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# 3274 Control Unit Models 51C and 52C Maintenance Concepts

SY27-2528-2

**Third Edition (February 1981)**

This edition is a revision of and supersedes SY27-2528-1. The new information concerns the X.21 Switched Feature. In addition to technical changes throughout this manual, the 31SD Diskette Drive Parts Catalog has been removed. The 31SD parts catalog is now included in Appendix F of *3274 Control Unit Models 51C and 52C Maintenance Information,* SY27-2513.

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# Preface

This manual contains the information needed by the support field engineering (FE) customer engineer to maintain the IBM 3274 Control Unit Models 51C and 52C.

The maintenance procedures described in this manual and performed by the support FE customer engineer represent a part of the overall support structure for the 3274 Control Unit. This support structure begins at the 3274 operator level and is briefly described as follows:

- *3274 Operator* — Performs initial problem isolation and recording of 3274 status indications by following the procedure in the *3274 Problem Determination Guide,* GA27-2854. If the problem is other than a customer operating procedure or customer-supplied power, the operator completes the *3274 Problem Report Form* and requests IBM service.
- *Product Customer Engineer* — Performs the maintenance procedures contained in the *3274 Maintenance Information* manual (MIM) to isolate the problem to a field replaceable unit (FRU). The *3274 Problem Report Form* prepared by the operator gives the 3274 indications necessary for performing these procedures. If the problem cannot be isolated and corrected, the product customer engineer requests assistance from the next level of the support structure.
- *Support Customer Engineer* — Verifies the results obtained by the product customer engineer and performs an in-depth analysis of the problem by means of the following:
  - Tests
  - Log Information
  - Error Code Definitions
  - Result of Host Test Routines
  - Special Tools and Test Equipment

If the problem cannot be isolated and resolved with the use of these service aids, the support customer engineer records the problem indications and supporting information on the 3274 Problem Checklist and requests assistance from the next level of the support structure.

## Organization

This manual is organized as follows:

- Chapter 1 — Maintenance Approach and System Overview
- Chapter 2 — Subsystem Indicators, Symbols, and Messages
- Chapter 3 — Subsystem Error Logs and Test Formats
- Chapter 4 — Subsystem Tests, External Tests, and Subsystem Service Aids
- Chapter 5 — Reference Data
- Chapter 6 — Tools and Test Equipment
- Appendix A — Support Structure Information Form
- Appendix B — 3274 Models 51C and 52C Error Codes
- Appendix C — Structured Field and Attribute Processing (SFAP) Data Stream Error Extensions
- Appendix D — IBM 31SD Diskette Drive Maintenance
- Appendix E — IBM 31SD Diskette Drive Maintenance Analysis Procedures (MAPs)
- Appendix F — X.21 Switched Feature F-1
- Appendix G — Abbreviations

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## CE SAFETY PRACTICES

All Customer Engineers are expected to take every safety precaution possible and observe the following safety practices while maintaining IBM equipment:

1. You should not work alone under hazardous conditions or around equipment with dangerous voltage. Always advise your manager if you MUST work alone.
2. Remove all power AC and DC when removing or assembling major components, working in immediate area of power supplies, performing mechanical inspection of power supplies and installing changes in machine circuitry. Pull the power plug from the receptacle to remove power source.
3. Wall box power switch, when used to disconnect power, should be locked or tagged in off position. "Do not Operate" tags, form 229-1266, should be securely attached to power switch or to outside of power box.
4. When it is absolutely necessary to work on equipment having exposed operating mechanical parts or exposed live electrical circuitry anywhere in the machine, the following precautions must be followed:
   a. At least one other person familiar with power off controls, emergency power off procedures, and the location of the wall box power switch, must be in the immediate vicinity at all times.
   b. Rings, wrist watches, chains, bracelets, metal cuff links, shall not be worn.
   c. Only insulated pliers and screwdrivers shall be used.
   d. Keep one hand in pocket.
   e. When using test instruments be certain they are of proper capacity and controls are set correctly. Only insulated probes are used.
   f. Avoid contacting ground potential (metal floor strips, machine frames, etc. — use suitable rubber mats purchased locally if necessary).
5. Safety Glasses must be worn when:
   a. Using a hammer to drive pins, riveting, staking, etc.
   b. Power hand drilling, reaming, grinding, etc.
   c. Using spring hooks, attaching springs.
   d. Soldering, wire cutting, removing steel bands.
   e. Parts cleaning, using solvents, sprays, cleaners, chemicals, etc.
   f. All other conditions that may be hazardous to your eyes. REMEMBER, THEY ARE YOUR EYES.
6. Special safety instructions such as handling Cathode Ray Tubes and extreme high voltages, must be followed as outlined in CEM's and Safety Section of the Maintenance Manuals.
7. Do not use solvents, chemicals, greases or oils that have not been approved by IBM.
8. Avoid using tools or test equipment that have not been approved by IBM.
9. Replace worn or broken tools and test equipment.
10. The maximum load to be lifted is that which in the opinion of you and management does not jeopardize your own health or well-being or that of other employees.
11. All safety devices such as guards, shields, signs, ground wires, etc., shall be restored after maintenance.
12. Each Customer Engineer is responsible to be certain that no action on his part renders product unsafe or exposes hazards to customer personnel.
13. Place removed machine covers in a safe out-of-the-way place where no one can trip over them.
14. All machine covers must be in place before machine is returned to customer.
15. Always place CE tool kit away from walk areas where no one can trip over it (i.e., under desk or table).
16. Avoid touching mechanical moving parts (i.e., when lubricating, checking for play, etc.).
17. When using stroboscope — do not touch ANYTHING — it may be moving.
18. Avoid wearing loose clothing that may be caught in machinery. Shirt sleeves must be left buttoned or rolled above the elbow.
19. Ties must be tucked in shirt or have a tie clasp (preferably nonconductive) approximately 3 inches from end. Tie chains are not recommended.
20. Before powering up or starting equipment, make certain other CEs and customer personnel are not in a hazardous position.
21. Maintain good housekeeping in area of machines while performing and after completing maintenance.
22. Even though preventive measures are taken, accidents do occur. CEs and support personnel should be prepared to follow emergency first aid procedures as outlined below.

**First Aid — General**

1. If accidental electrocution occurs:
   a. Remove power source before touching victim.
   b. If power cannot be removed, pull victim away from equipment by using non-conductive material such as a broom handle, leather belt, or necktie.
   c. Immediately begin rescue breathing; see below.
   d. Begin CPR if necessary and only if trained person is available.
   e. Call a doctor.
   Have someone summon medical aid.
   f. Remain in position.
   After victim revives, be ready to resume respiration if necessary.
2. For serious injury:
   a. Summon medical aid.
   b. Do not move victim unless absolutely necessary to remove from danger.
   c. Attempt to stop serious bleeding by using pressure points or a pressure bandage.
   d. Loosen clothing and keep victim warm.

**Artificial Respiration**

General Considerations

1. Start Immediately, Seconds Count
   Do not wait or look for help or stop to loosen clothing, warm the victim or apply stimulants.
2. Check Mouth for Obstructions
   Remove foreign objects — Pull tongue forward.

**Rescue Breathing for Adults — Place Victim on His Back Immediately**

1. Clear throat of water, food, or foreign matter.
2. Tilt head back to open air passage.
3. Lift jaw up to keep tongue out of air passage.
4. Pinch nostrils to prevent air leakage when you blow.
5. Blow until you see chest rise.
6. Remove your lips and allow lungs to empty.
7. Listen for snoring and gurglings, signs of throat obstruction.
8. Repeat mouth to mouth breathings 10-20 times a minute. Continue rescue breathing until he breathes for himself, or medical aid arrives.

Thumb and finger positions


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# Safety Notices

### Personal Safety

The Danger and Caution notices that appear in this manual refer mainly to the 31SD Diskette Drive. Before using this manual, review all the Danger and Caution notices that are listed in the front of the *3274 Control Unit Maintenance Information* manual, SY27-2513.

### General Personal Safety Information

AC voltages are present on the 31SD drive motor connector and capacitor terminals when the drive motor is running. The motor and the solenoid become hot after continuous use; let the parts cool before attempting servicing. The following Danger and Caution notices appear in this manual:

**DANGER**
**Input AC voltage is present in the Prime Power Box when the 3274 I/O (on/off) switch is in the O (off) position.**

**DANGER**
**Voltage is still present at the socket when the power cable is disconnected.**

**DANGER**
**High voltage may be present at the capacitor terminals.**

**CAUTION: The solenoid case becomes hot after continuous use.**

### Machine Safety

The notices that appear in this manual refer mainly to the 31SD Diskette Drive. Before using this manual, review all the Warning notices that appear in the *3274 Control Unit Maintenance Information* manual, SY27-2513.

### General Machine Safety Information

The 31SD Diskette Drive can be damaged if it is not operated or serviced correctly. Do not use IBM cleaning fluid or other chemical cleaning fluids near plastic parts. Never use damaged diskettes in a 31SD Diskette Drive. Diskettes that are damaged physically (creased or bent) or contaminated by pencil marks, finger marks, or cleaning fluids can cause data errors, equipment errors, or head damage. The following Warning notices appear in this manual:

**Warning: Do not attempt to remove the collet/flat spring before removing the bail. Too much pressure or binding can damage the spring.**

**Warning: Damage to the head can occur if the pressure pad is permitted to hit the head.**

**Warning: Too much pressure or binding of the flat spring will damage the spring.**

**Warning: The head/carriage assembly is adjusted and tested at the factory. Do not attempt to adjust or repair any part of this assembly.**

**Warning: The head area can be easily damaged or contaminated. Read the following before exchanging a pressure pad:**

- **Ensure that your tools are clean; use isopropyl alcohol (part 2200200) and a clean tissue (part 2162567), or use an alcohol pad (part 9900679).**
- **Do not touch the pressure pad with your fingers.**
- **Be careful not to damage the new pressure pad or loosen any of the pad's surface. The layer of adhesive on the new pad is very thin; do not damage the adhesive. Do not let the adhesive touch the surface of the pad that will touch the diskette. Do not use damaged pads.**
- **Do not scratch the head load arm.**
- **Do not let the head load arm hit the read/write head.**
- **Move the head load arm as little as possible. The tension spring can come out.**

**Warning: The head/carriage service check must be performed with the diskette drive installed (or with the diskette drive in the same position as when installed), or the adjustment might not be accurate.**

**Warning: The head/carriage assembly adjustment must be performed with the diskette drive installed (or in the same position as when installed), or the adjustment might not be accurate.**

**Warning: The band must not be bent or damaged in any way.**

**Warning: When you install the head/carriage assembly, ensure that the bail is under the head load arm. Ensure that the bail return spring is correctly installed. Ensure that the band is not damaged in any way.**

**Warning: The band is easily damaged. Do not bend, crease, or scratch the band. Do NOT use a damaged band.**

# Chapter 1. Maintenance Approach and System Overview

This chapter contains information to assist the support customer engineer in isolating and correcting 3274 subsystem problems that cannot be attributed to a failing field replaceable unit (FRU). The information supplements existing documentation covering problem isolation, use of serviceability aids, specialized tools, and test equipment. The topics presented include the following:

- *Overall Maintenance Approach:* The maintenance approach is outlined to provide flexibility both in the type of approach taken and in the selection of supporting serviceability aids. The maintenance approach identifies and refers to procedures, tests, specialized tools, and test equipment that will most likely help isolate various types of 3274 problems. Detailed descriptions of these serviceability aids and their use are contained in other chapters in this publication. In addition, examples using these serviceability aids are given for typical 3274 problems.
- *Subsystem Operation Overview:* This overview gives a general description of 3274 operations and functions.
- *Serviceability Aids:* A general description of serviceability aids and their use is given. These aids include the operational indicators, display symbols, error suffix codes, logouts, tests, test equipment, and host error recording.
- *Reference Material:* All supporting reference material in this publication is identified and described. This reference material provides detailed descriptions of error recording and indications, tests, error recovery procedures, 3270/3274 operational differences, error suffix code action chart, and tools and test equipment.
- *Supporting Publications:* Supporting IBM publications are identified and their contents briefly described.
- *Procedure for Requesting Assistance:* A procedure for requesting assistance from the next level of the support structure is outlined. This procedure includes 3274 problem recording which will aid the support structure in problem determination.

## 1.1 MAINTENANCE APPROACH

This maintenance approach is outlined to provide flexibility both in the type of approach taken and in the selection of supporting service aids. The approach used to isolate a specific 3274 problem may vary because of multiple error indications and the type of operation being performed at the time the error occurred. Therefore, the maintenance approach to typical problems described in the following is not necessarily the only effective approach that could be used.

The suggested maintenance approach identifies and refers to various procedures, tests, tools, and test equipment that will most likely aid in isolation of the problem. This approach has four basic steps, which are performed in sequence:

**Step 1**

Review and verify the results obtained by the product customer engineer by using the following reference material:

- *3274 Problem Report Form*
- *3274 Control Unit Maintenance Information*

**Step 2**

Analyze operational indicators (8 4 2 1), display symbols, and error suffix codes (nnn codes).

**Step 3**

Analyze logouts, hang conditions, and failing operation sequences.

**Step 4**

Record all problem symptoms, and complete the Support Structure Information Form in preparation for requesting assistance. The effectiveness of the assistance will depend largely on the information that you provide.

These four steps are illustrated in Figure 1-1.

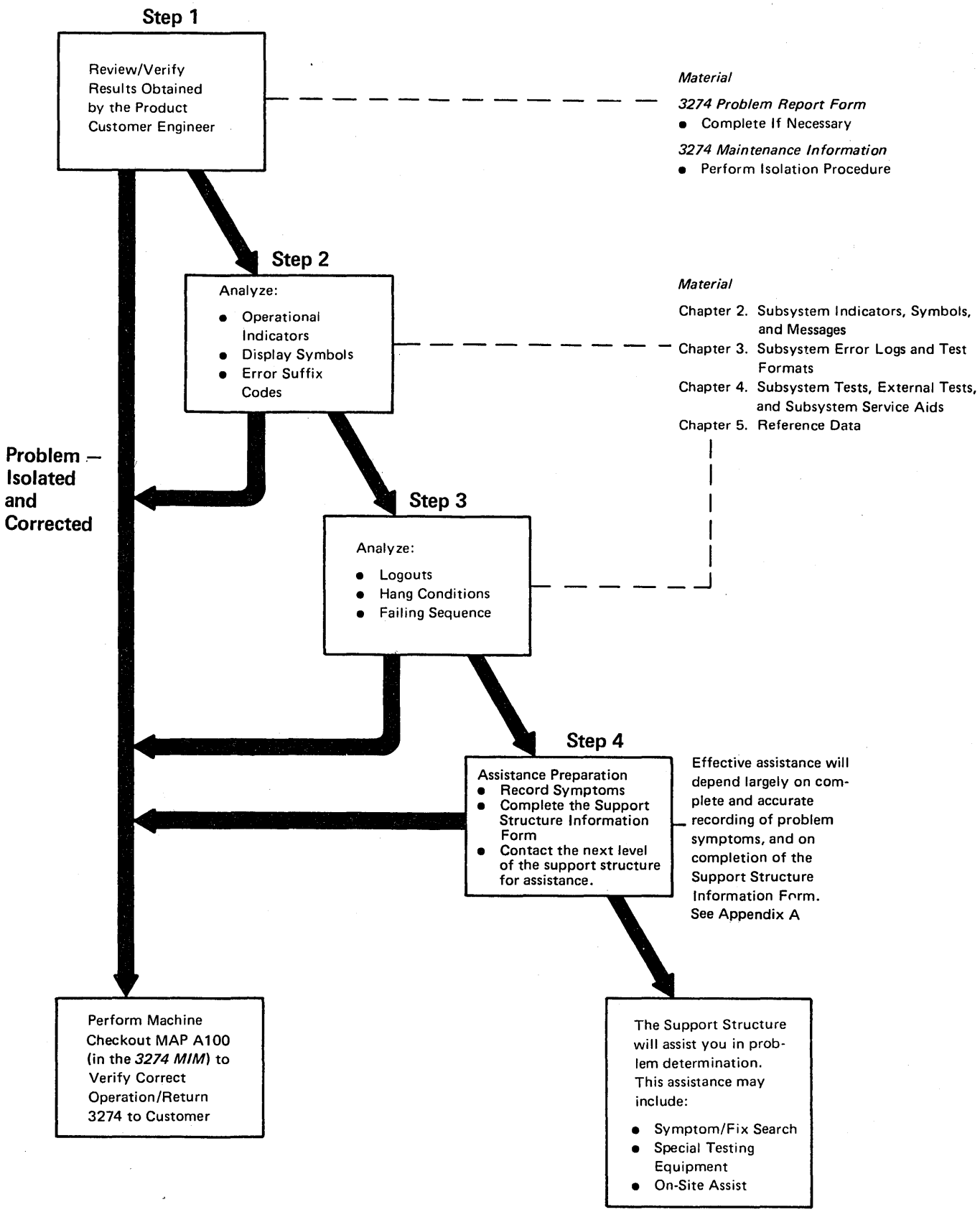



**Figure 1-1. Support Customer Engineer Maintenance Approach**

## 1.2 SUBSYSTEM DATA FLOW

The 3274 subsystem data flow consists of test data, control data (unit code); status, error, and log data; and message data between the components of the subsystem. Figure 1-2 illustrates the 3274 subsystem configuration. The data flow is described as follows:

- Initial Machine Load (IML) of Test Data – Loading the IML test data residing on the system diskette into control storage (paragraph 1.2.1 and Figure 1-3).
- Initial Machine Load (IML) of Unit Code – Loading the unit code residing on the system diskette into control storage (paragraph 1.2.2 and Figure 1-3).
- Message Data Flow between 3274 Control Unit and Attached Devices – The flow of message data between the 3274 Control Unit and attached devices (paragraph 1.2.3 and Figure 1-4).
- Message Data Flow between 3274 Control Unit and Host System – The flow of message data between the 3274 Control Unit and the host system (paragraph 1.2.4 and Figure 1-5).
- Status, Error, and Log Data Flow – The flow of data from the 3274 Control Unit, the host system, and attached devices to the data control block area of control storage (paragraph 1.2.5 and Figure 1-6).

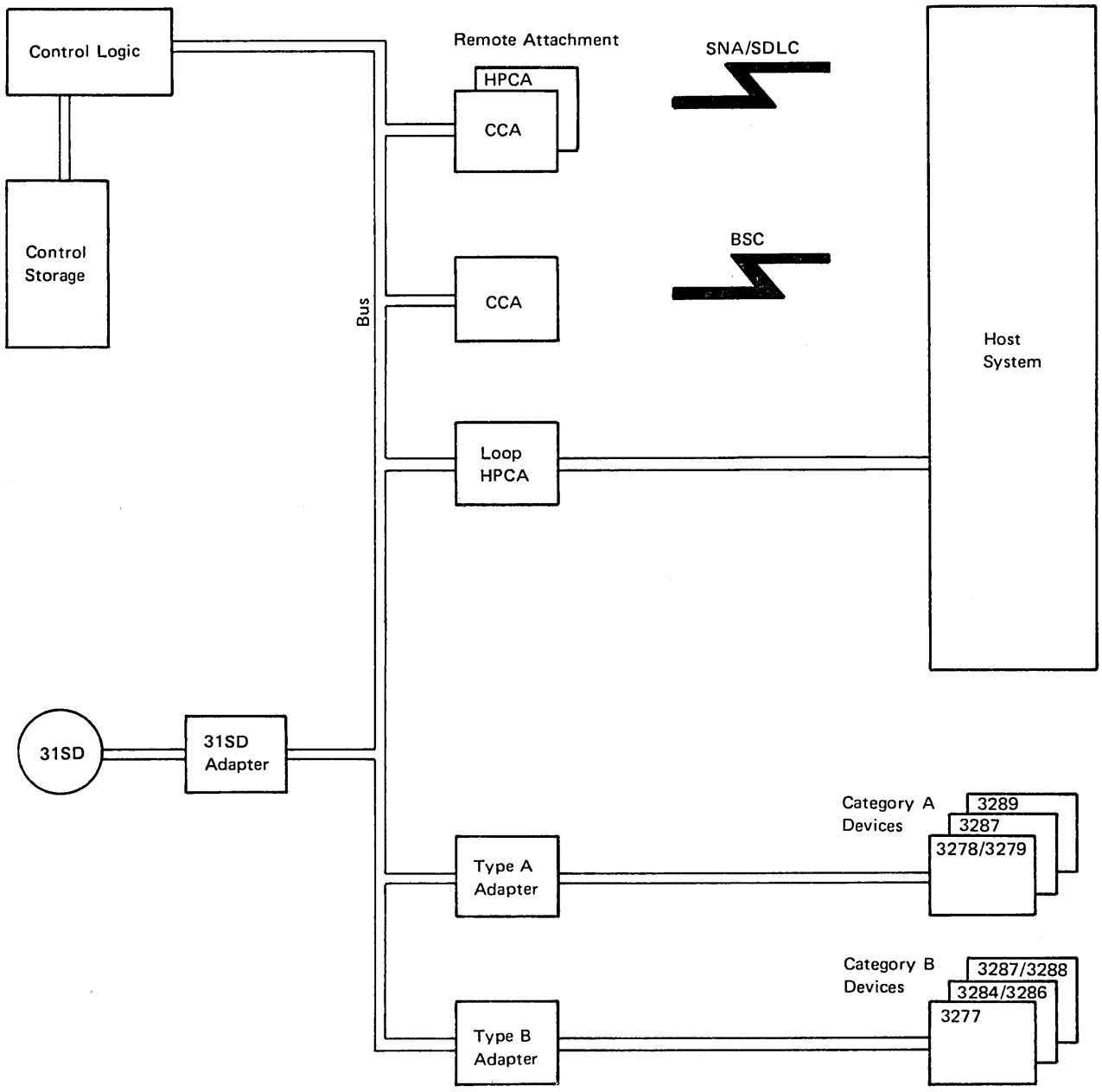



**Figure 1-2. 3274 Subsystem Overview**

### 1.2.1 IML Test Data Path

The IML test data path is shown in Figure 1-3. IML test data is retrieved from the 31SD after IML tests 0000, 0001, and 0002 have been successfully completed. IML test 0002 verifies that the 31SD and the 31SD adapter are functionally operational. The data path, from origin to destination, is identified as follows:

- 31SD
- 31SD Adapter
- Bus
- Control logic
- Control storage

### 1.2.2 IML of Unit Code

The data path of IML (loading of unit code) is the same as the IML test data path. Unit code is normally loaded after the IML tests are successfully completed. Placing the ALT switch in the ALT 1 position and pressing the IML push-button will cause the IML test to be bypassed and initiate loading of the unit code.

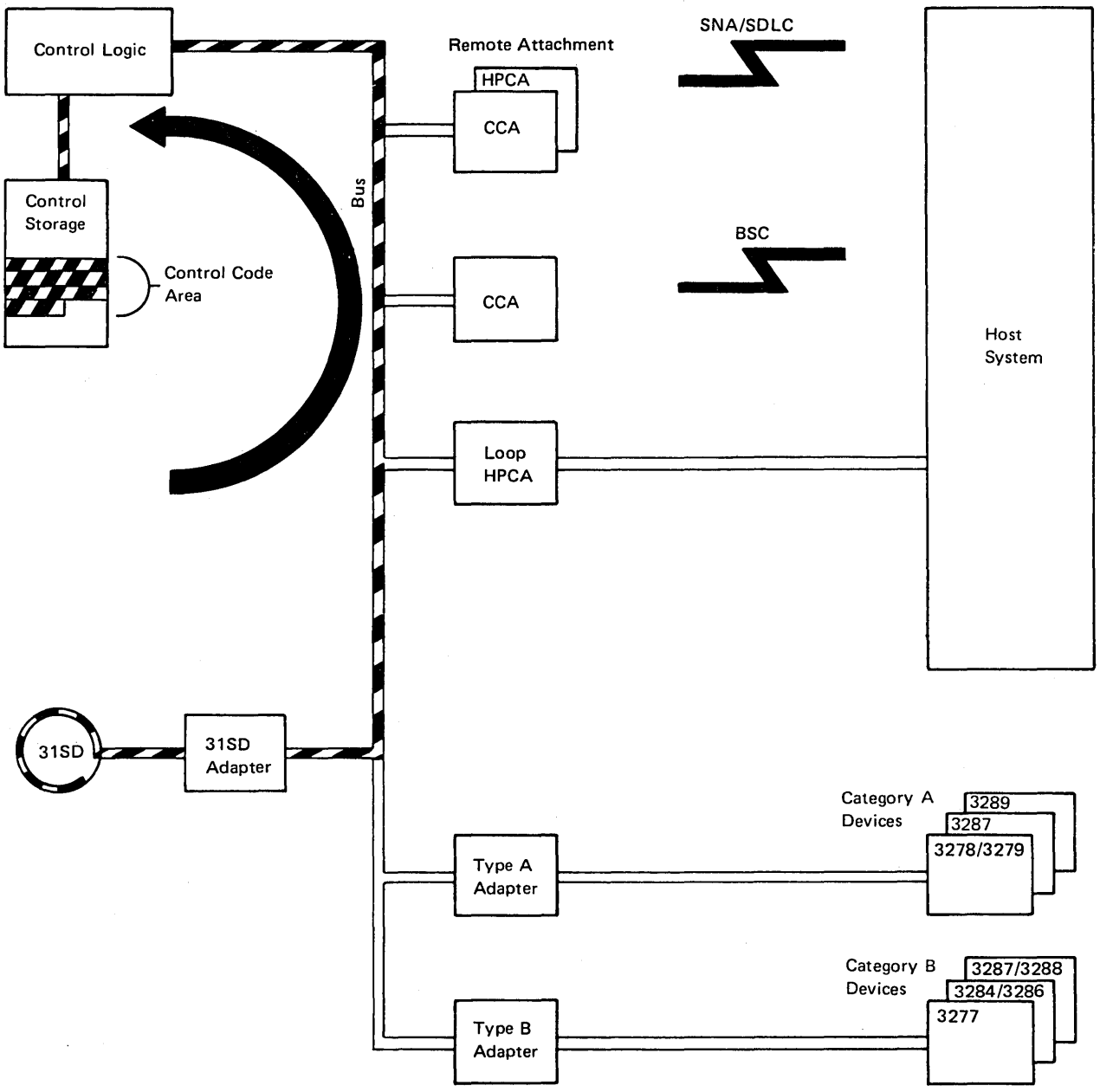



**Figure 1-3. Initial Machine Load (IML) Data Flow**

### 1.2.3 Message Data Flow between 3274 Control Unit and Attached Devices

Message data flow between the 3274 Control Unit and attached devices is shown in Figure 1-4. The message data paths, from origin to destination, are identified as follows:

*3274 Control Unit to Device*

- Control storage (message buffer area)
- Control logic
- Bus
- Type A or B adapter
- Category A or B device

*Device to 3274 Control Unit*

- Category A or B device
- Type A or B adapter
- Bus
- Control logic
- Control storage (message buffer area)

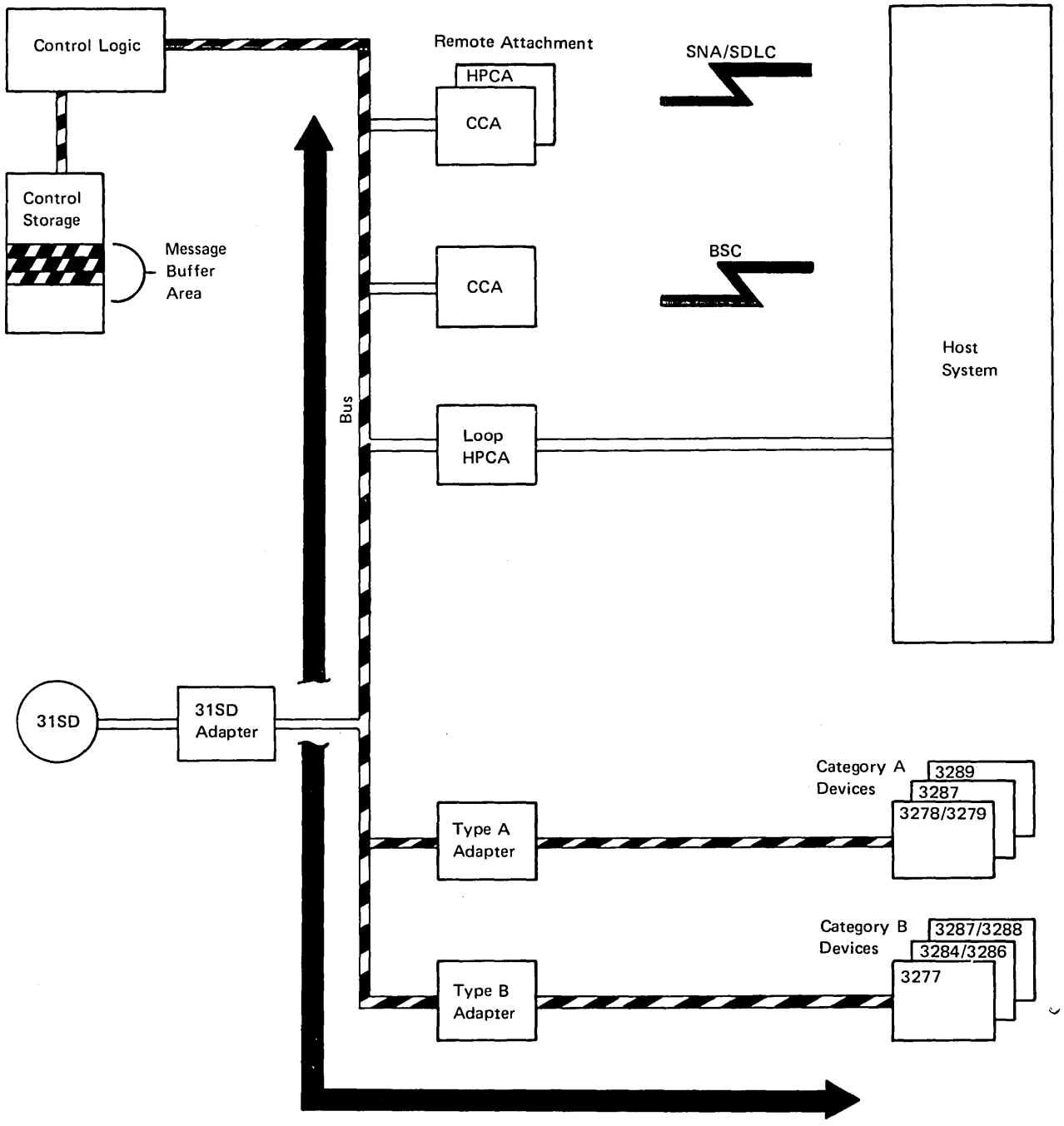



**Figure 1-4. Message Data Flow between 3274 Control Unit and Attached Devices**

### 1.2.4 Message Data Flow between 3274 Control Unit and Host System

Message data flow between the 3274 Control Unit and the host system is shown in Figure 1-5. The message data paths, from origin to destination, are identified as follows:

*3274 Control Unit to Host*

- Control storage (message buffer area)
- Control logic
- Bus
- Remote host adapter/ local channel attachment or local host attachment
- Host system

*Host to 3274 Control Unit*

- Host system
- Remote host adapter/ local channel attachment or local host attachment
- Bus
- Control logic
- Control storage (message buffer area)

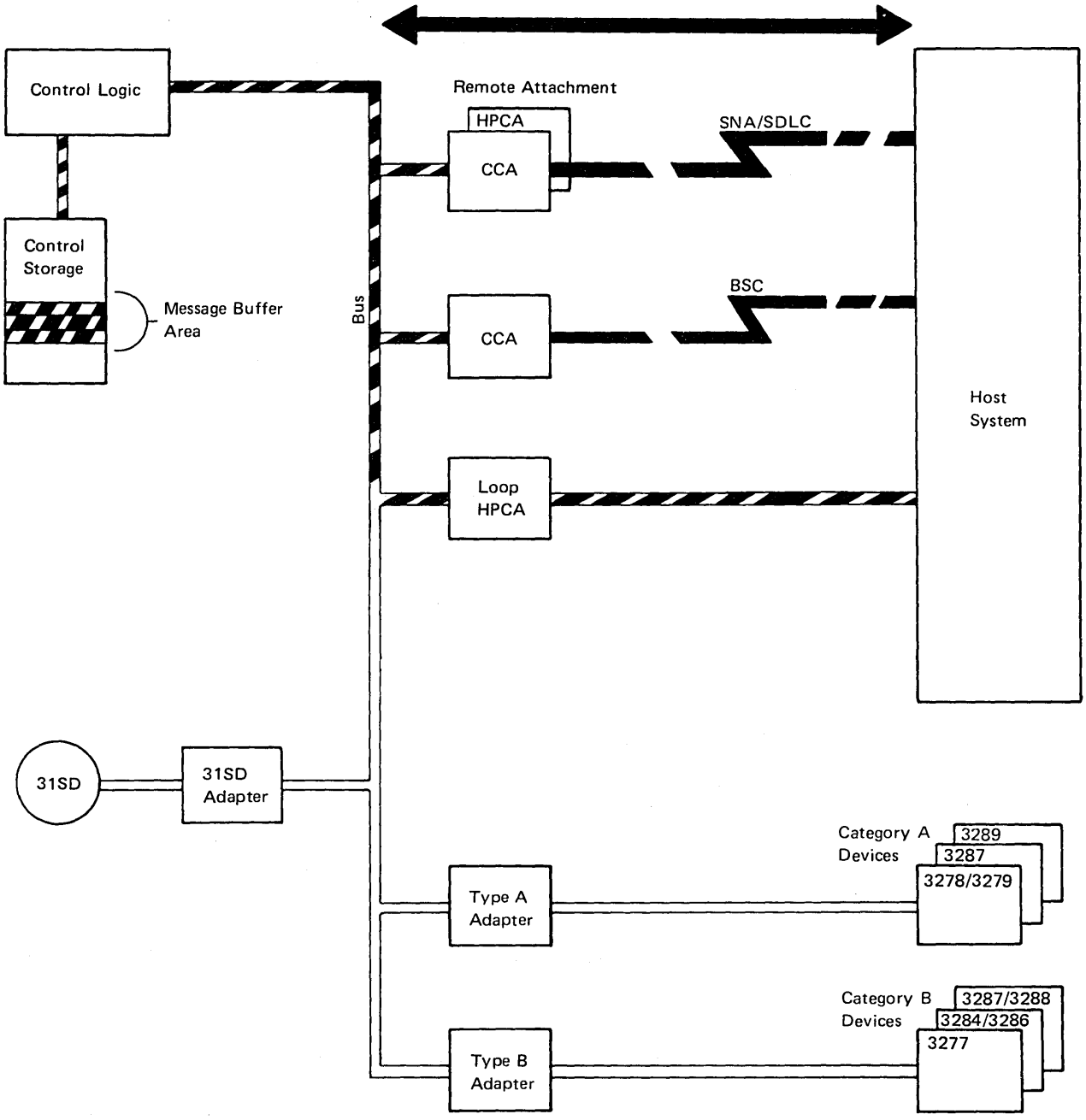



**Figure 1-5. Message Data Flow between 3274 Control Unit and Host System**

## 1.2.5 Logic Data Flow

Status, error, and log data flow is shown in Figure 1-6. The data paths, from origin to destination, are identified as follows:

*Host System*
- Remote host adapter

*Category A and B Devices*
- Type A or B adapter
- Bus
- Control logic
- Control storage (control block area)

*31SD*
- *31SD adapter*

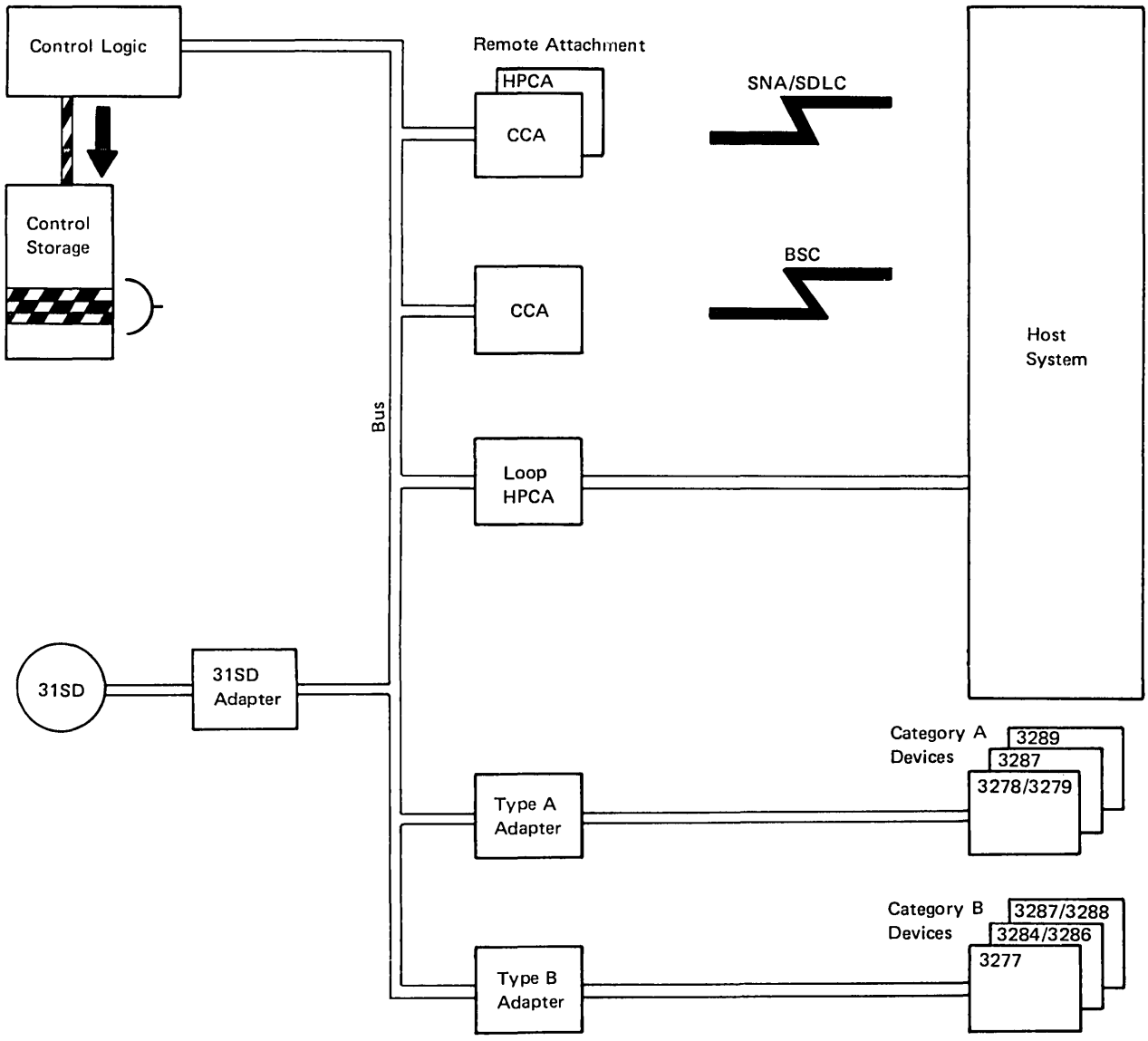



**Figure 1-6. Logic Data Flow**

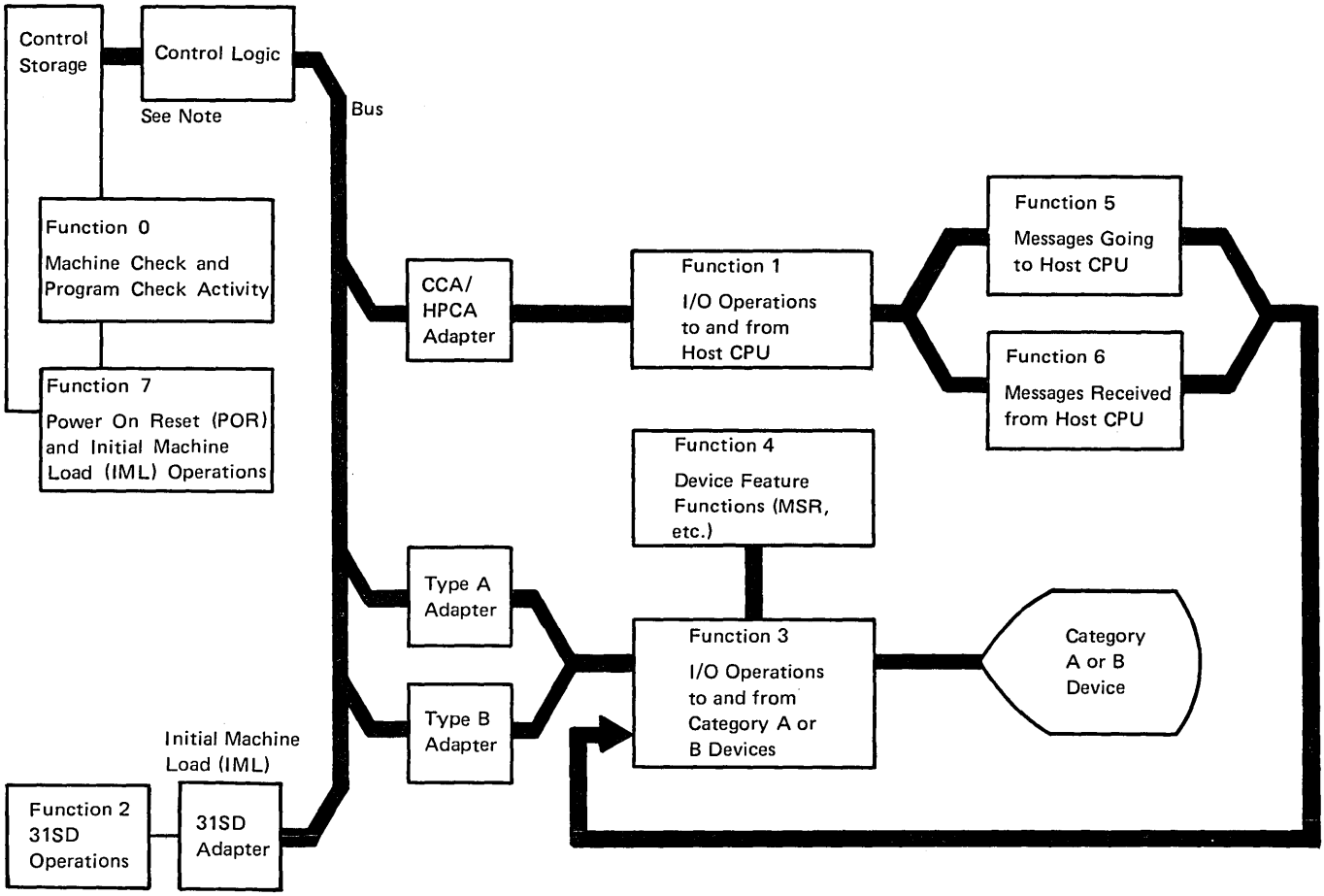
## 1.3 SUBSYSTEM FUNCTIONS

The following functions are provided by the 3274 subsystem:

| Function | Description |
|---|---|
| 0 | Machine check/program check activity |
| 1 | I/O operations to and from the host CPU |
| 2 | 31SD Operations |
| 3 | I/O operations to and from Category A and Category B devices |
| 4 | Device feature functions |
| 5 | Messages sent to the host CPU |
| 6 | Messages received from the host CPU |
| 7 | Initialization (POR and IML) |

The 3274 subsystem functions are illustrated in Figure 1-7.

The functions of the 3274 may be grouped into six basic categories: (1) Power On Reset (POR) operations, (2) key-tracking (moving data from the keyboard to the display screen), (3) receiving from the host, (4) sending to the host, (5) error handling and logging, and (6) internal testing.




**Note:** *The functions shown in this diagram are provided by the control logic.*

**Figure 1-7. 3274 Subsystem Functions**

### 1.3.1 Control Unit Power On Reset

When the 3274 is powered on, the Power On Reset (POR) signal is generated in the TSR power supply. The POR to the A1 board generates a restart to the control logic and, subsequently, starts a normal IML sequence. If two TSR power supplies are installed, the POR from each supply is connected to the other in the logic board. (See Figure B-3 in the *3274 Control Unit Models 51C and 52C Maintenance Information* manual, SY27-2513.)

### 1.3.2 Keystroke Handling

The requests and status from the attached devices are handled by the Keystroke control function. When an operator presses a key, the keyed data is read by the display base card 1, which, if it receives a poll, sends the data to the terminal adapter (Category A devices only). The terminal adapter then loads the status and scan code of the actuated key into a queue. The terminal adapter control retrieves this information from the buffer queue.

Keystroke control converts the scan code and distributes the data to the appropriate functions. See Figure 1-8 for an illustration of Type A adapter keystroke handling.

As an example of keystroke handling, when a graphic character key is pressed, the graphic key scan code is converted into internal code and then into regen code by means of a language code conversion table. The converted regen code is moved into the device regen buffer, after which the graphic character keyed may be seen displayed on the screen.

When a device is polled, if it has an error condition or request from a feature (selector pen, MSR), it sends status to the terminal adapter, and keytracking control handles the status as it does a status preceding keyed data.

An error condition detected by the device is signaled to the terminal adapter when the device is polled. Error conditions are (1) device check (a parity error was detected in the regen buffer), (2) keyboard overrun (keystrokes too close together), and (3) feature timeout (no response from the feature card within the expected time).

Special keyboard scan codes are used for the device POR signal and keyboard overrun conditions. Selector-pen data is sent to the terminal adapter by read commands. The row count is sent on the first read, and the field count is sent on the second.

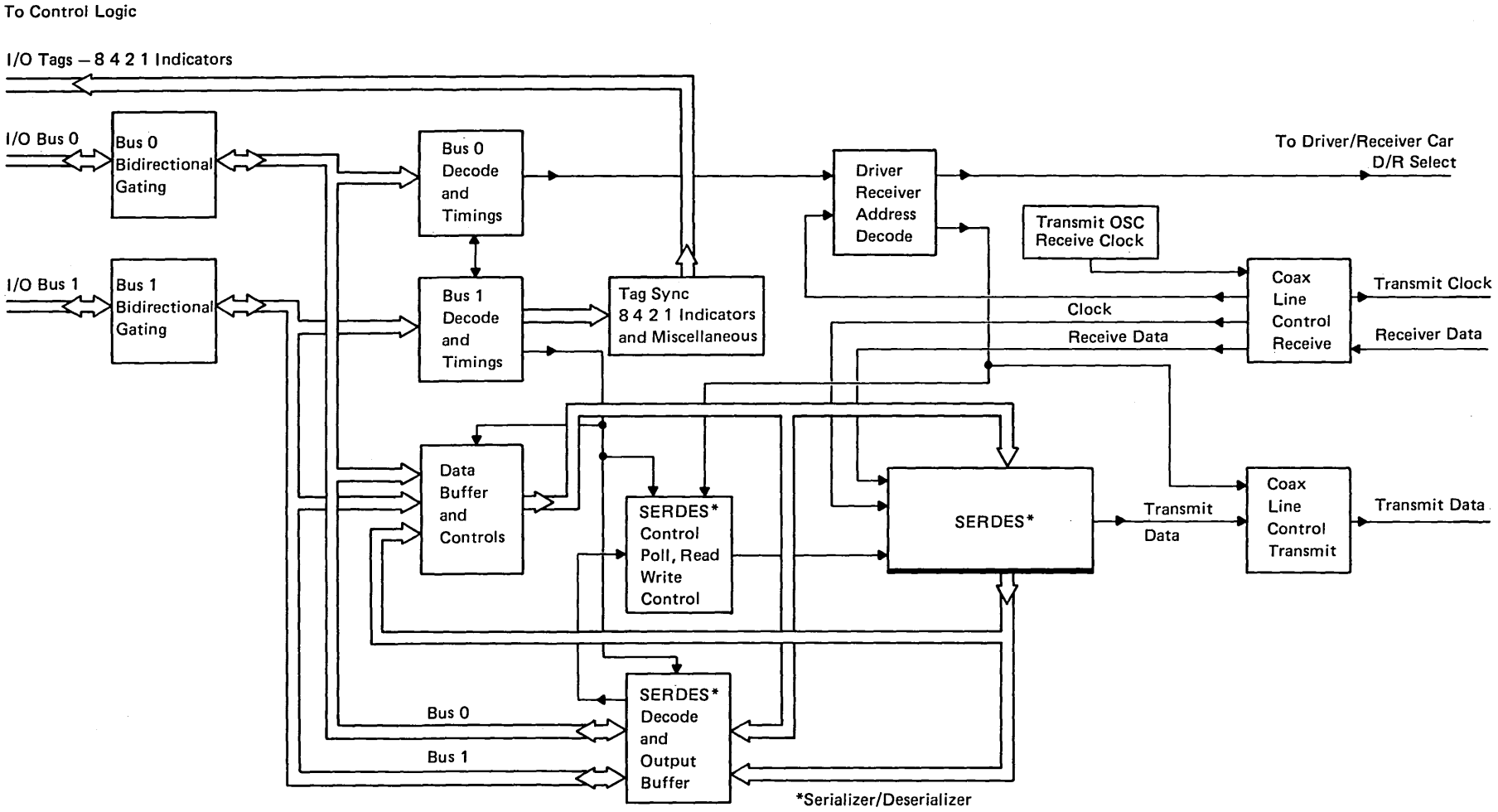



**Figure 1-8. Keystroke Handling, Type A Adapter**

### 1.3.3 Sending to Host

Data from Category A devices is queued via function 3 into various buffer formats, depending on the type of host attachment used, by the device control code. The data is then handled, again in queued buffer formats, by the data stream control code. The host processing control code then forwards the appropriate data from another queued buffer to the host. (See Figure 1-9.)

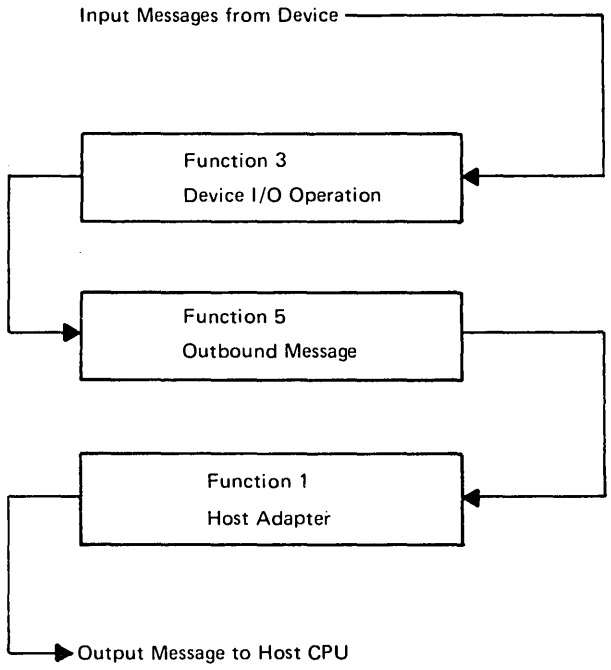



**Figure 1-9. Inbound Messages**

### 1.3.4 Receiving from Host

Data from the host is queued via function 1 into common transmit/receive buffers of various formats, depending on the type of host attachment used, by the host processing control code. The data is then handled in queued buffer formats by the data stream control code. The device control code then forwards the data to the device. (See Figure 1-10.)

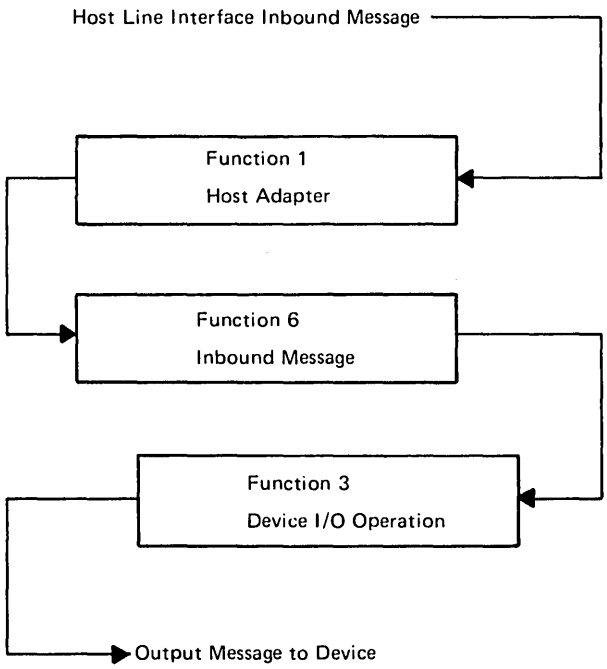



**Figure 1-10. Outbound Messages**

### 1.3.5 Error Handling and Logging

Error handling and logging is performed by the control logic and storage. Log statistics and information are available for each device and host adapter by means of test procedures.

### 1.3.6 Internal Testing

All internal tests are performed by the control logic, and indicators are provided for test results. Host support is not required for internal testing.

### 1.3.7 Function Priority

The priority scheme used by the 3274 subsystem is illustrated in Figure 1-11. Function 0 has the highest priority, and function 7 has the lowest priority. For example, if a machine check (function 0) and a 31SD operation (function 2) are both pending, the 3274 control logic performs function 0 followed by function 2.

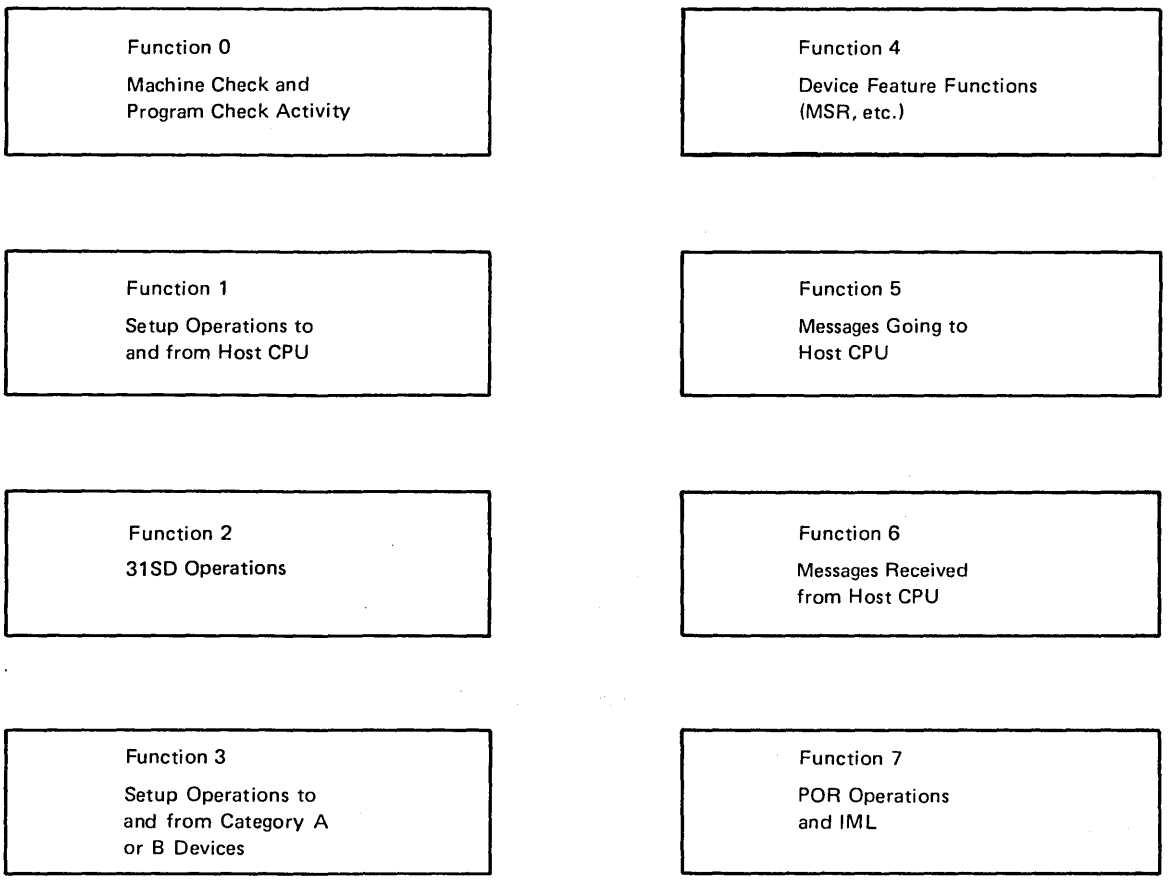



**Figure 1-11. 3274 Subsystem Functional Priorities**

### 1.3.8 Type A Adapter Coax Data Path

Figure 1-12 illustrates the bit path from the coax to the Type A adapter.

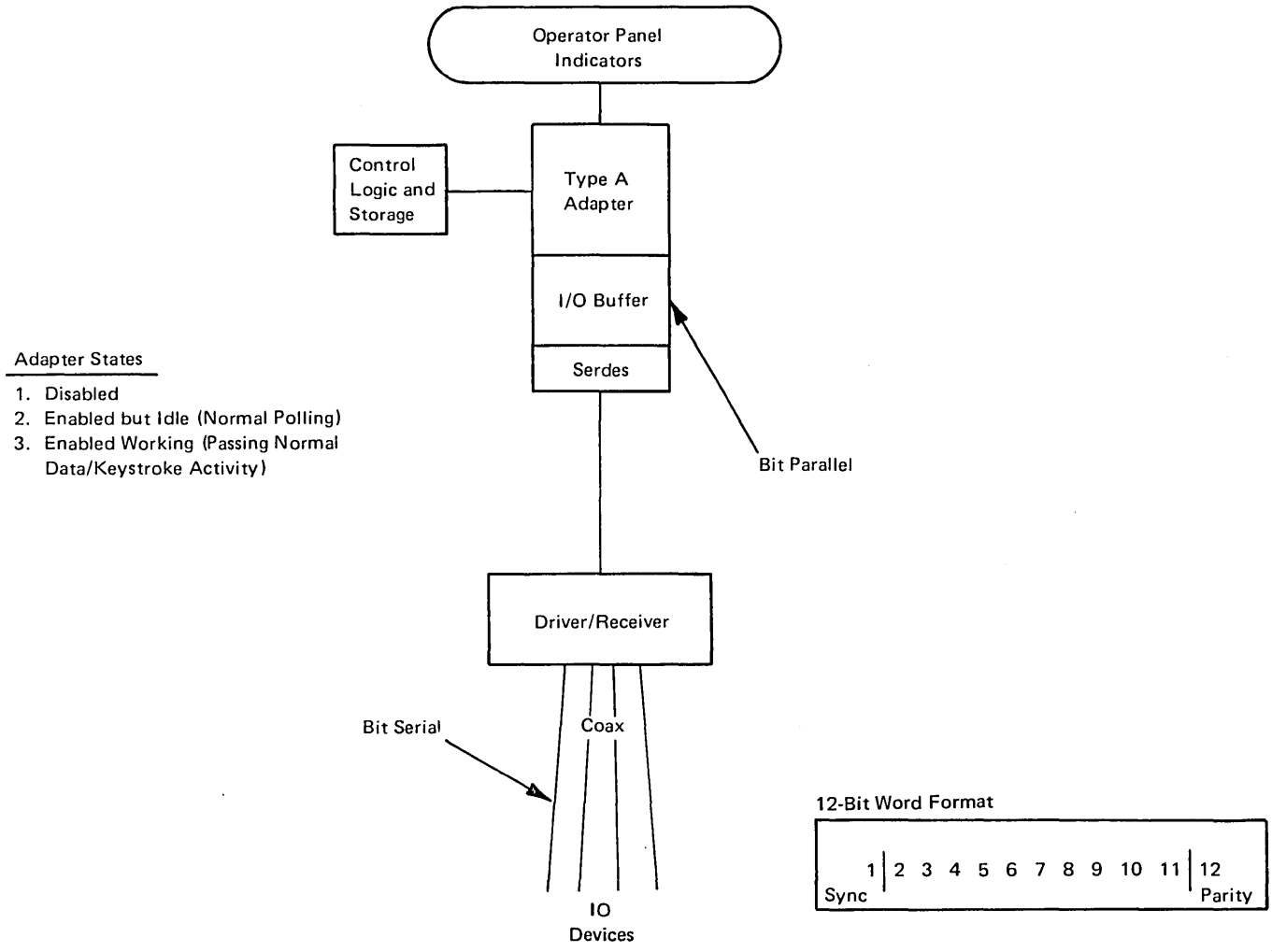



**Figure 1-12. Coax to Type A Adapter Data Flow**

## 1.4 SUPPORTING PUBLICATIONS

The publications identified in Figure 1-13 should be available for reference.

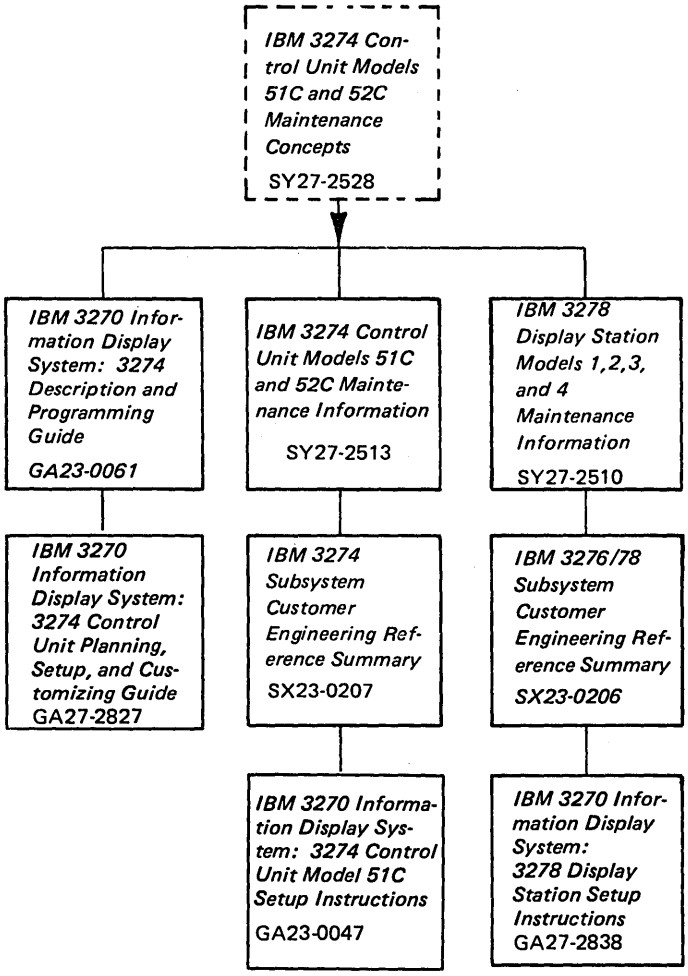



**Figure 1-13. Supporting Publications**

# Chapter 2. Subsystem Indicators, Symbols, and Messages

## 2.1 INTRODUCTION

This chapter provides information concerning the operator panel indicators and the 3278 display symbols and messages used to convey error and subsystem status conditions to the user and the customer engineer. The operator panel indicators include the 8 4 2 1 indicators and the Power On/Off indicator.

The subsystem symbols and messages displayed on the 3278 status line include the Readiness and System Connection symbols, Do Not Enter messages, Communication Reminders, Shifts and Modes symbols, Printer Status messages, and Machine, Program, and Communication Check numbers. The functional details of each item are described.

## 2.2 8 4 2 1 INDICATORS

The four indicators labeled 8 4 2 1 (Figure 2-1) are located on the operator panel. They are activated by the control logic to serve as prompting, progress, and/or success/failure indicators during the following operations:

- *IML Bus Test:* All four indicators are turned on by the IML pushbutton via the control logic and the Type A adapter card No. 12 if there is no activity on the internal logic bus.
- *IML Tests:* As the test routines are run, the control logic turns on and turns off each of the four indicators. A failure condition is indicated by a constant or flashing code displayed in the 8 4 2 1 indicators. The success of a given test is indicated by the 8 4 2 1 indicators progressing on the next hexadecimal value.
- *Operational Mode:* During online operations with the host CPU, the 8 4 2 1 indicators are turned on by the control logic when an error condition is detected by the control logic. Hexadecimal values are used to indicate the most likely failing component. If additional errors are detected the control logic writes over the prior indication with the new hexadecimal value. The indicators turned on by the control logic may represent recoverable errors or nonrecoverable errors. The error remains displayed in the 8 4 2 1 indicators until the machine is powered off or until the IML pushbutton is pressed.
- *Customizing Mode:* During customizing, the 8 4 2 1 indicators display the type of customizing operation in progress, as well as serving as progress and procedural-failure indicators. They also prompt the user to change diskettes during customizing and notify the user when customizing is completed.

## 2.3 POWER ON/OFF INDICATOR

The Power On/Off indicator is located on the operator panel PC board. It is turned on by +5 Vdc from the logic board. When the machine has two TSR power supplies, approximately half of the card sockets receive voltage from a particular supply. The Power On indicator will not light unless both supplies are active.

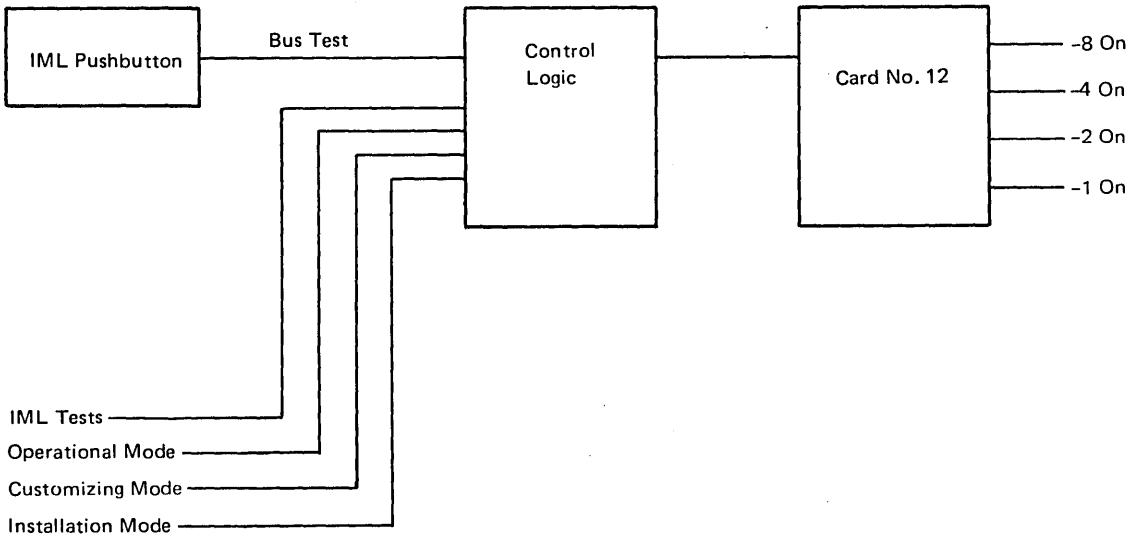



**Figure 2-1. 8 4 2 1 Indicator Control Logic**

## 2.4 OPERATOR INFORMATION AREA LAYOUT

The operator information area consists of five key fields located below the 3278/3279 status line. These five fields are not displayed on any Category B device (3277). The fields are (1) Readiness and System Connection, (2) Do Not Enter, (3) Reminders, (4) Shifts and Modes, and (5) Printer Status. The field lengths are shown in Figure 2-2.

### 2.4.1 Readiness and System Connection Symbols

The first six positions of the status line are allocated to Subsystem Ready, Host Ready, Application Ready, and Test. See Figure 2-3.

### 2.4.2 Do Not Enter (Input Inhibited) Symbols

The symbols shown in Figure 2-4 appear in positions 9 through 17 of the operator information area. Most of these symbols indicate an operator error. However, there are three categories of Do Not Enter symbols that are directly related to hardware or program failures: machine checks (X), program checks (X PROG), and communication checks (X). Each of these symbols is accompanied by a 3-digit code that further defines the error. The codes are defined in paragraphs 2.4.6, 2.4.7, and 2.4.8.

All the Do Not Enter symbols are shown in Figure 2-4. All the 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, but a change in state of the keyboard clicker (on-to-off or off-to-on) indicates that the keyboard is disabled. The symbols are arranged in descending order of assigned priority. In case of multiple conditions, the higher-priority symbol is displayed.

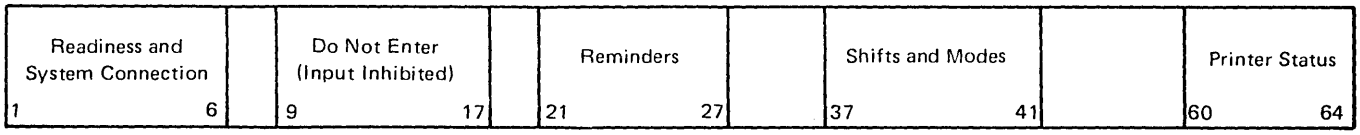



**Figure 2-2. Operator Information Area Layout**

| Symbol | Name | Explanation |
|---|---|---|
| 4 | 3274 Ready | 1 of the operator information area when the 3274 4 Control Unit to which the display is attached is ready (functional) and the display is ready. |
| A<br>B | Online A<br>Online B | The Online A and Online B symbols govern transactions with the host system. Certain keyboard functions and the meaning of some operator information area symbols differ depending upon which set of rules is applicable.<br><br>Online A. The control unit is connected to the system under A rules. The A symbol appears in remote systems using BSC protocol. It is turned on by receipt of the following commands: Write, Erase/Write, Erase All Unprotected, Copy, Read Modified, and Read Buffer.<br><br>The A symbol is turned off when<br>1. An operator action causes host communication.<br>2. The display station is turned off.<br>3. The Normal/Test switch is placed in Test, or the TEST key is pressed to place the 3274 in Test mode.<br><br>Online B. The control unit is connected to the system under B rules. The B symbol appears in systems that use SNA protocol. It is turned on by completion of an ACTPU/ACTLU command sequence, and is turned off by execution of DACTPU or DACTLU, including an internal DACTPU sequence, and when the Normal/Test switch is placed in Test or the TEST key is pressed. |
| ■ | My Job | The display station is connected to the operator's application program. This symbol is displayed in position 3. This symbol appears in systems that use BSC or SNA protocol. In systems using BSC, it 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, it is turned on when the operator's application session owns the screen. |

**Figure 2-3 (Part 1 of 2). Readiness and System Connection Symbols (Locations 1 through 6)**

| Symbol | Name | Explanation |
|---|---|---|
| | System Operator | This symbol is used with SNA protocol and indicates that the system operator (SSCP Control Program) session owns the display screen. Except for the ENTER key, the Program Attention keys are not functional 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 or to the system operator (control program). The SYS REQ key is used if LOGON is required. This symbol is displayed in position 3. |
| TEST | Test | The display station is in Test mode. Test mode is initiated or terminated by pressing the TEST key while holding the ALT key. TEST is displayed in positions 3 through 6. Test procedures are described in the *IBM 3270 Information Display System: 3278 Display Station Problem Determination Guide,* GA27-2839. |

**Figure 2-3 (Part 2 of 2). Readiness and System Connection Symbols (Locations 1 through 6)**

| Symbol | Name | Explanation |
|---|---|---|
| X | 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 preexisting "do not enter" condition may then be displayed. |
| X nnn | | The display station is not working properly. The symbol is accompanied by up to three digits, nnn (3278), which define the probable cause of the problem. Recovery procedures depend upon the type of error. |
| X *2%%* | Unavailable | The control unit is not equipped to handle a feature that has been invoked. RESET should be pressed and another action initiated. (See Appendix B.) |
| X nnn | Communication Check | A communication link error was detected and data cannot be sent. The RESET key should be pressed. This symbol is accompanied by up to three digits, nnn (3278), which 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 control unit. RESET should be pressed, and the operation should be retried. This symbol is accompanied by up to three digits which define the probable cause of the problem. |
| X ?<br>X | Questionable Card | The wrong magnetic stripe card was used with the MSR. RESET should be pressed, and the correct MSR card should be used. |
| X X | Operator Unauthorized | The operator has attempted to perform an unauthorized function. RESET should be pressed to restore the keyboard. The printer status area (location 60 through 64) should be checked for printer assignment. If the Operator Unauthorized symbol was displayed after the print key or IDENT key was pressed, a printer is not assigned. (If the Printer Assignment symbol is displayed in the printer status area, there is an error in the authorization matrix.) If the Operator Unauthorized symbol was displayed after the IDENT key was pressed and two numbers were entered, the operator is not authorized to use the printer. |
| X +?<br>X +?<br>X +?<br>X +?<br>X +? | Accent Plus What | These symbols indicate that an invalid dead key/character combination was entered (Canadian French keyboard only). RESET should be pressed to restore the keyboard, and a valid dead key/character combination should be entered. Valid combinations are as follows:<br>` à À è È ù Ù<br>´ a e E<br>^ â Â ê Ê ô Ô û Û<br>¨ ë Ë ï Ï ü Ü<br>ç Ç ¸ |
| X | Go Elsewhere | An action has been attempted that is invalid for the display screen location. RESET should be pressed, and either the cursor should be moved or some other action should be taken. |

**Figure 2-4 (Part 1 of 2). Do Not Enter Symbols (Locations 9 through 17)**

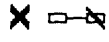
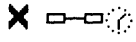
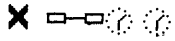
| Symbol | Name | Explanation |
|---|---|---|
| X  | Message Received | A message from the control operator was received and rejected. RESET should be pressed to restore the keyboard. The operator may view the message by pressing SYS REQ or may defer viewing of the message until a later time. |
| X SYSTEM | System Lock | The system has disabled the keyboard following an entry. The operator should look for a message and then press RESET to restore the keyboard. |
| X ?+ | What (Try Again) | The last input was not accepted. The screen should be rechecked, and the operation should be retried as follows:<br>1. Do not key while the X is displayed.<br>2. If ALT, or a shift key, was used, press the key again; then press RESET and retry the operation.<br>3. If ALT, or a shift key, was not used, press RESET and retry the operation. |
| X  | Printer Not Working | The printer assigned to the display station is not functioning. If this symbol appears after the Print key has been pressed, the print request is canceled, and the DEV CNCL key should be pressed to restore the keyboard. If the Printer Failure symbol is displayed in the printer status areas, the printer stopped during the last print operation. DEV CNCL should be pressed to restore the keyboard and to instruct the control unit to stop monitoring the operations of the printer that stopped. |
| X  | Printer Busy | The printer assigned to the display station is busy. If the Printer Printing symbol is displayed in the printer status area, the printer is printing. The operator may wait for the printer operation to complete, or he may press the DEV CNCL key. If the print key was used, it may be possible to select another printer. |
| X  | Printer Very Busy | This symbol means the same as Device Busy, except that more time than usual is anticipated before the print request is accepted. |
| X  | Time | Time is required for the system to perform a function. |
| X -S | Minus Symbol | The symbol you keyed is not available. The RESET key should be pressed to restore the keyboard. |
| X -f | Minus Function | A currently unavailable function was requested. RESET should be pressed to restore the keyboard. |
| X -f X | Minus Function | Operator Unauthorized. |
| X > | More Than | An attempt was made to enter more information into a field than can be entered. RESET should be pressed to restore the keyboard, and the operation should be retried and the entry corrected. |
| X #? | What Number | A numeral was entered that is unacceptable at the display screen location. RESET should be pressed to restore the keyboard, and the correct entry should be made. |
| X NUM | Numeric | A nonnumeric entry was made at a display screen location reserved for numeric information. RESET should be pressed to restore the keyboard, and the operation should be retried. |

**Figure 2-4 (Part 2 of 2). Do Not Enter Symbols (Locations 9 through 17)**

### 2.4.3 Communication Reminder Symbol

The communication reminder (Figure 2-5) is turned on and broadcast to all active Category A displays when the 3274 detects a failure in the local or remote communication path to the host system. The reminder will remain on until the failure condition has been cleared and the 3274 detects the cleared condition. When the reminder is broadcast to all displays, all retry activity has stopped. When a bisynchronous line error has been detected, the original contents of the screen are restored. The reminder then remains on the screen of the display affected until cleared by host-system recovery activity.

### 2.4.4 Shifts and Modes Symbols

There are three Shifts and Modes symbols (Figure 2-6). The Upshift key may be used to determine if the Type A adapter is still polling a display internally when the remainder of the keyboard may be locked up. (The adapter is disabled if the arrow ( ⇧ ) will not display.)

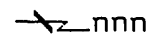
| Symbol | Name | Explanation |
|---|---|---|
|  | Communication Reminder | The communication link connecting the control unit to the system is not functioning. This symbol is displayed with the Communication Check symbol. |
|  | Reserved | This symbol is reserved for future use and should be ignored if it is displayed. |

**Figure 2-5. Reminders (Locations 21 through 27)**

| Symbol | Name | Explanation |
|---|---|---|
| APL | APL Mode | |
| TEXT | Text Mode | |
| NUM | Numeric | The keyboard is in numeric shifts, which allows use of the 0 through 9 keys and the (.), (—), and DUP keys only. |
| ⇧ | Upshift | The keyboard is in Upshift. |
| ^ | 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 characters. |
| PSA through PSF | Symbol set A through Symbol set F | The EBCDIC code for characters entered at the keyboard will be used to address the indicated symbol set for a displayable character. |
| S0 | Base Character | The base character set is addressed for a displayable character when the operator presses a character key. |
| ▯ | Extended Color | The color of the symbol is the color that will be used to display the next character at the keyboard. |
| ⊙ | Default Color | Green or white |
| a | Underlined | Character highlighting by underscore. |
| ✳ | Blinking | Character highlighting by blinking on and off at regular intervals. |
| a | Reversed | Character highlighting by reversing the light intensity between the character and its background. |
| + | Operator Select | The current extended color attribute was selected by the operator. |
| ▶▶ | Field Inherit | 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). |
| ▶ | Keyboard Extension | The keyboard is in an extended mode. |

**Figure 2-6. Shifts and Modes (Locations 37 through 41)**

### 2.4.5 Printer Status Messages

Printer status (Figure 2-7) messages are displayed in the operator information area layout whenever a printer has been assigned to a display requiring the use of a printer. Refer to the *3270 Information Display System: 3274 Description and Programming Guide,* GA23-0061, for detailed information regarding printer assignments, classes, and matrix structures.

### 2.4.6 Machine Check Numbers

Machine check numbers follow immediately after the machine check symbol ( ). They are divided into the following categories: Category A device and adapter errors, Category B device and adapter errors, host attachment and adapter errors, and control logic errors. The 200 series nnn machine check numbers are used for the devices and their respective adapter failures, and the 300 series nnn machine check numbers are used for host and control logic failures. For a summary of all machine check numbers, see Appendix B.

### 2.4.7 Program Check Numbers

Program check numbers follow immediately after the program check symbol ( P R O G). Program checks are divided into three categories: SNA protocol errors, print matrix definition errors, and data stream errors. Some program check numbers are not displayed at the device, but are logged in the event log for that device. See Appendix B for a summary of the program check numbers.

### 2.4.8 Communication Check Numbers

Communication check numbers follow immediately after the communication check symbol ( ). A communication check number may represent an interruption of the communication path to a remote attached 3274. The communication check number may also represent a normal communication path condition and not a hardware failure (for example, 532 = BSC line idle). The communication check numbers are directly related to the type of host adapter being used. The meaning of the nnn number may change from adapter to adapter. See Appendix B for a summary of the communication check numbers.

| Symbol | Name | Explanation |
|---|---|---|
| □—□__ | Assign Printer | When changing the printer IDENT, the two numbers entered (X X) appear in the printer authorization matrix. |
| □—□nn | Printer Assignment | The display station is authorized to use printer number nn. Individual printers may be assigned 01 through 31. Printer "class" is designated by 70 through 80. |
| □—■nn | Printer Printing | The printer identified by nn is printing. |
| □—◣nn | Printer Failure | The printer identified by nn has stopped while printing. |
| □—□?? | What Printer | The printer IDENT has changed. Pressing the IDENT key causes display of a new printer assignment. |
| (Nothing Displayed) | | If the display is attached to a 3274 (4 displayed in location 1), printing cannot take place. |

**Figure 2-7. Printer Status (Locations 60 through 64)**

# Chapter 3. Subsystem Error Logs and Test Formats

## 3.1 INTRODUCTION

There are six basic formats for entry into the subsystem log and test facility. This concurrent test facility provides path tests between the control unit and attached devices, device error statistics, device adapter error statistics, host adapter error logs and statistics, control logic error statistics, configuration and EC data, display of the status of all configured devices, reset capability of statistical error counters, and device control block displays for all configured devices. The use of the ALT and TEST keys is necessary to enter Test mode. The concurrent test facility is available only after Test mode is entered. Following are the concurrent test and log facilities:

- Test 0 – Checks the communication path between the 3274 and its attached devices. Also provides functional testing of Category A devices (displays 3278 and 3279) and 4-color override switch function on a 3279.
  - /0 – Transmits a test pattern from the control unit to the display from which you requested Test 0.
  - 00 to 31/0 – Transmits a test pattern from the control unit to another 3278 as specified by you when you entered the Test 0 format message.
- Test 1 – Displays error statistics for displays, printers, adapters, and control logic.
  - 00 to 31/1 – Displays log of any device from 00 to 31.
  - A0/1 – Displays the host adapter/attachment log formats: CCA BSC, CCA SDLC, HPCA, LCA attachment, and LHA attachment. Only the format for the host adapter installed in your machine is displayed in response to this request.
  - A1/1 – Displays log of the Type A adapters.
  - A2/1 – Displays log of the Type B adapters, encrypt/decrypt adapter, and Model 52C volume 3 storage errors.
  - A3/1 – Displays log of the configured terminal and summary counters.
- Test 2 – Displays configuration information.
  - /2 – For first (hex) 40 bytes.
  - – Enter only – second 40 bytes.
- Test 3 – Displays the status (off, on, disabled) of all configured devices and summary errors.
  - /3 – Status of ports and summary error counters.
- Test 4 – Reset logs.
  - XX/4 – Resets specified log counter (except summary).
- Test 6 – Displays key information in device control blocks.
  - 00 to 31/6 – For first (hex) 40 bytes. You may page from one page to the next by pressing the ENTER key. Paging beyond display 1C will result in a locked keyboard and X-f displayed on the status line.
- Test 7 – Color Convergence.
- Test 8 – Programmed Symbols, Highlighting, and Color Test.
- Test 9 – Kanji/Chinese Character Display.

## 3.2 TEST 0: COMMUNICATION PATH TEST AND 3278 DISPLAY TEST

### 3.2.1 Description

Test 0 performs the following functions:

- Transmits a test pattern from the control unit to the display from which you requested Test 0.
- Transmits a test pattern from the control unit to another 3278 as specified by you when you entered the Test 0 format message.
- Functionally tests the following using the test pattern transmitted by the control unit to the 3278 display specified by you: (1) high-intensity function, (2) non-display function, (3) various key functions, (4) selector-pen function, (5) MSR function, and (6) audible-alarm function.
- Executes communication path test to Category B display (3277).
- Executes communication path test to Category A or B printers.

A request for Test 0 will be executed to any Category A display (3278) except under the following conditions:

- If the device requested is in an SNA session, the test pattern function is not performed. Do Not Enter minus function indication is returned.
- If the device has the Wait indicator on and is attached to a Model 1B or is busy executing a command that requires asynchronous ending status (Op Complete), Do Not Enter minus function indication is returned.

This test, if requested for a Category B display (3277) or Type A or B printer, only checks the continuity of the coax communication path. Success or failure of this test is displayed on the requesting 3278 display as follows:

- The test message you entered followed by a: +, -, or 0.
  + = Test successful or path OK.
  - = Test failed, device disabled because of error
  0 = Test not run, device powered off

If no device is specified when the test is requested, an automatic default to the requesting device occurs.

### 3.2.2 Procedure for Requesting Test 0

- Press and hold ALT, and then press TEST to enter Test mode.
- Ensure the cursor is at location zero (0). Enter the following: (1) the device number you wish to test, using any two-digit number from 00 to 16 for Model 51C or 00 to 08 for Model 52C, (2) a slash, and (3) a zero. Press the ENTER key.
- If you are testing a 3278 display, the following pattern will appear on the screen if the test is successful:

  ```
  TEST: 3274;NN
  ?SEL PEN        SEL PEN
       &SEL PEN   )  SEL PEN
       DISPLAY    INSERT CK
  ```

  NN = The port number of the terminal that requested the test
- Use the *IBM 3278 Display Station Maintenance Information* manual, SY27-2510, to run the 3278 functional tests with the above test pattern.
- To exit Test mode, press and hold ALT and then press TEST.
- An entry of slash (/) only automatically defaults to Test 0 on the requesting display.

## 3.3 TEST 1: OVERVIEW

Test 1 is a variety of device and adapter error log and statistical counter information that can be displayed on any working 3278 while that 3278 is in Test mode. By using a two-digit prefix to the entry slash (/)1, specific device log or adapter log information can be retrieved. The formats for entering a Test 1 request are as follows:

- 00 to 16/1 (Model 51C) or 00 to 08/1 (Model 52C) – Displays log of any attached device from 00 to 16 for Model 51C or 00 to 08 for Model 52C.
- A0/1 – Displays three host adapter/attachment log formats: CCA BSC, CCA SDLC, and HPCA. Only the format for the host adapter installed in your machine is displayed in response to this request.
- A1/1 – Displays log of the Type A adapters.
- A2/1 – Displays log of the Type B adapters. For Model 52C, this test is used to isolate the Op code error of 0111.
- A3/1 – Displays control logic error log.

The error information contained in the above logs resides in the 3274 storage. The general format of all logs reflects: (1) the most recent error *event* information and (2) statistical counters that reflect the type of errors occurring. The event log may be a combination of significant information that will differ in content from adapter to adapter as well as format. The statistical counters record errors using hexadecimal values. The maximum value for any counter is hex 'ff'.

The terms used in the log descriptions are defined as follows:

*Machine Check* – The CCA hardware has detected an error and the failing operation is retried. If the retry is successful, the error is transparent. If the retry fails, the CCA is disabled and the machine check is logged. See nnn code 310 in Appendix B.

*Invalid Status* – The control logic has detected an unexpected or invalid combination of bit settings in the CCA Status Register. See nnn code 311 in Appendix B.

*DCE* – The control logic has detected the loss of Data Set Ready (DSR) from the modem. See nnn code 501 in Appendix B.

*Timeout*

Read Operation – This bit indicates that 3 seconds has elapsed without receipt of an Syn, ETX, or ETB.

Write Operation – See nnn code 530 in Appendix B.

*Overrun*

CCA – The 3274 was not ready to receive a byte of data from the device.

HPCA – Either the cycle-share buffers were full or the 3274 did not allow the adapter to cycle-share.

*Underrun* – The 3274 was not ready to transmit a byte of data at the time the transmission line was ready to receive it.

*Enq Received* – An inquiry character has been received by the 3274.

*NAK Sent* – A Negative Acknowledgment has been sent.

*NAK Received* – A Negative Acknowledgment has been received.

*15 NAKs Received* – 15 Negative Acknowledgments have been received.

*15 NAKs Sent* – 15 Negative Acknowledgments have been sent.

*N Timeouts Invalid* – N = number of invalid timeouts that have occurred.

*15 Timeouts Invalid* – 15 invalid timeouts have occurred.

*Count Exceeded* – The byte count has been exceeded.

*RI* – Ring Indicator (not used)

*RVI RCVD* – A reverse interrupt was received instead of ACK 0/ACK 1.

*ITB ATTN* – An ITB character was received.

*EOH ATTN* – An STX character was received signifying the End of Header.

*XPRNCY* – The receive operation has entered the transparent mode.

*Poll/Select* – This bit, when 1, indicates that this station has been polled. When this bit is 0, this station has to be selected.

### 3.3.1 Test 1 Device Logs

Perform the following steps before consulting the log:

1. If any 8 4 2 1 indicators are set, refer to the *MIM* for the failing FRU.
2. If a 3nn or 5nn code is displayed, refer to Appendix B for problem determination information. These codes can be found in the device logs.

If the above steps do not provide sufficient information for problem determination, then the log may be of assistance. The log statistical counters indicate the state of the interface (how many errors of a certain classification), and the event data provides error status on the interface for certain error events. For example, in BSC operation when an NAK is received (associated with a severe error condition), it is logged with associated event data and counted. This event data should be the last error information examined. The control logic normally examines the appropriate error data and sets the nnn code to the appropriate value.

The device logs should be accessed whenever a specific device is suspected of experiencing intermittent or difficult-to-define errors. These errors may or may not be generating nnn numbers on the failing device. (Not all nnn numbers are displayed.) Since four types of device logs are available when using Test 1, it is necessary to determine what type of device (3278, 3277, Category A printer, Category B printer) is attached to the device port number (00-16 for Model 51C or 00-08 for Model 52C) for which you are requesting log information. The format for all device logs requested using Test 1 is as follows:

- Line 1 –

  01/1

  This line is returned exactly as you entered your request. Example: You entered 01/1, and the first line of the display sent back to you should be 01/1.

- Line 2 –

  0000 0000

  This line displays the most current low-order digits of 200, 300, 400, and 500 series nnn numbers. If there are no errors generating nnn numbers, the second line of this display will appear as follows:

  0000 0000

  If error information had been recorded, the second line of this display could appear as follows:

  0400 0032

  04 = The most current 200 series error, in this example, 204, which is a device check*.
  00 = No 300 series errors are recorded.
  00 = No 400 series errors are recorded.
  32 = The most current 500 series error, in this example, 532, which is BSC line idle.

  The 200 numbers appear in the leftmost position and progress to the 500 numbers in the rightmost position.
  *A 2%% nnn code will appear as EEN in the error log.

- Line 3 –

  0000 0000 0000 0000

  This line displays the statistical counter information associated with this device. If no errors are recorded for this device, the counters will display as follows:

  0000 0000 0000 0000

  The counters are not numbered when they are displayed. They are, however, assigned counter position numbers. The leftmost two-digit position is counter number 01, and the rightmost counter position used is counter number 06. The value in each counter is given in hexadecimal. If errors were being recorded for this device, the display for line 3 would appear as follows:

  02FF 1A00 0013 0000

  Counter number 01 = 02 hex = 02 errors total
  Counter number 02 = FF hex = 255 errors (maximum)
  Counter number 03 = 1A hex = 26 power off total
  Counter number 04 = 00 hex = no errors
  Counter number 05 = 00 hex = no errors
  Counter number 06 = 13 hex = 19 errors total
  Counter number 07 = Reserved
  Counter number 08 = Reserved

  All counters for line 3 function in this manner. The counter numbers are assigned specific meanings according to the type of device log being requested. (See Figure 3-1.)

### 3278/3279 Log

| Counter | Meaning |
|---|---|
| 01 | Coax timeouts |
| 02 | Coax parity errors |
| 03 | Power Off |
| 04 | Device checks |
| 05 | Error status base machine |
| 06 | Error status features |

### 3277 Log

| Counter | Meaning |
|---|---|
| 01 | Coax timeouts |
| 02 | Coax parity errors |
| 03 | Power Off |
| 04 | Device checks |
| 05 | Not applicable |
| 06 | Not applicable |

### Type A Printer Log

| Counter | Meaning |
|---|---|
| 01 | Coax timeouts |
| 02 | Coax parity errors |
| 03 | Power Off |
| 04 | Device checks |
| 05 | Error status |
| 06 | Equipment checks |

### Type B Printer Log

| Counter | Meaning |
|---|---|
| 01 | Coax timeouts |
| 02 | Coax parity errors |
| 03 | Power Off |
| 04 | Device checks |
| 05 | Sync or equipment checks |
| 06 | Disabled or equipment checks |

### 3278/3279 Log Detail

| Counter | Meaning |
|---|---|
| 01 | Coax timeouts—This counter is incremented when the 3274 sends data or commands to the device and does not receive a response in a predetermined period of time.<br><br>**Note:** *Use the nnn code logged for the device for further analysis.* |
| 02 | Coax parity error — This counter is incremented when the 3274 detects a parity error in a 12-bit received from the device. |
| 03 | Normal power off — This counter indicates the number of times the device failed to respond to a poll retry sequence (device powered off). Counter 1 or 2 is incremented on the first failure to receive a poll sequence response; 32 successive poll sequence retries by the DCA then follow. If all retries are unsuccessful, the control logic assumes that the device is powered off and then increments counter 3. |
| 04 | Device checks — The device has detected an error and has returned device check statues to the 3274. See nnn code 204. |
| 05 | Error status base machine — Error status has been returned that indicates a device failure. |
| 06 | Error status features — An invalid response or error response has been received from a feature device. |

### Type A Printer Detail

| Counter | Meaning |
|---|---|
| 01 | Coax timeouts — See 3278/3279 log detail. |
| 02 | Coax parity error — See 3278/3279 log detail. |
| 03 | Normal power off — See 3278/3279 log detail. |
| 04 | Device checks — See 3278/3279 log detail. |
| 05 | Error status — An error condition has been detected by the 3274, or error status has been received indicating a device failure. |
| 06 | Equipment check — The printer has reported an unrecoverable error to the 3274. |

### Type B Printer Log

| Counter | Meaning |
|---|---|
| 01 | Coax timeouts — See 3278/3279 log detail. |
| 02 | Coax parity error — See 3278/3279 log detail. |
| 03 | Normal power off — See 3278/3279 log detail. |
| 04 | Device checks — See 3278/3279 log detail. |
| 05 | Sync or equipment check — The printer has returned sense information that indicates an equipment check while printing. See nnn code 276 in Appendix B. |
| 06 | Disabled and equipment check — The printer has posted an equipment check and is in a not-ready condition. See nnn code 275 in Appendix B. |

**Figure 3-1. Summary of Counter Definitions by Log Type**

Following is a device log as it would appear for an intermittently failing 3278 display on control unit port A07.

```
07/1
1200 0000
0000 001C 0000
```

If the log for this device is broken down, there is a record in the nnn number field showing that a 212 (invalid scan code received) error is the most recent 200 series error and that no other nnn errors are recorded. Counter number 04 has a value of 1C recorded, indicating that 28 device checks were pointing to this display as the source of failure. Repair activity can now be attempted at the display level. Control-unit failure is not suspected.

### 3.3.2 Test 1 Host Adapter Logs

The host adapter logs should be accessed whenever a problem is suspected to be intermittently causing host communication failures, host adapter failures, or other spurious or difficult-to-define failures. When a host adapter log is requested, the format will always be A0/1. The display sent from the control unit in response to this request will depend on the type of host adapter installed in your 3274. The display for each host adapter is slightly different. The display returned in response to an A0/1 request is covered in detail in subsequent sections; in general, however, all displays appear as follows:

- Line 1 – A0/1
- Line 2 – Event data is displayed
- Line 3 – This line displays the statistical counters associated with each host adapter

The host adapter logs can provide detailed information pertaining to the following questions: (1) What was the nnn number at the time of the last failure? (2) What was the operation being attempted at the time of the last failure? (3) How was that operation completed? (4) Why was that operation completed that way? (5) What is the frequency of this type of failure? If these questions are answered with the use of the information stored in the host adapter logs, remedial or repair activity can be attempted.

### 3.3.3 Test 1 Common Communications Adapter (CCA) Log for BSC

This host attachment log format is returned to the requesting 3278 in response to an A0/1 entry. The format detail is as follows:

- Line 1 – Returned the same as input, A0/1.
- Line 2 – Twenty-four bytes are displayed on this line, but only ten are used. The individual bytes are not labeled when displayed. Each byte is assigned a specific meaning. See the following example for byte identification:

| Byte 1 | | | | | | | Byte 24 |
|---|---|---|---|---|---|---|---|
| 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | ) ) | 0000 |
| NNFF | CCCC | SSSS | SSSS | SSXX | XXXX | ( ( | XXXX |

The leftmost byte is labeled NN. This code represents the two low-order digits of any 500 series nnn number in almost all cases. However, if NN equals zero (00) and the bytes labeled FF and CCCC are *not* zeros, then the entire log information does not pertain to a 500 series communication check and is to be considered machine-check data.

The next byte to the right of NN is FF. This byte represents the type of operation being attempted at the time of the failure. Refer to the CCA BSC Operation Attempted Chart (Figure 3-2) when FF is to be used.

The next two bytes to the right of FF are labeled CCCC. These two bytes indicate how the attempted operation ended. See the CCA BSC Operation Ending Chart (Figure 3-3) to determine if the operation was completed (1) normally, (2) with exception, or (3) with error.

The next five bytes to the right of CCCC are labeled SSSS. These five bytes contain sense information recorded at the time of the failure. After you have examined NN, FF, and CCCC, the SSSS bytes should give you some indication as to why the nnn code was generated and why the operation attempted was not completed normally.

All bytes labeled XXXX are not used.

- Line 3 – This line displays the statistical counter information associated with this adapter. If no errors are recorded for this adapter, the counters display as follows:

```
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```

The counters are not numbered when they are displayed. They are, however, assigned counter position numbers. The leftmost two-digit position is counter number 01, and the rightmost counter position *used* is counter number 11. The remaining positions are not used. The value in each counter is given in hexadecimal. The maximum value for any counter is FF.

Each counter is assigned a specific meaning, as follows:

| Counter | Meaning |
|---|---|
| 01 | NAK sent |
| 02 | NAK received |
| 03 | Enq received |
| 04 | Timeout invalid |
| 05 | 15 NAKs received |
| 06 | 15 Wrong ACKs (ACK 0 instead of ACK 1, etc.) |
| 07 | Underruns/overruns |
| 08 | Write timeout |
| 09 | DCE error |
| 10 | Number of Available Buffers Exceeded |

A complete log display for this adapter would appear as follows:

```
A0/1
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```

| FF Code | Operation Attempted | FF Code | Operation Attempted |
|---|---|---|---|
| 00 | Enable/Set Mode | 14 | Disable |
| 01 | Hardware Sense | 16 | STX/ETX Nonconversational |
| 02 | SOH/ETX Conversational Resp | 18 | Write WACK |
| 03 | Read Normal | 1A | STX/ETB Conv Response |
| 06 | SOH/ETX Nonconversational | 1E | STX/ETB Nonconversational |
| 07 | Read-Respond RVI | 40 | Monitor Line |
| 0A | SOH/ETB Conv Response | 46 | SOH/ETX Expect Conv Resp |
| 0E | SOH/ETB Nonconversational | 56 | STX/ETX Expect Conv Resp |
| 10 | Write EOT | 58 | Monitor Line-Respond WACK |
| 12 | STX/ETX Conv Response | | |

**Figure 3-2. CCA BSC Operation Attempted Chart (Code FF)**

Bits shown as 0 are not used unless specified otherwise.

Operation Attempted

00 Enable/Set Mode

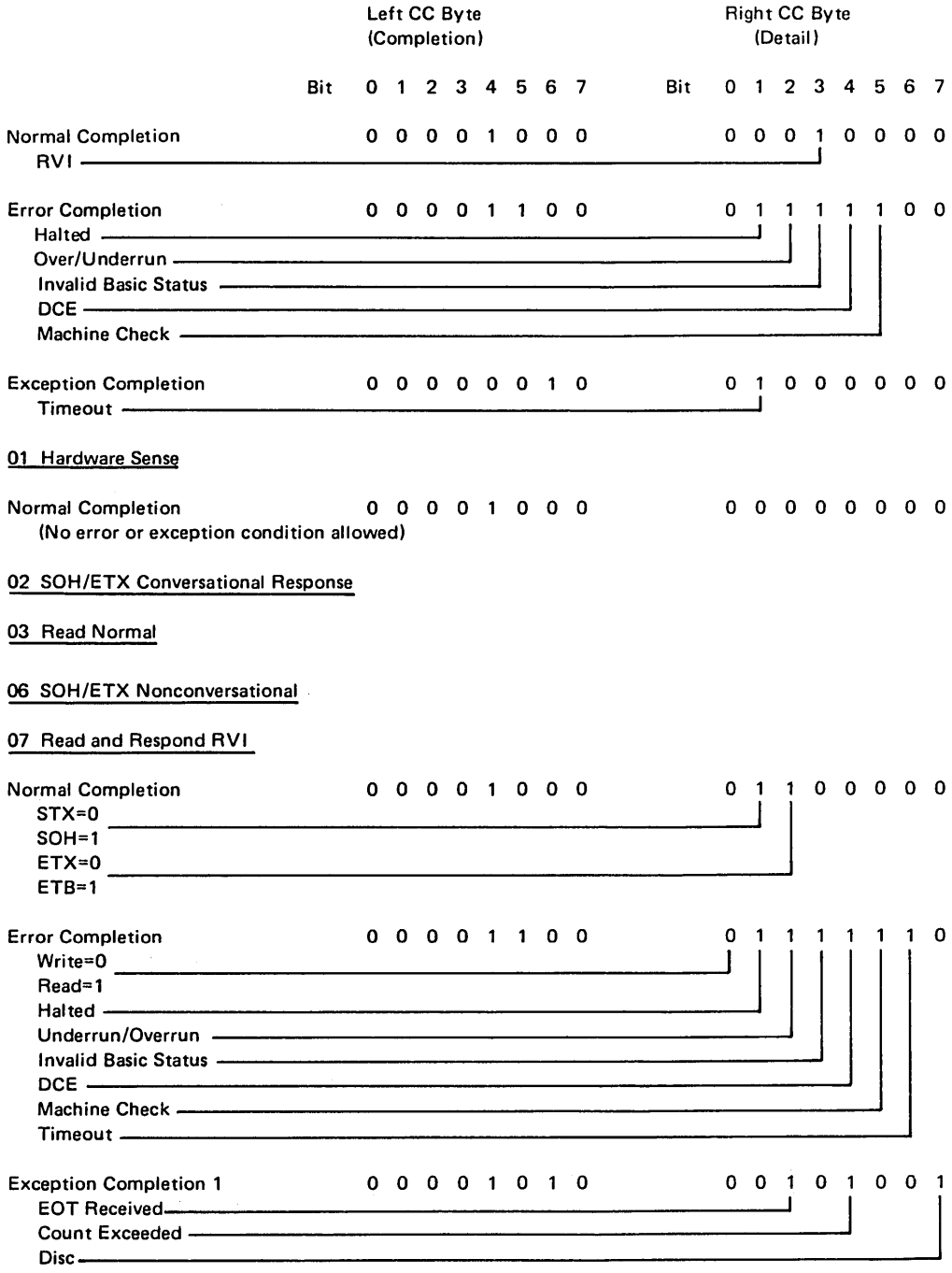



**Figure 3-3 (Part 1 of 4). CCA BSC Operation Ending Chart (Code CCCC)**

Operation Attempted

| | Left CC Byte (Completion) | | | | | | | | Right CC Byte (Detail) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Exception Completion 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| N Timeouts Invalid | | | | | | | | | | | 1 | | | | | | |
| ITB Attention | | | | | | | | | | | | 1 | | | | | |
| EOH Attention | | | | | | | | | | | | | 1 | | | | |
| Transparency | | | | | | | | | | | | | | 1 | | | |
| NAK Sent | | | | | | | | | | | | | | | 1 | | |
| TTD Received | | | | | | | | | | | | | | | | 1 | |
| 15 ENQs Received | | | | | | | | | | | | | | | | | 1 |

0A SOH/ETB Conversational Response

0E SOH/ETB Nonconversational

10 Write EOT

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal Completion | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Error Completion | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | |
| Underrun | | | | | | | | | | | | 1 | | | | | | |
| Invalid Basic Status | | | | | | | | | | | | | 1 | | | | | |
| DCE | | | | | | | | | | | | | | 1 | | | | |
| Machine Check | | | | | | | | | | | | | | | 1 | | | |
| Timeout | | | | | | | | | | | | | | | | 1 | | |

(Exception completion not valid for Write EOT)

12 STX/ETX Conversational Response

14 Disable

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal Completion | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Error Completion | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | |
| Invalid Basic Status | | | | | | | | | | | | | 1 | | | | | |
| DCE | | | | | | | | | | | | | | 1 | | | | |
| Machine Check | | | | | | | | | | | | | | | 1 | | | |

(Exception completion not valid for Disable)

16 STX/ETX Nonconversational

18 Write WACK

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal Completion | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Error Completion | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | |
| Write=0 | | | | | | | | | | | 1 | | | | | | | |
| Read=1 | | | | | | | | | | | | 1 | | | | | | |
| Halted | | | | | | | | | | | | | 1 | | | | | |
| Underrun/Overrun | | | | | | | | | | | | | | 1 | | | | |
| Invalid Basic Status | | | | | | | | | | | | | | | 1 | | | |
| DCE | | | | | | | | | | | | | | | | 1 | | |
| Machine Check | | | | | | | | | | | | | | | | | 1 | |
| Timeout | | | | | | | | | | | | | | | | | | 1 |

**Figure 3-3 (Part 2 of 4). CCA BSC Operation Ending Chart (Code CCCC)**

Operation Attempted

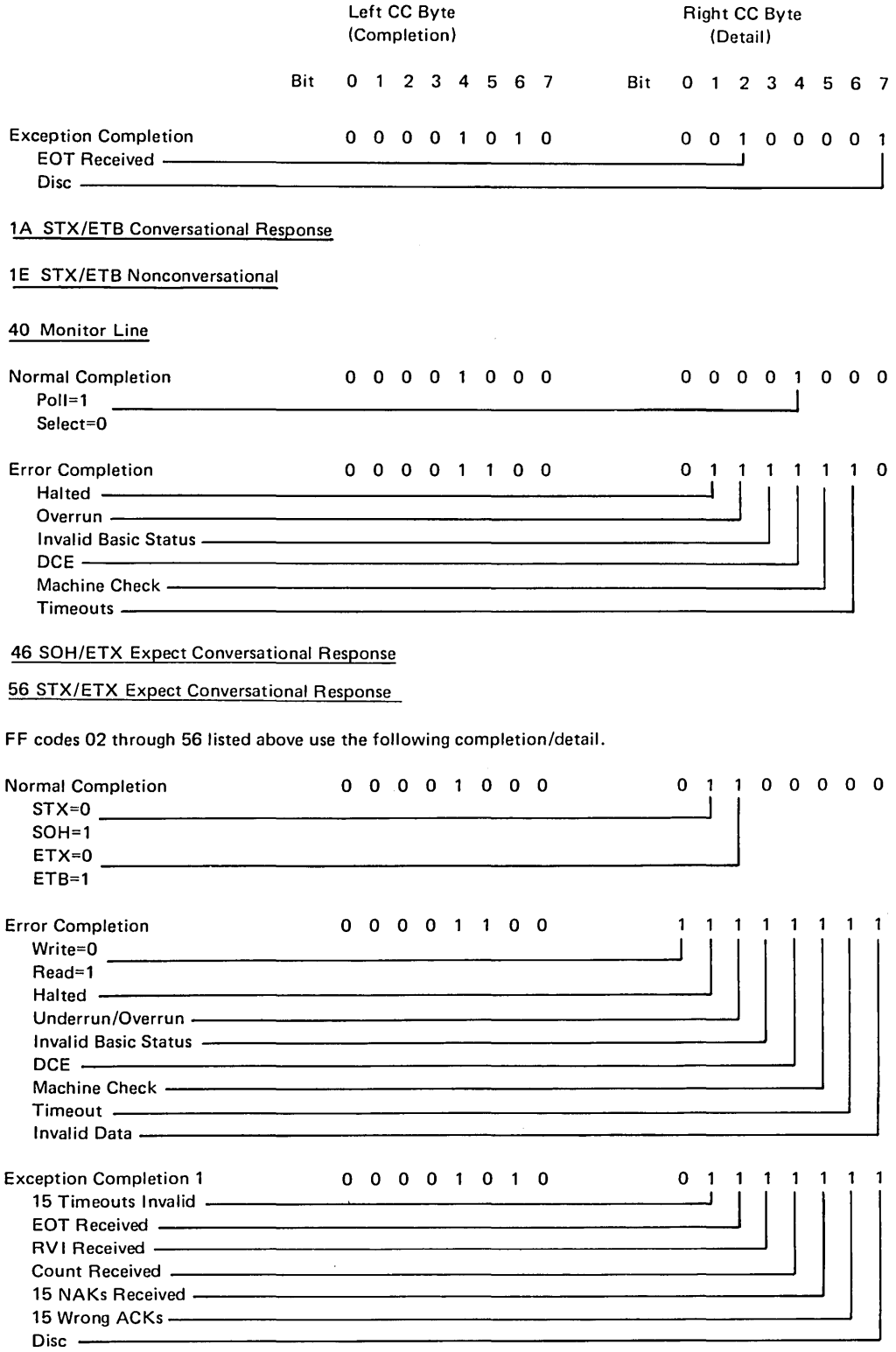
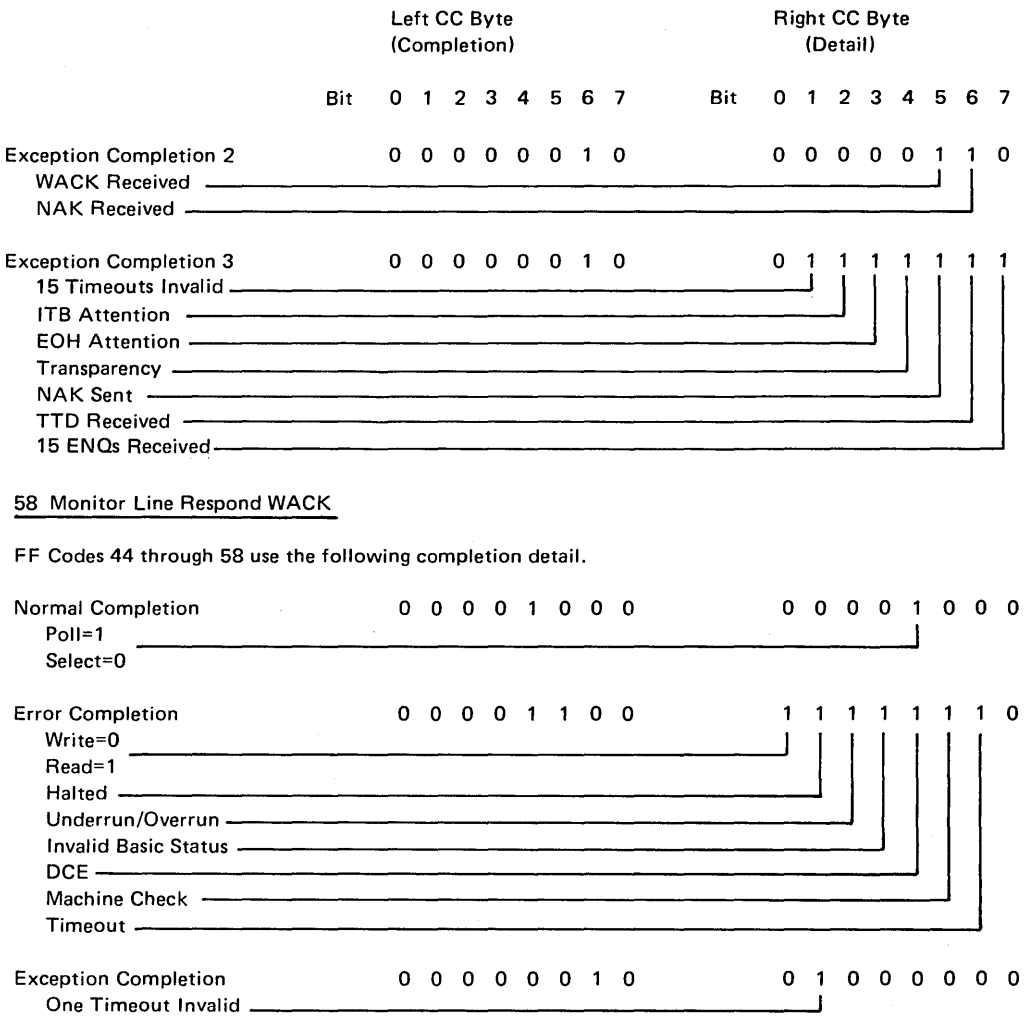



**Figure 3-3 (Part 3 of 4). CCA BSC Operation Ending Chart (Code CCCC)**

Operation Attempted




58 Monitor Line Respond WACK

FF Codes 44 through 58 use the following completion detail.




**Figure 3-3 (Part 4 of 4). CCA BSC Operation Ending Chart (Code CCCC)**

Figure 3-4 explains the sense-byte breakdown for CCA BSC. These conditions are logged only for nnn codes 311, 501, 530, 535, and 536, and the last error condition of that type.

Line 2 – NNFF CCCC SSSS SSSS SSSS
0102 0304 0506

SS bytes are labeled from left to right SS01, SS02, SS03, etc.

| Location | Bit | Meaning If Bit Is Turned On (1) |
|---|---|---|
| Byte SS01 | | Ignore |
| Byte SS02 | 0 | Input Request |
| | 1 | Output Request |
| | 2 | DCE Interrupt |
| | 3 | Timer Interrupt |
| | 4 | Exception |
| | 5 | Machine Check/Prog Check |
| | 6 | Enable/Disable |
| | 7 | Interrupt Request |
| Byte SS03 | 0 | Data Set Ready |
| | 1 | Clear to Send |
| | 2 | Recv Line Signal Det |
| | 3 | Ring Ind |
| | 4 | DSR Transition |
| | 5 | Reserved |
| | 6 | RLSD Transition |
| | 7 | CTS Transition |
| Byte SS04 | 0 | DTR/CDSTL |
| | 1 | Request to Send |
| | 2 | Wrap |
| | 3 | Test |
| | 4 | Select Standby |
| | 5 | Select Half Speed |
| | 6 | New Sync |
| | 7 | DCE Interrupt Disable |
| Byte SS05 | 0 | Overrun |
| | 1 | Underrun |
| | 2 | Receive Clk Running** |
| | 3 | SDLC Invalid Seq |
| | 4 | SDLC Frame |
| | 5 | Invalid Character** |
| | 6 | Break Byte Detected** |
| | 7 | Adapter in Sync |
| Byte SS06 | 0 | Receive Mode |
| | 1 | Transmit Mode |
| | 2 | Inhibit Zero Insertion |
| | 3 | Mode Select* |
| | 4 | Mode Select* |
| | 5 | +Code Length |
| | 6 | + Code Length |
| | 7 | NRZI |

* 00 = Auto
01 = EBCDIC
10 = ASCII
11 = SDLC

\+ 00 = 8 bit
01 = 6 bit
10 = 7 bit
11 = 5 bit

**Should always be zero

**Figure 3-4. Sense Byte Breakdown Chart for CCA BSC (Code SSSS)**

### 3.3.4 Test 1 Common Communications Adapter (CCA) Log and High-Performance Communications Adapter (HPCA) Log for SDLC

This host adapter log format is identical for both adapters and is returned to the requesting 3278 in response to an A0/1 entry. The format detail is as follows:

- Line 1 – Returned the same as input, A0/1.
- Line 2 – Twenty-four bytes are displayed on this line, but only 11 are used. Information is stored and displayed only in Line 2 on specific error conditions. These conditions are associated with nnn codes 501, 502, 529, 530, or 321 (see Appendix B for details). Code 321 will be indicated in this line as NN=00 and the remainder of Line 2 will be not equal to 0. Each byte is assigned a specific meaning. See the following example for byte identification:

Byte 1 Byte 24

0000 0000 0000 0000 0000 0000 0000 0000
NNFF CCCC SSSS SSSS SSSS SSXX XXXX XXXX

NN – This code represents the two low-order digits of any 500 series nnn number in almost all cases.

FF – This byte represents the type of operation being attempted at the time of the failure. Refer to the CCA/HPCA Operation Attempted Chart (Figure 3-5) when FF is to be used.

| FF Code | Operation Attempted |
|---|---|
| 00 | Open |
| 01 | Sense |
| 02 | Write/Read |
| 04 | Close |
| 05 | Adapter Prewrap (Test) |
| 09 | Adapter Wrap (Test) |
| 10 | Beacon |
| 0D | Model Wrap (Test) |
| 20 | Logical Open |
| 40 | Fast Close |
| 82 | Halt Write |

**Figure 3-5. CCA/HPCA SDLC Operation Attempted Chart (Code FF)**

CCCC – These two bytes indicate how the attempted operation ended. See the CCA/HPCA Operation Ending Chart (Figure 3-6) to determine if the operation was completed (1) normally, (2) with error, or (3) with exception.

SSSS – These seven bytes contain sense information recorded at the time of the failure. After examining NN, FF, and CCCC, the SSSS bytes should give you some indication as to why the nnn code was generated and why the operation attempted was not completed normally.

XXXX – All bytes labeled XXXX are not used in the CCA and should be ignored for the HPCA, since these bytes contain secondary levels of information, which are not associated with the problem.

- Line 3 – This line displays the statistical counter information associated with these adapters. If no errors are recorded for these adapters, the counters will display as follows:

0000 0000 0000 0000 0000 0000 0000 0000 0000 0000

The counters are not numbered when they are displayed. They are, however, assigned counter position numbers. The leftmost two-digit position is counter number 01, and the rightmost counter position *used* is counter number 12. The remaining positions are not used. The value in each counter is given in hexadecimal. The maximum value for any counter is FF.

Each counter is assigned a specific meaning, as follows:

| Counter | Meaning | nnn Code (App B) |
|---|---|---|
| 01 | Nonproductive Timeout | 520 |
| 02 | Idle Timeout | 521 |
| 03 | Write Retry | |
| 04 | Overrun | |
| 05 | Underrun | |
| 06 | Connection Problem | 525 |
| 07 | FCS Error | |
| 08 | Primary Abort | |
| 09 | Command Reject | 528 |
| 10 | DCE Error | 529 |
| 11 | Write Timeout | 530 |
| 12 | Count Exceeded | 519 |
| 13 | Secondary Busy | |
| 14 | RLSD Error | 507 |

The error to nnn code and counter relationship is shown below:

| Error | nnn Code (See App B) | Counter |
|---|---|---|
| DCE Error | 529 | 10 |
| Machine Check | | |
| CCA | 320 | – |
| HPCA | 330 | – |
| Invalid Status | | |
| CCA | 321 | – |
| HPCA | 331 | – |
| Write Timeout | 530 | 11 |
| Nonproductive Timeout | | 01 |
| Idle Timeout | 521 | 02 |
| Overrun | – | 04 |
| Underrun | – | 04 |
| Connect Problem | 525 | 06 |
| Secondary Busy | – | 13 |
| Write Retry | – | 03 |
| FCS Error | – | 07 |
| Primary Abort | – | 08 |
| Command Reject | 528 | 09 |
| Lost Data | 519 | 11 |
| No RLSD | 507 | 14 |
| Format Error | 555 | 2 |
| X.21 Timeout | 556 | 3 |
| Not Ready | 557 | 5 |
| Lost Data | 558 | 6 |
| DCE Cleared | 559 | 7 |
| Not +/Bel | 560 | 11 |
| Clear Timeout | 561 | 18 |
| CMPR Error | 562 | 1 |
| Invalid Sequence | 565 | 4 |

The following descriptions of conditions will help you analyze the logs:

Read Message Available – Indicates that an I-frame has been received and is destined to a physical or logical unit.

Link Test – Used in conjunction with the Read Message Available bit. When both bits are on (1), it indicates that the I-frame received is a test message.

Poll Request – This bit indicates that a valid poll has been received from the host.

SNRM Received – A Set Normal Response Mode sequence has been received from the host. An existing session will be terminated, and a new session may be established.

Underrun – The 3274 controller was not ready to transmit a byte of data at the time the transmission line was ready to receive.

Connection Problem – 20 consecutive occurrences of any of the following: ROL, FRMR, XID, NSA.

FCS Error – The 3274 controller detected an SDLC frame with an invalid block check character (BCC) or a frame-check sequence.

Primary Abort – The 3274 detected an abort message from the primary station.

Lost Data – An I-frame received by the 3274 was larger than the allocated buffer.

Write Timeout — A transmission of data took longer than expected and is suspected to be a result of a hardware function.

Dump Message — Addition status is contained in the register space that will indicate one of the following:

- FCS Error
- Primary Abort
- N (r) Sequence Error
- Wrong Length Message (same as lost data)
- Data with a command
- Invalid SDLC command

Secondary Busy — An RNR response has been sent to the primary station because the 3274 does not have sufficient buffers (receive).

Nonproductive Timeout — No valid SDLC frames have been received by the 3274 that contains either a valid FCS or a valid address for a period of 20 seconds.

XID Received — A valid XID was received from the primary station. The 3274 will go to normal disconnected mode (NDM) of operation.

Disconnect Received — A valid SDLC frame containing a Disconnect command was received from the primary station. The 3274 will go to normal disconnect (NDM) mode of operation.

Write Retry — A previously transmitted I-frame was not received by the host. The 3274 will transmit the same I-frame again.

Idle Line Timeout — No valid flag characters have been detected on the host link for 20 seconds.

Ring Indicate Timeout — A switched connection has not been detected in a 3-second period.

Ring Indicate — A switched connection has been made.

Invalid Basic Status — An adapter hardware register contains data that was not meaningful.

DCE Error — A modem problem has been detected.

CNFG — A valid Configure command was received and the appropriate action is being taken by the adapter microcode.

No RLSD — RLSD has been inoperative for at least 4 seconds.

Overrun

- CCA — The 3274 was not ready to receive a byte of data from the device.
- HPCA — Either the cycle share buffers were full or the 3274 did not allow the adapter to cycle share.

A complete log display for this adapter would appear as shown below:

A0/1
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000

Bits shown in the chart as 0 are not used unless specified otherwise.

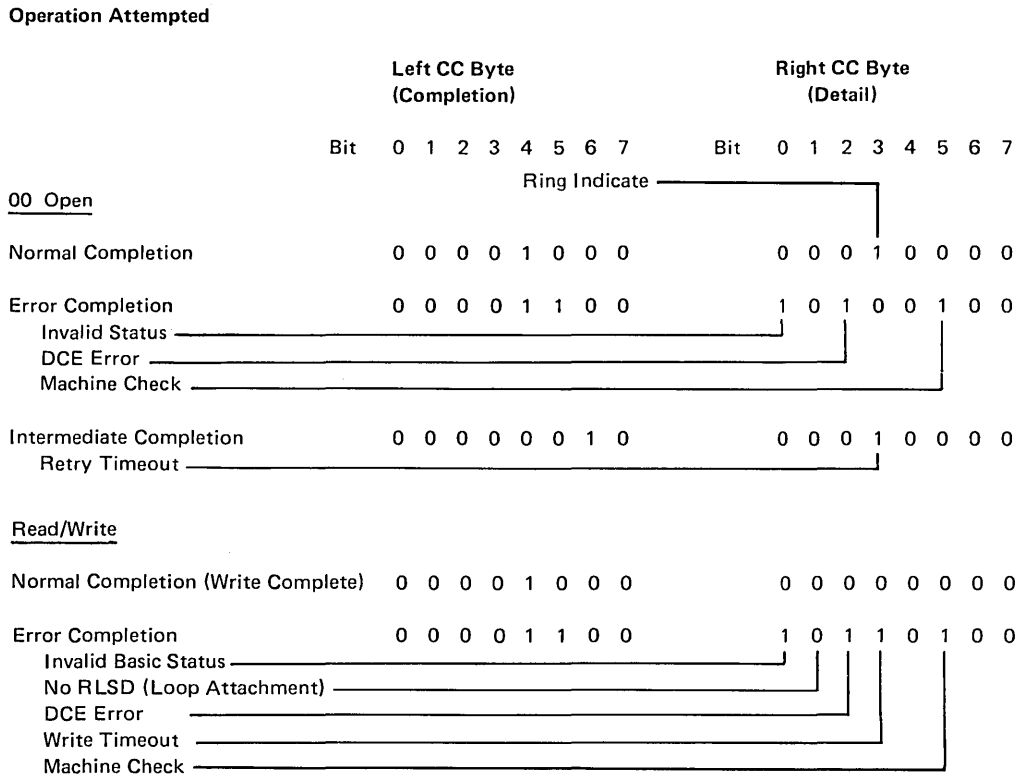



**Figure 3-6 (Part 1 of 2). CCA/HPCA SDLC Operation Ending Chart (Code CCCC)**

**Operation Attempted**

| | Left CC Byte (Completion) | | | | | | | | Right CC Byte (Detail) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Read Intermediate Complete | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| XID Received | | | | | | | | | | | | | | | | | |
| Link Test | | | | | | | | | | | | | | | | | |
| Nonproductive Timeout (Receive Overrun for HPCA) | | | | | | | | | | | | | | | | | |
| Lost Data | | | | | | | | | | | | | | | | | |
| Secondary Busy | | | | | | | | | | | | | | | | | |
| Read MSG Available | | | | | | | | | | | | | | | | | |
| Poll Received (Configure Command Received for Loop Attachment) | | | | | | | | | | | | | | | | | |
| Write Complete and Read Intermediate | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Lost Data | | | | | | | | | | | | | | | | | |
| Read MSG Available | | | | | | | | | | | | | | | | | |
| Read/Write Exception | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| SNRM Received | | | | | | | | | | | | | | | | | |
| Disc Received | | | | | | | | | | | | | | | | | |
| Write Retry | | | | | | | | | | | | | | | | | |
| Idle Timeout (Nonproductive for Loop attachment) | | | | | | | | | | | | | | | | | |
| Overrun | | | | | | | | | | | | | | | | | |
| Underrun | | | | | | | | | | | | | | | | | |
| Connect Problem | | | | | | | | | | | | | | | | | |
| Dump Message | | | | | | | | | | | | | | | | | |
| Exception Completion 4 (Write Only) (Halted) | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 04 Close | | | | | | | | | | | | | | | | | |
| Normal Completion | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Error Completion | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| Invalid Basic Status | | | | | | | | | | | | | | | | | |
| DCE Error | | | | | | | | | | | | | | | | | |
| Machine Check | | | | | | | | | | | | | | | | | |
| (Exception completion condition not allowed) | | | | | | | | | | | | | | | | | |
| 05 Adapter Prewrap | | | | | | | | | | | | | | | | | |
| 09 Adapter Wrap | | | | | | | | | | | | | | | | | |
| 10 Beacon (Loop Attachment) | | | | | | | | | | | | | | | | | |
| Normal Completion | 0 | 0 | 0 | 0 | | 1 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| Error Completion | 0 | 0 | 0 | 0 | | 1 | 1 | 0 | 0 | | 1 | 0 | 1 | 0 | | 0 | 1 | 0 | 0 |
| Invalid Status | | | | | | | | | | | | | | | | | | | |
| DCE Error | | | | | | | | | | | | | | | | | | | |
| Machine Check | | | | | | | | | | | | | | | | | | | |
| 0D Modem Wrap | | | | | | | | | | | | | | | | | | | |

FF Codes 05 through 0D are not logged.

**Note:** *Bits 0-3 of left cc byte are ignored except during Loop attachment. Bit 0 of left cc on indicates a valid SDLC Frame has been received.*

**Figure 3-6 (Part 2 of 2). CCA/HPCA SDLC Operation Ending Chart (Code CCCC)**

Figure 3-7 explains the sense-byte breakdown for CCA/HPCA SDLC.

Line 2 – NNFF CCCC SSSS SSSS SSSS SS
0102 0304 0506 07

SS bytes are labeled from left to right SS01, SS02, SS03, etc.

| Location | Bit | Meaning If Bit Is Turned On (1) | |
|---|---|---|---|
| | | CCA | HPCA |
| SS01 | 0 | See Figure 3-4 | Cycle Share Halt |
| | 1 | See Figure 3-4 | Transmit EOL |
| | 2 | See Figure 3-4 | Receive Control Entry |
| | 3 | See Figure 3-4 | Modem/Timer |
| | 4 | See Figure 3-4 | Exception |
| | 5 | See Figure 3-4 | Machine Check |
| | 6 | See Figure 3-4 | Enabled |
| | 7 | See Figure 3-4 | Interrupt Request |
| SS02 | 0 | See Figure 3-4 | Receive Mode |
| | 1 | See Figure 3-4 | Ping Valid |
| | 2 | See Figure 3-4 | Pong Valid |
| | 3 | See Figure 3-4 | Not used |
| | 4 | See Figure 3-4 | Specific Address Valid |
| | 5 | See Figure 3-4 | Group Address Valid |
| | 6 | See Figure 3-4 | Interrupt on Cont Flags |
| | 7 | See Figure 3-4 | Enable 15 Ones |
| SS03 | 0 | See Figure 3-4 | Invalid Seq/Address |
| | 1 | See Figure 3-4 | Byte Overrun |
| | 2 | See Figure 3-4 | Receive Control Entry |
| | 3 | See Figure 3-4 | 15 Ones |
| | 4 | See Figure 3-4 | Control Overrun |
| | 5 | See Figure 3-4 | Traffic |
| | 6 | See Figure 3-4 | Receive Cycle Share Halt |
| | 7 | See Figure 3-4 | Address in Sync |
| SS04 | 0 | See Figure 3-4 | Transmit Mode |
| | 1 | See Figure 3-4 | Control Valid |
| | 2 | See Figure 3-4 | NRZI |
| | 3 | See Figure 3-4 | Load Serializer |
| | 4 | See Figure 3-4 | Flag |
| | 5 | See Figure 3-4 | Continuous Character |
| | 6 | See Figure 3-4 | FCS Seq and Flag |
| | 7 | See Figure 3-4 | Inhibit Zero Insertion |
| SS05 | 0 | See Figure 3-4 | Reserved |
| | 1 | See Figure 3-4 | Reserved |
| | 2 | See Figure 3-4 | Reserved |
| | 3 | See Figure 3-4 | Reserved |
| | 4 | See Figure 3-4 | Reserved |
| | 5 | See Figure 3-4 | Reserved |
| | 6 | See Figure 3-4 | Transmit Cycle Share Halt |
| | 7 | See Figure 3-4 | Byte Underrun |
| SS06 | 0 | Not used | DTR |
| | 1 | Receive Seq Count | RTS |
| | 2 | Not used | Select Standby |
| | 3 | Not used | Data Rate Select |
| | 4 | Not used | Local Test |
| | 5 | Send Seq Count | Disable Ring |
| | 6 | Not used | Disable RLSD |
| | 7 | Not used | Disable CTS |
| SS07 | 0 | Not used | Timer |
| | 1 | Not used | Timer |
| | 2 | Not used | DSR |
| | 3 | Not used | CTS |
| | 4 | Not used | DSR Transition |
| | 5 | Not used | Ring Transition |
| | 6 | Not used | RLSD Transition |
| | 7 | Not used | CTS Transition |
| SS08 | 0 | Not used | Wrap |
| | 1 | Not used | T3/T4 Test |
| | 2 | Not used | New Sync |
| | 3 | Not used | Tx New Sync |
| | 4 | Not used | Diagnostic Clock |
| | 5 | Not used | Diagnostic Timer Control |
| | 6 | Not used | RSLD |
| | 7 | Not used | Ring |
| SS09 | 0 | Not used | Not used |
| | 1 | Not used | Not used |
| | 2 | Not used | Ptr Reg 0 |
| | 3 | Not used | Ptr Reg 1 |
| | 4 | Not used | Ptr Reg 2 |
| | 5 | Not used | Ptr Reg 3 |
| | 6 | Not used | Not used |
| | 7 | Not used | 0 |
| SS10 | 0 | Not used | Not used |
| | 1 | Not used | Not used |
| | 2 | Not used | Ptr Reg 0 |
| | 3 | Not used | Ptr Reg 1 |
| | 4 | Not used | Ptr Reg 2 |
| | 5 | Not used | Ptr Reg 3 |
| | 6 | Not used | Ptr Reg 4 |
| | 7 | Not used | 0 |
| SS11 | 0 | Not used | Data Chain |
| | 1 | Not used | Frame Chain |
| | 2 | Not used | Pad Insert |
| | 3 | Not used | FTA |
| | 4 | Not used | Xmit Turnoff |
| | 5 | Not used | 0 |
| | 6 | Not used | 0 |
| | 7 | Not used | Count 256 |
| SS12 | 0 | Not used | Count 128 |
| | 1 | Not used | Count 64 |
| | 2 | Not used | Count 32 |
| | 3 | Not used | Count 16 |
| | 4 | Not used | Count 8 |
| | 5 | Not used | Count 4 |
| | 6 | Not used | Count 2 |
| | 7 | Not used | Count 1 |
| SS13 | 0 | Not used | 1 |
| | 1 | Not used | 0 |
| | 2 | Not used | Ptr Reg |
| | 3 | Not used | Ptr Reg |
| | 4 | Not used | Ptr Reg |
| | 5 | Not used | Ptr Reg |
| | 6 | Not used | X |
| | 7 | Not used | 0 |

**Figure 3-7 (Part 1 of 2). Sense Byte Breakdown Chart for CCA/HPCA SDLC (Code SSSS)**

| Location | Bit | Meaning If Bit Is Turned On (1) | |
|---|---|---|---|
| | | CCA | HPCA |
| SS14 | 0 | Not used | 1 |
| | 1 | Not used | 0 |
| | 2 | Not used | Ptr Reg 0 |
| | 3 | Not used | Ptr Reg 1 |
| | 4 | Not used | Ptr Reg 2 |
| | 5 | Not used | Ptr Reg 3 |
| | 6 | Not used | Ptr Reg 4 |
| | 7 | Not used | 0 |
| SS15 | 0 | Not used | Valid Entry |
| | 1 | Not used | Invalid Sequence |
| | 2 | Not used | FCS Valid |
| | 3 | Not used | Pong Entry |
| | 4 | Not used | Byte Overrun |
| | 5 | Not used | Buffer Overrun |
| | 6 | Not used | Flag Received |
| | 7 | Not used | Count 256 |

| Location | Bit | Meaning If Bit Is Turned On (1) | |
|---|---|---|---|
| | | CCA | HPCA |
| SS16 | 0 | Not used | Count 128 |
| | 1 | Not used | Count 64 |
| | 2 | Not used | Count 32 |
| | 3 | Not used | Count 16 |
| | 4 | Not used | Count 8 |
| | 5 | Not used | Count 4 |
| | 6 | Not used | Count 2 |
| | 7 | Not used | Count 1 |
| SS17 | 0 | Not used | Count 256 |
| | 1 | Not used | Count 128 |
| | 2 | Not used | Count 64 |
| | 3 | Not used | Count 32 |
| | 4 | Not used | Count 16 |
| | 5 | Not used | Count 8 |
| | 6 | Not used | Count 4 |
| | 7 | Not used | Count 2 |

**Figure 3-7 (Part 2 of 2). Sense Byte Breakdown Chart for CCA/HPCA SDLC (Code SSSS)**

### 3.3.5 Test 1 Storage Card Isolation (Model 52C Only)

To isolate one of the four possible storage cards, perform the A2/1 variation of Test 1 from any Type A display. If bytes 5 through 8 are nonzero, the failing card is identified as follows:

| Nonzero Byte | Failing Card | nnn Code Displayed |
|---|---|---|
| 5 | S2 | 392 |
| 6 | T2 | 393 |
| 7 | U2 | 394 |
| 8 | V2 | 395 |

Display Example:

```
1122  3344  5566  7788  9900
XXXX  XXXX  0000  0048  XXXX
                    ↑
Failing Card V2 ————┘
```

### 3.3.6 Test 1 Device Adapter Logs

There are two types of device adapter log. The log for Category A devices is accessed by using an A1/1 format. The information returned in the log consists of the last nnn number recorded, some basic adapter status information at the time of the failure, and statistical counters similar to the device error log counters. The log for Category B devices is accessed by using an A2/1 format. The information returned in the log consists of the last nnn number recorded, the operation being attempted at the time of the failure, and information in byte form as to how the operation ended. There are also statistical counters similar to the device error log counters. The above log information should be used to determine the type of error condition that is disabling either of these device adapters. The logs can be used in the same manner as the host adapter logs to determine (1) the frequency of error, (2) what the adapter was doing at the time of error, (3) how the operation ended, etc.

### 3.3.7 Test 1 Type A Adapter Log

This device adapter log format is returned to the requesting 3278 in response to an A1/1 entry. The format detail is as follows:

- Line 1 – Returned the same as input, A1/1.
- Line 2 – Ten bytes are displayed on this line, but only three are currently used. The individual bytes are not labeled when displayed. Each byte is assigned a specific meaning. See the following example for byte identification:

```
0000  0000 0000  0000  0000
NNXX  SSSS XXXX  XXXX  XXXX
```

The leftmost byte is labeled NN. This code represents the two low-order digits of any 200 series nnn number. The nnn number may or may not be displayed on a 3278.

The next byte to the right of NN is XX and is not used.

The next two bytes to the right of XX are labeled SSSS and represent the adapter status associated with the last failure. See Figure 3-8 for SS byte meanings.

- Line 3 – This line displays the statistical counter information associated with this adapter. If no errors are recorded for this adapter, the counters will display as follows:

```
0000 0000 0000 0000 0000
```

The counters are not numbered when they are displayed. They are, however, assigned counter position numbers. The leftmost two-digit position is counter number 08. The rightmost counter position *used* is counter number 08. The remaining positions are not used. The value in each counter is given in hexadecimal. The maximum value for any counter is FF.

Each counter is assigned a specific meaning, as follows:

| Counter | Meaning |
|---|---|
| 01 | Status Q Entry Placed in Error Q |
| 02 | Unconfigured Device |
| 03 | Cycle Share Ended in Error |
| 04 | Invalid Adapter Status |
| 05 | Lost Status |
| 06 | Adapter stopped and was restarted |
| 07 | Cycle Share Machine Check |
| 08 | Non Command Cycle Share Machine Check |

| Bit | Meaning If Bit Is Turned On | Description |
|---|---|---|
| 0 | Counter Overflow | See nnn code 202, Appendix B. |
| 1 | Read Timeout | The DCA expected data or a response from the device while executing a command sequence and did not receive it in a predetermined amount of time. |
| 2 | Turnaround Error or Read Line Parity | The DCA detected a coax turnaround sequence error or a coax parity error while executing a command sequence. |
| 3 | Read Data Byte Parity Error | The DCA detected a parity error in the data transmitted by the device. |
| 4 | Stop Poll | The DCA is not polling. |
| 5 | Timer | The DCA "timer" has fired. The timer is of 1 to 4 seconds' duration and is used primarily to check for a hung device. |
| 6 | Error Q Entry | The DCA has detected error status while communicating with or from an attached device and has stored this information in the Error Q in the 3274. |
| 7 | Not Used | |
| 0 | Extended Status Data | The DCA has set information in extension (left SS byte) status. |
| 1 | Command Completed | The DCA has completed a command sequence with a device. |
| 2 | Adapter Active | The DCA is active performing an operation. |
| 3 | Keystroke or Status Q Entry | The DCA has polled a device, has received a keystroke or status, and has placed the data in a Q in the 3274. |
| 4 | Not Used | |
| 5 | Machine Check | The DCA has detected an error in itself or on the UC I/O bus. |
| 6 | Enable/Disable | The DCA is enabled for operation. |
| 7 | Interrupt Request | The DCA has caused an interrupt request. |

**Figure 3-8. Sense (SS) Byte Definitions**

### 3.3.8 Test 1 Type B Adapter Log

This device adapter log format is returned to the requesting 3278 in response to an A2/1 entry. The format detail is as follows:

- Line 1 – Returned the same as input, A2/1.
- Line 2 – Ten bytes are displayed on this line, but only four are currently used. The individual bytes are not labeled when displayed. Each byte is assigned a specific meaning. See the following example for byte identification:

```
0000  0000  0000  0000  0000
NNFF  CCCC  XXXX  XXXX  XXXX
```

The leftmost byte is labeled NN. This code represents the two low-order digits of any 200 or 300 series nnn number. The nnn number may or may not be displayed on a 3278.

The next byte to the right of NN is labeled FF. This represents the operation being attempted at the time of the failure. Refer to the Type B Adapter Operation Attempted Chart (Figure 3-9) to determine the type of operation in progress at the time of failure.

| FF Code | Operation Attempted |
|---|---|
| 00 | Initialize (Enable and Start Idle Poll) |
| 1F | Read Full Buffer without Start Idle Poll |
| 21 | Specific Poll without Start Idle Poll |
| 23 | Start Idle Poll |
| 26 | Write Full Buffer without Start Idle Poll |

**Figure 3-9. Type B Adapter Operation Attempted Chart (Code FF)**

The next two bytes to the right of FF are labeled CCCC. These two bytes indicate how the operation attempted ended. Refer to the Type B Adapter Operation Ending Chart (Figure 3-10) to obtain this information.

### 3.3.9 Control Logic Error Log

The control logic error log format is returned to the requesting 3278 in response to an A3/1 entry. The format detail is as follows:

- Line 1 – Returned the same as input, A3/1.
- Line 2 – Eight bytes are displayed on this line, but only seven are currently used. The individual bytes are not labeled when displayed. Each byte is assigned a specific meaning. See the following example for byte identification:

```
0000  0000   1010   1000
CCPP  MMRR   HHDD   AAXX
```

| Location | Bit | Meaning If Bit Is Turned On (1) |
|---|---|---|
| Left CC Byte | 0 | Retry Count |
| | 1 | Retry Count |
| | 2 | Retry Count = Number of times current operation retried |
| | 3 | Retry Count |
| | 4 | Complete—Operation terminated |
| | 5 | Error (Unrecoverable error encountered) (See Right CC Byte for detail) |
| | 6 | Exception (An attention was received before the idle poll could be stopped to perform the operation—valid only if Attention is on also) |
| | 7 | Attention |
| Right CC Byte | 0 | Overrun |
| | 1 | Parity Error on Serial Interface |
| | 2 | Device Not Available |
| | 3 | Busy |
| | 4 | Adapter Disabled |
| | 5 | Machine Check |
| | 6 | Idle Poll On |
| | 7 | Invalid Operation Attempted |

**Figure 3-10. Type B Adapter Operation Ending Chart (Code CCCC)**

CC represents the number of cycle share I/O errors encountered. The count is incremented when a cycle share error occurs. The counter will not wrap (increments to FF and then stops). For detailed log information for the associated adapter, see Adapter Logs A0—A2.

PP is the count of storage parity errors encountered for which recovery was successful. The counter will not wrap (increments to FF and then stops).

MM represents the engine machine checks encountered for which recovery was successful. The counter will not wrap (increments to FF and then stops).

RR is a reserved byte.

HH is a machine check threshold counter for the host adapter.

The count is incremented when an adapter I/O machine check occurs. The counter will not wrap (steps to FF and then stops).

DD represents the Type A adapter machine check threshold counter. It increments in the same manner as HH.

AA represents the Type B Adapter machine check threshold counter. It increments in the same manner as HH and DD.

Byte XX is used as the encrypt/decrypt adapter machine check counter. This counter increments in the same manner as HH.

- Line 3 — There is no line 3 assigned to this log; however, a third line may be displayed if you entered this log from another log display.

## 3.3.10 X.21 Switched Log

Figure 3-11 shows settings for the X.21 Switched Feature error logs, followed by descriptions of conditions that will help you analyze the logs.

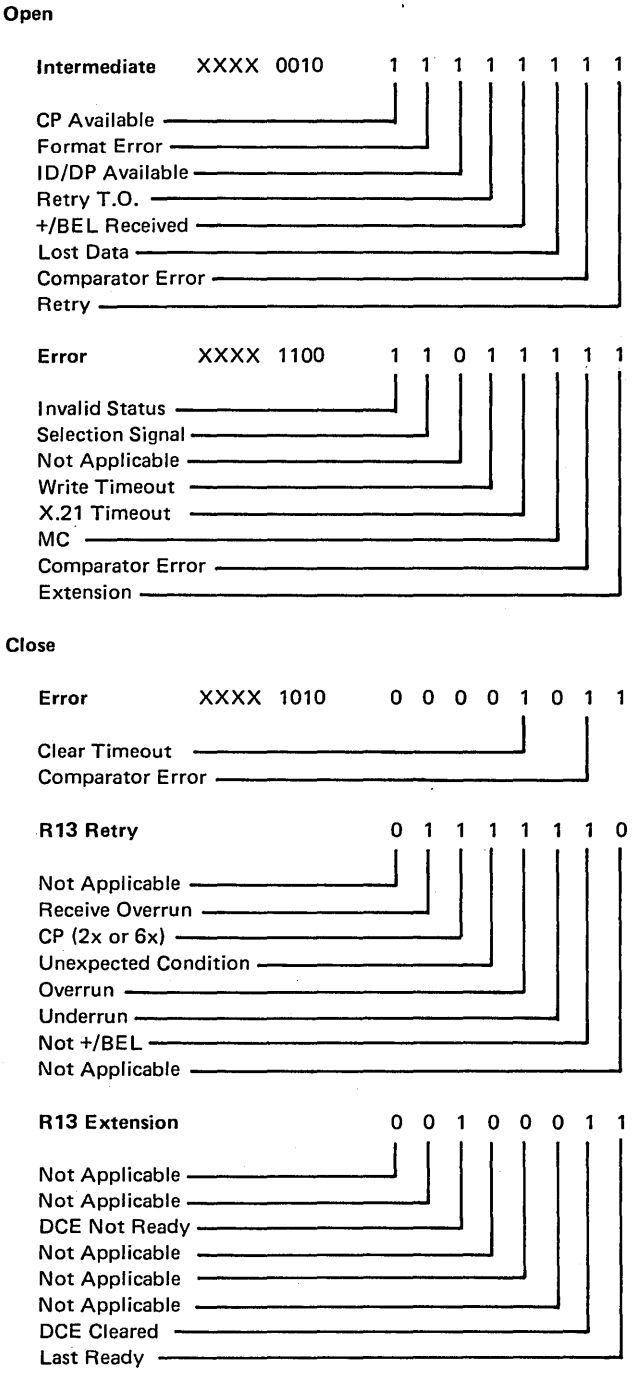



**Figure 3-11. X.21 Switched Log Settings**

Receive Overrun — Insufficient buffers were allocated for the current task.

CP (2x or 6x) — A Call Progress Signal was received that can be retried (Category 2x or 6x).

Unexpected Condition/Overrun/Underrun — Same as TP leased.

Not +/BEL — An unexpected character was received from the network while awaiting a "Proceed to Select" or "Incoming Call".

Invalid Status/Write Timeout/MC — Same as TP leased.

Selector Signal — An invalid character was detected in the selection signals.

X.21 Timeout — A network timeout has occurred.

Extension — Additional status can be found in Register 13 in Control Space.

DCE Not Ready — The controller detected that the network is not ready.

DCE Cleared — The controller has responded to a clearing sequence from the network.

CP Available — The controller has received a Call Progress Signal from an X.21 Switched Network as a result of issuing an outgoing call to the network.

Format Error — The Call Progress Signal or Line Identification or DCE Provide Information did not end with the proper delimiter (IA5+).

**Note:** *These functions are not supported by the 3274 Model 51C.*

ID/DP Available — The controller received either a Line Identification or DCE Provide Information from the network.

Retry Timeout — The controller has been monitoring the network for an incoming call for 3 seconds.

+/BEL Received —
BEL — The controller has detected an incoming call.
+ Received — The network has signaled to the controller to transmit the selection signals (dial number) as a result of a request to process an outgoing call.

Lost Data — Insufficient buffer allocation has been detected during receipt of either a Call Progress Signal or DCE Provide Information.

Comparator Error — The hardware has detected a mismatch between the signals on the input and output of the drivers and/or receivers.

Last Retry — The specifiable limit on retries has been exceeded.

Clear Timeout — During execution of a close function request, the clearing sequence did not terminate properly.

Receive Overrun — Insufficient buffers were allocated for the current task.

CP (2x or 6x) — A Call Progress Signal was received that can be retried (category 2x or 6x).

Invalid Status/Write Timeout/MC — Same as TP leased.

Clear Timeout — During execution of a close function request, the clearing sequence did not terminate properly.

### 3.3.11 Test 1 Extension for X.21 Switched

The following version of Test A0/1 is used for the X.21 Switched attachment. Line 4 is used for an X.21 Switched specific event. Line 5 contains X.21 Switched counters.

```
Line 1  A0/1
Line 2  EEEE  ....  EEEE (same as HPCA)
Line 3  XXXX  ....  XXXX (same as HPCA)
Line 4  0022  4455  6678  KKMM  LLII  PPRR  RRRR  RRRR  RRRR  RRRR
Line 5  CCCC  CCCC  CCCC  CCCC  CCCC  CCCC  CCCC  CCCC  CCCC  CCCC
```

Where:
- 00 = Last CP indicator of class 0X, 1X
- 22 = Last CP indicator of class 2X, 3X
- 44 = Last CP indicator of class 4X
- 55 = Last CP indicator of class 5X
- 66 = Last CP indicator of class 6X
- 78 = Last CP indicator of classes 7X, 8X and 9X
- KK = Error Completion Flag Bits
- MM = Extended Error Completion Modifier Bits
- LL = Retry Modifiers
- II = Intermediate Status Flag Bits
- PP = Intermediate Status Modifiers
- RR = Reserved
- CC = X.21 Switched Error Counters

| FIELD | BITS (NNN) IS NNN# ASSIGNED | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| KK | INV STAT (326) | SEL SIG (326) | 0 | WRTE T.O. (530) | X.21 T.O. (556) | MC (330) | CMPR ERR (562) | EXT |
| MM if X.21 T.O. set in KK* | 0 | 0 | T1 T.O. | T2 T.O. | T5 or T6 T.O. (CLR T.O.) (561) | T3A or T3B T.O. | T4 T.O. | |
| MM if EXT set in KK | 0 | 0 | NOT READY (557) | 0 | 0 | 0 | DCE CLRD (559) | LAST RETRY |
| LL if LAST RETRY set in MM | 0 | RCV OVRN (326) | CP (2X or 6X) | UNEX COND (326) | OVER RUN (326) | UNDER RUN (326) | NOT +/BEL (560) | |
| II | CP AVAIL | FORM ERR (555) | ID/DP AVAIL | RETRY T.O. | +/BEL RCVD | LOST DATA (558) | CMPR ERR (562) | RETRY |
| PP if RETRY set in II | 0 | RCV OVRN | CP | UNEX COND | OVER RUN | UNDER RUN | NOT +/BEL | 0 |

**Note:** *The modifier fields will be zero if the specified conditions are not met. If both Ext and X.21 T.O. are set, Ext will be shown.*

X.21 Switched Error/Exception Counts:

1. Comparator Error
2. Format Error
3. X.21 Timeout
4. Invalid Status
5. Not Ready
6. Lost Data
7. DCE Cleared
8. Last Retry
9. CP
10. Unexpected Condition
11. Not + BEL
12. CP available 0X, 1X
13. CP available 2X, 3X
14. CP available 4X
15. CP available 5X
16. CP available 6X
17. CP available 7X, 8X, 9X
18. Clear Timeout
19. Spare
20. Spare

## 3.4 TEST 2: DISPLAY CONFIGURATION INFORMATION

Test 2 displays the configuration table residing on the system diskette. The configuration table data is the result of the user customizing the feature diskette and writing the configuration data from storage to the system diskette. Test 2 is displayed by entering Test mode by means of the ALT and TEST keys and then keying in slash (/), two (2), and ENTER. You may page from one display to another by pressing the ENTER key.

The bytes displayed are labeled by position number. The following format shows the configuration bytes labeled.

```
0001 0203 0405 0607 0809 0A0B 0C0D 0E0F
0000 0000 0000 0000 0000 0000 0000 0000

1011 1213 1415 1617 1819 1A1B 1C1D 1E1F
0000 0000 0000 0000 0000 0000 0000 0000

2021 2223 2425 2627 2829 2A2B 2C2D 2E2F
0000 0000 0000 0000 0000 0000 0000 0000

3031 3233 3435 3637 3839 3A3B 3C3D 3E3F
0000 0000 0000 0000 0000 0000 0000 0000

4041 4243 4445 4647 4849 4A4B 4C4D 4E4F
0000 0000 0000 0000 0000 0000 0000 0000

5051 5253 5455 5657 5859 5A5B 5C5D 5E5F
0000 0000 0000 0000 0000 0000 0000 0000

6061 6263 6465 6667 6869 6A6B 6C6D 6E6F
0000 0000 0000 0000 0000 0000 0000 0000

7071 7273 7475 7677 7879 7A7B 7C7D 7E7F
0000 0000 0000 0000 0000 0000 0000 0000
```

The subsystem configuration for your machine can be determined from Figure 3-12.

| Byte ID | Description |
|---|---|
| 00 | Disk Type Identifier<br>D4 = Feature Diskette<br>E2 = System Diskette<br>D3 = Language Diskette (WT)<br>D9 = RPQ Diskette |
| 01 | Feature Disk Level ID } See Bytes 70 – 75 |
| 02 | System Disk Level ID } See Bytes 70 – 75 |
| 03 | Language Disk Level ID } See Bytes 70 – 75 |
| 04 | 3274 Model Number<br>84 = 51C/52C CCA/HPCA |
| 05 | Channel Address If an A Model |
| 06 | Internal Flag<br>00 = Not an A Model<br>01 = An A Model |
| 07 | Line Code (Model 51C/52C)<br>01 = EBCDIC<br>02 = ASCII |
| 08 | Communication Line Control (Model 51C/52C)<br>01 = BSC<br>02 = SDLC |
| 09 | BSC Poll Address (Model 51C/52C) |
| 0A | BSC/SDLC Selection Address (Model 51C/52C) |
| 0B | Communication Adapter Type (Model 51C/52C)<br>01 = CCA<br>02 = HPCA<br>04 = Encrypt/Decrypt<br>10 = Printer Polled by Host |
| 0C | Model 51C/52C<br>01 = Wrappable Modem<br>02 = DDSA<br>04 = X.21 Leased<br>10 = X.21 Switched |

| Byte ID | Description |
|---|---|
| | 20 = Loop Adapter<br>40 = EMI Switched<br>80 = 1200-bps IM Nonswitched (Model 51C only)<br>AO = 1200-bps IM Switched |
| 0D | Teleprocessing Options<br>01 = Omit Ans Tone<br>02 = Point-to-Point<br>04 = Half-Speed<br>08 = Select Standby<br>10 = Special RTS*<br>20 = Nonswitched Line<br>40 = NRZI<br>80 = WT DCE Sw Network |
| 0E | Card R2 Specification<br>00 = Not Installed<br>01 = Not Applicable<br>02 = Not Applicable<br>04 = 3 Control Storage<br>08 = 51C/52C Storage |
| 0F | Card S2 Specification<br>00 = Not Installed<br>01 = Not Applicable<br>02 = 2 Control Storage<br>04 = 4 Control Storage<br>08 = 51C/52C Storage |
| 10 | Card T2 Specification<br>00 = Not Installed<br>04 = 51C Storage |
| 11 | Card C2 Specification<br>00 = Not Installed<br>01 = Not Applicable<br>02 = Not Applicable<br>04 = 4 Control Storage |

*Active from STX to EOT for BSC, 4-wire, multipoint, and modem without New Sync.

**Figure 3-12 (Part 1 of 2). Subsystem Configuration**

| Byte ID | Description |
|---|---|
| 12 | Card B2 Specification<br>00 = Not Installed<br>10 = Model 52C only; 128K<br>20 = Model 52C only; 256K |
| 13 | Storage Expansion Feature<br>01 = Not Installed<br>02 = Installed<br>80 = Reserved<br>82 = Mass migrator IML |
| 14 | Reserved |
| 15 | Selector Pen<br>'01' 3289 Text Print Control<br>'02' Between Bracket Sharing<br>40 Alphameric MSR/MHS with Auto Enter<br>80 Alphameric MSR/MHS |
| 16 | Optional Code Select<br>01 SCS Printer support not installed<br>02 Host Loadable PAM not installed<br>04 Local Copy not installed<br>10 MSR/MHS not installed |
| 17 | Type B Dr/Rcvr Cards Installed<br>00 = None<br>01 = 1st Card<br>02 = 2nd Card<br>03 = 3rd Card<br>04 = 4th Card |
| 18 | Type A Dr/Rcvr Cards Installed<br>00 = None<br>02 = 1st Card<br>04 = 2nd Card<br>06 = 3rd Card<br>08 = 4th Card |
| 19 | Total Category B Terminals (Value given in hex) |
| 1A | Total Category A Terminals (Value given in hex) |
| 1B | Total All Terminals (Value given in hex) |
| 1C | Attached Ptrs<br>01 = High-Speed Loop |
| 1D | EBCDIC Control Unit ID (Value given in hex) |
| 1E | Language Code<br>01 = (US) English<br>02 = (US) ASCII<br>For others, see Appendix C in *IBM 3270 Information Display System: 3274 Planning, Setup, and Customizing Guide,* GA27-2827. |
| 1F | Reserved |
| 20 | Total Type A DCB Count (Value given in hex) |
| 21 | Total DCB Count (Value given in hex) |
| 22 | Print Authorization Matrix Entry Count |
| 23 | Keyboard Types Specified<br>01 = Typewriter<br>02 = Data Entry<br>04 = Data Entry II<br>08 = APL<br>10 = Text |
| '24' | Total Type A Extended DCB Count (value given in hex) |
| '25' | Attribute Select Typewriter Keyboard<br>01 3279 heads installed (convergence feature)<br>02 Programmed Symbol feature installed |
| '26' | Attribute Select Control Unit Options<br>01 3270 SFAP Extended Data Stream installed<br>02 PS Decompression installed |
| 27 | Reserved |
| 28 | Validation Number |
| 29 | Validation Number |
| '3D' | X.21 Switched — Key Top Definition<br>80 Direct key support on all terminals<br>40 Dial key support on all terminals<br>20 Local/Comm key support<br>10 Disconnect key support all terminals<br>08 Ext key support on all terminals<br>04 —<br>02 DCE support direct call<br>01 DCE support address call |
| '3E' | Number of automatic redial attempts allowed |
| '3F' | Ring time (see Note)<br>80 12.8 seconds<br>40 6.4 seconds<br>20 3.2 seconds<br>10 1.6 seconds<br>08 0.8 seconds<br>04 0.4 seconds<br>02 0.2 seconds<br>01 0.1 seconds |
| '41' | 38LS Responses<br>80 5500 feature<br>40 5501<br>20 5502<br>10 5507<br>08 5508 |
| 42-51 | Patch ID Values |
| 52 | Number of RPQ Diskettes Installed |
| 54-58 | Part Number and EC Level of First RPQ Installed (7-digit PN, 3-digit EC level) |
| 59-5D | Part Number and EC Level of Second RPQ Installed (7-digit PN, 3-digit EC Level) |
| 5E-62 | Part Number and EC Level of Third RPQ Installed (7-digit PN, 3-digit EC Level) |
| 63-6F | Reserved |
| 70 | Feature Diskette Level |
| 71 | Feature Diskette Suffix |
| 72 | System Diskette Level |
| 73 | System Diskette Suffix |
| 74 | Language Diskette Level |
| 75 | Language Diskette Suffix |
| 76, 77 | EC Level and Suffix Level of First RPQ Installed |
| 78, 79 | EC Level and Suffix Level of Second RPQ Installed |
| 7A, 7B | EC Level and Suffix Level of Third RPQ Installed |
| 7C | Reserved |
| '7D' | 01 - Attribute Select Typewriter Keyboards<br>02 - Numeric Lock feature on above |

**Note:** *Time between automatic redial attempts (X.21).*

**Figure 3-12 (Part 2 of 2). Subsystem Configuration**

## 3.5 TEST 3: DISPLAY THE STATUS OF ALL CONFIGURED TERMINALS AND DISPLAY THE CONTROL UNIT SUMMARY COUNTERS

Test 3 is invoked after the ALT and TEST keys are used to enter Test mode. An entry of /3 from any functioning 3278 display, and then an ENTER, will display one of the following formats on the screen (the actual format may vary, depending on how many devices have been configured):

Example 1:

- Line 1 – 01234567 8901
- Line 2 – 11111111 110 -
- Line 3 – 0000 0000 0000 0000 0000

Line 1 displays all the Category A devices, starting from the leftmost position. The digits correspond to the low-order digit of the coax port address. Therefore, port A0 = position number 0 and port A7 = position number 8. The Category B devices are separated from the Category A devices by 2 spaces. Therefore, port B0 = position number 8 in the log and port B03 = position number 11.

Line 2 displays the status (1 = on, 0 = off, and - = disabled) of each configured device.

Line 3 displays statistical counter information in summary form of control-unit-detected machine checks, communications checks, program checks, and SDLC test commands. The values are displayed in hexadecimal. The counters are two byte counters numbered from left to right starting at counter number 01. See the following example for counter meanings:

| Counter | Meaning |
|---|---|
| 0102 | Summary of all machine checks |
| 0304 | Summary of all communications checks |
| 0506 | Summary of all program checks |
| 0708 | SDLC test commands received |
| 0910 | SDLC test commands sent |

(Maximum counter values are FFFF)

Example 2:

Machine configured for 8 Category A and 4 Category B devices (Configuration Support B and C only)

- Line 1 – 01234567 8901
- Line 2 – 10111111 1001
- Line 3 – ddddddddd pppp TYP
- Line 4 – . . . . . * . . . COAX
- Line 5 – . . . . . . . . DEV
- Line 6 – ++++++++ +++ LU
- Line 7 ## .914 666 1234
- Line 8 – 0000 000

Line 1 shows coax port addresses (0-A1). In this example the 3274 is configured for 12 devices (3 Category A displays and 4 Category B printers). Category A devices are always shown first. Printer and Category B devices are then shown separated by two spaces.

Line 2 shows the status of each device, where:

1 = device powered on
0 = device recognized as powered off
- = device recognized as disabled because of control-unit-detected errors

Line 3 shows the type of device attached, where:

d = display
p = printer
i = other
- = never initialized

Line 4 shows a summary of coax errors, where:

. = 0 errors
: = 1 - 9 errors
| = 10 - 19 errors
* = 20 or more errors

Line 5 shows a summary of device errors, where:

. = 0 errors
: = 1 - 9 errors
| = 10 - 19 errors
* = 20 or more errors

Line 6 shows a summary of sessions bound (this line will appear only for SNA attachments and is required for X.21 Switched), where:

+ = session bound
blank = no session bound

Line 7 shows a display of dialed (X.21 Switched only), where:

## XXXX (up to 32 characters) dialed number entered by the keyboard
## 0000 = Direct call
## ---- = Incoming call

Line 8 consists of control unit statistical summaries.

## 3.6 TEST 4: RESET ANY TEST 1 LOG

Test 4 provides the capability of resetting any device adapter, device, host adapter, or control logic log. By using the ALT and TEST keys, you may enter Test mode. Test 4 may now be used as shown below:

- 00 to 16/4 (51C) – Resets the device log for the device
  00 to 08/4 (52C) specified to all zeros (0).
- A0/4 – Resets the host adapter log to all zeros (0).
- A1/4 – Resets the Type A adapter log to all zeros (0).
- A2/4 – Resets the Type B adapter log to all zeros (0).
- A3/4 – Resets the control logic log to its initial values.

Test 4 may be used to track intermittent failures without re-IML or powering off the machine to clear the error logs.

## 3.7 TEST 6: DEVICE CONTROL BLOCK DISPLAY

The device control block (DCB) contains common subsystem information pertaining to all terminals, device and host adapter information, and limited device-feature information. The Test 6 display represents the most current information regarding a specific device. The DCB should be checked when it is necessary to determine specific device parameters such as: (1) Is the device configured as a display or printer? (2) Is the display screen size correctly specified? (3) Is an MDT bit set? (4) The status of keyboard for this device, etc.

To invoke Test 6, you must first enter Test mode by means of the ALT and TEST keys. The DCB for any device from 00 to 16 (for 51C) or 00 to 08 (for 52C) may be displayed by keying the device number followed by a slash (/), the number 6, followed by an ENTER key. Each DCB consists of four displays of 64 bytes each. The individual bytes are not labeled. There are six lines to each display. The first line is always returned the same as input 00 to 16/6 or 00 - 08/6 for each display. The second line of each display will indicate the beginning byte ID of that display. See Figure 3-13 for details. You may page from one display to the next by pressing the ENTER key. Paging beyond display 1C will result in a locked keyboard and X-f displayed on the status line. See Figure 3-14 for DCB interpretation.

### 3.7.1 Test 6 Byte Identification

Figure 3-13 identifies the bytes of the DCB displays.

**First Display**

XX/6 – Returned as input XX = Any device

000 – ID of the first address of this display

ID only 0 1 2 3 4 5 6 7 8 9 A B C D E F –
ID only, not displayed

```
000   0000 0000 0000 0000 0000 0000 0000 0000
010   0000 0000 0000 0000 0000 0000 0000 0000
020   0000 0000 0000 0000 0000 0000 0000 0000
030   0000 0000 0000 0000 0000 0000 0000 0000
                                        Byte 3F
```

**Second Display**

XX/6 – Returned as input

040 – ID of the first address of this display

```
040   0000 0000 0000 0000 0000 0000 0000 0000
050   0000 0000 0000 0000 0000 0000 0000 0000
060   0000 0000 0000 0000 0000 0000 0000 0000
070   0000 0000 0000 0000 0000 0000 0000 0000
                                        Byte 7F
```

**Third Display**

XX/6 – Returned as input

080 – ID of the first address of this display

```
080   0000 0000 0000 0000 0000 0000 0000 0000
090   0000 0000 0000 0000 0000 0000 0000 0000
0A0   0000 0000 0000 0000 0000 0000 0000 0000
0B0   0000 0000 0000 0000 0000 0000 0000 0000
                                        Byte BF
```

**Fourth Display**

XX/6 – Returned as input

0C0 – ID of the first address of this display

```
0C0   0000 0000 0000 0000 0000 0000 0000 0000
0D0   0000 0000 0000 0000 0000 0000 0000 0000
0E0   0000 0000 0000 0000 0000 0000 0000 0000
0F0   0000 0000 0000 0000 0000 0000 0000 0000
                                        Byte FF
```

**Note:** *See Appendix C for extended data stream configuration.*

**Figure 3-13. Test 6 Byte ID Chart**

### 3.7.2 DCB Bit Definitions

Bytes not defined in Figure 3-14 are not used. Bits defined as "Reserved for engineering use" may contain zeros or ones. They should be disregarded unless otherwise directed by the next level of the support structure.

| Location | Bit | Meaning If Bit Is Turned On |
|---|---|---|
| Byte 02 | 0 | See figure A |
| | 1 | |
| | 2 | |
| | 3 | See figure B |
| | 4 | |
| | 5 | Keyboard is attached |
| | 6 | This is a Type B device |
| | 7 | Numeric Lock feature is present |

| Display Model | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Bit | | | | | |
| 0 | 0 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 | 1 |
| 2 | 1 | 0 | 1 | 1 | 0 |

figure A

| Bit | Data Entry KB | Printer | Typewriter, APL, Text-Keyboard |
|---|---|---|---|
| 3 | 0 | 1 | 0 |
| 4 | 1 | 1 | 0 |

figure B

| | | |
|---|---|---|
| Byte 03 | 0 | Katakana keyboard is attached |
| | 1 | SCS Feature on Type A Adapter Printer |
| | 2 | Text Keyboard |
| | 3 | 3289 Text Feature |
| | 4 | APL Keyboard |
| | 5-7 | Reserved |
| Byte 04 (Category A Devices) | 0 | Not used |
| | 1 | Security keylock present |
| | 2 | Selector pen attached |
| | 3 | Reserved for engineering use |
| | 4 | MSR/MHS attached |
| | 5 | Reserved for engineering use |
| | 6 | Reserved for engineering use |
| | 7 | ECS (APL/Test) |
| Byte 04 (Category B Devices) | 0 | Device busy |
| | 1 | Buffer parity |
| | 2 | Indeterminate write errors |
| | 3 | Inhibit start idle poll |
| | 4 | Buffer size (0=480, 1=1920) |
| | 5 | DAU issued |
| | 6 | Start print |
| | 7 | Format bits |
| Byte 06 | 0 | DCB busy |
| | 1 | Subsystem ready (DCB initialized) |
| | 2 | Nondisplay |
| | 3 | Op Complete pending from device |
| | 4 | Linkage Stacked |
| | 5 | Stacked status/keystroke/error present |
| | 6 | Numeric Lock field |
| | 7 | Reserved for engineering use |

**Figure 3-14 (Part 1 of 3). DCB Bit Definition Chart**

| Location | Bit | Meaning If Bit Is Turned On |
|---|---|---|
| Byte 07 | 0 | Protected field or attribute character |
| | 1 | ECS Buffer Updated |
| | 2 | Print ID entry mode |
| | 3 | Reserved for engineering use |
| | 4 | MDT bit not set |
| | 5 | Do not enter |
| | 6 | Reserved for engineering use |
| | 7 | Insert mode |
| Byte 08 | 0 | No indicators to write or erase (Category B displays and printers, Category A printers) |
| | 1 | Test mode |
| | 2 | Alpha shift (not Katakana shift) |
| | 3 | Reserved for engineering use |
| | 4 | Text indicator |
| | 5 | Upshift indicator |
| | 6 | Katakana shift |
| | 7 | APL indicator |
| Byte 09 | 0 | Online indicator |
| | 1 | System-wait condition |
| | 2 | Hard-lock condition |
| | 3 | Keyboard in use by operator |
| | 4 | DCB scheduled for function 6 — waiting (BSC) |
| | 5 | DCB scheduled for function 5 — waiting (BSC) |
| | 6 | Reserved for engineering use |
| | 7 | OK for function to be suspended |
| Byte A0 (52C only) | 0 | Keyboard mode — Kanji/Chinese (multishift input mode) |
| | 1 | Keyboard mode — (10-key input mode) |
| | 2 | Two-byte code character attempted |
| | 3-7 | Reserved for engineering use |
| Byte 0B | 0 | Reserved for engineering use |
| | 1 | Reserved for engineering use |
| | 2 | Reserved for engineering use |
| | 3 | Local copy (display to printer) in progress |
| | 4 | Alternate Screen Size |
| | 5 | Attributes not valid |
| | 6 | Monocase switch active in device |
| | 7 | Reserved for engineering use |
| Byte 0C | 0 | Printer messages queued — local copy |
| | 1 | Reserved for engineering use |
| | 2 | Local copy malfunction has occurred |
| | 3 | Wrong place |
| | 4 | Minus Function |
| | 5 | MSR — wrong card MSR/MHS |
| | 6 | Message pending |
| | 7 | Message reminder |
| Byte 0D | 0 | Printer printing — local copy |
| | 1 | If display has printer assigned for local copy |
| | 2 | Printer matrix changed (associated with this display) |
| Byte 0E | 0 | Invalid dead key (language 06 only) |
| | 1 | 2NN machine check |
| | 2 | Communication check |
| | 3 | Program check |
| | 4 | Security key off |
| | 5 | 3NN machine check |
| | 6 | Too much (keystroke-MSR) |
| | 7 | Operator not authorized |
| Byte 0F | 0 | Not enough |
| | 1 | Wrong number |
| | 2 | Numeric shift |
| | 3 | Operator retry |
| | 4 | Local-copy failure while printer printing (printer failure) |
| | 5 | Device busy doing local copy |
| | 6 | Reserved for engineering use |
| | 7 | System lock |
| Byte 10 | 0 | Communication check reminder |
| | 1 | My Job indicator |
| | 2 | System Operator indicator |
| | 3 | Unowned indicator |
| | 4 | Not enabled (not online) |
| | 5 | Reserved for engineering use |
| | 6 | Reserved for engineering use |
| | 7 | Minus Symbol indicator (WT only) |
| Bytes 14, 15 | | Cursor position (3278 only)[1] |
| Bytes 1A, 1B | | First character position on display[1] |
| Bytes 1C, 1D | | Last character position on display[1] |
| Byte 24 (Category A devices) | 0 | Model 5 Wide Screen |
| | 1 | Model 5 Wide Screen |
| | 2 | 480-character format |
| | 3 | Reserved for engineering use |
| | 4 | Inhibit display video |
| | 5 | Blank cursor |
| | 6 | Cursor reverse |
| | 7 | Cursor blink |
| Byte 25 | 4 | APL/Text Feature 3278 |
| Byte 34 | 0 | SNA — printer allocated to local copy |
| | 1 | SNA — local copy printer allocated for host use |
| | 2 | SNA — host request for local copy allocated printer |
| | 3 | Alternate row length indication |
| | 4 | Default row length indication |
| | 5 | Reserved for engineering use |
| | 6 | SNA — LU in ERP state |
| | 7 | SNA — host communications disabled (LU active) |
| Byte 35 | 0 | Local copy printing (host initiated) |
| | 2 | Local copy (printer available for next message) SNA |
| | 3-7 | Reserved for engineering use |

[1] When using this byte on Category A devices, subtract hex 50 from the cursor position. This will give you the current I/O interface code. (If Model = 1, subtract X"40".)

**Figure 3-14 (Part 2 of 3). DCB Bit Definition Chart**

| Location | Bit | Meaning If Bit Is Turned On |
|---|---|---|
| Byte 37 (52C only) | 0 | Kanji/Chinese terminals attached |
| | 1 | Kanji/Chinese keyboards attached |
| | 2 | Current field attribute is known |
| | 3 | Current field is Kanji/Chinese |
| | 4-7 | Reserved for engineering use |
| Byte 46 | 0 | Other function request |
| | 1 | Select pen for immediate detect field |
| | 2 | Required for Select Pen field |
| | 3 | Dup Key switch (Auto Tab) |
| | 4 | Reserved for Engineering |
| | 5 | Clicker disabled |
| | 6 | Reserved for engineering use |
| | 7 | Type B erase all unprotected |
| Byte 47 | 0 | Disable cursor display |
| | 5 | Dead key sequence in process |
| | 6 | Local copy received IR |
| Byte 4E (Category A devices) | 0-7 | Attribute affecting field cursor (3278 only) |
| Byte 4E (Category B devices) | 0 | Device check |
| | 1 | Transmit check |
| | 2 | Information pending |
| | 3 | Not ready (printer only) |
| | 5 | Equipment check (printer only) |
| Byte 4F (Category B devices) | 0 | Device busy |
| | 1 | Buffer size (0=480, 1=1920) |
| | 2 | 0 = display, 1 = printer |
| | 3-7 | Device address (type B adapter port number) Byte B6 (Mod BSC) Pending Device Status |
| Bytes 50, 51 | | Present attribute address (3278 only)[1] |
| Bytes 52, 53 | | Next attribute address (3278 only)[1] |
| Byte 68 | 0 | Printer equipment check/display disabled due to error |
| | 1 | Intervention required/Security Key Off |
| | 2 | Printer busy processor abort |
| | 3 | Reserved for engineering use |
| | 4 | Print in process |

[1]When using this byte on Category A devices, subtract hex 50 from the cursor position. This will give you the current I/O interface code. (If Model = 1, subtract X"40".)

**Figure 3-14 (Part 3 of 3). DCB Bit Definition Chart**

## 3.8 TEST 7: DYNAMIC CONVERGENCE (COLOR)

For a description of this test, see the *IBM 3279 Color Display Station Maintenance Information* manual, SY33-0069.

## 3.9 TEST 8: PSs, HIGHLIGHTING, AND COLOR

For a description of this test, see the *IBM 3279 Color Display Station Maintenance Information* manual, SY33-0069.

## 3.10 KANJI/CHINESE CHARACTER DISPLAY

For a description of this test, see the *IBM 3278 Model 52 Display Station Maintenance Information* manual, SY18-2032.

## 3.11 3277 PATH TEST AND TEST REQUEST KEY

### 3.11.1 BSC or Local Host Attached

On 3277s attached to a BSC or local host attached 3274, the coax path from the device to the control unit can be verified by means of the Test Request key. Pressing the Test Request key will cause the control unit to attempt to turn on the System Available indicator on the 3277. A Test Request message will also be generated if the control unit is online to the host.

### 3.11.2 SNA Attached

On 3277s attached to an SNA-configured 3274, the coax path from the device to the control unit can be verified by means of the Test Request key twice. The first pressing of the key will cause the control unit to attempt to turn off the Do Not Enter indicator; the second will cause the control unit to attempt to turn on the System Available indicator. Operationally, this sequence is used to enter and exit 2-key sequence mode. Test Request followed by Clear is functionally equivalent to the Systems Request key on 3278s in SNA mode. Test Request followed by PA1 is the equivalent in function to the ATTN key on 3278s in SNA mode. Test Request followed by Test Request returns the 3277 to normal operation.

# Chapter 4. Subsystem Tests, External Tests, and Subsystem Service Aids

## 4.1 INTRODUCTION

Subsystem tests consist of the Bus and Lamp test and the IML tests.

## 4.2 INITIAL MACHINE LOAD (IML) TESTS

Initiating a normal IML (ALT switch not pressed and system diskette installed) invokes a sequence of hardware tests before operational code is loaded. When the IML pushbutton is pressed, a hardware Bus and Lamp test is performed. When the IML pushbutton is released, the diagnostic sequence begins and the error indications described in Figure 4-1 may be displayed.

| Code | Description |
|---|---|
| 0000 | Control Logic failure — All four indicators not lit indicates a control logic failure. The test sequence will not proceed. The failure of any adapter can also cause this failure. Parity problems can also appear to be control-logic failures. |
| 0001 | Low Storage failure — A steady display of this code in the 8 4 2 1 indicators indicates a failure in low storage. |
| 0010 | 31SD failure — A flashing display of this code indicates the 31SD Diskette drive failed. A steady display of this code may be caused by any of the following:<br>• Failure of the 31SD Diskette drive to come "ready."<br>• A hung sequence (did not start) because of another adapter failure.<br>• Loss of ground to the 31SD Diskette drive (check A1Z2 cable).<br>• Defective diskette. |
| 0011 | Type A Adapter failure — A flashing display of this code indicates the test for this adapter not requiring a 3278 attached failed. A steady indication may indicate the sequence is hung (did not start). Any activity from a device that would normally disable the adapter will also cause this test to fail. |
| 0100 | Type A Adapter Failure — A flashing display of this code indicates the tests for this adapter that require a 3278 attached failed. If a POR response was not detected from Port A0, this test will automatically be bypassed. A failing display can also cause this test to fail. |
| 0101 | Storage Card Failure — A flashing display of this code indicates the storage test failed. The failure could be caused by a defective storage card, failure of a component interfacing with storage (Extended Function Store feature), or incorrect customizing parameters. If a 3278 display is powered on at port A0, additional failure information will be displayed on the screen. |
| 0110 | Host Adapter Failure — A flashing display of this code indicates the host adapter/attachment test failed. Failure could be caused by the following, in addition to defective cards: (1) model specified wrong when customized, (2) system diskette not for this machine, or (3) problem on the host interface has disabled the adapter. |
| 0111 | Modem Wrap failure — A flashing display of this code indicates the Modem Wrap/DDSA test failed. The wrap test is run only if a wrappable modem was specified at customizing time. If a 3278 is powered on at port A0, additional information concerning the failure is available on the screen. Data displayed is as follows:<br>0111 016 — Modem failed to set Clear to Send<br>0111 013 — General modem failure |
| 1000 | Type B Adapter failure — A flashing display of this code indicates the Type B Adapter test has failed. The test looks for the first Type B display powered on and attempts to do an Erase-Write-Erase operation. The cursor is left in the lower right portion of the screen. Any Type B device failure that would disable the adapter would cause this test to fail. |
| 1001 | Encrypt/Decrypt Adapter Failure — A flashing display of this code indicates that the Encrypt/Decrypt Adapter test has failed. |
| 1010 | 31SD Error — This flashing code is displayed whenever a 31SD problem has been detected *after* the initial 33FD test. This failure can also be caused by invalid tracks or data on the diskette. |

**Figure 4-1. IML Test Error Indications**

### 4.2.1 ALT 1 IML Mode

Pressing the IML pushbutton while holding the ALT switch in the ALT 1 position bypasses the normal IML test sequences and causes the unit code to be directly loaded. This will enable the user to bypass a failing test sequence (for example, a defective Type B adapter). In this case, the control unit is operational except for the Type B adapter. The Bus and Lamp test functions the same as during a normal IML. See Figure 4-2 for an ALT 1 IML sequence.

**Note:** *At least one complete IML test sequence is required to initialize control storage. Bypassing IML by using either ALT 1 or ALT 2 mode does not perform this initialization function; therefore it is possible that invalid parity may exist after initial power on if normal IML has been bypassed.*

| Step | Code | Meaning |
|---|---|---|
| 1. ALT 1 and IML pressed | 1111 | Bus and Lamp test OK |
| 2. ALT 1 and IML released | 0000 | Initiate Unit Code loading |
| 3. Wait | 1111 | Unit Code loading |
| 4. Begin normal operation | 0000 | Unit Code loaded |

A hang condition at either step 3 or step 4 usually indicates a defective system diskette or a configuration error.

**Figure 4-2. ALT 1 IML Sequence**

### 4.2.2 ALT 2 IML Mode, Models 51C and 52C with Wrappable Modem (Test/Operate Switch in Operate Position)

Pressing the IML pushbutton while holding the ALT switch in the ALT 2 position invokes an extended Modem Wrap test. Some types of modems require manual intervention to set up for wrap testing. The test checks the transmission path (Transmit and Receive Data lines) to and from the modem. Modem clocking is required to run this test successfully, and a missing or defective modem clock will result in a failure indication (flashing 0111). The intent of this test is *NOT* to test the modem. The Bus and Lamp test functions the same as during a normal IML. See Figure 4-3 for this ALT 2 sequence.

| Step | Code | Meaning |
|---|---|---|
| 1. ALT 2 and IML pressed | 1111 | Bus and Lamp test OK |
| 2. ALT 2 and IML released | 0000 | Begin Modem Wrap test |
| 3. Wait | 0110 | Communication Adapter Test running |
| | 0110 | Flashing – Communication Adapter Test failure |
| 4. Wait | 0111 | Prewrap, Adapter Wrap, and Modem Wrap tests are running |
| 5. End Test – A normal IML required to begin normal operation | 0111 | Flashing – Modem wrap test has failed. |
| | 1000 | Successful test – Carrier not present after completion of test. |
| | 1111 | Successful test – Carrier is present after completion of test. |
| | 0111 | Flashing – Modem wrap test has failed. |

When this test is run in ALT 2 mode, the 3278 does not display the 8 4 2 1 indications.

**Figure 4-3. ALT 2 IML Sequence, Models 51C and 52C with Wrappable Modem**

### 4.2.3 ALT 2 IML Mode, Models 51C and 52C without Wrappable Modem (Test/Operate Switch in Test Position)

Pressing the IML pushbutton while holding the ALT switch in the ALT 2 position invokes an extended Modem Wrap test. When a nonwrappable modem is being used, the EIA test cable Test/Operate switch should be in the TEST position. This test checks the transmission path (Transmit and Receive Data lines) to and from the Test/Operate switch at the end of the cable. The test cable must be attached to the modem, and the modem must provide clocking or a failure indication of 0111 (flashing) will result. The Bus and Lamp test functions the same as during a normal IML. See Figure 4-4 for this ALT 2 sequence.

| Step | Code | Meaning |
|---|---|---|
| 1. ALT 2 and IML pressed | 1111 | Bus and Lamp test OK |
| 2. ALT 2 and IML released | 0000 | Begin Modem Wrap test |
| 3. Wait | 0110 | Communication Adapter Test running |
| | 0110 | Flashing – Communication Adapter Test failure |
| 4. Wait | 0111 | Prewrap, Adapter Wrap, and Modem Wrap tests are running. |
| 5. End Test | 0111 | Flashing – Modem Wrap test has failed. |
| | 1000 | Successful test. |
| 6. Return TEST/OPERATE switch to Operate position. | 1000 | Carrier not present. |
| | 1111 | Carrier is present. |

**Figure 4-4. ALT 2 IML Sequence, Models 51C and 52C without Wrappable Modem**

A normal IML is required to begin normal operation. When this test is run in ALT 2 mode, there is no 3278 display of failing indications (0111 013, etc.). See paragraphs 5.4.3 and 5.4.4 of the 3274 MIM, for additional information on the Wrap Test without Modem, and DDS Adapter Wrap Test.

### 4.2.4 ALT 2 IML Mode, Modem Self Test for Model C with Greater than 1200-bps Integrated Modem

Pressing and holding the ALT IML Address switch in position 2 will cause the modem self-test to be initiated and repeated about every 4 seconds until the switch is released. Releasing the switch should return the modem to Operate mode, regardless of the test results.

While the test is being run, the TEST light on the operator panel is lit. If the test is successful, the Data Quality—Good indicator on the operator panel will flash each time the test is run. The indicators on the A1D2 card will also flash each time the test is run successfully.

If the test fails, the failing card is indicated in the A1D2 card indicators. Figures 4-5 through 4-7 show the meanings of the indicators. Cards indicated as failing are replaced in order of probability. If multiple A1D2 card indicators are displayed, replace all cards indicated.

| Flashing Indicator | Steady Indicator | Operator Panel Poor Indicator | Failing Card |
|---|---|---|---|
| 1111 | | Off | Test successful No failure |
| 111 | | On or flashing | D2, G2, C4 |
| | 000 | On or flashing | D2, G2, C4 |
| | 111 | On or flashing | D2, G2, C4 |
| | 100 | On | C2, G2, D2 |
| | 010 | On | G2, D2 |
| | 001 | On | D2, G2, C4 |
| 1 = On<br>0 = Off | | | |

**Figure 4-5. A1D2 Card Indicator for 2400-bps Integrated Modem**

| Flashing Indicator | Steady Indicator | Operator Panel Poor Indicator | Failing Card |
|---|---|---|---|
| 1111 | | Off | Test successful No failure |
| 1111 | | On or flashing | D2, G2, F2, C4 |
| | 0000 | On or flashing | D2, G2, C4 |
| | 1111 | On or flashing | D2, F2, G2, C4 |
| | 1000 | On | C2, G2, D2 |
| | 0100 | On | F2, D2, G2 |
| | 0010 | On | G2, F2, D2 |
| | 0001 | On | D2, F2, G2, C4 |
| 1 = On<br>0 = Off | | | |

**Figure 4-6. A1D2 Card Indicator for 4800-bps Integrated Modem**

| Flashing Indicator | Steady Indicator | Operator Panel Poor Indicator | Failing Card |
|---|---|---|---|
| 1111 | | Off | Test successful No failure |
| 1111 | | On or flashing | E2, G2, F2, D2, C4 |
| | 0000 | On or flashing | E2, G2, C2, C4 |
| | 1111 | On or flashing | E2, D2, F2, G2, C4 |
| | 1000 | On | D2, F2, E2 |
| | 0100 | On | F2, D2, E2, G2 |
| | 0010 | On | G2, E2, F2, D2 |
| | 0001 | On | E2, F2, G2, D2 |
| | 0000 | On | C2, G2, E2, D2 |
| 1 = On<br>0 = Off | | | |

**Figure 4-7. A1D2 Card Indicator for 9600-bps Integrated Modem**

## 4.3 3274 MODEL 51C DISPLAY SYSTEM ONLINE TESTS

### 4.3.1 Purpose

These Online Tests (OLTs) provide path testing for the 3274 Model 51C display system host attachment downline from a 270X or a 370X.

Prior to invocation of the OLT, the 3274 must complete its IML sequence; that is, the 3274 operational resident code is in control and ready for I/O operations with the host.

### 4.3.2 Applicable Executive Control Programs

These OLTs are compatible with the following control programs at the levels indicated or higher:

| | |
|---|---|
| DOS/VS OLTEP | 33 |
| OS/VS1 OLTEP | 6 |
| OS/VS2 SVS OLTEP | 1.7 |
| OS/VS2 MVS OLTEP | 3.7 |
| TCAM TOTE | 10 |
| OLTSEP | 9.0 |
| OS OLTEP | 21.8 |
| DOS OLTEP | 26 |

### 4.3.3 3274 Models 51C and 52C Online Tests

See Figure 4-8 to determine the OLT to be used for a specific configuration.

| Configuration | OLT User's Guide | OLT |
|---|---|---|
| 3274 Models 51C and 52C BSC operating with a 270X, or a 370X with the Emulator Program (EP). | D99-3274B | R3274A |
| 3274 Models 51C and 52C BSC operating with a 270X, 370X EP, or a 370X NCP. R3274B requires that the 3700 Series Diagnostics be cataloged at the host. It is suggested that R3274A be used when operating with a 270X, or 370X EP. | D99-3274C<br>D99-3700A | R3274B |
| 3274 Models 51C and 52C SDLC operating with a 370X NCP. Use the following Link Level Tests: | | |
| Link Level 1 | D99-3700C | T3700LTE |
| Link Level 0 | D99-3705A | T3705 |

**Figure 4-8. 3274 Models 51C and 52C Online Tests**

## 4.4 SERVICEABILITY AIDS

The following procedures are intended to supplement problem determination and troubleshooting techniques. Monitoring procedures for interface lines, coax checking procedures, and patching procedures are some of the aids provided.

### 4.4.1 Diskette Patching Procedure

This procedure is to be used by the Support Customer Engineer, at the direction of the next level of the support structure.

**Note:** *Diskette patching is an emergency procedure only. It should be used only when time will not permit waiting for an update diskette from the plant of manufacture.*

Before the patching procedure can be performed, the patch header information and the patch coding must be obtained from the next level of the support structure.

Use the steps listed below to perform the diskette patching procedure. If, while performing steps 4 and 5, you want to cancel what you have done and start again, enter FF and press the ENTER key. This will bring you back to step 3. If you enter an unacceptable response, the operator code in the upper center of the display will alert you to the problem. Figure 4-9 gives the meanings of the operator codes.

The 8 4 2 1 codes also provide a guide to your progress in the patching procedure.

1. Insert the feature diskette. While holding the ALT IML Address switch in position 1, momentarily press and release the IML button; then release the ALT IML Address switch. Within 2 minutes, the 8 4 2 1 indicator code will be flashing 1011.
2. Replace the feature diskette with the customized system diskette. DO NOT PRESS IML. Within 1 minute, the 8 4 2 1 indicator code will be flashing 1110.
3. Replace the system diskette with the feature diskette used in step 1. DO NOT PRESS IML. Within 1 minute, the 8 4 2 1 indicator code will be a steady 0001. If you are using a 3279, the color convergence pattern will be displayed on the display screen. To bypass this pattern, hold down the ALT key, momentarily press the TEST key, and release the ALT key. Sequence number 001 will be displayed on the display screen. Continue with step 4.

   If you want to converge the 3279, follow the instructions in the "Color Convergence Procedure" in the *IBM 3270 Information Display System 3274 Control Unit Customizing Guide,* GA23-0065.
4. When sequence number 001 appears in the upper-left corner of the display screen,
   - Key in the following characters:

     1234567890ABCDEF
   - Press the spacebar once.
   - Key in the two-digit Validation Number shown on the system diskette label.
   - Press ENTER.
5. When sequence number 011 appears, key a 1 and press ENTER.
6. When sequence number 012 appears, key in the patch header information and press ENTER.
7. When sequence number 013 appears, key in the patch information one line at a time. Press ENTER after each line. After all lines of the patch have been keyed in, type 49 and press ENTER.
8. Sequence number 011 will appear again. If you have another patch to enter, type 1, press ENTER, and go to step 7.

   If you do not have another patch to enter, key a 0, press ENTER, and go to step 9.

9. At this time, either sequence number 021 is displayed (meaning that no printer authorization matrix has been defined), or the defined matrix is displayed.

   If sequence number 021 is displayed, type 0 and press ENTER.

   If a matrix is displayed, move the cursor to the entry for 901, change it to a 1, and press ENTER.

10. When sequence number 031 appears, enter the number of RPQ diskettes being used (0, 1, 2, or 3), and press ENTER.

11. When sequence number 999 appears, move the cursor to the entry for 900, change it to a 1, and press ENTER.

12. Within 2 minutes, the 8 4 2 1 indicator code on the 3274 Control Unit will be flashing one of the following:

    1100 – Replace the feature diskette with the RPQ diskette. DO NOT PRESS IML. After the RPQ diskette is inserted, the code will change to 0111 within 30 seconds. If additional RPQ diskettes are required, the indicator code will again flash 1100. Repeat the procedure for each additional RPQ diskette. AT NO TIME SHOULD YOU PRESS IML. When the RPQ diskette procedure is completed, the indicator code will be flashing 1110. Reinsert the feature diskette. DO NOT PRESS IML. Within 2 minutes, the 8 4 2 1 indicator code will flash 1011 or 1101.

    1011 – Replace the feature diskette with the system diskette. DO NOT PRESS IML. Within 20 minutes, the indicator code will change to 1111. The patch procedure is now complete, and a normal startup can be initiated.

    1101 – Replace the feature diskette with the language diskette. DO NOT PRESS IML. Within 30 seconds, the indicator code will change to 0111 and then to flashing 1011 within 1 minute. When the indicator code is flashing 1011, replace the language diskette with the system diskette. DO NOT PRESS IML. Within 20 minutes, the indicator code will change to 1111. The patch procedure is now complete, and a normal startup can be initiated.

| Code | Meaning |
|---|---|
| 1 | One or more of the first 10 characters is incorrect; reenter response. |
| 2 | One or more of the 11th to 17th characters, including the space, is incorrect; reenter response. |
| 3 | The diskette level is wrong; use the correct diskette. |
| 11 | An invalid response has been entered (too many characters, value too high or too low, wrong character, etc.); reenter response. |
| 12 | An entry other than A, B, or C was entered in response to sequence 151; reenter response. |
| 13 | The response has too few characters; reenter response. |
| 14 | The numerical sum of the responses to sequence numbers 111 and 112 is greater than 32; verify, and reenter response(s). |
| 21 | An unacceptable change was made during modification (sequence 999); recheck entries, and correct. |
| 22 | If the response to sequence number 321 is 1, the responses to sequence numbers 121 and 131 must be 02 and 1, respectively.<br>If the response to sequence number 321 is 0, the response to sequence number 121 must not be 02. |
| 23 | One or more responses are not compatible with the response to sequence number 331; verify, and correct response(s). |
| 24 | The responses to sequence numbers 131, 132, and 133 are 0's (at least one must be a 1); verify, and correct response(s). |
| 80 | Invalid characters were entered; reenter response. |
| 81 | All patch areas are in use. |
| 82 | The patch ID number (header) already exists; use a new header. |
| 83 | The update number does not match the number in the configuration table; verify, and reenter response. |
| 84 | An attempt was made to delete a patch that does not exist. |
| 86 | The call line did not contain the correct data length. |
| 87 | Patch information was not entered. Sequence number 013 must have at least one patch before 48 is entered. |
| 89 | The number of lines entered does not agree with the count specified in the header line. |
| 99 | All entries are acceptable, but the entry for sequence number 900 has not been changed to 1. |

**Figure 4-9. Operator Codes**

### 4.4.2 3274 Subsystem Dump Procedure

The 3274 Dump Diskette is to be used when the System Support Center requests a 3274 subsystem dump. The 3274 Subsystem Dump Procedure should be performed by the customer engineer, but, for intermittent problems, it can be performed by the customer.

1. Replace the system diskette with the dump diskette.
2. While holding the Alt IML Address switch in position 1, momentarily press and release the IML switch; then release the Alt IML Address switch.
3. After a few minutes of operation, the 8 4 2 1 indicator lights will change to a flashing 1011 code. When this condition occurs, replace the dump diskette with the system diskette. Do *not* press IML.
4. After the system diskette is inserted, the 8 4 2 1 indicator lights will first change to a steady 0000 code; after approximately 10 seconds, they will change to a flashing 1001 code. When this condition occurs, replace the system diskette with the dump diskette. Do *not* press IML.
5. When the 8 4 2 1 indicator lights change to a steady 1111 code, the dump procedure is completed. When this condition occurs, replace the dump diskette with the system diskette and perform a normal IML to restore the subsystem for customer operation.

**Note:** *Follow this procedure exactly, using only the dump and system diskettes at the specified steps. If the wrong diskette was used, retry the procedure, starting at step 1.*

### 4.4.3 Coax Cables

Cables must be procured, installed, and maintained by the customer. Cable h is for indoor installation only; cable I is for outdoor installation, although it is approved for indoor use as well.

#### 4.4.3.1 Cable h (Indoor)

Presently, the only approved cable bears the commercial designation RG62A/U. Cables may be purchased from IBM or from a customer-selected source. Bulk cables may be ordered from IBM by specifying IBM part 323921 and the length on a Miscellaneous Equipment Specification (MES) form. Preassembled cables may be purchased from IBM by specifying IBM part 2577672 and the length on the MES form.

For fabricating cables, two BNC-type connectors are needed: IBM part 1836444 or equivalent. These two connectors can be ordered in a kit from IBM by specifying "Connector Group (indoor type), IBM part 1836418" on the MES form. Instructions for assembling BNC-type connectors on bulk cable are given in *Assembly of Coaxial Cable and Accessories for Attachment to IBM Products,* GA27-2805.

#### 4.4.3.2 Cable I (Outdoor)

Cable I is a RG62A/U modified for outdoor/underground installation. This cable is suitable for indoor and outdoor installation and for direct burial. Cable may be purchased from IBM or from a source selected by the customer.

Bulk cable may be ordered from IBM by specifying IBM part 5252750 and the length on a Miscellaneous Equipment Specification (MES) form. Preassembled cables may be purchased from IBM by specifying IBM part 1833108 and the length on the MES form.

For fabricating cables, two BNC-type connectors are needed, IBM part 1836447 or equivalent outdoor type. These two connectors may be obtained in a kit from IBM by specifying "Connector Group (outdoor type); IBM part 1836419" in the MES form. Instructions for assembling BNC-type connectors on bulk cable are given in *Assembly of Coaxial Cable and Accessories for Attachment to IBM Products,* GA27-2805.

### 4.4.3.3 Coaxial Cable Splicing

Do not cut and splice cables; instead, use a quick-disconnect adapter, IBM part 5252643, or commercial adapter, Amphenol Corp. part UG-914/U. A maximum of 13 connections is allowed in any given cable run. The adapter and the attached cable connectors must be covered with 127 mm (5 inches) of shrink tubing, 19.05 mm (0.75 inch) expanded diameter, to prevent accidental grounding of splice. This adapter and connecting jacks should be waterproofed for applications requiring this type of installation.

## 4.4.4 Coax Testing with Scope

This procedure describes how to test any length of coax cable—in segments of up to 1500 m (5000 ft)—with a Tektronix 453 oscilloscope, or equivalent. For additional information on coax testing, refer to the *Oscilloscope Measurement Procedure for Twisted and Coax Cables,* S226-3913.

**Note:** *Since the communication lines are the customer's responsibility, the following practice should be observed:*

1. *Use this procedure only after (1) all product maintenance procedures have been followed, (2) a communication line problem is suspected, and (3) the customer indicates he cannot locate the line problem.*
2. *Do not use the procedure for the purpose of checking the quality of the wiring work done by customer personnel or by a contractor.*

### 4.4.4.1 Testing for Discontinuities

This test consists of looking for impedances attached to the communication line that are different from the characteristic impedance of the line, Zo (93Ω). This is done by sending a wave front (leading edge of square wave) down the line and looking for energy that is reflected by any point that differs from the characteristic impedance.

The "B gate" out pulse is the square wave that is applied to the coax; it travels down the line at about 80% of the speed of light, depending upon the isolation material used in the cable. If no impedance impairment is present on the line, the wave front travels down the line until the termination is reached, and all the energy contained in the wave front is absorbed in the termination.

Zo of the cables and the termination can vary, in which case not all the energy contained in the wavefront is absorbed. The energy not absorbed is reflected back toward the sending end. Viewing the sending end with the oscilloscope allows display of both the transmitted wave (incident wave) and the reflected wave. Figure 4-10 shows examples of possible reflections for different terminations.

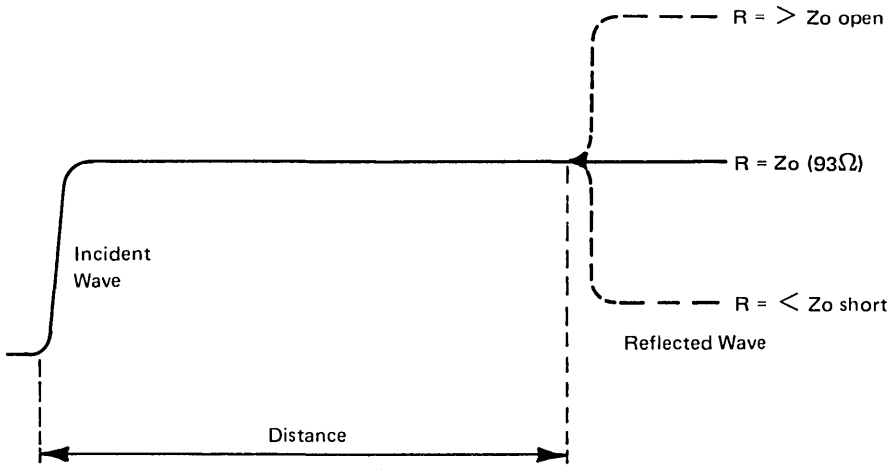



**Figure 4-10. Incident and Reflected Waves**

The reflected wave is delayed by the time it takes for the incident wave to travel to and return from the termination. The delay is called "propagation delay" and is expressed as a percentage of the speed electronic waves travel in a specific type of cable (usually 60-80%) as compared with the speed they travel in open air—the speed of light (100%).

If the propagation delay of the cable is known, the scope can be calibrated to meters or feet per division, and the distance to a mismatch—shorts, opens, etc.,—in the cable can thus be determined:

The speed of light is 300,000 km/sec, or 30 cm/nanosec, or 0.984 ft/nanosec. Propagation delay in a coax cable is about 1.25 nanosec/ft. The DC resistance is 44Ω/1000 ft.

### 4.4.4.2 Setup and Test Procedures

**Parts**

X1 probe (or short piece of coax with BNC connector on each end):

1 resistor equal to Zo of cable (93 ohms)
1 BNC-T (PN 1650789)
1 probe tip to BNC adapter PN 453199 (not needed if short coax is used as input from T-connector to scope input)

**Scope Hookup:** Make the connections shown in Figure 4-11.

**Initial Scope Settings**

| | |
|---|---|
| Mode: | ch 1 |
| Volt/div: | 0.2 V (initial) |
| Input: | ac |
| A triggering level: | fully counterclockwise |
| A sweep length: | full |
| Horiz. display: | delayed sweep B |
| B sweep mode: | B starts after delay time |
| A sweep mode: | auto trigger |
| Delay time multiplier dial: | fully clockwise (9.5) |

A and B time division initial setting:
A: 10 μsec
B: 0.1 μsec (pull to unlock)

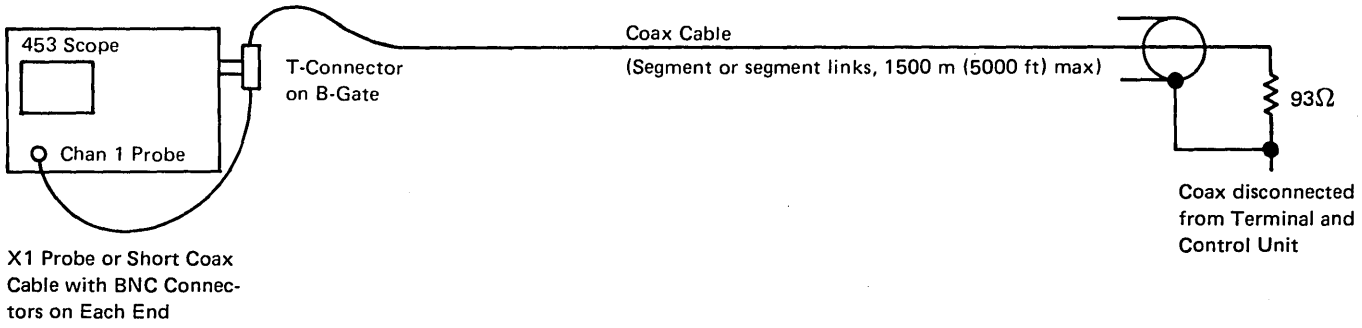



**Figure 4-11. Scope Setup**

**Test Procedures**

1. Consider the cable length:
   - Up to 100 m (300 ft)—use the initial scope setup.
   - Up to 1500 m (5000 ft)—use B time division up to 2.0 μsec.
   - Longer than 1500 m (5000 ft)—measure in segments not exceeding 1500 m.
   - Shorter than 20 m (60 ft)—use the X10 time base. This distance represents only about two horizontal divisions to the center of the screen. Switch to X10 magnifier. B time can now be set to .2 or .5, and speed can be considered 0.02 and 0.05.
2. Use the following conversion table to determine distances.

B-sweep setting (μsec)

| | (Meter/Div) | (Feet/Div) |
|---|---|---|
| 0.1 | 12.2 | 40 |
| 0.2 | 24.4 | 80 |
| 0.5 | 61 | 200 |
| 1.0 | 122 | 400 |
| 2.0 | 244 | 800 |

3. Use the following measurement techniques and become familiar with Figure 4-13 to gain understanding of what you may see displayed:
   - Measure from the point where the reflected pulse starts to change (Figure 4-12). (Rise time degrades with cable-length increase.)
   - Lower the volts/div, and use Vertical Position knob to position waveform on screen.
   - Identify the end of a cable by opening and shorting the cable end.
   - After finding mismatches, measure as closely as possible to the fault. Measuring from both ends of the cable enhances fault location; because of cable loss, major faults at long distances can appear as minor faults close to the test point.

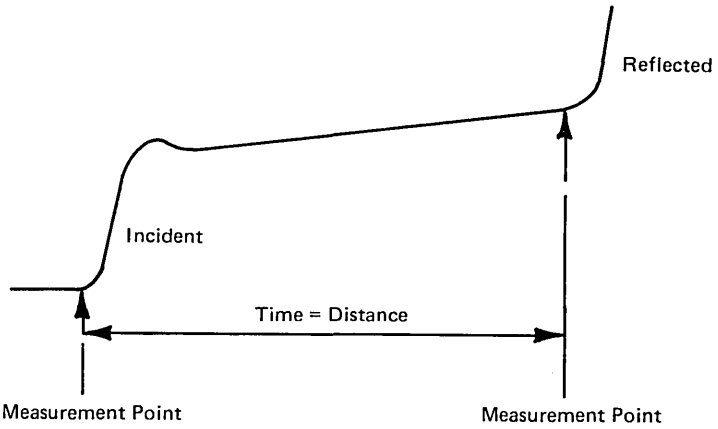
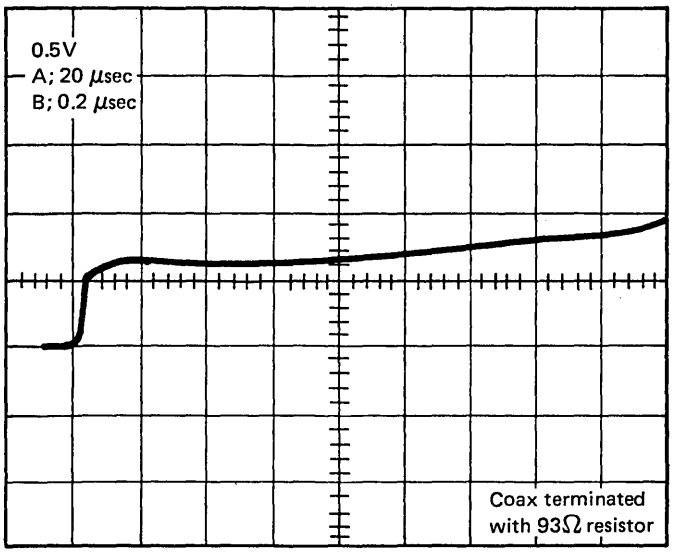



**Figure 4-12. Measurement Points**

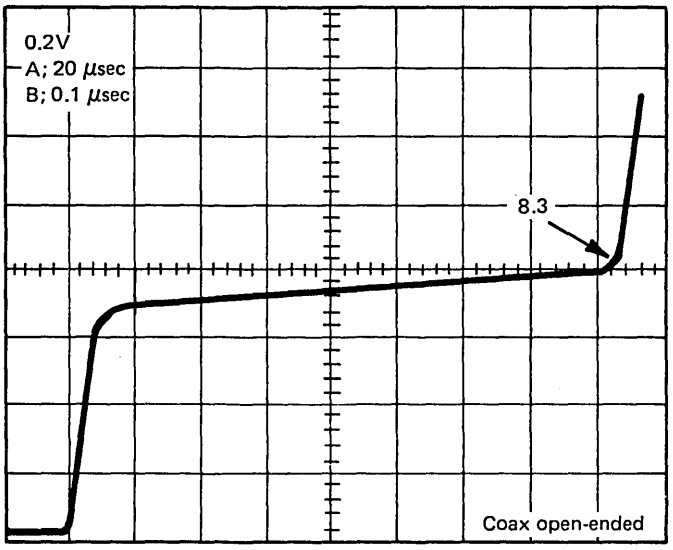



A

This waveform is an indication of a good coax cable — 190 m (624 ft). A gradual sloping and overshoot of rise time is normal.

*Impedance Zo Checking*

This 93-ohm cable is terminated at the end with a 93-ohm resistor. The straight line after 7.8 divisions proves that this cable's characteristic impedance is close to 93 ohms.

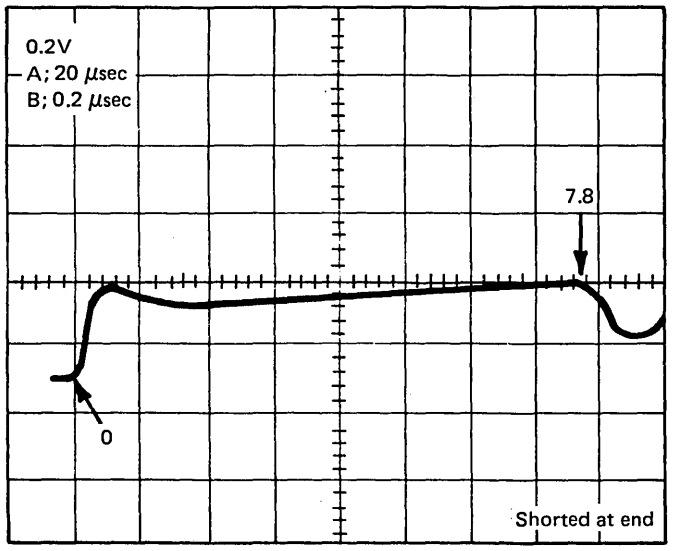



B

101 m (332 ft) of good coax cable, 8.3 div long. (This is an effective method to measure the length of the cable.)

8.3 x 40 = 332 ft or
8.3 x 12.2 = 101 meter

Rising slope is normal.



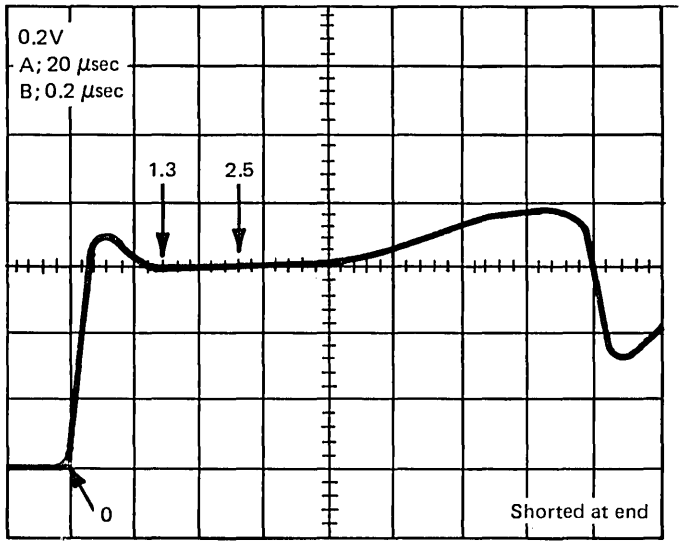

C

The same cable as A now shorted at end to show downward reflection and length.

Length of sweep is 7.8 divisions (see arrows).

B setting = 0.2 μsec or 80 ft/div
7.8 x 80 = 190 m (624 ft)

**Figure 4-13 (Part 1 of 3). Display Examples**

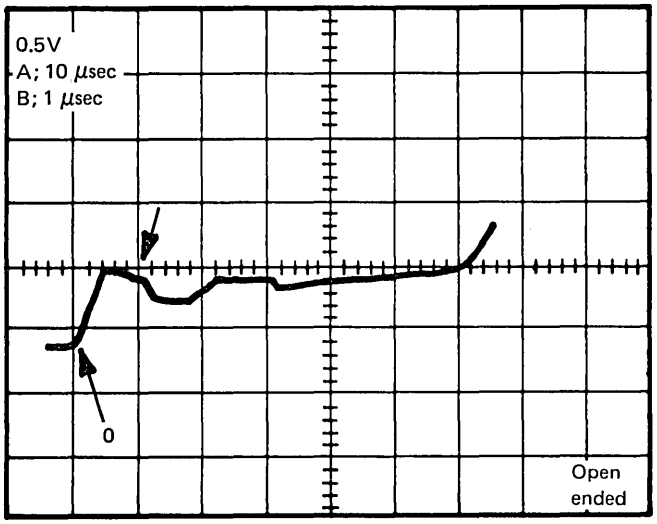



D

Same as C, now with higher vertical gain (0.2V/div).

Arrow points to start. At 1.3 and 2.5 divisions from start, very small mismatches from BNC connection occur. These are at 9.78 m (32 ft), 18.6 m (61 ft), 31.7 m (104 ft) and 61.0 m (200 ft) from start.

A reflection deviation of greater than 10% of the incident wave, usually indicates an undesirable impedance change and should be corrected.




E

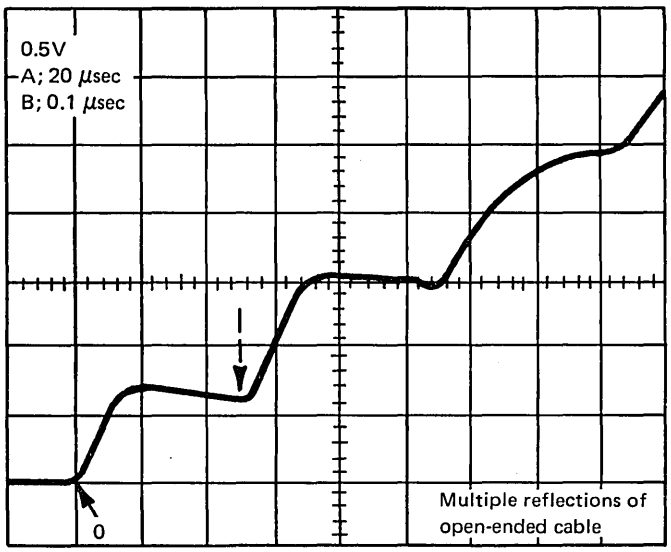
This 731.5 m (2400 ft) cable has a 100-ohm short to shield at the 121.9 m (400 ft) point (see arrow).

Total cable length

6 x 400 = 2400 ft (731.5 m)

Fault point

1 x 400 = 400 ft (121.9 m)




F

Improper setup of scope.

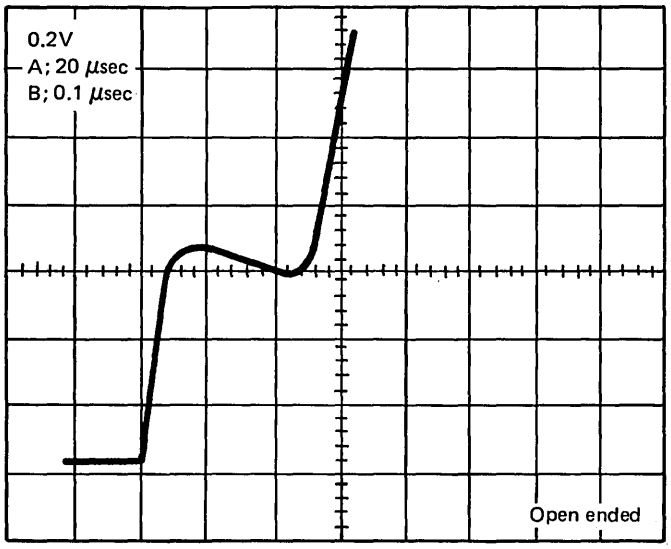
Multiple reflections. 26 m (100 ft) of good cable with open end.

Improper scope display due to wrong vertical gain setting, .5V/div.

Only the first reflection is significant and should be magnified.

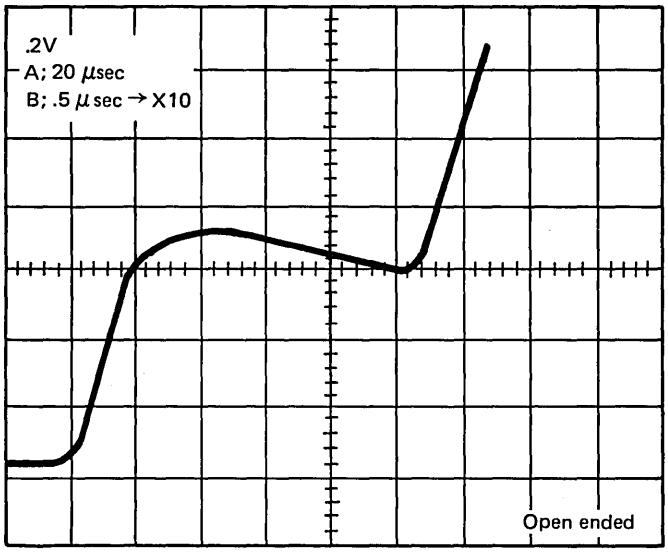
See G.

**Figure 4-13 (Part 2 of 3). Display Examples**




G

Same as F now with scope set to higher vertical gain, 0.2V.



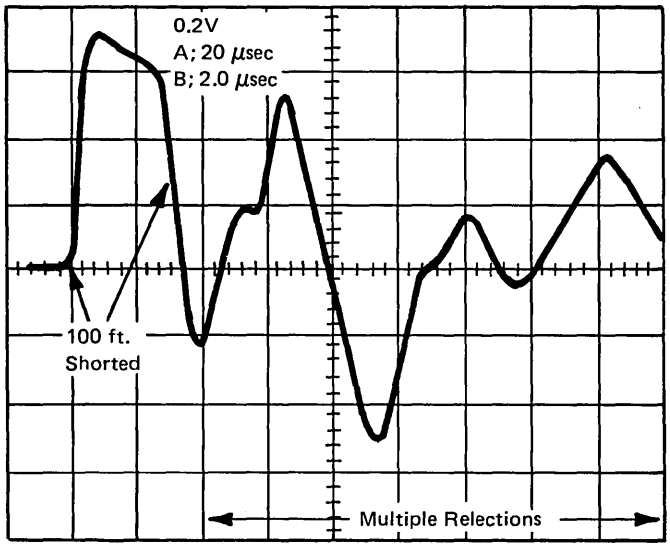

H

Same as G but magnified with X10.

This is the first reflection section of picture G.

A smooth cable 5.2 divisions long (as opposed to 2.6 div on A) with overshoot.

5.2 x 20 ft (6.2 m) = 104 ft (31.7 m)




J

Improper Setup of Scope.

Multiple reflections due to wrong, slow B group setting.

Same 28 m (100 ft) as in F, G, and H.

Only the first reflection is significant; the normal, multiple reflections of the test pulse should be cancelled out on the display by using a B time that will display the first reflection only, using the whole screen or as great a portion of the screen as possible. See H.

**Figure 4-13 (Part 3 of 3). Display Examples**

# Chapter 5. Reference Data

## 5.1 INTRODUCTION

This chapter provides the following information as an aid to maintenance:

Command summary
Order summary
Various codes
Sequence/response diagrams
Status and sense byte descriptions
Switches and controls

## 5.2 CONTROL UNIT COMMAND SUMMARY

See Figure 5-1 for control unit command codes.

| Command | 3274 Model 51C | |
|---|---|---|
| | EBCDIC Hex | Graphic |
| Copy[1] | F7 | 7 |
| Erase All Unprotected | 6F | ? |
| Erase/Write | F5 | 5 |
| Erase/Write Alternate[2] | 7E | = |
| Read Buffer | F2 | 2 |
| Read Modified | F6 | 6 |
| Read Modified All[3] | 6E | : |
| Write | F1 | 1 |
| No Operation | NA | NA |
| Select | NA | NA |
| Sense | NA | NA |

[1] Applicable to 3271, 3274 Model 51C (BSC).

[2] Applicable to 3274.

[3] Applicable to 3274 Models 51C and 52C (SNA/SDLC).

**Figure 5-1. Command Codes**

### 5.2.1 Write

The Write command:

1. Transfers the contents of the addressed device buffer to the control unit (CU) storage buffer.
2. Performs the operation specified by the write control character (WCC).
3. Enters data in any portion of the CU storage buffer (without erasing or modifying portions of the buffer in which a change is not required).
4. Allows execution of various order sequences within the data stream.
5. Transfers the updated CU buffer to the device buffer.

### 5.2.2 Erase/Write

The Erase/Write command:

1. Clears the CU buffer to nulls.
2. Performs operations specified by the WCC.
3. Stores new data characters provided by the program.
4. Allows execution of various order sequences within the data stream.
5. Transfers the updated CU buffer to the device buffer.

### 5.2.3 Erase/Write Alternate

1. Switches the device to alternate character capacity.
2. Performs normal erase/write operation.

### 5.2.4 Erase All Unprotected

The Erase All Unprotected command:

1. Clears all unprotected alphameric characters to nulls, resets modified data tag (MDT) bits of all unprotected fields to 0, restores the keyboard, resets the attention identifier (AID), and repositions the cursor to the first character location in the first unprotected field in the buffer.
2. Is performed at the device and has no data stream.

### 5.2.5 Read Buffer

The Read Buffer command:

1. Transfers the contents of the addressed device buffer to the CU buffer.
2. Data stream transferred to the host includes the AID character, the cursor address, and the contents of all device buffer locations (both protected and unprotected). These include attribute and alphameric characters (including nulls), starting at a specific location and continuing to the end of the buffer, unless the channel byte count goes to zero before the last location is reached.

### 5.2.6 Read Modified

Receipt of a Read Modified command (or a Poll when an AID is pending) generates one of three different data streams, depending on the AID code present. Their descriptions follow.

#### 5.2.6.1 Read Modified Read

The Read Modified Read command:

1. Transfers the contents of the addressed device buffer to the CU buffer.
2. Data stream transferred to the host includes the AID character, the cursor address, and all fields in which the MDT bit has been set. The data stream for each modified field contains the SBA order, the buffer address of the attribute character plus 1, and all alphameric characters (with nulls suppressed).
3. The command is issued by the program or as a result of an ENTER, PF key, selector-pen attention, or operator identification card read-in operation.

#### 5.2.6.2 Short Read Read

The Short Read Read command:

1. Permits the display operator to communicate with the host program without sending modified data characters. This action is initiated when the display operator presses CLEAR, CANCEL, or a PA key.
2. A read-modified operation is performed, but only the unique AID character, to identify the key pressed, is sent to the host program.

#### 5.2.6.3 Test Request Read (Model 51C, BSC)

1. A read-modified operation is performed if the TEST REQ or the SYS REQ (BSC only) key has been pressed at a device.
2. A Test Request Read heading is generated by the control unit. The sequence is: SOH % / STX.
3. If the device buffer is unformatted, all alphameric data in the buffer is included in the data stream (nulls are suppressed). If the device buffer is formatted, only fields that have the MDT bit set will be included in the data stream following the Test Request Read heading.

### 5.2.7 Read Modified All (3274 SNA Only)

1. The Read Modified All command is sent only by the primary logical unit (host application).
2. A read-modified operation is performed, and all modified fields in the selected device are sent to the host, regardless of the AID byte generated.

### 5.2.8 Copy (3274 Model 51C, BSC)

The Copy command:

1. Transfers the contents of one device buffer to another device buffer via the CU buffer.
2. The device whose contents are transferred is called the *from* device.
3. The receiving device is called the *to* device.
4. The *to* device is selected in the addressing sequence.
5. Two bytes always follow the command byte: (1) the copy control character (CCC) and (2) the address of the *from* device.
6. The CCC performs a function similar to that of the WCC in the Write and Erase/Write commands.
7. The *from* device buffer can be *locked* (incapable of being copied) by storing a protected alphameric attribute character in buffer address 0.
8. The addressed device (that is, the *to* device) may also be specified as the *from* device. This permits trouble-shooting the Copy command with a single device.

## 5.3 CONTROL UNIT ORDER SUMMARY

See Figure 5-2 for control unit order codes.

### 5.3.1 Set Buffer Address (SBA)

The Set Buffer Address (SBA) order loads data, starting at the address immediately following the SBA character.
The format is: SBA, address, address.

### 5.3.2 Start Field (SF)

The Start Field (SF) order specifies the next character as an attribute character.
The format is: SF, attribute character.

### 5.3.3 Insert Cursor (IC)

The Insert Cursor (IC) order changes the address in the CU buffer and thus repositions the cursor on the display screen. Because the CU buffer address is not advanced when the IC order is loaded in the CU buffer, the next byte is stored at the cursor address.
The format is: IC.

### 5.3.4 Repeat to Address (RA)

The Repeat to Address (RA) order loads a single character repeatedly, starting at the current CU buffer address and continuing to, *but not including,* the address specified in the order sequence. The cursor is not affected.
The format is: RA, address, address, character.

### 5.3.5 Erase Unprotected to Address (EUA)

The Erase Unprotected to Address (EUA) order deletes all unprotected-field characters beginning with the character at the current address to, *but not including,* the character at the address specified in the order sequence. If the address specified in the order sequence equals the *current address,* wraparound occurs, and all unprotected characters are deleted. The attribute characters defining the unprotected fields are not deleted.
The format is: EUA, address, address.

| Order Sequence / Order | Byte 1 (Order Code) EBCDIC (Hex) | Byte 1 (Order Code) ASCII (Hex) | Byte 2 | Byte 3 | Byte 4 |
|---|---|---|---|---|---|
| Start Field (SF) | 1D | 1D | Attribute Character[1] | | |
| Set Buffer Address (SBA) | 11 | 11 | 1st Address Byte | 2nd Address Byte | |
| Insert Cursor (IC) | 13 | 13 | | | |
| Program Tab (PT) | 05 | 09 | | | |
| Repeat to Address (RA) | 3C | 14 | 1st Address Byte | 2nd Address Byte | Character to Be Repeated[2] |
| Erase Unprotected to Address (EUA) | 12 | 12 | 1st Address Byte | 2nd Address Byte | |

[1] Figure 5-17 shows coding of this byte.
[2] Figures 5-3, 5-4, and 5-12 show coding of this byte.

**Figure 5-2. Buffer Control Orders and Order Codes**

### 5.3.6 Program Tab (PT)

The Program Tab (PT) order advances the CU buffer address to that of the character position immediately following the next attribute character that defines an unprotected field. The cursor is unaffected, and no wraparound occurs. The search begins at the current buffer address. The final result depends on one of three conditions:

1. When PT immediately follows a data character within an unprotected field, all remaining characters within that field are replaced by nulls.
2. When PT immediately follows a WCC or an order sequence, no nulls are inserted.
3. When the current buffer address contains an attribute character that defines an unprotected field, the CU buffer address is simply advanced one character location.

The format is: PT.

### 5.3.7 New Line (NL)

When included in the data stream addressed to a printer, the New Line (NL) order initiates a carriage return/line feed (CR/LF) operation by the printer. That is, the platen is advanced one line and the print mechanism is returned to the first print position of the new line. If this order is included in the data stream addressed to a display, the NL order is displayed as the number 5 (space 5 for Katakana), but does not cause action in the CU or display. In any case, it is stored in the CU buffer as the number 5 (space 5 for Katakana).
The format is: NL.

### 5.3.8 End of Message (EM)

The End of Message (EM) order must be included at the end of a message addressed to a printer to notify it when to stop printing. If the EM order is not included at the end of the printer message, the printer will print out the contents of the complete printer buffer (either 480 or 1920 characters). If this order is included in the data stream addressed to a display, the EM order is displayed as the number 9 (space 9 for Katakana), but does not cause action in the CU or display. In any case, it is stored in the CU buffer as the number 9 (space 9 for Katakana).
The format is: EM.

### 5.3.9 Duplicate (DUP)

The Duplicate (DUP) order informs the program that the DUP key was pressed by the display station operator. Its actual function is determined by the CPU program. The DUP order is displayed as an asterisk (*) with overscore. It is stored in the CU buffer, but does not cause action in the CU.
The format is: DUP.

### 5.3.10 Field Mark (FM)

The Field Mark (FM) order informs the CPU program that the FM key was pressed by the display operator. It indicates the end of a field to the program. The FM order is displayed as a semicolon (;) with overscore. It is stored in the CU buffer, but does not cause action in the CU. The format is: FM.

### 5.3.11 Forms Feed (FF) (3287, 3288, and 3289 Printers)

Valid Forms Feed (FF) orders are executed by the 3287, 3288, and 3289 Printers during printouts, both with and without a line-length format specified. (The FF order is described in the section "Page Length Control/VFC Operations," in the *IBM 3270 Information Display System Component Description*, GA27-2749-7.) When a valid FF order is encountered in the first print position of a line, with the Page Length Control/VFC feature installed, the print form indexes to a predetermined print line on the next form.

### 5.3.12 Suppress Index (SI) (3288)

The 3288 Printer, when equipped with the Text Print special feature, honors the Suppress Index (SI) order code. The SI order causes printing of two or more lines of data at the same paper position. The SI order is transferred as part of the data stream from the application program and is stored in the printer buffer as data.

### 5.3.13 Carriage Return (CR) (3287 with 3274 Attachment and 3289 Printers)

When the Carriage Return (CR) order code is found in the data stream, the next print position will be the leftmost character position on the current print line. CR orders are not executed when they occur in nonprint fields, and when the printer format bits in the WCC indicate a line length (40, 64, or 80 characters). In both cases, the CR order is printed as a space character.

## 5.4 I/O INTERFACE CODES

The I/O interface codes for the 3274 Control Unit are illustrated in Figures 5-3 through 5-12. For information concerning Buffer Address I/O Interface Codes, refer to *3270 Information Display System Reference Summary*, GX20-1878.

| Bits 4567 | Hex 1 | 00 | | | | 01 | | | | 10 | | | | 11 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| 0000 | 0 | NUL | | | | SP | & | — | | | | | | ( | ) | AA | 0 |
| 0001 | 1 | | | | | | | / | | a | j | – | | A | J | | 1 |
| 0010 | 2 | | | | | | | | | b | k | s | | B | K | S | 2 |
| 0011 | 3 | | | | | | | | | c | l | t | | C | L | T | 3 |
| 0100 | 4 | | | | | | | | | d | m | u | | D | M | U | 4 |
| 0101 | 5 | | NL | | | | | | | e | n | v | | E | N | V | 5 |
| 0110 | 6 | | | | | | | | | f | o | w | | F | O | W | 6 |
| 0111 | 7 | | | | | | | | | g | p | x | | G | P | X | 7 |
| 1000 | 8 | | | | | | | | | h | q | y | | H | Q | Y | 8 |
| 1001 | 9 | | EM | | | | | | | i | r | z | | I | R | Z | 9 |
| 1010 | A | | | | | ¢ | ! | 6A | : | | | | | | | | |
| 1011 | B | | | | | . | $ | , | # | | | | | | | | |
| 1100 | C | FF | DUP | | | < | * | % | @ | | | | | | | | |
| 1101 | D | | | | | ( | ) | _ | ' | | | | | | | | |
| 1110 | E | | FM | | | + | ; | > | = | | | | | | | | |
| 1111 | F | | | | | \| | ¬ | ? | " | | | | | | | | |

Bits 0,1 — Bits 2,3 — Hex 0

**Notes:**

1. Character code assignments other than those shown within all outlined areas of this chart are undefined. If an undefined character code is programmed, the character that will be displayed is not specified. The character displayed by the 3277 for a given undefined character code may be different for other devices. IBM reserves the right to change at any time the character displayed for an undefined character code.
2. Lowercase alphabetic characters (shown within the dotted outlined area) are converted to uppercase by the display station or printer and displayed or printed as uppercase characters, unless the terminal has Dual Case capability.

**Legend:**

= Stored as a lowercase symbol. Displayed on Mono Case display only. Blank on Dual Case display. Cannot be entered from keyboard.

6A or AA = Stored as Hex code shown. Nondisplayed on Mono and Dual Case displays.

**Figure 5-3. United States EBCDIC I/O Interface Code for 3274 Control Unit and Attached 3277 Display Stations**

| Bits 4567 / Hex 1 | Hex 0 | 00 | | | | 01 | | | | 10 | | | | 11 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| 0000 | 0 | NUL | | | | SP | & | - | | | | | | { | } | \ | 0 |
| 0001 | 1 | | | | | | | / | | a | j | ~ | | A | J | | 1 |
| 0010 | 2 | | | | | | | | | b | k | s | | B | K | S | 2 |
| 0011 | 3 | | | | | | | | | c | l | t | | C | L | T | 3 |
| 0100 | 4 | | | | | | | | | d | m | u | | D | M | U | 4 |
| 0101 | 5 | | NL | | | | | | | e | n | v | | E | N | V | 5 |
| 0110 | 6 | | | | | | | | | f | o | w | | F | O | W | 6 |
| 0111 | 7 | | | | | | | | | g | p | x | | G | P | X | 7 |
| 1000 | 8 | | | | | | | | | h | q | y | | H | Q | Y | 8 |
| 1001 | 9 | | EM | | | | | | ` | i | r | z | | I | R | Z | 9 |
| 1010 | A | | | | | ¢ | ! | ¦ | : | | | | | | | | |
| 1011 | B | | | | | . | $ | , | # | | | | | | | | |
| 1100 | C | FF | DUP | | | < | * | % | @ | | | | | | | | |
| 1101 | D | CR | | | | ( | ) | _ | ' | | | | | | | | |
| 1110 | E | | FM | | | + | ; | > | = | | | | | | | | |
| 1111 | F | | | | | \| | ¬ | ? | " | | | | SI | | | | |

Bits 0,1 → 00 01 10 11

Bits 2,3 → 00 01 10 11

Hex 0 → 0 1 2 3 4 5 6 7 8 9 A B C D E F

**Notes:**

1. Character code assignments other than those shown within all outlined areas of this chart are undefined. If an undefined character code is programmed, the character that will be displayed or printed is a hyphen. The character displayed by the 3276 or 3278 for a given undefined character code may be different for other devices. IBM reserves the right to change at any time the character displayed for an undefined character code.
2. NL (hex 15), EM (hex 19), FF (hex 0C), and NUL (hex 00) are not displayed or printed. The DUP (hex 1C) and FM (hex 1E) control characters on Dual Case featured terminals are displayed as * and ; respectively, and are printed as * and ; .
3. DUP (hex 1C) and FM (hex 1E) control characters on Mono Case terminals are displayed as * and ; respectively, and are printed as * and ;.

**Figure 5-4. United States EBCDIC I/O Interface Code for 3274 Control Unit and Attached 3278, 3279, 3287, and 3289 Terminals**

| Bits 4321 | Hex 1 | 000 | 001 | 010 | 011 | 100 | 101 | 110 | 111 |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 0000 | 0 | NUL | | SP | 0 | @ | P | ` | p |
| 0001 | 1 | | | ! | 1 | A | Q | a | q |
| 0010 | 2 | | | " | 2 | B | R | b | r |
| 0011 | 3 | | | # | 3 | C | S | c | s |
| 0100 | 4 | | | $ | 4 | D | T | d | t |
| 0101 | 5 | | NL | % | 5 | E | U | e | u |
| 0110 | 6 | | | & | 6 | F | V | f | v |
| 0111 | 7 | | | ' | 7 | G | W | g | w |
| 1000 | 8 | | | ( | 8 | H | X | h | x |
| 1001 | 9 | | EM | ) | 9 | I | Y | i | y |
| 1010 | A | | | * | : | J | Z | j | z |
| 1011 | B | | | + | ; | K | [ | k | { |
| 1100 | C | FF | DUP | , | < | L | \ | l | ¦ |
| 1101 | D | CR | | – | = | M | ] | m | } |
| 1110 | E | | FM | . | > | N | ^ | n | ~ |
| 1111 | F | | | / | ? | O | _ | o | |

Bits 7, 6, 5 ← (columns)

Hex 0 ← (column 7)

Notes:

1. *Character code assignments other than those shown within all outlined areas of this chart are undefined. If an undefined character code is programmed, the character that will be displayed is not specified. The character displayed by the 3277 or 3275 for a given undefined character code may be different for other devices. IBM reserves the right to change at any time the character displayed for an undefined character code.*
2. *Lowercase alphabetic characters (shown within the dotted outlined area) are converted to uppercase by the display station or printer and displayed or printed as uppercase characters, unless the terminal has Dual Case capability.*

**Figure 5-5. United States ASCII I/O Interface Code for 3274 Control Unit and Attached 3278, 3279, 3287, and 3289 Terminals**

| * | 1 | Printout Format | | Start Print | Sound Alarm | Kbd Restore | Reset MDT Bits |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

*Determined by the configuration of bits 2-7. See Figure 5-12.

**Figure 5-6. Format of Write Control Character (WCC) Byte**

| Bit | Explanation |
|---|---|
| 0 | Determined by the contents of bits 2-7 as shown in Figure 5-12. |
| 1 | Reserved (must be a 1). |
| 2,3 | Define the printout format, as follows:<br>= 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.<br>= 01 — Specifies 40-character print line.<br>= 10 — Specifies 64-character print line.<br>= 11 — Specifies 80-character print line. |
| 4 | Start Printer bit. When set to 1, initiates a printout operation at completion of the write operation. |
| 5 | The Sound Alarm bit. When set to 1, sounds the audible alarm at the selected device at the end of the operation if that device has an audible alarm. |
| 6 | The Keyboard Restore bit. When set to 1, restores operation of the keyboard by resetting the INPUT INHIBITED indicator on 3275 and 3277 displays, and the System Lock or Wait symbol on 3276 and 3278 displays. It also resets the AID byte at the termination of the I/O command. |
| 7 | 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. |

*The CR order is applicable to the 3287 and 3289 Printers only.

**Figure 5-7. Function of Write Control Character (WCC) Bits**

| Attribute | X | X | U/P | A/N | I/SPD | 0 | MDT |
|---|---|---|---|---|---|---|---|
| EBCDIC Bits | 0 | 1 | 2 | 3 | 4 5 | 6 | 7 |

EBCDIC

| | | | |
|---|---|---|---|
| Bit 0,1 | = | XX | Determined by contents of bits 2-7. |
| Bit 2 | = | 0 | Unprotected data. |
| Bit 2 | = | 1 | Protected data — Autolock. |
| Bit 2, 3 | = | 1, 1 | Autoskip. |
| Bit 3 | = | 0 | Alphameric data. |
| Bit 3 | = | 1 | Numeric data — Autoshift |
| Bit 4, 5 | = | 0, 0 | Normal Intensity/Nondetectable. |
| Bit 4, 5 | = | 0, 1 | Normal Intensity/Selector Pen Detectable. |
| Bit 4, 5 | = | 1, 0 | High Intensity/Selector Pen Detectable. |
| Bit 4, 5 | = | 1, 1 | Nondisplay/Nonprint/Nondetectable. |
| Bit 6 | = | 0 | Reserved. Must be zero. |
| Bit 7 | = | 0 | Field data not tagged as modified. |
| Bit 7 | = | 1 | Field data tagged as modified. |

| ATTRIBUTE | | | | | | Bits | | | |
|---|---|---|---|---|---|---|---|---|---|
| Prot | A/N | MDT ON | High Intens | Sel Pen Det | Non Disp PRT | 23 | 4567 | Hex | Graphic Display |
| U | | | | | | 00 | 0000 | 40 | |
| U | | Y | | | | 00 | 0001 | C1 | |
| U | | | | Y | | 00 | 0100 | C4 | |
| U | | Y | | Y | | 00 | 0101 | C5 | |
| U | | | H | Y | | 00 | 1000 | C8 | |
| U | | Y | H | Y | | 00 | 1001 | C9 | |
| U | | | — | — | Y | 00 | 1100 | 4C | |
| U | | Y | — | — | Y | 00 | 1101 | 4D | |
| U | N | | | | | 01 | 0000 | 50 | P |
| U | N | Y | | | | 01 | 0001 | D1 | |
| U | N | | | Y | | 01 | 0100 | D4 | |
| U | N | Y | | Y | | 01 | 0101 | D5 | |
| U | N | | H | Y | | 01 | 1000 | D8 | |
| U | N | Y | H | Y | | 01 | 1001 | D9 | |
| U | N | | — | — | Y | 01 | 1100 | 5C | |
| U | N | Y | — | — | Y | 01 | 1101 | 5D | |
| P | | | | | | 10 | 0000 | 60 | |
| P | | Y | | | | 10 | 0001 | 61 | |
| P | | | | Y | | 10 | 0100 | E4 | |
| P | | Y | | Y | | 10 | 0101 | E5 | |
| P | | | H | Y | | 10 | 1000 | E8 | |
| P | | Y | H | Y | | 10 | 1001 | E9 | |
| P | | | — | — | | 10 | 1100 | 6C | |
| P | | Y | — | — | Y | 10 | 1101 | 6D | |
| P | S | | | | | 11 | 0000 | F0 | |
| P | S | Y | | | | 11 | 0001 | F1 | |
| P | S | | | Y | | 11 | 0100 | F4 | |
| P | S | Y | | Y | | 11 | 0101 | F5 | |
| P | S | | H | Y | | 11 | 1000 | F8 | |
| P | S | Y | H | Y | | 11 | 1001 | F9 | |
| P | S | | — | — | Y | 11 | 1100 | 7C | |
| P | S | Y | — | — | Y | 11 | 1101 | 7D | |

H = High S = Special
N = Numeric U = Unprotected
P = Protected Y = Yes

**Figure 5-8. Attribute Character Bit Assignments for 3278s**

To examine data for proper attributes and the setting or resetting of modified data tags (MDTs), use the following procedure:

1. Place the CE jumper, as shown in Figure 5-9, on the A-gate top-card connector that connects card F2 to card G2 on the A-gate with three base cards (Figure 5-9), or card F4 to card G4 on the A-gate with two base cards (Figure 5-10).
2. Attribute and nondisplay fields will now be displayed and can be compared with the graphic display in this figure.
3. Remove the jumper when completed.

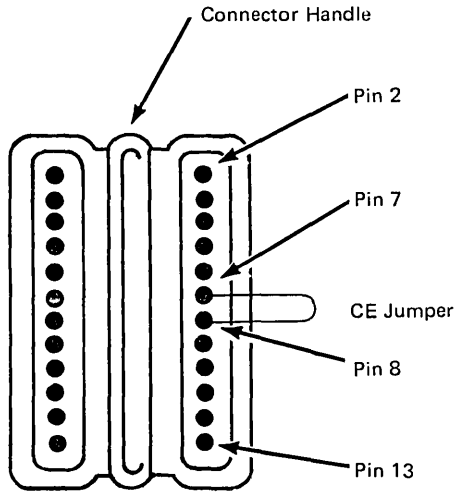



**Figure 5-9. 3278 Top-Card Connector CE Jumper (Three Base Cards)**

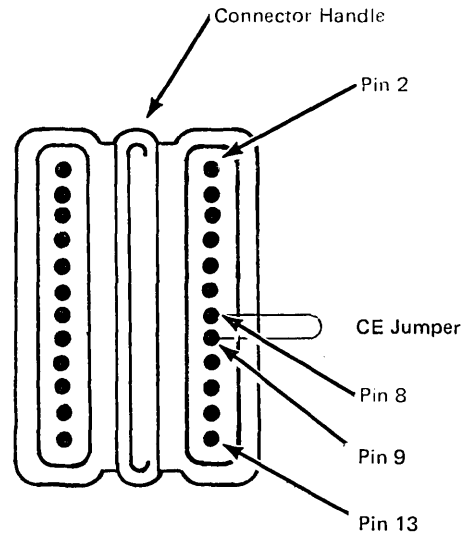



**Figure 5-10. 3278 Top-Card Connector CE Jumper (Two Base Cards)**

| X | 1 | U/P | A/N | D/SPD | Reserved | MDT |
|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 5 | 6 | 7 |

| EBCDIC Bit | Field Description |
|---|---|
| 0 | - Value determined by contents of bits 2–7. |
| 1 | - Must be a 1. |
| 2 | - 0 = Unprotected<br>- 1 = Protected |
| 3 | - 0 = Alphameric<br>1 = Numeric (causes automatic upshift of data entry keyboard)<br>**Note:** *Bits 2 and 3 equal to 11 causes an automatic skip. See text.* |
| 4 & 5 | - 00 = Display/not selector-pen-detectable<br>01 = Display/selector-pen-detectable<br>10 = Intensified display/selector-pen-detectable<br>11 = Nondisplay, noprint, nondetectable |
| 6 | - Reserved. Must always be 0. |
| 7 | - Modified Data Tag (MDT); identifies modified fields during Read Modified command operations.<br>0 = Field has not been modified<br>1 = Field has been modified by the operator. Can also be set by program in data stream. |

**Notes:**

1. *Bits 0 and 1 are not decoded when received by the 3270. When characters are being transferred to the CPU, bit 1 is a 1 and bit 0 is set, depending upon the character being transferred. All attribute characters are part of the defined character set. The default option (bits 2 through 7 all set to 0) results in an unprotected, alphameric, displayed, nondetectable field.*

2. *To examine data for proper attributes and the setting or resetting of modified data tags (MDTs), use the following procedure:*

   a. *Jumper J2M13 or H2D07 to Gnd (D08). 3277s with APL Text should also jumper K2B07 to Gnd (attribute byte of "6D" will not be displayed).*

   b. *Attribute and nondisplay fields will now be displayed and can be compared with Figure 5-12.*

   c. *Remove the jumpers when completed.*

**Figure 5-11. Attribute Character Bit Assignments for 3277s**

| Bits 2–7 | Graphic | EBCDIC | ASCII |
|---|---|---|---|
| 00 0000 | SP | 40 | 20 |
| 00 0001 | A | C1 | 41 |
| 00 0010 | B | C2 | 42 |
| 00 0011 | C | C3 | 43 |
| 00 0100 | D | C4 | 44 |
| 00 0101 | E | C5 | 45 |
| 00 0110 | F | C6 | 46 |
| 00 0111 | G | C7 | 47 |
| 00 1000 | H | C8 | 48 |
| 00 1001 | I | C9 | 49 |
| 00 1010 | ¢, [ | 4A | 5B |
| 00 1011 | . | 4B | 2E |
| 00 1100 | < | 4C | 3C |
| 00 1101 | ( | 4D | 28 |
| 00 1110 | + | 4E | 2B |
| 00 1111 | \|, ! | 4F | 21 |
| 01 0000 | & | 50 | 26 |
| 01 0001 | J | D1 | 4A |
| 01 0010 | K | D2 | 4B |
| 01 0011 | L | D3 | 4C |
| 01 0100 | M | D4 | 4D |
| 01 0101 | N | D5 | 4E |
| 01 0110 | O | D6 | 4F |
| 01 0111 | P | D7 | 50 |
| 01 1000 | Q | D8 | 51 |
| 01 1001 | R | D9 | 52 |
| 01 1010 | !, ] | 5A | 5D |
| 01 1011 | $ | 5B | 24 |
| 01 1100 | * | 5C | 2A |
| 01 1101 | ) | 5D | 29 |
| 01 1110 | ; | 5E | 3B |
| 01 1111 | ¬, ^ | 5F | 5E |

| Bits 2–7 | Graphic | EBCDIC | ASCII |
|---|---|---|---|
| 10 0000 | - | 60 | 2D |
| 10 0001 | / | 61 | 2F |
| 10 0010 | S | E2 | 53 |
| 10 0011 | T | E3 | 54 |
| 10 0100 | U | E4 | 55 |
| 10 0101 | V | E5 | 56 |
| 10 0110 | W | E6 | 57 |
| 10 0111 | X | E7 | 58 |
| 10 1000 | Y | E8 | 59 |
| 10 1001 | Z | E9 | 5A |
| 10 1010 | ¦ (EBCDIC) | 6A | C |
| 10 1011 | , | 6B | 2C |
| 10 1100 | % | 6C | 25 |
| 10 1101 | _ | 6D | 5F |
| 10 1110 | > | 6E | 3E |
| 10 1111 | ? | 6F | 3F |
| 11 0000 | 0 | F0 | 30 |
| 11 0001 | 1 | F1 | 31 |
| 11 0010 | 2 | F2 | 32 |
| 11 0011 | 3 | F3 | 33 |
| 11 0100 | 4 | F4 | 34 |
| 11 0101 | 5 | F5 | 35 |
| 11 0110 | 6 | F6 | 36 |
| 11 0111 | 7 | F7 | 37 |
| 11 1000 | 8 | F8 | 38 |
| 11 1001 | 9 | F9 | 39 |
| 11 1010 | : | 7A | 3A |
| 11 1011 | # | 7B | 23 |
| 11 1100 | @ | 7C | 40 |
| 11 1101 | ' | 7D | 27 |
| 11 1110 | = | 7E | 3D |
| 11 1111 | " | 7F | 22 |

**Note:** The following characters are used as attribute, AID, write control (WCC), copy control (CCC), CU and device address, and buffer address. They are also used as status and sense, except by the 3274 when operating in BSC. When any character is received by the CU, only the low-order 6 bits are used. When any of these characters is transmitted to the program, the CU assigns the appropriate EBCDIC code. If transmission is in ASCII, the CU translates the EBCDIC code to ASCII code prior to transmission.

For example, to use this table to determine the hex code transmitted for an attribute character, first determine the values of bits 2–7. Select this bit configuration in the table under "Bits 2–7". The hex code that will be transmitted (either in EBCDIC or ASCII) is to the right of the bit configuration.

Use this table also to determine equivalent EBCDIC and ASCII hex codes and their associated graphic characters.

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 *IBM 3270 Information Display System: Character Set Reference* manual, GA27-2837, for possible graphic character differences.

**Figure 5-12. Control Character I/O Codes**

## 5.5 EXAMINING 3279 ATTRIBUTES AND MODIFIED DATA TAGS

To examine data in the 3279 refresh buffer (not the ECS buffer) for proper attributes and the setting or resetting of modified data tags (MDTs), use the following procedure:

1. Place the CE jumper as shown in Figure 5-13.
2. Position the cursor at the location where the attribute is to be displayed.
3. Place the Normal/Test switch in the Test position. Nulls will display as ⊙ and attributes are blank. Note that base white and red change to red and white, respectively.
4. Press CONTROL D. The character, or attribute, at the cursor position is copied into the first position of the operator information area and the cursor advances.
5. Refer to Figure 5-14 to determine if the attributes are being correctly interpreted by the hardware.

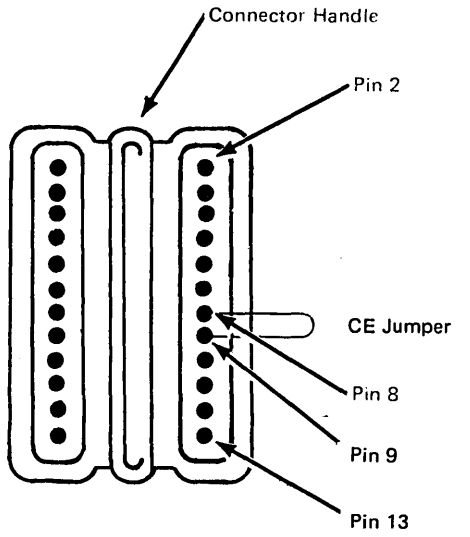
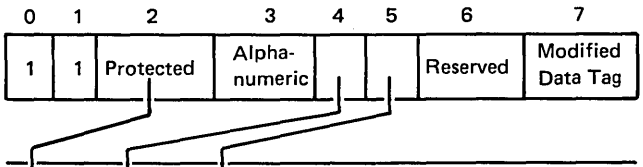



**Figure 5-13. 3279 Top-Card Connector CE Jumper**

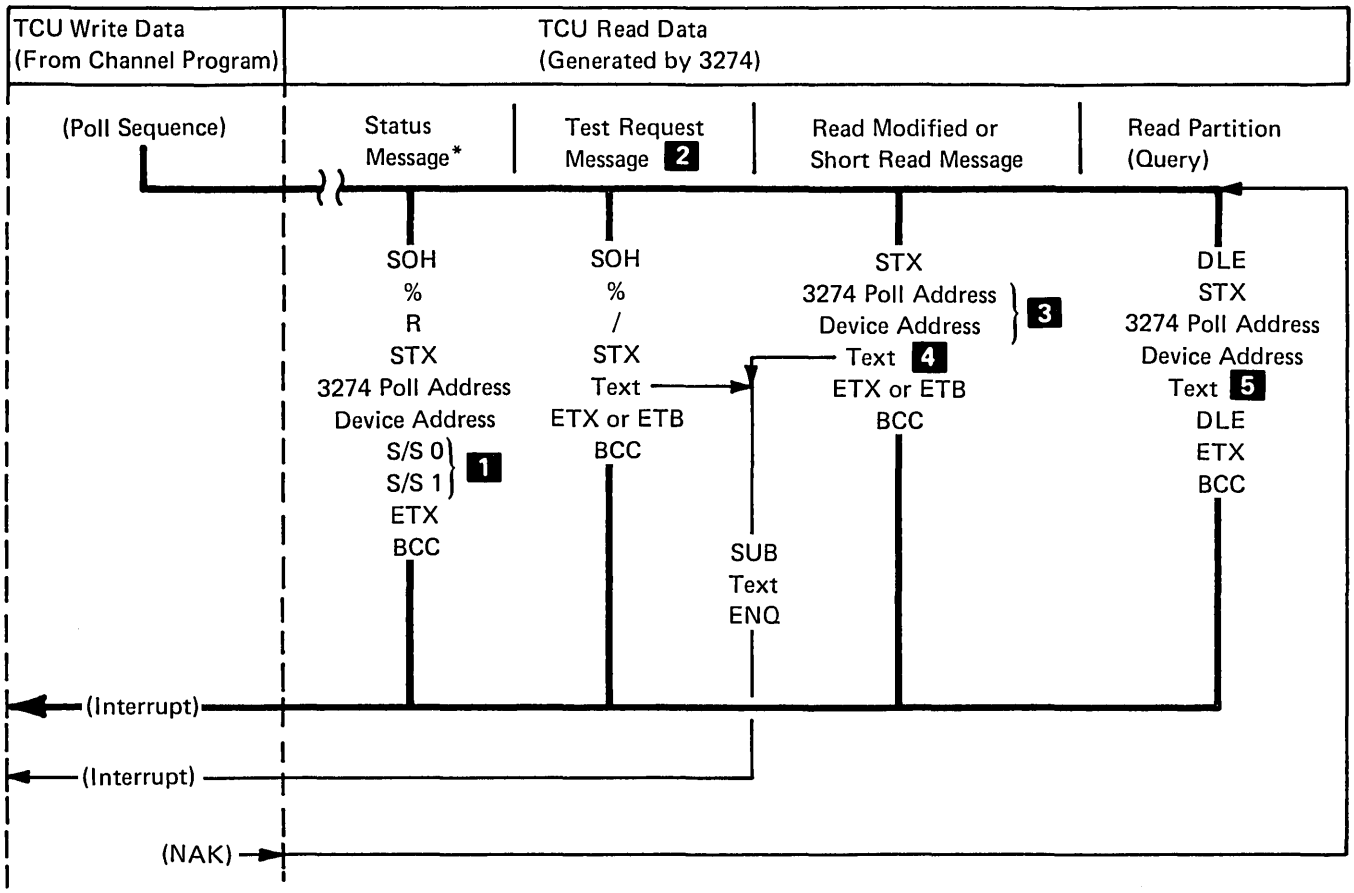



| 2 | 4 | 5 | Color of Field | Sel Pen Detectable |
|---|---|---|---|---|
| 0 | 0 | 0 | GREEN | NO |
| 1 | 0 | 0 | BLUE | NO |
| 0 | 0 | 1 | GREEN | YES |
| 1 | 0 | 1 | BLUE | YES |
| 0 | 1 | 0 | RED | YES |
| 1 | 1 | 0 | WHITE | YES |
| 0 | 1 | 1 | Non Display | NO |
| 1 | 1 | 1 | Non Display | NO |

**Figure 5-14. 3279 Base Field Attributes**

## 5.6 SEQUENCE/RESPONSE DIAGRAMS, BSC

Figures 5-15 through 5-20 provide the sequences and responses that occur during online BSC operation of the 3274 Models 51C and 52C.




**Notes:**

1. A status message response is issued to a General or Specific Poll if (1) the 3274 has pending status (General Poll ignores Device Busy and device "unavailable" and, if the 3274 continues polling of 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 TEST REQ key is pressed at the keyboard of a polled 3275 or 3277, or if a SYS REQ key is pressed at a 3278 or 3279 attached to a 3274.
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 3274.
5. The text portion of this message is the result of a Read Partition (Query) structured field function.

**Legend:**

(Interrupt) = TCU-generated interrupt.

*Response to General Poll or Specific Poll only (not program generated Read Modified command)

**Figure 5-15. 3274 Message Response to Polling or Read Modified Command**

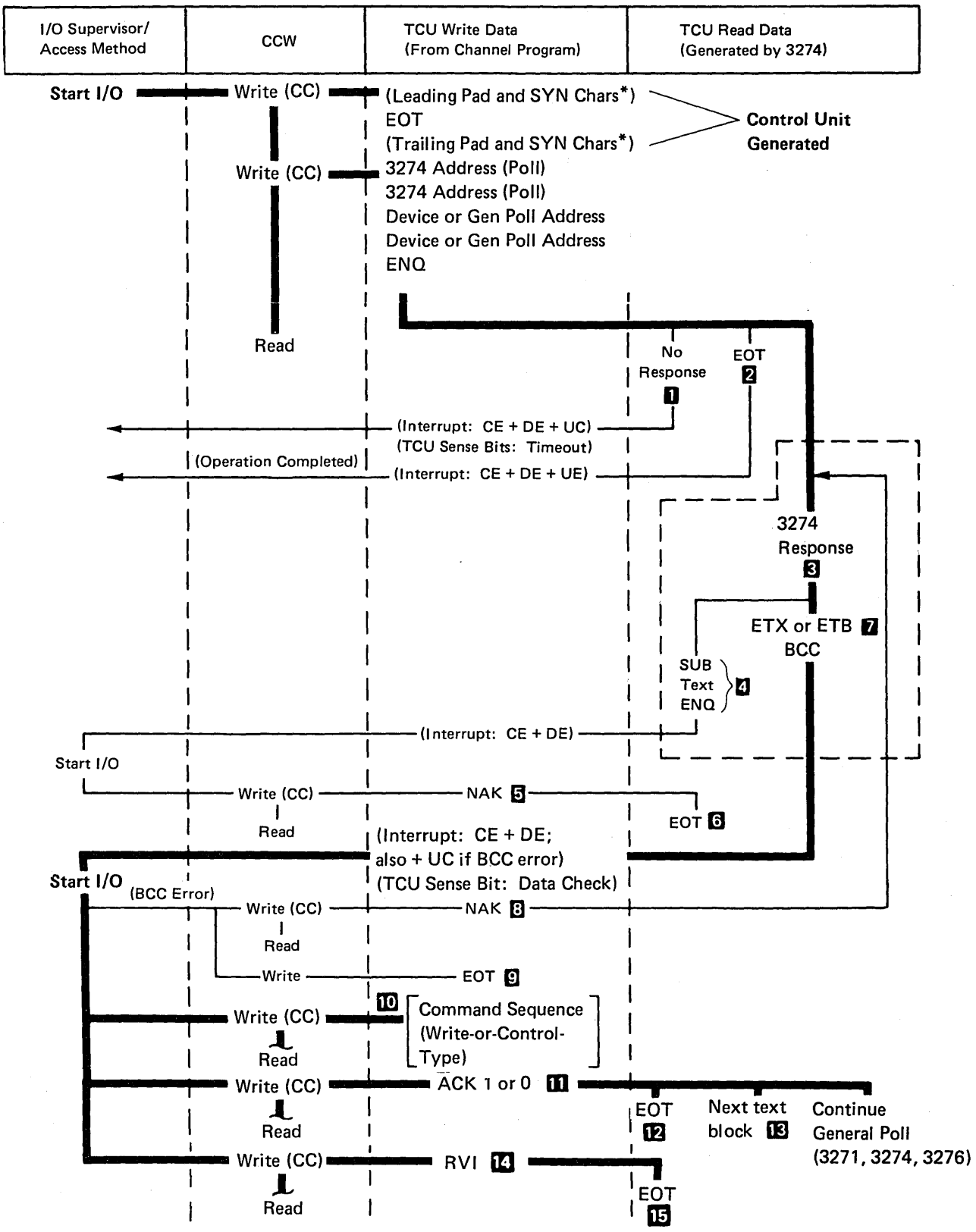



**Figure 5-16 (Part 1 of 2). General Poll and Specific Poll, Sequence/Response Diagram**

Notes:

1. The 3274 will fail to respond to the addressing or polling sequence, causing a TCU timeout, for any of the following reasons:
   - The 3274 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 3274 address is incorrect in the write data stream.
   - The addressed 3274 was left selected from the previous transmission.
2. There is no I/O pending nor 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.

   3274: 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 3274 (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 and that internal 3271/device polling is stopped.
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 3274 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 3274 to transmit the message. This response does not cause the 3274 to reset its sense/status information. Therefore, the same status message will be 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 would violate BSC standards on Limited Conversational mode.

    3274: 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.

    3274: 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 3274/device address sequence.
14. RVI to terminate polling sequence.
15. Termination of polling sequence on receipt of RVI.

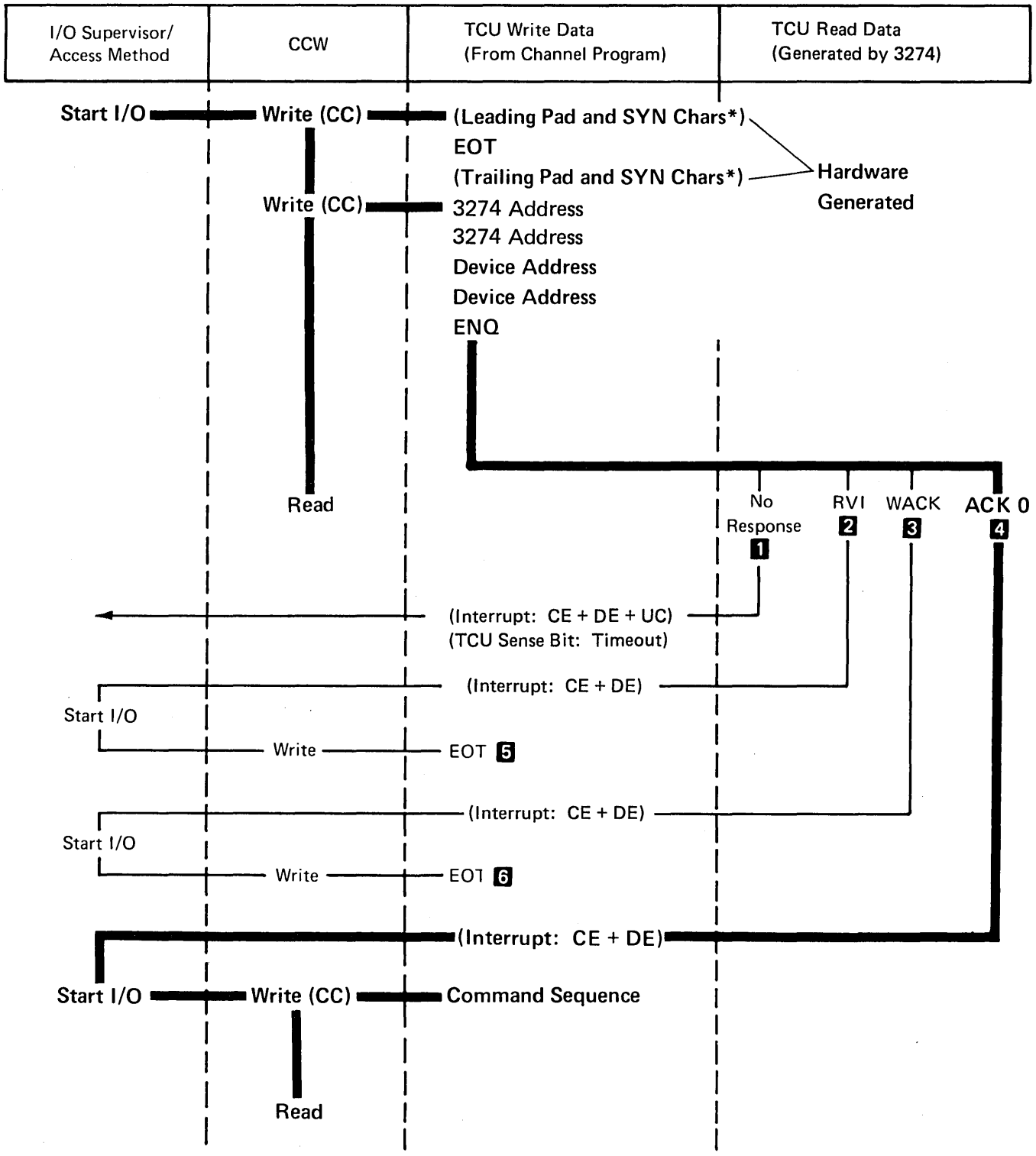
**LEGEND:**

(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).

*Only the critical framing characters (sync pattern and pad) are shown. All other framing characters are also hardware-generated as required. See SL *General Information - Binary Synchronous Communications,* GA27-3004, for a complete description.

**Figure 5-16 (Part 2 of 2). General Poll and Specific Poll, Sequence/Response Diagram**




*Only the critical framing characters (sync pattern and pad) are shown. All other framing characters are also hardware-generated as required. See SL *General Information — Binary Synchronous Communications,* GA27-3004, for a complete description.

**Figure 5-17 (Part 1 of 2). Selection Addressing, Sequence/Response Diagram**

Notes:

1. The 3274 will fail to respond to the addressing or polling sequence causing a TCU timeout, for any of the following reasons:
   - The 3274 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 3274 address is incorrect in the write data stream.
   - The addressed 3274 was left selected from the previous transmission.
2. 3274: The addressed device has pending status (excluding Device, Busy or Device End).
3. The addressed 3274 device, including the 3284-3 Printer 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:

   3274: 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 3274.
6. Termination of attempted addressing sequence.

**LEGEND:**

(CC) = Chain Command (CC) Flag in CCW is set to 1.

(Interrupt) = TCU-Generated interrupt (CE = Channel End, DE = Device End, and UC = Unit Check)

**Figure 5-17 (Part 2 of 2). Selection Addressing, Sequence/Response Diagram**

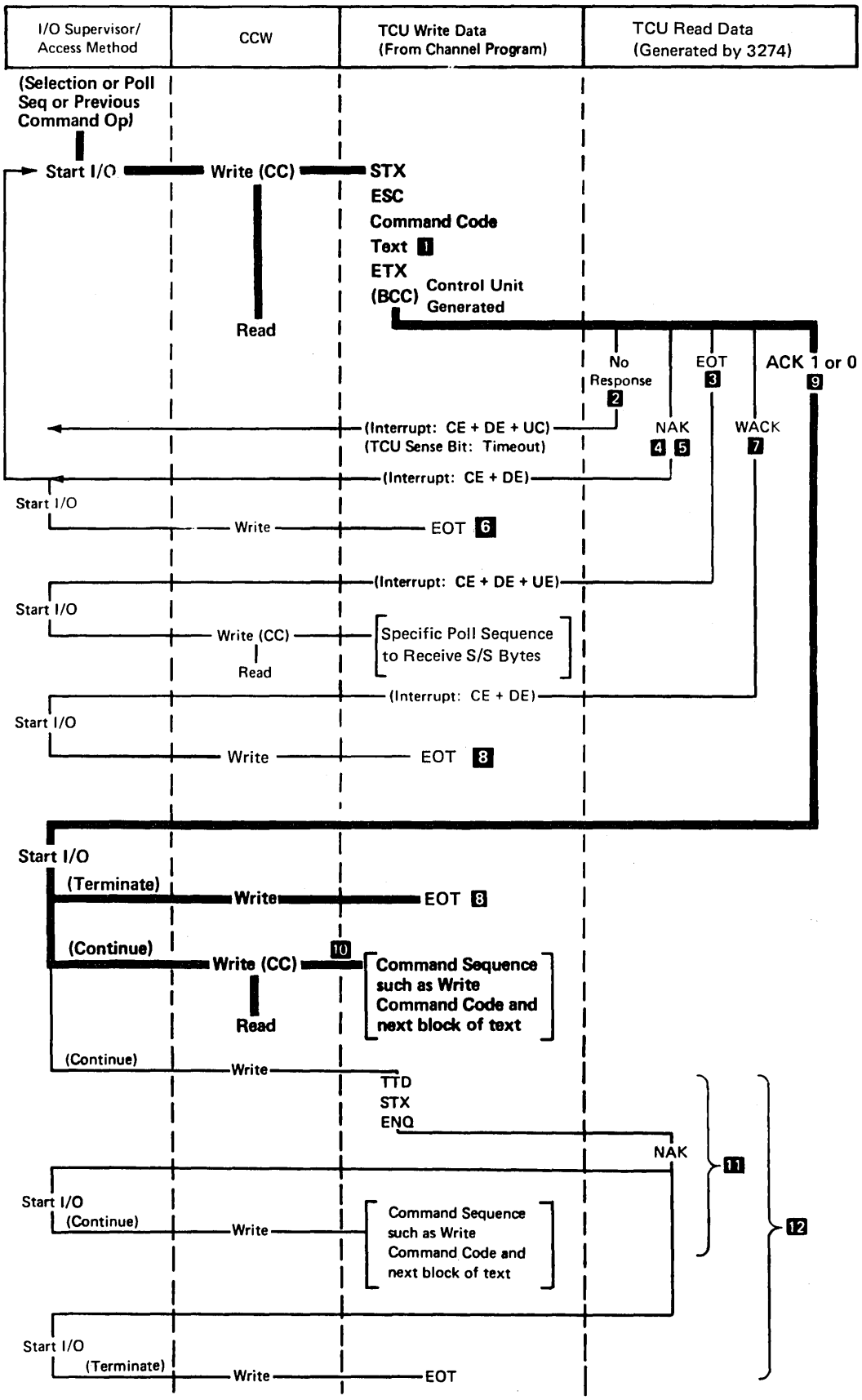



Figure 5-18 (Part 1 of 2). Write-Type and Control-Type Commands, Sequence/Response Diagram

**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. 3274: The control unit is unable to perform the operation indicated in the command transmission because of a busy/unavailable/not ready device.
   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, or
   f. a locked buffer.

   In the case of the Copy command: the "from" device is busy or has locked buffer, or CCC is missing.

   The EOT response to a command transmission indicates that status information is stored in the control unit. 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 control unit. Successful completion of a Specific Poll addressed to the responding device, a device selection addressed to any other device on the same control unit, or a General Poll addressed to the same control unit, is required to restart the internal control unit device polling operation.
4. 3274: If a transmission problem causes both a 3274 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. 3274: 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 3274 is unsuccessful in receiving a valid BCC following "n" attempts by the program to transmit the message.
7. 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 chained command cannot be accepted.

   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 Temporary Text Delay (TTD) sequence.
12. Example of terminating an operation using TTD (a forward abort sequence).

**Legend:**

(CC) = Chain Command (CC) Flag in CCW is set to 1.

(Interrupt) = TCU-generated interruption (CE = Channel End, DE = Device End, UE = Unit Exception, UC = Unit Check).

**Figure 5-18 (Part 2 of 2). Write-Type and Control-Type Commands, Sequence/Response Diagram**

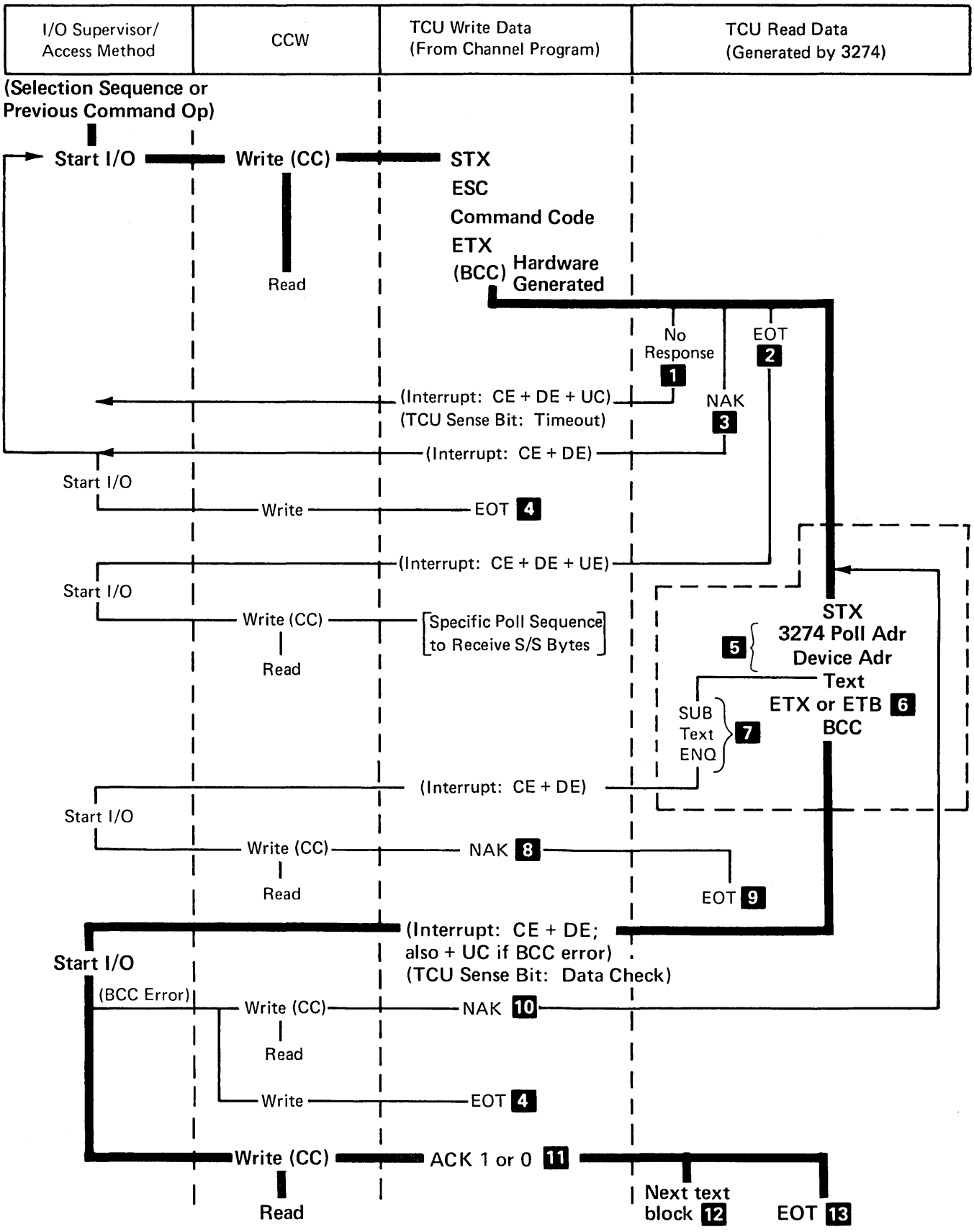



Figure 5-19 (Part 1 of 2). Read-Type Command, Sequence/Response Diagram

Notes:

1. Command transmission was not successfully received because of invalid framing (STX missing). Causes timeout at TCU.
2. 3274: The 3274 is unable to perform the operation indicated in the command transmission because of a busy/unavailable/not ready device or a 3274-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 3274. To ensure a retrieval of valid status, a Specific Poll must be issued to the device-responding EOT as the next addressing sequence issued to this 3274.
3. 3274: If a transmission problem causes both a 3274-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 3274 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 3274 automatically substitutes the SUB character for the character in error. If a parity or cursor check 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 3274 after transmitting the first block, the transmission cannot be completed because of power's 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. Retrieval information included in Note 2 applies.
10. BCC error has been detected. The program issues NAK to cause the 3274 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 3274/device address sequence.
13. Normal termination of the operation following transmission of the last text block.

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 5-19 (Part 2 of 2). Read-Type Command, Sequence/Response Diagram**

## 5.7 REMOTE STATUS AND SENSE BYTE DEFINITIONS, BSC

Figures 5-20 through 5-22 provide status and sense byte definitions, responses, conditions, and error recovery procedures for the 3274 Models 51C and 52C.

| Bit No. | Bit Definition |
|---|---|
| | S/S Byte 0: |
| 0 | Dependent upon 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) 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).<br>This bit is set with Operation Check when a Copy command is received which specifies a "busy" device with its "from" address.<br>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 which started a Printer or by chaining a command to a Specific Poll addressed to a busy device.<br>**Note:** DB is not returned for the 3278 when executing an Erase All Unprotected command, accepting data from the MSR, 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.<br>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 Device End, then the Device End bit is set and preserved along with the other pending status, and an RVI response is made. |
| 7 | *Transmission Check (TC)* — Not used by the 3274. TCU transmission. |
| | S/S Byte 1: |
| 0 | Dependent upon setting of bits 2-7. |
| 1 | Always a 1. |
| 2 | *Command Reject (CR)* — This bit is set upon receipt of an invalid 3270 command. |
| 3 | *Intervention Required (IR)* — This bit is set if:<br>• A Copy command contains a "from" address in its data stream which specifies an unavailable device.<br>• A command attempted to start a printer but found it not ready. The printout is suppressed.<br>• The 3274 receives a Selection Addressing sequence or a Specific Poll sequence for a device which is unavailable or which 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.<br>• The 3274 receives a command for a device which 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 3274 detected bad parity from the device. |
| 5 | *Data Check (DC)* — This bit indicates the detection of a parity check in a device buffer or a 3274 operation to a device was unsuccessful (i.e., the device was disabled with DC returned to the host. IR will be returned on subsequent retry by the host). |
| 6 | *Control Check (CC)* — This bit is not used by the 3274. |
| 7 | *Operation Check (OC)* — This bit, when set alone, indicates one of the following:<br>• Receipt of an illegal buffer address or of an incomplete order sequence on a Write, Erase/Write, or Erase/Write Alternate command.<br>• The device did not receive a CCC or a "from" address on a Copy command.<br>• Receipt of an invalid command sequence. (ESC is not received in the second data character position of the sequence.)<br>• This occurs if the internal buffering capability is exceeded.<br>This bit is set with Control Check, Intervention Required, Data Check, Device Busy, or Data Check with Unit Specify to indicate that the errors that set these sense bits were detected while the 3271 was executing an operation with the "from" device during a Copy command. 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). |

**Figure 5-20. Remote Status and Sense Byte Definitions, 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 Device End 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. Device End remains set with it, and the RVI response is made as usual.<br>CC is not used for the 3274.<br>IR — The addressed device is unavailable.<br>DC, EC (either or both) — Not used for the 3274.<br>DE, EC, US — A character generator or syn 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.<br>DE, IR — The addressed printer is out of paper, its power has been turned off, or its cover is open.<br>DE, IR, EC, US — The addressed printer is mechanically disabled and cannot recover.<br>DE, DC, US — A parity error is detected at the printer.<br>DC, US — 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 will be returned to the host. |
| EOT | Read Commands | CR — Invalid 3270 command is received.<br>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.<br>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.<br>DB, US, DE — Not used for the 3274.<br>IR — A command is addressed to an unavailable device.<br>DC — The 3274 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 3274 responds EOT.<br>DC, US — For a 3274, 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 will be returned to the host. |
| EOT | Write Commands | CR — An invalid or illegal 3270 command is received.<br>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.<br>(Not used for the 3274 or 3276.)<br>DC, US — 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 will be returned to the host.<br>CC — (Not used for the 3274.)<br>DB, US — The addressed device is busy. The message is accepted but not stored in the 3274 buffer. The command is aborted.<br>DE, DB, US — Not used for the 3274. |
| EOT | Copy Command | CC, OC — Not used for the 3274.<br>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.<br>IR, OC — The "from" device is not available.<br>OC, US — The "from" device has a locked buffer.<br>OC — The data stream contains other than two bytes (the CCC and the "from" address). The command is aborted.<br>DC, OC — Not used for the 3274. |

**Figure 5-21 (Part 1 of 2). Remote Error Status and Sense Responses, BSC**

| Device Response | Command | S/S Explanation |
|---|---|---|
| EOT | Copy Command | DC, OC, US — Set when "from" device detects an internal parity or cursor check. 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 will be returned to the host.<br>DB, US — The addressed "to" device is busy.<br>DB, US, OC — The addressed "to" device is also specified at the "from" device and is busy.<br>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.<br>IR, EC, US — Not used for the 3274. |
| EOT | Erase All Unprotected Command | OC — One or more data bytes followed the command (buffer overrun). |
| | Specific and General Poll | DE, IR, EC, US — An unrecoverable mechanical failure is detected at the printer.<br>DE, EC, US — A character generator or sync check error or a mechanical failure is detected at a 3284/3286/3288 printer but then recovered from.<br>DC, US — 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 will be returned to the host.<br>DC — The 3274 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 3274 responds EOT.<br>DC, EC (either or both) — Not used by the 3274.<br>DE — The poll finds a device (1), previously recorded as busy, now not busy or, (2) previously recorded as unavailable *or* not ready, now available *and* ready.<br>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.<br>DC, US, DE — A parity error is detected at printer.<br>CC (Specific Poll only) — Not used by the 3274. |
| | Specific Poll | CC — The poll finds a device, previously recorded as available and ready, now unavailable (timeout check). (The 3271 record is updated.) (Not used by the 3274.)<br>DB — The addressed device is busy. |
| NAK | Read and Write Commands | NAK is transmitted by the 3274 when it detects a Block Control Character (BCC) error on the TCU transmission. A BCC error has priority over all other 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 set by the 3274. |

**Figure 5-21 (Part 2 of 2). Remote Error Status and Sense Responses, BSC**

| Sense/ Status Bits | Detected during 3270 Operation | | | | | | Transmitted in Response to: | | Error Recovery Procedure |
|---|---|---|---|---|---|---|---|---|---|
| | Hex | | Selection Addressing Sequence | Specific Poll Sequence | General Poll Sequence | A 3270 Command | Specific Poll | General Poll | 3274 |
| | EBCDIC | ASCII | | | | | | | |
| 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 | | 13 |
| 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, US, DE | C6 C4 | 46 44 | | P | P | | P | P | 8 |
| EC, US, DE | C6 C8 | 46 48 | | P | P | | P | P | 7† |
| 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 |
| IR, EC, US | C4 D8 | 44 51 | | | | P | P | | NA |

**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 DB, US, and OC S/S bits will be 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.

†Occurs only if 3284, 3286, 3288 Printers are attached.

**Legend:**

NA — Not Applicable
D — Display (3277, 3278)
P — Printer

**Figure 5-22. Remote 3270 BSC Status and Sense Conditions**

## 5.7.1 Error Recovery Procedures

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 as 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 may still be retried. If an unrecoverable 3278 buffer error or an error occurring on a transfer between the 3276 and 3278 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 as a nonrecoverable error. Follow supplementary procedure A.

**Programming Note:** *A cursor check in the 3284 is indistinguishable from a data check that occurred in the 3271 or from a second selection to a 3277 with a cursor check. A selection addressing sequence or poll sequence to another device on the same control unit should be attempted before flagging the control unit as inoperative. A successful sequence indicates that the CU is probably satisfactory, and the device requires manual intervention to reset it (for example, a 3277 with a nonrecoverable data check). An unsuccessful sequence indicates that the CU may be at fault and requires manual intervention to reset it.*

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 since the user 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 Device End 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 will transmit Device End via a Specific or General Poll when it becomes not busy.
12. Indicates that the 3275 detected a BCC error during text transmission from the TCU. Follow procedure 2 if the failing command is a Write command with a data stream of more than one byte or if it is in a chain of commands and one of the previous commands in the chain is a Write command without an SBA order immediately following the WCC character. In all other cases, follow supplementary procedure D. If, after the recommended procedure has been tried six times, the problem is not corrected, follow supplementary procedure A.
13. 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.

### 5.7.2 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.

## 5.8 SDLC SEQUENCE RESPONSE DESCRIPTIONS

### 5.8.1 SLDC Transmission Frames

SDLC transmission frames are composed of a series of eight-bit binary-coded bytes which contain addressing, data, control, and checking information. Transmission between the controller and the 3274 unit takes place according to a predefined frame format which consists of the following sequence of bytes:

Flag (F) Sequence – 1 byte
Secondary Station Address (A) – 1 byte
Control (C) Field – 1 byte
Information (I) Field – up to 256 bytes of message data, preceded by header information
Frame Check Sequence (FCS) – 2 bytes
Flag (F) Sequence – 1 byte

Bit synchronization preceding transmission of an initial flag and following a line turnaround is achieved by transmission of 16 zero bits, after the clear-to-send signal is turned on and the NRZI encoder (when used) is enabled.

For a detailed description of the SDLC frame format, refer to *IBM Synchronous Data Link Control General Information,* GA27-3093. Support of the frame sequence, flag byte, Address byte, and Frame Check Sequence bytes conforms to the referenced document.

### 5.8.1.1 Response Modes

The 3274 unit functions in two link operating modes: normal response mode (NRM) and normal disconnect mode (NDM). In NRM, the 3274 can initiate transmission and raise the request-to-send signal only as a result of receiving a frame from the communications controller which contains the P bit set to 1. Single or multiple frames may be sent by the 3274. The last frame (or a single frame) transmitted by the 3274 in response to a command received with the P bit set to 1 must have the F bit set to 1. When the 3274 has completed a transmission, a new transmission cannot be initiated until a subsequent frame is received from the communications controller which contains the P bit set to 1. A response transmission initiated by the 3274 which requires acknowledgment from the communications controller, is repeated each time the communications controller polls until the acknowledgment is received. There is no limit to the number of transmissions. Responses that require acknowledgment from the communications controller are I-frames, CMDR and RR when transmitted with the F bit set to 0, to report clearing of a busy condition.

When in NDM, the 3274 cannot accept or transmit I or supervisory (S) frames. Nonsequenced responses are not transmitted unless the 3274 is solicited to reply. Invalid or nonimplemented commands received in NDM cause the 3274 to transmit an ROL response at the next response opportunity. ROL can be retransmitted until an SNRM or DISC command is received. Command reject conditions are not present in NDM.

The following paragraphs describe the 3274 port of the Control and Information fields.

### 5.8.1.2 Control Field

The Control field designates the frames as Supervisory (S), Nonsequenced (NS), or Information (I).

**Supervisory Commands:** The 3274 supports only the Supervisory commands Receive Ready (RR) and Receive Not Ready (RNR).

The C-field formats are as follows:

| | | | | |
|---|---|---|---|---|
| RR | Nr | P/F | 00 | 01 |
| | 012 | 3 | 45 | 67 |
| RNR | Nr | P/F | 00 | 01 |
| | 012 | 3 | 45 | 67 |

The 3274 will transmit RNR when the control unit cannot accept further data from the link.

When the reported RNR condition is cleared, the control unit will transmit an I-frame or RR with the F bit on after a frame with the P bit on is received.

If the 3274 has received an RNR, an I-frame will not be transmitted until an RR or I-frame with the poll bit on is received.

The transmission or receipt of an NS frame does not indicate the RNR condition has cleared.

**Nonsequenced Commands and Responses:** The Nonsequenced commands and responses listed in Figure 5-23 are supported by the 3274.

| Command/Response | C-Field | Hex Code |
|---|---|---|
| Set Normal Response Mode (SNRM) Command | 1 0 0 P 0 0 1 1<br>0 1 2 3 4 5 6 7 | 93 |
| Disconnect (DISC) Command | 0 1 0 P 0 0 1 1<br>0 1 2 3 4 5 6 7 | 53 |
| Nonsequenced Acknowledgment (NSA) Response | 0 1 1 F 0 0 1 1<br>0 1 2 3 4 5 6 7 | 73 |
| Request Online (ROL) Response | 0 0 0 F 1 1 1 1<br>0 1 2 3 4 5 6 7 | 1F |
| Command Reject (CMDR) Response | 1 0 0 F 0 1 1 1<br>0 1 2 3 4 5 6 7 | 97 |
| Test Command/Response | 1 1 1 P/F 0 0 1 1<br>0 1 2 3 4 5 6 7 | F3 |
| Exchange Station ID Command/Response | 1 0 1 P/F 1 1 1 1<br>0 1 2 3 4 5 6 7 | |

**Figure 5-23. Nonsequenced Commands and Responses Supported by 3274**

The SNRM command sets the 3274 in NRM. Receipt of SNRM causes the 3274 to deactivate the physical unit if it is in active state. The On-Line and Ownership symbols are turned off.

The DISC command sets the 3274 in NDM.

The NSA response is sent by the 3274 to acknowledge receipt and acceptance of the SNRM and DISC commands.

The Test command is used to initiate one round-trip transmission of test data in both NRM and NDM. The 3274 station 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.

The Request on Line (ROL) response is sent by the 3274 in normal disconnect mode (NDM) to request online status. ROL is sent in response to any command except Test and XID. ROL is sent in response to the SNRM command when the 3274 cannot enter NRM.

The CMDR response is implemented by the 3274 as described in GA27-3093. The CMDR will be sent in response to any poll until an SNRM or DISC is received to reset the control unit.

The Exchange Station Identification (XID) command and response contains additional data beyond the C byte. The 3274 responds to the XID command in NRM or NDM, except when a CMDR condition exists, in which case the CMDR response takes precedence over XID. The request/response unit (RU) of the XID response consists of 48 bits, defined as follows:

| Bits | Meaning |
|---|---|
| 0–3 | ID format B "0000' |
| 4–7 | PU type B "0010' |
| 8–15 | Self-description X "00' |
| 16–27 | X'017' (3274) and X'018' (3276) |
| 28–47 | ID number |

**Information (I) Frame:** The Information frame is used to transmit message data. When transmitted, the I-frame contains a maximum of 256 bytes of RU message data preceded by six bytes of transmission header (RH).

## 5.8.2 Sequence Error Recovery Procedures

A sequence error occurs when the 3274 receives an I-frame with an incorrect Ns sequence count and valid FCS bytes. The 3274 does not accept the I-frame that caused the sequence error and rejects all following I-frames, until an I-frame is received which contains the correct Ns value, at which time the sequence error condition is reset.

The 3274 transmits I-frames in the sequence indicated by the last Nr count received, which may include retransmission of previously transmitted I-frames that have not been acknowledged.

All I-frames are transmitted in contiguous sequence according to the Ns value within the constraints of the modulo count.

### 5.8.2.1 Abort Function

The abort function is used by the communications controller or by 3274 when a frame being transmitted is to be discarded. The abort function is performed by transmitting eight contiguous one bits without zero insertion at the earliest possible time following recognition of an abort situation. No FCS is transmitted. When, for example, the 3274 receives seven contiguous one bits, it discards the aborted frame. The 3274 employs the abort function when an equipment malfunction occurs that causes an erroneous transmission.

### 5.8.2.2 Timeout Control

When the 3274 is attached point-to-point or multipoint and does not recognize any valid outbound frame for 20 to 25 seconds, a nonproductive timeout occurs. This timeout causes the 3274 to set the Communication Check symbol on all attached 3278s. The timer is reset to zero every time the 3274 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 3274 for 20 to 25 seconds, the Communication Check symbol is set on all attached 3278s. The indicator will be turned off when a valid frame is received.

## 5.8.3 Hexadecimal Notation and Frame Summary

Figure 5-24 shows the hexadecimal notation for SDLC commands and responses.

*Nonsequenced Commands*

| | P | $\overline{P}$ |
|---|---|---|
| SNRM | '93' | '83' |
| DISC | '53' | '43' |
| SIM | '17' | '07' |
| NSI | '13' | '03' |
| NSP | '33' | '23' |
| XID | 'BF' | |
| TEST | 'F3' | 'E3' |

*Nonsequenced Responses*

| | F | $\overline{F}$ |
|---|---|---|
| NSA | '73' | '63' |
| ROL | '1F' | '0F' |
| CMDR | '97' | '87' |
| RQI | '17' | '07' |
| NSI | '13' | '03' |
| XID | 'BF' | |
| TEST | 'F3' | 'E3' |

*Supervisory Commands/Responses*
(See Legend)

| | |
|---|---|
| RR | '_1' |
| RNR | '_5' |
| REJ | '_9' |

*Information Commands/Responses*
(See Legend)

| | |
|---|---|
| I | '_*' |

*Legend*

*Hexadecimal digit for "—"*

| *Nr=* | *P/F* | $\overline{P/F}$ |
|---|---|---|
| 0 | 1 | 0 |
| 1 | 3 | 2 |
| 2 | 5 | 4 |
| 3 | 7 | 6 |
| 4 | 9 | 8 |
| 5 | B | A |
| 6 | D | C |
| 7 | F | E |

*Hexadecimal digit for "*"*

| *Ns=* | *Hex* |
|---|---|
| 0 | 0 |
| 1 | 2 |
| 2 | 4 |
| 3 | 6 |
| 4 | 8 |
| 5 | A |
| 6 | C |
| 7 | E |

**Figure 5-24. SDLC Commands and Responses in Hexadecimal Notation**

## 5.9 SNA INFORMATION

### 5.9.1 Session Control

Session Control (SC) requests are sent from the host to establish and maintain a session with 3274. Session Control also provides facilities to clear data flowing within a session after a catastrophic error occurs and then to resynchronize the data flow after such an error. All Session Control commands supported by 3274 are transmitted on the expedited flow. The specific SC function is identified by the first byte of the Request Unit (RU). The SC functions supported by 3274 are listed in Figure 5-25.

| Function | BU Byte | Support |
|---|---|---|
| Activate Physical Unit (ACTPU) | X'11' | Outbound |
| Deactivate Physical Unit (DACTPU) | X'12' | Outbound |
| Activate Logical Unit (ACTLU) | X'0D' | Outbound |
| Deactivate Logical Unit (DACTLU) | X'0E' | Outbound |
| Bind | X'31' | Outbound |
| Unbind | X'32' | Outbound |
| Clear | X'A1' | Outbound |
| Start Data Traffic (SDT) | X'A0' | Outbound |

**Figure 5-25. Session Control Functions Supported by 3274**

### 5.9.2 Data Flow Control

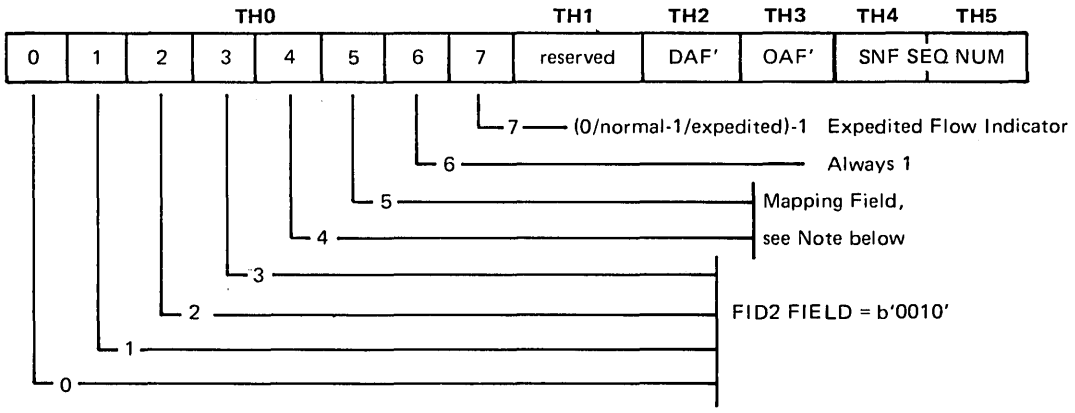
Data Flow Control (DFC) requests are passed between the application program and 3274 to provide control over session data flow. Data Flow Control functions are identified by the setting of the RU type bit to B'1' and the Subsystem Control bit to B'0'. The DFC requests listed in Figure 5-26 are supported by 3274.

| Function | Flow | RU Byte | Support |
|---|---|---|---|
| Cancel | Normal | X'83' | Inbound/Outbound |
| Bid | Normal | X'C8' | Outbound |
| Chase | Normal | X'84' | Outbound |
| Signal | Expedited | X'C9' | Inbound/Outbound |
| SHUTD | Expedited | X'C0' | Outbound |
| SHUTC | Expedited | X'C1' | Inbound |
| LUSTAT | Normal | X'04' | Inbound |
| RTR | Normal | X'05' | Inbound (LU types 1, 3) |

**Figure 5-26. Data Flow Control Requests Supported by 3274**

### 5.9.3 Transmission Header

The format of the transmission header is shown in Figure 5-27.



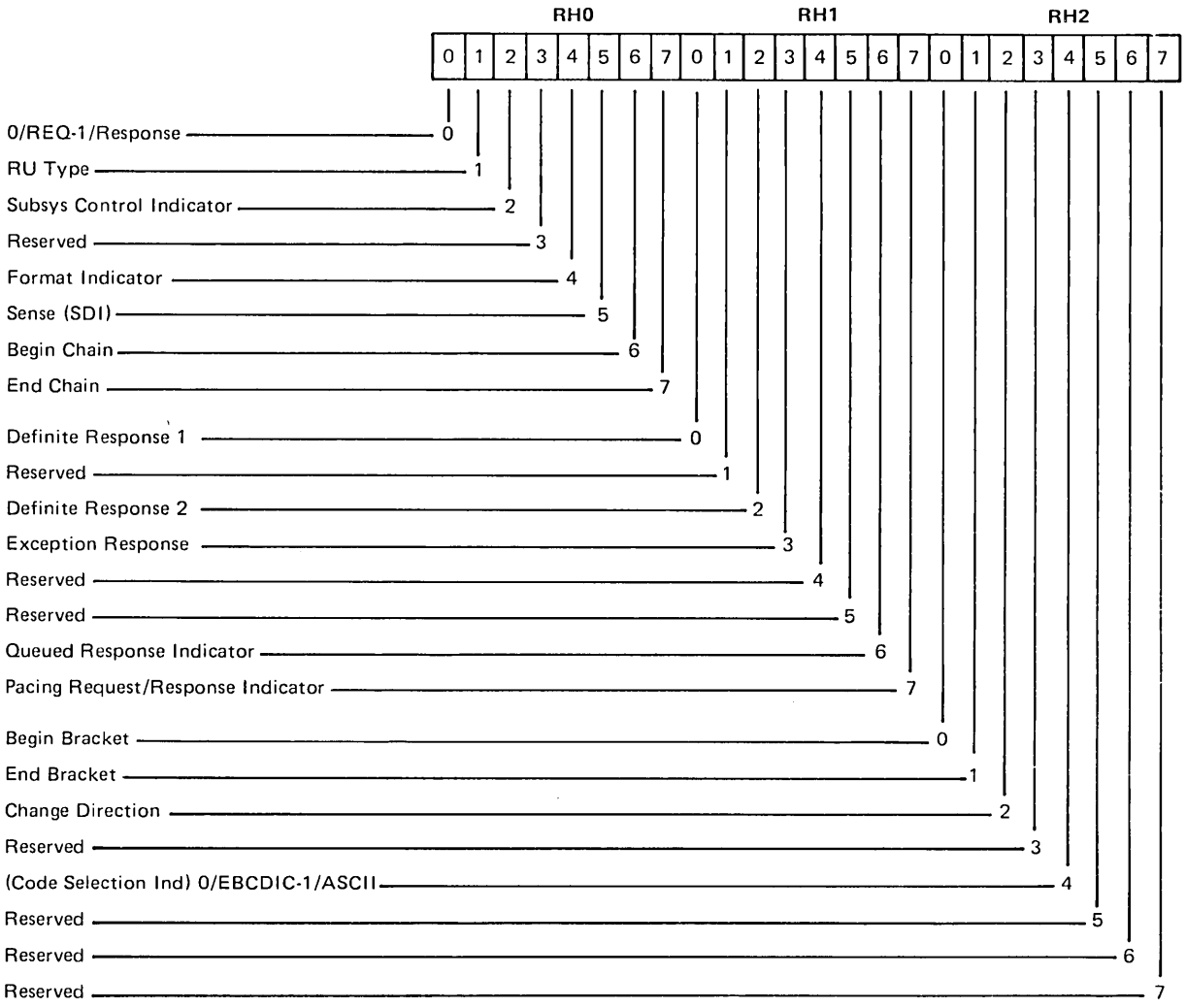

**Note:** *Mapping Fields*

| *Bits* 4 | 5 | |
|---|---|---|
| *0* | *0* | *Middle of segment* |
| *0* | *1* | *Last of segment* |
| *1* | *0* | *First of segment* |
| *1* | *1* | *Whole segment* |

**Figure 5-27. Transmission Header Format**

### 5.9.4 Request/Response Header

The format of the request/response header is shown in Figure 5-28.




**Note:** *RU0 Bits 1 and 2 — RU Type/Subsystem Control Indicator*

| | | |
|---|---|---|
| *1* | *1* | *Session Control* |
| *1* | *0* | *Data Flow Control* |
| *0* | *1* | *Network Control (not implemented)* |
| *0* | *0* | *FM Data* |

**Figure 5-28. Request/Response Header Format**

### 5.9.5 SNA Definitions

3274 – PU.T2

For all PIUs sent and received, the transmission header (TH) format is a FID2. (See Figure 5-27) for the layout for FID2 TH.)

3274 – FM Profile 3

Primary LU half-session and secondary LU half-session use delayed control mode and immediate-response mode. These half-sessions support the following DFC functions:

Cancel
Signal
LUSTAT (allowed secondary to primary only)
Chase
SHUTD
SHUTC
RSHUTD
Bid and RTR (allowed only if brackets are used)

The FM usage fields defining the options for Profile 3 are:

Chaining use (primary and secondary)
Request mode selection (primary and secondary)
Chain response protocol (primary and secondary)
Compression indicator (primary and secondary)
Send EB indicator (primary and secondary)
FM header usage
Brackets
Bracket termination rule
Alternate Code Set Allowed indicator
Normal-flow send/receive mode
Recovery responsibility
First speaker (for bracket protocol)
Contention resolution

3274 – TS Profile 3

Profile 3 specifies the following session rules:
Primary – secondary normal flow is paced.
Sequence numbers are used on normal flows.
Clear and SDT are required.
RQR and STSN may be used.

LU Types

LU1 – Printer 3289 (LYNX), 3287 (BAHIA-Feature only)
LU2 – Display 3278 (D), 3279
LU3 – Printers ANR – 3284, 3286, 3288
NDS – 3289, 3287

### 5.9.6 SDLC/SNA Command to Start a Session

Figure 5-29 shows the SDLC/SNA commands required to initialize a session with LU1 (DAF of 2). Only the requests are shown, but the SDLC receive count has been updated whenever a line direction change occurs to account for a positive response from the secondary station.

It should be noted the requests/responses do not carry the SDLC poll/final bit. The lines, in all cases, are turned around by the RR (SDLC) cmd after every response/request.

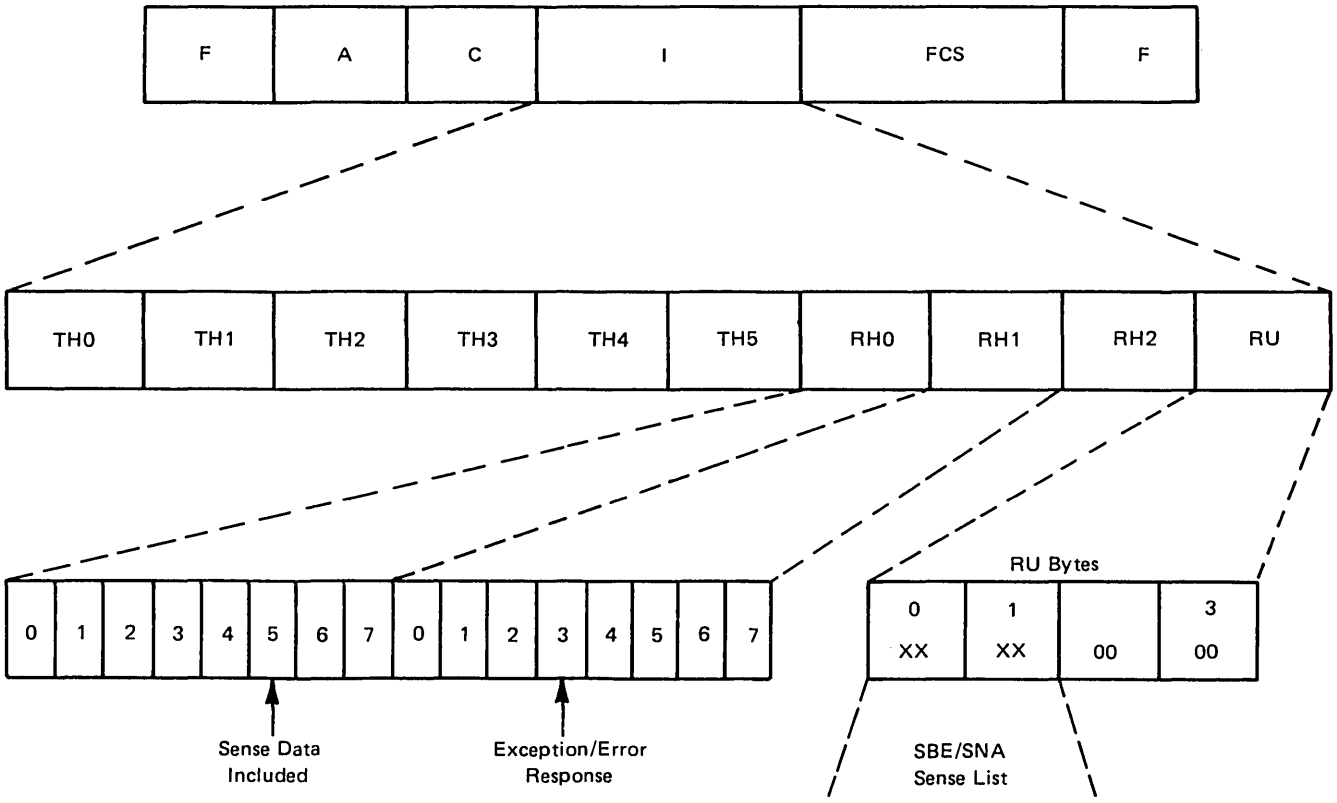
| | Frame | Address | Control | TH | RH | RU | BCC | Frame |
|---|---|---|---|---|---|---|---|---|
| SNRM | 7E | C1 | 93 | | | | 277A | 7E |
| RR | 7E | C1 | 11 | | | | 3DDD | 7E |
| ACTPU | 7E | C1 | 00 | 2F0000000001 | 6B8000 | 110101050000000001 | 02B9 | 7E |
| RR | 7E | C1 | 11 | | | | 3DDD | 7E |
| ACTLU | 7E | C1 | 22 | 2F0002000001 | 6B8000 | 0D0101 | 126B | 7E |
| RR | 7E | C1 | 31 | | | | 3FFC | 7E |
| Bind | 7E | C1 | 44 | 2F0002010001 | 6B8000 | 31010303B1A03080<br>0001858700000200<br>0000000018501850<br>02000006F3C5B2B3<br>C5D900 | 94FF | 7E |
| RR | 7E | C1 | 51 | | | | 399F | 7E |
| Clear | 7E | C1 | 66 | 2F0002010002 | 6B8000 | A1 | C62E | 7E |
| RR | 7E | C1 | 71 | | | | 3BBE | 7E |
| SDT | 7E | C1 | 88 | 2F0001010001 | 6B8000 | A0 | | |
| RR | 7E | C1 | 91 | | | | 3559 | 7E |

**Figure 5-29. SDLC/SNA Commands Required to Start Session with LU1**

## 5.10 SDLC/SNA ERROR INFORMATION

### 5.10.1 Exception Response with Sense Data Included

The exception responses for SDLC/SNA are shown in Figure 5-30.




Note: *SDI and EXR/FRR bits are on for sense information.*

**Figure 5-30. SDLC/SNA Exception Responses**

## 5.10.2 SNA Sense Codes

Each major error code has modifiers for further description in sense byte 1. Following are the modifier codes supported and the controller or terminal condition causing the negative response to be returned.

**Sense Byte One** **Description**

Path Error X'80'

X'04' Unrecognized DAF'
Controller does not have a terminal adapter for the DAF address.

X'05' — NO SESSION
- A Bind has not been received or accepted by the 3274.
- A request other than Bind is sent to an SLU which has already accepted a Bind, and the OAF' is not X'00' or the OAF in the accepted Bind.

X'08' — PU NOT Active
The 3274 has not received or accepted an ACTPU, or a control condition caused an internally generated DACTPU.

X'09' — LU NOT Active
The 3274 has not received or accepted an ACTLU, or a control condition caused an internally generated DACTLU.

X'0F' — Invalid Address Combination
A request was addressed to the PU (DAF'=X'00'), and the OAF was not SSCP (OAF'=X'00').

RH Error X'40'

X'06' — Exception Response Not Allowed
LIC carried exception response when Bind specified definite response.

X'07' — Definite Response Not Allowed
LIC carried definite response when Bind specified exception response or ¬ LIC carried definite response.

X'0A' — No-Response Not Allowed
A chain element did not have DR1, DR2, or the exception bit set to 1.

X'0F' — Format Indicator Not Allowed
An FM request received by the 3274 indicated formatted header included.

State Error X'20'

X'01' — Sequence Number Error
The sequence number of the normal flow request did not match the number expected by the 3274.

X'02' — Chaining Error
Chain elements were out of protocol sequence.

X'03' — Bracket State Error
A Bracket state error occurred.

X'04' — Direction Error
A normal flow without begin bracket was received while the 3274 was in Send state.

X'05' — Data Traffic Reset
An FM or DC request was received before an SDT was received or accepted.

**Sense Byte One** **Description**

X'03' – Function Not Supported.

- Unsupported Session Control Request
- Unsupported Data Flow Control Request
- SIGNAL Code is not X'00010000'
- Network Control Request
- FM Data Stream
- Invalid Command
  - Data Following a Read, RM, RMA, or EAU command
  - For LU type 3, any Read, RM or RMA command.

X'05' – Parameter Error

Invalid address following SBA, RA, or EUA order (SBA, RA, or EUA order without parameters), or SCS parameter error.

X'07' – Category Not Supported

- An FMD request from the SSCP was received by a SLU which has an attached device without a keyboard.
- An unsupported network service message received.

Request Reject X'08'

X'01' – Resource Not Available

- LU type 2, A printer is not allowed by the Authorization Matrix
- For LU type 1 or 3, Bind reject because printer is authorized for Local mode only.

X'02' – Intervention Required (on principal device).

- For LU type 2, security key is tuned off
- For LU type 1 or 3, printer condition such as end of form, paper jam, printer cover up, or hold time out.

X'05' – Session Limit Exceeded

A Bind was received whose OAF' differs from the PLU already bound.

X'0A' – Permission Rejected

Display or printer power is off. The SSCP will not be notified when the device powers on.

X'11' – Break

Sent on LU type 1 when the operator depresses the printer Hold Print key followed by Cancel key, if a chain has not completed printing.

X'13' – Bracket Bid Reject – (No RTR)

Returned by LU type 2 to a BID or BID with Begin Bracket if the display has won contention and started a bracket.

X'15' – Function Active

Bind reject if the same OAF' already has an accepted Bind to the SLU.

X'1B' – Receiver in Transmit Mode

- The SLU is Between Bracket but a data key has been depressed.
- An FM message was received from the SSCP while the display was owned by the PLU-SLU session or is in Test mode.
- An SSCP FM message is rejected if local copy is taking place while the SSCP-SLU session owns the display.

**Sense Byte One** **Description**

X'1C' — Request Not Executable
The 3274 or 3276 has a nonrecoverable error.

X'21' — Invalid Session Parameters
- Bind parameters do not match the 3274 Bind checks.

X'29' — Change Direction Required
A 3270 read-type command was received without a Change Direction, or with an End Bracket.

X'2A' — Presentation Space Altered, Request Executed
An LU type 2 3277 attached to a 3274 has a reset keyboard, and tried to enter while in receive state.

X'2B' — 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 returned to PLU-SLU session.

X'2D' — SLU Busy
- LU type 2 Display is owned by SSCP-SLU session or Test mode.
- LU type 2 Display is busy doing an operator-initiated local copy.
- LU type 2 3277 attached to 3274 is busy with a Back Tab.

X'2E' — Intervention Required at Subsidiary Device.
For LU type 2, a printer being copied to from a host-initiated print has intervention-required type error. Refer X'0802'. Printer power off or not attached to the controller is included in this category.

X'2F' — Request Not Executable Because of LU Subsidiary Device.
For LU type 2, a printer being copied to has a nonrecoverable error.

X'4A' — Presentation Space Altered, Request Not Executed
Refer to X'2A'.

X'31' — LU Component Disconnected
This response is returned if the device attached to the 3274 cannot be contacted by a device poll. This is due to device power off, cable detached from the controller port, or connecting cable broken.

X'43' — Required Function Manager Synchronization Not Supplied
For LU type 2 or 3 chains having the print bit on, must be definite response or exception response chain must carry CD.

## 5.10.3 Logical Unit Status (LUSTAT)

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). 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 | CD may be set | None |
| ERP1 | CD not set | None |
| Send | CD set for principal device | to Receive |
| | CD not set for subsidiary device | None |

Inbound LUSTATs are sent with exception response by the 3274.

**Programming 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 (S, *R).*

The following status codes will be used by 3274 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'081CZ000'* | 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. (Refer to "SNA Printer Sessions" for a description of principal and subsidiary devices.) The value of Z is defined as follows:

| | |
|---|---|
| LU type 1 Principal (printer) | Z = 0 |
| LU type 2 Principal (display) | Z = D |
| LU type 2 Subsidiary (printer) | Z = B |
| LU type 3 Principal (printer) | Z = 0 |

The priority of these status codes, in low to high order, is assigned as:

X'0002', X'0001', X'082B', X'0831', X'0801', X'081C'

3274 or 3276 will send the highest level of priority status when an opportunity allows its transmission.

Definition: (S, *R) = Send state, ERP1 state, or BETB state.

The upper section of Figure 5-31 shows the LUSTAT codes that are returned to clear the negative response condition listed in the left column. The lower section 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.

The usages of LUSTAT are as follows:

For all LU types, when the 3274 has sent -RSP 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).

**LUSTAT Returned**

| Negative Response Code | LU TYPE | | | |
|---|---|---|---|---|
| | T1 | T2 | T3 | SSCP |
| 0802 | 00010000<br>082B0000<br>081C0000<br>08310000 | 0001D000<br>082B0000<br>081CD000<br>08310000 | 00010000<br>082B0000<br>081C0000<br>08310000 | NA |
| 0807 | NA | 0001B000<br>0801B000<br>081CB000<br>081CD000 | NA | NA |
| 082D | NA | 0001D000<br>082B0000<br>081CD000 | NA | NA |
| 082E | NA | 0001B000<br>0801B000<br>081CB000<br>081CD000 | NA | NA |
| 0831 | 082B0000<br>081C0000 | 082B0000<br>081CD000 | 082B0000<br>081C0000 | NA<br>NA |

**Sent By**

| LUSTAT | LU TYPE T1 | T2 | T3 |
|---|---|---|---|
| *SEND*<br>*BETB*<br>*ERP.1* | | | |
| 00020000 | X | X | X |
| 081C0000 | X | | X |
| 081CB000 | | X | |
| 081CD000 | | X | |
| 082B0000 | X | X | X |
| 08310000 | X | X | X |
| 0801B000 | | X | |

**Figure 5-31. Summary Table of LUSTATs**

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 3274 SLU has sent -RSP with Secondary component not available (X'0807') and this condition is reset, LUSTAT with X'0001B000' will be sent.

For all LU types supported, the LUSTAT X'00020000' will be sent when the 3274 accepts a Normal flow request carrying CD, but no input components (keyboard, lightpen, MSR, etc.) are attached to the device.

For all LU types, LUSTAT with X'082B0000' will be sent to the PLU when the 3274 SLU detects presentation integrity lost (for example, regeneration buffer parity error), and is in (S *R) state for the 3274.

For LU type 2, when the 3274 has sent -RSP (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 PLU-SLU session.

For LU type 2, when the -RSP (Device Busy) (X'082D') has been returned from the 3274 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 3274 has sent -RSP (Device Busy) (X'082D') to a PLU because the SLU is busy executing a local copy, the 3274 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 which is in (S, *R) state, LUSTAT X'08310000' will be sent to the PLU.

For all LU types, when a principal device has sent -RSP or LUSTAT X'0831000' and then power is restored, LUSTAT with X'082B0000' will be sent to the PLU.

For all LU types, if 3274 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 defined in item 1.

For LU type 2, if the 3274 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 requests will be rejected with the proper sense code.

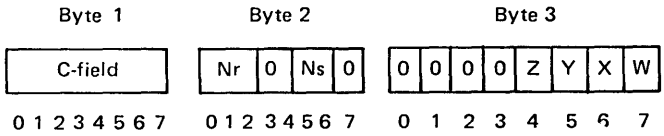
For LU type 2, if the 3274 finds the subsidiary device has been configured from Local or Shared mode to System mode, LUSTAT X'0001B000' will be sent if an LUSTAT is owed. The next outbound request will be rejected with the proper sense code.

**Note:** *An LUSTAT showing power off during send state carries CD. An LUSTAT showing power on cannot be sent until the PLU causes an SLU state change to (S, *R).*

### 5.10.4 Command Reject

The Command Reject (CMDR) response is sent by the 3274 control unit to report the following error conditions:

1. Receipt of a command code with valid BCC but which is an invalid command or a command not implemented for the 3274.
2. Receipt of a frame with valid BCC that contains an I-field and a command which should not be sent with an I-field.
3. Receipt of an I-format frame with valid BCC which contains an illegal Nr count in the C-field.
4. Receipt of an I-format frame in which the information field is too large to be accommodated by the available buffer space in the 3274.




Byte 1 is the C-field that caused the CMDR response. Byte 2 contains the Ns and Nr sequence counts that existed immediately prior to establishing the CMDR response. Byte 3 indicates the reason for the CMDR.

Bit W is set to 1 when the C-field returned in byte 1 represents an invalid or nonimplemented command.

Bit X is set to 1 when the C-field returned in byte 1 is considered invalid because the frame contained an information field not allowed with the command sent.

Bit Y is set to 1 when the information field associated with the valid and implemented C-field contained in byte 1 was too long for the available buffer space in the 3274 control unit. This condition never occurs when bit X is set.

Bit Z is set when the receive Nr sequence count contained in the C-field in byte 1 is out of range.

Figure 5-32 shows the CMDR message format.

### 5.10.5 Request Maintenance Statistics (REQMS) Command

The Request Maintenance Statistics (REQMS) command is sent by the SSCP to a 3274 when the Network Determination Aid Processor (NDAP) requests PU performance statistics. Four types of requests can be made, as follows:

- Type 1 — Link Test Statistics
- Type 2 — Summary Counters
- Type 3 — Communication Adapter Data Error Counts
- Type 5 — 3274 Configuration Information/3276 Machine Level 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 3274 is rejected with a negative response; an accepted REQMS request receives a positive response and the requested statistics (formatted as RECFMS) as an inbound message.

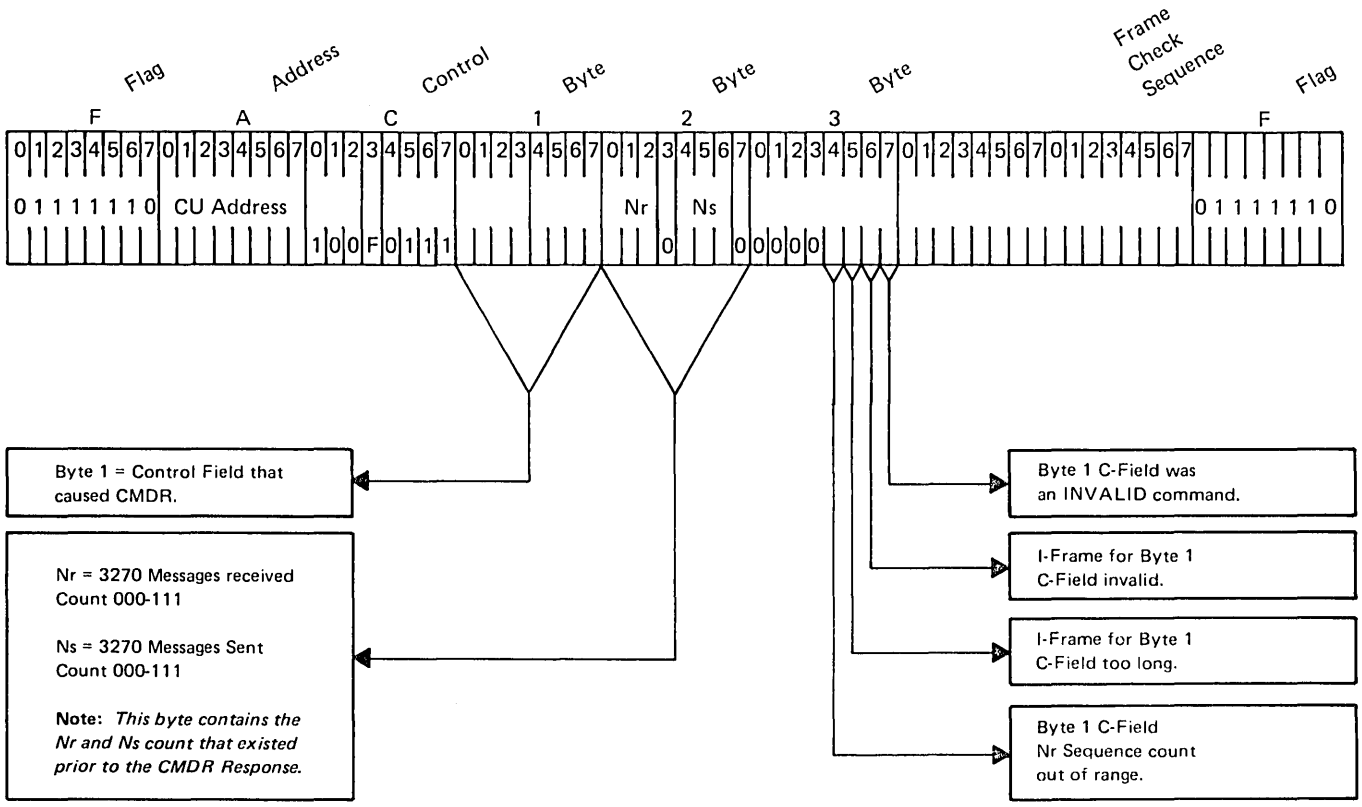



**Figure 5-32. Command Reject (CMDR) Message Format**

### 5.10.5.1 Record Formatted Maintenance Statistics (RECFMS)

Record Formatted Maintenance Statistics (RECFMS) is sent by the 3274 to the SSCP in response to an REQMS command. (The 3274 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 3274 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 3274 after the RECFMS is transmitted.

A description of RECFMS responses follows.

### 5.10.5.2 RECFMS Formats

The 3274 Control Unit can send the host system four types of RECFMS responses to an REQMS command.

Counters in type 1, 2, and 3 responses do not wrap when they exceed their maximum value, they maintain the maximum value.

The log areas are reset when:

- The 3274 is turned off (types 1, 2, and 3).
- The concurrent test, Error Log Erase, is executed for the 3274 CCA/HPCA Adapter (type 3 only).
- The execution of RECFMS is completed normally as the response to an REQMS with a "RESET" request (types 1, 2, and 3).

The formats of the four RECFMS responses are as follows:

- REQMS Request Type 1 — Link Test Statistics

  Bytes 14, 15 = Number of times the Test Command was received.

  Bytes 16, 17 = Number of times the Test response was transmitted.

- REQMS Request Type 2 — Summary Counters

  Byte 14 = Mask bits of the summary counters supported. All supported counters, including those containing zero count, are sent to the host by RECFMS.
  - Bit 0 = 1 = Machine Check.
  - Bit 1 = 1 = Communication Check.
  - Bit 2 = 1 = Program Check.
  - Bits 3–7 = Reserved.

  Bytes 15, 16 = Reserved.
  Bytes 17, 18 = Machine Check Summary Counter.
  Bytes 19, 20 = Communication Check Summary Counter.
  Bytes 21, 22 = Program Check Summary Counter.

- REQMS Request Type 3 — Communication Adapter Data Error Counts

  Byte 14 = Adapter Type.
  - = X'01' = CCA Link Adapter.
  - = X'02' = HPCA Link Adapter
  - = X'03' — X'FF' = Reserved.

  Byte 15 = Mask bits of the Communication Adapter Error Counters supported. All supported counters, including those containing zero count, are sent to the host by RECFMS.
  - Bit 0 = 1 = Nonproductive Timeout.
  - Bit 1 = 1 = Idle Timeout.
  - Bit 2 = 1 = Write Retry.
  - Bit 3 = 1 = Overrun.
  - Bit 4 = 1 = Underrun.
  - Bit 5 = 1 = Connection Problem.
  - Bit 6 = 1 = FCS Error.
  - Bit 7 = 1 = Primary Abort.

  Byte 16 = Mask bits of the Communication Adapter Error Counters supported. All supported counters, incuding those containing zero count, are sent to the host by RECFMS.
  - Bit 0 = 1 = Command Reject.
  - Bit 1 = 1 = DCE Error.
  - Bit 2 = 1 = Write Timeout.
  - Bits 3–7 = Reserved.

  Byte 17 = Reserved.
  Byte 18 = Nonproductive Timeout Counter.
  Byte 19 = Idle Timeout Counter.
  Byte 20 = Write Retry Counter.
  Byte 21 = Overrun Counter.
  Byte 22 = Underrun Counter.
  Byte 23 = Connection Problem Counter.
  Byte 24 = FCS Error Counter.
  Byte 25 = Primary Abort Counter.
  Byte 26 = Command Reject Counter.
  Byte 27 = DCE Error Counter.
  Byte 28 = Write Timeout Counter.

- REQMS Request Type 5 — 3274 Configuration Information

  Byte 14 = Always X'00'.
  Bytes 15–30 = Installed Patch ID Values.
  Byte 31 = Number of RPQs Installed on the 3274.
  Byte 32 = Reserved.
  Bytes 33–37 = RPQ 1 ID.
  Bytes 38–42 = RPQ 2 ID.
  Bytes 43–47 = RPQ 3 ID.
  Bytes 48–50 = Control Values for Suffix Numbers.
  Bytes 51–60 = Reserved.
  Byte 61 = Feature Disk Level.
  Byte 62 = Feature Disk Suffix.
  Byte 63 = System Disk Level.
  Byte 64 = System Disk Suffix.
  Byte 65 = Language Disk Level.
  Byte 66 = Language Disk Suffix.
  Byte 67 = RPQ 1 Disk Level.
  Byte 68 = RPQ 1 Disk Suffix.
  Byte 69 = RPQ 2 Disk Level.
  Byte 70 = RPQ 2 Disk Suffix.
  Byte 71 = RPQ 3 Disk Level.
  Byte 72 = RPQ 3 Disk Suffix.

## 5-11 SWITCHES AND CONTROLS

Figure 5-33 explains the switches and controls.

| Indicator/Control | Explanation |
|---|---|
| Power/Interface switch and On/Off switch (I = on; O = off) On Indicator | When locally attached to a host system, power for the 3274 can be applied and removed from the host processor (remote power control) or at the 3274 (local power control) by using the Power/Interface switch as follows:<br>1. Remote power control. When the Power/Interface switch is placed in the Remote/Online position and the On/Off switch to On, power can be turned on or off at the host processor.<br>2. Local power control. To apply power, the Power/Interface switch is placed in the Local/Online position and the On/Off switch is placed in the On position. The On indicator lights. To remove power, the Power/Interface switch is placed in the Local/Offline position and the On/Off switch is set to Off, after the Local/Offline indicator lights.<br>When remotely attached to a host system, power is applied and removed at the 3274 by using the On/Off switch. (The Power/Interface switch is not installed.) |
| IML and Alt IML Address 1/2 | The Initial Machine Load (IML) pushbutton and the Alternate (Alt) IML rocker switch are used to initiate manual IML operations at the 3274.<br>**Warning: The Power/Interface switch must be in the Local/Offline position and the Local/Offline indicator must be on.**<br>Pressing and holding the IML pushbutton causes a basic test to be run. Releasing IML allows execution of the IML tests, followed by loading of the machine. (Total operation time is approximately 50 seconds.)<br>**Warning: Pressing the IML pushbutton causes an interruption and temporarily disables all terminals attached to the 3274. If any attached terminals are in use, all terminal operators should be notified before proceeding.** |
| IML and Alt IML Address 1/2 | Holding the Alt IML Address switch in position 1, while pressing and holding the IML pushbutton, loads the machine directly. This procedure should be followed only when the normal loading procedure fails and useful work can still be done.<br>Holding the Alt IML Address switch in position 2 while pressing the IML pushbutton causes a communication link test to be run. The test is operable only when the Power/Interface switch is in the Remote position. |

**Figure 5-33. Switches and Controls**

## 5.12 BSC AND SNA READINESS SYMBOLS

Figures 5-34 and 5-35 show the readiness symbols associated with the BSC and SNA selection sequences, respectively.

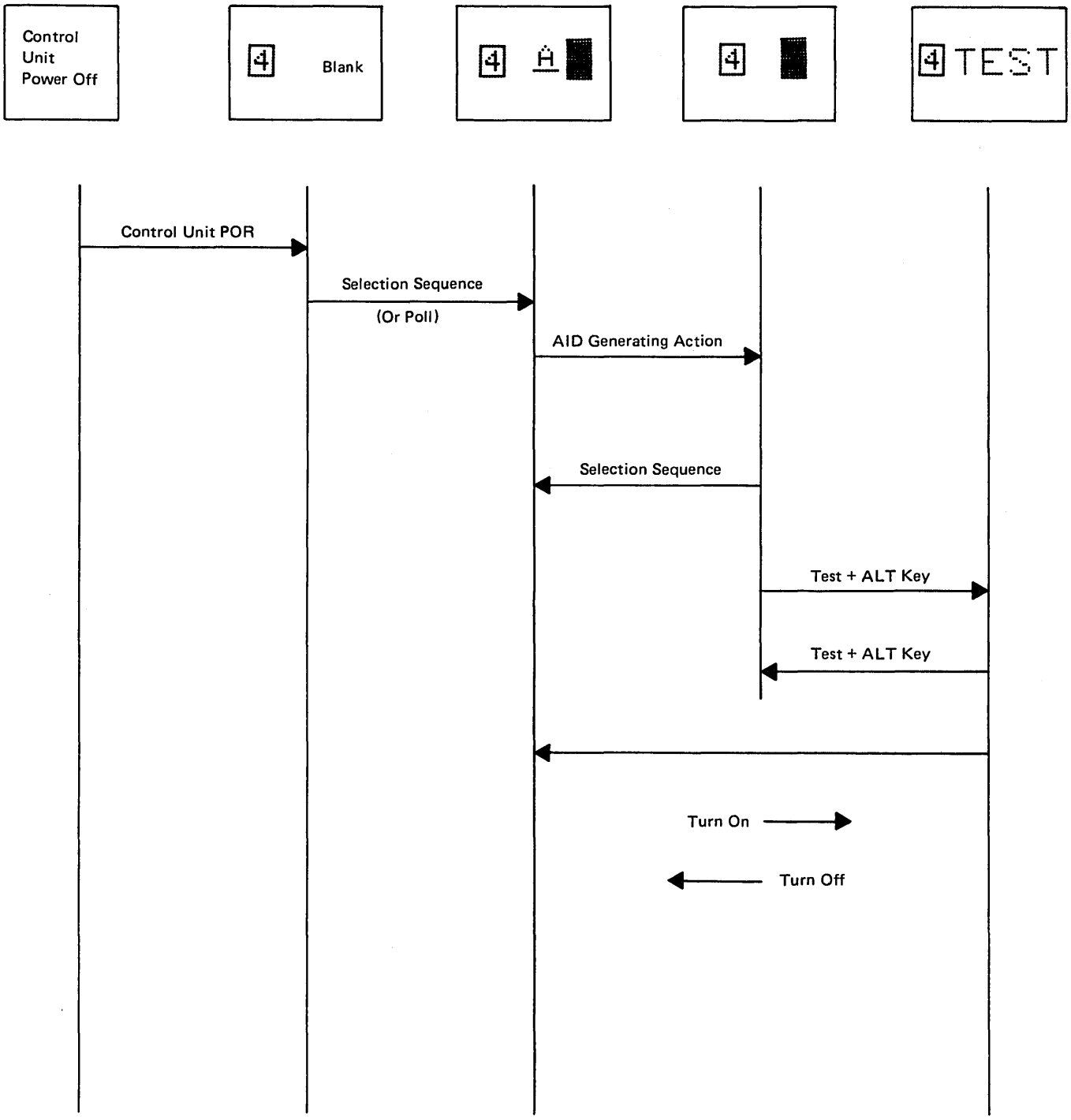
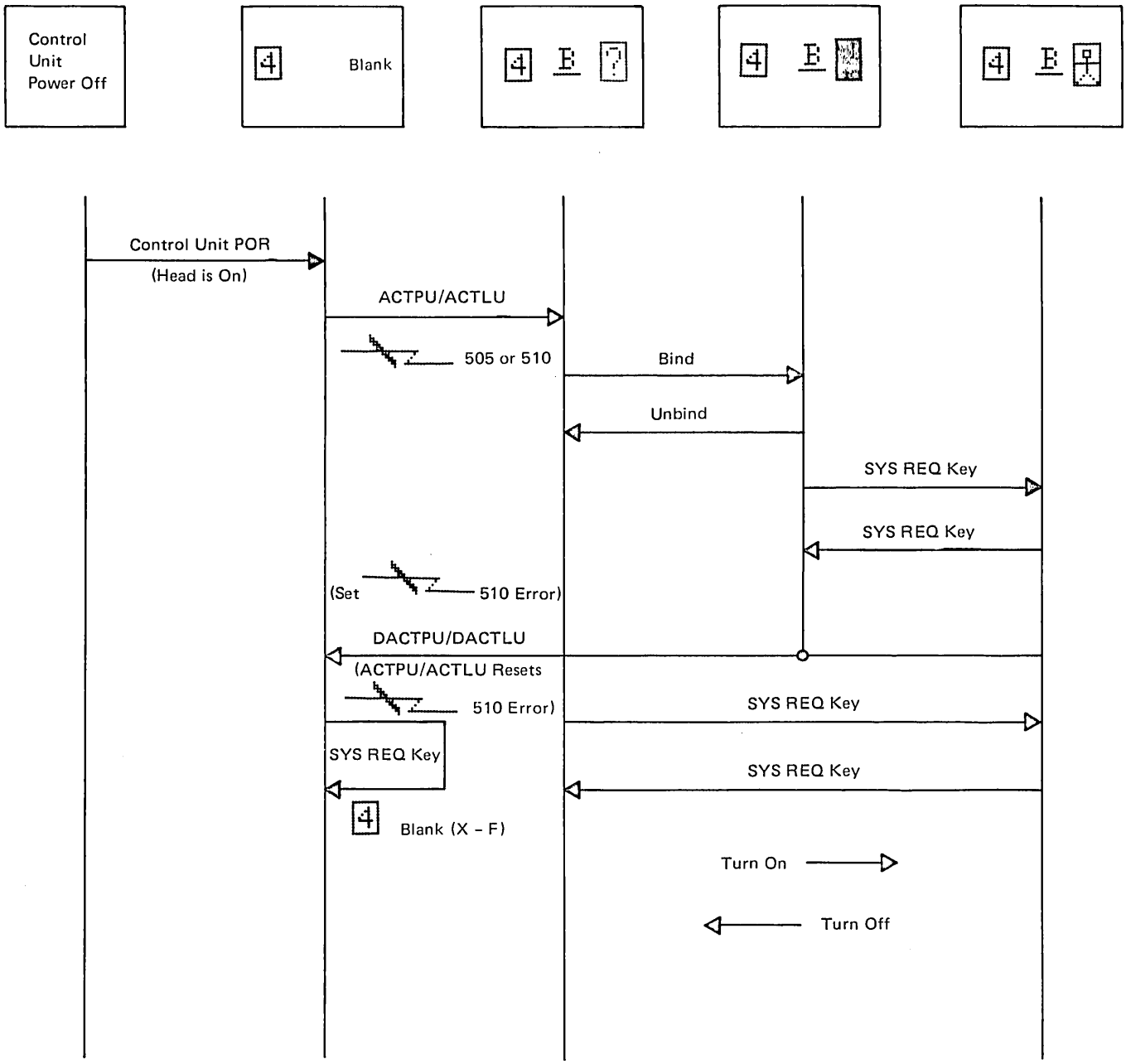



**Figure 5-34. BSC Readiness Symbols**




**Note:** *The TEST key with ALT will set* TEST. *The second depression will return to the state prior to the entry to Test mode.*

**Note:**

*505 = SNRM Required*

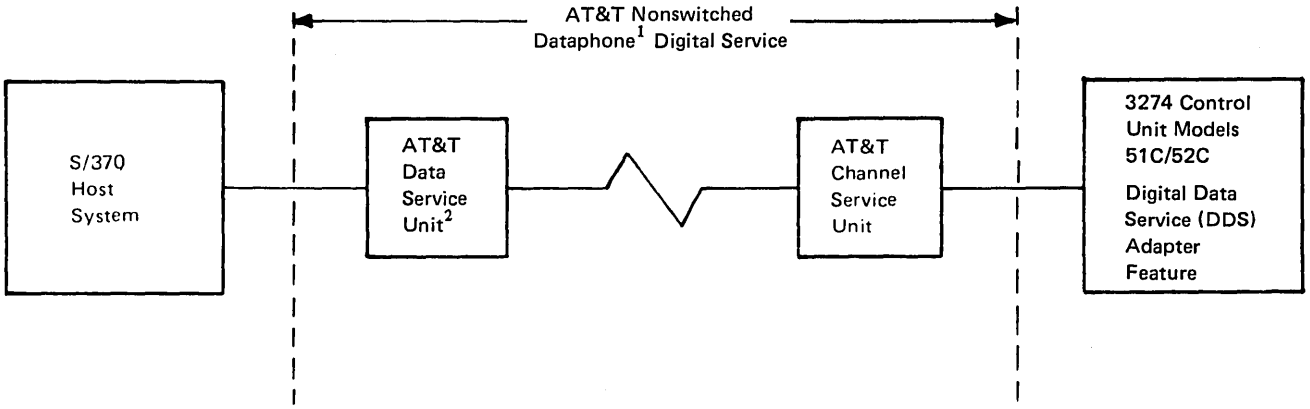
*510 = PU Not Active*

**Figure 5-35. SNA Readiness Symbols**

## 5.13 DIGITAL DATA SERVICE (DDS) ADAPTER

The Digital Data Service (DDS) Adapter provides for the connection of the 3274 Control Unit Model 51C to the AT&T nonswitched Dataphone[1] digital data service network. The DDS Adapter is an integrated adapter for BSC or SDLC data transmission at speeds of 2400, 4800 or 9600 bps. Access to the Digital Data Service (DDS) network is provided by the AT&T Channel Service Unit, which is the DDS network termination point at the customer site. See Figure 5-36.

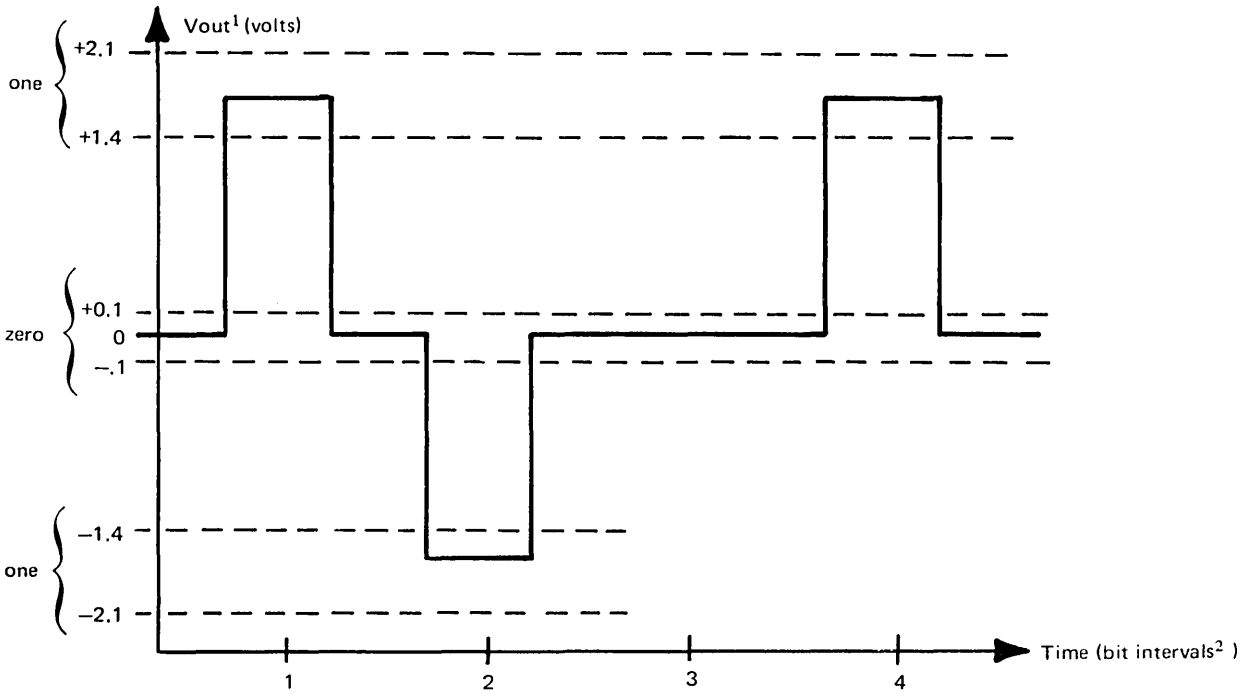
The 3274 must have either the Common Communications Adapter (CCA) or the High-Performance Communications Adapter (HPCA) installed. The DDS Adapter can be used in point-to-point or multipoint configurations. Wrap test capability of the DDS Adapter allows testing of the adapter only, or the adapter and the communications cable. Figure 5-37 illustrates the digital data waveshapes.



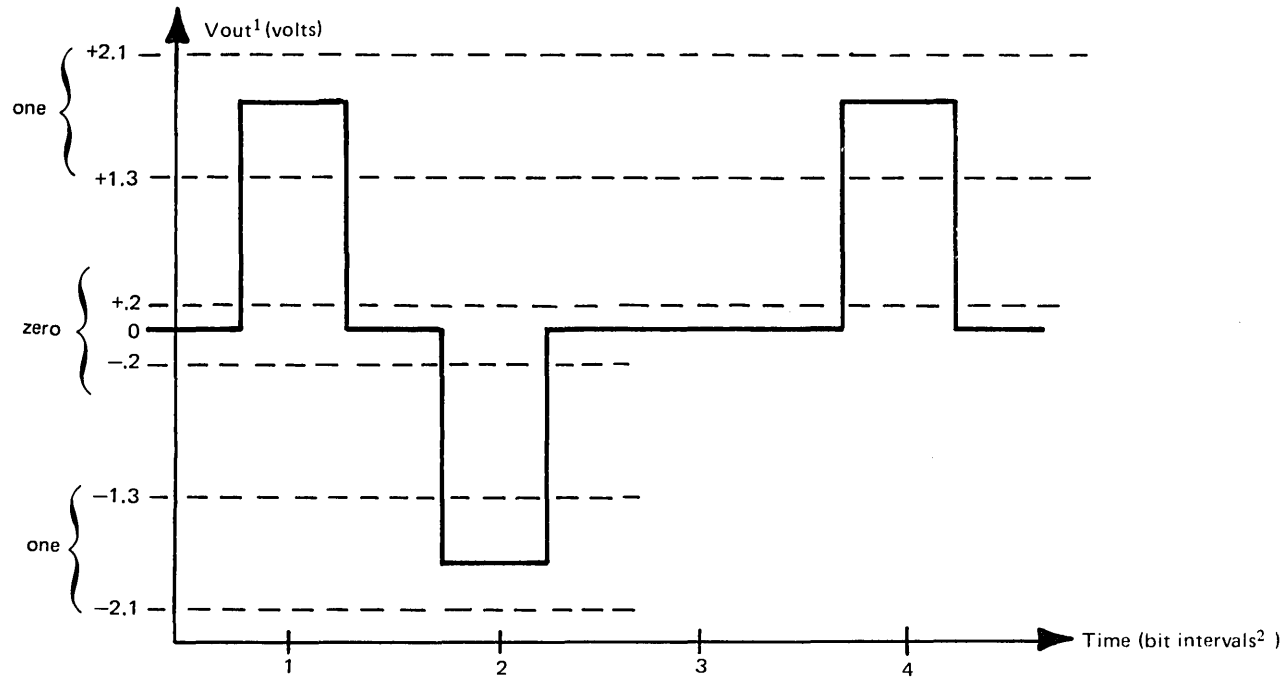

[1]Trademark of American Telephone and Telegraph Co.
[2]Or equivalent

**Figure 5-36. Connection of 3274 Control Unit Models 51C and 52C with DDS Adapter Feature**

DDSA Output to Channel Service Unit




Channel Service Unit Input to DDSA




[1] Vout is a differential ac voltage across a 135-ohm resistive termination

[2] Bit interval = $\frac{1}{\text{bit rate(bps)}}$

**Figure 5-37. Digital Data Waveshapes**

# Chapter 6. Tools and Test Equipment

## 6.1 INTRODUCTION

This chapter identifies and describes the specialized tools and test equipment that may be required for 3274 problem isolation.

These specialized pieces of test equipment are presently used with the 3274 Control Unit:

- Buffered Teleprocessing Diagnostic Analyzer and Tester (BTDAT)
- NU Data Tester, IBM PN 453637
- PT-2

## 6.2 BUFFERED TELEPROCESSING DIAGNOSTIC ANALYZER AND TESTER (BTDAT)

The Buffered Teleprocessing Diagnostic Analyzer and Tester (BTDAT) was designed as a branch office teleprocessing (TP) specialist's tool. The purpose of this tool is to trap transmit data and/or receive data for analysis and to further use this data to exercise local or downline TP devices.

The BTDAT consists of two 32K bit memories and various registers and controls to allow data in and out of these buffers.

## 6.3 NU DATA TESTER

The NU Data Tester (IBM PN 453637) is used to monitor and isolate problems between data terminal equipment and data transmission equipment that follow the standards outlined in EIA Standard RS-232-c.

Seven EIA leads are displayed for continuous monitoring: transmit and receive data, data terminal ready, data set ready, request to send, clear to send, and carrier detected.

This tester connects in series with the EIA/CCITT data set cable and the 25-pin data set connector. The CE may then monitor, measure, or control the leads on the data set interface.

## 6.4 PT-2 ATTACHMENT TO NON-EIA INTERFACES

This procedure will allow attachment of a PT-2 to the 3274 Models 51C and 52C in such a way as to allow monitoring of transmit and receive data when a Non-EIA Interface is present.

1. Assemble PT-2 using TP Line Monitor (TPLM) Adapter.
2. Set Optional Probe Switches on TPLM Adapter to the SLT/VTL (UP) position.
3. Attach optional probes as follows:

| TPLM | Line Name |
|---|---|
| #2 | Xmit Data |
| 3 | Req to Send |
| 4 | Clear to Send |
| 5 | Xmit Clock |
| 6 | Rec. Data |
| 7 | Carrier Detect |
| 8 | Receive Clock |
| #9 | Data Set Ready |

The appropriate tab pins are shown in Figure 6-1.

4. Load TP Tool Program and enter appropriate responses to questions displayed.
   a. Specify Product Clock
   b. When running above 9600 bps (via V.35, X.21 or DDSA features) it is necessary to use the High-Speed Monitor Function of the PT-2. Refer to PT-2 Line Monitor Manual, Section 6.

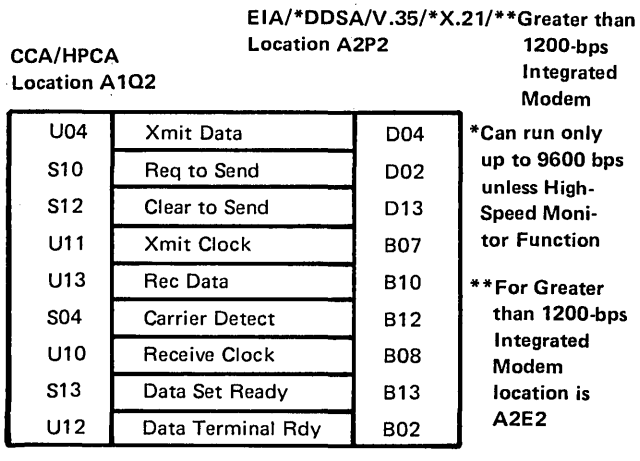



**Figure 6-1. TPLM Tab Pin Locations**

# Appendix A. Support Structure Information Form

CE Name _____ CE Telephone Number _____

Customer Name _____ Customer Telephone Number _____

Customer Number _____ Branch Office Number _____

Host System Type _____ Subsystem Type/Model _____

Incident Machine Type/Model _____

Serial Number _____ EC Level _____

Installed Microcode _____

Part Number _____ EC Level _____

REAs 1 _____ 2 _____ 3 _____ 4 _____

5 _____ 6 _____ 7 _____ 8 _____

If your subsystem is a local configuration, include the following information:

Control unit type/model _____

Channel type: Selector _____ Byte _____ Block _____

Channel cable length (max 200 ft) _____

Control unit position on channel (1-8) _____

Last unit on channel? Yes _____ No _____

If your subsystem is a remote configuration, include the following information:

Multiplexer type: 270x _____ 370x _____ OEM _____

Line type: Point to point _____ Multipoint _____ Switched _____

Number of wires: 2 _____ 4 _____

Modem type: IBM _____ OEM _____

Line speed (baud): 1200 _____ 2000 _____ 2400 _____ 4800 _____

7200 _____ 9600 _____ Other _____

Communications adapter type: CCA _____ HPCA _____ EIA _____

SLA _____ Other (specify) _____

Channel type: Selector _____ Byte _____ Block _____

Channel cable length (max 200 ft): _____

Control unit position on channel (1-8) _____

Control unit priority: High _____ Low _____

Multichannel switch: Yes _____ No _____

Number and type of attached devices.

Number of ports _____ Total number of displays _____

Number by IBM machine type:

3277-1 _____ 3278-1 _____

3277-2 _____ 3278-2 _____

3278-3 _____

3278-4 _____

Total number of printers _____

Number by IBM type:

3284-1 _____ 3286-1 _____ 3287-1 _____ 3288-2 _____

3284-2 _____ 3286-2 _____ 3287-2 _____ 3289-1 _____

3284-3 _____ 3289-2 _____

Subsystem features.

Subsystem machine type/model _____

List appropriate features _____

_____

_____

_____

_____

Does subsystem machine have any RPQs? Yes _____ No _____

If yes, list RPQs _____

_____

_____

_____

If the incident machine and the subsystem machine are not the same, list the appropriate features and/or RPQs for the incident machine.

Incident machine type/model _____

Features _____

_____

_____

_____

_____

Does the incident machine have RPQs? Yes _____ No _____

If yes, list the RPQs _____

_____

_____

_____

Host system program support information.

SCP type: OS _____ DOS _____ VS1 (SVS) _____ VS2 (MVS) _____ VM _____

APL _____ Other (specify) _____ Release level _____

Access method: BTAM _____ TCAM _____ TCAM-E _____ VTAM _____

GAM _____ Other (specify) _____ Version number _____

Application type: APLSV _____ CICS _____ CMS _____ TSO _____ IMS _____

MIS _____ Other (specify) _____ Version number _____

NCP type (370x only) _____ Release level _____

PEP type (270x only) _____ Release level _____

EP type (270x only) _____ Release level _____

General description of problem and the maintenance aids used.

Incident machine type/model _____

Brief description of problem: _____

_____

_____

Tools used: _____

_____

_____

_____

# Appendix B. 3274 Models 51C and 52C Error Codes

The three-digit error codes (nnn) are displayed in the operator information area on the display and follow the Machine Check ( ✕ ⍂ ), Program Check ( ✕ PROG ), and Communication Check ( ✕ ⍀ ) symbols. These codes further define the error conditions indicated by the error symbols.

The first digit of the nnn code indicates the type of error that occurred, as follows:

| nnn Code | Type of Error |
|---|---|
| 2XX, 3XX | Machine check |
| 4XX | Program check |
| 5XX | Communication check |

For example, a Communication Check symbol followed by an nnn code of 532 ( ✕ ⍀ 532) indicates that the BSC line is idle.

This appendix lists the nnn in numeric order with the following information to assist you in problem determination:

- Error description
- 8 4 2 1 indicator setting
- Test number used to retrieve the logout
- The error statistic counter that is incremented
- Where the code is displayed (one/all displays)
- Indication displayed in the operator information area on the display ( ✕ ⍂ 203)
- Probable cause and action to be performed
- Sense information
- Application features associated with the error condition

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 202 | Interrupt Threshold Exceeded<br>• Terminal with 202 error display caused keystroke/ status buffer overflow.<br>• The terminal is disabled. | – | nn/1 | – | – | – | X | – | • POR device | • Internal terminal error (see device MIM) | 081C | DC/US | Category A Terminal |
| 203 | Feature Bus Error<br>• Feature-bus error at terminal. | – | nn/1 | 6 | – | – | X | X 203 | • Reset key<br>• Retry operation | • Terminal Feature circuitry failure (see device MIM) | – | – | Features |
| 204 | Device Check<br>• Terminal-buffer parity error was detected.<br>• Control unit clears buffer.<br>• If recovery not successful, terminal is disabled. | – | nn/1 | 4 | – | – | X | X 204 | • Reset key<br>• Host recovery<br>• POR device If disabled | • Terminal buffer parity error (see device MIM) | 028B<br>081C | DC/US<br>DC/US | Category A Terminal |
| 205 | Unsupported Feature Address Attached<br>• Feature is not supported with configuration selected at customizing time, *or*<br>• Feature did not respond when the terminal was initialized. | – | nn/1 | – | – | – | X | X 205 | • Reset key<br>• Retry operation | • Verify customizing selected feature<br>• Reminder is on if display can be used | – | – | Feature |
| 206 | Invalid Feature Response on Initialization<br>• Invalid response from feature during initialization.<br>• Terminal remains enabled, *but* all features are disabled. | – | nn/1 | 6 | – | – | X | X 206 | • Reset key<br>• Retry operation | • Feature did not initialize properly (see device MIM) | – | – | Feature |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 207 | Lost Operation Completed<br>• Control unit started on operation to terminal that required deferred ending status (Op Complete).<br>• Over 1 second elapsed, and Op Complete not received.<br>• The terminal is disabled. | – | nn/1 | 5 | – | – | X | ✕ ⊠207 | • POR device | • Terminal failure (see device MIM)<br>• Loss of communication with device (Coax) | 081C | DC/US | Category A Terminal |
| 208 | Invalid Operation Completed<br>• Asynchronous Ending Status received when no operation. | – | nn/1 | 5 | – | | X | ✕ ⊠208 | • Reset key<br>• Retry operation | • Terminal error (see device MIM) | – | – | Category A Terminal |
| 209 | Command Queue Failed<br>• A Cycle Sharing command or data queue failed in transmission.<br>• Operation is retried, and counter is incremented.<br>• If retry fails, terminal is disabled. | | nn/1 | 1 or 2 | – | | X | ✕ ⊠209 | • POR device | • CU to terminal communication failure (Coax) | 081C | DC/US | Category A Terminal |
| 210 | Invalid Keyboard Attached<br>• The ID of the terminal's keyboard does not match the types selected during customizing.<br>• No table is available for this keyboard type. | | nn/1 | – | – | | X | ✕ ⊠210 | • Reset key<br>• Retry operation | • Verify keyboard type selected in customizing | – | – | Type A Adapter |
| 211 | Invalid Status Received<br>• Invalid combination of status bits received from terminal.<br>• Keyboard is locked.<br>• If Reset key fails, terminal is disabled. | | nn/1 | 5 | – | | X | ✕ ⊠211 | • Reset key<br>• Retry operation<br>• POR device | • Terminal error (see device MIM) | –<br><br>081C | –<br><br>DC/US | Category A Terminal |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 212 | Invalid Scan Code Received<br>• Invalid scan code was received from this terminal.<br>• Keyboard is locked. | | nn/1 | – | – | | X | ✕ ↯212 | • Reset key<br>• Retry operation | • Terminal keyboard error<br>• Customization error (see device MIM) | – | – | Category A Terminal Keyboard |
| 222 | Invalid Selector Pen Status or Command Queue Failure<br>• Illegal status received from selector pen or<br>• Selector pen I/O operation failed after retry. | | nn/1 | 6 | – | | X | ✕ ↯222 | • Reset key<br>• Retry operation | • Selector lightpen error (see device MIM) | – | – | Category A Terminal Light Pen |
| 223 | ECS Adapter Buffer Parity Error<br>• Control unit clears buffer and notifies host.<br>• If clear does not eliminate parity check, the terminal is disabled. | | nn/1 | 6 | – | | X | ✕ ↯223 | • Host recovery<br>• Retry operation<br>• POR device if disabled | • ECS adapter buffer (see device MIM) | 082B<br>081C | DC/US<br>DC/US | ECS Feature |
| 224 | Invalid MSR or MHS Status or Command Queue Failure<br>• Illegal status received from Mag Strip Reader or MHS.<br>• MSR or MHS I/O operation failed after retry. | | nn/1 | 6 | – | | X | ✕ ↯224 | • Reset key<br>• Retry operation | • MSR<br>• MHS (see device MIM) | | | Category A Terminal MSR or MHS |
| 225 | ECS Adapter Status/ Initialization Error<br>• Device is disabled if not recoverable. | | nn/1 | 6 | – | | X | ✕ ↯225 | • Reset key<br>• POR device if disabled | • ECS adaper error (see device MIM) | 081C | DC/US | Category A Terminal |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 226/ 227 | ECSA Feature Command Queue Failure<br>• A cycle-sharing command/ data operation failed in transmission.<br>• Operation is retried, and counter is incremented.<br>• If retry fails, the terminal is disabled. | | nn/1 | 1 or 2 | – | | X | ✕ ↯226 or ✕ ↯227 | • Device POR | • Transmission error while communicating with ECS Feature | 081C | DC/US | Category A Terminal ECS Feature |
| 228 | Convergence Backup Store Failure | | nn/1 | 6 | | | | ✕ ↯228 | • Reset key<br>• Retry operation | • Battery failure (see device MIM) | | | 3279 Color |
| 229 | Convergence Feature Memory Failure | | nn/1 | 6 | | | | ✕ ↯229 | • Reset key<br>• Retry operation | • Convergence logic (see device MIM) | | | 3279 Color |
| 231 | Printer Equipment Check<br>• Printer reported an unrecoverable error to the control unit. | | nn/1 | 6 | | – | X | – | • See Printer PDG | • Printer error | 081C | EC/IR/ US | Category A Printer |
| 234 | ECS without ROS | – | nn/1 | – | – | – | X | ✕ ↯234 | • POR device<br>• At 3278 terminal, activate test switch from Normal to Test and back again | • The ECS adapter does not have the required ROS | – | – | Category A Adapter |
| 270 | Unrecoverable Machine Check<br>• The control unit detected an unrecoverable error from the Type B adapter.<br>• Type B adapter is disabled.<br>• Type A terminals are not affected. | 1010 | A2/1 | 6 | X | – | – | – | • IML | • Type B adapter logic | – | – | Type B Adapter |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 271 | Adapter Disabled — Interrupt Threshold Exceeded<br>• Category B device exceeded interrupt threshold value within 1 second.<br>• Type B adapter disabled.<br>• Type A terminals are not affected. | 1010 | A2/1 | — | X | — | — | — | • IML | • Type B device<br>• Use /3 test — bad device indicated by '— '<br>• Device log for failing device should indicate 279 | | | Category B Terminal |
| 272 | Unrecoverable Overrun<br>• Type B adapter requested data, the request was not serviced within control unit cycle steal I/O time, and recovery attempts were unsuccessful. | 1010 | A2/1 | 2 | X | — | — | — | • Host recovery | • Type B adapter logic | 082B | DC/US | Type B Adapter |
| 273 | Adapter Timeout<br>• Type B adapter did not return I/O operation ending status within 2 seconds.<br>• Type B adapter is disabled.<br>• Type A adapter is unaffected. | 1010 | A2/1 | — | X | — | — | — | • IML | • Type B adapter logic | — | — | Category B Terminal |
| 274 | Solid Busy<br>• An EAU command sent to the terminal, and Busy condition does not clear.<br>• Terminal is disabled because of error. | | nn/1 | — | X | — | — | — | • POR device | • Type B device error | 081C | DC/US | Category B Terminal |
| 275 | Equipment Check and Printer Not Ready<br>• Printer has returned Sense of Equipment Check and Not Ready. | | nn/1 | 6 | X | — | — | — | • See Printer PDG | • Printer error | 081C | EC/IR/ US | Category B Printer |
| 276 | Equipment Check — Printer<br>• Printer has returned Sense of malfunction while printing.<br>• Print-buffer contents not affected. | | nn/1 | 5 | X | — | — | — | • See Printer PDG | • Printer error | 082B | EC/US | Category B Printer |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 277 | Device Check<br>• Device buffer parity error.<br>• Host error recovery should clear error.<br>• Device disabled if recovery is unsuccessful. | | nn/1 | 4 | X | – | – | – | • Host recovery<br>• POR device | • Type B device buffer | 082B<br>081C | DC/US<br>DC/US | Category B Terminal |
| 278 | Coax Parity<br>• Parity error while communicating with device via coax.<br>• Device disabled if retry fails. | | nn/1 | 2 | X | – | – | – | • Host recovery<br>• POR device | • Coax<br>• Device error<br>• Type B Dr/Rcvr | 081C | DC/US | Type B Adapter |
| 279 | Interrupt Threshold Exceeded<br>• Device exceeded interrupt threshold value.<br>• Type B adapter disabled. | 1010 | nn/1 | – | X | – | – | – | • IML | Device with nnn = 279 in log caused adapter to be disabled<br>• Type B device<br>• Search device error log to determine failing device.<br>• Use /3 test also. | 081C | DC/US | Category B Terminal |
| 292 | Illegal Entry in Error Queue<br>• Illegal combination of status in error queue for Type A adapter. | | A1/1 | 1 | – | X | – | X ↯ 292 | • Reset key<br>• Retry operation | • Type A adapter | – | – | Type A Adapter |
| 293 | Unconfigured Device<br>• Input received from a device address not in configuration table. | | A1/1 | 2 | – | X | – | X ↯ 293 | • Reset key<br>• Retry operation | • Ensure that port address is included in customizing | – | – | Type A Adapter |
| 294 | Unexpected End Cycle Share<br>• Control unit received End of Cycle Share when none was initiated. | | A1/1 | 3 | – | X | – | X ↯ 294 | • Reset key<br>• Retry operation | • Type A adapter | – | – | Type A Adapter |
| 295 | Invalid DCA Status<br>• Undefined combination of status bits received from Type A adapter. | | A1/1 | 4 | – | X | – | X ↯ 295 | • Reset key<br>• Retry operation | • Type A adapter | – | – | Type A Adapter |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 296 | Lost Status<br>• Type A adapter keystroke/ status buffers reached threshold (64CTR overflow).<br>• Status was lost during an attempted restart. | | A1/1 | 5 | – | X | – | X ↯ 296 | • Reset key<br>• Retry operation | • Type A adapter | – | – | Type A Adapter |
| 297 | Adapter Stopped and Was Restarted<br>• The DCA was detected to be stopped with active set for longer than allowed.<br>• The DCA was reset and successfully restarted. | | A1/1 | 6 | – | X | – | X ↯ 297 | • Reset key<br>• Retry operation | • Type A adapter<br>• Type A device | – | – | Type A Adapter |
| 298 | Command Queue Cycle Share Machine Check<br>• Machine check during command queue cycle share operation.<br>• Operation is retried. If unsuccessful, coax port disabled.<br>• Device status may have been lost. | | A1/1 | 7 | – | X | – | X ↯ 298 | • POR device | • Type A adapter<br>• Type A device<br>• Use device logs and/3 test to isolate | – | – | Type A Adapter |
| 299 | Non-Command Queue Cycle Share Machine Check<br>• Cycle Share machine check when no command queue operation was in progress.<br>• CU cannot isolate failing port.<br>• Device status may have been lost. | | A1/1 | 8 | – | X | – | X ↯ 299 | o Reset key<br>o Retry operation | • Type A adapter | | | Type A Adapter |
| 2%% (2EE) | Unsupported Feature Attached<br>• Feature is not supported with configuration selected during customizing.<br>• Feature did not respond when terminal was initialized.<br>• Keyboard ID does not match control unit keyboard table. | | nn/1<br>displays as NNN of 2EE in error log display | – | – | | X | X ↯ 2%% | • Reset key<br>• Retry operation | • Machine features do not match configuration<br>• Feature logic error | – | – | Features |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 310 | CCA Machine Check<br>• Control logic to CCA adapter operation error; if retry OK, is transparent to adapter control code.<br>• If recovery attempts are unsuccessful, the error is posted and the adapter is disabled. | 1001 | – | – | – | X | – | X 310 | • IML | • CCA adapter | – | – | CCA-BSC |
| 311 | CCA Invalid Status<br>• Invalid basic status bit combination has been received from the CCA adapter.<br>• Adapter disabled. | 1001 | | – | – | X | – | X 311 | • IML | • CCA adapter | – | – | CCA-BSC |
| 320 | CCA Machine Check (SDLC)<br>• Recovery attempts have failed.<br>• Adapter is disabled. | 1001 | – | – | – | X | | X 320 | • IML | • CCA adapter | – | – | CCA-SDLC |
| 321 | CCA Invalid Status (SDLC)<br>• Invalid status has been received from the CCA.<br>• Adapter is disabled. | 1001 | | – | – | X | | X 321 | • IML | • CCA adapter | – | – | CCA-SDLC |
| 326 | X.21 HPCA Machine Check | 1001 | A0/1 | 4, 5 or 10 | – | X | | X 326 | • IML | HPCA Failure:<br>• Invalid status from HPCA (X.21 – Ctr 4)<br>• Unexpected status condition from HPCA (X.21 – Ctr 10)<br>• Overrun – Receive overrun (Ctr 4)<br>• Underrun (Ctr 5) was received and recovery was unsuccessful | – | – | X.21 |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 330 | HPCA Machine Check<br>• Recovery attempts have failed.<br>• Adapter is disabled. | 1001<br>1001 | – | – | – | X | | X 330 | • IML | • HPCA adapter | – | – | HPCA-SDLC |
| 331 | HPCA Invalid Status<br>• Invalid status has been received from the HPCA.<br>• Adapter is disabled. | 1001 | | – | – | X | | X 331 | • IML | • HPCA adapter | – | – | HPCA-SDLC |
| 332 | HPCA Machine Check | 1001 | – | – | – | X | – | X 332 | • IML | • HPCA adapter wrap failed.<br>• Adapter is disabled | – | – | Loop |
| 333 | LSA Failure | – | – | – | – | X | – | X 333 | • IML | • LSA failure (Wrap Test)<br>• Adapter is disabled | – | – | Loop |
| 334 | CTS Transition or Shutoff | – | – | – | – | X | | X 334<br>X 334 | • IML | • LSA failure<br>• Three shutoffs rec'd from the host<br>• Adapter is disabled | – | – | Loop |
| 335 | DCE Error | – | – | – | – | X | | X 335 | • IML | • LSA failure<br>• Adapter is disabled | – | – | Loop |
| 336 | LSC Error | – | – | – | – | X | | X 336 | • IML | • LSC failure (wrap test)<br>• Connecting cable<br>• Adapter is disabled | – | – | Loop |
| 381 | Unrecoverable Control Logic Error<br>• Host communications disabled. | 0010 | A3/1 | – | – | X | | X 381 | • IML | • Control logic<br>• Storage<br>• Microcode | – | – | All |
| 390 | Storage Parity Error<br>• Unrecoverable storage parity error.<br>• Host communications disabled. | 0001 or 0011 through 0111 | – | – | | X | | X 390 | • IML | • Storage<br>• Control logic<br>• See Figure 2-8, of MIM, for storage card. | – | – | All |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 391 | Control Logic Machine Check<br>• Unrecoverable control logic error.<br>• Host communications disabled. | 0010 or 1101 | – | – | | X | | X ↯391 | • IML | • Control logic<br>• Storage<br>• Microcode | – | – | |
| 392 | Control Storage Error (Model 52C) | 0111 | A2/1 | – | – | | X | X ↯392 | • Reset key<br>• Retry operation | Replace card S2** | – | – | Model 52C |
| 393 | Control Storage Error (Model 52C) | 0111 | A2/1 | – | – | | X | X ↯393 | • Reset key<br>• Retry operation | Replace card T2** | | | Model 52C |
| 394 | Control Storage Error (Model 52C) | 0111 | A2/1 | – | – | | X | X ↯394 | • Reset key<br>• Retry operation | Replace card U2** | – | – | Model 52C |
| 395 | Control Storage Error (Model 52C) | 0111 | A2/1 | – | – | | X | X ↯395 | • Reset key<br>• Retry operation | Replace card V2** | – | – | Model 52C |
| 397 | Encrypt/Decrypt Adapter Permanent Error<br>• All attempts for recovery have been exhausted.<br>• Adapter disabled.<br>• Non-Encrypt/Decrypt operations may be run. | 1110 | A3/1 | 3 | – | | X | X ↯397 | • IML | • Encrypt/Decrypt logic | 0848 | – | Encrypt/ Decrypt |
| 398 | Encrypt/Decrypt Parity Error<br>• Master key parity error.<br>• Retry attempts failed.<br>• Adapter is disabled.<br>• Non-Encrypt/Decrypt operations may be run. | | A2/1 | 9 | – | | X | X ↯398 | • IML<br>• Enter master key | • Weak or defective battery<br>• Refer to master key entry and verification procedure. | 0848 | – | Encrypt/ Decrypt |
| 399 | Encrypt/Decrypt Adapter Failure<br>• Retry attempts failed.<br>• Adapter is disabled.<br>• Non-Encrypt/Decrypt operations may still be run. | | A2/1 | 10 | – | | X | X ↯399 | • IML | • Encrypt/Decrypt logic | 0848 | | Encrypt/ Decrypt |

*Where nn = port ID = 00-11

**See MIM, Figure 2-8, code 0111.

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 401 | Command Reject<br>• Invalid command received from host.<br>• See Note 1. | – | A0/1 | – | – | – | X | –<br>✕ PROG 401 | • Host recovery<br>• Reset key<br>• Retry operation | • Host has sent invalid command. | 1003 | Com Rej | All Models |
| 402 | Invalid ID Address<br>• Or out-of-range buffer.<br>• SNA generates X'1005', parameter error.<br>• See Note 2. | – | – | – | – | | X | –<br>✕ PROG 402 | • Host recovery<br>• Reset key<br>• Retry operation | • Host has sent invalid order parameters. | 1005 | Op Ck | BSC<br>SDLC |
| 403 | Data After Read/Read Modified/Equ Invalid or Out of Range<br>• Invalid or out-of-range data.<br>• SNA generates X'1003', Function Not Supported (see Note 1 ) | | nn/1 | – | – | – | X | –<br>✕ PROG 403 | • Host recovery<br>• Reset key<br>• Retry operation | • Host has sent data after RD, Rd mod, EAU command. | 1003 | Op Ck | BSC<br>SDLC |
| 404 | SBA/RA/EAU or SF Order Without Valid Parameters.<br>• BSC generates a Sense Operation Check; SNA generates X'1005', Parameter Error (see Note 2 ) | | nn/1 | – | – | – | X | –<br>✕ PROG 404 | • Host recovery<br>• Reset key<br>• Retry operation | • Host has sent an order (SBA, RA, EAU, or SF) without required data bytes. | 1005 | Op Ck | BSC<br>SDLC |
| 405 | Invalid Copy Command<br>• BSC generates an operation check. | | nn/1 | – | – | – | X | –<br>✕ PROG 405 | • Host recovery<br>• Reset key<br>• Retry operation | • Host has sent a copy command with invalid parameters. | – | Op Ck | CCA-BSC |
| 406 | Invalid Command Sequence<br>• Invalid command sequence was detected. | | nn/1 | – | – | – | X | ✕ PROG 406 | • Reset key<br>• Retry operation | • A CCW was chained to a write CCW that had the start print bit set in the WCC. | – | Op Ck | BSC |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 408 | (BSC) Count Exceeded<br>• Adapter read buffer unavailable.<br>• Sense/status set to OPCHECK and EOT sent to host. | | A0/1 | 10 | – | – | X | X PROG 408 | • Reset key<br>• Retry operation | • 3274 unable to handle host data stream<br>• Data stream has excessive program tab orders | – | Op Ck | BSC |
| 411 | RU Length Error<br>• LU1 RU is greater than BIND specification. | | nn/1 | – | – | – | X | X PROG 411 | • Reset key<br>• Retry operation | • Host software | 1002 | – | SDLC |
| 412 | Short Record<br>• Program check.<br>• A 'short' record was detected.<br>• Control unit sends SNA a negative response of X'1002', RU length error. | | nn/1 | – | – | – | X | X PROG 412 | • Reset key<br>• Retry operation | • Host software | 1002 | | SDLC |
| 413 | Function Not Supported<br>• Crypto verification (CRV) received, but no crypto session has been established.<br>• See Note 1. | – | nn/1 | – | | | X | X PROG 413 | • Reset key<br>• Retry operation | • Host software<br>• Procedural error | 1003 | – | SDLC<br>Encrypt/ Decrypt |
| 414 | Encrypt/Decrypt Data Error<br>• SNA program check.<br>• Invalid pad count or non-modulo-8 RU has been received during an Encrypt/Decrypt session. | | nn/1 | – | – | | – | X PROG 414 | • Reset key<br>• Retry operation<br>• Inform Host support program<br>• Non-Encrypt/ Decrypt operations may be run | • Host software<br>• Procedural error | 1001 | – | SDLC<br>Encrypt/ Decrypt |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 420 | Exception Response Not Allowed<br>• SNA program check | – | nn/1 | – | | | X | ✖ PROG 420 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host has sent invalid or incorrect data<br>• LIC carried exception response when BIND specified definite response | 4006 | – | SDLC |
| 421 | Definite Response Not Allowed<br>• SNA program check | – | nn/1 | – | | | X | ✖ PROG 421 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host has sent invalid or incorrect data<br>• LIC carried definite response when BIND specified exception response | 4007 | – | SDLC |
| 422 | No Response Not Allowed<br>• Program check | – | nn/1 | – | | | X | ✖ PROG 422 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 400A | – | SDLC |
| 423 | FI (Format Indicator) Bit Not Allowed<br>• Program check | – | nn/1 | – | | | X | ✖ PROG 423 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 400F | – | SDLC |
| 430 | Sequence Number Error<br>• SNA program check | – | nn/1 | – | | | X | ✖ PROG 430 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 2001 | – | SDLC |
| 431 | Chaining Error<br>• SNA program check | – | nn/1 | – | – | | X | ✖ PROG 431 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software<br>• Brackets incorrectly used | 2002 | – | SDLC |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 432 | Bracket Error<br>• SNA program check | – | nn/1 | – | – | | X | ✖ PROG 432 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software<br>• Brackets incorrectly used | 2003 | – | SDLC |
| 433 | Data Traffic Reset<br>• SNA program check | – | nn/1 | – | – | | X | ✖ PROG 433 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 2005 | – | SDLC |
| 434 | Half-Duplex Error (Direction Error)<br>• SNA program check | – | nn/1 | – | – | | X | ✖ PROG 434 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software<br>• Normal Flow request was received by SNA while in half-duplex Send state. | 2004 | – | SDLC |
| 439 | Encrypt/Decrypt Protocol Violation<br>• SNA program check | | nn/1 | – | – | | X | ✖ PROG 439 | • Reset key<br>• Retry operation<br>• Inform Host support program<br>• Non-Encrypt/ Decrypt operations may be run | • Host software<br>• An invalid CRU has been received. | 2009 | – | SDLC Encrypt/ Decrypt |
| 440 | Session Limit Exceeded<br>• SNA program check | – | nn/1 | – | – | | | none | • Reset key<br>• Retry operation<br>• Inform Host support program<br>• Non-Encrypt/ Decrypt operations may be run | • Host software | 0805 | – | SDLC |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 441 | Bracket Bid Reject No Ready to Receive (RTR) Returned or Receiver in Transmit<br>• SNA program check | – | nn/1 | – | – | | | none | • Reset key<br>• Retry operation<br>• Inform Host support program<br>• Non-Encrypt/ Decrypt operations may be run | • Host software | 0813 or 081B | –<br>– | SDLC |
| 442 | Request Not Executable<br>• SNA program check<br>• Function request cannot be executed because of a permanent hardware error. | – | nn/1 | – | – | | | X PROG 442 | • Device POR | • Terminal error - refer to 2nn portion of /1 test. | 081C | – | SDLC |
| 443 | Change Direction Required<br>• SNA program check | – | nn/1 | – | – | | X | X PROG 443 | • Device POR | • Host software<br>• Request required a Normal Flow reply, but SNA in Receive state. | 0829 | – | SDLC |
| 444 | Session Already Bound<br>• SNA Program Check | – | nn/1 | – | – | | | – | • Device POR | • Host software | 0815 | – | SDLC |
| 445 | ACTLU not supported | – | xx/1 | 3 | – | | X | X PROG 445 | • Press Reset | • Invalid ACTLU parameters | 081C | – | SNA |
| 450 | Bind Reject-Profile Error<br>• SNA program check: invalid session parameter. | – | nn/1 | – | – | | X | X PROG 450 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 0821 | – | SDLC |
| 451 | Bind Reject-Primary Protocol Error<br>• SNA program check: invalid session parameter. | – | nn/1 | – | – | | X | X PROG 451 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 0821 | – | SDLC |
| 452 | Bind Reject-Secondary Protocol Error<br>• SNA program check: invalid session parameter. | – | nn/1 | – | – | | X | X PROG 452 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 0821 | – | SDLC |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 453 | Bind Reject-Common Protocol Error<br>• SNA program check: invalid session parameter | – | nn/1 | – | – | | X | ✖ PROG 453 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 0821 | – | SDLC |
| 454 | Bind Reject-Screen Size Spec. Error<br>• SNA program check: invalid session parameter | – | nn/1 | – | – | | X | ✖ PROG 454 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 0821 | – | SDLC |
| 455 | Bind Reject-LU Profile Error<br>• SNA program check: invalid session parameter | – | nn/1 | – | – | | X | ✖ PROG 455 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 0821 | – | SDLC |
| 456 | Bind Reject-LU1 Error<br>• SNA program check: invalid session parameter | – | nn/1 | – | – | | X | ✖ PROG 456 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 0821 | – | SDLC |
| 457 | Bind Reject-Encrypt/Decrypt Parameter Error<br>• SNA program check | | nn/1 | – | – | – | X | ✖ PROG 457 | • Reset key<br>• Retry operation<br>• Inform Host support program<br>• Non-Encrypt/ Decrypt operations may be run | • Host software<br>• Bind specification for Encrypt/ Decrypt had an error in byte 26 or 27, Encrypt/ Decrypt was specified, and the Encrypt/Decrypt feature is not present, or a CRV was specified in CRV invalid. | 0821 | – | SDLC Encrypt/ Decrypt |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 458 | Bind Reject-Encrypt/Decrypt Test | – | nn/1 | – | – | | X | ✖ PROG 458 | • Host recovery or<br>• Control Unit key must be changed (the customer's security administrator should be notified)<br>• Non-Encrypt/ Decrypt operations may be run | • The test value (N) from the host does not match the one sent by the 3274.<br>• There is a master key mismatch between the host and the 3274.<br>• See *Planning and Setup Guide.* | 0821 | – | SDLC Encrypt/ Decrypt |
| 460 | Printer Authorization Matrix Error | – | | – | – | | X | ✖ PROG 460 | • Reset key<br>• Retry operation | • An invalid print matrix was sent from the host, or the Load key was hit at a time when the matrix was not on the screen. | | | SNA BSC |
| 470 | Unsupported Order | – | – | – | – | | X | ✖ PROG 470 | • Reset key<br>• Retry operation<br>• Fix application program | • Host software error.<br>• An unsupported order was decoded in the SFAP data stream. | 100C | Op Ck | SNA BSC |
| 471 | SFAP (Structured Field and Attribute Processing) Data Stream Error | – | – | – | – | | X | ✖ PROG 471 | • Reset key<br>• Retry operation<br>• Fix application program | • Host software error.<br>• Refer to App C. | 1003 or 1005 | Op Ck | SNA BSC |
| 472 | Read Partition Structured Field State Error | – | – | – | – | | X | ✖ PROG 472 | • Reset key<br>• Retry operation<br>• Fix application program | • Host software error.<br>• See Appendix C. | 0871 | Op Ck | SNA BSC |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 473 | PS Addressing Error | – | – | – | – | | X | ✕ PROG 473 | • Reset key<br>• Retry operation<br>• Fix application program | • Host software error. | 084C | Op Ck | SNA BSC |
| 474 | No Extended DCB Configured for This Device | – | – | – | – | | X | ✕ PROG 474 | • SFAP data stream should not be sent to this device | • SFAP data stream send – no extended DCB available. | 1003 | Op Ck | SNA BSC |
| 488 | Invalid Data Stream in Kanji/ Chinese field | – | nn/1 | – | – | | X | ✕ PROG 488 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 1003 | – | Model 52C |
| 489 | Invalid Data Stream in Kanji/ Chinese field | – | nn/1 | – | – | | X | ✕ PROG 489 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | 1005 | | Model 52C |
| 498 | Negative Response Received<br>• SNA program check<br>• No SNA sense returned | – | nn/1 | – | – | | X | ✕ PROG 498 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | – | – | SDLC |
| 499 | Exception Request<br>• SNA program check<br>• No SNA sense returned | – | nn/1 | – | – | | X | ✕ PROG 499 | • Reset key<br>• Retry operation<br>• Inform Host support program | • Host software | – | – | SDLC |
| 501 | • 3274 Data Set Ready Line Dropped | – | A0/1 | – (SDLC)<br>9 (SDLC) | | X | | ✕ ↘z_ 501 | • Indicator is reset when DSR is restored<br>• Reset keyboard<br>• Retry operation | • Missing DSR<br>• Check data set<br>• Check modem cable wrap switch | – | – | SDLC, BSC |
| | • 3274 Loop LOCAL/ COMMUNICATE Switch in LOCAL | – | – | – | – | X | | ✕ ↘z_ 501 | • Set LOCAL/ COMM Switch to COMM | • LOCAL COMM Switch in LOCAL | – | – | Loop |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 502 | Clear to Send Not Present<br>• Clear to Send not present while request to send was on<br>• Adapter indicates DCE error or write timeout<br>• DSR is up | – | A0/1 | – | – | X | – | X 502 | • Reset key<br>• Retry operation | • Check data set<br>• Run wrap test<br>• Check -8.5 V,F4 | – | – | BSC SDLC |
| 504 | Switched Network Connection Required | – | – | – | – | X | – | X 504 | • A connection should be initiated from the control unit or host. | • Initial status of Control Unit at IML.<br>• Operator Disconnected.<br>• DISC received from network.<br>• Three idle time-outs in succession. | – | – | Switched Network |
| 505 | 3274 Disconnected from Network. | – | – | – | | X | – | X 505 | • SNRM required from network | • Normal state after IML or disconnect has been received | – | – | SNA |
| 507 | No Carrier | – | A0/1 | 14 | – | X | – | X 507 | • Refer to nnn code 515,332, 333, or 336. | • Carrier down (no RLSD) for the last 4 seconds.<br>• Wrap tests are performed if IML tests are successful. Beaconing is initiated. See nnn code 515.<br>• If wrap tests fail, 332, 333, or 336 is displayed. | – | – | Loop |
| 508 | CNFG RCVD<br>–Monitor Mode | – | – | – | – | X | – | X 508 | • CNFG command or Reset or Clear required from host to return to online. | • CNFG command from host indicated to enter Monitor mode. | – | – | Loop |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 509 | CNFG RCVD<br>Suppress Carrier Mode | – | – | – | – | X | – | ✕ 509 | • CNFG command or Reset or Clear required from host to return to online. | • CNFG command from host indicated to suppress carrier.<br>• Station suppresses carrier. | – | – | Loop |
| 510 | Physical Unit Not Active | – | – | – | – | X | – | ✕ 510 | • Host issue ACTPU<br>• Retry operation | • ACTPU is required from host | – | – | BSC SDLC |
| 515 | Beaconing | – | – | – | – | X | – | ✕ 515 | • Carrier from the loop is required. | • A "no carrier" condition was detected on the loop. See nnn code 507.<br>• Loop tests were successfully run.<br>• Beacon commands were transmitted, and carrier is monitored.<br>• The loop is performing problem determination. | – | – | Loop |
| 518 | Segmenting Error<br>• The terminal is closed and reopened.<br>• All physical and logical units are deactivated. | – | – | – | – | X | | ✕ 518 | • An SNRM is required from the host | • An SNA segment was received with improper sequencing in the TH MPF bits. | – | – | SDLC |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 519 | Count Exceeded/Wrong Length Message | – | A0/1 | 12 | – | X | – | ✕ ↘z 519 | • Host recovery | • CCA: Host sent a message larger than the control unit buffer.<br>• HPCA: Host sent a message larger than the CU buffer. Receive count will not be updated, causing retransmission by host.<br>• Improper buffer size specified in NCP. | Com Rej | – | SDLC |
| 520 | Nonproductive Timeout | – | A0/1 | 1 | – | X | – | ✕ ↘z 520 | • Reset by receipt of a valid frame or a frame containing a poll. | • No valid SDLC frames received in last 20-25 seconds.<br>• Line may be inoperable at "space" or valid data character.<br>• Communication network problem. | – | – | SDLC Loop |
| 521 | Idle Timeout<br>• No activity on line for last 20 seconds (no flags received) | – | A0/1 | 2 | – | X | – | ✕ ↘z 521 | • Reset by receipt of a valid frame or a frame containing a poll. | • No host activity<br>• Verify operational status of communication network. | – | – | SDLC |
| 522 | Receive Overrun | – | A0/1 | 4 | – | X | – | ✕ ↘z 522 | • Receipt of a valid frame. | • Control Unit Read-control buffer overflows.<br>• Line may be hung at space or invalid data character. | – | – | Loop |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 525 | Connection Problem<br>• Condition exists on lines that prevent establishing or reestablishing communication with host.<br>• Status is posted after 20 ROLs, 20 CRs, 20 XIDs, or 20 NSAs | – | A0/1 | 6 | – | X | – | X → 525 | • Host recovery | • Communication problem between host and control unit. | – | – | SDLC |
| 527 | Write Timeout | – | A0/1 | 3 | – | X | – | X → 527 | • IML | • Write timeout condition occurred.<br>• Wrap tests were run.<br>• If wrap fails, 332, 333, or 336 is displayed.<br>• Station is closed. | – | – | Loop |
| 528 | Command Reject<br>• ALL PUs and LUs are deactivated. | | A0/1 | 9 | – | X | – | X → 528 | • Host recovery<br>• SNRM required<br>• Inform Host support programmer | • Adapter received invalid NR sequence count in an information or supervisory frame with good FCS.<br>• Received command with data that has no data field defined.<br>• Received an undefined or non-implemented command field in a frame with good FCS. | – | – | SDLC |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 529 | DCE Error<br>• Unexpected communication error has occurred.<br>• Host adapter is disabled, and an attempt is made to enable it again. | | A0/1 | 10 | – | X | – | ✕ ↯ 529 | • Host recovery<br>• SNRM required | • DCE error other than the loss of DSR (nnn 501) or of CTS (nnn 502).<br>• Run wrap test.<br>• Check modem. | – | – | SDLC |
| 530 | Write Timeout<br>• Microcode has issued a command to the CCA, and, after 1 second, no acknowledgment has been received.<br>• In SDLC, host adapter is disabled and an attempt is made to enable it again.<br>• All PUs and LUs are deactivated. | | A0/1 | 11-HPCA CCA-SDLC 8-CCA-BSC | – | X | – | ✕ ↯ 530 | • Host recovery<br>• SNRM required | • DSR is OK.<br>• CTS may have dropped during transmission, or clocking signal is not available from modem.<br>• Run wrap test.<br>• Check modem. | – | – | SDLC BSC |
| 531 | NAK Sent<br>• The contents of the screen are restored to their initial state on detection of the error. | | A0/1 | 1 | – | – | X | ✕ ↯ 531 | • Host recovery<br>• Retransmit data<br>• The Communication Reminder will be turned off upon successful retry from the host. | • Adapter detected BCC error on a received message block.<br>• During a read operation, 3 seconds elapsed without receipt of SYN, ETX, or ETB.<br>• A forward abort (ENQ in text) or TTD (STX ENQ) is received.<br>• Verify proper operation of the communication network. | – | – | BSC |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 532 | BSC Line Idle<br>• Adapter detected seven successive 3-second intervals without SYN characters on the line while in ADPREP mode (monitor line for poll or selection sequence) | | A0/1 | – | – | X | – | 532 | • Host recovery<br>• Reset by valid poll or selection sequence | • No host data being received.<br>• Run wrap test.<br>• Verify communication network operation. | – | – | BSC |
| 533 | ENQ Received<br>• CCA was overrun during a read operation, and data was lost when the ENQ was received. The control unit will retransmit its last response. The host should retransmit the message that was lost, *or*<br>• ENQ character received while adapter was waiting for STX or SOH (entire message lost)<br>• Retransmit last response<br>• Host will retransmit last message | | A0/1 | 3 | – | – | X | 533 | • Host recovery<br>• Retransmit last message | • Communication error.<br>• CCA adapter.<br>• Run wrap test. | – | – | BSC |
| 534 | Control Unit Sent Is ENQ<br>• Host did not return an ACK for last transmitted text block.<br>• Adapter sent 15 ENQs to attempt to solicit an ACK with no response<br>• EOT sent to host, *or*<br>• The control unit has acknowledged a selection sequence and has not seen a syn (pad syn) for 45 seconds.<br>• Adapter continues to monitor for a synchronization. | | A0/1 | 4 | – | X | – | 534 | • Host recovery<br>• A valid poll or selection will reset symbol<br>• Retry operation | • Host failed to respond.<br>• Communication failure.<br>• Run wrap test. | – | – | BSC |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 535 | 15 NAKs Received<br>• Text block failed to reach host after 15 attempts.<br>• EOT is sent to host.<br>• Control unit enters ADPREP mode (line monitor for poll or selection). | – | A0/1 | 5 | – | X | – | ✕ 535 | • Host recovery<br>• Valid poll or selection will reset symbol<br>• Retry operation | • Communication failure between host and control unit.<br>• Verify communication network operation.<br>• Run wrap test. | – | – | BSC |
| 536 | Error Description<br>15 Wrong Acknowledge<br>• Adapter received wrong ACK in response to text block transmission (ACK0 for ACK1 or vice versa), sent ENQ for repeat of ACK, and received wrong ACK 15 times.<br>• EOT is sent to host.<br>• Control unit enters ADPREP mode (line monitor for poll or selection). | – | A0/1 | 6 | – | X | – | ✕ 536 | • Host recovery<br>• A valid poll or selection will reset symbol<br>• Retry operation | • Host to control unit communication error (dropped a complete record during transmission).<br>• Host returns wrong ACK. | – | – | BSC |
| 555 | Format Error | – | A0/1 | 2 (X.21) | – | X | | ✕ 555 | • Reminder can be reset with COMM key to indicate X.21 state. | • CP (Call Progress) or line ID did not end with an IA +5 delimiter. | – | – | X.21 Switched 51C |
| 556 | X.21 Timeout | – | A0/1 | 3 (X.21) | – | X | | ✕ 556 | • Reminder can be reset with COMM key to indicate X.21 state. | • X.21 Network Timeout has occurred. | – | – | X.21 Switched 51C |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 557 | Not Ready | – | A0/1 | 5 (X.21) | – | X | | X 557 | • Monitor Mode is entered waiting for DCE to become ready | • X.21 Network is not ready.<br>• Monitor Mode X 559 is entered. | – | – | X.21 Switched 51C |
| 558 | Lost Data | – | A0/1 | 6 (X.21) | – | X | | X 558 | • Reminder can be reset with COMM key to indicate X.21 state. | • Insufficient buffer space was available in the control unit for Call in Progress signals or Line ID from the network. | – | – | X.21 Switched 51C |
| 559 | DCE Cleared | – | A0/1 | 7 (X.21) | – | X | | X 559 | • Reminder can be reset with COMM key to indicate X.21 state. | • Clearing sequence has been executed in response to a network Clear request. | – | – | X.21 Switched 51C |
| 560 | Not +/Bell | – | A0/1 | 11 (X.21) | – | X | | X 560 | • Reminder can be reset with COMM key to indicate X.21 state. | • Abnormal condition detected while waiting for proceed or Select Incoming Call:<br>– More characters than expected were received.<br>– Character was other than expected. | – | – | X.21 Switched 51C |
| 561 | Clear Timeout | – | A0/1 | 18 (X.21) | – | X | | X 561 | • Reminder can be reset with COMM key to indicate X.21 state. | • Network Clearing Sequence did not terminate properly (T5 or T6 timeout).<br>• Monitor mode is entered – waiting for the DCE to become ready. | – | – | X.21 Switched 51C |

*Where nn = port ID = 00-11

| nnn Code | Error Description | Operational Indicator | Test No. for Log* | Counter Incremented | Log Only | Displayed On | | Indicator Displayed | Recovery | Probable Cause/Action | Sense Codes | | Applicable Feature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | All | One | | | | SNA | Non-SNA | |
| 562 | Compare Error | – | A0/1 | 1 (X.21) | – | X | | ✕ ⟋z⟍ 562 | • Reminder can be reset with COMM key to indicate X.21 state. | • Control unit detected a mismatch between the signals on the input and output sides of the drivers/receivers | – | – | X.21 Switched 51C |
| 565 | Invalid Operation | – | A0/1 | 4 | – | X | – | ✕ PROG 565 | • Press COMM key (goes to Call Ready State) | • Unknown network failure | – | – | X.21 Switched 51C |
| 595 | Monitor Mode | – | – | – | – | X | | ✕ ⟋z⟍ 595 | • Control unit is waiting for DCE ready. | • Monitor mode was entered as a result of a Network Not Ready or a Compare error. | – | – | X.21 Switched 51C |
| 599 | Local Mode | – | – | – | – | – | | ✕ ⟋z⟍ 599 | • Put control unit in Call Ready state with COMM key sequence. | • Control unit has entered local mode state as a result of a Local sequence. | – | – | X.21 Switched 51C |

*Where nn = port ID = 00-11

**Notes:**

1. *SNA generates code X'1003', function not supported:*
   - *Unsupported session control request*
   - *Unsupported data control request*
   - *Signal code not X'00010000'*
   - *Network control request*
   - *FM data stream*
   - *Invalid command: data after Read, RM, RMA, EAU*
2. *Parameter error – invalid address after SBA, RA, or EAU order (SBA, RA, EAU without parameters) or SCS parameter error.*

# Appendix C. Structured Field and Attribute Processing (SFAP) Data Stream Error Extensions

Bytes 170-174 of the extended device control block (DCB) are used as a log area for additional information. This complements the PROG 4nn numbers displayed when the error is detected. Bytes X'170, 171' contain the displacement in hexadecimal to the byte in the Write Structured Field that was found to be in error. (The WSF command equals byte 1.) Bytes X'172, 173' contain the displacement into the particular structured field where the error was detected. Byte X'174' contains the SF type of the SF that contained the error.

Figure C-1 correlates the extended data stream 4nn numbers, the values found in XDCB X'172-174', the SNA sense code, and a description of the error. OP check is the sense set for BSC in all cases.

Bytes 170-174 may be displayed in the following manner. Enter Test mode by pressing the ALT and TEST keys. Select the DCB in question by typing in AA/6 (four characters); AA is the coax port number in question (00-31). (If the device being used for the test is the port in question, /6 (two characters) will suffice.) Press the ENTER key. The display should now contain:

Line 1 AA/6 (same as input)
Line 2 00
Line 3 XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX
Line 4 XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX
Line 5 XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX
Line 6 XXXX XXXX XXXX XXXX XXXX XXXX XXXX XXXX

where:

00 = The displacement from the start of the control block (in hexadecimal).

XXXX = The hexadecimal representation of the portion of the control block currently being displayed.

Press the PA1 key five times; line 2 should change to 40, 80, C0, 10, and then to 14. (The last two values drop the low-order digit and really represent X'100' and X'140'.) X'170'-'174' are the first five bytes on line 6.

| 4nn | DCB–'X' 172 | 174 | Sense | Error Description |
|---|---|---|---|---|
| 470 | ---- | -- | 1003 | An unsupported order was decoded in the data stream. |
| 471 | 0003 | XX | 1003 | Unsupported structured field type. |
| 471 | ---- | -- | 1003 | Advanced Data Stream (WSF) sent to a device without an ECSA feature. |
| 471 | 0004 | 06 | 1003 | Invalid Load Format addresses to PSS. |
| 471 | 0007 | 06 | 1005 | Out-of-range access to PSS (RAM out of range). |
| 471 | 000A | 06 | 1005 | Invalid X-value for Load PSS. |
| | 000B | 06 | 1005 | Invalid Y-value for Load PSS. |
| 471 | 000C | 06 | 1005 | Section ID not supported (byte 11 not equal to 0). |
| 471 | 0001 | XX | 1005 | Invalid-length structured field. |
| 471 | XXXX | XX | 1005 | Invalid-partition ID. |
| 471 | 0005 | 09 | 1003 | Invalid mode in Set Reply mode. |
| 471 | 0005 | 01 | 1003 | Invalid operation in read partition (not query). |
| 471 | 0005 | 06 | 1003 | Alias out of legal range. |
| 471 | 0006 | 06 | 1005 | Invalid EBCDIC code point. |
| 471 | 000D | 06 | 1003 | Byte 12, bits 0-4, 7 = 0 |
| 471 | XXXX | XX | 1005 | Invalid reserved Bits. |
| 472 | ---- | -- | 0871 | Read partition structured field state error. Improper sequence from host. |
| 473 | 0007 | 06 | 084C | ECSA present, but PSS RAM addressed not physically present. |
| 473 | 000D | 06 | 084C | Color plane—invalid. |
| 474 | ---- | -- | 1003 | No extended DCB configured for this device. |
| 475 | ---- | -- | 1001 | WCC has Start Print bit set, but not last structured field. |

**Note:** *As part of overall extended-data-stream problem determination, the usage of the following functions should be kept in mind. If the device in question does not have an extended DCB (not enough allocated during customizing) the DCB display procedure (described above) will inhibit the keyboard with the minus function indicator on the fourth depression of the PA1 or ENTER key. If the device does not have an ECSA feature, Test 8 (Enter test mode, type in /8, hit enter) will inhibit the keyboard with a wrong number indicator. This is also true if Extended Data Stream microcode is not configured. If Extended Data Stream microcode is not configured, the above nnn numbers will not appear.*

**Figure C-1. SFAP Error Relationships**

# Appendix D. IBM 31SD Diskette Drive Maintenance

## Safety Information

The CE Safety Practices, located at the front of this manual, should be reviewed before you service the 31SD Diskette Drive. To prevent personal injury and machine damage, observe all Danger and Caution notices, making sure you fully understand them.

AC voltages are present on the 31SD drive motor connector and capacitor terminals when the drive motor is running. The motor and the solenoid become hot after continuous use; let the parts cool before attempting servicing. The following Danger and Caution notices appear in this appendix in the sequence shown:

**DANGER**
**Input AC voltage is present in the prime power box when the 3274 I/O (on/off) switch is in the O (off) position.**

**DANGER**
**Voltage is still present at the socket when the power cable is disconnected.**

**DANGER**
**High voltage may be present at the capacitor terminals.**

**CAUTION: The motor case becomes hot after continuous use.**

This appendix contains the maintenance information needed to service the IBM 31SD Diskette Drive. It includes the service check, adjustment, removal, and replacement procedures for all field replaceable units (FRUs). It also includes information to help the customer engineer diagnose difficult and intermittent failures not found by the maintenance analysis procedures (MAPs).

A paragraph number precedes each paragraph title. These numbers are used as follows:

- The table of contents lists the paragraph numbers and titles.
- The MAPs (Appendix E) direct the customer engineer to maintenance procedures by paragraph number (for example, D.3.7.3, D.3.3.6, D.3.6.1).
- Steps in a procedure direct the customer engineer to another procedure by paragraph number.

Other information about the diskette drives is found in:

- Appendix E, IBM 31SD Diskette Drive Maintenance Analysis Procedures (MAPs)
- *The IBM Diskette General Information Manual,* GA21-9182

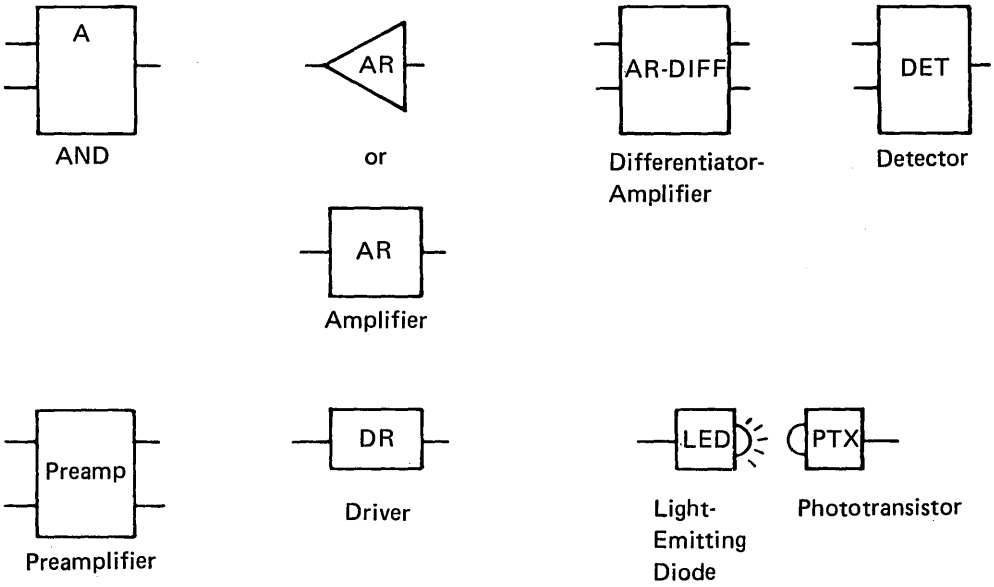
**Note:** *Tektronix, as used in this appendix, is a trademark of Tektronix, Inc.*

# Contents

# Abbreviations

**A.** ampere
**A.** symbol for AND logic (see legend)
**AC.** alternating current
**AR.** amplifier (see legend)
**AR-DIFF.** differentiator-amplifier (see legend)
**B/M.** bill of materials
**C.** Celsius
**CE.** customer engineer
**DC.** direct current
**DET.** detector (see legend)
**DR.** driver (see legend)
**D1.** diskette 1
**D2.** diskette 2 and 2D
**F.** Fahrenheit
**FM.** frequency modulation
**FRU.** field replaceable unit
**HCP.** head connector pin
**Hz.** hertz
**I/O CP.** I/O connector pin
**kg.** kilogram
**kHz.** kilohertz
**LED.** light-emitting diode (see legend)
**LEDCP.** light-emitting diode connector pin
**MAP.** maintenance analysis procedure
**MFM.** modified frequency modulation
**MIM.** maintenance information manual
**μs.** microsecond
**mm.** millimeter
**ms.** millisecond
**mV.** millivolt
**N.** inverter
**ns.** nanosecond
**PTX.** phototransistor (see legend)
**PTXCP.** phototransistor connector pin
**R/W.** read/write
**rpm.** revolutions per minute
**SCP.** solenoid connector pin
**SMCP.** stepper motor connector pin
**TCP.** test connector pin
**V.** volt
**Vac.** volts, alternating current
**Vdc.** volts, direct current
**VFO.** variable frequency oscillator

## Legend


A
AND
AR
or
AR
Amplifier
AR-DIFF
Differentiator-
Amplifier
DET
Detector
Preamp
Preamplifier
DR
Driver
LED
Light-
Emitting
Diode
PTX
Phototransistor

# Glossary

**A.** The logic block symbol for the AND function (see legend).

**access lines.** The pulses on these lines turn the stepper motor.

**alcohol pad.** A pad soaked with isopropyl alcohol.

**alternative cylinders.** Cylinders that can be assigned in place of primary cylinders that have failed.

**alternative tracks.** Tracks that can be assigned in place of primary tracks that have failed.

**amplifier (AR).** An electronic device that is used to increase voltage.

**AR.** See *amplifier.*

**AR-DIFF.** See *differentiator-amplifier.*

**bail assembly.** A mechanical arm that operates under control of the head load solenoid to load or release the read/write head load arm.

**band.** See *drive band.*

**belt clearance slots.** Grooves in the fan enclosure that permit the ac motor drive belt to turn without rubbing against the fan enclosure.

**carriage.** The part that carries the read/write head under control of the stepper motor drive.

**CE.** See *customer engineer.*

**characteristics.** Statements about the electrical, physical, or functional features of a machine that are not specifications.

**clamp.** A part used to lock another part.

**clamped.** Held tightly.

**collet.** The part that centers and holds the diskette to the drive hub.

**cooling fan.** A fan that makes the stepper motor cool.

**crosstalk.** Data bits sensed from one track while the read/write head is reading another track.

**customer engineer (CE).** A person who services IBM products in the field.

**DET.** See *detector.*

**detector (DET).** An electronic device that is used to recognize valid data in an electronic circuit.

**differentiator-amplifier (AR-DIFF).** An electronic circuit whose output signal is a function of the time rate of change of the input signal.

**diskette 1.** A diskette used for storing data on only one surface.

**diskette 2.** A diskette used for storing data on both surfaces.

**diskette 2D.** A diskette used for storing data on both surfaces with twice the bit density used on a diskette 2.

**DR.** See *driver.*

**drive band.** A metal band connected to the stepper motor pulley and the head/carriage assembly.

**drive hub.** A continuously running part that turns the diskette at 360 rpm.

**driver (DR).** An electronic circuit that converts a low-level logic voltage to the level needed to operate a stepper motor or a solenoid.

**enclosure.** The diskette drive motor cooling fan safety cover.

**environmental.** Pertaining to the environment.

**eyelet.** A small diameter ring at the end of a cable that makes it possible for the cable to be connected to a fixed bolt.

**field replaceable unit.** A part or an assembly that can be exchanged by the CE.

**FM (frequency modulation).** See *modulation.*

**FRU.** See *field replaceable unit.*

**gain.** The ratio of increase of output over input in an amplifier.

**head/carriage.** The unit that contains the read/write head.

**hub.** See *drive hub.*

**ID.** See *identifier.*

**identifier (ID).** A character or group of characters used to identify or name an item of data and possibly used to indicate some properties of that data.

**inverter (N).** An electronic circuit that inverts a signal (+ to –, or – to +).

**isopropyl alcohol.** A fluid used to clean some IBM parts.

**jacket.** A permanently attached cover that protects the diskette surface.

**LED.** See *light-emitting diode.*

**light-emitting diode.** An electronic part used as a source of light for a phototransistor.

**MFM (modified frequency modulation).** See *modulation.*

**millivolt (mV).** 0.001 volt.

**modulation.** The process of changing the amplitude and frequency of the read and write signals.

**mV.** See *millivolt.*

**N.** See *inverter.*

**oscillator.** A logic circuit that generates alternating current.

**phototransistor (PTX).** An electronic part used to sense the light of an LED.

**preamp.** See *preamplifier.*

**preamplifier (preamp).** A device that, by enabling a received wave to control a local source of power, can supply a larger copy of the necessary characteristics of the wave. Usually, a preamp is followed in the circuit by an amplifier.

**PTX.** See *phototransistor.*

**read/write.** Pertains to the function of reading data from and writing data to a diskette.

**replaceable part.** A part that can be reinstalled.

**solenoid plunger.** A moving part of the solenoid that operates the bail assembly to load and release the read/write head load arm.

**stepper motor.** The motor that steps the head/carriage assembly from track to track.

**theory.** Information that teaches how a device works.

**tunnel erase circuit.** An electronic circuit that is used to erase the edge of the track just recorded during a write operation. This erasing prevents crosstalk between tracks during later read operations.

**unclamped.** Released.

**unloaded.** Not loaded.

**variable frequency oscillator.** An electronic circuit that is used to synchronize the using system's reading circuits with the disk drive when it is performing a read operation.

**VFO.** See *variable frequency oscillator.*

**welded.** Connected together using heat (as in metal parts, such as adapter welded to band).

**write/erase.** Pertains to the function of writing data to and erasing data from a diskette.

## D.1 INTRODUCTION

### D.1.1 General Description

The IBM 31SD Diskette Drive is a direct-access, read/write, data storage device. This drive uses the flexible magnetic diskette for data entry, data exchange, and data storage.

The 31SD Diskette Drive, shown in Figure D-1, can read from and write to a diskette 1. The diskette drive reads and writes in frequency modulation (FM) only. If a diskette 2 or a diskette 2D is inserted into a 31SD Diskette Drive, the drive will never come ready.

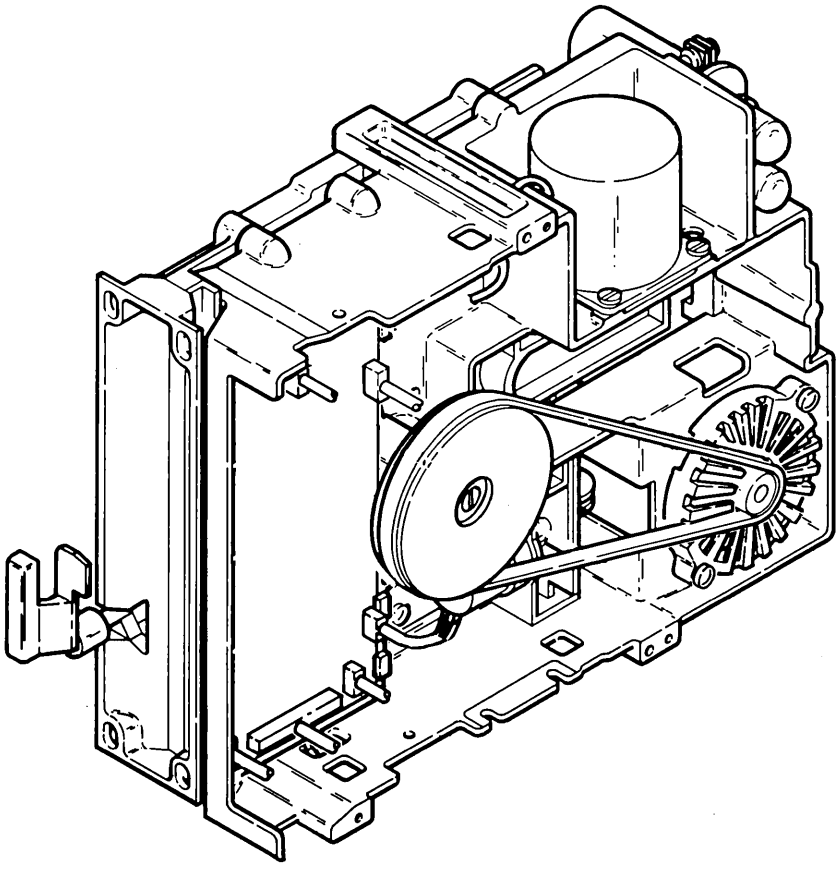
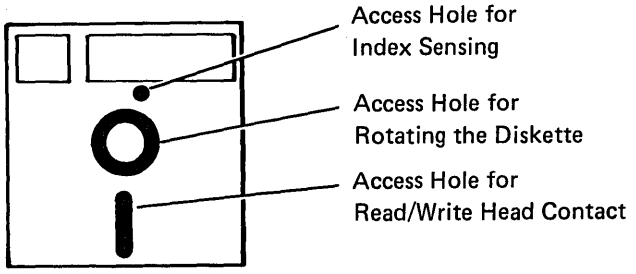
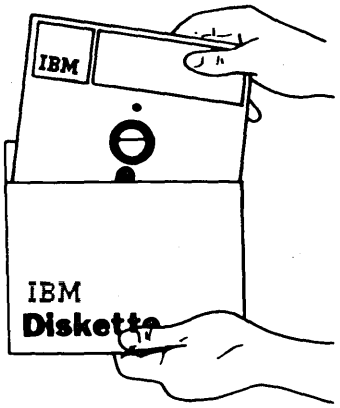


**Figure D-1. IBM 31SD Diskette Drive**

### D.1.1.1 Diskette Description

The IBM 31SD Diskette, shown in Figure D-2, is a thin, flexible disk, permanently protected in a jacket. Information is stored magnetically on the diskette surface, which is covered with magnetic recording material. The diskette is free to turn inside the jacket. As the diskette turns, the inner surface of the jacket cleans the diskette.




Diskette

The diskette jacket has three holes. The first hole permits the diskette drive to turn the diskette, the second hole permits the read/write head to make contact with the diskette, and the third hole permits the phototransistor light to go through the index hole to sense the type of diskette. For storage, the diskette, which is permanently protected in a thin jacket, can be placed in an envelope. Data can be read from or written on only one side of the diskette.

Information is written on the diskette in tracks. A track is a circular path on the diskette surface. Information is magnetically written to or read from a track by a read/write head as the diskette turns. See Figure D-2.

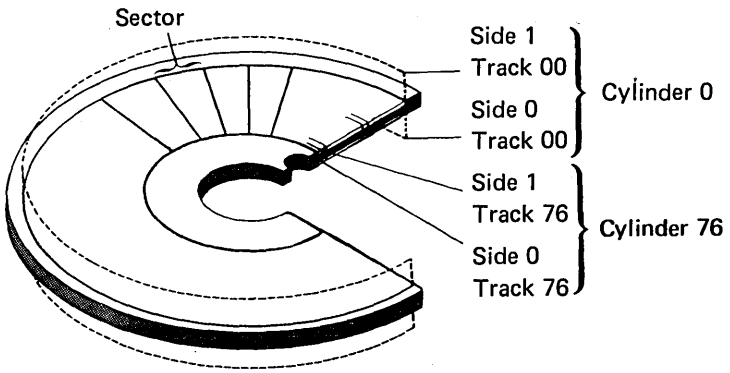



**Figure D-2. 31SD Diskette**

There are 77 tracks on each side of a diskette. Track 00, which is the outside track, is reserved as a label track and cannot be used for data. Tracks 75 and 76, the two tracks nearest the hub, are reserved as alternative tracks and can be used for data only if another track becomes damaged. There is a total of 74 tracks on one side of a diskette 1 available for recording data.

A sector is that part of a track used for one record of information.

A cylinder is defined as the tracks of a diskette that can be read from or written on without moving the read/write heads.

### D.1.1.2 Diskette Insertion and Removal

To insert or remove a diskette, proceed as follows:

A. Diskette Insertion (See Figure D-3)

1. Turn the operator knob to the open position.
2. Remove the diskette from its envelope.
3. Place the diskette squarely into the diskette drive (with the label facing the knob).
4. Turn the operator knob to the closed position.

B. Diskette Removal (See Figure D-3)

1. Turn the operator knob to the open position.
2. Remove the diskette.
3. Insert the diskette into its envelope.

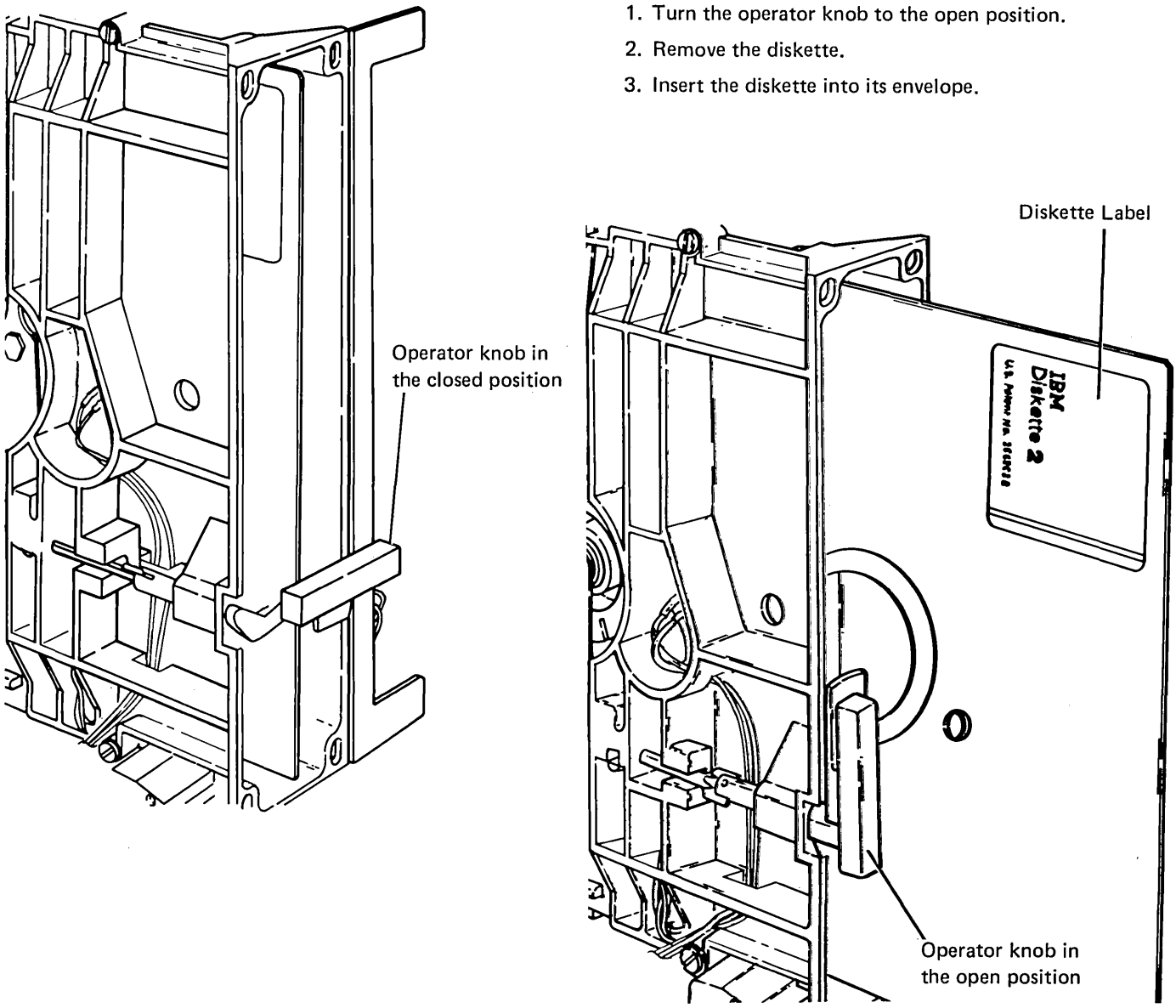



**Figure D-3. Diskette Insertion**

### D.1.1.3 Maintenance

The diskette drive needs no planned maintenance. The MAPs guide the CE in diagnosing diskette drive failures; the MAPs also send the CE to maintenance procedures in this appendix when an adjustment, service check, or FRU replacement is needed.

The CE should verify a repair online using the system or device diagnostic programs.

The head/carriage assembly and the drive hub and pulley assembly are adjusted and tested at the factory. The head/carriage assembly can be exchanged in the field; the drive hub and pulley assembly cannot be exchanged in the field. If the track 40 adjustment surface or the drive hub and pulley assembly is damaged, the diskette drive should be exchanged.

### D.1.1.4 Special Tools

The CE must use the following special tools (shown in Figure D-4):

- Timing pin **B** (part 5562019) to adjust or service the read/write head/carriage stepper motor pulley. (This part is supplied with each drive.)
- Force gauge (part 460870), **A**, to adjust or service-check the drive band tension.
- Spring (part 4240631), **D**, to keep the head/carriage in place against the thickness gauge when performing the head/carriage adjustments. (This part is supplied with each drive.)

  **Note:** *Spring must match view,* **E**.

- Clip (part 4240632), **C**, to keep the thickness gauge in contact with the track 40 adjustment surface.

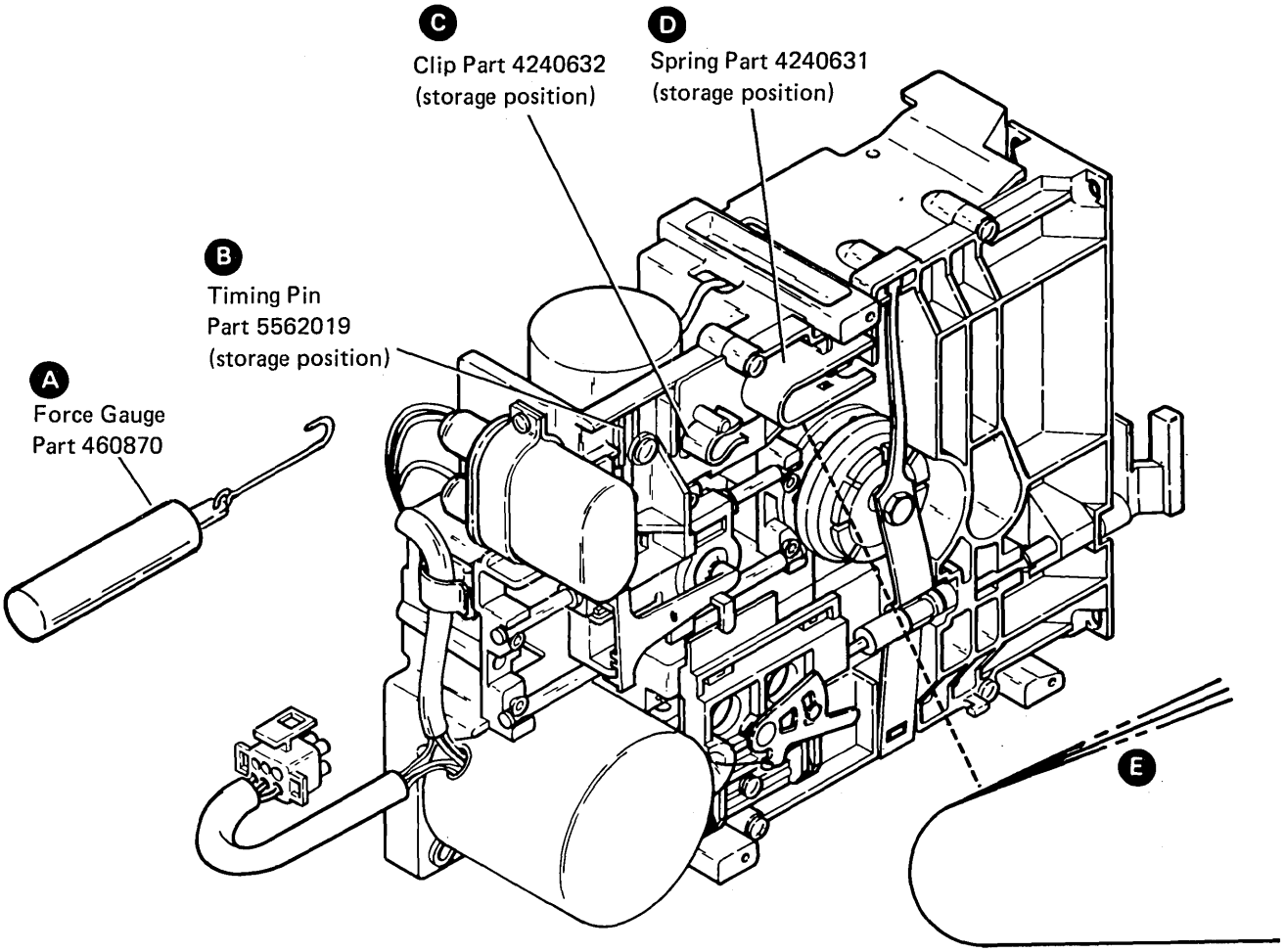



**Figure D-4. 31SD Special Tools**

## D.1.2 Machine Characteristics

### D.1.2.1 Physical Characteristics

The 31SD diskette weighs 5.0 kg (11.0 pounds) and has a speed of 360 rpm. See Figure D-5 for other physical characteristics.

### D.1.2.2 Electrical Characteristics

The system supplies all the power needed to operate the diskette drive, which includes:

- All the following:

| Logic Voltage (dc) | Maximum Operating Current (A) | Tolerance (%) |
|---|---|---|
| -5 | 0.08 | ±10 |
| +5 | 0.50 | ±10 |
| +24 | 0.50 | ±12 |

- A selection of the needed ac power from the following lists:

  -60 Hz, single-phase, ac power

| Input Voltage (V) | Input Voltage Range | Average Operating Current (A) |
|---|---|---|
| 100 | 90-110 | 0.30 |
| 110 | 96.5-119 | 0.30 |
| 120 | 104-127 | 0.30 |
| 127 | 111-137 | 0.30 |
| 200 | 180-220 | 0.20 |
| 208 | 180-220 | 0.20 |
| 220 | 193-238 | 0.20 |
| 240 | 208-254 | 0.20 |

-50 Hz, single-phase, ac power

| Input Voltage (V) | Input Voltage Range | Average Operating Current (A) |
|---|---|---|
| 100 | 90-110 | 0.30 |
| 110 | 96.5-119 | 0.30 |
| 200 | 180-220 | 0.25 |
| 220 | 193-238 | 0.20 |
| 230 | 202-249 | 0.20 |
| 240 | 210-259 | 0.20 |

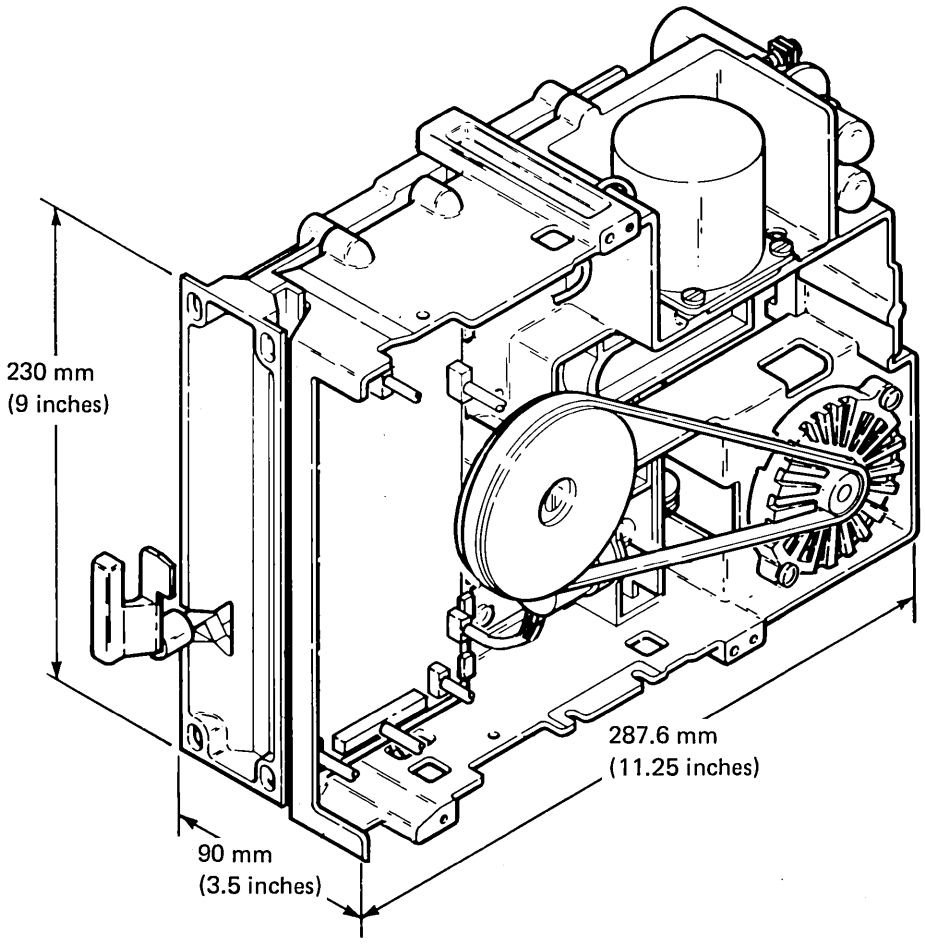



**Figure D-5. 31SD Physical Characteristics**

### D.1.2.3 Environmental Characteristics

IBM diskette drives can be operated or stored in the following temperature and humidity ranges, shown in Figure D-6.

### D.1.2.4 Functional Characteristics

The format of the data on a diskette is changed when the number of bytes written in a sector is changed. Diskettes are used with the formats shown in Figure D-7.

- The maximum number of formatted data bytes per diskette is shown in Figure D-8.
- Data rate: 250,000 bits (31,250 bytes) per second (FM).
- Cylinder-to-cylinder seek time: 5 ms, plus 35 ms for the head/carriage assembly to stop. (The total seek time is the number of cylinders the heads moved across multiplied by 5 ms, plus 35 ms.)
- Tracks per diskette side: 77 (cylinder 00 is the label cylinder; cylinders 01 through 74 are for data; cylinders 75 and 76 are reserved as alternative cylinders).

| | Temperature | | Relative |
|---|---|---|---|
| | Celsius | Fahrenheit | Humidity |
| Operate (Powered On) | 10° to 40.6° | 50° to 105° | 8% to 80% |
| Store (Powered Off) | 10° to 51.7° | 50° to 125° | 8% to 80% |

**Figure D-6. Environmental Characteristics**

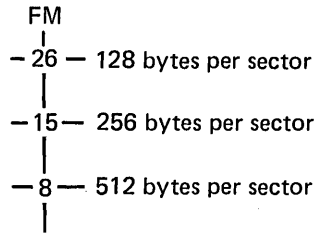



**Figure D-7. Data Formats**

## D.1.3 Safety

### D.1.3.1 Personal Safety

The system or device supplies ac and dc power. Ac voltages are present on the drive motor connector and capacitor terminals in the diskette drive when the drive motor is turning.

Motor and solenoid cases become hot after continuous use; let the parts cool before servicing them.

The Danger and Caution notices throughout this appendix are personal safety precautions.

### D.1.3.2 Machine Safety

Diskette drives can be damaged if they are not operated or serviced correctly. The Warning notices in this appendix are machine safety precautions.

Do not use IBM cleaning fluid or other cleaning fluids near plastic parts.

Never use damaged diskettes in a diskette drive. Diskettes that are physically damaged (creased or bent) or contaminated (by pencil marks, finger marks, or cleaning fluid) can cause data errors, equipment errors, or head damage.

| | Diskette 1 |
|---|---|
| 128 Bytes per Sector | 246,272[1] |
| 256 Bytes per Sector | 284,160 |
| 512 Bytes per Sector | 303,104 |

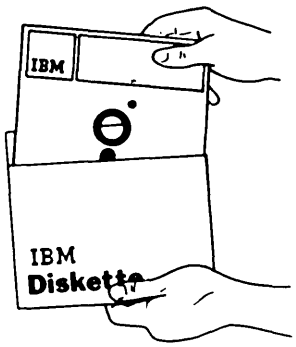
[1] The total number of data bytes that can be stored on the diskette. The Basic Data Exchange Standards for exchanging information from one system to another using diskette 1 are:
- Use 128 bytes per sector.
- Do not use track 74.
- Use 26 sectors per track.

The total number of usable data bytes then becomes 242944.

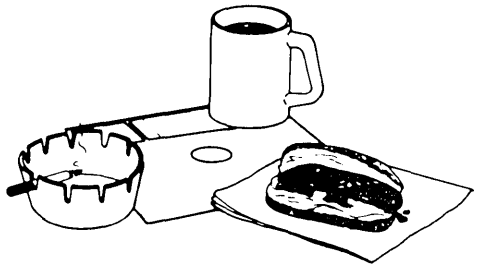
**Figure D-8. Maximum Number of Formatted Data Bytes**

## D.1.3.3 Diskette Safety

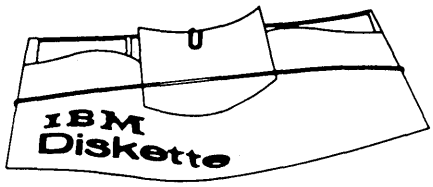
Return a diskette to its envelope when it is removed from the diskette drive.



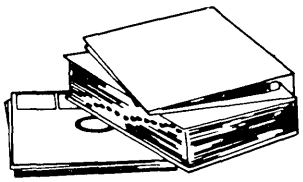

Do not lay diskettes near smoke or other sources that can contaminate the disk.



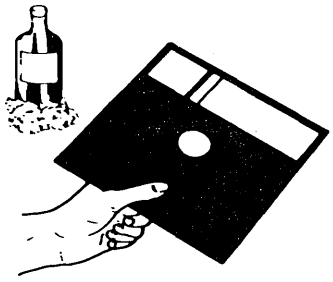
Do not use clips or rubber bands on a diskette.



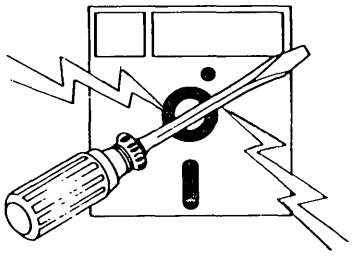

Do not place heavy books on diskettes.



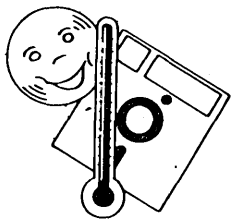
Do not touch or attempt to clean diskette surfaces: contaminated diskettes will not work correctly.



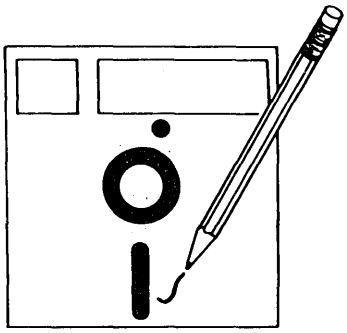
Do not place diskettes near magnetic materials: data can be lost from a diskette exposed to a magnetic field.



Do not expose diskettes to heat greater than 51.7°C (125°F) or to direct sunlight.



Do not write outside the label area on diskettes.



## D.1.4 Diskette Drive Parts

Diskette drive parts are shown in Figure D-9.

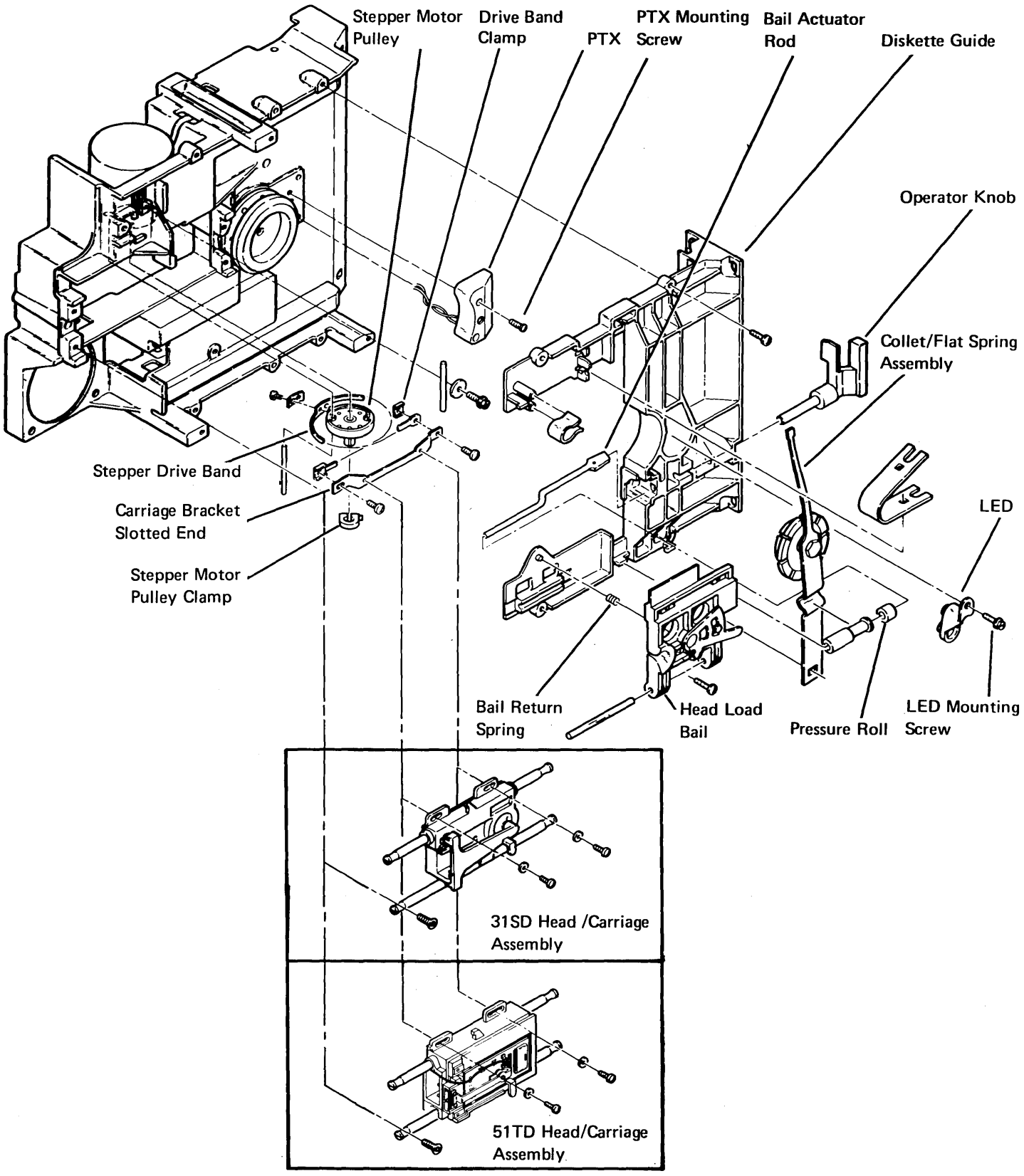



**Figure D-9 (Part 1 of 4). Diskette Drive Parts**

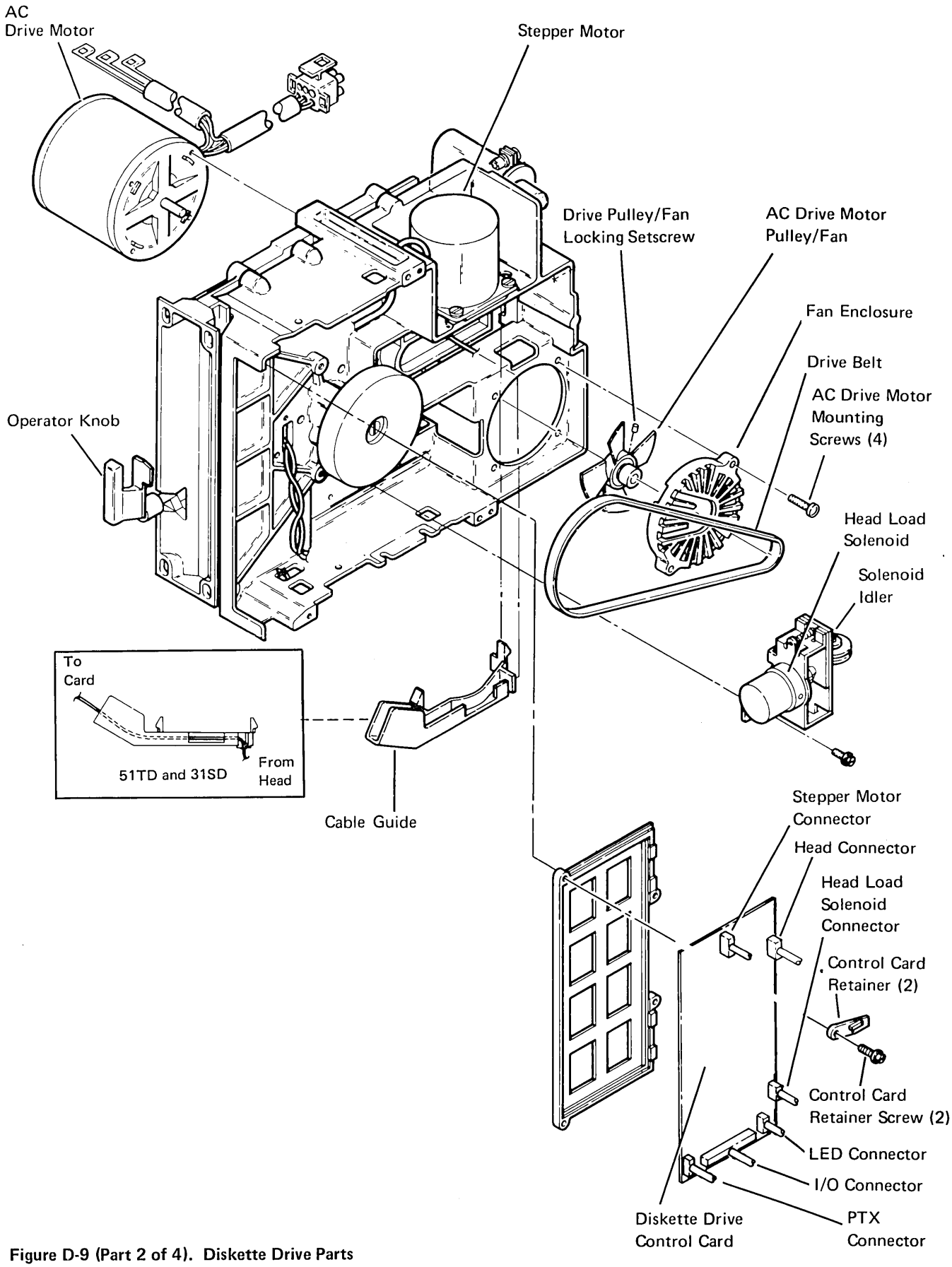
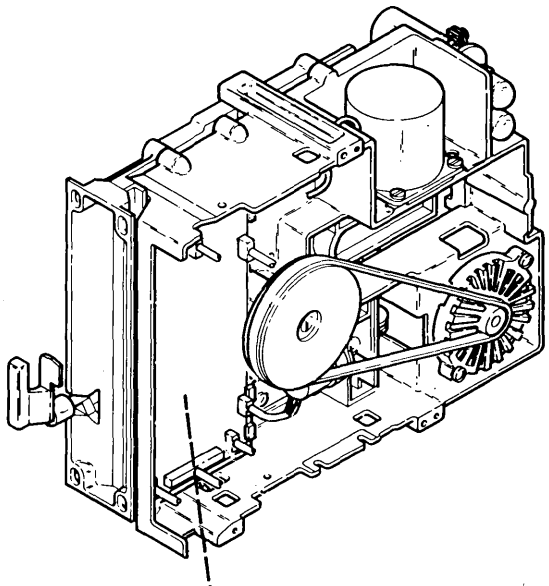



**Figure D-9 (Part 2 of 4). Diskette Drive Parts**



**31SD Control Card**

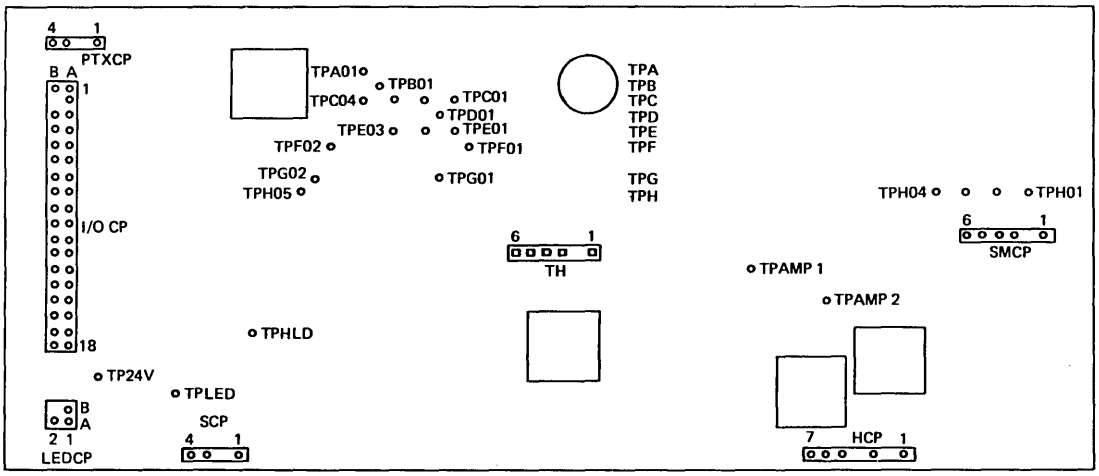



**Figure D-9 (Part 3 of 4). Diskette Drive Parts**

**31SD Control Card Cable**

| Test Points | Line Names |
|---|---|
| TH01 | Diff Read B |
| TH02 | No Pin |
| TH03 | Diff Read A |
| TH04 | Not Assigned |
| TH05 | -Disable Stepper Motor |
| TH06 | +18V |

| Test Points | Line Names |
|---|---|
| TPA01 | +5 Vdc |
| TPB01 | -5 Vdc |
| TPC01 | +Access 1 |
| TPC02 | D1 PTX |
| TPC03 | Write Data |
| TPC04 | Ground |
| TPD01 | +Inner Tracks |
| TPE01 | +Access 0 |
| TPE02 | +Head Engage |
| TPE03 | +Index |
| TPF01 | Ground |
| TPF02 | +Write/Erase Enabled |

| Test Points | Line Names |
|---|---|
| TPG01 | +File Data |
| TPG02 | +Erase Gate |
| TPH01 | MC-3 |
| TPH02 | MC-2 |
| TPH03 | MC-1 |
| TPH04 | MC-0 |
| TPH05 | +Write Gate |
| TPAMP1 | Preamp TP1 |
| TPAMP2 | Preamp TP2 |
| TPHLD | -Head Load |
| TP24V | +24 Vdc |
| TPLED | 31SD LED Voltage |

PTXCP – PTX Connector Pins
I/O CP – I/O Connector Pins
LEDCP – LED Connector Pins
SCP – Solenoid Connector Pins
HCP – Head Connector Pins
SMCP – Stepper Motor Connector Pins

**Figure D-9 (Part 4 of 4). Diskette Drive Parts**

## D.2 DEVICE THEORY OF OPERATION

The 31SD Diskette Drive is an I/O device that relies on the using system for power, commands, and control. The drive can read from, and write to one side of, a diskette. This section contains theory information about the device interface, data flow, and operation of the diskette drive.

### D.2.1 Control Card Interface

Cylinder access is shown in Figure D-10; the interface lines at connector A1 are shown in Figure D-11.

Following is a description of the interface lines at connector A1:

*Write Data:* For each change of this signal, the current switches in the read/write head. This process records the data on the diskette surface.

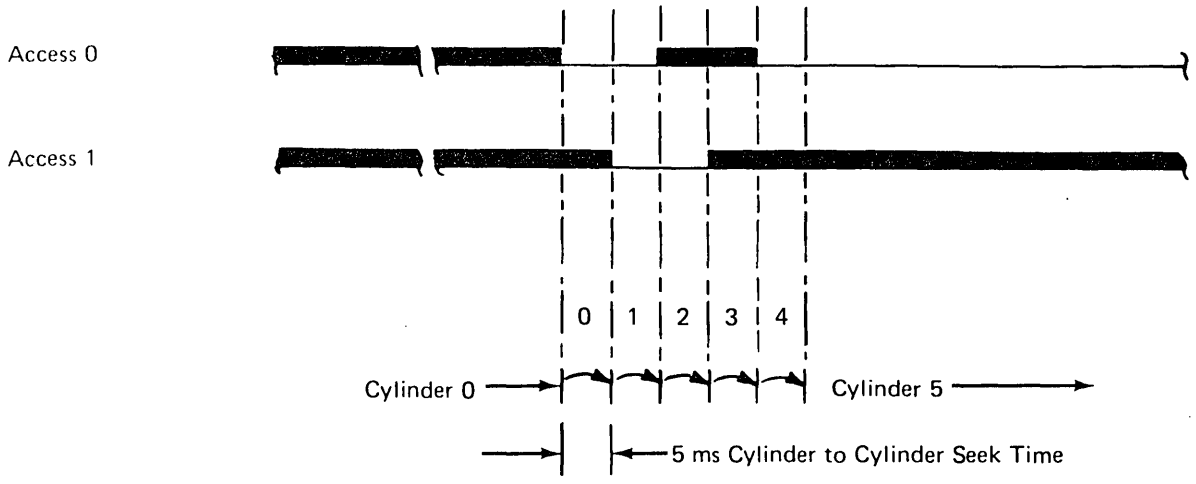
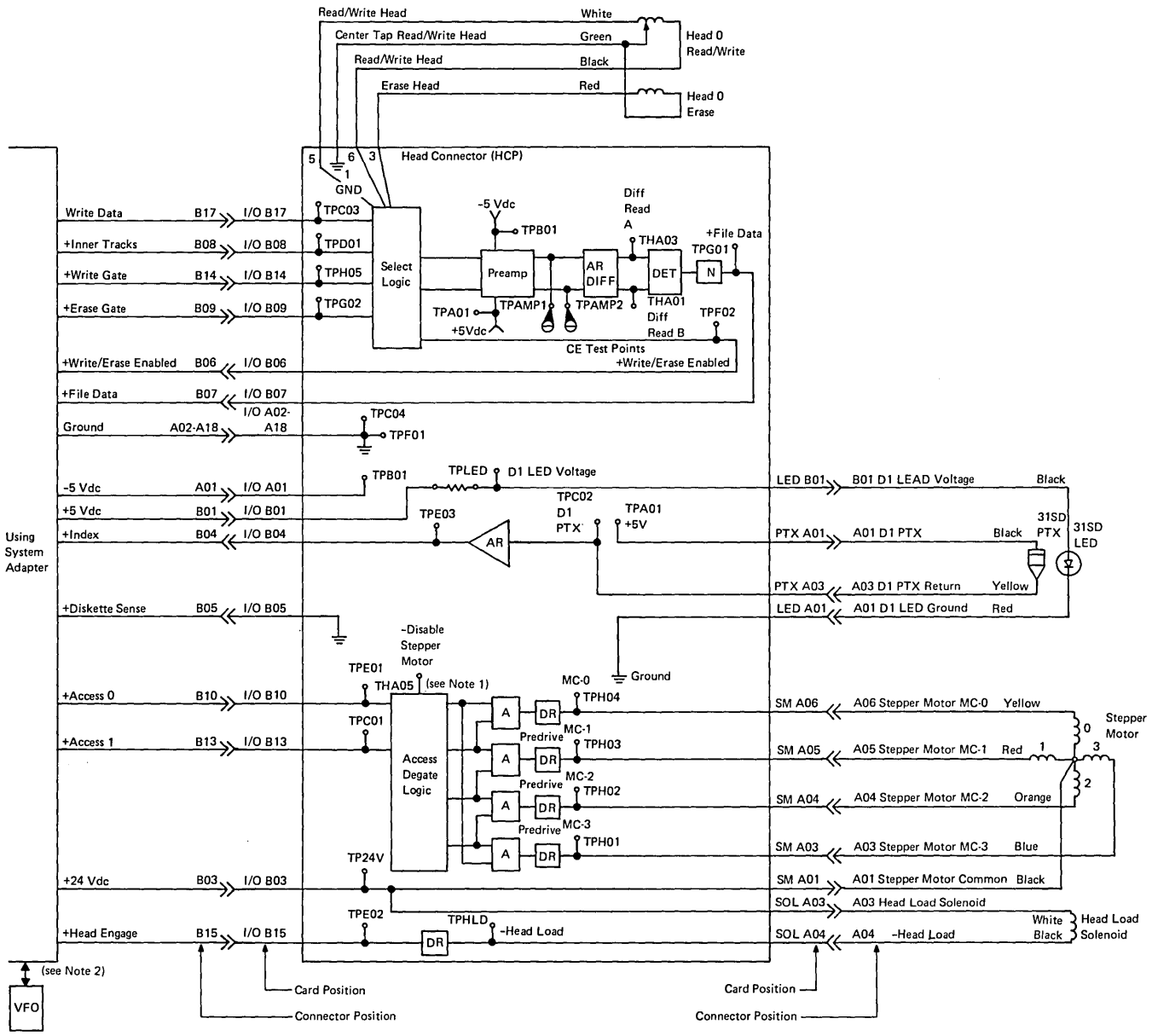



**Figure D-10. Cylinder Access**




**Notes:**

1. *A jumper from ground to disable stepper motor overrides any input access lines. This is used in making head/stepper motor adjustments.*
2. *The variable frequency oscillator is packaged in the using system logic. The function of the variable frequency oscillator is to separate and clock pulses.*

**Figure D-11. Control Lines at Connector A1**

*+Inner Tracks:* This line is active from track 43 through track 76. When this line is active, the write current through the data head is decreased, because the bit density increases toward the center tracks and, therefore, less write current is needed.

*+Write Gate:* This line activates the write circuits and deactivates the read circuits for a write operation.

*+Erase Gate:* This line activates the tunnel erase circuits during a write operation to erase the edges of the track just recorded. This erasing prevents crosstalk between tracks during later read operations.

*+Write/Erase Enabled:* When this line is active, either write or erase current has been enabled on the card.

*File Data:* This line is a series of clock and data pulses that represent the data read from the diskette surface. The VFO circuits supplied by the using system separate the clock pulses from the data pulses.

*+Index:* This line indicates the start of a track. This 1.5 to 3.0 ms pulse occurs every 166.7 ms.

*Diskette Sense:* This line is tied to ground to always indicate a diskette 1.

*Access Lines 0 and 1:* Sequentially activating the access signal lines causes the read/write head to move from one cylinder to the next. Note, in Figure D-10, that the sequence is repeated every four cylinders.

These two access signal lines, 0 and 1, are sequentially activated to cause the head to move in (toward the drive hub) or out (away from the drive hub).

*+Head Enagage:* When it is active, this line loads the read/write head.

## D.2.2 Mechanical Operation

Figure D-12 shows the operation of the read/write head on the 31SD Diskette Drive.

The operation of the 31SD is similar to that shown in Figure D-12, but has only one head.

- The diskette is ready to be inserted, **1** .
- The diskette is inserted into the diskette guide, **2** ; the operator closes the knob, which clamps the collet (R/W heads are now much nearer to the diskette).
- The head is loaded (touching the diskette), **3** . The solenoid is activated, the cable pulls the bail, and the bail lowers the head to the diskette.
- Read/Write operation takes place. The heads are moved to the desired cylinder on the disk when the system activates the two stepper motor access lines in a specific sequence.
- The head is released (deactivate the solenoid), **4** .
- The operator turns the knob to the open position; the diskette is released and then removed from the drive, **5** .

## D.2.3 Typical Device Operation

Figure D-13 shows the sequence of diskette operation.

1. The host system starts the diskette drive motor.
2. The operator inserts a diskette and turns the operator knob to the closed position. With the operator knob in the closed position, the diskette starts turning, and the read/write heads move into position on the diskette surface (see paragraph D.2.2 for mechanical operation).
3. Index pulses are sensed every revolution (166.7 ms).
4. The using system sequentially activates the two access lines to move the head/carriage assembly in (toward the hub) or out (away from the hub) to select the desired cylinder. Then the system sequentially activates the access lines to turn the stepper motor a distance equal to one cylinder. The two access lines last used to move the head/carriage to the desired cylinder remain active, **B** . Data from the selected cylinder is valid after 40 ms (minimum time for the head and carriage assembly to stop).
5. A head load command can be given before or during a seek to activate the head load solenoid. Data is valid 80 ms after the head is loaded. Address bytes of the first available ID (identifier) field are read, which locates the head in the correct position.
6. Reading or writing can occur 40 ms after seeking to the last cylinder, **A** , or 80 ms after the heads are loaded.
7. The read/write head is unloaded after the read or write operation.

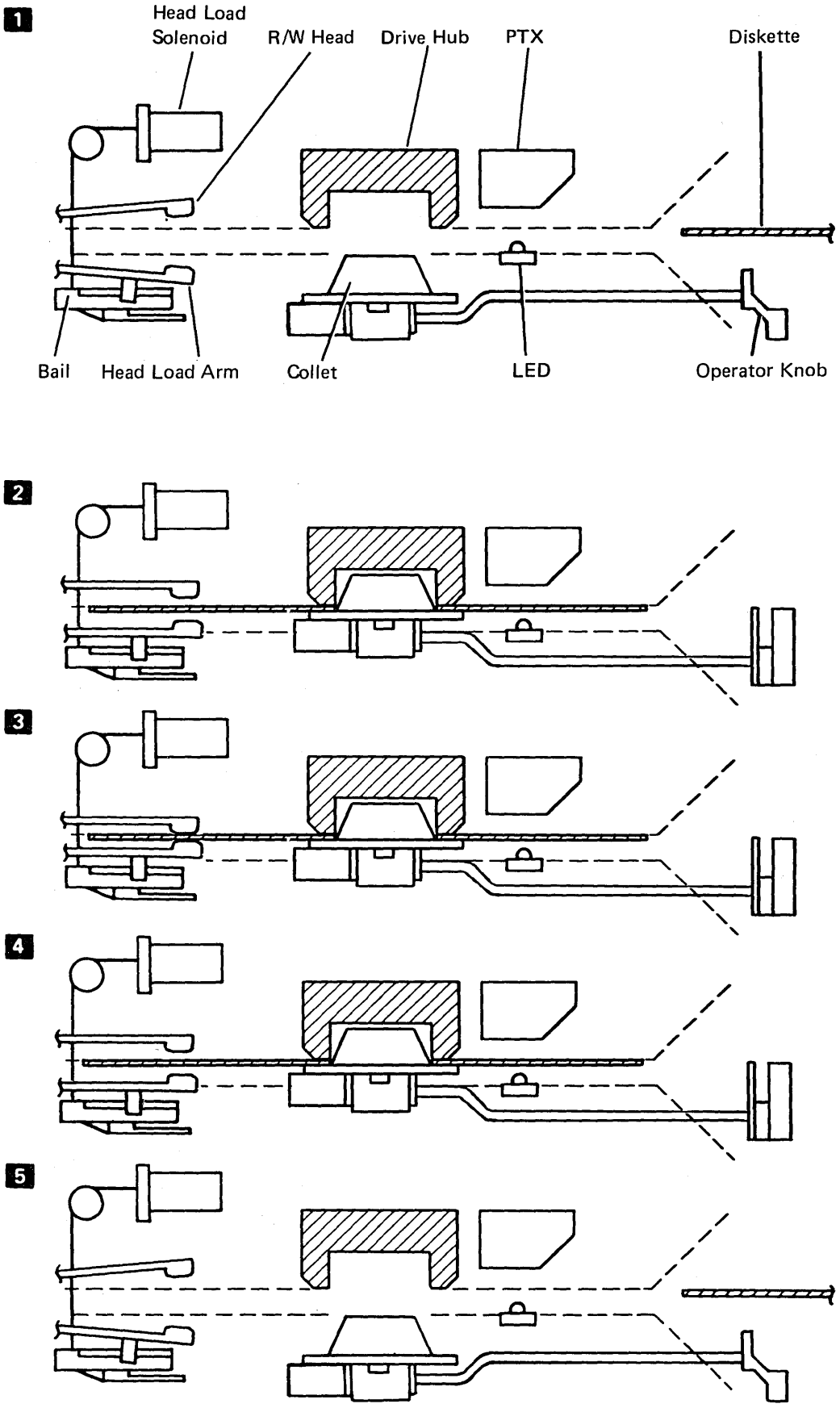
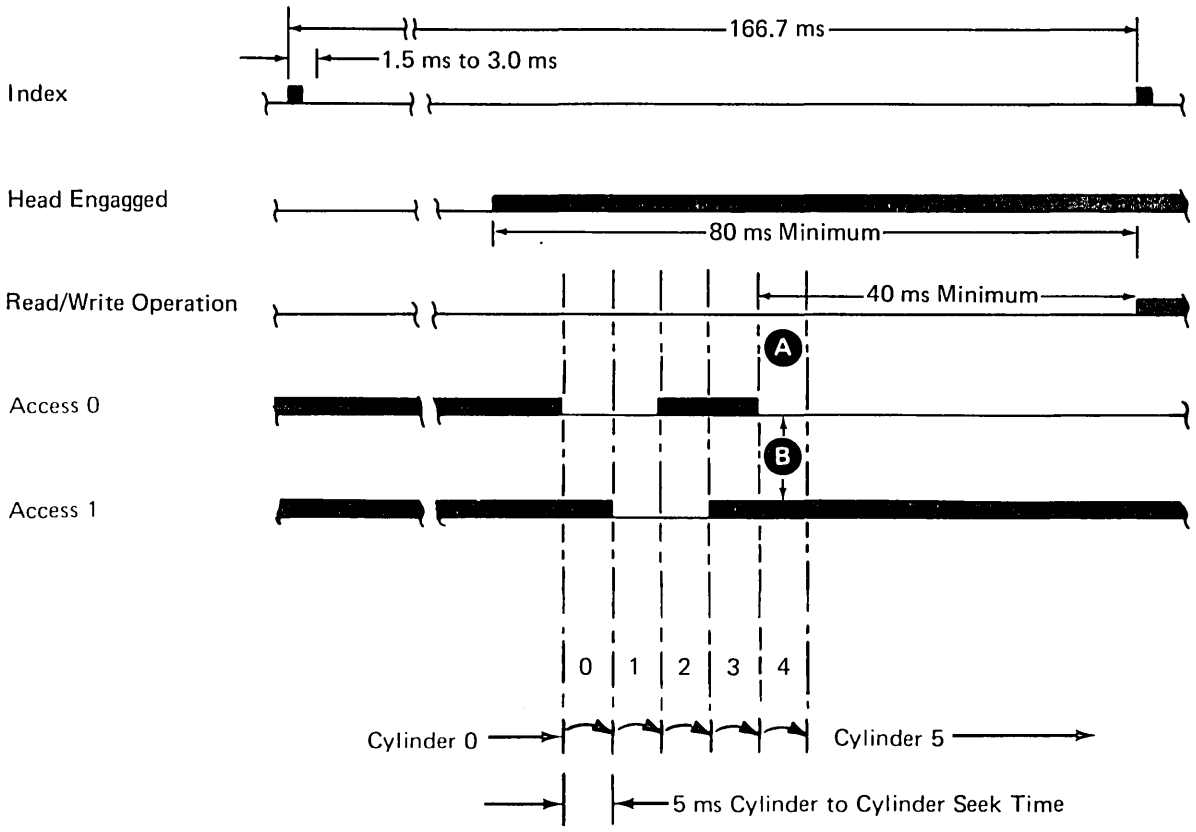



**Figure D-12. Diskette Insertion and Head Load Operation**



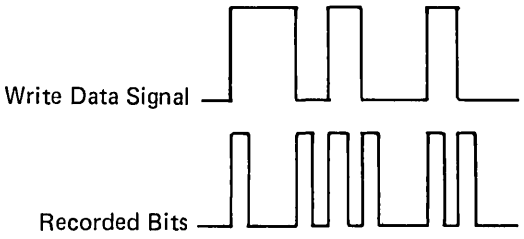

**Note:** *Seeking and head loading are not to the index.*

**Figure D-13. Diskette Operation Sequence**

## D.2.4 Read/Write Principles

### D.2.4.1 Write Data

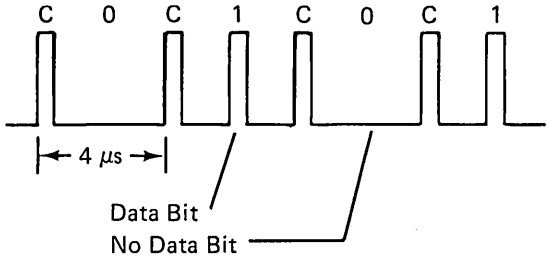
For each change of the write data signal, the current switches in the read/write head. This process records the data on the diskette surface.




*FM Encoding:* Writes data bits 4 μs apart. They are recorded on the diskette as follows:

| Data Bit to Be Recorded | Recorded As: Clock Bit | Data Bit |
|---|---|---|
| 1 | 1 | 1 |
| 0 | 1 | 0 |

Data bits 0101 appear as follows:



### D.2.4.2 Write Operation

For a write operation (Figure D-14), the write-gate signal activates the write circuits and deactivates the read circuits, (E)

The erase-gate signal activates the tunnel erase circuits during a write operation to erase the edge of the data track, (F), just recorded. This erasing process prevents crosstalk between tracks during later read operations.

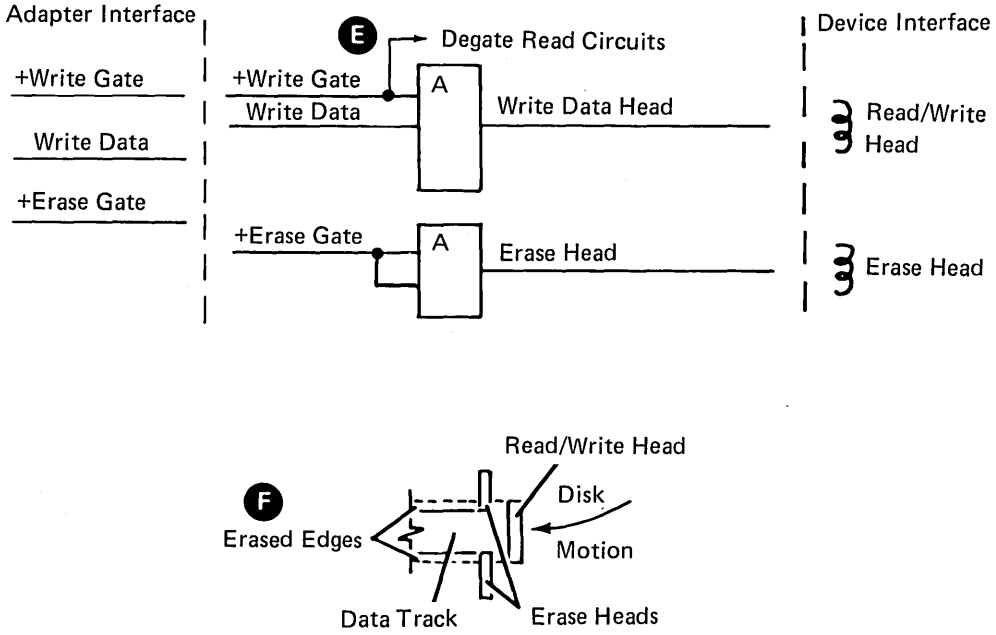
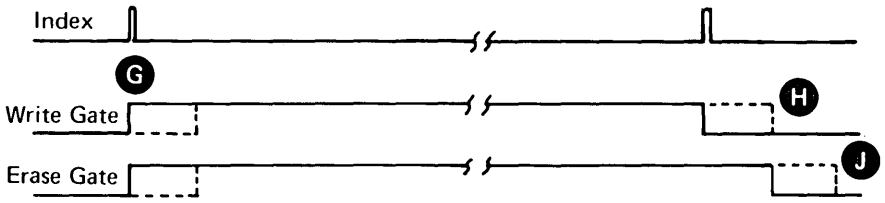






**Figure D-14. Write Operation**

*Format Write Operation:* Writes a full track exchanging all the identifier (ID) fields, data fields, and gaps. The index to the first ID field gap is 79 eight-bit bytes.




The write-gate signal is activated any time between the leading edge of the index pulse, (G), and 50 bytes after the leading edge of the index pulse. The write-gate signal is deactivated approximately 51 bytes after the leading edge of the next index pulse, (H).

The erase-gate signal is activated at the same time as the write-gate signal, but is deactivated 537 μs after the write-gate signal is deactivated (J).

*Record (Update) Write Operation:* Performed on a data field and its VFO sync field only. ID fields and gaps are not written. See Figure D-15.

The write-gate line is activated 316 μs after the last ID character is read, (K). The line is deactivated 5 μs after the last clock of the 2-bit pad is written, (L).

The erase-gate line is activated, (M), 221 μs after the write-gate line and is deactivated, (N), 537 μs after the fall of the write-gate line.

The writing of the new VFO sync field starts when the write-gate line is activated, (P).

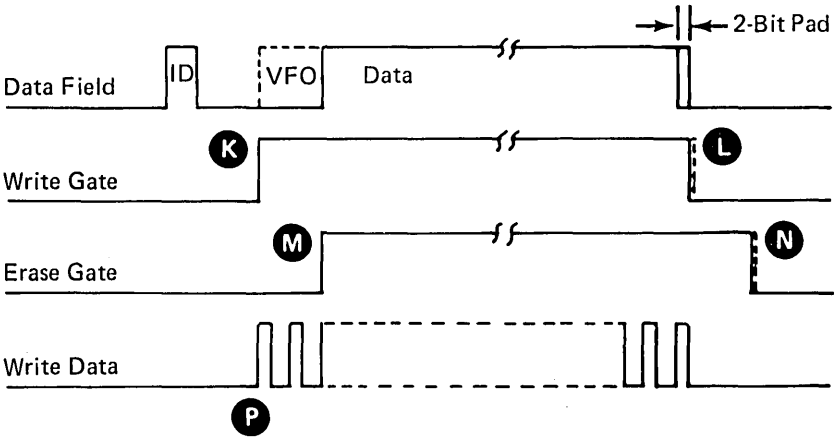



**Figure D-15. Record Update — Write Operation**

### D.2.4.3 Read Data

Read data is the FM encoded read head signal that can be observed at TPAMP1 and TPAMP2. See Figures D-16 through D-20.

Typical measurements for FM encoding are:

125 kHz: 120 to 300 mV (all 0's)
250 kHz: 100 to 250 mV (all 1's)

The voltage is higher at the outer tracks because of the higher track speeds and lower bit density.

**READ DATA : MFM ENCODED (51TD ONLY)**

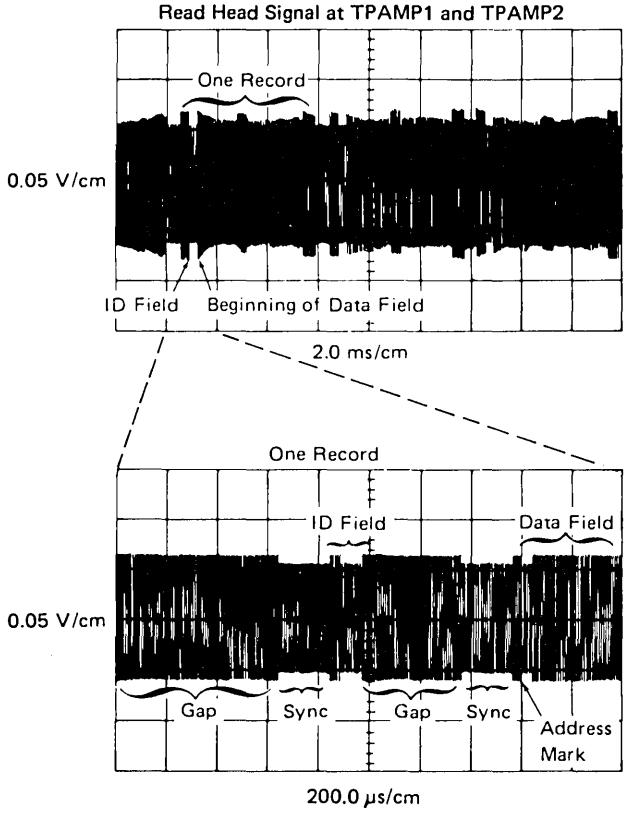



**Figure D-16. Read Data Signals**

**SCOPE SETUP**

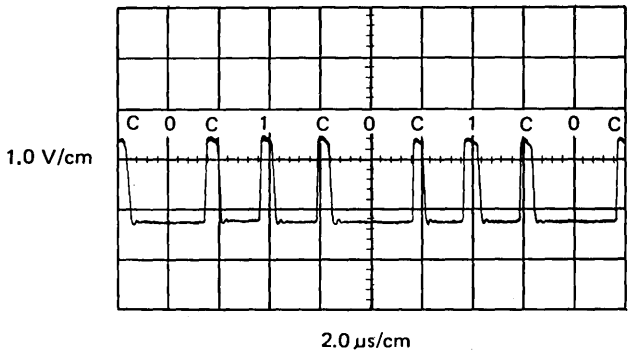
**Note:** *Use Tektronix 453, 454, or similar oscilloscope with x10 probes.*

| | |
|---|---|
| Channel A sweep mode | Normal |
| Channel A level | + |
| Channel A coupling | DC |
| Channel A slope | + |
| Channel A source | External |
| Trigger | Normal |
| Mode | Add |
| Channel 1 volts/ division | 5 mV/cm |
| Channel 2 volts/division | 5 mV/cm |
| Channel 1 input | AC |
| Channel 2 input | AC |
| Invert | Pull out |
| Times per division | 2 ms/cm |
| Connect channel 1 to | TPAMP1 |
| Connect channel 2 to | TPAMP2 |
| Connect trigger to | +Index test pin |
| *Observe:* The amplitude of the read signal should be between 6.5 to 560 mV. | |

**MFM FILE DATA**

Bit Pattern: Hex E5E5

Example; 0101111001




**SCOPE SETUP**

**Note:** *Use Tektronix 453, 454, or similar oscilloscope with x10 probes.*

| | |
|---|---|
| Channel A sweep mode | Normal |
| Channel A level | + |
| Channel A coupling | DC |
| Channel A slope | + |
| Channel A source | External |
| Trigger | Normal |
| Mode | Channel 1 |
| Channel 1 volts/division | 1.0V/cm |
| Channel 1 input | DC |
| Times per division | 2 μs/cm |
| Connect channel 1 to | +File data |
| Connect trigger to | +Index test pin |
| **Observe:** Clock or data pulses every 2 to 4 μs. Pulse duration should be between 100 and 500 ns. Pulse amplitude should be between 2.4 and 4.2 volts. | |

**Figure D-17. File Data Signals**

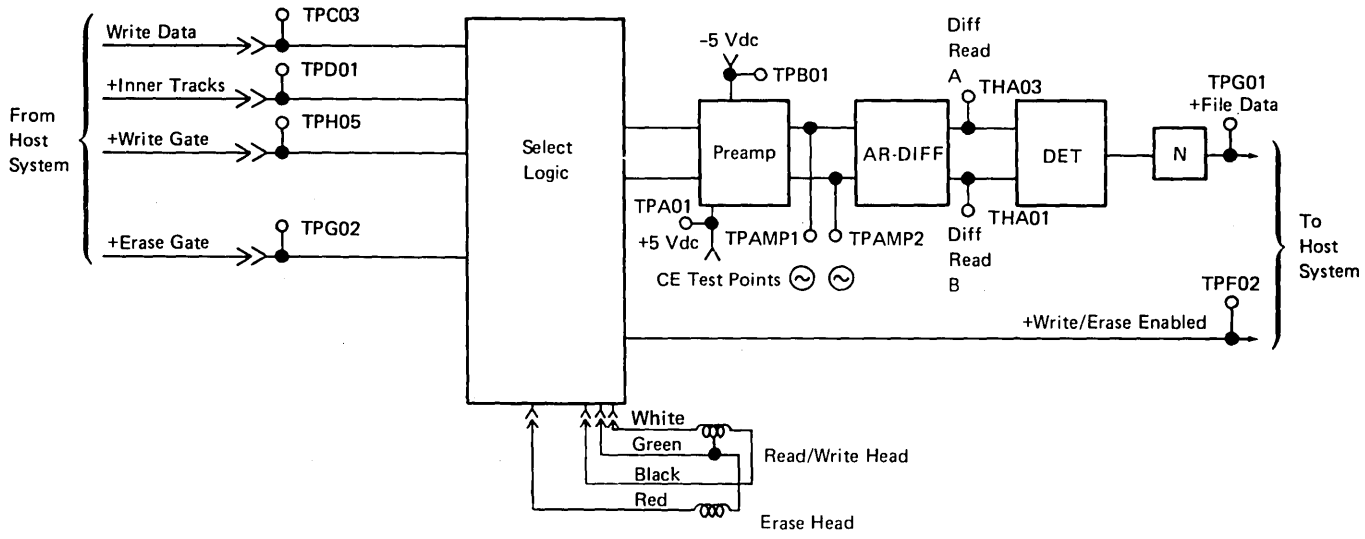
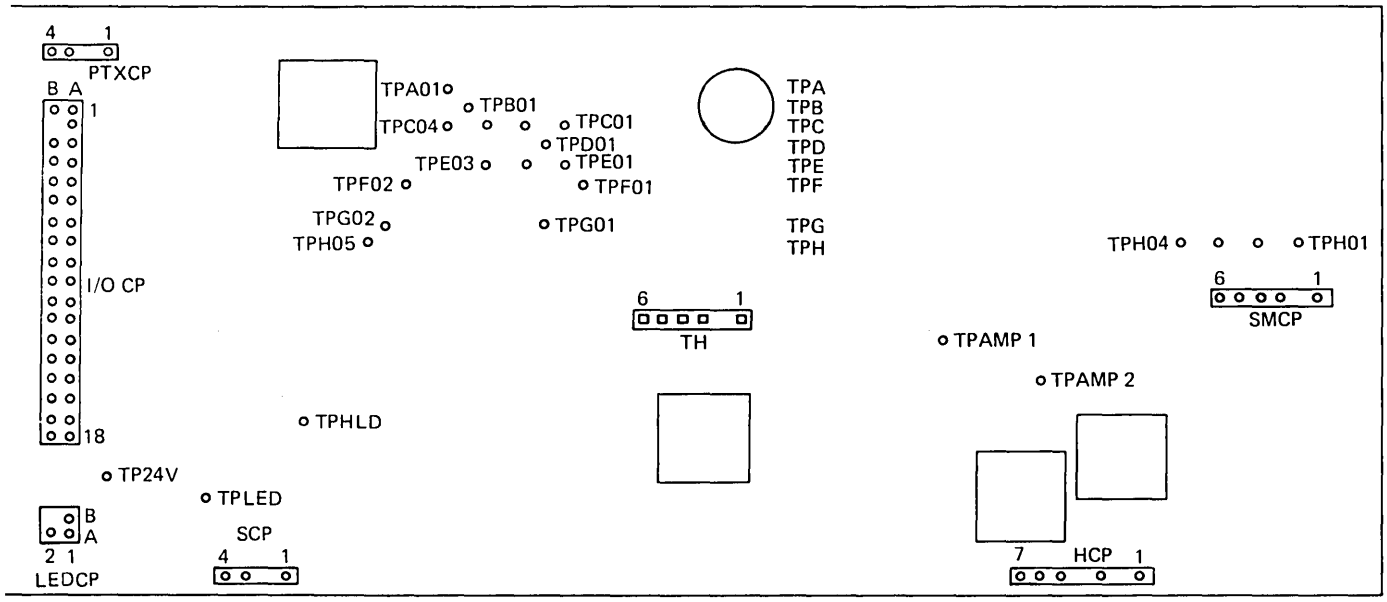



**Figure D-18. 31SD Test Pins**




igure D-19. 31SD Control Card

PTXCP – PTX Connector Pins
I/O CP – I/O Connector Pins
LEDCP – LED Connector Pins
SCP – Solenoid Connector Pins
HCP – Head Connector Pins
SMCP – Stepper Motor Connector Pins

| Test Points | Line Names |
|---|---|
| TH01 | Diff Read B |
| TH02 | No Pin |
| TH03 | Diff Read A |
| TH04 | Not Assigned |
| TH05 | -Disable Stepper Motor |
| TH06 | +18V |

| Test Points | Line Names |
|---|---|
| TPA01 | +5 Vdc |
| TPB01 | -5 Vdc |
| TPC01 | +Access 1 |
| TPC02 | D1 PTX |
| TPC03 | Write Data |
| TPC04 | Ground |
| TPD01 | +Inner Tracks |
| TPE01 | +Access 0 |
| TPE02 | +Head Engage |
| TPE03 | +Index |
| TPF01 | Ground |
| TPF02 | +Write/Erase Enabled |

| Test Points | Line Names |
|---|---|
| TPG01 | +File Data |
| TPG02 | +Erase Gate |
| TPH01 | MC-3 |
| TPH02 | MC-2 |
| TPH03 | MC-1 |
| TPH04 | MC-0 |
| TPH05 | +Write Gate |
| TPAMP1 | Preamp TP1 |
| TPAMP2 | Preamp TP2 |
| TPHLD | -Head Load |
| TP24V | +24 Vdc |
| TPLED | 31SD LED Voltage |

igure D-20. 31SD Control Card Cable

## D.3 MAINTENANCE

### D.3.1 Collet/Flat Spring Assembly

**Warning: Do not attempt to remove the collet/flat spring, (E) , before removing the bail, (L) . Too much pressure or binding can damage the spring.**

#### D.3.1.1 Collet/Flat Spring Removal

See Figure D-21 (2 parts).

1. Power down.
2. Turn the operator knob, (F) , to the closed position.

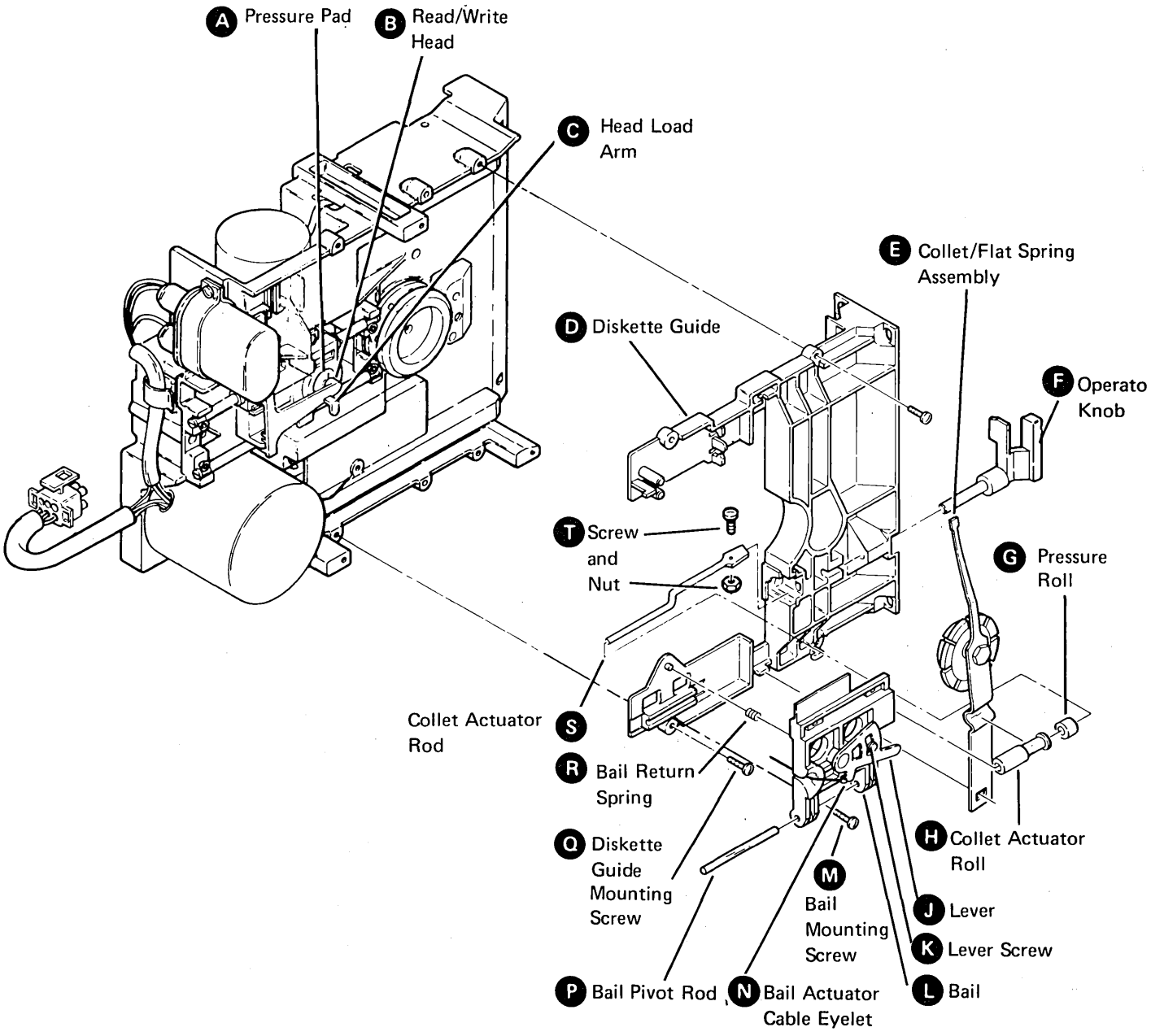



**Figure D-21 (Part 1 of 2). Collet/Flat Spring Removal**

3. Loosen the lever screw, K .
4. Push the bail, L , inward slightly, and disconnect the bail actuator cable eyelet, N , from the lever, J .
5. Turn the operator knob, F , to the open position.
6. Loosen the bail mounting screw, M .
7. Observe the position of the bail return spring, R ; then remove the bail pivot rod, P , the bail return spring, R , and the bail, L , by sliding the bail, L , out from under the head load arm, C .

**Warning: Damage to the head, B , can occur if the pressure pad, A , is permitted to hit the head.**

8. Remove the screw and nut, T , from the collet actuator rod, S .
9. Remove the operator knob, F .
10. Remove the collet actuator roll, H , and the pressure roll, G .
11. Turn the collet actuator rod, S , up and out of the way. Then remove the collet/flat spring assembly, E .

### D.3.1.2 Collet/Flat Spring Replacement

See Figure D-21 (2 parts).

**Warning: Too much pressure or binding of the flat spring, E , will damage the spring.**

1. Reinstall the collet/flat spring assembly, E .
2. Reinstall the collet pressure roll, G , and actuator roll, H .
3. Turn the collet actuator rod, S , down against the spring.
4. Reinstall the operator knob, F , in the open position.
5. Reinstall the screw and nut, T , that attach the operator knob to the collet actuator rod, S . Push the operator knob and the collet actuator rod, S , together until there is a maximum of 0.1-mm (0.004-inch) end play, W , between the operator knob, F , and the diskette guide, D . (See Part 2 of Figure D-21.) Tighten the screw.
6. Reinstall the bail return spring, R , the bail, L , and the bail pivot rod, P . Place the bail, L , on the collet actuator rod, S . Ensure that the spring, R , is in the correct position. Place the bail, L , under the head load arm. Place the bail pivot rod, P , in the groove, and tighten the bail mounting screw, M .

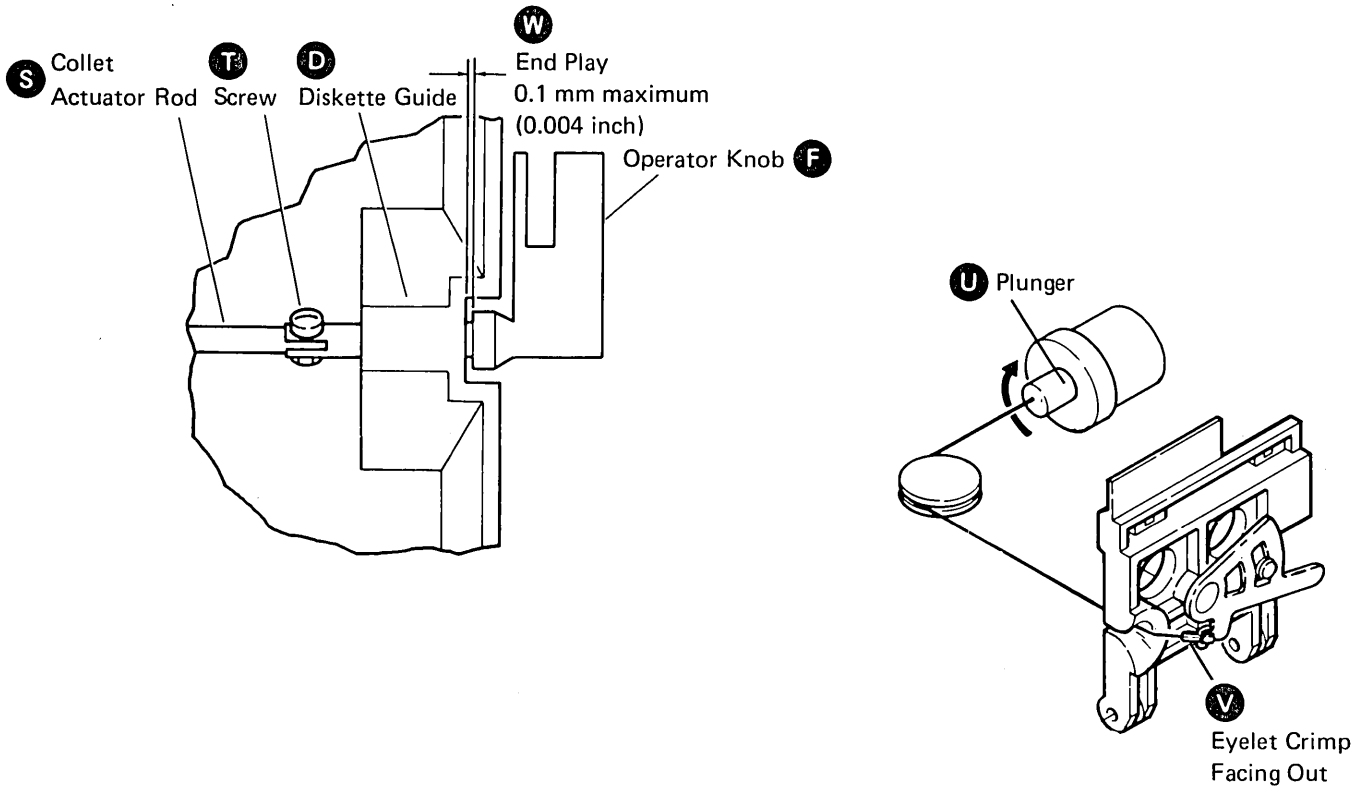



**Figure D-21 (Part 2 of 2). Collet/Flat Spring Removal**

7. Turn the operator knob, (F), to the closed position.
8. Push the bail, (L), inward slightly, and connect the cable to the lever, (J). Ensure that the eyelet crimp, (V), is facing outward, that the cable remains on the pulley, and that the cable is not twisted. (See Part 2 of Figure D-21.) Turn the solenoid plunger, (U), if necessary.
9. Turn the operator knob, (F), to the open position.
10. Ensure that the diskette moves in and out of the drive smoothly without hitting the collet. If the diskette will not move in and out smoothly, the flat spring, (E), has been damaged, and a new flat spring should be installed.
11. Perform the Head Gap Adjustment (paragraph D.3.3.3).

## D.3.2 Head/Carriage Assembly

**Warning: The head/carriage assembly is adjusted and tested at the factory. Do not attempt to adjust or repair any part of this assembly.**

Do not attempt to clean the head/carriage assembly. If the assembly is not clean, exchange it.

### D.3.2.1 Head/Carriage Pressure Pad Removal and Replacement

See Figure D-22.

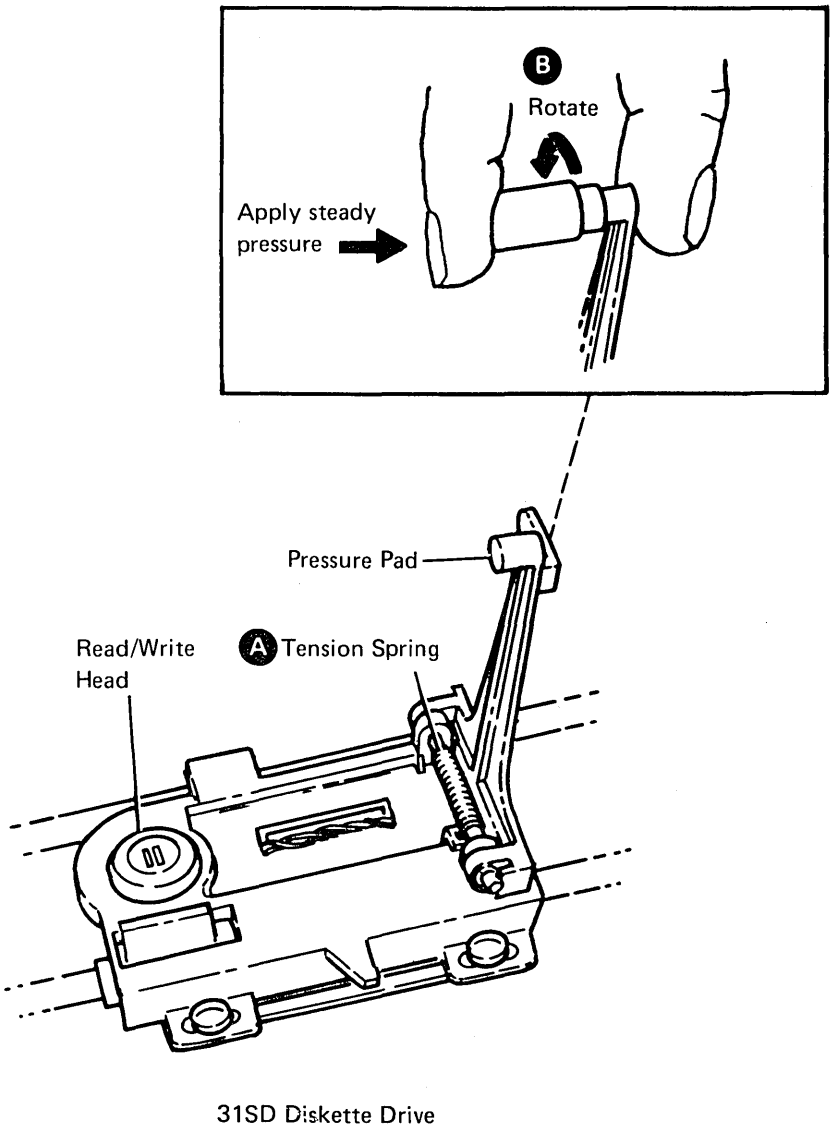



**Figure D-22. Head/Carriage Pressure Pad Removal and Replacement**

If the pressure pad is worn to a point nearly even with the surface of the head load arm, exchange the pad. Use pad B/M (part 2200751).

**Warning: The head area can be easily damaged or contaminated. Read the following before exchanging a pressure pad:**

- **Ensure that your tools are clean; use isopropyl alcohol (part 2200200) and a clean tissue (part 2162567), or use an alcohol pad (part 9900679).**
- **Do not touch the pressure pad with your fingers.**
- **Be careful not to damage the new pressure pad or loosen any of the pad's surface. The layer of adhesive on the new pad is very thin; do not damage the adhesive. Do not let the adhesive touch the surface of the pad that will touch the diskette. Do not use damaged pads.**
- **Do not scratch the head load arm.**
- **Do not let the head load arm hit the read/write head.**
- **Move the head load arm as little as possible. The tension spring, (A), can come out.**

1. Move the head load arm away from the read/write head.
2. Using your scissor clamp (part 9900233), pull the worn pad off the arm.
3. Carefully remove any adhesive that remains on the arm.
4. Ensure that the pressure pad mounting surface is lint-free; use tissue (part 2162567) moistened with isopropyl alcohol (part 2200200) or an alcohol pad (part 9900679). If the surface is not completely clean, the new pad may not seat correctly.
5. Using a knife (or similar thin blade), lift off the paper cover that protects the adhesive layer on the new pad.
6. Using your scissor clamp, carefully remove the new pressure pad from the other new pads.
7. Place the new pad in the center of its location on the head load arm.
8. Lightly press on the new pad with a clean screwdriver.
9. Using the small end of the pressure pad tool, (B), press at 90 degrees to the head load arm.
10. Use your other hand to turn the tool at least one revolution *in one direction only.*
11. Carefully move the head load arm back to its operational position.
12. Test the read/write head output. See Read/Write Principles (paragraph D.2.4).

### D.3.2.2 Head/Carriage Service Check

See Figures D-23 and D-24.

**Warning: The head/carriage service check must be performed with the diskette drive installed (or with the diskette drive in the same position as when installed) or the adjustment might not be accurate.**

1. Power down.

   **DANGER**
   **Voltage is still present at the socket when the power cable is disconnected.**

2. Disconnect the ac drive motor power cable, (J).
3. Remove the head cable guide, (A).
4. Turn the stepper motor pulley by hand to track 40, and insert a timing pin, (C). (Ensure that the pin goes into the casting.)
5. Power up.
6. To disable the stepper motor, install a jumper, (L), from TCP04 (ground) to TH05 (-'disable stepper motor').
7. To locate the stepper motor at track 40, install a jumper, (M), between TPF01 (ground) and TPH04 (MC-0).
8. Put the timing pin, (C), through the stepper motor pulley into the timing hole in the casting. Does the timing pin pass freely through the hole?

   Y N
   - Remove the timing pin, (C).
   - Remove the jumpers, (L) and (M).
   - Power down.
   - Go to the Head/Carriage Adjustment (paragraph D.3.2.3), step 3.

9. Remove the timing pin, (C).
10. To move the stepper motor to track 39, remove the jumper connected to TPH04 and install the jumper end on TPH01 (MC-3).
11. Verify that this is track 39 by visually checking for no gap, (D), between the timing pointer, (E), and the timing block, (G).

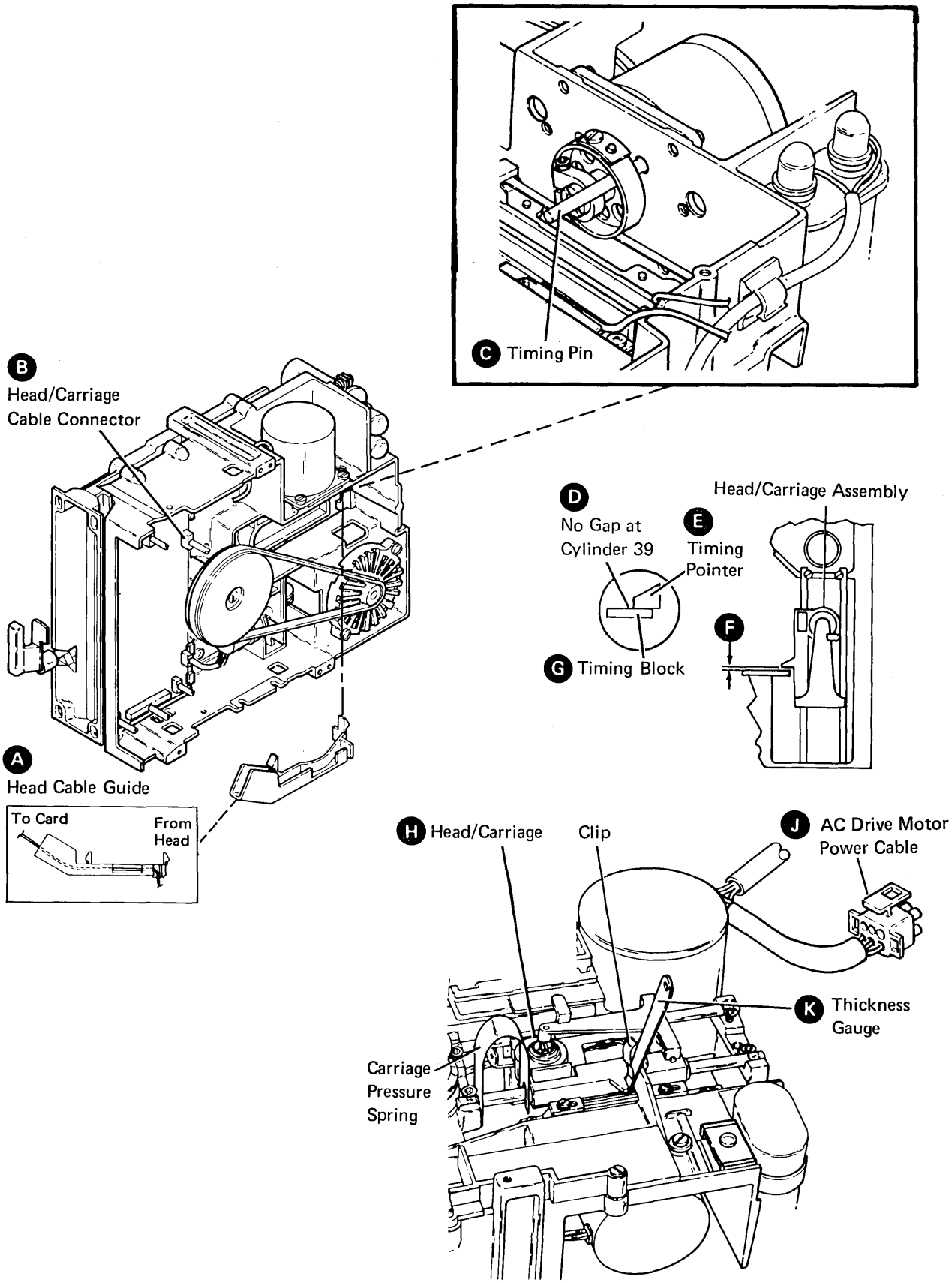



**Figure D-23. Head/Carriage Service Check**

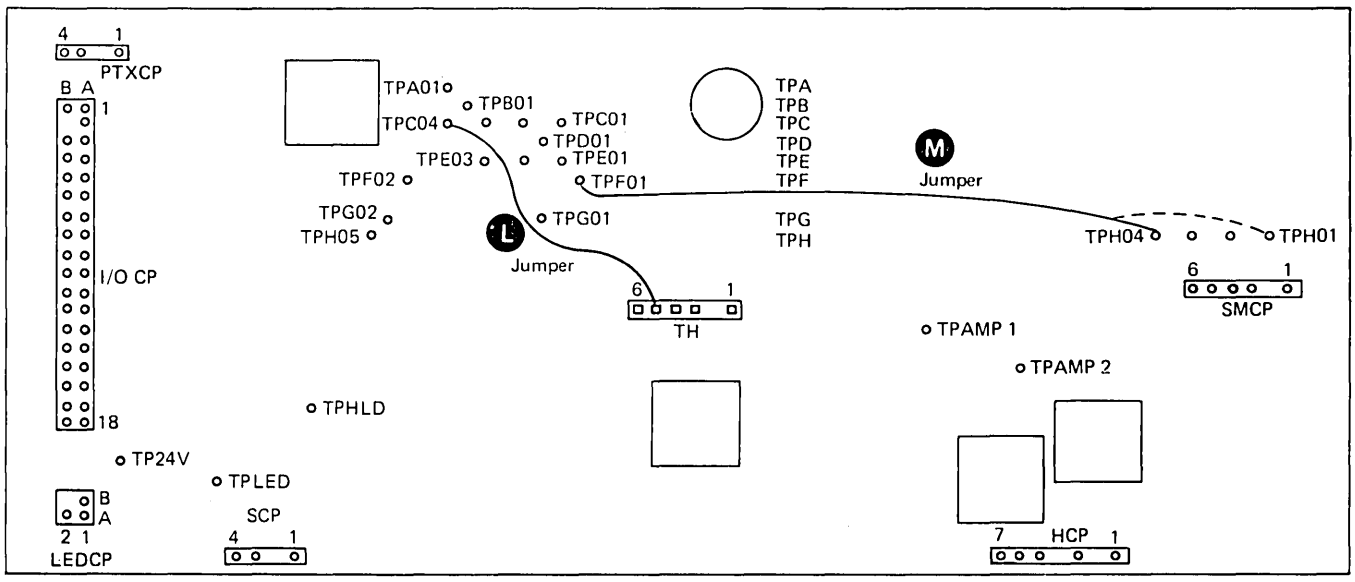



**Figure D-24. 31SD Control Card**

12. To move the stepper motor from track 39 back to track 40, remove the jumper connected to TPH01 and install the jumper end on TPH04 (MC-0).
13. Verify that this is track 40 by visually checking that the timing hole in the pulley lines up with the timing hole in the casting. (Use the dental mirror to verify; do not use a timing pin.)
14. Insert the thickness gauges from the end of the timing pointer, (E), and timing block, (G), to verify the indicated gap, (F):
    - 0.483 mm (0.019 inch). Go.
    - 0.533 mm (0.021 inch). No go.

    **Note:** *Because of the torque characteristics of the stepper motor, this step can be performed only once. If it is necessary to perform this step again, go back to step 10 of this service check.*
15. If the adjustment is not correct, go to step 12 of paragraph D.3.2.3.
16. Remove the jumpers, (L) and (M).
17. Reinstall the head cable guide, (A). (Ensure that the read/write head can move freely.)
18. Was the head/carriage assembly exchanged?

    Y N
    - Power down.
    - Reconnect the ac drive motor power cable.
    - Power up.
    - End of procedure.

19. Go to the Head Gap Service Check (paragraph D.3.3.2).

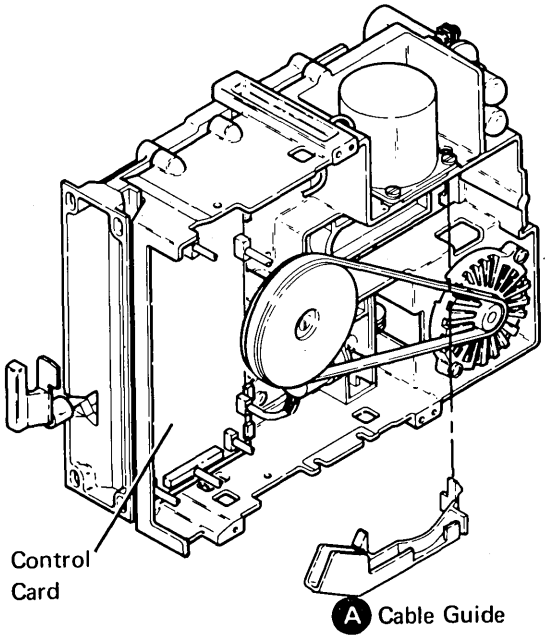
## D.3.2.3 Head/Carriage Adjustment

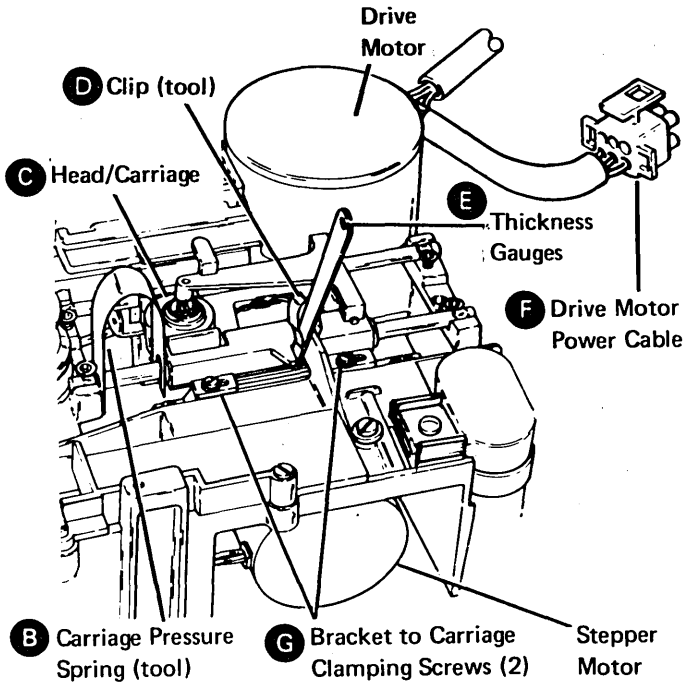
See Figure D-25.

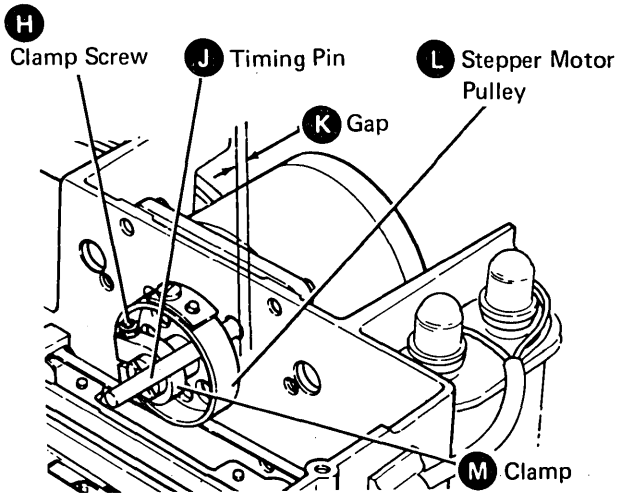
**Warning: The head/carriage assembly adjustment must be performed with the diskette drive installed (or in the same position as when installed), or the adjustment might not be accurate.**

1. Power down.
2. Remove the cable guide, (A) .
3. Measure and record the gap, (K) , between the stepper motor pulley, (L) , and the casting.

   Gap is: _____ .
4. Loosen the clamp screw, (H) , so the stepper motor drive shaft, (N) , can turn inside the pulley, (L) .
5. Turn the stepper pulley, (L) , by hand to track 40, and insert the timing pin, (J) . (Ensure that the pin goes into the casting.)



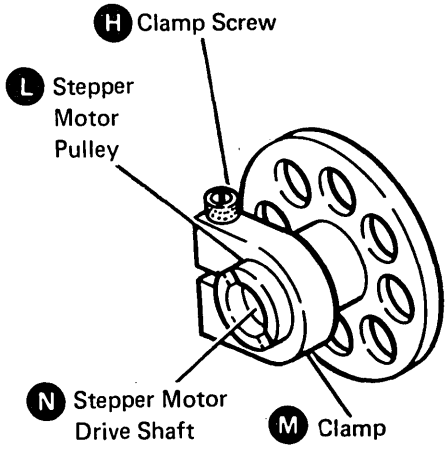




**Figure D-25 (Part 1 of 2). Head/Carriage Adjustment**

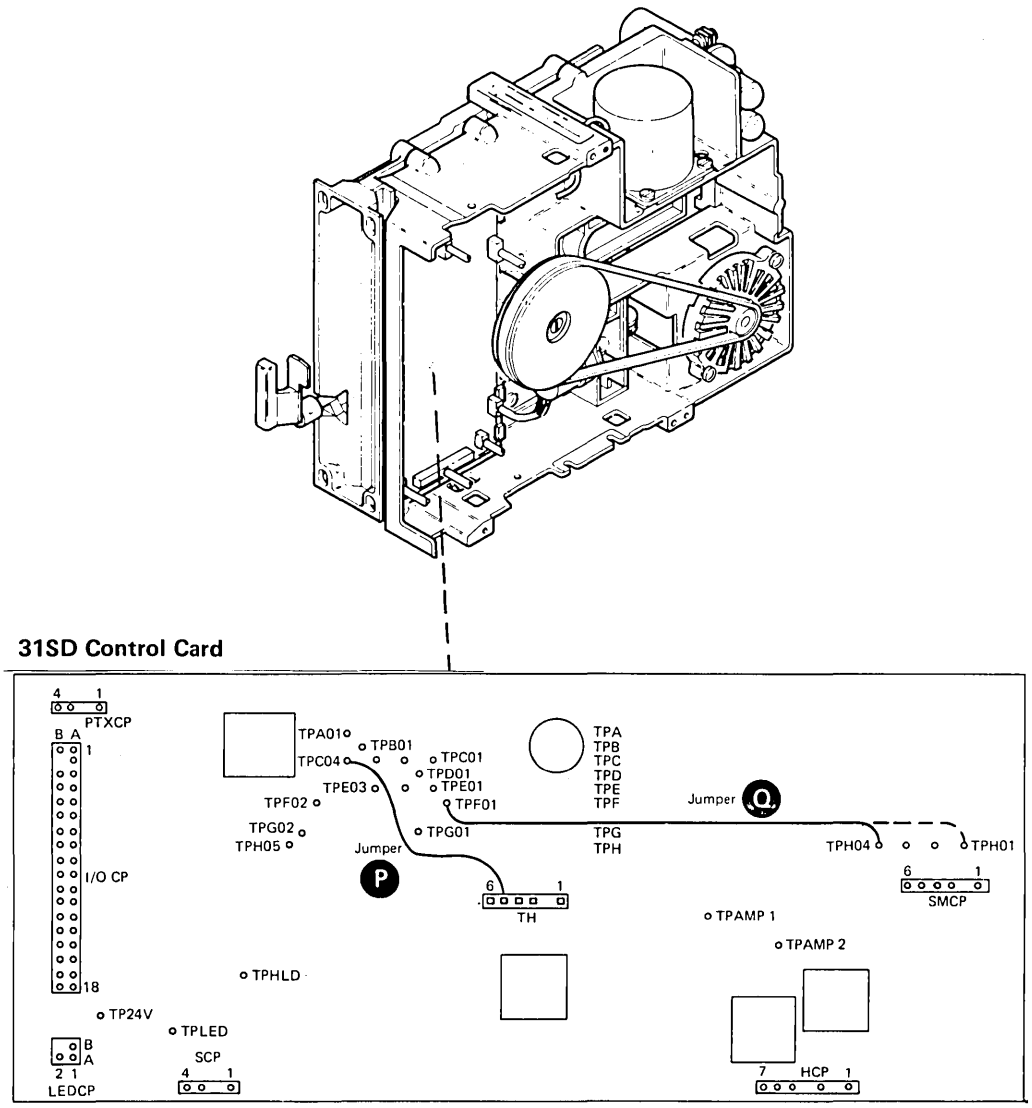



**Figure D-25 (Part 2 of 2). Head/Carriage Adjustment**

**DANGER**
**Voltage is still present at the socket when the power cable is disconnected.**

6. Disconnect the ac drive motor power cable, (F).
7. Power up.
8. To disable the stepper motor, install a jumper (P) from TPC04 (ground) to TH05 (-'disable stepper motor).
9. To locate the stepper motor at track 40, connect a jumper (P) from TPF01 (ground) to TPH04 (MC-0).
10. Make the gap, (K), the same size as the gap recorded in step 3, and tighten the clamp screw, (H). (Ensure that the timing pin passes freely through the stepper motor pulley into the hole in the casting.) The clamp, (M), should be placed even with the end of the stepper motor drive shaft, (N).
11. Remove the timing pin, (J).
12. Loosen the two bracket-to-carriage clamping screws, (G).
13. Remove the jumper end from TPH04, and install the jumper end on TPH01 (MC-3).
14. Remove the jumper end from TPH01, and connect the jumper end on TPH04 (MC-0).
15. Verify that this is track 40 by visually checking that the timing hole in the pulley lines up with the timing hole in the casting. (Use the dental mirror to check; do not use a timing pin.)
16. Insert a 0.508 mm (0.020 inch) thickness gauge, (E), between the timing pointer on the carriage and the track 40 adjustment surface on the casting. Use the clip (part 4240632), (D), to attach the thickness gauge to the casting. The clip is attached to the diskette guide (see Figure D-4).
17. Slide the head/carriage, (C), against the thickness gauge so it just touches but is not forced against the thickness gauge. Install the carriage pressure spring (part 4240631), (B), between the casting and the carriage to hold the head/carriage assembly against the thickness gauge. The pressure spring is attached to the diskette guide (see Figure D-4).
18. Tighten the two screws, (G), that fasten the bracket to the carriage.
19. Remove the clip, (D), and the carriage pressure spring, (B).
20. Go to step 10 of paragraph D.3.2.2.

### D.3.2.4 Head/Carriage Removal

See Figure D-26.

1. Power down.
2. Carefully remove the head/carriage cable connector, (A), from the control card. (Note the cable path for easier replacement.)
3. Remove the cable guide, (B).

**Warning: Band (C) must not be bent or damaged in any way.**

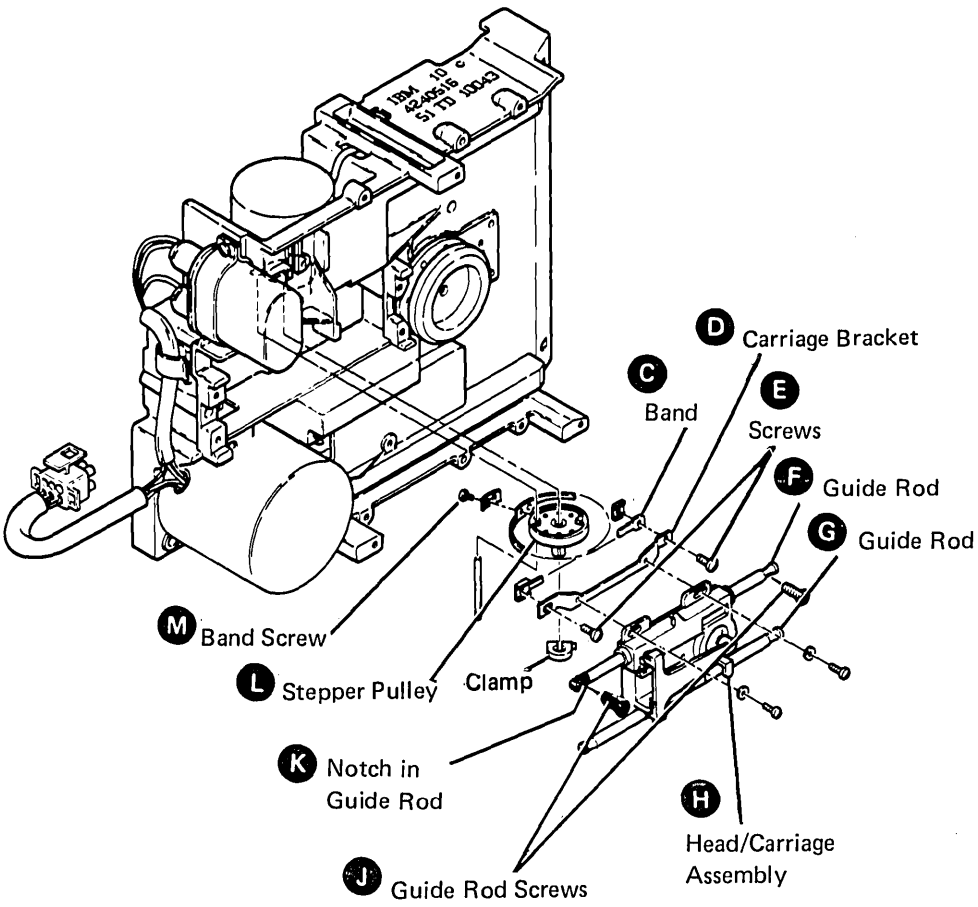
4. Remove the band, (C), by removing the three screws, (E) and (M), that attach the band to the stepper pulley, (L), and the carriage bracket, (D). (Note the position of the band and clamps; they must be in the same position for replacement.)
5. Remove the carriage bracket, (D), from the carriage.
6. Remove the two screws, (J), and remove the guide rod, (F).
7. Carefully lift and turn the head/carriage assembly, (H), to remove it from the guide rod, (G).

### D.3.2.5 Head/Carriage Replacement

See Figure D-27.

**Warning: When you install the head/carriage assembly, (S), ensure that the bail, (E), is under the head load arm, (D). Ensure that the bail return spring, (G), is correctly installed. Ensure that the band, (L), is not damaged in any way.**

1. Carefully install the head/carriage assembly, (S), on the guide rod, (Q). Then place the head/carriage assembly at track 00.
2. Reinstall the guide rod, (P), and tighten the two screws, (R). (Ensure that the guide rod notch, (U), is aligned with the screw, (T).)
3. Place the head/carriage assembly at track 40.
4. Reinstall the carriage bracket, (M), on the carriage with the screws and washers, (R), installed in the center of the hole.
5. Reconnect the band, (L), as follows: Install the adapter welded to band (V) to the slotted end, (B), of the carriage bracket, (M). Leave the screw loose. Install band (L) to the stepper motor pulley, (W), with clamp (J). Install the end of band (L) to the carriage bracket with clamp (K). Ensure that the band is parallel to the carriage bracket, (M), and the edge of the pulley, (H), during installation.



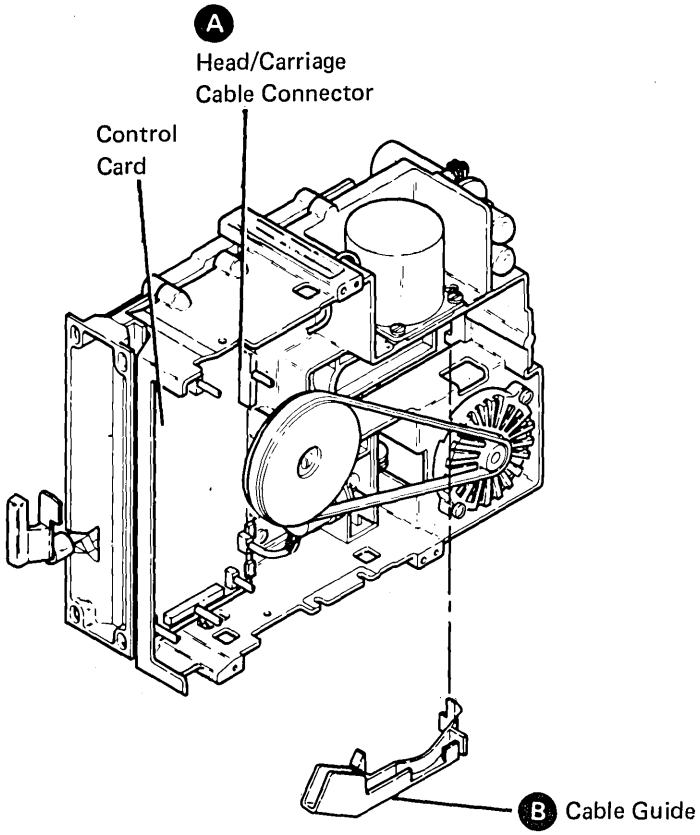




**Figure D-26. Head/Carriage Removal**

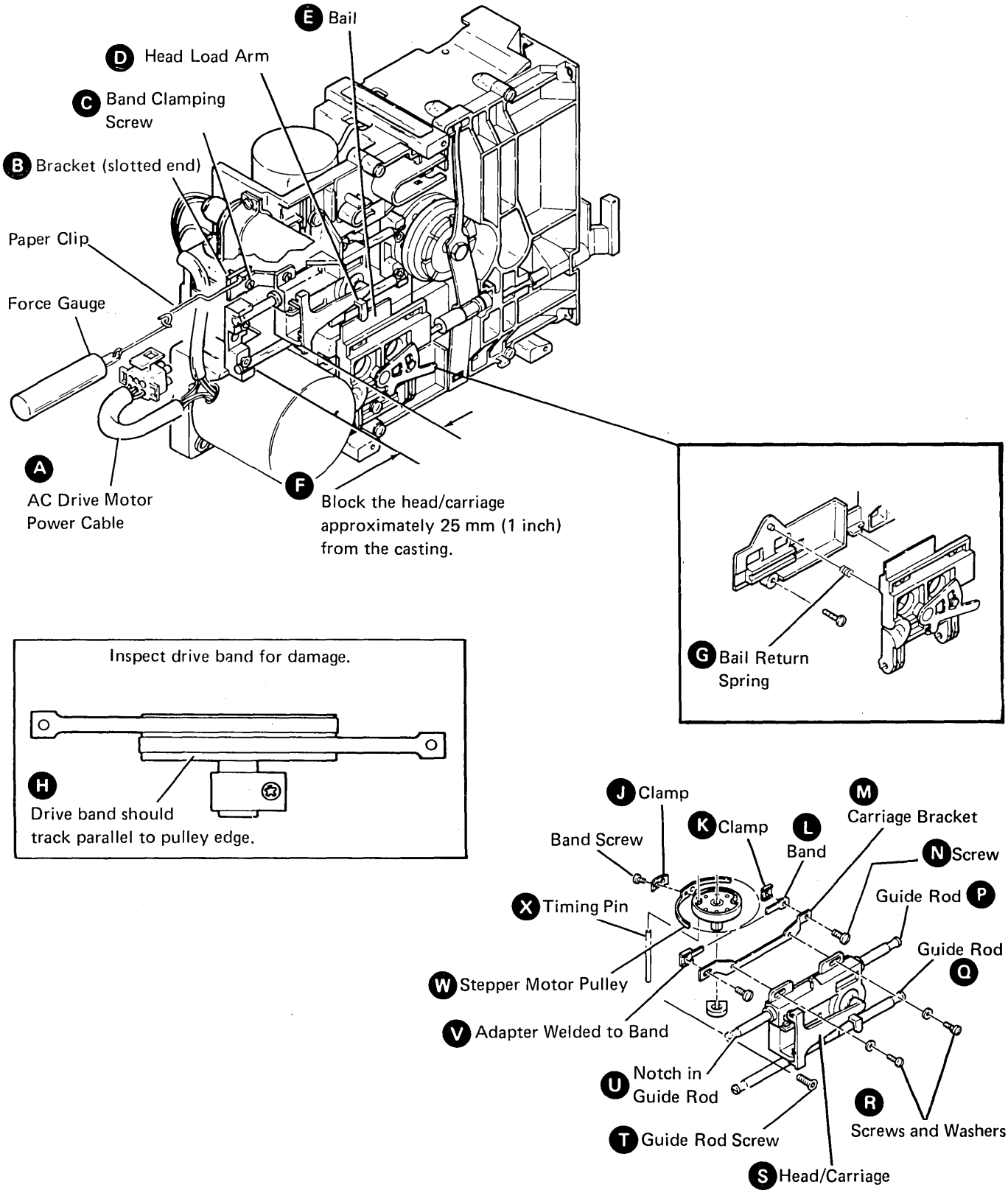



**Figure D-27 (Part 1 of 2). Head/Carriage Replacement**

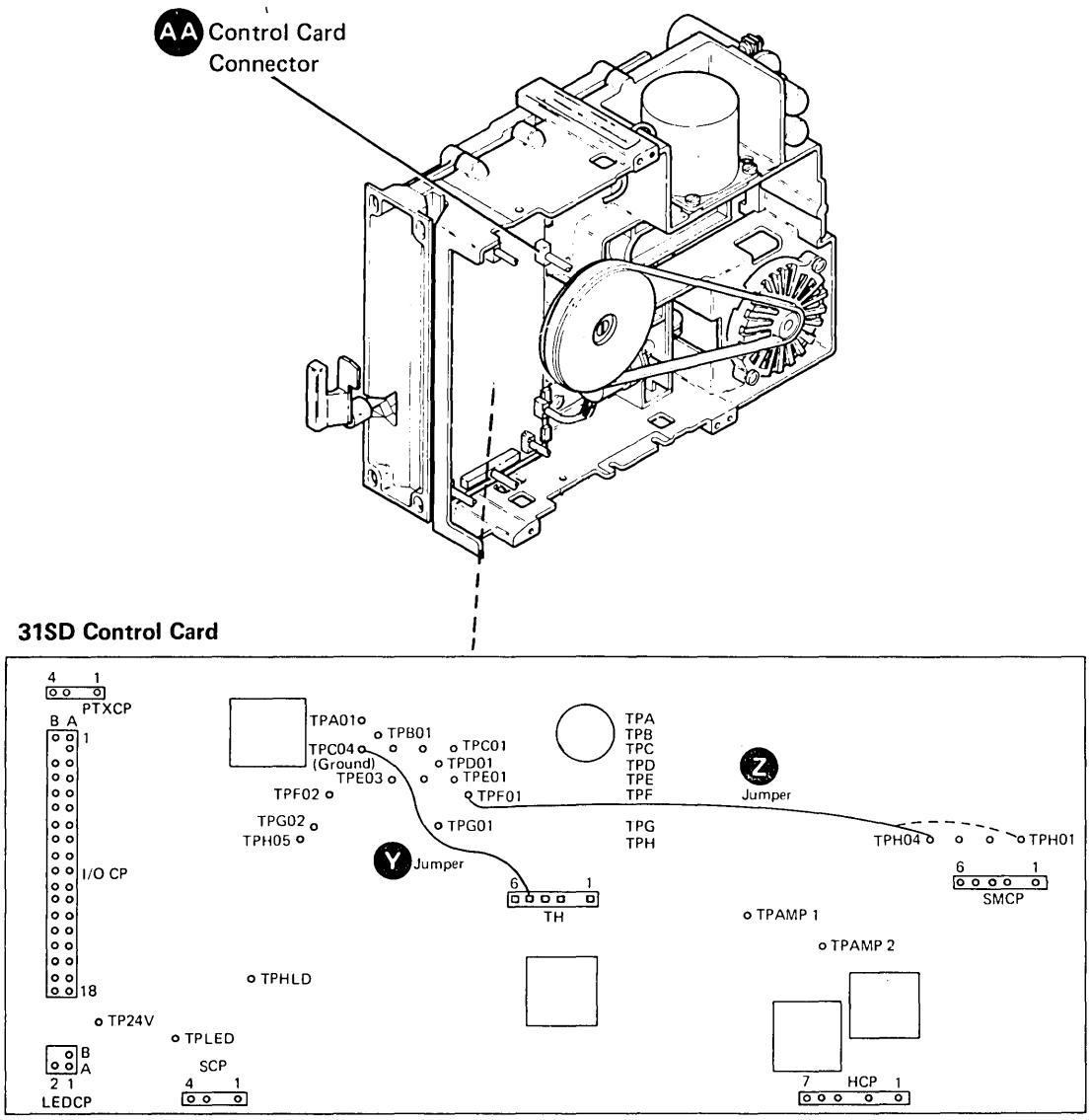



**Figure D-27 (Part 2 of 2). Head/Carriage Replacement**

6. Block the head/carriage about 25 mm (1 inch) from the casting, (F).
7. Pull on the adapter welded to band (V) with 2.5 ± 0.25 pounds' force, and tighten the band clamping screw, (C). Ensure that the band is parallel to the pulley edge, (H).
8. Move the carriage to track 00 and then to track 76. Ensure that the band track is straight and that the drive band is parallel to the pulley edge, (H).
9. Carefully connect the head/carriage cable to the control card connector, (AA).
10. Turn the stepper motor pulley, (W), by hand to track 40, and check with the timing pin, (X). Ensure that the pin goes into the casting.

**DANGER**
**Voltage is still present at the socket when the power cable is disconnected.**

11. Disconnect the ac drive motor power cable, (A).
12. Power up.
13. To disable the stepper motor, install a jumper, (Y), from TPC04 (ground) to TH05 (-'disable stepper motor').
14. Install a jumper, (Z), from TPF01 (ground) to TPH04 (MC-0).
15. Put the timing pin through the stepper motor pulley, (W), into the timing hole in the casting. Does the timing pin pass through the timing hole freely?

    Y N
    - Remove the timing pin, (X).
    - Remove the jumpers (Y) and (Z).
    - Power down.
    - Go to step 3 of paragraph D.3.2.3.

    Remove the timing pin (X).
16. Go to step 12 of paragraph D.3.2.3.

## D.3.3 Head Load Solenoid and Bail

### D.3.3.1 Solenoid and Bail Service Check

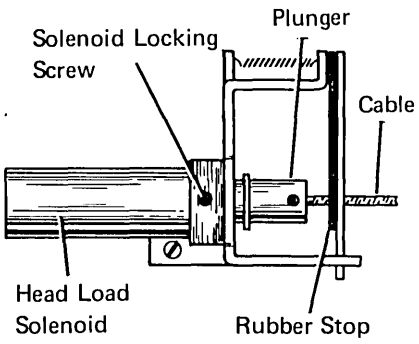
See Figure D-28.

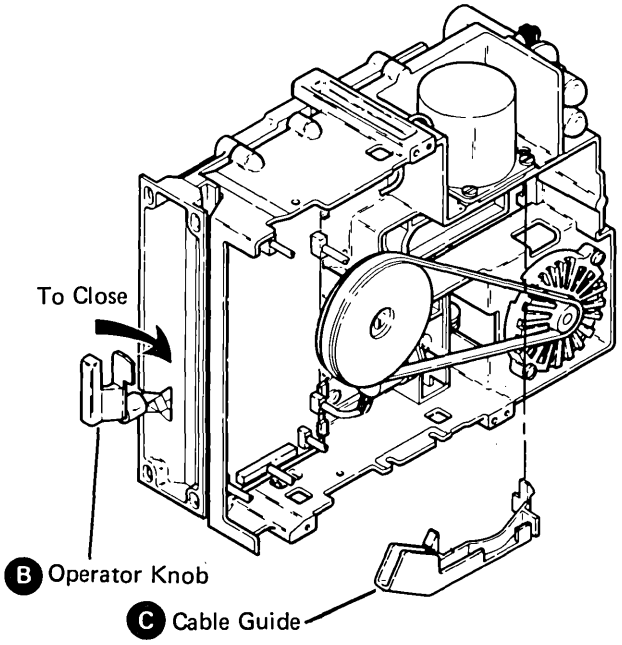
1. Power down.

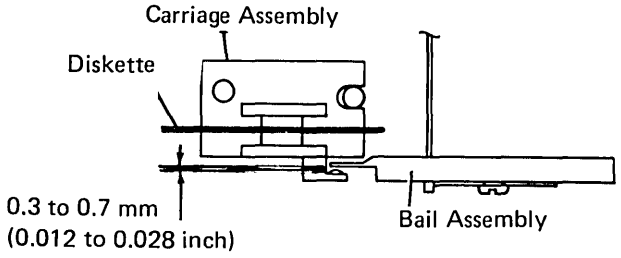
**DANGER**
**Voltage is still present at the socket when the power cable is disconnected.**

2. Disconnect the ac drive motor power cable, (G).
3. Insert a diskette, and turn the operator knob, (B), to the closed position.
4. Power up.
5. To activate the head load solenoid, install a jumper, (E), from TPC04 (ground) to the head load TPHLD (-'head load').
6. To deactivate the stepper motor, install a jumper, (F), from TPC04 (ground) to TH05 (-'disable stepper motor').
7. Verify a 0.3 to 0.7 mm (0.012 to 0.028 inch) gap, (D), between the bail and the head load arm at each end of the head movement.
8. Is the gap OK? If not, go to Bail Adjustment (paragraph D.3.3.4, step 5).
9. Remove the jumpers (E) and (F).
10. Turn the operator knob, (B), to the open position, and remove the diskette.
11. Turn the operator knob, (B), to the closed position.
12. Power down.
13. Reconnect the ac drive motor power cable, (G).
14. Power up.

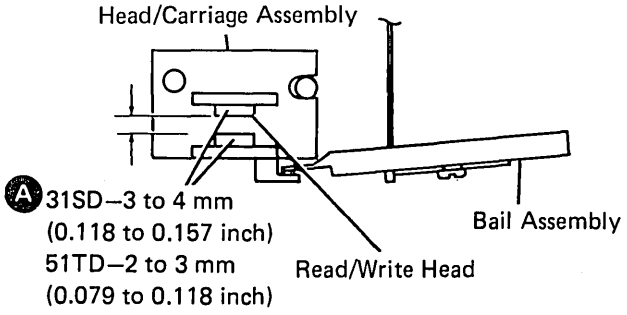
**Head Load Solenoid Activated**

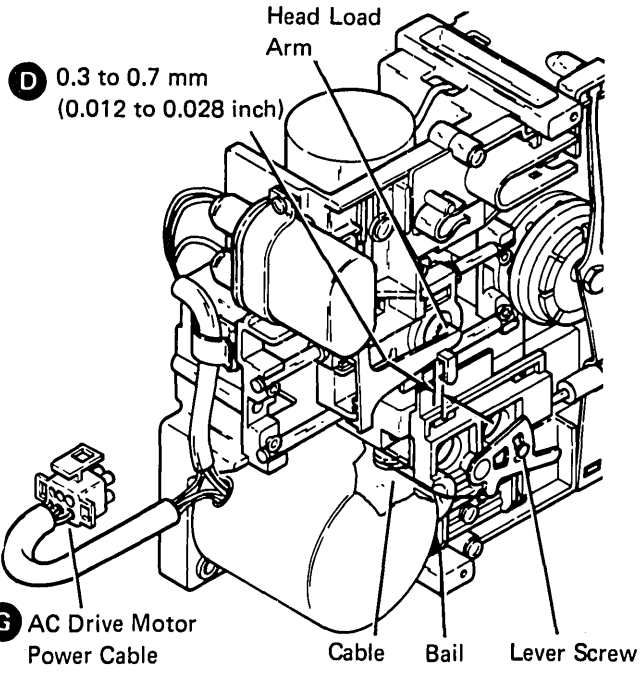



**Head Load Solenoid Deactivated**



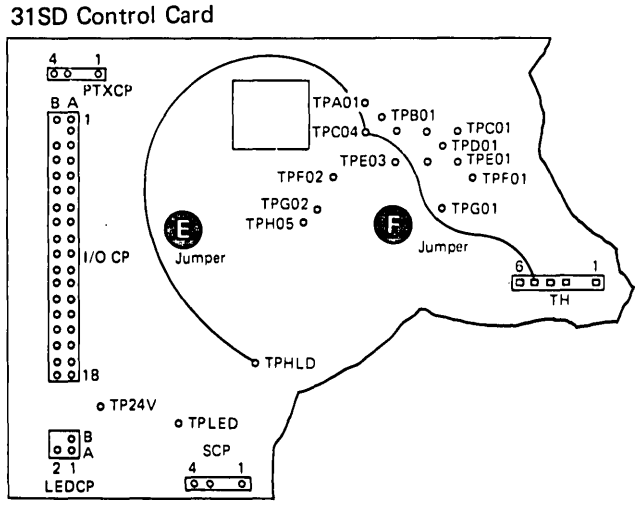




**Figure D-28. Solenoid and Bail Service Check**

### D.3.3.2 Head Gap Service Check

See Figure D-29.

1. Power down.
2. Turn the operator knob, (B), to the closed position.
3. Visually check for a gap of 3 to 4 mm (0.118 to 0.157 inch) between the bail assembly and the head load arm.
4. Is the gap OK? If not, go to step 3 of paragraph D.3.3.3.
5. Turn the operator knob, (B), to the open position.
6. Power up.
7. If the head/carriage assembly was exchanged, go to the Solenoid and Bail Service Check (paragraph D.3.3.1).

### D.3.3.3 Head Gap Adjustment

See Figure D-29.

1. Power down.
2. Turn the operator knob to the closed position.
3. Tighten the lever screw, (K), just enough so that the lever, (J), can still be adjusted.
4. While looking into the diskette opening, move the lever until the load arm, (F), just touches the head.
5. Note the lever marks, (H), on the lever relative to the bail alignment edge, (G).
6. Turn the lever 1-1/2 spaces clockwise.
7. Tighten screw (K).
8. The gap, (B), between the head load arm and the head should now be 3 to 4 mm (0.118 to 0.157 inch).
9. Is the gap OK?

   Y N
   - Go to Solenoid and Bail Service Check (paragraph D.3.3.1).
   - Go back to step 3.

### D.3.3.4 Bail Adjustment

See Figure D-29.

1. Power down.

   **DANGER**
   **Voltage is still present at the socket when the power cable is disconnected.**

2. Disconnect the ac drive motor power cable, (L).
3. Power up.
4. Insert a diskette, and turn the operator knob to the closed position.
5. To activate the head load solenoid, install a jumper, (C) from TPC04 (ground) to the head load TPHLD (-'head load').
6. To deactivate the stepper motor, install a jumper, (D), from TPC04 (ground) to TH05 (-'disable stepper motor').

   **CAUTION: The solenoid case becomes hot after continuous use.**

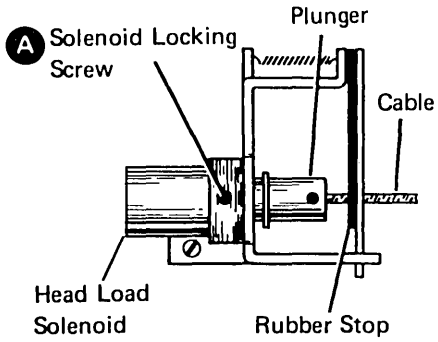
7. Loosen the solenoid locking screw, (A).

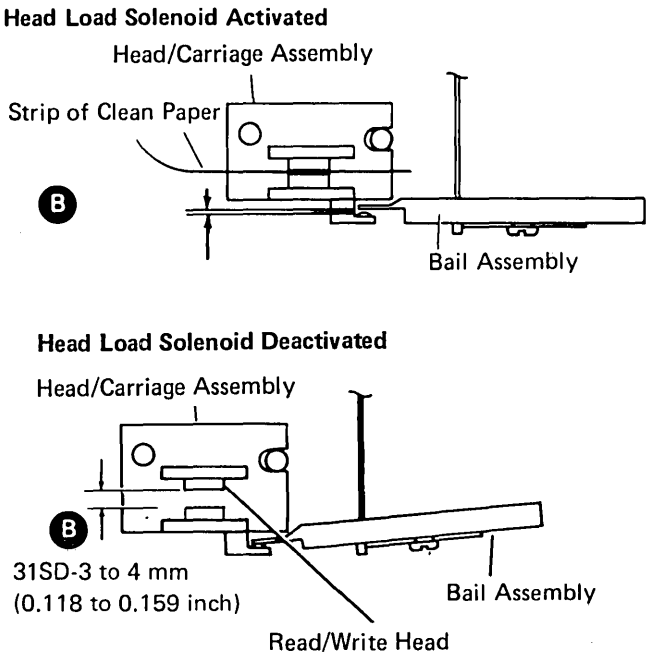
**Warning: Do not let the solenoid plunger and cable turn while you make this adjustment.**

8. Turn the solenoid in the mounting bracket to obtain a 0.3 to 0.7 mm (0.012 to 0.028 inch) gap, (E), between the head load arm and the bail.
9. Tighten screw (A).
10. Is the gap OK at each end of the head movement (step 8)?

    Y N
    - Go back to step 7.

11. Remove the jumpers, (C) and (D).
12. Turn the operator knob to the open position, and remove the diskette.
13. Power down.
14. Reconnect the ac drive motor power cable, (L).
15. Power up.



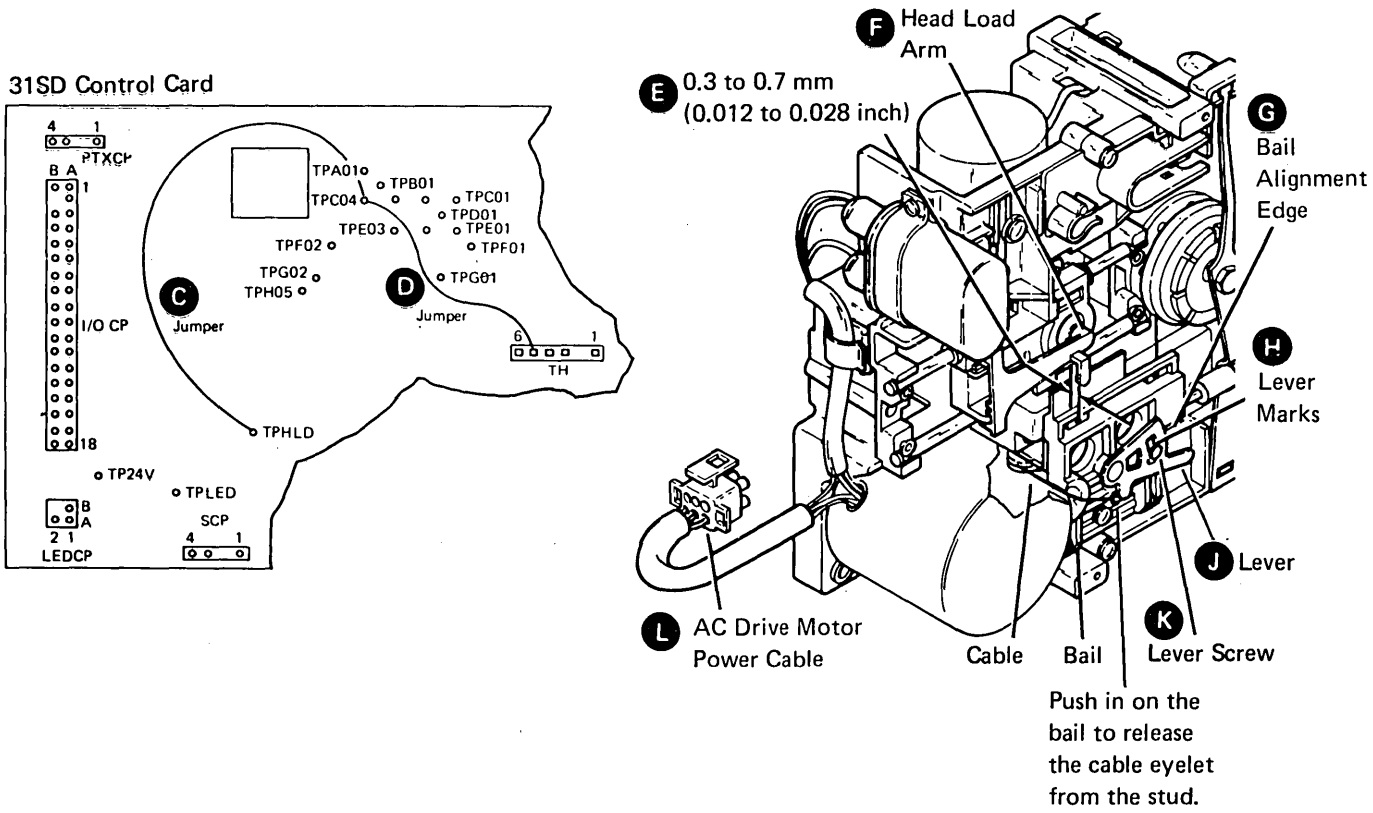




**Figure D-29. Head Gap Adjustment**

### D.3.3.5 Bail Removal

See Figure D-30.

1. Power down.

> **DANGER**
> **Voltage is still present at the socket when the power cable is disconnected.**

2. Disconnect the ac drive motor power cable, (A).
3. Turn the operator knob to the closed position.
4. Loosen the lever screw, (C).
5. Push the bail, (J), inward slightly, and disconnect the bail cable eyelet, (G), from the lever, (D).
6. Turn the operator knob to the open position.
7. Loosen the bail mounting screw, (E).

**Warning: Permitting the pressure pad to hit the head can damage the head.**

8. Observe the position of the bail return spring, (K). Now remove the pivot rod, (H), the bail return spring, (K), and the bail, (J) by lifting the bail out from under the head load arm, (B).

### D.3.3.6 Bail Replacement

See Figure D-30.

1. Reinstall the bail return spring, (K), the bail, (J), and the pivot rod, (H). Place the bail, (J), on the collet actuator rod, (L). Ensure that the bail return spring, (K), is in the correct position. Place the bail, (J), under the head load arm, (B), place the bail pivot rod, (H), in the groove, and tighten the screw, (E).
2. Turn the operator knob to the closed position.
3. Push the bail, (J), inward slightly, and connect the cable eyelet, (G), to the bail lever with the crimp, (N), facing outward. (Ensure that the cable remains on the pulley and is not twisted; turn the solenoid plunger, (M), if necessary.)
4. Turn the operator knob to the open position.
5. Perform the Head Gap Adjustment (paragraph D.3.3.3).

### D.3.3.7 Solenoid and Idler Removal

See Figure D-31.

1. Power down.

> **DANGER**
> **Voltage is still present at the socket when the power cable is disconnected.**

2. Disconnect the ac drive motor power cable, (B).
3. Turn the operator knob, (F), to the closed position.
4. Loosen the lever screw, (K).
5. Push the bail, (L), inward slightly, and disconnect the cable eyelet, (M), from the bail lever, (N).
6. Turn the operator knob, (F), to the open position.
7. Remove the ac motor drive belt, (A).
8. Remove the solenoid cable connector, (E), from the control card.
9. Remove the solenoid, the bracket, and the cable as a unit, (D).
10. Loosen the solenoid locking setscrew, (G), and unscrew the solenoid from the bracket. (The solenoid and the bail actuator cable are exchanged as a unit.)

### D.3.3.8 Solenoid and Idler Replacement

See Figure D-31.

1. Reinstall the solenoid, (D), on the bracket.
2. Reinstall the solenoid, bracket, and cable as a unit.
3. Reconnect the head load solenoid cable connector, (E), to the control card.
4. Reinstall the ac motor drive belt, (A).
5. Turn the operator knob, (F), to the closed position.
6. Push the bail, (L), inward slightly, and connect the cable eyelet, (M), to the bail lever, (N), with the eyelet crimp, (P), facing outward. (Ensure that the cable remains on the pulley and is not twisted; turn the solenoid plunger, (H), if necessary.)
7. Turn the operator knob, (F), to the open position.
8. Perform the Head Gap Adjustment (see paragraph D.3.3.3).

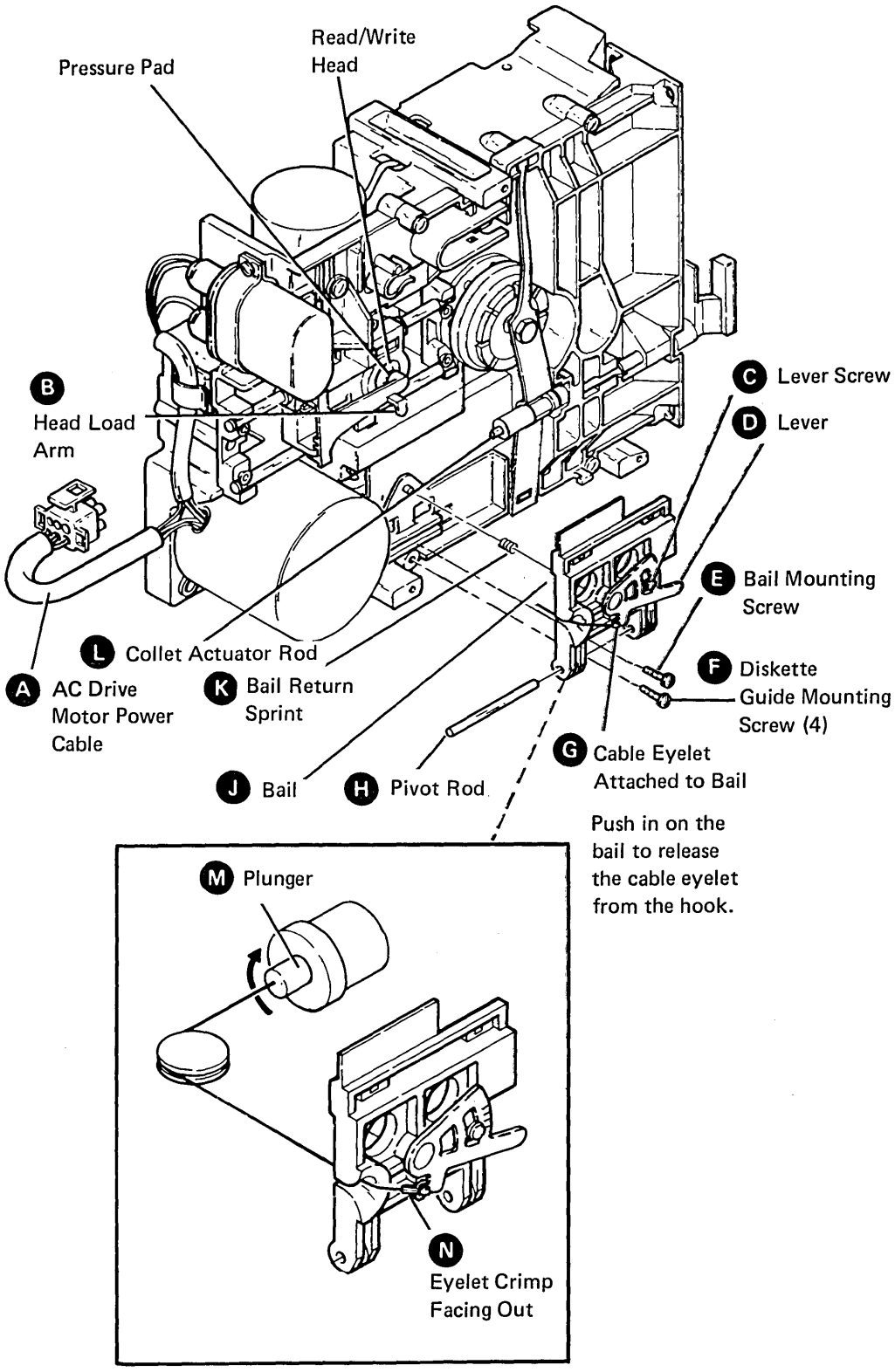



**Figure D-30. Bail Removal**

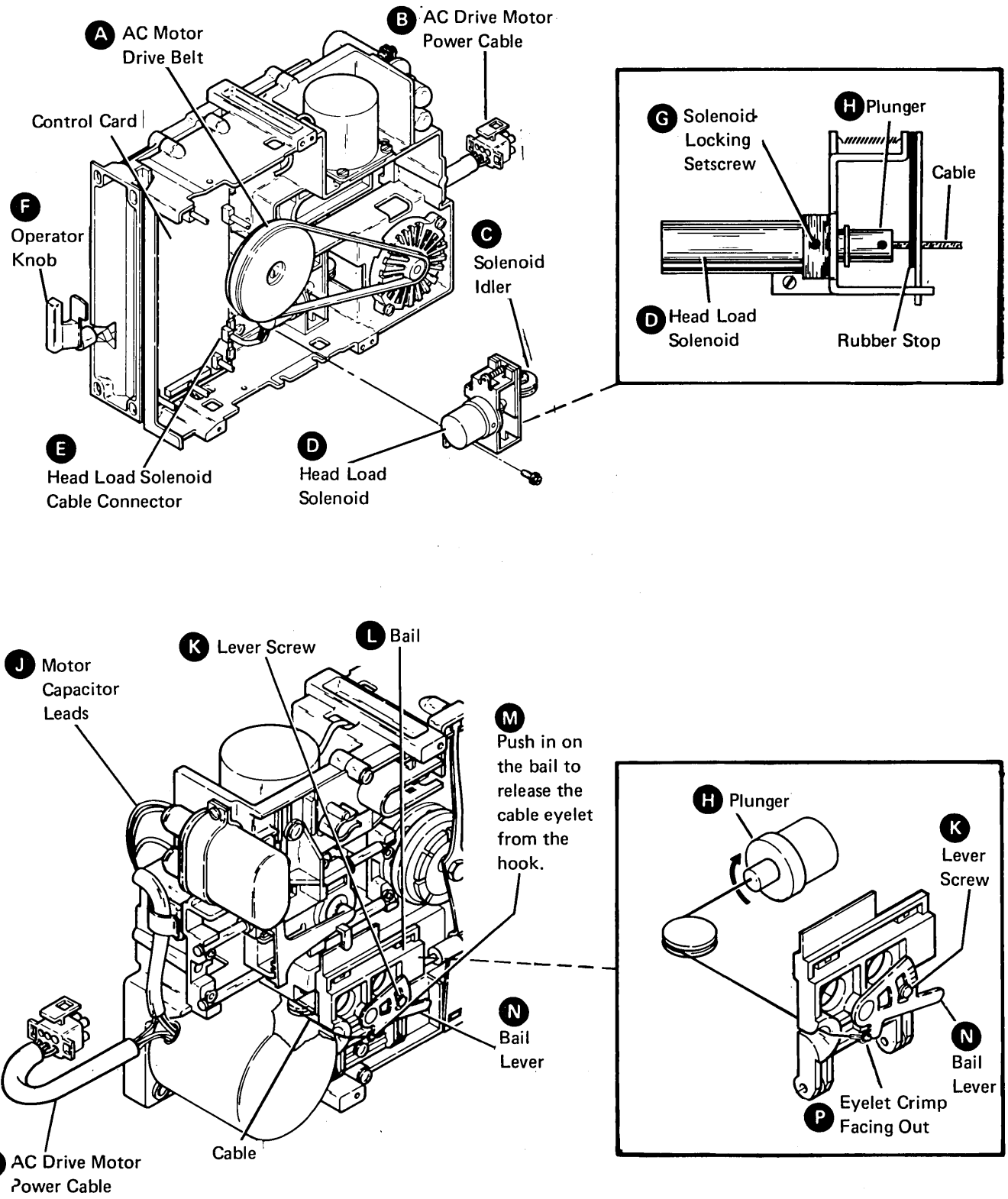



**Figure D-31. Solenoid and Idler Removal**

## D.3.4 AC Drive Parts

### D.3.4.1 Drive Motor Removal

See Figure D-32.

1. Power down.

**DANGER**
**Voltage is still present at the socket when the power cable is disconnected.**

2. Disconnect the ac drive motor power cable, (B) .
3. Remove the ac motor drive belt, (A) .

**CAUTION: The motor case becomes hot after continuous use.**

4. Remove the two enclosure mounting screws, (P) , and remove the fan enclosure.
5. Loosen the drive pulley/fan locking setscrew, (M) ; then remove the ac drive motor pulley/fan assembly, (K) .

**DANGER**
**High voltage may be present at the capacitor terminals, (F) .**

6. Remove the two capacitor insulator caps, (H) , from the capacitor terminals.
7. Discharge the capacitor by jumpering its terminals, (F) , with the large blade screwdriver.
8. Remove the motor capacitor leads, (G) , from the capacitor terminals.
9. Remove the motor capacitor leads, (G) , from the cable guide, (J) , on the casting.
10. Remove the insulator caps, (H) , from the motor capacitor leads, (G) .
11. Remove the remaining two motor mounting screws, (L) , and remove the motor, (A) .

### D.3.4.2 Drive Motor Replacement

See Figure D-32.

1. Install the ac drive motor, (A) , with the two mounting screws, (L) . Note in Figure D-31 that the cable, (B) , and the motor capacitor leads, (J) , should extend toward the rear of the machine.
2. Install the ac drive motor pulley/fan, (K) , on the new motor. Ensure that the setscrew, (M) , is centered in the flat surface of the motor shaft. (Leave the setscrew loose.)
3. Position the fan and pulley on the motor shaft with a gap of 0.5 mm ± 0.1 mm (0.020 ± 0.004 inch) between the motor face and the fan hub. Tighten the setscrew.
4. Reinstall the fan enclosure, (N) , with the belt clearance slots toward the drive hub, (R) .
5. Reinstall the drive belt, (Q) .
6. Reinstall the two capacitor insulator caps, (H) , on the motor capacitor leads, (G) (one on leads 2 and 3, and one on lead 1).
7. Reconnect the motor capacitor leads, (G) , in the guide, (J) , on the casting.
8. Reinstall the motor capacitor leads, (G) , on the capacitor terminals, (F) (leads 2 and 3 on the top terminal and lead 1 on the bottom terminal).
9. Reinstall the two insulator caps, (H) , on the capacitor terminals, (F) .
10. Reconnect the ac drive motor power cable, (B) .

### D.3.4.3 Capacitor Removal

See Figure D-32.

1. Power down.

**DANGER**
**Voltage is still present at the socket when the power cable is disconnected.**

2. Disconnect the ac drive motor power cable, (B) .
3. Remove the two insulator caps, (H) , from the capacitor terminals, (F) .
4. Discharge the capacitor by jumpering the capacitor terminals, (F) , with a large blade screwdriver.
5. Remove the motor capacitor leads, (G) , from the capacitor terminals.
6. Remove the screw, (C) , and remove the capacitor bracket assembly, (D) .

### D.3.4.4 Capacitor Replacement

See Figure D-32.

1. Reinstall the capacitor assembly, (D) , with the screw, (C) , and tighten the screw.
2. Reinstall the motor capacitor leads, (G) , on the capacitor terminals, (F) (leads 2 and 3 on the top terminal and lead 1 on the bottom terminal).
3. Reinstall the two insulator caps, (H) , on the capacitor terminals.

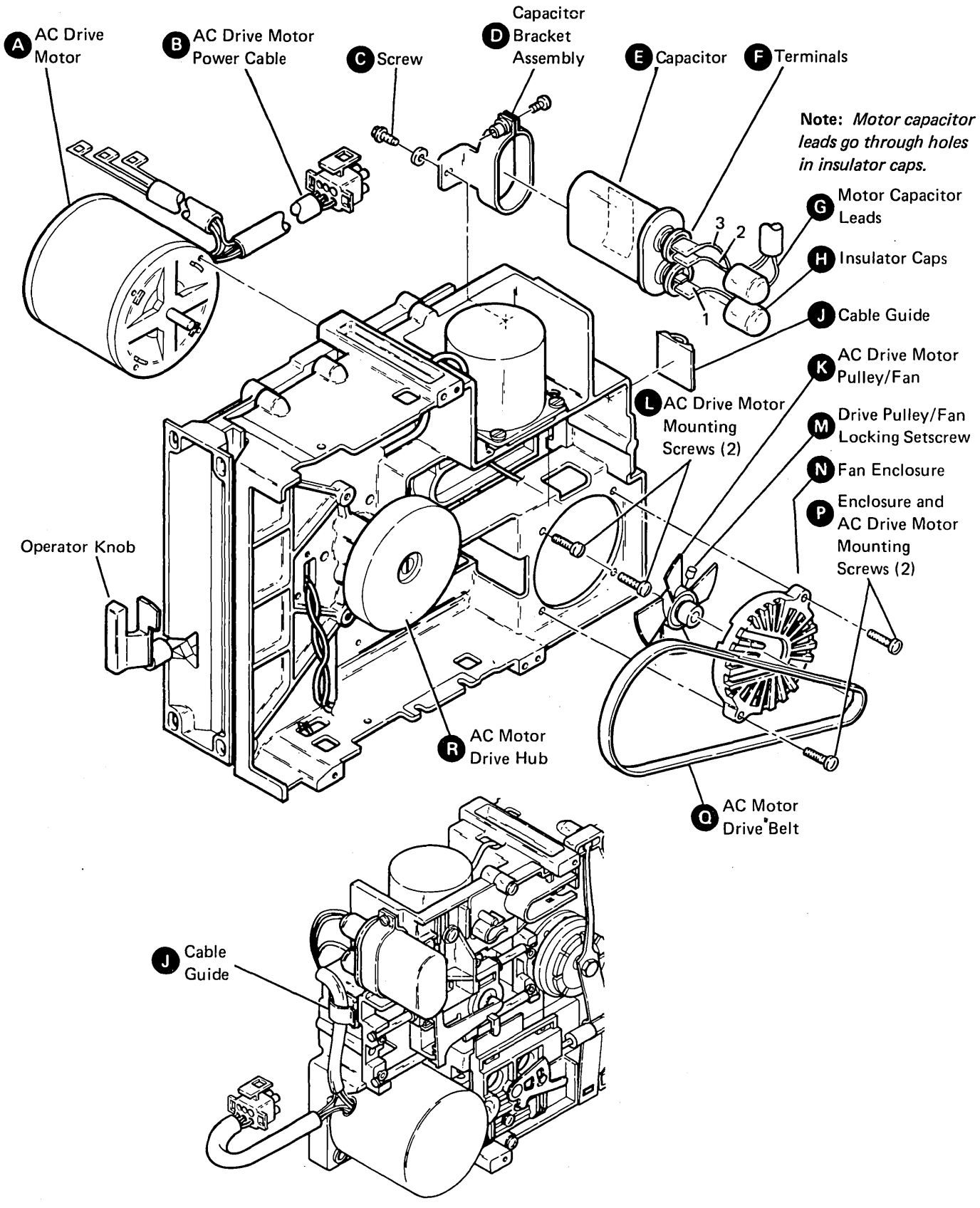



**Figure D-32. AC Drive Motor Removal**

### D.3.4.5 Drive Fan and Pulley Assembly Removal

See Figure D-32.

1. Power down.

**DANGER**
**Voltage is still present at the socket when the power cable, B, is disconnected.**

2. Remove the ac drive belt, Q.
3. Remove the fan enclosure mounting screws, P, and remove the fan enclosure, N.
4. Loosen the setscrew, M; then remove the ac drive motor pulley/fan, K.

### D.3.4.6 Drive Fan and Pulley Assembly Replacement

See Figure D-32.

1. Reinstall the ac drive motor pulley, K, on the motor shaft so that the setscrew, M, is centered in the flat surface of the shaft. (Leave the setscrew loose.)
2. Position the fan and pulley on the motor shaft with a gap of 0.5 mm ± 0.1 mm (0.020 ± 0.004 inch) between the motor face and the fan hub. Tighten the setscrew.
3. With the mou. ıg screws, P, reinstall the fan enclosure, N, with the belt clearance slots toward the drive hub, R.
4. Reinstall the drive belt, Q.
5. Reconnect the ac drive motor power cable, B.
6. Power up.

## D.3.5 Stepper Drive Parts

### D.3.5.1 Stepper Motor Removal

See Figure D-33.

1. Power down.
2. Remove the head cable connector, L, from the control card.
3. Remove the head cable guide, P.

**Warning: The stepper drive band, J, assembly can be easily damaged. Do not bend, crease, or scratch the band.**

4. Remove the three mounting screws, A, F, and G, and clamp, B, that attach the stepper drive band, J, to the stepper motor drive pulley, C, and carriage bracket, E. (Note the position of the band, J, and clamp, B, for easier replacement.)
5. Remove the band assembly.
6. Measure and record the gap, U, between the stepper motor pulley, C, and the casting for later use.

   Gap is _____ .
7. Loosen the stepper pulley clamp screw, Q, and remove the stepper pulley, C, and the clamp, H.
8. Remove the stepper motor cable connector, K, from the control card.
9. Remove the four stepper motor mounting screws, N.
10. Remove the stepper motor, M.

### D.3.5.2 Stepper Motor Replacement

See Figure D-33.

1. Reinstall the stepper motor, M, using the four mounting screws, N. (Locate the motor cable toward the control card.)
2. Reinstall the stepper motor cable connector, K, on the control card.
3. Reinstall the stepper motor pulley, C, and the clamp, H. (Adjust the gap, U, between the pulley and the casting to the measurement recorded in step 6 of paragraph D.3.5.1.) The clamp, H, should be placed even with the end of the stepper motor drive shaft, D.
4. Reinstall the drive band, J. Go to Head/Carriage Replacement (paragraph D.3.2.5, step 5).

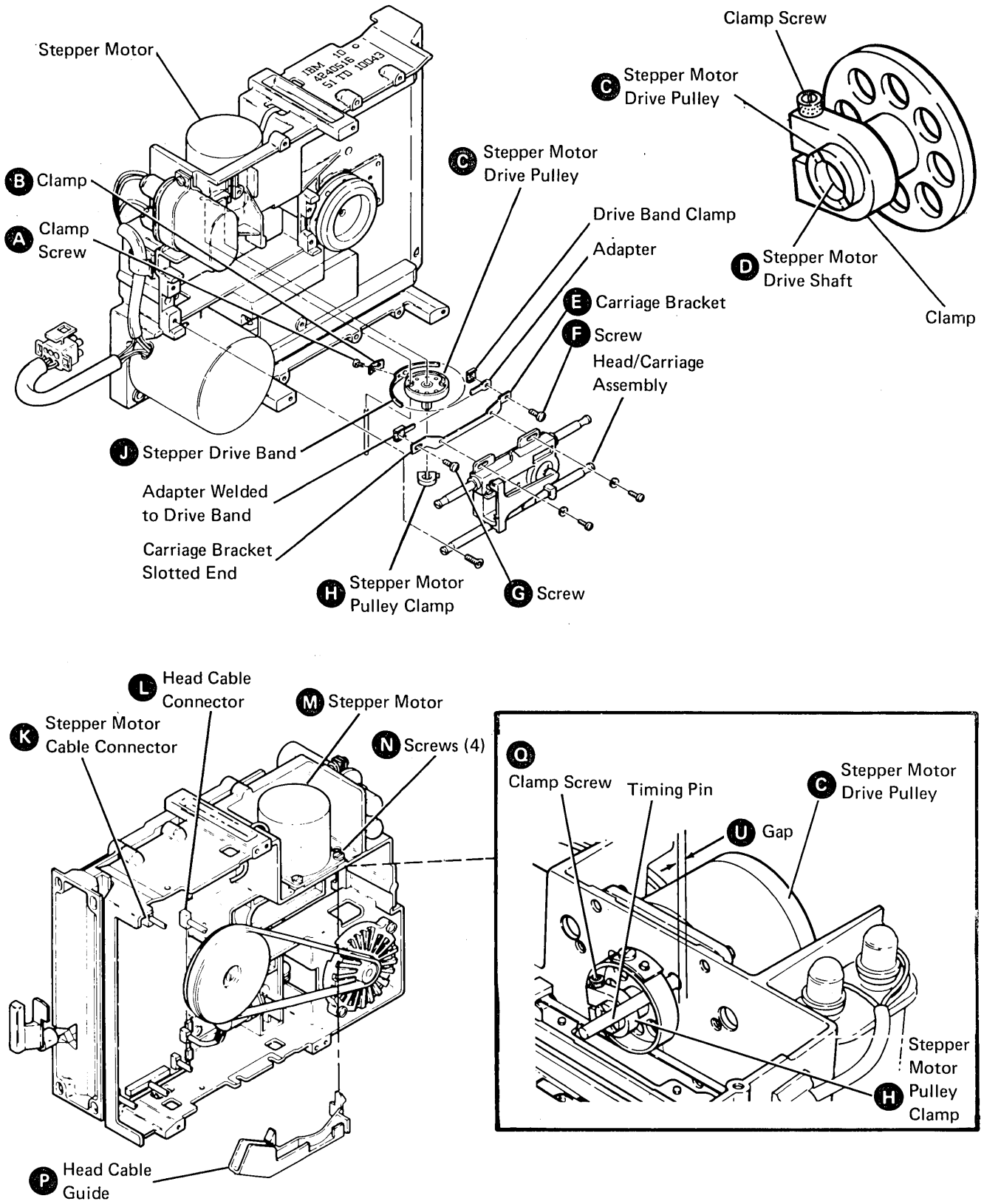



**Figure D-33. Stepper Motor**

### D.3.5.3 Stepper Pulley and Clamp Removal

See Figure D-34.

1. Power down.
2. Remove the drive band (see paragraph D.3.5.7).
3. Measure and record the gap, C, between the stepper motor pulley and the casting.

   Gap is: _____ .
4. Loosen the clamp screw, B; then remove the pulley, D, and the clamp, A.

### D.3.5.4 Stepper Pulley and Clamp Replacement

See Figure D-34.

1. Reinstall the pulley, D, the clamp, A, and the clamp screw, B. The gap should be the same as in step 3 of paragraph D.3.5.3. Ensure that the clamp is even with the end of the stepper motor drive shaft.
2. Reinstall the drive band. Go to Head/Carriage Replacement (paragraph D.3.2.5, step 5).

### D.3.5.5 Drive Band Service Check

See Figure D-34.

1. Power down.
2. Turn the stepper motor pulley by hand between tracks 00 and 76.
3. If the drive band does not track parallel to the pulley edge, F, go to Drive Band Adjustment (paragraph D.3.5.6, step 2).

   If the band shows signs of physical damage, F, exchange the band (see paragraphs D.3.5.7 and D.3.5.8).

### D.3.5.6 Drive Band Adjustment

See Figure D-35, Parts 1 and 2.

1. Power down.
2. Remove the head connector, M, from the control card.
3. Remove the head cable guide, N.
4. Place the head/carriage assembly, G, at track 40. (Insert the timing pin, R, into the timing hole in the casting to align the head/carriage assembly, G, at track 40.)
5. Loosen the three mounting screws, A, F, and H, that attach the band to the pulley, C, and the carriage bracket, E.
6. Tighten screw F. (Ensure that the band, L, remains parallel to the carriage bracket, E.)
7. Tighten screw A. (Ensure that the band remains parallel to the pulley edge, U.)
8. Block the head/carriage assembly, G, about 25 mm (1 inch) from the end of the casting, Q.
9. Pull on the loose end of the band with 2.5 ± 0.25 pounds' force, P, and tighten the screw, H. (Ensure that the band remains parallel to the pulley edge, U. If it does not, repeat the adjustment, starting at step 5.)
10. Move the carriage to track 00 and then to track 76, and ensure that the band, L, tracks parallel to the pulley edge, U.
11. Adjust the head/carriage assembly, G (go to paragraph D.3.2.3, step 12).

### D.3.5.7 Drive Band Removal

See Figure D-35, Parts 1 and 2.

1. Power down.
2. Remove the head connector, M, from the control card.
3. Remove the head cable guide, N.

   Observe the position of the band, L, and clamp, S, before performing the next step.

**Warning: The band, L, is easily damaged, T. Do not bend, crease, or scratch the band.**

4. Remove the three mounting screws, A, F, and H, and the clamp, B, that attach the band, L, to the stepper motor pulley, C, and the carriage bracket, E.
5. Remove the band assembly.
6. If you have entered this procedure from Stepper Pulley and Clamp Removal (paragraph D.3.5.3), return to step 3 of paragraph D.3.5.3.

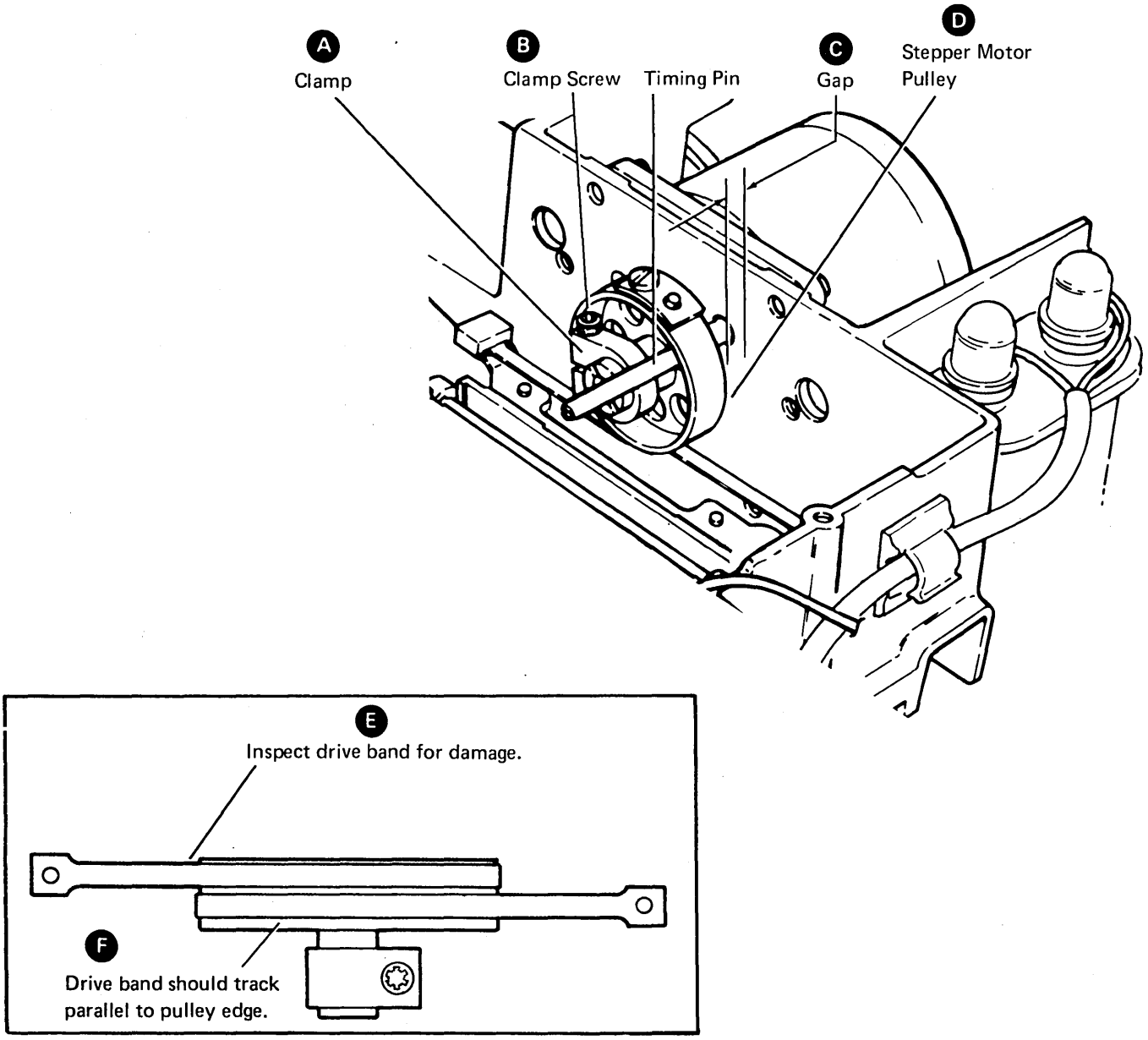


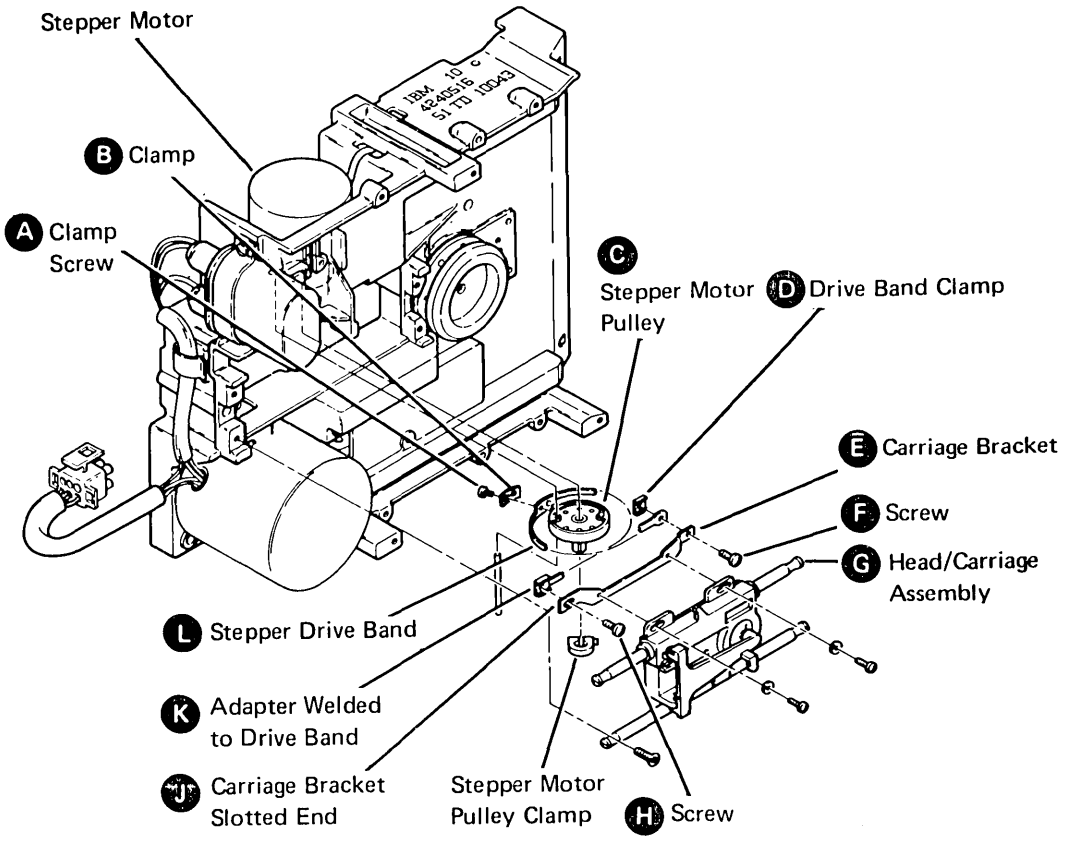

**Figure D-34. Stepper Motor Pulley and Clamp Removal and Replacement**

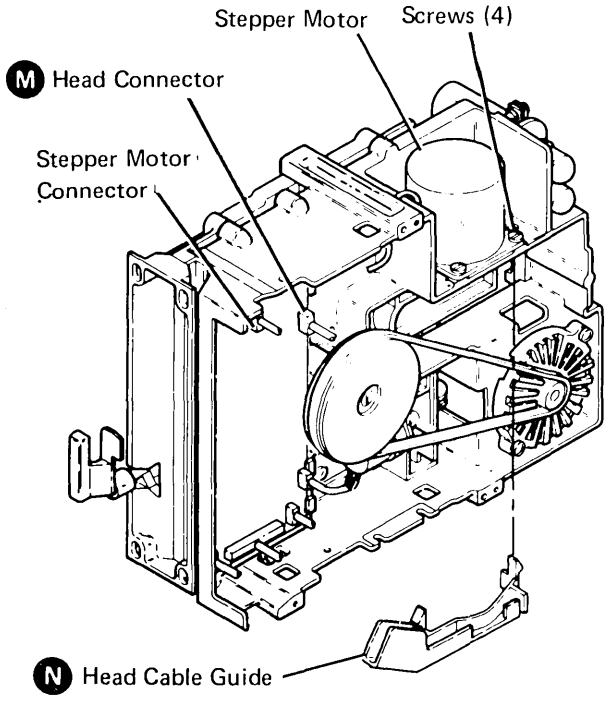
## D.3.5.8 Drive Band Replacement

See Figure D-35, Parts 1 and 2.

**Warning: The band, (L), is easily damaged, (T). Do not bend, crease, or scratch the band. Do NOT use a damaged band.**

1. Attach the end of the band, (L), with the welded adapter, (K), to the slotted end, (J), of the carriage bracket. Leave the clamp screw, (H), loose.
2. Attach the band to the stepper motor pulley, (C), with the clamp screw, (A), and the clamp, (B). Ensure that the band is parallel to the pulley edge, (U).
3. Attach the other end of the band to the carriage bracket with the screw, (F), and the drive band clamp, (D). Ensure that the band is parallel to the carriage bracket.
4. Adjust the drive band. (Go to step 8 of paragraph D.3.5.6.)



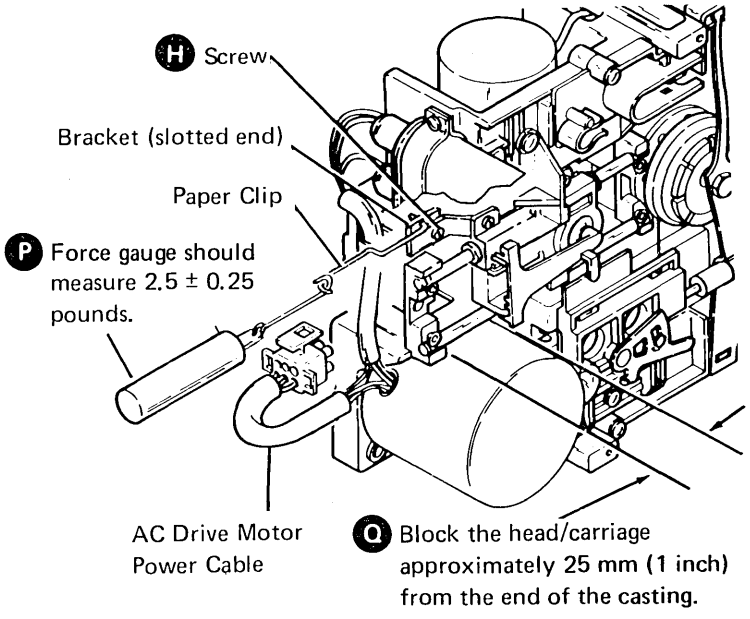




**Figure D-35 (Part 1 of 2). Drive Band Adjustments**

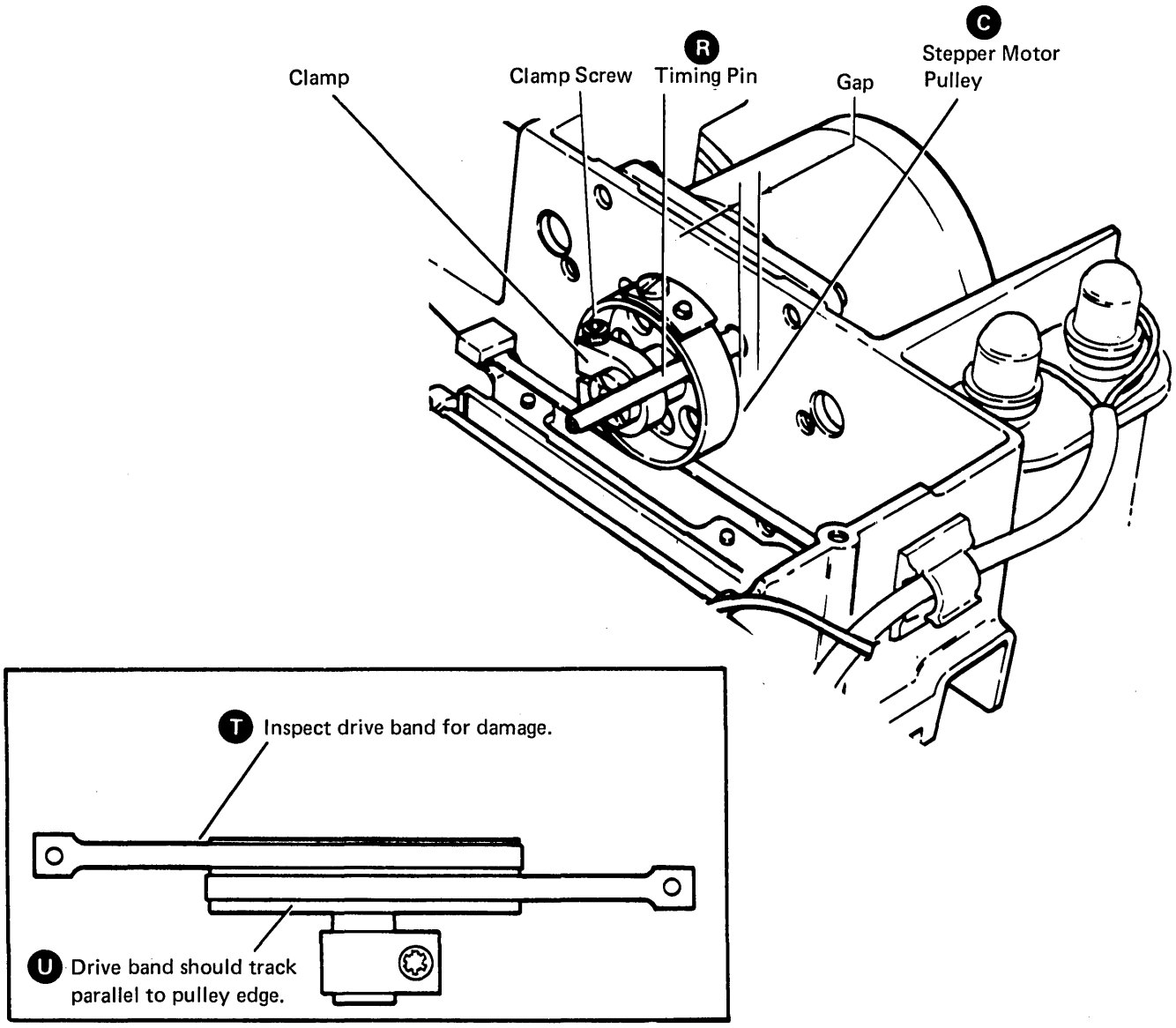



**Figure D-35 (Part 2 of 2). Drive Band Adjustments**

## D.3.6 LED and PTX Assemblies

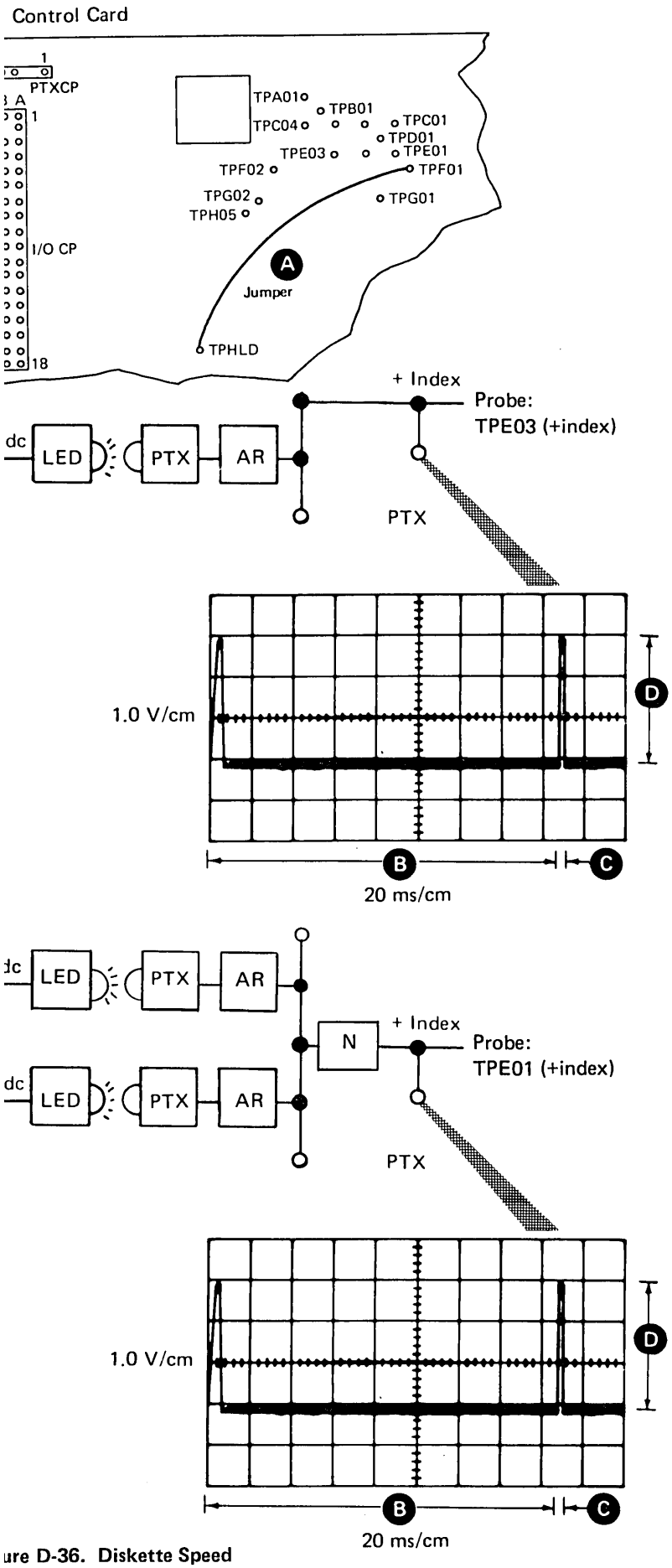
### D.3.6.1 Diskette Speed Service Check

See Figure D-36.

1. Insert a diskette 1, and close the operator knob. See Diskette Use (paragraph D.1.1.2).
2. To activate the head load solenoid, install a jumper, (A), from TPF01 (ground) to TPHLD (-'head load').
3. Set up an oscilloscope as shown in the chart, (E).

**Note:** *Use a Tektronix 453, 454, or a similar oscilloscope with x10 probes.*

4. Observe an index pulse width of 1.5 to 3.0 ms, (C), occurring every 166.7 ± 4.2 ms, (B). Pulse amplitude should be between 2.4 and 4.2 Vdc, (D).
5. Remove the jumper.
6. Remove the diskette. See Diskette Use (paragraph D.1.1.2).




E Oscilloscope Settings

| | |
|---|---|
| Channel A sweep mode | Normal |
| Channel A level | + |
| Channel A coupling | DC |
| Channel A slope | + |
| Channel A source | Internal |
| Trigger | Normal |
| Mode | Channel 1 |
| Channel 1 volts/division | 1.0 V/cm |
| Channel 1 input | DC |
| Times per division | 20 ms |
| Channel 1 probe to | +Index Test Pin |

**ure D-36. Diskette Speed**

### D.3.6.2 LED Output Service Check

See Figure D-37.

1. Connect the negative probe, (C), of the multimeter to the TPF01 (ground) on the control card, (A).
2. Set the multimeter scale to 5 Vdc, and connect the positive probe, (B), to the LED voltage test pin TPLED.
3. Check for a voltage level of 1 Vdc to 2 Vdc, (D).

### D.3.6.3 LED Removal

See Figure D-38.

1. Power down.
2. Remove the LED connector, (B), from the control card.
3. Remove the LED cable. (Note the cable path for future replacement.)
4. Remove the LED mounting screw, (D); then remove the LED assembly, (C).

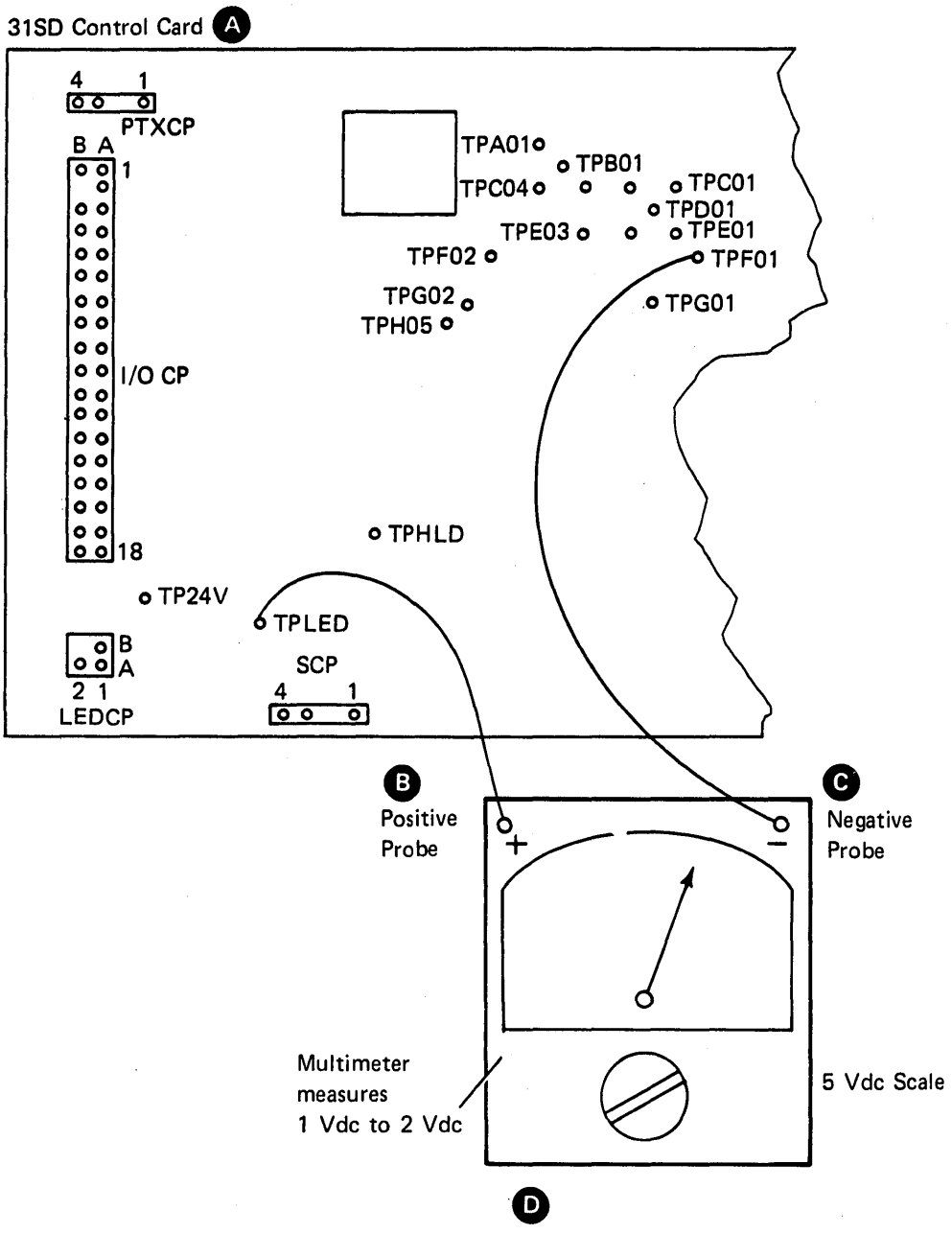



**Figure D-37. LED Output Check**

### D.3.6.4 LED Replacement

See Figure D-38.

1. Reinstall the LED cable, the LED assembly, (C), and the mounting screw, (D), on the diskette guide, (A).
2. Reconnect the LED connector, (B), to the control card.

### D.3.6.5 PTX Amplifier Service Check

See Figure D-39.

1. Power down.

**DANGER**
**Voltage is still present at the socket when the power cable is disconnected.**

2. Disconnect the ac drive motor power cable, (A).
3. Remove the PTX connector, (B), from the control card.
4. Power up.
5. Connect the positive probe, (E), of a multimeter, (D), (15 Vdc scale) to the index test pin (TPE03) on the control card.
6. Connect the negative probe, (F), of the multimeter of TPF 01 (ground).
7. Check the multimeter, (D), for a reading of less than 1 Vdc.

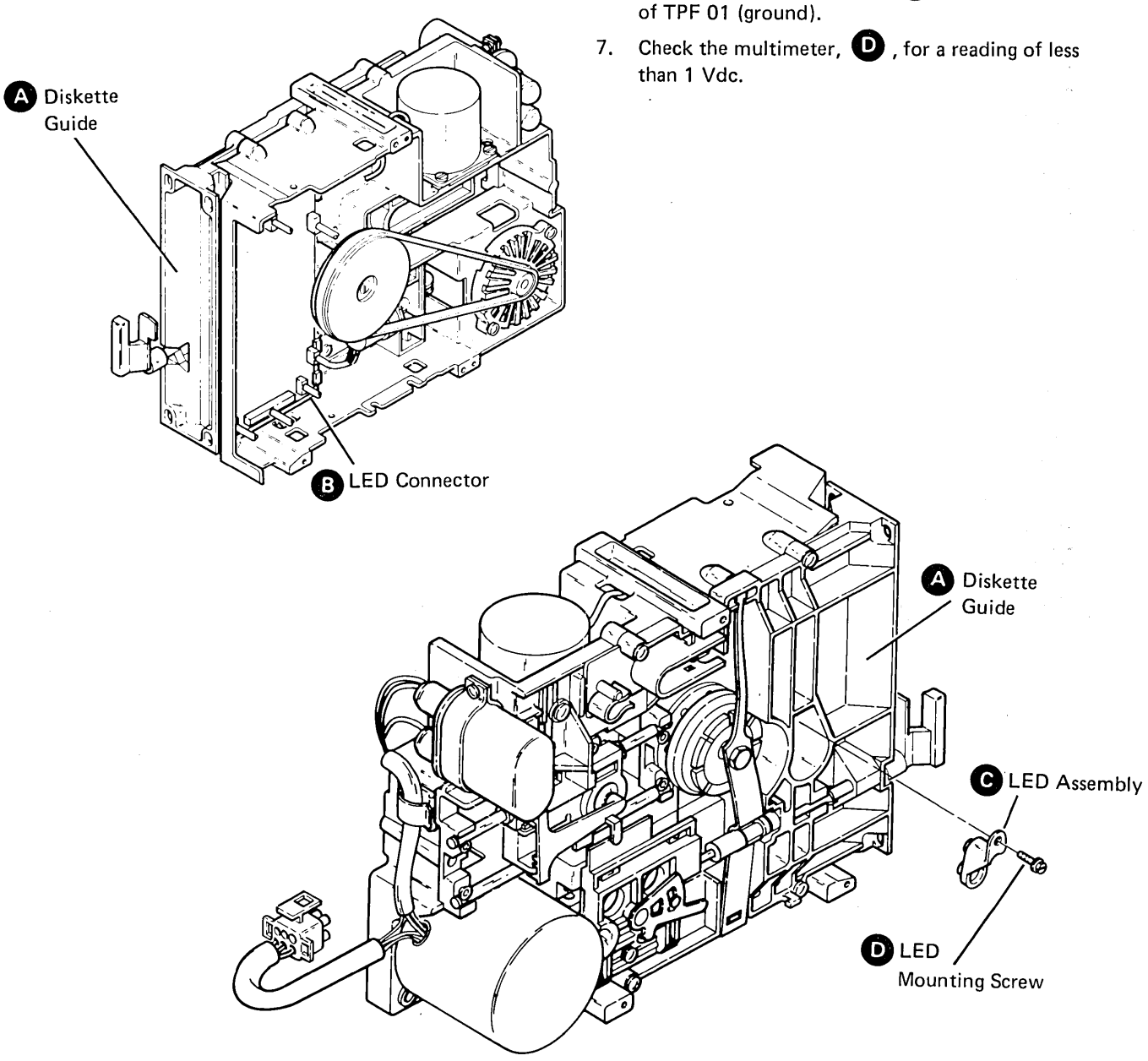
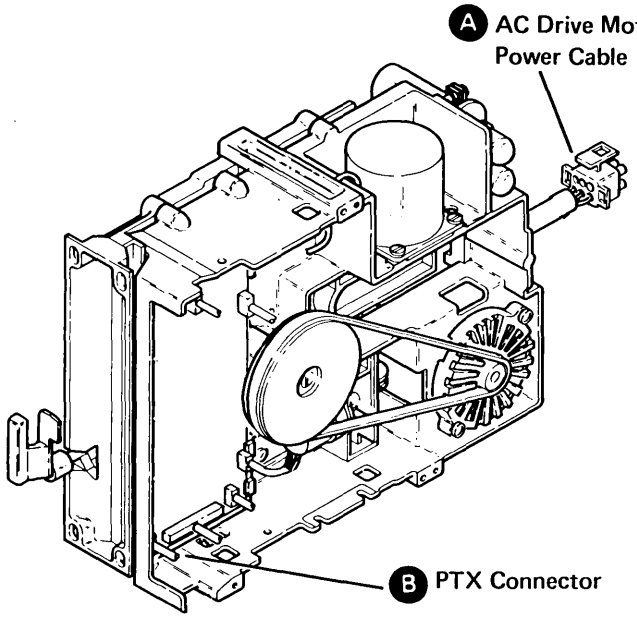



**Figure D-38. LED Removal and Replacement**



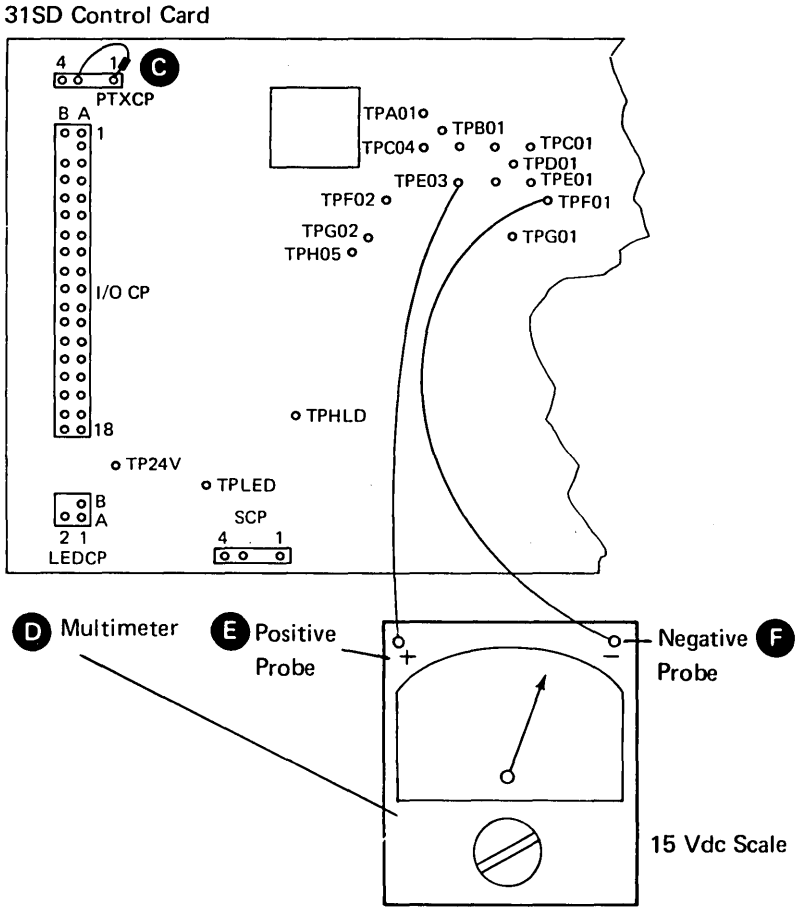




**Figure D-39. PTX Amplifier Service Check**

8. Install one end of a jumper, C, to pin A03 of the PTXCP socket on the control card.
9. Observe the multimeter, and touch the other end of the jumper several times to pin A01 of the PTXCP socket on the control card. The multimeter should read 2.5 Vdc or more when the test pin is touched. (A wrong measurement can occur the first time the test pin is touched.)
10. Power down.
11. Remove the jumper.
12. Reinstall the PTX connector on the control card.
13. Reconnect the drive motor power cable.
14. Power up.

### D.3.6.6 PTX Removal

See Figure D-40

1. Power down.
2. Remove the LED connector, F, from the control card. (Note the cable path for easier replacement.) Pull the cable and the connector through the casting.
3. Turn the operator knob, A, to the closed position.
4. Loosen the lever screw, R.
5. Push the bail, Q, inward slightly, and disconnect the bail actuator cable eyelet, I, from the hook, N, on the bail lever, S.
6. Turn the operator knob, A, to the open position.

**Warning: Damage to the head, H, can occur if the pressure pad, J, is permitted to hit the head.**

7. Remove the four diskette guide mounting screws, P.
8. Remove the diskette guide, M, by lifting it up and carefully sliding the bail, Q, from under the head load arm, G.
9. Remove the five remaining connectors, B, from the control card. (Note the connector locations and cable paths for easier replacement.)
10. Loosen the control card retainer screw, E.

**Warning: Be careful not to damage the control card.**

11. Turn the two control card retainers, D, out of the control card path, and remove the control card, C. (Note the position of the control card for easier replacement.)
12. Remove the PTX mounting screw, L, and the PTX assembly, K. (Note the cable path for future replacement.)

### D.3.6.7 PTX Replacement

See Figure D-40.

1. Reinstall the PTX assembly, K, and the PTX mounting screw, L.
2. Reinstall the control card, C, and turn the two retainers, D, inward until they prevent the control card from moving.
3. Tighten the two retainer screws, E.
4. Reinstall the five connectors, B, on the control card.
5. Reinstall the diskette guide, M. Place the bail below the head load arm, G.
6. Reinstall the four diskette guide mounting screws, P.
7. Reinstall the LED connector, F, on the control card. Go to Bail Replacement (paragraph D.3.3.6, step 2).

## D.3.7 Diskette Drive Control Card

### D.3.7.1 Control Card Removal

See Figure D-41.

1. Power down.
2. Remove the six connectors, A, from the control card.
3. Loosen the two retainer screws, D, and turn the two retainers, C, outward until they are no longer in the path of the control card, B.
4. Remove the control card.

### D.3.7.2 Control Card Replacement

See Figure D-41.

1. Reinstall the control card, B.
2. Turn the two retainers, C, inward slightly until they prevent the card from moving.
3. Tighten the two retainer screws, D.
4. Reinstall the six connectors, A, on the control card.
5. Power up.

### D.3.7.3 Control Card Test Pins and Connector Pins

See Figure D-42.

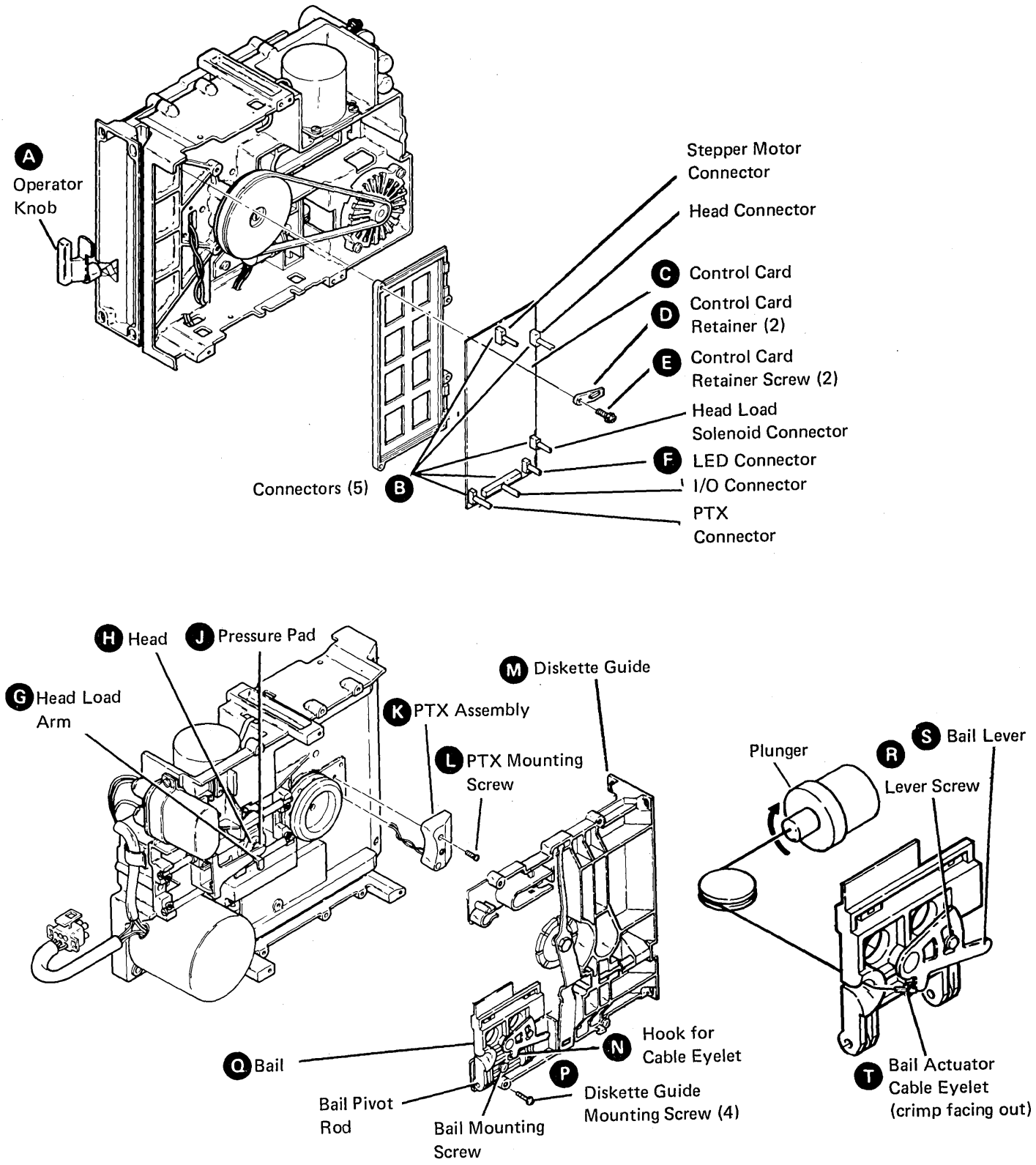



**Figure D-40. PTX Removal and Replacement**

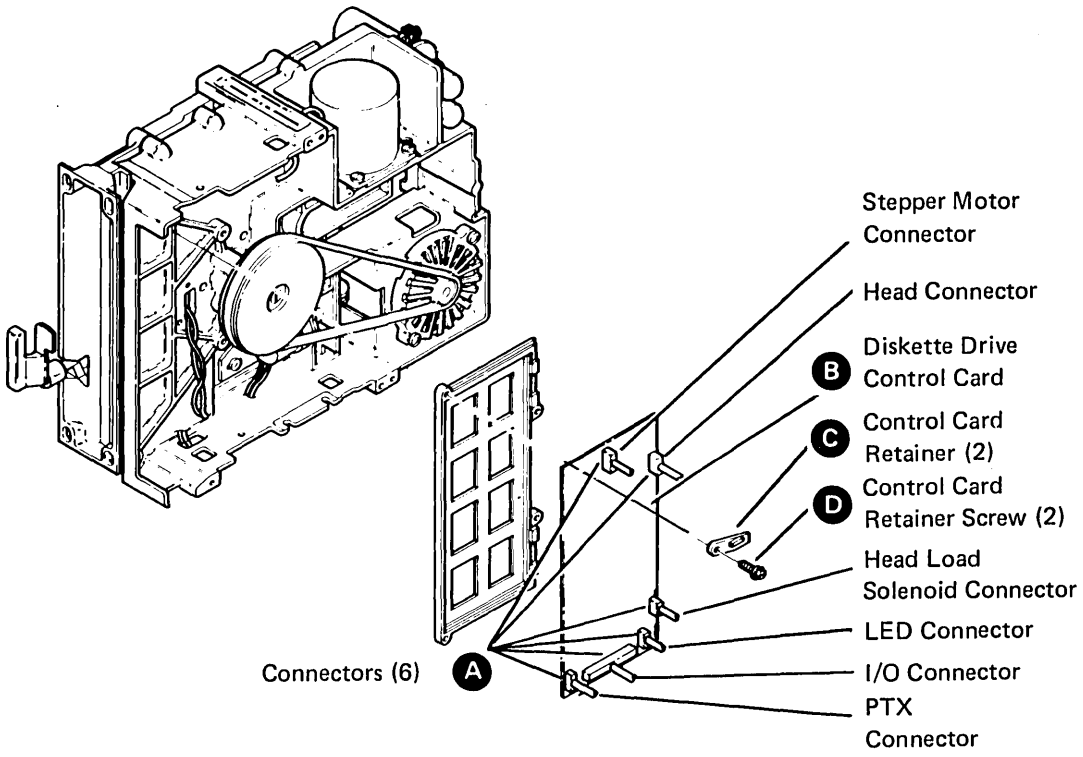
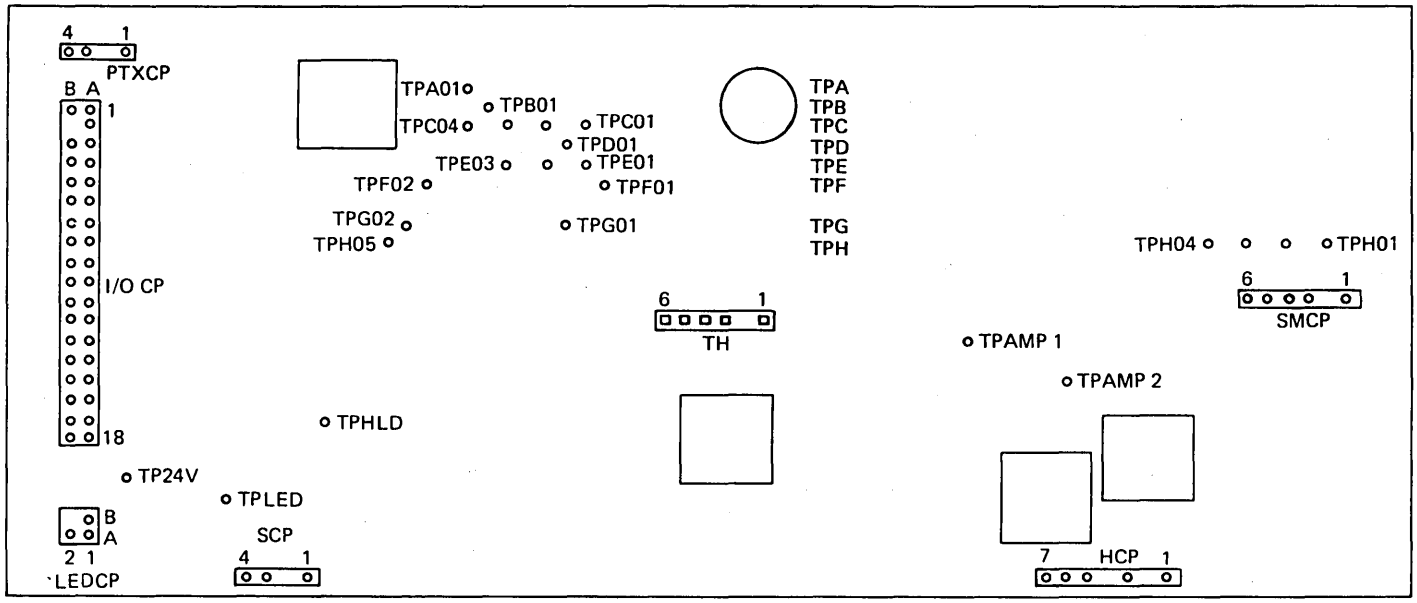



**Figure D-41. Diskette Drive Control Card**

**31SD Control Card**




PTXCP – PTX Connector Pins
I/O CP – I/O Connector Pins
LEDCP – LED Connector Pins
SCP – Solenoid Connector Pins
HCP – Head Connector Pins
SMCP – Stepper Motor Connector Pins

**31SD Control Card Cable**

| Test Points | Line Names |
|---|---|
| TH01 | Diff Read B |
| TH02 | No Pin |
| TH03 | Diff Read A |
| TH04 | Not Assigned |
| TH05 | -Disable Stepper Motor |
| TH06 | +18V |

| Test Points | Line Names |
|---|---|
| TPA01 | +5 Vdc |
| TPB01 | -5 Vdc |
| TPC01 | +Access 1 |
| TPC02 | D1 PTX |
| TPC03 | Write Data |
| TPC04 | Ground |
| TPD01 | +Inner Tracks |
| TPE01 | +Access 0 |
| TPE02 | +Head Engage |
| TPE03 | +Index |
| TPF01 | Ground |
| TPF02 | +Write/Erase Enabled |

| Test Points | Line Names |
|---|---|
| TPG01 | +File Data |
| TPG02 | +Erase Gate |
| TPH01 | MC-3 |
| TPH02 | MC-2 |
| TPH03 | MC-1 |
| TPH04 | MC-0 |
| TPH05 | +Write Gate |
| TPAMP1 | Preamp TP1 |
| TPAMP2 | Preamp TP2 |
| TPHLD | -Head Load |
| TP24V | +24 Vdc |
| TPLED | 31SD LED Voltage |

**Figure D-42. 31SD Control Card and Cable Pins**

# Appendix E. IBM 31SD Diskette Drive Maintenance Analysis Procedures (MAPs)

31SD

OPERATIONAL TEST PROCEDURE

PAGE 1 OF 2

001
THIS TEST CAN BE USED AS PART OF A 'GOOD MACHINE PATH' IN A HOST SYSTEM DIAGNOSTIC OPERATION. IF A SPECIFIC ERROR HAS ALREADY BEEN OBSERVED, THE 31SD MAP 0240 CAN BE USED FOR THE ENTRY POINT INTO THE CORRECT MAP.

TO PERFORM THIS TEST THE CE WILL NEED A DISKETTE 1 DISKETTE. THIS DISKETTE SHOULD BE A KNOWN GOOD DISKETTE THAT IS WITHOUT FAILURES AND WHICH HAS BEEN INITIALIZED TO THE FORMAT NEEDED BY THE USING HOST SYSTEM. THE DISKETTE WILL BE WRITTEN ON DURING THIS TEST PROCEDURE, SO DISKETTES THAT HAVE CUSTOMER DATA ON THEM SHOULD NOT BE USED.

INSERT DISKETTE 1 IN DRIVE AND ENGAGE COLLET. CHECK FOR INDEX PULSES.
SEE PAR. D.3.7.3 (SHOWING TEST PIN ARRANGEMENT).
ARE THERE PULSES ON '+INDEX' LINE?
Y N

002
GO TO 31SD NOT READY MAP 0270.

003
ENGAGE HEAD AND CHECK INDEX PULSE WIDTH.
IS WIDTH BETWEEN 1.5 AND 3.0 MILLISECONDS?
Y N

004
GO TO 31SD NOT READY MAP 0270.

A

A MAP 0230-1

005
CHECK INDEX PULSE PERIOD FROM LEADING EDGE TO LEADING EDGE.
IS PERIOD BETWEEN 162.5 AND 170.9 MILLISECONDS?
Y N

006
GO TO 31SD NOT READY MAP 0270.

007
SEEK HOME POSITION BY TAKING AT LEAST 80 REVERSE ACCESS OPERATIONS AND THEN CONDITION ALL ACCESS LINES FOR TRACK 0 LOCATION. READ TRACK 0 ID FIELDS AND COMPARE WITH EXPECTED.
CAN ALL ID FIELDS BE READ CORRECTLY?
Y N

008
GO TO 31SD ACCESS ERROR MAP 0280.

009
ACCESS TO AND READ ID FIELDS AND DATA FIELDS ON TRACKS
1,2,3,44,45,46,47,73,74,75,76,75,74,73, 47,46,45,44,3,2,1, AND 0.
CAN ALL ID FIELDS BE READ CORRECTLY?
Y N

010
GO TO 31SD ACCESS ERROR MAP 0280.

011
CAN DATA FIELDS BE READ CORRECTLY?
Y N

012
GO TO 31SD READ ERROR MAP 0260.

2
B

B 31SD

1 TEST

PAGE 2 OF 2

013
WHILE DOING THE ACCESS IN THE PRECEDING STATEMENT, CHECK TO SEE THAT '+WRITE/ERASE ENABLED' LINE IS ALWAYS DOWN DURING ACCESS AND READING.
IS '+WRITE/ERASE ENABLED' LINE ALWAYS DOWN?
Y N

| 014
| GO TO 31SD WRITE/ERASE UNSAFE MAP 0290.

015
ACCESS TO AND WRITE DATA FIELDS WITH DATA PATTERN A5A5 ON TRACKS 4,5,6,7,48,49, 50,51,69,70,71,72,71,70,69,51,50,49,48,7, 6,5, AND 4. PERFORM A READ CHECK AFTER EACH WRITE.
DOES DATA AND CRC READ BACK COMPARE WITH EXPECTED?
Y N

| 016
| GO TO 31SD WRITE ERROR MAP 0250.

017
WHILE DOING THE WRITING IN THE PRECEDING STATEMENT CHECK TO SEE THAT THE '+WRITE/ERASE ENABLED' LINE IS UP DURING THE TIME THAT '+WRITE GATE' IS UP AND BEFORE '+ERASE GATE' HAS COME UP.
IS '+WRITE/ERASE ENABLED' LINE AT AN UP LEVEL?
Y N

| 018
| GO TO 31SD WRITE/ERASE UNSAFE MAP 0290.

C

C MAP 0230-2

019
WHILE DOING THE WRITING IN THE PRECEDING STATEMENT CHECK TO SEE THAT THE '+WRITE/ERASE ENABLED' LINE IS UP DURING DURING THE TIME THAT '+ERASE GATE' IS UP AFTER THE FALL OF '+WRITE GATE'.
IS '+WRITE/ERASE ENABLED' LINE AT AN UP LEVEL?
Y N

| 020
| GO TO 31SD WRITE/ERASE UNSAFE MAP 0290.

021
31SD PASSES OPERATIONAL TEST PROCEDURE. REMOVE DISKETTE AND RETURN TO NORMAL OPERATIONS.

ENTRY POINT MAP



BEFORE USING THESE MAPS, ENSURE THAT THE DISKETTE IS NOT DAMAGED, AND THE PROBLEM OCCURS ON MORE THAN ONE DISKETTE.

THE FOLLOWING DEFINITIONS ARE USED WHEN MAPS REQUEST PROBING LINES.
----- LINE UP ------- UP LIGHT ON, DOWN LIGHT OFF.
----- LINE DOWN ----- DOWN LIGHT ON, UP LIGHT OFF.
----- LINE PULSING -- BOTH LIGHTS ON OR PULSING.

IF IT IS DIFFICULT TO REMOVE OR INSERT A DISKETTE IN THE DRIVE, CHECK THE HEAD LOAD BAIL RETURN SPRING AND THE PRESSURE PAD. SEE PAR. D.3.3.1.

AFTER ANY ADJUSTMENT OR PART REPLACEMENT, THE 31SD MUST BE TESTED. IF THE PROBLEM HAS NOT BEEN CORRECTED, START THE DIAGNOSTIC PROCEDURE AGAIN.

BEFORE STARTING THE PROCEDURES, REMOVE POWER AND CHECK FOR THE FOLLOWING FAILURES:

-- FOREIGN MATERIAL IN DISKETTE OR DISKETTE DRIVE.
-- BELT OFF OR DAMAGED.
-- UNSEATED CABLES (ON CARD OR AT HOST SYSTEM END).
-- AC MOTOR BINDING OR NOT TURNING.
-- AC MOTOR CAPACITOR HOUSING HAVING A CRACK OR BEING DISTORTED.
-- HUB BINDING OR NOT TURNING.
-- LOOSE PULLEYS.
-- ACCESS BAND BROKEN OR DAMAGED.
-- RED FELT PAD ON LOAD ARM OF HEAD ASSEMBLY MISSING OR CONTAMINATED.

WITH POWER ON, PERFORM THE VOLTAGE SERVICE CHECK. SEE PAR. D.3.7.3 FOR TEST POINTS. POWER SPECIFICATIONS ARE DESCRIBED IN PAR. D.1.2.3. IF VOLTAGES ARE NOT CORRECT, CHECK FOR UNSEATED I/O CABLE AND GO TO HOST SYSTEM MAP ENTRY POINT.

IF ANY FAILURES OR PROBLEMS ARE FOUND, SEE THE CONTENTS TABLE IN APPENDIX D FOR REPAIR PROCEDURES.

31SD ERROR INDICATING MIGHT DIFFER FROM HOST SYSTEM TO HOST SYSTEM. IN GENERAL, ERRORS ARE COVERED BY THE FOLLOWING FIVE CLASSES:

1. 31SD WRITE ERRORS

ERRORS OCCUR WHILE DOING A READ AFTER WRITE BUT DO NOT OCCUR WHEN READING CORRECT DATA.
GO TO MAP 0250, 31SD WRITE ERROR MAP.

2. 31SD READ ERRORS

NO DATA RECEIVED OR DATA RECEIVED WITH CRC ERRORS.
GO TO MAP 0260, 31SD READ ERROR MAP.

3. 31SD NOT READY

WRONG INDEX PULSES OBSERVED.
GO TO MAP 0270, 31SD NOT READY MAP.

4. 31SD ACCESS ERRORS

FAILED TO READ EXPECTED TRACK ADDRESS BECAUSE OF AN ACCESS TO WRONG TRACK, OR READ ID ERROR OCCURRED AFTER AN ACCESS TO CORRECT TRACK.
GO TO MAP 0280, 31SD ACCESS ERROR MAP.

5. 31SD WRITE/ERASE UNSAFE

FAILED BECAUSE ERASE CURRENT IS ON WHEN ERASE GATE IS OFF, OR ERASE CURRENT IS OFF WHEN ERASE GATE IS ON.
OR,.
FAILED BECAUSE WRITE CURRENT IS ON WHEN WRITE GATE IS OFF, OR WRITE CURRENT IS OFF WHEN WRITE GATE IS ON.
GO TO MAP 0290, 31SD WRITE/ERASE UNSAFE MAP.

WRITE ERROR MAP

PAGE 1 OF 1

001
USE THIS MAP ONLY WHEN THERE ARE ERRORS WHILE DOING A READ AFTER WRITE. IF ERRORS OCCUR WHILE READING CORRECT DATA, GO TO MAP 0260.

PERFORM A WRITE OPERATION.
PROBE 'WRITE DATA' AND '+WRITE GATE' WHILE WRITING.
SEE PAR. D.3.7.3.
BOTH LINES HAVE PULSES?
Y N

002
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR. D.3.7.3, THEN GO TO HOST SYSTEM MAP ENTRY POINT.

003
PROBE '+INNER TRACKS' WHILE DOING AN ACCESS FROM LOW TO HIGH TRACKS (MUST GO ACROSS TRACKS 40-44).
SEE PAR. D.3.7.3.
DID LINE LEVEL CHANGE FROM DOWN TO UP?
Y N

004
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR. D.3.7.3, THEN GO TO HOST SYSTEM MAP ENTRY POINT.

005
EXCHANGE DISKETTE DRIVE CONTROL CARD AND WRITE DATA.
ANY MORE ERRORS?
Y N

006
PROBLEM IS CORRECTED.

A

007
EXCHANGE HEAD/CARRIAGE ASSEMBLY AND WRITE DATA.
SEE D.3.2.4.
ANY MORE ERRORS?
Y N

008
PROBLEM IS CORRECTED.

009
GO TO HOST SYSTEM MAP ENTRY POINT.

31SD

READ ERROR MAP

PAGE 1 OF 4

ENTRY POINTS

| FROM | ENTER THIS MAP | | |
|---|---|---|---|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 0280 | A | 1 | 003 |

001
NO DATA RECEIVED OR DATA RECEIVED
WITH CRC ERROR.

VISUALLY CHECK CARRIAGE MOVEMENT BY
DOING AN ACCESS ELECTRICALLY SEVERAL
TRACKS IN EACH DIRECTION.
IS IT DOING AN ACCESS CORRECTLY?
Y N
|
| 002
| GO TO MAP 0280, ENTRY POINT A.
|
003
(ENTRY POINT A)

IF AN OSCILLOSCOPE IS AVAILABLE, SEE
PAR. D.3.6.1 AND PERFORM THE DISKETTE
SPEED SERVICE CHECK. IF NO
OSCILLOSCOPE IS AVAILABLE AN ESTIMATE
MUST BE MADE.
IS DISK SPEED CORRECT?
Y N
|
| 004
| GO TO MAP 0270, ENTRY POINT B.
|
|
|
|
|
|
|
|
|
|

2
A
.

EXIT POINTS MAP 0260-1

| EXIT THIS MAP | | TO | |
|---|---|---|---|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 1 | 004 | 0270 | B |
| 1 | 002 | 0280 | A |

005
PROBE '+ INNER TRACKS' WHILE DOING AN ACCESS FROM LOW TO HIGH TRACKS (MUST GO ACROSS TRACKS 40-44). SEE PAR. D.3.7.3
DID LINE LEVEL CHANGE FROM DOWN TO UP?
Y N

006
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR. D.3.7.3, THEN GO TO HOST SYSTEM MAP ENTRY POINT.

007
CHECK INPUT VOLTAGES '+5VDC', '-5VDC', AND '+24VDC'.

SEE PAR. D.3.7.3 FOR TEST POINTS AND PAR. D.1.2.2 FOR POWER SPECIFICATIONS.
ARE VOLTAGES CORRECT?
Y N

008
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR. D.3.7.3, THEN GO TO HOST SYSTEM MAP ENTRY POINT.

009
JUMPER '-HEAD LOAD' TEST POINT ON DISKETTE DRIVE CONTROL CARD TO DC GROUND. SOLENOID IS ACTIVATED CAUSING BAIL TO LOAD HEADS.

SEE PAR. D.3.7.3.
DOES THE HEAD LOAD BAIL MOVE?
Y N

3
B C



010
CHECK FOR THE CORRECT PATH OF BAIL ACTUATOR CABLE.
SEE PAR. D.3.3.8.
IS PATH CORRECT AND IS CABLE COMPLETE?
Y N

011
EXCHANGE OR CORRECT THE CABLE PATH.
PERFORM SOLENOID BAIL SERVICE CHECK. SEE PAR. D.3.3.1.

012
REMOVE BAIL. SEE PAR. D.3.3.5.
IS THE BAIL RETURN SPRING IN ITS CORRECT POSITION AND COMPLETE?
Y N

013
EXCHANGE BAIL RETURN SPRING. SEE PAR. D.3.3.6.

014
PROBE '+HEAD ENGAGE'.
SEE PAR. D.3.7.3.
IS LINE DOWN?
Y N

015
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR. D.3.7.3, THEN GO TO HOST SYSTEM MAP ENTRY POINT.

3
D

016
CHECK HEAD LOAD SOLENOID RESISTANCE.

SEE THE FIGURES ASSOCIATED WITH PAR. D.3.3.5.

RESISTANCE IS MEASURED 140 TO 210 OHMS AT NORMAL ROOM TEMPERATURE. IF SOLENOID HAS BEEN ACTIVATED AND CASE IS HOT, RESISTANCE CAN MEASURE UP TO 400 OHMS.
IS SOLENOID RESISTANCE INSIDE LIMITS?
Y N

017
REPAIR OR EXCHANGE WHEN NEEDED.

018
OPERATE BAIL BY HAND.
CHECK TO SEE THAT SOLENOID AND BAIL ARE FREE OF BINDS.
CHECK TO SEE THAT BAIL RETURN SPRING RETURNS BAIL TO ITS STOP.
ANY BINDS OBSERVED?
Y N

019
EXCHANGE DISKETTE DRIVE CONTROL CARD AND CHECK FOR GOOD OPERATION.

SEE PAR. D.3.7.1.

020
REPAIR OR EXCHANGE THE BINDING PART.

SEE PAR. D.3.3.5.

021
CHECK IDLER PULLEY BRACKET SCREW.
SEE PAR. D.3.3.8.
IS IT TIGHT?
Y N

E F



022
TIGHTEN BRACKET SCREW.
PERFORM SOLENOID BAIL SERVICE CHECK. SEE PAR. D.3.3.1.

023
PERFORM HEAD LOAD SOLENOID SERVICE CHECK
SEE PAR. D.3.3.1.
IS SERVICE CHECK CORRECT?
Y N

024
ADJUST OR EXCHANGE WHEN NEEDED.

025
CHECK ADJUSTMENT OF HEAD/CARRIAGE ASSEMBLY.

SEE PAR. D.3.2.2.
IS ADJUSTMENT CORRECT?
Y N

026
ADJUST HEAD/CARRIAGE ASSEMBLY.

SEE PAR. D.3.2.3.

027
EXCHANGE DISKETTE DRIVE CONTROL CARD AND CHECK FOR GOOD OPERATION.

SEE PAR. D.3.7.1.
ANY MORE ERRORS?
Y N

028
PROBLEM IS CORRECTED.

029
IS AN OSCILLOSCOPE AVAILABLE?
Y N

4 4
G H

READ ERROR MAP

PAGE 4 OF 4

030
EXCHANGE HEAD/CARRIAGE ASSEMBLY
AND CHECK FOR GOOD OPERATION.

SEE PAR. D.3.2.4
ANY MORE ERRORS?
Y N

031
PROBLEM IS CORRECTED.

032
GO TO HOST SYSTEM MAP ENTRY POINT.

033
CHECK READ SIGNAL AT 'TPAMP1' AND
'TPAMP2'. COMPARE TO SCREEN IMAGE IN
PAR. D.2.3
DOES THE READ SIGNAL APPEAR
DIFFERENT THAN SCREEN IMAGE?
Y N

034
PROBE '+FILE DATA'. COMPARE TO
SCREEN IMAGE IN PAR. D.2.3
DOES SIGNAL APPEAR DIFFERENT THAN
SCREEN IMAGE?
Y N

035
GO TO HOST SYSTEM MAP ENTRY
POINT.

036
EXCHANGE HEAD/CARRIAGE ASSEMBLY
AND CHECK FOR GOOD OPERATION.

SEE PAR. D.3.2.4

037
EXCHANGE HEAD/CARRIAGE ASSEMBLY
AND CHECK FOR GOOD OPERATION.

SEE PAR. D.3.2.4

NOT READY MAP

PAGE 1 OF 4

ENTRY POINTS

| FROM MAP NUMBER | ENTER THIS MAP: ENTRY POINT | PAGE NUMBER | STEP NUMBER |
|---|---|---|---|
| 0260 | B | 4 | 046 |

001
USE THIS MAP WHEN WRONG INDEX PULSES ARE OBSERVED.
SEE PAR. D.1.1.1 ABOUT DISKETTE HOLDING.

DO YOU HAVE THE CORRECT DISKETTE?
Y N

002
USE THE CORRECT DISKETTE.

003
IS DISKETTE FREE FROM DAMAGE?
Y N

004
EXCHANGE DISKETTE.

005
IS DISKETTE INSERTED CORRECTLY?
SEE PAR. D.1.1.1 ABOUT DISKETTE INSERTING.
Y N

006
RESEAT DISKETTE CORRECTLY.

A

A

007
JUMPER '- HEAD LOAD' TEST POINT ON DISKETTE DRIVE CONTROL CARD TO DC GROUND. SEE PAR. D.3.7.3. SOLENOID IS ACTIVATED CAUSING BAIL TO LOAD HEADS, AND PUT MAXIMUM LOAD ON DRIVE PARTS.
IS HUB PULLEY TURNING?
Y N

008
(ENTRY POINT A)
SEE PAR. D.3.3.7.
IS BELT INSTALLED AND FOLLOWING A CORRECT PATH?
Y N

009
INSTALL OR EXCHANGE BELT.

010
KEEP HEAD LOADED.
IS AC MOTOR PULLEY TURNING?
Y N

011
IS AC MOTOR SHAFT TURNING?
Y N

012
MEASURE AC VOLTAGE AT AC MOTOR CONNECTOR.
SEE PAR. D.1.2.2 FOR POWER SPECIFICATIONS.
IS AC VOLTAGE CORRECT AT AC MOTOR CONNECTOR?
Y N

013
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR. D.3.7.3.
THEN GO TO HOST SYSTEM MAP ENTRY POINT.

2 2 2 2
B C D E

014
SWITCH OFF AC POWER, REMOVE BELT, LET IT COOL 5 MINUTES, THEN SWITCH ON AC POWER.
DOES AC MOTOR START?
Y N

015
EXCHANGE AC MOTOR STARTING CAPACITOR. SEE PAR. D.3.4.1.
DOES AC MOTOR START?
Y N

016
EXCHANGE AC MOTOR. SEE PAR. D.3.4.1.

017
PROBLEM IS CORRECTED.

018
CHECK HUB ASSEMBLY FOR BINDS WITH COLLET ENGAGED.
IS HUB FREE OF BINDS?
Y N

019
DISENGAGE COLLET AND CHECK FOR BINDS AND NOISE.
IS HUB FREE OF BINDS AND NOISE?
Y N

020
COMPLETELY EXCHANGE 31SD ASSEMBLY.

021
EXCHANGE COLLET ASSEMBLY WHEN NEEDED.
SEE PAR. D.3.1.

022
REINSTALL BELT. IF A PROBLEM IS STILL PRESENT, EXCHANGE AC MOTOR.
SEE PAR. D.3.4.1.



023
AC MOTOR PULLEY IS LOOSE. ADJUST AND TIGHTEN.
SEE PAR. D.3.4.6.

024
CHECK HUB ASSEMBLY FOR BINDS WITH COLLET ENGAGED.
IS HUB FREE OF BINDS?
Y N

025
DISENGAGE COLLET AND CHECK FOR BINDS AND NOISE.
IS HUB FREE OF BINDS AND NOISE?
Y N

026
COMPLETELY EXCHANGE 31SD ASSEMBLY.

027
EXCHANGE COLLET ASSEMBLY WHEN NEEDED.
SEE PAR. D.3.1.

028
EXCHANGE BELT.
SEE PAR. D.3.4.

029
IS COLLET TURNING?
Y N

030
DISENGAGE COLLET AND REMOVE DISKETTE. THE HUB SHOULD BE TURNING.
IS THE HUB TURNING?
Y N

031
COMPLETELY EXCHANGE 31SD ASSEMBLY.

032
EXCHANGE 31SD COLLET ASSEMBLY.
SEE PAR. D.3.1.

033
PROBE '+ INDEX' WITH A FAILING DISKETTE INSERTED.
SEE PAR. D.3.7.3.
IS LINE PULSING?
Y N

034
CHECK '+5VDC', '-5VDC', AND '+24VDC' INPUT VOLTAGES TO DISKETTE DRIVE CONTROL CARD.
SEE PAR. D.3.7.3 FOR TEST POINTS.
POWER SPECIFICATIONS ARE DESCRIBED IN PAR. D.1.2.3.2.
ARE VOLTAGES CORRECT?
Y N

035
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR. D.3.7.3, THEN GO TO HOST SYSTEM MAP ENTRY POINT.

036
PERFORM LED OUTPUT SERVICE CHECK FOR FAILING DISKETTE.
SEE PAR. D.3.6.2.
IS LED VOLTAGE CORRECT?
Y N

037
REMOVE/EXCHANGE THE LED. SEE PAR. D.3.6.3.
ANY MORE ERRORS?
Y N

038
PROBLEM IS CORRECTED.

H J K



039
EXCHANGE DISKETTE DRIVE CONTROL CARD AND CHECK FOR GOOD OPERATION.
SEE PAR. D.3.7.1.

040
PERFORM PTX SERVICE CHECK.
SEE PAR. D.3.6.5.
IS OUTPUT CORRECT FOR DISKETTE BEING USED?
Y N

041
EXCHANGE DISKETTE DRIVE CONTROL CARD AND CHECK FOR GOOD OPERATION.
SEE PAR. D.3.7.1.
ANY MORE ERRORS?
Y N

042
PROBLEM IS CORRECTED.

043
EXCHANGE PTX ASSEMBLY.
SEE PAR. D.3.6.6.

044
EXCHANGE PTX ASSEMBLY.
SEE PAR. D.3.6.6.

045
USE HOST SYSTEM INDICATOR, OR, IF AN OSCILLOSCOPE IS AVAILABLE, PERFORM DISKETTE SPEED SERVICE CHECK.
SEE PAR. D.3.6.1.
HEAD MUST BE LOADED DURING DISKETTE SPEED CHECK.
IF HOST SYSTEM INDICATOR OR OSCILLOSCOPE IS NOT AVAILABLE, AN ESTIMATE MUST BE MADE OF THE DISK SPEED.
IS DISK SPEED CORRECT?
Y N

4 4
L M

NOT READY MAP

PAGE 4 OF 4

046
(ENTRY POINT B)
CHECK LEVER, SPRING, AND COLLET.
ARE LEVER, SPRING, AND COLLET OK?
Y N

047
EXCHANGE WHEN NEEDED.
SEE PAR. D.3.1.

048
PERFORM HEAD LOAD SOLENOID SERVICE CHECK.
SEE PAR. D.3.3.
IS ADJUSTMENT CORRECT?
Y N

049
ADJUST SOLENOID.

050
GO TO PAGE 1, STEP 008, ENTRY POINT A.

051
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR. D.3.7.3, THEN GO TO HOST SYSTEM MAP ENTRY POINT.

31SD

SEEK ERROR MAP

PAGE 1 OF 4

ENTRY POINTS

| FROM | ENTER THIS MAP | | |
|---|---|---|---|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 0260 | A | 2 | 005 |

EXIT POINTS

| EXIT THIS MAP | | TO | |
|---|---|---|---|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 1 | 004 | 0260 | A |

001
FAILED TO READ DESIRED TRACK ADDRESS BECAUSE OF AN ACCESS TO WRONG TRACK, OR READ ID ERROR OCCURRED AFTER AN ACCESS TO CORRECT TRACK.

CHECK HEAD/CARRIAGE ASSEMBLY ADJUSTMENT.
SEE PAR. D.3.2.2.
NOTE - IF STEPPER MOTOR WILL NOT DETENT DURING THIS ADJUSTMENT, GO TO ENTRY POINT 'A' OF THIS MAP.
HEAD ADJUSTMENT CORRECT?
Y N

002
PERFORM HEAD/CARRIAGE ADJUSTMENT.
SEE PAR. D.3.2.3.
CHECK FOR GOOD OPERATION.

003
CHECK CARRIAGE MOVEMENT BY DOING AN ACCESS AT LEAST FOUR TRACKS IN EACH DIRECTION. ALSO DO A SEEK FROM TRACK 4 TO TRACK 0 BY 4 TRACKS SEVERAL TIMES.
DOES CARRIAGE MOVEMENT LOOK UNUSUAL OR DOES NOT MOVE?
Y N

004
READ PROBLEM.
GO TO MAP 0260, ENTRY POINT A.

2
A

SEEK ERROR MAP

PAGE 2 OF 4

005
(ENTRY POINT A)
CHECK '+24 V DC' FROM THE HOST SYSTEM.
SEE PAR. D.3.7.3 FOR TEST POINTS, AND
PAR. D.1.2.2 FOR POWER
SPECIFICATIONS.
IS VOLTAGE CORRECT?
Y N

006
CHECK I/O TEST PINS FOR SIGNALS, SEE
PAR. D.3.7.3, THEN GO TO HOST
SYSTEM MAP ENTRY POINT.

007
PROBE '+ ACCESS 0' AND '+ ACCESS 1' WHILE
DOING AN ACCESS FOUR TRACKS.
SEE PAR. D.3.7.3.
DO BOTH LINES HAVE PULSES?
Y N

008
CHECK I/O TEST PINS FOR SIGNALS, SEE
PAR. D.3.7.3, THEN GO TO HOST
SYSTEM MAP ENTRY POINT.

009
DO A SEEK TO TRACK 00. USE THE
VOLTMETER TO MEASURE VOLTAGE ON
DISKETTE DRIVE CONTROL CARD TEST
POINTS 'MC-0', ' MC-1', ' MC-2',AND ' MC-3'
SEE PAR. D.3.7.3.
CHECK EACH TEST POINT AND COMPARE
RESULTS TO TABLE AT RIGHT. DOWN LEVEL
IS 0 TO 2.0 V DC AND UP LEVEL IS 21.6 TO
26.4 V DC. SINGLE CYCLE STEP TO TRACK 01
AND REPEAT MEASUREMENTS. REPEAT FOR
TRACKS 02 AND 03.

ARE RESULTS THE SAME AS TABLE AT
RIGHT?
Y N

| | STEPPER MOTOR TEST PINS | | | |
|---|---|---|---|---|
| | MC 0 | MC 1 | MC 2 | MC 3 |
| TRACK 00 | DOWN | UP | UP | UP |
| TRACK 01 | UP | DOWN | UP | UP |
| TRACK 02 | UP | UP | DOWN | UP |
| TRACK 03 | UP | UP | UP | DOWN |

3 3
B C

010
MEASURE RESISTANCES OF EACH STEPPER MOTOR COIL AT PINS IN STEPPER MOTOR CONNECTOR. RESISTANCE ACROSS EACH COIL TO COMMON IS 115-141 OHMS. (SEE PAR. D.3.7.3 FOR PIN LOCATIONS.)
ARE RESISTANCES OF ALL FOUR COILS CORRECT?
Y N

011
EXCHANGE STEPPER MOTOR.
SEE PARS. D.3.5.1 AND D.3.5.2.
ANY MORE FAILURES?
Y N

012
PROBLEM IS CORRECTED.

013
CHECK '+ 5 V DC' AND '+ 24 V DC' INPUT VOLTAGES TO DISKETTE DRIVE CONTROL CARD.
SEE PAR. D.3.7.3 FOR TEST POINTS AND PAR. D.1.2.2 FOR POWER SPECIFICATIONS.
ARE VOLTAGES CORRECT?
Y N

014
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR. D.3.7.3, THEN GO TO HOST SYSTEM MAP ENTRY POINT.

015
EXCHANGE DISKETTE DRIVE CONTROL CARD AND CHECK FOR GOOD OPERATION.
SEE PAR. D.3.7.1.

D



016
CHECK '+ 5 V DC ' AND '+ 24 V DC' INPUT VOLTAGES TO DISKETTE DRIVE CONTROL CARD.
SEE PAR. D.3.7.3 FOR TEST POINTS AND PAR. D.1.2.2 FOR POWER SPECIFICATIONS.
ARE VOLTAGES CORRECT?
Y N

017
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR. D.3.7.3, THEN GO TO HOST SYSTEM MAP ENTRY POINT.

018
EXCHANGE DISKETTE DRIVE CONTROL CARD AND CHECK FOR GOOD OPERATION.
SEE PAR. D.3.7.1.

019
MEASURE RESISTANCE OF EACH STEPPER MOTOR COIL AT PINS IN STEPPER MOTOR CONNECTOR. RESISTANCE ACROSS EACH COIL TO COMMON IS 115-141 OHMS. (SEE PAR. D.3.7.3 FOR PIN LOCATIONS)
ARE RESISTANCES OF ALL FOUR COILS CORRECT?
Y N

020
EXCHANGE STEPPER MOTOR.
SEE PAR. D.3.5.1.

021
CHECK THAT STEPPER MOTOR PULLEY CLAMP IS TIGHT AND PULLEY IS TIGHT ON STEPPER MOTOR SHAFT.
SEE PAR. D.3.5.4.
IS IT TIGHT?
Y N

022
ADJUST AND TIGHTEN STEPPER MOTOR PULLEY.

4
E

023
CHECK STEPPER MOTOR DRIVE BAND TO SEE THAT IT IS NOT DAMAGED.
SEE PAR. D.3.5.5.
IS STEPPER MOTOR DRIVE BAND NOT DAMAGED?
Y N

024
EXCHANGE BAND

025
REMOVE SCREWS THAT CLAMP DRIVE BAND TO CARRIAGE.
SEE PAR. D.3.5.6.
CAREFUL NOT TO DAMAGE BAND, CHECK TO SEE THAT CARRIAGE MOVES FREELY ON ITS GUIDE RODS AT CENTER AND BOTH LIMITS OF CARRIAGE MOVEMENT.
DOES CARRIAGE MOVE FREELY?
Y N

026
CLEAN OR EXCHANGE WHEN NECESSARY.

027
REMOVE DRIVE BAND FROM STEPPER MOTOR PULLEY.
SEE PAR. D.3.5.7.
DOES STEPPER MOTOR BIND WITH PULLEY ATTACHED?
Y N

028
INSTALL NEW DRIVE BAND AND ADJUST.

029
IS THERE A GAP BETWEEN STEPPER MOTOR PULLEY AND CASTING?
SEE PAR. D.3.5.1 FOR FIGURE OF WHERE TO OBSERVE GAP.
Y N

F G



030
ADJUST PULLEY SO THAT THERE IS A GAP AND THE DRIVE BAND TRACKS CORRECTLY.
SEE PAR. D.3.5.6.

031
EXCHANGE STEPPER MOTOR.
SEE PAR. D.3.5.1.

WRITE/ERASE UNSAFE MAP

PAGE 1 OF 2

001
FAILED BECAUSE ERASE CURRENT IS ON WHEN ERASE GATE IS OFF, OR ERASE CURRENT IS OFF WHEN ERASE GATE IS ON.

OR,

FAILED BECAUSE WRITE CURRENT IS ON WHEN WRITE GATE IS OFF, OR WRITE CURRENT IS OFF WHEN WRITE GATE IS ON.

PROBE '+ WRITE/ERASE ENABLED' WHILE GIVING A COMMAND TO WRITE DATA.
SEE PAR. D.3.7.3.
THIS LINE IS PULSING DURING THE COMMAND.
IS LINE PULSING FOR WRITE COMMAND?
Y N

002
IS LINE AT A DOWN LEVEL FOR WRITE COMMAND?
Y N

003
PROBE '+ERASE GATE' AND '+WRITE GATE' WHILE WRITING.
SEE PAR. D.3.7.3
THESE LINES ARE PULSING DURING A WRITE OPERATION.
ARE LINES PULSING DURING WRITE OPERATION?
Y N

004
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR. D.3.7.3, THEN GO TO HOST SYSTEM MAP ENTRY POINT.

005
EXCHANGE DISKETTE DRIVE CONTROL CARD AND CHECK FOR GOOD OPERATION.
SEE PAR. D.3.7.1.
IS OPERATION ACCEPTABLE?
Y N

006
EXCHANGE HEAD CARRIAGE ASSEMBLY AND CHECK FOR GOOD OPERATION.
SEE PAR. D.3.3.
IS OPERATION ACCEPTABLE?
Y N

007
FAILING HEAD/CARRIAGE ASSEMBLY THAT WAS EXCHANGED MAY HAVE DAMAGED DISKETTE DRIVE CONTROL CARD. EXCHANGE DISKETTE DRIVE CONTROL CARD AND CHECK FOR GOOD OPERATION.
SEE PAR. D.3.7.1.

008
PROBLEM IS CORRECTED.

009
PROBLEM IS CORRECTED.

010
PROBE '+ERASE GATE' AND '+WRITE GATE' WHILE WRITING.
SEE PAR. D.3.7.3.
THESE LINES ARE PULSING DURING A WRITE OPERATION.
ARE LINES PULSING FOR WRITE COMMAND?
Y N

011
CHECK I/O TEST PINS FOR SIGNALS, SEE PAR D.3.7.3, THEN GO TO HOST SYSTEM MAP ENTRY POINT.

2
A B C

2
D

```
A D          31SD
1 1
             WRITE/ERASE UNSAFE
| |
| |          PAGE   2 OF   2
| |
| |
| 012
| EXCHANGE DISKETTE DRIVE CONTROL
| CARD.
| SEE PAR. D.3.7.1.
|
013
PROBE '+WRITE/ERASE ENABLED' WHILE
GIVING A COMMAND TO READ DATA.
SEE PAR. D.3.7.3.
THIS LINE IS AT A DOWN LEVEL DURING
READ A OPERATION.
IS LINE DOWN DURING A READ
OPERATION?
Y N
|
| 014
| PROBE '+ERASE GATE' AND '+WRITE GATE'
| WHILE GIVING A COMMAND TO READ
| DATA.
| SEE PAR. D.3.7.3.
| THESE LINES ARE DOWN DURING A READ
| OPERATION.
| ARE LINES DOWN DURING A READ
| OPERATION?
| Y N
| |
| | 015
| | CHECK I/O TEST PINS FOR SIGNALS,
| | SEE PAR. D.3.7.3, THEN GO TO HOST
| | SYSTEM MAP ENTRY POINT.
| |
| 016
| EXCHANGE DISKETTE DRIVE CONTROL
| CARD.
| SEE PAR. D.3.7.1.
|
017
CHECK I/O TEST PINS FOR SIGNALS, SEE
PAR. D.3.7.3, THEN GO TO HOST SYSTEM
MAP ENTRY POINT.
```

# GLOSSARY

BAIL - IT ALLOWS THE HEADS OR HEAD AND PAD TO COME TOGETHER OR TO BRING THEM APART AND HOLDS THE MEDIA FIRMLY IN THE PLANE OF THE HEAD(S) ON DISKETTE STORAGE DEVICES.

BAND - SOMETHING THAT CONFINES OR CONSTRICTS WHILE ALLOWING A DEGREE OF MOVEMENT.

COLLET - A MECHANISM THAT CENTERS AND CLAMPS THE DISK.

CRC - CYCLIC REDUNDANCY CHECK.

DETENT - THE ACT OR FACT OF DETAINING OR HOLDING IN PLACE BY A FORCE.

HUB - PROVIDES A REGISTRATION SURFACE AND IMPARTS ROTATIONAL MOTION OF THE DISK.

ID - IDENTIFICATION

I/O - INPUT/OUTPUT

MC - MOTOR CONTROL

MIM - MAINTENANCE INFORMATION MANUAL

PAR - PARAGRAPH

PTX - PHOTOTRANSISTOR

STEPPER MOTOR - MOTOR THAT IS USED TO MOVE THE ACCESS MECHANISM OF A DIRECT-ACCESS STORAGE DEVICE TO A SPECIFIED LOCATION.

# Appendix F. X.21 Switched Feature

## F.1 INTRODUCTION

The 3274 X.21 Switched feature allows the 3274 Model 51C to be attached to the DCE that electrically matches CCITT Recommendation X.27, and that operates as specified in CCITT Recommendation X.21 at speeds of 2400, 4800, 9600 and 48,000 bps.

To use the X.21 Switched feature, the 3274 must have either a 3278 Display Station or 3279 Color Display Station attached.

## F.2 FUNCTIONAL DESCRIPTION

The 3274 supports the following for the X.21 Switched feature:

- SDLC CAC to support X.21 Switched protocol.
- Data Link Control, which is an interface to the SDLC CAC.
- X.21 Switched Adapter card.

This section defines the function of the Data Link Control, which issues function requests to the CAC and handles completion codes from the CAC. Figure F-1 outlines the Data Link Control function.

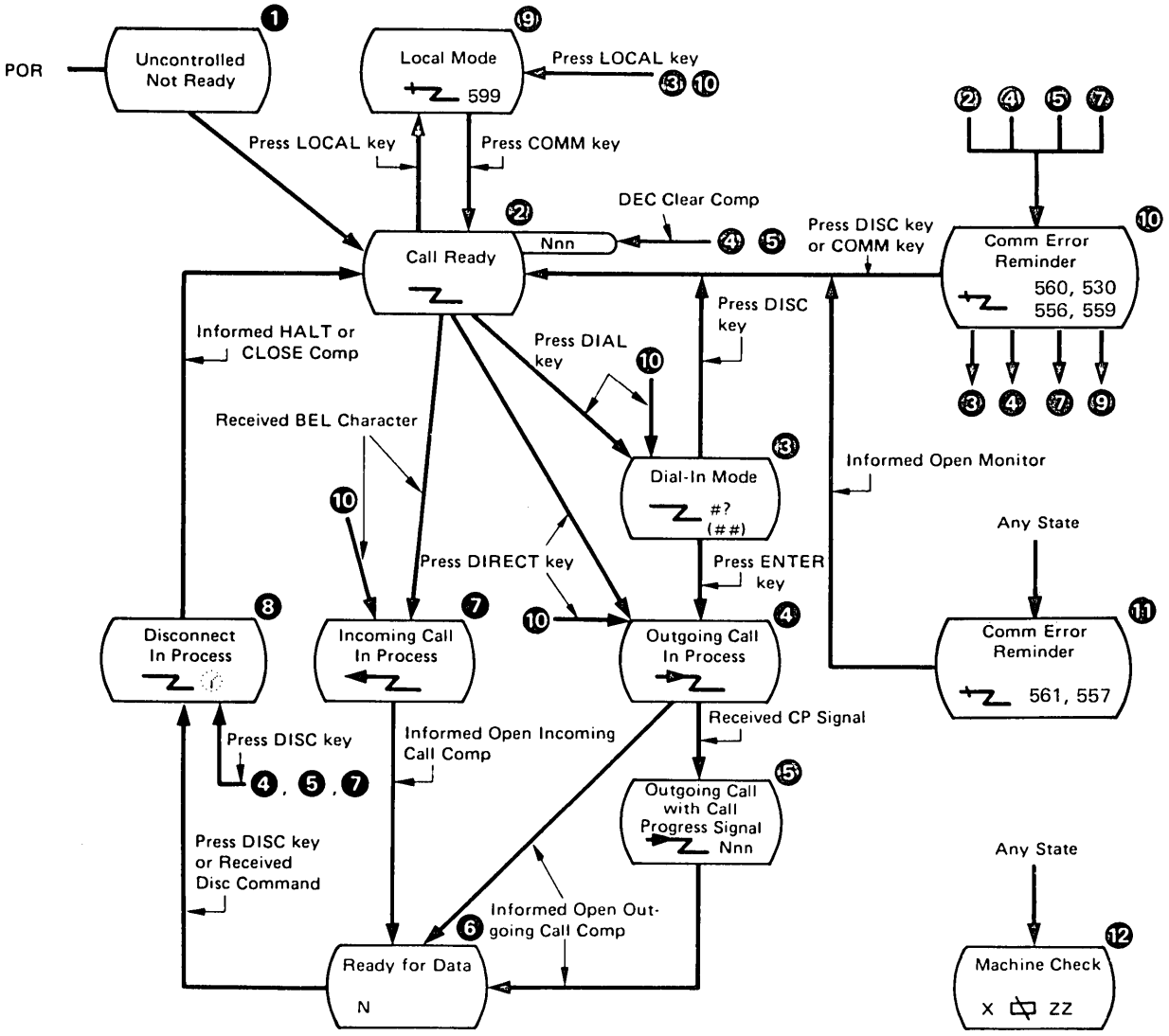



**Figure F-1. Data Link Control Function**

## F.2.1 X.21 Switched CAC Function

### F.2.1.1 Function Requests

1. OPEN for outgoing call

   By this request, the HPCA and the X.21 hardware are reset, enabled, and, after passing through the ready state, proceed with the outgoing call establishment.

   The CAC signals the X.21 hardware to enter the call-request state and awaits the reception of an IA5 plus (+) character from the network.

   When the request contains selection signals, the CAC/X.21 hardware sends two IA5 sync characters and the selection signals (including dial digits) that were set up by the Data Link Control in the selection signal buffer.

   The X.21 hardware monitors the network interface; if Call Progress signals and/or called line identification are received, they are passed on the the CAC. After translation, the CAC will pass the first Call Progress signal (normally two digits) or line ID to the Data Link Control's buffer and post an intermediate completion status.

   When the CAC detects that the network is ready for data, the CAC will enter the data-transfer phase after housekeeping and preparing the X.21 hardware and CAC to receive the first SDLC frame. The Data Link Control is notified that the Open is completed.

   The process is similar when the outgoing call is direct. A direct call by the Data Link Control identifies a direct call by specifying no dial digits. When the IA5 plus (+) character is received, signifying select from the network, the CAC enters the DTE waiting state for the reception of Call Progress signals, called line identification, or the indication that the network is ready for data.

2. OPEN for incoming call

   When the Data Link Control issues the X.21 Open function request for an incoming call, the action of the CAC/X.21 hardware differs slightly from that for an outgoing call.

   - The CAC/X.21 hardware determines that the network is ready, then enters the ready state to await an interrupt from the X.21 hardware signifying activity on the network.
   - Receipt of one IA5 BEL character identifies the incoming call state. The CAC posts an intermediate completion status (BEL RCVD) and, when it regains control, prompts the X.21 hardware to turn on the control lead that signifies the call-accepted state.
   - The CAC now waits for an interrupt to indicate either that the calling line identification has been received, or that the network is ready for data. If line identification is received, the CAC moves it to the Data Link Control's buffer, and the completion status is passed on the same way as for an outgoing call.

     When Ready-for-Data is detected, the data-transfer phase is entered after the CAC completes appropriate housekeeping and prepares the X.21 hardware for the first SDLC frame. A normal completion to the Open function request is posted by the CAC.

3. OPEN for monitoring

   The CAC checks the X.21 interface periodically. If the DCE's status coincides with the condition specified by the Data Link Control, that is, DCE ready or DCE not ready, the CAC reports normal completion.

4. Close

   If the clearing sequence has already completed, the CAC merely executes the final housekeeping requirements; otherwise, the CAC starts a clearing sequence. When the clearing ends properly, and no comparator error is indicated by the X.21 hardware, a normal completion is posted. When the clearing sequence does not end properly within its time limit, or if a comparator error exists, appropriate error status is posted. The HPCA and X.21 hardware are always reset prior to posting any completion code to the Close FR. The CAC/X.21 hardware will be in the controlled-not-ready state when this FR ends.

5. HALT

   The Data Link Control aborts an OPEN function request by issuing a HALT request. The CAC executes a clearing sequence to the network.

### F.2.1.2 Call Collision

A call-collision condition can exist when a call request is made to the network at the same time the network is making an incoming call. The network will resolve the collision in favor of the call request.

**Note:** *The X.21 recommendation does not permit deliberate call collisions; that is, the DTE entering the call-request state after becoming aware of the incoming-call state.*

*Therefore, the Data Link Control avoids deliberate situations by issuing the proper sequence of function requests; for example, by issuing a HALT request to the Open-for-Incoming request before issuing the Open-for-Outgoing request.*

### F.2.1.3 Call Progress (CP) Signals

The only time the CAC is affected by a particular call progress (CP) signal is if the first digit of a received CP signal is an IA5 "0," "2," or "6."

The IA5 "0" identifies the call-wait class (terminal called or waiting connection). The action of the CAC upon detecting the IA5 "0" is to initiate a 60-second timeout instead of the 2-second timeout, while waiting for the network to become ready for data. Upon detecting the IA5 "2" or "6" (short-term condition when clearing), the CAC prepares for the retry by initiating a clearing sequence. CP signals already received will be moved to the Data Link Control's buffer.

When reacting to a IA5 "0" CP, the CAC will post the intermediate completion status, indicating that CP signals are available in the buffer. When reacting to the IA5 "2" or "6" CPs, the retry intermediate status is posted, indicating that the retry is due to receipt of a retry type CP signal.

## F.2.2 Data Link Control Function

### F.2.2.1 Call Ready

The Call-Ready indicator is displayed in the Operator Information Area of the 3278 or 3279 and the use of either the DIAL key, DIRECT key, or LOCAL key is accepted, as is an incoming call.

This state is the X.21-Ready state and is entered by the Open-for-Incoming request to the CAC under the following conditions:

1. Immediately after POR of the 3274 by the Uncontrolled-Not-Ready state.
2. When the COMM key is pressed while operating in the local mode.
3. When the Dial-In mode is ended by the DISC key.
4. After the line is disconnected normally by the DISC key on the DISC command.
5. When the Open Outgoing request is rejected by CP signals.
6. After the line is disconnected by an error, or after the X.21 open request is completed erroneously, except if condition 7 exists. However, the Call-Ready indicator is overridden by the Comm Error Reminder. This reminder can be reset by the COMM key, and the Call-Ready indicator will appear.
7. If the DCE is not ready, the Comm Error Reminder is displayed, and the Open-Monitor request is issued. When this request is completed, the Call-Ready indicator is displayed in the Operator Information Area.

### F.2.2.2 Incoming Call In Process

When an incoming call comes to the 3274 while in the X.21 Ready state, the CAC returns the intermediate completion code with 'BEL RCVD'. The Data Link Control will display the Incoming-Call-In-Process indicator and returns control to the CAC. When the Ready-for-Data is sent from the DCE, the CAC will return a normal completion code. The Data Link Control turns off the Incoming-Call-In-Process indicator, turns on the In-Use indicator, and prepares for normal data exchange.

### F.2.2.3 Dialing

When the DIAL key is pressed in the Call-Ready state, the Data Link Control issues the HALT request to the CAC to inhibit an incoming call, clears the screen, and puts the cursor at the home position. The Wait indicator is displayed until the HALT request is completed. Then the Dial-In indicator is displayed.

The operator enters dial digits, or any facility request allowed by the network, and presses the Enter key.

The Data Link Control issues an Open-for-Outgoing request to the CAC with parameters that include selection signals entered by the operator, and displays the Outgoing-Call-In-Process indicator.

### F.2.2.4 Direct Call

When the DIRECT key is pressed in the Call-Ready state, the Data Link Control issues the HALT request, the Open-for-Outgoing request, with no selection signal, and displays the Outgoing-Call-In-Process indicator.

### F.2.2.5 Outgoing Call In Process

The CAC processes the Open-for-Outgoing request, as described under section F.2.1.1 and returns a normal-completion code to the Data Link Control when the X.21 Ready-for-Data signal is sent from the DCE. The Data Link Control turns off the Outgoing-Call-In-Process indicator, turns on the In-Use indicator, and prepares for normal data exchange.

### F.2.2.6 Local Mode

When the LOCAL key is pressed in the Call-Ready state, the Data Link Control issues the HALT request and displays the Local Mode indicator.

The Local mode is the X.21 Controlled-Not-Ready state and inhibits incoming and outgoing calls.

When the COMM key is pressed in the Local mode, the Data Link Control issues an Open-for-Incoming request to the CAC and displays the Call-Ready indicator.

### F.2.2.7 Disconnection

When the DISC key is pressed in the Ready-for-Data state or Outgoing/Incoming Call-In-Process state, the Data Link Control issues a CLOSE request in the Ready-for-Data state, or issues a HALT request in the Outgoing/Incoming-Call-In-Process state to the CAC, and displays the Disconnect-In-Process indicator. When the close-completion code is returned from the CAC, the Data Link Control turns off the In-Use indicator, issues an Open-for-Incoming request to the CAC, enters the Call-Ready state, and displays the Call-Ready indicator. When the halt-competition code is returned, the Data Link Control issues an Open-for-Incoming request to the CAC, enters the Call-Ready state, and displays the Call-Ready indicator.

The line is also disconnected automatically by a timeout condition or by the SDLC DISC command.

## F.2.3 X.21 Switched Adapter (X.21SA) Card

The X.21SA card is a 2W by 3H and is pin-compatible with the integrated modem, the EIA/CCITT interface, the Loop I/F, the DDSA, or the X.21NA. Its location is 01A-A1G2. The X.21SA card has the two interfaces: the HPCA interface and the DCE interface. The HPCA interface connects the X.21SA to the HPCA adapter in the 3274. The DCE interface connects the X.21SA card through X.27 (V.11) level of the X.21 interface, appropriate board wiring, and a communication cable to the external DCE.

# F.3 EXTENSION KEY AND MODIFIER KEYS

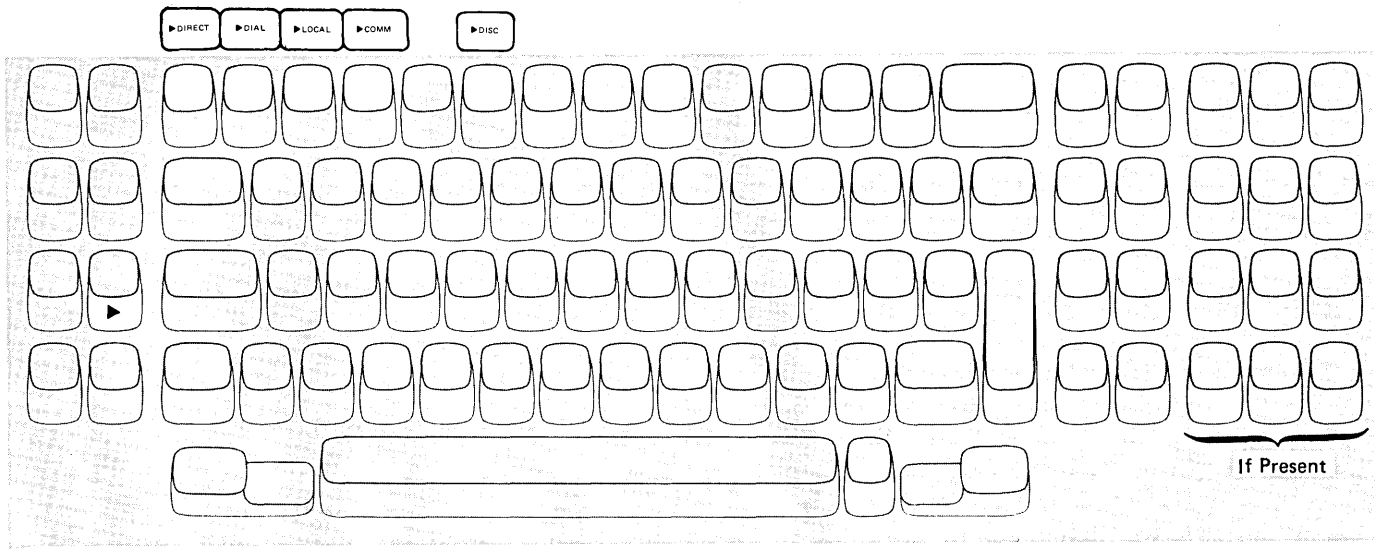
## F.3.1 Locations

Figure F-2 defines the positions for the Extension key and the Modifier keys, such as DIAL, DIRECT, DISC, LOCAL, and COMM keys for the X.21 Switched feature operation on the 3278 or 3279. The X.21 Switched feature operation is executed by pressing the Extension key, and then one of the modifier keys.

**Note:** *A decal and labels are provided to the customer to place on the keyboard to indicate the key positions.*

## F.3.2 Extension Mode

- The Extension mode is entered by pressing the Extension key except during the no-security-key condition or in the Test mode.
- All keyboard status indicators, such as KANA, ALPHA, APL, Text, NUM, UPSHIFT, and INSERT, are cleared when entering the Extension mode.
  The indication ' ▶ ' is displayed in column 30 of the information area when in the Extension mode.
- If a modifier key is pressed when in the Extension mode, the Extension mode is reset, and the function defined for the key is executed.
  The Extension key resets the Extension mode if pressed when in the Extension mode.




▶ is Extension key (ALT position of the ERASE EOF key).

**Figure F-2. Keyboard Layout with X.21 Switched Feature**

- The Reset key and the ALT key operate normally in the Extension mode and do not reset the Extension mode.
- If any key other than a modifier key and the Reset key is pressed, the Retry indicator is displayed, and the Extension mode is reset.
- Use of the DIAL key will be rejected in the Extension mode. The Retry indicator will be displayed when the device is busy, very busy, or not functional.
- The Extension key aborts the print ID mode and dead-key sequence.

## F.4 STATUS AND KEY OPERATION

Figures F-3 and F-4 show how keys are treated when pressed in the X.21 Switched states and when in the Dial-In mode.

| | Operation | | | | | |
|---|---|---|---|---|---|---|
| **Status** | **DIAL Key Pressed** | **DIRECT Key Pressed** | **DISC Key Pressed** | **LOCAL Key Pressed** | **COMM Key Pressed** | **AID Key Pressed** |
| Call Ready | Accept<br>#?<br>(##) | Accept | Ignore | Accept<br>599 | Ignore | X-f |
| Call Ready with Call Progress Signal | Accept<br>#?<br>(##) | Accept* | Accept* | Accept<br>599 | Accept* | X-f<br>Nnn |
| Outgoing Call In Process | X | X | Accept | X | Ignore | X-f |
| Outgoing Call In Process with Call Progress Signal | X<br>Nnn | X<br>Nnn | Accpet | X<br>Nnn | Ignore<br>Nnn | X-f<br>Nnn |
| Incoming Call In Process | X | X | Accept | X | Ignore | X-f |
| Data Ready | X | X | Accept | X | Ignore | Same as the base machine |
| Disconnect In Process | X | X | Ignore | X | Ignore | X-f |
| Local | X<br>599 | X<br>599 | X<br>599 | Ignore<br>599 | Accept | X-f<br>599 |

* Reset Call Progress Signals.

**Note:** *In each box under "Operation", the upper row shows an indicator from column 8 and the lower row shows an indicator from column 20.*

Figure F-3. 3278/3279 Key Operation (During X.21 Switched States)

| Key Pressed | Reaction | |
|---|---|---|
| | Dial Originating Terminal | Other Terminals |
| DIAL | Clear Screen<br>#? | X<br>## |
| DIRECT | <br> | X<br>## |
| LOCAL | <br>599 | X<br>## |
| COMM | Ignore<br>#? | Ignore<br>## |
| DISC | <br> | <br> |
| AID | X-f<br>#? | X-f<br>## |
| CLEAR | Clear Screen*<br>#? | Clear Screen<br>## |
| TEST | Test<br>Abort Dial | Test<br>## |
| ENTER | <br> | X-f<br>## |

* Clear only the dial-in area

**Note:** *In each box under "Reaction", the upper row shows an indicator from column 8 and the lower row shows an indicator from column 20.*

**Figure F-4. 3278/3279 Key Operation in Dial-In Mode**

## F.5 ERROR CODES AND RECOVERY

The X.21 Switched Adapter feature error codes and recovery are shown in Appendix B.

## F.6 CALL PROGRESS SIGNAL CODE

The Call Progress Signal (CPS) is sent by the network to advise a calling terminal/host about the progress of a call or about the circumstances that have prevented a connection from being established. It is transmitted by the network after receiving end-of-dialing and is not repeated. The CPS codes and meanings are shown in Figure F-5.

**Note:** *Meaning of the codes is different in each country. Ask a specialist for details about code meaning.*

| CPS Code | CPS Meaning |
|---|---|
| 00 | Wait |
| 01 | Terminal Called |
| 02 | Redirected Call |
| 03 | Connect When free |
| 20 | No connection |
| 21 | Number busy |
| 22 | Selection signal procedure error |
| 23 | Selection signal 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 class of service |
| 61 | Network congestion |
| 71 | Long-term network congestion |
| 72 | RPOA out of order |
| 81 | Registration/Cancellation confirmed |

**Figure F-5. Call Progress Signal Code**

# Appendix G. Abbreviations

**ACK.** Positive acknowledgment.

**ACTLU.** Activate logical unit.

**ACTPU.** Activate physical unit.

**AID.** Attention identification.

**APL.** A programming language.

**ASCII.** American Standard Code for Information Interchange.

**B.** Busy

**BB.** Begin bracket.

**BCC.** Block check character.

**BOC.** Bus out check.

**BSC.** Binary synchronous communications.

**BTDAT.** Buffered Teleprocessing Diagnostic Analyzer and Tester.

**C.** Control field.

**CAW.** Channel address word.

**CC.** Control check; chain command.

**CCA.** Common communications adapter.

**CCITT.** Consultative Committee on International Telephone and Telegraph.

**CCW.** Channel control word.

**CE.** Channel end.

**CMDR.** Command reject.

**CPS.** Call progress signal.

**CPU.** Central processing unit.

**CR.** Command reject; carriage return.

**CRC.** Cyclic redundancy check.

**CSU.** Channel service unit; customer setup.

**CSW.** Channel status word.

**CTS.** Clear to Send (CCITT 106).

**CU.** Control unit.

**CUE.** Control unit end.

**DACTLU.** Deactivate logical unit.

**DACTPU.** Deactivate physical unit.

**DB.** Device busy.

**DC.** Device check; data check.

**DCB.** Device control block.

**DCE.** Data communication equipment.

**DDSA.** Digital Data Service Adapter.

**DE.** Device end.

**DFC.** Data flow control.

**DISC.** Disconnect.

**DLE.** Data link escape.

**DSR.** Data Set Ready (CCITT 107).

**DUP.** Duplicate.

**EAU.** Erase all unprotected.

**EB.** End brackets.

**EC.** Equipment check.

**EM.** End of message.

**ENQ.** Enquiry.

**EOF.** End of field.

**EOI.** End of inquiry.

**EOR.** End of record.

**EOT.** End of transmission.

**EP.** Emulator program.

**ESC.** Escape.

**ETB.** End of transmission block.

**ETX.** End of text.

**EUA.** Erase unprotected to address.

**EX.** Exception (response).

**F.** SDLC flag sequence.

**FCS.** Frame check sequence.

**FF.** Forms feed.

**FI.** Format indicator.

**FM.** Field mark; function management.

**FRU.** Field replaceable unit.

**GP.** General poll.

**HEX.** Hexadecimal.

**HPCA.** High-performance communications adapter.

**HVPS.** High-voltage power supply.

**I.** Information (format).

**IC.** Insert cursor.

**I/O.** Input/output.

**IML.** Initial machine load.

**Ind.** Indicator.

**IR.** Intervention required.

**ITB.** End of intermediate transmission block.

**LCA.** Local channel attachment (Model 1A).

**LED.** Light-emitting diode.

**LHA.** Local host attachment (Model 1B).

**LRC.** Longitudinal redundancy check.

**LU.** Logical unit.

**LUSTAT.** Logical unit status.

**LVPS.** Low-voltage power supply.

**MAP.** Maintenance analysis procedure.

**MCM.** Maintenance Concepts Manual.

**MDT.** Modified data tag.

**MEM.** Memory.

**MIM.** Maintenance Information Manual.

**MSR.** Magnetic slot reader.

**NAK.** Negative acknowledgement.

**NCCF.** Network communications control facility.

**NCP.** Network control program.

**NDM.** Normal disconnect mode.

**NL.** New line.

**Nr.** Next sequence number expected to arrive.

**NRM.** Normal response mode.

**NRZI.** Zero-complemented differential coding (non-return-to-zero inverted).

**Ns.** Transmitter's sequence number.

**NS.** Nonsequenced format (C-field).

**NSA.** Nonsequenced acknowledgment.

**NSI.** Nonsequenced information.

**NUL.** Null.

**OC.** Operation check.

**OLT.** Online test.

**P.** Printer; protected.

**P/F.** Poll/final bit.

**PCM.** Plug-compatible mode.

**POR.** Power on reset.

**PT.** Program tab.

**PU.** Physical unit.

**RA.** Repeat to address.

**Rd Mod.** Read modified.

**Req.** Request.

**RH.** Request/response header.

**RI.** Ring indicator.

**RLSD.** Received Line Signal Detector (CCITT 109).

**RNR.** Receive not ready.

**ROL.** Request online status.

**ROI.** Request initialization.

**RR.** Receive ready.

**RTS.** Request to send.

**RU.** Request/response unit.

**RVI.** Reverse interruption.

**S.** Sequenced (format).

**SA.** Switched adapter.

**SBA.** Set buffer address.

**SC.** Session control

**SDLC.** Synchronous data link control.

**SDT.** Start data traffic.

**SF.** Start field.

**SI.** Suppress index.

**SIM.** Set initialization mode.

**SLHA.** Simplified local host attachment.

**SNA.** Systems network architecture.

**SNRM.** Set normal response mode.

**SOH.** Start of heading.

**SFAP.** Structured field and attribute processing.

**SP.** Space; specific poll.

**STX.** Start of text.

**SYN.** Synchronous idle.

**TC.** Transmission check.

**TH.** Transmission header.

**TP.** Teleprocessing.

**TPLM.** TP line monitor.

**TTD.** Temporary text delay.

**UC.** Unit check.

**UCW.** Unit control word.

**UE.** Unit exception.

**US.** Unit specify.

**WACK.** Wait before transmit.

**WCC.** Write control character.

**XID.** Exchange station identification.

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