track the overall call processing activity for the port.

The performance counters are:

Total Incoming Calls: The number of incoming call attempts, successful and unsuccessful. An incoming call is coming from the DSPU to the controller.

Total Outgoing Calls: Number of outgoing calls from the controller. Count value for this counter will always be 0 since the 3174 does not make outgoing calls.

Incoming Calls Rejected: The number of incoming calls rejected by the controller.

Total Outgoing Calls Rejected: Number of outgoing calls rejected by the DSPU. Count value for this counter will always be 0 since the 3174 does not make outgoing calls.

There are no error counters for Layer 3.

Table 13-4. Layer 3 Counter Set Names		
Type of Counter	**Counter**	**Hexadecimal Value**
Performance Counters	Total Incoming Calls	X'001C'
	Total Outgoing Calls	X'001D'
	Incoming Calls Rejected	X'001E'
	Total Outgoing Calls Rejected	X'001F'

What Is a Counter?

Each counter in a set is made up of 7 components:

Counter: The total value of the number of events that have occurred.

Counter Compare: The threshold value for the counter. When the counter reaches this value, if the counter switch is on, then a CMIP event report of the counter set is sent to NetView. An entry in the 3174 error log may also be made. If the counter is an error counter, then an alert is also sent inbound.

When the counter reaches the counter compare value, the counter compare value is updated for the next interval by setting it to the value of the counter plus the counter offset. Thus, the counter compare value is incremented through time as the counter value increases.

Counter Offset: When the counter reaches the counter compare value, the counter offset is used to update the counter compare value for the next interval.

Counter Switch: Value of the counter switch indicates whether or not a CMIP event report is sent when the counter reaches its counter compare value. A value of **on** indicates that a report will be sent if the CMIP Event Report function is enabled.

Time Compare: When time for the counter set reaches this threshold, a CMIP event report will be sent to NetView, provided that the time switch is set to **on**. When the time value reaches the time compare value, it is updated for the next interval by setting it to the value of time plus time offset.

Time Offset: This value is used to update the time threshold field when time becomes equal to the time threshold.

Time Switch: If time reaches the time threshold and the time switch is **on**, then a CMIP event report will be sent to NetView.

Note: A time (t) value is maintained per counter set.

What Events Cause a CMIP Event Report to be Sent?

CMIP Event Reports are sent to the NetView host when one of the following counter events is detected by the ISDN Adapter:

1. The count value for a counter reaches its count compare value.

   In this case, an event report is sent only if the count switch for the counter is set on. When the report is sent, all count values in the set are reset to 0. If this condition occurs and the count switch for the counter is off, then a report will not be sent, and the counter compare and time compare intervals are updated. The new value of count compare will be the count value plus the count offset value. The new value of time compare will be the time value for the set plus the time offset value for the counter.

2. A component of the counter wraps (reaches 65,535).

   The counter components that can wrap are count, time (for the set), count compare, and time compare.

3. An ISDN layer terminates on a channel.

   When a layer terminates, a report of the current counter values must be sent to NetView.

Priority Queuing of CMIP Event Reports

The 3174 will queue up to 20 CMIP event reports. If another event requiring a report to be sent occurs after 20 CMIP event reports are queued and waiting to be sent to the host, the new report will replace any report of equal or lower priority on the queue. The priorities for CMIP Event Reports are (with #1 having the highest priority):

1. Error reports for a layer 1 error counter reaching threshold
2. Error reports for error counters, buffer overrun, and buffer underrun reaching threshold
3. All error reports not included in #1 and #2
4. All performance reports.

What Is the Format of a CMIP Event Report?

CMIP Event Reports are sent to the NetView host on the SSCP-PU session. Since CMIP is an OSI protocol, it is necessary to wrap the event report in an NMVT format in order for it to be sent on the SSCP-PU session. The NMVT (CMIP) is sent to the host unsolicited.

In the following sections, the RU format for a CMIP event report is described.

Format of NMVT (CMIP)

The NMVT that carries the CMIP event report consists of 2 major vectors: the Resources Major Vector (X'000F') and the CMIP Major Vector (X'130F'). The Resources Major Vector carries the hierarchy information that NetView displays for the CMIP event report. The CMIP Major Vector contains the actual CMIP event report. The format of the NMVT (CMIP), the Resources Major Vector, and the CMIP Major Vector are defined in Tables 13-5 through 13-11.

Table 13-5. Format of NMVT (CMIP)

Byte	Bit	Content	Meaning
0-2		X'41038D'	NS header
3, 4		X'0000'	Retired
5, 6	0, 1	B'00'	Reserved
	2, 3	B'00'	Retired
	4-15	X'000'	Procedure Related Identifier (PRID)
7	0	B'0'	Unsolicited NMVT
	1, 2	B'00'	Only NMVT for this PRID
	3	B'0'	SNA Address List Subvector Not Included
	4-7	B'0000'	Reserved
8-m			Major Vectors X'000F'and X'130F'

Format of Resources Major Vector

Table 13-6. Format of Resources Major Vector X'000F'

Byte	Bit	Content	Meaning
0, 1		n+1	Length of this major vector
2, 3		X'000F'	Key
4-n			Subvectors: Hierarchy Name List Subvector (X'05') Product Set ID Subvector (X'10').

Format of Hierarchy Name List Subvector

Table 13-7. Format of Hierarchy Name List Subvector

Byte	Bit	Content	Meaning
0		n+1	Total Length of subvector
1		X'05'	Subvector Key
2-n			Subfields: Hierarchy Name List Subfield, X'10' Associated Resources Subfield, X'11'.

Format of Hierarchy Name List Subfield

Table 13-8. Format of Hierarchy Name List Subfield

Byte	Bit	Content	Meaning
0		p+1	Length of subfield
1		X'10'	Subfield Key
2	0	B'1'	Hierarchy Complete Indicator – Receiver must modify hierarchy
	1-7	B'0000000'	Reserved
3-p			Hierarchy name list entries – see below.
Note: The format of each hierarchy name list entry is shown below.			
0		s+1	Length of hierarchy name
1-s			Resource Name
s+1	0	B'0'	Reserved
	1		Display Resource Indicator: • B'0' Name should be displayed • B'1' Name should not be displayed.
	2	B'0'	Do not count this entry for resource list indexing
	3-7	B'00000'	Reserved
s+2			Resource Type: • X'FA' - D-Channel • X'F1' - PU.

There is a hierarchy name list entry in the Hierarchy Name List subfield for each resource that must be identified to NetView for the CMIP event report. If the CMIP event report is sent to report counters for a D-Channel, then there will be one entry in the name list: the D-Channel name. However, if the CMIP event report is sent to report counters for a B-Channel, the hierarchy name list will have 2 entries: the D-Channel name and the downstream PU (DSPU) name.

The format of the D-Channel name is HHPPCC where HH is a 2 character hardware group number for the adapter, PP is a 2 character port number for the port that the D-Channel is located on, and CC is a 2 character channel number. The channel number will be X'F0F0' if only a D-Channel is active on the port. The channel number will be X'F0F1' or X'F0F2' if a B-Channel is also active.

The name that is sent for a DSPU is the PUID. This is a 5-character name that is entered during customization of the ISDN Gateway. For a DSPU name list entry, the Display Resource Indicator will be on, indicating that the name should not be displayed. All names in the hierarchy name list will be encoded in EBCDIC.

Format of Associated Resources Subfield

Table 13-9. Format of Associated Resources Subfield

Byte	Bit	Content	Meaning
0		q+1	Length of subfield
1		X'11'	Subfield Key
2		X'00'	Reserved
3-q			Associated Resource Entries, see below.
Note: The format of each Associated Resource entry is shown below.			
0		X'15'	Length of name field
1-20			Resource Name
21	0-1	B'00'	Reserved
	2	B'0'	Do not count this entry for resource list indexing
	3-7	B'00000'	Reserved
22			Resource type identifier: • X'FA' for D-Channel • X'FB' for B-Channel.

When the CMIP event report is generated due to an event associated with the B-Channel, then the Associated Resources subfield will contain entries for the D-Channel and the B-Channel. If the report is generated due to an event associated with the D-Channel, then the subfield will only contain an entry for the D-Channel.

The D-Channel and B-Channel names are 20 characters in length (all EBCDIC) in the following format:

Byte	Meaning
0-3	Machine Type
4-6	Model Number
7-13	Serial Number
14, 15	Adapter Hardware Group Number
16, 17	Port Number
18, 19	Channel Number

Format of Product Set Identifier Subvector

Table 13-10. Format of Product Set Identifier Subvector X'10'

Byte	Bit	Content	Meaning
0		X'19'	Length of Subvector (SV)
1		X'10'	Subvector Key
2		X'00'	Retired
3		X'16'	Length of Product Identifier Subvector
4		X'11'	Product Identifier Subvector Key
5	0-3	B'0000'	Reserved
	4-7	B'0001'	Product Class – IBM Hardware
6		X'13'	Length of Hardware ID Subfield
7		X'00'	Hardware ID Subfield Key
8		X'12'	Format Type
9-12			Machine Type
13-15			Machine Model Number
16, 17			Plant of Manufacture
18-24			Sequence number: 7 characters, right justified, with X'F0' fill on the left.

Format of CMIP Major Vector

Table 13-11. Format of CMIP Major Vector X'130F'

Byte	Bit	Content	Meaning
0, 1		n+1	Length of this major vector
2, 3		X'130F'	Key
4-n			CMIP Event Report

Format of CMIP Event Report

An Application Protocol Data Unit (APDU) is used to transmit the CMIP event report. The specific APDU is a Remote Operation Invoke Protocol Data Unit (abbreviated ROIVapdu). The APDUs for Remote Operations are specified for OSI in the CCITT X.229 and ISO 9072/2 specifications. The protocol data unit for the CMIP event report is specified in the ISO 9596-2 standard.

In the following sections, the format of the CMIP Event Report is shown beginning with the ROIVapdu. Each portion of the event report is in the form Identifier Length Content (ILC). Sometimes the contents will be as simple as an integer. Many times the contents will contain more elements in the format of ILC. The value of the Length is always the exact size of the Content field. It does not contain the length of the Length Field or the length of the Identifier Field.

Integer values in CMIP event reports are always coded in the fewest possible bytes. They are also signed values. Therefore, if an integer is X'FFFF', it will be encoded in the event report as X'00FFFF'. Integer values in an event report can range from 0 to 65,535; therefore, the values will be encoded in the range from 1 to 3 bytes.

Format of ROIVapdu

Table 13-12. Format of ROIVapdu		
Byte	**Content**	**Meaning**
0	X'A1'	Identifier for ROIVapdu
1	X'82'	2-byte length of ROIVapdu follows
2, 3	m-3	Length of ROIVapdu
4-n		Invoke ID, see Table 13-40 on page 13-22.
(n+1) - (n+3)		Operation Value, see Table 13-41 on page 13-22.
(n+4) - m		Event Report Argument, see Table 13-13.

Format of Event Report Argument

Table 13-13. Format of Event Report Argument		
Byte	**Content**	**Meaning**
0	X'30'	Identifier for Event Report Argument
1	X'82'	2-byte Length of Event Report Argument follows
2, 3	m-3	Length of Event Report Argument
4-12		Object Class, see Table 13-14.
13-n		Object Instance, see Table 13-15 on page 13-14.
(n+1) - (n+9)		Event Type Identifier, see Table 13-17 on page 13-15.
(n+10) - m		Event Data, see Table 13-18 on page 13-16.

Format of Object Class

Table 13-14. Format of Object Class		
Byte	**Content**	**Meaning**
0	X'80'	Identifier for Object Class
1	X'07'	Length of Object Class Data
2-8		Object Class (one of the following): • X'2B 0C 02 87 6C 81 26' - Layer 1 Counter • X'2B 0C 02 87 6C 81 27' - Layer 2 Link Counter • X'2B 0C 02 87 6C 81 28' - Layer 2 Station Counter • X'2B 0C 02 87 6C 81 29' - Layer 3 Counter.

Format of Object Instance

Table 13-15. Format of Object Instance		
Byte	**Content**	**Meaning**
0	X'A4'	Identifier for Object Instance
1	m-1	Length of Object Instance Data
2	X'31'	Identifier for Relative Distinguished Name
3	m-3	Length of Relative Distinguished Name
4-m		List of Attribute Value Attribute pairs for this type of report

The Attribute Value Attribute (AVA) pairs listed are identified by the type of counter set that is being reported. The lists are:

- Layer 1
  - Port Number
- Layer 2 Link
  - Port Number
  - Channel Number
- Layer 2 Station
  - Port Number
  - Channel Number
  - Station Number
- Layer 3
  - ISDN Number.

For example, if the report contains the Layer 2 Link counter set, then 2 AVA pairs will be sent in the list: one for the port number and one for the channel number.

Format of Attribute Value Attribute Pair

Table 13-16. Format of Attribute Value Attribute Pair

Byte	Content	Meaning
0	X'30'	Identifier for AVA
1	m-1	Length of AVA
2	X'80'	Identifier for Attribute ID
3	X'07'	Length of Attribute ID
4-11		Attribute ID: • X'2B 0C 02 87 6C 81 33' – Port Attribute • X'2B 0C 02 87 6C 81 35' – Channel Attribute • X'2B 0C 02 87 6C 81 36' – Station Attribute • X'2B 0C 02 87 6C 81 37' – ISDN Number Attribute.
12-m		Attribute Value: • For port, see Table 13-39 on page 13-21 • For channel, see Table 13-38 on page 13-21 • For station, see Table 13-37 on page 13-21 • For ISDN Number, see Table 13-36 on page 13-21.

Format of Event Type

Table 13-17. Format of Event Type

Byte	Content	Meaning
0	X'86'	Identifier for event type
1	X'07'	Length of event type
2-8		Event Type Data: • X'2B 0C 02 87 6C 81 39' – Problem Report • X'2B 0C 02 87 6C 81 3A' – Performance Report.
Note: A problem report is the type of report sent when an error counter has reached its count compare (threshold) value. All other reports sent are performance reports.		

Format of Event Data

Table 13-18. Format of Event Data

Byte	Content	Meaning
0	X'A8'	Identifier for event report data
1	X'81'	1-byte Length of event report data follows
2	m-2	Length of event report data
3	X'30'	Identifier for Problem/Performance Report
4	X'81'	1-byte Length of Problem/Performance Report follows
5	m-5	Length of Problem/Performance Report
6-8		Problem/Performance Description and Cause, see Table 13-19.
9-m		Problem/Performance Data, see Table 13-22 on page 13-18.

Problem/Performance Description and Cause

Table 13-19. Problem/Performance Description and Cause

Byte	Content	Meaning
0	See Description Below	Identifier for problem/performance description. Varies depending on the type of report. See Table 13-20 on page 13-17 and Table 13-21 on page 13-17.
1	X'01'	Length of description and cause
2		Problem/Performance Description and Cause. See Table 13-20 on page 13-17 and Table 13-21 on page 13-17.

The Identifier for the Problem/Performance Description and Cause field is dependent upon the counter event and the counter set that is being reported. For each Identifier, there is a list of Problem/Performance Descriptions and Causes that can be sent. The possible identifiers and the associated description and cause values are shown in Table 13-20 on page 13-17 and Table 13-21 on page 13-17.

Identifiers for Performance Description and Cause

Table 13-20. Identifiers for Performance Description and Cause

Identifier	Description and Cause Value	Meaning
X'80'		Layer 1 Performance Event
	X'00'	Layer 1 Deactivated
	X'04'	Counter Compare value wrapped
	X'05'	Time Compare value wrapped
	X'06'	Counter Compare value reached
	X'07'	Time Compare value reached
X'81'		Layer 2 Performance Event
	X'01'	Layer 2 Disconnected
	X'02'	Layer 2 Station Disconnected
	X'04'	Counter Compare value wrapped
	X'05'	Time Compare value wrapped
	X'06'	Counter Compare value reached
	X'07'	Time Compare value reached
X'82'		Layer 3 Performance Event
	X'03'	Layer 3 Call Terminated
	X'04'	Counter Compare value wrapped
	X'05'	Time Compare value wrapped
	X'06'	Counter Compare value reached
	X'07'	Time Compare value reached

Identifiers for Problem Description and Cause

Table 13-21. Identifiers for Problem Description and Cause

Identifier	Description and Cause Value	Meaning
X'80'		Physical Connection Problem
	X'00'	Layer 1 Counter Report
X'81'		Logical Connection Problem
	X'00'	Layer 2 Counter Report
X'82'		Call Connection Problem
	X'00'	Layer 3 Counter Report

Format of Problem/Performance Report Data

Table 13-22. Format of Problem/Performance Report Data

Byte	Content	Meaning
0	X'A4'	Identifier for Problem/Performance Report data
1	X'81'	1-byte Length of Problem/Performance Report data follows
2	p-2	Length of Problem/Performance Report
3-n		Optional Counter and Threshold, see Table 13-23.
(n+1)-m		Elapsed Time, see Table 13-35 on page 13-21.
(m+1) to p		Set of Counter, see Table 13-27 on page 13-19.

Note: The Counter and Threshold field is optional if the report is a performance report. Problem reports always have a counter and threshold field. This field contains information on the counter that has either reached its count compare value or had a compare value wrap (either time or count).

Format of Counter and Threshold

Table 13-23. Format of Counter and Threshold

Byte	Content	Meaning
0	X'A0'	Identifier for counter and threshold
1	m-1	Length of counter and threshold
2-5		Counter Name, see Table 13-24.
6-n		Counter Value, see Table 13-25 on page 13-19.
(n+1) - m		Counter Attribute, See Table 13-26 on page 13-19.

Format of Counter Name

Table 13-24. Format of Counter Name

Byte	Content	Meaning
0	X'04'	Identifier for counter name
1	X'02'	Length of counter name
2-3		Counter name in hexadecimal

Note: Counter names for each counter are listed in "What Is a Counter Set?" on page 13-4.

Format of Counter Value

Table 13-25. Format of Counter Value		
Byte	**Content**	**Meaning**
0	X'02'	Identifier for counter value
1	n-1	Length of counter value
2-n		Counter value

Format of Counter Attribute

Table 13-26. Format of Counter Attribute		
Byte	**Content**	**Meaning**
0	X'30'	Identifier for counter attribute
1	n-1	Length of counter attribute
2-n		Counter Attribute. This is composed of the following values in this order: • Count Compare, see Table 13-29 on page 13-20 • Time Compare, see Table 13-30 on page 13-20 • Count Offset, see Table 13-31 on page 13-20 • Count Switch, see Table 13-32 on page 13-20 • Time Offset, see Table 13-33 on page 13-20 • Time Switch, see Table 13-34 on page 13-20.

Format of Counter Set

Table 13-27. Format of Counter Set		
Byte	**Content**	**Meaning**
0	X'A2'	Identifier for counter set
1	X'81'	1-byte Length of counter set follows
2	n-2	Length of counter set
3-n		Entry in counter format (see Table 13-28) for each counter in set.

Format of Counter

Table 13-28. Format of Counter		
Byte	**Content**	**Meaning**
0	X'30'	Identifier for counter
1	n-1	Length of counter contents
2-5		Counter name, see Table 13-24 on page 13-18.
6-n		Counter value, see Table 13-25.

Format of Count Compare Value

Table 13-29. Format of Count Compare Value

Byte	Content	Meaning
0	X'80'	Identifier for count compare value
1	n-1	Length of count compare contents
2-n		Count Compare Integer Value

Format of Time Compare Value

Table 13-30. Format of Time Compare Value

Byte	Content	Meaning
0	X'81'	Identifier for time compare value
1	n-1	Length of time compare contents
2-n		Time Compare Integer Value

Format of Count Offset Value

Table 13-31. Format of Count Offset Value

Byte	Content	Meaning
0	X'82'	Identifier for count offset value
1	n-1	Length of Count offset contents
2-n		Count Offset Integer Value

Format of Count Switch Value

Table 13-32. Format of Count Switch Value

Byte	Content	Meaning
0	X'83'	Identifier for count switch value
1	X'01'	Length of Count Switch contents
2		Count Switch value

Format of Time Offset Value

Table 13-33. Format of Time Offset Value

Byte	Content	Meaning
0	X'84'	Identifier for time offset value
1	n-1	Length of time offset contents
2-n		Time offset Integer Value

Format of Time Switch Value

Table 13-34. Format of Time Switch Value

Byte	Content	Meaning
0	X'85'	Identifier for Time Switch value
1	X'01'	Length of Time Switch contents
2		Time Switch value

Format of Elapsed Time

Table 13-35. Format of Elapsed Time

Byte	Content	Meaning
0	X'81'	Identifier for Elapsed time
1	n-1	Length of Elapsed time
2-n		Elapsed time value

Format of ISDN Number

Table 13-36. Format of ISDN Number

Byte	Content	Meaning
0	X'30'	Identifier for ISDN Number
1	n-1	Length of ISDN Number
2	X'16'	Identifier for ISDN Number string
3	n-3	Length of ISDN Number string
4-n		ISDN Number encoded as an IA5 string

Format of Station Number

Table 13-37. Format of Station Number

Byte	Content	Meaning
0	X'04'	Identifier for Station Number
1	X'02'	Length of Station Number
2-3		Station Number: the Data Link Control Identifier (DLCI)

Format of Channel Number

Table 13-38. Format of Channel Number

Byte	Content	Meaning
0	X'02'	Identifier for Channel Number
1	X'01'	Length of Channel Number
2		Channel Number

Format of Port Number

Table 13-39. Format of Port Number

Byte	Content	Meaning
0	X'02'	Identifier for Port Number
1	X'01'	Length of Port Number
2		Port Number

Format of Invoke Identifier

Table 13-40. Format of Invoke Identifier		
Byte	**Content**	**Meaning**
0	X'02'	Identifier for Invoke Identifier
1	n-1	Length of Invoke Identifier
2-n		Invoke Identifier, an integer value

Note: The value of the Invoke Identifier is generated internally by the 3174. It begins with 0 at IML, and is incremented by 1 for each report sent.

Format of Operation Value

Table 13-41. Format of Operation Value		
Byte	**Content**	**Meaning**
0	X'02'	Identifier for Operation Value
1	X'01'	Length of Operation Value
2	X'00'	Operation Value = Event Report Operation

Part 6. 3174 Features

This part contains the following chapters:

Chapter 14, "3174 Token-Ring and ISDN Support," describes the functions of Models 1L, 1R, 2R, 11L, 11R, 12L, 12R, 21L, 21R, 22L, 51R, 52R, 61R, 62R, and 90R (with the IBM Token-Ring Network 3270 Gateway Feature installed), 3R, 13R, 23R, 53R, and 63R in their support of IBM Token-Ring Network operations, and the ISDN Gateway.

Chapter 15, "Asynchronous Emulation Adapter (AEA)," describes the Asynchronous Emulation Adapter (AEA) which consists of both hardware and microcode.

Chapter 16, "Multi-Host Support," describes the methods by which terminals attached to a 3174 controller communicate with multiple hosts.

Chapter 17, "Local Format Storage," describes the feature and its advantages and limitations.

Chapter 18, "Advanced Peer-to-Peer Networking (APPN)," describes APPN for the 3174.

Chapter 19, "3174 Peer Communication," describes 3174 Peer Communication.

Chapter 14. 3174 Token-Ring and ISDN Support

Introduction

This chapter provides information on the different 3174 models in their support of the Token-Ring Network host attachment, the Token-Ring Network 3270 Gateway, and the Integrated Services Digital Network (ISDN) Gateway. The Token-Ring host attachment is discussed in "Token-Ring Support for Models 3R, 13R, 23R, 53R, and 63R." Characteristics common to both the Token-Ring 3270 and ISDN Gateways are discussed under "Common Gateway Support" on page 14-3. Token-Ring Network 3270 Gateway specific information is discussed starting with "Token-Ring 3270 Gateway Support" on page 14-6. Information specific to the ISDN Gateway begins with "Integrated Services Digital Network (ISDN) Gateway Support" on page 14-16.

The Token-Ring Network host attachment attaches a non-gateway 3174 controller to an SNA host via the Token-Ring Network 3270 Gateway or a communication controller gateway.

The Token-Ring Network 3270 and ISDN Gateways provide paths to SNA hosts for downstream physical units (DSPUs) attached to the Token-Ring and ISDN Networks, respectively. The DSPUs are PU type 2.0. For the Token-Ring 3270 Gateway, the DSPUs may be either workstations or non-gateway 3174s with the Token-Ring Network host attachment. For the ISDN Gateway, they are workstations.

The Token-Ring Network 3270 and ISDN Gateways share common gateway functions while providing independent unique interfaces to their respective downstream networks. As a result, a 3174 gateway may be a Token-Ring Network 3270 Gateway, an ISDN Gateway, or both.

Token-Ring Support for Models 3R, 13R, 23R, 53R, and 63R

Models 3R, 13R, 23R, 53R, and 63R provide for attachment of a 3270 Information Display System to the Token-Ring Network. These models can communicate with the host processors through another 3174 that has the Token-Ring Network 3270 Gateway feature, or through a 3720/37*x*5 Communication Controller, or the host may be directly attached to the ring.

At customization, the ring addresses of Models 3R, 13R, 23R, 53R, 63R, and of the host or the IBM Token-Ring Network Gateway must be specified. The address of Models 3R, 13R, 23R, 53R, and 63R can be either a locally administered address or a universal address. If a 372x Communication Controller is the IBM Token-Ring Network Gateway, a locally administered address should be used because a dial-digit number for an address in 372x connect-out processing is required. Using Single Link Multi-Host Support, these models can communicate with up to eight gateways/hosts on the ring.

Models 3R, 13R, 23R, 53R, and 63R with the Token-Ring attachment function are compatible with existing IBM host programming support. When the IBM Token-Ring Network 3270 Gateway feature is used as a channel-attached gateway, the SECNET operand on VTAM's PU system definition statement must be set to indicate that the hierarchy of the alert is not complete.

Except for the SECNET operand, there is no difference to the host if the 3174 is channel-attached or ring-attached. The SECNET operand is not set for the 3720/3725 NTRI gateway.

Common Gateway Support

This section describes those characteristics common to both the Token-Ring 3270 Gateway and the ISDN Gateway. Figure 14-1 on page 14-4 illustrates 3174 Gateway support.

The SNA host may be attached using channel or SDLC protocols. This attachment passes data among a host processor and the work stations and controllers attached to the IBM Token-Ring or ISDN Network.

The host function supports multiple subchannels and SDLC addresses for the gateway. The host process conforms to the SNA boundary node channel interface. (See Chapter 5, "Local Operation" and Chapter 6, "Remote Operation.")

The gateway can provide Multi-Host Support through the Concurrent Communication Adapters (CCAs) for the Token-Ring Network Gateway, and the ESCON Channel Single Link Multi-Host Support for both Gateways. For more information about Multi-Host Support, see Chapter 16, "Multi-Host Support."

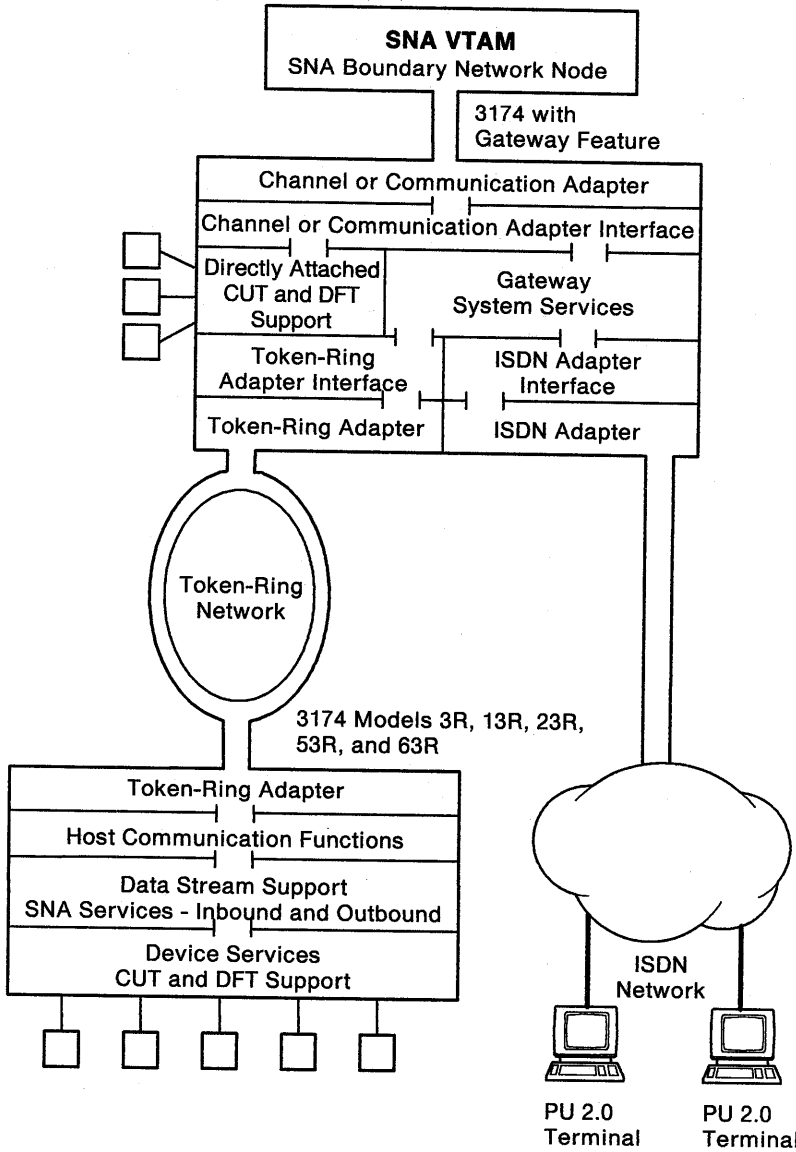


Figure 14-1. 3174 Gateway Support

Host Adapter Interface

In a local 3174 (x1L, x2L), the channel adapter provides communication between the system channel and the controller. The gateway takes advantage of the channel adapter's multiple subchannel address recognition capabilities to make each DSPU appear to VTAM as though it were a PU locally attached to the host.

In a remote 3174 (xxR) and for CCAs, the communication adapter provides communication between the remote host and the controller. the gateway appears as an SDLC multipoint configuration because each DSPU and the PU on the controller are defined as stations off a single leased line. Each PU is given a unique SDLC address. The gateway distinguishes between SDLC frames intended for the controller and the DSPUs via the customized SDLC addresses.

The functions of the channel and the communication adapters include initialization, inbound processing, outbound processing, error processing, and termination. The initialization processing activates the gateway's PU and ensures that the DSPUs receive only valid Connect requests. The outbound and inbound processes separate transmissions based on channel or SDLC addresses, and send them to either the DSPUs or the directly attached local devices.

Gateway System Services

The gateway system services are a set of functions that allow for data passthrough and link maintenance between the channel or the communication adapter and the Token-Ring or ISDN Adapter interface. The data passthrough function is divided into two separate processes: one for inbound and one for outbound. The outbound process handles copying of data into the outbound gateway feature internal storage buffers, buffer depletion and thresholding, segmentation if needed, and passing of data to the Token-Ring or ISDN Adapter interface. The inbound process handles copying of data from the Token-Ring or ISDN Adapter buffers into the inbound gateway feature internal storage buffers, buffer depletion and thresholding, segmentation if needed, and transmissions to the host system.

System services are also responsible for functions such as:

- Initializing
- Managing buffers
- Building NMVTs
- Maintaining the relationship between inbound and outbound links
- Logging errors.

Group Poll

With Configuration Support B or C, a gateway using SDLC can operate with or without Group Poll capability. When Group Poll is not used, the host explicitly polls each station that is managed by the gateway. If the gateway does not have data to send for a polled station, the poll is *unproductive*. These unproductive polls use time on the SDLC line that might otherwise be used for productive transactions, and may increase the response times for all the DSPUs. When Group Poll is used, the host can request data from the gateway by sending an unnumbered poll command with the gateway's group address. The gateway responds to this command with available data from any station. This mechanism expedites the transmission of data from the gateway to the host.

You must customize both the gateway and the host for Group Poll operation. In the gateway, you do this by providing a group address in response to customization question 912. This address must be coordinated with the group poll definition at the host.

The following releases of System Support Program (SSP) and Network Control Program (NCP) support Group Poll when the appropriate Small Programming Enhancements are installed:

- SSP Version 3 Release 4.1
- NCP Version 4 Release 3.1
- NCP Version 5 Release 2.1.

Multipoint Operation

In release B3.0 and later, a gateway using SDLC operates in duplex multipoint mode on the line to the host. The host must be configured to operate this way: ADDRESS= (nnn,FULL) should be specified on the NCP LINE macro. The host may then send data to one DSPU receiving data from another DSPU. In earlier releases, the host was configured to operate without duplex multipoint. See Chapter 6, "Remote Operation" for a description of multipoint operation.

Token-Ring 3270 Gateway Support

This section provides information pertaining to the IBM Token-Ring 3270 Gateway and to the different models of 3174 in their support of the Gateway feature and Token-Ring network operations. It does not deal in detail with Token-Ring Network protocols or the Token-Ring transmission subsystem. The following publications describe the IBM Token-Ring Network:

IBM Token-Ring Network Introduction and Planning Guide
IBM Token-Ring Network Installation Guide
IBM Token-Ring Network Problem Determination Guide.

Models 1L, 1R, 2R, 11L, 11R, 12L, 12R, 21L, 21R, 22L, 51R, 52R, 61R, 62R, and 90R with the IBM Token-Ring Network 3270 Gateway feature provide for IBM Token-Ring Network attachment to an SNA host.

Token-Ring Gateway controllers can provide Multi-Host support through Concurrent Communication and ESCON Adapters. For more information about Multi-Host support, see Chapter 16, "Multi-Host Support" on page 16-1. In addition, some 3174s can use Multi-Host support to appear as multiple gateways. This can provide the Token-Ring devices with access to more than one host.

The IBM Token-Ring Network 3270 Gateway feature does not supply SNA functions, except for Alert messages (see Chapter 12, "SNA Alert Function"). The LUs supported by each ring-attached PU are transparent to the IBM Token-Ring Network 3270 Gateway feature.

Models 3R, 13R, 23R, 53R, and 63R attach to the Token-Ring Network to communicate with an SNA host. Either a 3174 with IBM Token-Ring Network 3270 Gateway feature or a 3720 with NCP Token-Ring interconnection (NTR) can provide the gateway function to the host. Any of the devices attachable to other 3174s can be attached to Models 3R, 13R, 23R, 53R, and 63R.

Models 3R, 13R, 23R, 53R, and 63R communicate with the host through gateways. These gateways terminate the ring logical link control and pass the SNA protocol to the next node. With Single Link Multi-Host support, Models 3R, 13R, 23R, 53R, and 63R provide up to eight logical link connections to one or more gateways (specified at customization).

IBM Token-Ring Network 3270 Gateway Functions

The IBM Token-Ring Network 3270 Gateway routes data between a PU on the ring and a host. To pass the data, the IBM Token-Ring Network 3270 Gateway feature has a separate logical link control connection through the Token-Ring adapter to each PU on the ring. This connection involves XID negotiation, logical link connection, and activation/deactivation sequence. When you customize the IBM Token-Ring Network 3270 Gateway feature, you associate each logical link Station ID with a unique subchannel or SDLC address.

The IBM Token-Ring Network 3270 Gateway feature also performs problem determination. This includes receiving error reports from the ring and Token-Ring Adapter, maintaining a statistical table of temporary errors (called the *Ring Error Monitor*), beacon processing, and reporting soft and hard errors to the NetView program.

Token-Ring Network 3270 Gateway Adapter Interface

The Token-Ring Adapter interface communicates with the Token-Ring Adapter, which communicates with the Token-Ring attached PUs through the Token-Ring Network logical link connections. The Token-Ring interface consists of processes that:

- Initialize and terminate the adapter card
- Establish and terminate the links
- Transmit and receive data and control the data traffic
- Supply the status and statistics of the adapter and the remote stations.

Problem Determination Support

The IBM Token-Ring Network Gateway feature provides a central point for informing a host about problems in the Token-Ring system. Problem determination provides the following functions:

- Ring Error Monitor (REM)
- Beacon processing
- Ring-related error processing.

REM determines when a non-random or excessive soft error condition is occurring on the ring and isolates the most probable source of the soft error to a single fault domain.

Token-Ring Physical Unit Activation

TP-Attached 3174 Token-Ring 3270 Gateway: Figure 14-2 shows the information flow during the Token-Ring PU activation process in a remote Token-Ring Gateway environment.

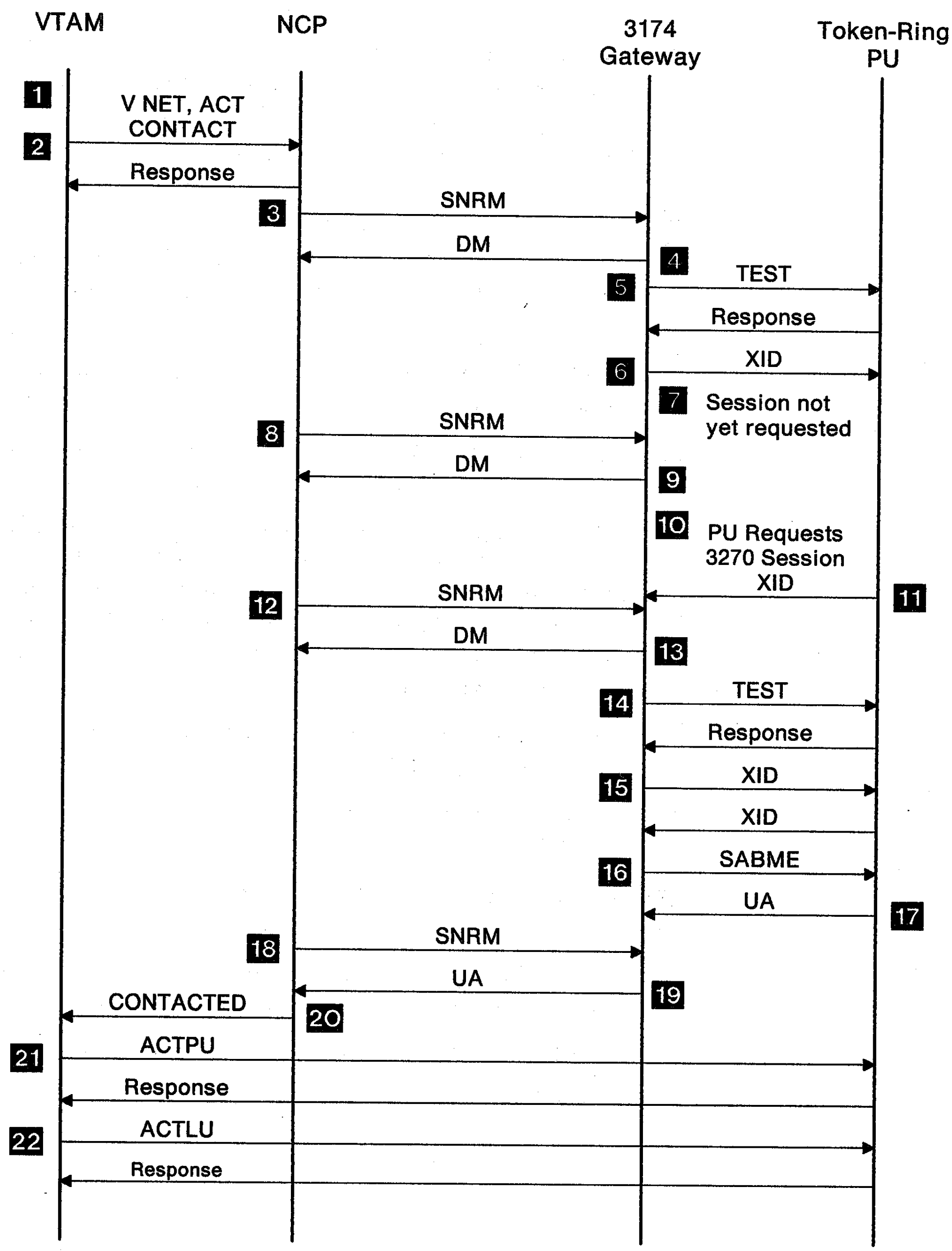


Figure 14-2. Token-Ring PU Activation in a Remote Gateway Environment

1 The network operator issues a VARY NET command to activate the Token-Ring PU (or VTAM can begin resource activation automatically when the NCP major node is activated).

2 VTAM sends a CONTACT request to the NCP for the PU on the Token-Ring.

3 The NCP sends a SNRM command to the Token-Ring Gateway when it is this PU's turn in the NCP contact poll list.

4 The gateway recognizes that no link exists with the Token-Ring PU and returns a DM response to the NCP. This causes the NCP to continue to the next PU in the polling list without delay, and also keeps this PU in the contact poll list. The VTAM state of the PU at this point is PCTD2, and will stay that way until a UA response is returned (19).

5 The gateway sends a TEST command to the Token-Ring PU's adapter. If no response is returned, then there is either a connection or addressing problem on the ring or the Token-Ring PU's adapter is not open on the ring.

6 If there is a response to the TEST command, the gateway sends an XID command to the Token-Ring PU. In this case, no response is received because the Token-Ring PU is not ready to start a 3270 session.

7 The activation process on the Token-Ring suspends waiting on the Token-Ring PU to request 3270 session activation.

8 While waiting for the Token-Ring PU to request session activation, each subsequent pass through the contact polling lists results in another SNRM sent to the gateway for this PU. Note that once Token-Ring link activation has been attempted (5 and 6), subsequent SNRMs do not result in additional activation attempts until a session activation request (11) has been received from the Token-Ring PU.

9 The gateway recognizes that no link exists with the Token-Ring PU and continues to send DM responses.

10 At a later time, the Token-Ring PU is initialized and made ready for session activation.

11 An XID is received from the Token-Ring PU, indicating a request for session activation.

12 The next SNRM following the Token-Ring PU session activation request restarts the Token-Ring link activation process.

13 The gateway recognizes that no link exists with the Token-Ring PU and sends a DM response.

14 The gateway sends a TEST command to the PU's adapter and receives a response.

15 The Gateway sends an XID to the Token-Ring PU. This time XIDs are exchanged.

16 The gateway sends a SABME, the Token-Ring link connection command.

17 The Token-Ring PU accepts the SABME command by sending a UA response. At this point, a Token-Ring link exists between the gateway and the Token-Ring PU.

18 The NCP sends another SNRM to the gateway for the Token-Ring PU.

19 The gateway sends a UA response, recognizing that a Token-Ring link with the PU does exist.

20 NCP informs VTAM that it has CONTACTED the Token-Ring PU.

21 VTAM sends an ACTPU request to the PU and receives a response.

22 VTAM sends ACTLU requests to and receives responses from the LUs supported by the Token-Ring PU device. Link and session activation are now complete.

Note: If the Token-Ring PU is ready to begin session activation before VTAM sends a CONTACT to NCP, then Token-Ring link activation will succeed on the first attempt. Thus, the flow would be as above without **5** through **13**.

Channel-Attached 3174 Token-Ring 3270 Gateway: Figure 14-3 shows the information flow during the Token-Ring PU activation process in a channel Token-Ring Gateway environment.

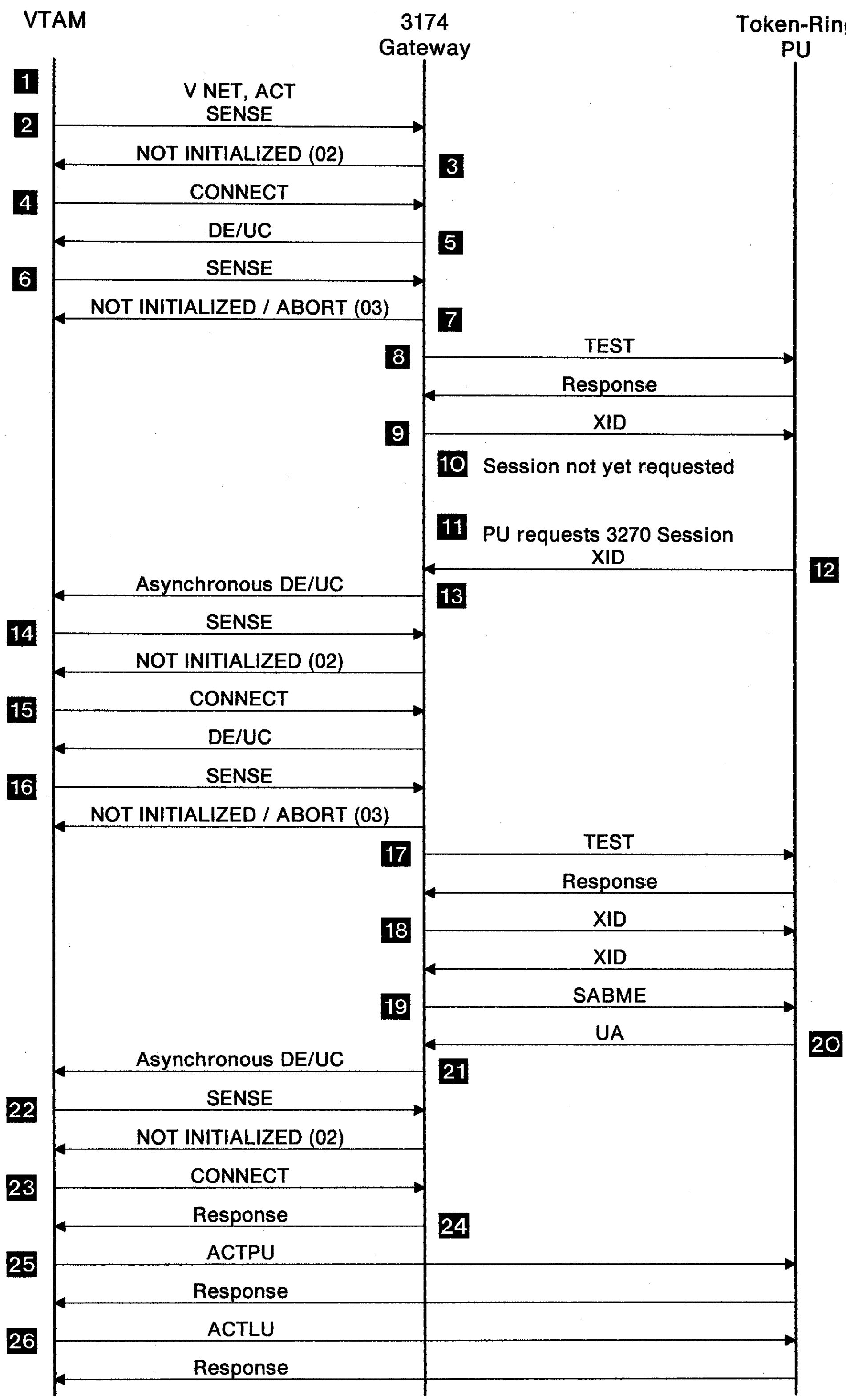


Figure 14-3. Token-Ring PU Activation in a Channel Gateway Environment

1 The network operator issues a VARY NET command to activate the Token-Ring PU (or VTAM can begin resource activation automatically when the major node is activated).

2 VTAM sends a SENSE command to check the state of the Token-Ring PU.

3 SENSE of NOT INITIALIZED is returned to VTAM, causing VTAM to send a CONNECT to the gateway.

4 VTAM sends a CONNECT command to the gateway for the Token-Ring PU.

5 The gateway recognizes that no link exists with the Token-Ring PU and returns a negative response of DE/UC to VTAM.

6 VTAM sends a SENSE command to the gateway to check the status of the PU again.

7 SENSE of NOT INITIALIZED/ABORT is returned to VTAM. This tells VTAM to go into a wait state. From this point on, VTAM will display a state of PCTD2 for this PU until the channel link is active (24).

8 The gateway sends a TEST command to the Token-Ring PU's adapter. If no response is returned, then there is either a connection or addressing problem on the ring or the Token-Ring PU's adapter is not open on the ring.

9 If there is a response to the TEST command, the gateway sends an XID command to the Token-Ring PU. In this case, no response is received because the Token-Ring PU is not ready to start a 3270 session.

10 The activation process on the Token-Ring suspends waiting on the Token-Ring PU to request 3270 session activation.

11 At a later time, the Token-Ring PU is initialized and made ready for session activation.

12 An XID is received from the Token-Ring PU, indicating a request for session activation.

13 The gateway sends an Asynchronous DE/UC to VTAM for the Token-Ring PU. This alerts VTAM to retry the connection sequence.

14 VTAM sends a SENSE command to check the state of the Token-Ring PU. SENSE of NOT INITIALIZED is returned to VTAM, causing VTAM to send a CONNECT to the gateway.

15 VTAM sends a CONNECT command to the gateway for the Token-Ring PU. Again, the gateway recognizes that no link exists with the Token-Ring PU and returns a negative response of DE/UC to VTAM.

16 VTAM sends a SENSE command to the gateway to check the status of the PU. SENSE of NOT INITIALIZED/ABORT is returned, causing VTAM to go into a wait state again.

17 The gateway sends a TEST command to the PU's adapter and receives a response.

18 The gateway sends an XID to the Token-Ring PU. This time, XIDs are exchanged.

19 The gateway sends a SABME, the Token-Ring link connection command.

20 The Token-Ring PU accepts the SABME command by sending a UA response. At this point, a Token-Ring link exists between the gateway and the Token-Ring PU.

21 The gateway sends an Asynchronous DE/UC to VTAM for the Token-Ring PU. This alerts VTAM to retry the connection sequence.

22 VTAM sends a SENSE command to check the state of the Token-Ring PU. SENSE of NOT INITIALIZED is returned to VTAM, causing VTAM to send a CONNECT to the gateway.

23 VTAM sends a CONNECT command to the gateway for the Token-Ring PU.

24 The gateway sends a positive response back to VTAM, indicating that a Token-Ring link with the PU does exist.

25 VTAM sends an ACTPU request to the PU and receives a response.

26 VTAM then sends ACTLU requests to and receives responses from the LUs supported by the Token-Ring PU device. Link and session activation are now complete.

Note: If the Token-Ring PU is ready to begin session activation before VTAM sends its first CONNECT (**4**), then Token-Ring link activation will succeed on the first attempt. Thus, the flow would be as above without **8** through **16** .

Token-Ring Physical Unit Deactivation

Host Initiated: Figure 14-4 shows the information flow during the Token-Ring PU deactivation process when VTAM deactivates the Token-Ring PU.

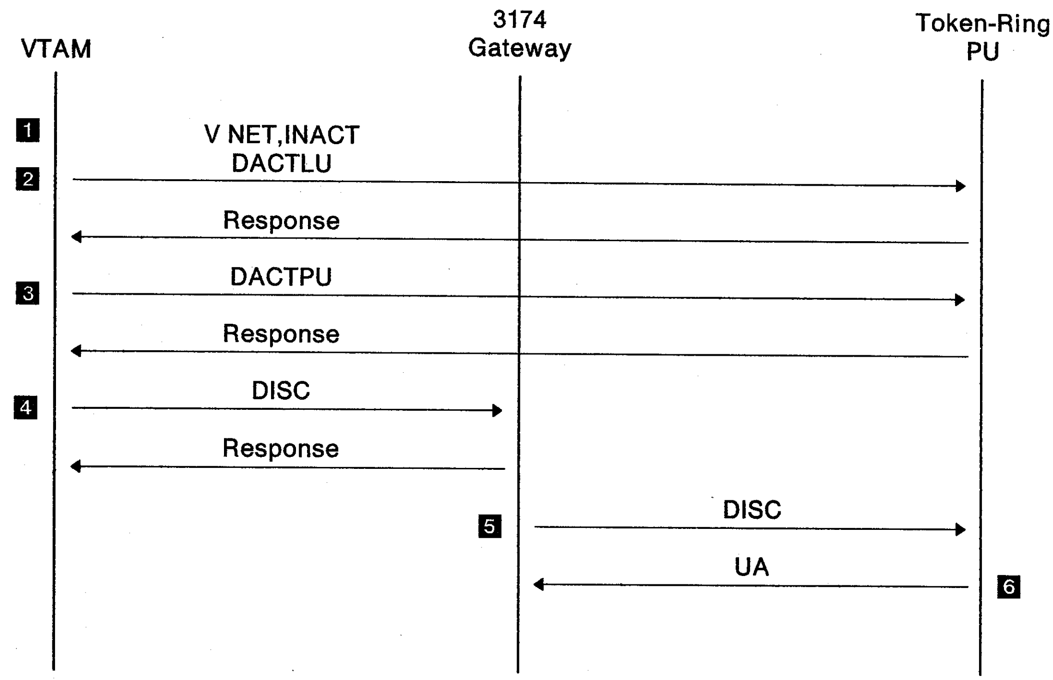


Figure 14-4. Token-Ring PU Deactivation — Host Initiated

1 The network operator issues a VARY NET command to deactivate the Token-Ring PU.

2 VTAM sends DACTLU requests to and receives responses from the LUs supported by the Token-Ring PU device.

3 VTAM sends a DACTPU request to the Token-Ring PU and receives a response. At this point, session deactivation is complete.

4 The Gateway then receives a disconnect from the host attachment for the Token-Ring PU. A positive response is always given. (For a TP-attached gateway, the disconnect would be a DISC from the NCP. For a channel-attached gateway, the disconnect would be a DISCONNECT from VTAM.)

5 In response to the disconnect, the Gateway sends a DISC to the Token-Ring PU.

6 The Token-Ring PU accepts the DISC command by sending a UA response. Link deactivation is now complete.

Gateway Initiated: Figure 14-5 shows the information flow during the Token-Ring PU deactivation process when it is determined that the Token-Ring link to the PU is gone. This scenario applies to both TP and channel-attached gateways.

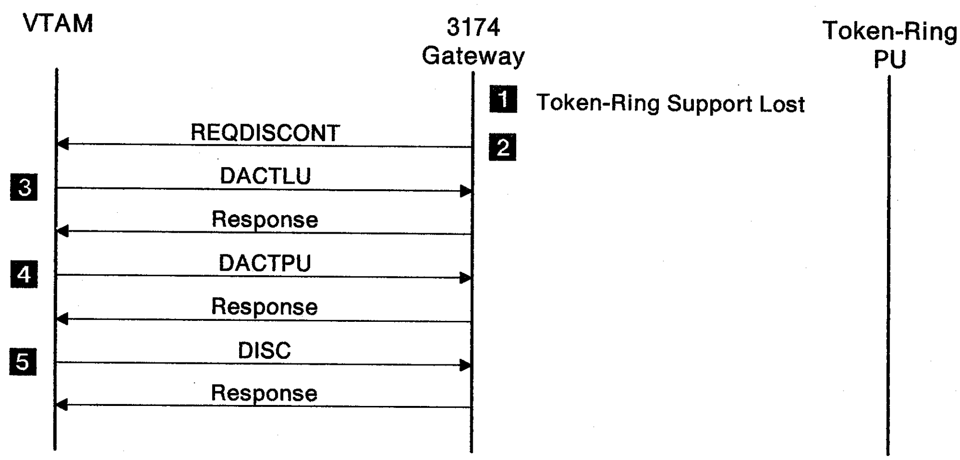


Figure 14-5. Token-Ring PU Deactivation – Gateway Initiated

1 For any one of several reasons (for example, ending the 3270 Token-Ring emulation, powering off the Token-Ring device, unplugging the Token-Ring device's ring access cable), the Token-Ring link between the PU and the gateway is lost.

2 Once the gateway has determined that the Token-Ring link to the PU is lost, it sends a REQDISCONT command to VTAM on behalf of the failed PU. This command requests VTAM to bring down the PU and its supported LUs.

3 VTAM sends DACTLU commands, and the gateway generates responses on behalf of the lost Token-Ring PU for each LU that was in session.

4 VTAM sends a DACTPU command, and the gateway generates a response on behalf of the lost Token-Ring PU.

5 The gateway then receives a DISC command from the host attachment for the Token-Ring PU. A positive response is always given. At this point, the deactivation is complete. (For a TP-attached gateway, the disconnect would be a DISC from the NCP. For a channel-attached gateway, the disconnect would be a DISCONNECT from VTAM.)

To allow the Token-Ring PU to reactivate its session automatically at some later time, the REQDISCONT command is sent with the CONTACT IMMEDIATE bit set. For both TP and channel-attached environments, this causes VTAM to immediately try to reactivate the Token-Ring PU. Thus, the activation sequence shown previously is retried.

Note: If the Token-Ring PU emulation program sends its own REQDISCONT command to initiate the deactivation process, it must set the CONTACT IMMEDIATE bit on to avoid requiring operator intervention to reactivate the session.

Integrated Services Digital Network (ISDN) Gateway Support

This section provides information pertaining to the ISDN Gateway, the ISDN Adapter, and to the different models of 3174 in their support of the ISDN Gateway. It does not deal in detail with ISDN protocols or the ISDN Basic Rate Interface.

Table 14-1 shows the 3174 models that support the ISDN Gateway and the corresponding number of ISDN Adapters that can be installed in each.

Table 14-1. ISDN Gateway Model Support

Number of ISDN Adapters	Models Supporting
Two	61R, 62R
Three	1L, 1R, 2R
Four	11L, 11R, 12L, 12R, 21L, 21R, 22L

Each ISDN Adapter can support up to 8 connections to DSPUs. Therefore, a 3174 may support up to 32 DSPUs, depending on its model number.

An ISDN Gateway controller can provide Multi-Host support through the ESCON Adapter. A gateway controller can appear as multiple gateways and provide the ISDN workstations with access to more than one host. For more information, see Chapter 16, "Multi-Host Support" and "ESCON Channel" on page 16-5.

The ISDN Gateway supports Alert messages and Common Management Information Protocol (CMIP) Event Reports. Information on these alerts and reports can be found in "Generic Alert Message Format" and Chapter 13, "Common Management Information Protocol Event Reports," respectively. The LUs supported by each ISDN-attached DSPU are transparent to the ISDN Gateway feature.

ISDN Gateway Functions

The ISDN Gateway provides for data passage between an SNA host and dial-in DSPUs. It passes the data through a logical link between the upstream host connection and the downstream ISDN connection, and provides the function to establish and terminate the link between these connections.

The host connection is defined by the subchannel or SDLC address. The common gateway support treats the host connections for Token-Ring and ISDN DSPUs identically.

The ISDN connection is defined by an ISDN B-Channel, the ISDN Adapter port carrying the B-Channel, and the ISDN Adapter containing the port. Unlike the Token-Ring connections in the Token-Ring Gateway, the ISDN connections are switched and exist only for the duration of an ISDN call from the DSPU to the 3174.

A DSPU is not restricted to a particular ISDN connection. Rather, it may call any port on any ISDN Adapter and obtain an available B-Channel from the dialed port.

The ISDN Gateway maps the dial-in DSPU to the correct host connection using the physical unit identification (PUID) of the DSPU. The PUID of each DSPU is assigned to a specific subchannel or SDLC address in the 3174 customizing data. Each PUID must be unique on a particular 3174 and have a nonzero value.

Once the link between the host and ISDN connections is established, the ISDN Gateway will pass data between the host and the DSPU until either the host or ISDN connection terminates. When one of the connections terminates, the gateway will terminate the logical link and the opposite connection. Detailed flows for the link establishment and termination are provided in "ISDN Physical Unit Activation" on page 14-20 and "ISDN Physical Unit Deactivation" on page 14-25.

The ISDN Adapter Interface

The ISDN Adapter Interface exists between the gateway system services and the ISDN Adapter. Refer to Figure 14-1 on page 14-4. Its primary functions are to enable communications between the the gateway system services and the ISDN Adapter and to validate the PUID of the DSPU during link establishment.

The communications function of the interface transforms requests from the gateway system services or ISDN Adapter into the format required by the other. The interface handles the requests relating to link establishment and termination, data passthrough, and data flow control.

The PUID validation function of the interface initiates the XID exchange with the DSPU and processes the DSPU's response. The validation sequence begins when the ISDN Adapter informs the interface that it has assigned a B-Channel to an incoming call. In response, the interface sends a null SNA XID to the DSPU via the ISDN Adapter. If the DSPU does not return an XID response, the interface instructs the ISDN Adapter to disconnect the B-Channel.

If the DSPU returns an XID response, the interface receives it from the ISDN Adapter. The interface checks the XID for a correct format and valid PUID. If either the XID format or PUID is invalid, the interface instructs the ISDN Adapter to disconnect the B-Channel. The interface will reject the XID for one of the following reasons:

- The XID format is not SNA XID format 0 or 3
- The XID length is less than the minimal length necessary to contain the PUID
- The PUID is all zeros
- The PUID is not in the gateway's customization data
- The PUID (and the corresponding host connection) is already in use by a DSPU using that PUID.

The interface places an entry in the controller's log for each call it disconnects during PUID validation. If the XID format and PUID are valid, the interface instructs the ISDN Adapter to set up the B-Channel data link protocol. Once the ISDN Adapter has completed this, it notifies the interface. Finally, the interface sends a request to the gateway system services to complete the corresponding host connection. A detailed flow for XID rejection is provided in "ISDN Exchange ID Rejection" on page 14-24. The detailed flow for XID acceptance is part of the PU activation flow in "ISDN Physical Unit Activation" on page 14-20.

The ISDN Adapter

Each ISDN Adapter contains four incoming ports. Each port on the ISDN Adapter represents an ISDN Basic Rate Interface. Each interface consists of one signal channel and two data transmission channels. The signal channel (or D-Channel) operates at 16 Kbps. The data transmission channels (or B1 and B2 channels) operate at 64 Kbps, and each channel can support a logical end-to-end connection with a downstream workstation.

The network attachments supported by the ISDN Adapter are:

- U.S. and Canada AT&T 5ESS/5E4
- U.S. and Canada AT&T 5ESS/5E5
- U.S. and Canada Northern Telecom DMS100/BSC29
- Japan NTT INSNET-64
- U.K. BTNR-191
- France VN2
- Germany 1TR6.

Special Features

Inactivity Timeout: Inactivity timeout is an optional feature that allows limits to be set on how long a B-Channel may remain idle (no data traffic flowing) while connected. A timeout value between 5 minutes and 1440 minutes (24 hours) can be selected for each adapter during customization.

An inactivity timer is set up during adapter initialization and is polled every minute. If no data traffic has flowed on the B-Channel since the last timer poll, then the corresponding counter is decremented. When the counter reaches a value of zero, the channel is disconnected.

Semi-permanent Connection: Semi-permanent connection supports the German ITR6 Network. This feature is subscribed to at the switch and configured in the 3174 during customization. It is customized on a port-by-port basis. Those ports not set up for semi-permanent connection are available for normal circuit switched connections.

Semi-permanent connection indicates to the public switch network the begin or end of the usage of a B-Channel connection. The connected B-Channel usage must be activated before end-to-end data transmission can take place. Activation is initiated at call setup time by passing (in the setup message) the network specific facilities information element indicating semi-permanent connection "activated." If the call is already up and the connection was deactivated, activation is initiated by sending the FACILITY message indicating usage activation.

A deactivated usage indicates that no end-to-end data transmission can take place. The connected B-Channel usage may be deactivated if the call is already up and the usage was already activated. Deactivation is initiated by the DSPU requesting usage deactivation. The 3174 sees this request in a Facility message as sent by the NT.

From a deactivated state, usage activation occurs when subsequent information frames are available for transmission. Either end of the connection may initiate usage activation, but it is up to the DSPU to initiate usage deactivation. The initiating end of the connection must always receive a positive acknowledgement from the other end before usage is activated or deactivated.

ISDN Network Management

ISDN Network Problem Determination Procedures provide a central point for communicating ISDN Network errors to a NetView host. The sending of Common Management Information Protocol (CMIP) flows to NetView and Generic Alerts are supported. For more information, see Chapter 13, "Common Management Information Protocol Event Reports" and "Generic Alert Message Format" on page 12-45.

ISDN Physical Unit Activation

TP-Attached 3174 ISDN Gateway: Figure 14-6 shows the information flow during the ISDN PU activation process in a remote ISDN Gateway environment. The connection between the Gateway and the PU is an ISDN B-Channel.

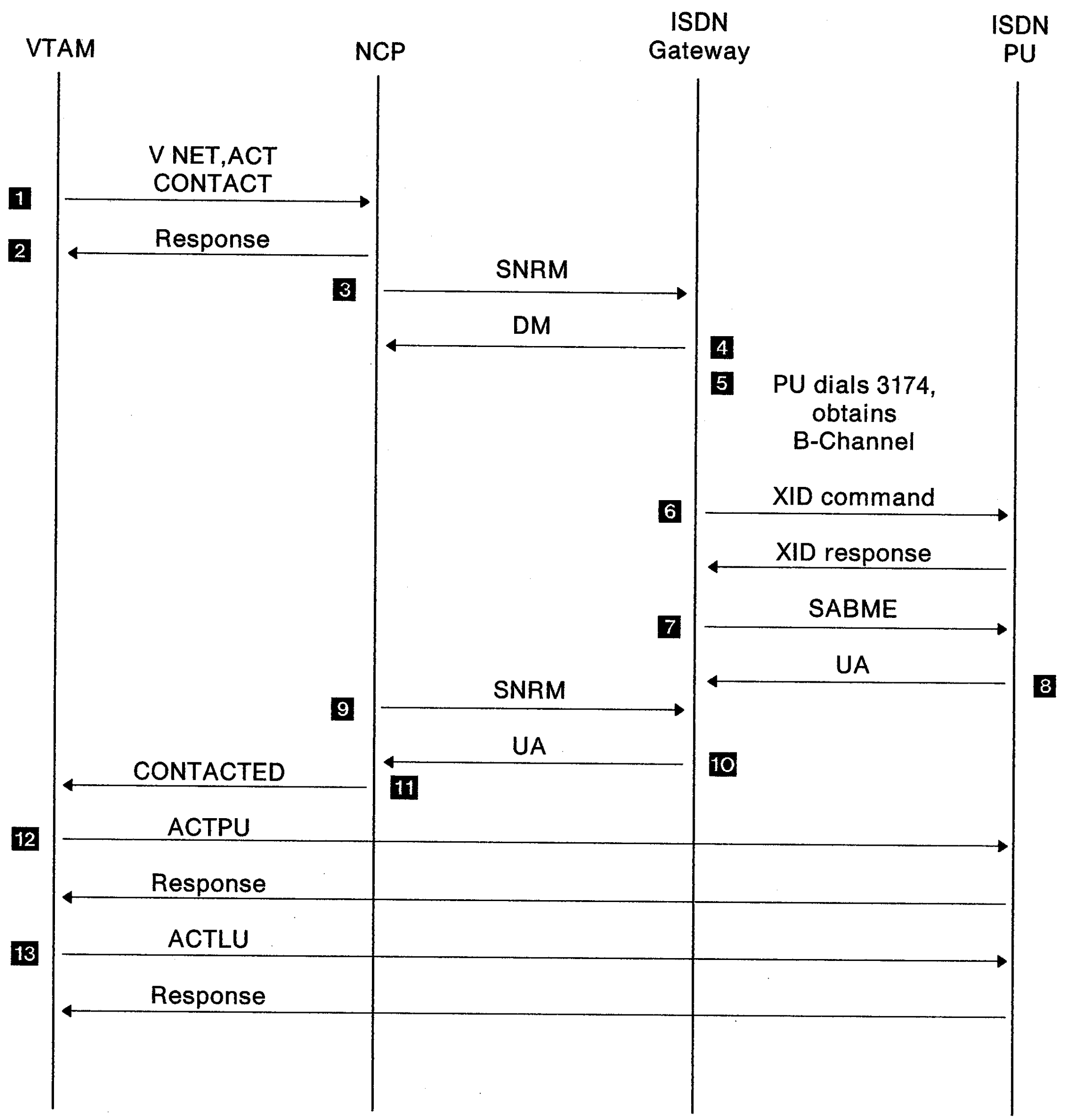


Figure 14-6. ISDN PU Activation in a Remote Gateway Environment

1 The network operator issues a VARY NET command to activate the ISDN PU (or VTAM can begin resource activation automatically when the NCP major node is activated).

2 VTAM sends a CONTACT request to the NCP for the ISDN PU.

3 The NCP sends a SNRM command to the ISDN Gateway when it is this PU's turn in the NCP contact poll list.

4 The Gateway recognizes that no connection exists with the ISDN PU and returns a DM response to the NCP. This causes the NCP to continue to the next PU in the polling list without delay, and also keeps this PU in the contact poll list. The VTAM state of the PU at this point is PCTD2, and will stay that way until a UA response is returned (**10**).

5 The ISDN PU calls the Gateway. The Gateway assigns a B-Channel for communications with the ISDN PU.

6 The Gateway and ISDN PU exchange XIDs.

7 The Gateway verifies the ISDN PU's XID. If it is acceptable, the Gateway sends a SABME, the ISDN data link connection command.

8 The ISDN PU accepts the SABME command by sending a UA response. At this point, an ISDN connection exists between the Gateway and the ISDN PU.

9 The NCP sends another SNRM to the Gateway for the ISDN PU.

10 The Gateway sends a UA response, recognizing that an ISDN connection with the PU does exist.

11 NCP informs VTAM that it has CONTACTED the ISDN PU.

12 VTAM sends an ACTPU request to the PU and receives a response.

13 VTAM then sends ACTLU requests to and receives responses from the LUs supported by the ISDN PU device. Link and session activation are now complete.

Note: If the ISDN connection between the Gateway and ISDN PU is established before VTAM sends a CONTACT to NCP, then the activation would succeed on the first attempt.

Channel-Attached 3174 ISDN Gateway: Figure 14-7 shows the information flow during the ISDN PU activation process in a channel ISDN Gateway environment. The connection between the Gateway and the PU is an ISDN B-Channel.

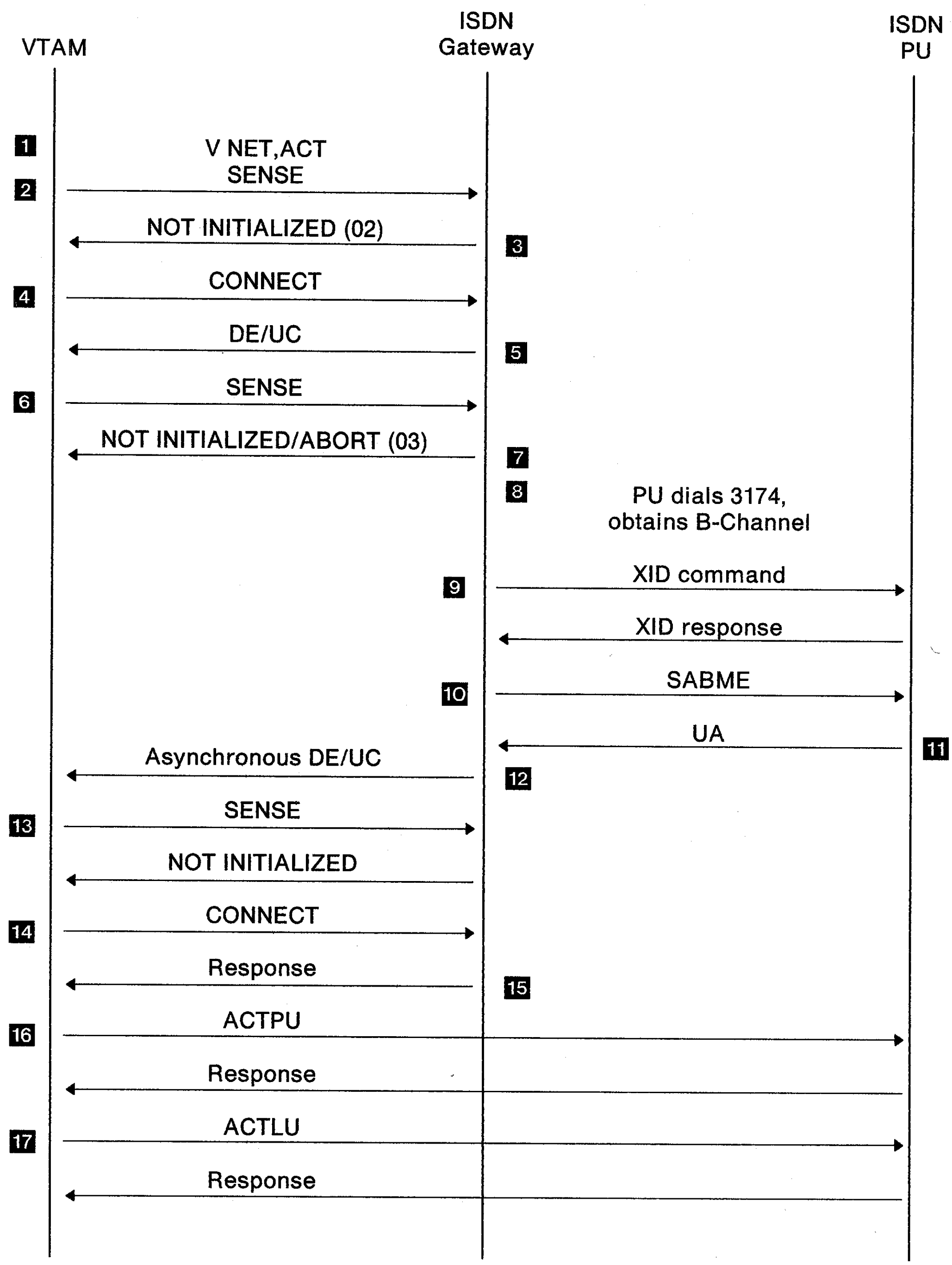


Figure 14-7. ISDN PU Activation in a Channel Gateway Environment

1 The network operator issues a VARY NET command to activate the ISDN PU (or VTAM can begin resource activation automatically when the major node is activated).

2 VTAM sends a SENSE command to check the state of the ISDN PU.

3 SENSE of NOT INITIALIZED is returned to VTAM, causing VTAM to send a CONNECT to the Gateway.

4 VTAM sends a CONNECT command to the Gateway for the ISDN PU.

5 The Gateway recognizes that no connection exists with the ISDN PU and returns a negative response of DE/UC to VTAM.

6 VTAM sends a SENSE command to the Gateway to check the status of the PU again.

7 SENSE of NOT INITIALIZED/ABORT is returned to VTAM. This tells VTAM to go into a wait state. From this point on, VTAM will display a state of PCTD2 for this PU until the channel link is active (**15**).

8 The ISDN PU calls the Gateway. The Gateway assigns a B-Channel for communications with the ISDN PU.

9 The Gateway and ISDN PU exchange XIDs.

10 The Gateway verifies the ISDN PU's XID. If it is acceptable, the Gateway sends a SABME, the ISDN data link connection command.

11 The ISDN PU accepts the SABME command by sending a UA response. At this point, an ISDN connection exists between the Gateway and the ISDN PU.

12 The Gateway sends an Asynchronous DE/UC to VTAM for the ISDN PU. This alerts VTAM to retry the connection sequence.

13 VTAM sends a SENSE command to check the state of the ISDN PU. SENSE of NOT INITIALIZED is returned to VTAM, causing VTAM to send a CONNECT to the Gateway.

14 VTAM sends a CONNECT command to the Gateway for the ISDN PU.

15 The Gateway sends a positive response back to VTAM, indicating that there does exist an ISDN connection with the PU.

16 VTAM sends an ACTPU request to the PU and receives a response.

17 VTAM then sends ACTLU requests to and receives responses from the LUs supported by the ISDN PU device. Link and session activation are now complete.

Note: If the ISDN connection between the Gateway and ISDN PU is established before VTAM sends a CONNECT to the Gateway, then the activation will succeed on the first attempt.

ISDN Exchange ID Rejection

Figure 14-8 shows the information flow during the XID process when it is determined that the ISDN PU's XID is not acceptable. This scenario applies to both TP and channel-attached gateways.

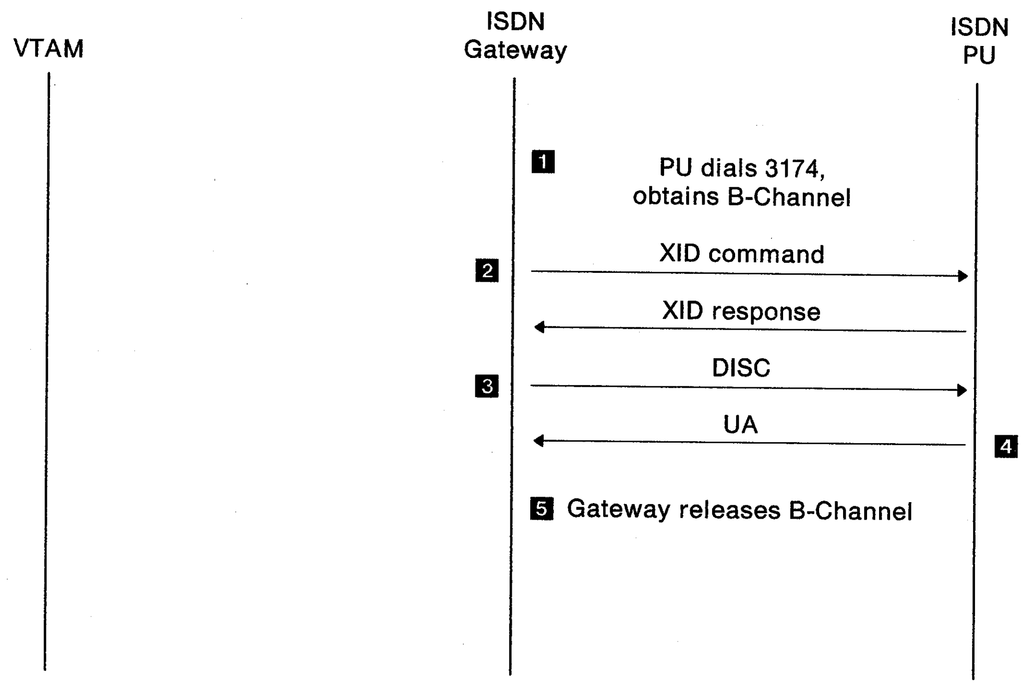


Figure 14-8. ISDN XID Rejection

1 The ISDN PU calls the Gateway. The Gateway assigns a B-Channel for communications with the ISDN PU.

2 The Gateway and ISDN PU exchange XIDs.

3 For one of several reasons (for example, invalid XID format, PUID not customized to use the Gateway, PUID already in use), the Gateway finds the ISDN PU's XID unacceptable. The Gateway sends a DISC, the ISDN data link termination command.

4 The ISDN PU accepts the DISC command by sending a UA response. The ISDN connection no longer exists between the Gateway and the ISDN PU.

5 The Gateway releases the B-Channel, making it available for a subsequent call.

No flows are shown between VTAM and the Gateway because the ISDN PU's unique identity is not established. Therefore, the Gateway is unable to map the ISDN PU to an available host (remote or channel) address.

ISDN Physical Unit Deactivation

Host Initiated: Figure 14-9 shows the information flow during the ISDN PU deactivation process when VTAM deactivates the ISDN PU. Note that this scenario applies to both TP and channel-attached gateways.

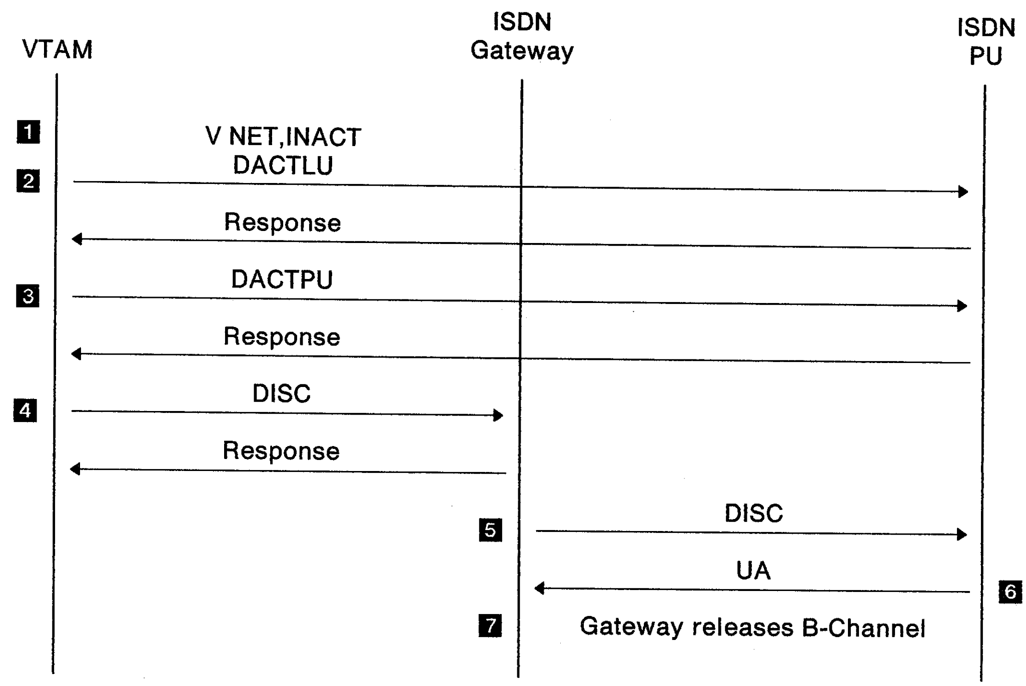


Figure 14-9. ISDN PU Deactivation – Host Initiated

1 The network operator issues a VARY NET command to deactivate the ISDN PU.

2 VTAM sends DACTLU requests to and receives responses from the LUs supported by the ISDN PU device.

3 VTAM sends a DACTPU request to the ISDN PU and receives a response. At this point, session deactivation is complete.

4 The Gateway then receives a disconnect from the host attachment for the ISDN PU. A positive response is always given. (For a TP-attached gateway, the disconnect would be a DISC from the NCP. For a channel-attached gateway, the disconnect would be a DISCONNECT from VTAM.)

5 In response to the disconnect, the Gateway sends a DISC on the B-Channel to the ISDN PU.

6 The ISDN PU accepts the DISC command by sending a UA response.

7 The Gateway releases the B-Channel. At this point, the ISDN connection between the Gateway and the ISDN PU no longer exists.

Gateway Initiated: Figure 14-10 shows the information flow during the ISDN PU deactivation process when it is determined that the ISDN link to the PU no longer exists. This scenario applies to both TP and channel-attached gateways.

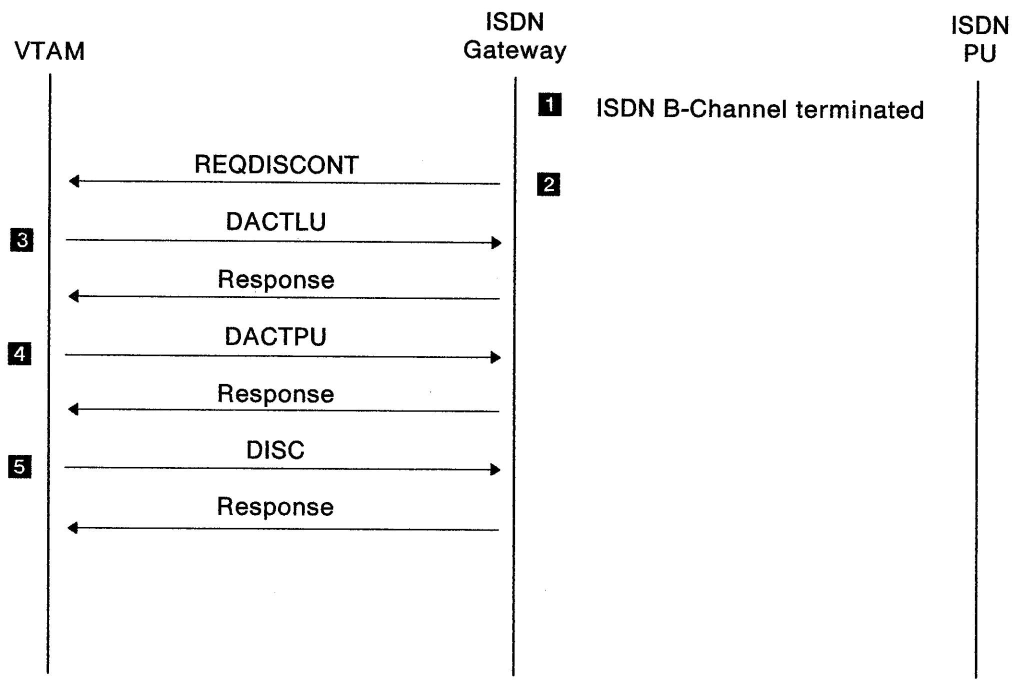


Figure 14-10. ISDN PU Deactivation—Gateway Initiated

1 For any one of several reasons (for example, a network disruption losing the B-Channel, unplugging the ISDN device's ISDN access cable, the ISDN device terminating the call), the ISDN connection between the PU and the Gateway no longer exists.

2 Once the Gateway has determined that the ISDN connection to the PU no longer exists, it sends a REQDISCONT command to VTAM on behalf of the ISDN PU. This command requests VTAM to bring down the PU and its supported LUs.

3 VTAM sends DACTLU commands, and the Gateway generates responses on behalf of the ISDN PU for each LU that was in session.

4 VTAM sends a DACTPU command, and the Gateway generates a response on behalf of the ISDN PU.

5 The Gateway then receives a DISC command from the host attachment for the ISDN PU. A positive response is always given. At this point the deactivation is complete.

To allow the ISDN PU to reactivate its session automatically at some later time, the REQDISCONT command is sent with the CONTACT IMMEDIATE bit set. For both TP and channel-attached environments, this causes VTAM to immediately try to reactivate the ISDN PU. Thus, the activation sequence shown previously is retried.

Note: If the ISDN PU emulation program sends its own REQDISCONT command to initiate the deactivation process, it must set the CONTACT IMMEDIATE bit on to avoid requiring operator intervention to reactivate the session.

Chapter 15. Asynchronous Emulation Adapter (AEA)

Introduction

This chapter provides an overview of the Asynchronous Emulation Adapter (AEA) feature, its modes of operation, and a list of the functions available with the feature.

The AEA feature consists of both hardware and microcode. It expands the connection capability for 3270 terminals, and allows the connection of ASCII terminals and hosts to the 3174.

Physical Description

The AEA feature includes:

- An adapter card that contains a microprocessor, storage, and control logic
- An input/output (I/O) panel with eight Electronics Industries Association (EIA) 232D connectors for modem, terminal, or host connection
- A DSL diskette with microcode for the AEA
- A wrap plug for testing.

A second diskette drive or a fixed disk drive must be installed in the 3174 to support downstream loading of the operational microcode.

Modes of Operation

The AEA feature provides three modes of operation:

3270 Terminal Emulation Provides protocol conversion that allows ASCII devices to communicate with IBM hosts.

ASCII Terminal Emulation Provides protocol conversion that allows 3270-type terminals to communicate with ASCII hosts.

ASCII Passthrough Allows ASCII devices to communicate with ASCII hosts.

Functions Available with AEA

The AEA feature supports a variety of functions. These functions are part of the microcode that supports AEA, some of which are enabled or disabled through 3174 customization.

The functions that are unique to AEA and ASCII are discussed in the *3174 AEA Description and Reference*. Some examples are:

- ASCII devices (including keyboard mapping)
- Protocol used by ASCII devices
- Modems that support ASCII (including switch settings)
- User-Defined Terminal Table
- User-Defined Translate Table
- ASCII Graphics.

Other functions that are 3174 functions, where AEA or ASCII is just part of their support, are found in the appropriate sections of this manual as well as in the *3174 AEA Description and Reference*. Some examples are:

- Multiple Logical Terminal (MLT)
- Display Host Addressable Printer
- Type Ahead.

Chapter 16. Multi-Host Support

Introduction

The 3174 Establishment Controller can be configured to access multiple 3270 hosts. Using the MLT function, each terminal connected to a 3270 controller port can have up to five host sessions. These sessions may be all to one host or to several hosts. A terminal can access the different hosts through a keying sequence that switches between the sessions and/or hosts.

There are several types of Multi-Host Support:

- An additional link to hosts through a Concurrent Communication Adapter (CCA)
- Single Link Multi-Host Support (SLMHS)
  - ESCON (Enterprise Systems Connection) Channel
  - Token-Ring
  - X.25.

Various combinations of Multi-Host Support can be used at the same time. For instance, Concurrent Communication Adapters and X839dh25 Single Link Multi-Host Support can be used simultaneously.

Multi-Host Support Terminology

Before discussing the various kinds of Multi-Host Support, we need to explain a few terms that you must know. These terms will be used to differentiate between hosts and links throughout this book.

Attachment to a host falls into one of two main categories:

- Link attachment
- Host attachment.

Link Attachment

Link attachment refers generally to the physical means of attaching to a host or network (the hardware link). Depending upon its type, the link is considered "primary" or "secondary." (A primary link is typically the link provided by the model you have purchased and does not require any optional features.)

Primary links are provided by:

- Channel Adapter
- ESCON Adapter
- Type 1 Communication Adapter
- Type 2 Communication Adapter
- Token-Ring Adapter.

Secondary links are provided by:

- Type 1 Concurrent Communication Adapter
- Type 2 Concurrent Communication Adapter.

Host Attachment

Some kinds of link attachment allow multiple hosts to be accessed. Consider one of these hosts the primary host and the others, secondary hosts. Thus, on a primary link, you can have a primary host (1A) and secondary hosts (1B-1H). And on a secondary link you can have a primary host (2A or 3A) and secondary hosts (2B-2D, 3B-3D). The following matrix illustrates this concept:

	Primary Link	Secondary Link
Primary Host	1A	2A, 3A
Secondary Host	1B-1H	2B-2D 3B-3D

You make primary and secondary host assignments as part of planning for customization. The number/letter combinations are the *host IDs*, by which you identify each host. A host ID is always two characters: the first character is a number and indicates the link, the second is a letter and indicates the host. The number **1** and the letter **A** always indicate **primary**. (Thus the 1A host is the primary host on the primary link, and the 2A host is the primary host on a secondary link.)

CCAs and SLMHS can be used individually or together. Each CCA attaches the 3174 to an additional communication link. SLMHS provides a way to access more than one SNA host on a single communication link. Table 16-1 shows, by release, the number of hosts that can be accessed for each type of attachment.

Table 16-1. Maximum Number of Hosts per Attachment by Release

Release	Attachment	Primary Communication Link	Secondary Communication Link
B1	Token-Ring	8	—
B2	SDLC	1	1
	X.25	1	1
	X.21SW	1	1
	BSC	1	1
	SNA channel	1	—
	Non-SNA channel	1	—
B3	Token-Ring	8	—
	SDLC	1	1
	X.25	8	4
	X.21SW	1	1
	BSC	1	1
	SNA channel	1	—
	Non-SNA channel	1	—
	SNA ESCON	8	—
	Non-SNA ESCON	1	—

Using the Concurrent Communication Adapter (CCA) Feature

The CCA feature consists of intelligent communication adapters and microcode that allow users to access one additional communication link for each CCA installed. The microcode associated with the Concurrent Communication Adapter is loaded into the CCA as part of the initial microcode load of the 3174.

Each CCA installed in a 3174 adds one teleprocessing host interface to the 3174.

Two types of Concurrent Communication Adapters are available:

Card	Interface
1 (9263)	Conforms to the EIA 232D/V.24/V.28 or CCITT V.35 standards and can be customized for BSC, SDLC, or X.25 remote link attachment.
2 (9267)	Conforms to the CCITT X.21 standards and can be customized for X.21 Switched communication mode, SDLC, or X.25 remote link attachment.

The number of Concurrent Communication Adapters that can be installed in the 3174 varies with the model number. You can install two CCAs in Models 1L, 1R, 2R, 3R, 11L, 11R, 12L, 12R, 13R, 21L, 21R, 22L, 23R, 61R, and 62R. You can install one CCA in Models 51R and 63R. You cannot install CCAs in Models 52R, 53R, 81R, 82R, 90R, 91R, and 92R.

The 3174 model type does not affect the type of Concurrent Communication Adapter that can be installed or the communication mode each adapter uses. For example, type 9263 CCA can be customized for BSC when installed in a Model *x*1R that is customized for SDLC. Type 9267 CCA customized for X.21 switched (SNA) can be used in a model *x*1L that is customized for local non-SNA mode.

When you have Concurrent Communication Adapters installed, you cannot use host loadable PAM.

Figure 16-1 illustrates the multiple 3270 hosts that a terminal can access when Concurrent Communication Adapters are present in a controller.

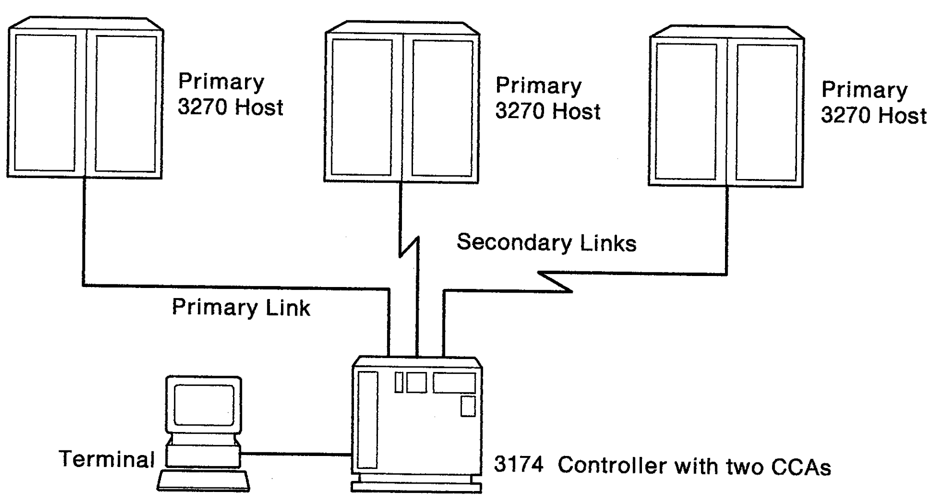


Figure 16-1. Multiple 3270 Host Access through Concurrent Communication Adapters

Multi-Host Gateway (Token-Ring)

With microcode release B3.0 or later, the 3174 can provide gateway support (Token-Ring) for hosts that are accessed with SDLC protocol through a CCA. This function can be used concurrently on 2 CCAs and can be concurrent with local or remote gateway support on the primary link, resulting in a "Multi-Host Gateway." Figure 16-3 on page 16-6 provides an example of a 3174 Multi-Host Gateway. Depending on its capabilities, and on the customization of the 3174 gateway controller, a station on the ring may access any or all of the gateway's hosts. For example, as shown in Figure 16-3 on page 16-6 , a 3174 model x3R with Single Link Multi-Host Support can have concurrent attachments to each of the 3 gateway hosts.

To customize a CCA for gateway function, the host attachment of the primary link must support SNA. Alerts that pertain to the gateway feature in the controller are then sent to the SNA host on the primary link that is customized as the alert control point.

Single Link Multi-Host Support

Single Link Multi-Host Support enables terminals attached to a controller to access multiple 3270 hosts on a single physical link. If the link is primary, up to eight hosts can be configured; if the link is secondary, up to four hosts can be configured. (For a definition of primary and secondary links, refer to "Multi-Host Support Terminology" on page 16-2.)

The 3174 Establishment Controller supports three types of Single Link Multi-Host Support. Each is explained in the following sections.

ESCON Channel

ESCON Channel Support allows you to access up to eight IBM SNA hosts on the primary link through an Enterprise Systems (ES) Connection Director connected to a S/390 host. This support is provided on 3174 Models 12L and 22L. These models can provide gateway support to the Token-Ring and ISDN Networks at the same time they are providing ESCON Channel Support. When providing gateway support, controllers and devices that are attached to the Token-Ring and ISDN Networks can be configured to access any of the hosts that are available through the gateway. For an illustration of ESCON Channel Support, see Figure 16-2.

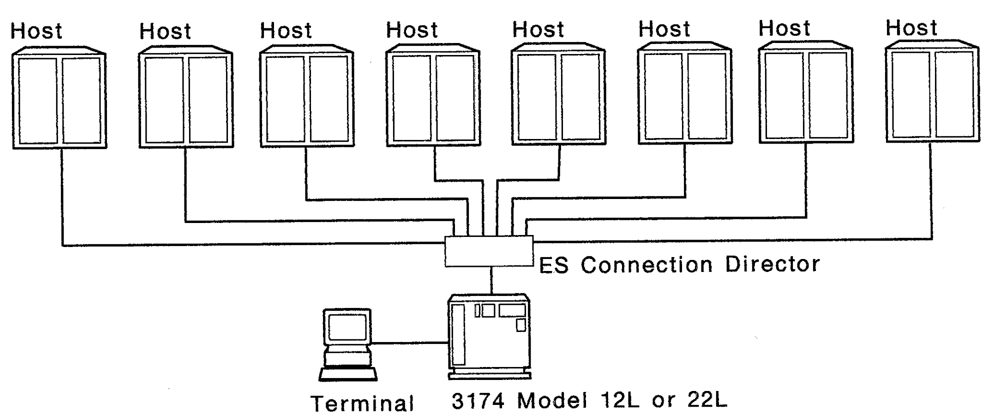


Figure 16-2. ESCON Channel Single Link Multi-Host Support

Token-Ring

This function is for controllers attached to the IBM Token-Ring Network. The single link is the link between the controller and the ring; it is the controller's primary link. Terminals attached to the controller can access multiple 3270 hosts.

The Token-Ring is attached to the hosts through gateways. Each gateway has a unique address. That address is used during the customization of a controller using Token-Ring Single Link Multi-Host Support to identify the path to the gateway. Service Access Points (SAPs), specified in conjunction with the gateway address, identify the different hosts upstream of the gateway communication path.

Models 3R, 13R, 23R, 53R, and 63R support Token-Ring Single Link Multi-Host Support. Controllers configured as a gateway do not. Alternate configurations allow other controllers to appear as one of these models and thus support this function. Figure 16-3 illustrates Token-Ring and Single Link Multi-Host Support.

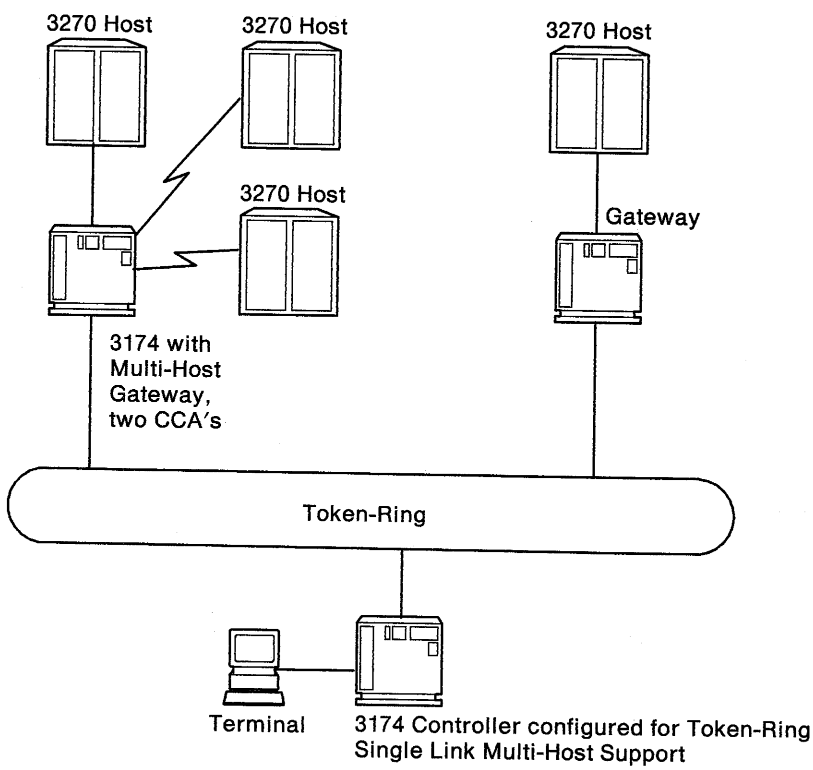


Figure 16-3. Token-Ring Single Link Multi-Host Support

Single Link Multi-Host Support over a Token-Ring means that primary and secondary hosts are accessed through the primary link, supplied by the Token-Ring Adapter. At customization, you can choose which host will be your primary host on the link and which hosts will be the secondary hosts.

X.25

This function is for controllers attached to X.25 networks. Unlike other types of single link support, X.25 Single Link Multi-Host Support can be accomplished over the primary or secondary link, or both at once.

On a primary link, up to eight hosts can be configured. The link is accomplished using a Type 1 or Type 2 Communication Adapter, X.25 protocol, and microcode function.

On a secondary link, up to four hosts can be configured. The link is accomplished using a Type 1 or Type 2 Concurrent Communication Adapter, X.25 protocol, and microcode function.

Two secondary links can be used on most models of the 3174, making the total number of hosts accessible through secondary links eight. Some controller models support only one CCA (and therefore one secondary link).

Figure 16-4 shows X.25 Single Link Multi-Host Support support through both primary and secondary links.

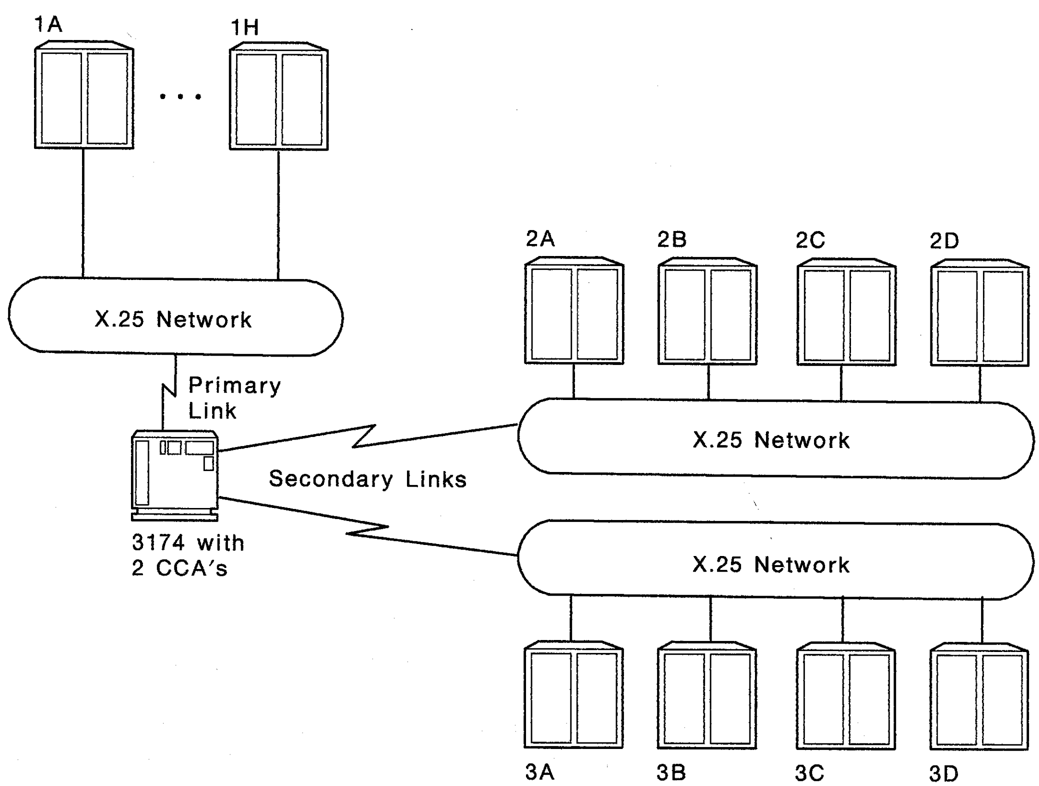


Figure 16-4. X.25 Single Link Multi-Host Support

Device-to-Host Attachment with MLT and Multi-Host Support

The following table lists the functions and hosts available for the devices that attach to a 3174 customized for both MLT and Multi-Host support.

Device	Function		Host			
	MLT/ MIS	Dial and Online Test	1A	ASCII	2A-2D[1] and 3A-3D[1]	1B-1H
CUT Display	Yes	Yes	Yes	Yes	Yes	Yes
DFT (SNA[2])	Yes	No	Yes[3]	No	Yes[3]	Yes
DFT (non-SNA[2])	Yes	No	Yes	No	No	No
DFT-E (SNA[2]) (DFT Mode)	Yes	No	Yes[3]	No	Yes[3]	Yes
DFT-E (non-SNA[2]) (DFT Mode)	Yes	No	Yes	No	No	No
DFT-E (CUT mode[4])	Yes	Yes [5]	No	Yes	No	No
3270 Printer	No	No	Yes	Yes	Yes	Yes
ASCII Display	Yes	Yes	Yes	Yes	No	No
ASCII Printer	No	No	Yes	Yes	No	No
HAP:						
ASCII	No	No	Yes	No	No	No
3270	No	No	Yes	No	No	No

Notes:

[1] 2A-2D and 3A-3D are not valid for HG27.
[2] Attachment protocol used by the primary link.
[3] Only when 1A is SNA, can the DFT access any SNA host.
[4] The CUT interface of the DFT-E cannot communicate with any 3270 host attached to the controller. In CUT mode, the DFT-E has up to three LTs so that it can perform Dial or Test for all communication links. Only LT-1 can be used to access an ASCII host. The host can be assigned to LT-1 by the AEA Default Destination screen, and/or the Connection Menu can be used to select an ASCII host.
[5] Can perform Dial only for hosts 1A, 2A, 3A.

Customizing the Logical Terminal Assignment (LTA)

You can use the LTA function to determine the hosts and applications that are associated with the LTs for a device. For each port of the 3174, you can customize an LTA. If you do not customize the LTA, the 3174 uses a default LTA, which differs for each type of device.

The LTA for a port consists of up to five Logical Terminal identifiers (LTIDs). Each LTID contains three characters. The first two characters are the host ID. The third character indicates the host address from the port assignment. For example, if the third LT on port 6 has an LTID of 2A4, the LT is associated with host 2A, and it uses the fourth host address from the port assignment of host 2A.

The following table lists the default LTIDs assigned to each device type.

Device	Without Multi-Host Support	Using SLMHS, with no CCAs	Using One CCA	Using Two CCAs
CUT Display	1A1, 1A2, 1A3, 1A4, 1A5	1A1	1A1[1], 2A1	1A1[1], 2A1, 3A1
DFT	1A1, 1A2, 1A3, 1A4, 1A5	1A1, 1A2, 1A3, 1A4, 1A5	1A1, 1A2, 1A3, 1A4, 1A5	1A1, 1A2, 1A3, 1A4, 1A5
Printers	1A1	1A1	1A1	1A1

Notes:

[1] For HG27, this is the only default LTID that is assigned.

Switching Sessions

You can use the Change Screen function to switch among the hosts and the applications. When you change screens, the LTID and the LT are updated in the OIA. If a host descriptor is associated with the updated LT, the host descriptor is displayed in the OIA.

See "Change Screen (ChgSc) Function" on page 4-45 for location of the Change Screen function on your keyboard.

Local Copy and Print ID

For CUT displays, local copy, if allowed by PAM, is available only from those LTs that are assigned to the same communication link as the printer. Local copy from LTs assigned to other links is rejected with an *Operator Not Authorized* indication in the OIA.

Refer to "Local Copy Function" on page 4-24 and "Ident Function" on page 4-19 for additional information on Print ID.

The Print ID affects all LTs associated with a communication link. When the Ident function is used to change the print ID, the same print ID change occurs for all LTs reporting through the same communication link.

For example, a port's LTA may be set as follows:

LT Number	LTA
1	1A1
2	1B1
3	1C1
4	2A1
5	3D1

When LT-1 is active and the Ident function is used to change the print ID, the change applies to LT-2 and LT-3 also. If LT-4 is active and the Ident function is used to change the print ID, the change applies only to LT-4.

If you select the printer rather than the print class while in Ident mode, you must select a printer assigned to a host associated with the same communication link as the LT. In the above example, when LT-1 is active and the Ident function is used to change the print ID, you must specify a printer assigned to host 1A-1H. In this example, you could not select a printer assigned to 2A or 3D.

Accessing AEA Functions

For CUT displays to access AEA functions, the host ID associated with an LT must be 1*x*.

When multi-host support and AEA are used together, the LTA may affect the Default Destinations that are assigned to ports. A description of this relationship can be found in the *3174 Planning Guide.*

Alerts

In a SNA environment, one host on the primary communication link is designated as the 3174 *alert control point*. When hardware-related failures occur, they are reported to the 3174 alert control point. With the SLMHS, when more than one host is accessed via the primary communication link, you can customize the host to which the failure will be reported. If only one host is customized on the primary link, the 3174 alert control point is automatically assigned to that host (ID = 1A).

Hardware-related failure alerts are not reported to hosts that are connected through CCAs.

Session-related failure alerts are reported to the host that owns the affected session.

For ISDN Gateway, Common Management Information Protocol (CMIP) event reports are used by the 3174 to send information about the status of the sets maintained by the ISDN Adapter. See Chapter 13, "Common Management Information Protocol Event Reports" for details.

CCA Failures

The base controller (and other CCAs) can continue to function if a CCA failure occurs (hardware or microcode failure). If a CCA fails, the CCA error *325* is displayed in the OIA for LTs associated with all hosts connected to that adapter. The Change Screen function can be used to access a functional LT.

An LT assigned to a CCA is kept in the change screen list when the CCA fails. The first time you press the Change Screen function to access such an LT, the screen is cleared, and the indicator row is cleared and updated with the LT number and a *325* CCA error indicator. The only functions that are operational at this time are Change Screen, Skip This LT, and Restore Skipped LTs. The LT is skipped on subsequent loops through the change screen sequence.

If you cannot access any LTs because of CCA outages, you can still perform certain 3174 local functions, for example, online test and dial. LT-X is displayed in the OIA and the Change Screen function is ignored.

Chapter 17. Local Format Storage

Introduction

The 3174 Local Format Storage (LFS) feature provides for host-controlled loading of screen formats into controller storage of SNA 3174s. Then upon request, these formats can be sent to a CUT display or a device emulating a CUT display (including ASCII terminals when in session with an IBM/3270 host). DFT devices are not supported.

Using the Local Format Storage feature reduces traffic on the host-to-controller transmissions and improves response time, because display of a stored format is accomplished by calling its name rather than by transmitting the format from the host.

Local Format Storage uses new and existing 3270 data stream structured fields to control loading and host-initiated presentation of stored formats. It also supports the 3270 data stream architecture for format presentation as carried out by the Customer Information Control System (CICS) Outboard Formatting Facility. A customer may choose, however, to provide his own format presentation support using the 3270 data stream architecture.

Format loading is controlled by a host-initiated utility session that is invoked when the host detects that a controller's initial microcode load (IML) has occurred. Formats can be added, replaced, or deleted; format groups can be deleted; or format storage can be reset at any time under control of the host utility session. The host utility can reside in the primary host or a secondary host (see "LFS Feature with Multi-Host Support" on page 17-9).

Presentation of any stored format can be initiated by host command, and presentation of selected *local* formats can be initiated by a terminal operator without host intervention, provided that local formats have been defined in the Load Format structured field and local format selection has been enabled.

Note: 3174 customizing question 179 is used to enable the Local Format Storage feature and to allow terminal users to select formats.

Refer to Chapter 3, "3270 Structured Fields" for the contents of the structured fields used with the Local Format Storage feature.

Implementation

There are three major phases of implementation:

1. Creating the formats
2. Distributing the formats
3. Presenting the formats.

This chapter discusses each of these phases in terms of customer or IBM responsibilities and describes, where applicable, their external interfaces. It does not address internal design.

Creating the Formats

The customer is responsible for creating the formats to be downloaded. How the formats are created depends on the transaction management system. The 3174 Local Format Storage feature requires that all stored formats contain the exact 3270 data stream to be sent to the terminal. The 3174 does not make any unique display modifications to the stored formats, nor does it attempt to decide which version of a format to present if multiple versions of the same format exist (except in the case of a secondary host that is customized to override the formats loaded by the primary host; see "LFS Feature with Multi-Host Support" on page 17-9.) Therefore, each format sent to the 3174 must be specifically tailored to the display for which it is intended, and must have a unique name.

Currently, CICS has the only existing IBM System/370 host support for Local Format Storage. CICS, with standard Basic Mapping Support (BMS) commands, allows the customer to create the exact 3270 data stream version of BMS formats needed by 3174 Local Format Storage.

- The ROUTE command in BMS allows the customer to generate a list of terminals to which BMS directs format requests.
- The SEND MAP command with the SET operand builds the 3270 data stream for a format and then returns the data to the host instead of sending it to the terminal.

Using this method, the customer can generate the 3270 data stream needed for each different type of terminal that supports format storage. These formats can be stored on disk in the host and retrieved when it is necessary to distribute them to the 3174 controller. Alternatively, the creation and distribution of the format data streams can be performed each time the formats are to be sent to the 3174.

Distributing the Formats

The customer is responsible for distributing the formats to the 3174 controller. This function is not automatically provided by any host support. In CICS, formats can be distributed via a CICS transaction written to the CICS interface. Formats are stored only in 3174 storage, and must be reloaded each time the 3174 power is turned on or an IML has occurred.

The 3174 Local Format Storage feature supports the receipt of formats on System Network Architecture (SNA) as Logical Unit (LU) address 1. This is not a valid LU address for a display; it is reserved for controller service functions and is used for format distribution via 3270 data stream as a customer migration aid to 3174 Local Format Storage. This LU address supports an LU type 2 session and expects to receive a subset of the 3270 data stream structured fields and commands that are necessary to support distribution of formats to the 3174.

Host Support

In the 3174 Local Format Storage implementation, the customer is responsible for automatically initiating the host format distribution transaction. This can be done by using the CICS facility for Automatic Transaction Initiation. It requires that the customer define controller LU address 1 (LU for format distribution) as a display terminal to NCP, VTAM, and CICS.

With this approach, when the controller power is turned on, VTAM starts the LU. CICS, for automatic transaction initiation, simulates a logon from this LU address to the format distribution transaction.

Note: The 3174 microcode also supports Central Site Change Management (CSCM) and a dependent LU 6.2 session. The function requires the use of LU address 1. At the beginning of a Plan, NDM Binds LU address 1, then Unbinds LU address 1 at the completion.

Local Format Storage supports a format distribution session on LU address 1. Therefore, because of this contention for LU address 1 between CSCM and the format loading process, the format distribution session must be terminated with an Unbind when the format is downloaded to enable other system activity directed to LU address 1.

Download Considerations

CICS cannot detect when a controller is IMLed. So, the following methods are used to allow the host to determine the state of the Format Storage Auxiliary Device.

- Two flags are used in the Format Storage Auxiliary Device Query Reply:
  - Byte 4 / Bit 1 indicates whether or not any formats are loaded
  - Byte 4 / Bit 3 indicates whether or not the formats are managed by the host receiving the query reply.
- A Request Summary Status operand is used in the Load Format Storage structured field.

  The response to this request is an Exception/Status structured field containing a self-defining parameter indicating the number of groups assigned, the total number of formats loaded, the number of local names used, and the amount of format storage space available.
- A Request Group Status operand is used in the Load Format Storage structured field.

  The response to this request is an Exception/Status structured field containing a self-defining parameter indicating, for the specified group, the number of formats loaded.

Format Distribution Transaction

The customer-written format distribution transaction is responsible for initiating itself and for beginning the distribution of the formats. The controller replies to each format load request.

Setup: Following is a typical setup sequence that can be expected to initiate the transaction:

1. Define to VTAM a new "display" on controller LU address 1.
2. Define to CICS a new "display" on controller LU address 1.
3. Define to CICS the format distribution transaction for Automatic Transaction Initiation with the "display" defined on controller LU address 1.

Data Flow: The sequence expected during format load is:

1. The host issues an Activate Logical Unit (ACTLU) for LU address 1.

   If the Local Format Storage feature or other LU address 1 service is present, the controller replies with a positive response. Otherwise, it rejects the ACTLU, preventing erroneous activation of the format distribution transaction.

2. A Bind is sent by the host to LU address 1 (LU Type 2 Default Bind).

   The controller accepts the Bind request if the Local Format Storage feature or other LU address 1 service is present and not already bound. Otherwise, it rejects it.

3. Start Data Traffic (SDT) is sent by the host, and the controller replies.

4. The transaction program may send an optional query.

   If queried, the Local Format Storage feature returns the following replies besides the ones currently applicable:

   - Auxiliary Device (for LU address 1 only)
   - Format Storage Auxiliary Device (for LU address 1 only)
   - Format Presentation (for all CUT-mode terminal addresses)
   - Partition Characteristics.

5. The distribution transaction then begins as follows:

   - The host sends formats using the following structured fields:

     a. Destination/Origination ID structured field specifying the Format Storage Auxiliary Device

     b. Load Format Storage structured field.

   - The Local Format Storage feature replies to each Load Format Storage structured field by sending:

     a. Destination/Origin ID structured field identifying the Format Storage Auxiliary Device

     b. Exception/Status structured field, with self-defining parameters set, to indicate the results of the operation.

   This sequence is repeated until all the formats are distributed or the controller replies with an insufficient storage exception.

A Load Format Storage structured field must be sent for each format. After sending each format, the distribution transaction must wait for a reply from the controller. In SNA, this means that only one Load Format Storage structured field can be sent in a chain, and the chain must contain the Change Direction (CD) indicator. A transaction can usually cause this SNA sequence to be generated by issuing a "write-read" type of request rather than a "write" type of request. The success or failure of the format load is reported as normal data to the distribution transaction through the Exception/Status structured field rather than as an SNA positive or negative response. This provides the customer-written format distribution transaction with maximum control over error recovery.

Presenting the Formats

CICS currently supports format presentation. The 3174 Local Format Storage feature implementation requires no modifications to CICS.

Because CICS is the only host application to provide support for Local Format Storage, this section describes format presentation from a CICS standpoint. However, the structured fields and protocol sequences are standard 3270 data stream architecture and can be used by any product that supports 3270 devices.

Host Dependencies

The customer is responsible for defining, to CICS, the terminals supporting Local Format Storage; and for defining, to BMS, the formats that are outboarded. The Local Format Storage feature presents the same interface (for format presentation) to CICS BMS as the 8100. This support is part of CICS and standard BMS, and is documented in the CICS application programming manuals.

CICS support allows a customer to define each terminal (not controller) that is to be supported by Local Format Storage. It also allows each format to be defined as outboarded or not. However, CICS does not make provision for a customer to group formats so that different terminals can be defined as having different groups of formats outboarded. If a format is outboarded, CICS expects that the format is outboarded in every terminal that is supporting Local Format Storage.

Format Presentation Invocation

This support is provided by CICS and does not require any customer-written transaction code to invoke it. It is automatically invoked by CICS when both a transaction calls a format that is outboarded and the terminal to which the transaction is attached is also defined as supporting Local Format Storage. If both of these requirements are not met, CICS goes through its normal format and terminal processing. The following sequence is expected:

- Select Format Group sent by the host:

  This is the first structured field sent by the host. The purpose of a format group varies for different host formatting facilities.

  Formats are stored in available storage using a directory structure in which each group name identifies a directory of all the formats loaded with the specified group name. The Select Format Group structured field assigns a directory to be searched when other Present Absolute Format or Present Relative Format structured fields are received from the host. The most recently selected group directory is the one searched for the format to be presented.

  The host can select another directory by issuing the Select Format Group structured field specifying a different name. If a request is made for a nonexistent group name, an exception indication is returned, and the selected group is set to indicate "no group selected." No default group name exists, so a group name must be correctly specified using a Select Format Group structured field before the host can request that any stored formats be presented by Local Format Storage.

  Only the currently assigned directory is searched for the specified format. The customer is responsible for ensuring that the proper group name has been specified and that the desired format was loaded with the specified group name.

- Present Absolute/Relative Format sent by the host:

  These two structured fields are used to select the format name of the format to be presented. The difference between them is that the Present Relative Format structured field contains an offset value that is added to each address-dependent order in the format data stream. This structured field is used predominantly by CICS to support BMS floating formats.

  Both the Present Absolute Format and Present Relative Format structured fields are sent with a presentation command specifying either a 3270 data stream Write, Erase/Write, or Erase/Write Alternate command. Both structured fields also contain a 3270 data stream Write Control Character (WCC) byte. The presentation command and the WCC are used to display the format on the screen.

  Because formats are processed as 3270 data stream outbound structured fields, screen size is not changed for the Erase/Write or Erase/Write Alternate commands that accompany the Present Absolute or Present Relative Format structured field. The host application can select an alternate screen size by sending an Erase/Write Alternate command prior to the Present Absolute or Present Relative Format structured field.

  Using the name from this structured field, Local Format Storage searches the currently selected group directory for a stored format with the same name. The customer must ensure that the resultant format name matches the group name and format name specified in a Load Format Storage structured field.

  When Local Format Storage finds the specified stored format in the assigned group directory, the format presentation command (Write, Erase/Write, or Erase/Write Alternate) and WCC are extracted from the Present Format structured field and applied to the format. They are then passed to outbound data stream processing. The only modification that the 3174 Local Format Storage makes is to add the specified offset to each address-dependent order in the data stream if the structured field is a Present Relative Format structured field.

If this sequence is violated, or if a format with the exact name is not located, Local Format Storage returns an exception status as documented in 3270 architecture.

Additional Functions Provided

The Local Format Storage feature supports functions other than storage and presentation of screen formats.

Dynamic Format Building

The 3270 data stream may contain multiple Present Format structured fields, and each one is processed in its turn. The resultant format is passed to outbound data stream processing for each iteration of the Present Format structured field in the data stream. By issuing Present Relative Format requests with different offset values, the customer can cause recurring portions of a format to be presented in different locations on the screen.

Appending Application Variable Data

The host can send additional 3270 data to a terminal following the Present Absolute Format and Present Relative Format structured fields. This is supported by the host concatenating a 3270 data stream structured field to the Present Absolute Format or Present Relative Format structured field. When this occurs, the controller sends the data, unaltered, to normal outboard data stream processing after presenting the specified format.

Operator-Selected Formats

Because the stored format name is really a group name and format name, and frequently contains an embedded suffix, the operator does not necessarily know this stored format name. To accommodate operator selection of formats, the Load Format Storage structured field provides a means of optionally specifying a "local name" for formats. When specified as an operator-selected format, and operator-selected formats have been enabled in the Set Partition Characteristics structured field or by customization, the local name is treated as either:

- A pseudonym for a group name and format name (that is the default), or
- A local format name qualified by the currently selected group name.

Operator-selected formats improve performance significantly in that they eliminate both the transmission to the host that requests the format, and the transmission from the host that sends the Present Absolute Format structured field.

This function may not apply to all host applications. Certain host applications do not accept input from a format that is invoked locally rather than by an application. The customer must determine if this option can be used.

The 3174 Local Format Storage feature does not make any modifications to formats that are unique to a device. If operator-selected formats are used, the customer must ensure that the formats can be displayed without modification on the operator's screen.

The name search is initiated when the operator enters the data on a clear unformatted screen. If operator-selected formats have been enabled, the data is considered to be an operator request for a local format presentation. Up to eight characters can be used in the local name, and the name must be entered starting in the top left corner of the screen. No validations or translations are performed on the name entered.

A search is then made for a format with the local name, or for a format with the local name that is a member of the currently selected format group (depending on the parameters of the Set Partition Characteristics structured field). If a match is found, the format is sent to the display as though a Present Absolute Format structured field had been received from the host; if no match is found, the data is sent to the host in the normal fashion.

The controller uses either the Erase/Write or Erase/Write Alternate as its format presentation command; however, screen size is not changed for either command. The command is determined by the screen size flag in the Load Format Storage structured field that distributed the format to the 3174. The default WCC (X'02' – Keyboard Restore) is used, and after the format is displayed, the SNA and keyboard states are the same as before the local format request was entered. While the local format is being searched and displayed, the SNA remains in 'send' state, causing normal outbound requests from the host to be rejected with sense code X'081B' (Receiver in Transmit Mode).

Identification and detection of a locally-displayed format, when it is read by the host, is the responsibility of the host application. The host application must also ensure that the keyboard is restored following a Clear AID to allow the operator to enter local format requests.

If the Local Format Storage feature itself has been enabled through customizing, then the operator-selected formats function can be enabled in one of two ways:

- Through the 3270 Data Stream.

  The Set Partition Characteristics structured field enables the function and must be used to enable it for each host application or logical session. Once the operator-selected formats function has been enabled by the data stream, it remains enabled until one of the following occurs:

  - A Set Partition Characteristics structured field is received that resets it.
  - An Erase Write or Erase Write Alternate command is received with WCC=Reset.
  - A Bind command is received.
  - An Erase/Reset structured field is received.

- Through a Customizing Option (question 179).

  This option enables the function for all logical sessions on this host. Individual sessions cannot be selected through this option. Even though the function has been enabled through customizing, it can be disabled through the data stream and the Set Partition Characteristics structured field.

LFS Feature with Multi-Host Support

The functions available by Local Format Storage (LFS) on a 3174's primary host are also available on a secondary host provided the host is SNA. A secondary host can be either a host attached through a Concurrent Communication Adapter (host IDs 2A through 2D, 3A through 3D) or a host attached through Single Link Multi-Host Support (host IDs 1B through 1H). Depending on 3174 customizing, secondary hosts may be allowed to present formats that are managed by the primary host, or they may be allowed to load and present formats of their own.

- If the 3174 is customized so the primary host manages all LFS formats, a format requested by a secondary host is fetched from the primary host LFS buffer. If the requested format is not present in the primary host LFS buffer, a 'format not found' condition is reported by the 3174.

  A reply to a Format Storage Auxiliary Device query sent from the secondary host indicates that formats are managed by another host and that no format storage space has been allocated to the secondary host.

- If the 3174 is customized so the secondary host can present formats managed by the primary host with an option to load overriding formats, buffer space is allocated for the secondary host formats separate from that of the primary host. A format requested by a secondary host is then fetched from the secondary host LFS buffer. If the requested format is not present in the secondary host LFS buffer, the format is then fetched from the primary host LFS buffer. If the format is not found in either buffer, a 'format not found' condition is reported by the 3174.

  A reply to a Format Storage Auxiliary Device query from the secondary host indicates the amount of storage space allocated for secondary host LFS formats.

Limitations Imposed by the Local Format Storage

The following limitations are enforced:

- Destination/Origin ID and Load Format Storage structured fields are accepted only on LU address 1. Non-SNA configurations are not supported.
- Only one Load Format Storage structured field can be sent in a chain of data, and the chain must contain a CD indicator.
- Formats are stored only in controller storage—not on disk. Formats must be reloaded whenever the 3174 is initially loaded.
- Only partition 0 is supported.
- No display-unique modifications are made by the 3174 before presenting formats to the screen (such as removing color or extended highlighting attributes).
- The period character (X'4B') is removed from all names.

Structured Field Definitions

The following structured fields are used by the Local Format Storage feature:

- Destination/Origin
- Load Format Storage
- Select Format Group
- Present Absolute Format
- Present Relative Format
- Set Partition Characteristics
- Exception/Status (see "Exception/Status Reporting" on page 17-11)
- Query Reply (Format Presentation)
- Query Reply (Auxiliary Device)
- Query Reply (Format Storage Auxiliary Device)
- Query Reply (Partition Characteristics).

See Chapter 3, "3270 Structured Fields" for the details and contents of these structured fields.

Exception/Status Reporting

Exception reporting can manifest itself either as a sense code or an Exception/Status structured field, depending on where the error is detected. All errors in the processing of Format Presentation structured fields are reported by sense codes. Some errors in the processing of the Load Format Storage structured field are reported as sense codes, and some are reported by the Exception/Status structured field.

The LFS microcode is part of the base microcode at the data stream processing level. Load Format Storage requests that pass the checks performed at the data stream level and enter the LFS code are responded to by Exception/Status structured fields. Errors detected in the base data stream microcode result in sense codes.

See "Exception/Status" on page 3-37 for the exception and status codes returned in the structured field, and Appendix H, "SNA Sense Codes" for the sense codes and explanations.

Defining Format Storage Space

Storage for the Local Format Storage feature is allocated during 3174 customizing. The customizing response allows you to specify the total amount of storage that is to be set aside for formats and format directories for each host connection. The maximum allowable space (for the sum of all host connections) is 1.5MB.

For the customizing responses defining LFS storage, see question 179 in the *3174 Planning Guide*.

Storage Requirements for Local Format Storage

The amount of storage required for the various format entries is as follows:

Group Directory Entry — 88 bytes

The 16-byte group name is included in this figure. A group directory entry is allocated each time a new group name is specified in a Load Format Storage structured field (bytes 15-30) requesting an add format operation. Whenever the last format in a given group directory is deleted, the group directory entry is also deleted.

Format Storage Block — 50 bytes + format storage space

The 16-byte format name is included in this figure. A format storage block is allocated each time a new format name is specified within a group in the Load Format Storage structured field (bytes 31-46) requesting an add format operation. In addition to the figure shown, space for the format data is allocated as part of this block.

Note: The format storage block is allocated in 4-byte increments.

Local Name Entry – 32 bytes

The 8-byte local name is included in this figure. A local name entry is allocated when both a local name is specified in the Load Format Storage structured field (bytes 7–14) requesting an add format operation, and the local format selection flag (byte 4 / bit 2) is set. If the local format selection flag is not set, the data in the local name field is ignored and no local name entry is allocated. Whenever a format is deleted, its associated local name entry, if one exists, is also deleted.

General Directory Block – 86 bytes

Each host customized for format storage space requires 86 bytes of storage in addition to the space allocated for blocks and entries defined above. This space is allocated as control blocks and directories to be used in managing the storage reserved for this host.

Usage Notes

- An add format operation of the Load Format Storage structured field is rejected if:
  - The first character of the group name or format name field is either an Extended Binary Coded Decimal Interchange Code (EBCDIC) blank or a null character, or
  - The local format selection flag is set and the first character of the local name field is an EBCDIC blank or null character.

  No other restrictions regarding the use of special characters or embedded blanks apply to the name fields. Name fields are case-sensitive. You must ensure that format names are specified exactly the same in both the Load Format Storage and the Select Format Group, and in Present Format structured fields.
- The Local Format Storage supports *suffixing* with the CICS Outboard Formatting feature. This allows a period suffix to be inserted into a Group or Local Format name when that name is requested. Because of this support, the EBCDIC period character (X'4B') must not be used in Group or Local Format names, except when followed by a suffix character.
- If no format data is included in the structured field for an add format operation of the Load Format Storage structured field, the request is rejected.
- When a data error exception code (X'0807') is returned for an add format operation that is replacing an existing format, the format being replaced and its local name (if one exists) are deleted. This error occurs whenever an add format operation is attempted and there is no format data in the structured field, or if there is a structured field length error.
- If formats with the same local name are specified in different groups, the format found and displayed on a global local name search is unpredictable.

Chapter 18. Advanced Peer-to-Peer Networking (APPN)

Introduction

Advanced Peer-to-Peer Networking (APPN) is an enhancement to IBM's Systems Network Architecture (SNA) and type 2.1 (T2.1) node architecture. It allows inter-connection of systems of widely differing sizes into networks of a dynamic topology. The resulting network is easier to use, more reliable, and provides more flexibility.

The T2.1 node allows peer-to-peer connection of distributed processors, and provides the physical and session-level connectivity required for support of logical unit 6.2 (LU 6.2). Other LU types may be supported through a boundary node. T2.1 nodes use protocols with reduced system-customization requirements. For example, independent-LU protocols do not require pre-assigned session addresses, and ACTLU and ACTPU are not required from an external system. Link station roles can be negotiated using XID3 exchanges instead of requiring system-customization assignment.

APPN extends T2.1 node support to provide any-to-any connectivity across an APPN network. Within an APPN network, automatic network topology and directory support are provided to simplify network definition and permit dynamic route selection. An APPN network is composed of any number of end nodes and network nodes connected by links. End nodes contain session end points and applications. Network nodes maintain the network, provide routing and directory services for end nodes, and route intermediate sessions.

The 3174 APPN feature provides network node-to-network node communication over the Token-Ring and network node-to-low entry networking host communication using SDLC, Token-Ring, and S/370 SNA channel. The 3174 provides APPN network node (NN) services to low entry networking (LEN) end nodes and APPN end nodes, and performs intermediate session routing of data for sessions that traverse it. The 3174 NN performs distributed searches of the network to locate remote LUs and calculates the best route based on Class of Service. It also provides route selection, directory, and network management services for APPN end nodes (ENs).

Network node communication is an addition to current 3174 functions, and it can coexist with all other 3174 functions. See Figure 18-1 on page 18-4 for an example of an APPN network.

Software Requirements

To use APPN, VTAM and NCP must have the proper level of support:

VTAM(TM) V3R2 or later for SDLC
VTAM(TM) V3R3 or later for 4361, ES/9370, or VM S/370 channel
VTAM(TM) V3R4 or later for MVS/ESA S/370 channel
NCP V4R3.1 or later for 3725
NCP V5R2.1 or V5R3 or later for 3270 or 3745
APAR #VM45562 for VTAM V3R3
APAR #VM45886 for VTAM V3R3
APAR #VM45911 for VTAM V3R3.

Model Support

APPN is supported on 3174 Models 1L, 1R, 2R, 3R, 11L, 11R, 12R, 13R, 21L, 21R, 23R, 51R, 53R, 61R, 62R, and 63R.

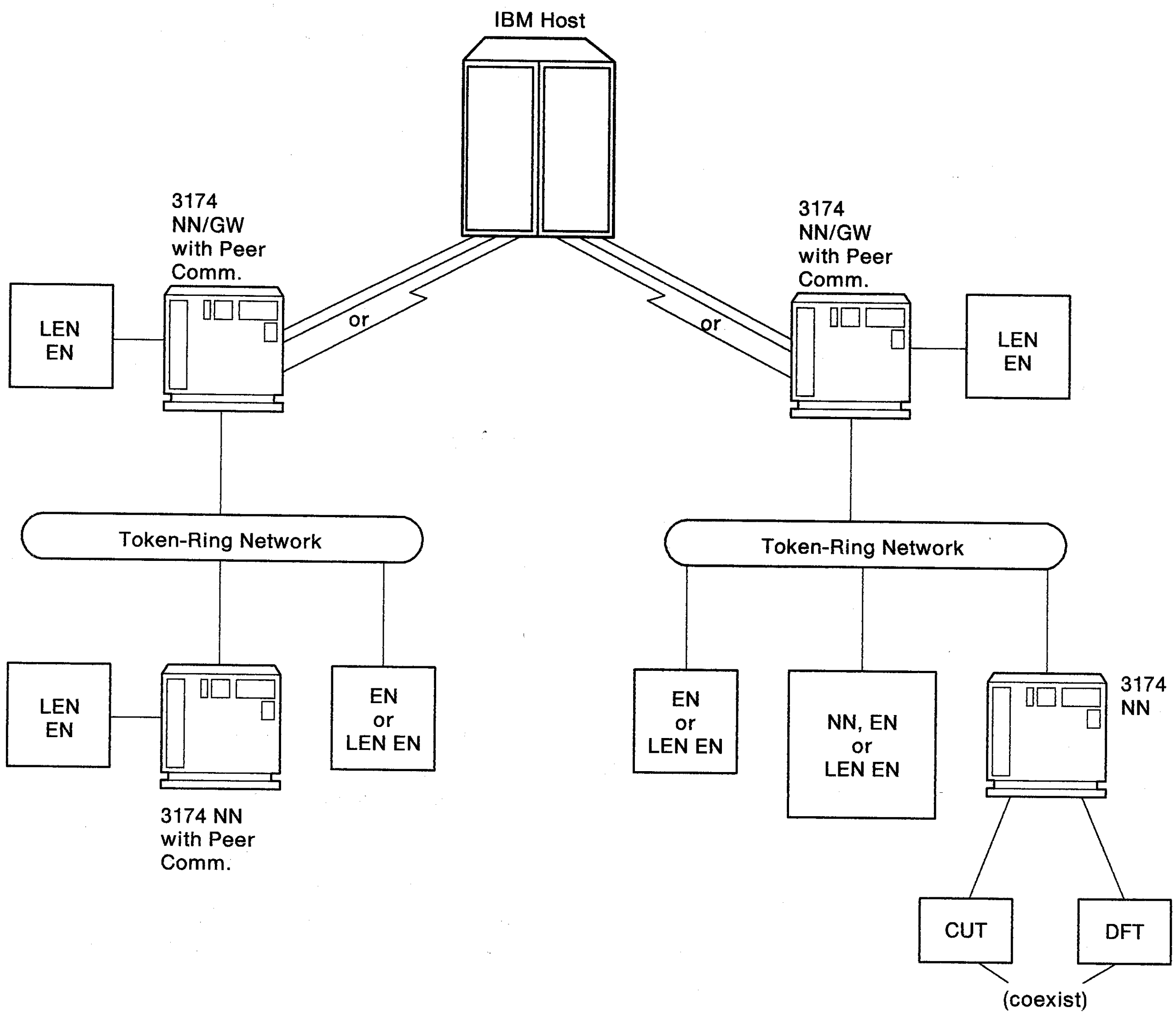


Figure 18-1. An Example of an APPN Network

Network Node Functions

An APPN network node (NN) connects end nodes into the APPN network. The NN provides directory, route selection, and management services to end nodes (ENs), and performs intermediate routing of data on sessions that traverse it. An NN performs distributed searches of the network to locate remote LUs and calculates the best route from origin node to destination node based on Class of Service.

The network node provides the following functions:

- Control Point
- Intermediate Session Routing
- LU 6.2 Services.

Control Point

Control point is responsible for managing the T2.1 node and its resources. In an NN, the control point communicates with its served end node and other NNs to provide:

- Control Point-to-Control Point Sessions
- CP Capabilities Exchanges
- Session Services
- Configuration Services
- Address Space Manager
- Topology and Routing Services
- Directory Services
- Management Services.

Control Point-to-Control Point Sessions

Adjacent APPN nodes throughout the APPN network use a pair of parallel control point-to-control point (CP-CP) sessions to exchange network information. All CP-CP sessions are used to conduct directory searches. Additionally, end node-to-network node CP-CP sessions may be used to register resources and to pass alerts between management services components. CP-CP sessions between adjacent network nodes are also used to exchange topology information. The result of the exchange of network topology information is the creation of the network topology database in each network node that holds the current network connectivity information.

CP-CP sessions are two LU 6.2 sessions that are parallel. When the CP-CP sessions are established, there is always one contention-winner and one contention-loser for each node. The purpose of the contention-winner session at each node is to allow network control information to be sent to the adjacent node without delay. Network nodes use CP-CP sessions to keep track of how nodes in a network are linked and also for directory and session services. A network node establishes its two parallel sessions with each adjacent network node and with each served APPN end node using LU 6.2 protocols and the CPSVCMG mode. An APPN end node establishes two parallel sessions with a single adjacent network node acting as its current server. Once a connection has been established, identification information is exchanged between the nodes, and CP-CP sessions are started between the control points in the directly attached network nodes.

When two adjacent nodes determine, via an XID exchange, that they wish to activate CP-CP sessions, Session Services in each node are responsible for:

1. Initiating the activation of a contention-winner CP-CP session with the other node, using the CPSVCMG mode name to identify a CP-CP session.
2. Using the contention-winner CP-CP session that is activated to send a request to the Session Services (SS) component in the other node for that node's CP capabilities. CP capabilities information describes the network functions (for example, management services capabilities) supported by that node and defines the basis of internode services and communications with that node.
3. Receiving the CP capabilities request on its contention-loser CP-CP session, and responding with the local node's CP capabilities, which are sent encoded in the CP Capabilities (X'12C1') GDS variable.
4. Notifying other node components (for example, Directory and Management Services) about the activated contention-winner and contention-loser CP-CP sessions, so that they may include the attached node in their operations.

Between any two network nodes in a network, there can only be one pair of active CP-CP sessions. If a network node is adjacent to one or more network nodes, it must have a set of parallel active CP-CP session with at least one of the adjacent NNs. LEN end nodes do not support CP-CP sessions.

CP Capabilities Exchanges

Immediately following the activation of the CP-CP sessions between the CPs in the two nodes, a CP capabilities exchange occurs on the CP-CP sessions. This exchange determines the extent of network services that each node supports, and provides the basis for future CP-CP communication between the nodes.

Each node requests the CP capabilities of its partner node over the CP-CP session it initiated (for example, the contention-winner session), and it includes its own CP capabilities in the request. Each node also sends its own CP capabilities when it receives a request for them over its contention-loser CP-CP session (for example, the CP-CP session initiated by the partner node).

A CP capabilities exchange is done using service transaction programs (TPs). The node that initiated the CP-CP contention-winner session requests the CP capabilities of the partner node by means of the REQUEST_CP_CAP_TP transaction program.

Session Services

The primary function of Session Services (SS) is to assist in initializing and terminating CP-CP and logical unit-to-logical unit (LU-LU) sessions. It provides session initiation information to the session manager (SM) at the endpoints of a session, and to the session connector manager (SCM) in each of the intermediate nodes along a session path. Session services interfaces with directory services, topology and routing services, and configuration services components in performing its session initiation functions. In addition, SS is responsible for CP-CP session management and generates Fully Qualified Procedure Correlation Identifier (FQPCID). (See "Fully-Qualified Procedure Correlation Identifier (FQPCID)" on page 18-23 for more information.)

Configuration Services

Configuration service (CS) is responsible for establishing, managing, maintaining, and terminating the local links that are connected to this node. To manage the local links, CS interfaces with other components to activate and deactivate the links, and also performs the appropriate process if the link failure has been detected. (See "Link Activation" on page 18-12 for more information.)

Address Space Manager

The address space manager (ASM) manages all the address space tables being used by the node. For each link in the node, there exists one address space. Each address space contains a set of Local Form Session Identifiers (LFSID). (See "Routing Data in the Network" on page 18-20 for more information.) For each LU 6.2 session, a unique LFSID is assigned for the duration of the session only. Additionally, ASM handles the routing and pacing of Binds and Unbinds.

Topology and Routing Services

In a Network Node (NN), Topology and Routing Services (TRS) is responsible for creating and maintaining the Class of Service (COS) database and a copy of the network topology database. The COS database contains an entry for each COS defined at the node. The network topology database (TDB) contains the current topology of the intermediate routing portion of the network. The TDB contains entries for the containing network node and all transmission groups (TGs) attached to the node, and for all other NNs and their attached intermediate routing TGs.

Topology Database Manager: CP-CP sessions between network nodes are used to exchange information to build and maintain a topology database. The network topology database is replicated in all network nodes in the APPN network. The topology database is kept current by transmitting updates among all network nodes whenever a new resource is activated or deactivated, or when characteristics of a resource change. This is accomplished by broadcasting topology database updates containing node and link characteristics and sequence numbers for each resource. The local configuration of local resources for which the network node is providing network services is also maintained. This information is unique to the node and never broadcast to other network nodes.

Class of Service Manager: At session-initiation time, the Bind sender requests a type of service by specifying a mode name. This mode name, besides implying various other session characteristics, is associated with a class of service (COS) definition that is used to determine the most desirable route between the origin and destination nodes of the session. The COS definitions specify the characteristics that nodes and links must possess to be included in the route selected for the session. This allows the route selection algorithm to first determine if a node or link is acceptable, and then, from the set that is acceptable, to calculate the best route dynamically.

Because COS definitions may vary, different sessions may use different routes between the same origin and destination nodes, depending on the associated COS selected.

The COS database is an unordered list of entries for COS names. There is one entry in the COS database for each COS name. A COS entry contains the following fields:

- The COS name
- The transmission priority associated with the COS
- The definition for the COS.

For additional information on COS, refer to the *3174 Planning Guide*.

Route Selection Services: A network node uses the network topology database to compute routes for sessions that originate at the LUs in it and at the end nodes that it serves. Each route that a network node computes is the current least-weight route from the node containing the origin LU to the node containing the destination LU. In order to provide an appropriate path through the network, the algorithm used to select the route first weighs TGs and nodes. The weighing algorithm computes a scalar value for each node and TG based on the relative significance of the characteristics for the request class of service.

Route Selection Control Vector (RSCV) contains the route computed by Route Selection Services (RSS) and is carried in the Bind to describe the route that a session is to take or has taken. The RSCV contains the following fields:

- Control vector length
- RSCV key
- Maximum hop count (number of TG descriptors in the RSCV)
- Current hop count (number of the last TG descriptor control vector processed)
- A list of TG descriptor control vectors.

Directory Services

A T2.1 network node provides directory services to the LUs located in it and to the LUs in the end nodes that it serves. It also assists in the directory services provided by the other network nodes in the network by responding to received directory search requests when the resource named is found in the local directory. The local directory maps an LU name or other resource name to the CP name of the node at which that LU or resource is located.

Upon receiving the name of a destination LU—in Bind from a LEN end node or in a locate search request from an APPN end node—the network node either verifies its current location if the LU is represented in its directory, or enlists the cooperation of all other network nodes when its destination is unknown. The verification is done by sending a directed locate to the destination network node server or by sending a broadcast search to every adjacent network node, each of which in turn propagates the broadcast and returns replies indicating success or failure. For its future needs, a network node caches information collected from prior broadcasts and changes information failing the verification process; this keeps the distributed directory up to date and adapted to actual use. When a fixed disk is available, the directory cache is copied from RAM storage to the fixed disk based on activity. When the controller is re-IMLed, the cache is refreshed to RAM from the fixed disk.

An entry can enter a node's directory services database in one of the following three ways:

- By customizing
- By resource registration from an APPN end node to its network node server
- By caching within the network nodes the results of directory searches.

There are three kinds of entries in the directory for APPN nodes. They are listed below in hierarchical order:

Local resources
Local resources are resources in the node. Each entry for local resources in the directory includes the resource LU name.

Network node control point (NNCP) domain resources
NNCP domain resources are EN resources that this NNCP supports. Each entry for NNCP domain resources contains the resource (LU) name and the CP name at which the resource is located.

NNCP cross-domain resources
Each entry for NNCP cross-domain resources contains the resource (LU) name and the CP name at which the resource is located, and the NNCP that provides directory and session services for that CP. The 3174 supports up to 64 different NETID entries.

Management Services

Control Point Management Services (CPMS) is a component of Control Point that provides facilities to assist in performing various management services functions. This component of the Control Point interfaces with Session Services and Directory Services to accomplish its tasks. Each component in the node is responsible for providing unsolicited notification of protocol Alert conditions to this component.

The 3174 NN provides support for the Management Services (MS) application layer and the MS transport layer for handling MS data. MS applications may reside in Entry Point Nodes and Focal Point Nodes. Entry Point Nodes may be defined as Network Nodes or End Nodes. These applications are used to pass MS messages within nodes and/or between nodes. The applications are defined as pairs known as Function Set Groups. Multiple Domain Support (MDS) is supported as the transport layer. MDS determines whether application messages are be routed within the node or routed externally to another node.

The following MS applications and Transaction programs are supported:

- EP_Alert
- Alert_Netop
- MS_Caps
- MDS Receive
- MDS Send
- MSU Handler.

APPN Alerts: All APPN alerts are Generic Alerts and are generated in CP_MSU format. Generic Alerts are transformed to NMVTs and sent to NetView on the SSCP-PU session. The focal point product (NetView) for the 3174 NN must support pre-generic alert formats as well as generic alerts, since the current 3174 alerts will not be converted. These alerts will be transported on the SSCP_PU session.

For the format of the Generic Alerts, see "Generic Alert Message Format" on page 12-45. For a listing of these alerts, see Appendix G, "Generic Alerts."

Transport of Management Services Data: The CP-CP session between the 3174 NN and its served End Nodes is used for the transport of management services data. However, the 3174 NN must be adjacent to the boundary function and the SSCP_PU session is the only session supported between the 3174 NN and NetView for the transport of management services data.

Management Services Data Formats Supported: All management services data flowing between the 3174 NN and NetView is in NMVT format. Any alerts received from End Nodes or generated by the 3174 NN may be segmented when they exceed 256 bytes.

Alerts received from End Nodes supporting Multiple Domain Support (MDS) will be received as an MDS_MU GDS message. This structure consists of the MDS header, UOW correlator GDS, and the CP_MSU. When MS capabilities are exchanged between the 3174 NN and its served ENs, the CP name of the 3174 NN will be indicated in the "E1" subvector for these flows.

For migration Control Points not supporting MDS, alerts are received from these nodes as CP_MSUs without the MDS header. The MSU_Handler transaction program processes these alerts.

CPMS Functions: The following functions are performed by the control point for Management Services in a Network Node:

- Receive unsolicited MDS_MUs from served end nodes and transform them to NMVT format to send to NetView on the SSCP-PU session.
- Receive unsolicited CP_MSUs from migration Control Points and transform them to NMVT format to send to NetView on the SSCP-PU session.
- Log unsolicited MS data generated by the node.
- Send all unsolicited MS data generated by the node to NetView.
- Queue alerts that flow on the SSCP-PU session between the 3174 and NetView. When resources are exhausted, the queues are pruned.

Intermediate Session Routing

Intermediate session routing (ISR) in APPN is a network node-only function that participates in setting up the two session stages, and is involved in certain session protocols, such as session pacing, after the session is set up. Intermediate session routing accepts traffic on one session stage and passes it to another. Since each session stage varies in RU sizes, flow control, and required outage notification, ISR is responsible for such functions as segmenting and supporting adaptive session pacing.

The ISR component is divided into two functions: Session connector manager (SCM), and session connectors (SC). The SCM performs the processing necessary, at an intermediate node, for activating and deactivating sessions. The SC performs functions necessary to receive message units from one path control (PC) and send them out on a different PC.

Session Connector Manager: The session connector manager (SCM) is responsible for activating and deactivating a session by negotiating Binds, allocating and freeing resources, and processing Unbinds. To support some LEN end nodes, SCM transforms non-extended Binds to an extended form.

Session Connector: The session connector (SC) is created and initialized by the SCM when an intermediate session is established. It remains in existence for the duration of the session transferring message units (MUs) between two path controls. Since many sessions can be running concurrently through an NN, multiple session connectors are used.

LU 6.2 Services

The architectural definition of an APPN T2.1 node provides for the existence of multiple LUs (all type 6.2) in the node. Some are LU 6.2s which service end users and applications or service transaction programs. In addition, the T2.1 control point itself contains an LU 6.2 for communication, along with other control points and focal point nodes in the APPN network.

The 3174 Network Node contains a single independent LU 6.2 with parallel session capability. This LU supports the T2.1 Control Point and can serve as the LU for CSCM. The only LU 6.2 application supported is the 3174 Central Site Change Management function.

Service Transaction Programs: Service transaction programs differ from user-application transaction programs in that they are SNA-defined and are considered part of the LU. The 3174 NN supports the following service transaction programs:

- CNOS
- Request CP Capabilities
- CP Capabilities
- Deactivate Session
- Resource Registration
- Send Network Search
- Receive Network Search
- Broadcast TDU
- Receive TDU
- MDS Send
- MDS Receive
- MSU Handler
- SNADS SEND and RECEIVE.

LU 6.2 Support: The 3174 supports the LU 6.2 base function for basic conversations. The 3174 LU 6.2 also supports parallel sessions and CNOS (as a target LU), T2.1 nodes, and all of the LU 6.2 towers required to support APPN. The 3174 LU 6.2 implementation has a closed protocol boundary.

Dynamic definition of partner LUs and modes is also supported. Therefore, partner LUs and modes do not have to be customized within the 3174.

For a list of the supported modes and their defaults, see "SNA-Defined Mode Name Defaults" on page 18-30. For information on 3174-specific bind negotiation and bind checks, see "LU 6.2 Bind Formats" on page 18-31.

3174 Network Node Services

Network nodes provide not only 3174 NN services to other NNs, but also a number of APPN functions for end nodes and LEN end nodes in order to enable them to participate in an APPN network.

The following 3174 network node services are discussed:

- Link activation
- Network node server
- Wildcard routing.

Link Activation

The activation of APPN networks is arbitrary in nature. APPN nodes become active network components by the decisions of their local operators to join the network.

Control points (CPs) activate, control, and deactivate links through the link stations (data link control elements) in the node. To activate a link, configuration services in the CP causes data link control to issue link-level commands to the link station for that link. Once a link between adjacent nodes is activated, that link can carry session traffic.

Phases of Link Activation: Link activation involves three phases: connect, prenegotiation, and contact. Figure 18-2 on page 18-13 illustrates these phases of link activation.

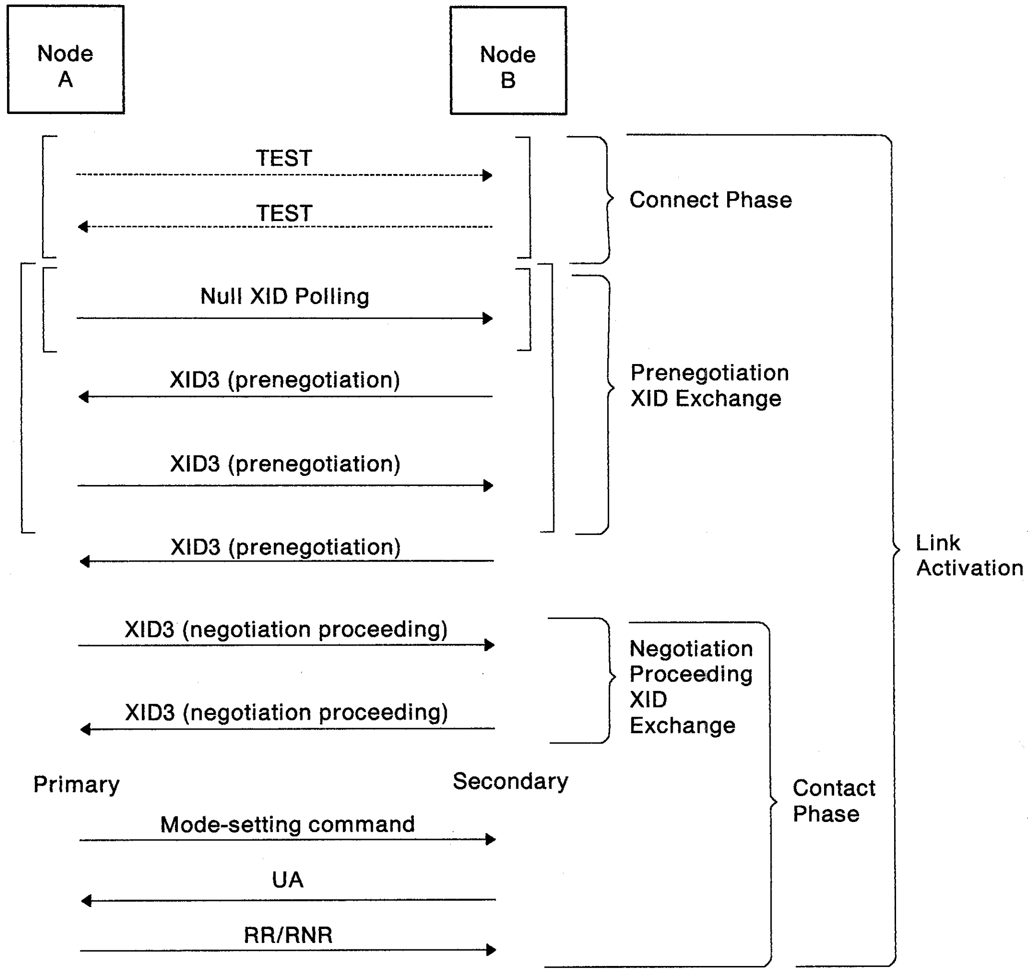


Figure 18-2. Phases of Link Activation

The connect phase allows initial establishment of communication between nodes.

The prenegotiation phase is begun with a poll to determine if the adjacent node is active. Type 2.1 nodes use a null XID poll to determine if the adjacent node is also a T2.1 node. If the adjacent node is a T2.1, it responds with an XID type 3 (XID3) with the exchange state indicators field set to "prenegotiation."

During the contact phase, link station roles, link characteristics, and certain node capabilities are conveyed by exchange ID commands and responses. The contact phase is completed when the primary link station sends a Set Mode command to the secondary link station, and the secondary link station returns an Unnumbered Acknowledgment (UA) response to the primary link station.

Exchange Identification (XID) Commands: Exchange Identification commands and responses enable communicating link stations to establish mutually acceptable link station roles and link characteristics, and to convey certain node characteristics and capabilities prior to the transmission of data. XID3 is used for exchanges between type 2.1 nodes. See "XID3 Format" on page 18-40 for details on the setting and checking of XID3.

Examples of node and link characteristics include:

- Segmentation and reassembly capability of the node
- Maximum message sizes allowed on the link
- End node or network node capability for APPN nodes.

Link station roles and certain link characteristics are negotiable on links between particular node types. The capability of certain nodes to negotiate eases the tasks of system customization and network maintenance because parameters that are negotiated need not be predefined. Negotiation takes place during the contact phase through XID command and response exchanges. After XID exchanges on a link are complete, the nature of all negotiable parameters on that link have been decided.

During initial link-activation XID exchange, before link station roles have been determined, the link station roles may be primary, secondary, or negotiable. Nodes that contain primary or negotiable link stations initiate polling. A node receiving a null XID responds with an XID3. The Exchange State Indicators (ESI) of XID3 may be set to either prenegotiation exchange or negotiation-proceeding exchange.

A node may elect to send a prenegotiation XID3 without a prior null XID if it knows that the adjacent node is able to accept an XID3. With or without a null XID, the optional prenegotiation exchange is concluded after both nodes have sent and received a prenegotiation XID3. This exchange allows each node to verify the identity of the adjacent node. Any node that requires such verification will not begin to send negotiation-proceeding XID3s until the verification has been completed, even though the adjacent node may be sending negotiation-proceeding XID3s. During the prenegotiation exchange, only the node identification information – the CP name in the Network Name control vector appended to XID3 or the Node Identification field of the fixed part of XID3 – is required to be valid.

XID3 negotiation is performed by APPN nodes to establish the primary and secondary roles of the link stations, the TG number, and other characteristics of the link. The result of the primary-secondary role negotiation determines which node will send the mode-setting command and is also used in setting the value of the ODAI bit in the LFSID. On TGs using Normal Response Mode (NRM) link stations, the primary link station controls the link.

Network Node Server

A network node that provides APPN functions for an EN or LEN end node is called a network node server for that node. The 3174 regards all ENs as authorized. An NN that is a server for a node performs routing and directory services for that node.

APPN End Node Support: The functions performed by a network node server for an EN with a CP-CP session capability are:

1. T2.1 link connection—Once a T2.1 link connection is established, the EN can use this link to transport multiple, parallel, or LU 6.2 session traffic for independent LUs.

2. CP-CP Sessions—To perform services for APPN ENs, the control points activate CP-CP sessions between themselves. Depending on the capability of the EN to support parallel sessions, one or two sessions using LU 6.2 protocols are requested. Once established, capabilities of the control points are exchanged.

3. Resource Registration—In order for a network node to provide service to end nodes within its domain and to respond to search requests from other NNs, a server must know the resources of the end node. To avoid querying each EN for a destination LU, an EN registers its resources with its serving NN. The NN stores this information in the local portion of its directory. When CP-CP sessions are terminated, the server deletes these registered resources. Registration of resources eliminates the need to customize LU names, thereby allowing LUs to be dynamically added or changed in the network.

4. Directory services and preferred route selection:

   An NN server will perform directory searches in order to locate a remote LU name specified by an adjacent EN. An EN with a CP-CP session to an NN server need not manually configure any remote locations with which it may require a session.

   When an EN sends a search request to the NN server for a session with a remote location, the following process takes place:

   a. The EN sends a search request to the NN server for a session with a remote location, along with information about the mode and COS table to be used for the session.

   b. Directory services on the NN server searches its directory database for the remote LU specified. If the remote LU is not found, the server forwards the search request (as a broadcast search) through the network to adjacent NNs in order to find the specified remote LU. Search requests are not sent to ENs unless the NN has previous knowledge of the requested LU residing in the EN.

      If the remote LU is found in the local directory database of the server, a directed search is sent to the remote LU to confirm that the directory information is still correct.

   c. The search request is returned to the network node server with a positive response and information about the CP that owns the remote LU, and the NN server also selects the preferred route from the EN to the remote CP, based on the COS information specified by the EN when the search request was initiated.

   d. The server then returns the search request to the EN with a route selection control vector (RSCV), which contains information about which route should be taken in order to establish a session between the local and destination LUs.

   e. The EN then sends the Bind with the RSCV attached to the specified LU along the preferred route as if it were an NN and had performed the work itself.

5. Network Problem Management is performed by an EN sending alerts to its NN server. The NN server then forwards EN alerts to a focal point. The NN server exchanges management services capabilities with an EN and identifies a focal point. The transport for network management on CP-CP sessions is multiple domain support. The EN transports alerts on its CP-CP session to its NN server. The 3174 NN uses its PU-SSCP session to transport these unsolicited alerts received on the CP-CP session from an EN to the NetView focal point. Note that an EN can establish its own session with a focal point for transporting alerts.

LEN End Node Support: A LEN EN does not have CP-CP session capability with an NN server so there is no way of transferring certain APPN information. Therefore, a LEN EN has reduced capabilities in comparison to an EN with a CP-CP session.

The functions performed by a network node server for a LEN EN are:

1. T2.1 link connection—Once a T2.1 link connection is established, a LEN node can use this link to transport multiple parallel, or LU 6.2 session traffic for independent LUs.
2. There are no CP-CP sessions to a LEN EN.
3. The LEN EN cannot send its local LU names to the NN server. The server cannot automatically register LU names of the adjacent ENs.

   The NN server should have configured the local LUs of the LEN EN so that it can respond to the search request on behalf of the LEN EN. However, network node servers cache results of directory searches. Therefore, once a LEN EN identifies an LU (by a Bind to the NN server), then the NN server can respond to directory search requests for that LU. See "Directory Services" on page 18-8 for details.
4. The LEN EN cannot send or receive a search request to locate a remote LU name. Therefore, the LEN EN must send a Bind to the NN server. When the NN receives the Bind, it will then perform directory services. Once the NN server has found the remote LU specified in the Bind, it selects the preferred route, attaches the RSCV, and forwards the Bind through the network transparently to the LEN EN.

   The NN server will not return the RSCV to the LEN EN when the preferred route is calculated. An NN server will perform preferred route selection for the LEN EN, but only in a limited capacity. When the server receives a Bind from the LEN EN, it will calculate the preferred route from the NN server to the target node based on the mode table specified by the LEN EN when it sends the Bind. It will then attach the RSCV to the Bind and forward it to its destination. Therefore, the session must travel the route by way of its network node server, not directly from the LEN EN to the target node. All LEN end node session traffic must go through the NN.
5. There is no network management support for LEN end nodes.

For additional information on directory services, see "Directory Services" on page 18-8. For additional information on routing see "Topology and Routing Services" on page 18-7.

Wildcard Routing

Wildcard routing is the ability for a 3174 Network Node to service resources that are not known explicitly in the APPN network.

Currently, VTAM/NCP subarea does not support CP-CP sessions on its T2.1 link connections and, therefore, cannot register LUNAMES or process LOCATE search requests. A wildcard option in the 3174 network node that is boundary attached to the subarea allows access to the host LUs.

When an NN server cannot locate a resource in the APPN network, it can calculate a route to the NN that indicated a wildcard response. The NN server cannot verify that the LU will be found, but if the LU is located in the subarea or defined to the subarea as in another APPN network attached to the subarea, then the subarea can route the Bind. If the LU is not found, the Bind will fail.

There are some cautions for using wildcard routing:

- Only one node in a connected APPN network may have the wildcard option.
- Since the NN server cannot verify the LU location, caching is not done. Therefore, a broadcast search is always initiated for this resource.
- Since the route is calculated to the NN with the wildcard option, all traffic for these resources must be routed through this one node.
- The AS/400 refers to the wildcard option as *ANY Routing. If an AS/400 is in the connected APPN network with the *ANY option, then there cannot be a 3174 in the network with the wildcard option (response to question 612 = 1).

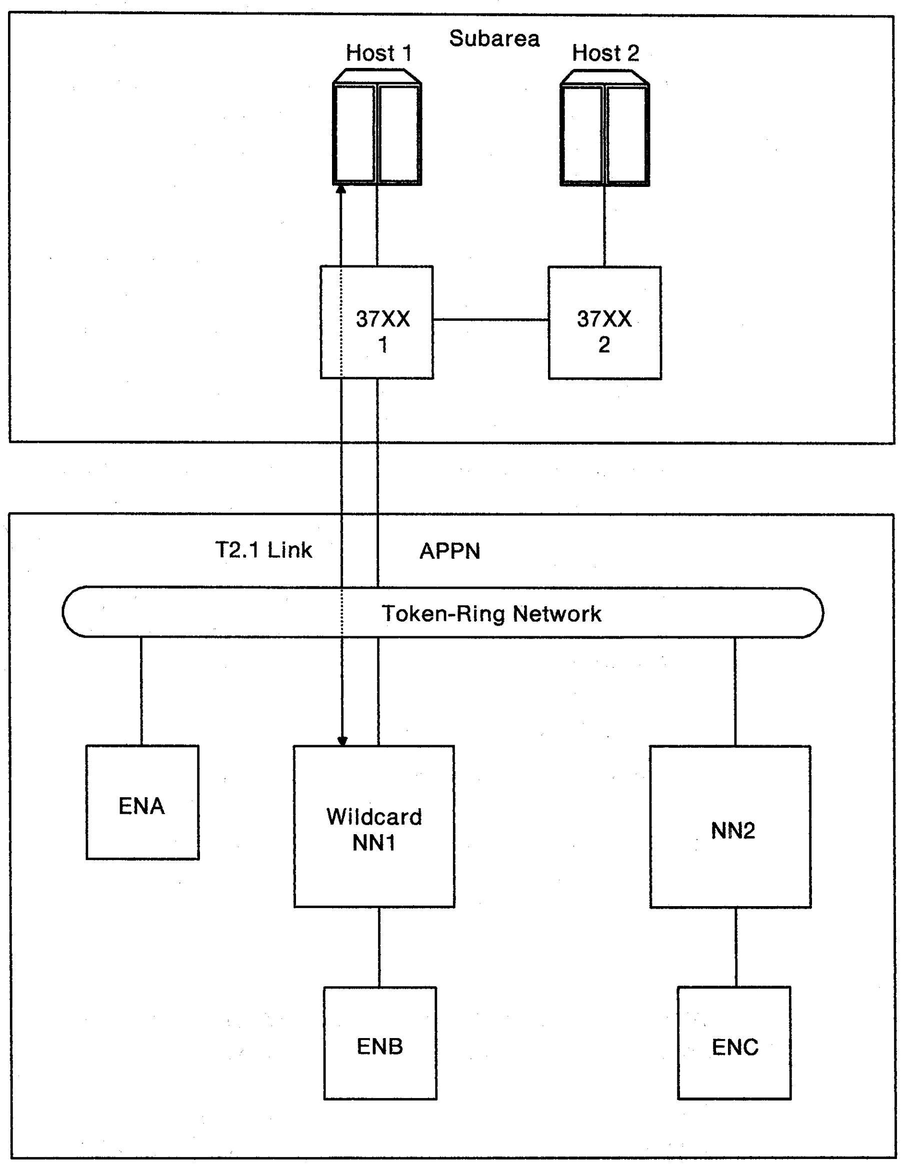


Figure 18-3. NN1 with Wildcard Entry

Figure 18-3 on page 18-17 represents a single link from an APPN network to a subarea network—NN1 to 37XX1 to HOST 1. All LUs in the connected APPN network that desire connectivity to or through the subarea must be defined at the host on the T2.1 link between NN1 and HOST 1. To access host LUs, the following occurs:

ENC sends locate Host LU to serving NN2
NN2 does a broadcast search
NN2 receives wildcard reply from NN1
NN2 calculates a route from ENC to NN1 to Host.

Note that NN2, although also boundary attached, cannot respond because it does not contain the wildcard. In addition, all APPN-subarea traffic passes through NN1. For example, ENC traffic is routed through NN2 to NN1 to Host 1.

Data Transport

The transporting of session data from one session endpoint, or half-session (HS), to the other is the responsibility of the transport network; this includes data link control (DLC), path control, and every session connector (SC) between endpoints.

The function performed by the transport network and the CPs in support of the transport network include:

- Management of data flow
- Congestion control within the network
- Segmentation and reassembly of messages to match link characteristics.

To manage the flow of data over a network, APPN support uses adaptive session-level pacing and transmission priority. The pacing occurs between each pair of adjacent sessions (HS and SC) components independently. Transmission priorities are controlled by path control for each transmission group along the session route.

Session-Level Pacing

Session-level pacing moderates traffic between end users to prevent an overrun of logical unit buffers. It is a local flow control algorithm implemented by transmission control in the LU 6.2. Session-level pacing enables a receiving half-session to control the rate at which it receives requests. The purpose of session-level pacing is to prevent one half-session from sending data faster than the receiving half-session can process it.

Session-level pacing is selected when a session is activated. The sending of half-session then initiates pacing by sending a pacing request in the first message unit of a pacing window. While transmitting message units, the sending of half-session (HS) keeps a running count of the number of message units that are left to send in a pacing window. The residual number of message units is called the pacing count. When the receiver returns a pacing response after having received the pacing request, it indicates that it is ready to accept an additional window. If the receiver delays returning the pacing response, it indicates that it is not ready to accept the next window. Upon receiving a pacing response, the sender first completes sending the number of message units remaining in the residual pacing count. It then sends the next pacing window.

An LU-LU session can be paced in both directions. The pacing of requests flowing toward an LU is called inbound pacing for that LU. Similarly, the pacing of requests flowing away from an LU is called outbound pacing. The window sizes do not have to be the same for the two directions. The maximum window size is 127.

Adaptive Session-Level Pacing

Adaptive session-level pacing allows a variable window size and adapts to the level of congestion. With adaptive session-level pacing, an APPN node can dynamically set the window size to any value from zero up to the maximum allowable size. This permits a node to control the amount of data that is sent and received during normal session operation. The window control allows the receiving node to manage the rate at which it receives data into its session buffers. Adaptive session-level pacing provides a node supporting many sessions a dynamic means to allocate resources to a session that has a burst of activity, and to reclaim unused resources from sessions that have no activity. Adaptive session-level pacing allows the receiving node to use its available buffer resources efficiently.

Because each session stage between the endpoints is independently paced, both endpoint nodes and intermediate nodes can adapt the pacing for the sessions they handle in accordance with their own local congestion conditions.

Window size flexibility is achieved by the use of a message called the isolated pacing message. An isolated pacing message (IPM) not only authorizes the sending of the next window of message units, but also specifies the next window size. When the IPM is received by a sending node, the sender increases its pacing count by the value contained in the IPM. APPN nodes respond to pacing requests exclusively by use of the IPM, not by use of normal-flow message unit headers.

IPMs transmitted by a receiver to respond to the sender's solicitation for permission to send another window of message units are called solicited IPMs. When a receiving node becomes congested, however, it can send an IPM regardless of whether there is an outstanding pacing request. IPMs transmitted to change the sender's pacing window due to congestion in the receiver are called unsolicited IPMs. A third type of IPM, called a reset acknowledgement IPM, is used to acknowledge the receipt of an unsolicited IPM.

Adaptive Bind Pacing

Session-level pacing cannot be invoked for traffic not flowing on sessions – such as the Binds used to activate them. However, Bind traffic itself can occur in bursts, particularly at node or network start-up, and so adaptive bind pacing exists to control the flow of Binds between two adjacent nodes. The same window algorithm used for session-level pacing is employed. Only one instance of adaptive Bind pacing is active for a given transmission group and it is managed by the address space manager at each node.

Transmission Priority

The transport network also allows message units to be transferred through the network at different priorities.

APPN allows the user to define a network priority and (via the class-of-service description) three session-level priorities: high, medium, and low. The transmission priority is carried in the session activation request (Bind) at session establishment, allowing the two halves of the session and each session connector along the session path to store the same transmission priority.

Path control maintains transmission priority queues for each TG over which it sends message units. It places outgoing message units in the appropriate priority queues (based on their corresponding sessions), where they get dequeued for transmission over the TG according to the priority of their queue. To ensure that lower-priority message units are not preempted indefinitely by higher-priority message units, an aging mechanism is also used.

Segmentation and Reassembly

3174 NN supports segmentation and reassembly. If segmenting is supported by a T2.1 node, session traffic and non-session traffic (Binds) may be segmented. Segmenting of basic information units (BIUs) into smaller BIU segments is performed in order to transmit message units (MUs) longer than the maximum-size BTU allowed by a particular link. These segments are reassembled into whole BIUs at the partner node.

Bind Segmentation and Reassembly

Segmentation and reassembly of Bind requests and responses is provided by 3174 NN. Like segmentation and reassembly for other basic information units (BIUs), Bind segmentation and reassembly uses the Mapping field in the FID2 transmission header.

Bind segmentation occurs when a SM or SCM sends a Bind BIU of a length too great to fit in the maximum-size basic transmission unit (BTU) allowed by the TG over which the Bind is to be sent. Whether or not the SM sends a Bind BIU larger than a single BTU can carry depends on whether or not the adjacent node supports Bind reassembly, which is specified in the XID.

Routing Data in the Network

Once a session is initiated and a route is selected for the session, then data can begin to flow on the session. During data transfer, each intermediate node along the route performs the routing function. For an intermediate node to determine the next transmission group to which a message unit should be sent, routing information must be present in the node. Within subarea networks, routing information is statically defined to all intermediate subarea nodes, and is changed only by redefinition. In contrast, the routing information in intermediate APPN network nodes is dynamically defined during session activation, and is maintained only as long as the session for which it was created.

Like routing in subarea networks, routing in APPN network uses both information carried in the transmission header (TH) of the message unit and information stored at the intermediate node. The two methodologies differ, however, in terms of the nature of the information carried in the TH and stored in the node. Routing information in a subarea network is route-oriented. The TH carries destination and route identifiers which are compared to those in the routing tables. By contrast, routing information in APPN networks is session-oriented. The TH carries session identifiers that are temporarily associated with transmission groups for the duration of the session.

An APPN node contains one path control element per transmission group. Since multiple sessions can flow concurrently on a transmission group, each path control element is responsible for maintaining multiple concurrent sessions. To uniquely identify a session, an address space manager assigns a session identifier called a local-form session identifier.

Local-Form Session Identifiers

A local-form session identifier (LFSID) is a 17-bit value used by path control to uniquely identify a session on a session stage. A session stage is a part of a session that extends from a path control element in one node to the corresponding path control element in the adjacent node. A session can therefore be thought of as a sequence of session stages extending from the origin node to the destination node. For a given session, the origin and destination nodes each control one session stage, and each intermediate node controls two.

The LFSID is composed of a 1-bit origin-destination assignor indicator and a 16-bit session identifier. The origin-destination assignor indicator (ODAI) bit divides the address space so that one node can use all possible combinations. The LFSID for a session stage between two nodes is assigned during session activation when the Bind message flows between the nodes. The address space manager in the sending node assigns the LFSID, and the address space manager in the receiving node accepts the LFSID as its own identifier for the session. But Binds can, of course, flow in both directions on a transmission group. Therefore, a mechanism is required to prevent the two path control instances on either side of a link from assigning the same identifying value for two different sessions.

The mechanism that prevents ambiguity between session identifiers on a session stage is the usage of the ODAI bit. Through XID exchange at link activation time, APPN nodes negotiate the value of the ODAI bit each node assigns. The path control element in one node owns the value "0" and the path control in the other node owns the value "1." Thereafter, for as long as the link is active, each node assigns LFSIDs using the ODAI bit it owns. This prevents session stages for two sessions between the same pair of adjacent path control elements from ever being assigned identical LFSIDs.

The 16-bit session identifier of the LFSID is composed of:

An 8-bit session identifier high (SIDH) value
An 8-bit session identifier low (SIDL) value.

Table 18-1 on page 18-22 summarizes the SIDH and SIDL usages.

Table 18-1. T2.1 Node LFSID Address Space Assignments	
SIDH, SIDL	**Usage**
X'00', X'00'	Used for SSCP-PU session
X'00', X'01' through X'00', X'FF'	Used for SSCP-LU sessions
X'01', X'00'	Used for BIND flow control
X'01', X'01' through X'01', X'FF'	If the link us used for dependent LU traffic then Used for dependent LU-LU sessions Otherwise Used for CP-CP and independent LU-LU sessions
X'02', X'00' through X'FE', X'FF'	Used for CP-CP and independent LU-LU sessions
X'FF', X'00' through X'FF', X'FF'	Reserved

Session Connectors

An intermediate network node is located at the junction of two session stages, and must therefore route message units pertaining to the session between the two stages. The component in an intermediate network node that is responsible for routing between session stages is the intermediate session routing component (ISR). Since multiple sessions can be running concurrently through an intermediate node, the ISR contains multiple session connectors to handle the sessions.

A session connector is a component in the ISR of an intermediate network node that connects two stages of a session. At any one time, there exists one session connector in an ISR for each session running concurrently through the ISR. When a message unit is received by a session connector, the transmission header (TH) of the message unit carries the LFSID of the session stage over which it was just received. It is the responsibility of the session connector to pair the LFSID of the inbound session stage to the LFSID of the outbound stage. The session connector then passes the paired LFSIDs to path control for encoding into the TH of the message unit. To enable this association to be made in the session connector, the two LFSIDs are stored during session activation.

Building Session Connectors

When a Bind request is created, an LFSID for the first session stage is assigned at the origin node and passed along with the Bind. When the Bind is received by an intermediate network node, the LFSID is extracted from the Bind and saved, and a new LFSID is assigned for the outbound session stage, replacing the old LFSID in the Bind. When the destination node receives the Bind request, it extracts the LFSID from the Bind and saves it. At this point all LFSIDs for the session have been assigned, but the session connectors are not yet completely initialized.

When the Bind response is sent out from the destination node, the same LFSID that was received by it is placed in the Bind response. When the response is received by an intermediate network node, it swaps the LFSID in the message for the one pertaining to the next session stage on the return route, completes session connector initialization, and sends the Bind response on its way. When the origin node receives the Bind response, all session connecters have been initialized and are ready to route data on the session.

Fully-Qualified Procedure Correlation Identifier (FQPCID)

The fully qualified procedure correlation identifier (FQPCID) is a network-unique session identifier that has various uses:

- Correlating messages sent between nodes (for example, correlating a Locate/CD-Initiate reply with a Locate/CD-Initiate request)
- Identifying a session for problem determination and resolution
- Identifying a session for accounting, auditing, and performance monitoring purposes.

The FQPCID is assigned at the node that contains the initiating Session Manager or Session Connector Manager. All messages sent between nodes that relate to a particular session (for example, Locate/CD-Initate, Bind, Unbind) include the FQPCID for that session.

The FQPCID is a fixed-length, 8-byte session-identifier field concatenated with a variable-length network-qualified name of the control point that generated the FQPCID, and is carried in a Fully-Qualified PCID (X'60') control vector. The algorithm for generating FQPCID field values is described below.

FQPCID Generation

The 8-byte portion of the Fully Qualified PCID (FQPCID) format is encoded as shown in Figure 18-4.

Bits 0–31	Bits 32–63
Bits 0,1,14,15 = 1. Bits 2-13,16-31 = HASH1(CPNAME)	← 32-Bit Counter → (initialized to: HASH2 + TOD)

Bits 0 15 31 47 63

Note: TOD is the time-of-day clock value.

Figure 18-4. PCID Session Identifier Format

The PCID session identifier generation consists of hashing at IML time and subsequent incrementing of the PCID counter for each assignment request.

The HASH1 function is the remainder from dividing the first 64 bits of a string, which resulted from an exclusive-OR of the network identifier (NETID) and CP name of the originating control point, by a 28-bit prime number. For example, the decimal number 268,453,399 (X'0FFFFFC7'). Once the 28-bit remainder is computed, it is right-aligned in the high-order 4 bytes of the format, bits 4 − 15 are shifted to bits (2 − 13), and bits 0, 1, 14, and 15 are forced to 1. The HASH2 divisor is the 31-bit prime decimal number 2,119,403,551 (X'7E53881F'). The HASH2 result is added to a 32-bit time-of-day clock (for the 3174, the time from IML is used). The resulting low-order 4 bytes of the PCID is incremented for each new FQPCID.

The dividend string used in computing the hash values is composed of the network ID and CP name of the origin control point as follows:

1. The CP name is padded on the right, as needed, with space (X'40') characters to make an 8-byte string.
2. The network ID is padded on the right, as needed, with space (X'40') characters to make an 8-byte string. Each (8-bit) character in the resulting string is then rotated two bits left. This shifts the high-order 2-bits of each character into the low-order 2-bits of each byte.
3. The two resulting binary strings are exclusive-ORed together to produce the dividend.

Inter-Nodal Flows

The flows in this section are between APPN NAUs and have two purposes. The first group of flows outlines the unique non-APPN interface between the network node and the VTAM/NCP boundary function. The second group of flows attempts to clarify when and for what purpose CP-CP and LU-LU sessions are established.

This section is not all comprehensive, and no attempt has been made to show every possible session establishment example.

Interface Flows to 370 VTAM/NCP

LU 6.2 Session Initiated By a 370 LU 6.2 Application: Figure 18-5 provides an example of LU 6.2 370 application establishing an LU session with an APPN end node's LU.

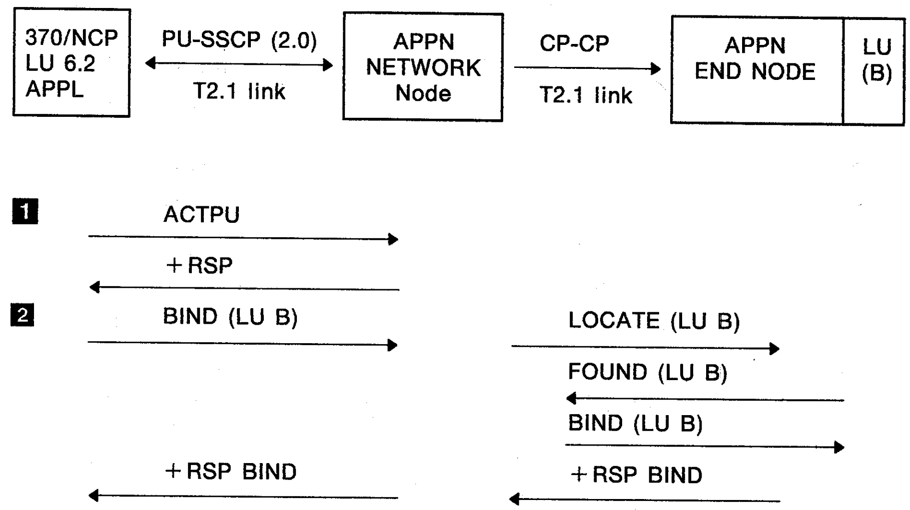


Figure 18-5. LU 6.2 Session Initiated by 370 LU 6.2 Application

1 370 SSCP sends an ACTPU to activate a SSCP-PU session. This is the only ACTPU sent. The APPN EN LUs are defined to VTAM as LUs that are on the link to the boundary attached APPN NN.

2 370 PLU sends a BIND to LU (B) via the link to APPN NN. If the APPN NN does not have LU (B) in its Directory data base, Locate/Cdinits will be sent to APPN NNs for which a CP-CP session has been established. The APPN NN that has knowledge of the LU (B) location will return a Locate Reply containing the TGs for the Control Point where LU (B) resides. The NN sends a directed search to the EN in order to obtain routing information. The EN responds with its tail vectors. The APPN NN maps the OAF and DAF fields of the BIND TH and sends the BIND to the APPN EN. The APPN EN sends a +RSP back to the APPN NN. The APPN NN maps the OAF and DAF fields of the TH for the BIND response, and forwards the response to the 370 PLU. At this point, an LU-LU session has been established between the 370 LU and LUB. The APPN NN acts as the intermediate routing node.

LU 6.2 Session Initiated By an APPN End Node LU: Figure 18-6 provides an example of an APPN end node's LU initiating an LU-LU session with a 370 LU Application.

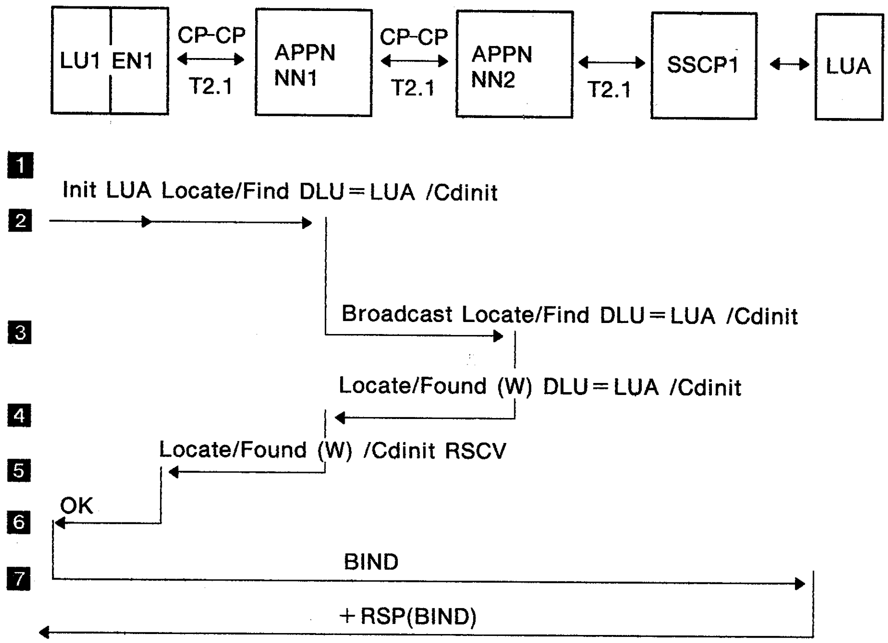


Figure 18-6. LU 6.2 Session Initiated by APPN End Node LU

1 This scenario assumes that a CP-CP session had been established.

2 LU1 wishes to initiate a session with LUA. EN1 does not have LUA in its directory, so it builds a Locate/Find/Cdinit. The OLU, LU1, DLU, and LUA, are provided by way of control vectors. EN1 provides its TG vectors and sends the search to its network node server, NN1.

3 NN1 does not have LUA in its directory. Supplying an additional control vector, NN1 adds itself to the origin information on Find, saves EN1's TG vectors, and begins a broadcast search.

4 NN2 is one of the network nodes that receives NN1's broadcast search (the only one shown here). NN2, boundary-attached to SSCP1, has the wildcard entry for the APPN subnetwork. NN2 does not find LUA in its domain, so NN2 sends Found (wildcard) to NN1.

5 When NN1 receives the Found reply, it does not cache any information but retains the wildcard reply until the broadcast search is complete (in this case, the only Locate reply shown completes the search). NN1 computes a route for the LU1-LUA session and forwards Found with RSCV to EN1.

6 EN1 passes a return code to LU1 indicating that the session initiation request was successful.

7 EN1 sends LU1's BIND, with the RSCV computed by NN1, to LUA. NN2, performing usual APPN intermediate routing, forwards the BIND to SSCP1, the last TG in the route. SSCP1 performs its normal search of the subarea network to locate LUA. It then forwards the BIND to LUA.

Interface Flows Between APPN Nodes

APPN NNs Establishing CP-CP Sessions: Figure 18-7 provides an example showing CP-CP sessions between APPN NNs in a Token-Ring Network.

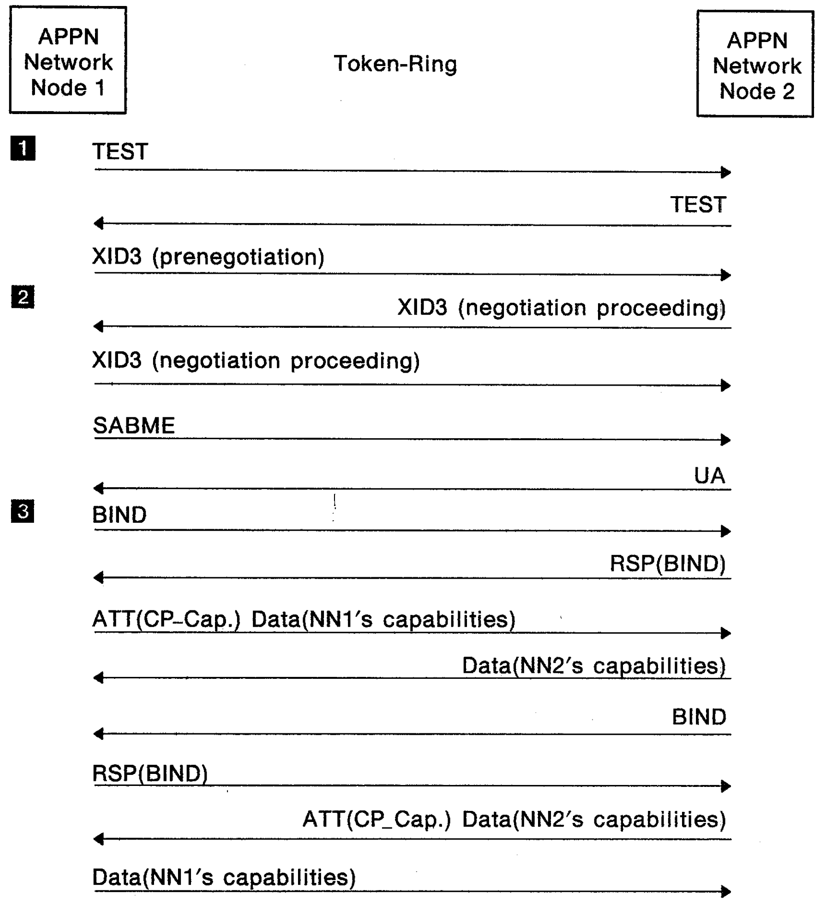


Figure 18-7. APPN NNs Establishing Parallel CP-CP Sessions

1 Connect Phase – Exchange of TEST commands allows initial establishment of communications between the Token-Ring Nodes. The XID3 prenegotiation is used to poll the adjacent link station to ensure that it is active. The CP Status field indicates that CP-CP sessions are supported. The APPN NNs also compute the shortest Token-Ring routes between the Nodes during this phase.

2 Contact Phase – During this phase, XID3 negotiation is performed by the APPN Nodes to identify themselves. The CP and Adjacent Link Station names are learned, and Node and transmission characteristics are conveyed to facilitate communications. Once the SABME and UA have been sent and RR has flowed on the link, the contact and link activation phase are complete and Token-Ring I-Frame data can be sent.

3 CP-CP session establishment – The sender of a CP-CP session BIND considers the CP-CP session to be enabled when it receives the other Node's CP capabilities. CP capabilities are encoded in the CP Capabilities GDS variable and include such information as: CP supports Locate/Cdinit search requests, Directory services are provided, Resource Registration is supported, Topology updates are provided, and so on.

APPN NN and APPN EN Establishing CP-CP Sessions: Figure 18-8 on page 18-28 provides an example showing CP-CP sessions between an APPN NN and an APPN EN on a Token-Ring.

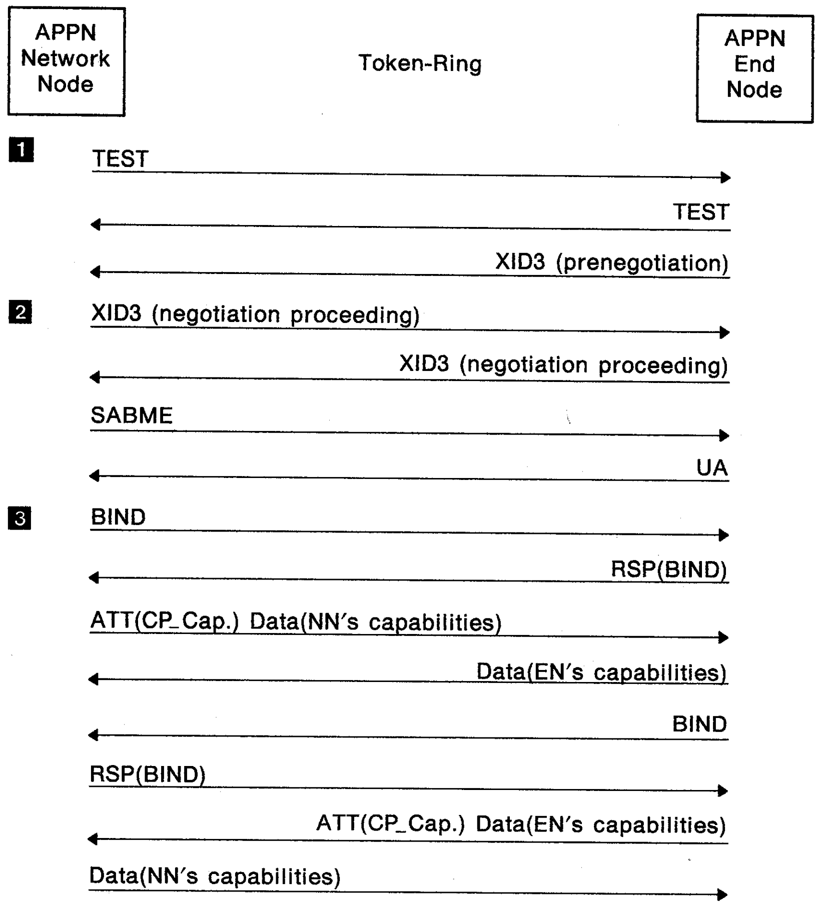


Figure 18-8. APPN NN and APPN EN Establishing Parallel CP-CP Sessions

1 Connect Phase – Exchange of TEST commands allows initial establishment of communications between the Token-Ring Nodes. The XID3 prenegotiation is used to poll the adjacent link station to ensure that it is active. The APPN EN indicates that it requires Network services in the XID3 CP Status field. The APPN Nodes also compute the shortest Token-Ring routes between the two link stations during this phase.

2 Contact Phase – Same as the Contact phase described in the previous example.

3 CP-CP session establishment – Same as the CP-CP session establishment described above with the exception that APPN ENs have limited CP capabilities. Out of the list specified above for Network Nodes, the only CP capability an APPN EN could specify is Locate/Cdinit search requests.

APPN Nodes Establishing an LU-LU Session: Figure 18-9 provides an example showing an LU-LU 6.2 session between APPN ENs with an APPN NN providing network node services in a Token-Ring Network.

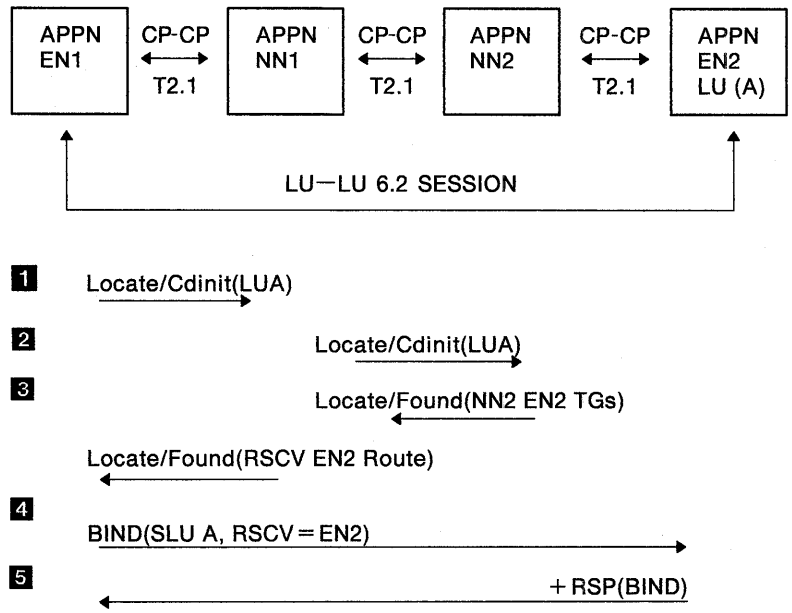


Figure 18-9. APPN Nodes Establishing a LU-LU 6.2 Session in a Connection Network

1 This scenario does not show the link activations and CP-CP session establishments between the APPN Nodes. It would be similar to the two examples shown previously. APPN EN1 sends a Locate/Cdinit (LU A) to APPN NN1.

2 APPN NN1 determines that its local LU directory does not contain LU (A) as an entry. APPN NN1 builds a Locate/Cdinit that contains the FQPCID, the PLU and SLU names, EN1's CP name, and NN1's CP name, and sends it to APPN NN2 with which it has a CP-CP session.

3 APPN NN2 knows about LU (A) and builds a LOCATE reply indicating that LU (A) is in APPN EN2 and its TG is EN2's Token-Ring MAC address and SSAP, and sends the reply to APPN NN1. APPN NN1 uses the TG vectors in conjunction with the topology data base to compute the least weight route. In this case, since APPN EN2 is in the same connection network, the least weight route is the TG provided by APPN NN2. APPN NN1 sends the Locate/Found with the RSCV for APPN EN2 to APPN EN1.

4 APPN EN1 appends the RSCV to the BIND, after activating a link to EN2, and sends it to APPN EN2. The BIND contains the session parameters requested by the PLU, as well as the SLU name and fully-qualified PCID. EN1 does not support the COS tower in this scenario.

5 LU (A) accepts the BIND and a +RSP BIND is routed back to APPN EN1. The LU-LU session is established at this point and session traffic can flow directly between EN1 and EN2. APPN NN1 provided Network Node services for EN1 but is not acting as an intermediate node.

SNA-Defined Mode Name Defaults

At session-initiation time, the Bind sender requests a type of service by specifying a mode name. The mode name refers to a group of sessions with the same characteristics.

The mode determines the values for the session characteristics and number of sessions between session partners. The mode name also implies a class of service (COS), which is used to select the route for the session.

A mode with the same name must exist at both end points (the local location and the remote location) of a session. The mode does not need to exist for an intermediate session except at the network node server for a LEN end node.

Note: Use caution when specifying names that use the special characters #, $, and @. These special characters are not supported for 3174 customization. The names that may be exchanged with remote systems include:

- Network IDs
- LU names
- Mode names
- Class-of-service names
- Control point names.

Table 18-2 shows the defaults for the SNA-defined mode names. Upper and lower bounds for the Max RU Size for mode names used by the 3174 are fixed and cannot be changed through customization. A MAX RU Size of 512 bytes on the CPSVCMG or SNASVCMG session is supported since this value is within the fixed bounds supported by the 3174.

Table 18-2. SNA-Defined Mode Name Defaults

SNA-Defined Mode Name	Local Max Session Limit	Min Contention Winner Source	Contention Winner Auto Activate Limit	RCV Pacing Window	Send Pacing Window	Send/RCV Max RU Size Upper Bound	Session Level Crypto
Default[1]	8	4	0	3	3	Variable	Not supported
X'7B'[2],BATCH	8	4	0	3	3	Variable	Not supported
X'7B',INTER	8	4	0	7	7	Variable	Not supported
X'7B',BATCHSC	8	4	0	3	3	Variable	Not supported
X'7B',INTERSC	8	4	0	7	7	Variable	Not supported
CPSVCMG	2	1	0	7	7	512	Not supported
SNASVCMG	2	1	0	7	7	512	Not supported

Legend:

[1]The default name is encoded as eight X'40' bytes in Bind.
[2]X'7B' is represented by # by the 3174.

LU 6.2 Component Mode Names

The following modes are supported by the LU 6.2 component of the 3174 NN:

BATCH This mode name is used to identify the LU-LU session used for Change Management.

#BATCH Same as BATCH. It is supported for migration purposes only.

CPSVCMG This SNA-defined mode name is used to identify the CP-CP sessions between the 3174 CP LU and other APPN Network Node and End Node CP LUs.

SNASVCMG This SNA-defined mode name is used to identify the LU-LU session used for exchanging CNOS requests and replies on the LU 6.2 session used for CSCM. This mode name is also used to identify the CP-FP (focal point) session used for Management Services in APPN, but this session is not supported by the 3174 NN.

Refer to "3174 Independent LU 6.2 Bind Response Format" on page 18-34 for additional information on mode names used by the 3174 and the upper and lower RU size bounds supported.

LU 6.2 Bind Formats

3174 Independent LU 6.2 Bind Request Format

The following is the format of the LU 6.2 Bind request sent by the 3174 to initiate an independent LU 6.2 CP-CP session:

Table 18-3 (Page 1 of 3). LU 6.2 Bind Request Format

Byte	Bit	Content	Meaning
0		X'31'	Bind command
1	0-3 4-7	X'0' X'0'	Format 0000 Type negotiable
2		X'13'	FM profile 19
3		X'07'	TS profile 7
4	0 1 2,3 4-6 7	B'1' B'0' B'11' B'000' B'0'	Multiple RU chains allowed from 3174 Immediate request mode is used 3174 can request definite or exception responses Reserved 3174 will not send end bracket
5	0 1 2,3 4-6 7	B'1' B'0' B'11' B'000' B'0'	Multiple RU chains allowed from SLU Immediate request mode is used SLU can request definite or exception responses Reserved SLU will not send end bracket
6	0 1 2 3 4 5,6 7	B'0' B'1' B'0' B'1' B'0' B'00' B'0'	3174 supports receipt of segmented RUs FM headers allowed Brackets are used and reset states are in-bracket Bracket termination rule 1, conditional termination is used Alternative code set not supported Reserved Bind request cannot be queued

Table 18-3 (Page 2 of 3). LU 6.2 Bind Request Format

Byte	Bit	Content	Meaning
7	0,1	B'10'	Half-duplex flip-flop normal flow send/receive protocol is used
	2	B'1'	Symmetric responsibility for error recovery
	3	B't'	Contention winner (see note 1)
	4,5	B'00'	Reserved – alternate code not supported
	6	B'1'	Control vectors included
	7	B'1'	HDX – FF reset state sent for 3174 and received for the SLU
8	0	B'0'	Staging indicator for SLU to 3174
	1	B'0'	Reserved
	2-7	B'000111'	SLU send pacing window size (see note 2)
9	0	B'1'	Adaptive pacing supported
	1	B'0'	Reserved
	2-7	B'000111'	SLU received pacing window size (see note 2)
10	0	B'1'	Indicates a maximum RU size specified
	1-7	B'0000111'	Maximum RU size sent on normal flow by SLU (see note 3)
11	0	B'1'	Indicates a maximum RU size specified
	1-7	B'0000111'	Maximum RU size sent on normal flow by 3174 (see note 3)
12	0	B'1'	Staging indicator for 3174 to SLU
	1	B'0'	Reserved
	2-7	B'000111'	3174 send pacing window size (see note 2)
13	0,1	B'00'	Reserved
	2-7	B'000111'	3174 receive pacing window size (see note 2)
14	0	B'0'	Basic PS usage format
	1-7	B'0000110'	LU type 6
15		X'02'	Level 2 of LU type 6
16-22		7 bytes of 0s	Reserved
23	0-2	B'000'	Reserved (retired fields)
	3	B'0'	Access Security Information field will not be accepted on incoming FMH-5s
	4,5	B'00'	Reserved
	6	B'0'	Already Verified indicator will not be accepted on incoming FMH-5s
	7	B'0'	Reserved
24	0	B'0'	Reserved
	1,2	B'01'	Synchronization level supported ID confirm
	3	B'0'	Reconnect is not supported
	4,5	B'00'	Reserved when parallel sessions supported
	6	B'1'	Parallel sessions are supported
	7	B'1'	CNOS is supported
25	0	B'0'	Priority session allocation for resynchronization is not supported
	1	B'0'	Limited resource not supported
	2-7	B'000000'	Reserved
26	0,1	B'00'	Reserved
	2,3	B'00'	Session level cryptography not supported
	4-7	B'0000'	Session level cryptography not specified; following cryptography options fields omitted
27			Length of Primary LU name
28-n			Primary LU name
n+1			Length of user data
n+2		X'00'	Structured subfields follow
n+3			Length of remainder of Modename subfield
n+4		X'02'	Subfeld Identifier

Table 18-3 (Page 3 of 3). LU 6.2 Bind Request Format			
Byte	**Bit**	**Content**	**Meaning**
n+5–o			Modename (CPSVCMG)
o+1			Length of remainder of Session Instance ID subfield
o+2		X'03'	Subfield Identifier
o+3–p			Session Instance Identifier
p+1			Length of remainder of Fully Qualified Primary LU Name
p+2		X'04'	Subfield Identifier
p+3–q			Fully Qualified Primary LU Name
q+1		X'00'	Length of User Request Correlation
q+2			Length of Secondary LU name
q+3–r			Secondary LU name
r+1		X'60'	Key for Fully Qualified PCID control vector
r+2			Length of Fully Qualified PCID
r+3–s			Fully Qualified PCID
s+1		X'2C'	Key for Class of Service/Transmission Priority control vector
s+2			Length of COS/TP
s+3–t			COS/TP
t+1		X'2B'	Key for Route Selection control vector (see note 4)
t+2			Length of RSCV
t+3–u			RSCV

Notes:

1. Contention Winner—This value is based on whether a contention-winner or a contention-loser session is being initiated. If a contention-winner session is being activated, the PLU (for example, 3174) is the contention winner (t=B'1'). If a contention-loser session is being activated, the SLU is the contention winner (t=B'0').
2. Pacing—The 3174 requests adaptive pacing when initiating an independent session. Therefore, the architected initial pacing window size of 7 is used.
3. Max RU Size—These values represent the preferred Max RU size for a given mode. Since this independent Bind request is for the CPSVCMG mode, the encoded values (8*2**7=1024 bytes) for Bind bytes 10 and 11 are sufficient for the expected traffic using this mode.
4. Control Vectors—The Route Selection control vector may not be included in the request if the Session Services component does not pass it to LU 6.2 in the CINIT_SIGNL. When inclusion of the RSCV causes the Bind request length to exceed 256 bytes and when the I-frame size is 265 bytes and the adjacent node does not support segment reassembly, the RSCV will not be included in the request.

3174 Independent LU 6.2 Bind Response Format

The following is the format of the LU 6.2 Bind response sent by the 3174 in response to an independent Bind request:

Table 18-4 (Page 1 of 2). LU 6.2 Bind Response Format

Byte	Bit	Content	Meaning
0		X'31'	Bind command
1	0-3	X'0'	Format 0000
	4-7	X'0'	Type negotiable
2		X'13'	FM profile 19
3		X'07'	TS profile 7
4	0	B'1'	Multiple RU chains allowed from PLU
	1	B'0'	Immediate request mode is used
	2,3	B'11'	PLU can request definite or exception responses
	4-6	B'000'	Reserved
	7	B'0'	PLU will not send end bracket
5	0	B'1'	Multiple RU chains allowed from 3174
	1	B'0'	Immediate request mode is used
	2,3	B'11'	3174 can request definite or exception responses
	4-6	B'000'	Reserved
	7	B'0'	3174 will not send end bracket
6	0	B'0'	3174 supports receipt of segmented RUs
	1	B'1'	FM headers allowed
	2	B'0'	Brackets are used and reset states are in-bracket
	3	B'1'	Bracket termination rule 1, conditional termination is used
	4	B'0'	Alternative code set not supported
	5,6	B'00'	Reserved
	7	B'0'	Bind request cannot be queued
7	0,1	B'10'	Half-duplex flip-flop normal flow send/receive protocol is used
	2	B'1'	Symmetric responsibility for error recovery
	3	's'	Contention winner (see note 1)
	4,5	B'00'	Reserved – alternate code not supported
	6	B't'	Control vectors included (see note 2)
	7	B'1'	HDX – FF reset state sent for PLU and received for the 3174
8	0	'u'	Staging indicator for 3174 to PLU (see note 3)
	1	'0'	Reserved
	2-7	'xxxxxx'	3174's send pacing window size (see note 3)
9	0	'v'	Adaptive pacing supported (see note 3)
	1	B'0'	Reserved
	2-7	'yyyyyy'	3174's receive pacing window size (see note 3)
10	0	B'1'	Indicates a maximum RU size specified
	1-7	'zzzzzzz'	Maximum RU size sent on normal flow by 3174 (see note 4)
11	0	B'1'	Indicates a maximum RU size specified
	1-7	'zzzzzzz'	Maximum RU size sent on normal flow by PLU (see note 4)
12	0	'w'	Staging indicator for PLU to 3174 (see note 3)
	1	B'0'	Reserved
	2-7	'yyyyyy'	PLU's send pacing window size (see note 3)
13	0,1	B'00'	Reserved
	2-7	'xxxxxx'	PLU's receive pacing window size (see note 3)
14	0	B'0'	Basic PS usage format
	1-7	B'0000110'	LU type 6
15		X'02'	Level 2 of LU type 6
16-22		7 bytes of 0s	Reserved

Table 18-4 (Page 2 of 2). LU 6.2 Bind Response Format

Byte	Bit	Content	Meaning
23	0-2	B'000'	Reserved (retired fields)
	3	B'0'	Access Security Information field will not be accepted on incoming FMH-5s
	4,5	B'00'	Reserved
	6	B'0'	Already Verified indicator will not be accepted on incoming FMH-5s
	7	B'0'	Reserved
24	0	B'0'	Reserved
	1,2	B'01'	Synchronization level supported ID confirm
	3	B'0'	Reconnect is not supported
	4,5	B'xx'	Reinitiation responsibility (see note 5)
	6	B'y'	Parallel session support (see note 6)
	7	B'z'	CNOS support (see note 6)
25	0	B'0'	Priority session allocation for resynchronization is not supported
	1	B'0'	Limited resource not supported
	2-7	B'000000'	Reserved
26	0,1	B'00'	Reserved
	2,3	B'00'	Session level cryptography not supported
	4-7	B'0000'	Session level cryptography not specified; following cryptography options fields omitted
27		X'00'	Length of Primary LU name (see note 7)
28			Length of user data (see note 8)
29		X'00'	Structured subfields follow
30			Length of remainder of Modename subfield
31		X'02'	Subfield Identifier
31—o			Modename
o+1			Length of remainder of Session Instance ID subfield
o+2		X'03'	Subfield Identifier
o+3—p			Session Instance Identifier
p+1			Length of remainder of Fully Qualified Secondary LU Name
p+2		X'05'	Subfield Identifier
p+3—q			Fully Qualified Secondary LU Name
q+1			Length of User Request Correlation (see note 9)
q+2—r			User Request Correlation
r+1		X'00'	Length of Secondary LU name (see note 10)
r+2		X'60'	Key for Fully Qualified PCID control vector (see note 2)
r+3			Length of Fully Qualified PCID
r+4—s			Fully Qualified PCID
s+1		X'2B	Key for Route Selection control vector (see note 2)
s+2			Length of RSCV
s+3—u			RSCV

Notes:

1. Contention Winner – If the PLU does not support parallel sessions and the minimum contention winner limit for this node is 1, then the 3174 will be the contention winner. Otherwise, the contention winner field in the response is copied from the Bind request.

2. Control Vectors – If control vectors are included, this field is set to B'1', otherwise it is set to B'0'.

   If the Bind request contained the Fully Qualified PCID control vector, it is returned in the response.

   If the Bind request contained the Route Selection control vector, it is returned in the response provided that one of the following is true:

   - Inclusion of the RSCV does not cause the Bind response length to exceed the frame size.
   - If the inclusion of the RSCV causes the Bind response length to exceed the frame size, the adjacent node must support segment reassembly.

3. Pacing – The staging indicators in the Bind response will be copied from the Bind request. The adaptive pacing bit is copied from the Bind request.

   3174's Send Pacing Window Size:

   This field is negotiable. If the Bind request indicates adaptive pacing is not supported, then this value will depend on the staging. If the Bind request indicates one stage pacing, then the 3174 send window size in the Bind response will be copied from the PLU receive window size in the Bind request. Otherwise, the 3174 send window size in the Bind response will be copied from the Bind request.

   If the Bind request indicates adaptive pacing is supported, this value will be set to zero.

   3174's Receive Pacing Window Size:

   This field is negotiable. If the Bind request indicates adaptive pacing is not supported, then the pacing value must be calculated based on buffer resources available and the value of the 3174 receive pacing window size in the Bind request. If the 3174 receive window size = 0, then the 3174 receive window size returned in the response = ([4K / PLU MAX SEND RU SIZE] + 1)/2. Otherwise, the 3174 receive window size returned in the response = Min (3174 receive window size from the request), ([4K / PLU MAX SEND RU SIZE] + 1)/2. The 4K value is the limit of buffer resources available per session.

   If the Bind request indicates adaptive pacing is supported, this value will be set to zero.

   PLU's Send Pacing Window Size:

   This field is negotiable. If the Bind request indicates adaptive pacing is not supported, then this value will be set equal to the 3174's receive pacing window size if one stage pacing is specified, otherwise it will be copied from the Bind request.

   If the Bind request indicates adaptive pacing is supported this value will be set to zero.

PLU's Receive Pacing Window Size:

This field is non-negotiable. If the Bind request indicates adaptive pacing is not supported, a special check is required if fixed send pacing is used. Due to buffer resource limitations, the PLU receive pacing window must satisfy the following algorithm:

(8K / 3174 Max Send RU Size) $\geq$ PLU Receive Pacing Window Size.

The 8K value is the buffer resources limit per session. If this test fails, the Bind request will be rejected, otherwise the value from the Bind request will be copied into the response.

If the Bind request indicates that adaptive pacing is supported, this value will be set to zero.

4. Max RU Size

3174 Send Max RU Size:

The Bind request will be rejected if the 3174 send Max RU Size is not specified.

Each mode has a 3174 Send Max RU Size lower and upper bound defined for it. These limits are used when determining the value for the Bind response. If the adjacent node does not support the reassembly of segments, the upper bound for this session may have to be adjusted. The adjustment is a temporary change to compute the value for this response. The mode's actual upper bound will not change. The adjustment is made by setting the upper bound to the minimum of the mode defined upper bound and the RU portion of the Max Sent BTU Size (BTU – TH – RH). The Max Sent BTU Size is the minimum of the Max BTU that the local node can send and the Max BTU that the adjacent node can receive. If the PLU supports the receipt of segments, no adjustment of the session's upper bound is required.

If the 3174 Send Max RU Size of the Bind request is between the lower and upper bound, then the value returned in the Bind response is copied from the Bind request.

If the 3174 Send Max RU Size of the Bind request is less than the lower bound, the value returned is the lower bound (negotiated up).

If the 3174 Send Max RU Size of the Bind request is greater than the upper bound, which may have been adjusted, the value returned in the Bind response is the upper bound (negotiated down).

The upper and lower bounds are:

- CPSVCMG

  3174 Send Max RU Size Upper Bound=1024
  3174 Send Max RU Size Lower Bound=256

- SNASVCMG

  3174 Send Max RU Size Upper Bound=512
  3174 Send Max RU Size Lower Bound=256

- BATCH

  3174 Send Max RU Size Upper Bound=2048
  3174 Send Max RU Size Lower Bound=256

- #BATCH

  3174 Send Max RU Size Upper Bound=2048
  3174 Send Max RU Size Lower Bound=256.

PLU Send Max RU Size:

The Bind request will be rejected if the PLU Send Max RU Size is not specified.

Each mode has a PLU Send Max RU Size lower and upper bound defined for it. These limits are used when determining the value for the Bind response. If the PLU Send Max RU Size defined in the Bind request is between the working copies of the upper bound and lower bound, the value returned in the Bind response is simply copied from the Bind request.

If the PLU Send Max RU Size defined in the Bind request is less than the working copy of the lower bound, the value returned in Bind response is the working copy of the lower bound (negotiated up).

If the PLU Send Max RU Size defined in the Bind request is greater than the working copy of the upper bound, the value returned in the Bind response is the working copy of the upper bound (negotiated down).

The upper and lower bounds are:

- CPSVCMG

  PLU Send Max RU Size Upper Bound=1024
  PLU Send Max RU Size Lower Bound=256

- SNASVCMG

  PLU Send Max RU Size Upper Bound=512
  PLU Send Max RU Size Lower Bound=256

- BATCH

  PLU Send Max RU Size Upper Bound=4096
  PLU Send Max RU Size Lower Bound=256

- #BATCH

  PLU Send Max RU Size Upper Bound=4096
  PLU Send Max RU Size Lower Bound=256.

5. Reinitiation Responsibility – If the Bind request indicates that parallel sessions are supported, then Reinitiation is set to operator controlled.

   If parallel sessions are not supported and the Bind request indicates reinitiation is operator controlled, this same value is returned in the response. If the Bind request indicates SLU only reinitiation, then the response indicates reinitiation is PLU or SLU. Otherwise, reinitiation is PLU only.

6. Parallel Sessions and CNOS – The parallel sessions and CNOS bits are set up based on the defined values in the partner LU definition.

7. Primary LU Name – This field is retired; therefore, its length is set to 0.

8. User Data Subfields:

   Mode Name – The mode name is copied from the Bind request.

   Session Instance Identifier – If this subfield is present in the Bind request, it will be copied into the Bind response.

   Fully Qualified SLU Network Name – This subfield is returned in the Bind response. The value returned in this subfield corresponds to the name defined at customization.

9. User Request Correlation – If this field was present in the Bind request, it is copied into the response. Otherwise, a field with length of 0 is returned in the response.

10. Secondary LU Name – This field is retired; therefore, its length is set to 0.

3174 Independent LU 6.2 Bind Response Checking

The 3174 performs the following unique checks on the independent Bind response:

- If the SLU has indicated Adaptive Pacing is not supported, the session is deactivated.
- If Random or Enciphered Data fields are present, the session is deactivated.
- If the SLU Send Max RU Size in the Bind response is lower than the lower bound defined for CPSVCMG mode, or greater than the upper bound defined for CPSVCMG mode, the session will be deactivated. The lower bound is 256 and the upper bound is 1024.
- If the PLU Send Max RU Size in the Bind response is lower than the lower bound defined for CPSVCMG mode, or greater than the upper bound defined for CPSVCMG mode, the session will be deactivated. The lower bound is 256 and the upper bound is 1024.

XID3 Format

This section describes the basic XID3 format, the DLC dependent sections for SDLC, Token-Ring, the channel of an XID3, and the control vectors (CV) that are appended to the XID3. In addition, the errors that result in an error CV being sent to the XID sender are described.

Table 18-5. Base XID Structure

Byte	Bit	Meaning
0	0−3	Format of XID (X'3' = XID3)
0	0−7	Node type (X'2' = PU 2.0/2.1, X'4' = PU 4, ...)
1		Length of the XID including CVs
2−5		Node ID
6,7		Reserved
8	0	Init_self supported
	1	Stand alone Bind supported
	2	Whole Bind PIU generated
	3	Whole Bind PIU requested
	4−7	FID type
9	0	1−no ACTPU wanted, 0−want ACTPU
	1	1−NN , 0−EN
	2	1−want CP-CP sessions
	3	1−support CP-CP sessions
	4,5	Exchange state indicator (pn=01, np=10, nonact=11)
	6	1−support secondary initiated non-act
	7	1−support non-act completion indicator
A	0	1−supports Bind Pacing (sender)
	1	1−supports Bind Pacing (receiver)
	2	Non-activation completion indicator
	3−7	Reserved
B−E		Reserved
F	0	1−parallel TGs are supported
	3−7	Reserved
10		TG number
11		DLC type (01=CDLC, 02=SDLC, or Token-Ring)

SDLC or Token-Ring DLC Dependent Section

Link Station Role: For SDLC, the link station role is secondary non-negotiable. For all Token-Ring links, the link station role is negotiable. If the senders link station role is not compatible, then the link establishment fails (for example, one node said secondary non-negotiable and the other node said the same thing). For negotiable links, Configuration Services (CS) uses the NODE_ID field to negotiate link role.

MAX_RECEIVE_SIZE: The 3174 sets the MAX_RECEIVE_SIZE in the XID to the max-receive-size of the particular adapter interface. Upon receipt of the adjacent nodes value, CS saves it. Other APPN components use this to determine what size messages should be sent over the link.

MAX_WINDOW_SIZE This is the maximum number of frames that can be received by the XID sender before it sends an acknowledgement.

Table 18-6. SDLC and Token-Ring DLC Dependent/CVs

Byte	Bit	Meaning
12		Length DLC section (X'0B')
13	0	Reserved
	1	Asynchronous Balance Mode (ABM) support (1 – ABM , 0 – NRM)
	2,3	XID Role (11 – negotiable, 01 – primary, 00 – secondary)
	4	Short hold status
	5	Short hold mode indicator
	6,7	Transmit receive capability
14		Reserved
15,16		Maximum receive BTU size
17	0 – 3	Reserved
	4 – 7	SDLC profile
18	0,1	Reserved
	2	SIM and RIM (SDLC init profile)
19 – 1A		Reserved
1B		Receive window size
1C		Reserved
1D		CV0EF4
1D+a		CV0EF7
1D+a+b		CV10
1D+a+b+c		CV4680 (Token-Ring Connection Network only)

CDLC DLC Dependent Section

Unlike Token-Ring and SDLC, Channel DLC has its own section of the XID3. It does not contain link role since the host is always primary. It contains maximum Link Path Information Unit (LPIU) size instead of maximum frame size. It contains no window size, but does contain the read channel program size.

Table 18-7. CDLC Fields and Values

Byte/Bit	Meaning	Value
Byte 12	Length of DLC section	X'13'
Byte 13 Bit 0	Reserved	0
Byte 13 Bit 1	Timeout Supported	0
Byte 13 Bit 2	Reserved	0
Byte 13 Bit 3	Change Parms	0
Byte 13 Bits 4−7	Reserved	0000
Byte 14	Reserved	00
Byte 15−16	Maximum LPIU (4109)	X'100D'
Byte 17	Buffer pre-fetch	2
Byte 18−19	Number of reads	MAXBFRU from last XID received (0 if Gateway)
Byte 1A−1B	Buffer Size (2064)	X'0810'
Byte 1C−1D	Block Delay	Customization Question 223
Byte 1E−1F	Attention Timeout	0
Byte 20−21	Reserved	00000000
Byte 22	Time Units	1
Byte 23	CV0EF4	
Byte 24+a	CV0EF7	
Byte 24+a+b	CV10	

XID Error Checks

The 3174 verifies the various fields in the XID received to ensure validity. If errors are found, then a CV22 is sent to the adjacent node to notify that node that there is an error in the XID. In addition, each error is logged.

During prenegotiation exchange, only the CP name (CV0EF4) and the length of the XID3 are verified. During negotiation-proceeding exchange, the following fields are checked for errors:

1. NODE_ID

   If CP name (CV0EF4) is not appended, then the NODE_ID must be a valid value (for example, BLOCK_NUMBER is not X'000' or X'FFF'). This NODE_ID is saved for future reference since there was no CP name appended to the XID.

2. Node Type (EN or NN)

   If NN is specified on the XID and this adjacent node was customized then it must have been customized as an NN node. Otherwise it is an error.

   If EN is specified on the XID and this adjacent node was customized, then it must have been customized as an EN or LEN end node. Otherwise, it is an error.

3. CP-CP Session Support/CP-CP Session Requested

   If the XID requests CP-CP sessions but indicates that CP-CP sessions are not supported, then it is an error.

   If the XID indicated Node Type of NN and CP-CP Session Support equals Yes but CP-CP sessions are not requested, then it is an error.

4. Bind Segmentation

   If the XID indicates Node Type of NN and Bind Segmentation for the receipt of Binds is not supported, then if MAX_I_FRAME is less than 521 it is an error.

   If the XID indicates Node Type of EN and Bind Segmentation for the receipt of Binds by the adjacent node is supported but Bind Segmentation generation is not supported, then it is an error.

5. Bind Pacing

   If the XID indicates that the adjacent node supports Bind Pacing as a sender but not as a receiver, then it is an error.

   If the XID indicates that the adjacent node does not support Bind Pacing as a sender but does as a receiver then the Bind Pacing support is "One Way."

6. TG Number

   If this number is less than 0 or greater than 239, then it is an error.

7. DLC Type

   If this is not SDLC (for SDLC or Token-Ring), then it is an error.

SDLC and Token-Ring DLC Dependent Checks

1. ABM Support

   If this does not match the XID sent by the 3174, then it is an error (for example, XID sent indicates ABM and XID received indicates NRM, or vice versa).

2. Link Role

   If the role is non-negotiable and the same as the 3174 had sent, then it is an error (for example, both sent and received XIDs are primary or both are secondary).

   If the value provided in this field is reserved (B'10'), then it is an error.

3. Maximum Receive I=Frame Length

   If MAX_I_FRAME is less than 265 bytes, then it is an error.

   If the XID indicates Node Type of NN and Bind Segmentation for the receipt of Binds is not supported, then if MAX_I_FRAME is less than 521 it is an error.

4. Maximum Receive Before Send Acknowledgement

   If this value is zero or greater than 128, then it is an error.

CDLC Dependent Section Checks

There are certain XID errors for which DLC has certain return codes to send back to the host. The errors checked are:

- An XID whose length does not match the length specified in the XID
- An XID that cannot be parsed (format unknown).

If errors are not found, the XID is passed to Configuration Services. The following fields are checked when an XID negotiation proceeding is received (a CV22 is appended if an error is detected):

Table 18-8. CDLC XID Error Checks

Byte/Bit	Meaning	Reject If
Byte 12	Length DLC section	> = X'13'
Byte 13 Bit 0	Change CDLC Parameters	¬ = 0
Byte 13 Bit 1	Timeout Supported	¬ = 0
Byte 13 Bit 2	Reserved	Not Checked
Byte 13 Bit 3	Change Parms	¬ = 0
Byte 13 Bits 4–7	Reserved	Not Checked
Byte 14	Reserved	Not Checked
Byte 15–16	Maximum LPIU	< 525
Byte 17	Buffer pre-fetch	Not Checked
Byte 18–19	Number of reads	= 0
Byte 1A–1B	Buffer Size	= 0
Byte 1C–1D	Block Delay	Not Checked
Byte 1E–1F	Attention Timeout	¬= 0
Byte 20–21	Reserved	Not Checked
Byte 22	Time Units	Not Checked

Reject XID if Number of reads × Buffer Size < 525 (Set RCP = Number of reads × Buffer Size).

Note that 1037 = 1024 + 6 + 3 + 4 = RU + TH + RH + LH,
and that 525 = 512 + 6 + 3 + 4 = RU + TH + RH + LH.

Control Vectors that the 3174 Sends in XID3s

1. CV 0E Type F4 – The CP name of this 3174. It is fully qualified in the form NETID.CP name.
2. CV 10 Product Set ID – This is identical to the Product Set ID sent in Alerts to NetView and in Network Asset Management Replies.
3. CV 46 Type 80 – This contains the Connection Network Name for the Token-Ring that the 3174 is attached to. It is fully qualified in the form of NETID.CNname. This is only sent on links that use the Token-Ring under the following conditions:
   - Token-Ring Dynamic links
   - When request for connection was an ACT_ROUTE.

4. CV 0E Type F7 – Link Station (LS) Name – 3174 CS sends the "Path Control ID" of the link being brought up.

   The LS name must be of type "symbol string A" which allows for uppercase EBCDIC alpha-numeric, with the first character being a non-numeric. To conform to this, the 3174 sends an LS name of format 'LINKnnnn', where nnnn is the EBCDIC representation of the LINK_ID for this link.

5. CV 22 – Whenever an error is detected on a received XID, then 3174 CS returns an XID3 with a CV22 appended.

CDLC Control Vectors

The following Control Vectors are built for each XID sent:

Network Qualified CP Name	CV0E type F4
Local Name of the ALS	CV0E type F7
Product ID	CV10 type F1
Network Product ID	SV11
Hardware Product ID	SF00

Processing of Control Vectors Received by the 3174

1. CV 0E Type F4 – This CV must be present in the XID for ENs and NNs. LEN end nodes may or may not send it. CP name must be fully qualified "NETID.CPname" and it must be 3 - 17 characters in length (See "XID3 Format" on page 18-40 for more information). The length must not exceed the maximum of 17 bytes, and each portion cannot exceed 8 bytes in length (1 byte for '.'). The CV0EF4 must match the CV0EF4 sent on previous XIDs during XID negotiations. If appended, then the CV0EF4 must be appended on every XID received. If the CP name was customized, then the CP name on the XID must match the customized value.

   If a LEN end node does not send CP name on its XID, then the CP name must be customized at the 3174. If this node is not customized as a LEN end node, then it is an error that no CP name is appended to the XID.

   If CP name is present on the XID received, then the following is true:

   - The NODE_ID must be a valid value (for example, BLOCK_NUMBER is not X'000' or X'FFF'). This NODE_ID is saved for future reference.
   - No TG # negotiation is performed – the 3174 selects the TG #.
   - No Bind Segmentation is supported on this link.
   - Assume that the node wants an ACTPU.
   - No Bind Pacing is supported on this link.

   The NETID does not need to match the NETID of the 3174, unless the partner node is an NN and requests CP sessions.

   The CP name in the XID cannot be the same as the 3174's CP name.

2. CV 10 Product Set ID – The information in this CV is saved only until XID negotiations are complete. It is kept around to use in the Log/Alert generated when an XID negotiations error is detected.

3. CV 46 Type 80 – If present, then this must match the CN name specified for the 3174. The NETIDs do not need to match, but the Connection Network names must match. This control vector is only validated if this is a connection network link. The absence of this CV is not an error.

4. CV 22 – The 3174 Logs/Alerts this XID negotiations error and terminates the link establishment attempt.

5. All other CVs – Ignored by the 3174.

T2.1 Channel DLC

The Channel Data Link Control (CDLC) assures the reliable delivery of information between paired stations. The CDLC protocol provides for sequencing, acknowledgement, error recovery, and the establishment and maintenance of synchronization across the channel. The following section describes the channel commands, channel programs, link activation flows, sense bit assignments, and status combinations including error recovery procedures.

T2.1 Channel Commands

The valid Channel Control Word (CCW) Op codes for the 3174 operating as a T2.1 node are shown in Table 18-9. For reference, the valid CCW Op codes for a T2.0 node are also included.

Table 18-9. CCW OP Codes

OP Code[1]	Name	T2.1	T2.0
X'00'	Test I/O[2]	Valid	Valid
X'01'	Write	Valid	Valid
X'02'	Read	Valid	Valid
X'03'	No-OP	Valid	Valid
X'04'	Sense	Valid	Valid
X'05'	Control	Invalid	Valid
X'09'	Write Break	Valid	Valid
X'31'	Write Start 0	Valid	Valid
X'32'	Read Start 0	Valid	Valid
X'51'	Write Start 1	Valid	Valid
X'52'	Read Start 1	Valid	Valid
X'61'	Write XID	Valid	Invalid
X'62'	Read XID	Valid	Invalid
X'93'	Restart Reset	Valid	Valid
X'A3'	Discontact	Valid	Invalid
X'C3'	Contact	Valid	Invalid
X'E4'	Sense ID	Valid	Valid

Legend:

[1]All CCW Op codes not shown are invalid.
[2]Test I/O is generated by the Test I/O instruction rather than by a CCW.

The following list contains descriptions of the commands that are valid for T2.1 nodes, but not supported for T2.0 nodes:

- X'61' – Write XID (WXID): Write XID is the first command to appear in an XID exchange. The primary sends this command signaling the secondary to expect to receive the primary's XID in the following Write Break.
- X'62' – Read XID (RXID): The primary sends this command to signal the secondary that the primary expects to read the secondary's XID. The primary then sends a Read to the secondary to obtain the XID.
- X'C3' – Contact: Establishes communication between the primary and secondary. Contact tells the secondary to use the latest XID information for operations with the primary, and signals the end of XID negotiation.
- X'A3' – Discontact: Indicates that the channel is no longer contacted, and the channel contact state should be exited.

Initialization/Termination Channel Programs

The channel programs used for data transfer by a channel-attached T2.1 node are exactly the same as those used by a T2.0 node. Examples of the channel programs used for initialization and termination of the link connection between channel-attached T2.1 nodes are described in this section. These are different than those used by T2.0 nodes.

Note: The recommended technique is to use "command chaining" as shown in the examples. However, if not used, the sequence of the CCWs must be maintained with no intervening commands except No-Op, Sense, and Sense ID.

1. **Exchange XIDs**

a. Write XID	SLI,CC	
b. Write Break	SLI,CC	Data: XID3
c. Read XID	SLI,CC	
d. Read	SLI,CC	Data: XID3 (CV X'22')
e. No-Op	SLI	

2. **Complete Initial Contact or Non-activation XID Exchange**

a. Contact	SLI,CC
b. Restart Reset	SLI,CC
c. No-Op	SLI

3. **Complete Non-activation XID Exchange**

a. Contact	SLI,CC
b. No-Op	SLI

4. **Discontact**

a. Discontact	SLI,CC
b. No-Op	SLI

5. **Complete Exchange XIDs with Primary Detected Error**

a. Write XID	SLI,CC	
b. Write Break	SLI,CC	Data: XID3 (with CV X'22')
c. Discontact	SLI,CC	
d. No-Op	SLI	

Channel Program Usage

For T2.1 CDLC, the host is always primary and the 3174 is always secondary.

1. **Normal Initial Contact**
   a. Primary executes channel program 1.
   b. Primary performs XID3 receive checks and finds no error.
   c. Primary executes channel program 2.
2. **Error on Initial Contact or Non-activation XID Exchange**
   a. Primary executes channel program 1.
   b. Primary performs XID3 receive checks and finds errors.
   c. Primary executes channel program 5.
3. **Error on Initial Contact or Non-activation XID Exchange**
   a. Primary executes channel program 1.
   b. Secondary performs XID3 receive checks and finds errors – XID3 with CV X'22' is returned by secondary.
   c. Primary executes channel program 4.
4. **Normal Non-activation XID Exchange**
   a. Primary executes channel program 1.
   b. Primary performs XID3 receive checks and finds no error.
   c. Primary executes channel program 2 or 3.
5. **Discontact**
   a. Primary executes channel program 4.

Link Activation Flows

Figures 18-10 through 18-12 provide examples of link activation flows for a channel-attached 3174 operating as a T2.1 node. These examples consist of both successful and unsuccessful activation sequences.

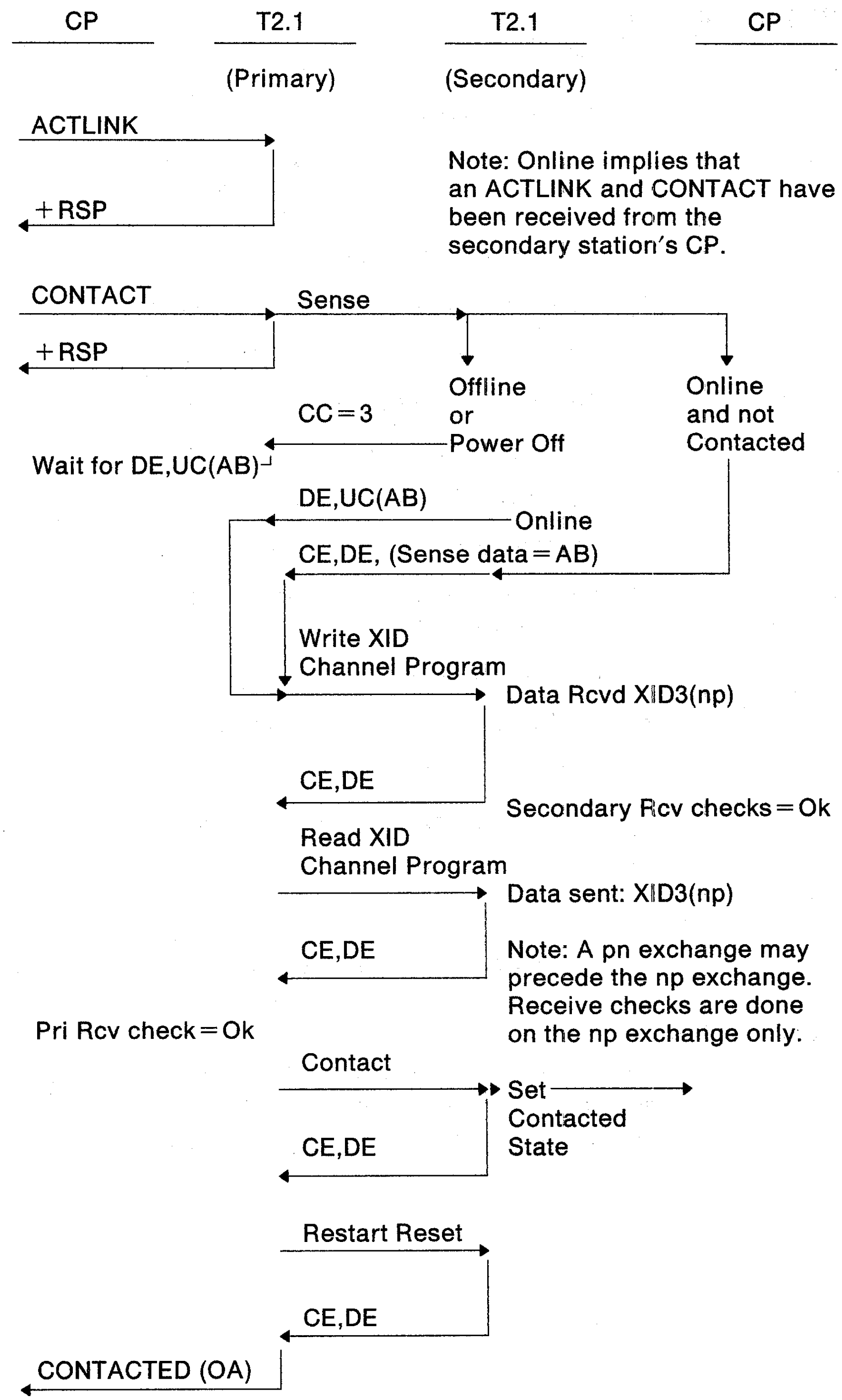


Figure 18-10. Successful Activation

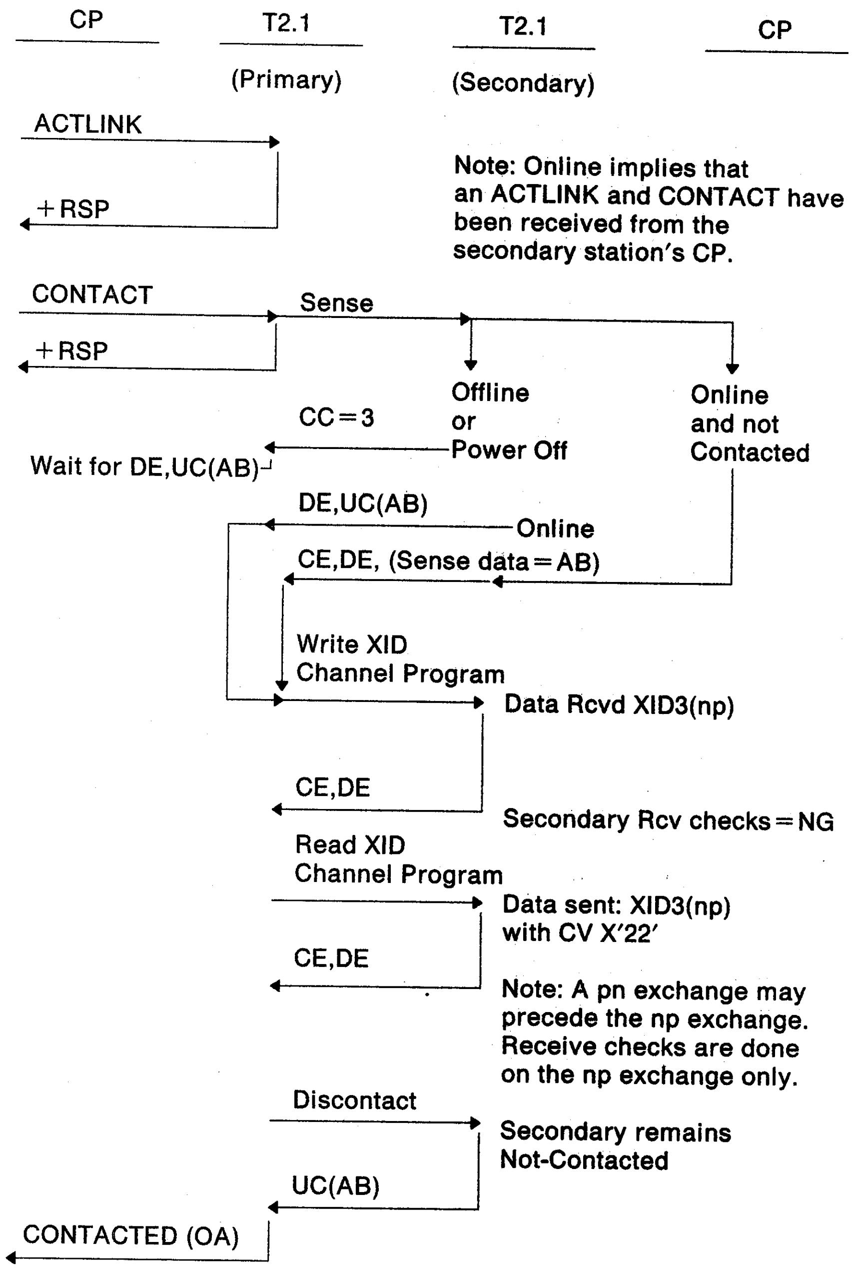


Figure 18-11. Unsuccessful Activation—Secondary Rejects XID3

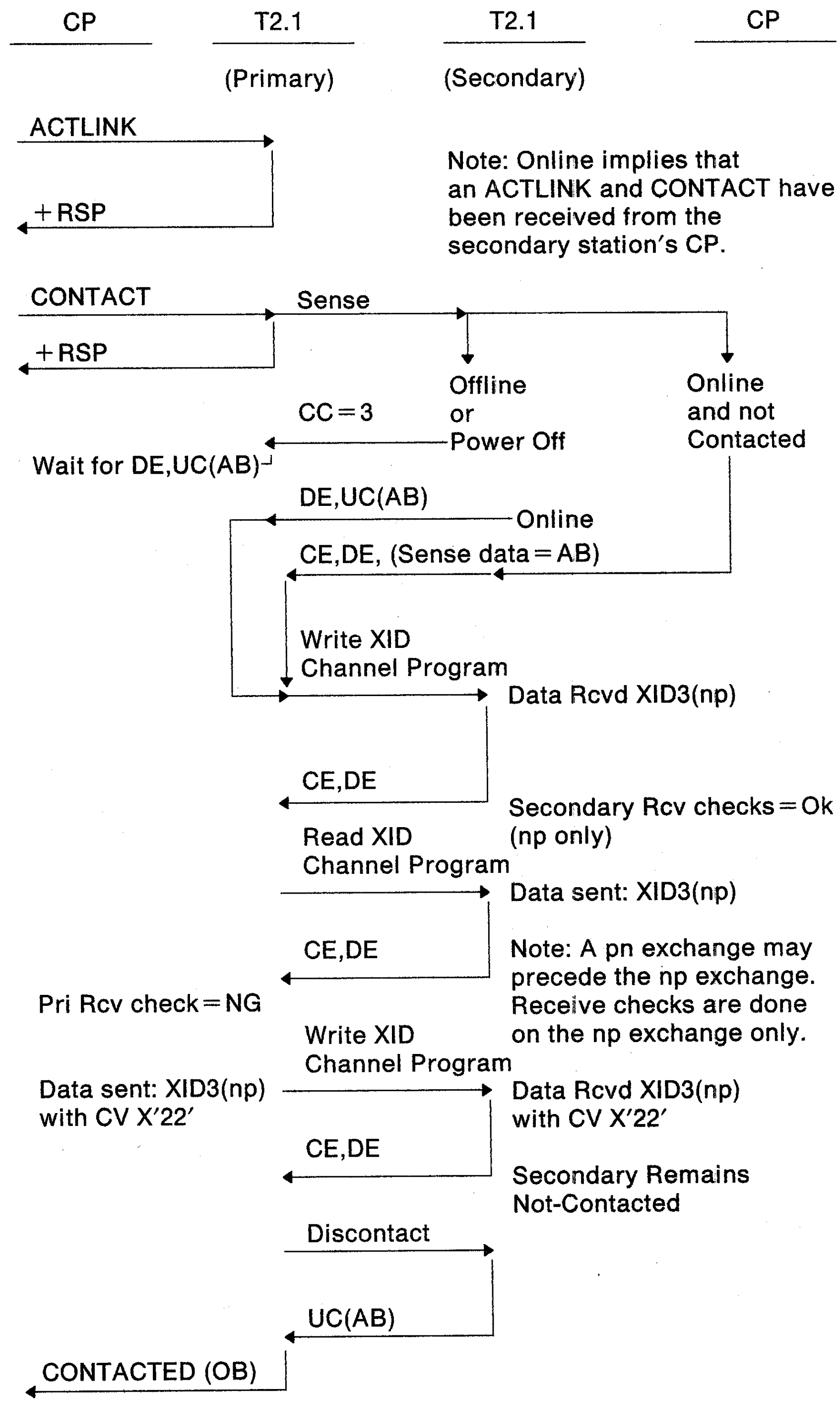


Figure 18-12. Unsuccessful Activation—Primary Rejects XID3

Sense Bit Assignments

Sense bit usage for the 3174 operating as a T2.1 node is shown in Table 18-10. For reference, the usage for a T2.0 node is also shown.

Table 18-10. Sense Bit Assignments

Byte	Bit	Name	T2.1	T2.0
0	0	Command Reject (CR)	Used	Used
	1	Intervention Required (IR)	Not Used	Not Used
	2	Bus Out Check (BOC)	Used	Used
	3	Equipment Check (EC)	Used	Used
	4	Data Check (DC)	Used	Used
	5	Overrun (OVR)	Used[2]	Used[2]
	6	Not Initialized (NI)	Not Used	Used
	7	Abort (AB)	Used	Used[1]
1	0	Data Length Check (DLC)	Used	Used
	1		Not Used	Not Used
	2	Resetting Event	Used[2]	Used[2]
	3		Not Used	Not Used
	4	Parity Check Modifier (PCM)	Used	Used
	5	Parity Check-1 (PC1)	Used	Used
	6	Parity Check-2 (PC2)	Used	Used
	7	Machine Check (MC)	Used	Used

Legend:

[1]Used beginning with Release 5 of Configuration Support S.
[2]Applies to ESCON only.

Status and Sense

This section defines the channel status combinations and associated sense bit usage for the 3174 operating as a T2.1 node.

Solicited Status Conditions

Solicited status is sent to the channel as a result of some host initiated action. For example, execution of a channel program. Categories of solicited status are defined as Initial Status and Ending Status with Ending Status consisting of either one or two ending sequences.

The following sections describe the conditions under which the various combinations of solicited status are sent:

Initial Status: Initial status is sent to the channel when the initial-selection address is recognized and the channel command is received by the controller. However, if a "busy" condition exists during initial-selection, it may be reported to the channel as either a short-busy sequence or an initial status.

When a short-busy sequence is used, the status is sent following recognition of the initial-selection address, but before the command is received. However, the short-busy sequence is not used in response to initial selection when chaining has been indicated.

When initial status is used, the status is sent following recognition of the initial-selection address and receipt of the channel command.

Table 18-11 and Table 18-12 show the various combinations of solicited status that may be sent to the channel in response to initial-selection. The ERP action is described in "Primary Error Recovery Procedures" on page 18-59. Pending or stacked status is indicated by an "x."

Table 18-11. Short-Busy Sequence Conditions

Status	**Sense**	**ERP**	**Condition**
B,SM	–	–	The controller has not completed a previously initiated operation.

Table 18-12 (Page 1 of 2). Initial Status Conditions

Status	**Sense**	**ERP**	**Condition**
All-zero	–	–	Normal status for all valid commands except immediate operation commands.[1]
B	–	–	The controller has not completed a previously initiated operation.
B,"x"	–	–	The controller has pending or stacked status available.
CE	–	–	Sent in response to: • Write XID, • Read XID, • Contact, • Discontact, • Restart Reset, • Write Start 0/1, • Read Start 0/1, in the absence of any initial exception conditions.
CE,DE	–	–	Sent in response to a No-Op command.

Table 18-12 (Page 2 of 2). Initial Status Conditions

Status	Sense	ERP	Condition
UE{,A}	–	3	1. Sent in response to: • Write Start 0/1, • Write, • Write Break, because of insufficient buffer space to receive data from the host. Optionally, a Read channel program may also be requested. 2. Sent in response to Read Start 0/1 to notify the host that an unsolicited read channel program has been received, or that there is no data available for transfer to the host. Optionally, a read channel program may also be requested. 3. Sent in response to Write XID because of insufficient buffer space to receive data from the host. Optionally, if in the contacted state, a Read channel program may also be requested.
UC	BOC,PC2	1	A parity error was detected on the command received from the host.
UC	CR{,AB}	1	An invalid command was received from the host. If the controller is in the not-contacted state, Abort is included with Command Reject.
UC	AB	2	Sent in response to: • Discontact, • Restart Reset, • Write Start 0/1, • Read Start 0/1, • Write, if the controller is in the not-contacted state.[2]

Legend:

[1]Immediate operation commands are: Write XID, Read XID, Contact, Discontact, Restart Reset, Write Start 0/1, Read Start 0/1 and No-Op.
[2]Not-contacted means that a successful channel contact procedure (XID exchange and channel CONTACT command) has not completed.

Ending Status: Table 18-13 on page 18-55 and Table 18-14 on page 18-57 show the various combinations of solicited ending status that may be sent in response to a channel initiated operation. Depending on the command and the conditions encountered during its execution, either one or two ending status sequences will be sent. The ERP action is described in "Primary Error Recovery Procedures" on page 18-59.

Table 18-13 (Page 1 of 3). First (or Only) Ending Status Conditions			
Status[1]	**Sense**	**ERP**	**Condition**
CE	–	–	Sent at the end of data transfer for: • Write, • Write Break, • Read, when the controller remains busy and is not prepared to execute the next command.
DE	–	–	Sent in response to: • Write XID, • Read XID, • Contact, • Discontact, • Restart Reset, • Write Start 0/1, • Read Start 0/1, when the controller is no longer busy and is prepared to execute the next command.
CE,DE	–	–	Sent at the end of data transfer for: • Sense, • Sense ID.
DE,UE{,A}	–	3	1. Sent in response to Read Start 0/1 to indicate that an unsolicited read channel program has been received, or that there is no data available for transfer to the host. Optionally, a new Read channel program may also be requested. 2. Sent in response to Write Start 0/1 to indicate that there is insufficient buffer space to receive data from the host. Optionally, a Read channel program may also be requested. 3. Sent in response to Write XID to indicate that there is insufficient buffer space to receive data from the host. Optionally, if in the contacted state, a Read channel program may also be requested.
CE,DE,UE{,A}	–	3	Sent in response to: • Write, • Write Break, to indicate that there is insufficient buffer space to receive data from the host. Optionally, a Read channel program may also be requested.

Table 18-13 (Page 2 of 3). First (or Only) Ending Status Conditions			
Status[1]	**Sense**	**ERP**	**Condition**
DE,UC	AB	5	Sent in response to: • Write XID, • Read XID, when conditions within the controller do not allow completion of an XID exchange at this time.
CE,DE,UC	BOC,PC1,PC2	1	A parity error was detected on the data being received from the host during the following commands: • Write, • Write Break.
CE,DE,UC	EC,PC1	1	A parity error was detected while processing the data for the following commands: • Write, • Write Break.
CE,DE,UC	EC,PC1,PCM	1	A parity error was detected while processing the data for the following commands: • Read, • Sense, • Sense ID.
CE,DE,UC	EC,PC2	1	A parity error was detected on the data being sent to the host during the following commands: • Read, • Sense, • Sense ID.
CE,DE,UC	EC,MC	1	An internal error was detected during a channel operation.
CE,DE,UC	DC,DLC	1	Sent at the end of data transfer for: • Write, • Write Break. 1. When fewer than 4 bytes have been received with the command. 2. The value contained in the XID3's length field does not equal the total number of XID3 bytes received. 3. The value contained in the Link Header's length field does not equal the total number of LPIU bytes received.

Table 18-13 (Page 3 of 3). First (or Only) Ending Status Conditions

Status[1]	Sense	ERP	Condition
CE,DE,UC	DC	1	Sent at the end of data transfer for: • Write, • Write Break. 1. If an LPIU containing an invalid function code is received. 2. If an LPIU containing an invalid FID is received. 3. If an XID containing an invalid format is received. Sent at the end of data transfer for Read: 1. When sending an XID3, if the value specified in the Read CCW's count field was not large enough to allow transfer of the entire XID3. 2. When sending an LPIU, if the value specified in the Read CCW's count field did not match the value specified in the received XID3 (Buffer Size).
CE,DE,UC,SM	'ssss'	1	Sent to request a channel command retry when the controller is prepared to accept an immediate retry of the failing command.[2] This status should not be seen by the host program support unless the channel does not have the command retry feature. In this case, the recommended ERP for the accompanying sense ('ssss') should be executed.

Legend:

[1]CUE could be generated and combined with the status before it is accepted by the channel.
[2]To request a command-retry, the "mark 0 in" line is raised in conjunction with this combination of status.

Table 18-14 (Page 1 of 2). Second Ending Status Conditions

Status[1]	Sense	ERP	Condition
DE	–	–	Sent in response to: • Write, • Write Break, • Read, when the controller is no longer busy and is prepared to execute the next command.
DE,UE{,A}	–	–	Sent in response to Read when no additional data is available to be sent with the current Read channel program. Optionally, a new Read channel program may also be requested.

Table 18-14 (Page 2 of 2). Second Ending Status Conditions			
Status[1]	**Sense**	**ERP**	**Condition**
DE,SM	–	–	May be sent in response to Write Break when the controller is no longer busy and has data available for transfer to the host. This status, which should not be seen by the host program, will cause the channel to skip a CCW in the channel program.
DE,UC	DC,DLC	1	Sent at the end of data transfer for: • Write, • Write Break. 1. When fewer than 4 bytes have been received with the command. 2. The value contained in the XID3's length field does not equal the total number of XID3 bytes received. 3. The value contained in the Link Header's length field does not equal the total number of LPIU bytes received.
DE,UC	DC	1	Sent at the end of data transfer for: • Write, • Write Break. 1. If an LPIU containing an invalid function code is received. 2. If an LPIU containing an invalid FID is received. 3. If an XID containing an invalid format is received. Sent at the end of data transfer for Read: 1. When sending an XID3, if the value specified in the Read CCW's count field was not large enough to allow transfer of the entire XID3. 2. When sending an LPIU, if the value specified in the Read CCW's count field did not match the value specified in the received XID3 (Buffer Size).

Legend:

[1]CUE could be generated and combined with the status before it is accepted by the channel.

Unsolicited Status Conditions

Unsolicited status is generated by the 3174 to report conditions that are unrelated to any host initiated function.

Table 18-15 shows the various combinations of unsolicited status that may be sent. The ERP action is described in "Primary Error Recovery Procedures."

Table 18-15. Unsolicited Status Conditions

Status	Sense	ERP	Condition
A	–	–	Sent as a request for a Read channel program.
DE,UC	AB	2	Sent when the controller is IMLed and has gone from the offline to online state.[1] This is a request for a normal initial contact procedure (for example, XID exchange).
DE,SM{,A}	–	–	Sent to indicate a buffer available condition. This is a signal to the host that it may resume sending data to the controller. Optionally, a Read channel program may also be requested.
DE,UC	AB	4	May be sent in the contacted state as a controller request for a discontact. All SNA sessions are terminated.

Legend:

[1]"Online" implies that an ACTLINK and a CONTACT have been received from the secondary station's CP.

Primary Error Recovery Procedures

Action 1: Issue a message containing the address of the channel and unit, the CSW, the sense data, and the CCW executed. If the first CCW of the chain is a valid Start command, begin retry from that point. If the failure is continuous, notify the operator.

Action 2: Initiate a normal initial contact procedure (for example, XID exchange) to establish contact with the secondary station.

Action 3: Wait for DE,SM status as a signal to resume sending outbound LPIUs. The recommended procedure is for the primary to send, as "new data," only those LPIUs that were not successfully received when buffer depletion was signaled by the secondary station.

Action 4: Initiate a discontact procedure to terminate the contacted state with the secondary station. All SNA sessions are terminated.

Action 5: Await asynchronous DE,UC(AB) status which will be presented when the secondary station is ready to accept an XID exchange. Upon receipt of the DE,UC(AB), perform action 2.

Chapter 19. 3174 Peer Communication

Introduction

3174 Peer Communication allows existing intelligent devices attached to a 3174 to form a star-wired Local Area Network (LAN) segment that may be bridged to an IBM Token-Ring through the 3174 Establishment Controller. 3174 Peer Communication extends the support on the 3174 to create a 3174-Peer segment, which is analogous to a LAN segment. 3174 Peer Communication supports reporting links with up to four LAN Network Managers, and provides a way for intelligent devices to:

- Communicate peer-to-peer
- Increase connectivity options
- Retain host connectivity
- Share resources (files, data bases, application programs, and printers)
- Be managed from the IBM LAN Network Manager.

3174 Peer Communication supports LAN sessions between:

- Devices attached to the same 3174-Peer controller
- A device attached to the 3174-Peer controller and a device connected to the same Token-Ring Network
- Devices attached to two different 3174-Peer controllers, if both those controllers are connected to the same Token-Ring Network.

3174 Peer Communication allows you to run LAN applications and provides:

- Bridge function
- Local management functions
- LAN Network Manager support.

A 3174-Peer segment can be created with IBM personal computers (PCs) or Personal System/2* (PS/2*) computers attached with existing 3270 wiring to a 3174 Establishment Controller.

3174 Peer Communication provides peer-to-peer communication for devices connected to a 3174 Establishment Controller through 3270 Connection Adapters or 3278/3279 Emulation Adapters. The controller connects devices that support an 802.2 interface, or a higher-level interface that utilizes the 802.2 interface. When higher-level interfaces are used, the same higher-level interface is required at each end of the connection.

A possible 3174-Peer configuration is illustrated in Figure 19-1 on page 19-3. For information on the parameters used in customizing for 3174 Peer Communication, see the *3174 Planning Guide*.

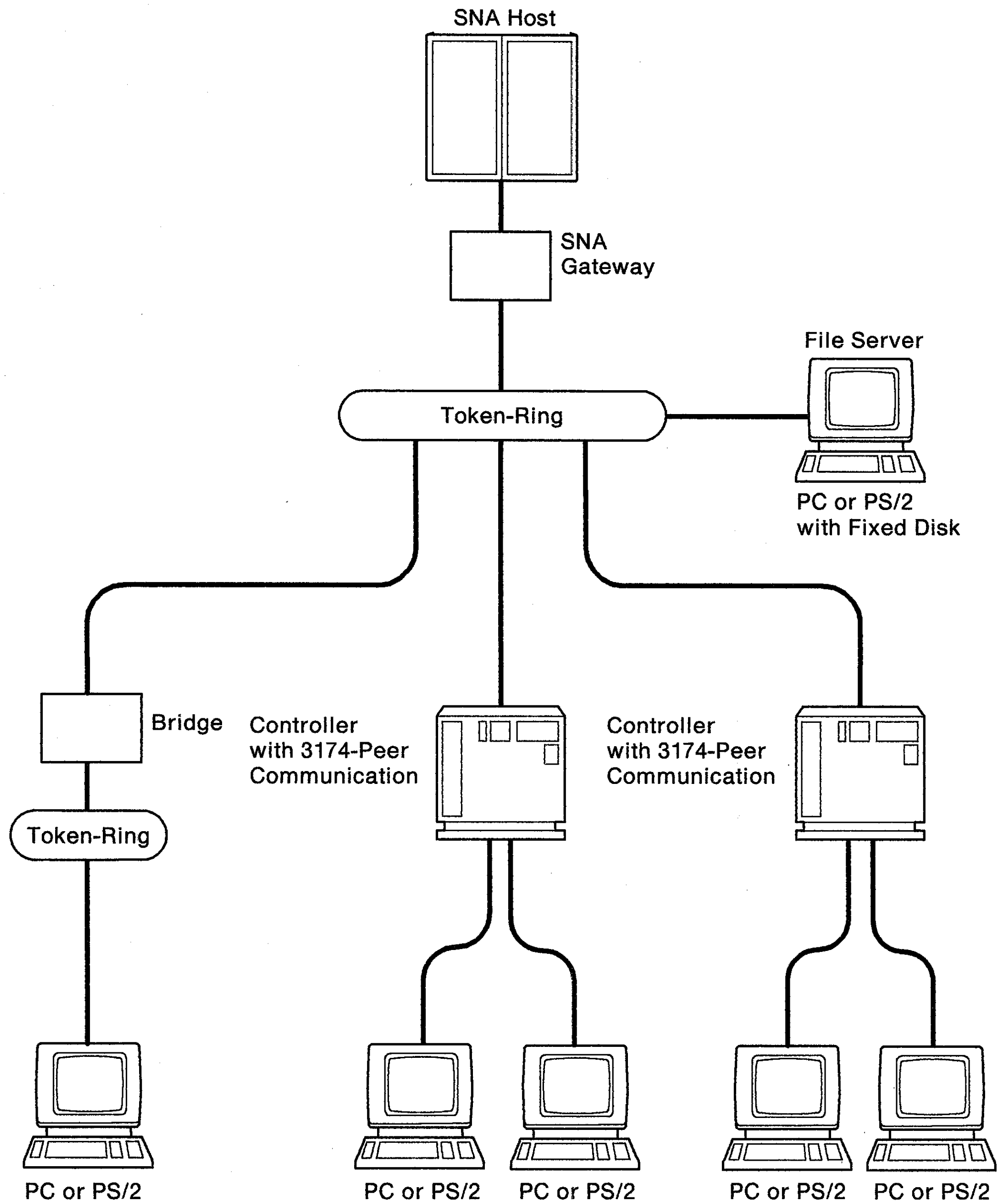


Figure 19-1. Sample 3174-Peer Configuration

Software Requirements

In order for intelligent devices to participate in 3174 Peer Communication, they must be running 3174-Peer device drivers (3174-Workstation Peer Communication Support Program, P/N 96X5677, or equivalent). Control Unit Terminals (CUTs) and other traditional devices can be attached to the 3174-Peer controller; however, only devices running a 3174-Peer device driver can participate in 3174 Peer Communication.

In order to have LAN Network Manager Support, *LAN Network Manager Version 1.1* or higher is required.

Model Support

3174 Peer Communication is supported on models 1L, 1R, 2R, 3R, 11L, 11R, 12L, 12R, 13R, 21L, 21R, 22L, 23R, 51R, 53R, 61R, 62R, and 63R.

Bridge Function

3174 Peer Communication allows devices to have access to a Token-Ring Network. When the 3174-Peer Bridge function is customized, the controller forms a bridge that attaches one 3174-Peer segment to a Token-Ring LAN segment. It operates as a medium access control (MAC) relay station, using source routing as described in the *IBM Token-Ring Network Architecture Reference.*

The controller must have a 3174 Type 3A Dual Speed (16/4Mbps) Communications Adapter in order to act as a 3174-Peer Bridge. You can configure the adapter to attach to a Token-Ring that operates at either 4Mbps or 16Mbps.

With Bridge Support, a 3174-Peer device may obtain Token-Ring Gateway services similar to any other DSPU that is bridged to a Token-Ring Gateway. A 3174-Peer device may receive Token-Ring Gateway services or network node services from the 3174 to which it is attached only if the 3174 Type 3A Dual Speed Communications Adapter is installed and Bridge Support is selected.

Because the controller is the only bridge to the 3174-Peer segment, it forwards single-route broadcast frames, allowing the 3174-Peer segment to function in a network using spanning tree protocols. The maximum frame size supported by the 3174 is 2052 bytes.

3174-Peer Bridge Address

The 3174-Peer Bridge is required to have an address for the 3174-Peer as well as for the Token-Ring when the 3174 is customized for LAN Network Manager support. Each port is allocated a default address, where the low order byte of the address is the port number. The 3174-Peer Bridge will be given the same address, with the low order byte being X'FF'. This address allows status, which describes the logical bridge adapter that attaches to the 3174-Peer, to be sent to a requesting LAN Network Manager. The 3174 supports both the Broadcast of a Test frame and the rejection of Set Reporting Point frames destined to this address. Other frames sent to this address are discarded.

Local Management Functions

If the 3174 is not customized for LAN Network Manager support and is customized for 3174-Peer Online Test Updates, the Local Management functions allow full local management of the 3174-Peer through the online tests. If the 3174 is customized for LAN Network Manager support and for 3174-Peer Online Test Updates, the online tests will allow you to change the passwords to the LAN Network Manager.

See the *3174 Planning Guide* and the *3174 Customer Problem Determination* for more information on the Local Management function.

LAN Network Manager Interface

LAN Network Manger is a network management program and problem determination aid for a LAN composed of one or more IBM Token-Ring Network segments or various other types of LAN segments. It runs on a PS/2 under OS/2 and can communicate with the NetView program at the host. The IBM LAN Network Manager monitors activity on the LAN segment to which it is attached and on remote LAN segments connected by bridges.

The IBM LAN Network Manager allows management of a LAN by maintaining records, monitoring the status of LAN segments and attaching devices, and determining the source of problems. In addition, LAN Network Manager has the capability to remove devices from a LAN segment.

When functioning as a bridge between a Token-Ring and a 3174-Peer segment, the 3174 reserves four reporting links. A LAN Network Manager may connect to any of the reporting links, allowing up to four LAN Network Managers to be simultaneously supported. The LAN Reporting Mechanism (LRM) is a server function that maintains and establishes the reporting links. The following management server functions are supported across each established reporting link:

- LAN Bridge Server (LBS)
- Ring Parameter Server (RPS)
- Configuration Reporting Server (CRS) — 3174-Peer segment only
- Ring Error Monitor (REM) — 3174-Peer segment only.

Note: If LAN Network Manager support is not customized and Bridge support is customized, RPS support is provided for the Token-Ring.

The 3174-Peer segment appears to a LAN Network Manager as being similar to a Token-Ring segment. The 3174 represents the 3174-Peer devices as having the same Nearest Active Upstream Neighbor (NAUN) relationship as Token-Ring attached devices. The logical relationship is any subset of the following: The 3174-Peer Bridge's NAUN is port 0, whose NAUN is port 1, ..., whose NAUN is port 63, whose NAUN is the 3174-Peer Bridge. The 3174-Peer Bridge is always present in this relationship and is its own NAUN whenever no attached devices are communicating as 3174-Peer devices.

In order to receive LAN Network Manager Support, *LAN Network Manager Version 1.1* or higher is required. For more information on the IBM LAN Network Manager, see the *IBM LAN Network Manager User's Guide*.

Network Management Components

Management Servers use the services of connection-oriented logical-link control (also known as type 2 flows) for communication with the LAN Network Manager. The following functions are provided:

- Status Determination Function: The LAN Network Manager may request information from a management server.
- Configuration Control Function: A controlling LAN Network Manager may change the operational values of a management server. The management server may then modify the operational values of a ring station. Updates received from the LAN Network Manager are written to disk and reported across IMLs. The exception to this is either when a disk error occurs or when it is explicitly stated in this document that parameters are not saved.
- Notification Function: A ring station may inform a management server of an event. In turn, a management server may then inform the LAN Network Manager of an event. Error conditions and topology changes are some examples of events which may result in notifications being sent.

LAN Reporting Mechanism (LRM)

One or more LAN Network Managers may establish a reporting link with the LAN Reporting Mechanism (LRM) support within the 3174-Peer Bridge. The LRM manages these links and is the server through which other 3174-Peer Bridge servers communicate with the LAN Network Manager.

The following types of LAN Network Managers are defined:

- Controlling LAN Network Manager: The controlling LAN Network Manager occupies reporting link 0, and is the only LAN Network Manager that may update 3174-Peer parameters. If no LAN Network Manager occupies reporting link 0, the LAN Network Manager occupying the lowest alternate reporting link is the controlling LAN Network Manager.
- Alternate LAN Network Manager: An Alternate LAN Network Manager is a LAN Network Manager that may become a controlling LAN Network Manager in the event that reporting link 0 is not occupied by a LAN Network Manager.
- Observing LAN Network Manager: An observing LAN Network Manager is a LAN Network Manager that may not become a controlling LAN Network Manager.

Any LAN Network Manager may issue requests, receive responses to the requests, and selectively choose to receive notifications.

Up to three observing LAN Network Managers are supported, and the default number of Alternate LAN Network Managers is zero. When the controlling LAN Network Manager establishes its reporting link with a 3174-Peer Bridge, it may override this default and specify the number of Alternate LAN Network Managers supported. The identifiers of observing reporting links sequentially follow the identifiers of the alternate reporting links. For example, if two Alternate LAN Network Managers are specified, reporting links 1 and 2 are reserved for Alternate LAN Network Managers, and reporting link 3 is reserved for an Observing LAN Network Manager.

Establishing a Reporting Link

The 3174-Peer Bridge broadcasts a Management Servers Present major vector onto the Token-Ring each minute. A LAN Network Manager may automatically initiate the establishment of a reporting link with the 3174-Peer Bridge upon receipt of this major vector or it may establish a reporting link with the 3174 whenever an operator requests the connection. If an operator requests the connection, a test frame is broadcast to one of the 3174-Peer Bridge port adapters to obtain the path between the LAN Network Manager and the 3174-Peer Bridge. Figure 19-2 on page 19-9 illustrates the establishment of a reporting link.

The LAN Network Manager requests a bridge to establish a reporting link by sending a Logical Link Control (LLC) frame containing a Set Reporting Point (SRP) major vector to the X'F4' Destination Service Access Point (DSAP) of the 3174-Peer Bridge. Upon receipt of a valid SRP major vector, the 3174-Peer Bridge establishes a session with the LAN Network Manager.

A New Reporting Link Established major vector is sent to all LAN Network Managers with previously established links to the 3174-Peer Bridge. In addition, if the Set Reporting Point major vector caused the establishment of either a new controlling LAN Network Manager or the first controlling LAN Network Manager since the 3174 has opened its Token-Ring Adapter, the Report LAN Network Manager Control Shift Notification major vector is sent to all LAN Network Managers with previously established links and to the controlling LAN Network Manager. Likewise, if the LAN Network Manager establishing the reporting link occupies an Alternate LAN Network Manager link that allows it to be the controlling LAN Network Manager, but the SRP contains a Number of Alternate LAN Network Managers subvector that causes this reporting link to no longer be an Alternate LAN Network Manager link, a Report LAN Network Manager Control Shift Notification is sent to all LAN Network Managers with reporting links indicating "control is lost" (unless control was already lost prior to the 3174-Peer Bridge receiving this SRP major vector).

During the parsing of the Set Reporting Point (SRP) major vector, additional checks are interspersed with normal parsing checks. If a parsing error is detected, a SRP Error major vector is returned to the LAN Network Manager (with the appropriate error code as described in "LLC Parsing" on page 19-24), and no communication link is established with the requesting LAN Network Manager. If any other error is detected, a LAN Network Manager Rejected major vector is returned to the LAN Network Manager with one of the rejection codes listed in Table 19-10 on page 19-41. Also, a Report LAN Network Manager Rejected Notification major vector is sent to each LAN Network Manager that has requested LRM Notifications.

The following checks are performed:

1. If the frame has an invalid major vector ID, it is discarded and no response is sent.
2. If the frame has an invalid frame length, it is rejected with a "parsing error" (SRP Error major vector).
3. The frame is parsed, similar to other frames. If the frame does not parse properly (except for the processing of the contents of the subvectors), it is rejected with a "parsing error" (SRP Error major vector).
4. If the reporting link identifier is invalid, the frame is rejected with an Invalid Reporting-Link Identifier code (LAN Network Manager Rejected major vector).
5. If the reporting link is already occupied and the frame is a type 1 (UI), the frame is rejected with a Reporting Link Already in Use code (LAN Network Manager Rejected major vector). If the reporting link is already occupied and the frame is a type 2 (LLC connection-oriented) frame, the frame is rejected with an Invalid Request major vector.
6. If the key does not match the corresponding password for the requested reporting link, the frame is rejected with an Invalid Key code (LAN Network Manager Rejected major vector), and the event is logged. If the LAN Network Manager interface is not supported, an alert is sent to NetView.
7. If any of the functional addresses in the Reporting Function Classes requested are not supported, the frame may be accepted, but the unsupported bits are not set in the corresponding Reporting Function Classes subvector in the response frame.
8. If the Routing Information indicates that the frame crosses the bridge, the frame is rejected with a Route Traverses This Node code (LAN Network Manager Rejected major vector).
9. If the 3174-Peer Bridge cannot establish a connection with the LAN Network Manager, the frame is rejected with an Unable to Establish Connection code in a LAN Network Manager Rejected major vector.

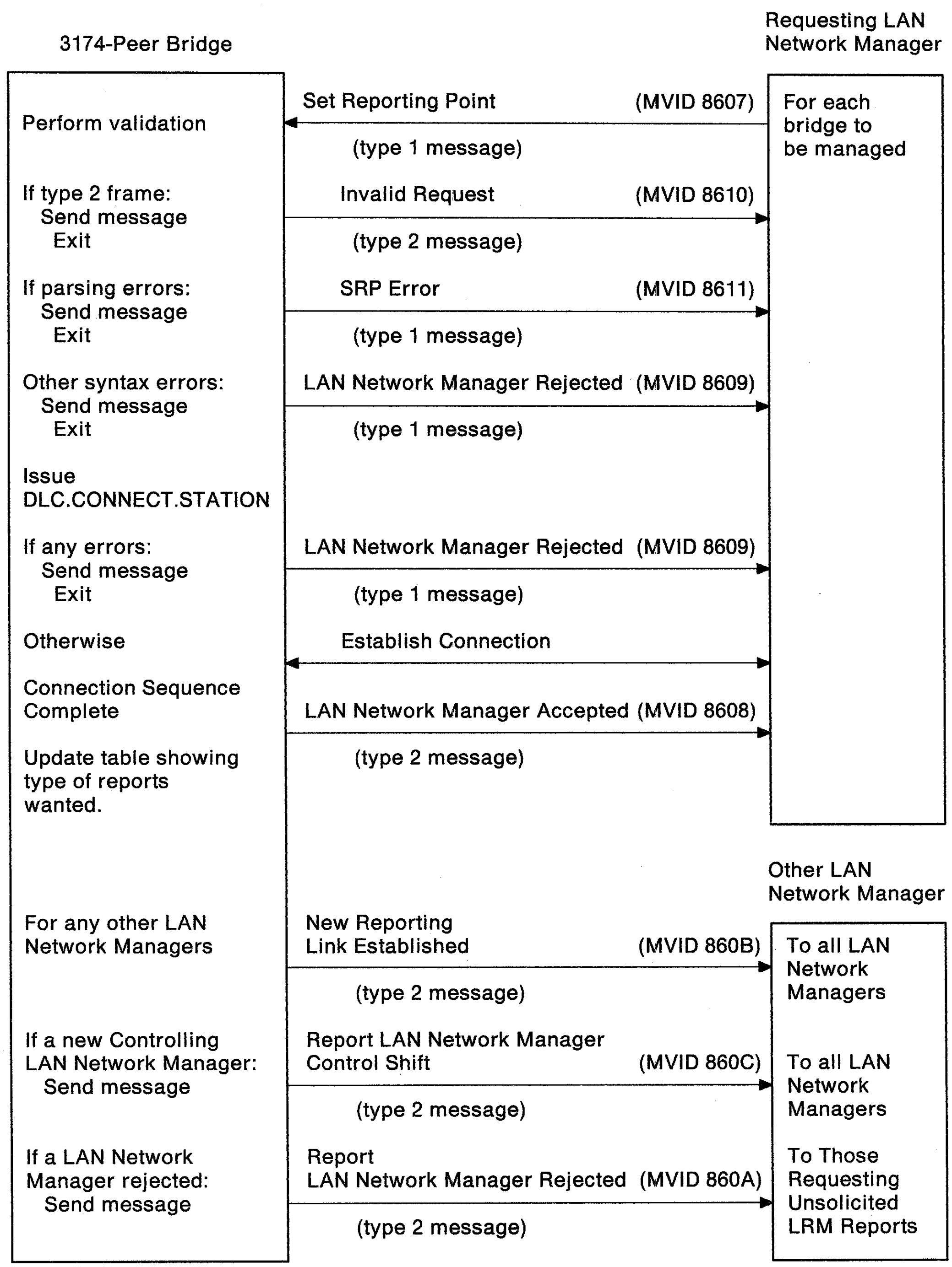


Figure 19-2. Establishing a Reporting Link

Closing a Reporting Link

A reporting link may be closed for various reasons:

- A LAN Network Manager may terminate a reporting link with the 3174-Peer Bridge by issuing:
  - Close Reporting Link major vector
  - Remove Ring Station major vector from the Configuration Report Server
- A LAN Network Manager reporting link may be lost
- Internal 3174 errors are detected.

A 3174 operator cannot easily terminate the LAN Network Manager reporting links. These links are terminated by the 3174-Peer Bridge only when the 3174's Token-Ring Adapter is closed (for example, by a lobe wire fault or the 3174 being IMLed).

A LAN Network Manager terminates a reporting link by sending a Close Reporting Link major vector (Figure 19-3) to the 3174-Peer Bridge. If this major vector does not parse correctly, an LRM Parsing Error major vector is returned. Otherwise, if the closed reporting link was the link to the controlling LAN Network Manager, the 3174-Peer Bridge issues a Report LAN Network Manager Control Shift to each LAN Network Manager with which it has a reporting link (even if its reporting classes do not request unsolicited LRM reports).

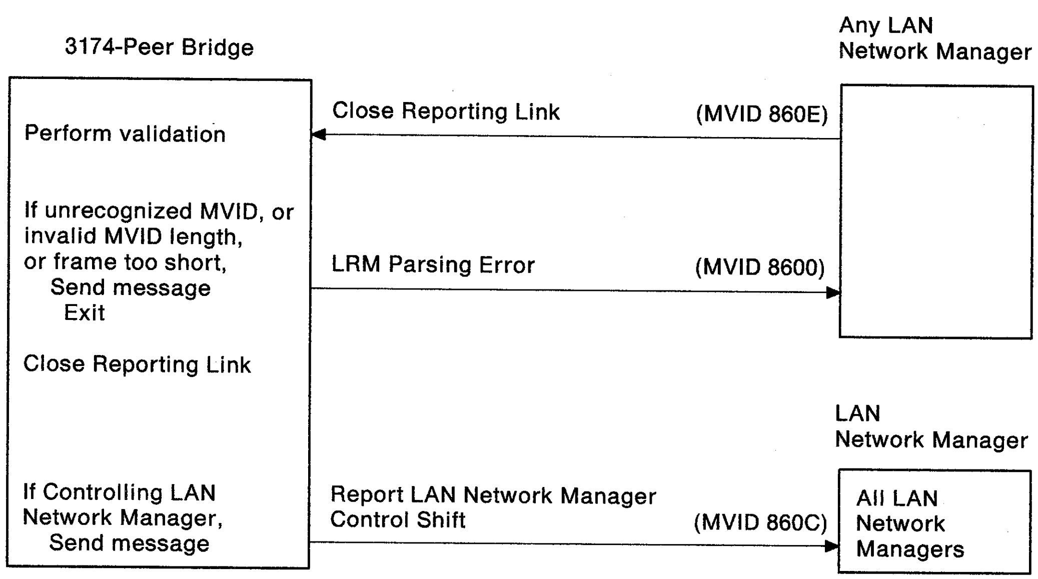


Figure 19-3. Close Reporting Link

If the LAN Network Manager issues a Remove Ring Station major vector (Figure 19-4 on page 19-11) to the Configuration Report Server in the 3174-Peer Bridge requesting that the bridge port attached to the 3174-Peer be removed, the 3174-Peer Bridge stops forwarding frames, discards SRP frames, and stops issuing Management Servers Present Notifications. The RPS functional address is reset for the Token-Ring side of the bridge and the event is logged. The 3174 will not function as a bridge until the Token-Ring Adapter is re-opened successfully by an action, such as a periodic re-open attempt after an adapter error, by a connection from a host operator to a PU 2.0 node serviced by the Token-Ring Gateway feature, or by IMLing the controller.

The 3174-Peer Bridge issues a Ring Station Removed major vector to the controlling LAN Network Manager that requested the ring to be removed, and issues a LRM Terminating Notification major vector to each LAN Network Manager (except for the controlling LAN Network Manager) with which it has a reporting link.

If the 3174-Peer Bridge port attached to the 3174-Peer segment is the station that is removed, devices that are using the Token-Ring for support other than 3174-Peer support (such as CUT or DFT host MFI support) may continue to operate. The LAN Network Manager may utilize a Configuration Report Server (CRS) attached to the Token-Ring to remove the 3174 from the ring. However, this inhibits 3174 attached devices that are not on the 3174-Peer segment from communicating with the Token-Ring.

If the Remove Ring Station major vector does not parse correctly, an LRM Parsing Error major vector is returned. If a syntax error is detected, a CRS Error major vector is returned.

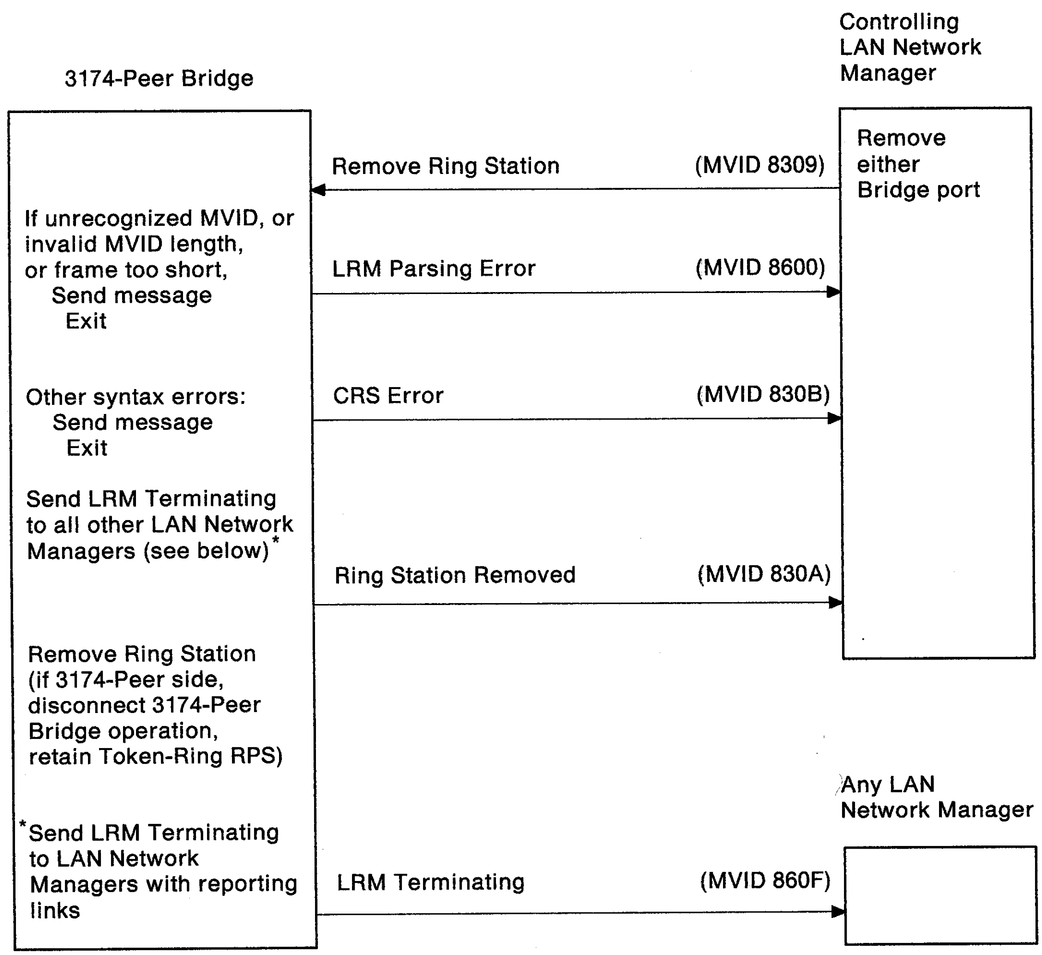


Figure 19-4. LAN Network Manager Removes a Bridge Port

If the LAN Network Manager Reporting Link is lost (Figure 19-5), the 3174-Peer Bridge will not attempt to re-establish connection with the LAN Network Manager. The Management Servers Present major vector is broadcast to inform the LAN Network Manager that the 3174 is prepared to re-establish connection at the LAN Network Manager's request.

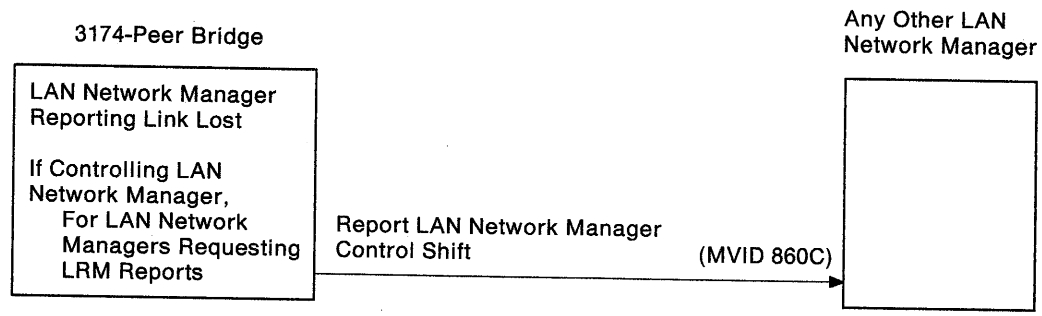


Figure 19-5. LAN Network Manager Reporting Link Lost

A LRM Terminating Notification major vector is sent to each established reporting link when 3174 internal errors are detected (Figure 19-6). This occurs if the Terminal Adapter breaks.

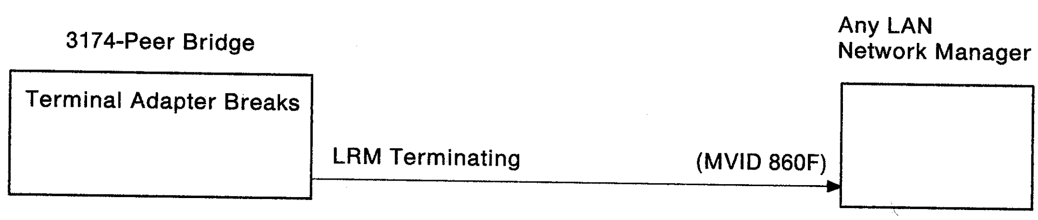


Figure 19-6. 3174 Internal Error Detected

See the *Token-Ring Network Architecture Reference* for more information.

LRM Parameters

The controlling LAN Network Manager may change the following LRM parameters by issuing a Set LRM Parameters major vector (Figure 19-7 on page 19-14):

- Ring Number to which either 3174-Peer Bridge port is attached
- Number of Alternate LAN Network Managers
- For one Reporting Link Identifier (per Set LRM Parameters major vector)
  - New Key
  - Reporting Function Classes for either 3174-Peer Bridge port
- Parameter changes may be Temporary or Permanent.

These parameter changes are retained across 3174 IMLs unless the Temporary/Permanent subvector indicates that the parameters are temporary.

Whenever the modified parameters are accepted, LRM sends a LRM Parameters Changes Notification major vector to each LAN Network Manager (except the controlling LAN Network Manager), that has reporting links with the 3174-Peer Bridge. If the Number of Alternate LAN Network Managers subvector is present and results in no controlling LAN Network Managers, a Report LAN Network Manager Control Shift is sent to all LAN Network Managers that have reporting links with the 3174-Peer Bridge.

If a ring number is changed, RPS broadcasts the new ring number to the corresponding ring segment. Changing the ring number causes all station connections that are bridged across that Token-Ring to be lost. If a LAN Network Manager is not directly attached to the same Token-Ring as the 3174-Peer Bridge, its reporting link is lost when the ring number is changed.

Any LAN Network Manager may request a LRM status report by issuing a Request LRM Status major vector. The LRM Status Report contains each of the parameters that may be set (except the New Key subvector and the Reporting Function Classes subvector), information on each established reporting link, and the following subvectors:

- LRM Version Level
- LAN Network Manager Address for each Reporting Link Identifier.

The Key subvector is not distributed to LAN Network Managers. The following subvectors are contained in the LAN Network Manager Accepted Notification when a new link is established, but are not contained in an LRM status report:

- Reporting Function Classes
- Available Port Function Classes
- Active Port Function Classes
- Enabled Functional Addresses.

Only a controlling LAN Network Manager can set LRM parameters. If a Set LRM Parameters major vector is attempted from a LAN Network Manager that is not the controlling LAN Network Manager, a Report LRM Control Breach Attempt major vector is sent to all LAN Network Managers with which LRM has a reporting link. If the Set LRM Parameters major vector is issued from the controlling LAN Network Manager and the major vector passes the remaining parsing checks, an LRM Parameters Changed major vector is sent to each LAN Network Manager whose reporting classes request unsolicited LRM reports.

If the Set LRM Parameters major vector does not parse correctly, an LRM Parsing Error major vector is returned. If a syntax error is detected, an LRM Error major vector is returned.

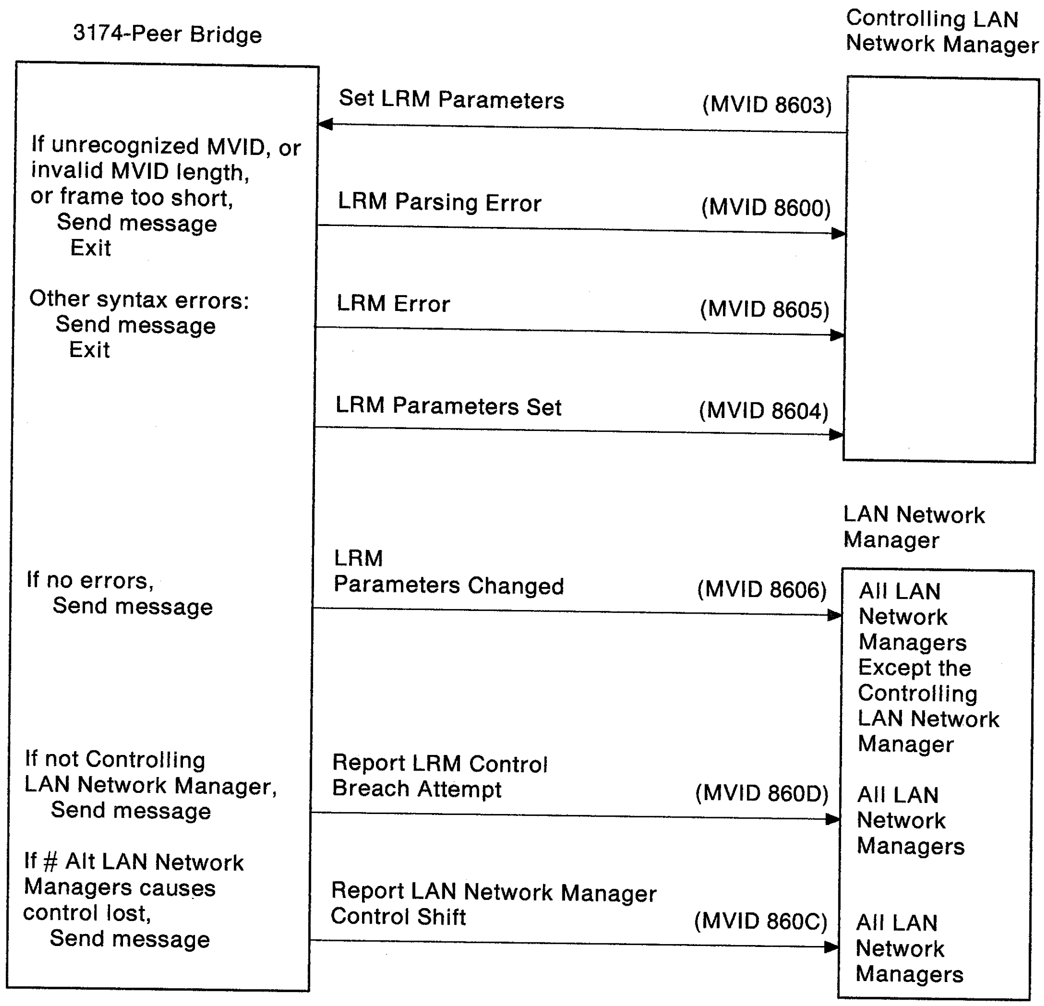


Figure 19-7. Set LRM Parameters

Any LAN Network Manager can request LRM status by issuing a Request LRM Status major vector (Figure 19-8 on page 19-15). If this major vector parses correctly, the 3174-Peer Bridge responds with a Report LRM Status major vector.

If the Request LRM Status major vector does not parse correctly, an LRM Parsing Error major vector is returned. If a syntax error is detected, an LRM Error major vector is returned.

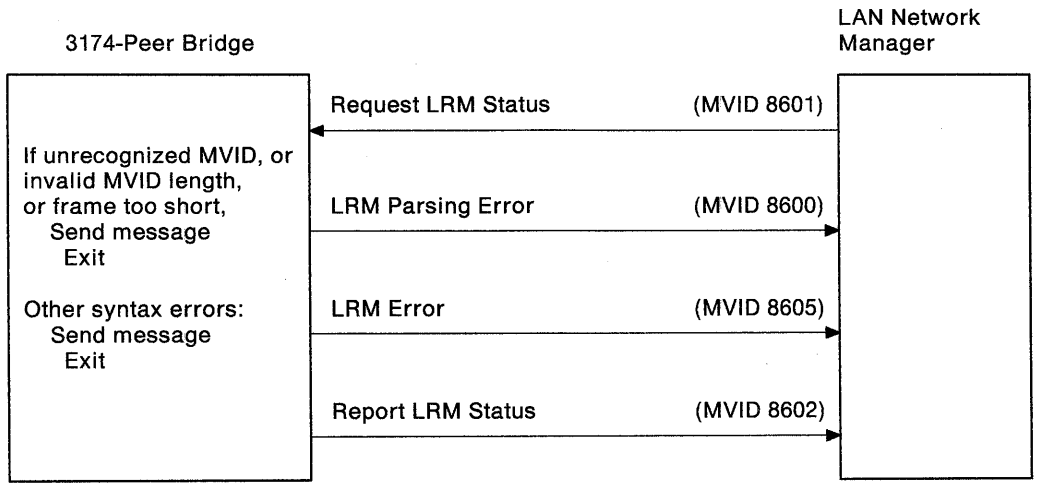


Figure 19-8. Request/Report LRM Status

When a LAN Network Manager is congested, it may request that LRM control the flow of traffic it sends to the LAN Network Manager. If LRM cannot send another frame to the LAN Network Manager until an acknowledge is returned, the queue of notifications and responses on a particular reporting link may become full and cause data to be discarded. In this event, at the next opportunity, an LRM Congestion Notification major vector is queued for transmission to the LAN Network Manager to which the discarded data should have been sent.

LAN Bridge Server (LBS)

There are three sets of bridge counters. One set is displayed through 3174 online tests. Although these counters may be reset locally, the resetting of these counters does not affect the other sets of counters.

The second set of counters are cumulative bridge counters that are reported to the LAN Network Manager. They wrap if the field size is exceeded, and are reset only when the 3174 is IMLed.

The third set of counters are also bridge counters that are reported to the LAN Network Manager. However, these counters are not cumulative. The name of a subvector which contains one of these counters begins with a "T." They count the frames discarded during a specific calculation interval, and are reset whenever a new interval begins. These counters wrap in the unlikely instance that they exceed their field size.

The counters that count bytes, rather than frames, count the frame length. Frames received from the Token-Ring are inclusively counted from the DSAP Field to the Cyclic Redundancy Check (CRC). For frames received from the 3174-Peer, the byte count is set equal to the Frame Length field.

Bridge Parameters

The controlling LAN Network Manager may change the following bridge parameters by issuing a Set Bridge Parameters major vector (Figure 19-9):

- Notification Interval (in 60 seconds)
- Percent Frames Lost Threshold
- Hop Count for each 3174-Peer Bridge port
- Bridge Identifier for an Identified Route across the 3174-Peer Bridge
- Frame Forwarding Status for an Identified Route across the bridge
- Parameter Changes may be Temporary or Permanent.

If the Set Bridge Parameters major vector is issued from the controlling LAN Network Manager and the major vector passes the remaining parsing checks, a Bridge Parameters Changed major vector is sent to each LAN Manager whose reporting classes requests unsolicited LBS reports. These parameter changes are retained across 3174 IMLs unless the Temporary/Permanent subvector indicates that the parameters are temporary.

If the Set Bridge Parameters major vector does not parse correctly, an LRM Parsing Error major vector is returned. If a syntax error is detected, a Bridge Error major vector is returned.

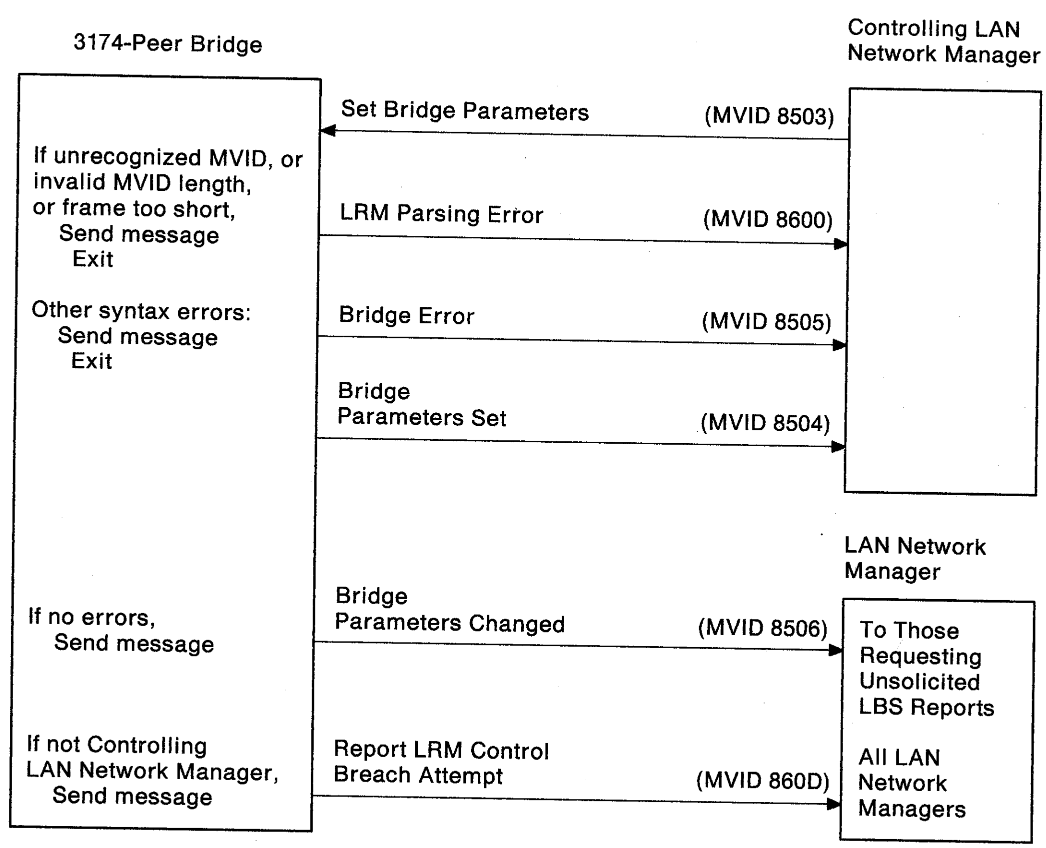


Figure 19-9. Set Bridge Parameters

Any LAN Network Manager can request Bridge status with a Request Bridge Status major vector (Figure 19-10 on page 19-17). The Bridge Status Report contains each of the parameters that may be set, and various other subvectors. First, LRM checks to see if the received frame can be parsed. If it parses incorrectly, an LRM

Parsing Error major vector is returned. If a syntax error is detected, the Bridge Error major vector is returned.

If a Set Bridge Parameters major vector is attempted from a LAN Network Manager that is not the controlling LAN Network Manager, a Report LRM Control Breach Attempt major vector is sent to all LAN Network Managers with which LRM has a reporting link. A Bridge Error (MVID 8505) is also sent to the requesting LAN Network Manager.

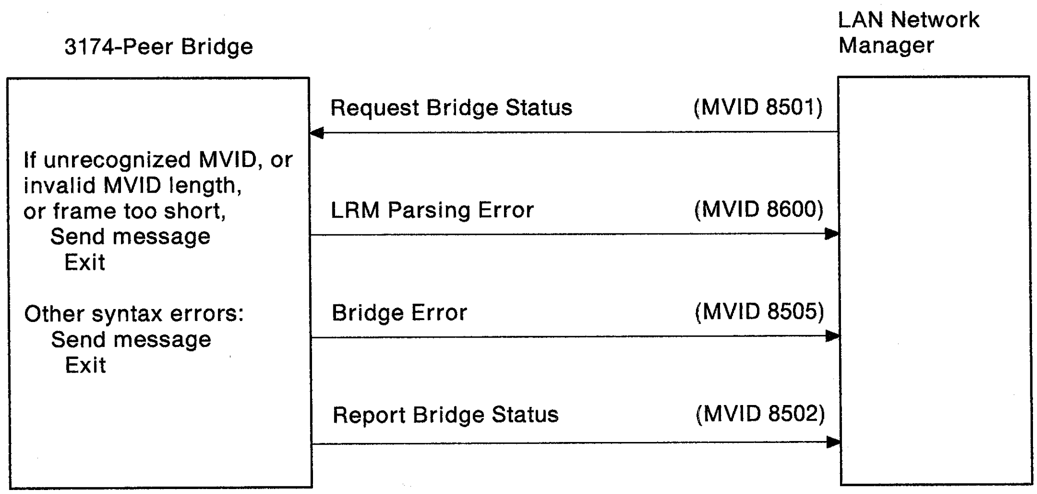


Figure 19-10. Request/Report Bridge Status

Bridge Notifications

The Bridge Threshold Exceeded Notification major vector (Figure 19-11) is sent to each LAN Network Manager whose reporting classes includes LBS whenever the percentage frames lost threshold is exceeded during the calculation interval. This major vector contains the percentage of frames lost threshold, the percentage of frames lost, and a breakdown of how many of each type of frames have been lost.

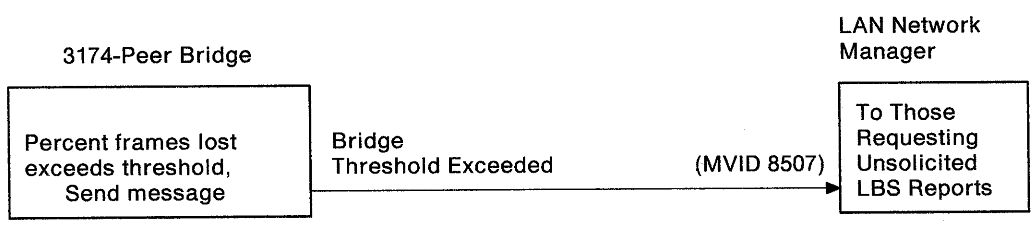


Figure 19-11. Bridge Performance Threshold Exceeded Notification

The Bridge Counter Report Notification major vector (Figure 19-12 on page 19-18) is sent to each LAN Manager whose reporting classes includes LBS each Notification Interval, if the Notification Interval is not zero. The major vector contains a Port Information subvector that identifies the port and ring number from which discarded frames were received, and subvectors that contain cumulative counters for the number of each type of frame that has been discarded. A Port Information subvector is present for each Bridge port.

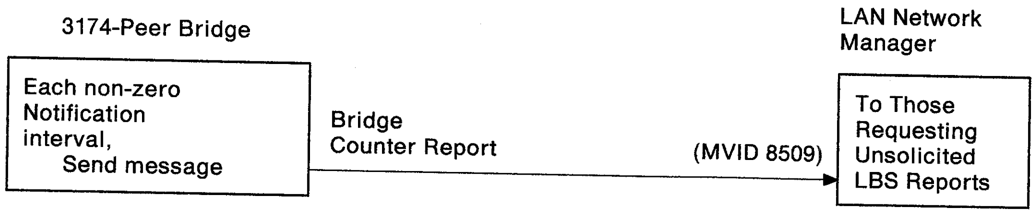


Figure 19-12. Bridge Threshold Exceeded

Configuration Report Server (CRS)

The Configuration Report Server support is for the 3174-Peer side of the bridge only. It exchanges station information with the LAN Network Manager, processes LAN Network Manager requests to remove a station from the 3174-Peer (including itself), and notifies the LAN Network Manager of topology changes.

Any LAN Network Manager may request the station information by issuing a Request Station Information major vector (Figure 19-13). The Report Station Information major vector is returned. If a parsing error is detected in a Request Station Information major vector, an LRM Parsing Error major vector is returned. If a syntax error is detected, a CRS Error major vector is returned.

The 3174-Peer Bridge issues an Invalid Request (MVID 8610) when the LAN Network Manager requests either Station Information or the removal of a station from a segment (ring) number that is not the 3174-Peer's segment number.

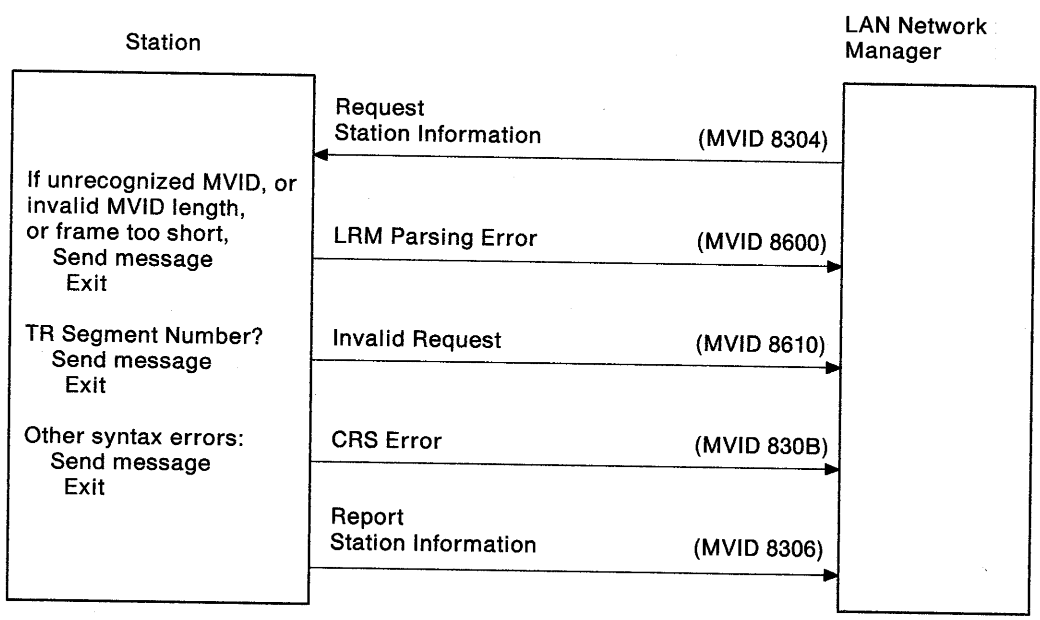


Figure 19-13. Request/Report Station Information

Note: The controlling LAN Network Manager cannot change the Station Parameters. See Table 19-11 on page 19-42.

Remove Operation

The controlling LAN Network Manager may request a station to be removed from a LAN segment by issuing a Remove Ring Station major vector (Figure 19-14 on page 19-20) to CRS. When CRS receives this major vector, it checks the Station Address subvector. If the Station Address subvector contains the 3174's 3174-Peer Individual Address, processing is performed as described in "Closing a Reporting Link" on page 19-10. If the Station Address subvector does not contain an individual address that is attached to the 3174-Peer, a Station Error subvector is included in the Ring Station Removed major vector.

If a Station Error subvector is not included in the Ring Station Removed major vector, CRS returns a Ring Station Removed major vector to the controlling LAN Network Manager and issues a Report NAUN Change major vector to each LAN Network Manager whose reporting class contains CRS. CRS labels the 3174-Peer attached device as not being attached to the 3174-Peer, and issues a Remove command to the device. If the device does not remove itself from the 3174-Peer after 10 seconds, the 3174 logically disconnects the device.

If a Remove Ring Station major vector is attempted from a LAN Network Manager that is not the controlling LAN Network Manager, a Report LRM Control Breach Attempt major vector is sent to all LAN Network Managers with which LRM has a reporting link.

The 3174-Peer Bridge issues an Invalid Request (MVID 8610) when the LAN Network Manager requests either Station Information or the removal of a station from a segment (ring) number that is not the 3174-Peer's segment number.

If a Remove Ring Station major vector does not parse correctly, an LRM Parsing Error is returned. If a syntax error is detected, the CRS major vector is returned.

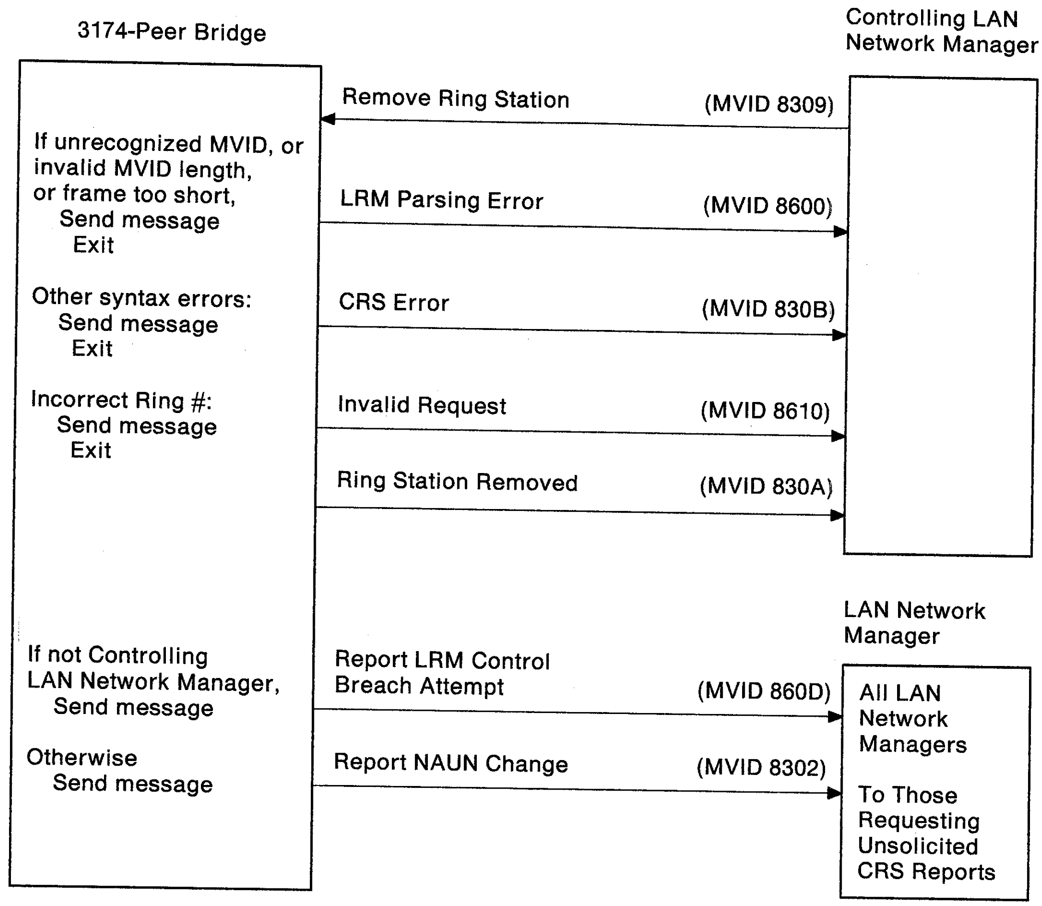


Figure 19-14. Ring Station Removal

Station Notifications

The Report NAUN Change Notification major vector (Figure 19-15) is sent to each LAN Network Manager whose reporting classes include CRS whenever a station enters or leaves the 3174-Peer segment. Two Report NAUN Change Notifications are sent to the LAN Network Managers that have requested CRS reports; one describes the new station's NAUN, and the other describes the station whose NAUN is the new station. When a station leaves the 3174-Peer segment, a Report NAUN Change Notification major vector is sent to the LAN Network Managers that have requested CRS reports. The station whose NAUN was previously the station that is leaving the network now has a new NAUN.

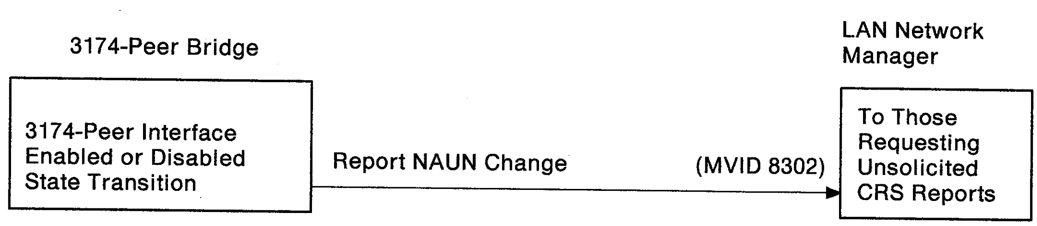


Figure 19-15. Report NAUN Change Notification

Ring Parameter Server (RPS)

Full Ring Parameter Server (RPS) support is provided for both the Token-Ring side and the 3174-Peer side of the bridge. This support is provided for the Token-Ring side of the bridge even if Bridge support is selected while LAN Network Manager support is not selected during the 3174 customization process. The RPS receives registration information from stations that are inserting into the LAN segment, provides the segment number to these stations, and provides the registration information to the LAN Network Manager. RPS parameter information is reported to the LAN Network Manager when requested. Invalid MAC frames received are ignored.

RPS Initialization

If there is at least one RPS already attached to the Token-Ring and its ring number for the Token-Ring does not match the ring number that the 3174 has for the Token-Ring, an alert is sent to NetView, reporting a segment number mismatch. The Bridge's Frame Forwarding Active is set to "No" and RPS functional address is not active. RPS functional address is not activated until a subsequent attempt is performed to open the Token-Ring Adapter (for example, the 3174 is IMLed). This inhibits the 3174 from providing RPS support for Token-Ring attached devices while allowing RPS to format LAN Network Manager reports. If no RPS is currently attached to the Token-Ring or if the 3174's segment number matches the segment number of the Token-Ring, RPS processing continues. The RPS function class is not set.

The RPS functional address is set in the 3174-Peer Bridge port which attaches to the Token-Ring unless one of the following conditions described prohibits this. If the RPS functional address is set and there is no other RPS attached to the Token-Ring, a Change Parameters MAC frame is sent on the Token-Ring to an all stations broadcast address of X'C000 FF FFFF', thereby establishing the ring number of the Token-Ring. The transmission of this frame is repeated twice on 1/2 second intervals. Ring station responses to this broadcast are ignored.

Change Parameters MAC Frame (MVID 0C): During RPS Initialization and Registration, a Change Parameters MAC Frame (MVID 0C) is sent onto the Token-Ring with a destination of the 3174-Peer Bridge's Individual Address. The destination class is the ring station, and the source address is CRS.

The Change Parameters MAC Frame contains the following subvector IDs (SVID):

- Correlator (SVID 09)
- Enabled Function Classes (SVID 06).

The Enabled Function Classes is X'2400', which enables the Bridge and RPS Function Classes.

Registration of a Station

When a station inserts into a LAN segment, it provides registration information to RPS. The RPS code provides the ring number for the LAN segment to the station, and registers the station with the LAN Network Manager.

The manner in which the segment number is exchanged varies, depending if the device is inserted into a Token-Ring (Figure 19-16 on page 19-22) or a 3174-Peer (Figure 19-17 on page 19-22). When a station inserts into a Token-Ring, it places a Request Initialization MAC frame onto the ring. If the Frame copied and Address

Recognized bits on the frame addressed to the RPS functional address are both '0'B, the 3174-Peer Bridge is the first RPS to receive the frame. RPS issues a Change Parameters MAC frame to the station to inform the station of the Token-Ring's ring number. This value replaces the default ring number in the station. The station issues a Response MAC frame to the 3174-Peer Bridge to acknowledge the receipt of the ring number. After successfully providing the segment number to a station, RPS issues a Report Station in Ring major vector to each LAN Network Manager whose reporting classes contain RPS.

When a station powers onto a 3174, information is exchanged that identifies the device as providing 3174-Peer support. RPS issues a Report Station in Ring major vector to each LAN Network Manager whose reporting classes contain RPS after the 3174-Peer interface is enabled.

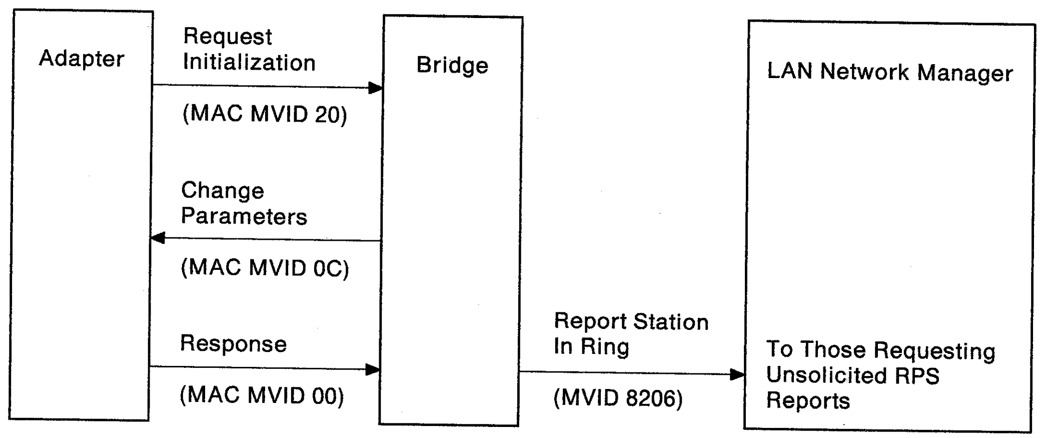


Figure 19-16. Token-Ring Station Registration

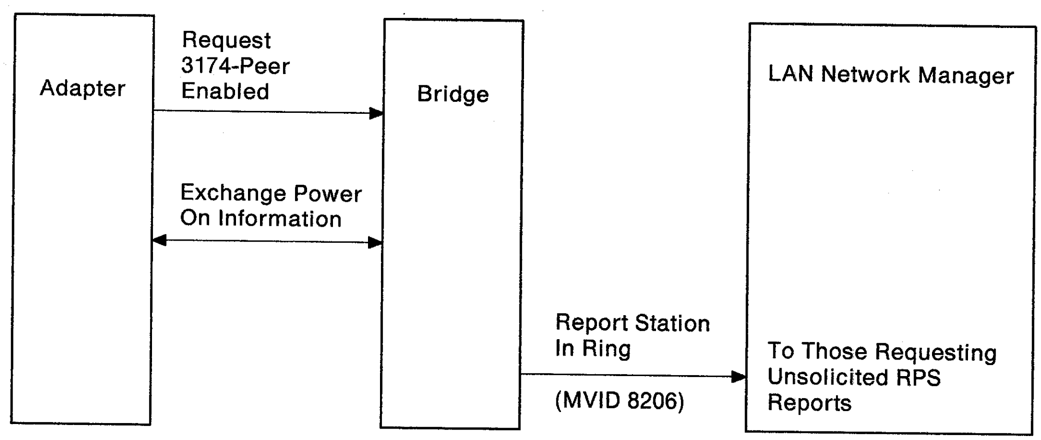


Figure 19-17. 3174-Peer Station Registration

RPS Parameters

Any LAN Network Manager may request RPS status by issuing a Request RPS Status major vector (Figure 19-18 on page 19-23). The Report RPS Status major vector is the response to this request. If a Request RPS Status major vector does not parse correctly, an LRM Parsing Error major vector is returned. If a syntax error is detected, the RPS Error major vector is returned.

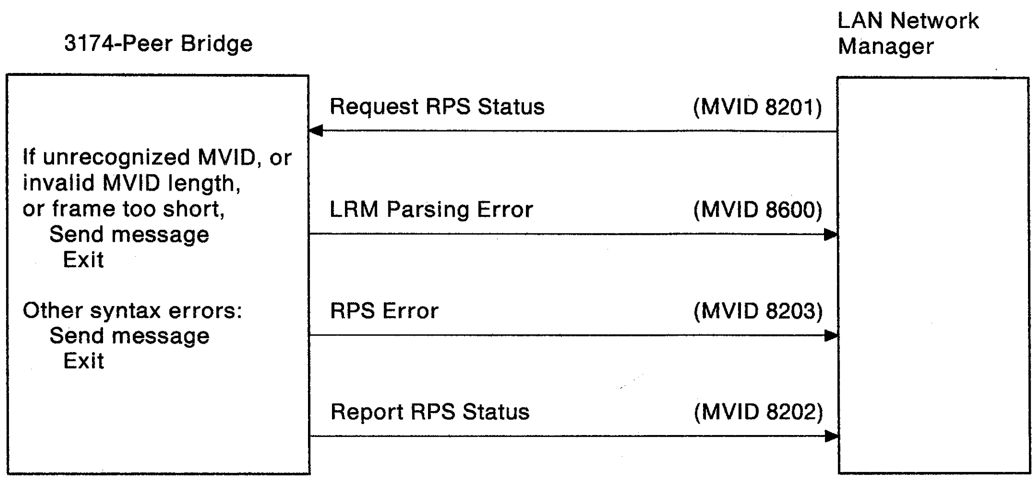


Figure 19-18. Request/Report RPS Status

Ring Error Monitor (REM)

The Ring Error Monitor (REM) support is provided for the 3174-Peer side of the 3174-Peer Bridge only. The supported major vectors allow notifications to be sent to any LAN Network Manager whose reporting class includes REM whenever counters wrap or an excessive number of frames destined to a specific 3174-Peer device are discarded. Isolating Mode Data is not required because the star-wired topology of a 3174-Peer does not require isolation of a faulty wire between two devices, as required on a ring or bus.

The Non-Isolating Threshold Exceeded Notification major vector (Figure 19-19) is sent to each LAN Network Manager whose reporting classes includes REM whenever the Multi-cast or Receive congestion counter for a 3174-Peer reaches its threshold value. A Multi-cast congestion counter is maintained to count the number of frames destined to multiple devices that are discarded.

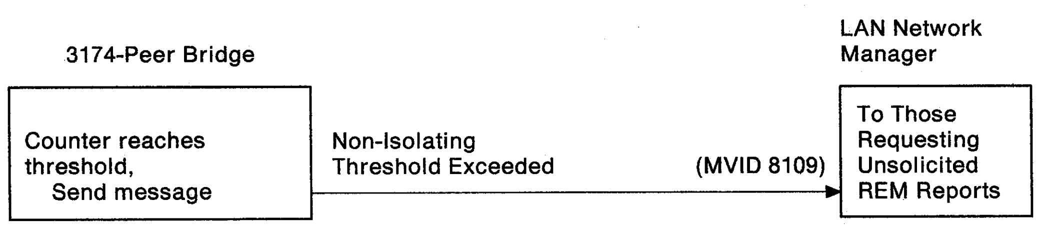


Figure 19-19. Non-Isolating Threshold Exceeded Notification

The Receiver Congestion Notification major vector (Figure 19-20) is sent to each LAN Network Manager whose reporting classes includes REM whenever more frames are discarded within 1 minute than the Device Performance Threshold percentage (specified during the 3174 customization process). This station enters a congestion state. The Receiver Congestion Notification major vector is not sent whenever a station is in a congestion state.

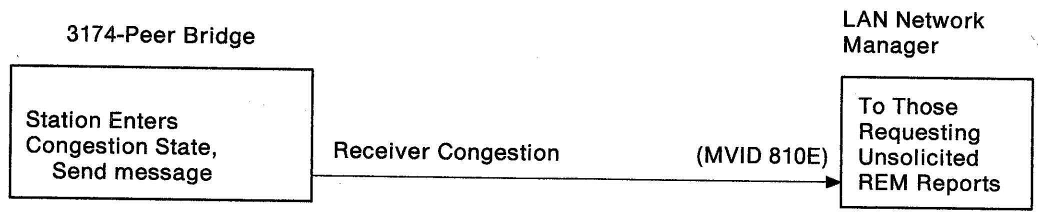


Figure 19-20. Receiver Congestion Notification

The Receiver Congestion Ended Notification major vector (Figure 19-21) is sent to each LAN Network Manager whose reporting classes includes REM whenever a ring station is in the congestion state and the number of frames discarded within the last minute are less than or equal to the Device Performance Threshold percentage (specified during the 3174 customization process). The station is no longer in a congestion state.

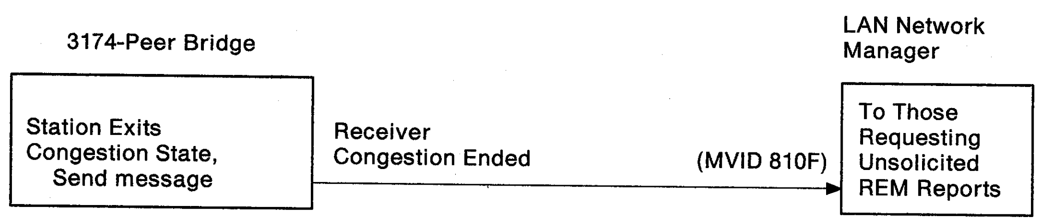


Figure 19-21. Receiver Congestion Ended Notification

LLC Parsing

LRM performs the following checks on each LLC frame received from a LAN Network Manager to determine if the frame can be parsed. If the answer to any of these questions is No, the frame cannot be parsed, and an LRM Parsing Error is returned to the LAN Network Manager from which the frame was sent.

- Is the frame long enough (at least 4 bytes)?
- Is the major vector identifier within the frame recognized? If the frame is a Type 1, is it a Set Reporting Point (SRP)? (If the Type 1 frame is not an SRP, it is ignored.)
- Does the major vector length equal the actual length of the received information?

Each of the other management servers perform the following syntax checks on each subvector contained within the major vector. If the answer to any of these questions is No, except for the question whether a subvector is recognized (if not, it is skipped), the Error major vector for the corresponding server is sent to the LAN Network Manager from which the frame was received.

- Does the sum of the major vector components equal its length − 4? If the answer is No, LRM is informed that the frame cannot be parsed because the major vector length is not equal to the actual length of the data.
- Does the length of each complex subvector equal the sum of the lengths of each of its components − 4?
- Is the subvector recognized? If not, it is skipped.
- Is the length of each subvector proper for the major vector and/or subvector in which it appears?
- Are all required subvectors present?
- Are any subvectors duplicates, where duplicates are not supported?
- Are the subvector values supported?
- In a “Set” command, is the frame from a controlling LAN Network Manager?
- If a frame containing an SRP major vector does not contain the Individual MAC address of either 3174-Peer Bridge port as its destination, it is ignored.

A “Command Could Not be Executed” (X'000C') diagnostic code is not supported.

Table 19-1. Diagnostic Codes for Request Status Major Vectors

Code	Meaning
X'0002'	Total (subvector lengths) does not equal vector length − 4
X'0004'	Optional subvectors present after the All subvector
X'0006'	Invalid subvector value
X'0007'	Invalid length for atomic subvector
X'0008'	Required subvector not present
X'0009'	Vector length less than 4
X'000A'	Unexpected duplicate subvector

Table 19-2. Diagnostic Codes for Set Parameter Major Vectors

Code	Meaning
X'0002'	Total (subvector lengths) does not equal vector length − 4
X'0004'	Value too high
X'0005'	Value too low
X'0006'	Invalid subvector value
X'0007'	Invalid length for atomic subvector
X'0008'	Required subvector not present
X'0009'	Vector length less than 4
X'000A'	Unexpected duplicate subvector
X'000B'	Unauthorized request

3174-Peer Major Vectors

The following tables list the major vectors exchanged between the 3174-Peer Bridge and a LAN Network Manager. These vectors are described in the *Token-Ring Network Architecture Reference*.

Ring Error Monitor Major Vectors

Table 19-3. Ring Error Monitor Major Vectors

ID	Frame Name	Subvector ID	Name	See Note
8109	Non-Isolating Threshold Exceeded Notification	4005	Ring Number	
		C001	Notification Enable	1
		8003	Non-Isolating Notification	
		C01B	Lost Frames	2
		C01C	Receiver Congestion Errors	3
810E	Receiver Congestion Notification	4005	Ring Number	
		4002	Ring Station Address	
810F	Receiver Congestion Ended Notification	4005	Ring Number	
		4002	Ring Station Address	

Notes to Table 19-3:

1. **Notification Enable (SVID C001):** The Notification Enable subvector contains a 2-byte bit-significant value field consisting of fields indicating the reporting modes for which REM is enabled. The first byte specifies the Enable Notification conditions reported. The value reported is X'08', indicating that a notification is sent whenever a counter exceeds its threshold. The threshold value is the field size of each counter.

   The second byte indicates the enable intensive conditions reported. The value reported is X'00', which indicates that the Intensive Mode Data subvector is not present.

2. **Lost Frames (SVID C01B):** The Lost Frames subvector is included only if the Multi-cast discard counter for the 3174 has reached 256. The subvector has a 2-byte integer value field that contains the following 1-byte fields:

   - Lost-Frame Count Field: This field contains the number of lost-frames reported to REM since the last count exceeded its threshold or has been reset. X'FF' is returned.
   - Lost-Frame Threshold Field: This field contains the number of lost frame errors that can be reported to REM before REM resets the count to zero and sends a Non-Isolating Notification frame to the LAN Network Managers whose reporting classes contain REM. The value returned is X'FF'. Although 255 is returned, the notification is sent whenever 256 frames have been discarded.

3. **Receiver Congestion Errors (SVID C01C):** The Receiver Congestion Errors subvector is included only if the Receive Congestion counter for the 3174 has reached 256. The subvector contains a 2-byte value field consisting of the following two 1-byte integer fields:

   - Receiver Congestion Count Field: This field contains the number of receiver congestion errors reported to REM since the last count exceeded its threshold or has been reset. X'FF' is returned. Although 255 is returned, the notification is sent whenever 256 frames have been discarded. If a device update causes the number of discards to exceed 256, the additional discards appear in the next notification.

- Lost-Frame Threshold Field: This field contains the number of lost frame errors that can be reported to REM before REM resets the count to zero and sends a Non-Isolating Notification frame to the LAN Network Managers whose reporting classes contain REM. The value returned is X'FF'.

Ring Parameter Server Major Vectors

Table 19-4. Ring Parameter Server Major Vectors

ID	Frame Name	Subvector ID	Name	See Note
8201	Request RPS Status			
		4001	Correlator	
		4005	Ring Number	
		4008	All	
8202	Report RPS Status			
		4001	Correlator	
		4005	Ring Number	
		400C	RPS Version Level	
		C001	Soft-Error-Report Timer Value	1
8203	RPS Error			
		4001	Correlator	
		4009	Error Code	2
		400A	Error Offset	
		400C	RPS Version Level	3
8206	Report Station in Ring Notification			
		4005	Ring Number	
		4002	Station Address	
		4003	NAUN of Inserting Station	
		400B	Product Instance Identifier	4
		C002	Adapter Microcode Level	
		C004	Attachment Status	5

Notes to Table 19-4:

1. **Soft-Error-Report Timer Value (SVID C001):** The Soft-Error-Report Timer Value subvector has a 2-byte value field that contains the frequency with which stations send error reports to the REM, encoded in 10-millisecond increments. 3174-Peer devices send error reports to the 3174 once every minute after errors are recorded, so the value returned in the value field is X'0258'. The value returned in this field for devices attached to the Token-Ring is zero.

2. **Error Code (SVID 4009):** The LRM Error and Set Reporting Point Error major vectors contain an Error Code subvector. This subvector contains a 2-byte diagnostic code describing the first error detected. See "LLC Parsing" on page 19-24 for more information.

3. **Version Level (SVID 400C):** Each Version Level subvector contains a 14-byte field consisting of:

   - Discriminator Field (1-byte)
   - Common Version Identifier Field (2-bytes)
   - Common Release Identifier Field (2-bytes)
   - Common Modification Identifier Field (2-bytes)
   - Software Product Program Number Field (7-bytes).

   The Discriminator Field is X'00', which indicates that this subvector is encoded in ASCII.

   The Common Version Identifier Field is '0001' encoded in ASCII, representing version 1.

   The Common Release Identifier Field is '0001' encoded in ASCII, representing the first release of the 3174-Peer support.

   The Common Modification Identifier Field is '0000' encoded in ASCII, representing suffix release 0.

   The Software Product Program Number Field is the ASCII character string '3174RPS'.

4. **Product Instance Identifier (SVID 400B):** The Product Instance Identifier subvector is included in the Attachments Information subvector. It contains an 18-byte integer value field that specifies some Vital Product Data. The following fields, except byte 1, are obtained from the Vital Product Data provided by a 3174-Peer device. The following describes the definition of the bytes:

   - Byte 0

     - bits 0-3: X'E' for a programmable device
     - bits 4-7: X'4' for IBM software.

   - Byte 1 — Format Type

     X'12' for a product is identified by a serial number (IBM plant of manufacture and sequence number) that is unique by machine type. The model number is provided for additional information, not to uniquely identify the product instance.

   - Byte 2-5 — Machine type

     Four numeric EBCDIC characters.

   - Byte 6-8 — Machine model number

     Three upper-case alphanumeric EBCDIC characters.

   - Byte 9-10 — Serial Number Modifier

     IBM plant of manufacture; two numeric EBCDIC characters.

   - Byte 11-17 — Sequence Number

     Seven upper-case alphanumeric EBCDIC characters, right justified with EBCDIC zeroes (X'F0') fill on the left.

5. **Attachment Status (SVID C004):** The Attachment Status subvector has a 2-byte value field that contains the status of the attachment process for a station that is attaching to either the Token-Ring or the 3174-Peer. The supported values for a device attaching to a Token-Ring are:

   - X'0000' — Successful attachment completion

   - X'0001' — Unsuccessful attachment with the receipt of at least one negative response

   - X'0002' — Same as X'0001', except no Response MAC frames were received from the attaching station.

   For a device attaching to the 3174, X'0000' is supported.

Configuration Report Server Major Vectors

Table 19-5. Configuration Report Server Major Vectors

ID	Frame Name	Subvector ID	Name	See Note
8302	Report NAUN Change Notification	4005	Ring Number	
		4002	Station Address	
		4003	NAUN Address	
		4004	Physical Location	
8304	Request Station Information	4001	Correlator	
		4002	Station Address	
		4005	Ring Number	
		4008	All	
		C002	Addressing Information	
		C003	State Information	
		C004	Attachments Information	
8306	Report Station Information	4001	Correlator	
		4002	Station Address	
		4005	Ring Number	
		8002	Addressing Information	
		4003	NAUN Address	
		4004	Physical Location	
		C00D	Group Address	
		C00F	Functional Addresses	
		8003	State Information	
		C010	Ring Station Microcode Level	1
		C011	Ring Station Status	2
		C012	Unique Station Identifier	3
		8004	Attachments Information	
		400B	Product Instance Identifier	4
		C013	Enabled Function Classes	5
		C014	Allowed Access Priority	6
		C00F	Functional Addresses	
		8005	Station Error	7
		C015	Reason Code	
8309	Remove Ring Station	4001	Correlator	
		4002	Station Address	
		4005	Ring Number	
830A	Ring Station Removed	4001	Correlator	
		C019	Status Code	8
		8005	Station Error	9
		C015	Reason Code	
830B	CRS Error	4001	Correlator	
		4009	Error Code	10
		400A	Error Offset	
		400C	CRS Version Level	11

Notes to Table 19-5 on page 19-29:

1. **Ring Station Microcode Level (SVID C010):** The value field will be written with zeroes.
2. **Ring Station Status (SVID C011):** Zeroes are written into this field.
3. **Unique Station Identifier (SVID C012):** This field will contain the default individual address the 3174 provides to a 3174-Peer device attached to this port when it powers on.
4. **Product Instance Identifier (SVID 400B):** The Product Instance Identifier subvector is included in the Attachments Information subvector. It contains an 18-byte integer value field that specifies some Vital Product Data. The following fields, except byte 1, are obtained from the Vital Product Data provided by a 3174-Peer device. The following describes the definition of the bytes:
   - Byte 0
     - bits 0-3: X'E' for a programmable device
     - bits 4-7: X'4' for IBM software.
   - Byte 1 — Format Type

     X'12' for a product is identified by a serial number (IBM plant of manufacture and sequence number) that is unique by machine type. The model number is provided for additional information, not to uniquely identify the product instance.
   - Byte 2-5 — Machine type

     Four numeric EBCDIC characters.
   - Byte 6-8 — Machine model number

     Three upper-case alphanumeric EBCDIC characters.
   - Byte 9-10 — Serial Number Modifier

     IBM plant of manufacture; two numeric EBCDIC characters.
   - Byte 11-17 — Sequence Number

     Seven upper-case alphanumeric EBCDIC characters, right justified with EBCDIC zeroes (X'F0') fill on the left.
5. **Enabled Function Classes (SVID C013):** The value specified is X'4A00' to represent support for the following:
   - DLC.LAN.MGR
   - Configuration Report Server
   - Ring Error Monitor.
6. **Allowed Access Priority (SVID C014):** X'0003' is returned in this field.
7. **Station Error (SVID 8005):** The Report Station Information major vector contains a Station Error subvector. The only supported Reason Code is X'0000', which is included in the Reason Code subvector if the Station Address requested is not attached to the 3174-Peer.
8. **Status Code (SVID C019):** The Ring Station Removed major vector contains a Status Code subvector. This subvector includes one of the following responses:
   - X'00' — Station removed
   - X'01' — Station could not be removed.

   The only instance in which a station could not be removed is if the station is not present on the 3174-Peer segment.

9. **Subvector Not Supported:** The Response Code subvector (SVID C016) is not included in the Station Error subvector since the X'0003' Reason Code is not supported.
10. **Error Code (SVID 4009):** The LRM Error and Set Reporting Point Error major vectors contain an Error Code subvector. This subvector contains a 2-byte diagnostic code describing the first error detected. See "LLC Parsing" on page 19-24 for more information.
11. **Version Level (SVID 400C):** Each Version Level subvector contains a 14-byte field consisting of:
    - Discriminator Field (1-byte)
    - Common Version Identifier Field (2-bytes)
    - Common Release Identifier Field (2-bytes)
    - Common Modification Identifier Field (2-bytes)
    - Software Product Program Number Field (7-bytes).

    The Discriminator Field is X'00', which indicates that this subvector is encoded in ASCII.

    The Common Version Identifier Field is '0001' encoded in ASCII, representing version 1.

    The Common Release Identifier Field is '0001' encoded in ASCII, representing the first release of the 3174-Peer support.

    The Common Modification Identifier Field is '0000' encoded in ASCII, representing suffix release 0.

    The Software Product Program Number Field is the ASCII character string '3174CRS'.

LAN Bridge Server Major Vectors

Table 19-6 (Page 1 of 3). LAN Bridge Server Major Vectors

ID	Frame Name	Subvector ID	Name	See Note
8501	Request Bridge Status			
		4001	Correlator	
		4008	All	
		C043	All (Long counters)	
8502	Report Bridge Status			
		4001	Correlator	
		C001	Bridge Type	1
		400C	Bridge Version Level	
		C002	Number of Ports	2
		C021	Partition Bits	3
		C026	Path Trace	4
		C02F	Calculation Interval	5
		C00C	Notification Interval	6
		C00A	Percent Frames Lost Threshold	7
		8003	Port Information (Per Bridge Port)	8
		4002	Port Identifier	
		4005	Ring Number	
		C004	Port Type	9
		C035	Ring Data Rate	10
		C005	Ring Status	11
		C006	Adapter Status	12
		C013	Port Hop Count	
		C009	Frames Discarded Counter Value	13
		C032	Frames Discarded Counter Value (Long)[1]	14
		C00B	B-Frames Transmitted Counter Value	
		C027	B-Bytes Transmitted Counter Value	
		C029	NB-Frames Transmitted Counter Value	
		C02B	NB-Bytes Transmitted Counter Value	
		C022	Frames Not Received Counter Value	
		C033	Frames Not Received Counter Value (Long)[1]	
		C024	Frames Not Forwarded Counter Value	
		C034	Frames Not Forwarded Counter Value (Long)[1]	
		C036	Frames Discarded – Telecommunications Error	15
		C042	Bytes Discarded – Telecommunications Error	16
		C044	Frames Not Routed Across Bridge	17
		C012	Single-Route Broadcast Enabled/Disabled	18
		800D	Route Status	19
		800E	Route Identifier	20
		C00F	Port Identifier	
		C010	Port Identifier	
		C011	Bridge Identifier	
		C015	Largest Frame Size	21
		C007	Route Active Status	22
		C041	Single-Route Broadcast Mode	23

Table 19-6 (Page 2 of 3). LAN Bridge Server Major Vectors

ID	Frame Name	Subvector ID	Name	See Note
8503	Set Bridge			24
	Parameters	4001	Correlator	
		C00C	Notification Interval[2]	6
		C00A	Percent Frames Lost Threshold[2]	7
		8003	Port Information (Per Bridge Port)	8
		4002	Port Identifier	
		C013	Port Hop Count[2]	
		800D	Route Status	19
		800E	Route Identifier	20
		C00F	Port Identifier	
		C010	Port Identifier	
		C011	Bridge Identifier[2]	
		C007	Route Active Status[2]	22
		4012	Temporary/Permanent	
8504	Bridge Parameters			
	Set	4001	Correlator	
8505	Bridge Error			
		4001	Correlator	
		4009	Error Code	25
		400A	Error Offset	
		400C	Bridge Version Level	26
8506	Bridge Parameters			
	Changed	C00C	Notification Interval	6
	Notification	C00A	Percent Frames Lost Threshold	7
		8003	Port Information (Per Bridge Port)	8
		4002	Port Identifier	
		C013	Port Hop Count	
		800D	Route Status	19
		800E	Route Identifier	20
		C00F	Port Identifier	
		C010	Port Identifier	
		C011	Bridge Identifier	
		C007	Route Active Status	22
8507	Bridge Performance			
	Threshold Exceeded	C00A	Percent Frames Lost Threshold	7
	Notification	C020	Percent Frames Lost	
		8003	Port Information (For one Bridge Port only)	
		4002	Port Identifier	
		4005	Ring Number	
		C023	T-Frames Discarded Counter Value	
		C025	T-B Frames Transmitted Counter Value	
		C028	T-NB Frames Transmitted Counter Value	
		C02A	T-Frames Not Received Counter Value	
		C02C	T-Frames Not Forwarded Counter Value	
		C037	T-Frames Discarded – Telecommunications Error	
		C045	T-Frames Not Routed Across Bridge (Promiscuous mode)	
		C030	T-B Bytes Transmitted Counter Value	
		C031	T-NB Bytes Transmitted Counter Value	

Table 19-6 (Page 3 of 3). LAN Bridge Server Major Vectors				
ID	**Frame Name**	**Subvector ID**	**Name**	**See Note**
8509	Bridge Counter Report Notification			
		8003	Port Information	
		4002	Port Identifier (Per Bridge Port)	
		4005	Ring Number	
		C009	Frames Discarded Counter Value	13
		C032	Frames Discarded Counter Value (Long)1	14
		C00B	B-Frames Transmitted Counter Value	
		C027	B-Bytes Transmitted Counter Value	
		C029	NB-Frames Transmitted Counter Value	
		C02B	NB-Bytes Transmitted Counter Value	
		C022	Frames Not Received Counter Value	
		C033	Frames Not Received Counter Value (Long)1	
		C024	Frames Not Forwarded Counter Value	
		C034	Frames Not Received Counter Value (Long)1	
		C036	Frames Discarded – Telecommunications Error	15
		C042	Bytes Discarded – Telecommunications Error	16
		C044	Frames Not Routed Across Bridge	17

Legend:

1Only provided if `all long` is requested (will not get `all` and `all long` both).
2These are the subvectors whose values are actually set.

Notes to Table 19-6 on page 19-32:

1. **Bridge Type (SVID C001):** The Bridge Type subvector contains a 2-byte bit string value field which identifies the type of bridge present. The value field for a 3174-Peer Bridge is X'0004'.

2. **Number of Ports (SVID C002):** The Number of Ports subvector has a 2-byte integer value field containing the number of ports attached to the bridge. The value field contains X'0002'.

3. **Partition Bits (SVID C021):** The Partition Bits subvector has a 1-byte integer value field which specifies the number of bits reserved in the Routing Information field for each bridge identifier. The supported value is X'04'.

4. **Path Trace (SVID C026):** The Path Trace subvector contains a 1-byte value field indicating if LBS is enabled to send Path Trace Report frames to LAN Network Managers. X'00' is included in the value field, which indicates that LBS is not enabled to send Path Trace Report frames to LAN Network Managers.

5. **Calculation Interval (SVID C02F):** The Calculation Interval subvector contains a 2-byte integer value field indicating the frequency with which LBS calculates the percentage of frames lost or discarded by the bridge. The interval is defined in seconds. The supported value is 60 seconds.

6. **Notification Interval (SVID C00C):** The default value initialized at 3174 IML time is zero, which causes no Bridge Counter Report major vectors to be sent to the LAN Network Manager until the Notification Interval is updated. Supported values are in multiples of the Calculation Interval, which is 60 seconds. This parameter is not retained across 3174 IMLs.

   If the value received is not a multiple of 60 seconds, it is rounded down either to the nearest 60 seconds or to 60 seconds, whichever is greater.

7. **Percent Frames Lost Threshold (SVID C00A):** The Percent Frames Lost Threshold subvector has a 2-byte integer value field that contains the threshold value for the following ratio: the number of frames lost or discarded by the bridge during the last calculation interval divided by the number of frames destined to be forwarded through the bridge during that interval. This value is expressed as 1/100th of a percent (or frames discarded or lost per 10,000), and is used to trigger the Bridge Performance Threshold Exceeded Notification. The calculation is performed only if at least 100 frames have been destined to be forwarded through the bridge during the calculation interval. The default value is specified during the 3174 customization process. The supported values are 0 - 9999.

8. **Subvector Not Supported:** The Single-Route Broadcast Enabled/Disabled subvector (SVID C012) is not supported in a Set Bridge Parameters major vector. It is included in a Report Bridge Status Report and is described in "Single-Route Broadcast Enabled/Disabled (SVID C012)" on page 19-36.

9. **Port Type (SVID C004):** The Port Type subvector is contained within the Port Information subvector for each Bridge port. It contains a 2-byte bit string value field specifying the type of port present. When the Port Information describes the port attached to the Token-Ring, the value is X'0001' for a Token-Ring station. When the Port Information describes the port attached to the 3174-Peer, the value is X'0006' for a 3174-Peer station.

10. **Ring Data Rate (SVID C035):** The Ring Data Rate subvector is contained within the Port Information subvector for each Bridge port. It contains a 2-byte integer value field indicating the data rate of the segment to which this port is attached. When the Port Information describes the bridge port attached to the Token-Ring, one of the following values are included in the value field:

    - X'0004' — 4 Mbps
    - X'0010' — 16 Mbps.

    When the Port Information describes the bridge port attached to the 3174-Peer, the value is X'0000', for less than 1 Mbps support.

11. **Ring Status (SVID C005):** The Ring Status subvector is contained within the Port Information subvector for each Bridge port. It contains a 2-byte value indicating the operational status of the ring to which a port is attached. The supported value is:

    X'0000' — The ring is operational.

12. **Adapter Status (SVID C006):** The Adapter Status subvector is contained within the Port Information subvector for each Bridge port. It contains a 2-byte bit string value field specifying the status of the port. The supported value is:

    X'0000' — Attached to the network.

    If a CRS Remove Ring Station causes the 3174-Peer Bridge to be removed from the 3174-Peer segment, a LRM Terminating major vector is sent to each LAN Network Manager, including the controlling LAN Network Manager, that has a reporting link with the bridge. Any Request Bridge Status major vectors received during this period of time are ignored.

13. **Frames Discarded Counter Value (SVID C009):** This subvector contains the number of frames received by a bridge port that are not forwarded to the target segment because the target segment is inoperative for a recoverable condition, such as beaconing. When the Port Information describes the bridge port attached to the Token-Ring, X'0000' is included in the value field.

14. **Frames Discarded Counter Value (long) (SVID C032):** This subvector contains the number of frames received by a bridge port that are not forwarded to the target segment because the target segment is inoperative for a recoverable condition, such as beaconing. When the Port Information describes the bridge port attached to the Token-Ring, X'00000000' is included in the value field because the 3174-Peer does not contain any instances where it is temporarily inoperative.

15. **Frames Discarded - Telecommunications Error (SVID C036):** The value included is always X'00000000'.

16. **Bytes Discarded - Telecommunications Error (SVID C042):** The value included is always X'000000000000'.

17. **Frames Not Routed Across Bridge (SVID C044):** The value field always contains X'00000000'.

18. **Single-Route Broadcast Enabled/Disabled (SVID C012):** The Single-Route Broadcast Enabled/Disabled subvector is contained within the Port Information subvector for each Bridge port. It contains a 1-byte integer value field used to determine whether this bridge port may be part of a single-route broadcast path. X'01' is included in the value field, which indicates that the 3174-Peer Bridge will accept and forward single-route (also called limited broadcast) frames.

19. **Subvector Not Supported:** The Single-Route Broadcast Mode subvector (SVID C041) is not supported in a Set Bridge Parameters major vector. It is included in a Report Bridge Status Report and is described in "Single-Route Broadcast Mode (SVID C041)" on page 19-36.

20. **Route Identifier (SVID 800E):** The Route Identifier subvector contains two subvectors, each of which identifies one of the 3174-Peer Bridge ports. The Port Identifier subvector (SVID C00F) identifies one of the 3174-Peer Bridge ports, while the Port Identifier subvector (SVID C010) identifies the other 3174-Peer Bridge port.

21. **Largest Frame Size (SVID C015):** The Largest Frame Size subvector is contained within the Route Status subvector. It contains a 1-byte integer value that specifies the largest information field within a frame that the 3174-Peer Bridge will forward. The supported value is 2052.

22. **Route Active Status (SVID C007):** The Route Active Status subvector contains a 1-byte bit string value field that indicates the frame forwarding status of the route specified in the Route Identifier subvector. Two values are supported. X'00' indicates active status, where frames are forwarded between the two LAN segments to which the identified ports are attached. X'01' indicates inactive status, where frames are not forwarded between the two LAN segments to which the identifier ports are attached. If X'01' is received, an alert is sent to NetView. The default value is specified during the 3174 customization process.

23. **Single-Route Broadcast Mode (SVID C041):** Although the 3174 copies single-route broadcast frames, it does not participate in the spanning tree algorithm. It includes X'00' in the value field, which indicates that the bridge is manually configured for single-route broadcast. The LAN Network Manager is not allowed to change this setting.

24. **Subvector Not Supported:** The Bridge Internal Status subvector (SVID C02E) is not supported in a Set Bridge Parameters major vector or a Report Bridge Status major vector. Implementation unique information is not available for the 3174-Peer Bridge.

25. **Error Code (SVID 4009):** The LRM Error and Set Reporting Point Error major vectors contain an Error Code subvector. This subvector contains a 2-byte diagnostic code describing the first error detected. See "LLC Parsing" on page 19-24 for more information.

26. **Version Level (SVID 400C):** Each Version Level subvector contains a 14-byte field consisting of:

    - Discriminator Field (1-byte)
    - Common Version Identifier Field (2-bytes)
    - Common Release Identifier Field (2-bytes)
    - Common Modification Identifier Field (2-bytes)
    - Software Product Program Number Field (7-bytes).

    The Discriminator Field is X'00', which indicates that this subvector is encoded in ASCII.

    The Common Version Identifier Field is '0001' encoded in ASCII, representing version 1.

    The Common Release Identifier Field is '0001' encoded in ASCII, representing the first release of the 3174-Peer support.

    The Common Modification Identifier Field is '0000' encoded in ASCII, representing suffix release 0.

    The Software Product Program Number Field is the ASCII character string '3174LBS'.

LAN Reporting Mechanism Major Vectors

Table 19-7 (Page 1 of 3). LAN Reporting Mechanism Major Vectors

ID	Frame Name	Subvector ID	Name	See Note
8600	Report LRM Parsing			
	Error	C002	MVID of Error Frame	
		400C	LRM Version Level	1
		C00F	Error Code	2
8601	Request LRM Status			
		4001	Correlator	
		4008	All	
8602	Report LRM Status			
		4001	Correlator	
		400C	LRM Version Level	1
		C004	Number of Alternate LAN Network Managers	3
			Reporting Link Information (Per Established	
		8005	Reporting Link)	
			Reporting Link Identifier	
		C006	LAN Network Manager Address	
		4002	Port Information (Per Bridge Port)	
		8007	Port Identifier	
		4002	Ring Number	
		4005		
8603	Set LRM			4
	Parameters	4001	Correlator	
		4002	Port Identifier	
		4005	Ring Number[1]	
		C004	Number of Alternate LAN Network Managers[1]	3
			Reporting Link Information	
		8005	Link Identifier	
		C006	New Key[1]	
		C00C	Port Information (Per Bridge Port)	
		8007	Port Identifier	
		4002	Reporting Function Classes[1]	
		C008	Temporary/Permanent	
		4012		
8604	LRM Parameters			
	Set	4001	Correlator	
8605	LRM Error			
		4001	Correlator	
		4009	Error Code	5
		400A	Error Offset	
		400C	LRM Version Level	1
8606	LRM Parameters			
	Changed	4002	Port Identifier Changed	
	Notification	4005	Ring Number Changed	
		C004	Number of Alternate LAN Network Managers	3
			Reporting Link Information	
		8005	Reporting Link Identifier	
		C006	New Key (No value field)	
		C00C	Port Information (Per Bridge Port)	
		8007	Port Identifier	
		4002	Reporting Function Classes	
		C008		6

Table 19-7 (Page 2 of 3). LAN Reporting Mechanism Major Vectors				
ID	**Frame Name**	**Subvector ID**	**Name**	**See Note**
8607	Set Reporting Point			
		4001	Correlator	
		C004	Number of Alternate LAN Network Managers[1]	
			Routing Information[2]	3
		C00C	Reporting Link Information	
		8005	Link Identifier	
		C006	Key	
		C00B	Port Information (Per Bridge Port)	7
		8007	Port Identifier	
		4002	Reporting Function Classes[1]	
		C008		6
8608	LAN Network			
	Manager Accepted	4001	Correlator	
		C004	Number of Alternate LAN Network Managers	3
			Reporting Link Information	
		8005	Reporting Link Identifier	
		C006	Port Information (Per Bridge Port)	
		8007	Port Identifier	
		4002	Ring Number	
		4005	Reporting Function Classes	
		C008	Available Port Function Classes	6
		C009	Active Port Function Classes	8
		C00A	Enabled Functional Addresses	8
		C011		9
8609	LAN Network			
	Manager Rejected	4001	Correlator	
		C00B	Rejection Code	10
		C004	Number of Alternate LAN Network Managers[3]	3
			Reporting Link Information[3]	
		8005	Reporting Link Identifier	
		C006	Port Information (Per Bridge Port)	
		8007	Port Identifier	
		4002	Ring Number	
		4005	Reporting Function Classes	
		C008	Available Port Function Classes	6
		C009	Active Port Function Classes	8
		C00A	Enabled Functional Addresses	
		C011		9
860A	Report LAN Network			
	Manager Rejection	C00B	Rejection Code	10
	Notification	4002	LAN Network Manager Address	
860B	New Reporting Link			
	Established	8005	Reporting Link Information	
	Notification	C006	Reporting Link Identifier	
		4002	LAN Network Manager Address	
860C	Report LAN Network			
	Manager Control	C00D	Status Code	11
	Shift Notification	C00E	Reason Code	12
		C004	Number of Alternate LAN Network Managers	3
			Reporting Link Information	
		8005	Reporting Link Identifier	
		C006	LAN Network Manager Address	
		4002		

Table 19-7 (Page 3 of 3). LAN Reporting Mechanism Major Vectors

ID	Frame Name	Subvector ID	Name	See Note
860D	Report LRM Control			
	Breach Attempt	8005	Reporting Link Information	
	Notification	C006	Reporting Link Identifier	1
		4002	LAN Network Manager Address	3
860E	Close Reporting Link			
860F	LRM Terminating			
	Notification	C010	Reason Code	13
8610	Invalid Request			14
		4001	Correlator	
		C012	Reason Code	
		C004	Number of Alternate LAN Network Managers	3
			Reporting Link Information	
		8005	Reporting Link Identifier	
		C006	Port Information (Per Bridge Port)	
		8007	Port Identifier	
		4002	Ring Number	
		4005	Reporting Function Classes	
		C008	Available Port Function Classes	6
		C009	Active Port Function Classes	8
		C00A	Enabled Functional Addresses	
		C011		9
8611	Set Reporting Point			15
	Error	4001	Correlator	
		C00F	Reason Code	16
		4009	Error Code	5
		400A	Error Offset	
		400C	LRM Version Level	1
8612	LRM Congestion			
8613	Management			
	Servers Present	400C	LRM Version Level	1
		8005	Reporting Link Information	
		8007	Port Information (Per Bridge Port)	
		4002	Port Identifier	
		4005	Ring Number	

Legend:

1These are the subvectors whose values are actually set.
2The actual RI field on the frame received is used, hence this subvector is ignored.
3Not present if rejection code is X'0001' (invalid key) or X'0003' (invalid reporting link identifier).

Notes to Table 19-7 on page 19-37:

1. **Version Level (SVID 400C):** Each Version Level subvector contains a 14-byte field consisting of:

   - Discriminator Field (1-byte)
   - Common Version Identifier Field (2-bytes)
   - Common Release Identifier Field (2-bytes)
   - Common Modification Identifier Field (2-bytes)
   - Software Product Program Number Field (7-bytes).

   The Discriminator Field is X'00', which indicates that this subvector is encoded in ASCII.

   The Common Version Identifier Field is '0001' encoded in ASCII, representing version 1.

The Common Release Identifier Field is '0001' encoded in ASCII, representing the first release of the 3174-Peer support.

The Common Modification Identifier Field is '0000' encoded in ASCII, representing suffix release 0.

The Software Product Program Number Field is the ASCII character string '3174LRM'.

2. **Error Code (SVID C00F):** The Report LRM Parsing Error major vector contains an Error Code subvector. This subvector contains a 1-byte value field that specifies the reason the frame cannot be parsed. The first of the following is included:
   - X'00' – Major vector missing (frame is too short)
   - X'01' – Major vector identifier is not recognized
   - X'02' – Major vector length is not equal to the actual length of received information.
3. **Number of Alternate LAN Network Managers (SVID C004):** If this subvector is not included, the number of Alternate LAN Network Managers remains at the last value set since a 3174 IML. At IML, the number of Alternate LAN Network Managers is set to zero.
4. **Subvector Not Supported:** The Enabled Functional Addresses subvector (SVID C011) is not supported in a Set LRM Parameters major vector.
5. **Error Code (SVID 4009):** The LRM Error and Set Reporting Point Error major vectors contain an Error Code subvector. This subvector contains a 2-byte diagnostic code describing the first error detected. See "LLC Parsing" on page 19-24 for more information.
6. **Reporting Function Classes (SVID C008):** The Reporting Function Classes subvector contains a 4-byte bit-significant value that specifies the management servers from which notifications are requested to be sent to the LAN Network Manager for the LAN segment attached to the 3174-Peer Bridge port identified in the Port Identifier subvector. See Table 19-8 for a list of the servers which are valid function classes supported for each port. If the Reporting Function Classes is not specified in an SRP for a port, no notifications are requested to be sent from that port. The Reporting Function Classes may be changed by a controlling LAN Network Manager issuing a Set LRM Parameters major vector.
7. **Key (SVID C00B):** The password defaults to the value specified during the 3174 customization process. It may be changed by a controlling LAN Network Manager issuing a Set LRM Parameters major vector. The password is restricted to containing "0-9" and "A-Z." Changes are retained across 3174 IMLs unless the updates are modified during the 3174 customization process or a 3174 online test.
8. **Available Port Function Classes (SVID C009):** This subvector contains a 4-byte bit-significant value field that indicates the function classes for which this port is capable of sending notifications. The subset of the Available Port Function Classes that is requested in the Reporting Function Classes is returned in the Active Port Function Classes subvector. See Table 19-8 for a list of the servers which are valid function classes for each port.

Table 19-8. Management Server Function Classes Supported

Function	MAC Function Class	Token-Ring	3174-Peer	Reporting Function Classes
LRM	–	Supported	Supported	Bit 0
Bridge Server	2	Supported	Supported	Bit 23
CRS	4	Not Supported	Supported	Bit 27
REM	6	Not Supported	Supported	Bit 28
RPS	5	Not Supported	Supported	Bit 30

9. **Enabled Functional Addresses (SVID C011):** This subvector has a 4-byte bit-significant value field that indicates the functional addresses supported by the port identified in the Port Identifier subvector. The Ring Parameter Server and Bridge Functional Addresses are the only additional functional addresses

that are set on the Token-Ring side of the 3174-Peer Bridge by this effort. The ability for the LAN Network Manager to disable this functional address is not supported. See Table 19-9 on page 19-41 for a list of the Management Server Functional Addresses supported by the 3174-Peer Bridge.

Table 19-9. Management Server Functional Addresses Supported

Functional Addresses	Bit	Token-Ring	3174-Peer
Bridge	23	Supported	Supported
Configuration Report Server	27	Not Supported	Supported
Ring Error Monitor	28	Not Supported	Supported
Ring Parameter Server	30	Supported[1]	Supported

Legend:

[1]Unless Segment Number Mismatch detected.

10. **Rejection Code (SVID C00B):** This subvector contains a 2-byte value field that indicates the reason code for which the Set Reporting Point attempt is rejected. Table 19-10 lists the rejection codes.

Table 19-10. "LAN Network Manager Rejected" Rejection Codes

Code	Meaning
X'0001'	Invalid Key
X'0002'	Reporting link already in use
X'0003'	Invalid reporting-link identifier
X'0004'	Unable to establish connection
X'0005'	Route traverses this node

11. **Status Code (SVID C00D):** The Report LAN Network Manager Control Shift Notification major vector contains a Status Code subvector. This subvector has a 2-byte value field that contains one of the following values:
    - X'0000'

      Control is lost. There is no new controlling LAN Network Manager.
    - X'0001'

      There is a new controlling LAN Network Manager.
12. **Reason Code (SVID C00E):** The Report LAN Network Manager Control Shift Notification major vector contains a Reason Code subvector whenever the Status Code is not X'0000'. This subvector consists of a 2-byte value field that contains one of the following values:
    - X'0000' – Normal termination

      A Close Reporting Link subvector has been issued.
    - X'0001' – Error in the Network

      An LLC connection is lost.
    - X'0002'

      A LAN Network Manager has assumed control from an Alternate LAN Network Manager.

13. **Reason Code (SVID C010):** The LRM Terminating Notification major vector contains a Reason Code subvector. The supported reason codes are:

    - X'02' – Remove command received and LRM removed
    - X'03' – Internal hardware or software error

      This reason code is specified if the Terminal Adapter ceases to function properly.

14. **Invalid Request (MVID 8610):** The Reason Code subvector returned is:

    X'0000' For CRS major vector for Token-Ring segment

    X'0002' For SRP in a Type 2 frame.

15. **Set Reporting Point Error (MVID 8611):** The Set Reporting Point Error major vector contains the following subvectors whenever the Reason Code subvector is X'00':

    - Error Code (SVID 4009)
    - Error Offset (SVID 400A)
    - LRM Version Level (SVID 400C).

16. **Reason Code (SVID C00F):** The Set Reporting Point Error major vector contains a Reason Code subvector. This subvector is a 1-byte value that indicates the type of error that occurred. Valid values for the Reason Code subvector are:

    - X'00'

      A parsing error was detected in the Set Reporting Point major vector. The Error Code, Error Offset, and LRM Version Level subvectors are present only if the value of the Reason Code subvector is X'00'.

    - X'01'

      The length specified in the Set Reporting Point major vector length field does not equal the received frame length.

Unsupported Major Vectors

The following major vectors are not supported:

Table 19-11. Major Vectors Not Supported

ID	Frame Name
8301	Report New Active Monitor Notification[1]
8303	Report Transmit-Forward Notification
8307	Set Station Parameters
8308	Station Parameters Set
8508	Path Trace Report Notification
850A	Single-Route Broadcast Status Change Notification

Legend:

[1]3174 is the active monitor for the 3174-Peer segment.

3174-Peer Alerts

3174-Peer Alerts are generic in format and can be found in "3174-Peer Alerts" on page G-34. The format of these generic alerts is described under "Generic Alert Message Format" on page 12-45. The 3174-Peer Alerts are sent to NetView if LAN Network Manager has not been configured. In the case where LAN Network Manager support is present, only X'92BAD21A' is sent to NetView.

The response to configuration question 677 (Alert Threshold) specifies when Bridge congestion information results in an alert being sent to NetView (see the *3174 Planning Guide* for more information).

Part 7. Appendixes

This part contains the following appendixes:

Appendix A, "Selector Light Pen and Magnetic-Stripe Reading Devices," describes the operation of selector light pens and magnetic-stripe reading devices when attached to the 3174.

Appendix B, "Extended Function Feature for CUT Devices," describes the 3174 support of the functions and features of the IBM 3180 and 3192 Display Stations.

Appendix C, "3174 Support of Intelligent Printer Data Stream (IPDS)," describes the 3174 support provided to enable an application to transmit the Intelligent Printer Data Stream (IPDS) to an IPDS-capable printer.

Appendix D, "Country Extended Code Page (CECP)," describes Country Extended Code Page (CECP) as an extension of existing code page support and its use in multi-lingual communication and explains the differences between CECP and current page support.

Appendix E, "Operator Information Area Symbols," describes the Operator Information Area symbols and indicators.

Appendix F, "Device Self-Description Data," describes Device Self-Description Data for the 3174.

Appendix G, "Generic Alerts," describes the 3174 Generic Alerts.

Appendix H, "SNA Sense Codes," provides a listing of the 3174 SNA Sense Codes.

Appendix A. Selector Light Pen and Magnetic-Stripe Reading Devices

Introduction

This appendix describes the operation of selector light pens and magnetic-stripe reading devices when attached to the 3174. You will find information about the following:

- Use of the selector light pen
- Field formats for the selector light pen
- Designator characters for defining fields
- The types of magnetic-stripe reading devices
- The types of character sets
- The magnetic-stripe format of each character set
- The operational differences of each character set.

The Selector Light Pen

The selector light pen, a light-sensitive pen, detects the light emitted from characters displayed on 3278 or 3279 display stations. When you select items from a list or table with the selector light pen, those items are passed to the application program. You operate the selector light pen by pressing the tip of the pen against the screen on fields programmed for selector light pen operations. Figure A-1 shows a selector light pen.

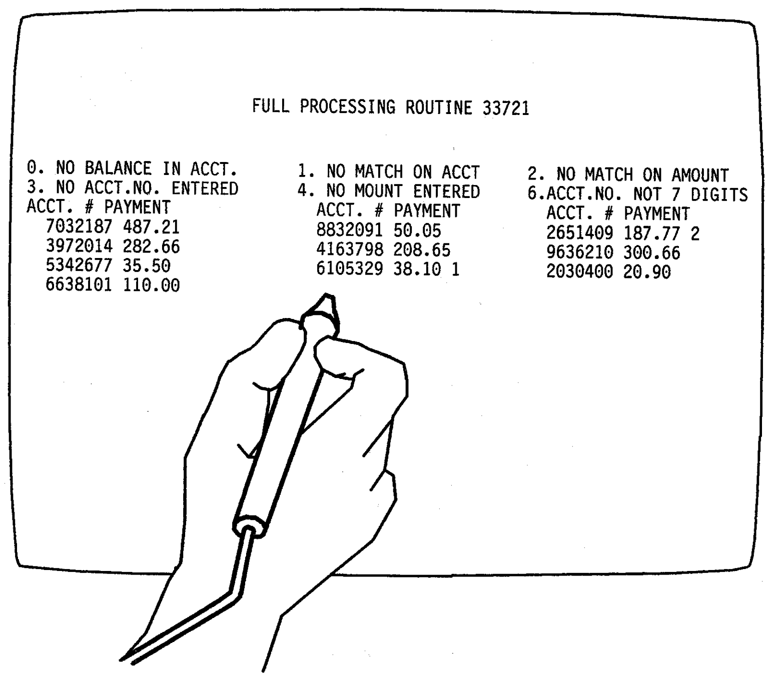


Figure A-1. Selector Light Pen

Selector Light Pen Field Format

You use this format to define any field used for selector light pen operations:

	Data Character	Preceding field (on the same line as the SPD field).
	3 Space or Null Characters	Three spaces or null characters must precede the field-attribute character defining the SPD field unless the attribute character is the first character on the line.
Selector-Pen-Detectable (SPD) Field Format	Field Attribute Character	The field-attribute character defines the field as displayed and selector-light-pen-detectable. (An SPD field may be protected or unprotected, alphanumeric or numeric.)
	Designator Character	The designator character defines the type of operation that will be performed by detection on this field.
	Displayed Data	One or more displayed alphanumeric characters for sensing by the selector light pen.
	3 Space or Null Characters	Three space or null characters are required when a new field follows on the same line as the SPD field.
	Field Attribute Character	Succeeding field (on the same line as the SPD field).
	Data Character	

The field attribute character, designator character, and displayed alphanumeric characters must be on the same line. If the field extends beyond one line, the selector light pen detects only those fields on the same line as the attribute character. A maximum of 12 detectable fields in the 3278-1, -2, -3, -4, or 3279 or a maximum of 15 detectable fields in the 3278-5 may precede the last detectable field on any given line.

Designator Characters

Designator characters define two types of selector light pen fields: selection fields and attention fields. Each field performs a different selector light pen operation.

Selection Fields: The selection field is defined by a question mark (?) designator character. When the selector light pen detects on a selection field, the following occur:

- The MDT bit in the field-attribute character for that field is set (1) in the display buffer.
- The designator character on the screen changes to a greater than (>) sign to show the detection was successful.

If a mistake was made and the selector light pen again detects on that same field:

- The > changes to a ?.
- The MDT bit for that field is reset (0).

Attention Fields: One type of attention field is defined by a space or null designator character. A detection on this attention field causes the following:

- An I/O pending (attention) at the display, which tells the program that the selector light pen operation has been completed
- The program to issue a Read Modified command to obtain the address of each field that you selected or modified.

A second type of attention field (for 3278 and 3279 displays) is defined by an ampersand (&) designator character. A selector light pen detection on a field containing an ampersand designator does the following:

- Sets the MDT bit
- Causes an Enter function I/O pending condition at the 3174
- Causes the display to respond to a poll or a Read Modified command
- Returns both the address and the data in each field that you modified to the application program.

You can modify both normal intensity and high intensity unprotected fields to become selector light pen detectable (SPD) fields.

If you use the Selector Light Pen feature without the ampersand (&) designator character, the program correlates the address of each SPD field with the data associated with it. Therefore, to minimize teleprocessing (TP) line loading, channel loading, and buffer size requirements, only the addresses of selector light pen detected fields are required to be sent to the application program. The field need not be included.

If you want to combine selector light pen detect input with keyboard input, you must use the keyboard or the ampersand designator character to generate the I/O pending. When you use the selector light pen on a space, a null designator field, or an attention field to generate the I/O pending, only the addresses of the fields in which the MDT bit was set are passed to the application program.

An Example

Figure A-2 on page A-5 shows a sample display with fields defined for selector light pen operation. In this display, FULL, 50MG, and 4 TIMES are all preceded by > designator characters to indicate that they were selected by the operator. When the selector light pen detects on the word EXIT, which has no displayed designator character the following occur:

- An I/O pending
- The addresses of the three selected fields are passed to the application program.

```
R JONES, 2-27-71, HOSPITAL VISIT

CARE-NORMAL, FOOD-SAME, --


DRUG-ASPIRIN,

STRENGTH              < FULL               ? 1/2                ? BABY

DOSE                  ? 20MG               < 50MG               ? 100MG

DAILY SCHEDULE        ? 1 TIME             ? 2 TIMES            ? 3 TIMES

                      < 4 TIMES            ? 6 TIMES            ? 8 TIMES

                      ? 12 TIMES           ? 24 TIMES           ? AS REQUIRED


   DRUG A             DRUG B               DRUG C               DRUG D
   EXIT               FOOD                 HISTORY
```

Figure A-2. Sample Display Screen for Selector Light Pen Operations

Magnetic Slot Reader and Hand Scanner

Two magnetic-stripe reading devices, shown in Figures A-3, and A-4 can attach to the 3174. These devices are the magnetic slot reader and the magnetic hand scanner.

Magnetic slot readers can read the character set shown in Table A-4 on page A-22 or the numeric and alphanumeric character sets shown in Table A-1 on page A-9 and Table A-2 on page A-10, respectively. The 3174 must be customized appropriately.

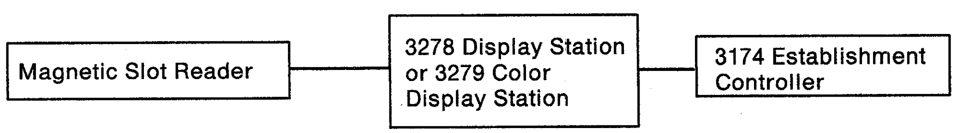


Figure A-3. Attachment of Magnetic Slot Readers to the 3174.

Magnetic hand scanners can read the numeric and alphanumeric character sets shown in Table A-1 on page A-9 and Table A-2 on page A-10, respectively. The 3174 must be customized appropriately.

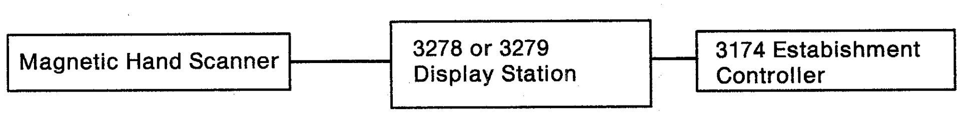


Figure A-4. Attachment of Magnetic Hand Scanners to the 3174.

Magnetic Slot Reader (MSR)

The MSR, shown in Figure A-5:

- Reads the magnetic stripe as the document, such as a card or a badge, is passed through the reader's slot
- Reads numeric, alphanumeric, and 3277-compatible numeric character sets
- Logs on and off in SNA mode (both LU-LU and SSCP-LU sessions) or non-SNA mode
- Must be attached to a 3278 or 3279 display station that connects to a properly configured 3174.

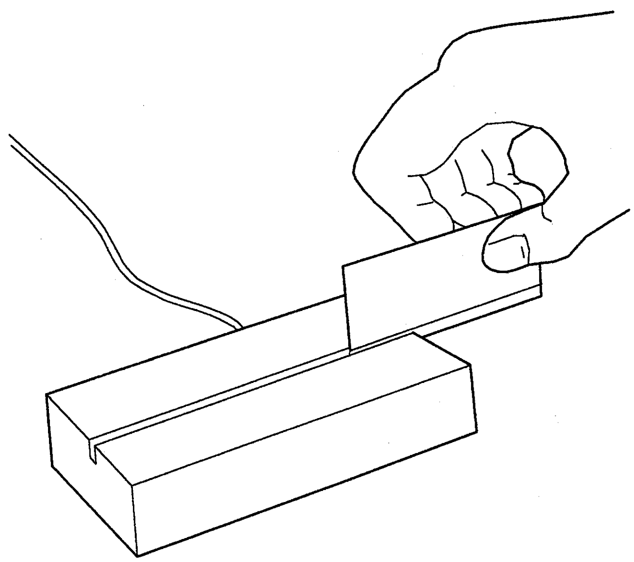


Figure A-5. Magnetic Slot Reader (3278 and 3279 Attachments)

Magnetic Hand Scanner (MHS)

The MHS, a hand-held device, shown in Figure A-6:

- Reads the magnetic stripe as the scanner is passed over the document, such as a label affixed to a shelf, carton, or other object
- Reads in both forward and reverse directions
- Reads only numeric and alphanumeric character sets
- Logs on and off in SNA mode (both LU-LU and SSCP-LU sessions) or non-SNA mode
- Must be attached to a 3278 or 3279 display station that connects to a properly configured 3174.

Note: The numeric character set described under "Numeric and Alphanumeric Character Sets (MSR or MHS)" on page A-8 is not the same as the 3277-compatible numeric character set described under "3277-Compatible Numeric Character Set (MSR Only)" on page A-21.

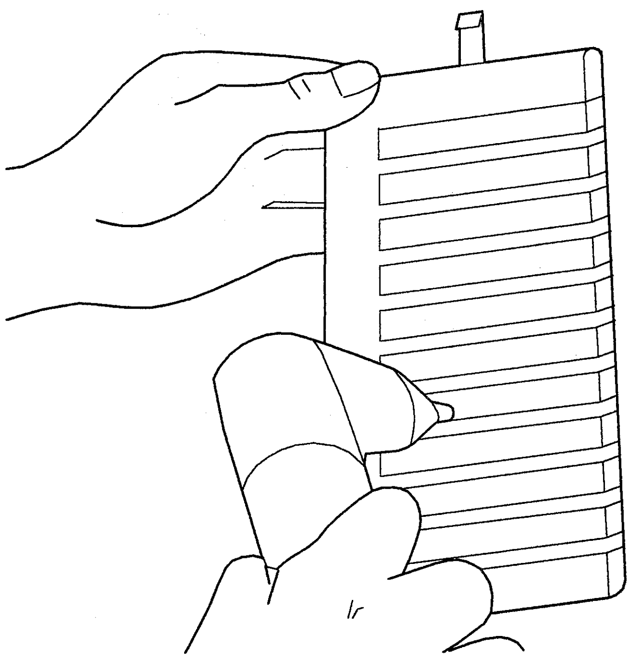


Figure A-6. Magnetic Hand Scanner (3278 and 3279 Attachments)

Customizing for MSR or MHS

You specify the character set or sets read by the MSR or MHS in the 3174 customizing procedure (question 141 in the *3174 Planning Guide*). Either the 3277-compatible numeric character set or the numeric and alphanumeric character sets are specified. This specification affects attached 3278s or 3279s only.

Numeric and Alphanumeric Character Sets (MSR or MHS)

When you specify the numeric and alphanumeric character sets, the header character of the magnetic-stripe record identifies which of the two character sets (numeric or alphanumeric) is recorded on the magnetic stripe. Protection, nondisplay, and nonprint are functions of the header character of the magnetic-stripe record. When these character sets are used, protection, nondisplay, and nonprint of the recorded information are not automatic as when the 3277-compatible numeric character set is used. You must provide data protection through proper encoding of the magnetic-stripe record and control over unauthorized access.

The *numeric character set*, shown in Table A-1 on page A-9, contains 10 numeric characters plus space and control characters. Each character consists of a 4-bit code and an odd parity bit.

The *alphanumeric character set*, shown in Table A-2 on page A-10, contains 10 numeric, 26 alphabetic, and 27 graphic characters, plus space and control characters. Each of the nonnumeric characters contains 2 hexadecimal (hex) characters, with each hex character consisting of 4 bits and a parity bit.

Looking at this as a *paired* 4-bit code, the letter *M*, for example, is recorded as hex D-4, with the hex D being recorded first. In the alphanumeric character set, each numeric character contains a single hex character consisting of a 4-bit code. Therefore, *two* numeric characters can be recorded in this paired 4-bit code structure.

When you use the alphanumeric character set, an even number of numeric characters must be in a contiguous string of numeric characters. If you record an odd number of numeric characters, a filler character (hex A) must be added after the odd-numbered numeric character to keep the paired 4-bit code structure.

Examples:

6A3CE6 59724A

Filler Character

Note: For both the numeric and the alphanumeric character sets, hex characters are recorded low-order bit first (2^0 2^1 2^2 2^3 P). (See Tables A-1 and A-2 for the hex characters.)

Table A-1. Numeric Character Set									
	Direction of Recording Bit Pattern					Hex Code	I/O Interface Code Sent to Host		
Character	2^0	2^1	2^2	2^3	P		EBCDIC	ASCII	SSCP
Data:									
0	0	0	0	1	1	0	F0	30	F0
1	1	0	0	0	0	1	F1	31	F1
2	0	1	0	0	0	2	F2	32	F2
3	1	1	0	0	1	3	F3	33	F3
4	0	0	1	0	0	4	F4	34	F4
5	1	0	1	0	1	5	F5	35	F5
6	0	1	1	0	1	6	F6	36	F6
7	1	1	1	0	0	7	F7	37	F7
8	0	0	0	1	0	8	F8	38	F8
9	1	0	0	1	1	9	F9	39	F9
Space character	1	0	1	1	0	D	40	20	40
Control: Secure date (note 1)	0	1	0	1	1	A	Not sent	Not sent	X'0450'SSR (note 6)
Start Sentinel (SS); Reverse Start Sentinel (note 2)	1	1	0	1	0	B	Not sent	Not sent	Not sent
Reserved (note 3)	0	0	1	1	1	C	Not sent	Not sent	Not sent
(See note 4)	0	1	1	1	0	E	Not sent	Not sent	Not sent
End Sentinel (ES) (note 5)	1	1	1	1	1	F	Not sent	Not sent	X'1E' IRS (note 6)

Notes:

1. Hex A, immediately after Start Sentinel (SS), indicates that the data section is secure (protected, nondisplay, and nonprint). Hex A is an error if it appears in the data section.
2. Hex B appearing anywhere but as SS or RSS is an error.
3. Hex C is an error if it appears in the data section.
4. Hex E identifies a 2-character sequence as a control code when located in the second character position of the data section. This control code is not supported by the 3174 and is an error.
5. Hex F is the End Sentinel character. If it is inadvertently included in the data section, it will terminate reading of the data section and the following character will be read as the LRC character.
6. Secure String Record (SSR) and Interchange Record Separator (IRS) are sent to SSCP as a bracket for the MSR/MHS data.

   The Questionable Card symbol is displayed in the operator information area, and the red light on the magnetic slot reader or on the magnetic hand scanner is turned on for all above error conditions except an LRC error, which turns on the red light only.

Numeric and Alphanumeric Character Sets (MSR or MHS)

Table A-2 (Page 1 of 2). Alphanumeric Character Set

Character	Direction of Recording Bit Pattern 2^0	2^1	2^2	2^3	P	2^0	2^1	2^2	2^3	P	Hex Code	I/O Interface Code Sent to Host EBCDIC	ASCII	SSCP
Data:														
0	0	0	0	0	1						0	F0	30	Same I/O
1	1	0	0	0	0						1	F1	31	codes as
2	0	1	0	0	0						2	F2	32	EBCDIC
3	1	1	0	0	1						3	F3	33	
4	0	0	1	0	0						4	F4	34	
5	1	0	1	0	1						5	F5	35	
6	0	1	1	0	1						6	F6	36	
7	1	1	1	0	0						7	F7	37	
8	0	0	0	1	0						8	F8	38	
9	1	0	0	1	1						9	F9	39	
A	0	0	1	1	1	1	0	0	0	0	C1	C1	41	
B	0	0	1	1	1	0	1	0	0	0	C2	C2	42	
C	0	0	1	1	1	1	1	0	0	1	C3	C3	43	
D	0	0	1	1	1	0	0	1	0	0	C4	C4	44	
E	0	0	1	1	1	1	0	1	0	1	C5	C5	45	
F	0	0	1	1	1	0	1	1	0	1	C6	C6	46	
G	0	0	1	1	1	1	1	1	0	0	C7	C7	47	
H	0	0	1	1	1	0	0	0	1	0	C8	C8	48	
I	0	0	1	1	1	1	0	0	1	1	C9	C9	49	
J	1	0	1	1	0	1	0	0	0	0	D1	D1	4A	
K	1	0	1	1	0	0	1	0	0	0	D2	D2	4B	
L	1	0	1	1	0	1	1	0	0	1	D3	D3	4C	
M	1	0	1	1	0	0	0	1	0	0	D4	D4	4D	
N	1	0	1	1	0	1	0	1	0	1	D5	D5	4E	
O	1	0	1	1	0	0	1	1	0	1	D6	D6	4F	
P	1	0	1	1	0	1	1	1	0	0	D7	D7	50	
Q	1	0	1	1	0	0	0	0	1	0	D8	D8	51	
R	1	0	1	1	0	1	0	0	1	1	D9	D9	52	
S	0	1	1	1	0	0	1	0	0	0	E2	E2	53	
T	0	1	1	1	0	1	1	0	0	1	E3	E3	54	
U	0	1	1	1	0	0	0	1	0	0	E4	E4	55	
V	0	1	1	1	0	1	0	1	0	1	E5	E5	56	
W	0	1	1	1	0	0	1	1	0	1	E6	E6	57	
X	0	1	1	1	0	1	1	1	0	0	E7	E7	58	
Y	0	1	1	1	0	0	0	0	1	0	E8	E8	59	
Z	0	1	1	1	0	1	0	0	1	1	E9	E9	5A	
¢(EBCDIC); [(ASCII)	0	0	0	0	1	0	0	1	1	1	0C	4A*	5B	
!(EBCDIC);](ASCII)	1	0	0	0	0	0	0	1	1	1	1C	5A*	5D	
:	1	1	0	0	1	0	0	1	1	1	3C	7A	3A	
<	0	0	1	0	0	0	0	1	1	1	4C	4C	3C	
•	1	0	1	0	1	0	0	1	1	1	5C	5C	2A	
%	0	1	1	0	1	0	0	1	1	1	6C	6C	25	
@	1	1	1	0	0	0	0	1	1	1	7C	7C*	40	
.	0	0	0	0	1	1	0	1	1	0	0D	4B	2E	
$	1	0	0	0	0	1	0	1	1	0	1D	5B*	24	
,	0	1	0	0	0	1	0	1	1	0	2D	6B	2C	
#	1	1	0	0	1	1	0	1	1	0	3D	7B*	23	
(	0	0	1	0	0	1	0	1	1	0	4D	4D	28	
)	1	0	1	0	1	1	0	1	1	0	5D	5D	29	
-	0	1	1	0	1	1	0	1	1	0	6D	6D	5F	
'	1	1	1	0	0	1	0	1	1	0	7D	7D	27	
|(EBCDIC); !(ASCII)	0	0	0	0	1	0	1	1	1	0	0E	4F*	21	
¬(EBCDIC); ^(ASCII)	1	0	0	0	0	0	1	1	1	0	1E	5F*	5E	
?	0	1	0	0	0	0	1	1	1	0	2E	6F	3F	
"	1	1	0	0	1	0	1	1	1	0	3E	7F*	22	

Table A-2 (Page 2 of 2). Alphanumeric Character Set

Character	Direction of Recording Bit Pattern				Hex Code	I/O Interface Code Sent to Host		
	2^0 2^1 2^2 2^3	P	2^0 2^1 2^2 2^3	P		EBCDIC	ASCII	SSCP
Data:								
+	0 0 1 0	0	0 1 1 1	0	4E	4E	2B	
;	1 0 1 0	1	0 1 1 1	0	5E	5E	3B	
>	0 1 1 0	1	0 1 1 1	0	6E	6E	3E	
=	1 1 1 0	0	0 1 1 1	0	7E	7E	3D	
\	0 1 1 1	0	0 0 0 0	1	E0	E0*	5C	
/	0 1 1 1	0	1 0 0 0	0	E1	61	2F	
&	1 0 1 1	0	0 1 0 1	1	DA	50	26	
.	0 1 1 1	0	0 1 0 1	1	EA	60	2D	
SP	0 0 1 1	1	0 1 0 1	1	CA	40	20	
Control:								
Secure Data; Filler (note 1)	0 1 0 1	1			A	Not sent	Not sent	X'0450' SSR (note 6)
Start Sentinel (SS); Reverse Start Sentinel (RSS) (note 2)	1 1 0 1	0			B	Not sent	Not sent	Not sent
(See note 3)	0 0 1 1	1			C	Not sent	Not sent	Not sent
Test Record (note 4)	0 1 1 1	0	0 1 1 1	0	EE	Not sent	Not sent	Not sent
End Sentinel (note 5)	1 1 1 1	1			F	Not sent	Not sent	X'1E' IRS (note 6)

* The characters shown for EBCDIC codes 4A, 5A, 7C, 5B, 7B, 4F, 5F, 7F, and E0 are U.S. EBCDIC. For National Use differences, see the *3270 Character Set Reference*.

Notes:

1. Hex A, when located in the first hex character position of the header (that is, immediately following the Start Sentinel (SS) character), indicates that the data section is secure (protected, nondisplay, nonprint). When located in the second hex character position of the header (following hex C), it is recognized as a filler character. It is also recognized as a filler character in the data section when it is the last hex character following a single numeric character or an odd number of consecutive numeric characters.

2. Hex B appearing anywhere but as SS or RSS is an error.

3. Hex C indicates the alphanumeric character set when located in the first or second hex character position of the header, that is, immediately following the SS character.

4. The hex EE sequence denotes a Test record. The Test card is encoded with hex CAEE in the header and first two hex positions of the data section indicating the alphanumeric character set, nonsecure data. The 3174 will treat the Test card as a data card. The hex EE will be discarded and the data record displayed. No Auto Enter is performed; however, the data may be sent to the host by pressing the Enter function, a PF function, or CURSR SEL function, by a selector light pen, or by another MSR/MHS Auto Enter operation.

5. Hex F is the End Sentinel character. If it is inadvertently included in the data section, it will terminate reading of the data section and the following character will be read as the LRC character.

6. Secure String Record (SSR) and Interchange Record Separator (IRS) are sent to SSCP as a bracket for MSR/MHS data.

   The Questionable Card symbol is displayed in the operator information area, and the red light on the MSR or on the MHS hand scanner is turned on for all above error conditions except an LRC error, which turns on the red light only.

Capacities

When you use the numeric or alphanumeric character sets, the magnetic-stripe capacities shown in Table A-3 apply.

Table A-3. Magnetic-Stripe Capacities

MSR/MHS	Minimum Number of Hex Codes Between Start Sentinel and End Sentinel Characters	Maximum Number of Characters Between Start Sentinel and End Sentinel Characters	Bit Density in Bits Per Millimeter (and Bits Per Inch)
Numeric Character Set	7	37	3 (75)
	7	118	5 (127)
Alphanumeric Character Set*	7	37 numerics	3 (75)
	7	18 nonnumerics	3 (75)
	7	118 numerics	5 (128)
	7	59 nonnumerics	5 (128)
	7	37 numerics	8.3** (210**)
	7	18 nonnumerics	8.3** (210**)

Note: Encoding across the full width of the magnetic stripe is recommended for the MSR and is required for the MHS.

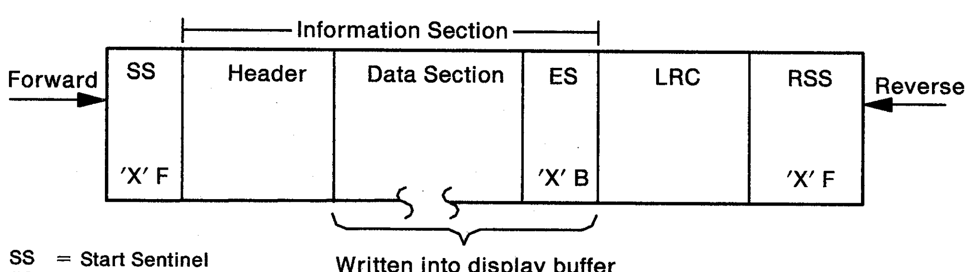
* 1 hex code = 1 numeric character
2 hex codes = 1 nonnumeric character or 2 numeric characters

Maximums shown are for all-numeric or all-nonnumeric characters. If a combination of numeric and nonnumeric characters is recorded, the total number of hex codes must not exceed the numeric character maximum. For example, at 75 bpi, a combination of 20 numeric and 10 nonnumeric characters is permissible.

** MSR only

Magnetic-Stripe Format

You use the format shown in Figure A-7 to record the numeric and alphanumeric character sets.



SS = Start Sentinel
ES = End Sentinel
LRC = Longitudinal Redundancy Check
RSS = Reverse Start Sentinel

Figure A-7. Magnetic-Stripe Format When Using Numeric or Alphanumeric Character Sets

Each part of the magnetic-stripe format has a different purpose:

- Start Sentinel (SS), X'B', identifies the beginning of the information section.
- The Information Section consists of the header, the data section, and the End Sentinel. The End Sentinel (ES), X'F', identifies the end of the information section.

  The **header** does the following:

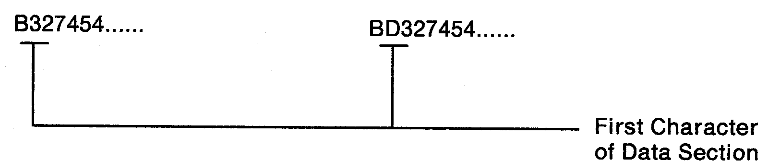
  - Specifies whether the data section is protected or nonprotected.

    If the character following the Start Sentinel is X'A', as BA, the data section is protected and may *not* be displayed or printed. If the hex character immediately following the Start Sentinel character is not X'A', the data section is unprotected and may be displayed or printed.

  - Identifies the character set (numeric character set or alphanumeric character set) used in the data section.

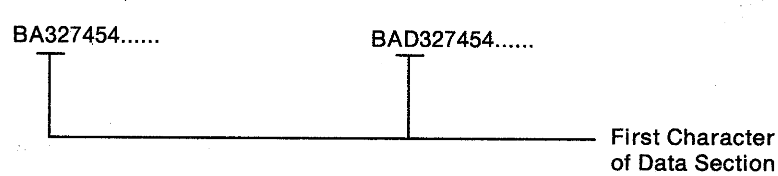
  The header identifies the character set as follows:

  - For nonsecure data, if a numeric character (0—9) or the space character (hex D) immediately follows the Start Sentinel character (hex B), the numeric character set is specified. For example:



    If hex C immediately follows the Start Sentinel character (hex C is in the first hex character position of the header), the alphanumeric character set is specified. (In this case, hex A, in the second hex character position of the header, is the filler character.) For example, BCA32D6E5 ......

  - For secure data, if the character immediately following hex A (denoting secure data) is a numeric character of the space character (hex D), the numeric character set is specified. For example:



    If the character immediately following hex A is hex C (hex C is in the second hex character position of the header), the alphanumeric character set is specified. For example, BAC32D6E5 ......

- The Longitudinal Redundancy Check (LRC) character, which follows the ES, performs a parity check from the SS to ES. The Reverse Start Sentinel is not included in this calculation.
- Reverse Start Sentinel (RSS), X'B', is ignored unless the magnetic stripe is read in the reverse direction (available on MHS only). The RSS is read before the LRC, but still is not part of the LRC calculation.

Operation in SNA mode (LU-LU Session) or non-SNA mode

Screen formatting causes differences in the way the 3174 handles MSR/MHS data, whether the data is secure or nonsecure. This section describes the differences in operation for non-SNA mode and LU-LU sessions in SNA mode. For information about the differences in operation for SSCP-LU sessions in SNA mode, see "Operation in SNA mode (SSCP-LU Session)" on page A-18.

Secure Data

Whether operating in non-SNA mode or SNA mode, the 3174 always formats secure MSR/MHS data on the screen by putting a field-attribute character at the current cursor position. When the screen is unformatted (that is, is without attribute characters or fields), an MSR/MHS read operation results in an inbound data stream as shown in Figure A-8 on page A-15.

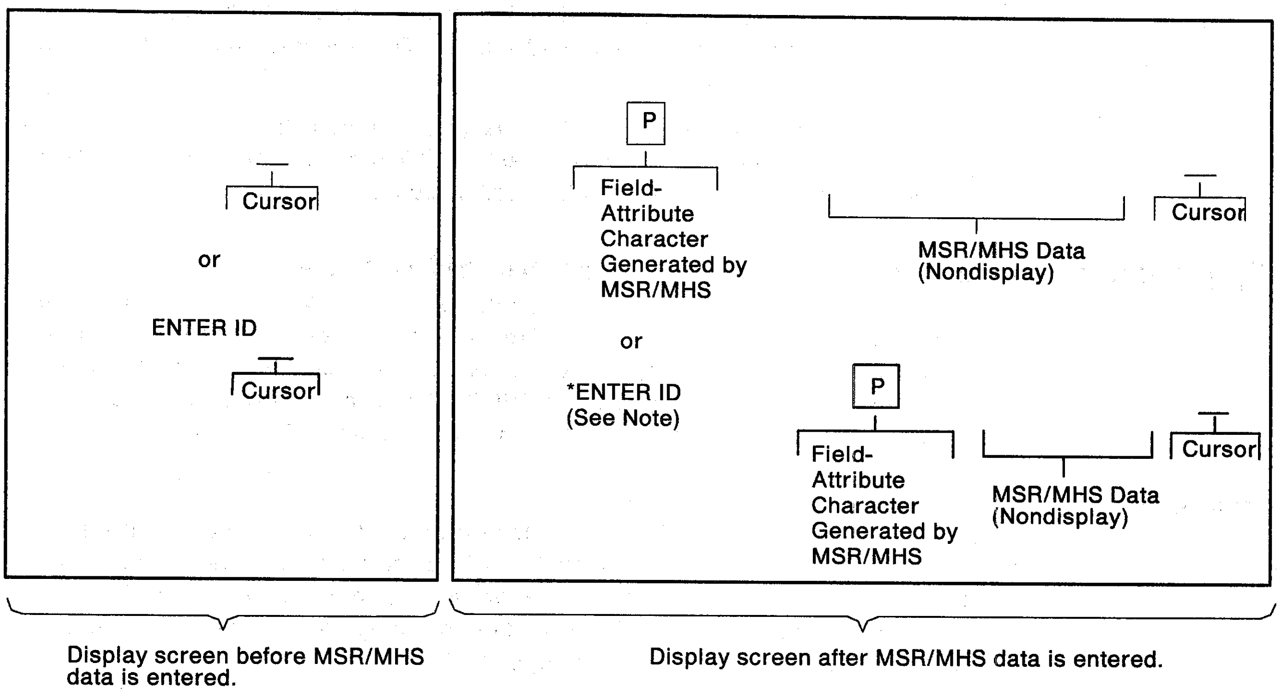
A formatted screen has at least one field-attribute character defined initially. This initial character may be the only attribute character, as in the instruction sequence Enter ID, or many attributes may be required, as in the instruction sequence NAME, TITLE, ID DEVICE.

The 3278 and 3279 treat all information from the MSR/MHS as data until after the information is written into the buffer. Thus, two fields with the MDT bits set, the new data field and the previous data field, are sent to the application program. Also, the MDT bit is set in the MSR/MHS attribute byte that was initiated when the data was entered.

The following examples illustrate the processing of secure MSR/MHS data with a formatted screen:

Example 1: The inbound data stream shown in Figure A-9 on page A-16 results when the MSR/MHS field is set up by the application program as an unprotected field containing instruction information (Enter ID, in the example).

Example 2: The inbound data stream shown in Figure A-10 on page A-17 results when the screen is formatted and the MSR/MHS field is set up by the application program as an unprotected field, with the cursor directly following an unprotected field attribute character.



Note: The ENTER ID is not displayed, because it is within a nondisplay field, defined by the MSR/MHS-generated field-attribute character.

P = Protected field-attribute character

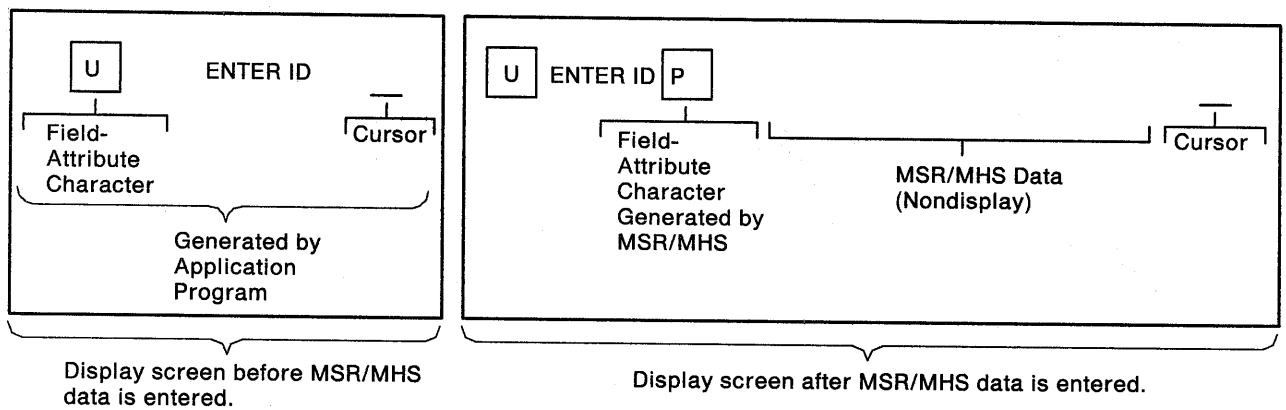
Inbound Data Stream

AID	Set to indicate MSR/MHS input.
Cursor Address	Address of the cursor upon completion of the MSR/MHS operation.
SBA	Set Buffer Address.
Start of Data Address	Address of the first data character following the field-attribute character.
Data	The MSR/MHS data followed by any additional information present in the display buffer. The additional information can be initiated by the application program as ENTER ID (as shown in the example) or entered by the operator before the MSR/MHS operation is started.

Note that with an unformatted screen the MSR/MHS data is the first text in the reader operation is started.

Figure A-8. An Unformatted Screen Using the Numeric or Alphanumeric Character Set

Numeric and Alphanumeric Character Sets (MSR or MHS)



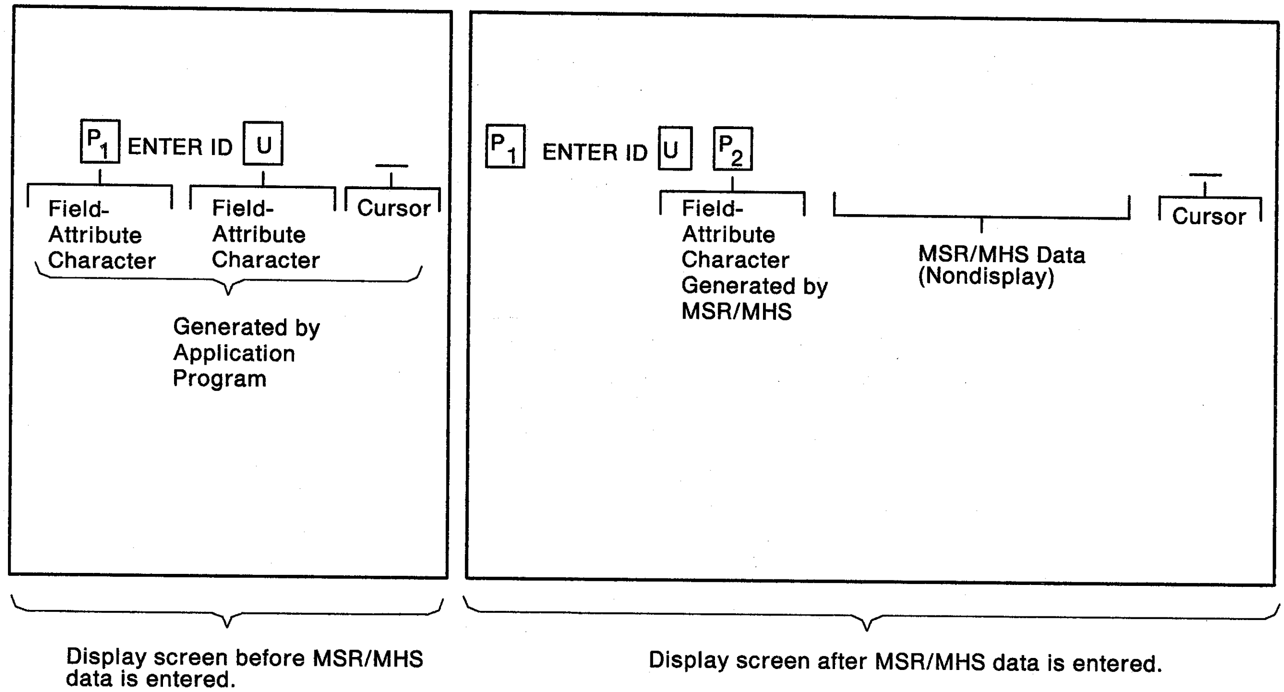
Inbound Data Stream

Inbound Data Stream	
AID	Set to indicate MSR/MHS input.
Cursor Address	Address of the cursor upon completion of the MSR/MHS read operation.
SBA	Set Buffer Address.
Start of Data Address	Address of the unprotected (U) field-attribute character +1.
Data	ENTER ID, in the example above.
SBA	Set Buffer Address.
Start of Data Address	Address of the protected field-attribute character +1; in this case, the address of the first data character from the MSR/MHS following the MSR/MHS-generated field-attribute character.
Data	The MSR/MHS data (and any data between the cursor and the next field attribute character).

U = Unprotected field-attribute character.

P = Protected field-attribute character.

Figure A-9. A Formatted Screen Using the Numeric or Alphanumeric Character Set, Example 1



U = Unprotected field-attribute character

P = Protected field-attribute character

Note: Rules for positioning modified data on formatted screen apply. The position of MSR/MHS data in the inbound data stream depends on the field position in the format.

AID	Set to indicate MSR/MHS input.
Cursor Address	Address of the cursor upon completion of the MSR/MHS read operation.
SBA	Set Buffer Address.
Start of Data Address	Address of the unprotected (U) field-attribute character + 1; in the example above, it will be the address of the P_2 field-attribute character.
SBA	Set Buffer Address.
Start of Data Address	Address of the P_2 field-attribute character + 1; in this case, the address of the first data character from the MSR/MHS following the MSR/MHS-generated field-attribute character.
Data	The MSR/MHS data (and any data between the cursor and the next field-attribute character).

Figure A-10. A Formatted Screen Using the Numeric or Alphanumeric Character Set, Example 2

Nonsecure Data

When the MSR or MHS reads nonsecure data, no field attribute character is generated. The MSR/MHS data is displayed if:

- The screen is unformatted,
- The screen is formatted, and the cursor is located in an unprotected display field.

You send the MSR/MHS data upstream by:

- Pressing the Enter function
- Pressing a PF function
- Pressing a CURSR SEL function
- Using the selector light pen
- Issuing a secure MSR/MHS read operation
- Configuring the 3174 for the auto entry option (question 141 in the *3174 Planning Guide*).

Note: The auto entry option is used for situations when you cannot be at the display keyboard. When the MSR/MHS data is written into the display buffer, the 3174 automatically initiates an inbound data stream with the Enter function AID code (X'7D').

Error Conditions

If the following error conditions exist when the magnetic stripe is read, data is not written into the display buffer:

- The cursor is located in a protected field
- The cursor is located in an attribute character location
- The display is busy performing another operation
- The field is too small to contain the MSR/MHS data.

Operation in SNA mode (SSCP-LU Session)

The display screen is unformatted in an SSCP-LU session.

When the display keyboard is unlocked, the current cursor position, that is, the *initial cursor position*, identifies the beginning of the operator input area. So data can be sent to the SSCP, you must only enter data (both keyboard and magnetic data) in the initial position through the following 255 screen positions, or in the initial position through the last character position on the screen, whichever occurs first.

When using the cursor move keys (including Tab, Backtab, and New Line), be careful not to enter data outside the operator input area. You press the Clear function to move the cursor to the first screen location and define this location as the new initial cursor position. Because the screen is also cleared, other data may be lost.

When the 3174 is customized for the numeric and alphanumeric character sets, you can also use the MSR and MHS for secure logon in the SSCP-LU session. MSR/MHS input is restricted to the operator input area. If MSR/MHS input is attempted outside this area, the data is rejected.

With MSR/MHS secure data, a protected nondisplay field attribute character precedes the MSR/MHS secure data. An unprotected display field-attribute character follows the data. This permits additional keyboard or MSR/MHS data to be written into the display buffer. No Auto-Enter operation is performed. When the Enter function is pressed, the information is sent to the SSCP. MSR/MHS secure data is bracketed by the SSR and IRS control codes. No SBAs are generated, and no field-attribute characters are sent to the SSCP. Upon transmission to the SSCP, MSR/MHS secure data and associated attribute characters are removed from the operator input area of the screen.

Erase Input and Erase EOF Functions

Because MSR/MHS secure data may be present on the screen, the Erase Input and Erase EOF (End of Field) functions operate differently.

The Erase Input function erases the entire display buffer contents, including the field-attribute characters generated by the MSR/MHS read operation. The cursor moves to the first screen location, but the operator input area remains unchanged.

The Erase EOF function erases all information from the current cursor position to the end of the screen, including the MSR/MHS data and associated attribute characters. If the cursor is located within an MSR/MHS secure data field, the entire field is erased, including the associated attribute characters.

Error Conditions

If any of the following error conditions exist when the magnetic stripe is read, data is not written into the display buffer:

- The display is busy performing another operation
- An MSR/MHS read operation is attempted outside the operator input area
- An attempt is made to overlay other MSR/MHS secure data
- The keyboard is already locked.

Notes:

1. In an SSCP-LU session, the inbound RU is limited to 256 bytes of data. Therefore, when you use an APL/Text-unique keyboard, do not exceed the 256-byte limit when keying in APL/Text-unique characters. Each APL/Text-unique character displayed on the screen generates a 2-byte Graphic Escape sequence to be sent to the SSCP. Thus, the information sent to the SSCP may be truncated.

2. If a Graphic Escape character with its associated data byte exceeds the 256-byte limit of the inbound RU, neither the Graphic Escape character nor its associated data byte will be included in the inbound RU.

3. Because of the APL/Text Graphic Escape character sequence, the IRS control code may be omitted from the inbound RU. This is an error, and the SSCP should send an error message to the operator.

4. MSR/MHS secure data is sent to the SSCP bracketed by the SSR and IRS control codes. No ES (End Sentinel) or LRC characters are included in this data stream, and receipt of IRS ensures data validity.

Validity Tests

To use the MSR or MHS as a secure data entry device, your application program must perform certain validity tests. Your application program must follow these guidelines:

1. No field should be accepted as secure data input unless the AID byte (EBCDIC E7; ASCII 58) is set.
2. For application-formatted displays, the application program must know, on the basis of the hardware operation previously performed, the location of the field defined to receive the secure data and the exact location of the entered data. The use of the cursor address present in the data stream, in combination with the AID byte to ensure secure input, is an additional technique that can be used to ensure the integrity of the data. For unformatted displays, the secure data is always presented as the first data entry in the input record to the application program.
3. For application-formatted displays, it is advisable to terminate the secure data field with another attribute byte.
4. No ES (End Sentinel) or LRC character is included in the inbound data stream. Receipt of the AID byte (EBCDIC E7; ASCII 58) ensures valid MSR/MHS secure data.
5. The header information is not included in the inbound data stream. The application program should be prepared to accept the alphanumeric and special characters shown in Table A-1 on page A-9 and Table A-2 on page A-10.
6. If the MSR/MHS field is to be reused, the application program must remove the hardware-generated attribute character and MSR/MHS input data. The location of this attribute character can be derived from the inbound data stream by using one less than the start-of-data address preceding the MSR/MHS data. Additionally, the cursor is located one position beyond the end of the MSR/MHS data field.
7. Data from all fields having the MDT bit set are included in the inbound data stream when the MSR/MHS data is retrieved in response to the MSR/MHS-generated I/O pending.
8. The cursor must be moved out of the MSR/MHS-generated field before further keyboard activity is permitted.
9. If the application program desired to call attention to a particular MSR/MHS secure input, it is recommended that a message be written to the screen and that the WCC include the Sound Alarm bit.
10. A test card, P/N 1742659, is delivered with each 3278 Magnetic Reader Control feature. The test card data placed in the display buffer is as follows:

    ```
    0123456789987654321001234567
    ```

    Care should be taken that the card is not accidentally auto-entered. The display should be placed in test mode to avoid auto-entering magnetic stripe information to the host.

Test Cards

A test card, P/N 1742659, is delivered with each 3278 or 3279 Magnetic Reader Control feature. The test card data written into the display buffer is as follows:

```
0123456789987654321001234567
```

Care should be taken that the character string is not accidentally sent to the application program.

The test card supplied with the IBM 3630 Plant Communication System may also be used, provided that the 3174 has been customized to use the numeric and alphanumeric character sets. This test card is encoded with CAEE in the header and first two hex positions of the data section, indicating an alphanumeric character set and nonsecure data. The 3174 will accept this test card as a data card, strip off the EE, and display the data following the EE. Auto Enter is not performed; that is, the data is not automatically sent to the host.

If the magnetic stripe of either of the above test cards is read successfully, the MSR/MHS green light is turned on. If the 3278 or 3279 is in test mode, the Do Not Enter and Minus Function symbols are displayed in the Operator Information Area. If the magnetic stripe is not read successfully, the red light is turned on and the Do Not Enter symbol may be displayed in the OIA.

3277-Compatible Numeric Character Set (MSR Only)

The MSR is the only device that uses the 3277-compatible numeric character set. When the MSR reads a card:

- The data is written into the display buffer at the location specified by the cursor, but is not displayed on the screen
- The extended attribute buffer is updated
- An I/O pending is generated at the display to inform the program that the data can be retrieved and transferred to main storage.

With the 3277-compatible numeric character set (Table A-4 on page A-22), the maximum number of characters that can be read is:

- 40 characters at 3 bits per millimeter (75 bits per inch) and at 8.3 bits per millimeter (210 bits per inch)
- 100 characters at 5 bits per millimeter (128 bits per inch).

Note: A minimum of 7 characters must be encoded between the Start Sentinel and End Sentinel characters.

The 3277-compatible numeric character set may be used to log on and log off in SNA mode with LU-LU session and non-SNA mode, but **not** in SNA mode with SSCP-LU session.

Table A-4. 3277-Compatible Numeric Character Set

Character	Direction of Recording Bit Pattern					Hex Code	I/O Interface Code (note 5)	
	2^0	2^1	2^2	2^3	P		EBCDIC	ASCII
Data:								
0	0	0	0	0	1	0	F0	30
1	1	0	0	0	0	1	F1	31
2	0	1	0	0	0	2	F2	32
3	1	1	0	0	1	3	F3	33
4	0	0	1	0	0	4	F4	34
5	1	0	1	0	1	5	F5	35
6	0	1	1	0	1	6	F6	36
7	1	1	1	0	0	7	F7	37
8	0	0	0	1	0	8	F8	38
9	1	0	0	1	1	9	F9	39
Control:								
(Special – See note 1)	0	1	0	1	1	A	7A	3A
SOR, SS, or RSS (note 2)	1	1	0	1	0	B	7B	23
EOI (note 3)	0	0	1	1	1	C	7C	40
Field Separator	1	0	1	1	0	D	7D	27
(Unassigned)	0	1	1	1	0	E	7E	3D
EOR or ES (note 4)	1	1	1	1	1	F07F	22	

Notes:

1. This character is reserved for operator identification only and must be located in the first data character position.
2. MSR: SS (Start Sentinel); RSS (Reverse Start Sentinel).
3. EOI (End of Inquiry) is treated as an error by the MSR (3278 and 3279 displays). The card is rejected, and the MSR red light is turned on.
4. MSR: ES (End Sentinel).
5. Programmers use only the four least-significant bits of the I/O interface code.

The 3277-compatible numeric character set contains 10 numeric characters plus a field separator and control characters. Each character consists of a 4-bit pattern plus an odd-parity bit. This bit pattern is recorded with the low-order bit recorded first. A longitudinal redundancy check (LRC) character is placed at the end and is protected by an odd-parity bit of its own.

Characters are recorded, low-order bit first, beginning at the left side of the magnetic stripe (when the stripe is at the bottom of the card or badge as you face the magnetic material). The characters are read in one direction only.

Magnetic-Stripe Format

The format used on the magnetic stripe is in the sequence shown in Figure A-11 on page A-23. When the start of record (SOR) character is read from the magnetic stripe, a field-attribute character is entered automatically into the cursor-identified location of the buffer (provided the cursor is at an unprotected character location). This attribute character defines the following data field as protected, alphanumeric, and nondisplay or nonprint. As the data characters are read into the buffer, they are stored starting at the first character location after the field-attribute character. As each data character is stored in the buffer, the cursor advances one buffer location. The cursor advancement is all the operator sees on the display screen when using the operator identification card reader. When the operator uses the magnetic slot reader, the cursor does not move as the card is passed through the slot, but is repositioned after the card has been read.

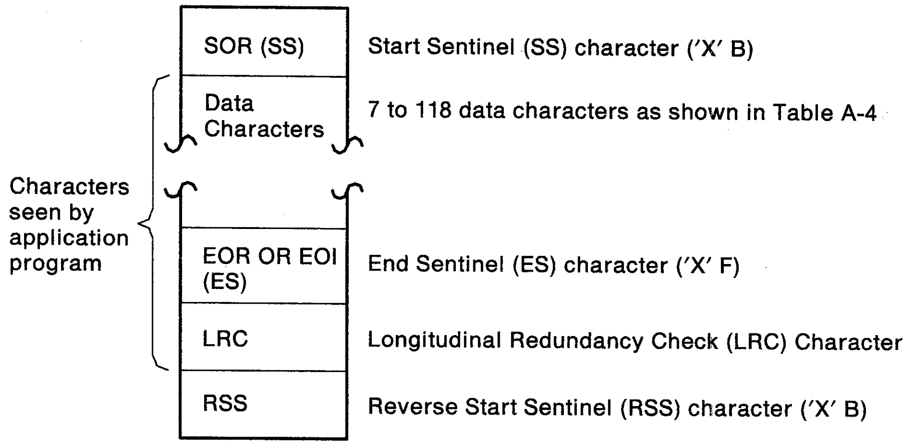


Figure A-11. Magnetic-Stripe Format When Using 3277-Compatible Numeric Character Set

Operation in SNA mode and non-SNA mode

When the 3277-compatible numeric character set is used with the MSR, differences exist in the content of the data stream sent to the application program, depending upon whether the display screen is unformatted or formatted.

When an unformatted screen (that is, a screen without attribute characters or fields) is being used, the operation of the display results in an inbound data stream as shown in Figure A-12 on page A-24.

The MSR formats the screen by the automatic generation of the field-attribute character at the cursor position. A formatted screen has at least one field-attribute character defined at initial presentation. This may be the only field-attribute character, as in the instruction sequence Enter ID, or one or more attributes may be required as in the instruction sequence NAME, TITLE, ID CARD READER.

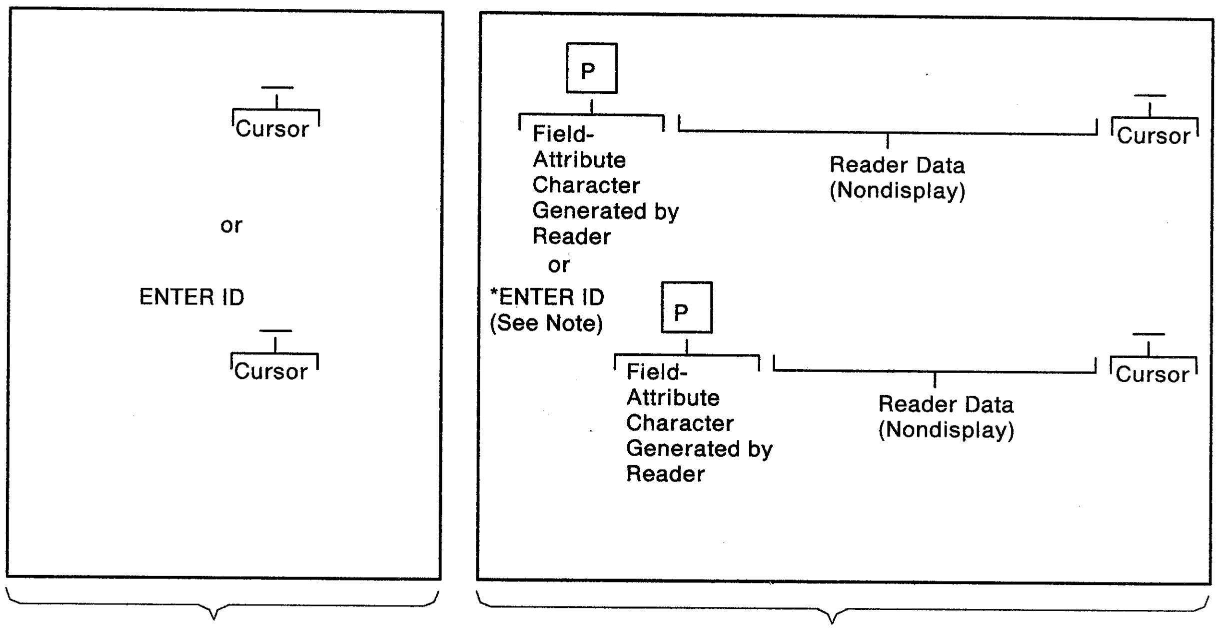
The 3278 and 3279 displays treat all information from the MSR as data until the information is written into the display buffer. Thus, two fields with the MDT bits set, the new data field and the previous data field, are sent to the application program. Also, the MDT bit is set in the reader-generated field-attribute character that was initiated when the data was entered.

The following examples show how the MSR operates with a formatted screen:

Example 1: The data stream, shown in Figure A-13 on page A-25, results if the application program sets up the MSR field as an unprotected field containing instruction information.

Example 2: The inbound data stream, shown in Figure A-14 on page A-26, results when the application program sets up the MSR field as an unprotected field, with the cursor following an unprotected field-attribute character.

3277-Compatible Numeric Character Set (MSR Only)



Display screen before MSR/MHS data is entered.

Display screen after reader data is entered.

Note: The ENTER ID is not displayed, because it is within a nondisplay field, defined by the reader attribute character.

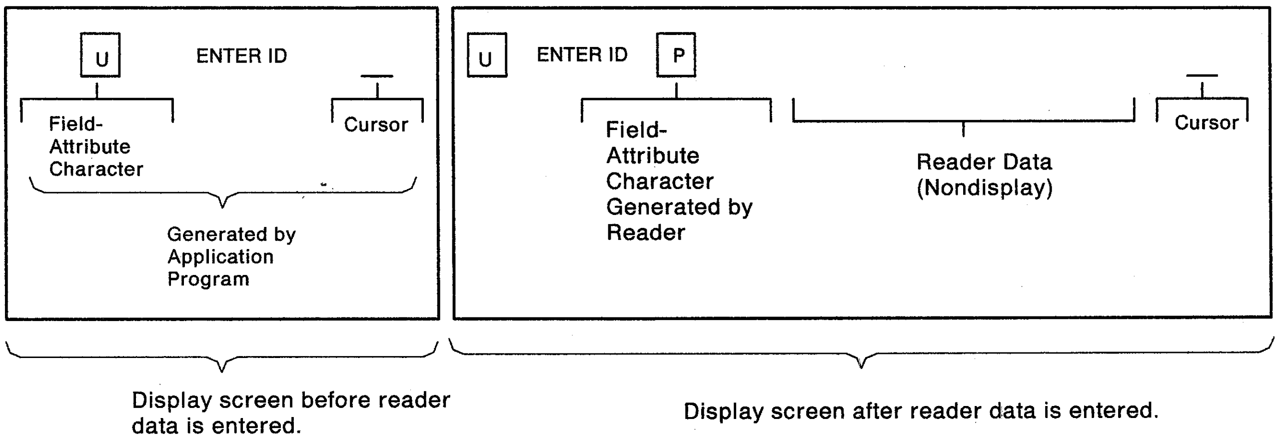
P = Protected field-attribute character.

Inbound Data Stream

Inbound Data Stream	
AID	Set to indicate input from a magnetic-stripe reading device.
Cursor Address	Address of the cursor upon completion of the reader operation.
SBA	Set Buffer Address.
Start of Data Address	Address of the first data character following the field attribute character.
Data	The reader data followed by any additional information present in the display buffer. The additional information can be initiated by the application program as ENTER ID (as shown in the example) or entered by the operator before the reader operation is started.

With an unformatted screen, the reader data is the first text in the data stream sent to the application program.

Figure A-12. An Unformatted Screen Using the 3277-Compatible Numeric Character Set



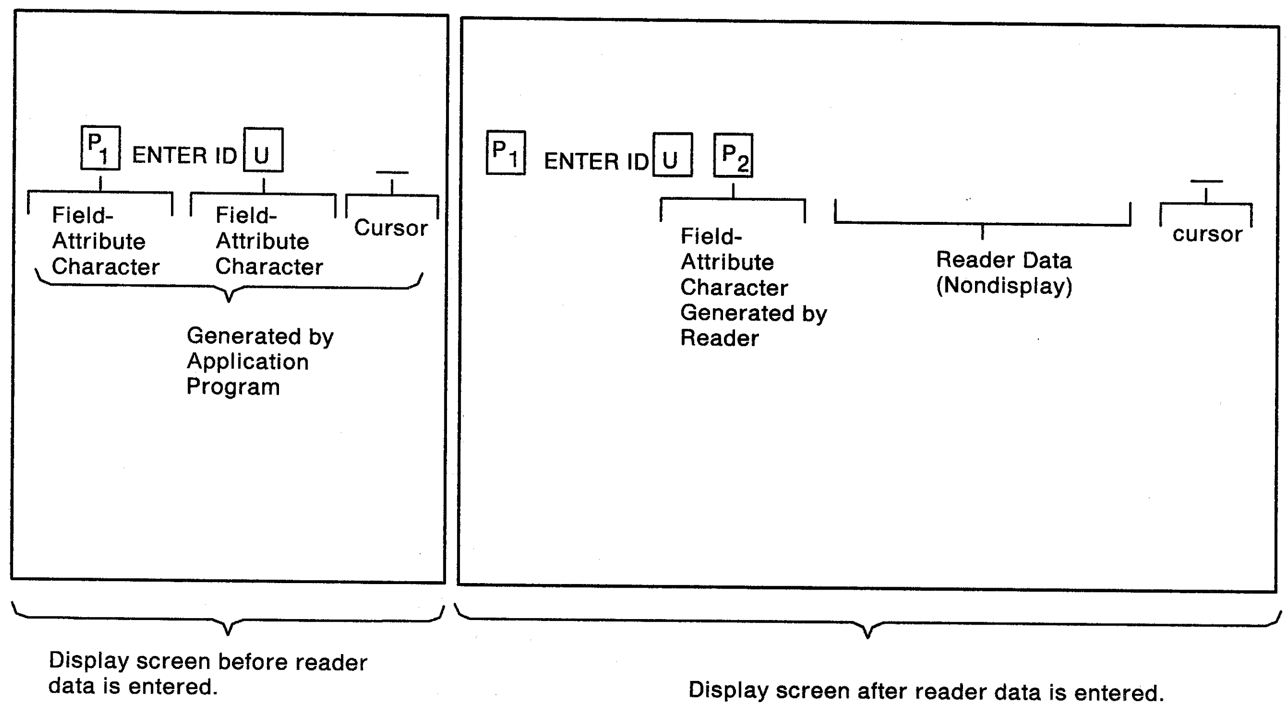
Inbound Data Stream

AID	Set to indicate input from a magnetic-strip reading device.
Cursor Address	Address of the cursor upon completion of the reader operation.
SBA	Set Buffer Address
Start of Data Address	Address of the unprotected (U) field-attribute character + 1.
Data	ENTER ID, in the example above.
SBA	Set Buffer Address.
Start of Data Address	Address of the protected field-attribute character + 1; in this case, the address of the first data character from the reader following the protected field-attribute character.
Data	The reader data (and any data between the cursor and the next field-attribute character).

$\boxed{U}$ = Unprotected field-attribute character

$\boxed{P}$ = Protected field-attribute character

Figure A-13. A Formatted Screen Using the 3277-Compatible Numeric Character Set, Example 1



U = Unprotected field-attribute character

P = Protected field-attribute character

Note: Rules for positioning modified date on formatted screen apply. The position of reader data in the inbound data stream depends on the field position in the format.

Inbound Data Stream

Inbound Data Stream	
AID	Set to indicate input from magnetic-stripe reading device.
Cursor Address	Address of the cursor upon completion of the reader operation.
SBA	Set Buffer Address.
Start of Data Address	Address of the unprotected (U) field-attribute character +1. In the example above, it will be the address of the P_2 field-attribute character.
SBA	Set Buffer Address.
Start of Data Address	Address of the P_2 field-attribute character + 1; in this case, the address of the first data character from the reader following the P_2 field-attribute character.
Date	The reader data (and any data between the cursor and the next field-attribute character).

Figure A-14. A Formatted Screen Using the 3277-Compatible Numeric Character Set, Example 2

Error Conditions (MSR)

MSR data will not be written into the display buffer if any of the following error conditions exist when the magnetic stripe is read:

- The SS (MSR) character is not successfully connected to a field-attribute in the display buffer
- The cursor is located in a protected field
- The cursor is located in a field-attribute character location
- The display is busy performing another operation.

Validity Tests

To use the MSR as an identification and data-entry device, the application program must perform certain validity tests. Your application program should follow these guidelines:

1. No field should be accepted as reader input unless the reader AID code is set.
2. For preformatted displays, the application program must know the location of the field defined to receive the reader data and the exact location of the entered data, based upon the hardware operation that was previously defined. The use of the cursor address present in the inbound data stream, in combination with the AID byte to ensure reader input, is an additional technique that can be used to ensure the integrity of the data. For unformatted displays, the reader data is always presented as the first data entry in the input record to the application program.
3. For preformatted displays, it is advisable to terminate the reader data field with another attribute byte.
4. Upon completion of the reader operation, the application program should check for the presence of the ES character (MSR). Absence of this character means the reader data has not been transferred successfully.
5. Upon completion of the reader operation and a successful check for the character, the LRC character may be used for a parity check to ensure integrity of the data.

   Because of the makeup of the 3277-compatible numeric character set codes (4 bits plus parity bit), only the right-hand 4 bits are of concern. The application program should set up a 1-byte field initialized to X'0B'. This is the SOR (SS) character, which is not included in the inbound data stream but which is used to compute the LRC. As each character is checked for validity, it is exclusively ORed into this field. This operation should include the LRC, resulting in the byte containing zero. If the byte is nonzero, it means the result of the check on the data characters, including EOR/EOI(ES) does not equal the LRC, and a parity error has occurred.
6. If the reader input field is to be reused, the application program must remove the hardware-generated field-attribute character and reader input data. The location of this character can be derived from the inbound data stream by using one less than the start of the data address preceding the input data. Additionally, the cursor is located one position beyond the end of the reader data field.

   The card field may be reused if more than one card input is required or if the original attempt was unsuccessful and the application program desires to retry the operation.

7. Text for all fields having the MDT bit set is transferred to main storage when the reader data is retrieved in response to the reader-generated I/O pending.
8. The cursor must be moved out of the reader-generated field before further keyboard activity is allowed.

A test card, P/N 1742659, is delivered with each 3278 Magnetic Reader Control feature. The test card data placed in the display buffer is as follows:

```
0123456789987654321001234567F4
```

Care should be taken that these cards are not accidentally auto-entered. The display should be placed in test mode to avoid auto-entering magnetic-stripe information to the host.

Operator Indicators and Alarm (MSR and MHS)

The MSR and the MHS each contain three operator indicators and a buzzer. The indicators are color-coded green, yellow, and red. When all indicators are off, power has not been applied to the MSR/MHS.

Green Indicator On

Indicates that the MSR/MHS is ready to read a magnetic stripe. This indicator is turned on when:

- The 3278 or 3279 is turned on
- The 3278 or 3279 Test/Normal switch is operated
- The 3174 IML pushbutton is pressed
- The MSR/MHS data has been successfully transferred to the host if this is an Auto-Enter operation. The data has been successfully written into the 3278 or 3279 buffer if this is not an Auto-Enter operation.

Yellow Indicator On

Indicates the magnetic stripe has been read successfully by the MSR/MHS. Subsequent read operations are ignored while the yellow indicator is on. The yellow indicator is turned off when either the red or the green indicator is turned on.

Red Indicator On

Indicates that the MSR/MHS data is rejected. The red indicator is turned on when:

- Invalid magnetic-stripe information (for example, invalid character, LRC error, parity error) is detected by the MSR/MHS hardware.
- The keyboard is already locked. The operator should check the symbols in the display's operator information area and take the appropriate action.
- An unsuccessful read operation is detected. The keyboard is locked.

The red indicator is turned off when the yellow indicator is turned on.

Buzzer

The MSR/MHS gives a short tone (one-quarter second) when the green indicator turns on and a longer tone (one second) when the red indicator turns on.

Appendix B. Extended Function Feature for CUT Devices

Introduction

This appendix describes the functions that are available for IBM Control Unit Terminals (CUT) which support the Extended Function feature. The functions that are available through the Extended Function feature are:

- Partitioning
- Windowing
- Cursor Locator
- APL2 Support
- CECP Support
- Extended Vital Product Data
- Large Screen Size Support.

For a description of Vital Product Data, see "Vital Product Data" on page 11-11. CECP support is described in Appendix D.

Notes:

1. Partitioning is for a single partition only; multiple partitions are not allowed.
2. Not all functions above are available on every device with the Extended Function feature. See the description of each function and your display documentation to determine which functions your display will support.

The devices that support the Extended Function feature are:

- 3180 Control Unit Terminal
- 3191 Control Unit Terminal, Models D, E, and L
- 3192 Control Unit Terminal
- 3471 Control Unit Terminal, Model B
- 3472 Control Unit Terminal, every model except G.

The following display set-up mode options must be used to enable the Extended Function feature. See the documentation for your display to determine how to enter set-up mode and select these options.

- For 3180 displays, Model IDs 6—9 must be selected
- For 3191 and 3192 displays, the Extended Function Model IDs (2+, 3+, 4+, or 5+) must be selected
- For 3471 and 3472 displays, a keyboard type other than 78EMU (3278 Emulation) must be selected.

Partitioning

Partitioning allows the host to define a "logical" screen (called a *partition*) which may be different, both in size and in shape, from the physical display screen. The partition is defined by use of the Create Partition structured field. Once a partition has been created, data is transmitted to and from the partition as if it were a physical screen with the geometrical characteristics specified in the Create Partition structured field. The mapping from the host view of the device to the physical screen is transparent to the host once the partition has been successfully created.

When partition support is provided, the 3174 allows a single partition to be defined (explicit partition zero) with the following characteristics:

- Operator interaction is allowed
- A buffer is allocated
- The host can perform operations on data in the buffer.

Note: Partitioning is not supported on devices with more than one session.

Presentation Space

A partition has associated with it a conceptual two-dimensional surface, called the *presentation space*. Data may be thought of as being presented on this two-dimensional surface, although the surface does not exist physically as such on the device. A window on the presentation space identifies that part of the presentation space that is visible to the operator on the physical screen (Figure B-1 and Figure B-2 on page B-5).

The viewport is that area on the display surface where the terminal operator sees the partition data displayed. Each viewport is related to a window, so that the data in the presentation space within the window appears on the screen within the viewport.

The term *windowing* refers to the movement of the window along the presentation space. *Scrolling* refers to the movement of the data relative to the viewport. Thus, as the window moves toward the beginning of the presentation space, the data is scrolled down through the viewport.

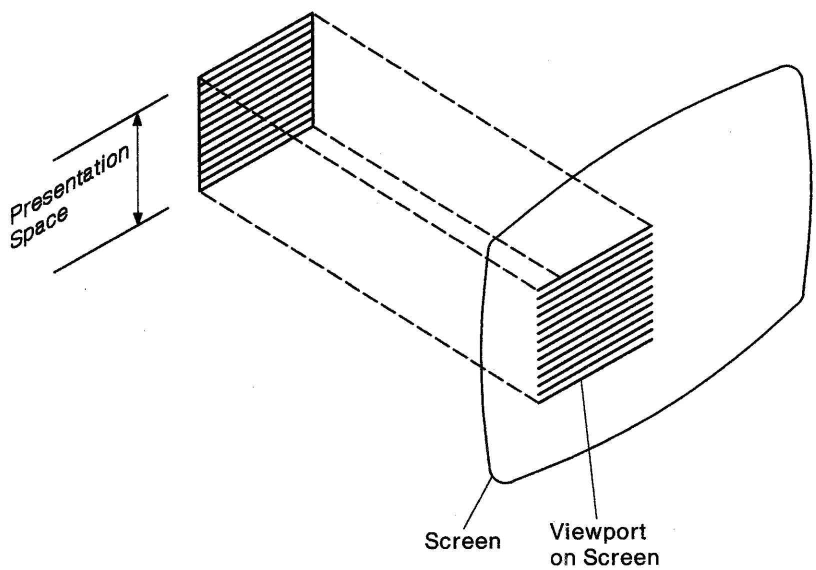
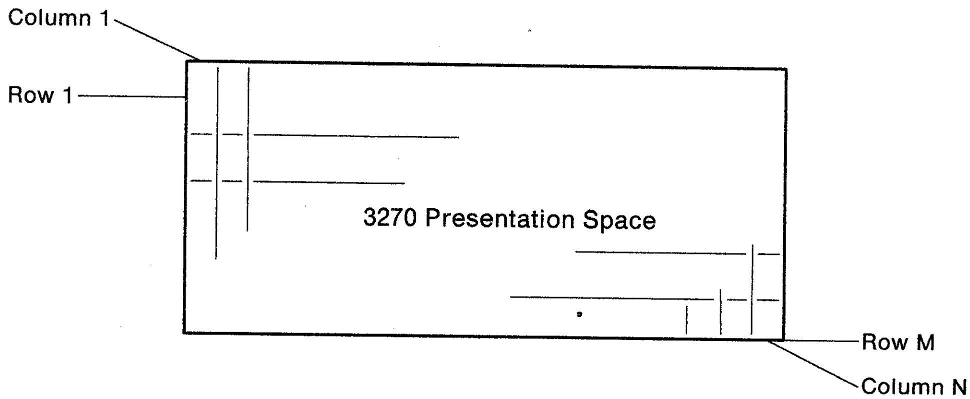


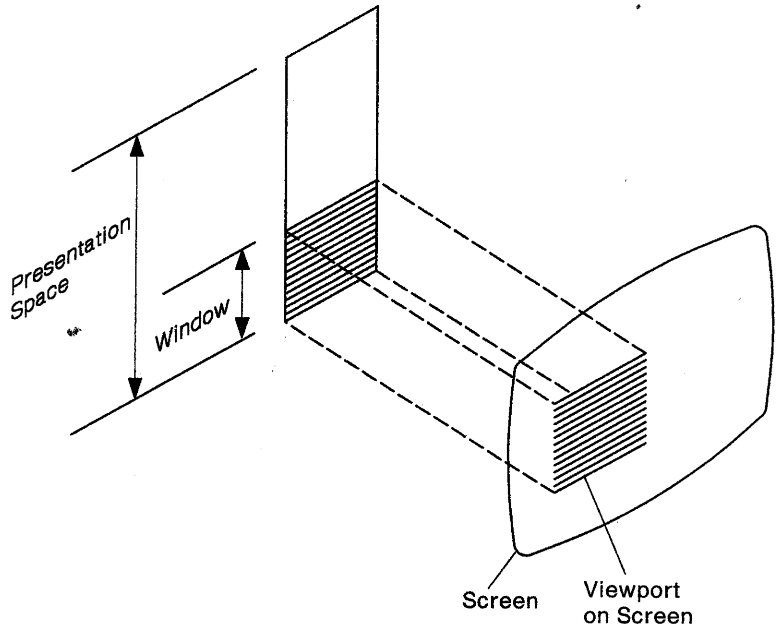
Figure B-1. Presentation Space and Viewport (without Windowing)

Data appearing on the physical viewing surface of the device must lie on character cell boundaries. For processing 3270 alphanumeric data streams, the presentation space must be defined by a row-and-column coordinate system, where addressability of the presentation space begins at row 1/column 1, with row numbers increasing downwards and column numbers increasing to the right.



Rather than formatting data on the presentation space in row/column coordinates, 3270 compatibility requires the addressing (using the 3270 Set Buffer Address order) of the character buffer associated with the presentation space. The mapped buffer of the 3270 architecture predefines the mapping from the character buffer to the presentation space.

For alphanumeric data using a mapped buffer, the size of the buffer is W × H, where W is the width and H is the height of the presentation space. Associated with a partition is a current cursor position (CCP), which determines where alphanumeric data is placed during operator keystroking. The alphanumeric screen cursor is displayed at the CCP of the partition. Data entry or cursor movement causes the CCP of the partition to be changed.



Window moved forward to bottom of presentation space

Window moved back to top of presentation space

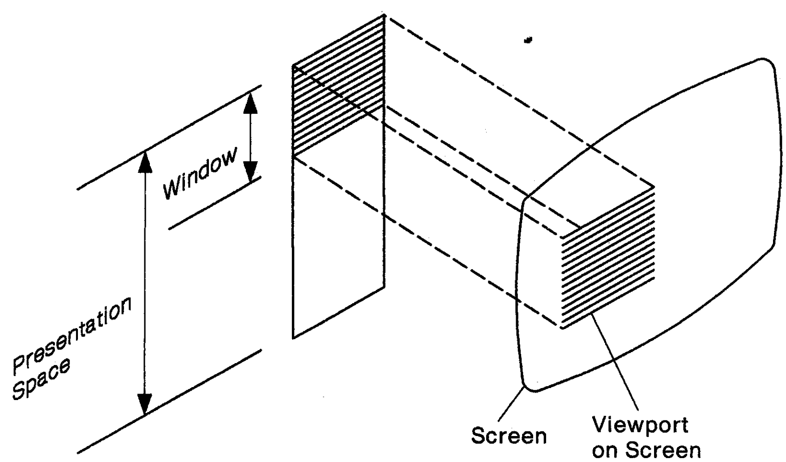


Figure B-2. Presentation Space, Window, and Viewport (with Windowing)

Implicit Partition

At Bind time (SNA) or at power-on (non-SNA), the display is placed in implicit partition state. A single implicitly defined partition is automatically created and assigned a partition identifier (PID) of zero and a default size. While the display is in implicit partitioned state, the size of the partition is controlled by the Erase/Write (EW) and Erase/Write Alternate (EWA) commands.

EW redefines implicit partition zero with the default size. EWA redefines implicit partition zero with the alternate size.

For SNA, the default and alternate sizes are specified in Bind SESSION. Allowed bind values are dependent on the display station's screen size.

For non-SNA, the default and alternate sizes are also dependent on the display station's screen size.

The characteristics of the implicit partition are:

- Partition parameters expressed in row/column coordinate system
- Partition size = Viewing surface size
- Window size = Partition size
- Viewport size = Window size
- Viewport origin = Viewing surface origin
- No windowing permitted
- A/N buffer allocated
- Unprotected (operator interaction allowed).

The Create Partition structured field is used to replace the implicitly created partition zero with a partition that is explicitly defined. The first Create Partition structured field causes the implicit partition zero to be destroyed and the display to be placed in an explicit partitioned state.

Alphanumeric Data to Partitions

Alphanumeric data to an explicit partition zero (PID = 0) is transmitted outbound either by (1) a 3270 EW, EWA, or Write command, or (2) a Write Structured Field (WSF) command followed by the Outbound 3270DS structured field specifying PID = 0.

Buffer addresses in the SBA, RA, and EUA orders are relative to the origin of the character buffer associated with the partition. During the write operation, a current buffer address (CBA) is maintained, as on 3270. The CBA is set initially to the current cursor position (CCP) of the named partition. It can be set from the host with a Set Buffer Address (SBA) order. A WSF command followed by multiple Outbound 3270DS structured fields, with no intervening operation to cause cursor movement, assumes the current cursor position for each Outbound 3270DS structured field.

The Insert Cursor (IC) order sets the CCP of the named partition.

Data from a partition with a PID equal to 0 is transmitted inbound in 3270 format. Hence, existing applications receive data in 3270 format.

Write Control Character (WCC)

The 3270 Write, Erase/Write, and Erase/Write Alternate commands are all followed by a write control character (WCC), as defined for the 3270 data stream. In addition, the Outbound 3270DS structured field contains a similar WCC for the above commands.

WCC Reset

The definable partition characteristics (reply mode) can be reset by use of a WCC with bit 1 set to 1 following an Erase/Write or Erase/Write Alternate command. The following table indicates the effect WCC bit 1 has on reply mode:

	Reply Mode With:	
	WCC Bit 1 = 0 (X0XX XXXX)	**WCC Bit 1 = 1 (X1XX XXXX)**
Erase/Write command	Unchanged	= Field*
Erase/Write Alternate command	Unchanged	= Field*
Erase/Write 3270DS structured field	Unchanged	= Field
Erase/Write Alternate 3270DS structured field	Unchanged	= Field
Write command	Unchanged	Unchanged
Write 3270DS structured field	Unchanged	Unchanged

* The WCC Reset following an Erase/Write or Erase/Write Alternate command also resets the partition characteristics. See "Usable Area Transitions" for details.

Device States

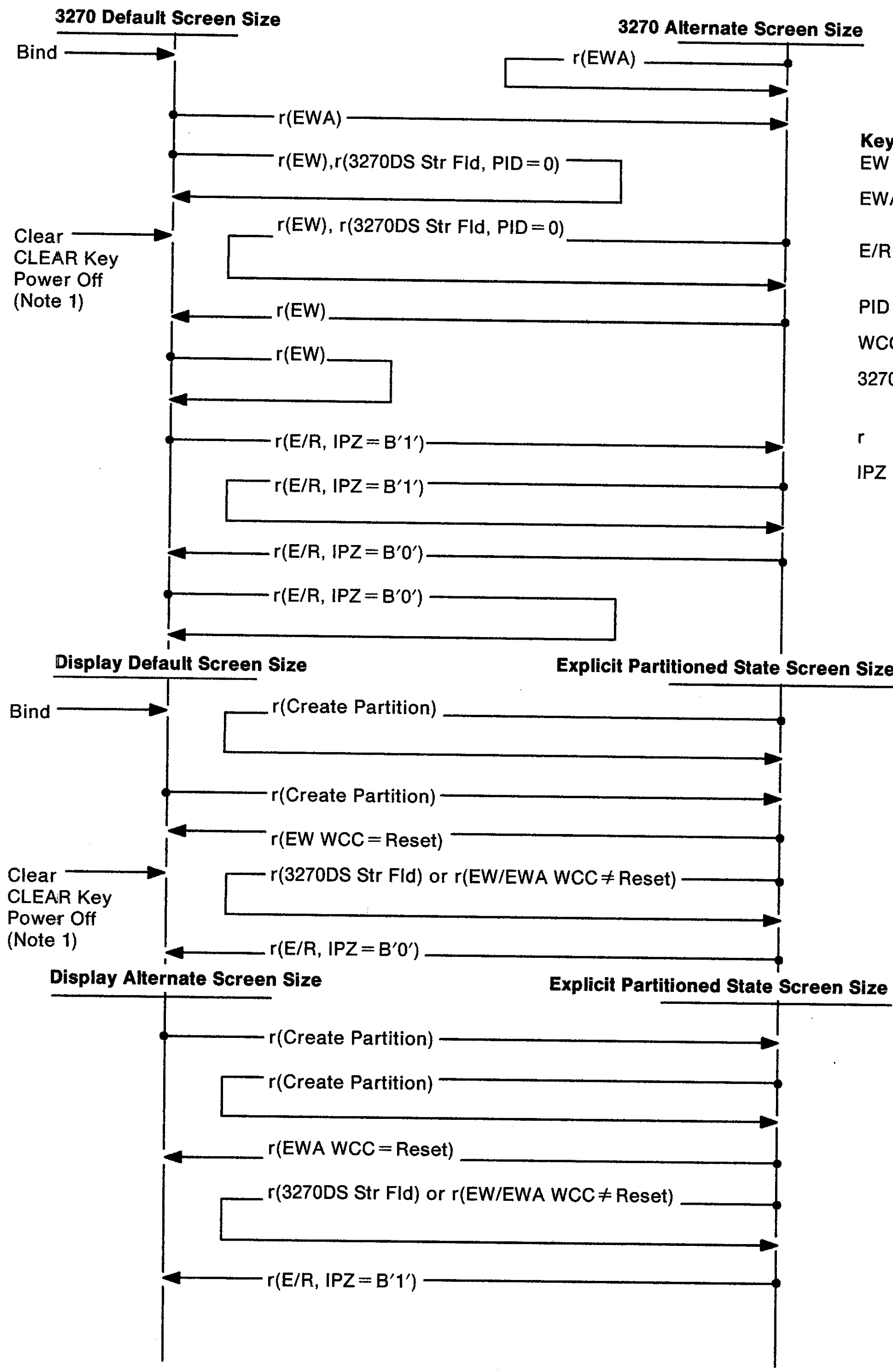
The 3174 implementation permits operation in one of two defined states. When operating with an implicit partition zero, the device is said to be in the implicit partitioned state. When an explicit partition has been created, the device is said to be in the explicitly partitioned state. In each of these two states, all the orders and commands described in this manual are valid. The distinction between the two states relates to the way in which the usable area is managed.

Usable Area Transitions

The alphanumeric presentation space is the two-dimensional representation of the character buffer. It controls the value at which buffer addresses wrap. The presentation space must be equal to, or greater than, the viewport on the screen. In practice, for those devices that support windowing, the presentation space is larger than the viewport. For nonwindowing devices, the presentation space is the same size as the viewport.

In the implicit partitioned state, the size of the presentation space and of the viewport is controlled by use of EW and EWA commands, as defined for the base 3270.

In explicit partition zero, there is one presentation space and one viewport. Both are controlled by the Create Partition structured field. The management of presentation spaces is shown in the following diagram:



Key:

EW	= Erase/Write command
EWA	= Erase/Write Alternate command
E/R	= Erase/Reset structured field
PID	= Partition Identifier
WCC	= Write Control Character
3270DS Str Fld	= Outbound 3270DS structured field
r	= Receive
IPZ	= Implicit Partition Size

Notes:

1. Any local action, such as device return from local test use or SSCP use, may reset the device size to the default state.
2. If a structured field cannot be processed, because of a data stream error, no state transition occurs.
3. If the CLEAR function is pressed, the device may be set to the default partition size or remain the same depending on the customization value selected or the option that has been designed into the product.

When the device is in the implicit partitioned state, the EW and EWA commands operate as defined; that is, EW establishes the default state and EWA establishes the alternate state.

Windowing

Windowing on a partition is possible if a partition has been created and the presentation space is larger than its associated viewport. Windowing makes different areas of the presentation space available for viewing. Windowing is performed directly by the operator through the keyboard or by the host using a structured field.

Note: Windowing is not supported on the 3471 Model B.

General Characteristics

When creating a partition, you can set it up for windowing by making the presentation space larger than the viewport. A window is placed on the presentation space, and its contents are displayed in the viewport. The location of the window on the presentation space determines the data displayed in the viewport. The initial position of the window is established by the Create Partition structured field. The position of the window is modified via the Set Window Origin structured field.

Vertical windowing is controlled by the operator, with the BACK and FWD (Forward) functions on the keyboard. These functions cause the window to move back (toward the beginning of the presentation space), and forward (toward the end of the presentation space), by a scroll unit. (A scroll unit is defined via the Create Partition structured field when the partition is created.) Horizontal windowing is not supported. Details of window function operations are described below.

The cursor is always kept within the viewport. Whenever keystroking causes the cursor to leave the viewport, an automatic windowing is performed. Conversely, when windowing moves the window so that the cursor no longer is within the viewport, the effect, as seen by the operator, is that the cursor is "dragged" along at the top or bottom edge of the window and so always remains within the viewport.

The cursor movement functions (Up, Down, Right, Left, Backspace) cause the cursor to wrap at the viewport boundary.

With data or field-oriented functions, cursor wrap is at the presentation space boundary.

If the host data stream sets the cursor position outside the window, automatic windowing is performed. As a result, the cursor remains at a peripheral row of the window and so appears at the top or bottom row of the viewport.

Vertical Windowing Functions

The FWD and BACK functions control vertical windowing. These functions work on an explicit partition with a presentation space larger than the viewport and with RS set to a nonzero value. The window is moved up and down the presentation space.

The vertical scroll unit, RS rows, is defined when the partition is created. If the RS value is specified as X'FFFF', the scroll unit (the number of rows moved) is defined as 1.

Action for the Forward Function

The Forward (FWD) function is the alternate shift (Alt function pressed) of the Cursor Down function.

The following definition applies if RS is *not* X'0000' or is defaulted to 1. The FWD function moves the data up the viewport. This is achieved by moving the window down, that is, toward the end of the presentation space.

If RS is X'0000', the FWD function is ignored. Input is not inhibited, nor is any indication displayed to the operator.

If possible, the window is moved by the scroll unit, RS. However, if there are fewer than RS rows below the window, the window is moved to the bottom of the presentation space.

If the current cursor position (CCP) is now outside the window, the CCP is moved to the top row of the window. Its column position is unchanged.

When the FWD function is used typematically, the effect seen by the operator is that the cursor is dragged along at the top edge of the viewport.

If the window is already positioned at the bottom of the presentation space, the FWD function has no effect. Note that input is not inhibited and that no indication is displayed to the operator.

The formula defining this process is as follows:

Let	*(RW,CW*[1]*)*	be the window origin
	RS	be the scroll unit
	H	be the height of the presentation space
	HV	be the height of the viewport
	R	be the minimum of RS and (H-RW-HV).

Then, the new window origin is *(New_RW, CW)*

Where: $NEW\_RW = RW + R$.

1 Note that the 3174 and the 3180/3192 support only $CW = 0$.

Action for the Backward Function

The Backward (BACK) function is the alternate shift (Alt function pressed) of the Cursor Up function.

The following definition applies if RS is *not* X'0000' or is defaulted to 1. The BACK function moves the data down the viewport. This is achieved by moving the window up the presentation space.

If RS is X'0000', then the BACK function is ignored. Input is not inhibited, and no indication is displayed to the operator.

If possible, the window is moved by the scroll unit, RS. If there are fewer than RS rows above the window, however, the window is moved to the top of the presentation space.

If the current cursor position (CCP) is now outside the window, the CCP is moved to the bottom row of the window. Its column position is unchanged.

When the BACK function is used typematically, the effect seen by the operator is that the cursor is dragged along at the bottom edge of the viewport.

If the window is already positioned at the top of the presentation space, the BACK function has no effect. Note that input is not inhibited and no indication is displayed to the operator.

The formula defining this process is as follows:

Let	*(RW,CW[2])*	be the window origin
	RS	be the scroll unit
	H	be the height of the presentation space
	HV	be the height of the viewport
	R	be the minimum of RS and RW

Then, the new window origin is *(New_RW, CW)*

Where: $NEW\_RW = RW - R$.

2 The 3174 and the 3180 support only $CW = 0$.

Screen Size Support

When operating in explicit partition state, the display uses the viewport height and width parameters from the Create Partition structured field that created the partition to adjust the viewport for "best fit" on the viewing surface of the display.

The 3174 supports SNA host application program setting of screen size via the Bind command, when the display is in implicit partition state. The width and height of the usable area and alternate usable area (if present), determines the maximum Bind size that can be accepted. (Usable area sizes are defined in "Query Reply (Usable Area)" on page 3-56.) When the Bind is accepted, it overrides the screen size selected by the operator during display set-up mode.

Through customization question 126 digit 5 (Configuration Support B Release 4 or later), the maximum Bind that is accepted for displays with multiple sessions can be restricted to the screen size that is selected by the operator during display set-up mode on displays with more than 1 session. For example, if a 3192 display operator selected the Extended Function Model ID 3+, the maximum Bind that would be accepted is 80 columns and 32 rows (a Model 3 screen size). Restricting the Bind size will affect the amount of MLT storage required for each session on the display. See the *3174 Planning Guide*, for more information.

Clear Function Support

If the device is in implicit partitioned state, pressing the Clear function clears the buffer to nulls and resets implicit partition zero to the default size.

If the device is in explicit partitioned state, pressing the Clear function clears the buffer to nulls and resets the display to implicit partition zero (default size). The action of the Clear function destroys the explicit partition.

Support of Cursor Locator

The 3174 sets the cursor locator on as part of 3174 power-on processing. Column and row offsets are set to 0, and the terminal displays the row and column values in the operator information area, starting with a value of 0001/001 for the upper left corner of the presentation space. (No facility is provided for the host to set offsets.)

When the Entry Assist capability of the 3174 is being used and the terminal is in partition mode:

- The 3174 disables the display of the cursor locator when the scale line is displayed in the Operator Information Area, thereby giving the 3174 ownership of the Operator Information Area. When the 3174 replaces the scale line with the normal operator information in the Operator Information Area, the 3174 reenables the cursor locator.
- The display does not provide the entry-assist cursor position function, because the cursor locator is continually displayed.

Structured Fields

Structured fields contain data that is transmitted to the host and received from the host. If a device supports the Extended Function feature, then the host is notified of this when it is sent the structured fields for the Usable Area and Alphanumeric Partition query replies. The 3174 will accept the Create Partition and Set Window Origin structured fields from the host if the device supports the Extended Function feature.

For the description and format of the structured fields, see Chapter 3, "3270 Structured Fields."

Operational Considerations

This section discusses local copy of a window, BSC Copy command considerations, state resets, and 3174 Entry Assist functions when the terminals are in explicit-partition mode.

Local Copy

The 3174 supports local copy of the window. The 3174 maps the data from the terminal buffer into the printer buffer, using the data from Create Partition (how wide) and the current window origin to determine the mapping.

Local copy of the partition is *not* supported.

If (Printer Buffer Size −80) > (HV × WV), then the copy is performed if otherwise authorized. If (Printer Buffer Size) ≤ (HV × WV), the copy operation is rejected and the Operator Unauthorized (input inhibited) indicator is displayed in the operator information area.

BSC Copy

BSC Copy is *not* supported if either the *from* or the *to* device is in explicit partitioned state. Op Chk is returned to the host.

Entry Assist Operations

When the terminal is emulating a 3278 (that is, the terminal has not been put in partition state by the host/3174), the 3174 Entry Assist capability performs in exactly the same manner as it does on a 3278 Display Station.

When the terminals are in explicit partition state, the 3174 Entry Assist capability is extended as follows:

- For the implementation of partitions, the width of the presentation space must equal the width of the viewport (referred to here as the *width of the partition*).
- The 3174 Entry Assist capability assumes that the device has the physical origin for both the scale line and the viewport in the same column on the screen. This is true even if the device accepts values of CV that are not equal to 0, because the terminal always sets the column physically to origin 0 by definition.
- Partitions whose presentation space width ranges from 2 through 80 characters are supported.

- If a viewport > 80 is created:
  - Entry into DOC mode is not allowed
  - DOC mode is exited if the display was in DOC mode.

  Note that the above operation is analogous to entry-assist operations on a 3278 Model 5.

- For partitions whose presentation space width is between 2 and 80 (1 < W < = 80):
  - The concept of presentation space delimiters is created.
  - These delimiters are displayed as a left bracket ([) for the left partition delimiter and as a right bracket (]) for the right partition delimiter.
  - Each partition delimiter is displayed only when the corresponding margin is outside the viewport; that is, if the left margin is outside the viewport, then a left partition delimiter is displayed at the left edge of the viewport. The left partition delimiter acts as the effective left margin. Similarly, if the right margin is outside the viewport, a right partition delimiter is displayed at the right edge of the viewport. The right partition delimiter acts as the effective right margin and inherits all the properties of the right margin (for example, right margin type as selected in change-format mode).
- The partition delimiter symbol priority is:
  - Less than margins (< , >)
  - Greater than tabs, bell (– , *)
- Any tabs or bells that lie to the right of the partition delimiter are ignored.
- The full 80-character scale line is always displayed when requested, even though the presentation space width is less than 80.

APL2 Support

The 3174 provides support for APL2, which is an expanded version of APL. APL2 provides 10 new characters for a total of 138. The 3174 presents these 10 new APL2 characters when they are sent from a host to a device that supports APL2 and allows entry of the seven APL2 characters that are found on an APL2 keyboard. For the characters and code points of these 10 new characters, refer to the *3174 Character Set Reference*.

Note: Characters unique to APL2 that are sent to an APL device, are presented as blanks.

APL2 is available on 3191 (Models D, E, and L), 3192, and 3472 (all models except G). In addition to having the Extended Function feature enabled, the display must also contain an Extended Attribute Buffer (EAB). If the device is APL2-capable, it notifies the 3174 when it is powered on. However, the host must send a Query or Query List to determine the device type. In response to the query, the 3174 sends a Character Sets Query Reply. In this reply, the 3174 notifies the host as to which of its attached devices are APL2-capable.

Throughout this manual, the terms *APL keyboards* and *APL mode* are devices that support APL2.

Appendix C. 3174 Support of Intelligent Printer Data Stream (IPDS)

Introduction

This appendix describes the 3174 support provided to enable an application to transmit the Intelligent Printer Data Stream (IPDS) to an IPDS-capable printer. Two protocols for IPDS printer attachment are presented: one for an SNA network, one for a non-SNA network.

The IPDS itself is not discussed (refer to the printer product and programming publications).

System Attachment

The 3174 Establishment Controllers support printers capable of processing an Intelligent Printer Data Stream (IPDS) through the following attachments:

- Using SNA Communication Protocol
  - Channel
  - SDLC
  - Token-Ring
- Using Non-SNA Communication Protocols
  - Channel
  - BSC.

Two procedures are provided, one for SNA communication (LU-1 session; IPDS is not supported in LU-3) and one for non-SNA:

- The SNA procedure uses the Function Management Header Type 1 (FMH-1) and the Read Partition (Query) and Query Reply structured fields.
- The non-SNA procedure uses the WSF command and the Data Chain, Read Partition (Query), Select IPDS Mode, and Query Reply structured fields.

The FMH-1 is discussed in Chapter 9, the WSF command in Chapter 2, and the Data Chain, Read Partition (Query), and Query Reply structured fields in Chapter 3. The Select IPDS Mode and the Query Reply (3270 IPDS) structured fields are discussed in this appendix under "Non-SNA Procedure."

SNA (LU-1) Procedure

Supporting an IPDS printer requires switching the data stream mode from SCS (SNA Character String) to IPDS mode during an LU-1 session. The intelligent printer data stream itself is carried in IPDS structured fields and, similar to SCS data, is processed entirely by the attached printer.

Querying for IPDS capability, selecting and terminating IPDS mode, inbound structured fields, implicit termination of IPDS mode, and copy considerations are described in the following section.

Determining IPDS Capability

To determine IPDS capability, issue a Read Partition (Query or Query List) structured field. (If Query List is used, the list should contain a query code of X'A2'.)

A printer supporting the IPDS will return a Query Reply (Data Streams) structured field containing a data stream identifier indicating IPDS capability (X'02') (see Chapter 3, "3270 Structured Fields"). Note that both the base data stream capability [SCS(X'00')] and the IPDS capability (X'02') are returned, that is, X'0002'. Both the query and the query reply from the printer are sent in a sequence that begins with an FMH-1 containing a destination select of *Begin/End* and a data stream profile of *structured fields*.

The FMH-1 that precedes a Read Partition structured field is encoded as:

```
X'0601000B6000'
```

The FMH-1 that precedes a query reply is encoded as:

```
X'0601008B6000'
```

Selecting IPDS Mode, Transmitting Data and Terminating IPDS Mode

To select IPDS mode, issue an FMH-1 containing a destination select of *Begin* and a data stream profile of *IPDS*. **This FMH-1 must be sent as Only-in-Chain (OIC) and can have no other accompanying data.**

Once IPDS mode is selected, IPDS structured fields must be sent, in single or multiple element chains, without an FMH-1 preceding them. If 3270 data stream orders or control sequences are sent, they will be treated as IPDS data with unpredictable results.

The FMH-1 that selects IPDS mode is encoded as:

```
X'0601300D4000'
```

To terminate IPDS mode, issue an FMH-1 containing a destination select of *End* and a data stream profile of *IPDS*. **This FMH-1 must be sent as Only-in-Chain (OIC) and can have no other accompanying data.**

Terminating IPDS mode returns the LU-1 session to its default data stream mode of SCS.

The FMH-1 that terminates IPDS mode is encoded as:

```
X'0601300D2000'
```

Inbound Structured Fields

A printer in LU-1 SCS data stream mode sends only the Query Reply structured field inbound. A printer in LU-1 IPDS mode sends only an IPDS Acknowledge Reply structured field inbound.

Implicit Termination of IPDS Mode

When IPDS mode is active, any of the following will cause termination of the active destination selection and is an implicit termination of IPDS mode:

- A chain indicating End Bracket (EB)
- Clear
- Power-On Reset (POR).

Copy Considerations

Since an End Bracket is also an implicit termination of IPDS mode, between bracket printer sharing can be used for either operator-initiated or host-initiated copy operations.

SNA LU-1 VTAM Application Example

Figure C-1 shows an example of an application's use of Select IPDS mode and data chaining to send IPDS structured fields to a printer. The IPDS structured fields total 6K bytes in length.

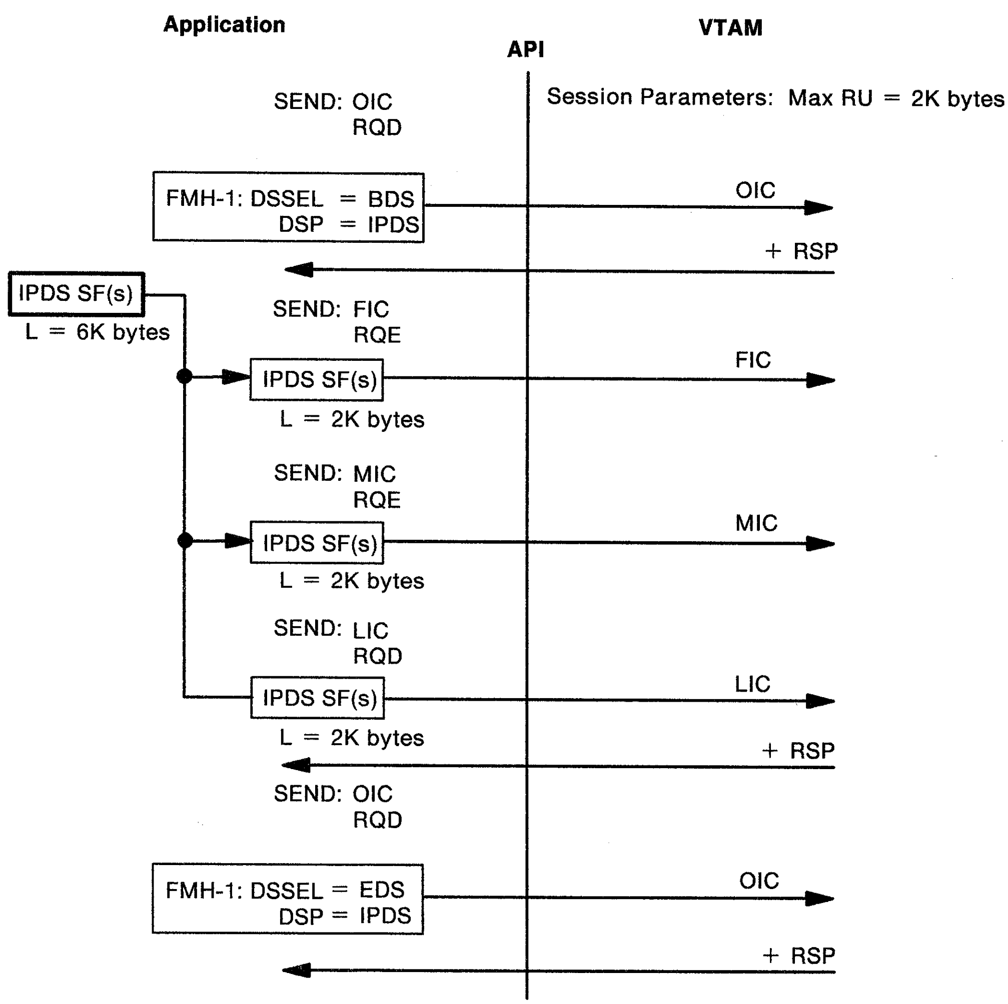


Figure C-1. Example of IPDS Support (SNA LU-1 session)

Non-SNA Procedure

Supporting an IPDS printer in the non-SNA environment (channel or BSC protocol) requires switching the data stream mode from the 3270 data stream to IPDS mode. IPDS data is carried in IPDS structured fields and is processed entirely by the attached printer. (The 3270 data stream is processed by the 3174 before being passed to the printer.)

To provide a chaining capability in the non-SNA environment, Data Chain and Query Reply (Data Chaining) structured fields are provided (see Chapter 3, "3270 Structured Fields").

For determining IPDS capability and switching the data stream mode to IPDS, the structured fields Query Reply (3270 IPDS) and Select IPDS mode are provided. (See Table C-1 and Table C-2 on page C-6.)

All outbound data streams containing structured fields are sent using the Write Structured Field (WSF) command.

Querying for IPDS and data chaining capabilities, selecting and terminating the IPDS mode, inbound structured fields, implicit termination, and copy considerations are described in the following material.

Determining IPDS and Data Chaining Capability

To determine IPDS and data chaining capability, issue a Read Partition (Query or Query List) structured field.

A printer supporting IPDS will return the Query Reply (3270 IPDS) structured field shown in Table C-1.

A printer supporting data chaining will return the Query Reply (Data Chaining) structured field shown in Table 3-40 on page 3-45.

The Query Reply (3270 IPDS) structured field indicates that IPDS is supported in the non-SNA environment. It flows inbound only.

Table C-1. Format of Query Reply (3270 IPDS) Structured Field

Byte	Bit	Content	Meaning
0,1		X'0008'	Length of structured field
2		X'81'	Query Reply
3		X'9A'	3270 IPDS supported
4,5		X'0000'	Reserved – Must be zeros
6,7			Maximum outbound transmission size allowed

Selecting IPDS Mode, Transmitting Data, and Terminating IPDS mode

An application selects IPDS mode and initiates transmission of IPDS structured fields by issuing a WSF command, followed by the Select IPDS mode structured field, followed by the IPDS structured fields.

The IPDS mode is terminated at the end of the transmission containing the Select IPDS mode structured field unless Data Chaining is in effect.

If Data Chaining is in effect, IPDS mode remains active until receipt of a Data Chain *end* structured field. (See "Data Chaining" in Chapter 3, "3270 Structured Fields.")

When the amount of IPDS data requires multiple transmissions, data chaining must be initiated along with the selection of IPDS mode. An application initiates data chaining and selects IPDS mode by issuing a WSF command, followed by a Data Chain *begin* structured field, followed by a Select IPDS Mode structured field, followed by IPDS data.

Subsequent transmissions consist of the WSF command followed by a Data Chain *continue* or *end*. Receipt of Data Chain *end* terminates IPDS mode, and the default mode of the 3270 data stream becomes active.

For BSC protocol, transmissions are defined as the data delimited by DLE STX and DLE ETX.

For channel protocol, transmissions are defined as the data transferred by a WSF command (that is, a CCW transmission).

The Select Intelligent Printer Data Stream (IPDS) mode structured field is used to select IPDS mode in the non-SNA environment. When the controller has interpreted the Select IPDS mode structured field, the preceding Data Chain SF (if present), the Select IPDS mode SF itself, and any following data are passed through the controller to an IPDS-capable printer (such as the 4224 Printer).

The Select IPDS mode structured field must either be the first structured field in the transmission (WSF...Select IPDS Mode...) or immediately follow a Data Chain structured field with the group indicator set to *begin* or *only* (WSF...DC *begin or only*...Select IPDS Mode...).

The Select IPDS mode structured field must be contained within a single transmission. Table C-2 shows the format for the Select IPDS mode structured field.

Table C-2. Format of Select IPDS Mode Structured Field

Byte	Bit	Content	Meaning
0,1		X'0006'	Length of structured field
2,3		X'0F83'	Select IPDS mode
4,5		X'0000'	Reserved — must be zeros

Inbound Structured Fields

A printer in 3270 data stream mode in the non-SNA environment sends only the Query Reply structured field inbound.

A printer in IPDS mode in the non-SNA environment sends Select IPDS mode inbound if it had previously received an outbound IPDS structured field and a reply is required via the Acknowledge Reply structured field.

Implicit Termination of IPDS Mode

When data chaining is in effect, receipt of any of the following commands will cause termination of the in-chain state and of IPDS mode:

- Copy (BSC)
- Erase/Write (WCC=Reset)
- Erase/Write Alternate (WCC=Reset)
- Power-on Reset (POR).

Termination of IPDS mode and of the in-chain state does not occur if the commands listed above are received as partition commands within an outbound 3270DS structured field.

Abnormal Termination of Printer Operation

Any of the conditions stated in the data chaining discussion in Chapter 3, "3270 Structured Fields" will cause termination of printer operation with Sense = Op Chk and cause the controller to send an "abort" to the addressed printer.

Copy Considerations

A printer is not available for operator-initiated copy operations when in IPDS mode.

If a BSC Copy command is received when IPDS mode is active, IPDS mode is terminated and the BSC copy operation performed.

Non-SNA VTAM Application Example

Figure C-2 shows an example of an application's use of Select IPDS Mode and data chaining to send IPDS structured fields to a printer. The IPDS structured fields total 6K bytes in length.

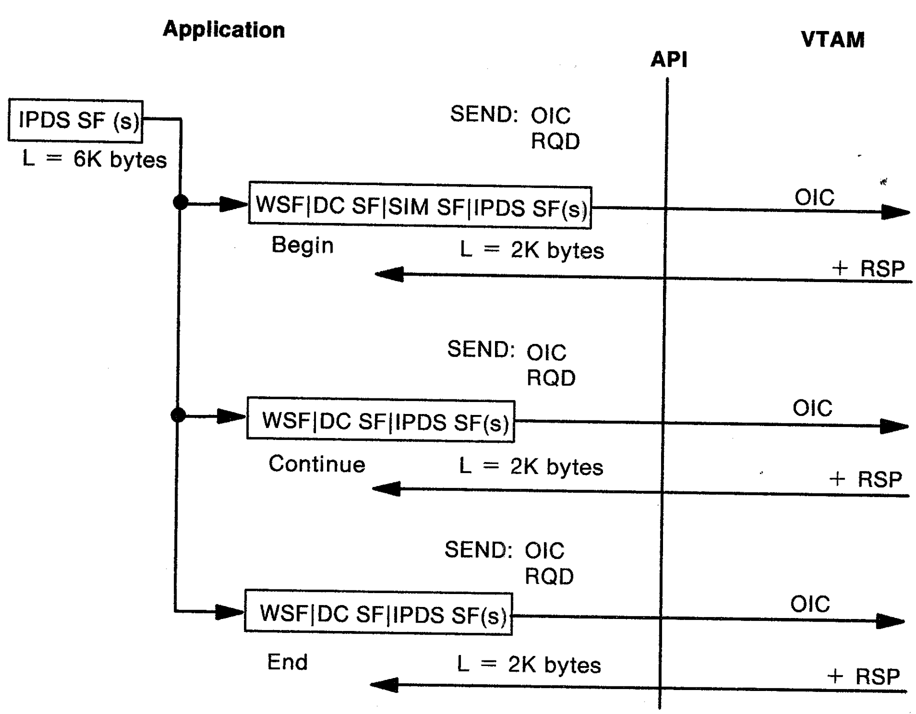


Figure C-2. Example of IPDS Support (Non-SNA Protocols)

Appendix D. Country Extended Code Page (CECP)

Introduction

This appendix explains Country Extended Code Page (CECP) and its use in multilingual communication. It describes CECP as an extension of existing code page support and explains the difference between CECP and current code page support.

CECP and Its Use

Country Extended Code Page (CECP) is an extension of the support for each country's code page. It allows the user to display and print an expanded set of characters.

For example, the French Base support, which contains 105 graphic characters, under CECP expands to 190 graphic characters plus a space. The Base support, a subset of CECP support, remains the same.

Warning: Installation of CECP may cause a loss of data integrity in data bases and applications. Therefore, please read "System Considerations" on page D-5 in this book before customizing for CECP.

Prior to CECP, communication could be conducted only in the character set of a given language. For example, a keyboard customized for German was restricted to only the characters and punctuation necessary for German. The flexibility of using characters from another language, French, for example, was not feasible.

Correct communication across country environments requires users to make an additional choice between converting all databases in an international network to the same code page, or implementing software capable of transforming characters as they are sent to a system with a different code page installed.

With CECP, a German keyboard can be modified using the Keyboard Definition Utility (KDU), to contain the same characters as a French keyboard. CECP enables all languages to support one universal set of characters, character set 697. Characters from other languages can then be entered, displayed, printed and sent to the host.

CECP is selected on your system during customizing. When you are familiar with CECP and are ready to install it, you should refer to the *3174 Planning Guide.*

Code Pages and Character Sets

This section defines code pages, character sets, and base support.

Code Pages

A *code page* is an assignment of graphic characters and control function meanings to all code points in the page. To understand this, consider a 1-byte (8-bit) binary code. Such a code consists of 0's and 1's that can be arranged in up to 256 different patterns. Each pattern is a *code point.* Each code point is assigned a meaning, either as a character or as a control function. An arrangement of code points and their meanings together make up a *code page.*

A code page is the I/O interface between a host and a 3174. It is divided into two parts: commands and graphic characters. *Commands* are control instructions to devices that define how devices should format data for presentation. Commands are the same for each language; they do not change. Commands take up 64 code point positions (from 00 to 3F) in a code page. *Graphic characters* are the characters that are displayed or printed on a device. These graphic characters are assigned to positions 40 through FE in each country's code page. But, within these positions, the location of the characters can be different from one language to another. Also, within existing code pages, the supported characters can differ between languages. (For example, the French code page supports E-accent grave; the German does not. They both have the character !, but that character is assigned a different position on each page.)

Character Sets

A *character set* is the collection of graphic characters required to support a specific language. In addition to supporting a language's character set, the 3174 supports the "Space". Base character sets may differ in size. For example, the French character set contains the 105 characters required to support French, and the German character set contains 94 characters.

For CECP, one universal character set has been defined that contains the 190 graphic characters plus a space required to support all CECP languages. It is known as *character set 697*. In this book, references to character set 697 include the character set and the space.

Base Support

Prior to CECP, each language defined a character set which consists of 94 to 161 graphic characters. The code points that have been defined to represent these graphic characters make up a subset of the code points available on the whole page. For each country, this subset is known as its *base support*. The remaining code points, those not assigned a graphic character, are undefined and unsupported.

CECP Languages

The following table lists the languages for which CECP provides character set 697 support. Beside each language name is its 2-digit identifying ID used during controller customization. More explanation will be given about these languages and the IDs later in this appendix.

Table D-1. IDs for Customizing CECP Languages

Austrian/German (EBCDIC 76)	03	Netherlands	47
Canadian Bilingual	29	New Belgian	43
Danish	07	New Swiss/French	41
English (UK)	22	New Swiss/German	42
English (US)	01	Norwegian	23
Finnish	09	Portuguese	28
French AZERTY (105)	30	Spanish	19
Icelandic	37	Spanish speaking	21
Italian	15	Swedish	24

CECP has its own terminology. Some of the more commonly used terms are explained in the table below. This table is provided as a point of quick reference for you. These terms are also defined in the glossary at the back of the book.

Table D-2. CECP terminology

Base data set	A data set that does not contain CECP-unique graphics.
CECP-capable device	A device that has the necessary features to support CECP, which are enabled.
CECP Character Set	A collection of symbols in Character Set 697 required for CECP languages.
CECP data set	A data set that contains at least one CECP-unique graphic.
CECP-unique graphic	A graphic that is in the CECP character set and not in the Base support.
Synonym	A code point that is supported only by a device that contains an extended attribute buffer (EAB). For devices without an EAB, synonyms are translated to hyphens.

CECP and Devices

The following devices support CECP when attached to a 3174 customized for a CECP language:

- 3191 Control Unit Terminals, Models D, E, and L
- 3192 Control Unit Terminals, Models C, D, F, L, and W
- 3471 Control Unit Terminal, Model B
- 3472 Control Unit Terminal, all models except G
- 3812-2 printer
- 4224 printers
- 4234 printers
- 6262 printers.

CECP support requires the Extended Function feature for displays. Refer to Appendix B to determine how to enable this feature.

Printers and Displays

There are two versions of character set 697 or CECP. CECP-capable printers support character set 697 Version 0, while CECP-capable displays support Version 1. The difference between the two versions is 4 characters previously unsupported in Version 0. The differences are shown in the table below.

Version 0		Version 1	
Dotless "i"	ı	Superscript 1	¹
Florin symbol	ƒ	Copyright symbol	©
Numeric space		Divide symbol	÷
Double underscore	‗	Multiply symbol	×

CECP mode of operation does not support Intelligent Printer Data Stream (IPDS), since IPDS manages the character set within the data stream. CECP mode of operation also does not support a printer attached to a port on the AEA.

Keyboards

CECP extended characters are supported on the IBM Enhanced Keyboards and the IBM Converged Keyboards.

On these keyboards, any of the characters on a CECP code page may be defined by using the Keyboard Definition Utility (KDU). The characters can be assigned to the upper shift, lower shift, or alternate shift position of keys on the keyboards.

Notes:

1. When using KDU, you may need to refer to the code pages in the *3174 Character Set Reference*.
2. A CECP-capable display with an IBM Converged Keyboard that is used in 3278 Emulation mode will not be supported as a CECP-capable display.
3. CECP-unique graphics will only be presented correctly on a CECP-capable display.

Entering/Exiting CECP Mode

If a device is CECP-capable and a CECP language is customized, then the controller places the device in CECP mode whenever the device is connected to an IBM host session. Printers remain in CECP mode unless data is being copied from a device that is not CECP-capable. These printers return to CECP mode after the copy operation is complete.

System Considerations

Users may need to consider whether host programs will accept CECP data before customizing for CECP. When CECP is supported, conventions may need to be adopted. IBM host applications, vendor applications, and in-house applications may be affected.

CECP generally doubles the number of valid I/O code points generated from a keyboard and sent inbound. It is the customer's responsibility to ensure that host programs and data bases can accept CECP data. You should be careful of the following:

- Host filters
- Host use of previously defined I/O code points
- Data integrity.

The customer may be required to keep track of which data sets will be CECP and which will not.

Host Filters

Filters in host programs could generate undesired results. The filters might reject or translate some CECP unique graphic code points from their original values to incorrect values. This might cause data loss, a program check, or undetected, erroneous alteration of data.

Host Use of Previously Undefined I/O code points

Since a user could not directly enter previously undefined character code points, a host program could be using those code points for other purposes without causing conflicts before CECP support. However, with CECP support, host usage of these previously undefined code points may now result in conflict with the CECP usage. For example, a host application (such as a data base manager) may use the previously undefined character code points as control codes (such as end of file markers) or as values for a special font (such as APL).

Data Integrity

When the host properly manages CECP data, the data can generally be sent to either CECP-capable devices or devices that are not CECP-capable. Devices that are not CECP-capable will present the data in the best manner they can. Care must be exercised when critical data is sent to a display that does not contain an EAB (such as the 3191 Model A or B). These displays physically cannot store nine I/O code points which vary per language. These nine I/O code points are called *synonyms*.

Warning: If synonyms are sent to a device that does not contain an EAB, they will be translated to a hyphen. If this data is read back by the host, the original CECP data that corresponded with these I/O code points will be lost.

When unexpected hyphens appear, there is one primary action you should take. At the device on which the unexpected hyphens appear, make sure that the work being done is not filed or saved, so the altered code points are not transmitted back to the host to overwrite the correct data. The *3174 Character Set Reference* shows the synonyms for each CECP code page.

Note: You can avoid problems by ensuring that CECP data sets are accessed only by CECP devices.

CECP Structured Fields

To determine if a device is in CECP mode, a host application issues a Read Partition Query (or Query List). The response to this query is the Character Set Query Reply. This reply includes the Coded Graphic Character Set Global Identifier (CGCSGID), which specifies the character set and code page supported. If the device is CECP-capable, the character set reported will be character set 697.

For the formats of the structured fields, see Table 3-13 on page 3-24 and Table 3-36 on page 3-42.

Local Copy Considerations

In a Local Copy operation, a display will be the source of the operation and a printer will be the target. If the source is CECP-capable and the target is not, CECP-unique characters will not print properly. For all other combinations of source and target, characters will print correctly.

Messages and Codes Generated by CECP

This section contains messages and error codes that may appear when CECP has been installed. Where applicable, responsive action is described.

Table D-3. CECP Message and Error Codes	
Message	**Explanatory Information**
X - S	**Location:** Operator Information Area. **Meaning:** You have pressed a function on the keyboard that the display cannot support. **Action:** Press the Reset function and continue your work. Press only those functions supported in the Table 5A character set.
235-01	**Location:** Operator Information Area. **Meaning:** Device does not have an EAB. **Action:** Press the Reset function and continue.
245-01	**Location:** Operator Information Area **Meaning:** Device cannot enter CECP. Display will be powered off. **Action:** Power on display. If the message reappears and the display is powered off again, call your IBM service representative.
2%%-33	**Location:** Operator Information Area. **Meaning:** Display keyboard is not in CECP mode. **Action:** Press Reset function and continue.
2%%-35	**Location:** Event log. **Meaning:** Printer feature mismatch. Printer tried to enter CECP mode, but is not CECP-capable. Printer enters Table 5A mode. **Action:** None required. If your printer does not have a Reset function turn the printer off and back on.

Appendix E. Operator Information Area Symbols

Operator Information Area Symbols

For X.21 and X.25 symbols and explanations, see Chapter 7, "X.21 Operation" and Chapter 8, "X.25 Operation."

Ready Symbol (Location 1):

Symbol	Name	Explanation
S	3174 Ready	The ready symbol is displayed when the 3174 to which the display is attached is ready (functional), and the display is ready.

System Connection Symbols (Locations 2 through 7):

Symbol	Name	Explanation
A B	Online A Online B	The Online *A* and Online *B* symbols govern transactions with the host system. Certain keyboard functions and the meanings of some Operator Information Area symbols differ depending on which set of rules is applicable. Online A: The controller is connected to the system under *A* rules. The *A* symbol appears in remote systems using BSC protocol, and in locally attached non-SNA systems. The *A* symbol is turned on by receipt of the following commands: Write, Erase/Write, Erase All Unprotected, Copy, Read Modified, and Read Buffer. The *A* symbol is turned off when: 1. An operator action causes host communication. 2. The display station is turned off. 3. The Normal/Test switch is placed in Test, or the TEST function is pressed to place the 3174 in test mode. Online B: The controller is connected to the system under *B* rules. The *B* symbol appears in systems that use SNA protocol. The *B* symbol is turned on by completion of an ACTPU/ ACTLU command sequence, and is turned off by execution of DACTPU or DACTLU, including session termination upon host link failure, and when the Normal/Test switch is placed in Test or the Test function is pressed.
▮	My Job	The display station is connected to the operator's application program. It appears in systems that use BSC or SNA protocol, or in locally attached non-SNA systems. In systems using BSC or locally attached non-SNA systems, this symbol is turned on with the *A* symbol, and is turned off when power is removed, and when the Normal/Test switch is placed in Test. When using SNA protocol, this symbol is turned on when the operator's application session owns the screen.

Symbol	Name	Explanation
	System Operator	This symbol is used with SNA protocol and indicates that the system operator (SSCP) session owns the display screen. Except for the ENTER function, the Program Attention functions are not operational when this symbol is displayed.
	Unowned	The display station is connected to the system (using SNA only), but not to the operator's application program. The system operator (SSCP) session is active. The SYS REQ function is used if LOGON is required.
TEST	Test	The display station is in test mode. Test mode is initiated or terminated by using the Test function. This indicator is displayed only with Configuration Support A and S. Test procedures are described in the *3174 Customer Problem Determination.*
nTEST	Test	The display station is in Test mode. This indicator overlays all other indicators in location 2−7. Test mode is initiated or terminated by using the Test function. *n* is a number from 1 to 3 and represents the Host ID number assigned during controller customization. This indicator is displayed only with Configuration Support B and C. Test procedures are described in the *3174 Customer Problem Determination.*
LT-n	LT Identifier	Displayed on MLT devices and represents the current LT session. *n* may be a number from 1 to 5 or an X. See "Session Indicators" on page 4-46 for more information. **Note:** For X.21 and X.25 sessions, only the -n is displayed.

Do Not Enter (Input Inhibited), Locations 9 through 17: All these symbols contain an X in position 9 (do not enter), combined with other symbols in positions 11 through 17, which define why input is disabled. The keyboard does not lock mechanically, but a change in state of the keyboard clicker (on to off, or off to on) indicates that the keyboard is disabled. However, with Type Ahead enabled for the session and the Time, System Lock, Printer Busy, or Printer Very Busy indicator displayed, the keyboard is not disabled and the clicker state is not changed. The session is put into stack mode and keystrokes are placed in the Type Ahead queue. These stacked keystrokes are then processed once the indicators are erased.

While the keyboard is disabled, most keystrokes are discarded. Valid keystrokes in the input inhibited condition are: RESET, DEV CNCL, ALT CURSR, CURSR BLINK, Click, and keystrokes that only display an indicator (such as, Shift). Under certain conditions, ATTN, SYS REQ (for SNA), and TEST REQ are allowed.

If an input inhibit error occurs during processing of the keystrokes stacked in the Type Ahead queue, the error is applied to the remaining keystrokes in the queue as well as any keystrokes following the display of the indicator. In other words, the stacked and subsequent keystrokes are discarded unless they are valid keystrokes during an input inhibited condition.

The Reset function removes the input inhibited condition and restores the keyboard under most conditions. (See "Reset Function" on page 4-11 for more information.) The Test function and System Request function (SNA only) also remove an input inhibited condition unless the session is in a state that does not allow it.

Symbol	Name	Explanation
X	Message Pending	A message is expected from the host.
X	Time	Time is required for the system to perform a function. This symbol is displayed due to: 1. Line protocol requirements. 2. A keyboard that has been locked by the host, for example, during a host-initiated print operation. 3. Internal processing constraints of the controller, such as loading of the PAM from display stations into a 3174. 4. A request being processed from the Connection menu. 5. A test request being processed while in test mode. 6. A keystroke being typed during an unsolicited host read or write or during buffer transfer while a BSC Copy command is being executed. A limited number of keystrokes can be queued when this occurs, with the keystrokes being processed after the host operation is completed. 7. An AID function being pressed. 8. In SNA, receipt of Bid or Begin Bracket. When operating with SNA protocol, the keyboard is restored and the Time symbol is removed by a WCC that contains the keyboard restore bit set to 1. If a "Change Direction" (CD) is also received, the 3174 enters send state. However, if a CD is not received, the session remains in receive state when the WCC contains the keyboard restore bit set to 1.

Symbol	Name	Explanation
	Time (cont.)	In this state, all functions can be used except the Program Attention and Print functions. Use of a Program Attention function results in display of the Minus Function symbol. If a WCC that contains a keyboard restore bit set is not received, display of the Time symbol is determined by whether the CD has been received, as follows: 1. If CD has not been received, the session remains in receive state and the Time symbol remains displayed with the keyboard locked. 2. If CD has been received, the 3174 enters send state; and, if the keyboard is unlocked prior to receipt of the command, the Time symbol is removed and the keyboard is restored. Otherwise, the Time symbol is replaced by the System Lock symbol. If End Bracket is received, the Time symbol is removed, the session enters contention state, and the keyboard is restored regardless of the WCC setting. When using BSC protocol or locally attached non-SNA systems, the keyboard is unlocked and the Time symbol is removed, if the WCC keyboard restore bit is on, or if the keyboard is unlocked prior to receipt of the command. Otherwise, Time is replaced by the System Lock symbol.
X SYSTEM	System Lock	The program has disabled the keyboard following an entry. In systems that use SNA protocol, the System Lock symbol appears when the application program has replied to the last message sent by the operator and is requesting the operator to send the next message. The host has not unlocked the keyboard at this time. The keyboard restore bit is not set in any WCC that follows the last message from the operator. When the System Lock symbol appears in BSC systems, or in locally attached non-SNA systems, the host is notified of the last AID generated.
X nnn	Machine Check	The display station or a piece of hardware in the controller is not working properly. The symbol is accompanied by three digits, nnn, that define the probable cause of the problem. Recovery procedures depend upon the type of error.

Symbol	Name	Explanation
X -\Z_nnn	Communication Check	An attempt was made to cause host communication or to use the MSR, MHS, or selector light pen that causes host communication, and a communication link error was detected. While the Communication Check is displayed, data cannot be sent. This symbol is accompanied by up to three digits, nnn, that define the probable cause of the problem. (The Communication Reminder symbol is displayed as long as the condition exists.)
X PROGnnn	Program Check	A programming error was detected in the data received by the controller. This symbol is accompanied by up to three digits, nnn, that define the probable cause of the problem.
X ?+	What	The last input was not accepted. Some of the conditions that cause a What symbol to appear are: 1. Keystrokes are queued during an unsolicited read, write, or buffer transfer and the capacity of the queue is exceeded. 2. The operator continued to key while the Printer Not Working symbol was displayed, or when the Time, Printer Busy, or Printer Very Busy indicator was displayed and Type Ahead was not configured. 3. A dead key operation has been aborted by an unsolicited host write, MSR, or selector light pen operation. 4. Print ID mode has been aborted. 5. An invalid function has been used in Extension/Extended Select mode or Extended Graphics mode. 6. Entry Assist Change Format mode was exited because of an unsolicited host write. 7. Test mode could not be entered because of a host operation in progress. Because of uncertainty about what was accepted, the operator should check the contents of the screen before repeating the operation. In addition, if RESET does not remove this indicator and an ALT or Shift function was used at the time of the error, press and release the ALT or Shift function and then press RESET again.

Symbol	Name	Explanation
X -f	Minus Function	A currently unavailable function was requested. Some of the conditions that cause a Minus Function are: 1. Use of an ATTN, PF, or PA function while in SSCP session or in the "unowned state," or prior to ACTLU. 2. Use of the ENTER function in the "unowned state" or prior to ACTLU. 3. Use of SYS REQ prior to receipt of ACTLU. 4. Any of the following actions in receive state with the keyboard unlocked: Print and all AID-generating functions. 5. Use of ATTN while operating with remote systems that use BSC or locally attached non-SNA systems. 6. Use of SYS REQ, ATTN, and any PA or PF function that is not specified for test mode or the Connection menu. 7. Use of the IDENT function during a printing operation. 8. Host Loadable PAM was attempted on a controller that contains and is customized for a Concurrent Communication Adapter. 9. An invalid keystroke in stack mode while using the Type Ahead function. 10. The session is in a state that does not support an MSR operation.
X -f X	Minus Function Operator Unauthorized	This symbol means the display operator tried to change the Programmed Symbols, Color, or Extended Highlighting attributes when disallowed by the host program. The symbol is also displayed when Programmed Symbols terminal storage is referenced (PS-A – PS-F attribute functions) but the storage has no symbol set currently associated with it, or the symbol set is marked not keyboard-selectable.
X o-	Security Key	The security key is turned off and no operator input can be accepted. When the key is turned on, this symbol disappears, but any other pre-existing do-not-enter condition can then be displayed. Pressing the RESET function does not remove the Security Key symbol. The Shift, ALT CURSR, CURSR BLINK, and Click functions, and associated symbols, and all other non-input disabled symbols function when the Security Key symbol is displayed. The Security Key has priority over other input disabled symbols.

Symbol	Name	Explanation
X	Printer Not Working	The printer assigned to the display station is not functioning, and no other printers in the class are available. If this symbol appears after the Print function was pressed, and if the Printer Failure symbol is not displayed, the printer assigned to the display (or the most available printer in the class) is not functional. The print request is cancelled. Press the Device Cancel function to restore the keyboard. (RESET has no effect.) Restoration of the printer does not automatically remove the Printer Not Working symbol. If the Printer Failure symbol is displayed in the printer status area, the printer stopped during the last print operation. If the print operation was initiated by the Print function, the Device Cancel function should be pressed to restore the keyboard. The Printer Not Working symbol may appear as long as two minutes before a comparable indicator lights on the printer. The Printer Not Working symbol may also appear for a host-initiated print operation. Operators are not instructed to use the Device Cancel function, but, if used, the Printer Not Working symbol is replaced with the Time symbol, and the host must continue the operation. Subsequent receipt of outbound FM data removes the Printer Not Working symbol.
X	Printer Busy	The printer assigned to the display station is busy. The operator may either wait for the printer to become available or press the Device Cancel function. For print requests initiated by the Print function, the Device Cancel function cancels the request, removes the Printer Busy symbol, and restores the keyboard. For host-initiated requests, Device Cancel function causes Printer Busy to be replaced by the Wait symbol, and a negative response to be sent to the host. If the Print function was used, it may be possible to select another printer.
X	Printer Very Busy	This symbol applies only to Print function requests when the printer is allocated to the host. Additional time is required for print-request acceptance: 1. If SB is displayed, the printer is currently "in bracket" with a host PLU if Between Bracket Printer Sharing is customized. If the 3174 has not been customized for Between Bracket Printer Sharing, the symbol continues to appear until the session with the host application is terminated. 2. If SA is displayed, a host Write, Erase/Write, or Copy command has been addressed to the printer, and the host has not started the print operation.

Symbol	Name	Explanation
X 大 X	Operator Unauthorized	The operator has requested a printer for which the terminal or attached device is not authorized. This symbol appears when: 1. The Print function is pressed while the Printer Assignment columns of the Operator Information Area show no printer assignment or question marks. 2. The IDENT function is pressed when there is no printer assignment. 3. During a print ID sequence, the operator enters a number that is in the PAM, but not authorized for the display. 4. During a local print operation the "printer" assigned is really a display. This can occur if an invalid device description is loaded into the PAM. 5. The print buffer cannot store the contents of the display buffer during an operator-initiated local copy operation.
X ←大→	Go Elsewhere	An action has been attempted that is invalid for the display screen location. For example, the Go Elsewhere symbol appears when an attempt has been made to enter, insert, erase, or delete a character when the cursor is in a protected field or at an attribute location.
X 大>	More Than	This symbol means the operator has attempted to enter too much information into a field. For example, an insert was attempted in a field that contained no nulls or spaces to replace.
X 大NUM	Numeric	A non-numeric entry was made at a display screen location reserved for numeric information. This type of error can occur when the Numeric Lock feature is installed.
X 大#?	What Number	The operator has entered a number that is unacceptable at the display screen location. This message appears when a selected print ID is not numeric or is not in the matrix, or an incorrect entry is made in test mode, or on the X.21 or X.25 Dial Screen.
X 大▭?	Questionable Card	The operator tried to read an invalid magnetic stripe card. Press the RESET function and use the correct MSR card. If a keyboard is not available, repeat the operation using a valid MSR card.
X 大a+?	Invalid Dead Key Sequence	This symbol indicates that an invalid dead (accent) key/character key combination was entered, where a = the accent character.
X -S	Minus Symbol	The symbol keyed is not available.
X 大>⁘	Type Ahead Queue Full	This symbol is displayed when Type Ahead is enabled and the queue is filled. See "Type Ahead Function" on page 4-5 for more information.

Host ID Area (Locations 18 through 20):

Symbol	Name	Explanation
xyz	Host ID	Displayed on CUT display stations (both 3270 and ASCII), when configured for MLT. The meaning of this field depends on the type of host. • If the CUT display station is in session with an IBM/370 host, the value of xyz is: x = The number (1 – 3) assigned, during customizing, to the host communication link currently in use. y = The character (A – H) assigned, during customizing, to the host on the communication link currently in use. z = The Port Assignment Table entry (1 – 5) assigned, during customizing, to the session. • If the CUT display station is in session with an ASCII host, the value of xyz is: xyz = Station ID number assigned during customizing, to the ASCII host Station Set currently in use.

Reminders (Locations 21 through 29):

Symbol	Name	Explanation
Time	RTM Last Transaction Time	Displayed on authorized display stations upon request. The `time` indicated to the right of the clock symbol represents the actual time taken for the display station's previous transaction. The time is represented in seconds and tenths of seconds (:xx.x), or in minutes and seconds (xx:xx). If the time value is all zeros, no transaction time is available. When the operator is not authorized to display the RTM transaction data, the clock will be followed by a ":" and no time value will appear.
nnn	Communication Reminder	The communication link connecting the controller to the system is producing errors. The Communication Reminder appears when: 1. The controller detects a permanent error condition in the connection to the host. (Attempts to retry have ceased.) In this case, the reminder symbol is sent to all terminals attached to the controller. 2. In BSC mode, a line error is detected that causes the original contents of the screen to be restored and a request for retransmission made to the host. In this case, the reminder symbol is sent only to the affected terminal.

Programmed Symbols (Locations 31 through 34): The symbol set indicators, locations 31 through 33, show the symbol set that will be addressed for a displayable character or symbol in response to the next character entered at the keyboard. A supplementary indicator in location 34 is present if the application program allows the operator to select a PS character attribute for character positions in the current field.

Symbol	Name	Explanation
S0	Base character set	The base character set is addressed for a displayable character when the operator presses a character key.
PSA through PSF	Symbol Set A through Symbol Set F	The EBCDIC code for characters entered at the keyboard is used to address the indicated symbol set for a displayable character.

Supplementary Indicators (Location 34):

Symbol	Name	Explanation
None		The operator is not allowed to select a symbol set.
		The current character set or symbol set was selected by the operator.
		The current character set or symbol set is determined by the extended field attribute; either (1) operator selection is allowed, but no selection has been made, or (2) the operator has selected field inherit.

Host Descriptor Area (Locations 31 through 50):

Symbol	Name	Explanation
(Up to 20 characters)	Host Descriptor	Descriptive name associated with the host link currently active on this session. Displayed on CUT display stations (both 3270 and ASCII) when configured for MLT. The Host Descriptor overlays other information in the Operator Information Area, and appears: 1) when the device power is turned on, 2) when the change screen sequence is used to advance to the next LT session, 3) the 3270 host or ASCII host is selected from the Connection menu, or 4) you exit test mode. The Host Descriptor is removed when an update is made to one of the overlay areas, or the RESET function is pressed (provided there is no other input inhibited condition to reset). The Host Descriptor meaning depends on the type of host that is currently in session with the CUT display station. • For IBM hosts, the Host Descriptor is taken from the Host Definition Panel. When the IBM host is selected from the Connection menu, the Host Descriptor for that host link is displayed. • For ASCII hosts, it's called the Station Descriptor and is taken from the AEA Port Set Panel. Only 20 of the 24 Station Descriptor characters are displayed.

Mode Area (Locations 36 through 40):

Symbol	Name	Explanation
APL	APL	The keyboard is in APL mode.
TEXT	Text	The keyboard is in Text mode.
KANA	Katakana Shift	This symbol indicates the keyboard displays Japanese Katakana characters when the keys are pressed. You can put the keyboard in Katakana mode by operating one of the language shift functions.
ALPHA	Alpha Shift	This symbol indicates the keyboard displays Latin characters when the keys are pressed. You can put the keyboard in Latin mode by operating one of the language shift functions.
▶	Extension/Extended Select	The Extension/Extended Select mode is in effect.

Symbol	Name	Explanation
+	Extended Graphics	This symbol indicates the keyboard is in the Extended Graphics mode or layer. To activate the Extended Graphics layer, you must shift into the Extended Graphics function by holding the Alt function and pressing either Shift function. While in the Extended Graphics layer, the keyboard displays a set of characters different from those that appear on the keyboard. The keyboard returns to the normal layer after a character from the Extended Graphics layer is selected.
LA	LATIN	This symbol indicates the keyboard displays Latin characters when the keys are pressed. You can put the keyboard in Latin mode by operating one of the language shift functions.
TH	THAI	This symbol indicates the keyboard displays Thai characters when the keys are pressed. You can put the keyboard in Thai mode by operating one of the language shift functions.
CY	CYRILLIC	This symbol indicates the keyboard displays Cyrillic characters when the keys are pressed. You can put the keyboard in Cyrillic mode by operating one of the language shift functions.
E* where * is the Lambda symbol (similar to an upside down V)	GREEK	This symbol indicates the keyboard displays Greek characters when the keys are pressed. You can put the keyboard in Greek mode by operating one of the language shift functions.

Shift Area (Locations 42 through 44):

Symbol	Name	Explanation
NUM	Numeric	The Numeric Lock feature is installed and the keyboard is in numeric shift, which allows use only of the 0 through 9 keys, the decimal sign, minus (-), and DUP functions. (The comma replaces the decimal sign in certain World Trade languages.)
⇧	Upshift	The keyboard is in upshift.
ALT	Alternate Shift	The keyboard has been placed in Alternate Shift by using the Pseudo-Alt function while in Extension mode.
A	Caps Lock	The Caps Lock function has been toggled on. Lowercase characters are converted to their uppercase equivalents.

Extended Highlighting (Locations 46 and 47): The Extended Highlighting indicators in locations 46 and 47 show how the next character entered at the keyboard is highlighted on the display screen. Any symbol in location 46 confirms that the operator is allowed to select an extended highlighting character attribute for character positions in the current field.

Symbol	Name	Explanation
None		The operator is not allowed to select extended highlighting.
a	Normal	Normal condition. No extended highlighting in effect.
$\boxed{a}$	Reverse Video	Character highlighting by reversing the light intensity between the character and its background.
:a:	Blink	Character highlighting by blinking on and off at regular intervals.
$\underline{a}$	Underscore	Character highlighting by underscore.

Supplementary Indicators (Location 47):

Symbol	Name	Explanation
大		The current extended highlighting attribute was selected by the operator.
▶		The current extended highlighting is determined by the extended field attribute; either (1) operator selection is allowed, but no selection has been made, or (2) the operator has selected field inherit.

Extended Color (Locations 49 and 50): The color indicators in locations 49 and 50 show the color used to display the next character entered at the keyboard; any indication in location 49 confirms that the operator is allowed to select an extended color character attribute for character positions in the current field.

Symbol	Name	Explanation
None		The operator is not allowed to select extended color.
■	Extended color	The color of the symbol is the color used to display the next character at the keyboard.
0	Default	The color is green or white by default.

Supplementary Indicators (Location 50):

Symbol	Name	Explanation
웃		The current extended color attribute was selected by the operator.
▶		The current extended color is determined by the extended field attribute; either (1) operator selection is allowed, but no selection has been made, or (2) the operator has selected field inherit.

Insert Indicator (Location 52):

Symbol	Name	Explanation
^	Insert	The keyboard is in Insert mode. A character may be inserted at the cursor location. Characters beyond the cursor position move to make room for the inserted character.

Printer Status (Locations 60 through 64):

Symbol	Name	Explanation
□-□ nn	Printer Assignment	The display station is authorized to use printer address number *nn*. If *nn* is less than 70, then it is either a printer port number (1—55), or a PAM entry number (1—47). The answer to customization question 800 determines which value is used. If *nn* is between 70 and 85, then it designates a printer class.
□-□??	What Printer	The printer assignment has changed. Pressing the IDENT function causes display of a new printer assignment.
□-■nn	Printer Printing	The printer identified by *nn* is printing information from the display station.
□-■nn	Printer Failure	The printer identified by *nn* has stopped while printing information from the display station. This symbol remains on until: 1. The condition is cleared following operator intervention. 2. The operator uses the Device Cancel function following a printer-not-functional condition. 3. Receipt of outbound FM data.
□-□_ _	Assign Printer	When the operator changes the assigned printer using the IDENT function, the two numbers appear in the assignment columns replacing the underlines.

Symbol	Name	Explanation
a = _+?	Enhanced Dead Key Indicator	An accent key has been pressed and the keyboard has been placed in Non-Escaping Key (Dead Key) mode. The underscore (_) represents the accent key pressed. By keying a valid character, the accent/character combination is displayed on the screen and the indicator is erased.
	(nothing displayed)	If a display is attached to a 3174 (S displayed in location 1), local copy printing cannot take place.

Entry Assist and Null/Space Area (Locations 66 through 68):

Symbol	Name	Explanation
DOC	Entry Assist	Entry Assist is enabled on this session.
D→	Entry Assist with Null/Space	Both Entry Assist and Null/Space processing are enabled on this session.
N→	Null/Space	Null/Space processing is enabled on this session.

Word Wrap Area (Location 70):

Symbol	Name	Explanation
⬇	Entry Assist Word Wrap	When the cursor reaches the right margin and you continue to enter text, the text is continued on the next line if the line contains all nulls or spaces.

Cursor Position Area (Locations 75 through 80):

Symbol	Name	Explanation
xx/yy	Row/Column	This symbol indicates the position of the cursor in a row/column format, where xx = the row number, and yy = the column number. The position of the cursor is displayed when you press the Row/Column function. Row/Column is active only during Entry Assist.

Appendix F. Device Self-Description Data

Introduction

This appendix describes the Sense ID Reply and the Read Configuration Data Record contents for 3174 SNA and non-SNA controllers.

The configuration record consists of a number of 32-byte fields. The number of 32-byte fields contained in a particular configuration record is determined by dividing 32 into the value provided in the count field of the Sense ID reply that is returned in response to the Sense ID command. Each 32-byte field is identified as one of three types:

- Node Element Descriptor (NED)
- Node Element Qualifier (NEQ)
- Unused.

3174 Non-SNA controllers contain three records:

- NED
- Token NED
- General NEQ.

3174 SNA controllers contain five records:

- NED
- Token NED
- Specific NEQ No. 1
- Specific NEQ No. 2
- General NEQ.

The contents of each field in the NED or NEQ are described in Table F-2 on page F-4 through Table F-6 on page F-7.

Sense ID Reply

Table F-1 describes the Sense ID Reply.

Table F-1. Sense ID Reply

Byte	Bit	Content	Description
0		X'FF'	Sense ID Reply
1,2		X'3174'	Controller Type Number
3			Controller Model Number
		X'1D'	If non-SNA
		X'1A'	If SNA
4,5		X'00000000'	I/O Device Number
		X'BA000001'	I/O Device Number if a SOEMI device
6		X'00'	I/O Device Model Number
7		X'00'	Reserved
8-11			Command Information Word (CIW) for Read Configuration Data
8	0,1	B'01'	Entry Type
	2,3	B'00'	Reserved
	4-7	X'0'	CMD Type = Read Configuration Data
9		X'72'	CMD Code for Read Configuration Data
10,11		X'0060'	Count for non-SNA
		X'00A0'	Count for SNA

Node Element Descriptor

Table F-2 describes the contents of the field for each byte in the Node Element Descriptor.

Table F-2. Node Element Descriptor

Byte	Bit	Content	Description
0		X'D0'	Flags
	0,1	B'11'	This field contains a NED
	2	B'0'	This NED is not a Token NED
	3,4	B'10'	The serial number in this NED, is the serial number of the node element described in this NED
	5	B'0'	Reserved
	6	B'0'	This NED does not describe an emulated node element
	7	B'0'	Reserved
1		X'01'	Type = I/O Device
2		X'06'	Class = Communications Controller
3			Fixed Pattern
	0-6	B'0000000'	Reserved
	7	B'1'	Level – no hierarchical relationship to the next NED exists
4-9		C'003174'	Type number
10-12		C'12L' or C'22L'	Model Number
13-15		C'IBM'	Manufacturer
16,17		C'xx'	Plant of Manufacture
18-29		C'0000000xxxxx'	Sequence Number
30,31		X'0017'	Tag = Hardware Group 17

Token Node Element Descriptor

Table F-3 describes the contents of the fields for each byte in the Token Node Element Descriptor.

Table F-3. Token Node Element Descriptor

Byte	Bit	Content	Description
0		X'F0'	Flags
	0,1	B'11'	This field contains a NED
	2	B'1'	This NED is a Token NED
	3,4	B'10'	The serial number in this NED is the serial number of the node element described in this NED
	5	B'0'	Reserved
	6	B'0'	This field does not describe an emulated node element
	7	B'0'	Reserved
1		X'01'	Type = I/O Device
2		X'06'	Class = Communications Controller
3			Fixed Pattern
	0-6	B'0000000'	Reserved
	7	B'1'	Level — no hierarchical relationship to the next NED exists
4-9		C'003174'	Type number
10-12		C'12L' or C'22L'	Model Number
13-15		C'IBM'	Manufacturer
16,17		C'xx'	Plant of Manufacture
18-29		C'0000000xxxxx'	Sequence Number
30,31		X'3174'	Tag

Specific Node Element Qualifier No. 1 (SNA Only)

Table F-4 describes the contents of the fields for each word in the Specific Node Element Qualifier No. 1 (SNA only).

Table F-4. Specific Node Element Qualifier No. 1

Word	Byte	Bit	Content	Description
0	0		X'40'	Flags
		0,1	B'01'	This field contains a specific NEQ
		2-7	B'000000'	Reserved
	1-3		X'000000'	Reserved
1	0-3		X'00000000'	Reserved
2	0		X'20'	PU Type
	1			Flags
			B'0'	Only the PU type field is valid
		0	B'1'	All values in this field are valid
		1-7	B'0000000'	Reserved
	2,3		X'0000'	Reserved
3	0,1		X'1009' or X'2009'	Maximum PIU size
	2,3		X'0000'	Reserved
4	0-3		X'00000000'	Reserved
5	0-3		X'00000000'	Reserved
6,7			X'bb....bb'	Logical Terminal Bit Mask*

* The Logical Terminal Bit Mask is a series of 256 bits each of which corresponds to an LU address. If a bit is ON, then an LU is configured for that address. Bit position 0 corresponds with address 0. For example, if the bit map is B'0011 1101 0000 ... 0000', then LUs at addresses 2, 3, 4, 5, and 7 are defined in the 3174. This bit map corresponds to the Port Assignment Table for a particular host. Note that bits 64—255 are defined in the second Specific NEQ. Bit position 0 in this case corresponds with address 64.

Specific Node Element Qualifier No. 2 (SNA Only)

Table F-5 describes the contents of the fields for each word in the Specific Node Element Qualifier No. 2 (SNA only).

Table F-5. Specific Node Element Qualifier No. 2

Word	Byte	Bit	Content	Description
0	0		X'40'	Flags
		0,1	B'01'	The fields contain a specific NEQ
		2-7	B'000000'	Reserved
	1-3		X'000000'	Reserved
1	0-3		X'00000000'	Reserved
2-7			X'bb....bb'	Logical Terminal Bit Mask*

* The Logical Terminal Bit Mask is a series of 256 bits each of which corresponds to an LU address. If a bit is ON, then an LU is configured for that address. Bit position 0 corresponds with address 0. For example, if the bit map is B'0011 1101 0000 ... 0000', then LUs at addresses 2, 3, 4, 5, and 7 are defined in the 3174. This bit map corresponds to the Port Assignment Table for a particular host. Note that bits 64—255 are defined in the second Specific NEQ. Bit position 0 in this case corresponds with address 64.

General Node Element Qualifier

Table F-6 describes the contents of the fields for each word in the General Node Element Qualifier.

Table F-6. General Node Element Qualifier

Word	Byte	Bit	Content	Description
0	0		X'80'	Flags
		0,1	B'10'	The field contains a general NEQ
		2-7	B'000000'	Reserved
	1		X'00000000'	Reserved
	2,3		X'0017'	Tag=Hardware Group 17
1	0		X'00'	Device Dependent Timeout Value (results in a 15 second default value)
	1-3		X'000000'	Reserved
2*			C'cccc'	Device Family
3-7			X'00....00'	Reserved

* cccc = C'3971' for SNA
cccc = X'00000000' for non-SNA

Appendix G. Generic Alerts

Introduction

All alerts for Advanced Peer-to-Peer Networking, Integrated Services Digital Network, 3174 Peer Communication, and Token-Ring are generic in format. The subvectors and subfields that make up each alert are listed in this appendix. For a description of the byte format of a generic alert RU that is generated by the 3174 Establishment Controller, see "Generic Alert Message Format" on page 12-45.

LAN LLC and Token-Ring Alerts

Hierarchy/Resource List Formats

3174 node refers to the following Hierarchy/Resource List (HRL) formats so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each alert description in this section refers to one or more of the following formats:

LAN_HRL1

Hierarchy name list = empty
Hierarchy complete indicator = NO

LAN_HRL2

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'39' - LAN	Response to configuration question 908, padded on the right with blanks.
X'F1' - Physical Unit	Low-order 4 bytes of DSPU MAC address in EBCDIC.
Hierarchy complete indicator = NO	

LAN_HRL3

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'39' - LAN	Response to configuration question 908, padded on the right with blanks.
X'F4' - Control Point	The CP name of adjacent node received in XID, padded on the right with blanks. If unavailable, then the CP name will be substituted with the string "UNKNOWN" and the "display resource" indicator will be set. Note that for these errors, the CP name of the adjacent node is expected to be available.
Hierarchy complete indicator = NO	

LAN_HRL4

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.
X'39' - LAN	Response to configuration question 908, padded on the right with blanks.
X'F4' - Control Point	The CP name of adjacent node received in XID, padded on the right with blanks. If unavailable, then the CP name will be substituted with the string "UNKNOWN" and the "display resource" indicator will be set. Note that for these errors, the CP name of the adjacent node is expected to be available.
Hierarchy complete indicator = YES	

LAN_HRL5

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'39' - LAN	Response to configuration question 908, padded on the right with blanks.
X'2E' - Token-Ring	"RINGxxxx" where xxxx is a two-byte Ring ID converted to EBCDIC.
Hierarchy complete indicator = NO	

LAN_HRL6

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'39' - LAN	Response to configuration question 908, padded on the right with blanks.
Hierarchy complete indicator = NO	

LAN_HRL7

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'21' - Adapter	A three byte type-location number of the communications adapter involved, in six EBCDIC bytes padded with two blanks.
Hierarchy complete indicator = NO	

X'016E5F4E' – Architected Token-Ring LAN Alert 05

Alert Condition: An error was detected during the insertion process that was not defined previously. These conditions are not expected to occur, so they are included within one Alert definition. The insertion process did not complete.

Corresponding SSC-Qualifier pair: 580-14.

Alert ID Number		X'016E5F4E'
Alert Type	X'01'	Permanent
Alert Description	X'3211'	Open Failure
Probable Causes Probable Causes	X'3702' X'3701'	Token-Ring lobe Token-Ring LAN component
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3712' X'3701' X'2600'	Local Token-Ring lobe Token-Ring LAN component Interference
Actions	X'2010' X'3101' X'32D0' X'82' SF X'82' SF X'82' SF	Review link detailed data Contact Token-Ring administrator responsible for this LAN Report the following:[1] (Adapter Number) (Error Code) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'03' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Local Individual MAC Address Relative Time Hierarchy/Resource List: LAN_HRL6

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'0C6C96C7' – 3174 Token-Ring LAN Alert 04

Alert Condition: LAN adapter command error – communications disabled.

Corresponding SSC-Qualifier pair: 380-21.

Alert ID Number		X'0C6C96C7'
Alert Type	X'01'	Permanent
Alert Description	X'6100'	Microcode program error
Probable Causes	X'3220'	Local Token-Ring Adapter remote node interface
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3220' X'3320'	Local Token-Ring Adapter interface Local Token-Ring Adapter
Actions	X'2001' X'3000' X'32D0' X'82' SF X'82' SF X'82' SF	Report detailed data Contact appropriate service representative Report the following:[1] (Adapter Number) (Error Code) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Hierarchy/Resource List: LAN_HRL7

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'1F524C4C' – Architected Token-Ring LAN Alert 12

Alert Condition: The ring error monitor (REM) has detected excessive soft errors for the ring.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 or a 3174 that has not been configured for soft error reporting.

Corresponding SSC-Qualifier pair: 890-01.

Alert ID Number		X'1F524C4C'
Alert Type	X'01'	Permanent
Alert Description	X'4001'	Token-Ring fault domain
Probable Causes	X'3703'	Token-Ring fault domain
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3703'	Token-Ring fault domain
Actions	X'2010' X'3101' X'32A0' X'82' SF	Review link detailed data Contact Token-Ring administrator responsible for this LAN Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'06' SF X'09' SF X'05' SV	3174 Product Set ID LAN LCS Data Fault domain description Fault domain error weight pair Hierarchy/Resource List: Ring carries focal point link => LAN_HRL1 Otherwise => LAN_HRL5

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'2102FCEB' – Architected Token-Ring LAN Alert 09

Alert Condition: The ring has been beaconing for a time longer than the hard-error detection timer. Manual intervention is necessary to recover the ring.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174.

Corresponding SSC-Qualifier pair: 580-18.

Alert ID Number		X'2102FCEB'
Alert Type	X'01'	Permanent
Alert Description	X'3215'	Token-Ring inoperative
Probable Causes	X'3703'	Token-Ring fault domain
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3703'	Token-Ring fault domain
Actions	X'2010' X'3101' X'0105' X'32C0' X'82' SF X'82' SF	Review link detailed data Contact Token-Ring administrator responsible for this LAN Request verification of management server reporting links[1] Report the following:[1] (Ring Status) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'06' SF X'07' SF X'05' SV	3174 Product Set ID LAN LCS Data Fault domain description Beacon data Hierarchy/Resource List: Ring carries focal point link => LAN_HRL1 Otherwise => LAN_HRL5

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'216D1033' – Architected LAN LLC Alert 10

Alert Condition: A LAN logical link has been lost. The remote link station sent a frame with an invalid N(r). This resulted in the local link station returning a Frame Reject response.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 583-10.

Alert ID Number		X'216D1033'
Alert Type	X'01'	Permanent
Alert Description	X'2100'	Software program error
Probable Causes	X'2007' X'1023'	LAN LLC communications Communication program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023' X'F022'	Communications program in remote node Invalid N(r) received: Maximum I-field length exceeded
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'25AC0D84' – Architected LAN LLC Alert 11

Alert Condition: A LAN logical link has been lost. The remote link station sent a frame with an I-field that was too long. This resulted in the local link station returning a Frame Reject response.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 583-10.

Alert ID Number		X'25AC0D84'
Alert Type	X'01'	Permanent
Alert Description	X'2100'	Software program error
Probable Causes	X'2007' X'1023'	LAN LLC communications Communication program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023' X'F023'	Communications program in remote node Received I-field exceeded maximum length: Maximum I-field length exceeded
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'28EF2B5D' – Architected LAN LLC Alert 08

Alert Condition: A LAN logical link has been lost. The local link station sent an invalid or unsupported command or response to the local link station. This resulted in the local link station returning a Frame Reject response.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 583-10.

Alert ID Number		X'28EF2B5D'
Alert Type	X'01'	Permanent
Alert Description	X'2100'	Software program error
Probable Causes	X'2007' X'1023'	LAN LLC communications Communication program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023' X'F020'	Communications program in remote node Invalid/unsupported command or response received: Maximum I-field length exceeded
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'2C2E36EA' – Architected LAN LLC Alert 09

Alert Condition: A LAN logical link has been lost. The remote link station sent an I-field when not permitted to the local link station. This resulted in the local link station returning a Frame Reject response.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 583-10.

Alert ID Number		X'2C2E36EA'
Alert Type	X'01'	Permanent
Alert Description	X'2100'	Software program error
Probable Causes	X'2007' X'1023'	LAN LLC communications Communication program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023' X'F021'	Communications program in remote node I-field received when not permitted: Maximum I-field length exceeded
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'2F36696E' – Architected Token-Ring LAN Alert 11

Alert Condition: The ring was in a beaconing condition for less than 52 seconds and then recovered. The sender of this Alert either knows that neither station in the fault domain left the ring, or has no knowledge about whether a station removed itself from the ring in order to bypass the fault.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174.

Corresponding SSC-Qualifier pair: 580-68.

Alert ID Number		X'2F36696E'
Alert Type	X'01'	Permanent
Alert Description	X'3216'	Token-Ring temporary error
Probable Causes	X'3703'	Token-Ring fault domain
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3703'	Token-Ring fault domain
Actions	X'2010' X'3101' X'32A0' X'82' SF	Review link detailed data Contact Token-Ring administrator responsible for this LAN Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'06' SF X'07' SF X'05' SV	3174 Product Set ID LAN LCS Data Fault domain description Beacon data Hierarchy/Resource List: Ring carries focal point link => LAN_HRL1 Otherwise => LAN_HRL5

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'3BA03B6D' – 3174 Token-Ring LAN Alert 03

Alert Condition: A Token-Ring Adapter check occurred. The microcode residing on the Token-Ring has been program checked.

Corresponding SSC-Qualifier pair: 341-32.

Alert ID Number		X'3BA03B6D'
Alert Type	X'01'	Permanent
Alert Description	X'1010'	Adapter Error
Probable Causes	X'3320'	Local Token-Ring Adapter
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3320'	Local Token-Ring Adapter
Actions	X'2010' X'3101' X'32D0' X'82' SF X'82' SF X'82' SF	Review link detailed data Contact Token-Ring administrator responsible for this LAN Report the following:[1] (Adapter Number) (Adapter Check Status) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Hierarchy/Resource List: LAN_HRL7

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'44D1AD86' – Architected Token-Ring LAN Alert 04

Alert Condition: The adapter received a Remove Ring Station MAC frame during the insertion process. The insertion process did not complete.

Corresponding SSC-Qualifier pair: 580-13.

Alert ID Number		X'44D1AD86'
Alert Type	X'01'	Permanent
Alert Description	X'3211'	Open Failure
Probable Causes	X'3705'	Token-Ring remove command received
User Causes	X'7101'	Token-Ring remove adapter command received
Install Causes	(none)	
Failure Causes	(none)	
Actions	X'2010' X'3101' X'32D0' X'82' SF X'82' SF X'82' SF	Review link detailed data Contact Token-Ring administrator responsible for this LAN Report the following:[1] (Adapter Number) (Error Code) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'03' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Local Individual MAC Address Relative Time Hierarchy/Resource List: LAN_HRL6

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'55BF3E1C' – Architected Token-Ring LAN Alert 01

Alert Condition: The adapter detected a problem on its lobe during the wrap-test portion of the insertion process. The insertion process did not complete.

Corresponding SSC-Qualifier pair: 580-11.

Alert ID Number		X'55BF3E1C'
Alert Type	X'01'	Permanent
Alert Description	X'3211'	Open Failure
Probable Causes	X'3702'	Token-Ring lobe
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3320' X'3711' X'3434'	Local Token-Ring Adapter Local access unit Local lobe cables
Actions	X'1009' X'3301' X'2010' X'3101' X'32D0' X'82' SF X'82' SF X'82' SF	Attempt to reopen the adapter after 30 seconds If problem persists then do the following: Review link detailed data Contact Token-Ring administrator responsible for this LAN Report the following:[1] (Adapter Number) (Error Code) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'03' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Local individual MAC address Relative Time Hierarchy/Resource List: LAN_HRL6

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'57D16A21' – Architected Token-Ring LAN Alert 13

Alert Condition: The ring error monitor (REM) has detected that an adapter is experiencing excessive congestion and is discarding a significant number of frames.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 or a 3174 that has not been configured for soft error reporting.

Corresponding SSC-Qualifier pair: 890-06.

Alert ID Number		X'57D16A21'
Alert Type	X'03'	Performance
Alert Description	X'5011'	Token-Ring fault domain
Probable Causes	X'3223'	Token-Ring Adapter interface
User Causes	(none)	
Install Causes	(none)	
Failure Causes Failure Causes	X'1022' X'3324'	Communication program Token-Ring Adapter
Actions	X'2010' X'3101' X'32A0' X'82' SF	Review link detailed data Contact Token-Ring administrator responsible for this LAN Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'08' SF X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Single individual MAC address Hierarchy/Resource List: Ring carries focal point link => LAN_HRL1 Otherwise => LAN_HRL5

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'59F32622' – Architected Token-Ring LAN Alert 08

Alert Condition: The reporting station's adapter received a Remove Adapter command from a LAN manager and, as a result, left the LAN.

Corresponding SSC-Qualifier pair: 580-17.

Alert ID Number		X'59F32622'
Alert Type	X'01'	Permanent
Alert Description	X'3214'	Remove Adapter command received
Probable Causes	X'7013'	LAN manager operator
User Causes	X'7101	Token-Ring remove adapter command received
Install Causes	(none)	
Failure Causes	(none)	
Actions	X'2010' X'3101' X'0105' X'32D0' X'82' SF X'82' SF X'82' SF	Review link detailed data Contact Token-Ring administrator responsible for this LAN Request verification of management server reporting links[1] Report the following:[1] (Adapter Number) (Error Code) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local Individual MAC Address Hierarchy/Resource List: Ring carries focal point link => LAN_HRL1 Otherwise => LAN_HRL5

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'5B8F5BA7' – Architected LAN LLC Alert 01

Alert Condition: A LAN logical link has been lost. The remote link station does not respond. The inactivity timer (Ti) or acknowledgement timer (T1) has expired, causing the remote station to be polled. The remote station does not respond to the poll.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pairs: 583-15,16.

Alert ID Number		X'5B8F5BA7'
Alert Type	X'01'	Permanent
Alert Description	X'3300'	Link Error
Probable Causes	X'2107'	LAN LLC communications/remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'2107' X'F017'	LAN LLC communications/remote node Poll count exhausted
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'748194B4' – 3174 LAN LLC Alert 02

Alert Condition: Excessive receive buffer depletion on LAN logical link.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 531-81.

Alert ID Number		X'748194B4'
Alert Type	X'03'	Performance
Alert Description	X'4011'	Threshold has been exceeded
Probable Causes	X'2007' X'1022'	LAN LLC communications Communications program
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'F044'	Communications program Receive queue overrun
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'83D91642' – Architected LAN LLC Alert 06

Alert Condition: A LAN logical link has been lost. The local link station sent a frame with an invalid N(r). This resulted in the remote link station returning a Frame Reject response.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 583-11.

Alert ID Number		X'83D91642'
Alert Type	X'01'	Permanent
Alert Description	X'2100'	Software program error
Probable Causes	X'2007' X'1000'	LAN LLC communications Software program
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1000' X'F012'	Software program Frame reject received – invalid N(r) sent
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'87180BF5' – Architected LAN LLC Alert 07

Alert Condition: A LAN logical link has been lost. The local link station sent a frame with an I-field that was too long. This resulted in the remote link station returning a Frame Reject response.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 583-11.

Alert ID Number		X'87180BF5'
Alert Type	X'01'	Permanent
Alert Description	X'2100'	Software program error
Probable Causes	X'2007' X'1000'	LAN LLC communications Software program
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1000' X'F013'	Software program Frame reject received: Maximum I-field length exceeded
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'8A5B2D2C' – Architected LAN LLC Alert 04

Alert Condition: A LAN logical link has been lost. The local link station sent an invalid or unsupported command or response to the remote link station. This resulted in the remote link station returning a Frame Reject response.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 583-11.

Alert ID Number		X'8A5B2D2C'
Alert Type	X'01'	Permanent
Alert Description	X'2100'	Software program error
Probable Causes	X'2007' X'1000'	LAN LLC communications Software program
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1000' X'F010'	Software program Frame reject received: Invalid/unsupported command or response sent
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'8E9A309B' – Architected LAN LLC Alert 05

Alert Condition: A LAN logical link has been lost. The local link station sent an I-field when not permitted to the remote link station. This resulted in the remote link station returning a Frame Reject response.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 583-11.

Alert ID Number		X'8E9A309B'
Alert Type	X'01'	Permanent
Alert Description	X'2100'	Software program error
Probable Causes	X'2007' X'1000'	LAN LLC communications Software program
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1000' X'F011'	Software program Frame reject received: I-field sent when not permitted
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'933804CB' – 3174 LAN LLC Alert 01

Alert Condition: Excessive retransmits on a LAN logical link. The number of frame retransmits over a certain period has exceeded the allowable threshold.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 531-80.

Alert ID Number		X'933804CB'
Alert Type	X'03'	Performance
Alert Description	X'4011'	Threshold has been exceeded
Probable Causes	X'2007' X'1023'	LAN LLC communications Communications program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023' X'F00F'	Communications program in remote node RNR received threshold reached
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'A676B230' – Architected Token-Ring LAN Alert 06

Alert Condition: The report station's adapter detected a wire-fault condition on the ring.

Corresponding SSC-Qualifier pair: 580-15.

Alert ID Number		X'A676B230'
Alert Type	X'01'	Permanent
Alert Description	X'3212'	Wire Fault
Probable Causes	X'3702'	Token-Ring lobe
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3711' X'3434' X'3320'	Local access unit Local lobe cables Local Token-Ring Adapter
Actions	X'2010' X'3101' X'0105' X'32D0' X'82' SF X'82' SF X'82' SF	Review link detailed data Contact Token-Ring administrator responsible for this LAN Request verification of management server reporting links[1] Report the following:[1] (Adapter Number) (Error Code) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'03' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Local Individual MAC Address Relative Time Hierarchy/Resource List: Ring carries focal point link => LAN_HRL1 Otherwise => LAN_HRL5

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'C2B2FDCD' – 3174 Token-Ring LAN Alert 02

Alert Condition: A failure has occurred in a Token-Ring Adapter open process. It is possible that the universal address specified does not match the address of the Token-Ring Adapter.

Corresponding SSC-Qualifier pairs:

- 381-23
- 581-12.

Alert ID Number		X'C2B2FDCD'
Alert Type	X'01'	Permanent
Alert Description	X'3211'	Open Failure
Probable Causes	X'1022'	Communications program
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'3220'	Communications program Local Token-Ring Adapter interface
Actions	X'2001' X'3000' X'32D0' X'82' SF X'82' SF X'82' SF	Report detailed data Contact appropriate service representative Report the following:[1] (Adapter Number) (Error Code) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'03' SF X'05' SV	3174 Product Set ID LAN LCS Data Local individual MAC address Hierarchy/Resource List: LAN_HRL7

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'C7D142D1' – Architected LAN LLC Alert 03

Alert Condition: A LAN logical link has been lost. The remote link station sent a SABME command to the local link station which was already open (previously initialized via a SABME-UA exchange).

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 583-13.

Alert ID Number		X'C7D142D1'
Alert Type	X'01'	Permanent
Alert Description	X'2100'	Software program error
Probable Causes	X'2007' X'1023'	LAN LLC communications Communications program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'2007' X'F016'	LAN LLC communications SABME received while in ABME
Actions	X'3301' X'2010' X'3103' X'32C0' X'82' SF X'82' SF	If problem persists then do the following: Review link detail data Contact LAN administrator responsible for this LAN Report the following:[1] (Adapter Number) (Reference Code)
Additional SVs	X'10' SV X'51' SV X'02' SF X'03' SF X'04' SF X'05' SF X'52' SV X'02' SF X'04' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Ring ID Local individual MAC address Remote individual MAC address LAN routing information[2] LCS Configuration Remote SAP address Local SAP address Link Station Data Current Ns/Nr counts Outstanding frame count Last control field received Last control field sent Sequence number modulus Link station state LLC reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: Focal point link => LAN_HRL1 Pure 2.0 link => LAN_HRL2 Shared link => LAN_HRL3 Pure 2.1 link => LAN_HRL4

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]This subfield is present if the lost logical link traversed a MAC bridge.

X'CA919DA1' – 3174 Token-Ring LAN Alert 01

Alert Condition: A Token-Ring Adapter initialization failure has occurred.

Corresponding SSC-Qualifier pair: 341-31.

Alert ID Number		X'CA919DA1'
Alert Type	X'01'	Permanent
Alert Description	X'3210'	Initialization failure
Probable Causes	X'3320'	Local Token-Ring Adapter
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3320'	Local Token-Ring Adapter
Actions	X'2010' X'3101' X'32D0' X'82' SF X'82' SF X'82' SF	Review link detail data Contact Token-Ring administrator responsible for this LAN Report the following:[1] (Adapter Number) (Adapter Return Code) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'03' SF X'05' SV	3174 Product Set ID LAN LCS Data Local individual MAC address Hierarchy/Resource List: LAN_HRL7

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'CAF3C58A' – Architected Token-Ring LAN Alert 02

Alert Condition: The adapter detected a beaconing condition on the ring during the insertion process. The insertion process did not complete.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174.

Corresponding SSC-Qualifier pair: 580-12.

Alert ID Number		X'CAF3C58A'
Alert Type	X'01'	Permanent
Alert Description	X'3211'	Open Failure
Probable Causes	X'3703'	Token-Ring fault domain
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3703'	Token-Ring fault domain
Actions	X'1009' X'3301' X'2010' X'3101' X'32D0' X'82' SF X'82' SF X'82' SF	Attempt to reopen the adapter after 30 seconds If problem persists then do the following: Review link detailed data Contact Token-Ring administrator responsible for this LAN Report the following:[1] (Adapter Number) (Error Code) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'06' SF X'07' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Fault domain description Beacon data Relative Time Hierarchy/Resource List: LAN_HRL6

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'D615A61E' – Architected Token-Ring LAN Alert 03

Alert Condition: The adapter detected the presence of a station with its individual address on the ring during the insertion process. The insertion process did not complete.

Corresponding SSC-Qualifier pair: 581-11.

Alert ID Number		X'D615A61E'
Alert Type	X'01'	Permanent
Alert Description	X'3211'	Open Failure
Probable Causes	X'3704'	Token-Ring duplicate station addresses assigned
User Causes	(none)	
Install Causes	X'3704'	Token-Ring duplicate station address
Failure Causes	(none)	
Actions	X'2010' X'3101' X'32D0' X'82' SF X'82' SF X'82' SF	Review link detailed data Contact Token-Ring administrator responsible for this LAN Report the following:[1] (Adapter Number) (Error Code) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'03' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Local Individual MAC Address Relative Time Hierarchy/Resource List: LAN_HRL6

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'EB61E14F' – Architected Token-Ring LAN Alert 07

Alert Condition: The reporting station's adapter has left the ring as part of the beacon automatic-recovery process. That is, the reporting station's adapter was a member of the beacon fault domain and removed itself from the ring to perform a self test, which was unsuccessful.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174.

Corresponding SSC-Qualifier pair: 580-16.

Alert ID Number		X'EB61E14F'
Alert Type	X'01'	Permanent
Alert Description	X'3213'	Auto-removal
Probable Causes	X'3702'	Token-Ring lobe
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3320' X'3711' X'3434'	Local Token-Ring Adapter Local access unit Local lobe cables
Actions	X'2010' X'3101' X'0105' X'32D0' X'82' SF X'82' SF X'82' SF	Review link detailed data Contact Token-Ring administrator responsible for this LAN Request verification of management server reporting links[1] Report the following:[1] (Adapter Number) (Error Code) (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'03' SF X'05' SV	3174 Product Set ID LAN LCS Data Local Individual MAC Address Hierarchy/Resource List: Ring carries focal point link => LAN_HRL1 Otherwise => LAN_HRL5

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

3174-Peer Alerts

Hierarchy/Resource List Formats

3174-Peer alerts refer to the following Hierarchy/Resource List (HRL) format so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each 3174-Peer alert description in this section refers to the following SV05 format:

LOC_HRL1

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'2E' - Token-Ring	"RINGxxxx" where xxxx is the operational 3174-Peer segment number.
X'3A' - Bridge	3174-Bridge number, response to configuration question 670 padded on the right with blanks.
Hierarchy complete indicator = YES	

X'5487872E' – Architected Bridged LAN Alert 02

Alert Condition: The 3174-Peer bridge "Frame Forwarding" condition was set to "No" by a LAN bridge operator via an online slash test.

Corresponding SSC-Qualifier pair: 852-03.

Alert ID Number		X'5487872E'
Alert Type	X'01'	Permanent
Alert Description	X'B003'	LAN bridge taken offline
Probable Causes	X'7012'	LAN bridge operator
User Causes	X'7109'	LAN bridge operator took bridge offline
Install Causes	(none)	
Failure Causes	(none)	
Actions	X'2010' X'3103' X'32A0' X'82' SF	Review link detailed data Contact LAN administrator responsible for this LAN Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' X'51' SV X'0A' SV X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Bridge identifier Relative Time Hierarchy/Resource List: LOC_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'92BAD21A' – 3174-Peer Alert 01

Alert Condition: During RPS initialization, an RPS that was already on the ring had a segment number that did not match the number that the 3174-bridge had for the ring. The bridge is inactive.

Corresponding SSC-Qualifier pair: 852-01.

Alert ID Number		X'92BAD21A'
Alert Type	X'02'	Temporary
Alert Description	X'3252'	LAN segment number mismatch
Probable Causes	X'8050'	Inconsistent bridge configuration data
User Causes	(none)	
Install Causes	X'8050'	Inconsistent bridge configuration data
Failure Causes	(none)	
Actions	X'2010' X'3103' X'32A0' X'82' SF	Review link detailed data Contact LAN administrator responsible for this LAN Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'0A' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Bridge identifier Relative Time Hierarchy/Resource List: LOC_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'A2522513' – 3174-Peer Alert 02

Alert Condition: Since the number of frames discarded within one minute has exceeded the bridge discard threshold, the bridge is said to be congested. A logging interval begins when the bridge is congested. The alert threshold has been reached during the logging interval, causing this alert to be sent.

Corresponding SSC-Qualifier pair: 852-02.

Alert ID Number		X'A2522513'[1]
Alert Type	X'03'	Performance
Alert Description	X'4010'	Error-to-traffic ratio exceeded
Probable Causes	X'3740'	LAN bridge
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3700' X'3741' X'2007'	LAN component Congestion in LAN bridge LAN communications error
Actions	X'2010' X'3103' X'32A0' X'82' SF	Review link detailed data Contact LAN administrator responsible for this LAN Report the following:[2] (Product Alert Reference Code)
Additional SVs	X'10' SV X'51' SV X'0A' SF X'42' SV X'05' SV	3174 Product Set ID LAN LCS Data Bridge identifier Relative Time Hierarchy/Resource List: LOC_HRL1

[1]This is the 3174's version of the Architected Bridged LAN Alert 1.
[2]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

ISDN Gateway Alerts

Hierarchy/Resource List Formats

3174 ISDN Gateway alerts refer to the following Hierarchy/Resource List (HRL) formats so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point. Each alert description in this section refers to one of the following formats:

ISDN_HRL1

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'FA' - D-Channel	The D-Channel name consists of 6 characters: 2 character adapter hardware group, 2 character adapter port number, and 2 character channel number.
Display resource indicator = OFF	

Associate Resources X'11' SF	
Resource Type	*3174 Implementation*
X'FA' - D-Channel	The D-Channel name is 20 bytes in length: 4-byte machine type, 3-byte model number, 7-byte serial number, and a 6 byte ID containing the adapter number (hardware group), port number, and channel number.
Hierarchy complete indicator = NO	

ISDN_HRL2

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'FA' - D-Channel	The D-Channel name consists of 6 characters: 2 character adapter hardware group, 2 character adapter port number, and 2 character channel number.
Display resource indicator = OFF	
X'F1' - PU	PUID of the downstream PU that the error is associated with.
Display resource indicator = ON	

Associate Resources X'11' SF	
Resource Type	*3174 Implementation*
X'FA' - D-Channel	The D-Channel name is 20 bytes in length: 4-byte machine type, 3-byte model number, 7-byte serial number, and a 6 byte ID containing the adapter number (hardware group), port number, and channel number.
X'FB' - B-Channel	The B-Channel name is 20 bytes in length: 4-byte machine type, 3-byte model number, 7-byte serial number, and a 6 byte ID containing the adapter number (hardware group), port number, and channel number.
Hierarchy complete indicator = NO	

X'0D245F3E' – Architected ISDN B-Channel LAPE Alert 07

Alert Condition: ISDN Logical Link has been lost – SABME received while in ABME. This alert indicates that the remote station sent a SABME command to this local link station, which was already initialized.

Corresponding SSC-Qualifier pairs: 832-57.

Alert ID Number		X'0D245F3E'
Alert Type	X'01'	Permanent
Alert Description	X'3402'	B-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F016'	ISDN Communications/remote node Communications program in remote node Logical Link Control SABME received while in ABME
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL2

X'1179CD4A' – Architected ISDN B-Channel LAPE Alert 08

Alert Condition: ISDN Logical Link has been lost – Frame reject received. This alert indicates that the local link station sent an invalid or unsupported command or response to the remote link station. This resulted in the remote link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 832-58.

Alert ID Number		X'1179CD4A'
Alert Type	X'01'	Permanent
Alert Description	X'3402'	B-Channel ISDN error
Probable Causes	X'1022' X'2052'	Communications program Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'2055' X'F010'	Communications program Logical Link Control Frame Reject received: Invalid/unsupported command or response sent
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL2

X'15B8D0FD' – Architected ISDN B-Channel LAPE Alert 09

Alert Condition: ISDN Logical Link has been lost – Frame reject received. This alert indicates that the local link station sent an I-field when not permitted to the remote link station. This resulted in the remote link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 832-59.

Alert ID Number		X'15B8D0FD'
Alert Type	X'01'	Permanent
Alert Description	X'3402'	B-Channel ISDN error
Probable Causes	X'1022' X'2052'	Communications program Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'2055' X'F011'	Communications program Logical Link Control Frame reject received: I-field sent when not permitted
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL2

X'18FBF624' – Architected ISDN B-Channel LAPE Alert 10

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the local link station sent a frame with an invalid N(r). This resulted in the remote link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 832-60.

Alert ID Number		X'18FBF624'
Alert Type	X'01'	Permanent
Alert Description	X'3402'	B-Channel ISDN error
Probable Causes	X'1022' X'2052'	Communications program Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'2055' X'F012'	Communications program Logical Link Control Frame reject received: Invalid N(r) sent
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL2

X'192D2D89' – Architected ISDN D-Channel LAPD Alert 16

Alert Condition: Terminal Equipment Identifier (TEI) Assignment Failure. This alert is generated when the attempt to request TEI from the network has failed.

Corresponding SSC-Qualifier pairs: 831-14.

Alert ID Number		X'192D2D89'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'230B' X'3222' X'200A'	Link setup failure ISDN Adapter interface ISDN network
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3529' X'200A' X'2055' X'230B'	ISDN TE-NT connection ISDN Communications error Logical Link Control TEI assignment
Actions	X'1204' X'3301' X'3109' X'32D0' X'82' SF X'82' SF X'82' SF X'3106' X'32A0' X'82' SF	Attempt to reestablish the connection If problem persists then do the following: Contact personnel responsible for ISDN connection Report the following:[1] (Adapter Number) (Port Number) (Telephone Number) Contact ISDN network information service Report the following:[1] (Telephone Number)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: ISDN_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'1BBEA353' – Architected ISDN D-Channel LAPD Alert 02

Alert Condition: Excessive D-Channel Link Station Errors. This alert is generated when either of the following station error counters reaches its threshold: PDUs retransmitted or Received Sequence Errors. This indicates that there are excessive link errors between two DLC stations across the D-Channel.

Corresponding SSC-Qualifier pairs: 831-62.

Alert ID Number		X'1BBEA353'
Alert Type	X'03'	Performance
Alert Description	X'4012'	Threshold has been reached
Probable Causes	X'210A' X'3529'	ISDN Communications/remote node ISDN TE-NT connection
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2057' X'3529' X'200E' X'40A0' X'82' SF	ISDN Communications/remote node Communications program in remote node D-Channel ISDN error ISDN TE-NT connection Local DCE loop Threshold reached[1] (Counter)
Actions	X'3301' X'2010' X'2002' X'3106'	If problem persists then do the following: (Review link detail data) (Review most recent traffic statistics) Contact ISDN network information service
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Relative Time Hierarchy/Resource List: ISDN_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'1C3AEB93' – Architected ISDN B-Channel LAPE Alert 11

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the local link station sent a frame with an I-field that was too long. This resulted in the remote link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 832-61.

Alert ID Number		X'1C3AEB93'
Alert Type	X'01'	Permanent
Alert Description	X'3402'	B-Channel ISDN error
Probable Causes	X'1022' X'2052'	Communications program Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'2055' X'F013'	Communications program Logical Link Control Frame reject received: Maximum I-field length exceeded
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL2

X'2040E8A6' – Architected ISDN B-Channel LAPE Alert 01

Alert Condition: Excessive B-Channel Receive Errors. This alert is generated when the CRC Errors Received counter reaches its threshold. This indicates that there are excessive link errors between two DLC stations across the B-Channel.

Corresponding SSC-Qualifier pairs: 832-50.

Alert ID Number		X'2040E8A6'
Alert Type	X'03'	Performance
Alert Description	X'4012'	Threshold has been reached
Probable Causes	X'200A'	ISDN Network
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'2056' X'200A' X'40A0' X'82' SF	B-Channel ISDN error ISDN Communications error Threshold reached[1] (Counter)
Actions	X'3301' X'2010' X'2002' X'3106'	If problem persists then do the following: (Review link detail data) (Review most recent traffic statistics) Contact ISDN network information service
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Relative Time Hierarchy/Resource List: ISDN_HRL2

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'208EA5C3' – Architected ISDN D-Channel LAPD Alert 10

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the local link station sent a frame with an invalid N(r). This resulted in the remote link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 831-08.

Alert ID Number		X'208EA5C3'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'1022' X'2052'	Communications program Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'2055' X'F012'	Communications program Logical Link Control Frame reject received: Invalid N(r) sent
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL1

X'244FB874' – Architected ISDN D-Channel LAPD Alert 11

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the local link station sent a frame with an I-field that was too long. This resulted in the remote link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 831-09.

Alert ID Number		X'244FB874'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'1022' X'2052'	Communications program Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'2055' X'F013'	Communications program Logical Link Control Frame reject received: Maximum I-field length exceeded
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL1

X'290C9EAD' – Architected ISDN D-Channel LAPD Alert 08

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the local link station sent an invalid or unsupported command or response to the remote link station. This resulted in the remote link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 831-06.

Alert ID Number		X'290C9EAD'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'1022' X'2052'	Communications program Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'2055' X'F010'	Communications program Logical Link Control Frame reject received: Invalid/unsupported command or response sent
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL1

X'2DCD831A' – Architected ISDN D-Channel LAPD Alert 09

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the local link station sent an I-field when not permitted to the remote link station. This resulted in the remote link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 831-07.

Alert ID Number		X'2DCD831A'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'1022' X'2052'	Communications program Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'2055' X'F011'	Communications program Logical Link Control Frame reject received: I-field sent when not permitted
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL1

X'3828C45A' – Architected ISDN B-Channel LAPE Alert 06

Alert Condition: ISDN Logical Link has been lost – DM received by local link station. This alert indicates that the remote link station sent a Disconnect Mode (DM) response to the local link station.

Corresponding SSC-Qualifier pairs: 832-56.

Alert ID Number		X'3828C45A'
Alert Type	X'01'	Permanent
Alert Description	X'3402'	B-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F01A'	ISDN Communications/remote node Communications program in remote node Logical Link Control DM received
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL2

X'472F155D' – Architected ISDN D-Channel LAPD Alert 07

Alert Condition: ISDN Logical Link has been lost. The remote link station sent a SABME to the local link station which was already initialized.

Corresponding SSC-Qualifier pairs: 831-05.

Alert ID Number		X'472F155D'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F016'	ISDN Communications/remote node Communications program in remote node Logical Link Control SABME received while in ABME
Actions	X'1204' X'3301' X'2010' X'3106'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact ISDN network information service
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL1

X'55DF0F61' – Architected ISDN Physical Layer Alert 02

Alert Condition: ISDN Adapter Lost Synchronization. This condition indicates that the synchronization is lost and not reestablished between the TE and the NT. A permanent loss is declared when alignment has not occurred in a specific time.

Corresponding SSC-Qualifier pairs: 831-58.

Alert ID Number		X'55DF0F61'
Alert Type	X'01'	Permanent
Alert Description	X'3404'	ISDN Physical Layer Error
Probable Causes	X'3530' X'3310'	ISDN Network Component Local ISDN Adapter
User Causes	(none)	
Install Causes	X'3405'	Local Communication Cable not properly connected
Actions	X'0301'	Check cable and its connection
Failure Causes	X'F06F' X'3530' X'3310'	Synchronization lost and not recovered ISDN Network Component Local ISDN Adapter
Actions	X'3301' X'3109' X'32D0' X'82' SF X'82' SF X'82' SF	If the problem persists then do the following: Contact personnel responsible for connection to ISDN network Report the following:[1] (Adapter Number) (Port Number) (Local Telephone Number)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: ISDN_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'64BBFE11' – Architected ISDN Physical Layer Alert 12

Alert Condition: This alert is generated when TE connection to the NT1 could not be achieved.

Corresponding SSC-Qualifier pairs: 831-60.

Alert ID Number		X'64BBFE11'
Alert Type	X'01'	Permanent
Alert Description	X'3405'	ISDN Physical Layer Activation Error
Probable Causes	X'3531' X'3463'	ISDN Network Termination Equipment (NT1) Premises wiring
User Causes	(none)	
Install Causes	X'3400'	Cable installed incorrectly
Actions	X'0301'	Check cable and its connection
Failure Causes	X'3531' X'3463'	ISDN Network Termination Equipment (NT1) Premise wiring
Actions	X'3109' X'32D0' X'82' SF X'82' SF X'82' SF	Contact personnel responsible for connection to ISDN network Report the following:[1] (Adapter Number) (Port Number) (Local Telephone Number)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: ISDN_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'72238E39' – Architected ISDN D-Channel LAPD Alert 06

Alert Condition: ISDN Logical Link has been lost. The remote link station sent a Disconnect Mode (DM) response to the local link station.

Corresponding SSC-Qualifier pairs: 831-04.

Alert ID Number		X'72238E39'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F01A'	ISDN Communications/remote node Communications program in remote node Logical Link Control DM received
Actions	X'1204' X'3301' X'2010' X'3106'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact ISDN network information service
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL1

X'79931598' – Architected ISDN B-Channel LAPE Alert 02

Alert Condition: Excessive B-Channel Link Station Errors. This alert is generated when either of the following station error counters have reached their thresholds: PDU's retransmitted or Receive sequence errors. This indicates that there are excessive link errors between two DLC stations across the B-Channel.

Corresponding SSC-Qualifier pairs: 832-51.

Alert ID Number		X'79931598'
Alert Type	X'03'	Performance
Alert Description	X'4012'	Threshold has been reached
Probable Causes	X'210A' X'200A'	ISDN Communications/remote node ISDN Network
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2056' X'200A' X'40A0' X'82' SF	ISDN Communications/remote node Communications program in remote node B-Channel ISDN error ISDN Communications error Threshold reached[1] (Counter)
Actions	X'3301' X'2010' X'2002' X'3106' X'3122'	If problem persists then do the following: (Review link detail data) (Review most recent traffic statistics) Contact ISDN network information service Contact called DTE's operator
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Relative Time Hierarchy/Resource List: ISDN_HRL2

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'80190E11' – Architected ISDN D-Channel LAPD Alert 14

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the remote link station sent a frame with an invalid N(r). This resulted in the local link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 831-12.

Alert ID Number		X'80190E11'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F022'	ISDN communication node Communication program(Remote) Logical Link Control Invalid N(r) received
Actions	X'1204' X'3301' X'2010' X'3106'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact ISDN network information service
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL1

X'84D813A6' – Architected ISDN D-Channel LAPD Alert 15

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the remote link station sent a frame with an I-field that was too long. This resulted in the local link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 831-13.

Alert ID Number		X'84D813A6'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F023'	ISDN communication node Communication program (remote) Logical Link Control Received I-field exceeded maximum length
Actions	X'1204' X'3301' X'2010' X'3106'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact ISDN network information service
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL1

X'899B357F' – Architected ISDN D-Channel LAPD Alert 12

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the remote link station sent an invalid or unsupported command or response to the local link stations. This resulted in the local link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 831-10.

Alert ID Number		X'899B357F'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F020'	ISDN communication node Communication program(Remote) Logical Link Control Invalid/unsupported command or response received
Actions	X'1204' X'3301' X'2010' X'3106'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact ISDN network information service
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL1

X'8D5A28C8' – Architected ISDN D-Channel LAPD Alert 13

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the remote link station sent an I-field when not permitted to the local link station. This resulted in the local link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 831-11.

Alert ID Number		X'8D5A28C8'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F021'	ISDN communication node Communication program(Remote) Logical Link Control I-field received when not permitted
Actions	X'1204' X'3301' X'2010' X'3106'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact ISDN network information service
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL1

X'965033D0' – Architected ISDN D-Channel LAPD Alert 05

Alert Condition: ISDN Logical Link has been lost. The local link station inactivity timer or acknowledgement timer has expired, causing the remote station to be polled. The remote station does not respond to the poll.

Corresponding SSC-Qualifier pairs: 831-03.

Alert ID Number		X'965033D0'
Alert Type	X'01'	Permanent
Alert Description	X'3401'	D-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F019' X'F017'	ISDN Communications/remote node Communications program in remote node Logical Link Control Inactivity timer expired Poll count exhausted
Actions	X'1204' X'3301' X'2010' X'3106'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) contact ISDN network information service
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL1

X'9C8449A0' – Architected ISDN B-Channel LAPE Alert 05

Alert Condition: ISDN Logical Link has been lost – Timer expired. The local link station inactivity timer or acknowledgement timer has expired, causing the remote station to be polled. The remote station does not respond to the poll.

Corresponding SSC-Qualifier pairs: 832-55.

Alert ID Number		X'9C8449A0'
Alert Type	X'01'	Permanent
Alert Description	X'3402'	B-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F019' X'F017'	ISDN Communications/remote node Communications program in remote node Logical Link Control Inactivity timer expired Poll count exhausted
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL2

X'A77C91CB' – Architected ISDN B-Channel LAPE Alert 03

Alert Condition: Excessive B-Channel Invalid Frame Errors. This alert is generated as a result of one of the following counters reaching threshold:

- Short Frames Received
- Aborted Frames Received
- Aborted Frames Transmitted
- Misaddressed Frames Received
- Unbounded Frames Received
- Non-Integral Frames Received.

This indicates that there are either excessive link errors between two DLC stations across the B-Channel or the remote node is failing.

Corresponding SSC-Qualifier pairs: 832-52.

Alert ID Number		X'A77C91CB'
Alert Type	X'03'	Performance
Alert Description	X'4012'	Threshold has been reached
Probable Causes	X'210A' X'200A'	ISDN Communications/remote node ISDN Network
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3311' X'200A' X'40A0' X'82' SF	Remote ISDN Adapter ISDN Communications error Threshold reached[1] (Counter)
Actions	X'3301' X'2010' X'2002' X'3106' X'3122'	If problem persists then do the following: (Review link detail data) (Review most recent traffic statistics) Contact ISDN network information service Contact called DTE's operator
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Relative Time Hierarchy/Resource List: ISDN_HRL2

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'AD564CF0' – Architected ISDN D-Channel LAPD Alert 04

Alert Condition: This alert indicates that either the buffer overrun counter or the buffer underrun counter reaches threshold.

Corresponding SSC-Qualifier pairs: 831-52.

Alert ID Number		X'AD564CF0'
Alert Type	X'03'	Performance
Alert Description	X'4012'	Threshold has been reached
Probable Causes	X'3310' X'3222'	Local ISDN Adapter ISDN Adapter interface
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3310' X'40A0' X'82' SF	Local ISDN Adapter Threshold reached[1] (Counter)
Actions	X'3301' X'2002' X'3109' X'32D0' X'82' SF X'82' SF X'82' SF	If problem persists then do the following: (Review most recent traffic statistics) Contact personnel responsible for connection to ISDN network Report the following:[1] (Adapter Number) (Port Number) (Local Telephone Number)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: ISDN_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'AD564CF0' – Architected ISDN B-Channel LAPE Alert 04

Alert Condition: ISDN Adapter Buffer Overrun/Underrun. This alert is generated as a result of either the buffer overrun or the buffer underrun counter reaching threshold.

Corresponding SSC-Qualifier pairs: 832-53.

Alert ID Number		X'AD564CF0'
Alert Type	X'03'	Performance
Alert Description	X'4012'	Threshold has been reached
Probable Causes	X'3310' X'3222'	Local ISDN Adapter ISDN Adapter interface
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3310' X'40A0' X'82' SF	Local ISDN Adapter Threshold reached[1] (Counter)
Actions	X'3301' X'2002' X'3109' X'32D0' X'82' SF X'82' SF X'82' SF	If problem persists then do the following: (Review most recent traffic statistics) Contact personnel responsible for connection to ISDN network Report the following:[1] (Adapter Number) (Port Number) (Telephone Number)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: ISDN_HRL2

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'AD6607B6' – Architected ISDN D-Channel LAPD Alert 03

Alert Condition: Excessive D-Channel Invalid Frame Errors. This alert is generated as a result of one of the following counters reaching threshold:

- Short Frames Received
- Aborted Frames Received
- Aborted Frames Transmitted
- Misaddressed Frames Received
- Unbounded Frames Received
- Non-Integral Frames Received.

This indicates that there are either excessive link errors between two DLC stations across the D-Channel or the remote node is failing.

Corresponding SSC-Qualifier pairs: 831-63.

Alert ID Number		X'AD6607B6'
Alert Type	X'03'	Performance
Alert Description	X'4012'	Threshold has been reached
Probable Causes	X'210A' X'3529'	ISDN Communications/remote node ISDN TE-NT connection
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'3311' X'3529' X'40A0' X'82' SF	Remote ISDN Adapter ISDN TE-NT connection Threshold reached[1] (Counter)
Actions	X'3301' X'2010' X'2002' X'3106'	If problem persists then do the following: (Review link detail data) (Review most recent traffic statistics) Contact ISDN network information service
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Relative Time Hierarchy/Resource List: ISDN_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'BBF58700' – Architected ISDN Physical Layer Alert 01

Alert Condition: ISDN Adapter Lost Frame Alignment. This alert is generated when the Loss of Frame Alignment counter has reached its threshold. This indicates temporary loss of alignment, but recovery is performed between the TE and the NT.

Corresponding SSC-Qualifier pairs: 831-53.

Alert ID Number		X'BBF58700'
Alert Type	X'03'	Performance
Alert Description	X'4012'	Threshold has been reached
Probable Causes	X'3530' X'3310'	ISDN Network Component Local ISDN Adapter
User Causes	(none)	
Install Causes	X'3405'	Local Communication Cable not properly connected
Actions	X'0301'	Check cable and its connection
Failure Causes	X'3536' X'3310' X'40A0' X'82' SF	ISDN Network Termination Device Local ISDN Adapter Threshold reached[1] (Counter)
Actions	X'3301' X'2002' X'3109' X'32D0' X'82' SF X'82' SF X'82' SF	If problem persists then do the following: (Review the most recent traffic statistics) Contact personnel responsible for connection to ISDN network Report the following:[1] (Adapter Number) (Port Number) (Local Telephone Number)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: ISDN_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'C3907F1C' – Architected ISDN B-Channel LAPE Alert 12

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the remote link station sent an invalid or unsupported command or response to the local link station. This resulted in the local link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 832-62.

Alert ID Number		X'C3907F1C'
Alert Type	X'01'	Permanent
Alert Description	X'3402'	B-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F020'	ISDN Communications/remote node Communications program in remote node Logical Link control Invalid/unsupported command or response received
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL2

X'C506D595' – Architected ISDN D-Channel LAPD Alert 01

Alert Condition: Excessive D-Channel Receive Errors. This alert is generated when the CRC Errors Received counter reaches its threshold. This indicates that there are excessive link errors between two DLC stations across the D-Channel.

Corresponding SSC-Qualifier pairs: 831-61.

Alert ID Number		X'C506D595'
Alert Type	X'03'	Performance
Alert Description	X'4012'	Threshold has been reached
Probable Causes	X'3529'	ISDN TE-NT connection
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'2057' X'3529' X'200E' X'40A0' X'82' SF	D-Channel ISDN error ISDN TE-NT connection Local DCE loop Threshold reached[1] (Counter)
Actions	X'3301' X'2002' X'2010' X'3106'	If problem persists then do the following: (Review most recent traffic statistics) (Review link detail data) Contact ISDN network information service
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'0A' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Local Telephone Number Relative Time Hierarchy/Resource List: ISDN_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'C75162AB' – Architected ISDN B-Channel LAPE Alert 13

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the remote link station sent an I-field when not permitted to the local link station. This resulted in the local link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 832-63.

Alert ID Number		X'C75162AB'
Alert Type	X'01'	Permanent
Alert Description	X'3402'	B-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F021'	ISDN Communications node Communications program (Remote) Logical Link control I-field received when not permitted
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL2

X'CA124472' – Architected ISDN B-Channel LAPE Alert 14

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the remote link station sent a frame with an invalid N(r). This resulted in the local link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 832-64.

Alert ID Number		X'CA124472'
Alert Type	X'01'	Permanent
Alert Description	X'3402'	B-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F022'	ISDN Communications/remote node Communications program in remote node Logical Link control Invalid N(r) received
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL2

X'CED359C5' – Architected ISDN B-Channel LAPE Alert 15

Alert Condition: ISDN Logical Link has been lost. This alert indicates that the remote link station sent a frame with an I-field that was too long. This resulted in the local link station returning a Frame Reject response.

Corresponding SSC-Qualifier pairs: 832-65.

Alert ID Number		X'CED359C5'
Alert Type	X'01'	Permanent
Alert Description	X'3402'	B-Channel ISDN error
Probable Causes	X'210A' X'1023' X'2052'	ISDN Communications/remote node Communications program in remote node Logical Link Control
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'210A' X'1023' X'2055' X'F023'	ISDN Communications/remote node Communications program in remote node Logical Link control Received I-field exceeded maximum length
Actions	X'1204' X'3301' X'2010' X'3109'	Attempt to reestablish the connection If problem persists then do the following: (Review link detail data) Contact personnel responsible for connection to ISDN network
Additional SVs	X'10' SV X'52' SV X'01' SF X'04' SF X'06' SF X'07' SF X'09' SF X'0A' SF X'8C' SV X'01' SF X'02' SF X'03' SF X'04' SF X'05' SF X'06' SF X'07' SF X'08' SF X'42' SV X'05' SV	3174 Product Set ID LCS Configuration Data Port Address Local Device Address LCS Link Station Attributes LCS Link Attributes Remote Telephone Number Local Telephone Number Link Station Data Current Ns/Nr counts Outstanding frame count Last Data Link control field received Last Data Link control field sent Sequence number modulus Link station state Data link reply timer expiration count Last received Nr count Relative Time Hierarchy/Resource List: ISDN_HRL2

Management Services Alerts

Hierarchy/Resource List Formats

3174 Management Services alerts refer to the following Hierarchy/Resource List (HRL) format so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each alert description in this section refers to the following format:

MS_HRL1

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.
X'F4' - Control Point	The CP name of adjacent node received in XID, padded on the right with blanks. If unavailable, then the CP name will be substituted with the string "UNKNOWN" and the "display resource" indicator will be set.
Hierarchy complete indicator = YES	

X'2313A399' – Architected MS Alert CPMS002

Alert Condition: Management Services protocol error. The received Multiple Domain Support message unit (MDS_MU) cannot be processed.

Corresponding SSC-Qualifier pairs: 850-01,02,03,04,05.

Alert ID Number		X'2313A399'
Alert Type	X'01'	Permanent
Alert Description	X'3114'	Link Error
Probable Causes	X'1023' X'1022'	Communication program in remote node Communication program
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023' X'1022'	Communication program in remote node Communication program
Actions	X'3000' X'32C0' X'82' SF X'82' SF	Contact appropriate service representative Report the following:[1] (SNA sense data) (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: MS_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'32631180' – 3174 MS Alert 01

Alert Condition: The controller is unable to forward an Alert from a downstream device because of an RU size limitation.

Corresponding SSC-Qualifier pair: 850-06.

Alert ID Number		X'32631180'
Alert Type	X'01'	Permanent
Alert Description	X'3114'	Management Services protocol error
Probable Causes	X'2003'	SNA Communications
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'10C1' X'82' SF X'82' SF	(SF82) Unable to forward Alert originally sent by (SF82)[1] (CP name of the node that tried to forward the alert) (CP name of the node that originally sent the alert)
Actions	X'2203' X'2204' X'F0A0' X'82' SF	Review supporting data at alert sender Review network log at alert forwarder For (SF82)[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'48' SV X'42' SV X'05' SV	3174 Product Set ID Supporting Data Correlation[2] Relative Time Hierarchy/Resource List: MS_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]The contents of this subvector will be the received X'48' SV.

Configuration Services Alerts

Hierarchy/Resource List Formats

3174 Configuration services alerts refer to the following Hierarchy/Resource List (HRL) formats so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each CS alert description in this section refers to one or more of the following SV05 formats:

CS_HRL1

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'21' - Adapter	A three byte type-location number of the communications adapter involved, in six EBCDIC bytes padded with two blanks.
X'F1' - Physical Unit	"UNKNOWN" is used in reference to the adjacent node's PU name since it is unlikely that this information will be available.
Hierarchy complete indicator = NO	

CS_HRL2

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'21' - Adapter	A three byte type-location number of the communications adapter involved, in six EBCDIC bytes padded with two blanks.
X'F4' - Control Point	The CP name of adjacent node received in XID, padded on the right with blanks. If unavailable, then the CP name will be substituted with the string "UNKNOWN" and the "display resource" indicator will be set.
Hierarchy complete indicator = NO	

CS_HRL3

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.
X'21' - Adapter	A three byte type-location number of the communications adapter involved, in six EBCDIC bytes padded with two blanks.
X'F4' - Control Point	The CP name of adjacent node received in XID, padded on the right with blanks. If unavailable, then the CP name will be substituted with the string "UNKNOWN" and the "display resource" indicator will be set.
Hierarchy complete indicator = YES	

X'034A6F0B' – Architected CS Alert CPCS002

Alert Condition: XID negotiation was terminated by this node because the remote node violated protocols for XID exchange.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 851-02.

Alert ID Number		X'034A6F0B'
Alert Type	X'01'	Permanent
Alert Description	X'3110'	XID protocol error
Probable Causes	X'1023'	Communications program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023' X'F0A4' X'82' SF	Communications program in remote node XID negotiation failed with (SF82)[1] (SNA sense data)
Actions	X'3110' X'32A0' X'82' SF	Contact communications systems programmer Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'10' SV X'42' SV X'05' SV	3174 Product Set ID Other Product Set ID[2] Relative Time Hierarchy/Resource List: Pure 2.0 link => CS_HRL1 Shared link => CS_HRL2 Pure 2.1 link => CS_HRL3

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]The Product Set ID X'10' SV is taken from the received XID. For those cases in which the PSID is not available, this SV is omitted.

X'0DF28A14' – Architected CS Alert CPCS003

Alert Condition: Invalid SET MODE was received. This error could be detected by either a DLC level component or Configuration Services.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair:

- 583-14
- 851-03.

Alert ID Number		X'0DF28A14'
Alert Type	X'01'	Permanent
Alert Description	X'1605'	Wrong link mode setting command received
Probable Causes	X'1023'	Communications program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023'	Communications program in remote node
Actions	X'3110' X'32C0' X'82' SF X'82' SF	Contact communications systems programmer Report the following:[1] (SNA sense data) (Product Alert Reference Code)
Additional SVs	X'10' SV X'10' SV X'42' SV X'05' SV	3174 Product Set ID Other Product Set ID[2] Relative Time Hierarchy/Resource List: Pure 2.0 link => CS_HRL1 Shared link => CS_HRL2 Pure 2.1 link => CS_HRL3

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]The Product Set ID X'10' SV is taken from the received XID. For those cases in which the PSID is not available this SV is omitted.

X'6D27D125' – Architected CS Alert CPCS004

Alert Condition: XID negotiation was terminated by remote node. CV22 was received.

Restrictions: This alert will not be sent by a Token-Ring host-attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 851-04.

Alert ID Number		X'6D27D125'
Alert Type	X'01'	Permanent
Alert Description	X'1604'	XID negotiation terminated
Probable Causes	X'1022' X'1023'	Communications program Communications program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'F0A4' X'82' SF	Communications program XID negotiation failed with (SF82)[1] (SNA sense data)
Actions	X'3110' X'32A0' X'82' SF	Contact communications systems programmer Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'10' SV X'42' SV X'05' SV	3174 Product Set ID Other Product Set ID[2] Relative Time Hierarchy/Resource List: Pure 2.0 link => CS_HRL1 Shared link => CS_HRL2 Pure 2.1 link => CS_HRL3

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]The Product Set ID X'10' SV is taken from the received XID. For those cases in which the PSID is not available, this SV is omitted.

X'E9D0BA9D' – Architected CS Alert CPCS007

Alert Condition: XID negotiation was terminated by the alert sender because of a software problem (unable to allocate storage).

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 851-05.

Alert ID Number		X'E9D0BA9D'
Alert Type	X'01'	Permanent
Alert Description	X'1604'	XID negotiation terminated
Probable Causes	X'1022'	Communications program
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022' X'F0A4' X'82' SF	Communications program XID negotiation failed with (SF82)[1] (SNA sense data)
Actions	X'3000' X'32A0' X'82' SF	Contact appropriate service representative Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'10' SV X'42' SV X'05' SV	3174 Product Set ID Other Product Set ID[2] Relative Time Hierarchy/Resource List: Pure 2.0 link => CS_HRL1 Shared link => CS_HRL2 Pure 2.1 link => CS_HRL3

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]The Product Set ID X'10' SV is taken from the received XID. For those cases in which the PSID is not available, this SV is omitted.

X'EBEE390E' – Architected CS Alert CPCS001

Alert Condition: XID negotiation was terminated by this node because the received XID was either invalid in format or contained unacceptable values.

Restrictions: This alert will not be sent by a Token-Ring host attached 3174 if it detects this error on a host link.

Corresponding SSC-Qualifier pair: 851-01.

Alert ID Number		X'EBEE390E'
Alert Type	X'01'	Permanent
Alert Description	X'3111'	Invalid XID received
Probable Causes	X'1023'	Communications program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023' X'F0A4' X'82' SF	Communications program in remote node XID negotiation failed with (SF82)[1] (SNA sense data)
Actions	X'3110' X'32A0' X'82' SF	Contact communications systems programmer Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'10' SV X'42' SV X'05' SV	3174 Product Set ID Other Product Set ID[2] Relative Time Hierarchy/Resource List: Pure 2.0 link => CS_HRL1 Shared link => CS_HRL2 Pure 2.1 link => CS_HRL3

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.
[2]The Product Set ID X'10' SV is taken from the received XID. For those cases in which the PSID is not available, this SV is omitted.

Path Control Alerts

Hierarchy/Resource List Formats

3174 Management Services alerts refer to the following Hierarchy/Resource List (HRL) format so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each alert description in this section refers to the following format:

PC_HRL1

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.
X'2C' - TG number	A one byte value specifying the TG number of the link that the error was detected on.
X'F4' - Control Point	The CP name of adjacent node received in XID, padded on the right with blanks.
Hierarchy complete indicator = YES	

X'C781E91E' – Architected PC Alert CPPL001

Alert Condition: A SNA protocol violation. The received path information unit (PIU) is discarded.

Corresponding SSC-Qualifier pair: 851-06.

Alert ID Number		X'C781E91E'
Alert Type	X'01'	Permanent
Alert Description	X'3100'	SNA protocol error
Probable Causes	X'1023'	Communications program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023' X'F06E'	Communications program in remote node Invalid PIU received
Actions	X'3110' X'32C0' X'82' SF X'82' SF	Contact communications systems programmer Report the following:[1] (SNA sense data) (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: PC_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

Address Space Manager Alerts

Hierarchy/Resource List Formats

3174 ASM alerts refer to the following Hierarchy/Resource List (HRL) format so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each alert description in this section refers to the following format:

ASM_HRL1

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.
X'F4' - Control Point	The CP name of adjacent node received in XID, padded on the right with blanks. If unavailable, then the CP name will be substituted with the string "UNKNOWN" and the "display resource" indicator will be set.
Hierarchy complete indicator = YES	

X'BCDAE87E' – Architected ASM Alert CPAM001

Alert Condition: A Bind request has been rejected due to a protocol error. The error is serious enough to warrant deactivating the link.

Corresponding SSC-Qualifier pairs: 853-01,02.

Alert ID Number		X'BCDAE87E'
Alert Type	X'01'	Permanent
Alert Description	X'3112'	SNA session setup failure
Probable Causes	X'1023'	Communication program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023' X'F0BC' X'82' SF	Communications program in remote node BIND rejected with (SF82)[1] (SNA sense data)
Actions	X'3000' X'32A0' X'82' SF	Contact appropriate service representative Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: ASM_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

Node Buffer Manager Alerts

Hierarchy/Resource List Formats

3174 NBM alerts refer to the following Hierarchy/Resource List (HRL) format so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each alert description in this section refers to the following format:

NBM_HRL1

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.
Hierarchy complete indicator = YES	

X'FFD94582' – 3174 NBM Alert 01

Alert Condition: The number of Node Buffer Manager buffers for APPN function available for use has declined to the critical level.

Corresponding SSC-Qualifier pairs: 853-04.

Alert ID Number		X'FFD94582'
Alert Type	X'03'	Performance
Alert Description	X'4012'	Threshold has been reached
Probable Causes	X'1022'	Communications program
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022'	Communications program
Actions	X'3302' X'3110' X'32A0' X'82' SF	If problem continues to occur repeatedly then do the following: Contact communications system programmer Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: NBM_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

Network Link Channel-Attached Alerts

Hierarchy/Resource List Formats

3174 NLCA alerts refer to the following Hierarchy/Resource List (HRL) format so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each alert description in this section refers to the following format:

NLCA_HRL1

Hierarchy name list = Empty
Hierarchy complete indicator = NO

X'89DDCD29' – 3174 NLCA Alert 01

Alert Condition: The secondary channel DLC received a link path information unit (LPIU) containing a link header function code that is not supported by the secondary.

Corresponding SSC-Qualifier pairs: 540-10.

Alert ID Number		X'89DDCD29'
Alert Type	X'01'	Permanent
Alert Description	X'2100'	Software program error
Probable Causes	X'1023'	Communications program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023'	Communications program in remote node
Actions	X'3110' X'32A0' X'82' SF	Contact communications systems programmer Report the following:[1] (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05'	3174 Product Set ID Relative Time Hierarchy/Resource List: NLCA_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

Session Services Alerts

Hierarchy/Resource List Formats

3174 Session Services alerts refer to the following Hierarchy/Resource List (HRL) formats so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each alert description in this section refers to one or more of the following formats:

SS_HRL1

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.
Hierarchy complete indicator = YES	

SS_HRL2

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.

Associated Resources X'11' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name of adjacent node received in XID, padded on the right with blanks.
Hierarchy complete indicator = YES	

SS_HRL3

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.
X'F4' - Control Point	The CP name of adjacent node received in XID, padded on the right with blanks.
Hierarchy complete indicator = YES	

X'21745F28' – Architected SS Alert CPSS003

Alert Condition: Protocol violation on a Locate or Bind request.

Corresponding SSC-Qualifier pairs: 854-01,03,04.

Alert ID Number		X'21745F28'
Alert Type	X'01'	Permanent
Alert Description	X'3002'	Session Services protocol error
Probable Causes	X'1023'	Communications program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'2209'	Session Services program in remote node
Actions	X'3000' X'32C0' X'82' SF X'82' SF	Contact appropriate service representative Report the following:[1] (SNA sense data) (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: SS_HRL2

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'B8E072C2' – Architected TRS Alert CPDB001

Alert Condition: Format error detected in a topology database update (TDU) GDS variable.

Corresponding SSC-Qualifier pairs: 854-08.

Alert ID Number		X'B8E072C2'
Alert Type	X'01'	Permanent
Alert Description	X'3113'	CP-CP session failure
Probable Causes	X'1023'	Communications program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1023' X'2205'	Communications program in remote node Topology Protocol Error
Actions	X'3000' X'32C0' X'82' SF X'82' SF	Contact appropriate service representative Report the following:[1] (SNA sense data) (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: SS_HRL3

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'EDD0D10F' – Architected SS Alert CPSS001

Alert Condition: Required transaction program cannot be started (initiated by setup CP-CP session).

Corresponding SSC-Qualifier pairs: 854-05.

Alert ID Number		X'EDD0D10F'
Alert Type	X'01'	Permanent
Alert Description	X'3113'	CP-CP session failure
Probable Causes	X'8003'	Communication configuration
User Causes	(none)	
Install Causes	X'1301'	Communications program
Failure Causes	(none)	
Actions	X'3110' X'32C0' X'82' SF X'82' SF	Contact communications systems programmer Report the following:[1] (Product Alert Reference Code) (Transaction Program)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: SS_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

Directory Services Alerts

Hierarchy/Resource List Formats

3174 Directory Services alerts refer to the following Hierarchy/Resource List (HRL) formats so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each alert description in this section refers to one or more of the following formats:

DS_HRL1

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.

DS_HRL2

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.

Associated Resources X'11' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	CP Name of adjacent node received in XID, padded on the right with blanks.
Hierarchy complete indicator = YES	

X'170F7710' – Architected DS Alert CPDN001

Alert Condition: Protocol violation on a LOCATE request.

Corresponding SSC-Qualifier pairs:

- 854-07
- 855-06,07,08,09,10.

Alert ID Number		X'170F7710'
Alert Type	X'01'	Permanent
Alert Description	X'3001'	Directory Services protocol error
Probable Causes	X'1023'	Communications program in remote node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'2206'	Directory program in remote node
Actions	X'3000' X'32C0' X'82' SF X'82' SF	Contact appropriate service representative Report the following:[1] (SNA sense data) (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: Failure during initialization => DS_HRL1 Otherwise => DS_HRL2

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'769022F0' – Architected DS Alert CPDN002

Alert Condition: Insufficient resources available for Directory Services (DS). Deadlock detected between DS components in two nodes. When this condition is detected, DS will instruct Session Services (SS) to UNBIND the CP-CP session to the other node. If this problem reoccurs, it may indicate a node system definition error or a configuration problem.

Corresponding SSC-Qualifier pairs: 855-01,02,03.

Alert ID Number		X'769022F0'
Alert Type	X'01'	Permanent
Alert Description	X'3113'	CP-CP session failure
Probable Causes	X'1022'	Communications program
User Causes	(none)	
Install Causes	X'8002' X'8003'	Insufficient storage for directory services Communications subsystem definition
Failure Causes	(none)	
Actions	X'3302' X'3110' X'32C0' X'82' SF X'82' SF	If problem continues to occur repeatedly then do the following: Contact communications system programmer Report the following:[1] (SNA sense data) (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: Failure during initialization => DS_HRL1 Otherwise => DS_HRL2

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

Topology Routing Services Alerts

Hierarchy/Resource List Formats

3174 Topology Routing Services alerts refer to the following Hierarchy/Resource List (HRL) format so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each alert description in this section refers to the following format:

TRS_HRL1

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.
Hierarchy complete indicator = YES	

X'0CAB2FAE' – Architected TRS Alert CPDB003

Alert Condition: The architected maximum for the Resource Sequence Number (RSN) has been reached. The resource (a node or transmission-group) is no longer available for use. The topology database manager continues to run, but the TDU causing the alert is discarded.

Corresponding SSC-Qualifier pairs: 856-01.

Alert ID Number		X'0CAB2FAE'
Alert Type	X'01'	Permanent
Alert Description	X'1607'	Topology Protocol error
Probable Causes	X'1022'	Communications program
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'1022'	Communications program
Actions	X'3110' X'32C0' X'82' SF X'82' SF	Contact communications system programmer Report the following:[1] (Name of the resource causing the error) (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: TRS_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'F2BA7BF2' – Architected TRS Alert CPDB002

Alert Condition: The node table is full. This condition is probably the result of a system definition error (for example, inadequate storage allocated for the table). If the node table is dynamically extendable, this may be a failure to obtain additional storage.

Corresponding SSC-Qualifier pairs: 856-02.

Alert ID Number		X'F2BA7BF2'
Alert Type	X'01'	Permanent
Alert Description	X'1606'	Topology capacity exceeded
Probable Causes	X'1022'	Communications program
User Causes	(none)	
Install Causes	X'8001'	Topology storage exceeded
Actions	X'3110' X'32C0' X'82' SF X'82' SF	Contact communications system programmer Report the following:[1] (Maximum number of node table entries) (Product Alert Reference Code)
Failure Causes	(none)	
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: TRS_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

Session Connector Manager Alerts

Hierarchy/Resource List Formats

3174 Session Connector Manager alerts refer to the following Hierarchy/Resource List (HRL) format so that the focal point product can display the correct alert hierarchy. These rules assume that the alert will travel on an SSCP-PU session to its focal point, and not on an FP-CP session. Each alert description in this section refers to the following format:

SCM_HRL1

Hierarchy Name List X'10' SF	
Resource Type	*3174 Implementation*
X'F4' - Control Point	The CP name from configuration question 511, padded on the right with blanks.
Hierarchy complete indicator = YES	

X'2110D168' – Architected SCM Alert CPIM001

Alert Condition: ABEND of a Session Connector. This occurs when the Session Connector is unable to allocate storage for processing. Session Connector Manager UNBINDS the session.

Corresponding SSC-Qualifier pairs: 857-01.

Alert ID Number		X'2110D168'
Alert Type	X'01'	Permanent
Alert Description	X'5004'	Out of resources
Probable Causes	X'1022'	Communications program
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'2054'	Insufficient storage for intermediate session processing
Actions	X'3302' X'3110' X'32C0' X'82' SF X'82' SF	If problem continues to occur repeatedly then do the following: Contact communications system programmer Report the following:[1] (SNA sense data) (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: SCM_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

X'DCC97D6B' – Architected SCM Alert CPIM002

Alert Condition: Session Connector received an invalid RU. Session Connector signals Session Connector Manager to UNBIND the session.

Corresponding SSC-Qualifier pairs: 857-02.

Alert ID Number		X'DCC97D6B'
Alert Type	X'01'	Permanent
Alert Description	X'3100'	SNA protocol error
Probable Causes	X'2131'	Communications program in adjacent node
User Causes	(none)	
Install Causes	(none)	
Failure Causes	X'2208'	Communications program in adjacent node
Actions	X'3110' X'32C0' X'82' SF X'82' SF	Contact communications system programmer Report the following:[1] (SNA sense data) (Product Alert Reference Code)
Additional SVs	X'10' SV X'42' SV X'05' SV	3174 Product Set ID Relative Time Hierarchy/Resource List: SCM_HRL1

[1]Refer to "X'82' SF Contents" on page 12-59 for a detailed description.

Appendix H. SNA Sense Codes

Each sense data category has modifiers for further description in sense byte 1. The modifier codes supported and the controller or terminal condition causing the sense data to be returned are described below. You can refer to the *SNA Formats Reference Summary* for a generic definition.

The following are 3174-specific definitions. Also listed are the Central Site Change Management (CSCM) SNA registered sense codes with a reference to the *3174 Central Site Customizing User*. For architecture sense codes, see the *SNA Formats Reference Summary*.

Note: In addition to the SNA sense codes, the error log and the SNA Alert function may provide additional information about error recovery.

Path Error X'80'

X'8002 0000' – Link Failure
Data link failure.

X'8004' – Unrecognized DAF
The DAF address is not customized.

X'8005' – No Session

- A Bind has not been received or accepted.
- A Request/Response Unit was received with an invalid or incorrect origin address.

X'8006 0000'
Improper FID type.

X'8007' – Segmenting Error
One of following conditions exists:

- First BIU segment had less than 10 bytes.
- BIU segments were received out of order.
- The sequence number of a middle or last BIU segment did not match the sequence number of the first BIU segment.
- The OAF of a middle or last BIU segment did not match the OAF of the first BIU segment.
- A segmented RU, which was not a Function Management Data request, was received.

X'8007 0002' – Interleaved Bind Segments Not Allowed
A Bind receiver that is in the middle of receiving segments of one Bind received a segment from a different Bind. The receiver rejects both Binds and disconnects the link.

X'8008' – PU Not Active
The 3174 has not received or accepted an ACTPU.

X'8009' – LU Not Active
The 3174 has not received or accepted an ACTLU.

X'800B 0000'
Incorrect transmission header length.

X'800F' – Invalid Address Combination
A request was addressed to the PU (DAF=X'00'), and the OAF was not SSCP (OAF=X'00').

X'800F 0000'
The DAF, OAF (FID2) combination, or the LSID (FID3) specified an invalid type of session.

X'800F 0001'
The FID2 ODAI setting in a received Bind was incorrect, and the Bind was rejected.

X'8014 0001'
No route exists.

X'8014 0003'
The destination is not available.

X'8014 0005'

- The Route Selection Control Vector (RSCV) exceeds the maximum length.
- The Route Selection Control Vector (RSCV) was truncated because the route was too long.

X'8019 0001' – Receiving Node Incorrect
See "Appendix C" in the *3174 Central Site Customizing User* for more information.

X'8019 0002' – Receiving Node Incorrect
See "Appendix C" in the *3174 Central Site Customizing User* for more information.

RH Error X'40'

X'4003' – Begin Bracket (BB) Not Allowed
An FMD request carried BB, but it was either not first in chain or did not contain an FMH-5.

X'4004' – Conditional End Bracket (CEB) or End Bracket (EB) Not Allowed

- An FMD request or LUSTAT request carried EB.
- A ¬LIC FMD request carried CEB.
- An FMD request or LUSTAT request carried CEB, and the DR2 and Exception Response bits in the RH were set to ***1***.
- An FMD request or LUSTAT request carried BB, CEB, and specified exception response.
- An FIC request carried BB, and the LIC request carried CEB and specified exception response.

X'4005' – Incomplete RH
First BIU segment was less than 3 bytes in length.

X'4005 0000'
Incorrect RH length.

X'4006' – Exception Response Not Allowed
LIC carried exception response when the Bind specified definite response only.

X'4007' – Definite Response Not Allowed
LIC carried definite response when the Bind specified exception response only, or ¬ LIC carried definite response.

X'4008' – Pacing Not Supported
An SC request specified pacing.

X'4009' – Change Direction (CD) Not Allowed

- A BIS, RTR, or SIGNAL request carried CD.
- A ¬LIC FMD request carried CD.
- An FMD or LUSTAT request carried CD and CEB.
- An FMD or LUSTAT request carried CD, and the DR1 bit was set to ***1*** and the DR2 and Exception Response bits in the RH were set to ***0***.

X'400B' – Chaining Not Supported
A DFC request, a SC request, or a response was received that did not have both the Begin and End Chain indicators on.

X'400C' – Brackets Not Supported
A BIS, RTR, SIGNAL, or SC request carried a bracket indicator (BB, EB, or CEB).

X'400D' – CD Not Supported
An SC request carried CD.

X'400F' – Incorrect Use of Format Indicator (FI)

- For LU Type 1 – An FM request received by the 3174 indicated FM header included when the Bind command specified that FM headers were not allowed.
- For LU Type 6.2 – A DFS or SC request was received with the FI bit in the RH set to ***0***.

X'4010' – Alternate Code Not Supported
A DFC, FMD, or SC request was received with the Code Selection indicator bit in the RH set to ***1***.

X'4011' – Incorrect Specification of RU Category

- For LU Types 1, 2, and 3 – The RU category indicator was specified incorrectly; for example, an expedited flow request was specified with RU category = FMD.
- For LU Type 6.2:
  - An expedited FMD request or FMD response was received.
  - A normal flow SC request was received.
  - A normal flow response was received with an RU category that was different from the RU category of the last request sent.

X'4012' – Incorrect Specification of Request Code

- An expedited DFC response with a request code ¬ = SIGNAL was received.
- A normal flow DFC response was received with a request code that was different from the request code of the last DFC request sent.

X'4013' — Incorrect Specification of Sense Data Indicator (SDI), RTI

- A negative response was received with the SDI bit in the RH set to ***0***.
- A positive response was received with the SDI bit in the RH set to ***1***.

X'4014' — Incorrect Use of Definite Response (DR) and Exception Response (ER) Indicators

- A SIGNAL, RTR, or SC request was received that did not have the DR1 bit set to ***1*** and the DR2 and ERI bits set to ***0***.
- A BIS request did not have the DR1 bit or the ERI bit set to ***1***.
- An FMD or LUSTAT request did not have the DR1 or DR2 bit set to ***1***.

X'4015' — Incorrect Use of Queued Response Indicator (QRI)
A BIS, RTR, SIGNAL, or SC request carried QRI.

X'4016' — Incorrect Use of Enciphered Data Indicator (EDI)
A DFC or SC request was received with the EDI bit in the RH set to ***1***.

X'4017' — Incorrect Use of Padded Data Indicator (PDI)
A DFC or SC request was received with the PDI bit in the RH set to ***1***.

X'4018' — Incorrect Setting of Queued Response Indicator (QRI) with Bidder's BB

- An FMD or LUSTAT request carried BB, but did not carry QRI.
- An LUSTAT request or first-in-chain FMD request carried QRI, but did not carry BB.

X'4019' — Incorrect Indicators on Last-In-Chain (LIC) Request

- An LUSTAT request or LIC FMD request specified exception response, but did not carry CEB or CD.
- An LIC FMD request with the DR1 bit set to ***1***, and the DR2 and ERI bits set to ***0*** did not carry CEB.

State Error X'20'

X'2001' — Sequence Number Error
The sequence number of the normal flow request did not match the number expected.

X'2002' — Chaining Error
Chain elements were received out of order.

X'2003' — Bracket State Error

- For LU Types 1, 2, and 3 — A bracket state error occurred.
- For LU Type 6.2:
  - An RTR request was received on a first speaker session.
  - An Attach Header was received before a bracket was started, or a second Attach Header was received after a bracket was started.

X'2004' — Direction Error

- A normal flow request without Begin Bracket was received while the 3174 was in Send State.
- For LU Type 6.2 — A first-in-chain normal flow request was received after a request carrying Change Direction.

X'2005' – Data Traffic Reset

An FMD or DFC request was received before a SDT was received or accepted.

X'2005 0001' – Type Address Field Error

The type address field in the SNA address list subvector is not equal to **2**.

X'2008' – No Begin Bracket

A request carrying Begin Bracket was received after a BIS request.

X'2009' – Session Control Protocol Violation (Encrypt/Decrypt feature)

An FMD request was received prior to a valid CRV on a Crypto session. SDT was already received and accepted.

X'200A' – Immediate Request Mode Error

A normal flow request was received before the response was sent to a chain that requested definite response.

X'200B' – Queued Response Indicator (QRI) Error

The QRI bit value was different for the middle or last-in-chain FMD request than for the first-in-chain FMD request.

X'200E' – Response Correlation Error

- A positive FMD or LUSTAT response was received and one of the following occurred:
  - The session was between brackets
  - There was not an outstanding request
  - The sequence number of the response was incorrect.
- An RTR response was received and one of the following occurred:
  - There was not an outstanding request
  - The sequence number of the response did not match the sequence number of the outstanding request.
- A SIGNAL response was received when a SIGNAL request was not outstanding.

X'200F' – Response Protocol Error

- A positive FMD response was received when one of the following occurred:
  - Before the LIC request was sent
  - After a negative response to the chain was already received
  - In response to a chain or to a request that specified exception response.
- A positive LUSTAT response was received in response to a request that specified exception response.
- A negative FMD response was received after a negative response to the chain was already received.

X'2010' – BIS Protocol Error

- A second BIS request was received on the same session.
- A BIS reply was received.

X'2011' – Pacing Error
An outbound pacing overrun occurred.

X'2011 0000'
A normal flow request was received by a half session after the pacing count had been reduced to ***0***, and before a pacing response had been sent.

X'2011 0001' – Unexpected Isolated Pacing Message (IPM)
An IPM was received when the receiver was in a state that did not allow it.

X'2011 0002' – Unexpected Pacing Request Received
A request with the pacing indicator set was received when the receiver was in a state that did not allow it.

X'2011 0003' – Pacing Response Indicator Incorrectly Set
The pacing indicator was set in a non-IPM response that was received while adaptive pacing was being used.

X'2012' – Invalid Sense Code Received

- A negative BIS response was received.
- A negative RTR response was received with a sense code other than X'08190000'.
- A negative FMD or negative LUSTAT response was received with a sense code other than X'08460000' or X'088B0000'. (X'088B0000' is valid only if the corresponding request carried Begin Bracket.)

Request Error X'10'

X'1001' – RU Data Error (With Index)
Data in the Request RU is not acceptable to the 3174; for example, a character code is not in the set supported, a formatted data field is not acceptable to presentation services, a value specified in the length field (LL) of a structured field is invalid, a required name in the request has been omitted, or a CONFIRM verb was issued when the synchronization level of the conversation was "none."

Bytes 2 and 3 following the sense code may contain a 15-bit binary count that indicates the location of the first byte in the RU chain detected to be causing the error. The count (zero origin) begins at the start of the first RU, and continues until the error byte is detected. When the count is present, the high-order bit in byte 2 is set to ***1***.

Note: If the X'1001' error occurs during Local Format Storage processing, the *8xxx* qualifier in bytes 2 and 3 does not represent an accurate offset value and should be ignored.

If the data stream ends without containing sufficient data to process an SBA, SFE, RA, EUA, MF, or SA order, the value of B3B4 will be set to ***8001***.

A value of all zeroes in bytes 2 and 3 indicates that no additional information is specified.

X'1001' – RU Data Error
Data is not acceptable to the receiving transaction program. For example, a logical record was truncated, a logical record had an invalid length field, or a CONFIRM verb was issued by the remote transaction program.

X'1001 0003' – Isolated Pacing Message (IPM) Format Error
An incorrectly formatted IPM was received.

X'1002' – RU Length Error

- An RU was received that was greater than 4096 bytes in length (3174 Models 1L and 11L only).
- An RU was received that exceeded the maximum allowable length specified in the Bind.
- For LU Type 6.2 – An RU was received that was less than the minimum required length. For example, a DFC request with an RU length of 0, or a negative FMD response with an RU length < 4 bytes.

X'1002 0000'

- Incorrect RU length.
- The Topology Database Update (TDU) has an invalid length.

X'1003' – Function Not Supported

- Unsupported Session Control Request.
- Unsupported Data Flow Control Request.
- For LU Types 1, 2, and 3 – Signal Code is not X'00010000'.
- For LU Type 3 – Any Read, RM, or RMA command.

X'1003 0001' – Function Not Supported

- RTM Request and host RTM are not customized.
- A Network Services header was not NMVT or REQMS.

X'1003 000D'

The TDU General Data Stream (GDS) variable was not received by the TP program.

X'1003 000E'
through
X'1003 0017' – General Data Stream Error

X'1005' – Parameter Error

- For LU Type 1 – An incorrect SCS parameter was received.
- For LU Type 6.2:
  - A SIGNAL request did not have an extension value of X'0001'
  - An LUSTAT request did not have a status value of X'0006'.

X'1005 0001' – SNA Address List Incorrect

The Type Address field in the SNA Address List subvector is not equal to ***0***.

X'1005 0007' – General Data Stream Error

X'1007' – Category Not Supported

- A Network Control request or response was received.
- For LU Types 1 and 3 – An FMD request from the SSCP was directed to a printer.
- For LU Types 1, 2, and 3 – An unsupported FMD request was received.
- For LU Type 6.2 – A request was received from the SSCP.

X'1007 0001' – Invalid Network Service (NS) Header

An unsupported network service message was received.

X'1008' – Invalid FM Header (FMH)

- For LU Type 1 – An invalid FMH-1 was received.
- For LU Type 6.2:
  - An FMH with a type other than 5, 7, or 12 was received
  - An invalid FMH-5 or FMH-7 was received.

X'1009' – Format Group Not Selected

- A Present Absolute Format or Present Relative Format structured field was received prior to a Select Group structured field that activates a particular Group Name.
- A Present Absolute Format or Present Relative Format structured field was processed, but the selected Group Name was either not found or in error.

X'100B 0001'
through
X'1019 0003' – General Data Stream Error

The following sense codes that are included in this range have specific definitions:

X'1010 0000'

- Unrecoverable error on CP-CP session supported.
- CPCAPS length error.

X'1010 0004'

Unrecoverable error.

X'1010 1002'

An invalid General Data Stream (GDS) was received.

X'1010 4004'

- Incomplete negative or neutral reply.
- Reservation on broadcast.
- Search All on directed.

X'1010 5002'

A LOCATE request was received without cross domain initiate (CDINIT).

X'1010 5006'

Session polarity or initiate type is not supported.

X'1010 A002'

No FIND on search request.

X'1010 B080'

No Control Vector X'80' on FOUND.

X'1014 003C'

Missing Control Vector X'3C'.

X'1014 003D'

Missing Control Vector X'3D'.

X'1014 0080'
Invalid Control Vector.

X'1014 023C'
Conflicting directory entry.

X'1014 5046'
A cross domain initiate (CDINIT) was received from an end node without TG vectors.

X'1014 A082'
Missing FIND Control Vector X'82'.

X'1014 B280'
A wild card was received from ENCP.

X'1015 0000'
The length of the XID exceeds 255 bytes.

X'1015 0001'
The length of the XID is less than 29 bytes.

X'1015 0002'
The number of bytes in the length field of the XID3 is not the same as the actual length of the received XID3.

X'1016 0000'
The XID received was invalid or for a non-SNA link.

X'1016 0001'
The "MAX number of I-frames the sender can receive" is either zero or greater than 128 (invalid window size).

X'1016 0002'
TG number is not in the range of 0 to 239.

X'1016 0003'
The maximum BTU that the sender can receive is less than 265.

X'1016 0004'
The XID received was not XID3, and XID3 was expected.

X'1016 0007'
The XID indicates it is a Network Node, it does not support bind segmenting, and its Maximum I-Frame BTU is less than 521 bytes.

X'1016 0009'
The adjacent node supports CP-CP sessions, but does not provide CP-CP sessions.

X'1016 000D'
Different CP names were in the last two XIDs received, or the received CP name was not the same as the CP name in the LSB.

X'1016 000F'
Both the sender and the receiver are primary/secondary.

X'1016 0013'
The DLC type in the XID is not correct.

X'1016 0015'
Invalid support of bind pacing.

X'1016 001B'
The adjacent node provides CP-CP sessions, but does not support CP-CP sessions.

X'1016 001C'
An XID was received whose LINK STATION ROLE is reserved. The name is not the same as the CP name in the LSB.

X'101A nnmm'
Invalid Control Vector ordering in the Topology Database Update (TDU), where:
nn = Key of last Control Vector
mm = Key of current Control Vector that is out of order.

Request Reject X'08'

X'0801' – Resource Not Available

- For LU Type 1 – The outbound pacing algorithm is overrun.
- For LU Type 2 – A printer is not allowed by the authorization matrix.
- For LU Types 1 and 3 – Bind reject because the printer is authorized for local mode only.

X'0802' – Intervention Required (on principal device)

- For LU Type 2 – The security keylock is turned off.
- For LU Types 1 and 3 – A printer condition such as end of form, paper jam, printer cover up, or hold time out occurred.

X'0805' – Session Limit Exceeded
A Bind was received for an SLU that was already bound.

X'0806 0002'
CN or CP name error.

X'0806 002C'

- The 3174 received an XID that had a CP name that was the same as the 3174.
- The 3174 received an XID identified as a Network Node, but the 3174 recognized it as an End Node.
- The 3174 received an XID identified as an End Node, but the 3174 recognized it as a Network Node.

X'0807' – Subsidiary Device Temporarily Not Available
For LU Type 2 – No printer is available to service a host-initiated local copy request, or an operator has pressed the DEV CNCL key.

X'0807 9003'
Invalid Routing flags.

X'0809' – Requested Function Cannot Be Performed in the Current State of the Receiver
CRV received when a CRV had already been received.

X'0809 0039'
CPCAP protocol error.

X'0809 003C'
Out of sequence error.

X'0809 0040'
A mode setting command (SABME, SNRM, etc.) was either invalid for the receiving node or received but not expected.

X'0809 0041'
Both the sender and the receiver either support or do not support ABM.

X'0809 0049'
The received XID3 had a Control Vector X'22' appended.

X'0809 004B' – Function Out of Sequence
The requested function was out of sequence. For example, an Initiate Session request was received before the previous session was terminated.

X'0809 004C' – Mandatory Major Vector Out of Sequence

X'0809 004D' – Invalid Multiple Occurrence of Subvector

X'080A' – Permission Rejected
Display or printer power is off. The SSCP will not be notified when the device is switched on.

X'080C' – Procedure Not Supported
An unsupported REQMS type request was received.

X'080C 0002'
Invalid Major Vector length.

X'080C 0005' – Major Vector Not Supported
- NMVT major vector was not X'8080' (RTM) or X'8090' (Request PSID).
- Major Vector does not equal MS capabilities.

X'080C 0006' – Mandatory Subvector Not Included
A mandatory subvector was not included in the NMVT (X'92' for RTM, X'81' or X'83' for PSID).

X'080C 000A' – Address List Subvector Incorrect
The number of LTs in the SNA address list subvector was not equal to ***1***.

X'080C 000B'
through
X'080C 0011' – Function Not Supported
See "Appendix C" in the *3174 Central Site Customizing User* for more information.

X'080C 0161'
X'61' subvector is not present.

X'080F' – End User Not Authorized

- An FMH-12 was received.
- Random Data and/or Enciphered Data User Data subfields were present in the BIND request.
- A BIND request specified that the Access Security Information field will not be accepted on incoming FMH-5s and that the Already Verified Indicator will be accepted on incoming FMH-5s.

X'0811' – Break

Sent on LU Type 1 when the operator presses the printer Hold Print key followed by Cancel key, if a chain has not completed printing. (Not sent when LU Type 1 data stream is IPDS.)

X'0812 0000' – Insufficient Resources

- The 3174 has temporarily run out of resources.
- The 3174 canonical name directory is full. See "Appendix C" in the *3174 Central Site Customizing User* for more information.

X'0812 0007'

The LFSID table space in the 3174 is depleted. There may be a design error in the system initialization code that calculates the needed space, or a failure in the ASM code that deallocates empty tables.

X'0812 000D' – Link Buffer Space Depleted

- The 3174 has no space to receive unpaced Binds. If a Bind gets as far as the Address Space Manager (ASM), however, it is already in a link buffer. If this sense code is issued by ASM, it indicates failure of the microcode which logically transfers the bind buffer into a reserved pacing pool. The error will be in ASM or NBM components.

- If this sense code is present and the Bind request came from an adjacent node that paces Bind requests, it indicates that the adaptive pacing mechanism has been successful in controlling a large number of Bind requests. The "overcommit" limit in NBM may need to be adjusted. This sense code and status code may, however, be a reasonable response to a large number of Bind requests received from nodes that are not adaptively pacing Bind requests.

X'0812 0010'

- There are no resources to handle LOCATEs.
- Directory Services (DS) is out of resources.

X'0812 0014'

A BIND has been rejected due to an ISR resource depletion (session connector blocks). You have attempted to establish more concurrent ISR sessions than are allowable for the customized session support level (question 610).

X'0812 0016'

- The NETID table is out of entries.
- There are no resources for the new NETID during CP session activation.

X'0812 0018'

A BIND request cannot be forwarded to an adjacent node because 64,767 architected LFSIDs are already in use. The 3174 is not handling that many concurrent sessions on one link. Instead, a microcode failure probably occurred in the Address Space Manager (ASM) code, which frees and reassigns LFSIDs, or in the Session Connector Manager (SCM) or Session Manager (SM) components, which request LFSIDs to be freed.

X'0812 001A'

There is not enough storage to activate the link.

X'0813' – Bracket Bid Reject-(No RTR)

- Returned by LU Types 1 and 2 to a BID or Begin Bracket if the device has won contention and started a bracket.
- Returned by all LU types when a BID or Begin Bracket was received and INB state already exists. This may be a protocol error.

X'0814' – Bracket Bid Reject-(RTR to Follow)

- For LU Types 1 and 3 – The printer is busy doing local copy from a display. RTR will be returned when the printer becomes available.
- For LU Type 6.2 – Session is already in use. An RTR request will be returned when the session becomes available.

X'0815' – Function Already Active
A Bind request was received while the 3174 was waiting to receive an Unbind response.

X'0815 0003' – Insufficient Resource

- The queue of unprocessed RTM, PSID, REQMS, and CSCF requests has exceeded its limit.
- No SSCP-PU buffer available.
- No Presentation Space available.

X'0815 0007'
A CP-CP session is already enabled.

X'0819'
An RTR was received, but the 3174 has nothing to send.

X'081B' – Receiver in Transmit Mode

- The SLU is between brackets, but a data key has been pressed.
- An FMD message was received from the SSCP while the display was either owned by the PLU-SLU session or in test mode.
- An SSCP FMD message is rejected if local copy is taking place while the SSCP-SLU session owns the display.

X'081C' – Request Not Executable
The 3174 has a nonrecoverable error.

X'081D 0001' – Network/LUNAME Mismatch
See "Appendix C" in the *3174 Central Site Customizing User* for more information.

X'081D 0003'
A Duplicate CP name was detected.

X'0821' – Invalid Session Parameters
Master key value mismatch between the host and the controller.

X'0821 0002'
Mode not known.

X'0829' – Change Direction Required
A 3270 read-type command was received without a Change Direction or with an End Bracket.

X'082B' – Presentation Space Integrity Lost

- A temporary error has occurred; for example, parity check in device.
- An operator has cleared the display by switching to SSCP-SLU session or test mode, and has returned to PLU-SLU session.

X'082D' – SLU Busy

- For LU Type 2 – A display is either owned by SSCP-SLU session or is in test mode.
- For LU Type 2 – A display is busy doing an operator-initiated local copy.

X'082E' – Intervention Required at Subsidiary Device
For LU Type 2 – A printer being copied to, from a host-initiated print, has an intervention-required type error. Refer to X'0802'. A printer that is either switched off or not attached to the controller is included in this category.

X'082F' – Request Not Executable Because of LU Subsidiary Device
For LU Type 2 – A printer being copied to has a nonrecoverable error.

X'0831' – LU Component Disconnected
This response is returned if the device attached to the 3174 cannot be contacted by a device poll. This is due to device power off, cable detached from the controller port, or a broken connecting cable.

X'0835' – Invalid Parameter (With Index)
A Bind request contained parameters that are invalid or not supported by the 3174. Bytes 2 and 3 contain a 2 byte binary count that indexes (zero origin) the first byte of the request found to have invalid contents.

X'0835 0005' – Invalid PRID Value
The NMVT request from the host contained an invalid PRID value of X'0000'.

X'0838 0000'
through
X'0838 0016'
See "Appendix C" in the *3174 Central Site Customizing User* for CSCM-related codes. See the *SNA Formats Reference Summary*, GA27-3136, for architecture-related codes.

X'083B' Invalid Fully Qualified Procedure ID (FQPCID)
A Bind was received with an FQPCID that duplicated the FQPCID assigned to another session.

X'083E 0004'
The Implementation retry limit was exceeded.

X'0840 0007'
Resource not found.

X'0843' – Required Function Manager Synchronization Not Supplied
For LU Types 2 and 3 – Chains having the print bit on in the Write Control Character (WCC) must be definite response or exception response with CD.

X'0845' – Permission Rejected
Display or printer power is off. The SSCP will be notified when the device is switched on.

X'0846' – ERP Message Forthcoming
The received request was rejected. The reason will be specified in a forthcoming FMH-7.

X'084B' – Requested Resources Not Available-Transaction Program (TP) Not Available, Retry Allowed

- The requested TP is already in conversation. Retry user action.
- The requested TP has been temporarily disabled by the 3174, pending completion of a SNA Distribution Services (SNADS) transaction. Retry user action.

X'084C' – Permanent Insufficient Resource

- For LU Type 6.2 – 3174 hardware or microcode failure.
- For LU Types 1, 2, and 3 – The 3174 cannot act on the request because resources required to honor the request are permanently unavailable. The sender should not retry immediately because the situation is not transient. Bytes 2 and 3 following the sense code may contain a 15-bit binary count that indicates the location of the first byte in the chain detected to be causing the error. The count (zero origin) is begun at the start of the first RU, and continues through concatenated RUs until the error byte is detected. When the count is present, the high-order bit in byte 2 is set to ***1***. A value of all zeroes in bytes 2 and 3 indicates that no additional information is specified or that the resource was not explicitly defined in the request.

X'084C 0002'
through
X'0851'
See "Appendix C" in the *3174 Central Site Customizing User* for CSCM-related codes. See the *SNA Formats Reference Summary*, GA27-3136, for architecture-related codes.

X'0852' – Duplicate Session Activation Request
A Bind was received that contained a session ID that duplicated the session ID assigned to another session.

X'0852 0001'
through
X'085D 0005'
See "Appendix C" in the *3174 Central Site Customizing User* for CSCM-related codes. See the *SNA Formats Reference Summary*, GA27-3136, for architecture-related codes.

X'0861 0002'
Invalid Class of Service (COS) name.

X'0863' – Referenced Local Character Set Identifier (LCID) Not Found
The character set referred to does not exist. Bytes 2 and 3 following the sense code will contain a 15-bit binary count that indexes (zero origin) the first byte of the RU chain identifying the character set. The high-order bit in byte 2 is set to ***1***.

X'0864' – Function Abort
A Transaction Program detected an error and has issued a DEALLOCATE_ABEND verb.

X'0868' – No Formats Loaded
The 3174 has received a Present Absolute Format or Present Relative Format structured field, but no formats have been loaded into controller storage.

X'0869' – Format Not Found
A Present Absolute Format or Present Relative Format structured field has been received requesting a format name that was not previously loaded into controller storage.

X'086C nn00' – Subvector nn Not Included
Subvector nn was specified as being present in this request, but was not included.

X'086C 0100' – Invalid Subvector
The first subvector was not a function-type subvector.

X'086C 2100'
X'21' Subvector is not present.

X'086C 2B00'
Bind without Route Selection Control Vector (RSCV) from network node.

X'086C 2C00'
Bind without COS/TPF vector.

X'086C 8100'
Required subvector missing: Origin subvector.

X'086C 8200'
Required subvector missing: Destination subvector.

X'086C 9000'
Required subvector missing: Routing flags.

X'086D nnmm' – Required Subfield Missing
Subfield mm was missing from subvector nn.

X'086D 4680'
The Route Selection Control Vector (RSCV) contains Control Vector X'46' without a Control Vector X'80'.

X'086D 8101'
Required Subfield missing: Origin NETID.

X'086D 8102'
Required Subfield missing: Origin NAU.

X'086D 8103'
Required Subfield missing: Origin Application.

X'086D 8201'
Required Subfield missing: Destination NETID.

X'086D 8202'
Required Subfield missing: Destination NAU.

X'086D 8203'
Required Subfield missing: Destination Application.

X'086F 0001' – Length Error
The length of the NMVT major vector was incorrect for the RU length.

X'086F 0002' – Length Error

- The length of the NMVT request subvector was less than the minimum required for this subvector.
- Invalid Routing Length.

X'086F nn05' – Length Error
The length of NMVT subvector nn was either incorrect or contained an invalid range.

X'086F nn06' – Subfield Length Error
The length of subfield nn was invalid.

X'086F 8103'
Invalid Subvector length: X'81' SV.

X'086F 8106'
Invalid Subfield Length: X'81' SV.

X'086F 8203'
Invalid Subvector length: X'82' SV.

X'086F 8206'
Invalid Subfield Length: X'82' SV.

X'0870 9002'
Unknown MDS message type.

X'0870 9404' – Boundary Not Included
Change of boundaries was specified, but the boundaries were not included in the request.

X'0870 9408' – New Definition Invalid
The new definition was outside the valid range (1–4).

X'0870 9409' – Time Measurement Not Zero (100 ms)

X'0870 9410' – Number of Boundaries Invalid
The number of boundaries specified was not within the valid range (1–4).

X'0870 94nn' – Boundaries Out of Sequence
Where *nn* is the displacement of the boundary that was not in ascending order.

X'0870 nnxx' – Invalid Panel ID
Subvector nn contained an invalid Panel ID. xx represents the 1 byte binary count that indexes the first byte in which the invalid value falls. Indexing is zero origin from the beginning of the subvector.

X'0871' – Read State Error

X'0872 0001' – Parameter Not Set
See "Appendix C" in the *3174 Central Site Customizing User* for more information.

X'0879 0001' – Disk Error
See "Appendix C" in the *3174 Central Site Customizing User* for more information.

X'0879 0002' – Disk Error
See "Appendix C" in the *3174 Central Site Customizing User* for more information.

X'087A' – Format Processing Error
An error occurred during the processing of a Present Absolute Format or Present Relative Format structured field.

X'0889' – Transaction Program Processing Error
A Transaction Program detected an error and has issued a SEND_ERROR verb.

X'088C 0E00'
Control Vector X'0E' was missing when it was required.

X'088C 4400'
Control Vector X'44' was not received in correct order on the Topology Database Update (TDU).

X'088C 4580'
Control Vector X'4580' was not received in the Topology Database Update (TDU).

X'088C 4680'
Control Vector X'4680' was not received in the Topology Database Update (TDU).

X'088C 8000'
Control Vector X'80' was not received in the correct order on the Topology Database Update (TDU).

X'0890 0010'
Routing error during directed search. The link from this node to the next node is not active, or the CP-CP from this node to the next node is not enabled.

X'0890 0022'
Invalid Control Vector X'0E'.

X'0890 0048'
Neutral reply from ENCP.

X'0890 0080'
Duplicate Fully Qualified Procedure Correlation Identifier (FQPCID) on search.

X'0891 0000'
The Netid.CP Name is not fully qualified.

X'0891 0004'
- An invalid resource name was received during CP session activation.
- The NETID is greater than eight characters.

X'0891 0005'
The CP name is greater than eight characters.

X'0895 0000' – Control Vector Length Error:
- The Control Vector X'0E' length is 0.
- The Control Vector X'11' length is less than 1.
- An invalid Control Vector length was received on the CP session.

X'0897 0000'
The link is defined as Type 2.1 and Type 2.0, but has come up 2.0 only.

X'0897 000D'
Invalid resource type.

X'0897 0011'

- The End Node does not support LOCATE.
- A CP session was requested by an End Node that does not support the LOCATE function.

X'089A 0001'
through
X'08A0 0003'
See "Appendix C" in the *3174 Central Site Customizing User* for CSCM-related codes. See the *SNA Formats Reference Summary*, GA27-3136, for architecture-related codes.

X'08A0 0004'
Reversed FRSN values in Topology Database Update (TDU).

X'08A0 0005'
The Topology Database Update (TDU) was sent out of order.

X'08A0 0006'
FRSN error on CPCAPS exchange.

X'08A0 0007'
through
X'08A4 0002'
See "Appendix C" in the *3174 Central Site Customizing User* for CSCM-related codes. See the *SNA Formats Reference Summary*, GA27-3136, for architecture-related codes.

X'08A8 0001'
Unknown Destination name.

X'08A8 0003'
Unknown Application name.

X'08A8 0004'
The Mode Name does not equal SNASVCMG.

X'08AA 1310'
The General Data Stream (GDS) is not a MDS_MU.

X'08AA 1311'
Missing Routing Information General Data Stream (GDS).

X'08AA 1549'
Missing UOW General Data Stream (GDS).

X'FFFF 0002'
Extra reply on search.

X'FFFF 0006'
Cannot delete entry for node.

List of Abbreviations

A

A. (1) Ampere. (2) Angstrom.

ACF/VTAM. Advanced Communications Function for the Virtual Telecommunications Access Method.

ACK. Acknowledge.

ACTLU. Activate Logical Unit.

ACTPU. Activate Physical Unit.

AEA. Asynchronous Emulation Adapter.

AID. Attention identifier.

ALS. Adjacent link station.

Alt. Alternate.

A/N. Alphanumeric.

APAR. Authorized program analysis report.

APL. A Programming Language.

APPN. Advanced peer-to-peer networking.

ASCII. American National Standard Code for Information Interchange.

ASM. Address space manager.

ATTN. Attention.

B

B. Busy.

BB. Begin bracket.

BCC. Block-check character.

BDY. Boundary.

BETB. Between-bracket state.

BF. Boundary function.

BIS. Bracket initiation stopped.

BIU. Basic information unit.

BOC. Bus-out check.

bps. Bits per second.

BSC. Binary synchronous communication.

Btu. British thermal unit.

BTU. Basic transmission unit.

C

C. Celsius.

CA. Character attributes.

C&D. Cause and diagnostic (codes)

CAW. Channel address word.

CBA. Current buffer address.

CC. (1) Control check. (2) Chain Command (flag).

CCA. Concurrent Communication Adapter.

CCC. Copy control character.

CCITT. International Telegraph and Telephone Consultative Committee.

CCW. Channel command word.

CD. Change direction.

CE. (1) IBM Customer Engineer. (2) Correctable error. (3) Channel-end.

CECP. Country extended code page.

CGCSGID. Coded graphic character set global identifier.

ChgSc. Change screen.

CICS. Customer Information Control System.

CID. Connection identifier.

cncl. Cancel.

comm. Communication.

cont. Continuous.

COS. Class of service.

CP. Control point.

cps. Characters per second.

CPS. Call Progress Signal.

CR. (1) Command Reject. (2) Carriage return.

CRC. Cyclic redundancy check.

CRS. Configuration reporting server.

CRV. Cryptography Verification.

CS. Configuration services

CSCF. Central Site Control Facility.

CSCM. Central Site Change Management.

CSW. Channel status word.

ctr. Counter.

CU. Control unit.

CUE. Control Unit End.

CUG. Closed user group.

Cursr Sel. Cursor select.

CUT. Control unit terminal.

CV. Control Vector

D

D. Display.

DACTLU. Deactivate logical unit.

DACTPU. Deactivate physical unit.

DAF'. Destination address field prime

DASD. Direct access storage device.

dB. Decibel.

DB. (1) Data base. (2) Device Busy.

DC. (1) Data communication. (2) Direct current. (3) Data check.

DCE. Data circuit-terminating equipment.

DE. Device-end.

dec. Decimal.

DEL. The delete character.

dev. Device.

Dev Cncl. Device Cancel.

DFC. Data flow control.

DFT. (1) Distributed function terminal. (2) Diagnostic function test.

DFT – E. Distributed function terminal – extended.

DISC. Disconnect.

DLC. (1) Data link control. (2) Data length check.

DLE. Data link escape.

DLU. Destination logical unit.

DM. (1) Disconnect mode. (2) Distribution Manager.

DOID. Destination/origin ID.

DR. Definite response.

DS. Directory services.

DSC. Data stream compatibility.

DSL. (1) Downstream load. (2) Data set label.

DSPU. Downstream physical unit.

DTE. Data terminal equipment.

E

EAB. Extended Attribute Buffer.

EAU. Erase All Unprotected.

EB. End bracket.

EBCDIC. Extended Binary-Coded Decimal Interchange Code.

EC. Engineering change.

ECSA. Extended Character Set Adapter.

EFI. Expedited flow indicator.

EIA. Electronic Industries Association.

EM. End of message.

EN. End node.

ENCP. End node control point.

ENP. Enable Presentation.

ENQ. Enquiry.

EOF. End of field.

EOI. End of Inquiry.

EOR. End of Record.

EOT. End-of-transmission character.

EPC. Early Print Complete.

ERI. Exception response indicator.

ERP. Error recovery procedures.

ESC. Escape.

ESCON. Enterprise Systems Connection.

ETB. End-of-transmission-block character.

ETX. End of Text.

EUA. Erase Unprotected to Address.

EVPD. Extended Vital Product Data.

F

F. Fahrenheit.

FA. Field attribute.

FCS. Frame check sequence.

FF. Form Feed.

FID. Format identification.

FM. (1) Frequency modulation. (2) Function management. (3) Field mark.

FMD. (1) Function management data. (2) Field macro diagram.

FMH. Function management header.

FP. (1) Faceplate. (2) Focal point.

FQPCID. Fully qualified procedure correlator identifier.

FRMR. Frame reject response.

FRU. Field-replaceable unit.

G

GDS. General data stream.

GE. Graphic escape.

H

H. Height.

HAP. Host addressable printer.

hex. Hexadecimal.

HG. Hardware group.

HNAD. Host network (DTE) address.

HT. Horizontal Tab.

I

I. Information (format).

IC. Insert Cursor.

ID. (1) Identification. (2) Identifier.

Ident. Identification.

IML. Initial microcode load.

in. Inch (or inches).

INOP. Inbound operation.

INPID. Inbound partition identity.

I/O. Input/output.

IOPT. Incoming call option.

IPDS. Intelligent Printer Data Stream.

IPM. Isolated pacing message.

IPR. Isolated pacing response.

IR. Intervention Required.

IRS. Interrecord-separator character.

ISO. International Organization for Standardization.

ISDN. Integrated Services Digital Network.

ISR. Intermediate session routing

ITB. End of intermediate transmission block.

K

k. 1000.

K. 1024.

KDU. Keyboard Definition Utility.

L

L. Left.

LAN. Local area network.

LAPB. Link access procedure balanced.

LBS. LAN bridge server.

LCID. Logical channel identifier.

LEN. Low-entry networking.

LF. Line feed.

LFS. Local Format Storage.

LFSID. Local-form session identifier.

LH. Link header.

LIC. Last in chain.

LLC. Logical link control.

LRC. Longitudinal redundancy check.

LRM. LAN reporting mechanism

LT. Logical terminal.

LTA. Logical terminal assignment.

LTTI. Last transaction time indicator.

LU. Logical unit.

LUSTAT. Logical unit status.

LU/SSCP. Logical unit/system services control point.

M

m. Meter (or meters).

MAC. (1) Medium access control. (2) Message authentication code.

MAP. Maintenance analysis procedure.

max. Maximum.

Mbps. Megabits per second.

MDT. Modified data tag.

MF. Modify field.

MHS. Magnetic hand scanner.

min. (1) Minimum. (2) Minute.

MIS. Multiple interactive sessions.

MLT. Multiple Logical Terminals.

mm. Millimeter (or millimeters).

modem. Modulator-demodulator.

MPF. Mapping field.

MPP. Maximum print position.

MS. Management services.

MSR. Magnetic stripe reader.

MU. Message unit.

MVID. Major vector identifier.

MVS. Multiple virtual storage.

N

NAK. Negative acknowledge.

NAU. (1) Network accessible unit. (2) Network addressable unit.

NAUN. Nearest active upstream neighbor.

NCCF. Network Communications Control Facility.

NCP. Network Control Program.

NETID. Network identifier.

NI. Not initialized.

NL. New Line.

NLDM. Network Logical Data Manager.

NMPF. Network Management Productivity Facility.

NMVT. Network Management Vector Transport.

NN. Network node.

NNCP. Network node control point.

No. Number.

NOP. No operation.

NPDA. Network Problem Determination Application.

NPKT. Negotiated packet size.

NS. Nonsequenced (format).

NTRI. NCP Token-Ring Interconnection.

NTT. Nippon Telephone and Telegraph.

NUM. Numeric.

NWND. Negotiated window size.

O

OAF′. Origin address field prime.

OC. Operation Check.

ODAI. Origin-Destination Assignor indicator.

OEM. Original equipment manufacturer.

OIA. Operator information area.

OLU. Origin logical unit.

OOPT. Outgoing call option.

P

P. (1) Printer. (2) Protected.

PA. (1) Program access. (2) Program attention.

PAM. Printer authorization matrix.

PC. (1) Path control. (2) Personal computer.

pF. Picofarad.

PF. Program function.

PID. Product-set ID.

PIU. Path information unit.

PLU. Primary logical unit.

PN. Port number.

P/N. Part number.

PRID. Procedure-related identifier.

PS. Programmed symbols.

PSID. Product set identification.

PT. Program Tab.

PU. Physical unit.

PUID. Physical unit identification.

PVC. Permanent virtual circuit.

Q

QA. Qualifier.

QLLC. Qualified logical link control.

QRI. Queued response indicator.

QSM. Qualified set mode.

R

R. (1) Rear. (2) row. (3) riser.

RA. Repeat to Address.

RAM. Random access memory.

RB. Read Buffer.

RBP. Read Buffer from Position.

RCV. Receive.

Rd Mod. Read Modified.

RECFMS. Record Formatted Maintenance Statistics.

rel. Relative.

REM. Ring error monitor.

Req. Request.

REQMS. Request Maintenance Statistics.

resp. Response.

RH. Request/response header.

RI. (1) Ring In. (2) Ring Indicate.

RM. Read Modified.

RMP. Read Modified from Position.

RNR. (1) Request not ready. (2) receive not ready.

ROS. Read-only storage.

RPOA. Recognized Private Operating Agency.

RPQ. Request for price quotation.

RPS. Ring parameter server.

RR. (1) Receive ready. (2) Request ready.

R/R. Request/response.

RSCV. Route selection control vector.

RSP. Response.

RSS. (1) Reverse start sentinel. (2) Route selection services.

RTI. Response type indicator.

RTM. Response Time Monitor.

RTR. Ready to receive.

RU. Request/response unit.

RVI. Reverse interrupt.

RWS. Read/write storage.

S

S. Sequenced (format), side.

SA. Selection addressing.

SABME. Set Asynchronous Balance Mode Extended (command).

SAP. Service access point.

SBA. Set Buffer Address.

SC. Status code.

SCS. SNA character string.

SDLC. Synchronous Data Link Control.

SDT. Start data traffic.

SF. (1) Special feature. (2) Specify feature. (3) Start field.

SFE. Start Field Extended.

SHF. Set Horizontal Format.

SHM. Short-hold mode.

SLI. Suppress length indication.

SLU. Secondary logical unit.

SM. Status modifier.

SNA. Systems Network Architecture.

SNBU. Switched network backup.

SNF. Sequence number field.

SNRM. Set Normal Response Mode.

SOEMI. Serial Original Equipment Manufacturer Interface.

SOH. Start-of-heading character.

SOR. Start of record.

SP. (1) Space. (2) Specific Poll.

SPC. Set Printer Characteristics.

SPD. Selector pen detect.

SRM. Set Reply Mode.

SS. (1) Session services. (2) Surge suppressor.

SSCP. System services control point.

SSR. Secure string record.

STX. Start of text.

SUB. Substitute.

SVC. Switched virtual circuit.

SVF. Set Vertical Format.

SVID. Subvector identifier.

SYN. Synchronous idle.

SYSGEN. System generation.

T

TCLS. Throughput class negotiation.

TCU. Transmission control unit.

TDU. Topology Data base Update.

TG. Transmission group.

TH. Transmission header.

TMA. Terminal Multiplexer Adapter.

TP. (1) Teleprocessing. (2) Transaction program.

TRS. Topology and routing services.

TS. Transmission services.

TTD. Temporary text delay.

U

U. Unprotected.

UA. Unnumbered acknowledgment.

UC. Unit check.

UDT. User defined terminal tables.

UE. Unit exception.

unsol. Unsolicited.

U.S. United States.

US. (1) Unit specify. (2) Unit separator.

V

V. Volt.

VFC. Vertical forms control.

VM. Virtual machine.

VPD. Vital Product Data.

VTAM. Virtual Telecommunications Access Method.

W

WACK. Wait before transmit positive acknowledgement.

WCC. Write control character.

WE. Western Electric.

WRT. Write.

WSF. Write Structured Field.

X

X.25. Packet-switched networks.

XID. Exchange identification.

Glossary

A

access method. A technique for moving data between main storage and input/output devices.

access priority. The maximum priority that a token can have for the adapter to use it for transmission.

access procedure. The procedure or protocol used to gain access to a shared resource. In a LAN, a shared resource is the medium. Some medium access procedures specified by the IEEE 802 standards are carrier sense multiple access with collision detection (CSMA/CD), token bus, and token ring.

access unit. A unit that allows multiple attaching devices access to a token-ring network at a central point such as a wiring closet or in an open work area.

acknowledgment. The transmission, by a receiver, of acknowledge characters as an affirmative response to a sender.

active. (1) Able to communicate on the network. A token-ring network adapter is active if it is able to transmit and receive on the network. (2) Operational. (3) Pertaining to a node or device that is connected or is available for connection to another node or device. (4) Currently transmitting or receiving.

active logical terminal (LT). In MLT, the currently displayed logical terminal. Synonymous with *foreground logical terminal.* Contrast with *background logical terminal.*

active monitor. A function in a single adapter on a ring network that initiates the transmission of tokens and provides token error recovery facilities. Any active adapter on the ring has the ability to provide the active monitor function if the current active monitor fails.

adapter. (1) A general term for a device that provides some transitional function between two or more devices. (2) In a local area network, within a communicating device, a circuit card with its associated software that enables the device to communicate over the network.

adaptive session-level pacing. A form of session-level pacing in which session components exchange pacing windows that may vary in size during the course of a session. This allows transmission within a network to adapt dynamically to variations in availability and demand of buffers on a session-by-session basis. Session-level pacing occurs within independent stages along the session path according to local congestion at the intermediate nodes.

address. (1) A value that identifies a register, a particular part of storage, a data source, or a data sink. The value is represented by one or more characters. (2) To refer to a device or an item of data by its address. (3) In word processing, the location, identified by an address code, of a specific section of the recording medium or storage. (4) The location in the storage of a computer where data is stored. (5) In data communication, the unique code assigned to each device or workstation connected to a network.

address space. A set of addresses used to uniquely identify network accessible units, sessions, adjacent link stations, and links in a node for each network in which the node participates. A type 2.1 node has one address space for intranode routing and one for each transmission group on which it can send message units.

address space manager (ASM). A component in a type 2.1 node that assigns and frees session addresses.

adjacent link station (ALS). With respect to a specific node, a link station partner in an adjacent node.

advanced peer-to-peer networking (APPN). An extension to SNA featuring (a) greater distributed network control that avoids critical hierarchical dependencies, thereby isolating the effects of single points of failure; (b) dynamic exchange of network topology information to foster ease of connection and reconfiguration, adaptive route selection, and simplified network definition; and (c) automated resource registration and directory lookup. APPN extends the LU 6.2 peer orientation for end-user services to network control; APPN also uses LU 6.2 protocols on its own control point sessions that provide the network control.

advanced peer-to-peer networking (APPN) end node. A type 2.1 end node that provides full SNA end-user services and supports sessions between its local control point (CP) and the CP in an adjacent network node, to dynamically register its resources with the adjacent CP (its network node server), to send and receive directory search requests, and to obtain management services; it can also attach to a subarea network as a peripheral node.

Advanced peer-to-peer networking (APPN) network. A type 2.1 network having at least one APPN node.

Advanced peer-to-peer networking (APPN) network node. A type 2.1 node that besides offering full SNA end-user services, provides intermediate routing services within a T2.1 network, and network services to its local LUs and attached T2.1 end nodes in its domain;

it can also attach to a subarea network as a peripheral node.

AEA. See *Asynchronous Emulation Adapter*.

AEA port. A communication connector on the Asynchronous Emulation Adapter (AEA).

AEA port set. (1) One or more 3174 ports that support individual AEA station sets; they must have the same port (connection) type and modem type, but different station types. (2) One or more 3174 station sets that have different station types, but the same port type, modem type, and number of default destinations.

Alert. A message sent to a management services focal point in a network to identify a problem or an impending problem.

alternate cursor. (1) An image reversal of each dot in the character cell at the cursor position. (2) A cursor other than the one displayed on the display surface at power on time.

American National Standard Code for Information Interchange (ASCII). The standard code, using a coded character set consisting of 7-bit coded characters (8 bits including parity check), used for information interchange among data processing systems, data communication systems, and associated equipment. The ASCII set consists of control characters and graphics characters.

APAR. Authorized program analysis report. A report of a problem caused by a suspected defect in a current unaltered release of a program.

application. (1) The use to which an information processing system is put, for example, a payroll application, an airline reservation application, or a network application. (2) A collection of software components used to perform specific types of work on a computer.

application program. (1) A program written for or by a user that applies to the user's work. Some application programs receive support and services from a special kind of application program called a network application program. (2) A program used to connect and communicate with stations in a network, enabling users to perform application-oriented activities.

APPN end node. See *advanced peer-to peer networking (APPN) end node*.

APPN intermediate routing. The capability of an APPN network node to accept traffic from one adjacent node and pass it on to another, with awareness of session affinities in controlling traffic flow and outage notifications.

APPN network node. See *advanced peer-to peer networking network node*

ASCII emulation. The ability of a 3270 display station or printer to communicate with an ASCII host using the DEC VT100, DEC VT220, Data General D210, or IBM 3101 data stream.

asynchronous. (1) Pertaining to two or more processes that do not depend upon the occurrence of a specific event such as a common timing signal. (2) In Fiber Distributed Data Interface (FDDI) rings, a type of data traffic that does not need bounded access delay to the medium and guaranteed throughput.

Asynchronous Emulation Adapter (AEA). In the 3174, an adapter that enables an ASCII terminal to communicate with a 3270 host using the 3270 data stream, an ASCII terminal to communicate with an ASCII host through the 3174, and a 3270 terminal to communicate with an ASCII host using data streams, such as the DEC VT100, DEC VT220, Data General D210, or IBM 3101 data streams.

attach. To make a device part of a network logically.

attention (ATTN). An occurrence external to an operation that could cause an interruption of the operation.

attention field. In the 3270 Information Display System, a detectable field in which the designator character is a null, a space, or an ampersand.

attention identifier (AID). (1) A code in the inbound 3270 data stream that identifies the source or type of data that follows. (2) A character in a data stream indicating that the user has pressed a key, such as ENTER, that requests an action by the system.

attention interruption. An I/O interruption caused by a terminal's user pressing an attention key, or its equivalent. See also *simulated attention.*

attribute. (1) A characteristic. (2) A terminal display language or transformation definition language (TDL) keyword that specifies a particular quality for the TDL object with which it is associated.

attribute type. In the 3270 data stream, a code that identifies the properties from which an associated set of attribute values can be selected. See also *extended color.*

attribute value. In the 3270 data stream, a code immediately following the attribute type that specifies a particular property from the set defined by the attribute type.

audible alarm. (1) An alarm that is sounded when designated events occur that require operator attention or intervention before system operation can continue.

(2) A special feature that sounds a short, audible tone automatically when a character is entered from the keyboard into the next-to-last character position on the screen. The tone can also be sounded under program control.

automatic answering (auto-answer). (1) Answering in which the called data terminal equipment (DTE) automatically responds to the calling signal.

Note: The call may be established whether or not the called DTE is attended.

(2) A machine feature that permits a station to respond without operator action to a call it receives over a switched line. See also *manual answering.* Contrast with *automatic calling.*

automatic calling (auto-call). (1) Calling in which the elements of the selection signal are entered into the data network contiguously at the full data signaling rate. (2) A machine feature that permits a station to initiate a connection with another station over a switched line without operator action. (3) See also *manual calling.* Contrast with *automatic answering.*

automatic polling (auto-poll). (1) A hardware feature of a telecommunications unit that processes a polling list, polling the terminals in order and handling negative responses to polling without interrupting the processing unit. At the end of the list, polling is automatically begun again at the beginning of the list. (2) See also *polling.*

auto-removal. The removal of a device from data-passing activity without human intervention. This action is accomplished by the adapter in the device, and can be initiated by a network management program.

automatic skip (auto-skip). After entry of a character into the last character position of an unprotected display field, automatic repositioning of the cursor from a protected and numeric field to the first character position of the next unprotected display field.

B

background logical terminal (LT). In MLT, any logical terminal that is not currently displayed. Contrast with *active logical terminal (LT).*

base color. The capability of displaying or printing all characters in a field, in one of four colors, on a color terminal by use of combinations of the field protection and the field intensify bits of the field attribute.

Base data set. A data set that contains only those characters contained in a country's base character set. A base character set may or may not be a subset of CECP.

basic information unit (BIU). The unit of data and control information that is passed between half-sessions. It consists of a request/response header followed by a request/response unit.

basic transmission unit (BTU). The unit of data and control information passed between path control components. A BTU can consist of one or more path information units (PIUs).

batch. A program or operation that is performed with little or no interaction between the user and the system. Contrast with *interactive.*

bidder session. The half-session defined at session activation as having to request and receive permission from the other half-session to begin a bracket. Synonym for *contention-loser session*. Contrast with *first-speaker session*.

beacon. (1) A frame sent by an adapter on a ring network indicating a serious ring problem, such as a broken cable. It contains the addresses of the beaconing station and its nearest active upstream neighbor (NAUN). (2) To send beacon frames continuously. An adapter is *beaconing* if it is sending such a frame.

beaconing. An error-indicating function of token-ring adapters that assists in locating a problem causing a hard error on a token-ring network.

binary synchronous communication (BSC). A form of telecommunication line control that uses a standard set of transmission control characters and control character sequences, for binary synchronous transmission of binary-coded data between stations. Contrast with *synchronous data link control (SDLC).*

bind command. A command used to start a session and to define the characteristics of that session. Contrast with *unbind command*.

bind pacing. A technique by which the address space manager (ASM) at one node controls the rate of transmission of Bind requests of a sending ASM at another node. Bind pacing can be used to prevent Bind standoff, in which each of two nodes has reserved most of its resources for sessions it is attempting to initiate through the other and thus rejects any Binds received from the other.

bits per second (bps). The rate at which bits are transmitted per second.

block-check character (BCC). (1) In cyclic redundancy checking, a character that is transmitted by the sender after each message block and is compared with a character computed by the receiver to determine if the transmission has been successful. (2) In binary synchronous communication (BSC), a transmission control character that is used to determine whether all of the bits transmitted are also received.

block matrix. The total array of dots that can be used to describe a graphic character for a 3270 display or printer.

boundary function (BF). (1) A capability of a subarea node to provide protocol support for attached peripheral nodes, such as: (a) interconnecting subarea path control and peripheral path control elements, (b) performing session sequence numbering for low-function peripheral nodes, and (c) providing session-level pacing support. (2) The component that provides these capabilities.

boundary node (BN). A subarea node with boundary function.

bracket. One or more chains of request units and their responses that are exchanged between two session partners and that represent a transaction between them. A bracket must be completed before another bracket can be started. Examples of brackets are data base inquiries/replies, update transactions, and remote job entry output sequences to workstations.

bracket protocol. A data flow control protocol in which exchanges between two session partners are achieved through the use of brackets, with one partner designated at session activation as the first speaker and the other as the bidder. The bracket protocol involves bracket initiation and termination rules.

bridge. (1) An attaching device that connects two LAN segments to allow the transfer of information from one LAN segment to the other. A bridge may connect the LAN segments directly by network adapters and software in a single device, or may connect network adapters in two separate devices through software and use of a telecommunications link between the two adapters. (2) A functional unit that connects two LANs that use the same logical link control (LLC) procedures but may use the same or different medium access control (MAC) procedures. Contrast with *gateway* and *router*.

bridge number. The identifier that distinguishes parallel bridges (that is, bridges spanning the same two rings).

broadcast. Simultaneous transmission of data to more than one destination.

broadcast search. The propagation of a search request, when the location of a resource is unknown to the requester, to all network nodes in an APPN network. Contrast with *directed Locate search*.

buffer. (1) A portion of storage used to hold input or output data temporarily. (2) A routine or storage used to compensate for a difference in data rate or time of occurrence of events, when transferring data from one device to another.

buffer address. The address of a location in the buffer.

burst. In data communication, a sequence of signals counted as one unit in accordance with some specific criterion or measure.

bus. (1) In a processor, a physical facility on which data is transferred to all destinations, but from which only addressed destinations may read in accordance with appropriate conventions. (2) A network configuration in which nodes are interconnected through a bidirectional transmission medium. (3) One or more conductors used for transmitting signals or power.

bypass. To eliminate an attaching device or an access unit from a ring network by allowing the data to flow in a path around it.

byte. (1) A string that consists of a number of bits, treated as a unit, and representing a character. (2) A binary character operated upon as a unit and usually shorter than a computer word. (3) A string that consists of a particular number of bits, usually 8, that is treated as a unit, and that represents a character. (4) A group of 8 adjacent binary digits that represent one extended binary-coded decimal interchange code (EBCDIC) character.

C

cache. An optional part of the directory data base, in network nodes where frequently used directory information may be stored to speed directory searches.

canonical name. In CSCM, a name used to identify 3174 data objects. This name is created according to Change Management Architecture rules.

card. In the 3174, a unit of electronic circuitry contained in a plastic casing (or cassette) and providing the controller with a specialized function, for example, a Terminal Adapter or an Encrypt/Decrypt Adapter.

CECP-capable device. A device that supports the Country Extended Code Page.

CECP character set. A collection of symbols in Character Set 697 required for CECP languages.

CECP data set. A data set that contains any CECP-unique graphic.

CECP-unique graphic. A graphic symbol that is in the CECP character set and not in the base character set.

Central site change management (CSCM). A function of the 3174 microcode that tracks the microcode for each controller in a network and, in conjunction with NetView DM, electronically distributes and retrieves microcode changes for each controller.

central site customizing. The process of tailoring the 3174 Licensed Internal Code for each controller in a network, at the central site.

chain. (1) A group of logically linked user data records processed by LU 6.2. (2) A group of request units delimited by begin-chain and end-chain. Responses are always single-unit chains.

change direction (CD). A data flow control function in which the sending logical unit stops sending requests, signals the receiving logical unit using the change direction indicator (in the request/response header of the last request), and prepares to receive requests.

channel. (1) A functional unit, controlled by a host computer, that handles the transfer of data between processor storage and local peripheral equipment. (2) A path along which signals can be sent. (3) The portion of a storage medium that is accessible to a given reading or writing station. (4) In broadband transmission, a designation of a frequency band 6 MHz wide.

channel-attached. Pertaining to attachment of devices directly by data channels (I/O channels) to a computer. Synonym for *local*. Contrast with *telecommunication-attached.*

channel command. An instruction that directs a data channel, control unit, or device to perform an operation or set of operations.

character attribute. The properties of a character with respect to its color, highlighting, and character set. See also *extended field attribute.*

character buffer. The read/write storage used by a partition for storing character or graphic data for display or printing on a terminal.

character mode. A mode in which input is treated as alphanumeric data, rather than graphic data.

character position. (1) A location on the screen at which one character can be displayed. (2) An addressed location in the buffer at which 1 character can be stored.

character set. (1) A defined collection of characters. (2) A group of characters used for a specific reason, for example, the set of characters a printer can print. (3) The collection of graphic characters required to support a specific language.

Class of service (COS). A designation of the transport network characteristics, such as route security, transmission priority, and bandwidth, needed for a particular session. The class of service is derived from a *mode name* specified in the Bind by the initiator of a session.

class-of-service (COS) database. A database maintained independently by each network node, and optionally by APPN end nodes. It contains one entry per class-of-service name; each database entry contains:

- A definition of the acceptable values for transmission group (TG) and node characteristics for routes described by that class-of-service name and the weight function to be used to compute the weights of nodes and TGs that meet the acceptable values
- The transmission priority to be used for traffic that flows on routes described by that class-of-service name.

cluster. A station that consists of a control unit (a cluster controller) and the terminals attached to it.

cluster control unit. Synonym for *cluster controller.*

cluster controller. A device that can control the input/output operations of more than one device connected to it. A cluster controller may be controlled by a program stored and executed in the unit, for example, the IBM 3174 Establishment Controller. Or, it may be entirely controlled by hardware, for example, the IBM 3272 Control Unit. See also *cluster* and *cluster controller node.* Synonymous with *cluster control unit.*

cluster controller node. A peripheral node that can control a variety of devices. See also *host node, Network Control Program (NCP) node,* and *terminal node.*

coaxial cable. A cable consisting of one conductor, usually a small copper tube or wire, within and insulated from another conductor of larger diameter, usually copper tubing or copper braid.

code page. An assignment of graphic characters and control function meanings to all code points.

code point. A 1-byte code representing one of 256 potential characters.

collision. (1) An unwanted condition that results from concurrent transmissions on a channel. (2) When a frame from a transmitting adapter encounters any other signal in its path (frame, noise, or another type of signal), the adapter stops transmitting and a collision is registered.

command. (1) A request for performance of an operation or execution of a program. (2) A character string from a source external to a system that represents a request for system action.

command retry. A channel and control unit procedure that causes a command to be retried without requiring an I/O interruption.

communication adapter. (1) A circuit card with associated software that enables a processor, controller, or other device to be connected to a network. (2) See *EIA communication adapter*, *V.35 communication adapter*, and *X.21 communication adapter.*

communication controller. (1) A device that directs the transmission of data over the data links of a network; its operation may be controlled by a program processed in a processor to which the controller is connected or by a program executed within the device. (2) A type of communication control unit whose operations are controlled by one or more programs stored and executed in the unit. It manages the details of line control and the routing of data through a network. (3) See also *cluster controller*, *communication controller node*, and *transmission control unit.*

communication controller node. A subarea node that does not contain a system services control point (SSCP).

communication link. Physical (hardware) link.

communication management host. In ACF/TCAM, the host in a communication management configuration that performs all network-control functions in the network except control of locally attached stations of data hosts.

component. (1) Hardware or software that is part of a functional unit. (2) A functional part of an operating system, for example, the scheduler or supervisor. (3) In systems with VSAM, a named, cataloged collection of stored records, such as the data component or index component of a key-sequenced file or alternate index. (4) In System/38 graphics, the representation of a data group on a chart. (5) See *terminal component* and *solid state component.*

Concurrent Communication Adapter (CCA). In the 3174, a communication adapter that, along with the necessary microcode, provides terminals attached to the 3174 the ability to concurrently access an additional 3270 host.

configuration. The arrangement of a computer system or network as defined by the nature, number, and chief characteristics of its functional units. More specifically, the term *configuration* may refer to a hardware configuration or a software configuration. See also *system configuration.*

configuration services (CS). One of the types of network services in a control point (SSCP, NNCP, ENCP, or PUCP). CS activates, deactivates, and records the status of physical units, links, and link stations.

connect phase. An optional phase of link activation during which initial communication is established. It includes "dialing" and "answering" on switched links and may include modem equalization. The connect phase is followed either by the optional prenegotiation phase or by the contact phase.

Connection Menu. A menu on the screen of a display station attached to the 3174, from which a user can select an available host.

connection network. A representation within an APPN network of a shared-access transport facility, such as a token-ring, that reduces the system-definition burden on each APPN end node attached to the facility. Each such node may represent its connectivity to the other, *real* nodes on the facility generically, by a single, *virtual* routing node, which each reports to its network node server in the APPN network. The report includes local signaling information needed by any partner wanting to contact it over the facility. The transport facility represented this way, and the assemblage of nodes using the same virtual routing node representation, are collectively referred to as a *connection network*. By matching references to the same virtual routing node during its route selection, the network node server passes the required DLC signaling information in the search reply to the node originating a session over the connection network.

connector. A means of establishing electrical flow.

contact phase. A phase of link activation during which negotiation-proceeding XID3s are exchanged between the connected link stations to establish the primary and secondary roles of the link stations, the TG number to be used, and other characteristics of the link, and during which the mode-setting command is sent and acknowledged after the primary and secondary roles are established. Link activation may consist only of the contact phase, or it may also have either a connect phase or a prenegotiation phase or both preceding the contact phase.

contention. In a session, a situation in which both NAUs attempt to initiate the same action at the same time, such as when both attempt to send data in a half-duplex protocol (half-duplex contention). At session initiation, one NAU is defined to be the contention winner; its action will take precedence when contention occurs. The contention loser must get explicit or implicit permission from the contention winner to begin its action.

contention-loser session. To a NAU, a session for which it was defined during session initiation to be the contention loser.

contention-winner session. To a NAU, a session for which it was defined during session initiation to be the contention winner.

control character. (1) A character whose occurrence in a particular context specifies a control function. (2) A character used to specify that a control unit is to perform a particular operation.

control codes. (1) Code points and their assigned control function meanings. (2) The hexadecimal values hex 00 through hex 3F, and hex FF in the 3270 data stream. ASCII control codes are the hexadecimal values hex 00 through hex 1F and 7F.

Control (CTL) disk. A customized diskette or fixed disk containing the microcode that describes a particular controller's attached terminals, and its method of attachment to the host.

Control (CTL) diskette. A customized diskette containing the microcode that describes a particular controller's attached terminals, and its method of attachment to the host.

control function. Synonym for *control operation.*

control operation. An action that affects the recording, processing, transmission, or interpretation of data; for example, starting or stopping a process, carriage return, font change, rewind, and end of transmission. Synonymous with *control function.*

control point (CP). (1) A component of a node that manages resources of that node and optionally provides services to other nodes in the network. Examples are a system services control point (SSCP) in a type 5 node, a physical unit control point (PUCP) in a type 4 node, a network node control point (NNCP) in a type 2.1 (T2.1) network node, and an end node control point (ENCP) in a T 2.1 end node. An SSCP and an NNCP can provide services to other nodes. (2) A component of a T 2.1 node that manages the resources of that node. If the T2.1 node is an APPN node, the CP is capable of engaging in CP-CP sessions with other APPN nodes. If the T2.1 node is a network node, the CP also provides services to adjacent end nodes in the T2.1 network.

control unit. A general term for any device that provides common functions for other devices or mechanisms. Synonym for controller.

control unit terminal (CUT). A terminal that relies on the 3174 to interpret the data stream. Examples are the 3178, 3179, 3278 Model 2, and 3279 Model S2A.

control unit terminal (CUT) mode. A host-interactive mode that enables an IBM 3270 Personal Computer customized in this mode to run only one session emulating a 3178, 3179, 3278 Model 2, or 3279 Model S2A.

control vector. One of a general class of RU substructures that has variable length, is carried within some enclosing structure, and has a one-byte key used as an identifier.

controller. A unit that controls input/output operations for one or more devices.

conversation. A logical connection between two transaction programs using an LU 6.2 session. Conversations are delimited by brackets to gain exclusive use of a session.

conversion. (1) In programming languages, the transformation between values that represent the same data item but belong to different data types. Information may be lost as a result of conversion because accuracy of data representation varies among different data types. (2) The process of changing from one method of data processing to another or from one data processing system to another. (3) The process of changing from one form of representation to another, for example, to change from decimal representation to binary representation.

copy control character (CCC). A character used in conjunction with the Copy command to specify the type of data to be copied.

copy operation. An operation that copies the contents of the buffer from one terminal to another terminal attached to the same controller.

core. (1) In a fiber optic cable, the central region of an optical fiber through which light is transmitted. (2) In a fiber optic cable, the central region of an optical fiber that has an index of refraction higher than the surrounding cladding material. See also *optical fiber*.

country extended code page (CECP). A function of the 3174 microcode that provides a code page containing additional code points beyond those available with Table 5A code pages. CECP is supported by a universal character set, Character Set 697, which contains 190 characters.

CP capabilities. The level of network services provided by the control point (CP) in an APPN end node or network node. CP capabilities information is exchanged during the activation of CP-CP sessions between two nodes.

CP-CP sessions. The parallel sessions between two control points, using LU 6.2 protocols and a mode name of CPSVCMG, on which network services requests and replies are exchanged. Each CP of a given pair has one contention-winner session and one contention-loser session with the other.

CP name. A network-qualified name of a control point (CP), consisting of a network ID qualifier identifying the network (or name space) to which the CP's node belongs, and a unique name within the scope of that network ID identifying the CP. Each T2.1 node has one CP name assigned to it at system-definition time. Within an APPN network, all network nodes share a common network ID. End nodes may have distinct network IDs; this allows them to connect into separate APPN networks and to manage their own name spaces independently of the rest of the network.

create. In 3174 central site customizing, to create a library member for a network controller, and store the customizing data for that library member on a Library diskette.

cursor. (1) A movable, visible mark used to indicate the position at which the next operation will occur on a display surface. (2) A unique symbol that identifies a character position in a screen display, usually the character position at which the next character to be entered from the keyboard will be displayed.

Customer Information Control System (CICS). An IBM licensed program that enables transactions entered at remote terminals to be processed concurrently by user-written application programs. It includes facilities for building, using, and maintaining data bases.

customization. Procedures that tailor the controller microcode to fit the various types of display stations and printers and the method of host attachment that a particular controller will handle.

cyclic redundancy check. A system of error checking performed at both the sending station and the receiving station after a block check character sequence has been accumulated.

D

data. (1) A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by human or automatic means. (2) Any representations such as characters or analog quantities to which meaning is or might be assigned.

data base. A set of data, part or the whole of another set of data, that consists of at least one file, and that is sufficient for a given purpose or for a given data processing system.

data chaining. In synchronous data link control (SDLC) data transmission, the chaining together of scattered segments of storage data to assemble a complete SDLC frame.

data circuit. (1) A pair of associated transmit and receive channels that provide a means of two-way data communication. (2) In SNA, see also *link connection.*

Notes:

1. Between data-switching exchanges, the data circuit may include data circuit-terminating equipment (DCE), depending on the type of interface used at the data-switching exchange.
2. Between a data station and a data-switching exchange or data concentrator, the data circuit includes the data-terminating equipment at the data station end. It may also include equipment similar to a DCE at the data-switching exchange or data-concentrator location.

data circuit-terminating equipment (DCE). In a data station, the equipment that provides the signal conversion and coding between the data terminal equipment (DTE) and the line.

Data Entry keyboard. A keyboard layout designed for data entry applications.

data flow control (DFC). In SNA, a request/response unit category used for requests and responses exchanged between the data flow control layer in one-half session and the data flow control layer in the session partner.

data flow control (DFC) layer. The layer within a half-session that controls whether the half-session can send, receive, or concurrently send and receive, request units (RUs); groups related RUs into RU chains; delimits transactions via the bracket protocol; controls the interlocking of requests and responses in accordance with control modes specified at session activation; generates sequence numbers; and correlates requests and responses.

data frame. See *frame.*

data host. In an ACF/TCAM communication management configuration, a host that is dedicated to processing applications and does not control network resources, except for its locally attached devices. See also *communication management host.*

data link. (1) Any physical link, such as a wire or a telephone circuit, that connects one or more remote terminals to a communication control unit, or connects one communication control unit with another. (2) The assembly of parts of two data terminal equipment (DTE) devices that are controlled by a link protocol, and the interconnecting data circuit, that enable data to be transferred from a data source to a data sink. (3) In SNA, see also *link.*

Note: A telecommunication line is only the physical medium of transmission. A data link includes the physical medium of transmission, the protocol, and associated devices and programs; it is both physical and logical.

data link control (DLC). The process responsible for performing communication over a link using a specific data link control protocol, such as SDLC or token ring.

data link control (DLC) layer. (1) In SNA or Open Systems Interconnection (OSI), the layer that schedules data transfer over a link between two nodes and performs error control for the link. Examples of DLC are synchronous data link control (SDLC) for serial-by-bit connection and DLC for the System/370 channel. (2) See *Systems Network Architecture (SNA)*. (3) See also *logical link control (LLC) sublayer*, *medium access control (MAC)*.

Note: The DLC layer is usually independent of the physical transport mechanism and ensures the integrity of data that reach the higher layers.

data link control (DLC) protocol. DLC protocol is used to send information onto and receive information from the network, exchange data, and control information with network higher level protocols and interfaces.

data packet. (1) At the interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE), a data unit used to transmit user data over a virtual circuit. (2) In an Open Systems Interconnection (OSI) network, a data unit passed between transport layer entities.

data stream. (1) All data transmitted through a data channel in a single read or write operation. (2) A continuous stream of data elements being transmitted, or intended for transmission, in character or binary-digit form, using a defined format. See also *data stream format*.

data stream format. In SNA, the format of the data elements (end-user data) in the request unit (RU). See also *3270 data stream* and *SNA character string (SCS)*.

data streaming. A protocol for transmitting data on a channel. In this protocol, the sender maintains the channel in a transmit state for an extended length of time.

data terminal equipment (DTE). (1) That part of a data station that serves as a data source, data receiver, or both. (2) Equipment that sends or receives data, or both.

data transfer. (1) The result of the transmission of data signals from any data source to a data receiver. (2) The movement, or copying, of data from one location and the storage of the data at another location.

decibel (dB). (1) One tenth of a bel. (2) A unit that expresses the ratio of two power levels on a logarithmic scale. (3) A unit for measuring relative power. The number of decibels is 10 times the logarithm (base 10) of the ratio of the measured power levels; if the measured levels are voltages (across the same or equal resistance), the number of decibels is 20 times the log of the ratio.

decode. (1) To convert data by reversing the effect of some previous encoding. (2) To interpret a code. Contrast with *encode*.

decrypt. To convert encrypted data into clear data. Contrast with *encrypt*.

default. Pertaining to an attribute, value, or option that is assumed when none is explicitly specified.

default destination. A destination for display stations and printers that is defined in AEA customization.

definite response 1. In VTAM, a response that indicates whether its associated message was successfully forwarded to its final destination (such as the display screen of an output device).

definite response 2. In VTAM, a response that indicates that the node sending the response has accepted recovery responsibility for the associated message.

delimiter. (1) A character used to indicate the beginning or end of a character string. (2) A bit pattern that defines the beginning or end of a frame or token on a LAN.

designator character. A character or space that immediately follows the field attribute character in a detectable field to denote either a selection field or an attention field. The designator character controls whether a detect on the field will or will not cause an attention. For a nonattention-producing field, the designator character also determines whether the modified data tag for the field is to be set or reset as a result of a selector-pen detect.

destination. Any point or location, such as a node, station, or a particular terminal, to which information is to be sent.

destination address. A code that identifies the location to which information is to be sent. Contrast with *origin address*.

detectable. An attribute of a display field.

device. (1) A mechanical, electrical, or electronic contrivance with a specific purpose. (2) An input/output unit such as a terminal, display, or printer.

device address. (1) The first subchannel address recognized by a channel-attached device. (2) In data communication, the identification of any device to which data can be sent or from which data can be received.

device driver. A program that provides a software interface for a device, such as a printer, keyboard, or adapter.

directed Locate search. A search request sent to a specific destination node known to contain a resource, such as a logical unit, to verify the continued presence of the resource at the destination node and to obtain the node's connectivity information for route calculation. Contrast with *broadcast search*.

directory. A database in an APPN node that lists names of resources (in particular, logical units) and records the CP name of the node where each resource is located.

directory services (DS). A component of an APPN node that maintains a directory and manages searches of that directory.

disk. A direct-access data storage medium, which may be either flexible (diskette) or hard (fixed disk).

diskette. A flexible magnetic disk enclosed in a protective container.

diskette drive. The mechanism used to seek, read, and write data on diskettes.

display field. (1) An area in the display buffer that contains a set of characters that can be manipulated or operated upon as a unit. (2) A group of consecutive characters (in the buffer) that starts with an attribute character (defining the characteristics of the field) and contains one or more alphanumeric characters. The field continues to, but does not include, the next attribute character.

display station. An input/output device containing a display screen and an attached keyboard that allows a user to send information to or receive information from the system.

distributed function terminal (DFT). A programmable terminal that can perform operations previously performed by the control unit. These terminals can interpret the 3270 data stream themselves. Examples are the IBM 3270 Personal Computer and the 3290 Information Panel.

distributed function terminal – extended (DFT – E). A distributed function terminal that can support a CUT interface and a DFT interface on the same controller port at the same time. An example is the IBM 3472 Model G Graphics Display Station.

distributed function terminal (DFT) mode. A host-interactive mode that enables an IBM 3270 Information Display System customized in this mode to run as many as four host sessions. The sessions can emulate a 3178, 3179, 3278 Model 2, or 3279 Model S2A.

dot. One point in a printer or display block matrix.

downstream. (1) In the direction of data flow or toward the destination of transmission. (2) From the processor toward an attached unit or end user. (3) Contrast with *upstream*.

downstream load (DSL). The capability of a distributed function terminal to receive its control program from the control unit to which it is attached. A disk containing the terminal's control program is loaded into the control unit.

downstream physical unit (DSPU). A controller or a workstation downstream from a gateway that is attached to a host.

drop. A cable that leads from a faceplate to the distribution panel in a wiring closet. When the IBM Cabling System is used with the IBM Token-Ring Network, a drop may form part of a lobe. See also *lobe.*

duplex. Pertaining to communication in which data can be sent and received at the same time. Synonymous with *full duplex*.

E

EBCDIC. Extended binary-coded decimal interchange code. A coded character set consisting of 8-bit coded characters.

EIA communication adapter. A communication adapter conforming to EIA standards that can combine and send information on two lines at speeds up to 19.2 kbps.

EIA 232D. An electrical interface defined by the Electronics Industries Association for establishing connections and controlling data flow between data terminal equipment and data communication equipment. The interface has been adapted to allow communication between DTEs.

emulate. To imitate one system with another, primarily by hardware, so that the imitating system accepts the same data, executes the same computer programs, and achieves the same results as the imitated computer system.

emulation. (1) The imitation of all or part of one system by another, primarily by hardware, so that the imitating system accepts the same data, executes the same programs, and achieves the same results as the imitated computer system. (2) The use of programming techniques and special machine features to permit a computing system to execute programs written for another system. (3) Imitation; for example, imitation of a computer or device. (4) See *terminal emulation*. (5) Contrast with *simulation*.

enabled. (1) On a LAN, pertaining to an adapter or device that is active, operational, and able to receive frames from the network. (2) Pertaining to a state of a processing unit that allows the occurrence of certain types of interruptions. (3) Pertaining to the state in which a transmission control unit or an audio response unit can accept incoming calls on a line.

encode. To convert data by the use of a code or a coded character set in such a manner that reconversion to the original form is possible. *Encode* is sometimes loosely used when complete reconversion is not possible. Contrast with *decode*.

encrypt. To scramble data or convert it, before transmission, to a secret code that masks the meaning of the data to any unauthorized recipient. Contrast with *decrypt*.

end node. A T2.1 node that supports sessions between its own control point (CP) and the CP in an adjacent network node, to dynamically register its resources with the adjacent CP, to send and receive directory search requests, and to obtain network services and management services.

envelope. (1) Information added to a frame or other message unit to allow it to be transmitted using a protocol other than the protocol in which the message unit originated. (2) To surround or enclose a message unit in information to allow the message unit to be transmitted using a protocol other than the protocol in which the message originated.

Erase All Unprotected (EAU) command. A 3270 data stream command that erases all unprotected fields and inserts nulls.

Erase Unprotected to Address (EUA) order. A data stream order that erases all unprotected character positions (inserts nulls) from the current buffer address up to, but not including, the specified stop address.

Enterprise Systems Connection Adapter (ESCON Adapter). In the 3174, this adapter allows the controller to communicate with an IBM S/390* host through an Enterprise Systems Connection Channel using optical fiber cable.

event. (1) An occurrence or happening. (2) An occurrence of significance to a task; for example the completion of an asynchronous operation, such as an input/output operation.

Exchange Identification (XID). A specific type of basic link unit that is used to convey node and link characteristics between adjacent nodes. XIDs are exchanged between link stations before and during link activation to establish and negotiate link and node characteristics, and after link activation to communicate changes in these characteristics.

extended attribute buffer (EAB). The buffer in which the extended field attributes are stored. Examples of extended field attributes are:

- Extended highlighting
- Color (blue, red, pink, green, turquoise, yellow, white)
- Character sets
- Transparency.

extended binary-coded decimal interchange code (EBCDIC). A coded character set consisting of 8-bit coded characters.

extended color. (1) A capability that allows color terminals to display or print fields or characters in colors using extended field and character attributes. (2) An attribute type in the extended field attribute and character attribute.

extended field attribute. Additional field definition to the field attribute that controls defining additional properties; for example, color, highlighting, character set, and field validation. The extended field attribute is altered by information passed in the Start Field Extended and Modify Field orders.

extended highlighting. (1) A function that provides blink, reverse video, and underscore for emphasizing fields or characters on devices supporting extended field attributes and character attributes. (2) An attribute type in the extended field attribute and character attribute. (3) An attribute passed between session partners in the Start Field Extended, Modify Field, and Set Attribute orders.

F

fault. An accidental condition that causes a functional unit to fail to perform its required function.

fault domain. (1) In IBM LAN problem determination, the portion of a network that is expected to be involved with an indicated error. (2) The segment of a token-ring network between a station and its nearest active upstream neighbor (NAUN).

feature. A part of an IBM product that may be ordered separately by the customer.

fiber. See *optical fiber*.

fiber optics. The branch of optical technology concerned with the transmission of radiant power through fibers made of transparent materials such as glass, fused silica, and plastic.

Notes:

1. Telecommunication applications of fiber optics use optical fibers. Either a single discrete fiber or a nonspatially aligned fiber bundle may be used for each information channel. Such fibers are often called *optical fibers* to differentiate them from fibers used in noncommunication applications.
2. Various industrial and medical applications use (typically high-loss) flexible fiber bundles in which individual fibers are spatially aligned, permitting optical relay of an image.
3. Some specialized industrial applications use rigid (fused) aligned fiber bundles for image transfer.

field. See *display field.*

field attribute. A control character stored in the character buffer in the first character position of a field. For those devices supporting the 3270 data stream, a field attribute defines protected/unprotected, alphanumeric/numeric, detectable/nondetectable, display/nondisplay, intensity, and modified data tag (MDT).

field inherit. A bit setting in the character attribute that defaults the character properties to the extended field attributes or device default if the buffer is unformatted.

file. A named set of records stored or processed as a unit.

filter. A device or program that separates data, signals, or material in accordance with specified criteria.

first-speaker session. The half-session defined at session activation as: (a) able to begin a bracket without requesting permission from the other half-session to do so, and (b) winning contention if both half-sessions attempt to begin a bracket simultaneously. Synonym for *contention-winner session.* Contrast with *bidder session.*

fixed disk. A rigid magnetic disk used in a fixed disk drive.

fixed disk drive. A disk storage device that reads and writes on rigid magnetic disks.

flag. (1) An indicator or parameter that shows the setting of a switch. (2) Any of various types of indicators used for identification, for example, a wordmark. (3) A character that signals the occurrence of some condition, such as the end of a word. (4) Deprecated term for *mark*.

flow control. (1) In data communication, control of the data transfer rate. (2) In SNA, the process of managing the rate at which data traffic passes between components of the network. The purpose of flow control is to optimize the rate of flow of message units with minimum congestion in the network, that is, neither to overflow the buffers at the receiver or at intermediate routing nodes nor to leave the receiver waiting for more message units. (3) The methods used to control the flow of information across a network.

focal point. See *management services focal point.*

foreground logical terminal (LT). Synonym for *active logical terminal (LT).*

formatted display. A display screen in which the attributes of one or more display fields have been defined by the user. Contrast with *unformatted display.*

frame. (1) The unit of transmission in some LANs, including the IBM Token-Ring Network and the IBM PC Network. It includes delimiters, control characters, information, and checking characters. On a token-ring network, a frame is created from a token when the token has data appended to it. On a token bus network (IBM PC Network), all frames including the token frame contain a preamble, start delimiter, control address, optional data and checking characters, end delimiter, and are followed by a minimum silence period. (2) A housing for machine elements. (3) In synchronous data link control (SDLC), the vehicle for every command, every response, and all information that is transmitted using SDLC procedures. Each frame begins and ends with a flag.

frame check sequence (FCS). (1) A system of error checking performed at both the sending and receiving station after a block check character has been accumulated. (2) A numeric value derived from the bits in a message that is used to check for any bit errors in transmission. (3) A redundancy check in which the check key is generated by a cyclic algorithm. Synonymous with *cyclic redundancy check (CRC).*

full duplex. Synonym for *duplex.*

fully qualified procedure correlator identifier (FQPCID).. A network-unique identifier that is used for:

- Correlating messages sent between nodes, such as correlating a Locate search request with its replies.
- Identifying a session for problem determination and resolution.
- Identifying a session for accounting, auditing, and performance monitoring purposes.

It is normally assigned at the node that contains the LU for which a procedure or session is initiated, but may be assigned by the network node that is providing network services to that end node. The FQPCID consists of a fixed-length correlator concatenated with the network-qualified name of the control point that generated the correlator.

function. In NetView DM, a function is the specification of a transmission activity on a resource or group of resources. Functions are grouped into phases. In CSCM, resources are known as data objects.

function management data (FMD). An RU category used for end-user data exchanged between logical units (LUs) and for requests and responses exchanged between network services components of LUs, PUs, and control points.

function management header (FMH). One or more headers, optionally present in the leading request units (RUs) of an RU chain, that allow one half-session to: (a) select a destination at the session partner and control the way in which the end-user data it sends is handled at the destination, (b) change the destination or the characteristics of the data during the session, and (c) transmit between session partners status or user information about the destination (for example, a program or device). Function management headers can be used with LU type 1, 4, and 6.2 protocols.

functional address. In IBM network adapters, a special kind of group address in which the address is bit-significant, each *on* bit representing a function performed by the station.

G

gateway. A device and its associated software that interconnect networks or systems of different architectures. The connection is usually made above the reference model network layer. For example, a gateway allows LANs access to System/370 host computers. Contrast with *bridge* and *router*.

general data stream (GDS) variable. A type of RU substructure that is preceded by an identifier and a length field and includes either application data, user control data, or SNA-defined control data.

general polling. (1) An input technique for remote 3270 devices in which special invitation characters are sent to a device controller instructing that controller to begin transmission from all devices ready to enter data. (2) See also *polling* and *specific polling*.

generate. In 3174 central site customizing, to write a Control diskette containing the customizing data for a particular controller. Also, to print a mailing address label and a diskette label for a particular controller.

Generic Alert. A product-independent method of encoding Alert data by means of both (1) code points indexing short units of stored text and (2) textual data.

get. In 3174 central site customizing, to select the type of data you want and store it in working copy.

graphic escape. In the 3270 data stream, a control code used to introduce a graphic character (hex 40 through hex FE) from an alternate character set.

group. (1) A set of related records that have the same value for a particular field in all records. (2) A collection of users who can share access authorities for protected resources. (3) A list of names that are known together by a single name.

group address. In a LAN, a locally administered address assigned to two or more adapters to allow the adapters to copy the same frame.

H

half-duplex. In data communication, pertaining to transmission in only one direction at a time. Contrast with *duplex*.

half-session. A session-layer component consisting of the combination of data flow control and transmission control components comprising one end of a session.

hard error. An error condition on a network that requires that the source of the error be removed or that the network be reconfigured before the network can resume reliable operation. See also *beaconing*. Contrast with *soft error*.

hexadecimal. (1) Pertaining to a selection, choice, or condition that has 16 possible values or states. (2) Pertaining to a fixed-radix numeration system, with radix of 16. (3) Pertaining to a numbering system with base of 16; valid numbers use the digits 0 through 9 and characters A through F, where A represents 10 and F represents 15.

hexadecimal number. The 1-byte hexadecimal equivalent of an EBCDIC character.

hop. In APPN, a portion of a route that has no intermediate nodes. It consists of only a single transmission group connecting adjacent nodes.

hop count. (1) On a Token-ring, the number of bridges through which a frame has passed on the way to its destination.

Note: Hop count applies to all broadcast frames except single-route broadcast frames.

(2) In APPN, the number of network nodes traversed by a Locate search, or the number of APPN nodes traversed by a Bind for session establishment.

host application program. An application program processed in the host computer.

host attachment. A mode of SNA communication in which the processor acts as a secondary SNA device.

host computer. (1) In a computer network, a computer that provides end users with services such as computation and data bases and that usually performs network control functions. (2) The primary or controlling computer in a multiple-computer installation. (3) A computer used to prepare programs for use on another computer or on another data processing system; for example, a computer used to compile link edit, or test programs to be used on another system. (4) Synonym for *host processor*.

host interface. Interface between a network and the host computer.

host logical unit (LU). An SNA logical unit (LU) located in a host processor, for example, an ACF/VTAM application program.

host node. (1) A node at which a host processor is located. (2) In SNA, a subarea node that contains a system services control point (SSCP); for example, a System/370 computer with OS/VS2 and ACF/TCAM.

host processor. (1) A processor that controls all or part of a user application network. (2) In a network, the processing unit in which resides the access method for the network. (3) In an SNA network, the processing unit that contains a system services control point (SSCP). (4) A processing unit that executes the access method for attached communication controllers. (5) The processing unit required to create and maintain PSS. (6) Synonymous with *host computer*.

host system. (1) A data processing system used to prepare programs and operating environments for use on another computer or controller. (2) The data processing system to which a network is connected and with which the system can communicate. (3) The controlling or highest-level system in a data communication configuration; for example, a System/38 is the host system for the workstations connected to it.

I

individual address. An address that identifies a particular network adapter on a local area network.

initial microcode load (IML). The action of loading the operational microcode.

input device. A device in a data processing system by which data may be entered into the system.

input mode. A mode in which records can be read from a file.

input/output (I/O). (1) Pertaining to a device whose parts can perform an input process and an output process at the same time. (2) Pertaining to a functional unit or channel involved in an input process, output process, or both, concurrently or not, and to the data involved in such a process. (3) Pertaining to input, output, or both.

integrated services digital network (ISDN). A digital end-to-end telecommunication network that supports multiple services including, but not limited to, voice and data.

Note: ISDNs are used in public and private network architectures.

Insert Cursor (IC) order. An order that displays the cursor at the current buffer address.

intensified display. An attribute of a display field; causes data in that field to be displayed at a brighter level than other data displayed on the screen.

interactive. Pertaining to a program or system that alternately accepts input and then responds. An interactive system is conversational, that is, a continuous dialog exists between user and system. Contrast with *batch*.

interface. (1) A shared boundary between two functional units, defined by functional characteristics, common physical interconnection characteristics, signal characteristics, and other characteristics as appropriate. (2) A shared boundary. An interface may be a hardware component to link two devices or a portion of storage or registers accessed by two or more computer programs. (3) Hardware, software, or both, that links systems, programs, or devices.

intermediate network node. In APPN, a node that is part of a route between an origin LU (OLU) and a destination LU (DLU) but neither contains the OLU or the DLU nor serves as the network server for either the OLU or DLU.

intermediate session. In APPN, a session which has been routed through an APPN network node, but the origin and destination LUs are not located in the network node.

intermediate session routing (ISR). A type of intermediate routing function provided by an APPN network node that provides session-level outage reporting and flow control for all routes passing through it.

International Organization for Standardization (ISO). An organization of national standards bodies from various countries established to promote development of standards to facilitate international exchange of goods and services, and develop cooperation in intellectual, scientific, technological, and economic activity.

interrupt. (1) A suspension of a process, such as execution of a computer program, caused by an external event and performed in such a way that the process can be resumed. (2) To stop a process in such a way that it can be resumed. (3) In data communication, to take an action at a receiving station that causes the sending station to end a transmission. (4) A means of passing processing control from one software or microcode module or routine to another, or of requesting a particular software, microcode, or hardware function.

K

keyboard definition. A customizing procedure for defining a maximum of four modified keyboard layouts for modifiable keyboards only. Most characters, symbols, and functions can be relocated, duplicated, or deleted from almost any keyboard position. Synonym for *modify keyboard*.

keyboard mapping. A table that defines which keyboard sequences are equivalent to functions on another keyboard.

L

LAN segment. (1) Any portion of a LAN (for example, a single bus or ring) that can operate independently but is connected to other parts of the establishment network via bridges. (2) An entire ring or bus network without bridges.

LAN segment number. The identifier that uniquely distinguishes a LAN segment in a multi-segment LAN.

layer. (1) One of the seven levels of the Open Systems Interconnection reference model. (2) In open systems architecture, a collection of related functions that comprise one level of hierarchy of functions. Each layer specifies its own functions and assumes that lower level functions are provided. (3) In SNA, a grouping of related functions that are logically separate from the functions of other layers. Implementation of the functions in one layer can be changed without affecting functions in other layers.

leased line. Synonym for *nonswitched line.*

LEN end node. See *low-entry networking (LEN)* .

LEN node. Synonym for *LEN end node*.

light pen. A light-sensitive pick device that is used by pointing it at the display surface.

limited broadcast. The forwarding of specially designated broadcast frames only by bridges that are enabled to forward them.

link. (1) The logical connection between nodes including the end-to-end link control procedures. (2) The combination of physical media, protocols, and programming that connects devices on a network. (3) In computer programming, the part of a program, in some cases a single instruction or an address, that passes control and parameters between separate portions of the computer program. (4) To interconnect items of data or portions of one or more computer programs. (5) In SNA, the combination of the link connection and link stations joining network nodes.

link-attached. Pertaining to the attachment of devices to a central computer through a communication control unit. Contrast with *channel-attached.* Deprecated term for *telecommunication-attached.*

link connection. (1) All physical components and protocol machines that lie between the communicating link stations of a link. The link connection may include a switched or leased physical data circuit, a LAN, or an X.25 virtual circuit. (2) In SNA, the physical equipment providing two-way communication and error correction and detection between one link station and one or more other link stations.

link station. (1) A specific place in a service access point (SAP) that enables an adapter to communicate with another adapter. (2) A protocol machine in a node that manages the elements of procedure required for the exchange of data traffic with another communicating link station. (3) A logical point within a SAP that enables an adapter to establish connection-oriented communication with another adapter. (4) In SNA, the combination of hardware and software that allows a node to attach to and provide control for a link.

lobe. In the IBM Token-Ring Network, the section of cable (which may consist of several cable segments) that connects an attaching device to an access unit.

local. Pertaining to a device accessed directly without use of a telecommunication line. Synonym for *channel-attached*. Contrast with *remote*.

local area network (LAN). A computer network located on a user's premises within a limited geographical area.

Note: Communication within a local area network is not subject to external regulations; however, communication across the LAN boundary may be subject to some form of regulation.

local-form session identifier (LFSID). A dynamically assigned value used by a type 2.1 node to identify traffic for a particular session using a given transmission group (TG). The LFSID is encoded in the ODAI, OAF', and DAF' fields of the transmission headers that accompany session messages exchanged over the TG.

local format storage. In the 3174, this function allows the controller to store pre-defined formatted screens and subsequently be viewed by a terminal user. The formatted screens are downloaded from the host into the 3174.

locally administered address. An adapter address that the user can assign to override the universally administered address. Contrast with *universally administered address*.

Locate/CD-Initate. An abbreviated term for an inter-node message that contains one of the following sets of GDS Variables:

- A Locate (X'12C4'), a Find Resource (X'12CA'), and a Cross-Domain Initiate (X'12CA') GDS variable used for a network search request.
- A Locate (X'12C4'), a Found Resource (X'12CB'), and a Cross-Domain Initiate (X'12CA') GDS variable used for a search reply when a network resource has been located.

These message structures correspond to the CP components that perform the search of the distributed network directory and establish the session. The Locate GDS variable contains information used to control the delivery of the search messages in the network. Find and Found GDS variables contain information used in the directories: origin cache data (control point information) and search arguments (destination LU name), and located resource information, respectively. The Cross-Domain Initiate GDS variable contains endpoint TG vector information to be used in selecting the route for the session. The length of the Locate/CD-Initiate message is limited to 1024 bytes.

Locate search. The means directory services in a node uses to find a resource that is not in that node. The Locate search enables directory services to ask the directory services components in other APPN nodes for information on the target resource.

location. With reference to a 3174, a place within the 3174 chassis where a particular card or adapter is inserted.

logical connection. In a network, devices that can communicate or work with one another because they share the same protocol. See also *physical connection*.

logical link control (LLC) sublayer. One of two sublayers of the ISO Open Systems Interconnection data link layer (which corresponds to the SNA data link control layer), proposed for LANs by the IEEE Project 802 Committee on Local Area Networks and the European Computer Manufacturers Association (ECMA). It includes those functions unique to the particular link control procedures that are associated with the attached node and are independent of the medium; this allows different logical link protocols to coexist on the same network without interfering with each other. The LLC sublayer uses services provided by the medium access control (MAC) sublayer and provides services to the network layer.

logical terminal (LT). In MLT, one of five sessions available to share one display station.

logical unit (LU). A type of network accessible unit that enables end users to communicate with each other and gain access to network resources.

loop. A closed unidirectional signal path connecting input/output devices to a network.

low-entry networking (LEN). A capability in type 2.1 nodes allowing them to be directly attached to one another using peer-to-peer protocols and allowing them to support multiple and parallel sessions between logical units.

LU-LU session. A session between two logical units (LUs) in an SNA network. It provides communication between two end users, or between an end user and an LU services component.

LU type. The classification of an LU in terms of the specific subset of SNA protocols and options it supports for a given session, namely:

- The mandatory and optional values allowed in the session activation request.
- The usage of data stream controls, function management headers (FMHs), request unit parameters, and sense data values.
- Presentation services protocols such as those associated with FMH usage.

LU types 0, 1, 2, 3, 4, 6.1, 6.2, and 7 are defined.

LU type 6.2 (LU 6.2). A type of logical unit that supports general communication between programs in a distributed processing environment. LU 6.2 is characterized by (a) a peer relationship between session partners, (b) efficient utilization of a session for multiple transactions, (c) comprehensive end-to-end error processing, and (d) a generic application program interface consisting of structured verbs that are mapped into a product implementation.

M

MAC frame. Frames used to carry information to maintain the ring protocol and for exchange of management information.

management services (MS). One of the types of network services in control points and physical units. Management services are the services provided to assist in the management of SNA networks, such as problem management, performance and accounting management, configuration management, and change management.

management services focal point (MSFP). For any given management services discipline (for example, problem determination or response time monitoring), the control point that is responsible for that type of network management data for a sphere of control. This responsibility may include storing or displaying the data or both. (For example, a problem determination focal point is a control point that stores and displays problem determination data).

main storage. Program-addressable storage from which instructions and other data can be loaded directly into registers for subsequent processing.

maintenance analysis procedure (MAP). A maintenance document that gives an IBM service representative a step-by-step procedure for tracing a symptom to the cause of a failure.

manual answering. (1) Answering in which a call is established only if the called user signals a readiness to receive the call by means of a manual operation. (2) Operator actions to prepare a station to receive a call on a switched line. Contrast with *automatic answering*.

manual calling. (1) Calling that permits the entry of selection signals from a calling data station at an undefined character rate. (2) Operator actions to place a call over a switched line. Contrast with *automatic calling*.

mark. A symbol or symbols that indicate the beginning or the end of a field, a word, an item of data or a set of data such as a file, record, or block.

medium. A physical carrier of electrical or optical energy.

Medium Access Control (MAC) frame. Frames that control the operation of the IBM Token-Ring Network and any ring station operations that affect the ring.

medium access control (MAC) protocol. In a local area network, the part of the protocol that governs access to the transmission medium independently of the physical characteristics of the medium, but taking into account the topological aspects of the network, in order to enable the exchange of data between data stations.

memory. Program-addressable storage from which instructions and other data can be loaded directly into registers for subsequent execution or processing. Synonymous with *main storage*.

message unit (MU). The unit of data processed by any layer, for example, a basic information unit, a path information unit, or a request/response unit.

microcode. (1) One or more microinstructions. (2) A code, representing the instructions of an instruction set, that is implemented in a part of storage that is not program-addressable. (3) To design, write, and also to test one or more microinstructions.

mode name. The name used by the initiator of a session to designate the characteristics desired for the session, such as traffic pacing values, message-length limits, sync point and cryptography options, and the class of service within the transport network.

modem (modulator/demodulator). A device that converts digital data from a computer to an analog signal that can be transmitted on a telecommunication line, and converts the analog signal received to data for the computer.

modified data tag (MDT). A bit in the attribute character of a display field that, when set, causes that field to be transferred to the channel during a read-modified operation. The modified data tag may be set by a keyboard input to the field, a selector-pen detection in the field, a card read-in operation, or program control. The modified data tag may be reset by a selector-pen detection in the field, program control, or ERASE INPUT key.

Modify Field (MF) order. An order that allows specified field and extended attributes to be modified, without having to respecify all of the attributes of the field.

modify keyboard. Synonym for *keyboard definition*.

multidrop (network). A network configuration in which there are one or more intermediate nodes on the path between a central node and an endpoint node.

multi-host support. In the 3174, the ability of a terminal to access more than one host at a time.

multiple logical terminal (MLT). In the 3174, a function that provides a CUT-attached, fixed-function display station with the ability to interact with as many as five host sessions. Each session is processed as though it were a separate display station.

multipoint. Pertaining to communication among more than two stations over a single telecommunication line.

multipoint line. A telecommunication line or circuit connecting two or more stations. Contrast with *point-to-point line*.

N

name. An alphanumeric term that identifies a data set, statement, program, or cataloged procedure.

nearest active upstream neighbor (NAUN). For any given attaching device on an IBM Token-Ring Network, the attaching device that is sending frames or tokens directly to it.

NetView. A host-based IBM licensed program that provides communication network management (CNM) or communications and systems management (C&SM) services. It supersedes NCCF, NPDA, NLDM, and NPM.

network. (1) A configuration of data processing devices and software connected for information interchange. (2) An arrangement of nodes and connecting branches. Connections are made between data stations.

network accessible unit (NAU). A logical unit (LU), physical unit (PU), control point (CP), or system services control point (SSCP). It is the origin or the destination of information transmitted by the path control network. Synonymous with *network addressable unit*.

Network Control Program (NCP) node. In SNA products, a subarea node that contains an ACF/NCP program but not a system services control point (SSCP).

network management vector transport. The portion of an alert transport frame that contains the alert message.

network node (NN). A node that can define the paths or routes, control route selection, and handle directory services for APPN.

network node server. An APPN network node that provides network services for its local LUs and adjacent end nodes.

Network Problem Determination Application (NPDA). An IBM licensed program that helps the user identify network problems from a central control point using interactive display techniques.

node. An endpoint of a link or junction common to two or more links in a network. Nodes can be processors, communication controllers, cluster controllers, or terminals. Nodes can vary in routing and other functional capabilities.

node type. A designation of a node according to the protocols it supports and the network accessible units that it can contain. Five types are defined: 1, 2.0, 2.1, 4, and 5. Within a subarea network, type 1, type 2.0, and type 2.1 nodes are peripheral nodes, while type 4 and type 5 nodes are subarea nodes.

nonswitched line. (1) A connection between systems or devices that does not have to be made by dialing. Contrast with *switched line*. (2) A telecommunication line on which connections do not have to be established by dialing. Synonymous with *leased line*.

O

online test. A diagnostic test or data collection program that is run without interrupting the normal operation of the 3174 and its associated terminals.

open. (1) To make an adapter ready for use. (2) A break in an electrical circuit. (3) To make a file ready for use.

operator information area (OIA). The area below the line near the bottom of the display area where graphics and alphanumeric characters are displayed to define the status of the terminal or the system to the operator.

optical fiber. Any filament made of dielectric materials that guides light, regardless of its ability to send signals. See also *fiber optics*.

option. (1) A specification in a statement, a selection from a menu, or a setting of a switch, that may be used to influence the execution of a program. (2) A hardware or software function that may be selected or enabled as part of a configuration process. (3) A piece of hardware (such as a network adapter) that can be installed in a device to modify or enhance device function.

order code. A code that may be included in the write data stream transmitted for a display station or printer; provides additional formatting or definition of the write data.

order sequence. A sequence in the data stream that starts with an order code and includes a character address and/or data characters related to the order code.

origin address. A code that identifies the location from which information is sent. Synonymous with source address. Contrast with *destination address*.

Origin-Destination Assignor indicator (ODAI). The ODAI is a bit in a FID2 transmission header used to divide the address space so that an address space manager (ASM) in one node may use all possible combinations of OAF', DAF' with the ODAI having one setting and the ASM in the adjacent node may use all possible combinations of OAF', DAF' with the ODAI having the complementary setting.

original equipment manufacturer (OEM). A manufacturer of equipment that may be marketed by another manufacturer.

P

pacing. (1) A technique by which a receiving station controls the rate of transmission of a sending station to prevent overrun. (2) In SNA, a technique by which a receiving component controls the rate of transmission of a sending component to prevent overrun or congestion.

packet. (1) In data communication, a sequence of binary digits, including data and control signals, that is transmitted and switched as a composite whole. (2) Synonymous with *data frame*. Contrast with *frame*.

parallel. (1) Pertaining to a process in which all events occur within the same interval of time, each handled by a separate but similar functional unit; for example, the parallel transmission of the bits of a computer word along the lines of an internal bus. (2) Pertaining to concurrent or simultaneous operation of two or more devices or to concurrent performance of two or more activities in a single device. (3) Pertaining to concurrent or simultaneous occurrence of two or more related activities in multiple devices or channels. (4) Pertaining to the simultaneity of two or more processes. (5) Pertaining to the simultaneous processing of the individual parts of a whole, such as the bits of a character and the characters of a word, using separate facilities for the various parts. (6) Contrast with *serial*.

parallel sessions. Two or more concurrently active sessions between the same two network accessible units using different pairs of network addresses or local-form session identifiers. Each session can have independent session parameters.

parameter. (1) A variable that is given a constant value for a specified application and that may denote the application. (2) An item in a menu for which the user specifies a value or for which the system provides a value when the menu is interpreted. (3) Data passed between programs or procedures.

parity. (1) A transmission error-checking scheme in which an extra bit is added to some unit of data, usually a byte, in order to make the total number of one bits even or odd. For the AEA feature, odd, even, mark, space, or no-parity coding is supported. No-parity means that no parity bit is sent or expected. Mark and space mean that the parity position is always set to one or zero, respectively, and that received parity is not checked. (2) The state of being either even-numbered or odd-numbered.

parity bit. (1) A binary digit appended to a group of binary digits to make the sum of all the digits, including the appended binary digit, either odd or even as pre-established. (2) A check bit appended to an array of binary digits to make the sum of all the binary digits, including the check bit, always odd or always even.

parity check. (1) A redundancy check by which a recalculated parity bit is compared with the pre-given parity bit. (2) A check that tests whether the number of ones (or zeros) in an array of binary digits is odd or even.

parity (even). A condition when the sum of all of the digits in an array of binary digits is even.

parity (odd). A condition when the sum of all of the digits in an array of binary digits is odd.

password. In computer security, a string of characters known to the computer system and a user, who must specify it to gain full or limited access to a system and to the data stored within it.

path. In a network, a route between any two nodes.

path control. The function that routes message units between network accessible units in the network and provides the paths between them. It converts the BIU's from transmission control into path information units (PIUs) and exchanges basic transmission units containing one or more PIUs with data link control.

path information unit (PIU). A message unit consisting of a transmission header (TH) alone, or of a TH followed by a basic information unit (BIU) or a BIU segment. See also *transmission header*.

path trace. A function that may be requested of a bridge by a received frame. The request is for a record of the bridges through which the frame has passed.

physical connection. (1) A connection that establishes an electrical circuit. (2) In ACF/VTAM, a point-to-point connection or multipoint connection.

physical unit (PU). The component that manages and monitors the resources (such as attached links and adjacent link stations) associated with a node, as requested by an SSCP via an SSCP-PU session. An SSCP activates a session with the physical unit in order to indirectly manage, through the PU, resources of the node such as attached links. This term applies to type 2.0, type 4, and type 5 nodes only.

point-to-point line. A switched or nonswitched telecommunication line that connects a single remote station to a computer. Contrast with *multipoint line*.

polling. (1) On a multipoint connection or a point-to-point connection, the process whereby data stations are invited one at a time to transmit. (2) Interrogation of devices for such purposes as to avoid contention, to determine operational status, or to determine readiness to send or receive data.

port. (1) An access point for data entry or exit. (2) A connector on a device to which cables for other devices such as display stations and printers are attached.

primary logical unit (PLU). In SNA, the logical unit (LU) that contains the primary half-session for a particular LU-LU session. Contrast with *secondary logical unit.*

primary session. In MLT, the primary session is the first session defined on a port.

printer authorization matrix (PAM). A matrix stored in the controller that establishes printer assignment and classification.

program access (PA) key. On a display device keyboard, a key that produces a call to a program that performs display operations. See also *program function (PF) key.*

program function (PF) key. On a display device keyboard, a key that passes a signal to a program to call for a particular display operation. See also *program access (PA) key.*

programmable symbols (PS). Customer-defined symbols. There are a maximum of 190 symbols in a programmed symbol set.

programmed symbol set (PSS). A set of fonts that can be system-defined or defined by the user and to which a code can be assigned.

programmed symbols (PS). In the 3270 Information Display System, an optional feature that stores up to six user-definable, program-loadable character sets of 190 characters each in terminal read/write storage for display or printing by the terminal.

Program Tab (PT) order. An order that advances the current buffer address to the address of the first character location of the next unprotected field and resets the character attributes of all characters in the field that are replaced by nulls.

protected field. (1) In word processing, preset data or an area that cannot be changed or overridden by an operator without altering the program. (2) On a display device, a display field in which a user cannot enter, modify, or erase data. Contrast with *unprotected field.*

protocol. (1) A set of semantic and syntactic rules that determines the behavior of functional units in achieving communication. (2) In SNA, the meanings of and the sequencing rules for requests and responses used for managing the network, transferring data, and synchronizing the states of network components. (3) A specification for the format and relative timing of information exchanged between communicating parties.

protocol conversion. For the AEA feature, emulation of one device protocol by a device designed for a different protocol.

put. In 3174 central site customizing, to store data from the working copy into a library member.

R

random access memory (RAM). A computer's or adapter's volatile storage area into which data may be entered and retrieved in a nonsequential manner.

register. A storage device having a specified storage capacity such as a bit, byte, or computer word, and usually intended for a special purpose.

remote. Pertaining to a system, program, or device that is accessed through a telecommunication line.

remove. (1) To take an attaching device off a network. (2) To stop an adapter from participating in passing data on a network.

Repeat to Address (RA) order. An order that stores a specified alphanumeric or null character in up to 480 buffer locations, starting at the current buffer address and ending at, but not including, the specified stop address.

request for price quotation (RPQ). An alteration or addition to the functional capabilities that the controller provides.

request header (RH). Control information preceding a request unit. See also *request/response header.*

request/response header (RH). Control information, preceding a request/response unit (RU), that specifies the type of RU (request unit or response unit) and contains control information associated with that RU.

request/response unit (RU). A generic term for a request unit or a response unit. See also *request unit* and *response unit.*

request unit (RU). A message unit that contains control information, end-user data, or both.

response header (RH). A header, optionally followed by a response unit, that indicates whether the response is positive or negative and that may contain a pacing response.

response unit (RU). A message unit that acknowledges a request unit; it may contain prefix information received in a request unit. If positive, the response unit may contain additional information (such as session parameters in response to a Bind), or if negative, contains sense data defining the exception condition.

Response Time Monitor (RTM). A network management tool that measures and records the transaction times of inbound host attention (AID) operations from display stations that communicate with the host.

return code. (1) A code used to influence the execution of succeeding instructions. (2) A value returned to a program to indicate the results of an operation requested by that program.

ring in (RI). In the IBM Token-Ring Network, the receive or input receptacle on an access unit or repeater. Contrast with *ring out.*

ring network. A network configuration in which a series of attaching devices is connected by unidirectional transmission links to form a closed path. A ring of an IBM Token-Ring Network is referred to as a LAN segment or as a Token-Ring Network segment.

ring out (RO). In an IBM Token-Ring Network, the transmit or output receptacle on an access unit or repeater.

ring segment. A ring segment is any section of a ring that can be isolated (by unplugging connectors) from the rest of the ring. A segment can consist of a single lobe, the cable between access units, or a combination of cables, lobes, and/or access units.

ring station. A station that supports the functions necessary for connecting to the LAN and for operating with the token-ring protocols. These include token handling, transferring copied frames from the ring to the using node's storage, maintaining error counters, observing medium access control (MAC) sublayer protocols (for address acquisition, error reporting, or other duties), and (in the full-function native mode) directing frames to the correct data link control (DLC) link station.

ring status. The condition of the ring.

route. An ordered sequence of nodes and transmission groups (TGs) that represent a path from an origin node to a destination node traversed by the traffic exchanged between them.

Route Selection control vector (RSCV). A X'2B' control vector that describes a route in an APPN network. The RSCV consists of an ordered sequence of control vectors — either TG Descriptor (X'46') control vectors (when carried in the Bind RU) or Network-Qualified Name (X'0E') control vectors (when carried in the Locate search message) — that identify the TGs and nodes that make up the path from an origin node to a destination node.

route selection services (RSS). A type 2.1 facility that determines the preferred route between a specified pair of nodes for a given class of service.

router. An attaching device that connects two LAN segments, which use similar or different architectures, at the reference model network layer. Contrast with *bridge* and *gateway.*

routing. (1) The assignment of the path by which a message will reach its destination. (2) In SNA, the forwarding of a message unit along a particular path through a network, as determined by parameters carried in the message unit, such as the destination network address in a transmission header.

S

scroll. To move all or part of the display image vertically or horizontally to display data that cannot be observed within a single display image.

secondary logical unit (SLU). In SNA, the logical unit (LU) that contains the secondary half-session for a particular LU-LU session. Contrast with *primary logical unit.*

segment. A section of cable between components or devices on the network. A segment may consist of a single patch cable, multiple patch cables connected, or a combination of building cable and patch cables connected.

selector pen. A pen-like instrument that can be attached to a display station. When a program using full-screen processing is assigned to the display station, the pen can be used to select items on the screen or to generate an attention. Synonym for *light pen.*

serial. (1) Pertaining to a process in which all events occur one after the other; for example, serial transmission of the bits of a character according to V24 CCITT protocol. (2) Pertaining to the sequential or consecutive occurrence of two or more related activities in a single device or channel. (3) Pertaining to the sequential processing of the individual parts of a whole, such as the bits of a character or the characters of a word, using the same facilities for successive parts. (4) Contrast with *parallel.*

server. (1) A device, program, or code module on a network dedicated to providing a specific service to a network. (2) On a LAN, a data station that provides facilities to other data stations. Examples are a file server, print server, and mail server.

service access point (SAP). (1) A logical point made available by an adapter where information can be received and transmitted. A single SAP can have many links terminating in it. (2) In Open Systems Interconnection (OSI) architecture, the logical point at which an n + 1-layer entity acquires the services of the n-layer. For LANs, the n-layer is assumed to be data link control (DLC). A single SAP can have many links terminating in it. These link "end-points" are represented in DLC by link stations.

session. (1) In network architecture, an association of facilities necessary for establishing, maintaining, and releasing connections for communication between stations. (2) In MLT, synonymous with logical terminal (LT). (3) In SNA, a logical connection between two network addressable units that can be activated, tailored to provide various protocols, and deactivated as requested.

session connector. A session-layer component in an APPN network node or in a subarea node boundary or gateway function that connects two stages of a session. Session connectors swap addresses from one address space to another for session-level intermediate routing, adaptively pace the session traffic in each direction, and segment message units as needed.

session limit. (1) In SNA, the maximum number of concurrently active LU-LU sessions that a particular logical unit (LU) can support. (2) For the 3174 AEA, the total number of logical terminals or defined AEA default destinations for an AEA port set.

session services. One of the types of network services in the control point (CP) and in the logical unit (LU). These services provide facilities for an LU or a network operator to request that a control point (an ENCP or NNCP) assist with initiating or terminating sessions between logical units.

Set Attribute (SA) order. (1) An order that specifies an attribute-type-value pair defining the property to be applied to subsequent characters in the data stream. An SA order is required for each property assigned. (2) An order that associates attributes in the EAB with individual characters.

Set Buffer Address (SBA) order. An order that sets the buffer address to a specified location.

Set Printer Characteristics. This 3270 data stream structured field allows an application program to control the setting and resetting of certain functions on CUT printers.

simulated attention. A function that allows a terminal without attention keys to interrupt processing. The terminal is queried periodically for a specified character string. See also *attention interruption*.

simulation. (1) The representation of selected characteristics of the behavior of one physical or abstract system by another system. In a digital computer system, simulation is done by software; for example, (a) the representation of physical phenomena by means of operations performed by a computer system, and (b) the representation of operations of a computer system by those of another computer system. (2) Contrast with *emulation*.

single link multi-host support. In the 3174, the ability of a terminal to access multiple hosts over a single physical link connected to the IBM Token-Ring Network, an X.25 Network, or an Enterprise Systems Connection Director.

single-route broadcast. The forwarding of specially designated broadcast frames only by bridges which have single-route broadcast enabled. If the network is configured correctly, a single-route broadcast frame will have exactly one copy delivered to every LAN segment in the network. Synonymous with *limited broadcast*.

SNA character string (SCS). A character string composed of EBCDIC controls, optionally intermixed with end-user data, that is carried within a request/response unit.

soft error. An intermittent error on a network that requires retransmission. Contrast with *hard error*.

Note: A soft error by itself does not affect overall reliability of the network, but reliability may be affected if the number of soft errors reaches the ring error limit.

solid state component. A component whose operation depends on control of electric or magnetic phenomena in solids, for example, a transistor, crystal diode, or ferrite core.

source address. Synonym for origin address.

specific polling. A polling technique that sends invitation characters to a device to find out whether the device is ready to enter data. See also *general polling* and *polling*.

star. A wiring arrangement in which an individual cable runs from each work area to a concentration point.

Start Field (SF) order. (1) A data stream order that establishes the start of a data field for displaying or printing. (2) An order that indicates a specified location that contains an attribute byte and not a text character.

Start Field Extended (SFE) order. (1) A data stream order that defines the start of a field that includes extended field attribute type-value pairs. (2) An order that generates an extended field attribute in the EAB and at the current buffer location.

station. (1) An input or output point of a system that uses telecommunication facilities; for example, one or more systems, computers, terminals, devices, and associated programs at a particular location that can send or receive data over a telecommunication line. (2) A location in a device at which an operation is performed, for example, a read station. (3) In SNA, a link station.

storage. A unit into which recorded text can be entered, in which it can be retained and processed, and from which it can be retrieved. See also *memory*.

structured field. A data stream format that permits variable-length data and controls to be parsed into its components without having to scan every byte.

subarea. A portion of the SNA network consisting of a subarea node, any attached peripheral nodes, and their associated resources. Within a subarea node, all network accessible units, links, and adjacent link stations (in attached peripheral or subarea nodes) that are addressable within the subarea share a common subarea address and have distinct element addresses.

subsystem. A secondary or subordinate system, or programming support, usually capable of operating independently of or asynchronously with a controlling system. The 3174 and its attached terminals are an example of a subsystem.

switched line. A telecommunication line in which the connection is established by dialing. Contrast with *nonswitched* line.

synchronous. (1) Pertaining to two or more processes that depend on the occurrences of a specific event, such as common timing signal. (2) Occurring with a regular or predictable time relationship.

Synchronous Data Link Control (SDLC). A discipline conforming to subsets of the Advance Data Communication Control Procedures (ADCCP) of the American National Standards Institute (ANSI) and High-level Data Link Control (HDLC) of the International Organization for Standardization, for managing synchronous, code-transparent, serial-by-bit information transfer over a link connection. Transmission exchanges may be duplex or half-duplex over switched or nonswitched links. The configuration of the link connection may be point-to-point, multipoint, or loop. See also *binary synchronous communication (BSC)*.

synonym. A code point that is supported only by a device that contains an extended attribute buffer (EAB). For devices without an EAB, synonyms are translated to hyphens.

system configuration. A process that specifies the devices and programs that form a particular data processing system.

system generation (SYSGEN). The process of selecting optional parts of an operating system and of creating a particular operation system tailored to the requirements of a data processing installation. System generation enables a host computer to identify and communicate with the I/O devices connected to it.

system services control point (SSCP). In SNA, the focal point within an SNA network for managing the configuration, coordinating network operator and problem determination requests, and providing directory support and other session services for end users of the network. Multiple SSCPs, cooperating as peers, can divide the network into domains of control, with each SSCP having a hierarchical control relationship to the physical units (PUs) and logical units (LUs) within its domain.

Systems Network Architecture (SNA). The description of the logical structure, formats, protocols, and operational sequences for transmitting information units through, and controlling the configuration and operation of, networks.

T

telecommunication-attached. Pertaining to the attachment of devices by teleprocessing lines to a host processor. Synonym for *remote*. Contrast with *channel-attached*.

telecommunication control unit. See *communication controller*.

terminal. In data communication, a device, usually equipped with a keyboard and display device, capable of sending and receiving information.

terminal adapter (TA). In the 3174, an adapter that provides control for a maximum of 32 terminals per adapter. The maximum number of terminals that can be connected depends on the model of the 3174.

terminal component. A separately addressable part of a terminal that performs an input or output function, such as the display component of a keyboard-display device or a printer component of a keyboard-printer device.

terminal emulation. The capability of a microcomputer, personal computer, 3270 CUT mode display station, 3270 printer, ASCII display station, or ASCII printer to operate as if it were a particular type of terminal linked to a processing unit and to access data.

terminal multiplexer. A device, such as the 3299 Terminal Multiplexer, for interleaving the signals for many devices onto a single cable.

terminal multiplexer adapter (TMA). This adapter is connected to the terminal adapter in the 3174 and provides control for a maximum of eight terminals.

terminal node. (1) In a hierarchical data base, a node that has no subordinate records or segments. (2) In SNA products, a peripheral node that is not user-programmable and has less processing capability than a cluster controller node. Examples are nodes consisting of the IBM 3277 Data Station, 3767 Communication Terminal, 3614 Consumer Transaction Facility, and 3624 Consumer Transaction Facility.

threshold. (1) A level, point, or value above which something is true or will take place and below which it is not true or will not take place. (2) In IBM bridge programs, a value set for the maximum number of frames that are not forwarded across a bridge due to errors, before a "threshold exceeded" occurrence is counted and indicated to network management programs. (3) An initial value from which a counter is decremented to zero, or a value to which a counter is incremented or decremented from an initial value. When the counter reaches zero or the threshold value, a decision is made and/or an event occurs.

time-out. (1) An event that occurs at the end of a predetermined period of time that began at the occurrence of another specified event. (2) A time interval allotted for certain operations to occur; for example, response to polling or addressing before system operation is interrupted and must be restarted. (3) A terminal feature that logs off a user if an entry is not made within a specified period of time.

token. A sequence of bits passed from one device to another on the token-ring network that signifies permission to transmit over the network. It consists of a starting delimiter, an access control field, and an end delimiter. The access control field contains a bit that indicates to a receiving device that the token is ready to accept information. If a device has data to send along the network, it appends the data to the token. When data is appended, the token then becomes a frame. See *frame*.

token ring. A network with a ring topology that passes tokens from one attaching device (node) to another. A node that is ready to send can capture a token and insert data for transmission.

token-ring network. (1) A ring network that allows unidirectional data transmission between data stations by a token-passing procedure over one transmission medium so that the transmitted data returns to and is removed by the transmitting station. The IBM Token-Ring Network is a baseband LAN with a star-wired ring topology that passes tokens from network adapter to network adapter. (2) A network that uses a ring topology, in which tokens are passed in a sequence from node to node. A node that is ready to send can capture the token and insert data for transmission. (3) A group of interconnected token rings.

topology. The physical or logical arrangement of nodes in a computer network. Examples include ring topology and bus topology.

topology and routing services (TRS). An APPN control point component that manages the topology data base and computes routes.

topology data base update (TDU). A message broadcast among APPN network nodes to maintain the network topology data base, which is fully replicated in each network node. A TDU contains information to identify the sending node, node and link characteristics about various resources of the network, and update sequence numbers to identify the most recent updates for each of the resources described.

trace. (1) A record of the execution of a computer program. It exhibits the sequences in which the instructions were executed. (2) A record of the frames and bytes transmitted on a network.

transaction. In an SNA network, an exchange between two programs that usually involves a specific set of initial input data that causes the execution of a specific task or job. Examples of transactions include the entry of a customer's deposit that results in the updating of the customer's balance, and the transfer of a message to one or more destination points.

transaction program. A program that processes transactions in or through a logical unit (LU) type 6.2 in an SNA network. Application transaction programs are end users in an SNA network; they process transactions for service transaction programs and for other end users. Service transaction programs are IBM-supplied programs that typically provide utility services to application transaction programs.

translate table. A table that defines the translation of ASCII to EBCDIC and EBCDIC to ASCII and that allows the use of special characters and nonstandard codes.

transmission control unit (TCU). A communication control unit whose operations are controlled solely by programmed instructions from the computing system to which the unit is attached. No program is stored or executed in the unit, for example, the IBM 2702 and 2703 Transmission Controls. Contrast with *communication controller*. Synonymous with *telecommunication control unit*.

transmission group (TG). A group of links between adjacent subarea nodes appearing as a single logical link for routing of messages. A transmission group may consist of one or more SDLC links (parallel links) or of a single System/370 channel. In APPN, transmission group is synonymous with *link*.

transmission header (TH). Control information, optionally followed by a basic information unit (BIU) or a BIU segment, that is created and used by path control to route message units and to control their flow within the network. See also *path information unit*.

transmission priority. A rank assigned to a message unit that determines its precedence for being selected by the path control component in each node along a route for forwarding to the next node in the route.

transmitter. See *universal receiver-transmitter*.

transparency. See *transparent*

transparent. (1) Pertaining to operations or data that are of no significance to the user. (2) In data transmission, pertaining to information not recognized by the receiving program or device as transmission control characters.

type. In the 3174, the identifying number of a card. For example, 9150 is a type number of the terminal adapter in the 3174.

type 1 communication adapter. The 3174 adapter that supports communication between the 3174 (and its terminals) and a host over telecommunication links using any of these interfaces: (a) EIA 232D/V.24 and V.35 for SNA/SDLC, (b) BSC, and (c) X.25. The user selects the appropriate interface.

type 2 communication adapter. The 3174 adapter that supports communication between the 3174 (and its terminals) and a host over telecommunication links using either the X.21 interface for SNA/SDLC or the X.25 interface. The user selects the interface.

type 2.1 (T2.1) node. An SNA node that can be configured as an endpoint or intermediate routing node in a T2.1 network, or as a peripheral node attached to a subarea network.

U

unbind. In SNA, to deactivate a session between logical units.

unbind command. A command used to reset the protocols for a session. Contrast with *bind command*.

unformatted display. A display screen on which the user has not defined a display field. Contrast with *formatted display*. See also *protected field*.

universal receiver-transmitter. A circuit used in asynchronous, synchronous, or synchronous/asynchronous data communication applications to provide all the necessary logic to recover data in a serial-in parallel-out fashion and to transmit data in a parallel-in serial-out fashion. It is usually duplex; that is, it can transmit and receive simultaneously with the option to handle various data word lengths.

universally administered address. The address permanently encoded in an adapter at the time of manufacture. All universally administered addresses are unique. Contrast with *locally administered address*.

unnumbered acknowledgment (UA). A data link control (DLC) command used in establishing a link and in answering receipt of logical link control (LLC) frames.

unprotected field. A displayed field in which a user can enter, modify, or delete data. Contrast with *protected field*.

update. In 3174 central site customizing, to tailor a library member's customizing data, in working copy, and put it back to the library disk.

upstream. (1) In the direction opposite to data flow or toward the source of transmission. (2) Toward the processor from an attached unit or end user.
(3) Contrast with *downstream*.

V

V.35 communication adapter. A communication adapter that can combine and send information on one line at speeds up to 64 kbps, and conforms to the CCITT V.35 standard.

variable. (1) In computer programming, a character or group of characters that refers to a value and, in the execution of a computer program, corresponds to an address. (2) A quantity that can assume any of a given set of values.

vector. One or more related fields of data, in a specified format. A quantity usually characterized by an ordered set of numbers.

version. A separate IBM-licensed program, based on an existing IBM-licensed program, that usually has significant new code or new function.

viewport. In the 3270 Information Display System, an area on the usable area of the display surface through which an operator views all or a portion of the data outlined by the window on the presentation plane.

virtual circuit. Synonym for *virtual connection*.

virtual connection. (1) A connection between two nodes on the network that is established using the transport layer and that provides reliable data between nodes. (2) A logical connection established between two data terminal equipment (DTE) devices. Synonymous with *virtual circuit*.

virtual machine (VM). A functional simulation of a computer and its associated devices. Each virtual machine is controlled by a suitable operating system, for example, a conversational monitor system. VM controls concurrent execution of multiple virtual machines on one host computer.

W

wire fault. An error condition caused by a break in the wires or a short between the wires (or shield) in a segment of cable.

working copy (WC). In 3174 central site customizing, a set of customizing data and label data held in main storage, which is tailored to reflect a network controller's attached terminals, its method of host attachment, and other pertinent information.

workstation. (1) An I/O device that allows either transmission of data or the reception of data (or both) from a host system, as needed to perform a job: for example, a display station or printer. (2) A configuration of I/O equipment at which an operator works. (3) A terminal or microcomputer, usually one connected to a mainframe or network, at which a user can perform tasks.

wrap test. A test that checks attachment or control unit circuitry without checking the mechanism itself by returning the output of the mechanism as input. For example, when unrecoverable communication adapter or machine errors occur, a wrap test can transmit a specific character pattern to or through the modem in a loop and then compare the character pattern received with the pattern transmitted.

write. To make a permanent or transient recording of data in a storage device or on a data medium.

write control character (WCC). A character used in conjunction with a Write command to specify that a particular operation, or combination of operations, is to be performed at a display station or printer.

Write Structured Field (WSF) command. A command used to transmit data in structured field format.

X

X.21. In data communication, a recommendation of the International Telegraph and Telephone Consultative Committee (CCITT) that defines the interface between data terminal equipment and public data networks for digital leases and circuit switched synchronous services.

X.21 communication adapter. A communication adapter that can combine and send information on one line at speeds up to 64 kbps, and that conforms to CCITT X.21 standards.

X.25. In data communication, a recommendation of the CCITT that defines the interface between data terminal equipment and packet switching networks.

3

3174 Peer Communication (3174-Peer). A network of personal computers, with adapter support and associated program interfaces, attached with 3270 wiring to a 3174 that has the associated microcode installed. The personal computers attached to the 3174 communicate as if they were Token-Ring LAN devices.

3270 data stream. (1) The commands, control codes, orders, attributes, and data or structured fields for 3270 devices, that are transmitted inbound to an application program or outbound to a terminal. (2) Data being transferred from or to an allocated primary or tertiary device, or to the host system, as a continuous stream of data and 3270 Information Display System control elements in character form.

3270 emulation. The use of a program that allows a device or system such as a personal computer or a System/38 to operate in conjunction with a host system as if it were a 3270-series display station or control unit.

Index

A

B

C

D

E

F

G

H

I

M

N

O

P

S

T

U

V

W

X

Numerics

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