

TECHNICAL USER MANUAL

MICRO **B**

SERIES

DM30



BEEHIVE INTERNATIONAL



TECHNICAL USER MANUAL

MICRO **B**

Model DM30 Video Display Terminal

DECEMBER 1979

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WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. As temporarily permitted by regulation it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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SECTION I

INTRODUCTION

This manual provides a general description and operating instructions for Beehive International's DM30 video display terminal. Included are sufficient diagrams, tables and descriptive text to provide an understanding of the operational characteristics of the equipment. Three general sections are included:

- Section I provides a brief description of the DM30 terminal and a specifications listing on Table 1-1.
- Section II describes the installation and initial checkout of the terminal.
- Section III describes operational characteristics and functions of the terminal. Basic operator instructions are provided first, followed by a detailed operating description.

Beehive International's DM30 (see Figure 1-1) is an 8085A microprocessor-controlled buffered video display terminal which offers the latest advances in technology and human engineering. Its numerous features are tailored to address both interactive and batch mode markets. Specific product enhancements formerly found only in more sophisticated and expensive terminals are designed into the DM30, giving it superior cost/performance value.

Among the DM30 features is the memory lock, which allows the operator or host computer to lock a portion of the display while retaining the capability to enter or receive data in the unlocked portion of the display memory. The invisible memory address pointer is used to read and write to and from the display memory independently of visible screen functions. Standard visual attributes include normal, reverse, blink, underline, and half-intensity video levels. These are further enhanced by the addition of

logical attributes which include protected data fields, numeric only fields, alpha only fields, constant fields and modified data field transmission.

Line 25 of the DM30 display is a "status" line which the system firmware uses to indicate modes of operation, error messages, communications protocol information, and to convey terminal status messages. The self-diagnostic results are also selectively displayed for the user in this reversed display area.

Two full pages of display memory is a standard DM30 feature. Operator access to any unlocked memory area can be very rapid (even across page boundaries) using the scroll up/down keys. The terminal is therefore especially useful in text scanning and editing applications.

DM30 interfacing capabilities are exceptional. Both the main and auxiliary ports are bidirectional, communicating serially with full buffering. The Centronics®* compatible parallel interface permits rapid data transfer to printers, making hard copy from the CPU, auxiliary device or the terminal readily available.

The most predominant video characteristic is found in the terminal display memory organization. The display format is based upon 24 lines of data per page with 96 characters in each line. Eighty of the character positions are displayable, which leaves sixteen nondisplayable character cells available for field attributes. Finally, the line drawing graphics capability allows for the creation of forms on the display, using the vertical and horizontal line feature.

The DM30 keyboard is designed with particular attention being given to combining TTY and typewriter layouts. The shape and positioning of the

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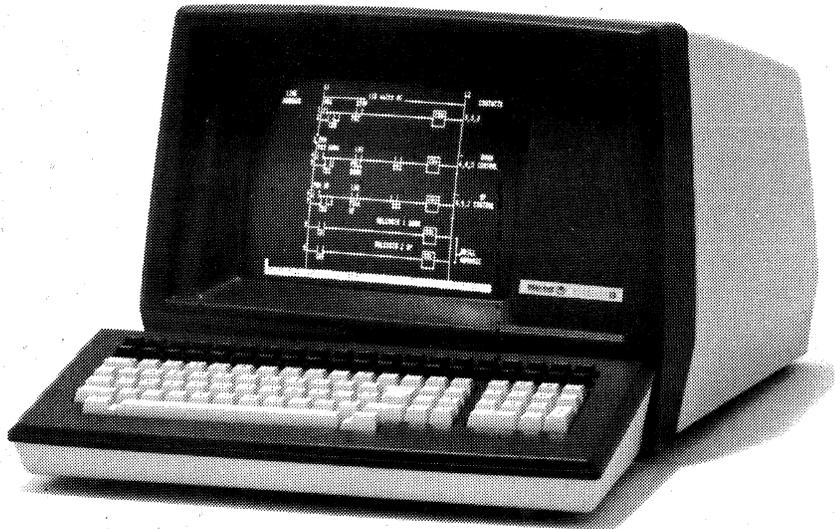


Figure 1-1 Micro Bee/Model DM30

Table 1-1 Specifications

DISPLAY FORMAT

24 lines x 80 characters

DISPLAY MEMORY

Two pages, 3840 characters
48 lines x 80 characters

STATUS LINE

25th line of display

CRT SIZE

12" measured diagonally

CHARACTER SIZE

Approximately 0.2" high x 0.1" wide

CHARACTER TYPE (Alphanumeric)

128 displayable ASCII characters, each formed within an 8 x 8 dot matrix, Descenders on lower case characters.

CHARACTER TYPE (Line Drawing)

Eleven graphic symbols for drawing forms and contiguous lines.

CHARACTER GENERATION

MOS ROM

REFRESH RATE

50/60 Hz (Programmable)

CHARACTER DISPLAY

Light characters on a dark background or dark characters on a light background (switch selectable)

VISUAL ATTRIBUTES

Normal, Reverse, Blink, Underline, Half Intensity and Security Fields.

LOGICAL ATTRIBUTES

Protected numeric only, modified data transmission. Must fill, total fill, constants

TABULATION

Fixed tab stops occur each eight character positions

CURSOR

Non-destructive blinking block

READ CURSOR CHARACTER

Character at cursor position is transmitted to the host upon request

MEMORY LOCK

The display area above the line the cursor is currently on is frozen on the screen

LINE LOCK

The host CPU may selectively designate reserved display lines

MEMORY ADDRESS POINTER

An invisible cursor that is used to read and write to and from the display memory independent of visible screen functions

CURSOR CONTROL

Up, down, left, right, home, carriage return, line feed

CURSOR SENSE

Cursor position is transmitted to the host upon request

CURSOR ADDRESSING

Absolute or relative cursor positioning by line and column

MEMORY POINTER DATA SENSE

ASCII value of the character located at the memory address pointer

READ TERMINAL STATUS

A 30 byte status message reflecting switch settings, self-test results, communication protocol, etc.

SCROLL

Displayed data may be moved up or down a line or a page at a time

EDITING OPERATIONS

Insert/Delete on a character or a line basis plus tab, back tab, backspace and character overwrite. The clear entry (CE) operation erases the field the cursor occupies and positions it to the beginning of the same field while in a protected mode of operation

ERASE FUNCTIONS

Erase to end of page
Erase to end of field (protected)
Erase to end of line (unprotected)
Clear variable data
Clear all data

PRINTER INTERFACE

Parallel Centronics® compatible

COMMUNICATIONS INTERFACE

Serial RS232C/Current Loop

TRANSMISSION RATE

19.2K X-On/X-Off protocol
Switch selectable 110 to 9600 baud (EIA)
Switch selectable 110 to 9600 baud (CL)

PARITY

Switch selectable odd, even, mark or space

COMMUNICATION MODES

Full duplex
Half duplex
Echoplex
Asynchronous only

OPERATIONAL MODES

Conversational (character by character)
Line: Line at a time
Page: Full or partial page
Forms: Allows for operator or host CPU

building of formatted display

Local: Off line display data entry
Line Monitor: Displays all ESC codes and control code sequences

TERMINATION CHARACTER

Switch selectable CR, EOT, ETX and CR-LF

TIME OF DAY CLOCK

A real time clock that may be set by the host CPU or operator

CPU MESSAGE DEPOSIT

An 80 character message buffer holds host CPU data and prints "MSG WAIT" on status line for operator recovery

ERROR INDICATORS

Status line messages reflect operator error and system status

BELL

Audible alarm upon receipt of CONTROL G or as the cursor passes through the 72nd character location when data are entered from the keyboard. The continuous alarm on/off feature is included.

KEYBOARD

A 81-key ANSI compatible TTY/ typewriter-compatible arrangement featuring autorepeat, two-key rollover, alpha lock and lower case inhibit. Also includes a 14-key numeric pad with associated field termination control keys. Sixteen programmed function keys, cursor control keys, and system mode control keys are also included.

AUXILIARY INTERFACE

A serial bidirectional interface that has a character buffer on both the send and receive lines. Transparent communications control keys are also included.

SELF TEST

Initiated through host CPU control, by the operator, and at power-up

INPUT VOLTAGE AND FREQUENCY

115 VAC ±10% 60Hz

ENVIRONMENTAL SPECIFICATIONS

Altitude- Sea level to 10,000 feet
Temperature- 0 to 40 degrees C
Humidity- 0 to 80% (noncondensing)

TERMINAL SIZE

24" (61cm) L X 18³/₁₆" (46.2cm) W X 13¹/₈" (33.3cm) H

TERMINAL WEIGHT

40 lbs. (Approximate)

TERMINAL FINISH

Textured

OPTION

230 VAC ±10% 50 Hz

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RETURN key and the additional field termination control keys associated with the numeric pad are two important user-oriented features. Autorepeat, two-key rollover and highly reliable reed switch keying are also included. The half-size keys located above the standard keyboard layout include programmed function keys, editing keys, cursor control keys and terminal mode control keys.

The DM30 is designed to address the most demanding operational mode requirements found in the communications market. Data transmission can be selectively defined as conversational, line, mes-

sage or page and transmitted in serial or parallel fashion. Operational characteristics are enhanced by the addition of local and line monitor modes. The forms mode allows the operator to prepare a form with specific visual and logical attributes on the display screen and then transmit it to a host computer or auxiliary device.

The expanded characteristics of the DM30 include X-Y addressing, read cursor address, read terminal status, time-of-day clock, and 128 ASCII characters with descenders on lower case characters.



SECTION II INSTALLATION

2.1 INTRODUCTION

This section contains information on unpacking, receiving inspection, connection of the communications interface, physical placement of the terminal and preliminary functional control settings for specific user requirements.

2.2 UNPACKING

The following items are furnished with each DM30 terminal:

- a. The display terminal with detachable keyboard
- b. Technical User Manual

There are no tie-downs or packing materials inside the unit that need to be removed.

2.3 INSPECTION FOR IN-SHIPMENT DAMAGE

Upon receipt, carefully check components for any signs of shipping damage. All shipping containers have been specially designed to protect their contents and special care has been taken to prevent damage under normal shipping conditions. Mishandling should be evident upon inspection of the shipping container. If damage is found after visual inspection, take care not to destroy the evidence. If necessary, document the damage with photographs and contact the transport carrier as soon as possible.

2.4 IDENTIFICATION

An identification plate located on the bottom cover of the terminal provides the model number, part number, serial number, weight, voltage and current requirements, and frequency/power classifications.

2.5 INSTALLATION

2.5.1 Placement for Operation

The terminal is fully self-contained and easily relocated to alternate operating positions without removing or altering any wiring. Select a convenient, level surface and place the terminal where the power, I/O and keyboard cables are not in the way of the operator. Route the cables in such a manner that they are not inadvertently pulled or disturbed by minor changes in terminal position or by the operator. Position the terminal and keyboard so that operator use is as convenient as possible.

CAUTION: Do not place the terminal on any surface that blocks cooling air from the back of the cabinet. The terminal is provided with an internal fan for cooling. Air enters through the fan grill in the back and leaves through spacing at the bottom sides between the cover and terminal frame. To maintain efficient air circulation, keep at least three-and-one-half (3½) inches of clearance at the rear and on the sides of the terminal (see Figure 2-1).

2.5.2 Power Connection

The terminal is shipped with a three-conductor power cord which grounds the instrument through the offset pin. The safety feature of this ground should always be preserved by grounding the terminal to the outlet box or other earth ground. If it is necessary to use an adapter, ground the pigtail.

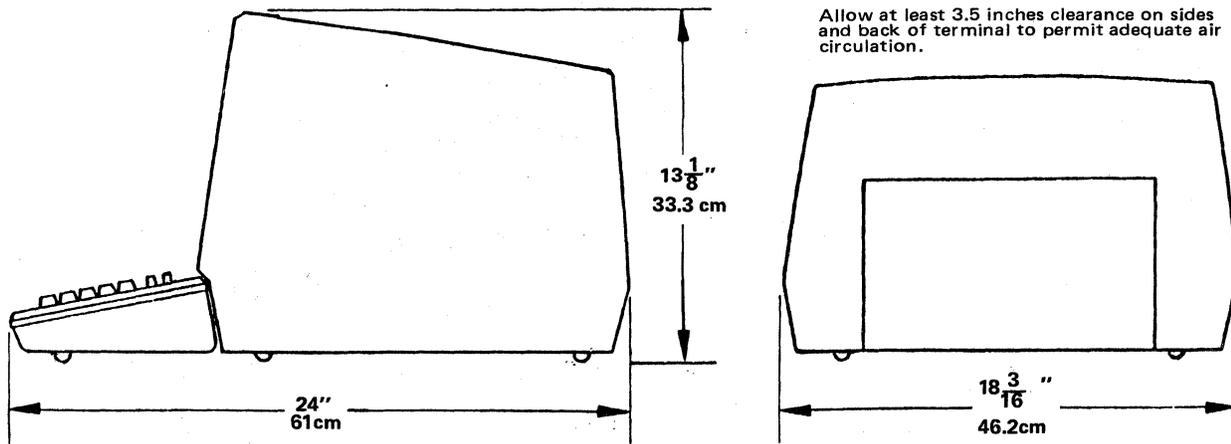


Figure 2-1 Mounting Requirements

2.5.3 Current Loop Interface

The current loop interface is a 20mA constant current device which allows the terminal to be used up to 2000 feet (608m) from the CPU. Baud rates of 9600 or less must be used. If shielded, twisted pairs are used, the terminal may be located up to 6000 feet (1.8km) away if utilized at slower baud rates.

Data transmission without the current loop interface is normally limited to 50 feet. The current loop converts the TTL logic signals into current signals at one end of the loop, transmits the pattern, reconverts the pattern to TTL logic signals at the other end, and delivers it to the computer or terminal. The current loop connections are contained within the RS232C I/O connector and do not interfere with normal RS232C signals required for asynchronous operation. Figure 2-2 illustrates four common interfacing schemes for simplex and full duplex operation using current loop.

2.5.4 Data Interface Connection

Signals used in communicating with the DM30 conform to the requirements of EIA specification RS232C. In particular, output voltage swings from -10V to +10V, while the receivers present a minimum of 3K ohms impedance to the line. The input resistance is approximately

4K ohms. The driver circuits current limit at 10mA on both source and sink. All data source interconnections are made via the rear panel Input/Output connector (refer to Figure 2-3). A 25-pin miniature D-type ITT Cannon connector (DM-25S or equivalent) is used for connecting to the computer. Pin assignments are defined in Table 2-1.

2.5.5 Parallel Interface

High speed unidirectional data transfer from the CPU, terminal or auxiliary device is possible through this port. It is Centronics®* plug-compatible and easily used with most printers. When the parallel port is selected via the parallel aux-on-mode (see Section III), CPU-to-printer interfacing may take place with the display fully active. Signal and pin-out information is contained in Table 2-1, and a timing diagram is presented in Figure 2-3.

2.5.6 Auxiliary Interface

The auxiliary port provides for serial communications between the DM30 and immediate peripheral equipment. Data interchange is bidirectional, buffered and RS232C compatible. System expansion for off-line storage is a typical application involving this interface. Signal and pinout information is contained in Table 2-1. A minimum Aux port configuration requires that connector pins 20 and 6 be jumpered.

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2.5.7 PC Board-Mounted Control Switches

Three switch blocks are mounted on the printed circuit board. Two are located at the rear of the PC board and are accessible through an external opening for repositioning. The other switch block is located near the other two switch blocks and is only alterable by removing the cover. These switches are described in Table 2-2 (External Switches) and Table 2-3 (Internal Switches).

2.6 INITIAL TURN-ON PROCEDURE

The proper turn-on procedure for the terminal is described in 3.2.2.

2.7 REAR PANEL SWITCH USE

The operating configuration of the DM30 is defined by rear panel and internal switch positions as described below. Whenever any of these switches is changed, it is necessary to reset the terminal using CONTROL RESET to ensure that all new switch positions are scanned by software.

2.7.1 Receiver Error Check (S1-1)

When receiver error check is selected (S1-1 up), an ASCII substitute (S_B) is displayed if a receiver frame, overrun or parity error is detected. Only even or odd parity are checked as selected by switches S1-7 and S1-8. With this feature disabled, data are written to the display as they are received and all errors are ignored.

2.7.2 Roll Mode (S1-2)

When roll mode is enabled (S1-2 up), data scroll upward if the cursor is on line 48 and any operation that would move the cursor down one line is performed (such as line feed, tabulation, or data entry). As a result of the upward scroll, all data on the page move up by one line, (with data previously on the top being lost) and a new blank line appears at the bottom of the page.

If the roll is disabled, the display page does not scroll. A command which attempts to move the cursor down from line 48 (i.e. a line feed, tab or data entry) has no effect on the cursor's vertical position. Instead, the cursor returns to the beginning of line 48, and existing display memory in that line begin to be overwritten.

2.7.3 Auto Line Feed Mode (S1-3)

In auto line feed mode (S1-3 up), the RETURN key transmits carriage return-line feed codes and performs a return and line feed locally. With auto line feed mode off, the key transmits and performs only a carriage return.

2.7.4 Inhibit Lower Case (S1-4)

With the switch in the up position, all alpha characters a-z are forced to the upper case regardless of the condition of SHIFT or LOCK. No other codes are affected. With the switch down, all keys are fully shiftable. Received data remain unaffected by this switch setting.

2.7.5 Termination Character (S1-5, S1-6)

The user may select the termination character which is transmitted by the ENTER key in an on-line mode and is the last character sent after a block, line transmit, or function key sequence. The choices are ETX, EOT, CR or CR-LF.

2.7.6 Parity (S1-7, S1-8)

The parity selection allows for an odd or even parity bit, or a mark or space parity bit to be generated following the data in the serial data word. Mark or space parity is generated by transmitting an 8-bit data word and forcing the eighth bit low or high. The switches also select the parity condition to be checked if switch S1-1 is up (receiver error check).

continued on page 2-8

Figure 2-2 Current Loop Cabling

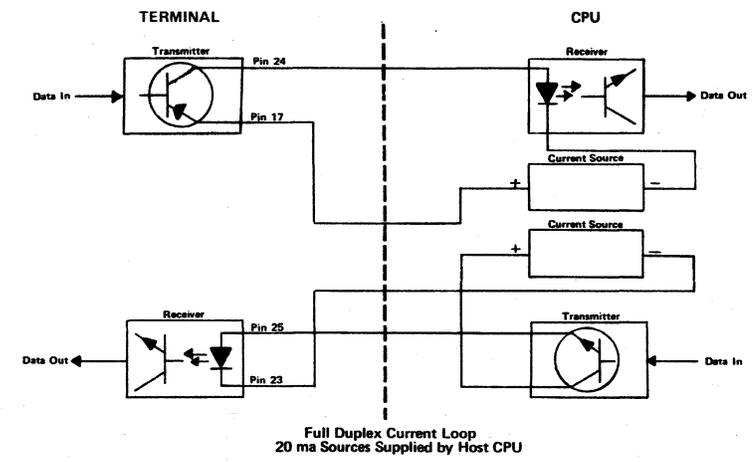
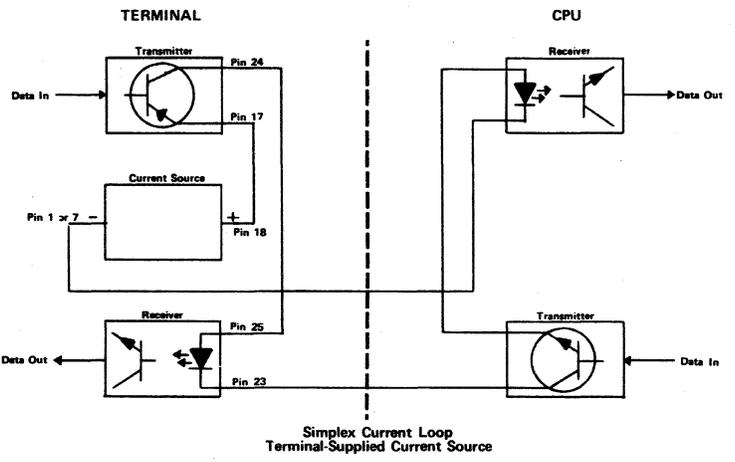
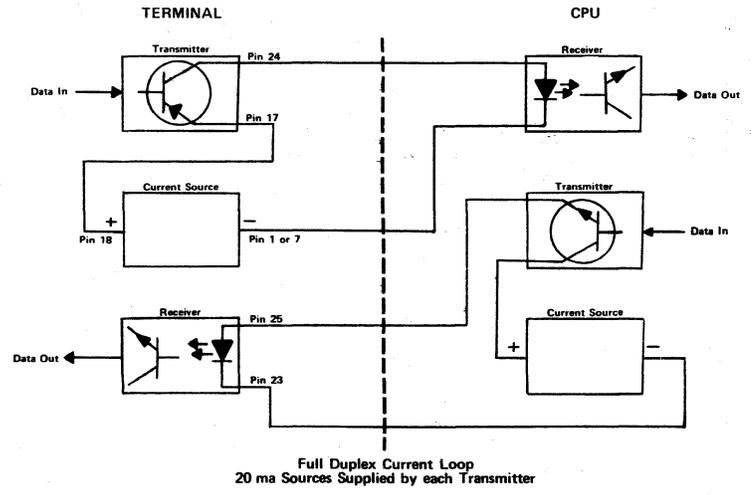
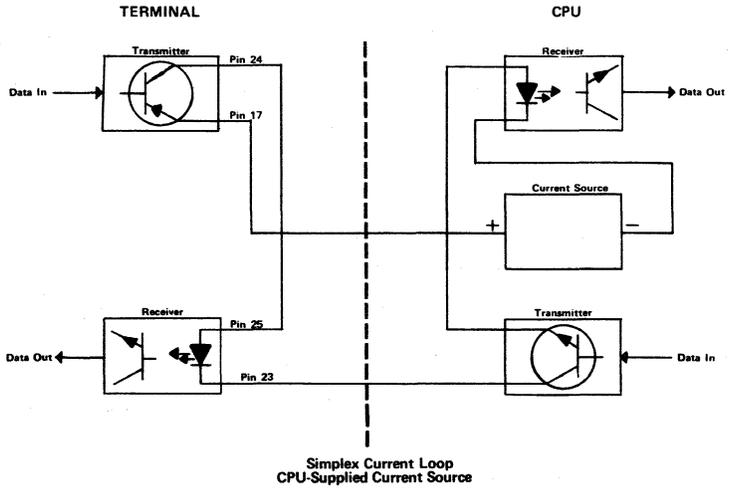


Table 2-1 Main, Auxiliary and Parallel Port Pin Assignments

MAIN PORT				
PIN NO.	RS232-C	SIGNAL NAME	SIGNAL DIRECTION	DESCRIPTION
1	AA	Frame Ground	—	Chassis ground; electrically bonded to frame.
2	BA	Transmitted Data	DM30 → Data Set	Transmitted data; Pin 2 is in the mark condition with no output signal.
3	BB	Received Data	DM30 ← Data Set	Received data or terminal input.
4	CA	Request to Send	DM30 → Data Set	When off line, RTS is held low; when on line in full duplex, it is kept high. In half duplex on line, it remains low until data transmission. It goes high during transmission and drops low upon completion.
5	CB	Clear to Send	DM30 ← Data Set	When clear to send is high, transmission is enabled. When CTS is held low, the transmitter is disabled.
6	CC	Data Set Ready	DM30 ← Data Set	Indicates the host data set is ready.
7	AB	Signal Ground	—	Same potential as chassis ground (pin 1).
16		TTLX8 Clock		X8 TTL clock (normally strapped)
20	CD	Data Terminal Ready	DM30 → Data Set	This pin is high when terminal is on.
AUXILIARY PORT				
1	AA	Frame Ground	—	Chassis ground; electrically bonded to frame.
2	BA	Transmitted Data	DM30 ← Auxiliary Device	Data input to terminal.
3	BB	Received Data	DM30 → Auxiliary Device	Data output to auxiliary device.
4	CA	Request to Send	DM30 ← Auxiliary Device	Ignored by DM30; does not evoke terminal response.
5	CB	Clear to Send	DM30 → Auxiliary Device	When high, indicates Auxiliary port enabled and ready to receive data.
6	CC	Data Set Ready	DM30 → Data Set	Remains on at all times.
7	AB	Signal Ground	—	Same potential as pin 1.
8	CF	Carrier Detect	DM30 → Auxiliary Device	Same as CC (pin 6). High at all times.
11 & 19		Ready/Busy	DM30 ← Auxiliary Device	Both pins are low if Auxiliary device is not ready to receive/ Transmit data.
20 ¹	CD	Data Terminal	DM30 ← Auxiliary Device	High indicates aux device is operational & connected. Low indicates aux device busy or disconnected. When this pin goes low, all data transmission from the terminal ceases.

(continued on next page)

Table 2-1 (concluded)

PARALLEL PORT				
PIN NO.	RS232-C	SIGNAL NAME	SIGNAL DIRECTION	DESCRIPTION
1,19 ²	—	Data Strobe	DM30 → Printer	A 1 μsec pulse (min.) used to clock data from the processor to the printer logic.
2,20	—	Data 1	DM30 → Printer	Data input bit. A high represents a binary 1 and a low is a binary 0.
3,21	—	Data 2	"	"
4,22	—	Data 3	"	"
5,23	—	Data 4	"	"
6,24	—	Data 5	"	"
7,25	—	Data 6	"	"
8,26	—	Data 7	"	"
9,27	—	Data 8	"	"
11,29	—	Busy	DM30 ← Printer	A high indicates the printer cannot receive data.
12	—	PE	DM30 ← Printer	A high indicates the printer is out of paper.
13	—	SLCT	DM30 ← Printer	A high indicates the printer is selected.
14	—	±OV	—	Signal Ground
16	—	±OV	—	Signal Ground
17	—	Chassis Ground	—	Frame Ground
32	—	Fault	DM30 ← Printer	A low indicates a printer fault condition such as paper empty, light detect, or a deselect condition.

¹When the auxiliary equipment being used does not provide this signal, external jumpering must be provided on the auxiliary port between pins 6 and 20.

²Second pin number indicates twisted pair return (±OV).

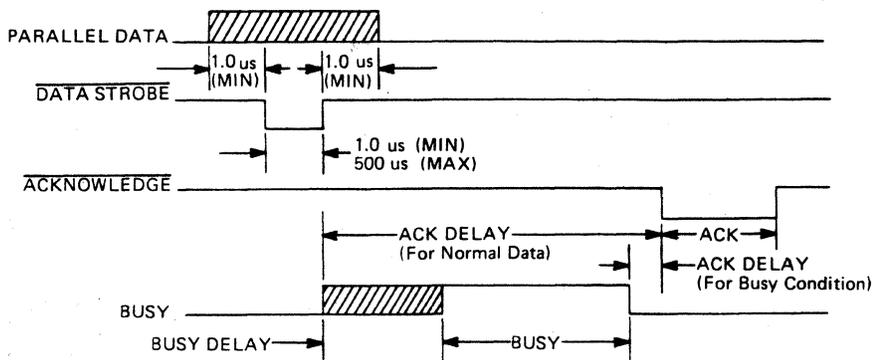
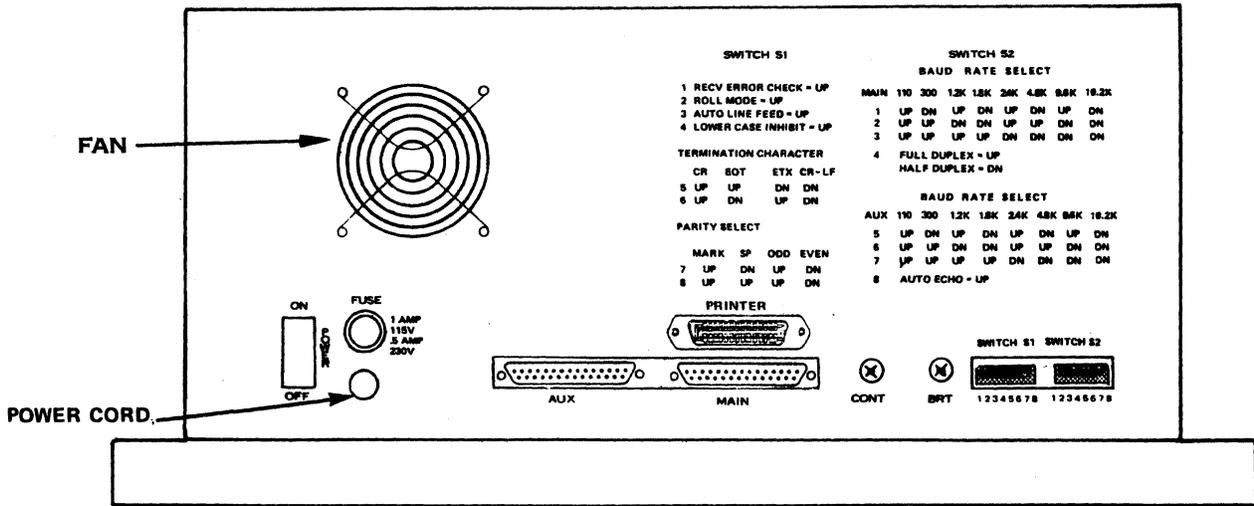


Figure 2-3 Parallel Port Timing



FUSE
Prevents damage to circuitry during voltage/current overload

AUXILIARY PORT
This connector provides an interface for peripheral device, such as disks, printers, tape drives, etc.

MAIN PORT
This port provides data source interface for the terminal, RS232C or current loop interface.

Figure 2-4 DM30 Rear Panel

SWITCH S1	SWITCH S2
1 RECV ERROR CHECK = UP 2 ROLL MODE = UP 3 AUTO LINE FEED = UP 4 LOWER CASE INHIBIT = UP TERMINATION CHARACTER CR EOT ETX CR-LF 5 UP UP DN DN 6 UP DN UP DN PARITY SELECT MARK SP ODD EVEN 7 UP DN UP DN 8 UP UP DN DN	BAUD RATE SELECT MAIN 110 300 1.2K 1.8K 2.4K 4.8K 9.6K 19.2K 1 UP DN UP DN UP DN UP DN 2 UP UP DN DN UP UP DN DN 3 UP UP UP UP DN DN DN DN 4 FULL DUPLEX = UP HALF DUPLEX = DN BAUD RATE SELECT AUX 110 300 1.2K 1.8K 2.4K 4.8K 9.6K 19.2K 5 UP DN UP DN UP DN UP DN 6 UP UP DN DN UP UP DN DN 7 UP UP UP UP DN DN DN DN 8 AUTO ECHO = UP

Table 2-2 External Switches

ON	SWITCH	OFF
Go on line after block send	1	Remain off line after block send
All single key ESC sequences are performed locally only	2	All single key ESC sequences are transmitted
Display programmed for 50 Hz	3	Display programmed for 60 Hz
X-Suppress On	4	X-Suppress Off
Double buffer enable off	5	Double buffer enable on
Visual attribute is half intensity	6	Visual attribute is normal
White character on black field	7	Black character on White field
Enables Current Loop	8	Disables current loop

Table 2-3 Internal Switches

2.7.7 Main Baud Rate (S2-1, S2-2, S2-3)

The main baud rate change is accomplished thru switch selection on the back panel of the terminal. The user may select the following rates: 110, 300, 1200, 1800, 2400, 4800, 9600 or 19,200 baud. The switch settings are defined in Table 2-2. For host CPU selection of both main and aux baud rates, a three-code escape sequence is used (see Table 2-4).

Table 2-4 Remote Baud Rate Selection

	110	300	1200	1800	2400	4800	9600	19200
MAIN BAUD RATE ESC, 7,	0	1	2	3	4	5	6	7
AUX BAUD RATE ESC, 5	0	1	2	3	4	5	6	7

2.7.8 Full/Half Duplex (S2-4)

The full half duplex (FDX/HDX) switch setting (see Table 2-2) determines how data originating from the keyboard are routed within the terminal when operating on-line and in conversational mode. In half duplex mode, data entered via the terminal keyboard are sent to the I/O port and the display memory simultaneously. In full duplex mode, data entered via the terminal keyboard are sent to the I/O port only. Data must be received to be displayed. In full duplex mode, RTS (request to send) is raised any time the terminal is on line. In half duplex RTS is raised only when transmission occurs.

2.7.9 Auxiliary Baud Rate (S2-5,S2-6,S2-7)

The auxiliary baud rate change is accomplished through switch selection on the back panel of the terminal. The user may select the following rates: 110, 300, 1200, 1800, 2400, 4800, 9600, or 19,200 baud.

2.7.10 Auto Echo (S2-8)

With the auto echo switch on, the terminal displays and operates on all data transmitted over the main EIA serial port in conversational mode. With the switch set off, no automatic echo occurs. This switch is only effective in full duplex and allows full duplex communications without need for echo from the host CPU.

2.8 INTERNAL SWITCH USE

2.8.1 Go On Line (S3-1)

With the switch on, the terminal goes On Line after a block or line transmit or page dump function via either the auxiliary port or main port. With the switch off, the terminal remains off line.

2.8.2 Inhibit Escape Codes (S3-2)

With the switch on, all single key escape code sequences are performed locally without transmission, regardless of half or full duplex modes. The ESC key remains unaffected and operable.

With the switch off, single key escape code sequences obey the normal rules of HDX and FDX.

2.8.3 50/60 Hz (S3-3)

This switch is used to program the display to 50 or 60 Hz. To avoid beat interference, the display rate should match the power line frequency.

2.8.4 X-Suppress (S3-4)

Suppresses transmission of X-ON/X-OFF sequences during buffer overflow conditions. Alters response to received X-ON/X-OFF commands as per Section 3.3.8.

2.8.5 Double Buffer Enable On/Off

This switch has no user definable function and must be in the off position for proper terminal operation.

2.8.6 Normal/Half Intensity (S3-6)

This switch reverses the meaning of normal and half intensity visual attributes. With switch on, normal data becomes half intensity and half intensity data becomes highlighted.

2.8.7 Normal/Reverse (S3-7)

This switch reverses the meaning of normal and reverse video attributes. With the switch off, characters are black on white and reverse video attributes cause data to be displayed white on black. Brightness and contrast must be adjusted for proper screen display.

2.8.8 Current Loop (S3-8)

This switch must be on if the current loop option is selected for use.

SECTION III OPERATION

3.1 INTRODUCTION

This section provides both basic and detailed operating instructions for the DM30. Section 3.2 is a simplified operating guide which explains in nontechnical language how to turn on the terminal and use it for most data communications tasks. Operating modes and other terminal features are explained and examples are given where necessary. Section 3.3 provides more detailed operating information which is necessary for the programmer or technician who must install and interface the terminal with other data communications equipment.

3.2 BASIC OPERATION DESCRIPTION

3.2.1 General

The DM30 is not a difficult device to operate and, with sufficient practice, any typist can master this very versatile machine. The keyboard bears close resemblance to a standard typewriter and also includes features found in teletype equipment. The big difference, however, is the CRT (picture tube) display. Unlike printed paper output, video data can be easily altered and corrected by the operator before transmission to an auxiliary device, printer, or host computer.

3.2.2 Turn-On Procedure

Before the DM30 is used, it must be properly installed and set up in accordance with Section II of this manual. This should be attempted only by qualified personnel.

An identification plate located on the bottom

cover of the terminal specifies the electrical power requirements of the DM30. When moving the terminal to an alternate operating position, make sure that the selected power outlet is properly grounded and supplies the correct operating voltage/frequency. Get technical assistance, if necessary, in making this determination.

The proper turn-on procedure for the terminal is as follows:

- a. Set the rear panel POWER ON/OFF switch to ON (see Figure 2-3); allow a warm-up period of about a minute and ensure that the cursor and status line have appeared on the screen. If both the cursor and status line do not appear, check the brightness and contrast adjustments, as explained in b.
- b. Turn the brightness control (located on the rear panel; see Figure 2-3) until a raster is faintly visible on the screen. Write several characters on the screen with the terminal in half duplex (see Section 2.7.5), using both high and low intensity. Use the half intensity visual attribute as described under ASET in Table 3-2 for an accurate half-intensity level. Reduce the brightness until the background raster is extinguished. Adjust the contrast control (another rear panel component) until the difference between full and half intensity characters is easily distinguished.
- c. Any time power is applied to the DM30 it performs a display memory test and a system operation test. Because of the CRT warmup time, there is no visible effect on the screen. If the unit is turned off and

back on, a slight display flicker occurs while the self test is run. When the self test is successfully completed, "SYSTEM RDY" appears on the status line. In the event of a test failure, "ERR CHECK" appears. Self test may also be initiated from the keyboard as described under TEST in Table 3-2, or it may be initiated by the host computer.

3.2.3 Rear Panel Switches

Switch blocks 1 and 2 (S1 and S2) on the rear panel enable/disable certain operating features of DM30. There are a total of 16 miniature switches, eight on each switch block. Most rear panel switches require no operator attention because they must be properly set when the terminal is installed. Section 2.7 describes how to change a switch and the reset procedure which must be used following each switch change.

3.2.4 Keyboard Controls

The DM30 keyboard is shown in Figure 3-1. The keyboard's main function is to generate codes which the terminal uses to display information and communicate with other equipment. The keyboard produces three main types of codes:

- a. Character codes - For example, striking the "A" key causes the displayable character code for the letter "a" to be produced ("A" when shifted). Depending on the mode of operation selected, the "a" will be transmitted, displayed on the screen, or both.
- b. Control Character codes - These are not displayed, but cause specific functions to occur. To generate a control character code, depress **and hold down** the CONTROL key while simultaneously typing the required alphanumeric key. Example: CONTROL G rings the bell.
- c. Escape sequence codes - These are also nondisplayed and cause specific functions to occur. To perform an Escape operation, **depress and release the ESC key**, followed by the designated alphanumeric key. Example: ESC E clears the screen. If the CONTROL key is held down with the ESC key, the Escape sequence takes place within the terminal only and does not affect other equipment.

Table 3-1 is an ASCII chart which the operator may use in determining what keyboard sequence to use in performing a given control or escape function. Note that the chart has three columns: Control Characters, Displayable

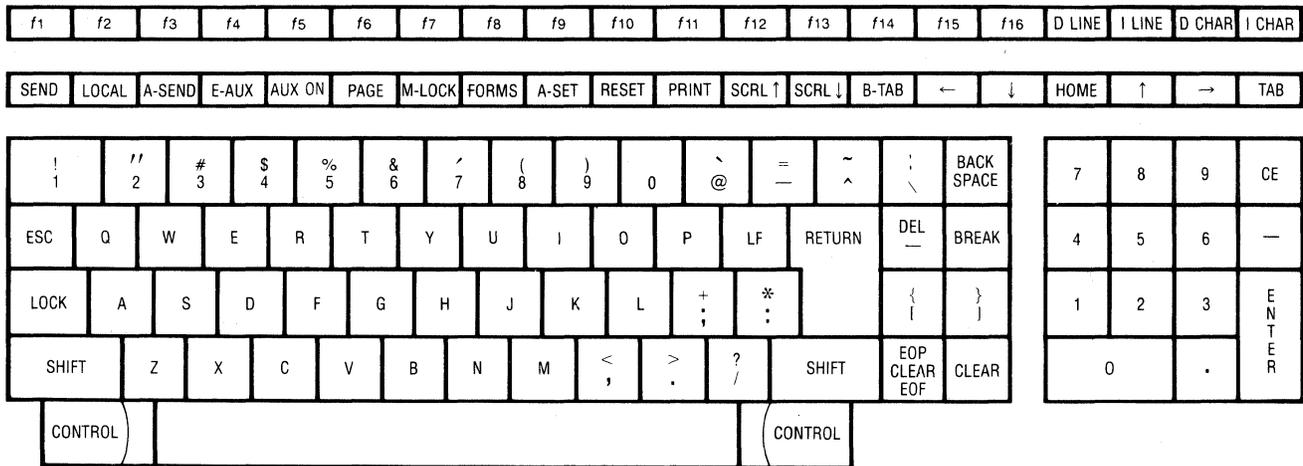


Figure 3-1 DM30 Keyboard

Table 3-1 DM30 ASCII Chart

BIT 7 6 5 4 3 2 1 0	CONTROL CHARACTERS		DISPLAYABLE CHARACTERS						ESCAPE SEQUENCES						3-CODE EXTENSION
	000	001	010	011	100	101	110	111	010	011	100	101	110	111	
0000	NUL [ⓐ]	DLE [Ⓟ]	SP	␣	@	P	'	p	SET CLOCK [Ⓢ]	AUX SEND [Ⓢ]	INSERT CHARACTER OFF [ⓐ]	LINE DELETE CHARACTER [Ⓟ]	PAGE DELETE CHARACTER [Ⓢ]	F1	SCROLL UP [Ⓢ]
0001	SOH [ⓐ]	DC1 X-ON [Ⓟ]	!	1	A	Q	a	q	PAGE MODE [!]	DISPLAY MESSAGE ON ¹	↑ [ⓐ]	LINE INSERT ON [Ⓟ]	PAGE INSERT ON [Ⓢ]	F2	NEXT PAGE ¹
0010	STX [Ⓟ]	DC2 [Ⓢ]	"	2	B	R	b	r	BOOT LD RUN ["]	DISPLAY MESSAGE OFF ²	↓ [Ⓟ]	GRAPHIC MODE ON [Ⓢ]	KEYBOARD ENABLE [Ⓢ]	F3	SCROLL DOWN ²
0011	ETX [Ⓢ]	DC3 X-OFF [Ⓢ]	#	3	C	S	c	s	LINE MODE [#]	AUX PAGE SEND ³	→ [Ⓢ]	GRAPHIC MODE OFF [Ⓢ]	KEYBOARD DISABLE [Ⓢ]	F4	PREVIOUS PAGE ³
0100	EOT [Ⓢ]	DC4 [Ⓢ]	\$	4	D	T	d	t		AUX LINE SEND ⁴	← [Ⓢ]	MODIFIED MODE ON [Ⓢ]	ATTRIBUTE SET [Ⓢ]	F5	PRINT PARALLEL ⁴
0101	ENQ [Ⓢ]	NAK [Ⓢ]	%	5	E	U	e	u	START CONSTANT FIELD [%]	AUX BAUD RATE SET ⁵	CLEAR [Ⓢ]	MODIFIED MODE OFF [Ⓢ]	ATTRIBUTE DELETE [Ⓢ]	F6	PARALLEL ENABLE ⁵
0110	ACK [Ⓢ]	SYN [Ⓢ]	&	6	F	V	f	v	FORMS BUILD ^{&}	WRITE CONTROL MODE ⁶	CURSOR ADDRESS [Ⓢ]	RESET [Ⓢ]	SELF TEST [Ⓢ]	F7	ABSOLUTE HOME ⁶
0111	BEL [Ⓢ]	ETB XMIT [Ⓢ]	'	7	G	W	g	w	SEND ENTER CODE [']	MAIN BAUD RATE SET ⁷	HEAD CURSOR CHARACTER [Ⓢ]	FORMS MODE ON [Ⓢ]	MEMORY LOCK ON [Ⓢ]	F8	ABSOLUTE M.A.F. ⁷
1000	BS [Ⓢ]	CAN [Ⓢ]	(8	H	X	h	x	AUX ON ⁽	CONTINUOUS ALARM ON ⁸	HOME [Ⓢ]	FORMS/FORMS BLD OFF [Ⓢ]	MEMORY LOCK OFF [Ⓢ]	F9	SERIAL AUX STATUS ⁸
1001	HT [Ⓢ]	EM [Ⓢ])	9	I	Y	i	y	AUX OFF ⁾	CONTINUOUS ALARM OFF ⁹	PAGE SEND [Ⓢ]	CURSOR ADDRESS [Ⓢ]	LINE SEND [Ⓢ]	F10	PARALLEL AUX STATUS ⁹
1010	LF [Ⓢ]	SUB [Ⓢ]	*	:	J	Z	j	z	LINE MONITOR OFF [*]	LINE MONITOR ON [:]	CLEAR EOP [Ⓢ]	CURSOR DISPLAY ON/OFF [Ⓢ]	ENABLE AUX PORT [Ⓢ]	F11	PAGE DUMP BLOCK SIZE & TERM [:]
1011	VT [Ⓢ]	ESC [Ⓢ]	+	;	K	[	k	}	START FIELD SPECIAL ⁺	CPU MESSAGE DEPOSIT [Ⓢ]	CLEAR EOL [Ⓢ]	START UN-PROTECTED FIELD [Ⓢ]	DISABLE AUX PORT [Ⓢ]	F12	ABSOLUTE CURSOR ADDRESS [;]
1100	FF [Ⓢ]	FS [Ⓢ]	,	<	L	\	l	|	CLEAR ENTRY (CE) [,]	LINE LOCK ^{<}	INSERT LINE [Ⓢ]	CURSOR SENSE [Ⓢ]	START BLINK [Ⓢ]	F13	ABSOLUTE CURSOR SENSE ^{<}
1101	CR [Ⓢ]	GS [Ⓢ]	-	=	M	]	m	}	PARALLEL ON ⁻	LINE UNLOCK ⁼	DELETE LINE [Ⓢ]	*START PROTECTED FIELD [Ⓢ]	NORMAL VIDEO [Ⓢ]	F14	
1110	SO [Ⓢ]	RS [Ⓢ]	.	>	N	^	n	~	3 CODE EXTENSION [.]	BACK TAB ^{>}	OFF LINE (LOCAL) [Ⓢ]	SET MEM POINTER [Ⓢ]	ON LINE [Ⓢ]	F15	
1111	SI [Ⓢ]	US [Ⓢ]	/	?	O	_	o	DEL	AUX PAGE DUMP [/]	UNLOCK ALL LINES [?]	READ TERMINAL STATUS [Ⓢ]	READ DATA AT MEMORY POINTER [Ⓢ]	PAGE DUMP [Ⓢ]	F16	DEL

 I/O Functions Only

*Deletes field if cursor is positioned at field start and ESC [ESC] is performed. (4 codes.)

Characters, and Escape Sequences. Using the chart is best explained by giving examples: If the operator wants a line feed (LF) to occur, the sequence CONTROL J is used; to initiate the self test, the sequence ESC f is used.

Table 3-2 is a summary of escape sequences which are defined for the DM30. This list may be extracted from the manual and posted for reference during initial operator training. Complete descriptions of each terminal function are presented in Section 3.3.

Table 3-3 is a listing of all DM30 keyboard keys. Each is described in sufficient detail to enable the operator to use it effectively. A technical approach to this information which is considerably more detailed and complete is included in Section 3.3.

3.2.5 Communication Modes

The DM30 terminal is capable of operating off line (local) or on line. Two operational modes of communication are provided when the unit is on line: full duplex (FDX) and half duplex (HDX). "LOCAL" or "ON LINE" is displayed in field A of the status line, depending on the mode selected.

Local - Data communication takes place between the keyboard and display memory only. No data transmission occurs unless the SEND or ASEND functions are used for block transmission.

On Line - Data are entered into memory, displayed and transmitted to the CPU. Transmission of the data to the CPU takes place in either full duplex or half duplex.

- a. Full duplex - Data sent from the keyboard through the I/O port go to the CPU only and are not displayed. Only data received from the CPU are displayed by the terminal.
- b. Half duplex - Keyboard entered data are displayed and transmitted to the CPU simultaneously.

3.2.6 Transmission Modes

When the DM30 is on line, transmission occurs in a character-by-character fashion as the keys are depressed. This is called a "conversational" mode and is used by the terminal to communicate with both the CPU and auxiliary devices. When the terminal is in the local mode, the screen contents may be transmitted in block send fashion a line or a page at a time. The SEND key initiates such transmissions out the Main I/O and the ASEND performs a similar job for the auxiliary port. The PRINT key sends data out the parallel port.

3.2.7 Additional Operating Features

Many of the following DM30 capabilities are not readily apparent when looking at the keyboard. Some are implemented using Control and Escape functions and others occur as an end result of the terminal operating program.

Subcharacter Display - When using the DM30 in communication with a CPU in full duplex and a receiver error occurs on either a transmitted or received message, the S_B character is displayed and a simultaneous audible alarm occurs.

Audible Alarm - The CONTROL G sequence (bell character) causes momentary action of the audible alarm. This is usually a result of the cursor passing the 72nd character position while entering data from the keyboard in local or half-duplex to warn the operator of the approaching line end. The momentary alarm also occurs when an illegal keyboard entry is attempted or a receiver error is detected. When the data entry begins in line 48, the audible alarm sounds when the cursor moves past character position 3 to warn the operator he is in the last line. Scrolling past line 48 also causes the alarm to sound. The CPU may gain the attention of the operator using the continuous alarm feature (ESC 8). The operator can end a continuous alarm by striking any keyboard key.

Clock - A 24-hour clock which can be used to indicate elapsed time or time of day can be made to appear in the status line by using the procedure outlined in Section 3.3.

Graphics - The construction of line drawings and forms may be accomplished using the terminal's Graphics mode. Eleven characters are

continued on page 3-8

Table 3-2 Escape Sequence Reference Chart

Attribute Delete -----	ESC e	Forms Build -----	ESC &
Attribute Set -----	ESC d	Forms Off/Forms Build Off -----	ESC X
Aux Baud Rate Set -----	ESC 5	Forms On -----	ESC W
Aux Line Send -----	ESC 4	Graphic Mode Off -----	ESC S
Aux Off -----	ESC)	Graphic Mode On -----	ESC R
Aux On -----	ESC (	Home -----	ESC H
Aux Page Dump -----	ESC /	Insert Character Off -----	ESC @
Aux Page Send -----	ESC 3	Insert Line -----	ESC L
Aux Port Disable -----	ESC k	Keyboard Disable -----	ESC c
Aux Port Enable -----	ESC j	Keyboard Enable -----	ESC b
Aux Send -----	ESC Ø	Line Delete Character -----	ESC P
Back Tab -----	ESC>	Line Insert On -----	ESC Q
Boot Load Run -----	ESC "	Line Lock -----	ESC <
Clear to End of Line -----	ESC K	Line Mode -----	ESC #
Clear to End of Page -----	ESC J	Line Send -----	ESC i
Clear Entry -----	ESC ,	Line Unlock -----	ESC=
Clear Screen -----	ESC E	Main Baud Rate Set -----	ESC 7
Continuous Alarm Off -----	ESC 9	Memory Lock Off -----	ESC h
Continuous Alarm On -----	ESC 8	Memory Lock On -----	ESC g
CPU Message Deposit -----	ESC ;	Modified Mode Off -----	ESC U
Cursor Address -----	ESC Y	Modified Mode On -----	ESC T
Cursor Address -----	ESC F	Monitor Mode Off -----	ESC *
Cursor Display On/Off -----	ESC Z	Monitor Mode On -----	ESC :
Cursor Down -----	ESC B	Normal Video -----	ESC m
Cursor Left -----	ESC D	Off Line -----	ESC N
Cursor Right -----	ESC C	On Line -----	ESC n
Cursor Sense -----	ESC \	Page Delete Character -----	ESC `
Cursor Up -----	ESC A	Page Dump -----	ESC o
Delete Line -----	ESC M	Page Insert On -----	ESC a
Display Message Off -----	ESC 2	Page Mode -----	ESC!
Display Message On -----	ESC 1	Page Send -----	ESC I
F1 -----	ESC p	Parallel On -----	ESC -
F2 -----	ESC q	Read Cursor Character -----	ESC G
F3 -----	ESC r	Read Data at Memory Pointer -----	ESC -
F4 -----	ESC s	Read Terminal Status -----	ESC O
F5 -----	ESC t	Reset -----	ESC V
F6 -----	ESC u	Self Test -----	ESC f
F7 -----	ESC v	Send Enter Code -----	ESC '
F8 -----	ESC w	Set Clock -----	ESC _{SP}
F9 -----	ESC x	Set Memory Pointer -----	ESC ^
F10 -----	ESC y		
F11 -----	ESC z		
F12 -----	ESC {		
F13 -----	ESC !		
F14 -----	ESC }		
F15 -----	ESC ~		
F16 -----	ESC _E		

Three Code Extensions

Absolute Cursor Address -----	ESC . ;	Parallel Enable -----	ESC . 5
Absolute Cursor Sense -----	ESC . <	Parallel Status -----	ESC . 9
Absolute Home -----	ESC . 6	Previous Page -----	ESC . 3
Absolute Memory Address Pointer -----	ESC . 7	Print Parallel -----	ESC . 4
Next Page -----	ESC . 1	Serial Status -----	ESC . 8
Page Dump Block Size & Term -----	ESC . :	Scroll Down -----	ESC . 2
Scroll Up -----	ESC . Ø		

Table 3-3 Keyboard Functions

KEY	FUNCTION
F1- F16 (Special Function keys)	The operation of the special function keys is determined by the user. Depression of any of these keys causes transmission of the codes indicated on Table 3-1. The CPU responds to these codes as determined by local programming. Seek local technical advice when necessary in determining what functions (if any) have been assigned to these keys.
DLINE	The DLINE key causes the cursor-occupied line to be deleted and the remaining lines below to move up one line.
I LINE	Depressing the ILINE key causes data from the cursor-occupied line on down to be moved one line lower. The cursor is positioned to the beginning of the blank line which is created and data may then be entered in that line as desired by the operator.
DCHAR	The DCHAR key causes the character at the current cursor position to be deleted. The remaining data from the cursor position to the end of the line move one character position left for each deleted character. Spaces for each deleted character are added to the end of the line. The CONTROL DCHAR sequence causes characters to be deleted on a total memory basis, with all data past the cursor to the end of the display moving left. As before, spaces are inserted at the end of memory for each deleted character.
ICHAR	Depression of this key initiates the insert character mode. All data on the current line move one character position right of the cursor as new characters are inserted at the cursor location. Data at the end of the line are lost. The CONTROL ICHAR sequence initiates the page insert mode. As characters are entered at the cursor location, all data to the right of the cursor are moved one position to the right for each character entered. Characters are deleted as they reach the end of memory.
SEND	The SEND key initiates a block transmission out the main port when the terminal is in a local mode. In the Page mode "PAGE" is displayed in Field B of the status line and the following events occur when the SEND key is struck: 1) "Ex" is displayed at the current cursor position; 2) the cursor backsearches through the screen until it encounters another Ex symbol or the Home position (top left corner of the display); 3) each character of each line is then transmitted (with spaces to the end of line suppressed) and the line is followed by a CR LF or a CR only in the case of a completely full 80 character line. When the cursor reaches its original position, it halts. The operator must move the cursor to the end of the next data block if another block send of subsequent material is desired. During data transmission, the status line indicates "MAIN SEND" and the keyboard is disabled. In Line mode, "LINE" is displayed in status line. The cursor returns to the start of the present line before transmission and only the cursor-occupied line (minus trailing spaces) is sent. No Ex character is written on the screen and the cursor appears in the first position of the following line after transmission.
LOCAL	Depression of the LOCAL key alternately toggles the terminal from local to on line modes. The host computer (CPU) can place the terminal on line with an ESC n sequence and in local mode with an ESC N. "LOCAL" or "ON LINE" appears in the status line, depending on the mode selected.
A-SEND	The A-SEND key is the equivalent of the SEND key except that transmission is out the aux port to the auxiliary device.
E-AUX	This key is analogous to the LOCAL key because it alternately enables/disables full communications between the keyboard, screen and auxiliary device. When E-AUX is on, "AUX RDY/BSY" appears in the status line. When interlocked with the CONTROL key, E-AUX alternately enables/disables the parallel port.
PAGE	The PAGE key toggles the terminal between the line and page transmission modes. "LINE" or "PAGE" appears in the status line depending on the mode selected. In the line mode, the SEND key initiates a line send function. In the page mode the SEND key initiates a block or page transmission. Further information is available under SEND in this table and in Section 3.3.
AUX ON	<p>The Aux On key is a toggle function also which logically connects/disconnects the main I/O port and auxiliary I/O port. In this way, the CPU may communicate directly with the auxiliary device. If the terminal is on line, incoming data from the CPU is displayed on the screen. "AUX ON" is present in field D of the status line when this mode is selected. When interlocked with the CONTROL key, AUX ON alternately activates/deactivates the parallel on mode.</p> <p>NOTE: Do not use combinations of On Line, Aux On and Aux Enable. Unwanted data paths resulting in multiple characters and other problems may occur.</p>
MLOCK	This toggle key alternately enables/disables the memory lock function. When enabled (on depression of key or receipt of ESC g), the display area above the cursor-occupied line is locked from operator access, but the area below this line functions normally. Subsequent depression of the MLOCK key or receipt of ESC h disables the memory lock function and the entire display screen is returned to normal operation. "MEM LOCK" on the status line indicates this mode is being used.
FORMS	<p>This key puts the terminal in forms mode or when interlocked with the CONTROL key, the forms build mode is entered. "FORMS" or "FORMS BLD" appears in the status line, depending on which mode is selected.</p> <p>The forms mode is usually used when the operator must deal with a preconstructed form which is transmitted to the terminal by the CPU for the operator to complete. Such a form usually contains protected data which in the forms mode the operator is unable to alter. Other areas of the form are unprotected fields which are reserved for operator entry of such information as name, address, telephone number, zip code, etc. The forms mode is often automatically entered when a form is presented to the operator for completion. The cursor is positioned to the beginning of the first unprotected field. The exit requirements of that field must be met before the operator may proceed to the next field. If an error is made while completing an unprotected field, the operator is notified of this by a message which appears in the status line in reversed blinking video. The error must be corrected before the operator can continue on to the next field. The completed form may then be transmitted by the operator using the SEND key.</p> <p>The forms build mode is used to generate forms locally for eventual transmission to the host computer. This mode is not commonly used by most operators. Forms and forms build are explained in detail in Section 3.3.</p>

(continued on next page)

Table 3-3 Keyboard Functions (continued)

KEY	FUNCTION
ASET	The ASET key when depressed causes the next entry to be interpreted as a visual attribute. Other keys are ignored. Example: ASET Q causes the screen to become half intensity reversed video from the cursor position to the end of the screen (or until another attribute is set). See Section 3.3.
RESET	The CONTROL RESET sequence causes the terminal to revert to the initial "power on" condition, except that the screen contents remain undisturbed.
PRINT	Activation of this key causes the terminal to transmit all memory contents from absolute Home to the current cursor location out the printer (parallel) port.
SCRL ↑	Each activation of the scroll up key causes the display "window" to move down one line.
SCRL ↓	Each activation of the scroll down key causes the display "window" to move up one line.
BTAB	Depressing the BTAB key causes the cursor to move to the previous tab location to the left. When the cursor reaches the first tab position on a line, it then moves to the last tab position of the previous line. The cursor remains at the HOME position when back-tabbed there and does not wrap around to the last line.
← (Cursor Left)	Depression of this key or ESC D moves the cursor to the left. If the cursor is at the first character position on a line, the cursor moves to the last character on the line above and upon reaching Home, remains there.
↓ (Cursor Down)	Depression of this key or ESC B moves the cursor to the same character position on the next line down. If on the last line, the cursor remains there.
HOME	Depression of this key or ESC H moves the cursor to the upper left corner of the display. This is the relative Home position. The cursor can be placed in the absolute Home position (line 1, column 1) with the CONTROL HOME sequence or ESC . 6.
↑ (Cursor Up)	Depression of this key or ESC A moves the cursor to the same character position in the next line above. Upon reaching the top line, the cursor remains there.
→ (Cursor Right)	Depression of this key or ESC C moves the cursor to the next character position. When the cursor reaches the last character position on the line, it moves to the first position on the next line down. When the cursor reaches the last position on the last line, it remains there.
TAB	<p>The TAB key moves the cursor to the next tabulation position. Fixed tab locations occur each eight character positions, e.g., position 0, 8, 16, etc. <u>Tabs cannot be set by the operator.</u></p> <p>Selection of roll or non-roll mode also affects TAB key operation. In roll mode TAB key actuation advances the cursor to the next available tabulation stop. When the cursor is at the last tab stop of line 48, the next TAB key actuation scrolls the screen and moves the cursor to the next tab. In non-roll mode, the cursor, is also positioned from tab stop to tab stop when the TAB key is pressed. However, when the cursor is in the last position of line 48, TAB key actuation has no effect on cursor position except to move it around in line 48.</p>
Alphanumeric Keys (A-Z, punctuation, and shiftable numeric keys)	The remaining keys, which are arranged and like the familiar standard typewriter keyboard, function as such. When used in conjunction with SHIFT/LOCK keys, the associated letter, number, symbol or punctuation mark is displayed and/or transmitted.
BACK SPACE	This key is equivalent to the ← key, except that the ASCII back space code is transmitted when on line. CONTROL H is the ASCII back space (BS) code.
ESC	Depression of ESC, followed by an alphanumeric or symbol key, causes the terminal to perform an Escape function as described in part c of 3.2.4 and as listed on the ASCII Code chart, Table 3-1.
LF	Depression of this key causes the cursor to move down one line while occupying the same character position.
RETURN (Carriage Return)	This key causes the cursor to move to first position of the current line while not in auto line feed mode (switch S1-3 down). If auto line feed is on the cursor advances to the beginning of the following line.
DEL/_ (Delete/ underline)	Depression of this key causes an underline to be displayed (if struck over existing data, it replaces the data with an underline). With the SHIFT key depressed, it causes a delete code to be transmitted but not displayed.
BREAK	The CONTROL BREAK sequence may be used to interrupt transmission from the host CPU. Actuation of the BREAK key alone causes no operation.
LOCK	The LOCK key is more accurately described as a "caps lock" because it affects the alpha characters (A-Z) only. It is a toggle key also. This means striking the key once causes it to assume a detent position (the key remains depressed) and upper case characters only may be produced. Striking the key again releases it from the detent position, enabling lower case characters to be produced.
SHIFT	Nonalpha displayable keys such as !/1 are manipulated with the SHIFT keys. When entering an alpha character with the LOCK on and a SHIFT depressed, a double shift occurs which results in a lower case character being displayed.
EOP CLEAR EOF	When interlocked with the CONTROL key, this key causes erasure of all displayed data from the current cursor position to the end of memory. When actuated alone, data from the current cursor position to the end of the line is erased.

(continued on next page)

Table 3-3 Keyboard Functions (concluded)

KEY	FUNCTION
CLEAR	When this key is used with the CONTROL key, the entire screen contents are erased and the cursor is positioned to Home. The interlocking of the two keys is a safety feature to prevent accidental erasure.
CONTROL	Depression of either CONTROL key followed by an alphanumeric or symbol key causes the terminal to perform a Control function as described in part b of 3.2.4 and as listed on the ASCII Code chart, Table 3-1.
SPACE BAR	The space bar is not labeled because its location and operation are very similar to the equivalent typewriter key. Its basic function is to move the cursor right one character position. After the cursor reaches the last character position of the currently-occupied line, it moves to the next line down leaving a space on the screen. The space is treated as a standard character code.
0-9 keys (Numeric pad)	These are stand-alone numeric entry data keys. Numeric pad keys are not affected by the SHIFT, LOCK, or CONTROL keys.
CE	The CE (clear entry) key only works when the terminal is in forms mode. Depressing this key moves the cursor to the beginning of the current unprotected field and erases to the end of the field. Forms mode is described later in Section 3.3.
(-) (Minus)	The Minus key generates the same code as in the typewriter array.
ENTER	The ENTER key generates the termination character selected by the rear panel switches. If CR (carriage return) or CR LF (carriage return-line feed) are selected, the terminal performs these functions when the ENTER key is depressed. If EOT (end of transmission) ETX (end of text) are selected, the terminal transmits these codes but no visible display functions occur.
(.) (Decimal Point)	The decimal point key generates the same code as the period on the typewriter array. This key is included on the numeric pad as a convenience feature.

continued from page 3-4

available to make graphs, charts, etc., which can be transmitted to the CPU for storage and later recall. See Section 3.3.

Read Terminal Status — The ESC O sequence may be used by the operator to promote a 27-character status line message which summarizes the current terminal operating configuration (baud rates, duplex setting, rear panel switch positions, etc.,). The message appears in the status line and is interpreted using Section 3.3.19.

Line Lock — The CPU may designate display lines as reserved for its exclusive use. The operator has no control over this, but "LINE LOCK" appears on the status line when such has occurred. The operator may enter data in any locked area of display that remains.

3.2.8 Display Memory Management

The capacity of the DM30 display memory is 3840 character positions organized as 48 lines each 80 characters long.

The memory is structured as a contiguous block of 48 lines with a 24 line display "window" which automatically adjusts at all times to ensure the cursor position is always displayed on the screen. The display window may be scrolled up and down a line at a time (see scroll up/scroll down functions), or selected

to display the first or second page of memory. (Next page/previous page functions.) Figure 3-2 illustrates how the display "window" may be moved through both pages of memory.

Along with the 24 lines which are displayed is the status line which is always presented in line 25. This line is not considered a part of normal display memory and is accessed only under special conditions. See Section 3.3.19.

Data received to the display memory automatically overflow each line end, and on reaching the bottom line of the display window normally causes scrolling without losing the data from memory. On reaching the end of memory scrolling causes data at the top of memory to be discarded a line at a time. To prevent data loss caused by scrolling, the roll mode is disabled as described in Section 2.7.2.

3.3 DETAILED OPERATION DESCRIPTION

3.3.1 General

This section provides detailed functional information on the DM30. It is assumed that the reader has some background in digital communications and is familiar with some of the terminology involved. To understand all terminal

continued on page 3-11

Figure 3-2 Display Window/Memory Relationships

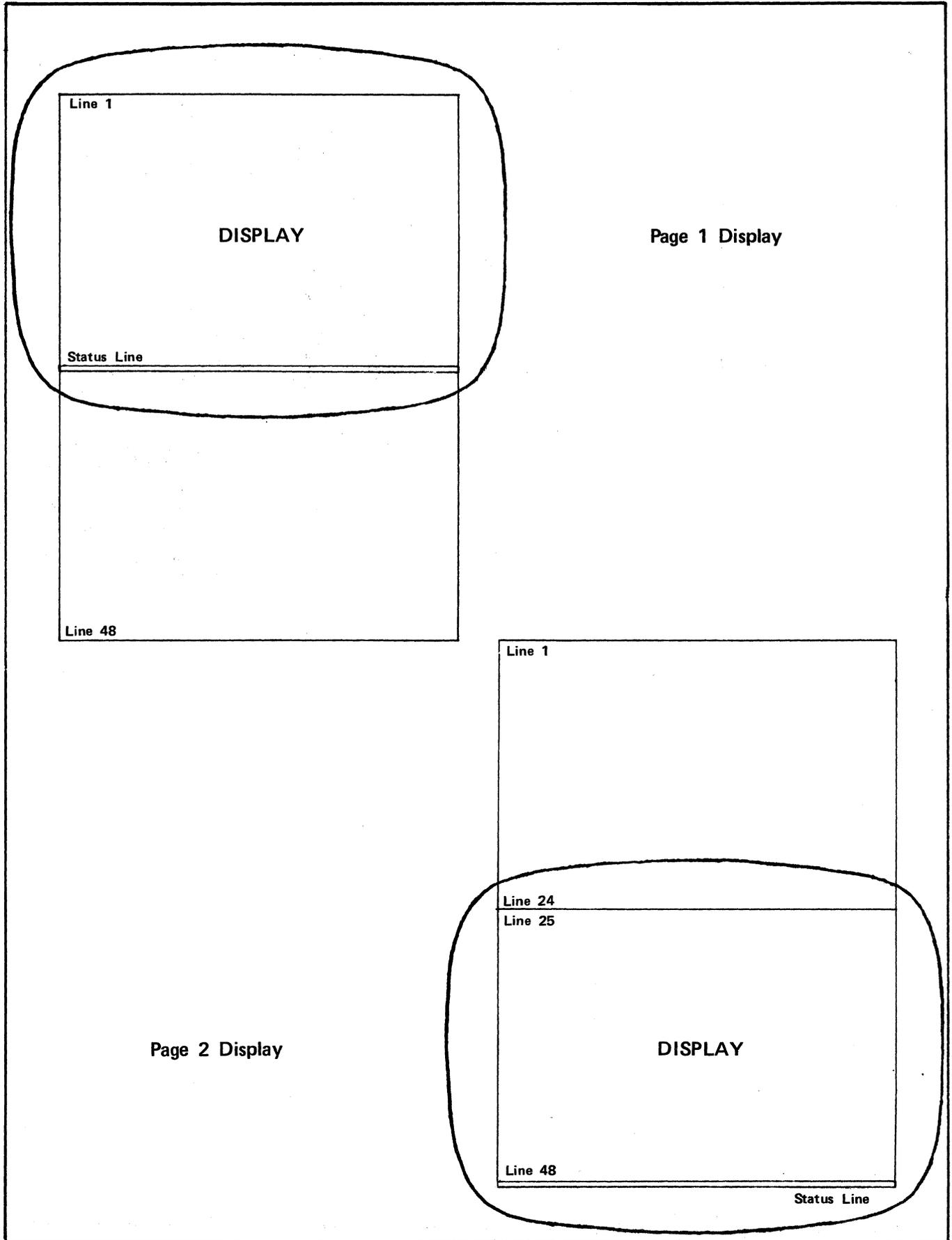
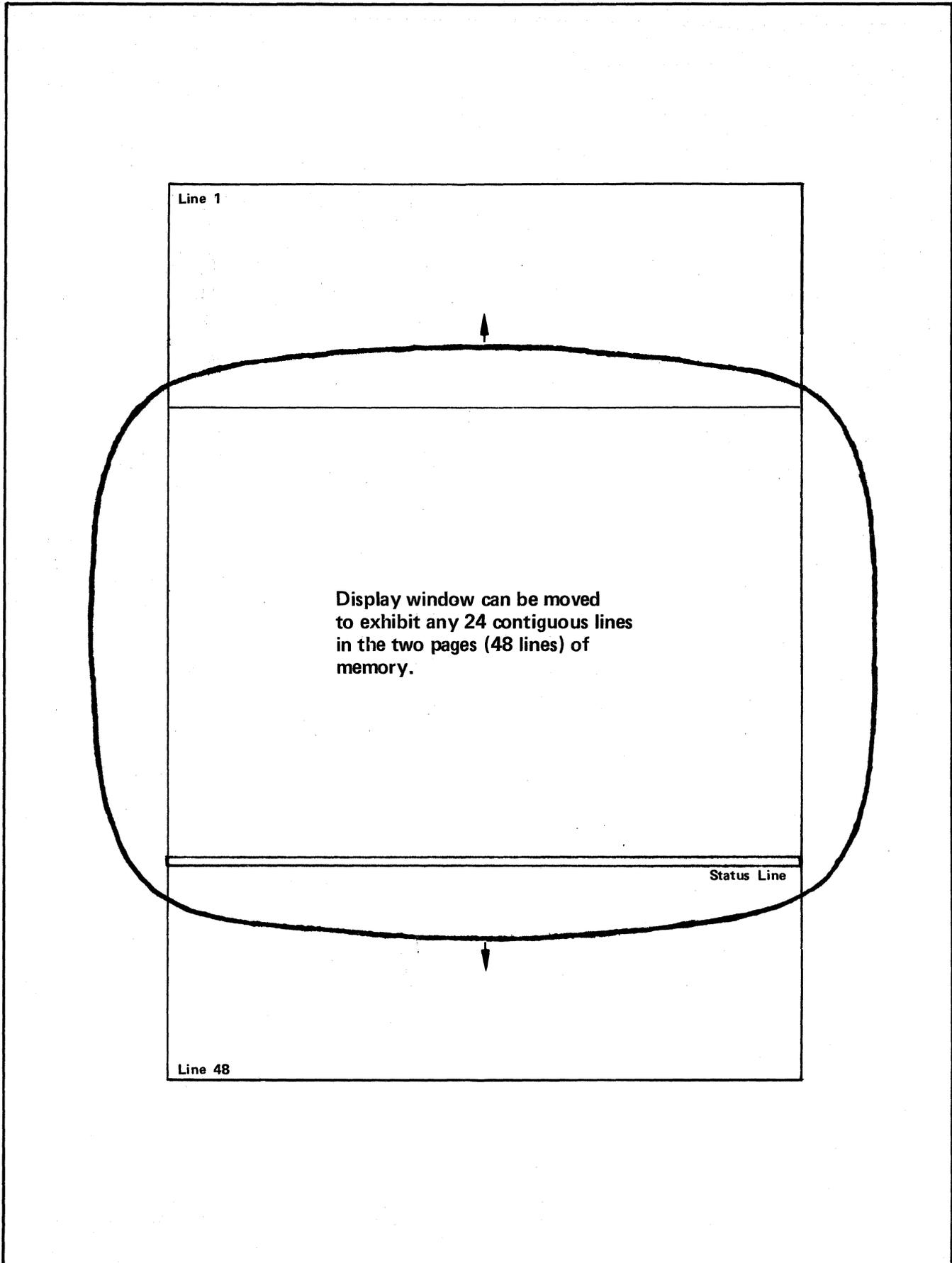


Figure 3-2 (concluded)



continued from page 3-8

capabilities thoroughly, the user must read this section because it covers terminal functions which are interrelated and mode-dependent. While none of the following material is difficult, the user must be acquainted with it to realize maximum efficiency from the DM30.

3.3.2 Keyboard Management

Control Functions



To perform a Control operation, depress the CONTROL key and hold this key down while simultaneously typing the alphanumeric key desired. The CONTROL key is used to modify the meaning (and code) of certain other keys. When held down during action of any displayable character key (columns 2-7 of ASCII Code Chart), bits 6 and 7 of the code are forced to zero so that the codes from rows 0 and 1 of the chart can be produced from the keyboard. It is also used as a safeguard for functions like clear, break, reset and others so that the accidental striking of these keys does not destroy screen contents or disrupt communications. CONTROL does not affect the 16 special function keys or the numeric pad.

Escape Functions



To perform an escape operation, depress and release the ESC key, followed by the designated alphanumeric key. Be careful that any commas or dashes appearing in the explanation of an escape or control operation are actually part of the intended sequence before entering them on the keyboard. Often the punctuation is included in the text only to help clarify the explanation of a multiple entry keyboard operation. The ASCII Code chart is the best place to verify unfamiliar control or escape sequences.

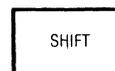
The ESC key is used as the first code in a multiple code sequence. It must be pressed and released before the second key is struck.

On Line: ASCII ESC is transmitted.

The CONTROL ESC sequence allows local action of escape code sequences. The codes will not be transmitted even if On Line. This sequence overrides full duplex and all other switch settings. For example, setting the clock as described in 3.3.16

and using the CONTROL key in conjunction with this operation would result in a clock displayed on the terminal screen with no clock information being transmitted out the I/O.

SHIFT and LOCK



The SHIFT and LOCK keys are used to generate upper case codes and are operated the same as the equivalent typewriter keys, except as follows:

The LOCK key (also called the alpha lock key) affects alpha characters (A-Z, upper and lower case) only, so the SHIFT key must be used to manipulate the other displayable keys such as !/1. When entering an alpha character with the LOCK on and the SHIFT depressed, a double shift occurs which results in lower case characters being displayed. The SHIFT keys do not affect special function keys or numeric pad keys.

3.3.3 Numeric Pad Functions

The numeric pad keys shown below, when depressed, cause the associated character to be

7	8	9	CE
4	5	6	—
1	2	3	ENTER
0		.	

displayed and/or transmitted. The numeric pad includes a CE, Minus, and ENTER key. This group is a stand-alone numeric data entry key pad, not affected by the SHIFT, LOCK, or CONTROL keys.

The ENTER key generates the termination character designated by the rear panel switches (see Section 2.7.5). If a CR or CR-LF is the selected termination character and the ENTER key is struck while in Local or half duplex, the terminal activates the code locally and transmits it if in On Line. There is no visible screen response to EOT or ETX, but these codes are transmitted. The Minus key in the numeric pad generates the same code as the typewriter Minus key. The CE (Clear Entry) feature is operational only while in the FORMS mode and positions the cursor to the beginning of the current unprotected field, erasing to the end of the field. If On Line in the Forms mode or normal mode, the CE key generates ESC , (comma).

3.3.4 Edit Functions

The edit function keys are shown below.



Delete Line (DLINE)

Keyboard action of the delete line key (DLINE) causes the current cursor line to be deleted. The remaining lines are each moved up one line and a blank line is inserted at the end of the display. The cursor is positioned to the beginning of the line it currently occupies. If DLINE is used on a line where an attribute is set, the attribute is also deleted, even if the attribute affects multiple lines.

Forms Mode: Illegal; rings bell.

Keyboard Operation: D LINE or ESC M.

I/O Operation: Receipt of ESC M.

Transmitted Code: ESC M.

Insert Line (ILINE)

Keyboard action of the insert line key (ILINE) causes all data to be moved down one line, starting at and including the cursor-occupied line. A blank line is inserted at the original cursor line position and the cursor is positioned to the beginning of the new blank line. Any data in the last line of memory (line 48) are lost.

Forms Mode: Illegal; rings bell.

Keyboard Operation: ILINE or ESC L

I/O Operation: Receipt of ESC L

Transmitted Code: ESC L

Delete Character – On a Line Basis (DCHAR)

Keyboard action of the Delete Character (DCHAR) key causes the current cursor character to be deleted. All data to the end of the line is moved left one position and a space is inserted at the end of the line.

Forms Mode: Character deletion is on a field basis.

Keyboard Operation: DCHAR or ESC P

I/O Operation: Receipt of ESC P

Transmitted Code: ESC P

Delete Character – On a Total Memory Basis (CONTROL DCHAR)

Keyboard action of the delete character key in conjunction with the control key (CONTROL-DCHAR) causes character deletion on a total memory basis. All data to the end of memory are moved and wrapped around to the left with a space inserted at the end of memory.

Forms Mode: Illegal; rings bell.

Keyboard Operation: CONTROL DCHAR or ESC`

I/O Operation: Receipt of ESC`

Transmitted Code: ESC`

Insert Character – On a Line Basis (ICHAR)

Keyboard action of the insert character key (I CHAR) initiates the insert character mode and the message "LINE INSRT" appears in field F of the status line. All data in the current line are moved to the right, from and including the character at the cursor, as new characters are entered. The cursor moves to the right as each character is inserted, indicating the location of the next inserted character. Data are lost at the end of the line. Striking the ICHAR key a second time cancels the insert character mode.

Forms Mode: Character insertion is on field basis.

Keyboard Operation: ICHAR or ESC Q sets mode on.

ICHAR or ESC @ sets mode off.

I/O Operation: Receipt of ESC Q sets mode on.
Receipt of ESC @ sets mode off.

Transmitted Code: ESC Q for mode on.
ESC @ for mode off.

Insert Character – On a Total Memory Basis (CONTROL ICHAR)

Keyboard action of the insert character key in conjunction with the CONTROL key initiates the page insert mode. "PAGE INSRT" appears in field F of the status line and all data to the end of memory are moved and wrapped around to the right as characters are inserted at the cursor position. Characters are lost at the end of memory. Striking the ICHAR key again resets this mode.

Forms Mode: Illegal; rings bell.

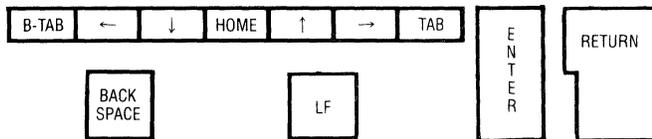
Keyboard Operation: CONTROL ICHAR or ESC a sets mode on;
ICHAR or ESC @ sets mode off.

I/O Operation: Receipt of ESC a sets mode on.
Receipt of ESC @ sets mode off.

Transmitted Code: ESC a when mode on.
ESC @ when mode off.

3.3.5 Cursor Movement

The cursor movement keys are shown in below.



Home (HOME)

Two Home locations are available within memory to which the cursor may be directed. Relative Home is the top left character position of the display. The cursor is directed there by striking the HOME key or using the ESC H sequence. Absolute Home is line 1, column 1, which is the first memory location. The cursor is directed there using CONTROL HOME or ESC .6. When the cursor is directed to either relative or absolute Home, the display "window" (See Section 3.2.8) adjusts automatically to maintain cursor visibility.

Forms Mode: The cursor moves to the first location of the first unprotected location on the screen. Absolute Home is illegal.

Memory Lock/Line Lock: When portions of the memory are locked, the cursor

moves to the first unlocked location available (moving from the top of the screen down).

Keyboard Operation: HOME or ESC H for relative Home CONTROL Home or ESC .6 for absolute HOME.

I/O Operation: ESC H or ESC .6.

Transmitted Code: ESC H or ESC .6.

Cursor Left (←)

Action of the ← key advances the cursor one position to the left. On reaching column 1 of a line, it wraps to column 80 of the previous line. On reaching Home, it stops.

Forms Mode: Moves cursor left within the field.

Memory Lock/Line Lock: On reaching an area of memory lock, the cursor stops. On reaching a locked line, the cursor wraps from column 1 of the line below the locked line to column 80 of the first unlocked line above. If no further unlocked lines remain before reaching Home, the cursor stops.

Keyboard Operation: ← or ESC D.

I/O Operation: Receipt of ESC D.

Transmitted Code: ESC D.

Cursor Right (→)

Action of the → key advances the cursor one position right. On reaching line end, it wraps to column 1 of the next line below. On reaching column 80 of line 48, it stops.

Forms Mode: Moves cursor right within the field.

Line Lock: On reaching a locked line, the cursor advances to the next unlocked line, stopping on line 48.

Keyboard Operation: → or ESC C.

I/O Operation: Receipt of ESC C.

Transmitted Code: ESC C.

Cursor Up (↑)

Action of the ↑ key advances the cursor up one line; on reaching the Home line, it stops.

Forms Mode: Moves cursor up within the field.

Memory Lock/Line Lock: On reaching an area of memory lock, the cursor stops. On reaching a locked line, it advances to the first free unlocked line, stopping on line 1, if necessary.

Keyboard Operation: ↑ or ESC A.

I/O Operation: Receipt of ESC A.

Transmitted Code: ESC A.

Cursor Down (↓)

Action of the ↓ key advances the cursor down one line. On reaching line 48, it stops.

Forms Mode: Moves cursor down within the field.

Line Lock: On reaching a locked line, the cursor advances to the next unlocked line, stopping on line 48.

Keyboard Operation: ↓ or ESC B.

I/O Operation: ESC B.

Transmitted Code: ESC B.

Line Feed (LF)

Action of the line feed key causes the cursor to advance to the next line down. On reaching line 48, if the terminal is in the roll mode (switch S1-2 up), action of the line feed key causes scrolling to occur. Line 1 is lost and the data moves upward to create a new line 48. If the terminal is in the non-roll mode (switch S1-2 down), the cursor stops on line 48.

Forms Mode: The cursor moves within an unprotected field extending through multiple lines.

Line Lock: In non-roll mode, encountering a locked line advances the cursor to the first unlocked line available stopping on line 48.

Keyboard Operation: LF or CONTROL J.

I/O Operation: Receipt of CONTROL J (LF)

Transmitted Code: CONTROL J (LF)

Carriage Return (RETURN)

Action of the RETURN key causes the cursor to move to column 1 of the current line while not in the auto line feed mode (switch S1-3 down). If auto line feed is on, the cursor advances to column 1 of the following line.

Forms Mode: The cursor returns to the first unprotected location of the current field.

Roll Mode: If the auto line feed mode is selected, the DM30 display scrolls if the cursor is on the bottom line.

Non-Roll Mode: If the auto line feed mode is on, the cursor stays in line 48 if the RETURN key is struck while the cursor occupies the bottom line.

Enter Key (ENTER)

If the selected termination character is CR or CR-LF (see Section 2.7.5), action of the ENTER key causes cursor movement. See carriage return and line feed sections elsewhere in this manual for relevant details.

Tabulate (TAB)

Action of the tab key causes the cursor to advance to the right and halt at the next tab stop location. Tab stops are fixed at locations 0, 8, 16, 24, 32, 48, 56, 64, and 72 of each line. The tab key automatically wraps at the end of each line.

Forms Mode: Action of the tab key moves the cursor sequentially to each unprotected field start delimiter on the screen provided the exit parameters

of the current field have been met. Attempts to tab when exit parameters are not met sounds the alarm and the cursor does not move. Tabbing from the last field in memory causes the cursor to halt.

Roll Mode: In roll mode, action of the tab key advances the cursor sequentially until it reaches the end of memory. Tabbing beyond line 48 causes scrolling to occur.

Non-Roll Mode: In non-roll mode, the cursor stops when tabbing is attempted from line 48, character position 72.

Keyboard Operation: TAB or CONTROL I (HT)

I/O Operation: Receipt of CONTROL I (HT)

Transmitted Code: CONTROL I (HT)

Back Tab (BTAB)

Action of the BTAB causes the cursor to back up to the previous tab location, wrapping as necessary. On reaching Home, the cursor halts. Locked lines are tabbed around, not through.

Forms Mode: The BTAB causes the cursor to reverse to the beginning of the field it currently occupies. Action of the BTAB key a second time reverses the cursor to the start of the previous field. BTAB stops on reaching the Home location in the first field.

Keyboard Operation: BTAB or ESC >

I/O Operation: Receipt of ESC >

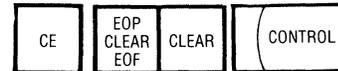
Transmitted Code: ESC >

Back Space (BACK SPACE)

This key is equivalent to the ← key except that the ASCII back space code is transmitted when on line. Local effects are identical to ←.

3.3.6 Screen Erasure

The keys associated with screen erasure are shown below.



Clear Screen (CONTROL CLEAR)

Action of the clear key in conjunction with the CONTROL key causes erasure of all data in memory with the cursor returning to the Home position. The clear key actuated without the CONTROL key causes no action. This is a safety feature to prevent accidental erasure.

Forms Mode: The clear screen function causes the erasure of all unprotected data to the null codes with the cursor returning to the first unprotected location of the first field.

Memory Lock/Line Lock: The clear function causes erasure of all unlocked areas of memory while allowing locked areas of data to remain. The cursor moves to the first unlocked memory location.

Keyboard Operation: CONTROL CLEAR or ESC E

I/O Operation: Receipt of ESC E

Transmitted Code: ESC E

Erase to End of Line (CLEAR EOP/EOF)

Action of this key causes erasure of displayed data from the current cursor position to the end of the line.

Note: If forms delimiters are present in memory but forms mode is not currently selected, these delimiters are **not** altered by using the erase to end of line function.

Forms Mode: Erases all unprotected data to the null codes from the current cursor position to the end of the field.

Keyboard Operation: Action of the CLEAR EOP/EOF key or ESC K

I/O Operation: Receipt of ESC K

Transmitted Code: ESC K

Erase to End of Page (CONTROL CLEAR EOP/EOF)

Action of the CLEAR EOP/EOF key in conjunction with the CONTROL key erases all displayed data from the current cursor position to the end of memory.

Note: If forms delimiters are present in memory but forms mode is not currently selected, these delimiters are not altered by using the erase to end of page function.

Forms Mode: Erases all unprotected data from the current cursor position to the end of memory.

Keyboard Operation: Action of the CONTROL CLEAR EOP/EOF sequence or ESC J

I/O Operation: Receipt of ESC J

Transmitted Code: ESC J

Clear Entry (CE)

The CE key is operable only while in the forms mode. Action of this key causes total erasure of the current unprotected field and the cursor to be placed in the first location of that field.

Keyboard Operation: CE or ESC ,

I/O Operation: Receipt of ESC ,

Transmitted Code: ESC ,

3.3.7 Communications

Communication-related keys are shown below.



The DM30 offers bidirectional, serial communications capability from both the main and auxiliary ports. Baud rates to 19.2K may be used with both these ports. At 19.2K baud X-On X-Off protocol should be used to prevent buffer overflow. (See Section 3.3.8 which follows for more complete information on X-On/X-Off.) The DM30 is RS232C interactive, responding to standard control and handshaking signals over both serial ports. The DM30 may communicate up to 9600 baud with a remote data set using the current loop interface which is available over the main I/O. (See Section 2.5.3 for complete current loop details.) Software control of the DM30 is extensive. A high-speed Centronics-compatible parallel port provides unidirectional output which may originate from the terminal, the CPU, or the auxiliary device. When a printer is connected to the terminal, hard copy is immediately accessible to the operator from all these sources.

A number of communication modes are described in the following paragraphs. The reader should refer periodically to Figure 3-3 which is a simplified pictorial approach to help explain communication modes and associated data paths.

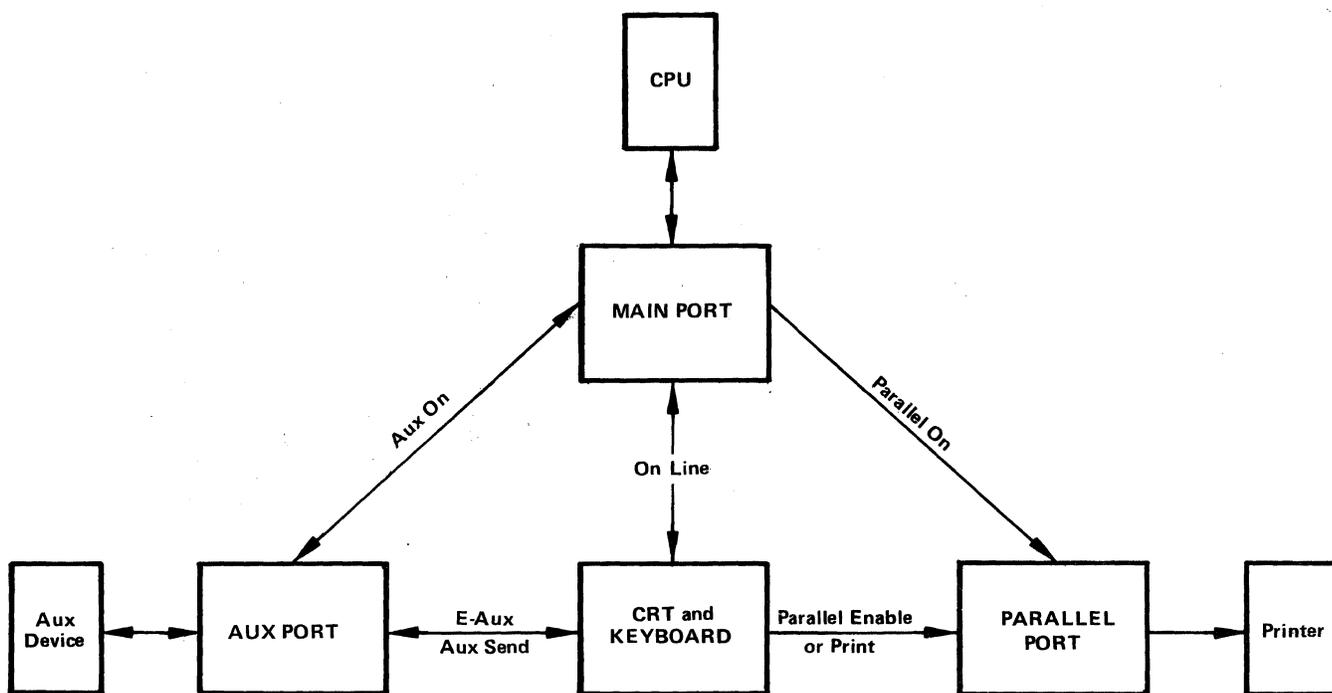
Send (SEND)

In local mode, the SEND key initiates a block transmission out the main port.

In page mode, an ETX (E_X) is displayed at the current cursor position. An STX code is transmitted and the send program backsearches through the memory until it encounters another ETX or the Home position. (Absolute Home; line 1, column 1.) Each character of each line is then transmitted (with spaces to the end of line suppressed) and the line is followed by CR-LF. A CR code only is transmitted after a full 80-character line. When the cursor reaches its original position, the termination character is transmitted (see Section 2.7.5)

*May be subject to trademark claim.

Figure 3-3 Mode/Data Path Relationships



Arrows indicate direction of data flow

Each labeled line indicates the mode entered to cause the associated data path

and the terminal remains in the local mode. During data transmission, the status line indicates MAIN SEND and the keyboard is disabled. (Internal switch 1, when enabled, allows the terminal to go on line after a block transmission.) All applicable RS232C control signals are active during a block transmission.

In line mode, the whole line that the cursor is on (minus trailing spaces) is transmitted. No ETX character is written on the screen and the cursor appears in column 1 of the following line after transmission of the termination character. If internal switch 1 is enabled, the terminal goes on line at the end of line transmission. Again, all applicable RS232C control signals are active during the transmission.

Forms Mode & Page Mode: Regardless of cursor position, in the page mode, all of the unprotected fields of data are transmitted with an ASCII HT code between fields. There is no displayed ETX, and any constant field is transmitted first.

Forms + Modified Mode: If the modified mode is on, only the fields which have been altered are transmitted with HT codes replacing unmodified fields.

Forms + Line Mode: In the line mode, only the current field is transmitted and the cursor skips to the next field, if exit requirements of the current field have been met. All characters of the variable field are transmitted, including all spaces in the field.

On Line: The ETB code is transmitted by the SEND key in either the page or line mode. The send function cannot be initiated from the keyboard when on line unless the ETB code is echoed to the terminal by the CPU.

Note: Receipt of X-Off code disables transmission until X-On is received (See Section 3.3.8)

Keyboard Operation: The SEND key or ETB (CONTROL W) initiates a page send or a line send, according to the current mode selected.

I/O Operation: Receipt of an ETB code causes either a line send or a page send, according to the mode selected.

Receipt of an ESC I code forces a page send to be initiated, regardless of the current mode selected. The original mode is assumed when transmission is complete.

Receipt of ESC i similarly forces a line send to occur, the original mode again being assumed upon completion.

Transmitted Code: CONTROL W (ETB)

Line/Page Modes (PAGE)

The PAGE key alternates the terminal between page and line modes, the two types of transmission initiated by the SEND key. Both are discussed in the following paragraphs.

In the Line mode the SEND key initiates a line send function. The transmission begins at the start of the present line and the whole line (minus trailing spaces) is transmitted. No ETX character is written on the screen and the cursor appears at column 1 of the following line after transmission of the termination character. If internal switch 1 is enabled, the terminal goes on line at the end of the line transmission. All applicable RS232C control signals are active during the transmission.

On Line: ESC # is transmitted

Forms Mode: If the terminal is in forms mode and a line send is initiated, then only the field the cursor presently occupies is transmitted.

Modified Mode: If the terminal is in a modified mode and a line send is initiated, then only a cursor-occupied field in which the data have been modi-

fied may be sent. The exit parameters of the field must be met and the selected termination character is included.

Keyboard Operation: LINE key or ESC #

I/O Operation: Receipt of ESC #

Transmitted Code: ESC #

In the Page mode the SEND key initiates a block transmission of a selected portion of memory. An STX code is transmitted and the send program backsearches through the screen until it encounters another ETX symbol or the Home position (absolute Home). Each character of each line is then transmitted with spaces to the end of line suppressed. A CR-LF sequence is transmitted at the end of each data line when spaces are suppressed. A CR code only is transmitted after an 80-character line. When the cursor reaches its original position, the selected termination character is transmitted (see Section 2.7.5) and the terminal remains in the local mode. (Internal switch 1 when enabled allows the terminal to go on line after a block transmission.)

Forms Mode: A constant field (if present) plus all unprotected fields is sent when the SEND key is struck, but no STX is sent. An ASCII HT is sent between fields. After sending the last field, the termination character (switch selectable) is transmitted and the terminal remains in local mode.

Modified Mode: If the terminal is in modified mode and a page send is initiated, then only modified fields are sent. In place of unmodified fields, an HT is sent.

Keyboard Operation: PAGE key or ESC !

I/O Operation: Receipt of ESC !

Transmitted Code: ESC !

Local Mode (LOCAL)

The LOCAL key is a toggle function; it alternately switches the terminal from on line to local and vice versa. In the on line mode, all alphanumeric characters are transmitted through the main I/O port when keys are struck. All control keys (such as RETURN) send their associated control code. All function keys send their associated two-code sequence if enabled by the appropriate internal switch. (See Section II.) If the switch is disabled, the code is performed locally only.

In the local mode, the keyboard is connected directly to the display and any key activated only affects the display; no transmission occurs. The terminal must be in the local mode before a block transmission may be initiated. The receiver is only partially disabled while in local mode. It continues to monitor for the receipt of certain code sequences that may be performed while the terminal is in a local mode. These sequences are:

GO ON LINE
AUX-ON
AUX-OFF
SET MEM ADD POINTER
CPU MSSGE DEPOSIT
PARALLEL ON

Keyboard Operation: LOCAL or ESC n for on line
LOCAL or ESC N for local

I/O Operation: Receipt of ESC n for on line
Receipt of ESC N for local

Transmitted Code: ESC n for on line
ESC N for local

Line Monitor Mode

The line monitor mode allows the entry of received control code and escape sequences into display memory. Remote command execution is inhibited and all codes are displayed. Control codes and escape codes are generated on the keyboard and written to display memory without command execution.

Keyboard Operation: On with ESC : and off with ESC *

I/O Operation: Receipt of ESC : for on or ESC * for off.

Transmitted Code: ESC : for on or ESC * for off

Page Dump

The page dump feature allows the user to transmit the entire memory contents (including graphics, visual and logical attributes) to the CPU for later retrieval and recomposing. To perform a page dump from the keyboard, the terminal must be in local mode and not in forms or forms build mode. Page dump is initiated with an ESC o. After this sequence is entered, an ESC E (clear screen) is transmitted, followed by the entire memory contents including visual attributes and associated codes. Codes necessary to build forms are also sent. These include the cursor address to position the cursor to the beginning of a field, the escape sequence and logical attributes associated with that field, the field-ending cursor address, and the escape sequence to end the field. Graphical information is similarly transmitted as a sequence of graphic on/off commands. This enables exact representation of the original screen contents at a later time.

Auxiliary Send (ASEND)

The ASEND key is the equivalent of the SEND key except that data transmission is out the auxiliary port (not the main port) and is routed to the auxiliary device. All lines are followed by a CR-LF sequence regardless of line length. Transmission of data while in the forms mode via the auxiliary port causes all protected data to be transmitted as space codes. If a constant field is present, it is transmitted as constructed on the CRT. Space suppression is performed as required, page format being maintained. The ASEND functions in both line and page modes are similar to SEND while obeying the go on line switch (internal switch 1) after the transmission is completed. If the terminal is aux enabled when an auxiliary send is activated, an ESC Ø is transmitted to the auxiliary device and no action occurs unless the code is echoed. While doing a block transmit out the auxiliary port, AUX SEND appears in the status line.

Note: Transmission to the auxiliary port while in modified mode is an illegal operation.

Line Mode: With the DM30 in local and line modes, action of the ASEND key causes transmission a line at a time to occur. No STX is sent and an ETX does not appear on the terminal screen. A CR-LF is sent following the line.

Page Mode: When the ASEND key is actuated in the Page mode, an ETX is printed at the present cursor location. The cursor then backsearches to Home or the next previous ETX and transmission occurs from that point until another ETX is encountered.

Keyboard Operation: ASEND or ESC Ø

I/O Operation: Receipt of ESC Ø

Transmitted Code: ESC Ø

Auxiliary On (AUX ON)

The AUX ON key logically connects the main I/O port to the auxiliary I/O port in a daisy chain configuration. Communication may be bidirectional and data transfer does not interfere with terminal keyboard and screen operations. When the terminal is in local mode, all keys operate locally without transmission to either port. Baud rate settings on the two ports need not be the same. Each port is buffered and the terminal may optionally control data flow in a way that no overrun or data loss occurs. If the terminal is unable to accept more data from the main port, an X-Off code is sent to the host to stop data flow. When the buffer is sufficiently empty, an X-On code is sent to restart the flow of data without loss. If the terminal is unable to accept more data from the aux port, the CTS signal (pin 5, clear to send) is dropped to inhibit data flow until the buffers can accept more data. If the terminal is placed on line or aux enabled, the screen monitors data from the port selected and the keyboard codes are routed to that port. When aux on is selected, AUX ON is presented in the status line.

Keyboard Operation: AUX ON or ESC (for aux on AUX ON or ESC) for aux off (AUX ON is a toggling key.)

I/O Operation: Receipt of ESC (for aux on
Receipt of ESC) for aux off

Transmitted Codes: ESC(and ESC)

Note: Combinations of on line, aux on and aux enable are used primarily for line diagnostic purposes. They may cause multiple character entry or unwanted multiple paths for data when used together. It is therefore not advisable to use these modes simultaneously during normal terminal operation.

Auxiliary Enable (E-AUX)

This key has a function similar to the local key. It puts the terminal on line with the auxiliary I/O port and full communications are enabled between the keyboard, CRT and the auxiliary device. All communications are half duplex only, regardless of main port switch settings. (Echoed characters appear double on the screen.) The terminal controls incoming data by dropping and raising pin 5 (CTS) on the auxiliary port. The aux port is disabled when the E-AUX key is struck a second time. When E-AUX is on, it is reflected by the AUX RDY/BSY message in the status line.

Keyboard Operation: E-AUX or ESC j enables the aux
E-AUX or ESC k disables it
(E-AUX is a toggling key)

I/O Operation: Receipt of ESC j enables the aux
Receipt of ESC k disables it

Transmitted Code: ESC j or ESC k

Note: If the DM30 is on line with the aux enabled, keyboard data go to both ports and the screen, and each port has access to the screen. If either device echoes, multiple characters appear on the screen. The terminal may also be aux on and aux enabled simultaneously. Under these conditions, data from the main receiver passes directly to the auxiliary device without appearing on the screen. Data from the keyboard appears on the screen and is passed to the auxiliary device. Data from the auxiliary device appear on the screen and are passed to the main port transmitter. Under this condition, the status line indicates AUX ON, since it has priority over AUX RDY.

Auxiliary Page Dump

This function is similar to page dump as described earlier, except that data transmission occurs from the auxiliary port to the auxiliary device. ESC / initiates the dump. Again, the DM30 may not be in forms or forms build mode. The terminal responds to the go on line switch (Internal switch 1) following transmission.

Keyboard Operation: ESC / initiates the aux page dump

I/O Operation: Receipt of ESC /

Transmitted Code: ESC /

Print Key (PRINT)

The PRINT key is used to transmit DM30's memory contents out the parallel port to the associated hard-copy printer. Except for handshaking signals, communication out this port is always unidirectional away from the terminal. The entire memory from absolute Home to the current cursor location is transmitted, making it possible for the operator to obtain printed copy of any CRT-displayable data except visual attributes and graphics. Hard copy limitations imposed by the printer must be kept in mind while performing a print operation. For example, an upper-case only machine cannot be expected to exactly reproduce a CRT display which consists of upper and lower case characters.

Keyboard Operation: PRINT or ESC . 4 starts print.

I/O Operation: ESC . 4

Transmitted Code: ESC . 4

Parallel On (CONTROL AUX ON)

The parallel-on sequence is not associated with a particular function key, but it is still an important operation which should be understood. Its purpose is to logically connect the CPU with the printer so that data from the CPU may be readily printed for the operator.

Parallel on may be initiated with either the CONTROL AUX ON keyboard sequence or ESC-. With the parallel port on line, the CPU may actuate the printer directly. Keyboard/CRT interaction remains active during this mode, allowing the operator to manipulate display and memory even during a printing operation. To take the parallel port off line, use the CONTROL AUX ON keyboard sequence or ESC).

Keyboard Operation: CONTROL AUX ON or ESC- for Parallel On
CONTROL AUX ON or ESC) for Parallel Off
(CONTROL AUX ON is a toggling function)

I/O Operation: ESC - for Parallel On
ESC) for Parallel Off

Transmitted Code: ESC - and ESC)

Parallel Enable (CONTROL E-AUX)

This key is similar to the LOCAL key in that it alternately turns the parallel port on and off, regulating the printer's ability to respond to incoming data. The mode is enabled with the CONTROL EAUX keyboard sequence or ESC.5 and disabled with CONTROL EAUX or ESC k.

Keyboard Operation: CONTROL EAUX or ESC.5 turns mode on
CONTROL EAUX or ESC k turns mode off
(CONTROL EAUX is a toggling function.)

I/O Operation: ESC.5 turns mode on
ESC k turns mode off

Mode Prioritization

The parallel and auxiliary functions described above have equal priority in the DM30 operating system and may be interrupted each other as required. For example, the aux on or enable aux functions may be interrupted by any parallel function. Similarly, the parallel on and parallel enable modes may be interrupted by any aux functions. Note, however, that the parallel and auxiliary functions use the same output buffer. Any output operation to either function must be given enough time for completion or data loss will occur because of the interrupted function.

Table 3-4 which follows summarizes the auxiliary and parallel modes and lists the ways each mode is entered and exited.

Table 3-4 Auxiliary/Parallel Mode Entry and Exit

MODE	TO TURN MODE ON		TO TURN MODE OFF	
	Keyboard Entry	I/O Entry	Keyboard Entry	I/O Entry
Aux on	AUX ON	ESC (	AUX ON (toggles) or any Parallel function	ESC) or any Parallel function
Enable Aux	EAUX	ESC]	E-Aux(toggles) or any Parallel function	ESC k (disable Aux) or any Parallel function
Parallel On	CONTROL AUX ON	ESC --	CONTROL AUX ON (toggles) or any Aux function	ESC) (Aux off) or any Aux function
Parallel Enable	CONTROL EAUX	ESC . 5	CONTROL EAUX (toggles) or any Aux function	ESC k (disable Aux) or any Aux function

Modified Page Dump

Sometimes it is not possible to do a total page dump because of buffer size limitations imposed by the off line storage device. In such cases, modified page dump is used. This mode enables the terminal to do a series of block sends with each block being a predetermined size. This mode is prompted by first entering the three code extension command string (ESC . :), then a code determining the number of characters to be transmitted in each block, and finally the selected termination character. This is then followed by the appropriate page dump command.

Table 3-10 (normally used for cursor addressing and memory address pointer) is used to define the block length in characters. The number of characters sent in the modified page dump is twice the numeric value of the selected code.

The termination character may be any ASCII code except nul and rub out.

Example: To dump memory in 160-character blocks, the following sequence is used;

ESC . : o EOT Page Dump Command
 160 characters of memory (including the terminator) are transmitted each time a DC1 (X-On) is entered over the I/O.

3.3.8 Transmit On and Transmit Off (X-ON/X-OFF)

The DM30 is provided with a switch-selectable full duplex line protocol. Designed to allow full control of both data transmission and reception by the terminal, it enables the user to gain the maximum permissible data throughput on any full duplex system. The use of the full protocol is limited to full duplex systems because of the requirement to simultaneously transmit and receive data.

The terms X-On and X-Off as used herein mean Transmit On (CONTROL Q) and Transmit Off (CONTROL S), respectively. They are ASCII control codes used in data communications to interrupt transmission and reception when necessary to prevent data loss.

The protocol which is described below accomplishes X-On and X-Off automatically. This automatic, periodic suppression of the transmit function is called "X Suppress," an acronym for "Transmit Suppress," and is controlled by Internal switch No. 4.

The protocol is subdivided into two major areas :
 (1) Control of data output from the terminal and
 (2) Control of data received by the terminal.
 Each is discussed in detail.

Internal switch 4 governs the automatic assertion of Transmit Suppress.

When switch 4 is on, X-Suppress is also on. The terminal does not transmit X-On or X-Off codes unless these control codes have been generated as valid data. The terminal responds to receipt of X-On and X-Off only if it is currently transmitting.

When switch 4 is off, X-Suppress is also off. The terminal transmits X-On and X-Off codes and responds to the receipt of X-On and X-Off in all transmission modes.

Terminal Output Control

The control of data output from the terminal via protocol exchange depends on the setting of internal switch 4.

Switch 4 On (X-Suppress On) – Under this condition, any time the terminal is performing a block transmission (i.e., page send/dump, line send,

etc.), the receiver is enabled and is monitoring for the reception of an X-Off control code (CONTROL S). Upon detecting an X-Off, transmission ceases within two character times. The terminal then enters an idle state until such time as an X-On (CONTROL Q) is received. At this time, data transmission recommences without data loss and is maintained until such time as transmission is completed or a subsequent X-Off is received.

In this manner, a host device having a specific input block size requirement may control the terminal's transmission without the need for manual intervention.

The following constraints apply when controlling terminal output with X-Suppress On: (1) The terminal must be operating in full duplex environment to permit simultaneous data transmission and reception. (2) The terminal must be currently performing a block transmit when the X-Off code is received. X-Off received at any other time is ignored.

Switch 4 Off (X-Suppress Off) – With X Suppress Off, the terminal reacts exactly as in X Suppress On except that receipt of an X-Off is valid at any time. Even if the terminal is in a conversational mode, receipt of an X-Off halts the output of transmitted data. These characters, however, are being placed into the output buffer at this time and up to 15 may be entered sequentially. Receipt of an X-On command releases the contents of this buffer for immediate transmission. If output is halted because of receipt of an X-Off and keyboard entry continues (once 15 characters are received), the terminal rings the bell and prevents further acceptance of keyboard characters until the output is released by receipt of an X-On.

The following constraints apply when controlling terminal output with X Suppress Off: (1) The terminal must be operating in full duplex environment to enable simultaneous transmission and receive; (2) Receipt of an X-Off always halts data transmission, regardless of mode.

Auxiliary Output Control

Reception of the X-On/X-Off protocol is also valid while the terminal is transmitting data from

an auxiliary source in the aux on mode. Under this condition, receipt of the X-Off code again halts the transmission of the data within two characters. However, once data output has ceased, the auxiliary device is halted only when the terminal's auxiliary buffer has become full. The auxiliary device is halted by the lowering of the auxiliary clear-to-send (CTS) circuit. When an X-On is subsequently received, data output recommences and as soon as buffer space is available, the CTS circuit is raised to permit passing of further data from the auxiliary device.

Auxiliary output control must be accomplished under the following constraints: (1) The terminal main port must be operating in a full duplex environment. (2) The auxiliary device must be capable of observing the clear to send circuit. (3) X-On and X-Off commands received on the main port while outputting from the auxiliary device are also passed through to the auxiliary device. (4) With the X-Suppress switch on, transmission must be in progress when the X-Off is received. With the X-Suppress off, it may be received at any time to halt output.

Terminal Input Control

A separate X-On/X-Off protocol controlling data input to the terminal is available under switch selection (Internal switch 4).

With the switch in the on position, the protocol is disabled and the terminal is reliant upon the host computer to ascertain and compensate for any timing requirements within data streams. (Since certain functions of the terminal require time to perform, pad codes such as null or delete must be inserted to allow the operations to be completed. With the switch off and the protocol enabled, the host can permit the terminal to command its own data reception rate and thus take no consideration of pad times.

The terminal has a receiver buffer of 254 characters length and the function of the protocol is controlled by the state of this buffer. When data is being received at a high rate, the terminal is normally able to remove data from the buffer at sufficient speed to prevent a potential buffer overrun condition. However, if a number of codes are included in a long data stream which requires time to perform, incoming data begin to stack

up on the buffer. On reaching a condition of being 80% full (205 unprocessed characters received), the terminal issues an X-Off command via the main port to halt the host CPU. After the issuance of the first X-Off, additional characters received cause an X-Off to be transmitted for each received character. The terminal continues to process data from the buffer and reduce the number of unprocessed characters during this time. When the buffer content has been reduced such that it is 20% full (approximately 51 unprocessed characters), the terminal issues an X-On command to the host, calling for data to recommence.

Since the terminal is effectively controlling its own reception rate, it is therefore possible to permit communications at 19200 baud while the protocol is enabled. The terminal's transmitter maintains 19200 baud operation without difficulty.

The following are terminal input control operating considerations: (1) The terminal main port must be operating in full duplex environment to permit transmission of codes while receiving data. (2) The host device must be able to receive and respond to X-On/X-Off protocol commands. Further, upon receipt of an X-Off command, the CPU receives further X-Off commands for each code transmitted prior to the receipt of an X-On. Theoretically, the host may send up to approximately 50 additional characters after receipt of the initial X-Off prior to a buffer overrun occurring and data being lost at the terminal. (3) Switch No. 4 must be off to permit X-ON/X-OFF transmission.

Auxiliary Input Control

The switch selectable protocol when enabled is also applicable to received data being passed to the auxiliary device. Thus, if the terminal is in an aux on mode and data are being received at a high rate (for example, 19200 baud) but the auxiliary device is operating at 1200 baud, then the protocol can control this situation.

The auxiliary port has a similar but separate structure to the receiver main port buffer. Thus, if data are being received faster than they can be released to the auxiliary device, the buffer again stacks up and commences issuing X-Off/X-On commands as the buffer load permits. If the ter-

terminal is on line and aux on simultaneously, such that all received data are being both displayed and passed to the auxiliary device, the slower of the two operations commands the data rate. Thus, if a slow speed printer is connected, the terminal does not request additional data until both buffers are able to receive additional characters.

The following are auxiliary input control operating considerations: (1) Terminal main port must be operating in a full duplex environment. (2) While aux on is enabled and the terminal remains off line, normal keyboard operations are maintained. The operator may therefore continue to prepare data for eventual block transmission while the communications circuit is effectively timeshared to permit passing of data in either direction to an auxiliary device. It should be noted that when operating in an aux on mode with both ports selected for high speed, keyboard operations causing a heavy processor load, such as page mode insert, degrades the overall operating speed between the main and auxiliary ports. This does not cause any data loss but increases the incidence of X-Off transmissions while the processor is unable to clear the buffers as fast due to a temporary high throughput. (3) Operating speed of the auxiliary device is immaterial due to full buffering in both directions. If the speed of the auxiliary device is higher than that selected for the main port, then the data received does not cause any issuance of protocol commands. (4) Should the auxiliary device become "not ready" and drop pin 20 of the auxiliary port low, the auxiliary buffer again fills if data reception is maintained and X-Off is transmitted until the device is again able to receive data. If the system is aux-on and on line simultaneously, the auxiliary device becoming "not ready" also causes data reception to the screen to halt until the device is again ready.

3.3.9 Formatting Modes

Keys associated with the forms and forms build modes are shown below.



Forms Mode (FORMS)

Action of the FORMS key selects the forms mode and the message "FORMS" is reflected in the status line.

Selection of this mode causes previously entered attributes to be asserted, defining areas of protected and unprotected data upon the screen. Attempts to select forms mode without previously entering field attributes aborts and the alarm sounds.

Field delimiting attributes are invisible and occupy no space in memory. A range of attributes allows selection of various field types designed to limit the type of data being entered by the operator (see Table 3-5 for field type definitions).

NOTE: When data are being entered in forms mode via the I/O, fields do not automatically overflow; a horizontal tab (HT) is required to advance the cursor between fields.

Defining Forms – Forms may be built via the I/O or the keyboard. A special method permitting local definition of forms data is described next under forms build mode.

With no field delimiters entered, the screen is considered to be totally protected. Thus, in defining a form, it is necessary to define the unprotected data fields. Data entered directly to the screen from the keyboard or I/O without setting attributes is considered protected when the forms mode is asserted. To define an unprotected area, enter the code sequence defining the starting delimiter for that field, i.e., ESC [defines a regular unrestricted entry field. The cursor must be positioned to the required ending location for that field by means of cursor addressing or by any movement instruction desired, and the start protect delimiter entered (ESC] for all field types). Data entered between fields again becomes protected. Unprotected fields may be located at any position on the screen and may be built in random order. Data may be entered into unprotected areas during definition and remain displayed but unprotected when forms mode is asserted.

Operator Entry – Once a form has been defined and forms mode asserted, the form is ready for operator entry. The action of turning on the forms mode positions the cursor to the first unprotected character position from the Home position. Since field definitions are not displayed, the areas to be entered may be defined to the operator by containing data, visual attributes, or by entering a clear

Table 3-5 Logical Field Attributes

3-code Sequence	Field Definition (Unprotected)	Graphic Symbol
ESC, +, 0	Must Enter Alphanumeric	┌
ESC, +, 1	Must Enter Alpha only	┌
ESC, +, 2	Must Enter Numeric only	┌
ESC, +, 3	Must Enter Alphanumeric	┌┐
ESC, +, 4	Total Fill Alphanumeric	┌┐┐
ESC, +, 5	Total Fill Alpha only	┌┐┐
ESC, +, 6	Total Fill Numeric only	┌┐┐
ESC, +, 7	Total Fill Alphanumeric	┌┐┐
ESC, +, 8	Normal Alphanumeric	┌┐┐
ESC, +, 9	Normal Alpha only	┌┐┐
ESC, +, :	Normal Numeric only	┌┐┐
ESC, [	Normal Alphanumeric	┌┐┐
ESC,]	Start Protect (End of Field) used after all fields	┌┐┐
ESC, %	Start Constant field	┌┐┐

Definitions:

- Alphanumeric – All characters accepted in field entry.
- Alpha Only – All characters except the digits 0-9.
- Numeric Only – All characters less than A, hexadecimal.
- Normal – Fields may be skipped or entered without restriction.
- Must Enter – At least one valid character must be entered into field before cursor may advance to next field.
- Total Fill – Field must be totally filled (specified length) before cursor may advance to the next field.
- Constant – One field may be defined with identification data which is not accessible or alterable in the FORMS mode but which will be transmitted before the unprotected fields in a Page Send.

NOTE: If more than one constant field is set up on the screen, only the last one defined is valid.

screen code sequence, the unprotected areas becoming defined by delete codes throughout their length (.).

The operator may now proceed to enter data as required. If the field definitions are for normal fields, on reaching the last character of an unprotected field, the cursor automatically tabs to the first character position of the next unprotected field. Again in normal fields, action of the TAB key automatically advances the cursor to the next field.

Tab stops may be set within unprotected fields by the inclusion of additional start unprotect delimiters at the requisite positions during form construction. During eventual transmission, these additional start delimiters appear as additional horizontal tabs.

On reaching a field having a total fill definition, any attempt to advance from the field before every

location is completed sounds the bell and displays a message indicating the error in the status line. This error message identifies the field type and the error, i.e., TOTAL FILL

ALPHA ONLY
NUMERIC ONLY
MUST ENTER

Fields defined as must enter require the entry of at least one character before attempts are made to leave the field. If at least one character is not entered, an error message is produced and the alarm sounds. In this case, the error message indicates MUST ENTER

Fields specifically defined as alpha or numeric only again refuse entry illegal codes and provide an alarm and a status message indicating the error, i.e., alpha only, etc.

Editing is permissible within any unprotected field (see Section 3.3.4 for definition).

Having reached the completion of the entry, the operator may transmit the entered data under the following rules:

a. SEND Key Operation in Forms and Page Modes:

Striking the SEND key causes all unprotected data to be transmitted with ASCII HT codes inserted between fields. No space suppression occurs and any delete codes present are transmitted as spaces. If a constant field is present upon the screen, it is transmitted first, regardless of its position on the screen.

Under these conditions, activating the SEND key does not write an ETX on the screen and the cursor position is irrelevant, since all unprotected data present are transmitted. The terminal finishes by transmitting the selected termination character and finally responding to the go-on-line switch (internal switch 1), if selected.

b. SEND Key Operation in Forms and Line Modes:

Striking the SEND key causes the current field in which the cursor resides to be transmitted. If the exit requirements of that field have been met, the cursor advances to the next sequential field. Constant fields are ignored in these modes and are not transmitted. The

selectable termination character is transmitted at the end of the data and the terminal then references the go-on-line switch.

c. ASEND Key Operation in Forms and Page Modes:

Striking the ASEND key causes transmission of the entire page of data via the auxiliary port. The constant field, if present, is transmitted as it appears on the screen. Protected data are transmitted as spaces, with trailing space suppression permitted, provided the page format is maintained. In this way, a complete representation of the format page may be passed to a printer to enter onto a preprinted form.

d. ASEND Key Operation in Forms and Line Modes:

Striking the ASEND key causes the transmission of the current cursor field via the auxiliary port. Constant fields are not transmitted in line mode.

Forms Build Mode

The forms build mode (FBM) is entered by simultaneously activating the FORMS and CONTROL keys (or ESC &) and is reflected by the message FORMS BLD in the status line.

The mode is specifically designed to allow the normally invisible logical field attributes to become visible and thus allow the user to generate forms locally for eventual transmission to the host device (via page dump).

Having entered FBM, fields may be entered in any sequence on the screen since at this time they are being held as visual data. The screen is generally considered a protected area and therefore all unprotected fields must now be specified. Entry of a start unprotected attribute (see Table 3-5 for available codes) causes display of a half-intensity blinking graphics symbol marking the first unprotected location. The cursor may now be moved to the required ending location of the field by means of the space bar, cursor movement keys or any other method. Entry of the start protect attribute (ESC]) causes the area between the two attributes to fill with delete codes, thus visually defining the extent of the field, the graphics character at the first location remaining visible to permit identification of the field type.

All data entered into areas not defined as unprotected are treated as protected data when the form is retransmitted by the terminal.

Constant Field

One exception to the field definition is the "constant field". Entry of an ESC % produces no graphic display; data may be entered for the duration of the field and terminated by EXC]. These data are treated as a constant when the form is in use; that is, the operator may not alter it as it is truly protected, but during transmission it is sent as a prefix to all unprotected data regardless of its position on the screen. It is possible to enter multiple constant fields in a display page; however, only the last one entered is effective, as each prior constant field is relegated to being normal, protected data upon receipt of an additional constant field.

While in FBM, full editing facilities remain operable, thus permitting movement and adjustment of field sizes and data content. In this way, existing forms data may be received from the I/O in forms build mode, modified via the edit routines and retransmitted to the host via page dump.

NOTE: Visual attributes may be used in building a form. However, a graphics character (delimiter) immediately following visual attribute appears as an ASCII character. When FBM is exited, the field will be valid, since the graphics character only marked the location of the field during the building of the form.

Delete Field

A previously defined field may be effectively deleted by redefining its length as zero characters. The cursor is moved to the start of the field to be deleted and the following sequence is entered:

ESC [ESC]

Modified Mode

When using the forms mode, a modified mode may be set such that any unprotected fields which are changed in any way from the keyboard (written, erased, inserted, deleted, etc.) are flagged as modified. When the page is transmitted (all unprotected fields), only those that were modified are trans-

mitted in their entirety. Fields not altered are replaced by a single horizontal tab code in the data stream to indicate their position among modified fields. Aux page send sends all fields as described earlier in this manual.

Keyboard Operation: ESC T turns modified mode on; ESC U turns it off.

I/O Operation: Receipt of ESC T turns modified mode on; receipt of ESC U turns it off.

Transmitted Code: ESC T or ESC U.

3.3.10 Attribute Set (ASET)

Keys associated with setting visual attributes are shown below.



Visual attributes when introduced into DM30's memory cause succeeding displayed characters to take on special characteristics to visually set them off from the rest of the display. Characters which are generated in this manner become half intensity, reversed, underlined, etc. according to the attribute selected from Table 3-6.

Visual attributes are generated via software interaction with a hardware LSI video controller. Attributes may be placed into memory at any location without consuming display space to a maximum of 16 per line. Attributes may not be placed in column 80.

Attributes placed in memory cause the selected video level to be effective through the memory until a subsequent attribute is introduced. Video levels only propagate through memory areas containing data and after a clear screen command, all lines are cleared to a null status for memory management purposes. Writing a video attribute on line 1 causes line 1 only to take on that attribute. Moving the cursor down through any subsequent line or writing data in any subsequent line causes the line to cancel its null status and the selected attribute to become effective through

that line. Care must be exercised when using cursor addressing in conjunction with attributes after a clear screen function. For example, setting an attribute at Home (the cursor's position after a clear screen) causes the Home line to take on the attribute. A subsequent cursor address to a line further down with the same page causes that line also to take on the selected video attribute. However, the area of the screen that was bypassed by cursor addressing remains at a null status and does not take on the attribute unless the cursor is moved through those lines.

Video attributes are page oriented and must be set correctly to produce the desired results in a multi-page environment. In order for an attribute to cause the desired video level to be asserted, it must pass through the video controller. Only the data of the currently displayed page is passed through the controller. For this reason, a video attribute set on the first page ceases to have an effect if the memory is scrolled up such that the location containing the attribute is no longer displayed.

Therefore, when designing video formats several choices are available in attribute placement. If the terminal is to be utilized in a paging mode, whereby the next page/previous page functions call separate pages, attributes may be placed at random throughout the pages and produce the desired effect.

However, if video is to be used in a scrolling environment, special precautions are necessary. An attribute set on any line that may be scrolled off the top of the display page must be re-introduced at the first location of any line that the video level is required to propagate through. It then remains active for the remainder of the display unless deleted or changed. In this way the display may be scrolled up and the attribute maintained for the balance of the remaining display area.

The ASET key sets up the terminal so that the next key is interpreted as a visual attribute according to Table 3-6. Other keys are ignored. Example: ASET Q causes the screen to become half intensity reverse video from the cursor

position to the end of the screen (or until another visual attribute code is introduced). Attributes may not be followed immediately by graphics characters.

Table 3-6 Visual Attributes

Key (ASCII Code)	Visual Attributes
@	Normal (Stop Visual Attribute)
A	Half Intensity
B	Blinking
C	Half-Blink
P	Reverse-Video
Q	Reverse-Half
R	Reverse-Blink
S	Reverse-Half-Blink
~	Underline-Normal
a	Underline-Half
b	Underline-Blink
c	Underline-Half-Blink
p	Underline-Reverse
q	Underline-Reverse-Half
r	Underline-Reverse-Blink
s	Underline-Reverse-Half-Blink
\$	Security (Invisible)
4	Reverse-Security
5	Half-Reverse-Security
6	Blinking-Reverse-Security
7	Blinking-Half-Reverse-Security

Forms Mode: ASET is not allowed while in forms mode. The audible alarm sounds. Attributes may be set prior to entering the forms mode.

The ASET key in conjunction with the CONTROL key causes an attribute delete function to occur. An attribute may be overwritten with another attribute; however, the maximum total per line is 16.

Keyboard Operation: Enter mode with ASET or ESC d followed by desired attribute ASCII Code from Table 3-6.

Exit mode (i.e., generate a delete attribute function) with CONTROL-ASET or ESC e. A normal attribute (@) may be entered in lieu of deletion.

I/O Operation: ESC d followed by the appropriate ASCII Code from Table 3-6 sets an attribute.

3.3.11 Graphics

Eleven graphic characters are available and may be displayed in normal video, half intensity, blinking or blinking half intensity. The graphic mode is turned on by entering an ESC R sequence and turned off with an ESC S sequence. To use the graphic mode, follow this procedure:

- Turn on graphic mode with an ESC R.
- Move the cursor to where the graphic character is to start. At least one character must separate a graphics character and any preceding ASET.
- Then key the ASCII character required for the given graphic symbol as shown on Table 3-7.
- Repeat steps b and c as needed.
- Exit the graphic mode with ESC S.

While in graphics mode, the 44 characters listed in Table 3-7 appear on the screen as corresponding graphics characters. All other codes are interpreted normally.

Table 3-7 Graphic Characters

SYMBOL	NORMAL	ASCII EQUIVALENT		HALF BLINK
		HALF	BLINK	
␣	@	A	B	C
␣	D	E	F	G
␣	H	I	J	K
␣	L	M	N	O
␣	P	Q	R	S
␣	T	U	V	W
␣	X	Y	Z	[
␣	\]	^	_
␣	^	a	b	c
␣	d	e	f	g
␣	h	i	j	k

Keyboard Operation: ESC R sets graphics mode on
ESC S turns graphics mode off

I/O Operation: ESC R sets graphics mode on
ESC S turns graphics mode off

Transmitted Codes: ESC R
ESC S

3.3.12 Display Locking

Associated key:



Portions of display memory may be selectively locked from operator access under the control of memory lock or line lock functions.

The memory lock/line lock features enable selected areas of display memory to become locked on the screen relative to the display "window". (See Section 3.2.8.) Operator access to locked areas is prohibited. Areas locked under memory lock are releasable via the keyboard while line locks are removable (and set) only via the CPU. The CPU may write into these locked areas via the use of the memory address pointer (MAP) which is discussed in detail elsewhere in this manual.

Lines or areas to be locked must be currently displayed in order for the function to operate. Once an area is locked, it maintains its relative screen position in memory regardless of scroll up or scroll down functions. It should be noted that even though display relative position is maintained the absolute location varies during scrolling.

A block move may be effectively accomplished from the keyboard using the memory lock feature. First, scroll the line(s) to be block-moved to the top of the screen. Next, move the cursor directly beneath the line(s) and strike the M-LOCK key. ("MEM LOCK" should appear on the status line when the memory lock is properly asserted.) Memory is next scrolled up or down to move the lines into the desired display position. Striking the M-LOCK key a second time disables the memory lock and returns the screen to normal. The previously locked area can now be manipulated as desired along with the other memory contents.

The CPU may write into any memory location using the absolute or relative memory address pointers (MAPs) which are both described later in this manual. Once a MAP is set in a line, it will follow that line wherever it moves throughout the memory. Logic is arranged such that if the absolute MAP overflows line end it moves to the absolute line number it was originally addressed to +1. Care must be exercised when managing this function in conjunction with scrolling to prevent the MAP from entering a wrong succeeding line.

Memory Lock (MLOCK)

The MLOCK key causes the display memory above the cursor line to be locked from operator access or scrolling. The display area below the locked portion of the screen functions normally. The cursor position is not affected by memory lock. Data in the locked portion of the screen cannot be altered by the operator but remain available for CPU control and data entry using the memory address pointer. Locking of display memory not operable beyond line 23. A status message of "MEM LOCK" appears during this mode.

Forms Mode: Illegal; rings bell.

NOTE: Entering Forms mode cancels MEM LOCK condition.

Keyboard Operation: MLOCK or ESC g activates Memory Lock.
MLOCK or ESC h deactivates Memory Lock.
MLOCK toggles the DM30 in and out of Memory Lock.

I/O Operation: ESC g for Memory Lock On;
ESC h for Memory Lock Off.

Transmitted Codes: ESC g and ESC h.

Line Lock

By way of the remote command ESC < , followed by a relative line address, from Table 3-10 the host CPU may selectively designate display lines as reserved for exclusive CPU use. When lines are so locked, keyboard and received data and terminal functions have no effect on those lines. The terminal does not allow cursor positioning in locked lines; the cursor moves down to the next available unlocked line. Clear screen and scroll functions operate normally except that locked lines are left unaffected and fixed in display position. A status message of "LINE LOCK" appears while in this mode.

The CPU cannot lock all lines on the screen.

Forms Mode: Illegal; rings bell.

NOTE: Entering Forms mode cancels Line Lock.

Keyboard Operation: None

I/O Operation: ESC < locks, ESC = unlocks. These escape sequences must be followed by a third code which specifies which line is to be locked or unlocked. These codes are specified in Table 3-10.

Example: ESC < + locks line 12.
ESC ? is a CPU-entered code which unlocks all lines.

3.3.13 Special Function Keys (F1-F16)

Associated Keys:

f1 through f16

These keys transmit a 4- or 5-code sequence according to Table 3-8. Example: F1 when depressed transmits

STX ESC p TERM

(where TERM = the termination character selected by the rear panel switches. [See 2.7.5]. The choices are CR, EOT, ETX, or CR-LF). If the terminal is in a local mode, it obeys the go-on-line switch (Internal switch 1) setting after the transmission occurs (with the terminal remaining on-line) regardless of switch settings. Under no conditions is the function key to be sent via the auxiliary port.

Local: Associated codes are transmitted.

Line Monitor Mode: Code sequence is displayed. No data are written to display except in line monitor mode.

On Line: Code sequence is transmitted.

Table 3-8 Function Key Table

FUNCTION KEY	CODE TRANSMITTED
F1	STX, ESC, p, TERM
F2	STX, ESC, q, TERM
F3	STX, ESC, r, TERM
F4	STX, ESC, s, TERM
F5	STX, ESC, t, TERM
F6	STX, ESC, u, TERM
F7	STX, ESC, v, TERM
F8	STX, ESC, w, TERM
F9	STX, ESC, x, TERM
F10	STX, ESC, y, TERM
F11	STX, ESC, z, TERM
F12	STX, ESC, {, TERM
F13	STX, ESC, |, TERM
F14	STX, ESC, }, TERM
F15	STX, ESC, ~, TERM
F16	STX, ESC, DEL, TERM

3.3.14 Other Key Operations

Associated keys:



Break (CONTROL BREAK)

When the terminal is on line, this key generates a 250 (+ 10%) ms. break ("spacing" condition) on the transmit data line (pin 2, main I/O). The BREAK key is interlocked with the CONTROL key. This key is inoperative in the local mode. Actuating BREAK by itself causes no operation.

Keyboard Operation: CONTROL BREAK

I/O Operation: None

Delete (DEL/-)

This key normally produces the underscore character (-). When shifted, this key transmits the delete (rub out) code (•) but does not display it.
Transmitted Codes: Underscore is sent when unshifted; delete (rub out) is sent when shifted.

Scroll Up (SCRL ↑)

Activation of this key or entering the ESC. Ø causes the display memory window to move one line down. This can be thought of as the memory moving up one line behind the display window. (See Figure 3-2.)

Scroll Down (SCRL ↓)

Striking this key or entering the sequence ESC.2

causes the display window to move up one line. This can also be thought of as memory moving down one line behind this display window. (See Figure 3-2.)

Next Page/Previous Page

Receipt of the sequence ESC.3 or striking the SCRL↓ key while holding the CONTROL key down causes the first page (first 24 lines) to be displayed. The sequence ESC.1 or activating the SCRL ↑ key while holding down the CONTROL key causes the second page (last 24 lines) to be displayed.

Keyboard Operation: CONTROL SCRL ↓ or ESC.3 for previous page
 CONTROL SCRL ↑ or ESC.1 for next page.

I/O Operation:
 ESC.3 for previous page
 ESC.1 for next page

Transmitted Codes: ESC.3/ESC.1

Reset (CONTROL RESET)

Execution of the Reset sequence (CONTROL RESET or ESC V) causes the terminal to be set to its initial state without altering the display memory. Reset functions the same as power-on, except the display memory is not altered and the power-on diagnostic is not invoked. The reset sequence must be executed if any rear panel switches are changed to ensure these changes have been read into the software. A hardware reset which is equivalent to the power up state is initiated with ESC V.

Hard Reset (CONTROL SHIFT V)

Depressing the right hand Control and Shift keys along with the V key will execute a Reset as above except that will work when the keyboard is disabled.

3.3.15 I/O Functions

Keyboard Locking

- The ESC b sequence causes the keyboard to be enabled (data can be entered from the keyboard).
- The ESC c sequence causes the keyboard to be disabled (data cannot be entered from the keyboard). A message indicating KEYBD LOCK blinks in Field E of the status line.

- The keyboard cannot be enabled/disabled from the keyboard. This is an I/O function only.

Keyboard Operation: ESC C disables the keyboard.

I/O Operation: Receipt of ESC b enables the keyboard and ESC c disables the keyboard.

Control Code Handling

When in normal operating modes, the ASCII control, and Escape code sequences that are valid terminal remote commands as listed in Table 3-1 are not written in display memory. Received control codes and escape code sequences that are not listed in Table 3-1 are ignored. Control code display symbols are listed on Table 3.9. Line monitor mode allows display of all received codes.

The majority of the ASCII codes listed in Table 3-1 (from 00 through 1F Hex) are not acted upon. The following codes are operational:

- NUL (00 Hex) — Used as a pad code
- BEL (07 Hex) — Sounds the audible alarm
- BS (08 Hex) — Back Space
- HT (09 Hex) — Horizontal Tab
- LF (0A Hex) — Line Feed
- CR (0D Hex) — Return
- DC1 (11 Hex) — X-On
- DC3 (13 Hex) — X-Off
- ETB XMIT (17 Hex) — Performs a block transmit if the terminal is on line.
- SUB (1A Hex) — Used to indicate a received error.
- ESC (1B Hex) — First part of an Escape sequence.
- GS (1D Hex) — Terminates CPU messages.

All control codes are displayed in line monitor mode. (See Table 3-9 for the displayable symbols and Section 3.3.7 for an explanation of Line Monitor mode.)

Table 3-9 Control Code Symbols

@ - •	H - BS	P - DL	X - CN
A - SH	I - HT	Q - D1	Y - EM
B - SX	J - LF	R - D2	Z - SB
C - EX	K - VT	S - D3	[- EC
D - FT	L - FF	T - D4	\ - FS
E - FD	M - CR	U - NK	] - GS
F - PK	N - SO	V - SY	^ - RS
G - DB	O - S	W - EB	_ - US

Screen Relative Cursor Addressing

Cursor addressing allows the cursor to be positioned anywhere in the currently visible display by sending a four-code sequence. The cursor may be addressed from the keyboard or from the I/O port. The current cursor location has no effect on cursor addressing. The cursor is addressed by receiving the following four-character sequence:

ESC, F or Y, line address, column address

Table 3-10 Cursor Address Codes

USE FOR
ABSOLUTE OR RELATIVE CURSOR POSITIONING

LINE OR COLUMN	ASCII CODE	LINE OR COLUMN	ASCII CODE	LINE OR COLUMN	ASCII CODE
1	SPACE	33	@	65	\
2	!	34	A	66	a
3	"	35	B	67	b
4	*	36	C	68	c
5	\$	37	D	69	d
6	%	38	E	70	e
7	&	39	F	71	f
8	'	40	G	72	g
9	(	41	H	73	h
10	)	42	I	74	i
11	*	43	J	75	j
12	+	44	K	76	k
13	,	45	L	77	l
14	-	46	M	78	m
15	.	47	N	79	n
16	/	48	O	80	o
17	0	49	P	81	p
18	1	50	Q	82	q
19	2	51	R	83	r
20	3	52	S	84	s
21	4	53	T	85	t
22	5	54	U	86	u
23	6	55	V	87	v
24	7	56	W	88	w
25	8	57	X	89	x
26	9	58	Y	90	y
27	:	59	Z	91	z
28	;	60	[	92	{
29	<	61	\	93	:
30	-	62	]	94	}
31	>	63	^	95	DEL
32	?	64	_	96	DEL

For example, to position the cursor to line 15 and character position 41, send the following sequence:

ESC, F, period, H or
ESC, Y, period, H

Table 3-10 gives the character and line location ASCII characters required to address any position on the display. If either the line or column address is out of bounds, the whole sequence is ignored.

Memory Relative Cursor Addressing

The above addressing procedure is valid for moving the cursor within display memory only.

To position the cursor in a currently non-displayed memory area, use the sequence ESC . ; followed by the absolute line and column address from Table 3-10. After this information is entered, the cursor moves directly to the designated address. The display "window" moves with the cursor, keeping it visible.

Screen Relative Cursor Sense

The cursor sense feature provides for the transmission of the currently displayed cursor location to the host processor. An ESC \ command causes the cursor position to be transmitted by line and column as shown in the cursor addressing scheme, Table 3-10.

Cursor sense is an I/O function only and is not operable from the keyboard. When the terminal receives this command, it replies with ESC F followed by the line and column coordinates of the current cursor position. This allows the CPU or other I/O to store away the cursor address and later reposition the cursor to its original location. For example, if the cursor is on line 5 at character position 34, the response is ESC F \$ A .

Keyboard Operation: None

I/O Operation: Receipt of the ESC \ sequence causes the terminal to transmit the current relative cursor location.

Memory Relative Cursor Sense

The memory relative cursor sense functions the

same as screen relative cursor sense, except that the terminal transmits the absolute cursor location instead of the display relative cursor location. This function is prompted with ESC . < .

For example, if the cursor is on line 32 at character position 34, the response is ESC . ; ? A.

Keyboard Operation: None

I/O Operation: Receipt of ESC . < sequence causes the terminal to transmit the current absolute cursor location.

Read Cursor Character

The read cursor character feature provides for the transmission of the character at the current cursor location to the host processor. An ESC G command causes the character to be transmitted to the host CPU. Graphics characters are sent as ASCII characters from Table 3-5.

Keyboard Operation: Illegal, rings bell.

I/O Operation: Receipt of ESC G causes cursor character to be transmitted.

Screen Relative Memory Address Pointer

The memory address pointer is an I/O-controlled, invisible cursor that is used to read and write to and from the display memory independently of visible screen functions. The memory address pointer is positioned just like the cursor but only by the I/O. The sequence is: ESC, ^ , line address, character address. If an invalid row or column address is sent, the MAP is set at its previous location (see Table 3-8). After the MAP is set, the data to be written in display are entered. Attempts to write characters beyond column 80 of the current line cause automatic wrap to the beginning of the next line. On reaching column 80 of line 48, the data entered via the memory address pointer automatically wraps to Home. Any control or attribute characters (with the exception of a group separator [GS] cannot be acted upon and are only displayed. The GS (CONTROL]) terminator must be used when the data to be entered at the pointer are complete. To reposition the memory address pointer without sending data, the sequence ESC, ^ , line, column, GS is used.

The CPU may write in locked areas of the display by using the memory address pointer.

The memory address pointer may be positioned and data entered while the terminal is Off Line without interference to the operator.

Keyboard Operation: None

I/O Operation: Terminal responds to codes as explained above.

Memory Relative Memory Address Pointer

The memory address pointer is moveable to any memory location by prefixing the line and column address codes with ESC.7. Again, Table 3-10 is used for addressing purposes. The MAP may be used to update the contents of nondisplayed memory while the operator is still working with displayed memory. The same conditions that apply to the screen relative memory address pointer to the memory relative address pointer, except that it will not function while the terminal is off line.

Data Read at Memory Address Pointer

Using the sequence ESC _ (Escape, underscore), data located at the memory address pointer are transmitted out of the I/O port. If, for example, the memory address pointer is at position 10 of a given line, the character there is transmitted. After a read, the MAP automatically increments to the next location, thus allowing sequential reading of screen data.

Keyboard Operation: None

I/O Operation: Receipt of ESC _ causes the data at the memory address pointer to be transmitted.

Read Terminal Status

The terminal status message (displayed in Fields F and G of line 25) is generated in response to the code ESC O. When this code is entered from the keyboard, no communication occurs to the I/O but the terminal status message appears in line 25. When ESC O is received from the I/O, the terminal status along with the clock (if set) is transmitted back in response, but the message is not displayed. See Section 3.3.19 for an explanation of the status line and Section 3.3.16 for an explanation of the clock.

Keyboard Operation: ESC O causes the Status Message to be displayed.

I/O Operation: Receipt of ESC O causes the Status Message to be transmitted.

Transmitted Code: ESC O

Serial Aux Check

The ESC . 8 sequence may be used by the I/O to ascertain the status of the auxiliary port. The terminal responds with an ACK if the auxiliary port is not busy and a NAK if it is.

Parallel Aux Check

The ESC . 9 sequence may be used by the I/O to ascertain the status of the parallel port. The terminal responds with an ACK if the port is not busy and a NAK if it is.

CPU Message Deposit and Display

The procedure for the host CPU to deposit data into the message waiting buffer is the code sequence ESC,;, message, GS – the last characters being the control code GS or "Group Separator" (CONTROL]). The operator is notified of the message deposit by "MSG WAIT", which appears in the status line in reversed blinking video. When the operator simultaneously depresses and holds down either the right or left pair of SHIFT and CONTROL keys, the message on deposit is displayed on line 25 in half-intensity reversed video, replacing the original status message. This new message remains as long as the selected SHIFT/CONTROL key pair is held down. On releasing the keys, the original status line reappears. The CONTROL ESC 1 keyboard sequence also places CPU message in line 25. It remains there until removed by the CPU or the keyboard sequence CONTROL ESC 2. If no message is present, the status line appears blank and nonreversed.

The function of displaying the deposited message may be controlled via the I/O by use of the ESC 1 sequence. This causes the message to remain displayed until the normal status line is displayed on receipt of an ESC 2 sequence.

The user therefore has the ability to force an alternate status line and gain additional system information.

916 484 388
454 2361

The following constraints apply to data which are to be held as a waiting message:

- a. A maximum of 80 characters can be stored. Overflow overwrites in character position 80.
- b. Attribute codes and control codes are not recognized. For example, sending CR-LF to the message waiting buffer results in "CR-LF" being displayed in the data stream as control code symbols.
- c. The GS terminator (CTRL]) must be used at all times. For example, if a 10-character message is sent to the MESSAGE WAITING buffer and it is followed by a GS, any data past that point reverts to normal display memory.

The CPU memory deposit function is operable whether the terminal is in on line or in local mode.

NOTE: The status line can be made to disappear by sending ESC; GS ESC 1 (zero length message followed by display message command).

Keyboard Operation: Depressing and holding the SHIFT and CONTROL keys down or depressing CONTROL ESC 1 promotes display of a waiting CPU message.

Releasing the SHIFT/CONTROL pair or depressing CONTROL ESC 2 removes the message.

I/O Operation: Receipt of ESC 1 displays message, if present. Receipt of ESC 2 causes status line to reappear.

Self Test

A self-testing firmware is invoked at power-up. This may also be initiated by the operator or through CPU intervention with the sequence ESC f. This performs a memory test throughout the terminal's RAM, and an LRC check of the internal ROM memory. Successful completion of the test and correct terminal operation is verified by the appearance of "SYSTEM RDY" on the status line. Failure to perform the test correctly promotes an "ERR. CHECK" message in Field E of the status line.

Keyboard Operation: ESC f invokes the self test

I/O Operation: Receipt of ESC f causes the Self Test to be invoked.

Send Enter Code

This is similar to the function performed by the ENTER key. On receipt of ESC', the terminal responds by sending the selected termination character (see 2.7.5). This escape sequence may be received over the I/O entered from the keyboard. The ENTER key evokes the same terminal response.

Keyboard Operation: ESC' or ENTER key

I/O Operation: Receipt of ESC'

Transmitted Code: Selected termination character.

Baud Rate Setting

Baud rates for either the main or auxiliary port may be set over the I/O or via the keyboard to any data rate selectable by the rear panel switches. A three-part escape sequence is used as outlined in Table 3-11.

Table 3-11 Remote Baud Rate Selection

	110	300	1200	1800	2400	4800	9600	19200
MAIN BAUD RATE ESC, 7,	0	1	2	3	4	5	6	7
AUX BAUD RATE ESC, 5	0	1	2	3	4	5	6	7

Example: To set the Main baud rate at 1800, the sequence ESC 7 3 is used.

Example: To set the Auxiliary baud rate at 4800, the sequence ESC 5 5 is used.

Write Control Mode

Receipt of the write control code sequence (ESC 6) from the receiver or the keyboard causes the next received control or escape sequence to be written into memory without execution. The terminal then reverts to the previous operating condition prior to the receipt of the sequence.

Keyboard Operation: ESC 6 causes the mode to be entered.

I/O Operation: Receipt of ESC 6 causes the mode to be entered.

Page Send

With the terminal on line and upon receipt of ESC I, the terminal performs a block send to the main port in accordance with the constraints of page mode (as outlined in Section 3.3.7) without altering the page/line mode.

Keyboard Operation: ESC I initiates Page Send

I/O Operation: Receipt of ESC I

Auxiliary Page Send

With the terminal on line and upon receipt of ESC 3, the terminal performs a block aux send out to the aux port in accordance with the constraints of aux send (3.3.7) without altering the page/line mode.

Keyboard Operation: ESC 3 initiates Aux Page Send

I/O Operation: Receipt of ESC 3.

Line Send

With the terminal on line and upon receipt of ESC i, the terminal performs a line send to the main port in accordance with the constraints of line mode (in Section 3.3.7) without altering the page/line mode.

Keyboard Operation: ESC i initiates line send

I/O Operation: Receipt of ESC i

Auxiliary Line Send

With the terminal on line and upon receipt of ESC 4, the terminal performs an aux line send in accordance with the constraints of aux send (in Section 3.3.7) without altering the Page/line mode.

Keyboard Operation: ESC 4 initiates aux line send

I/O Operation: Receipt of ESC 4.

3.3.16 Special Keyboard Functions

Clock

A 24-hour clock which provides time of day or indicates elapsed time can also be made to appear on the status line using the keyboard sequence ESC, space bar, hours, minutes. For example, to set the time at 06:45, the keys ESC, space bar, 0, 6, 4, and 5 are struck. The colons are inserted automatically and the seconds begin counting when the last minute digit is entered. Erasing the clock from the status line can be accomplished with the RESET sequence ESC V. If a clock-setting mistake is made, the operator must complete the erroneous entry until all clock digits are filled, then key ESC, space bar again and reenter the correct time. A correct clock setting sequence must contain any initial or trailing zeros and consist of four digits.

Keyboard Operation: ESC, space bar, hours, minutes

I/O Operation: Receipt of ESC, space bar, hours, minutes

Baud Rate Setting

A complete description of how to set Main and Auxiliary baud rates from the keyboard is contained in Section 3.3.15.

Write Control Mode

A complete description of how to enter the Write Control mode via the keyboard is contained in Section 3.3.15.

3.3.17 Boot Load

The Boot Load sequence, ESC ", allows loading of 8085 Machine Code programs directly into the RAM memory area. A program can be entered either from the keyboard or over the I/O port. The load address and program data are loaded using ASCII characters of 0-9 and A through F representing their hex value. Two sequential characters are used to form an 8-bit byte. The program load operation is terminated by either an @ or # character code. An @ character causes the programs just loaded to be executed, starting at the defined load address. A # character saves the program (allowing its later execution) and returns the terminal to normal operation.

A program is loaded and executed in the following manner:

- a. ESC " initiates the Boot Load.
- b. The first four characters are used as the high-low load address.
- c. Subsequent bytes are stored sequentially, starting at the load address.
- d. All codes other than ASCII 0 through 9, A through F, @ or # will terminate the program load.
- e. The program load is terminated by either an @ or a #.
- f. An @ character terminates the load sequence and starts execution of the loaded program starting at the load address.
- g. A # character terminates the load sequence and returns the terminal to normal operation, allowing for later execution of the program.
- h. If a run address other than what was initially loaded is desired, it is possible to load only the address by entering ESCAPE, "four-digit hexadecimal address, and @ (program run terminator). If a later run is desired at the same address, an ESCAPE, " @ will do this. The address, however, is cleared out at reset time to prevent accidental running of nonexistent programs.

3.3.18 Audible Alarm

An audible tone is sounded in the terminal if the BELL (Control G) character is received. This is consistent with the bell control of teletypewriters. When data entry from the keyboard causes the cursor to pass through the 72nd position of a line, an audible alarm sounds. The bell rings when illegal keys are struck or when other error conditions exist, such as a numeric entry in an alpha only field, attempting to lock memory when lines are locked, etc.

The **continuous** alarm feature allows the host processor to gain the attention of the terminal oper-

ator. The continuous alarm is turned on with an ESC 8 sequence from the keyboard or over the main I/O port. The alarm can be turned off by either striking any key or by receiving an ESC 9 sequence over the main I/O port.

The audible alarm also sounds when the operator writes in or attempts to scroll past line 48.

3.3.19 Status Line

The status line occupies the 25th display line of the CRT and is displayed in half intensity reverse video. The breakdown of the status line display fields is outlined in Tables 3-12 and 3-13.

To display an alternate status line or no status line at all, use the CPU message deposit function. In order to inhibit display of status line, the sequence ESC ; GS ESC 1 is employed. This causes no message to be deposited and forces the status line to be displayed in normal video with no data present. The 25th line remains inaccessible to the operator. In order to display an alternate status line, the complete CPU message deposit sequence is followed (see Section 3.3.15).

An additional status line for host CPU system information can be implemented through the use of the CPU line lock feature. (See Section 3.3.2.)

Following is an explanation of messages which may appear in status line fields A through H:

Field A — reflects the status of the main port either being on line or in local mode.

Field B — reflects the terminal being either in monitor mode or conditioned to provide a page or line send if a block send is implemented.

Field C — indicates the status of the data set ready line of the main I/O port, DSR indicating true, blank indicating false.

Field D — indicates the status of the aux port.

Blank — Disabled

AUX ON — Aux connected to main on line

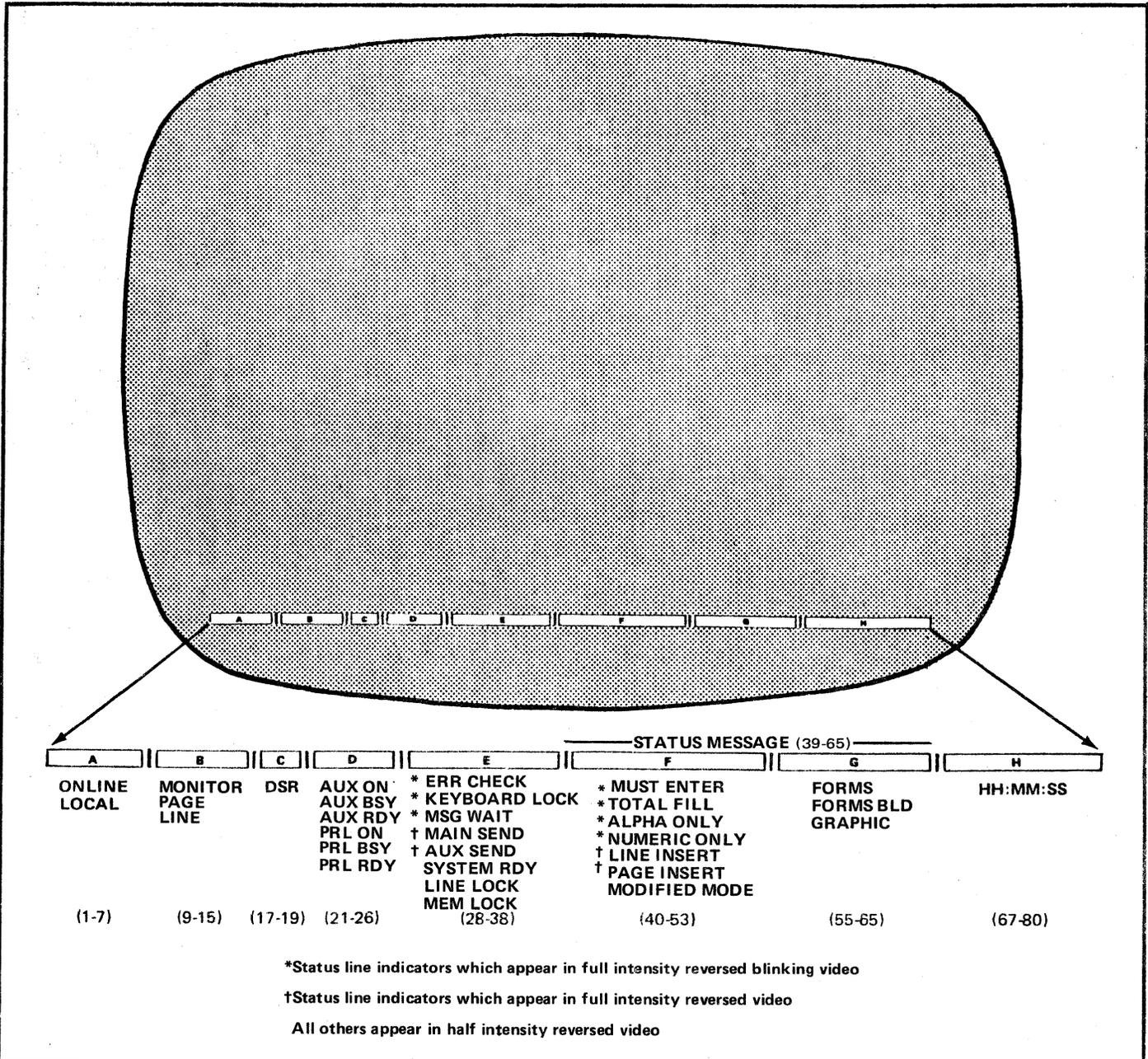
AUX BSY/RDY — Aux enabled from keyboard to aux; BSY/RDY indicates status of aux pin 20

PRL ON — indicates Parallel port is on line to the CPU

PRL RDY/BSY — indicates current status of Parallel port.

continued on page 3-39

Table 3-12 Status Line Display Fields



The status line is an invaluable ready-reference tool which enables the operator to tell at a glance which operating modes/features are currently in use on the DM 30, and whether the terminal is operating correctly.

It is normally continuously visible unless superseded by a CPU message or other I/O function. The status line occupies a complete 80-character display line on the bottom (25th) row of the screen and consists of 8 fields displayed in full intensity reversed blinking or half-intensity reversed video.

The possible messages for each field are explained in Section 3.3.19 of this manual and are shown graphically here. Please note only one message at a time can be displayed in each field.

The all-numeric status message, when displayed, occupies Fields F and G. It may be requested by the operator or the CPU using the sequence ESC O. It is broken down character by character in Table 3 - 13 which follows on the next page.

Field E — indicates main message sequences on a priority basis.

- 1 = Main Send 5 = Message Wait
- 2 = Aux Send 6 = Line Lock
- Priority 3 = Error Check 7 = Memory Lock
- 4 = Keyboard Lock 8 = System Ready

Field F — indicates status messages of terminal operation.

1. ALPHA ONLY — Displayed if illegal entry attempted to an alpha only format field.
2. NUMERIC ONLY — Displayed if illegal entry attempted to a numeric only format field.
3. MUST ENTER — indicates that an entry must be made in the field.
4. TOTAL FILL — alerts the operator of a field which must be totally filled.
5. LINE/PAGE INSERT— indicates insert mode

selected; qualified by line or page to further identify mode.

6. **MODIFIED MODE** —indicates modified mode selected while in format mode to limit data transmission.

Field G — indicates terminal is in either Forms/Forms Build or Graphics mode.

Field H — contains the 24-hour clock in an hours: minutes: seconds format.

A 27-character terminal status message appears in character positions 39 through 65 (Fields F and G) in response to ESC O. This action is initiated by the CPU or operator and contains information which pertains to the current terminal operating configuration.

The message supersedes existing display and remains until any keyswitch is pressed. At that time, the 27-character message disappears and the status line returns to its former condition.

Table 3-13 is a key to aid the operator in decoding this numeric message.

Table 3-13 Status Message Indicators

CHARACTER POSITION	CHARACTER DISPLAYED	FEATURE CONVEYED	MESSAGE CONVEYED
39	1 - 7	Main Baud Rate	5 = 4800 6 = 9600 4 = 2400 3 = 1800 1 = 300 2 = 1200 0 = 110
40	1 - 7	Auxiliary Baud Rate	Same as above
41	0 - 3	Termination Character	0 = CRLF 1 = ETX 2 = EOT 3 = CR
42	0 - 3	Parity Select	0 = Even 1 = Space 2 = Odd 3 = Mark
43	0 - 3	Self-diagnostics	0 = No fault 1 = ROM fault 2 = RAM fault 3 = I/O fault
44	0 - 1	Receiver Error Check	0 = Off 1 = On
45	0 - 1	Roll Mode	0 = Off 1 = On
46	0 - 1	Auto Line Feed	0 = Off 1 = On
47	0 - 1	Lower Case Inhibit	0 = Off 1 = On
48	0 - 1	Duplex Mode	0 = Half Duplex 1 = Full Duplex
49	0 - 1	Auto Echo	0 = Off 1 = On
50	0 - 1	Screen Display	0 = Off 1 = On
51	0 - 1	Main Port	0 = On Line 1 = Local
52	0 - 1	Aux Port	0 = Off 1 = On
53	0 - 1	Graphics Mode	0 = Off 1 = On
54	0 - 1	Line Lock	0 = Off 1 = On
55	0 - 1	Memory Lock	0 = Off 1 = On
56	0 - 1	Keyboard Lock	0 = Off 1 = On
57	0 - 1	Error Check	0 = No error 1 = Diagnostic error detected
58	0 - 1	CPU Message Wait	0 = No message waiting 1 = Message waiting
59	0 - 1	ESC Code Suppression	0 = Off 1 = On
60	0 - 1	Main Baud Reset	0 = Under rear panel switch command 1 = Under software command
61	0 - 1	Aux Baud Reset	0 = Under rear panel switch command 1 = Under software command
62	Various	Software version	Reflects ROM revision level
63	Various	Software version	Reflects ROM revision level
64	Various	Software version	Reflects ROM revision level
65	Blank	Reserved	-

TYPICAL TRANSMITTED MESSAGE: STX-27 - character string - clock (HH-MM-SS) - selected termination character.
The clock digits appear only when the clock is properly set.

BEEHIVE INTERNATIONAL

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Beehive's Equipment is warranted against defects in material and workmanship for a period of ninety (90) days from date of shipment to Beehive's direct customer.¹ Beehive will repair or, at its option, replace Equipment which proves to be defective during the Warranty Period, provided such Equipment is returned to Beehive's factory as hereinafter provided.

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<input type="checkbox"/> MONTHLY EXCHANGE
<input type="checkbox"/> CARRY-IN | <input type="checkbox"/> PLEASE HAVE A FACTORY REPRESENTATIVE CALL:
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Telephone No. _____ |
|--|--|

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2. Did your terminal arrive in satisfactory operating condition? If not explain _____
3. What applications will this terminal be performing? _____
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