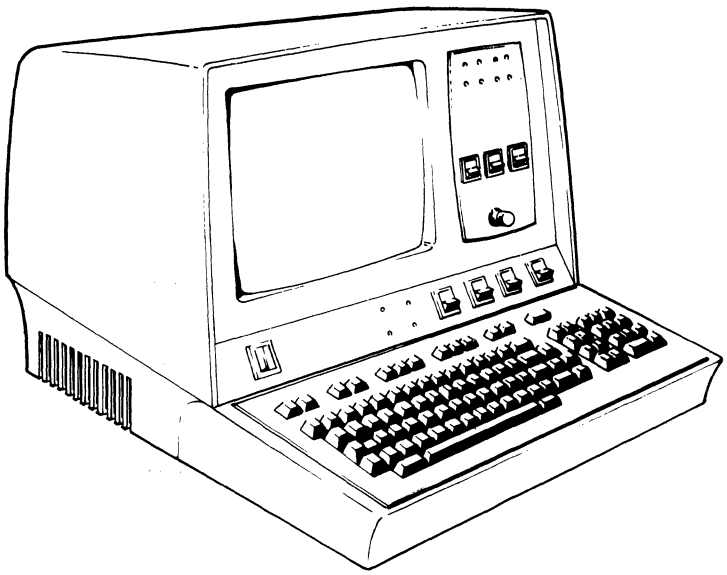
62962800

CONTROL DATA CORPORATION

CONTROL DATA®
750
TERMINAL SUBSYSTEM



SUBSYSTEM REFERENCE MANUAL

REVISION RECORD

New features, as well as changes, deletions, and additions to information in this manual are indicated by bars in the margins or by a dot near the page number if the entire page is affected. A bar by the page number indicates pagination rather than content has changed.

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or use Comment Sheet in the back of this manual.

FOREWORD

This subsystem reference manual explains the operation of the CONTROL DATA® 750 Terminal Subsystem (referred to in this manual as simply "the terminal") with particular emphasis upon the operation as a receiving terminal.

Intended to deal with the operation of a terminal as a subsystem in a larger system, a subsystem reference manual deals with what information can be transmitted from the terminal and with what action results at the terminal when certain information is sent to it. Operation of the receive-only printer and the send-receive tape cassette is also included.

The terminal subsystem may also be used as an independent device not subordinate to a master terminal or host processor, or also as a peripheral to a controller or computer. A brief description of these applications is also included.

Unlike many terminals, the terminal subsystem may employ any of a number of communications protocols through selection of a circuit board as an option. Protocols currently offered are described.

This manual contains no operating instructions because it is written expressly for the engineer or analyst who programs another device to communicate with the terminal. Operating instructions are covered in the operators guide, and installation and field repair are covered in the hardware maintenance manual. Following is a list of these manuals.

Publication	Publication Number
750 Terminal Subsystem Operators Guide	62951400
750 Terminal Subsystem Hardware Maintenance Manual	62962300

Another publication to which the reader may wish to refer is the Bell System Technical Reference, Publication No. 41702, entitled 85A1 and 85A2 Data Selective Calling Service Stations, October 1971.

NOTE

This product is intended for use only as described in this document. Control Data cannot be responsible for the proper functioning of undefined parameters.

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GENERAL DESCRIPTION 1

This section briefly introduces the components of the terminal subsystem and summarizes their features. Following this introduction is a description of the broad range of possible configurations and brief functional descriptions.

TERMINAL SUBSYSTEM COMPONENTS

Subsystem components include the display terminal, an optional matrix printer or nonimpact printer, and an optional single- or dual-drive tape cassette unit.

DISPLAY TERMINAL

The display terminal, shown in figure 1-1, is a versatile input/output device that may be configured in a communications network, connected via telephone lines to a remote computer, or cabled directly to a local computer.

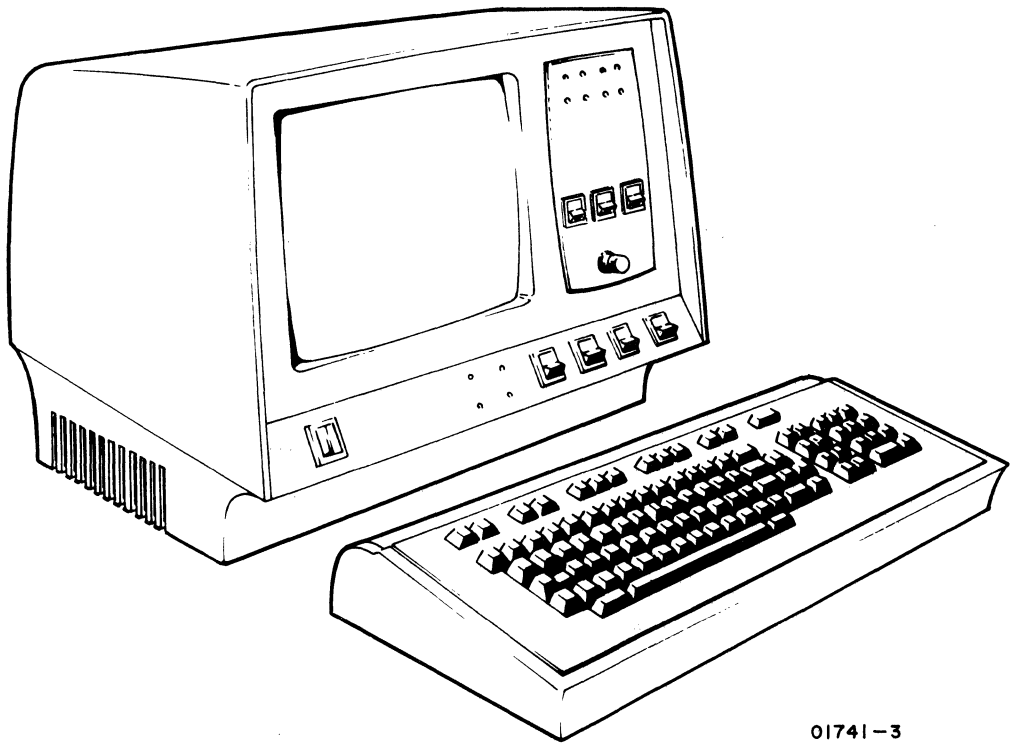


Figure 1-1. Display Terminal

The versatility is obtained from the basic features of the display terminal and from an extensive list of installation options. The following listings briefly summarize these basic features and the available options. Some of the more notable features are described in greater detail later in this manual.

Display

Following are the features of the display.

- 12-inch diagonal crt
- 1920 characters (24 lines by 80 characters)
- 7- by 9-dot matrix
- Uppercase/lowercase letters
- Bonded nonglare faceplate
- White characters on dark background
- Operator-adjustable display brightness

Keyboard

Following are the features of the keyboard.

- Detachable with 22-inch extension cable
- Typewriter layout/trilevel operation
- Generates 64/96 ASCII * characters (switch selectable) plus 32 control codes
- HERE IS key (for answerback option)
- Two clear control keys
- Eleven transmission control keys
- Three print control keys
- Three tape cassette control keys
- Eleven-key numeric cluster
- Cursor controls: up, down, left, right, reset
- All keys repeatable using REPEAT key
- Four deep-dished keys to aid the operator in locating keys by touch alone

---

* American Standard Code for Information Interchange

Interface

Following are the features of the interface.

- EIA RS-232-C/CCITT V.24 compatible
- Asynchronous
- Transmission speeds of 110 through 9600 baud (switch selectable)
- Full/half duplex (switch selectable)
- Selectable parity (odd/no/even)
- 10- and 11-bit operation

Functional Features

Following are functional features.

- Audible alarm at 73rd character and last line of page
- Blinking underline cursor
- Character/line/block mode operation
- Batch mode operation (switch selectable)
- Scroll enable/disable (in block mode)
- Communication indicators
- Display control codes
- Self-test
- Edit: includes tabulation, character and line insert and delete, wraparound, cursor addressing, and protected format
- Highlighting: includes low-intensity and blink highlighting

Options

Following are optional features.

- Printer interface
- Tape cassette interface
- Current-loop communications interface
- Answerback: automatic, programmable, 21 characters
- Polling: provides addressing capability for up to 128 terminals
- Paging: provides ready access to two additional display pages of 1920 characters each

Switch-Selectable Operating Conventions

Following are switch-selectable operating conventions.

- Keyboard lockout feature
- Choice of Request to Send signal conventions
- Choice of End of Transmission signal conventions
- Enable/disable communications circuit assurance feature
- Choice of null or space background characters
- Choice of X-Y positioning feature
- Enable/disable transmission of protected fields

Physical, Electrical, and Environmental Data

Dimensions and Weight

Height: 38.1 cm (15 in.)
Width: 55.8 cm (22 in.)
Depth: 50.8 cm (20 in.)
Weight: 27 kg (60 lb)

Power Requirements

120 vac, 60 Hz, 1.5 amps
or
220/240 vac, 50 Hz, 1.0 amp

Environmental Specifications

Temperature (Convection Cooled): $+10^{\circ}C$ to $+40^{\circ}C$ ($+50^{\circ}F$ to $+104^{\circ}F$)
Relative Humidity: 20% to 80% — no condensation

MATRIX PRINTER

Figure 1-2 shows the matrix printer that may be used in the terminal subsystem. This printer produces printed copies of messages directed to it by the display terminal, optional tape cassette, or remote data source. It is capable of printing multiple copies at speeds of 173 characters per second for a 60-Hz version and 180 characters per second for a 50-Hz version. Up to four copies plus one original can be printed.

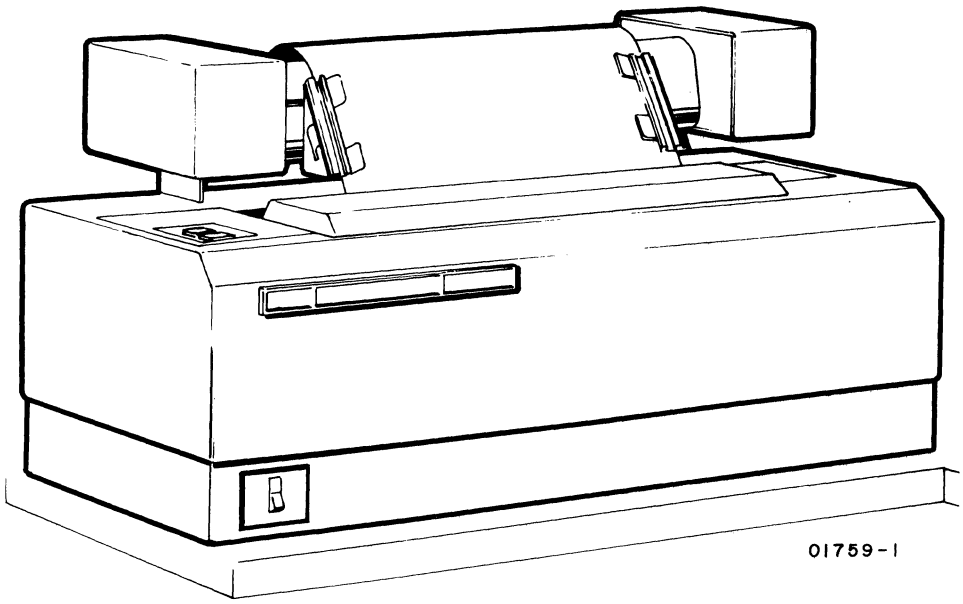


Figure 1-2. Matrix Printer

Features

Following are features of the matrix printer.

- Front-of-form impacting eliminates hammer framing and character clipping
- Serial printing eliminates character ghosting
- Immediate visibility to last line printed
- Quiet operation
- Low-mass printhead results in low vibration
- 64-, 96-, or 128-character set
- Original plus four copies
- External forms thickness control
- 7- by 7-dot matrix
- Print Speed: 173 characters per second at 60 Hz; 180 characters per second at 50 Hz
- Line density: 6 lines per inch
- Characters per line: 132 maximum, 10 columns per inch

Physical, Electrical, and Environmental Data

Dimensions and Weight

Height: 37.5 cm (14.75 in.)
Width: 69.8 cm (27.5 in.)
Depth: 38.1 cm (15 in.)
Weight: 35 kg (78 lbs)

Power Requirements

115 vac, 60 Hz
or
220/240 vac, 50 Hz

Environmental Specifications

Temperature: +10°C to +35°C (+50°F to +95°F)
Relative Humidity: 20% to 80%

NONIMPACT PRINTER

The nonimpact printer, shown in figure 1-3, is a tabletop unit that silently prints up to 30 characters per second by pressing a 5- by 7-dot matrix printhead against heat sensitive paper and selectively heating individual dots within the matrix to form a character. Printing is done on continuous roll paper.

The function of the nonimpact printer is the same as that of the matrix printer. That is, it produces hardcopy messages directed to it either by the display terminal, an optional tape cassette, or a remote source.

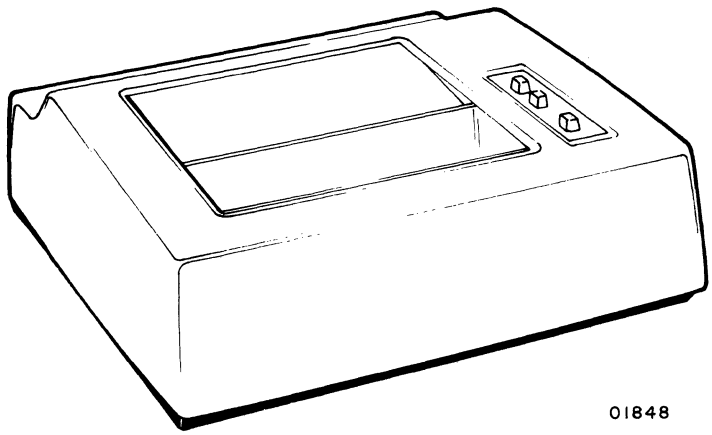


Figure 1-3. Nonimpact Printer

Features

Following are features of the nonimpact printer.

- Self-contained tabletop unit
- Prints up to 80 columns at 30 characters per second
- 94 printable characters
- 5- by 7-dot matrix

Physical, Electrical, and Environmental Data

Dimensions and Weight

Height: 15.1 cm (6 in.)
Width: 45.7 cm (18 in.)
Depth: 40.3 cm (16 in.)
Weight: 14 kg (30 lbs)

Power Requirements

115 vac, 60 Hz
or
220/240 vac, 50 Hz

Environmental Specifications

Temperature: +10°C to +40°C (+50°F to +104°F)
Relative Humidity: 10% to 90%

TAPE CASSETTE UNIT

The tape cassette unit, shown in figure 1-4, emulates a paper-tape reader/punch and provides bulk storage for the terminal. Buffered operations allow information to be stored on tape from a remote source or from the display terminal. The storage medium used is ANSI/ECMA standard Philips tape cassette.

Either a single- or dual-drive tape cassette unit may be configured in the subsystem.

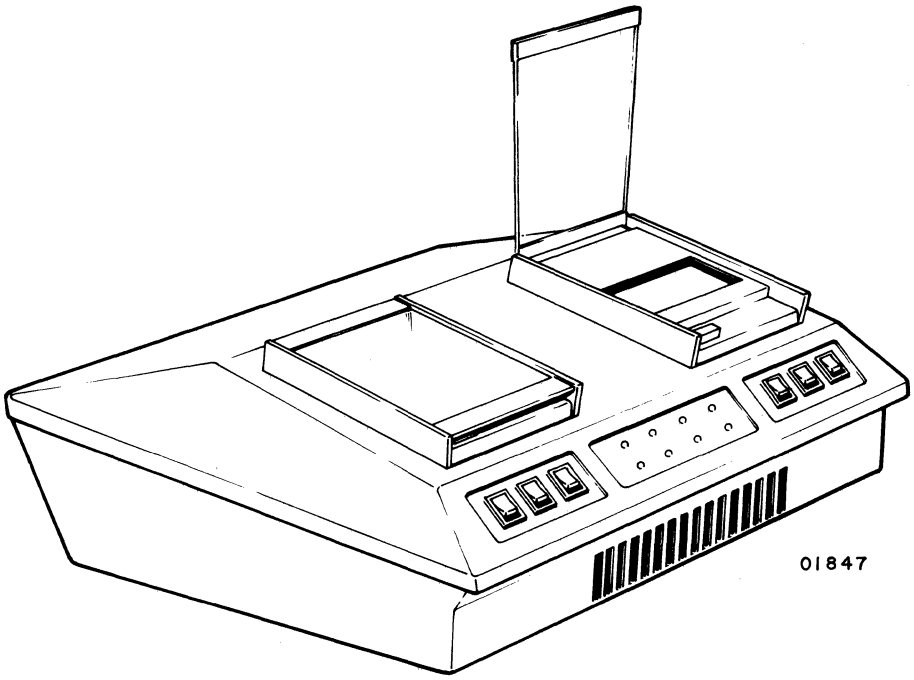


Figure 1-4. Tape Cassette Unit

Features

Following are features of the tape cassette unit.

- Self-contained tabletop unit
- Special interface
- Tape message transfer rate of 120 characters per second
- Search forward/reverse
- Phase-encoded recording at 780 bits per inch (5855 bits per second)
- Two 128-character buffers per drive
- Single-drive capacity of 300,000 characters per tape cassette
- Tape speed: 7.5 inches per second read/write and 50 inches per second rewind

Dimensions and Weight

Height: 21.5 cm (8.5 in.)
Width: 48.2 cm (19 in.)
Depth: 53.3 cm (21 in.)
Weight: Single-drive — 19 kg (41.5 lb)
Dual-drive — 17 kg (37.5 lb)

Power Requirements

115 vac, 60 Hz
or
220/240 vac, 50 Hz

Environmental Specifications

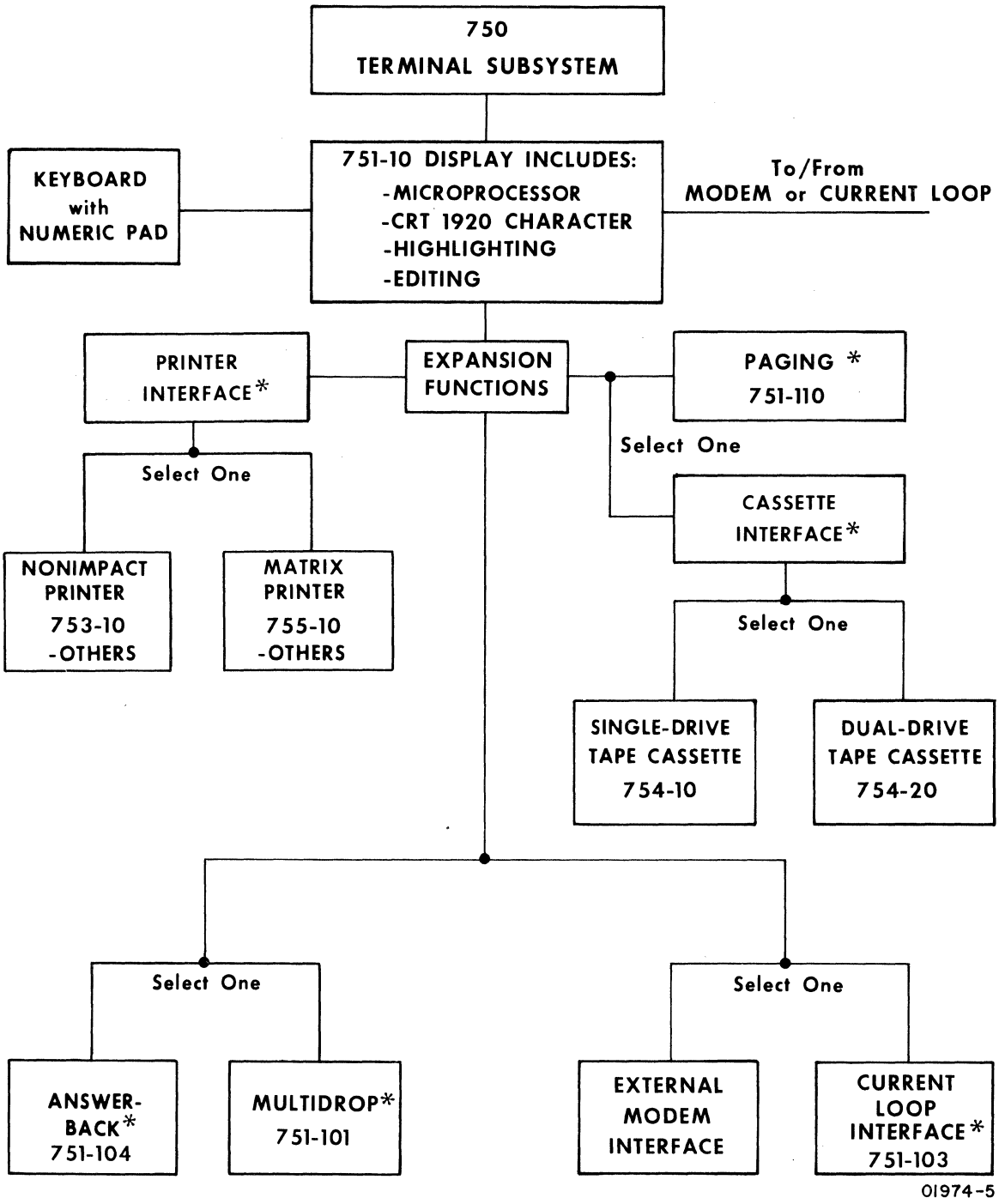
Temperature: +10°C to +40°C (+50°F to +104°F)
Relative Humidity: 10% to 80%

CONFIGURATIONAL OPTIONS

The terminal may be configured as follows:

- Alone
- With either a matrix printer or a nonimpact printer
- With either a single- or dual-drive tape cassette
- With both a printer and a cassette
- With a number of other options

Figure 1-5 illustrates the configurations available.



* DENOTES EXPANSION FUNCTION IN THE FORM OF A CIRCUIT CARD WHICH FITS INSIDE THE 751-10 CABINET. OTHER EXPANSION FUNCTIONS, IN THE FORM OF PERIPHERALS, HAVE THEIR OWN CABINET (E.G., PRINTER OR TAPE CASSETTE UNIT).

A 751-10 WHICH MAY CONTAIN INTERNAL CARD EXPANSION FUNCTIONS BUT IS WITHOUT ANY PERIPHERAL, IS DESIGNATED AS A 751-10 STAND-ALONE TERMINAL SUBSYSTEM.

Figure 1-5. 750 Terminal Subsystem Configuration

FUNCTIONAL DESCRIPTION

The functional description of the terminal includes information relating to the function of the display screen and memory, keyboard, switches and indicators, modem interface, test mode, and basic operation.

DISPLAY SCREEN AND MEMORY

The display screen enables the viewing of messages directed to it by an external device and permits monitoring messages composed on its associated keyboard. The rectangular screen measures 30.48 cm (12 inches) diagonally with a display area measuring 20.3 cm (8 inches) wide by 13.3 cm (5.24 inches) high. The screen displays 24 lines of 80 characters per line. Symbols are refreshed at a rate of 60 Hz on the 60-Hz model and at a rate of 50 Hz on the 50-Hz model.

The character repertoire consists of either 64 or 96 characters and 32 control symbols. Each symbol is displayed as white-on-black within a 7- by 9-dot matrix.

A 1920-word display memory holds display messages for transmission in half duplex and full duplex.

KEYBOARD

The alphanumeric keyboard, shown in figure 1-6, is a 91-key keyboard. It is composed of a basic typewriter keyboard with an adding machine-type numerical entry keyboard and several additional control keys. The keyboard is housed separately from the main part of the cabinet. It can be moved as far away from the main cabinet as the connector cable will permit, a distance of nearly two feet.

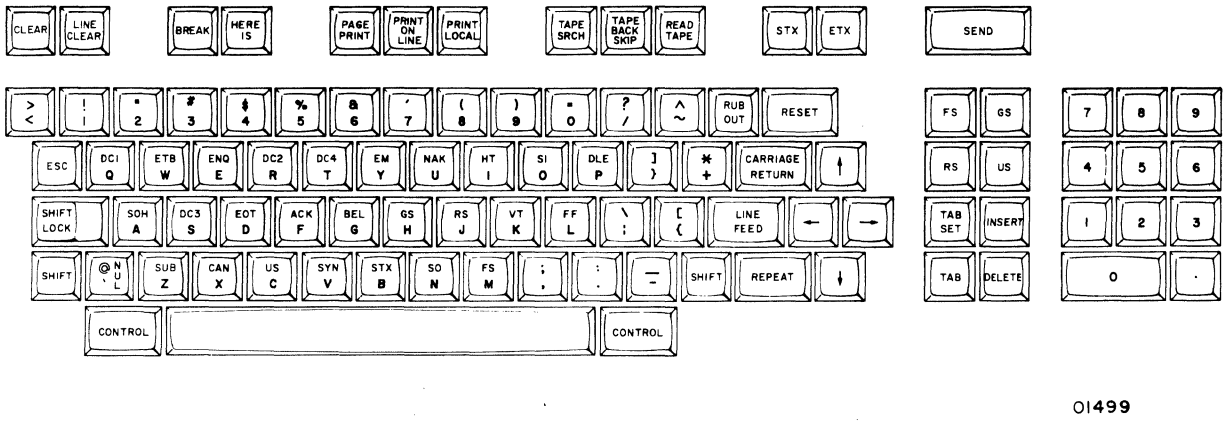


Figure 1-6. Alphanumeric Keyboard

SWITCHES AND INDICATORS

There are two panels of switches and indicators on the front of the main cabinet (figure 1-7). A long panel that runs the full width of the cabinet contains the POWER ON/OFF switch, the CHARACTER/LINE/BLOCK switch, the ODD PAR/NO/EVEN PAR (Odd Parity/No Parity/Even Parity) switch, the FULL DUPLEX/HALF DUPLEX switch, and the HIGH RATE/300/LOW RATE (High Baud Rate/300 Baud/Low Baud Rate) switch. This panel also contains the DTR (Data Terminal Ready), RTS (Request to Send), and REC (Received) and TRANS (Transmitted) DATA indicators. A wider vertical panel to the immediate right of the display tube contains the INTENSITY adjustment and the 64 CHAR/96 CHAR (64 Character/96 Character) switch, the FORMAT switch, and the ON LINE/LOCAL switch. It also contains the TRANSMISSION MODE indicators, the CO (Carrier On) indicator, the CTS (Clear to Send) indicator, the KEYBOARD LOCK indicator, the ALERT indicator, and the FORMAT MODE indicator.

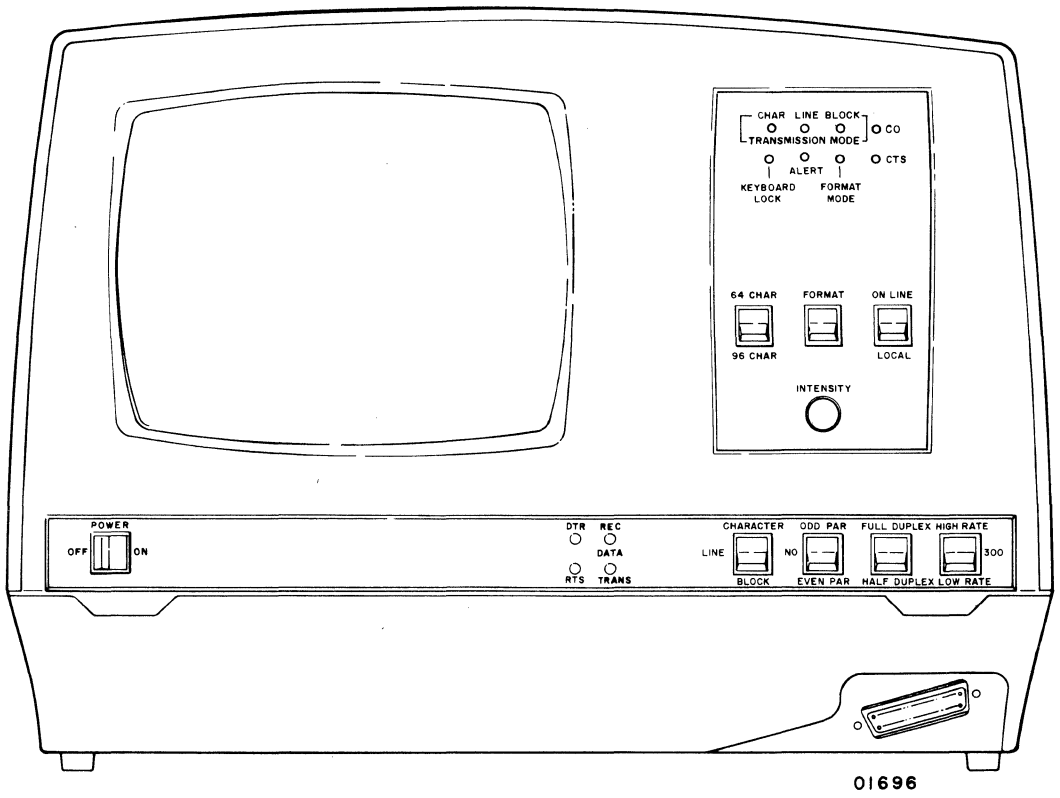


Figure 1-7. Front Panel of Display

The remaining switches accessible to the operator are on the rear of the cabinet, either on the ac entry panel or the connector panel. Figure 1-8 shows the INPUT VOLTAGE RANGE switch used on 50-Hz models, and a circuit breaker that can be reset. Figure 1-9 shows the MASTER CLEAR switch and the TEST/NORMAL mode switch as well as the PERIPHERAL CONNECTOR and the DATA SET CONNECTOR. All other switches are inside the cabinet and are accessible by removing the hood.

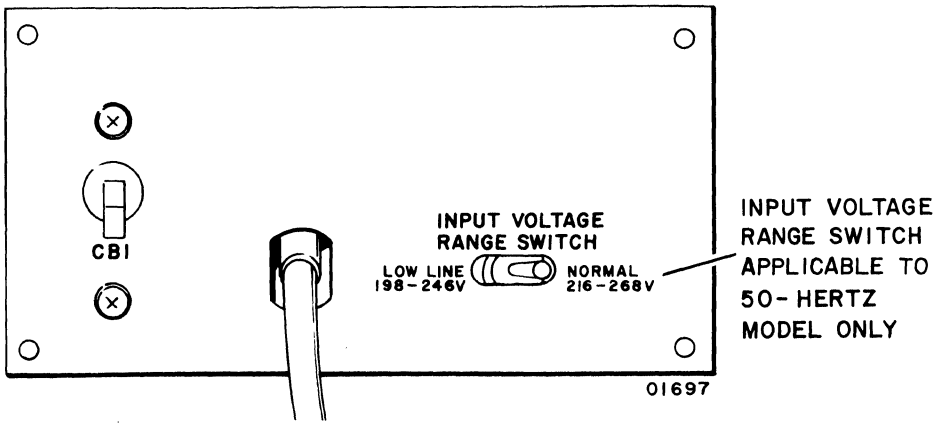


Figure 1-8. AC Entry Panel

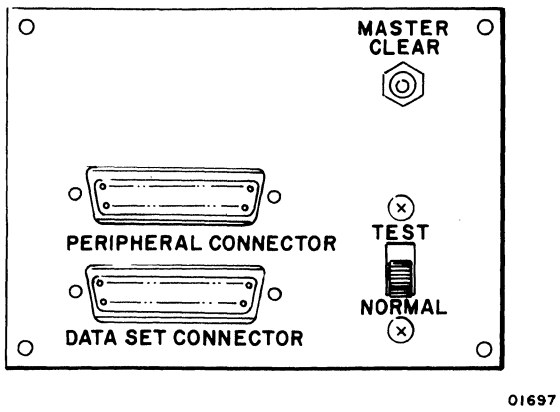


Figure 1-9. Connector Panel

MODEM INTERFACE

The terminal operates on any RS-232-C asynchronous communication line at baud rates as high as 9600. The modem interface can connect either to an external EIA RS-232-C or CCITT V.24 modem or to an internal modem housed within the cabinet. A third option is the current loop in which the terminal is one of a number of terminals used in a local communications facility. When used in this manner, no modem is necessary because the modem interface signals suffice. Also available as options are a receive-only RS-232-C compatible printer and a tape cassette.

TEST MODE

The diagnostic capacity is a series of tests called test mode. The mode is entered when the TEST/NORMAL switch on the rear of the machine is in the TEST position and the MASTER CLEAR switch is pressed. There are a series of eight tests that the device cycles through, with the last test revealing the settings of internal and external switches.

BASIC OPERATION OF THE TERMINAL

The basic terminal is capable of three operating modes: character mode, line mode, and block mode. Additionally, highlighting and edit features make possible protected data fields and selective transmission.

Character Mode

In character mode, each character is transmitted over the communication line as it is keyed into the keyboard. In full-duplex operation, only what is received over the line is displayed; what has been entered at the keyboard is not displayed unless it is returned over the line. In half-duplex operation, whatever is entered at the keyboard is both sent out over the line and sent to the display memory from which it is displayed. Anything received over the line, however, is displayed in preference to that which is being entered at the keyboard.

Line Mode

In line mode, each line of text is transmitted when the CARRIAGE RETURN key is pressed. Whatever remains to the right of the cursor when the CARRIAGE RETURN key is pressed is not cleared. The keyboard is disabled during the transmission. Except for a Break signal which aborts the transmission, received data is ignored during the transmission. Line mode utilizes half-duplex transmission.

Block Mode

In block mode, as much as an entire screen may be filled by entries from the keyboard. The content of the screen is not transmitted until the SEND key is pressed. Data transmission begins at the STX character immediately preceding the cursor, or at the beginning of the screen if there is no STX character. Transmission continues to the first termination character following the start. The termination character may be selected as either an ETX and/or an EOT, depending upon the setting of an internal switch. If a termination character is not present between where the transmission starts and the end of the screen, transmission continues to the end of the screen, and the cursor is left in the last character position of the screen. The keyboard is disabled during transmission. Block mode utilizes half-duplex transmission.

Scroll

Character and line mode operation is always in scroll mode. In scroll mode, the cursor is always on the bottom line of the display unless it is moved upward by a cursor up or backspace command. As each line is written on the screen, the entire

displayed screen moves up one line to make room for another line to be added at the bottom. The top line moves off the screen. Block mode can be either scroll mode or nonscroll mode, depending on the setting of an internal switch. (This switch must be set to nonscroll mode if the edit option is present.) In nonscroll mode, the home position of the cursor is the first position of the top line of the screen. After the top line has been written, the cursor moves to the first position of the second line, and so on to the end of the screen. From the last position of the last line of the screen, it goes to the first position of the first line again.

Highlighting

Highlighting permits all or portions of the screen to be displayed either as a blinking field that alternates between high and low intensity, or as a low-intensity field. An ETB (027_8) code in the memory causes everything following it to be displayed as a blink field that alternates between normal and low intensity at about one change per second. An SO (016_8) code will cause everything following it to be displayed at reduced intensity. If the SO code appears in a blink field, it terminates the blink field and initiates the reduced-intensity field. An SI (017_8) code in memory terminates both blink and reduced-intensity fields. The blink field is subordinate to the reduced-intensity field. A reduced-intensity field can terminate and immediately succeed a blink field, but a blink field can neither terminate nor immediately succeed a reduced-intensity field.

Edit Feature

Operation and capability of the terminal is greatly enchanced by the edit feature, which provides:

- Tabbing in character, line and block modes
- Character insertion and deletion in line and block modes
- Line insertion and deletion and X-Y positioning in block mode
- Protected fields and selective transmission with format mode
- Transmission mode selection in block and format modes

Tabbing

Tabbing is the capacity to set an End Tab SI (017_8) code in memory and then place the cursor in the next position by pressing the TAB key or receiving an HT (011_8) code from an external source. In character mode, the SI code is transmitted but not entered into memory. In line and block modes, the SI code is entered into memory for tabbing purposes. A back tab function can also be employed. The back tab moves the cursor backward to just after an End Tab code when the TAB key is pressed in conjunction with the SHIFT key.

Character Insertion and Deletion

The edit feature provides the ability to insert and delete characters in line and block modes. This ability also exists in format mode with an allowance for protected fields. The mechanics of the operations change depending upon whether the wraparound option is disabled or enabled.

If the wraparound option is disabled, pressing the INSERT key inserts a space code at the current cursor position and moves everything on the line at and to the right of the current cursor position one position to the right. Any character at the end position of the line or against a protected field to the right of the cursor is lost. Pressing the DELETE key deletes the character at the current cursor position. The remainder of the line, up to a protected field, is moved one space to the left to close the gap. A space code is put in at the right margin or against a protected field if there was one to the right of the cursor.

If the wraparound option is enabled, character insertion and deletion is performed in the same way, but the moving over of the characters on the line is continued down through the remaining lines to either the end of the displayed page or to the beginning of a protected field. Only if there is a character in the last position of the last line of the screen or immediately preceding a protected field could a character be lost in an insert operation.

Line Insertion and Deletion

In block mode, an entire line may be inserted or deleted. Pressing the INSERT key with the SHIFT key moves the current line and everything below it down one line and makes a blank line at the current line position. The bottom line of the display is lost. Pressing the DELETE key with the SHIFT key deletes the current line. Everything below the current line is moved up one line to close the gap. The last display line becomes cleared.

X-Y Positioning

In block mode, the cursor may be placed at any position on the screen by a code series from an external source. Further, a slightly different code series causes the terminal to transmit the coordinates of the current cursor position in the same format as they are received from an external source.

Format Mode

Format mode is a special case of block mode. It is entered when the FORMAT switch is placed into the FORMAT position. Format mode is always nonscroll, (Scroll Enable/Disable switch is in Disable position). In format mode, highlighted fields (blink and reduced intensity) become protected fields that cannot be altered by keyboard entry. They can be altered by a communication line message if the message is preceded by an STX code. When information is typed into the keyboard in format mode, the cursor skips over protected fields.

An internal switch makes possible two types of transmission. In the first, variable data and blink fields are transmitted, but reduced-intensity fields are not. In the second, everything is transmitted; variable fields, blink fields, and reduced-intensity fields.

Transmission Mode Selection

In a terminal, with the background character selected to be a null (000_8) rather than a space (040_8), alternative transmission methods are desirable because the null is not transmitted. If a protected field is encountered in a format mode transmission, an HT (horizontal tab) is inserted into the data stream at the beginning of the protected field. That tabs the cursor to the next unprotected data. In block mode, if the X-Y positioning feature is enabled, the X-Y coordinates of each SO or ETB code are transmitted before the SO or ETB codes themselves are transmitted. In this manner, the receiving device can reproduce the transmitted page exactly, even though not every position on it was transmitted.

Paging Option

Installation of the paging option provides memory for holding two additional 24-line display pages of 1920 characters each, thereby increasing the total capacity of the display terminal to three 24-line pages. The paging option is mutually exclusive with the tape cassette control option because the two logic boards are assigned the same physical location within the terminal.

Control of the paging operation is accomplished online by the central computer system or locally by the operator at the terminal keyboard.

The paging option is described in greater detail in section 2, Subsystem Communication.

SUBSYSTEM COMMUNICATION 2

Communication with the terminal subsystem or within the terminal subsystem is by ASCII code using EIA RS-232-C asynchronous transmission, either half or full duplex. Communication particulars are dependent on, or at least related to, the switches and options. Accordingly, this section covers the switches and indicators, the printer option, the tape cassette option, the paging option, the current loop option, the answerback option, and the multidrop option. Also included to provide a guide to the switches and options is the terminal configuration test of test mode. To illustrate cabling, there is a table of modem connector pin assignments.

SWITCHES AND INDICATORS

The basic terminal contains 11 external switches, 15 internal switches, and 12 external indicators. Additional internal switches are provided with and described under terminal options.

EXTERNAL SWITCHES

The following paragraphs explain the functions of the external switches on the terminal.

POWER ON/OFF Switch

The POWER ON/OFF switch controls the application of power to the terminal. It is essentially connected in series with the circuit breaker on the ac entry panel. The application of power to the terminal exercises a master clear function.

NOTE

When the POWER ON/OFF switch is turned off, it should not be turned on again within 90 seconds, or the circuit breaker may trip.

INPUT VOLTAGE RANGE Switch

The INPUT VOLTAGE RANGE switch is used only on the 50-Hz models to allow for variations in line voltage. It has no other effect on the operation of the terminal.

ON LINE/LOCAL Switch

The ON LINE/LOCAL switch controls the relationship of the keyboard, memory, and display to the modem interface. In the LOCAL position, these three elements are not connected to the modem interface. Information typed into the keyboard is transmitted to memory and displayed. Operation of the terminal in local mode can allow for offline preparation of bulk data when the tape cassette and printer peripherals are associated with the terminal. Unless there are peripherals maintained in an online mode, placing the terminal into local mode causes the Data Terminal Ready signal to maintain an off condition when constant DTR is disabled.

In the ON LINE position, the keyboard and memory are connected to the modem interface in such a way that information can be sent and/or received, and the Data Terminal Ready signal is maintained in an on condition.

TEST/NORMAL Switch

The TEST/NORMAL switch controls the entry of the terminal into test mode, a series of eight tests. Entry into test mode is accomplished by a master clear while the switch is in the TEST position. The normal mode of operation is entered when a master clear occurs at a time when the switch is in the NORMAL position. The test mode overrides the ON LINE/LOCAL switch so that its setting is inconsequential while the terminal is in test mode.

MASTER CLEAR Switch

The MASTER CLEAR switch is a momentary switch that clears the display memory and returns the cursor to its home position.

In scroll mode, the home position of the cursor is the first character position of the bottom line. In nonscroll mode, the home position of the cursor is the first character position of the top line.

FULL DUPLEX/HALF DUPLEX Switch

The FULL DUPLEX/HALF DUPLEX switch selects whether the terminal will transmit and receive in full or half duplex when the terminal is in character mode. When the terminal is in other than character mode, the setting of the switch is of no consequence, and it will receive and transmit in half duplex.

CHARACTER/LINE/BLOCK Switch

The setting of the CHARACTER/LINE/BLOCK switch determines whether the terminal will operate in character, line, or block mode as long as the FORMAT switch is not in the FORMAT position. If the FORMAT switch is in the FORMAT position, the terminal will be in half-duplex, block mode with the format features enabled regardless of the setting of the FULL DUPLEX/HALF DUPLEX switch, or the CHARACTER/LINE/BLOCK switch.

FORMAT Switch

The FORMAT switch, in the FORMAT position, makes the terminal operate in format mode. In the alternate position, the terminal can operate in character, line, or block mode, depending upon the setting of the CHARACTER/LINE/BLOCK switch.

HIGH RATE/300/LOW RATE Switch

The HIGH RATE/300/LOW RATE switch is a three-position switch that governs which of two internal baud rate selector switches will control the baud rate clock in the terminal, or if the baud rate shall be 300 regardless of the settings of the internal switches. There is no requirement that one rate be greater than another or that all three may not be equal.

64 CHAR/96 CHAR Switch

The 64 CHAR/96 CHAR switch is a two-position switch that permits either the 64-character set or the 96-character set to be selected from the keyboard. When the switch is in the 64 CHAR position, selection of characters with octal equivalents of 140 through 176 cannot successfully be made. The SHIFT key is essentially continuously enabled for all alphabetic characters, so that bit 2^5 is forced to a zero whenever bit 2^6 is a 1.

ODD PAR/NO/EVENPAR Switch

The ODD PAR/NO/EVEN PAR switch is a three-position switch that selects even, odd, or no parity. In the EVEN PAR or ODD PAR position, the terminal will generate parity for transmitted data and check the parity of received data in conformity with the setting of the switch. In the NO position, the logic level corresponding to the setting of the internal Mark/Space Parity switch is supplied for bit 2^7 of all transmitted data, but no parity check is made on received data.

INTERNAL SWITCHES

The following paragraphs explain the functions of the internal switches of the terminal.

Baud Rate Selector Switches

The Baud Rate Selector switches are two sets of internal rocker switches, either one or both of which may be set to 110, 150, 200, 300, 600, 1200, 1800, 2400, 4800, or 9600 baud.

Mark/Space Parity Switch

The Mark/Space Parity switch is enabled only when the external ODD PAR/NO/EVEN PAR switch is in the NO position. When enabled, it selects a mark (binary 1) or space (binary 0) signal level to be transmitted as bit 2^7 of each data word. Received data parity is not checked when the Mark/Space Parity switch is selected.

Request to Send Switched/Constant Switch

The Request to Send Switched/Constant switch, when in the Constant position, causes the Request to Send (RTS) signal to maintain an on condition whenever DSR and DTR are in an on condition. In the Switched position, Request to Send will be maintained in an on condition:

- In character mode, half duplex:
  - In normal operation, the RTS signal is on with the first keystroke and is switched off 1 millisecond after the transmission of a CR (015_8) code or the actuation of the BREAK key on the keyboard.
  - For special operation, the operator may specify as many as four specific delimiter codes to terminate the RTS signal. These delimiter codes may be any from columns 0 through 7 of ANSI X3.4-1973. When in character mode, four of these characters are entered into the keyboard after the SEND key has been pressed. If fewer than four characters are needed, some must be entered more than once; but, in any instance, four entries must be made after the SEND key has been pressed. After this operation has been performed, the RTS signal is initiated on the first keystroke and switched off 1 millisecond after the transmission of one of the special delimiter codes. The entry of these special delimiters has no effect on data received from the communication line.

If the terminal is master cleared, either manually or by a removal of power, the special delimiter codes are voided and the CR delimiter alone remains. The preceding procedure must be repeated to restore special delimiters.

- In character mode, full duplex, with the first keystroke. It is switched to an off condition when the terminal is placed into line or block mode, or local mode, or when a master clear condition occurs, or when the BREAK key is pressed.
- In line mode, when the CR key is pressed, or, in block mode, when the SEND key is pressed. Request to Send remains in an on condition during the transmission of the message and for at least 1 millisecond after the transmission of the last bit in the message. It is then switched to an off condition. A line or block transmission may be terminated, and RTS consequently switched to an off condition, whenever power is turned off, whenever a master clear condition occurs, whenever the ON LINE/LOCAL switch is placed in the LOCAL position, or when the BREAK key is pressed.

Constant Data Terminal Ready Switch

The Constant Data Terminal Ready switch, when in the Enable position, maintains the Data Terminal Ready (DTR) circuit in an on condition whenever power is applied to the terminal except as modified by the EOT Disconnect feature. When the Constant Data Terminal Ready switch is in the Disable position, the Data Terminal Ready circuit is switched to an off condition whenever the On Line/Local switches of the terminal and all peripherals are in the Local position.

EOT Disconnect Enable/Disable Switch

The EOT Disconnect Enable/Disable switch controls the operation of the terminal upon receipt of an EOT (0048) code. When in the Enable position, receipt of an EOT causes the Data Terminal Ready circuit to be switched to an off condition for at least 50 milliseconds but for no more than 100 milliseconds after Data Set Ready has been switched to an off condition. If Data Set Ready is never switched to an off condition, Data Terminal Ready will not be switched to an on condition until a data transmission is initiated. If the EOT Disconnect Enable/Disable switch is in the Disable position, receipt of an EOT code has no effect on the DTR circuit.

Enable ETX Termination Switch

The Enable ETX Termination switch applies only to block mode transmission and controls the operation of the terminal when an ETX (0038) code is encountered in the transmit data stream. When the switch is in the On position, transmission is terminated when an ETX is encountered in the transmit data stream. In the Off position, an encountered ETX code has no effect on the transfer.

Enable EOT Termination Switch

The Enable EOT Termination switch applies only to block mode transmission and controls the operation of the terminal when an EOT (004_8) code is encountered in the transmit data stream. When the switch is in the On position, transmission is terminated when an EOT code is encountered in the transmit data stream. In the Off position, an encountered EOT code has no effect on the transfer.

Enable Transfer Termination Code Switch

The Enable Transfer Termination Code switch applies only to block mode transmission and determines whether or not the code selected as a termination code (ETX or EOT) is transmitted as part of a transfer. If the switch is in the On position, the termination code is transmitted as the last character in the transmission. In the Off position, transmission ends with the character preceding the termination code.

Enable Communications Circuit Assurance Feature Switch

The Enable Communications Circuit Assurance Feature switch is a two-position switch that permits the use of the secondary channel carrier to interrupt data transmission either to or from the terminal. In the Enable position, the Secondary Received Line Signal Detector is monitored during any transmit operation. If an off condition occurs on this circuit, the transmission is terminated, the Request to Send circuit is switched to an off condition, the Secondary Request to Send circuit is switched to an on condition, the keyboard is disabled, and the ALERT indicator lights. The keyboard may be enabled by pressing the BREAK key. The Break signal is not transmitted in this instance.

Normally, the Secondary Request to Send circuit is maintained in the on condition during periods of no transmission. It is switched to an off condition for a minimum of 240 milliseconds when the BREAK key is pressed.

When the Enable Communications Circuit Assurance Feature switch is in the Disable position, the terminal does not respond to a loss of the carrier on the secondary channel.

Select Background Character Switch

The Select Background Character switch permits the selection of either an ASCII space (040_8) or an ASCII null (000_8) as the background fill character to be inserted in memory during a clear operation. If the space code is selected, the terminal will transmit all codes as stored, including the space code, except as modified by protected fields and such delimiter codes as CR, STX, ETX, and EOT.

If the null code is selected, all codes except the null code are transmitted as stored, except as modified by protected fields and such delimiter codes as CR, STX, ETX, and EOT. If a reduced-intensity field is encountered during a format mode transmit operation, and if the Enable Transmit Protected Fields switch is in the Disable position, an HT (011_8) code is automatically inserted into the data stream at that character position. The entire reduced-intensity field is transmitted. In a block mode transmission, the X-Y coordinates of each SO (016_8) and ETB (027_8) code are transmitted if the X-Y positioning feature is enabled. The transmission of the X-Y coordinates is accomplished in the following manner — encountering an SO or an ETB initiates the transmission of an ESC (033_8) code followed by an 061_8 (numeric 1) and two data words that represent the X-Y coordinates of the SO or ETB code, the SO or ETB code itself, and the data that follows the SO or ETB code.

Scroll Enable/Disable Switch

The Scroll Enable/Disable switch determines whether or not the terminal will operate in scroll mode when it is in block transmission mode. When the switch is in the Enable position, the cursor moves only in the bottom line, unless positioned elsewhere by a cursor moving key. Each line moves up on the display as it is completed, and the cursor returns to the left side of the last line.

When the switch is in the Disable position, the home position of the cursor is the first position of the first line.

In terminals using FORMAT mode, the switch should always be set to the Disable position.

Enable X-Y Positioning Switch (Edit Model, Block Mode Only)

The Enable X-Y Positioning switch permits the cursor to be positioned by an incoming message and permits an incoming message to initiate a response that contains the current position of the cursor.

When the switch is in the Enable position, the terminal considers the two 8-bit bytes following an ESC (033_8), numeric 1 (061_8) sequence to be X-Y positioning coordinates. The first of the two bytes is the X-positioning value. It ranges from 040_8 representing position 1 through a maximum value of 157_8 representing position 80. The second byte is the Y-positioning value. It ranges from 040_8 for the first line through a maximum value of 067_8 representing line 24. Codes received outside these value ranges cause random positioning.

In response to the sequence ESC (033_8), numeric 2 (062_8), the terminal transmits the current cursor position in precisely the same format as it is received if the multidrop option is not present. If the multidrop option is present X-Y coordinates are not transmitted.

When the switch is in the Disable position, the X-Y positioning feature is disabled.

Enable Transmit Protected Fields Switch

The Enable Transmit Protected Fields switch permits protected fields to be transmitted along with unprotected fields. When this switch is in the Enable position, the terminal transmits all data encountered including protected fields. Transmission delimiters contained within a protected field are acted on when encountered. If a message is terminated within a protected field, the cursor is repositioned to the next variable field following termination of the transmit function.

If this switch is in the Disable position, transmitted data will include variable and blink fields, but no reduced-intensity fields. All data is transmitted except an SO (016_8) code, the next succeeding SI (017_8) code, and whatever lies between these two codes. Transmission delimiters contained within protected fields are acted on only if contained within a blink field. If a message is terminated within a blink field in this manner, the cursor is repositioned to the next variable field following termination of the transmit function.

Batch Mode Switch

When the Batch Mode switch is in the Enable position, the terminal is maintained in full-duplex character mode with scroll disabled regardless of the setting of the CHARACTER/LINE/BLOCK switch, the FULL DUPLEX/HALF DUPLEX switch, and the Scroll Enable/Disable switch. The keyboard remains enabled regardless of the position of the FORMAT switch, and the terminal remains online regardless of the setting of the ON LINE/LOCAL switch. The Request to Send Switched/Constant switch must be set to Constant. Operation of the terminal is consistent with full duplex, character mode operation, with the following exceptions.

- Receipt of an STX (002_8) code from an external device disables everything on the keyboard except the BREAK key. Pressing the BREAK key causes the Transmitted Data signal to switch from a static mark condition to a space condition for a 240- to 300-millisecond period and enables the keyboard. The STX code is not stored.
- Receipt of an EOT (004_8) code enables the keyboard. If the keyboard is already enabled, the EOT code is disregarded. The EOT code is not stored.
- The DEL (177_8) code is stored and displayed when received.
- Receipt of a DC2 (022_8) code causes the data word stored in memory at the current cursor position to be transmitted. The cursor is not repositioned, nor is stored data affected.
- Receipt of a CAN (030_8) code causes the terminal to perform a clear operation.
- Receipt of a NAK (025_8) code causes the terminal to perform a skip operation.

- Receipt of a SYN (026_8) code causes the terminal to perform a line clear operation.
- Receipt of a SUB (032_8) code causes the terminal to perform a cursor up operation.
- Receipt of an EM (031_8) code causes the terminal to perform a reset operation.
- The ETX (003_8) code is stored when received.
- The LINE CLEAR key transmits a SYN (026_8) code.
- The SEND key transmits an ETX (003_8) code.

Wraparound Enable Switch

The Wraparound Enable switch is located on the edit ROM board. When this switch is in the Enable position, the wraparound feature for character and line insertion and deletion is enabled. In the Disable position, these features are not operative. A discussion of the wraparound feature, appears in section 1 under the headings Character Insertion and Deletion and Line Insertion and Deletion.

EXTERNAL INDICATORS

The following paragraphs explain the functions of the external indicators.

ALERT Indicator

The ALERT indicator lights upon detection of a break condition at the modem interface. Such a break condition may be caused by a space condition as the 10th bit of any received data, in which instance both the ALERT and the KEYBOARD LOCK indicators light, or a loss of the Secondary Received Line Signal Detector, if enabled. The BREAK key on the keyboard may be used to extinguish the indicators and unlock the keyboard. The break condition is not transmitted when the BREAK key is used in this manner.

CO (Carrier On) Indicator

The CO indicator lights when both the Received Line Signal Detector and the Data Set Ready signals are in an on condition.

CTS (Clear to Send) Indicator

The CTS indicator is lit by the modem when the Data Set Ready and Request to Send signals are both in the on condition and the modem is prepared to transmit information. The terminal will not transmit data to the modem unless the CTS signal is in the on condition, but it transmits immediately upon detection that CTS is in the on condition.

RTS (Request to Send) Indicator

The RTS indicator is lit by the terminal when Data Set Ready and Data Terminal Ready are both in the on condition and the terminal attempts to initiate a transmission. The RTS signal remains in the on condition for at least 1 millisecond following the transmission of the last data bit.

DTR (Data Terminal Ready) Indicator

The DTR indicator is lit by the terminal to indicate that the terminal is conditioned to accept data from the modem. The DTR signal is in the on condition whenever power is applied to the terminal except:

- When no equipment in the terminal configuration is online
- Upon receipt of an EOT code when the EOT Disconnect feature is enabled

REC DATA (Received Data) Indicator

The REC DATA indicator lights to indicate the presence of data received from the modem.

TRANS DATA (Transmitted Data) Indicator

The TRANS DATA indicator lights when the terminal is transmitting data to the modem.

TRANSMISSION MODE Indicators

There are three transmission mode indicators: the CHAR (character) mode indicator, the LINE mode indicator, and the BLOCK mode indicator. These indicators reflect the position of the CHARACTER/LINE/BLOCK switch with the exceptions listed below.

- If the Batch Mode switch is enabled, character mode is maintained and indicated.
- If the FORMAT switch is in the FORMAT position, block mode will be maintained and indicated.
- If the position of the CHARACTER/LINE/BLOCK switch is changed while a line or block transmission is in progress, the transmission mode selected when the transmission was initiated will be maintained and indicated until the transmission is terminated.

KEYBOARD LOCK Indicator

The KEYBOARD LOCK indicator lights to indicate that all of the keyboard, except the peripheral control keys, is disabled. This condition arises:

- In block or edit mode, between receipt of an STX (002_8) code and receipt of an EOT (004_8) code.
- During transfer of data from display memory to an external device.
- Receipt of a break condition or framing error (10th bit received as a space condition).

FORMAT MODE Indicator

The FORMAT MODE indicator operates lights to indicate that the terminal is in format mode. The terminal, if in format mode, is out of format mode between receipt of an STX (002_8) code and receipt of a termination code. During this period, the keyboard is disabled and the indicator is extinguished.

PRINTER OPTION

The printer option consists of a printer interface board, keyboard switches, peripheral cabling, and a receive-only printer with an RS-232-C interface. Printer interface signals conform to RS-232-C and CCITT Recommendation V.24 for interface between a modem and a device as applied to a receive-only device. Connection is made to the printer through the peripheral connector located on the rear panel of the display terminal. If a tape cassette is associated with the terminal, connection is made through the tape cassette device.

PRINTER INTERFACE BOARD

The printer interface board is an addressable board that contains read-only memory for the printer firmware and a transmitter to send data or control information to the printer in an RS-232-C bit-serial manner. The printer interface board is mounted in the display logic module and contains the following internal switches.

Baud Rate Selector Switch

The Baud Rate Selector switch consists of four rocker switches that permit the selection of 110, 150, 200, 300, 600, 1200, 1800, 2400, 4800, or 9600 baud.

Parity Switches

The two Parity switches permit the selection of even, odd, mark, or space parity. One switch is labeled Parity Enable/Disable, and the other switch is labeled Parity Even/Odd. When the Parity Enable/Disable switch is in the Enable position, parity is generated as determined by the setting of the Parity Even/Odd switch. When the Parity Enable/Disable switch is in the Disable position, mark parity is selected if the Parity Even/Odd switch is in the Even position, and space parity is selected if the Parity Even/Odd switch is in the Odd position.

Auto Print Enable Switch

If the Auto Print Enable switch is placed in the Enable position, receipt of an ETX (003g) code causes the entire displayed page to be transferred to the printer channel at the baud rate selected on the printer option card. The keyboard is disabled during this transfer. If the terminal is online and data is received during the transfer, the operation is aborted and received data is stored in the display memory beginning at the current cursor position. The cursor moves as the transfer to printer is accomplished.

Whenever one of the following events or conditions occurs, the auto print enable feature is instantly disabled.

- PRINT ON LINE key is pressed
- PRINT LOCAL key is pressed
- The printer channel Data Terminal Ready signal goes to an off condition

When the Auto Print Enable switch is in the Disable position, receipt of an ETX code has no effect on printer operation.

KEYBOARD SWITCHES

The following paragraphs explain the functions of the keyboard switches.

PRINT ON LINE Key

The PRINT ON LINE key is a key on the keyboard that stays down when pressed and releases when pressed again. When the key is in the depressed position, all data routed to or from the modem interface is also routed to the printer if the terminal is operating in half duplex. If the terminal is operating in full duplex, locally originated data is not routed to the printer. If the terminal is in local mode, all data received will be routed to the printer and not to the display memory. The Data Terminal Ready signal at the modem interface is maintained in the on condition.

If the terminal is receiving at a baud rate in excess of the printer speed, data characters will be lost. All idle time required by the printer for paper or carriage motion functions must be accommodated in the received data stream. In all cases, regardless of printer capability, 10 idle characters must be provided following each CR-LF operation. The nonimpact printer prints at a rate of 30 characters per second, and the matrix printer prints at the rate of 173 characters per second for the 60-Hz model and 180 characters per second for the 50-Hz model.

Transmission rates from a local source to the modem interface are no greater than the character rate of the printer as long as the PRINT ON LINE key is pressed. If the terminal baud rate is set at a rate in excess of the printer speed, transmission will be at a character rate that the printer can handle, even though the baud rate is not affected.

PRINT LOCAL Key

The PRINT LOCAL key on the keyboard stays down when pressed and releases when pressed again. When this key is in the depressed position, data may be transferred from an offline tape cassette to the printer, or from the keyboard to the printer if the display is in local mode.

The PRINT LOCAL key can be overridden by the PRINT ON LINE key.

PAGE PRINT Key

The PAGE PRINT key is a momentary contact key on the keyboard. When the PAGE PRINT key is pressed, the entire displayed page is transferred from the display memory to the printer channel at the rate selected on the printer option card while the cursor follows the read on the screen. The keyboard, including the BREAK key and the peripheral control keys, is disabled during this transfer. A carriage return encountered in this transfer is changed to an LF-CR sequence to the printer, and the transfer continues at the first position of the next displayed line. All characters at the right of the CR are not transmitted. If the terminal is online and data is received during the transfer, the transfer is aborted and received data is processed and routed to the appropriate device.

The page print function is disabled if the PRINT ON LINE key is pressed, the PRINT LOCAL key is pressed, or the printer Data Terminal Ready signal goes to an off condition.

PERIPHERAL CABLING

A cable from the peripheral connector on the back of the terminal connects to the printer. If there is a tape cassette associated with the terminal, the cassette is cabled to the terminal and the printer is cabled to the cassette. In either instance, the same cable is used to the printer. Peripheral cabling pin assignments for the printer and cassette are shown in table 2-1. The characteristics of the Secondary Request to Send and Data Terminal Ready circuits are explained in following paragraphs.

TABLE 2-1. PERIPHERAL CABLING PIN ASSIGNMENTS

PERIPHERAL CONNECTOR PIN NUMBER	CCITT MODEM CIRCUIT	EIA MODEM CIRCUIT	SIGNAL NAME	ORIGIN
1	101	AA	Protective Ground	Tape Cassette/ Printer/Terminal
2			Play	Tape Cassette
3	104	BB	Received Printer Data	Terminal
4			Reserved	
5			BOT/EOT	Tape Cassette
6	107	CC	Printer Data Set Ready (DSR)	Terminal
7	102	AB	Signal Ground	Tape Cassette/ Printer/Terminal
8	109	CF	Printer Received Line Signal Detector (CO)	Terminal
9			Line/Local	Tape Cassette
10			Reserved	
11			Receive Clock	Tape Cassette
12			Ready	Tape Cassette
13			Record Gap	Tape Cassette
14			Write	Terminal
15			Write Data	Terminal
16			Go	Terminal
17			Forward	Terminal
18			Terminate Write	Terminal
19	120	SCA	Secondary Request to Send (SRTS)	Printer
20	108	CD	Printer Data Terminal Ready (DTR)	Printer
21			Read	Terminal
22			Select Unit 2	Terminal
23			Times 16 Clock	Terminal
24			Read Data	Tape Cassette
25			Record	Tape Cassette

Secondary Request to Send Circuit

The Secondary Request to Send (SRTS) circuit is used to control the flow of locally originated bulk data from the display memory to the printer. If data to be printed originates at the keyboard or at the modem interface, the SRTS signal is disregarded. If the SRTS signal is determined to be in the off, or open, condition, the terminal interrupts the data stream for at least 250 milliseconds to accommodate the following paper or carriage motion control codes.

Name	Mnemonic	Code
Carriage Return	CR	015_8
Line Feed	LF	012_8
Backspace	BS	010_8
Form Feed	FF	014_8
Horizontal Tabulation	HT	011_8
Vertical Tabulation	VT	013_8

As long as the SRTS signal is determined to be in the on condition, data is transferred to the printer without embedded delays.

Data Terminal Ready Circuit

The terminal monitors the Data Terminal Ready (DTR) circuit before each character is presented to the printer. Data is transferred normally as long as the DTR signal is maintained in the on condition. If the DTR goes to an off or open condition, the terminal reacts differently depending upon the function in which it is engaged.

- Display memory to printer transfer (page print). Data transfer is aborted, the keyboard is unlocked, the alarm sounds for 200 milliseconds, and the message CHECK PRINTER is written in the last character positions of the bottom line of the display.

- Cassette to printer transfer or cassette transfer to both modem interface and printer. Data transfer is halted, the alarm sounds, and the message CHECK PRINTER is written in the last character positions of the bottom line of the display. Actuation of the READ TAPE key reinitiates the transfer of data until a termination code is reached or the transfer is manually disabled.

- Display memory transmit (local or online). Data transfer is aborted, the alarm sounds, and the message CHECK PRINTER is written in the last character positions of the bottom line of the display.

- Modem interface to printer. Data transfer continues, the alarm sounds, and the message CHECK PRINTER is written in the last character positions of the bottom lines of the display.

PRINTER

The terminal operates any RS-232-C compatible printer. The printer prints its standard ASCII repertoire with the following exceptions.

- The display terminal automatically transfers an immediate carriage return (015_8), line feed (012_8) sequence to the printer whenever any of the following conditions occur.
  - PAGE PRINT key is pressed
  - Receipt of an auto print command if auto print is enabled
  - Receipt of an unconditional auto print command
  - Termination of a page print or an auto print
  - Upon transfer of the termination code during a block mode transmission with the PRINT ON LINE key pressed (the termination code is not transferred to the printer)
  - Following the termination of a list operation from the tape cassette device
  - Upon receipt of a CAN (030_8) code from either the modem interface or the tape cassette station (the CAN code is not transferred to the printer)
- The display terminal automatically substitutes space (040_8) codes for the following codes when they are transferred from the modem interface, tape cassette station, or display memory.
  - STX (002_8)
  - ETX (003_8)
  - SO (016_8) with edit option
  - SI (017_8) with edit option
  - ETB (027_8) with edit option
- The NUL (000_8) and DEL (177_8) codes are not transferred to the printer and may be used as delay codes.

In addition to the page print feature which prints the contents of the screen when the PAGE PRINT key is pressed and the ETX auto print feature which prints the contents of the screen when an ETX is received, the unconditional auto print feature prints the contents of the screen when an ESC (033_8), numeric 3 (063_8) sequence is received over the communication line, no matter what the setting of the ETX Auto-print switch happens to be.

TAPE CASSETTE OPTION

The tape cassette option allows for storage and retrieval of bulk data at the terminal site. The device uses the Philips style cassette cartridge and is available as a single- or dual-drive device.

Tape cassette operation allows for data transfers to and from the communications line (either operator or program controlled), data transfers to or from the display terminal (online or offline), and data transfer to the printer, if available. Data routing is determined by the setting of On Line/Local switches associated with each device.

When operating online, word structure, baud rate, and line control are determined by the display terminal. The tape cassette data transfer is buffered in tape cassette control memory located in the display terminal but separate from the displayed section of memory. This buffer memory allows for operation of the tape cassette at optimum speed regardless of the line speed or printer speed.

Recording density, internal word structure, and record definition allow for a maximum of approximately 144,000 data words to be recorded on each side of a 91.44-meter (300-foot) cassette. Total capacity of the cassette is 288,000 data words.

A standard feature of the tape cassette option is the search capability. This feature is not dependent upon specific coding entered by the operator or received from a remote source. The search operation is bidirectional and is controlled by keyboard entries. The search feature may not be implemented by a remote device.

The tape cassette option consists of a tape cassette interface board located in the display terminal, a single- or dual-drive cassette unit, and a 3.2-meter (10.5-foot) interconnecting cable. Operator controls are found on both the display terminal keyboard and the tape cassette unit.

TAPE CASSETTE INTERFACE BOARD

The tape cassette interface board is an addressable board that contains read-only memory for the tape cassette firmware, and logic for sending data and control information to and receiving data and status information from the tape cassette unit. The interface board is mounted in the display logic module. It contains one internal switch, the Device Control Codes switch.

The following paragraphs describe features of the tape cassette firmware and use of the Device Control Codes switch.

Tape Cassette Firmware

The tape cassette firmware formats and records tape cassette data, reads and strips the essential data from the formatted information, writes tape gaps, performs tape search operations, and detects tape errors and faults.

Tape Formats

Tape cassette data storage is serial with a maximum recording density of 780 bits per inch (bpi). All data received is recorded, including idle codes. The firmware formats the data to be recorded into 8-bit words, which it assembles into blocks or physical records of 128 characters each. Each side of a tape cassette contains 1200 ($4B0_{16}$) physical records. Eight of the 128 characters are format control characters that are internally generated by the firmware. These control characters include the hexadecimal record number assigned to that record by the firmware for tape search operations. Control characters are stripped off during read operations.

The physical record size of 128 characters is the minimum number of characters recorded. If fewer than 128 characters are transferred to the cassette, the remainder of the physical record will contain fill characters. Fill characters are stripped off during read operations.

The firmware assembles each physical record in a block of tape cassette control memory and transfers it to the tape cassette in block form. While one record is being written from cassette control memory, a second physical record may be assembled in a second block of memory. While the second physical record is being written, the first block of memory is available for assembly of another record. Thus, the terminal is able to accommodate a continuous stream at 1200 baud by alternating blocks of tape cassette memory in this manner.

Each tape drive has two blocks of memory organized in this way, allowing one tape drive to copy transmissions originating from the other tape drive. However, if copies are made in this manner, transmission speeds are reduced by 50 percent.

Record Operations

The manner of initiating a record operation depends upon whether the tape drive is operating in local mode or online mode. Once a record operation is initiated, all data received by the tape cassette interface board is recorded until a termination code is detected.

A record operation in local mode is initiated by the operator at the terminal keyboard. The manner in which a local record operation is initiated is determined by whether the terminal is operating in block, line, or character mode.

In block mode, actuation of the SEND key causes display data to be transferred to the tape cassette unit in the same format as it is transferred to the communication line. In line mode, actuation of the CARRIAGE RETURN key causes all display data on the line up to and including the carriage return code to be recorded. In character mode, as each alphanumeric or control key is pressed, the character is transferred to the tape cassette control memory and recorded when a termination code or 120 characters have been entered.

Initiation of a record operation in online mode depends upon whether the device control codes are enabled. If the Device Control Codes switch is set to the Enable position, the record operation is initiated upon receipt of a DC2 code on the communications interface from an external source. The DC2 code is not recorded. All data following the DC2 code, either sent or received by the terminal, is recorded until a termination code is received.

If the Device Control Codes switch is set to the Disable position, all data received or sent from the terminal is recorded until a termination code is detected.

The termination code used may be any one or all of the following:

- ETX — The Enable ETX Termination switch in the terminal must be in the Enable position. The ETX code is recorded unless data is originating from the display terminal and the Termination Codes Transmission switch is in the Disable position.
- EOT — The Enable EOT Termination switch in the terminal must be in the Enable position. The EOT code is recorded unless data is originating from the display terminal and the Termination Codes Transmission switch is in the Disable position.
- DC4 — The Device Control Codes switch on the tape cassette interface board must be in the Enable position. The DC4 code is recorded.
- CR — The carriage return code (CR) is recognized as a terminator if the terminal is operating in line mode and data is originating from the display terminal. The carriage return code is recorded and a line feed code (LF) is provided automatically following the carriage return code.

Each recorded message must be terminated to ensure the stored data is transferred to the tape drive. Also, without a recorded termination code, subsequent read operations will be improperly terminated. If operating in line mode, and a line of data contains more than one termination code other than the carriage return code, data will be lost. The carriage return code is recognized as a termination code during read operations in line mode only.

Following transfer of the selected termination code, any further data directed to the tape cassette must be delayed by a minimum of 430 milliseconds. Failing to incorporate this delay will result in lost data. Data rates exceeding 1200 baud may be accommodated by delaying the transfer of data following each 120 characters for the period of time necessary to bring the total transmission time of that physical record to 430 milliseconds. Failure to incorporate this delay will result in lost data.

The following conditions cause a record operation to be aborted:

- Master clear
- Opening the tape cassette drive cover
- Actuation of the UNLOAD switch
- Changing position of the RECORD/STBY/PLAY switch
- Changing position of the ON LINE/LOCAL switch

If the interruption occurred when a number of characters were stored in the tape cassette control memory and were not recorded, data will be lost.

Read Operations

The manner of initiating a read operation depends upon whether the tape drive is operating in local mode or online mode. A read operation in local mode is always initiated by the operator at the terminal keyboard by pressing the READ TAPE key. Initiation of a record operation in online mode depends upon whether the device control codes are enabled. If the Device Control Codes switch is set to the Enable position, the read operation is initiated upon receipt of a DC1 code on the communications interface from an external source.

If the Device Control Codes switch is set to the Disable position, the read operation is initiated by the operator at the terminal keyboard by pressing the READ TAPE key.

A tape is read until one of the following termination codes or tape gap is detected:

- ETX — The Enable ETX Termination switch in the terminal must be in the Enable position to halt the read operation when this code appears in the data stream from the tape cassette unit.
- EOT — The Enable EOT Termination switch in the terminal must be in the Enable position for this code to halt the read operation when it appears in the data stream from the tape cassette unit.

- DC3 — The Device Control Codes switch on the tape cassette interface board must be in the Enable position for this code to halt the read operation when it appears on the communications line.
- DC4 — The Device Control Codes switch on the tape cassette interface board must be in the Enable position for this code to halt the read operation when it appears in the data stream from the tape cassette unit.
- Tape Gap — When operating the tape cassette drive in local mode with the display in local and line mode, encountering a tape gap will halt the read operation.

The following conditions cause a read operation to be aborted:

- Master clear
- Opening the tape cassette drive cover
- Actuation of the BREAK key
- Actuation of the UNLOAD switch
- Changing position of the RECORD/STBY/PLAY switch
- Changing position of the ON LINE/LOCAL switch
- When online, receipt of a Break signal

A read operation may be interrupted with data remaining in the tape cassette control memory. The data remaining in the memory will be the first characters read following a restart command, unless power to the display is removed or a master clear is performed.

Tape Gaps

The mechanics of starting and stopping tape motion during write operations result in an unrecorded section of tape, called a record gap, between each physical record. The time required to record a single record, including record gap time, is 430 milliseconds.

When writing at the beginning of tape, an erase of 15.24 cm (6 inches) of the first part of the tape will take place. This erase takes approximately 800 milliseconds. To avoid the possibility of losing data, a write should not start at the beginning of tape if both tape drives are active.

The firmware incorporates an erase function, which writes an extended record gap of approximately 15.24 cm (6 inches). The erase function is performed by placing the display terminal and tape cassette in local mode, locating the position on the tape just prior to the area to be erased, conditioning the cassette to write, and actuating the BREAK key. Each actuation of the BREAK key will cause the erase function to be initiated.

Tape Search Operations

Actuation of the TAPE SEARCH key while the display terminal and tape cassette are in local mode places the terminal in tape search mode.

Entry into tape search mode causes the terminal to display a 3-digit hexadecimal number in the last three character positions of the display. These characters represent the address of the current record. Exit from tape search mode causes the three characters that were overwritten on the display screen to be replaced.

While in tape search mode, numeric entry from the keyboard will be interpreted as a search address. The terminal will accept three hexadecimal characters representing the address of the record desired by the operator. Upon entry of the third character, the keyboard is disabled and a search operation is initiated. The three characters representing the desired address are not displayed when entered. Completion of the search operation is indicated by replacement of the previous address with the new address.

The search operation is bidirectional and is accomplished at a rate of approximately 400 milliseconds for each record position moved in either direction.

If the search address is nonexistent, one of three things will happen depending on the addresses of the records on tape. If the tape has no records less than the search address, the tape will advance to the beginning of the tape. If the tape has no records greater than the search address, the tape will advance to the end of tape. If there are both records less than and greater than the searched record, the tape will advance to the first record greater than the search address and display that record's address. To abort the search operation, the operator may actuate the REWIND or UNLOAD switch.

Error Detection and Recovery

The tape cassette control performs word parity checks on each word recorded through a read-after-write operation and on each word read from tape. If an error is detected, the display alarm sounds and the words TAPE ERROR appear in the last character positions of the last line of the display. The operation in progress continues and the word in error is not modified. If it is found impossible to write on a certain area of tape, the erase function must be used.

Fault Detection

The firmware continuously monitors the various operating conditions involved in a read or write operation. The alarm sounds and the words CHECK TAPE will appear in the last character positions of the last line of the display under the following conditions:

- A write operation is initiated or in progress and the end of tape is detected
- A read operation is initiated following detection of the end of tape
- A read or write operation is initiated and no cassette is in a tape drive
- A write operation is initiated and the selected cassette has the write tabs removed or disabled
- Power to the tape cassette unit is turned off

Device Control Codes Switch

The Device Control Codes switch is a two-position switch located on the tape cassette interface board. When the switch is in the Enable position, the tape cassette will be responsive to device control codes DC1 through DC4 originating at the terminal communications interface, as well as the DC4 code originating at the tape cassette or display terminal. The codes and their associated actions are as follows:

- DC1 — Start read if tape cassette is online and in read mode.
- DC2 — Start record if tape cassette is online and in record mode.
- DC3 — Stop read operation if tape cassette is online and reading.
- DC4 — Stop record operation if tape cassette is recording online or offline. The DC4 is recorded. If encountered in the data stream of a read operation, the DC4 code will stop the read operation.

If the switch is placed in the Disable position, the device control codes do not affect operation of the tape cassette.

KEYBOARD SWITCHES

The following paragraphs explain the function of keyboard switches used to control tape cassette operations.

READ TAPE Key

The READ TAPE key is located on the terminal keyboard. When this key is actuated, the terminal begins reading the tape cassette of the tape drive that is in read mode and is ready. If both tape drives are in read mode and ready, tape 1 is read.

TAPE BACK SKIP Key

The TAPE BACK SKIP key on the keyboard is active only when the display terminal is in local mode. Pressing this key causes the tape cassette drive that is also in local mode to reposition the tape cassette to the beginning of the previous record. If both tape cassette drives are in local mode and ready, tape 1 is repositioned. If tape 1 is not ready, tape 2 is repositioned.

TAPE SRCH Key

The TAPE SRCH key is located on the display terminal keyboard. Actuation of this key when the display terminal is in local mode causes the terminal to enter a tape search mode of operation. Pressing the key a second time causes the terminal to exit tape search mode. Tape search mode assists the operator by identifying the current tape position by record number, and if requested to, positions the tape to a specified record anywhere on the tape. Search mode operations are performed on a tape cassette in a tape drive that is in local mode and ready. If both tape drives are in local mode and ready, tape 1 is searched.

BREAK Key

The BREAK key is located on the display terminal keyboard. When the display terminal is in local mode, this key may be used to write an extended record gap of 15.2 cm (6 inches) on a tape cassette that is in local mode and ready to record. Each time the BREAK key is pressed, an erase function is performed.

PERIPHERAL CABLING

Since the tape cassette unit and printer often share peripheral cabling to the display terminal, tape cassette cabling is described with the printer cabling earlier in this section.

TAPE CASSETTE UNIT

The following paragraphs describe the functions of switches and indicators located on the tape cassette unit.

ON LINE/LOCAL Switches

There is an ON LINE/LOCAL switch located on the front panel of the tape cassette unit for each tape drive. The switch located on the left is associated with the tape cassette drive on the left. The switch located on the right is associated with the tape

cassette drive on the right. If both cassette drives in a dual-drive unit are ready and are both switched to LOCAL or to ON LINE, the drive on the left (drive 1) has priority. If the unit is a single-drive unit, the tape drive and its associated switches and indicators are on the left side of the cassette unit.

Placing the ON LINE/LOCAL switch in the LOCAL position causes the drive associated with that switch to transfer data to or to receive data from devices that are also in local mode. That is, if the tape cassette drive is conditioned to a read operation, prerecorded data is routed to only those devices that are also in local mode. Similarly, if the tape cassette drive is conditioned to a record operation, it will be sensitive only to data originating from a device that is also in local mode.

If no device other than the cassette drive in use is in local mode, the read or write operation is inhibited. Note that each drive in a dual-drive tape cassette unit is considered as a separate device.

Placing the ON LINE/LOCAL switch in the ON LINE position causes the associated tape cassette drive to transfer data to or receive data from the communications interface and from devices that are also in online mode. That is, if the tape cassette drive is conditioned for a read operation, prerecorded data is routed to the communications interface and to any terminal device that is also online. Similarly, if the tape cassette drive is conditioned for a record operation, it will be sensitive to data received or transmitted on the communications interface.

NOTE

If the display, printer, or other cassette drive is online and data transfers take place on the communications line, terminal operations will be delayed. The total delay time depends upon the terminal baud rate, number of devices online, and the operation being performed.

All transfers of data are limited in character rate to the slowest device active during the transfer. If the terminal baud rate is selected to be 110 baud (approximately 10 characters per second), the transfer of data from the tape cassette will, when online, be limited to that rate. If the cassette is offline, the transfer of data is not limited to the terminal baud rate.

RECORD/STBY/PLAY Switches

There is a three-position RECORD/STBY/PLAY switch associated with each tape cassette drive unit. If both cassette drives in a dual-drive unit are switched to RECORD or to PLAY, the cassette drive on the left (drive 1) is checked first, and if ready, is used. Drive 2 is then ignored.

Placing the switch in the RECORD position when the associated drive is ready enables data to be recorded from sources determined by the position of the ON LINE/LOCAL switch at the tape drive.

Placing the switch in the PLAY position when the associated drive is ready enables data to be read from the tape cassette and transferred to destinations determined by the position of the ON LINE/LOCAL switch at the tape drive.

Placing the switch in the STBY position removes the associated tape cassette drive from an active state.

UNLOAD Switches

There is an UNLOAD switch located on the front panel of the tape cassette unit for each tape drive. Actuation of this switch causes the tape cassette to abort all current activity and rewind to clear leader. Rewind speed is approximately 1.22 meters (48 inches) per second.

Rewind Switch

The Rewind switch is located under the tape drive cover. Inserting a tape cassette and closing the cover or momentarily opening and closing the cover actuates the switch and causes the tape to rewind to clear leader and then advance to the beginning of tape.

READ Indicator

The READ indicator, located on the front panel of the cassette unit, lights during tape motion of a read operation on either tape drive.

WRITE Indicator

The WRITE indicator, located on the front panel of the cassette unit, lights during tape motion of a record on either tape drive.

TAPE OUT Indicators

A TAPE OUT indicator is provided for each tape cassette drive. A lighted indicator indicates that the beginning or end of tape for the associated tape cassette has been reached.

READY Indicators

A READY indicator is provided for each tape cassette drive. When lighted, an indicator signals that the associated tape drive is ready for a read or write operation. The READY indicator is extinguished if:

- The tape is on clear leader
- A write operation is initiated for a tape cassette that has write tabs removed or disabled
- A tape cassette is not present
- The end of tape is sensed
- The tape drive is actively reading or writing

POWER Indicators

The paging option provides additional storage and control of three 24-line display pages.

PAGING OPTION

The paging option with the extended memory option provides storage and control of three 24-line display pages.

The paging module is a single plug-in printed-circuit board that contains 4096 8-bit words of random-access memory for holding two display pages and up to 2048 8-bit words of read-only memory for use by the display terminal processor board. When installed, the paging module prohibits installation of the tape cassette option because the two options share the same physical location in the display terminal logic rack.

Paging can be initiated online by the central processor system or locally by the operator. Paging operations can be performed in character, line, block, batch, or format modes.

ONLINE PAGING OPERATIONS

The central computer system obtains access to the three display pages by embedding device control codes (DC1 and DC3) in the data stream to the display terminal. A delay of 400 milliseconds must follow either code before more data is transmitted to allow time for a new page to be displayed.

Upon recognizing a DC1 code in the data stream from the central computer system or upon application of power to the display terminal, the paging option will bring up page 1. If the terminal is already displaying page 1, the DC1 code will be ignored.

Upon recognizing a DC3 code in the data stream from the central computer system, the paging option will advance the display to the next page (page 1 to page 2, page 2 to page 3). However, once page 3 is displayed, receipt of a DC3 code is ignored and the display remains at page 3.

LOCAL PAGING OPERATIONS

The display terminal operator obtains access to the three display pages by using the TAPE SRCH and TAPE BACK SKIP keys on the terminal keyboard while the display terminal is in local mode.

Pressing the TAPE BACK SKIP key brings up page 1. If the terminal is already displaying page 1, pressing the TAPE BACK SKIP key causes no action.

Pressing the TAPE SRCH key causes the display to advance to the next page (page 1 to page 2, page 2 to page 3). If the terminal is displaying page 3, pressing the TAPE SRCH key causes no action.

Paging operations by the operator are inhibited if the terminal subsystem is busy with another local operation. However, paging is allowed if the terminal subsystem is busy with an online operation as long as the display terminal is in local mode. If the operator is performing paging operations in format mode while an online print is in progress, some delay will occur in bringing up the next display.

CURRENT LOOP OPTION

The current loop option is a method by which terminals can communicate with others in a local communications facility. The option, which requires that no terminal be connected to a modem, is totally electronic and provides for electrical isolation and proper signal level conversion between low-voltage (RS-232-C/CCITT V.24) signal levels and high-voltage dc unipolar and bipolar levels. Modes of operation are unipolar half duplex, unipolar full duplex, and bipolar full duplex.

No current (unipolar) or reverse current (bipolar) is interpreted to be a spacing condition. Current flow (unipolar) or forward current flow (bipolar) is interpreted as a marking condition.

Functional programming does not apply to this option. It merely operates as a current loop I/O channel according to the various switch settings available. Word size, word format, parity, and baud rate of current loop communications are all under the control of the display terminal that uses the current loop option for I/O communications.

Request to Send is internally connected to Clear to Send, and Data Terminal Ready is internally connected to Data Set Ready and Received Line Signal Detector.

The current loop option is typically used in a local communications facility where the carrier lines are furnished by a communications carrier company or by the purchaser of the terminal equipment. As a practical matter, the baud rate that can be employed for this type of communication relates to the quality of the line and the distance over which the signals are expected to travel.

Establishing a current loop option depends on basic terminal switch settings, current loop circuit card switch settings, and system line arrangements.

BASIC TERMINAL SWITCH SETTINGS

Table 2-2 shows the settings of the internal switches that must be employed if the current loop option is to operate properly.

TABLE 2-2. CURRENT LOOP INTERNAL SWITCH SETTINGS

SWITCH	SETTING
Request to Send Switched/Constant	Constant
EOT Disconnect Enable/Disable	Disable
Enable Communications Circuit Assurance Feature	Disable
Parity Switches, Enable ETX Termination Switch, Enable EOT Termination Switch, Enable Transfer Termination Code Switch, Enable X-Y Positioning Switch, Select Background Character Switch, Scroll Enable/Disable Switch, and Enable Transmit Protected Fields Switch.	As required by system

CURRENT LOOP CIRCUIT CARD SWITCH SETTINGS

Figure 2-1 shows the location of the switches on the current loop circuit card, and table 2-3 shows the function of each switch. In the switch settings shown in figures 2-2, 2-3, and 2-4, S8 is the first binary digit.

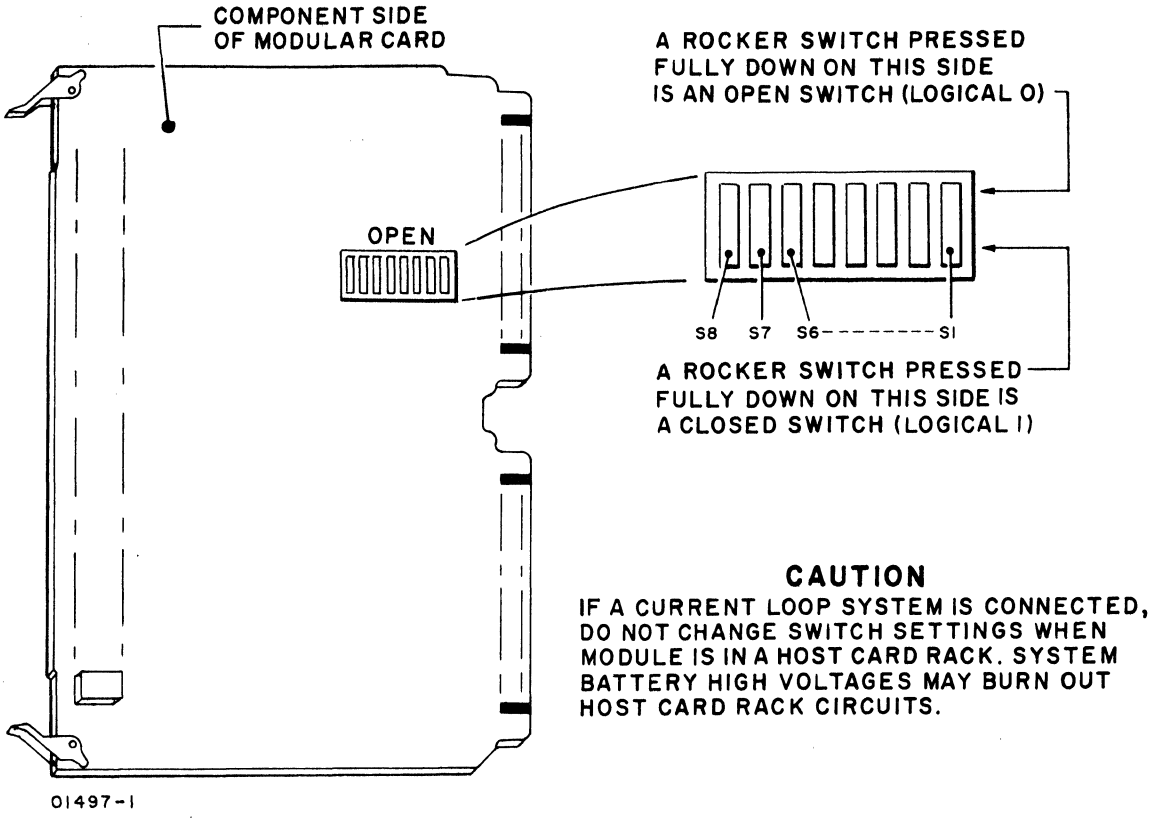


Figure 2-1. Module Control Switches

TABLE 2-3. MODULE CONTROL SWITCHES

SWITCH	FUNCTION
S1	Open/close the transmit (-) output line which is normally open.
S2	Open/close the transmit (+) output line which is normally closed.
S3	Open/close the transmitter common output line.
S4	Open/close the transmitter common output to the receiver (-) input.
S5	Open/close the transmit (+) output to the receiver (-) input.
S6	Open/close the receiver (-) input line.
S7	Open/close the transmitter common output to the receiver (+) input.
S8	Open/close the receiver (+) input line.

SYSTEM LINE ARRANGEMENTS

Figures 2-2, 2-3, and 2-4 show the 8-bit binary code representing the required rocker switch settings for each current loop operating mode illustrated in these figures. The leftmost digit of each group corresponds to rocker switch 8. An open switch represents a logical 0 and a closed switch represents a logical 1. Each circuit is shown in the marking condition of serial bit communication across current loop lines.

Actual communication over the current loop lines requires a system power source (battery). Such external power must conform to the following.

Open Circuit System Voltage: 120 vdc maximum
10 vdc minimum

System Current (for marking condition): 60 milliamps maximum
20 milliamps minimum

Voltage Drop Across Transmitter: 2 vdc maximum

Voltage Drop Across Receiver: 2 vdc maximum

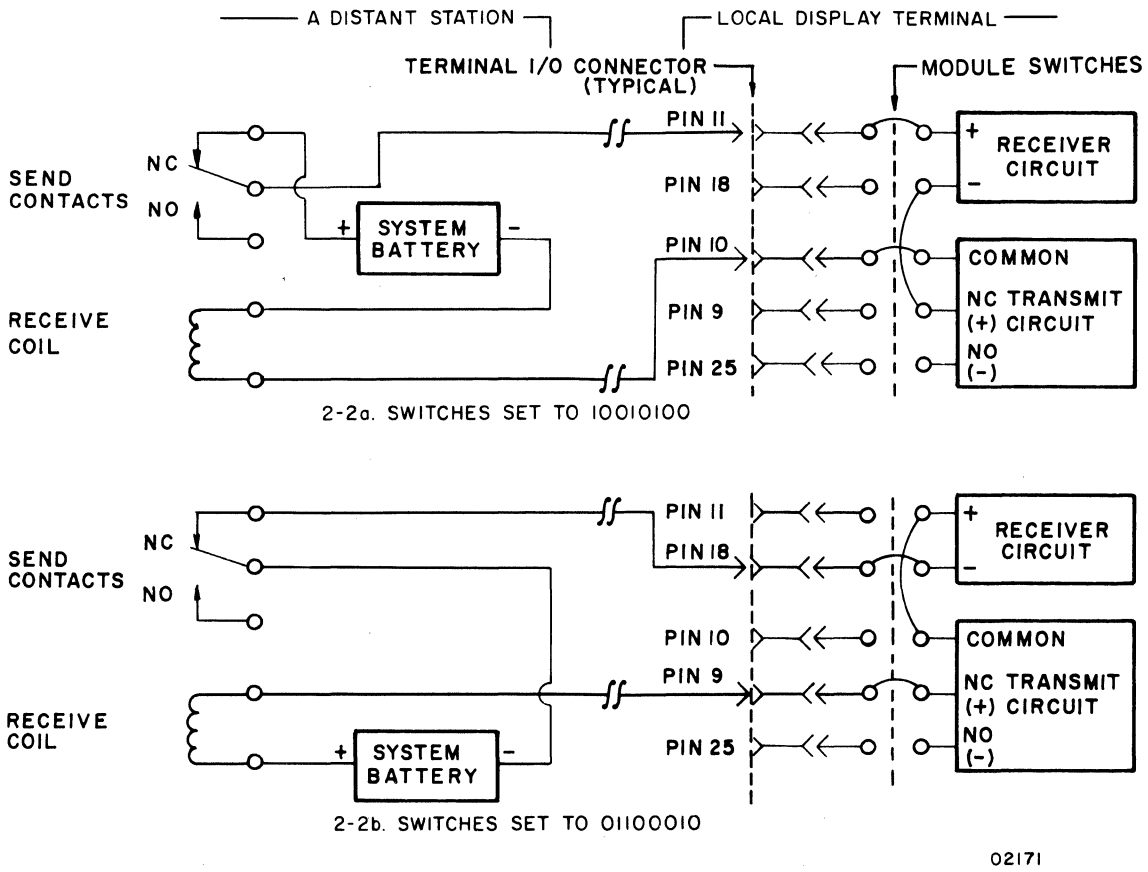


Figure 2-2. Unipolar Half Duplex Typical System Diagrams

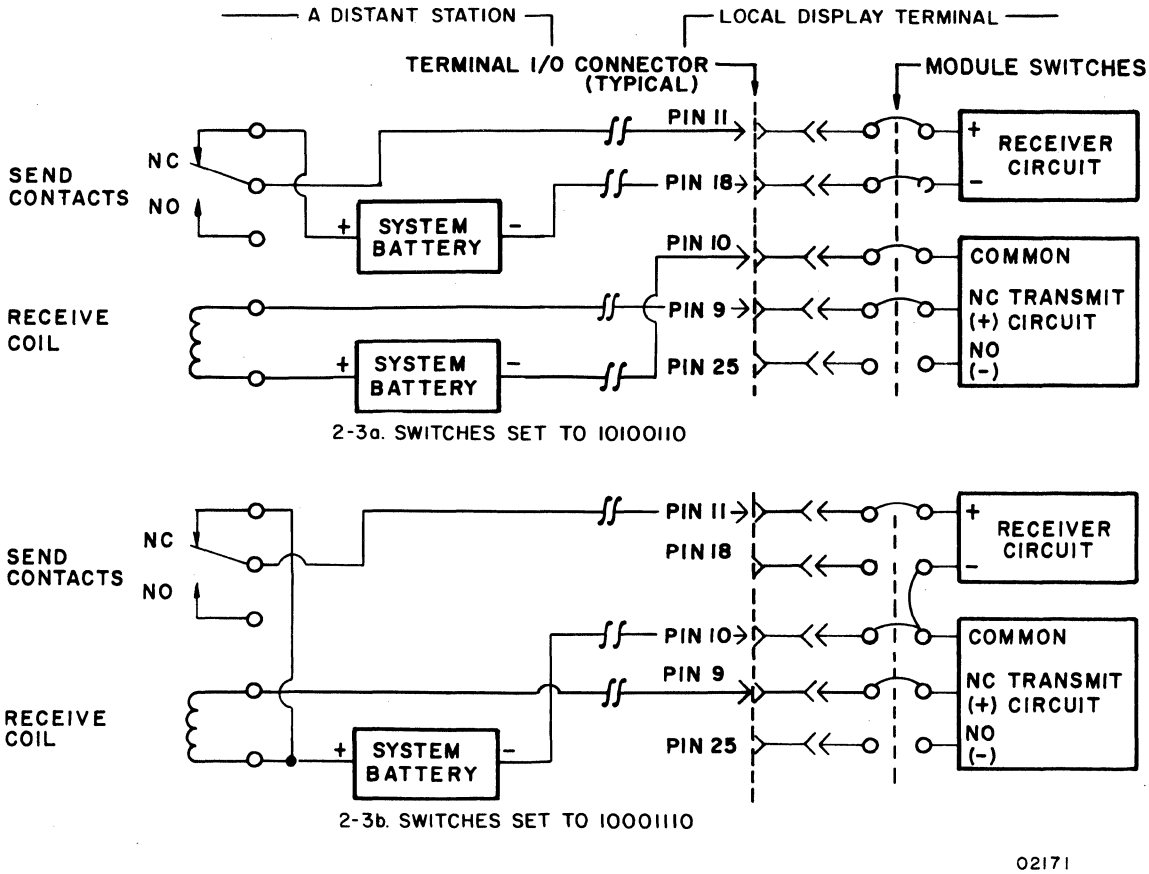


Figure 2-3. Unipolar Full Duplex Typical System Diagrams

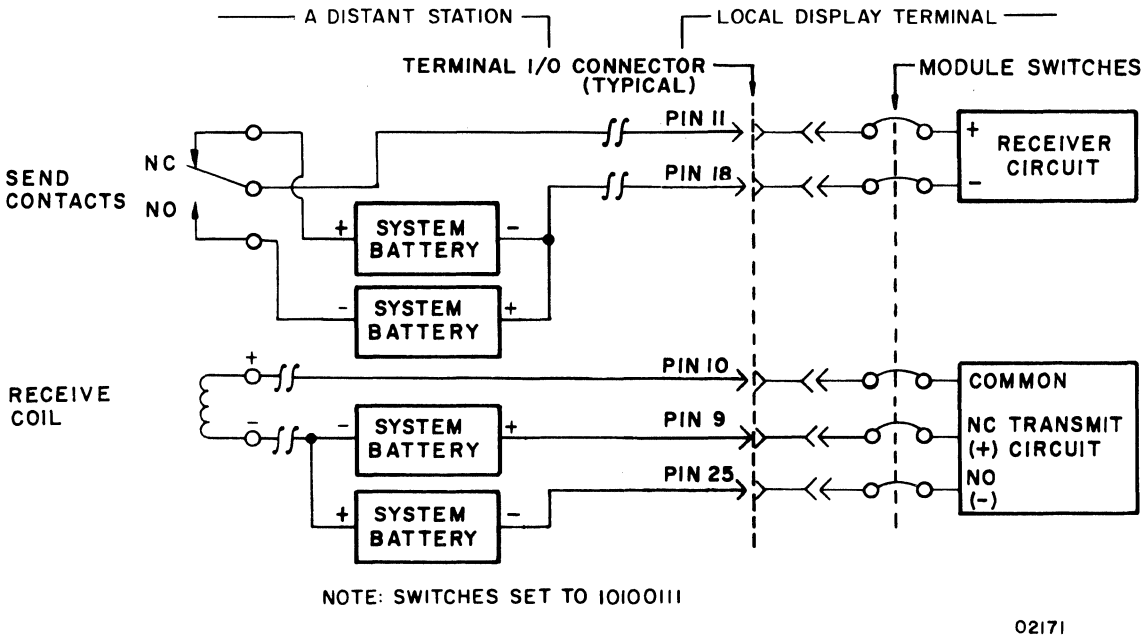


Figure 2-4. Bipolar Full Duplex Typical System Diagrams

ANSWERBACK OPTION

The answerback option provides automatic identification of the terminal upon receipt of an ENQ (005_8) code from the modem interface or pressing of the HERE IS key. When either of these conditions occurs, the terminal transmits a series of as many as 21 characters to the modem interface. A Mode switch is provided on the option card. When the Mode switch is in the Maint position, data from the answerback option is entered into the display memory. When the Mode switch is not in the Maint position, data from the option is sent directly to the modem interface without local copy. Except for the break condition, which aborts the sequence, data received during the answerback sequence is ignored. The keyboard is locked during the answerback sequence.

Encoding of the 21 or fewer characters is accomplished at installation through the insertion of diodes. The delivered option is configured to transfer the following code sequence.

Code	Mnemonic	Code	Mnemonic
015_8	CR	103_8	C
012_8	LF	113_8	K
177_8	DEL	040_8	Space
101_8	A	124_8	T
116_8	N	105_8	E
123_8	S	123_8	S
127_8	W	124_8	T
105_8	E	015_8	CR
122_8	R	012_8	LF
102_8	B	177_8	DEL
101_8	A		

An 8th-bit location is present in each word of the diode matrix to allow for transmission for fewer than 21 characters. The 8th bit is used in the last character to be transmitted.

Parity, baud rate, and line control are determined by the basic terminal.

The answerback option may not be used in conjunction with the multidrop option.

MULTIDROP OPTION

The 68564-1 Multidrop Option is a single, plug-in, printed-circuit board that contains a fixed memory and switches. The fixed memory contains a program that provides for the addition of a fixed message envelope and automatic responses to specific inquiries concerning the status of the terminal. This option permits the terminal to be operated in conjunction with systems configured to support 85A1 Selective Calling Service Stations*. This protocol is intended for multidrop data systems using half-duplex communication facilities at data rates as fast as 9600 baud.

The discussion of the multidrop option requires an explanation of the operation of the 85A1 protocol and an explanation of the switches.

OPERATION OF THE 85A1 PROTOCOL

A discussion of the operation of the 85A1 protocol involves a discussion of the equipment, general system operation, operating modes and conditions, operating and maintenance techniques, and alarms and error messages.

Equipment

The two types of equipment necessary for an 85A1 protocol system are a line control unit and one or more terminals.

Line Control Unit

The line control unit is a computer switcher that controls all traffic on the lines. It administers the system and governs the selection of terminals to send or to receive. The line control unit provides the store-and-forward capability required to deal with traffic that originates on one line for delivery to a terminal on another line. Such traffic is called interline. The line control unit also provides the controls required to transfer traffic with the originating terminal and destination terminal or terminals on the same line. Such traffic is called intraline traffic.

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* The source and ultimate authority for the design and operation of the 85A1 protocol is contained in 85A1 and 85A2 Data Selective Calling Service Stations. See foreword for further information on this manual.

Normal terminal operation allows the line control unit to perform the following functions.

- Pick up one or more messages from a selected sending terminal.
- Deliver a message to a selected receiving terminal.
- Deliver a message simultaneously to two or more selected receiving terminals that are on a common line.
- Cause the text of a message that is being transmitted from a selected sending terminal to be received directly by one or more selected receiving terminals on the same line as the originating terminal, concurrent with its transmission by the originating terminal.

Terminals

The terminal is a display that may include either a printer or a tape cassette, or both. The printer may be the low-speed nonimpact printer, the medium-speed matrix printer, or another printer that meets the requirements of this system. Similarly, the tape cassette may be a single- or dual-drive meeting the requirements of this system. Normal operation of the terminal allows the operator to perform the following functions.

- Transmit messages from the display memory while simultaneously copying those messages on an associated tape cassette and/or printer.
- Compose messages in the display memory for later transmission while incoming messages are recorded on the tape cassette and/or printed.
- Compose messages on the tape cassette through the display memory while incoming messages are recorded on the other drive of a dual-drive cassette and/or printed.
- Transfer messages from the tape cassette to the printer while storing incoming data on the other drive of a dual-drive cassette and/or display memory.
- Cause all incoming messages to be rejected and the line control unit to be notified of the message rejection if peripherals are unavailable and the display memory is in use for message preparation.

General System Operation

Generally speaking, the entire system operates on the basis of the line control unit successively polling each terminal until it finds one that has traffic to send. Each terminal that is queried is in poll mode for as long as the query and/or transmission

lasts. The terminal that has traffic to send is then the selected sending terminal. Upon command, it sends the line control unit the addresses of the intended receiving terminals.

The line control unit "calls in" each intended receiving terminal, and each one selected is in call-in mode. As each terminal is addressed, it becomes receptive to information following the address (station code character) code, a condition called "unblinded." Before addressing (and unblinding) the next receiving terminal, the line control unit "blinds" the first one so that it is responsive only to line control codes. When all the intended receiving terminals have been called in, the line control unit issues a universal unblind code, and then all the selected terminals respond to all codes that are sent, copying text and reacting to all control coding.

Before sending an EOT to disconnect the terminals, or even between individual parts of one transmission, the line control unit can "roll call" each of the receiving terminals in turn. Each of the terminals responds to the roll call in a manner that indicates whether or not the previous transmission was properly received.

Some differences in operation may arise between interline and intraline transmission. Interline transmission is likely to be on a store-and-forward basis, but it need not necessarily be so. However, on a store-and-forward basis, the transmission need not occur to receiving stations coincident with its reception by the line control unit. Neither must the transmission speed to receiving stations be at the same baud rate as it was transmitted to the line control unit. It is the line control unit's task to determine an appropriate transmission rate.

In intraline communication, at least one receiving terminal is on the same line as the transmitting terminal. Instead of receiving the transmission from the line control unit, such a receiving terminal is coincidentally receiving the same transmission as the line control unit. In this case, the transmitting terminal is required to transmit at a speed that the receiving terminal can tolerate. Inasmuch as transmission speed is regulated by online peripheral devices, if the receiving station and the transmitting station have the same peripheral devices online, the transmission speed should be tolerable for reception.

It should be remembered that intraline communication is used to save time on connects. In a system capable of store-and-forward transmission, all communication could be interline.

In the 85A1 system, there are special operating characteristics associated with online terminal operation, and there are required message formats.

Terminal Operation

The operation of the terminal with the multidrop option installed differs in some respects from the operation of the terminal without the option. These differences are generally in the area of online operation and in the permissible functions of the BREAK key.

When the ON LINE/LOCAL switch is in the ON LINE position, the following operating characteristics are imposed.

- The keyboard is disabled except for the BREAK key, the READ TAPE key, and the printer mode controls.
- The terminal can receive in any mode, but can transmit only in block mode.
- Message transmission begins in the upper-left position of the screen. Reset to an STX character is disabled.
- The NAK (025_8), ACK (006_8), DLE (020_8), and ENQ (005_8) codes cannot be transmitted. Any message containing one of these codes terminates in an alert.
- If the CHAR, LINE, and BLOCK indicators are all lit, the terminal is in call-in mode.
- All online activity is administered by the line control unit.
- Line control characters are automatically transmitted to satisfy line control disciplines.

The Break signal is not transmitted, and the use of the BREAK key is limited to the following functions:

- Aborting transmission from the terminal and returning the terminal to an idle condition.
- Aborting any connected condition and returning the terminal to an idle condition.
- Extinguishing the ALERT indicator and stopping the alarm.

The edit option operates as specified with the following exceptions:

- An STX will switch the receiving terminal out of format mode so that protected fields can be altered only if the receiving terminal is called in and unblinded.
- Although the ESC (033_8) and numeric 2 (062_8) codes are routed to all selected unblinded devices, X-Y positioning is not returned in response to this sequence.

Message Format

The format of a complete message requires the following six elements: SOH, addresses, STX*, message text, ETX, and EOT.

Start of Header (SOH) — The Start of Header (SOH) is the first character of any message. The presence of an SOH (001_8) code alerts the line control unit that destination addresses of a message follow and that buffer space should be allocated for whatever might have to be stored. In the 85A1 system, single and multiple messages are prepared offline and switched online to send. The terminal sends one SOH at the beginning of the transmission regardless of whether or not an SOH was entered by the operator. At the end of the message, an SOH immediately following the ETX, with or without intervening DEL codes, alerts the line control unit that the transmission contains a multiple message and that preparation should be made for another set of message addresses. Multiple messages reduce poll and connect time.

Addresses — There must be a separate address for each destination terminal. The exact form of the address and the amount of information that can accompany it is a characteristic of the system and a function of the capacity of the line control unit. Whatever characteristics are applied to the address as it is sent, it must be in the form of a 7-bit station code character in order to select a destination terminal. Each terminal is addressed on the basis of the 7-bit station code character that is determined by a switch setting in the terminal. Each terminal on a common line must have a unique station code character switch setting.

Start of Text (STX) — The Start of Text (STX) code (002_8) separates the heading from the text. It signals the end of the heading and the beginning of the text. It is an optional code that is functional only if the STOP on STX Enable/Disable switch option is employed.

Message Text — The message is anything the sender wants it to be. There are no restrictions on its length other than the physical capacity of the device that is supposed to contain it as it is prepared.

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*An STX code is not an unconditional requirement. See following Start of Text (STX) paragraph for conditions.

End of Text (ETX) — The End of Text (ETX) code (003_8) signifies the end of the text of a single message. Ordinarily the sender of the message appends the ETX to the message text proper, but if no further data exists in display memory or on the tape cassette, an ETX will automatically be transmitted upon encountering the end of page or the end of tape. When a message is terminated in this manner, an EOT is also automatically appended.

To send multiple messages in the same poll, an SOH code is placed immediately after the ETX. This alerts the line control unit to prepare for another set of addresses for another message text.

End of Transmission (EOT) — An End of Transmission (EOT) code (004_8) signals the line control unit to disconnect and resume polling. The EOT code is automatically sent following an ETX code if neither an SOH code nor a DEL (rub out) code follows the ETX. If the sender enters an EOT code without an ETX code preceding it, the terminal automatically transmits an ETX-EOT sequence, but it causes an alarm condition at the sending terminal. The ALERT indicator is lit and the message TRANSMISSION ERROR is displayed.

Operating Modes and Conditions

In operation, the terminal with the multidrop option installed can be in any one of four conditions or modes at any time. These are: the idle condition, poll mode, test poll mode, and call-in mode.

Idle Condition

A terminal is considered to be in the idle condition if it is not selected to either send or receive, it is not in either local test mode or loopback test mode, and no test poll is in progress. A terminal enters idle mode upon the application of primary power and upon actuation of the MASTER CLEAR switch. Because an operating terminal may not exit the idle condition except to enter poll, test poll, or call-in mode, it is not responsive to any line data except that which will place it in one of these other operating modes.

Poll Mode

The task of the line control unit is to poll terminals in search of traffic to send and, when such traffic is found, to route it to the appropriate receivers that it calls in. Poll mode is the condition of those terminals that are being questioned concerning the presence of traffic to send or are in the process of transmitting traffic subsequent to such a query.

The line control unit does the polling one line at a time. When it issues a DLE to a line, each terminal on that line is placed into poll mode. As the station code character for each terminal is sent out on the line, the corresponding terminal issues a reply based on the presence or absence of traffic to send or on the condition in which the previous message was received.

Traffic-to-Send Response — Transmission by the polled terminal of any one of the three switch-selectable traffic-to-send responses indicates that the terminal has assumed the selected-to-send state.

The first response is automatic starting of message transmission beginning with the SOH character. As soon as the SOH is sent out on the line, all the other terminals on the line exit poll mode and enter the idle condition.

The second response is an ACK (006_8) code, and the third is the station identity code of that terminal. When these responses are made, the terminal stops transmission after the response and does not resume transmission until the line control unit issues an STX (002_8) code to it. The terminal then resumes transmission, beginning with its SOH which takes all the other terminals on the line out of poll mode.

No-Traffic-to-Send Response — A response from a polled terminal of a single NAK (025_8) code indicates that the terminal has no traffic to send.

Message-Improperly-Received Response — A polled terminal responds with a single CAN (030_8) code to indicate that the immediately preceding transmission was incorrectly received. The CAN response is given only once in response to a poll, call in, test poll, or roll call following an error. A second poll of the terminal is required to ascertain the readiness of the terminal to transmit. The possible reasons for a CAN response are:

- A parity error was detected while the terminal was selected.
- The terminal detected an EOT or DLE before detecting an ETX when the terminal was in call-in mode.
- The terminal detected the universal alarm sequence ENQ-EOT when the terminal was in call-in mode.
- The terminal detected an ETX while in call-in mode and blinded.
- The tape cassette or printer went not ready while the terminal was in call-in mode and unblinded.
- All devices initially online were switched to offline (local) when the terminal was in call-in mode and unblinded.

Termination of Poll Mode — An entire line is placed into poll mode with the sending of a DLE. When the DLE is sent, all the terminals on that line are in poll mode. Termination of poll mode may be made on the basis of the entire line, or on the basis of all but the selected sending terminal, depending on the method used. Poll mode is terminated by the following conditions:

- An EOT sent over the line. This method places all terminals on the line into the idle condition.
- An ENQ sent over the line. The ENQ blinds every terminal on the line and takes all but the selected sending terminal out of poll mode and alerts them to watch for the station code character that will call them in. After all the selected receiving terminals have been called in, a universal unblind sequence unblinds all the selected receiving terminals to copy the text of the message. The universal unblind sequence also unblinds the selected sending terminal so that it can copy the text it sends.
- An SOH sent out by the selected sending station. Either as a response to the poll or as the next character, the selected sending station must send an SOH. Sending this SOH takes every other terminal on the line out of poll mode and into idle condition.

Test Poll Mode

Test poll mode is a condition to which the terminals on a line can be brought by the line control unit issuing an ENQ-EOT-DLE sequence to an idle line. The test poll can determine whether a terminal is ready to send or ready to receive, but not both, and it can determine if the last transmission was properly received. A switch determines whether the inquiry shall send or receive status. The test poll initiates neither transmission nor reception of a message; it merely surveys. The test poll routine can be terminated with either an EOT or a DLE. The EOT returns the line to an idle condition, and the DLE initiates poll mode.

The responses that each terminal can make after being addressed with its station code character are ready to receive, ready to transmit, not ready to receive, not ready to transmit, and message improperly received.

Ready-to-Receive Response — The ready-to-receive response to a test poll is the ACK or station identity code, depending on the setting of a switch. This response indicates that the display is online and that the SEND key has not been pressed; or that the printer is online and ready; or that the tape cassette is online, set to write, and ready; or a combination of these conditions.

Ready-to-Transmit Response — If the switch is set to select the transmit status, the ready-to-transmit response is the ACK or station identity code, the same as the previous response. In this instance, the response indicates that the display is online and that the SEND key has been pressed; or that the tape cassette is online and set to read and that the READ TAPE key has been pressed.

Not-Ready-to-Receive Response — If the switch is set to select receive status, a NAK response indicates that the display and any peripherals are offline; that the display is online, but the SEND key has been pressed; that the peripherals are not ready; or that the tape cassette, if ready, is not set to write.

Not-Ready-to-Transmit Response — If the switch is set to select transmit status, a NAK response indicates that neither the SEND key nor the READ TAPE key has been pressed.

Message-Improperly-Received Response — Just as in the poll mode response, a CAN response indicates that the previous transmission was incorrectly received. The reasons are exactly the same as those in the Poll Mode paragraph.

Call-In Mode

Call-in mode is the mode that results from calling in intended receivers of a message. When the line control unit has received the addresses of the intended receivers from the selected sending terminal, it issues the sequence ENQ-station code character on the line. This sequence selects and unblinds the terminal that has the address given by the station code character. It blinds every other terminal on the line, including the selected sending terminal, if it is on that line. The terminal selected is expected to give a response that will indicate that it is ready to receive, not ready to receive, or previous message incorrectly received.

When the line control unit is satisfied with the response from the selected receiving terminal, it proceeds to select another, if it must, by issuing another ENQ-station code character sequence. By unblinding the one it selects, it blinds the one it previously selected. This procedure continues until all of the intended receivers are in call-in mode. The line control unit then issues a universal unblind sequence, ENQ-DC2, that unblinds all the selected receivers as well as the selected sending terminal. The line control unit can then issue an STX on the line that will cause the selected sending terminal to begin transmission of the message text.

Ready-to-Receive Response — An ACK or the station identity code, depending upon the setting of an internal switch, is the ready-to-receive response. It indicates that the display, the printer, either tape cassette, or any combination thereof are online and that, if only a peripheral is online, it is ready. With the sending of the ACK or station identity code response, the terminal becomes a selected receiving terminal, and it is actually at this time that it becomes unblinded. As a selected receiving terminal, the CHAR, LINE, and BLOCK indicators are all lit to evidence the call-in mode. A condition causing either the active tape cassette or the printer to become not ready while the terminal is unblinded will cause the alarm to sound, the ALERT indicator to light, and the next status response to the line control unit to be the error response (message-incorrectly-received response). The ALERT indicator may be extinguished by pressing the BREAK key and either clearing the fault on the affected peripheral or placing that peripheral offline.

Not-Ready-to-Receive Response — A NAK is the not-ready-to-receive response. This response is given if neither the display nor any of the other terminal devices is online, or if both any printer or cassette are online but not ready. Upon transmission of the NAK, the terminal reverts to the idle condition, the ALERT indicator lights, and the alarm sounds for 200 milliseconds. The ALERT indicator may be extinguished by pressing the BREAK key. It is automatically extinguished upon receipt of a subsequent call to which the terminal responds in a positive manner.

If the NAK response arose because the printer was online but not ready, the message CHECK PRINTER appears in the lower-right corner of the display. If the NAK response arose because either tape cassette was online but not ready, the message CHECK TAPE appears in the lower-right corner of the display. If both devices were online but not ready, only the printer message appears. Either of these messages is in addition to the previous indications that accompany a NAK response.

Message-Incorrectly-Received Response — A CAN code is the response to indicate that the previous message was incorrectly received. Reasons are the same as those in the Poll Mode paragraph.

Roll Call — Roll call is a procedure used by the line control unit to determine if messages were properly received. It can be used only on those terminals that are in call-in mode, and only after the ETX from a message has been sent out over the line. At that time, the line control unit can issue an ENQ-station code character sequence as an inquiry to determine whether or not the message text was properly received, questioning each receiving terminal in turn.

A CAN response is made if an error was detected in the received message. Following the transmission of this code, the terminal is returned to an idle condition.

A NAK response is made if the device or devices selected to copy were placed offline while blinded following message termination. The terminal is returned to an idle condition following transmission of this code.

An ACK or the station identity code response is made if the message was properly received. The terminal is in call-in mode, unblinded, following the transmission of this response. All other called-in terminals are blinded by the roll call.

Termination of Call-In Mode — Call-in mode is terminated by the following message sequences.

- A CAN or NAK response to an ENQ-station code character sequence, whether call-in or roll call. The terminal is returned to an idle condition.
- An ETX-EOT sequence. The terminal is returned to an idle condition.
- An ETX-DLE sequence. The terminal is placed into poll mode.

Operating and Maintenance Techniques

There are several operating and maintenance techniques that are a part of the protocol. These are the universal unblind sequence, the alarm sequence, the emergency stop technique, the turnaround technique, and loop back mode.

Universal Unblind Sequence

The universal unblind sequence is ENQ-DC2. This sequence, when received by a terminal that is selected to receive or send, causes the terminal to unblind. Any terminal that is selected to receive copies all data received and performs control functions as issued. The terminal that is selected to send copies all data received or transmitted if a device not selected to transmit is available to copy the data; the device that is the data source does not copy received or transmitted data.

Alarm Sequence

The alarm sequence is ENQ-EOT. This sequence, when received by a terminal that is selected to receive, lights the ALERT indicator, momentarily sounds the alarm, and causes a CAN response to the next message.

Emergency Stop Technique

Emergency stop is a technique that permits the line control unit to stop the transmission in progress in the event that message heading errors or other irregularities are encountered during system operation. The format of the emergency stop sequence is as shown in figure 2-5.

Break-Pause-ENQ-DC2-Service Message-ENQ-EOT-EOT

Figure 2-5. Emergency Stop Sequence

The Break signal may be a spacing signal on the primary data line for a period greater than one character time or, as determined by an internal switch, may be a loss of carrier on the secondary channel for the sending station only, or it may be a combination of both conditions. The Break signal will halt the transmitter and blind both the sending and receiving terminals.

Following the Break signal, a one-character-time pause of steady marking is required to allow the terminals to resynchronize internal timing.

The ENQ-DC2 universal unblind code sequence causes all selected terminals to copy received data on any device that is online and ready and not selected to transmit.

Following the unblind sequence, a service message may be sent.

The ENQ-EOT alarm sequence lights the ALERT indicator and sounds the alarm. The alarm sequence is treated as an ETX when received, so a subsequent EOT does not produce an error condition for lack of an ETX.

The final EOT code is the command to assume the idle condition. A DLE code may be transmitted to the terminals in place of the EOT to put all the selected stations in test poll mode.

In the event that the service message is not used, the unblind sequence ENQ-DC2 is unnecessary. The format of the emergency stop then is as shown in figure 2-6.

Break-Pause-ENQ-EOT-EOT

Figure 2-6. Shortened Emergency Stop Sequence

Turnaround Technique

The turnaround technique is identical to the emergency stop technique except that an alarm sequence is not employed. The format of turnaround is as shown in figure 2-7.

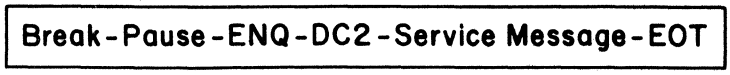

Figure 2-7. Turnaround Sequence

Because there is no alarm sequence, a part of the service message must be a final ETX. If it is not present, the transmission will be considered to be improperly received.

Again, the unblind sequence ENQ-DC2 is not necessary if there is no service message. In this case, the proper format is as shown in figure 2-8.

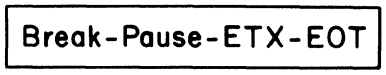

Figure 2-8. Shortened Turnaround Sequence

The turnaround technique is useful to make sure that a line is inactive when there is no particular reason to presume that it is not. In such an instance, there is no need to alert the terminals on the line that there is anything wrong or that there is any action that should be taken. It merely provides a line that is truly idle.

Loop Back Mode

Loop back is an operating mode in which the terminal responds to control sequences (polling, call-in, etc.) in the normal manner, but echoes back to the line all data received when selected to receive and unblinded. This mode is intended for test purposes only.

The terminal enters loop back mode and call-in mode simultaneously upon receipt of the ENQ-station code character sequence anytime after receiving an ENQ-EOT sequence, but before receiving an EOT or a DLE.

The terminal exits loop back mode upon receipt of an emergency stop or turnaround sequence, or upon receipt of one of the following:

- Break-Pause-EOT: Returns the terminal to an idle condition.
- Break-Pause-ENQ-EOT-DLE: Causes terminal to assume test poll mode.

Alarms and Error Messages

Alarms and error messages are used to notify the operator of a terminal that things are not quite right or that an operator action is required. These fall into the categories of operator alert conditions, alarm conditions, and local error messages.

Operator Alert Conditions

The ALERT indicator lights under any of the following conditions.

- Receipt of an emergency stop sequence.
- A NAK response to a call-in sequence.
- The selected sending device (display or tape cassette) is placed in local mode prior to completing a transmission.
- A tape error, parity error, or unrecognized character is detected.
- The tape cassette goes not ready while online and actively writing data.
- An ACK, NAK, ENQ, or DLE code is detected in the data stream.
- Receipt of an alarm sequence from the line control unit.
- The BREAK key is pressed while a message is being transmitted.
- The printer goes not ready while actively printing data online.

In all cases, the indicator can be extinguished by pressing the BREAK key. Alternatively, the indicator is always extinguished upon entry into call-in mode.

Alarm Conditions

The display terminal's audible alarm is sounded for approximately 250 milliseconds for each of the conditions listed in the Operator Alert Conditions paragraph.

Local Error Messages

In addition to the ALERT indicator lighting and the alarm sounding, the terminal displays messages on the screen to indicate error or malfunction. These messages are written in the extreme lower-right corner of the screen and replace any data that might be stored in these locations. The last character of each message is written in the last character position of the display. These messages are the tape error message, the check tape message, the check printer message, and the transmit error message.

Tape Error Message — The message TAPE ERROR appears in the lower-right corner of the screen to indicate that the terminal has detected an error in the data currently being transferred from the active tape cassette. The possible errors that would cause this message to appear are:

- Word parity error
- Internal control character not valid or detected out of sequence
- Physical record length error

None of these errors causes the terminal to stop the data transfer.

Check Tape Message — The message CHECK TAPE appears in the lower-right corner of the screen to indicate that the tape cassette selected to record data is not ready. The message appears if either cassette is online, set to record, and any status request is made by the line control unit. The conditions that would cause this message to appear are:

- End of tape has been detected
- No cassette is in the drive
- The cassette has the write tabs removed
- Power is off on the cassette drive

The terminal does not attempt to record data if a tape not ready condition exists. If the tape was recording data originating at the display, the data transfer is halted. If online, the message is terminated.

Check Printer Message — The message CHECK PRINTER appears in the lower-right corner of the screen to indicate that the data terminal ready circuit from the active printer to the display has gone to an off condition. Loss of the data terminal ready on the active printer will cause the terminal to halt the data transfer and, if online, to terminate the message.

Transmit Error Message — The message TRANSMIT ERROR appears in the lower-right corner of the screen to indicate one of the following:

- The device selected to transmit has been switched to local mode
- The BREAK key has been pressed during the transmission
- An ACK, NAK, ENQ, or DLE was detected in the transmitted data stream

Any of these conditions will terminate transmission.

SWITCHES

There are switches on the multidrop board that are set for each installation. There are also switch settings on the terminal that must be made in order for the option to operate.

Multidrop Board Switches

There are 16 switches (two banks of eight switches each) on the multidrop board. These switches are described in the following paragraphs.

Station Code Character-Station Identity Code Selector Switch

In this application, the station code character and the station identity code are identical. They are set by seven of the rocker switches on one 8-bit bank. The switch corresponding to bit 2^7 is not used. Any printable ASCII code is appropriate, and there may be as many as 128 separate address codes on one line.

Unblind On SOH Enable/Disable Switch

If the Unblind On SOH Enable/Disable switch is in the Enable position the sending terminal, upon having been polled and transmitting an SOH code, becomes automatically unblinded. It then copies all data transmitted following the SOH code, provided that a device other than the device actively transmitting is online and ready. If no copying device is online and ready a NAK response is made to the poll, and the ALERT indicator lights. If the Unblind On SOH Enable/Disable switch is in the Disable position, the terminal continues to transmit data after transmitting an SOH code and does not copy the data as transmitted.

Stop On SOH Enable/Disable Switch

If the Stop On SOH Enable/Disable switch is in the Enable position, the sending terminal will stop transmission immediately following the SOH code. The transmission will continue upon receipt of an STX code from the line control unit. In the Disable position, transmission of the SOH code will not cause the transmission to halt.

Stop On STX Enable/Disable Switch

If the Stop On STX Enable/Disable switch is in the Enable position, the sending terminal will stop transmission immediately following transmission of an STX code. The terminal will resume transmission upon receipt of an STX code. In the Disable position, the STX code has no effect on the transmitted message.

Stop On ETX Enable/Disable Switch

If the Stop On ETX Enable/Disable switch is in the Enable position, the sending terminal will stop transmission immediately following transmission of an ETX code. Transmission will be resumed upon receipt of an STX code. In the Disable position, transmission of the message will not be interrupted upon encountering an ETX code.

Station Identity Code Response Enable/Disable Switch

If the Station Identity Code Response Enable/Disable switch is placed in the Enable position, the positive response given by the terminal is the selected station identity code as opposed to an ACK code. In the Disable position, the ACK code is used as a positive response.

Test Poll Response, Ready to Send/Ready to Receive Switch

If the Test Poll Response selection switch is set to Ready to Send, the terminal will return a positive response to a test poll if a message has been prepared by the operator, the SEND or READ TAPE key has been actuated, and the sending device is online and ready.

If the Test Poll Response switch is set to Ready to Receive, the terminal will respond in a positive manner if a device in the terminal subsystem is prepared to receive data.

Switched Carrier Enable/Disable Switch

If the Switched Carrier Enable/Disable switch is in the Enable position, the terminal will check the carrier received signal prior to activating Request to Send. If the received carrier is present, the terminal will not activate Request to Send until the received carrier is off. In the Disable position, the received carrier is not tested prior to activating Request to Send.

Poll Acknowledge Enable/Disable Switch

If the Poll Acknowledge Enable/Disable switch is placed in the Enable position, the terminal will respond to a poll message with either an ACK or station identity code (determined by Station Identity Code Response Enable/Disable switch when in the Enable position) prior to transmitting a message if the SEND or READ TAPE key has been actuated. Following transmission of the ACK or station identity code, the terminal will stop transmission until an STX code is received from the line control unit. Following receipt of the STX, the terminal will transmit the SOH code followed by the message text. If the Poll Acknowledge Enable/Disable switch is in the Disable position, the terminal will respond to a poll message with the SOH code followed by the message text.

Terminal Switch Settings

The basic terminal switch configuration must be as follows for proper operation of the multidrop option:

Switch	Setting
Parity	As system requires
64 CHAR/96 CHAR	As system requires
EOT Disconnect Enable/Disable	Disable
Baud Rate Selection	As system requires
Enable ETX Termination	Disable
Enable EOT Termination	Enable
Enable Transfer Termination Code	Enable
Batch Mode	Disable
Enable Communications Circuit Assurance Feature	As system requires
Constant Data Terminal Ready	Enable
Select Background Character	As system requires
Scroll Enable/Disable	Disable
Auto Print (Printer Option)	Disable

TERMINAL CONFIGURATION TEST OF TEST MODE

The last test in test mode is a display of eight hexadecimal digits (four groups of two) that reflect the states of the internal and external switches and the presence or absence of options. These digits appear in the upper-left part of the screen and are arranged logically as follows: aa bb cc dd.

Each group of two represents eight status bits as follows:

Group	Bit	Status	Active Level
aa	2^0	Character Mode *	1
	2^1	Block Mode *	1
	2^2	Full Duplex	1
	2^3	Printer Option Present	0
	2^4	Edit Feature Present	0
	2^5	Not Used	0
	2^6	FORMAT Switch Set to FORMAT	1
	2^7	On Line	1

* Line mode is represented by both 2^0 and 2^1 at a 1 value.

Group	Bit	Status	Active Level
bb	2^0	Constant Request to Send Enabled	1
	2^1	Scroll Mode Enabled	1
	2^2	Batch Mode Selected	1
	2^3	Multidrop Option Present	0
	2^4	Answerback Option Present	0
	2^5	1920-Character Memory Present	0
	2^6	Enable Communication Circuit Assurance Feature Switch Enabled	1
	2^7	Null Background Character Enabled	1
cc	2^0	Enable ETX Termination	1
	2^1	Enable EOT Termination	1
	2^2	Enable EOT Disconnect	1
	2^3	Maintenance Mode (Answerback Option)	0
	2^4	Enable Constant DTR	0
	2^5	Enable X-Y Positioning	1
	2^6	Enable Transmit Protected Fields	1
	2^7	Enable Transmit Termination Code	1
dd	2^0	Print On Line	1
	2^1	Print Local	1
	2^2	Test Mode	1
	2^3	Not Used	0
	2^4	Not Used	0
	2^5	Not Used	0
	2^6	Cassette or Paging Option Present	0
	2^7	Auto Print	0

MODEM CONNECTOR PIN ASSIGNMENTS

Table 2-4 lists modem connector pin assignments.

TABLE 2-4. MODEM CONNECTOR PIN ASSIGNMENTS

DATA SET CONNECTOR PIN NUMBER	CCITT MODEM CIRCUIT	EIA MODEM CIRCUIT	SIGNAL NAME	ORIGIN
1	101	AA	Protective Ground	Modem/Terminal
2	103	BA	Transmitted Data	Terminal
3	104	BB	Received Data	Modem
4	105	CA	Request to Send (RTS)	Terminal
5	106	CB	Clear to Send (CTS)	Modem
6	107	CC	Data Set Ready (DSR)	Modem
7	102	AB	Signal Ground	Modem/Terminal
8	109	CF	Received Line Signal Detector (CO)	Modem
9			Unused	
10			Unused	
11			Unused	
12	122	SCF	Secondary Received Line Signal Detector (SCO)	Modem
13	121	SCB	Secondary Clear to Send (SCTS)	Not Used
14	118	SBA	Secondary Transmitted Data	Not Used
15	114	DB	Transmission Signal Element Timing	Not Used
16	119	SBB	Secondary Received Data	Not Used
17	115	DD	Receiver Signal Element Timing	Not Used
18			Unused	
19	120	SCA	Secondary Request to Send (SRTS)	Terminal
20	108	CD	Data Terminal Ready (DTR)	Terminal
21	110	CG	Signal Quality Detector	Not Used
22	135	CE	Ring Indicator	Not Used
23	111/112	CH/CI	Data Signal Rate Indicator	Not Used
24	113	DA	Transmit Signal Element Timing	Not Used
25			Unused	

The terminal transmits and receives the 7-bit, 128-character ASCII set. For convenience, the set is grouped into control characters, shown in table 3-1, and alphanumeric characters, shown in table 3-2. In the tables, b1 represents the least significant bit position, and b7 represents the most significant bit position.

TABLE 3-1. CONTROL CHARACTER CODES

b7 → b6 → b5 → / Bits ↓					0 0 0	0 0 1	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → / ROW ↓	0	1	
0	0	0	0	0	NUL	DLE	
0	0	0	1	1	SOH	DC1	
0	0	1	0	2	STX	DC2	
0	0	1	1	3	ETX	DC3	
0	1	0	0	4	EOT	DC4	
0	1	0	1	5	ENQ	NAK	
0	1	1	0	6	ACK	SYN	
0	1	1	1	7	BEL	ETB	
1	0	0	0	8	BS	CAN	
1	0	0	1	9	HT	EM	
1	0	1	0	10	LF	SUB	
1	0	1	1	11	VT	ESC	
1	1	0	0	12	FF	FS	
1	1	0	1	13	CR	GS	
1	1	1	0	14	SO	RS	
1	1	1	1	15	SI	US	DEL

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The alphanumeric set is composed of alphabetic characters, numerals, punctuation, and special characters. If the 64-character set is used, the last two columns are not available for transmission but are recognized when received.

TABLE 3-2. ALPHANUMERIC CHARACTER CODES

Bits b_4	b_3	b_2	b_1	ROW / COLUMN	b_7 b_6 b_5 = 0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
					2	3	4	5	6	7
0	0	0	0	0	SP	0	@	P	`	p
0	0	0	1	1	!	1	A	Q	a	q
0	0	1	0	2	"	2	B	R	b	r
0	0	1	1	3	#	3	C	S	c	s
0	1	0	0	4	$	4	D	T	d	t
0	1	0	1	5	%	5	E	U	e	u
0	1	1	0	6	&	6	F	V	f	v
0	1	1	1	7	'	7	G	W	g	w
1	0	0	0	8	(	8	H	X	h	x
1	0	0	1	9	)	9	I	Y	i	y
1	0	1	0	10	*	:	J	Z	j	z
1	0	1	1	11	+	;	K	[	k	{
1	1	0	0	12	,	<	L	\	l	¦
1	1	0	1	13	-	=	M	]	m	}
1	1	1	0	14	.	>	N	^	n	~
1	1	1	1	15	/	?	O	_	o	

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Table 3-3 lists the action taken by the display upon receipt of any of the control codes. Without exception, alphanumeric codes are stored and displayed as received. If a printer is associated with the display, the alphanumeric codes may also be printed depending upon the character repertoire of the printer.

The audible alarm caused by receipt of the BEL (007_8) code sounds the alarm for 200 to 250 milliseconds.

NOTE

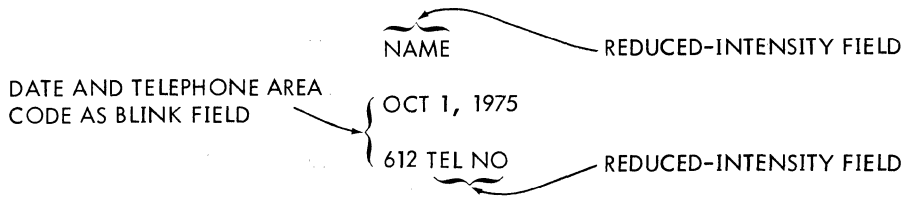
Table 3-3 cannot adequately explain variations caused by settings of all internal and external switches. See section 2 for switch setting details.

TYPICAL PROGRAMMING SEQUENCES 4

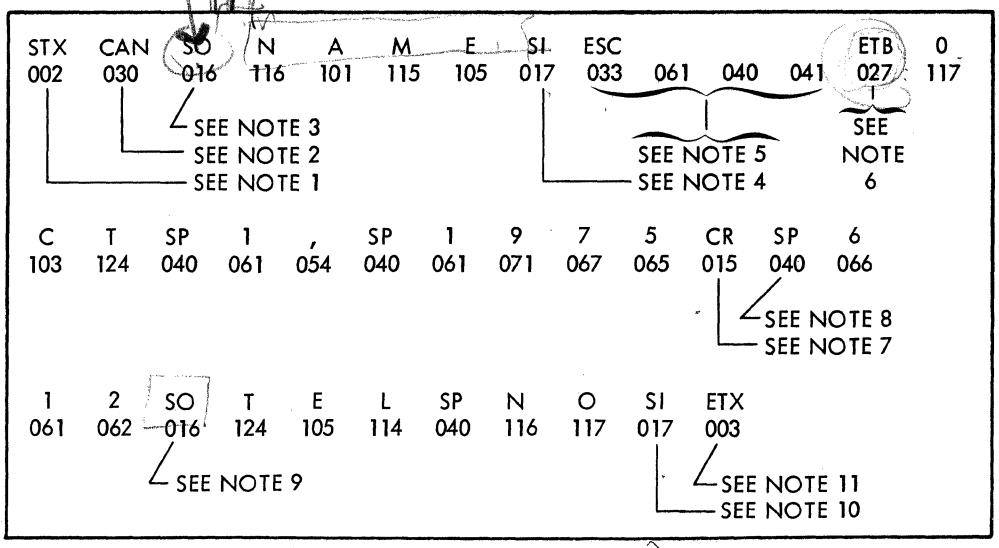
As an example of a programming sequence, consider the case of a receiving terminal with switches set as follows:

Switch	Setting
FORMAT	FORMAT
ON LINE/LOCAL	ON LINE
Enable Transmit Protected Fields	Disable
Select Background Character	Null
Enable X-Y Positioning	Enable
Enable ETX Termination	Enable
Scroll Enable/Disable	Disable

The following formatted message composed of blink fields and reduced-intensity fields is to be transmitted to the terminal. It is to be displayed in the upper-left corner of the screen.



To enter this formatted message on the screen requires the code sequence shown in figure 4-1. All codes are in 7-bit octal.



Note 1: The initial STX is required to alter anything that might already be formatted and to create new blink and reduced-intensity fields. The STX locks the keyboard and changes the receiving mode from format to block. Without an STX, the terminal remains in format mode, and messages can write only between protected fields. In this instance, the STX is stored and permits the next code to clear the screen, even of old formatted data. (See the paragraphs entitled Format Mode in section 1 and Format Switch in section 2.)

Note 2: The CAN code completely clears the screen and leaves the cursor in the upper-left corner. It even clears the STX that enabled it to clear. The upper-left corner is the home position for the cursor in block mode when the scroll feature is disabled.

Note 3: The SO code determines that whatever follows it is to be a reduced-intensity protected field. In this instance, the letters N A M E are displayed at reduced intensity beginning at the second position of the first line. The stored SO occupies the first position of the first line.

Note 4: The SI code terminates the reduced-intensity field, or any protected field, for that matter.

Note 5: The four-character escape sequence positions the cursor at the first position of line 2. Because the 061_8 follows the ESC code, the next two bytes are interpreted as X and Y coordinates, respectively. The first byte, 040_8, shows that the X position is position 0, the first position. The next byte, 041_8, shows that the Y position is line 0+1, or the second line. Both X and Y coordinates have a positive bias of 40_8. See note 8. (For a discussion of this feature, see paragraph entitled Enable X-Y Positioning Switch in section 2.)

Note 6: The ETB code occupies the first position of the second line. This code determines that whatever succeeds it shall be displayed as a blinking field. In this case, the date that begins in the second position of the line is blinking.

Note 7: The CR (carriage return) code places the cursor at the first position of the next line. This is another method of achieving what was accomplished with the X-Y positioning scheme described in note 5. The CR method is more useful when the cursor is to be moved to the first position of the following line. The X-Y positioning technique is more useful when the cursor is to be moved to something other than the first position or to a line other than the next succeeding line.

It should also be noted that by continuing the blink field on the next line using a CR, the remainder of the line in which the CR appears is also a blink field, even though there is nothing further in it to blink.

Note 8: NAME in the first line begins in the second position. The SO code has the first position. The date in the second line begins in the second position. The ETB code has the first position. To start the 612 in the second position, a space code moves the cursor from the first position of the third line where the CR placed it.

Note 9: The SO code here terminates the blink field and initiates the reduced-intensity field.

Note 10: The SI code terminates any protected field, in this case the reduced-intensity field that contains TEL NO.

Note 11: The ETX code terminates the message, unlocks the keyboard, and returns the terminal to format mode. The ETX code is stored. The Enable ETX Termination switch in this instance is set to Enable.

Figure 4-1. Code Sequence

TABLE 3-3. ACTION TAKEN UPON RECEIPT OF ASCII CONTROL CODES

ASCII CODE	EQUIVALENT OCTAL	EQUIVALENT HEX	BATCH MODE	CHARACTER MODE	LINE MODE	BLOCK MODE	FORMAT MODE
NUL	000	00	Idle	Idle	Idle	Idle	Idle
SOH	001	01	Idle	Idle	Idle	Idle	Idle
STX	002	02	Display Keyboard	Idle	Idle	Disable Keyboard	Disable Keyboard ①
ETX ②	003	03	Store	Idle ③	Idle ③	Store, Enable Keyboard ④	Store, Enable Keyboard ④
EOT	004	04	Enable Keyboard	Idle, Disconnect, Enable Keyboard ④ ⑤	Idle, Disconnect, Enable Keyboard ④ ⑤	Idle, Disconnect, Enable Keyboard ④ ⑤	Idle, Disconnect Enable Keyboard ④ ⑤
ENQ	005	05	Idle	Idle ⑥	Idle ⑥	Idle ⑥	Idle ⑥
ACK	006	06	Idle	Idle	Idle	Idle	Idle
BEL	007	07	Audible Alarm	Audible Alarm	Audible Alarm	Audible Alarm	Audible Alarm
BS	010	08	Backspace	Backspace	Backspace	Backspace	Backspace
HT	011	09	Idle	Idle	Idle	Forward Tab to SI	Forward Tab to SI
LF	012	0A	Line Feed	Line Feed	Line Feed	Line Feed	New Line
VT	013	0B	Idle	Idle	Idle	Idle	Idle
FF	014	0C	Idle	Idle	Idle	Idle	Idle
CR ⑦	015	0D	Carriage Return	Carriage Return	Carriage Return	Store and Carriage Return	Store and Carriage Return
SO	016	0E	Idle	Store, Begin Reduced Intensity	Store, Begin Reduced Intensity	Store, Begin Reduced Intensity	Idle
SI	017	0F	Idle	Store, End Tab, End Blink, or Reduced Intensity	Store, End Tab, End Blink, or Reduced Intensity	Store, End Tab, End Blink, or Reduced Intensity	Store, End Tab, End Blink, or Reduced Intensity
DLE	020	10	Idle	Idle	Idle	Idle	Idle
DC1	021	11	Idle	Initiate Tape Read	Initiate Tape Read	Initiate Tape Read	Initiate Tape Read
DC2	022	12	Idle	Initiate Tape Write	Initiate Tape Write	Initiate Tape Write	Initiate Tape Write
DC3	023	13	Idle	Stop Tape Read	Stop Tape Read	Stop Tape Read	Stop Tape Read
DC4	024	14	Idle	Stop Tape Write	Stop Tape Write	Stop Tape Write	Stop Tape Write
NAK	025	15	Skip	Skip	Skip	Skip	Skip
SYN	026	16	Line Clear	Idle	Idle	Idle	Idle
ETB	027	17	Idle	Store, Begin Blink Field	Store, Begin Blink Field	Store, Begin Blink Field	Idle
CAN	030	18	Clear Screen	Clear Screen	Clear Screen	Clear Screen	Clear Screen
EM	031	19	Reset	Reset	Reset	Reset	Reset
SUB	032	1A	Move Cursor Up	Move Cursor Up	Move Cursor Up	Move Cursor Up	Move Cursor Up
ESC	033	1B	Begin Escape Sequence Processing ⑧	Begin Escape Sequence Processing ⑧	Begin Escape Sequence Processing ⑧	Begin Escape Sequence Processing ⑧	Begin Escape Sequence Processing ⑧
FS	034	1C	Idle	Idle	Idle	Idle	Idle
GS	035	1D	Idle	Idle	Idle	Idle	Idle
RS	036	1E	Idle	Idle	Idle	Idle	Idle
US	037	1F	Idle	Idle	Idle	Idle	Idle
DEL	177	7F	Store and Display	Idle	Idle	Idle	Idle

① Receipt of an STX actually takes the terminal out of format mode and puts it into block mode in which protected fields no longer exist. The terminal is returned to format mode upon receipt of an ETX or EOT termination code.

② If enabled, an ETX autoprint operates in all modes.

③ If it is not an ETX autoprint.

④ In block, or format mode, an ETX or EOT used as a termination code enables the keyboard and, in block mode, puts the terminal into format mode if the FORMAT switch is in the FORMAT position.

⑤ An EOT is an idle code only if it is neither a termination code nor a disconnect code.

⑥ If the answerback option is present, the ENQ (005_8) code initiates an answerback sequence.

⑦ Carriage return means no more than a return of the cursor to the left margin. It does not mean a line feed as well.

⑧ The escape sequence processing may be X-Y positioning, if the switch is set to enable it, or an unconditional autoprint.

Note: Cursor control keys will be allowed to wrap around the end of line or page. Cursor right or down out of the bottom line in scroll mode will cause the screen to scroll. Cursor up from the first line will cause the cursor to be positioned to the bottom line. A backspace operation from the first character position of any line will cause the cursor to be positioned to the last position of the previous line.

Transmission is 10 bits in all baud rates except 110 baud in which it is 11 bits by the addition of another stop bit. Transmission of bits is in the following sequence regardless of whether transmission is to or from the terminal.

Start (space) bit

Data bit 2^0

Data bit 2^1

Data bit 2^2

Data bit 2^3

Data bit 2^4

Data bit 2^5

Data bit 2^6

Parity bit

Stop (mark) bit

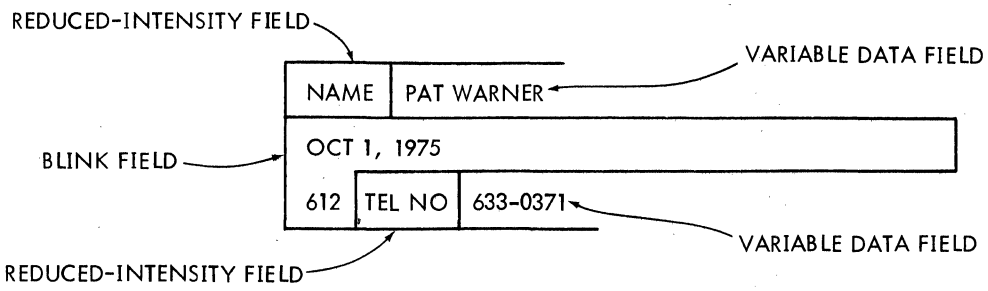
Stop (mark) bit (used only in 110-baud transmission)

All data or control transmission, whether to the modem or to any peripheral device, is according to the RS-232-C Communication Standard.

The message is now on the screen and the cursor is three positions beyond the O in TEL NO. The operator presses the RESET key and the cursor skips to the upper-left corner of the screen, avoids the protected-field NAME, and comes to rest two positions beyond the E in NAME. The operator types in the name, PAT WARNER, and hits the TAB key. The TAB key positions the cursor at the position following the SI code, two positions past the O in TEL NO. At this point the operator enters the telephone number, 633-0371, overwriting the ETX code with the 6.

The response to the formatted message is ready to send. The operator sends the response by pressing the SEND key. Inasmuch as the Enable Transmit Protected Fields switch was set to Disable, the blink fields and variable data fields are to be transmitted, but the reduced-intensity fields are not.

The contents of the screen appear as follows:

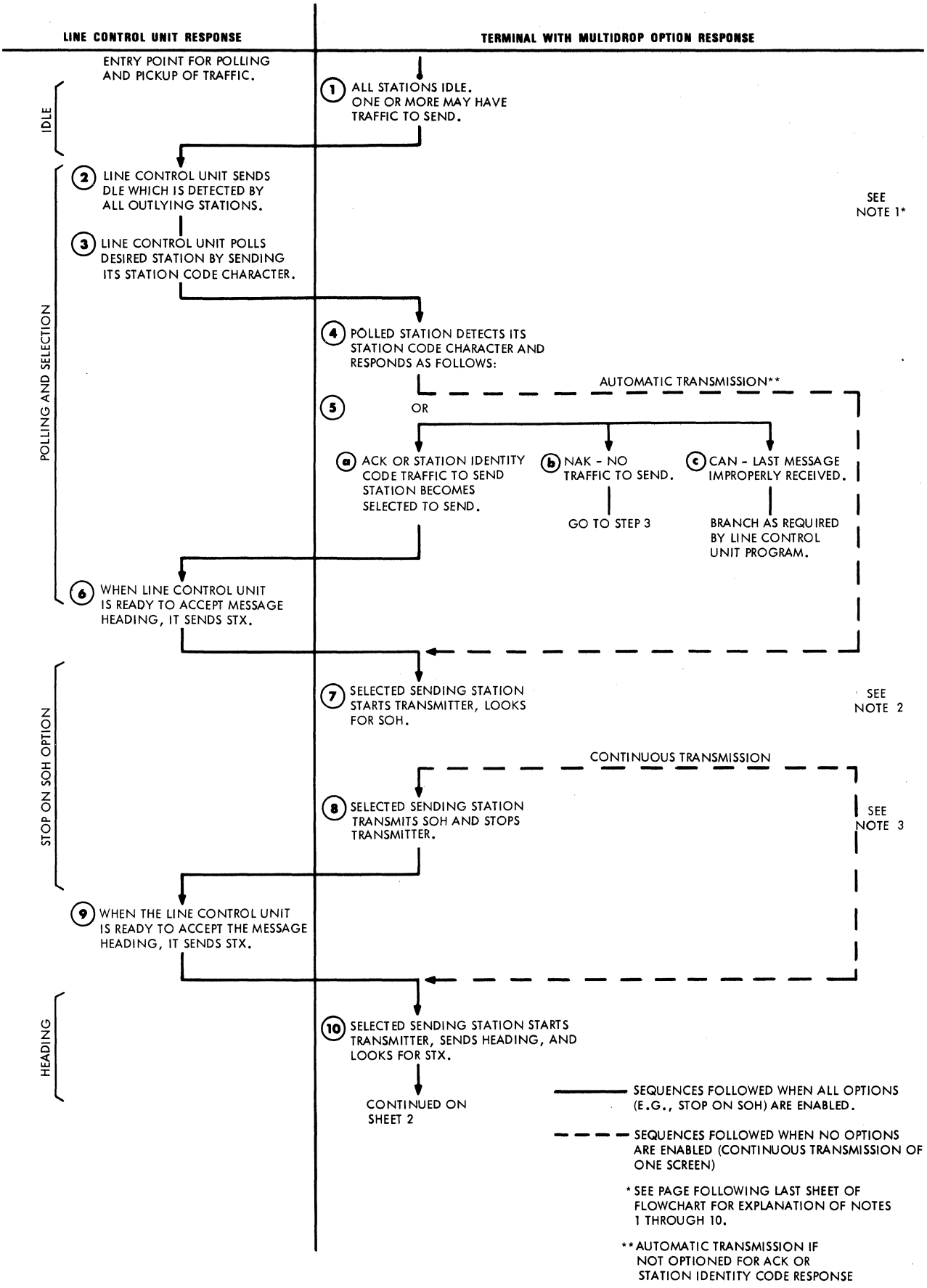


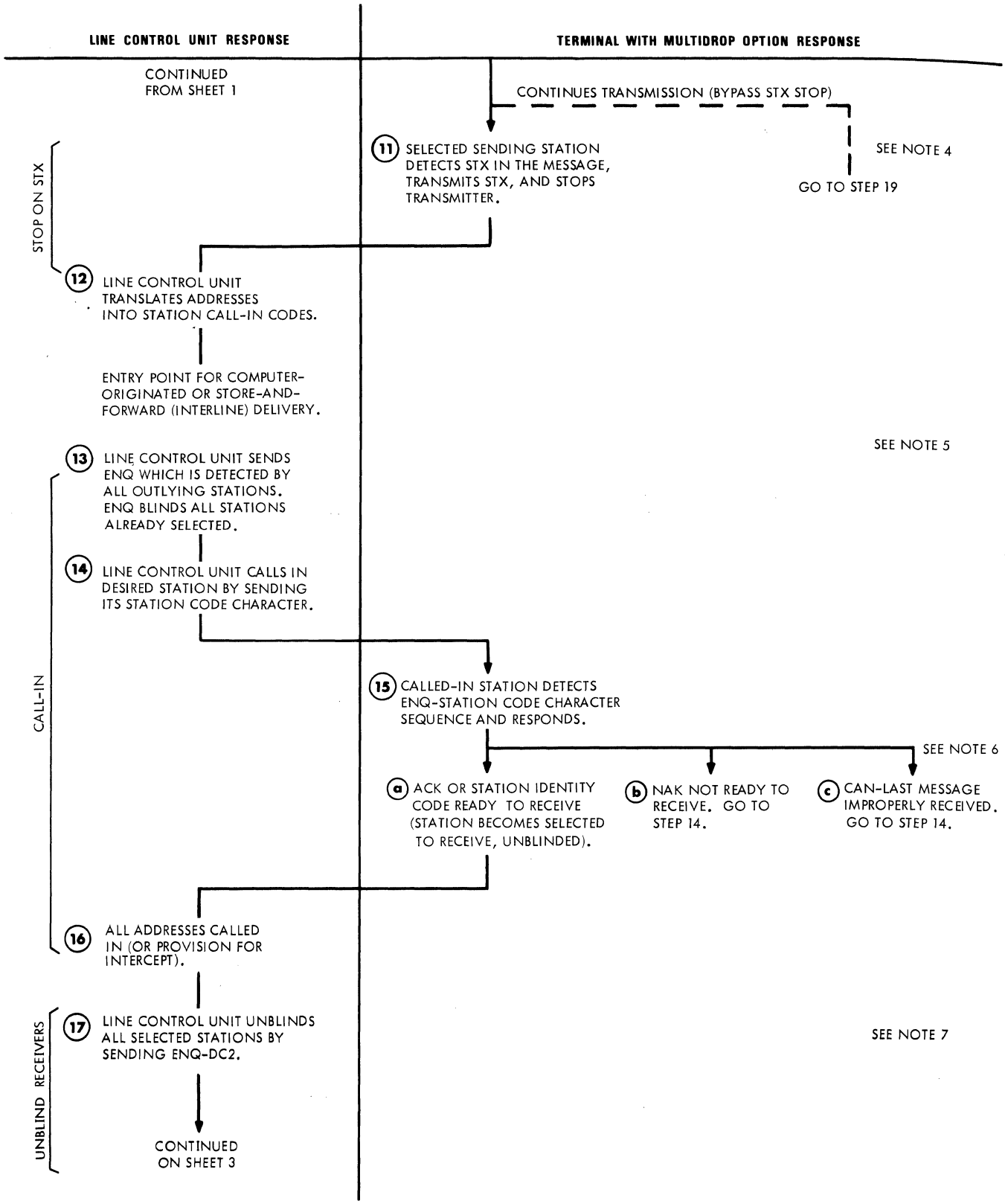
When the SEND key is pressed, the cursor moves to the first position of the first line, finds that it is the beginning of a protected field, issues an HT code and tabs to the first character past the SI code, and begins transmitting the name. It transmits the name and the blink field, tabs over the TEL NO protected reduced-intensity field, transmits the telephone number, and stops. The following code sequence is produced:

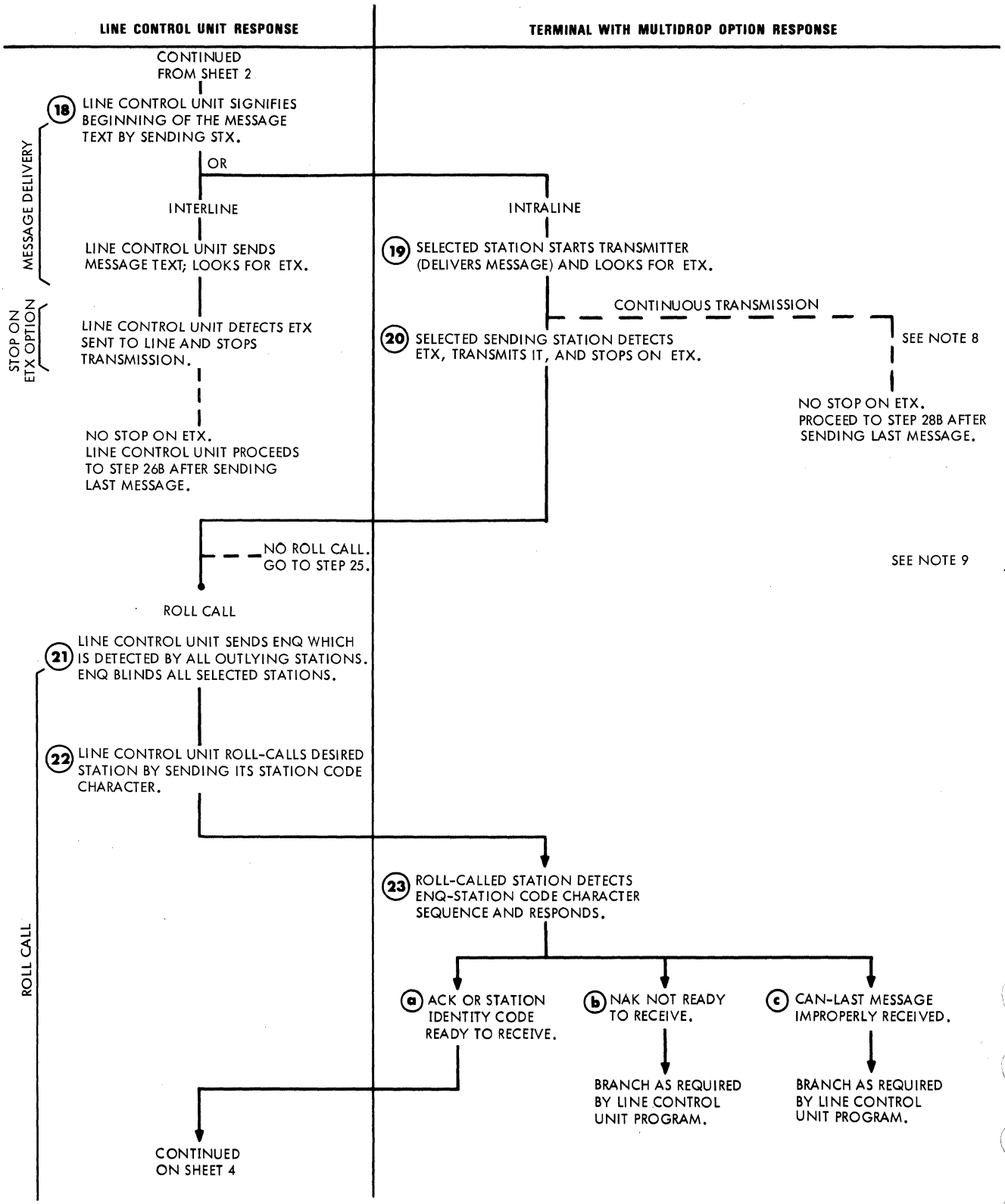
HT	P	A	T	SP	W	A	R	N	E	R	ETB	O	C
011	120	101	124	040	127	101	122	116	105	122	027	177	103
T	SP	1	,	SP	1	9	7	5	CR	SP	6	1	2
124	040	061	054	040	061	071	067	065	015	040	066	061	062
HT	6	3	3	-	0	3	7	1					
011	066	063	063	055	060	063	067	061					

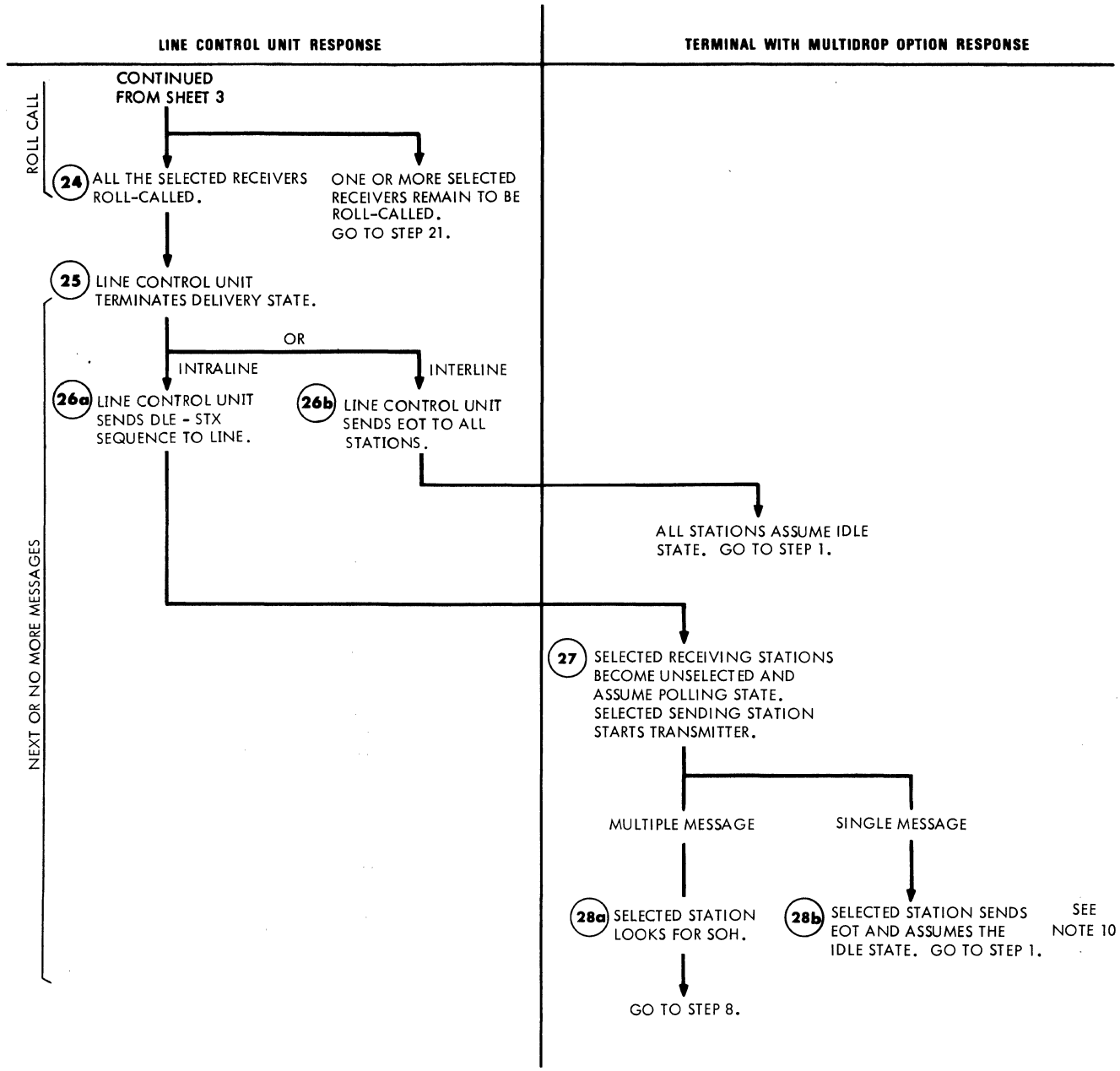
EXAMPLE OF PROTOCOL OPERATION A

The following flowchart describes the sequence of operations in a typical terminal configuration employing the 85A1 protocol. The 85A1 is the earlier version of the 85A protocol. For additional information about the 85A1 protocol, refer to 85A1 and 85A2 Data Selective Calling Service Stations. See foreword for further information on this manual.


LINE CONTROL UNIT RESPONSE
TERMINAL WITH MULTIDROP OPTION RESPONSE
ENTRY POINT FOR POLLING AND PICKUP OF TRAFFIC.
IDLE
1 ALL STATIONS IDLE. ONE OR MORE MAY HAVE TRAFFIC TO SEND.
POLLING AND SELECTION
2 LINE CONTROL UNIT SENDS DLE WHICH IS DETECTED BY ALL OUTLYING STATIONS.
SEE NOTE 1*
3 LINE CONTROL UNIT POLLS DESIRED STATION BY SENDING ITS STATION CODE CHARACTER.
4 POLLED STATION DETECTS ITS STATION CODE CHARACTER AND RESPONDS AS FOLLOWS:
AUTOMATIC TRANSMISSION**
5 OR
a ACK OR STATION IDENTITY CODE TRAFFIC TO SEND STATION BECOMES SELECTED TO SEND.
b NAK - NO TRAFFIC TO SEND.
GO TO STEP 3
c CAN - LAST MESSAGE IMPROPERLY RECEIVED.
BRANCH AS REQUIRED BY LINE CONTROL UNIT PROGRAM.
6 WHEN LINE CONTROL UNIT IS READY TO ACCEPT MESSAGE HEADING, IT SENDS STX.
STOP ON SOH OPTION
7 SELECTED SENDING STATION STARTS TRANSMITTER, LOOKS FOR SOH.
SEE NOTE 2
CONTINUOUS TRANSMISSION
8 SELECTED SENDING STATION TRANSMITS SOH AND STOPS TRANSMITTER.
SEE NOTE 3
9 WHEN THE LINE CONTROL UNIT IS READY TO ACCEPT THE MESSAGE HEADING, IT SENDS STX.
HEADING
10 SELECTED SENDING STATION STARTS TRANSMITTER, SENDS HEADING, AND LOOKS FOR STX.
CONTINUED ON SHEET 2
SEQUENCES FOLLOWED WHEN ALL OPTIONS (E.G., STOP ON SOH) ARE ENABLED.
SEQUENCES FOLLOWED WHEN NO OPTIONS ARE ENABLED (CONTINUOUS TRANSMISSION OF ONE SCREEN)
* SEE PAGE FOLLOWING LAST SHEET OF FLOWCHART FOR EXPLANATION OF NOTES 1 THROUGH 10.
** AUTOMATIC TRANSMISSION IF NOT OPTIONED FOR ACK OR STATION IDENTITY CODE RESPONSE


LINE CONTROL UNIT RESPONSE
TERMINAL WITH MULTIDROP OPTION RESPONSE
CONTINUED FROM SHEET 1
CONTINUES TRANSMISSION (BYPASS STX STOP)
SEE NOTE 4
GO TO STEP 19
STOP ON STX
11 SELECTED SENDING STATION DETECTS STX IN THE MESSAGE, TRANSMITS STX, AND STOPS TRANSMITTER.
12 LINE CONTROL UNIT TRANSLATES ADDRESSES INTO STATION CALL-IN CODES.
ENTRY POINT FOR COMPUTER-ORIGINATED OR STORE-AND-FORWARD (INTERLINE) DELIVERY.
SEE NOTE 5
CALL-IN
13 LINE CONTROL UNIT SENDS ENQ WHICH IS DETECTED BY ALL OUTLYING STATIONS. ENQ BLINDS ALL STATIONS ALREADY SELECTED.
14 LINE CONTROL UNIT CALLS IN DESIRED STATION BY SENDING ITS STATION CODE CHARACTER.
15 CALLED-IN STATION DETECTS ENQ-STATION CODE CHARACTER SEQUENCE AND RESPONDS.
SEE NOTE 6
a ACK OR STATION IDENTITY CODE READY TO RECEIVE (STATION BECOMES SELECTED TO RECEIVE, UNBLINDED).
b NAK NOT READY TO RECEIVE. GO TO STEP 14.
c CAN-LAST MESSAGE IMPROPERLY RECEIVED. GO TO STEP 14.
16 ALL ADDRESSES CALLED IN (OR PROVISION FOR INTERCEPT).
UNBLIND RECEIVERS
17 LINE CONTROL UNIT UNBLINDS ALL SELECTED STATIONS BY SENDING ENQ-DC2.
SEE NOTE 7
CONTINUED ON SHEET 3


LINE CONTROL UNIT RESPONSE
TERMINAL WITH MULTIDROP OPTION RESPONSE
CONTINUED FROM SHEET 2
18 LINE CONTROL UNIT SIGNIFIES BEGINNING OF THE MESSAGE TEXT BY SENDING STX.
MESSAGE DELIVERY
OR
INTERLINE
INTRALINE
LINE CONTROL UNIT SENDS MESSAGE TEXT; LOOKS FOR ETX.
19 SELECTED STATION STARTS TRANSMITTER (DELIVERS MESSAGE) AND LOOKS FOR ETX.
CONTINUOUS TRANSMISSION
STOP ON ETX OPTION
LINE CONTROL UNIT DETECTS ETX SENT TO LINE AND STOPS TRANSMISSION.
20 SELECTED SENDING STATION DETECTS ETX, TRANSMITS IT, AND STOPS ON ETX.
SEE NOTE 8
NO STOP ON ETX. PROCEED TO STEP 28B AFTER SENDING LAST MESSAGE.
NO STOP ON ETX. LINE CONTROL UNIT PROCEEDS TO STEP 26B AFTER SENDING LAST MESSAGE.
NO ROLL CALL. GO TO STEP 25.
SEE NOTE 9
ROLL CALL
21 LINE CONTROL UNIT SENDS ENQ WHICH IS DETECTED BY ALL OUTLYING STATIONS. ENQ BLINDS ALL SELECTED STATIONS.
22 LINE CONTROL UNIT ROLL-CALLS DESIRED STATION BY SENDING ITS STATION CODE CHARACTER.
23 ROLL-CALLED STATION DETECTS ENQ-STATION CODE CHARACTER SEQUENCE AND RESPONDS.
ROLL CALL
a ACK OR STATION IDENTITY CODE READY TO RECEIVE.
b NAK NOT READY TO RECEIVE.
c CAN-LAST MESSAGE IMPROPERLY RECEIVED.
BRANCH AS REQUIRED BY LINE CONTROL UNIT PROGRAM.
BRANCH AS REQUIRED BY LINE CONTROL UNIT PROGRAM.
CONTINUED ON SHEET 4


LINE CONTROL UNIT RESPONSE
TERMINAL WITH MULTIDROP OPTION RESPONSE
CONTINUED FROM SHEET 3
ROLL CALL
24 ALL THE SELECTED RECEIVERS ROLL-CALLED.
ONE OR MORE SELECTED RECEIVERS REMAIN TO BE ROLL-CALLED. GO TO STEP 21.
25 LINE CONTROL UNIT TERMINATES DELIVERY STATE.
OR
INTRALINE
INTERLINE
26a LINE CONTROL UNIT SENDS DLE - STX SEQUENCE TO LINE.
26b LINE CONTROL UNIT SENDS EOT TO ALL STATIONS.
ALL STATIONS ASSUME IDLE STATE. GO TO STEP 1.
NEXT OR NO MORE MESSAGES
27 SELECTED RECEIVING STATIONS BECOME UNSELECTED AND ASSUME POLLING STATE. SELECTED SENDING STATION STARTS TRANSMITTER.
MULTIPLE MESSAGE
SINGLE MESSAGE
28a SELECTED STATION LOOKS FOR SOH.
28b SELECTED STATION SENDS EOT AND ASSUMES THE IDLE STATE. GO TO STEP 1.
SEE NOTE 10
GO TO STEP 8.

NOTES:

NOTE 1: DLE PLACES SYSTEM IN THE NORMAL POLLING STATE.

NOTE 2: LINE CONTROL UNIT MUST BE ABLE TO ACCEPT A STRING OF DELETES BEFORE SOH.

STATION CHECKS THAT FIRST NONDELETE IS SOH.

NOTE 3: SOH TERMINATES POLLING STATE AND RETURNS NONSELECTED STATIONS TO IDLE STATE. LINE CONTROL UNIT MAY SEND TO THE SELECTED SENDING STATION. (FOR EXAMPLE, ORIGINAL MESSAGE NUMBER.)

NOTE 4: LINE CONTROL UNIT MAY SEND TO THE SELECTED SENDING STATION. (FOR EXAMPLE, ORIGINAL MESSAGE NUMBER.)

NOTE 5: ENQ PLACES SYSTEM IN THE NORMAL CALL-IN STATE.

NOTE 6: IF ONE OR MORE STATIONS RESPOND WITH NAK TO REPETITIVE CALL-INS, LINE CONTROL UNIT SHOULD START INTERCEPT ACTION.

NOTE 7: LINE CONTROL UNIT MAY DELIVER ANY COMMON INFORMATION TO ALL SELECTED STATIONS. (FOR EXAMPLE, DATE AND TIME.)

NOTE 8: WHEN SELECTED SENDING STATION STOPS ON ETX, LINE CONTROL UNIT MAY DELIVER ANY COMMON INFORMATION TO ALL SELECTED STATIONS. (FOR EXAMPLE, DATE AND TIME.)

NOTE 9: ROLL-CALL FUNCTION PROVIDES A MEANS FOR CHECKING ON DELIVERY OF MESSAGE TEXT BY EMPLOYING A NORMAL CALL-IN OPERATION.

NOTE 10: FOLLOWING STEP 28A. A "FILL" CHARACTER IS REQUIRED AFTER THE EOT TO PROVIDE THE TIMING NECESSARY TO STOP THE TRANSMITTER.

COMMENT SHEET

MANUAL TITLE 750 Terminal Subsystem

Subsystem Reference Manual

PUBLICATION NO. 62962800 REVISION B

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