65190/65191

REMOTE TERMINAL

SUBSYSTEM

ORIGINATOR	PROJ ENG	QA	MFG ENGRG	PRGM MGT	MGR OF ENGRG
M. J. O'Donnell 3/1/78	M. J. O'Donnell 3/27/78				

MEMO

CONTROL DATA

TO:	LOCATION:	FROM:	LOCATION:
DISTRIBUTION		G.H. CRAWFORD	AARMEB
SUBJECT:			DATE:
714 REPLACEMENT TERMINAL		65190/65191	11/4/78

c.c.				
	D.C. KENT	NWZWEL	D.E. BROWN	AARPER
	H.W. SLEATH	AARBNE	W.J. MATTHEWS	AARPER
	T. KISS	AARSYD	P. COSTELLOE	AARMEB
	A.J. TOUZEAU	AARMEB	L.G. RANDELL	AARMFG
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	R.B DONNELLY	AARMEB	R.R. ARCHBALD	AARMEB
	R.J. ROBERTSON	AARADL	B.J. HIGGINS	AARSYD
	L.H. HOLSWADE	AARMEB	J.P. O'NEIL	AARMEB
	A. ERDSTEIN	AARMEB	L.J. BARNETT	AARSYD
	W.F. MASON	AARCBR	D.H. WATKINS	AARCBR

Please find enclosed a copy of the specification No.16042812 for the 714 replacement product which has been subject to much discussion over the last months.

Basically, the external specification are thos of a 714. The expections are:

- 753 and 755 printers will be used.
- old and new H/W cannot be intermixed in a configuration but be intermixed on a communications line.
- 9600 Baud will be supported by terminal.
- SCROLL and 24 line options will be available.
- Controller and Master CRT are single, integral unit.

While pricing has yet to be finalized, it is expected to be similar to the current 714 products, Australian List Pricing are:

- 65190 - US$9771 Equal to 714-10 plus 714-123,
- 65191 - US$4259 Equal to 714-123.

Current status is that we expect the first of the products to arrive in Australia early in June, however these are committed against a customer order.

As soon as all the pertinent documentation is to hand, application will be made for TYPE APPROVAL from the Australian Telecom Authorities.

G.H. CRAWFORD.
Manager Marketing Adminstration.

REVISION RECORD

REV.	E.C.O.	PAGE	PARAGRAPH	DESCRIPTION	APVD.	DATE
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1.0 SCOPE

This specification describes the 65190/65191 Subsystem, hereafter referred to as the Terminal, including all capabilities to operate with Keyboard/Display Devices and Receive-Only Printer Devices for use in a remote environment and communication with a central site over common carrier lines. This terminal will operate as a 714 but with enhanced features.

2.0 APPLICABLE DOCUMENTS

15632032 - EC Expanded Memory Option
15631301 - EC Master Station Display, 50Hz CC622B
15631303 - EC Master Station Display, 60Hz CC622A
15631305 - EC Slave Station Display, 50Hz CC623B
15631307 - EC Slave Station Display, 60Hz CC623A
95372300 - Engineering Specification, 755-21 Impact Printer
95382300 - Engineering Specification, Asynchronous Communication Interface
16033400 - Engineering Specification, 752 Non-Impact Printer
1.10.XXX - Mode 4 C Data Communication Control Procedures Standard
1.30.011 - Computer and Peripheral Equipment Design Requirements
1.30.022 - Electromagnetic Compatibility Performance Requirement. The equipment does not comply with test RE-1, radiated emission requirements and RS-1, radiated susceptibility.
1.70.000 - General Quality and Finishing Standards
UL STD 478 Electronic Data-Processing Units and Systems
EIA RS-232-C - Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange
USAS X3.4-1968 - American National Standard Code for Information Interchange
CCITT V.24 Functions and Electrical Characteristics of Circuits at the Interface Between Data Terminal Equipment and Data Communication Equipment.

3.0 PERFORMANCE REQUIREMENTS

3.1 General Description

The Terminal operates in a system as shown in Figure 1. The data source controls transfer of information over common carrier lines at rates up to 9600 bits per second using synchronous modems (data clock must be supplied by the modem). Telecommunications operation is half duplex, alternating carrier, however, the telecommunications facility may be either two wire (half duplex private or switched network) or four wire (full duplex private network). Several Terminals may be connected to one link of a private network; however, this service must be arranged and confirmed by the common carrier involved.

The modem interface is in accordance with EIA Standard RS-232-C and CCITT recommendation V.24.

The Terminal block diagram is shown in Figure 2.

The keyboard/display combination, shown in Figure 3, is an input device in terms of operator initiated messages and an output device in terms of data source initiated messages.

The Receive-Only Printers are output devices, accessible to both the data source and the Terminal operator. The Receive-Only Non-Impact Printer is shown in Figure 4 and the Receive-Only Impact Printer is shown in Figure 5.

The 65190 is the master station and controls operation between the 65191 slave station, printers and the higher level processor. The 65191 is the slave station and can communicate with the 65190. The 65192 is an expanded memory option for the 65191. It is only installable at the factory. This option allows the 24 lines of display instead of 16 lines.

Each unit has a quick look diagnostic that operates when power is applied to the unit. See Appendix A for the operation of the diagnostic.

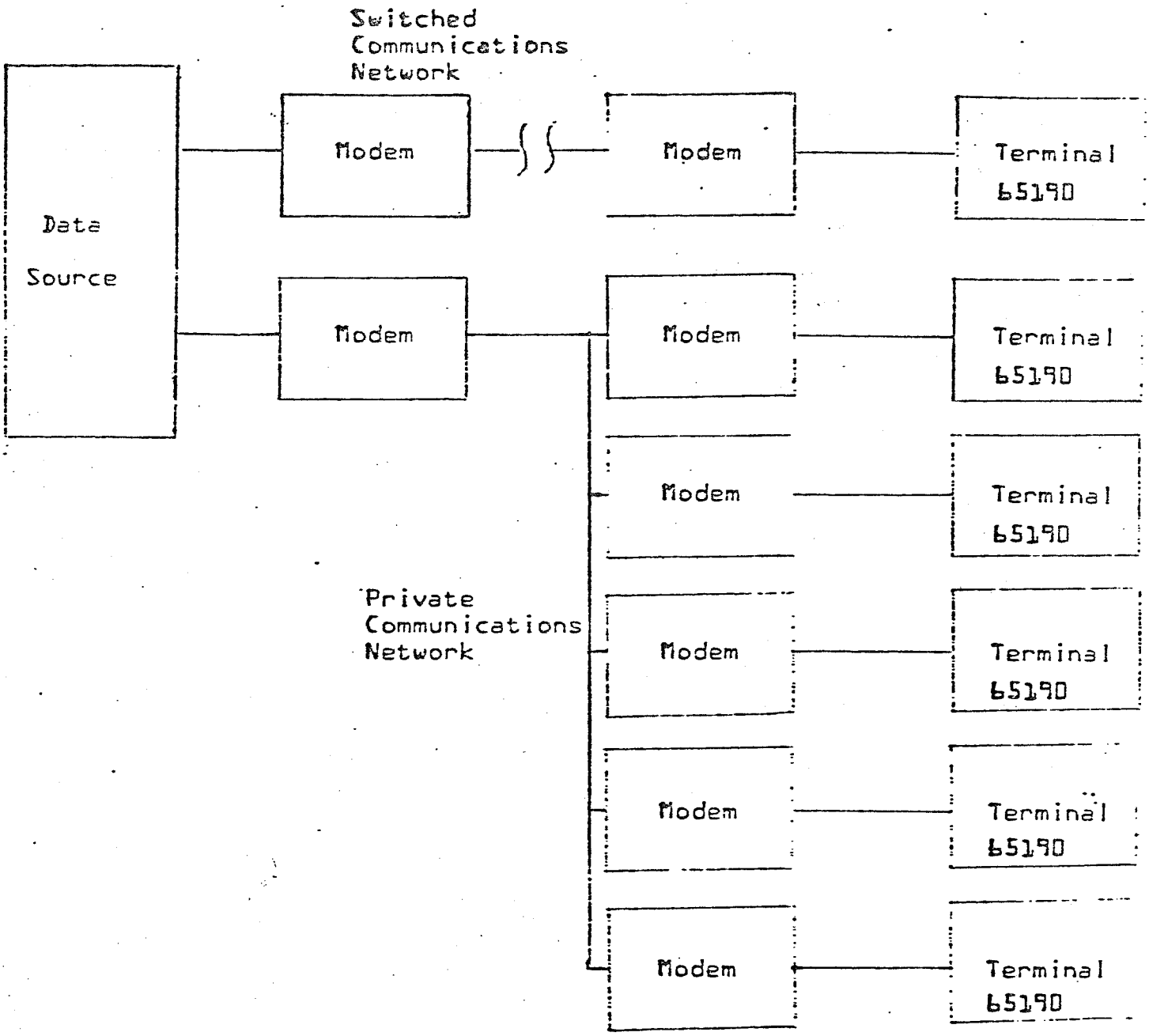
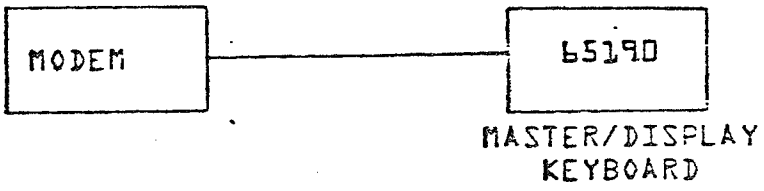
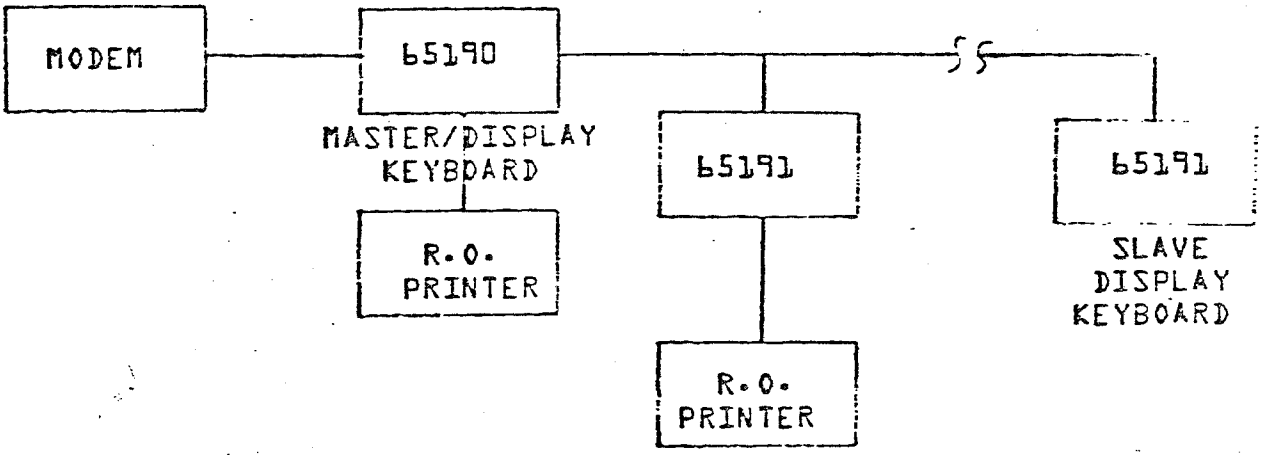


Figure 1. Typical Terminal Communications Network



BASIC CONFIGURATION



SYSTEM WITH SLAVE DISPLAYS AND R.O. PRINTERS

The total data source addressable capability is 15 devices.

Figure 2. Terminal Configuration

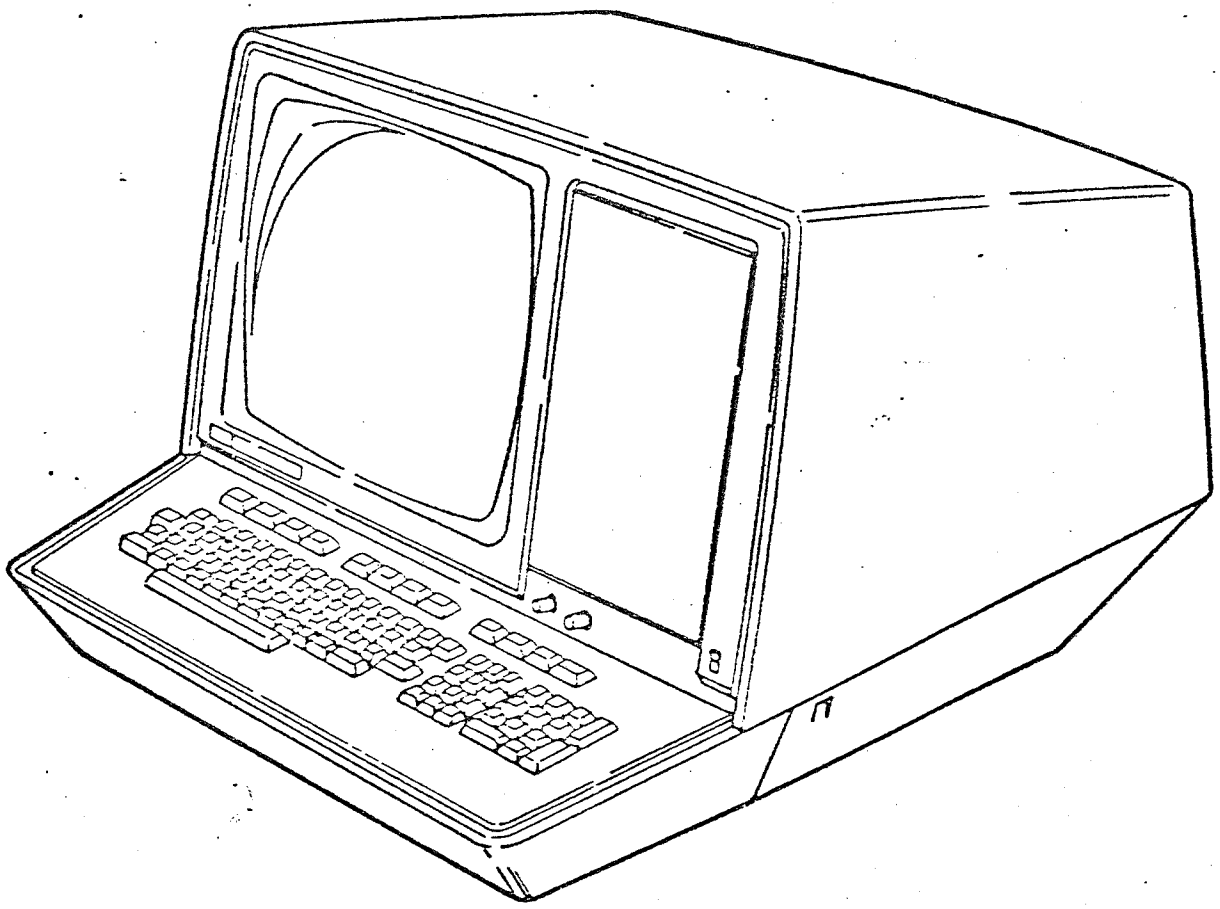
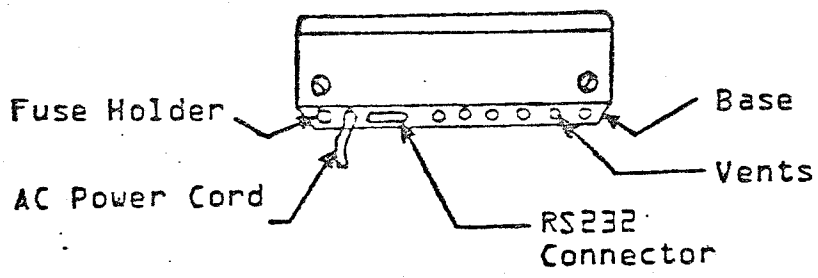
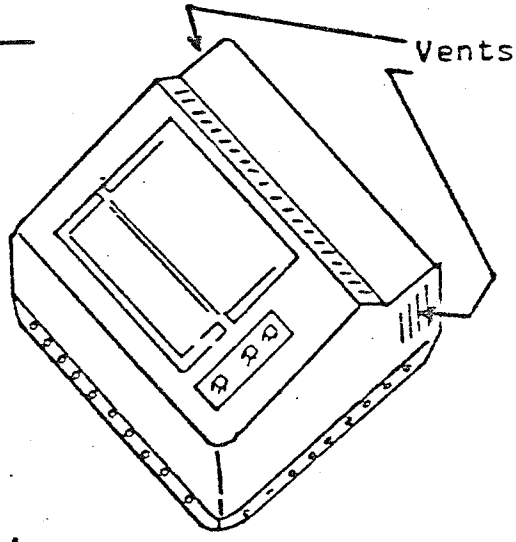
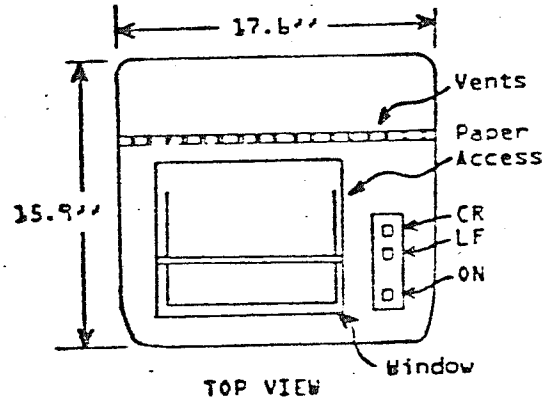


Figure 3. Keyboard/Display Device Controls and Indicators

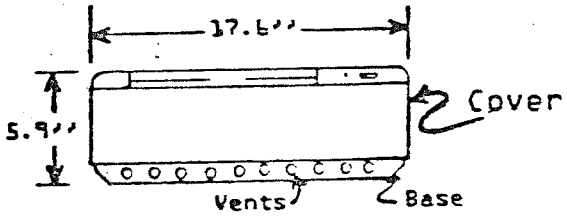


REAR VIEW

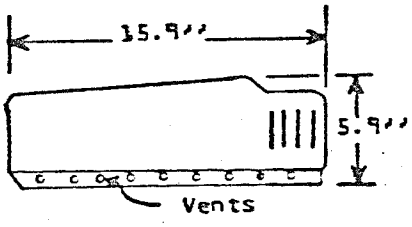




TOP VIEW



FRONT VIEW



SIDE VIEW

NOTE: Detailed information about the indicators can be obtained from the printer specification.

Figure 4. Non-Impact Printer

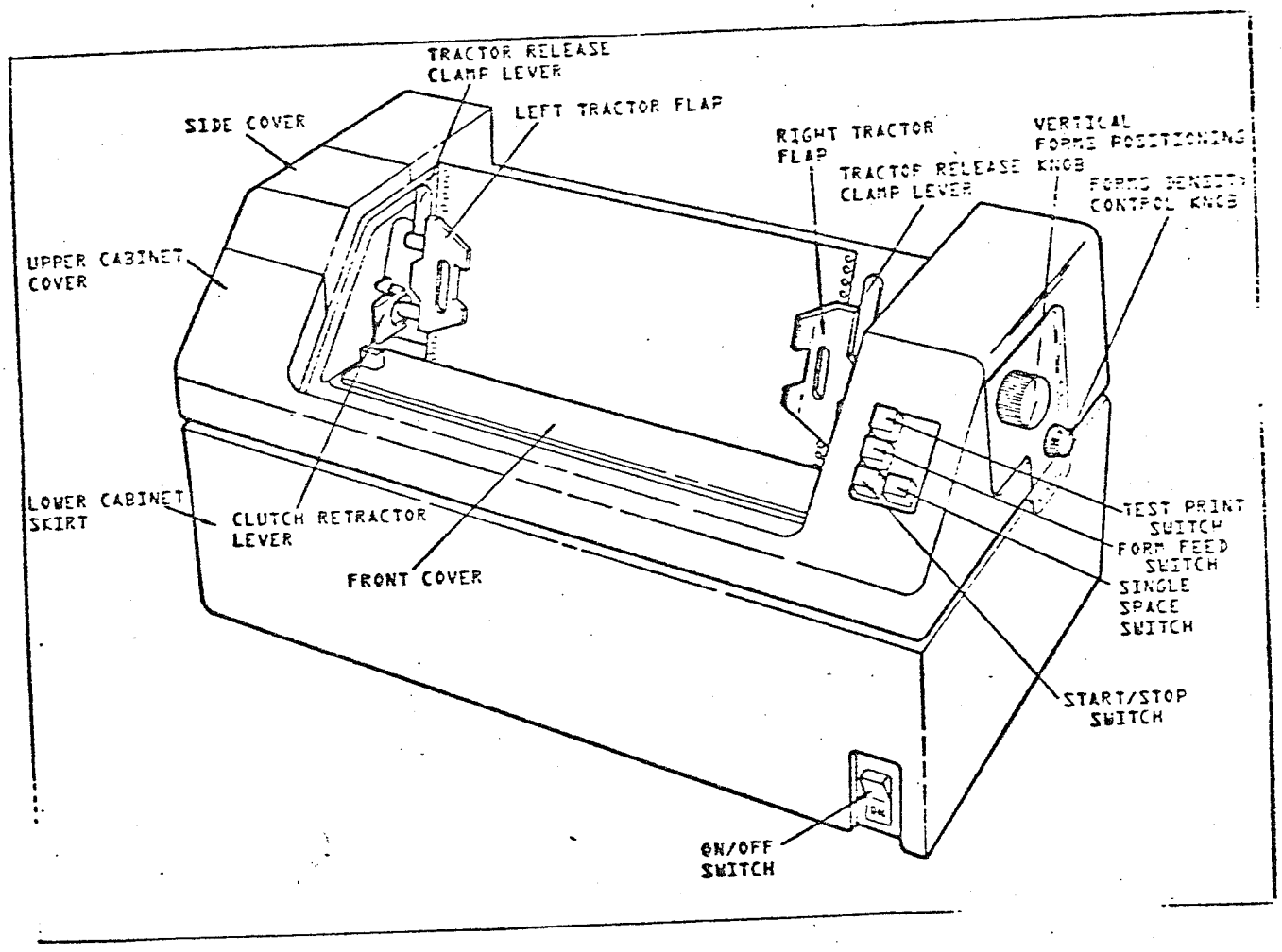


Figure 5. Impact Printer

3.1.1 Subsystem Configuration

The 65190 is capable of controlling up to fourteen data source addressable peripherals (Keyboard/Display Devices and R.O. Printer Devices) with configuration limitations as indicated below. Total Terminal peripheral limitation is 14. Since the printers are addressed thru the display/keyboard, a display/keyboard is required for each printer used. Maximum mixed configuration is eight keyboard displays and 7 printers.

Devices may be associated with each other for offline operations in accordance with the following:

(a) Keyboard/Display Device(s) may be associated with one R.O. Printer Device. The R.O. Printer Device address must be higher than an associated Keyboard/Display Device (s) but lower than any other peripheral.

(b) Access of any peripheral to another peripheral is handled on a scan basis, i.e., the first Keyboard/Display Device to request a data transfer to an associated R.O. Printer Device reserves that Device until the requested transfer is completed. Additional Keyboard/Display Devices requesting access to the same R.O. Printer are serviced when the previous data message transfer is completed in the order of increasing device address.

(c) When a data transfer from a Keyboard/Display Device to an R.O. Printer Device is requested and there is no R.O. Printer Device associated with the Keyboard/Display Device or the R.O. Printer is not ready either before or during printout, an error symbol is displayed at the current cursor position on the requesting Keyboard/Display Device and the data transfer is aborted.

(d) An alert message initiated by the data source to an R.O. Printer Device reserves that device for use by only the data source. The reserve condition is cleared when the data source transmits a write message terminating in E1 to the reserved device. The E1 (released) write message must not contain data intended to be printed.

3.1.2 Terminal Controller Data Storage

The Terminal Controller provides the capability of determining how many printer buffers (0 thru 7) are configured in the subsystem and reporting that information to the data source via the station status word. Each printer buffer provides data storage for up to 1280/1920 (decimal) data characters.

3.1.3 Subsystem Device Transfers

The Terminal provides the capability of transferring data between devices in the subsystem. The data source (CPU) is included as one of these devices. Concurrent data transfers between pairs of devices within the subsystem is allowed if conflicts in the use of buffer memory are not encountered. The allowable data transfers are as follows:

(a) Write: CPU to any device: Data is held in the Controller storage until the complete message is received and found to be error free, then it is transferred to the Addressed Device.

(b) Control: CPU to any device: Control messages include alert, poll, status request, configuration request messages and under some conditions, write messages.

(c) Read: Any device to CPU: On command from the CPU, and if data is ready to be transmitted, a data message is transferred to the CPU. Ability to retransmit the message is retained by the 65190 Terminal until the CPU specifically releases the Terminal from this requirement.

(d) Status: Any device to CPU: Status messages include Read Message with E Code, acknowledge, reject, status read, configuration read and error messages. The exact meaning of each of these messages is explained in this specification.

(e) Print: Keyboard/Display to R.O. Printer: Includes full screen and selective print.

The Terminal becomes busy to the data source when one of the following device transfers is in process:

1. Data source attempts to transmit a write message to a Display Device and the Display is in the process of transferring data to a Printer or has a print request set {PRINT or SELECT PRINT} and is waiting for the Printer to become available.

2. Data source attempts to transmit a write message to a Printer and the Printer is printing a message from either the data source or a Display Device or a print buffer is not available for the data in the write message.

3.1.4 Buffer Management

The 65190 Terminal provides two alternating 1280/1920 character buffers for all messages sent to it from the higher level processor. Both word and message parity are checked before the 65190 acts on the message. If a parity error occurs, an error message is returned and no other action occurs. Two buffers are used so one can be sending data to the addressed slave device while the other is receiving from the higher level processor.

Both the 65190 and 65191 contain a 1280/1920 character printer buffer. This buffer does not affect the operation of the keyboard of display. This buffer is used only for the printer attached to that display. All off-line prints are routed through the 65190 to the proper printer buffer. The displays cannot communicate directly with the printer attached to it.

3.1.5 Installation Aids

Upon completion of the quick look diagnostics or a restart, data is displayed on the last line of the screen that defines the terminals configuration. This display can be used to determine the setting of the Fix 1 and Fix 2 switches without removal of the board. The data displayed is as follows:

ITEM DESCRIBED	XXX STATION ADDRESS	XXX ATTACHED PRINTER ADDRESS	XX NUMBER OF LINES	XX CHARACTER SET SIZE	XXX TYPE PRINTER	XX COMM MODE	XXX SCROLL ENABLED	XXX LAST DISPLAY ADDRESS
ALLOWABLE DATA	{140 on Master} {142 - 157 on Slaves}	{142 - 157}	16 or 24	64 or 96	NIP or IMP	4B or 4C	SCR IF ENABLE, BLANK IF NOT ENABLED	{Master Only} {142 - 157}

DATA DISPLAYED

If a switch is set that is not allowed the words "switch error" appears at the upper left corner of the screen and the alarm sounds.

3.2 Display Device

The Display Device contains a CRT and the necessary electronics for refresh and data storage and is associated with a keyboard which provides a man/machine interface.

3.2.1 Display Presentation

The Display Device contains a high resolution television monitor accepting EIA standard composite video from the self-contained logic. The CRT is a rectangular 15-inch standard television tube with P-4 phosphor. The display format size is 9 1/4 x 5 1/4 inches ± 1/4 inch (235 X 135 mm). Symbols are displayed on the CRT screen by selectively unblanking dots in a 5 x 9 dot matrix as shown in Figure 6. Symbol size is nominally 3/32 wide by 3/16 inch high (2.4 x 4.8 mm). The display is regenerated approximately 60 times per second on 60Hz units and 50 times per second for 50Hz units.

The displayed symbol repertoire is the character set conforming to the USAS X3.4-1968 as shown in Table 2. The character set allows display of all 96 ASCII characters plus five control symbols. In addition to the symbol repertoire, a cursor is displayed. The cursor appears as a blinking underline at the position where the next input or output will occur. Blink rate is approximately 4 Hz.

3.2.2 Screen Size

The screen size can be 80 characters per line by 16 lines or 80 characters per line by 24 lines. There is a switch on the Fix 2 bank that determines the number of lines. To use this option extra memory must be added to the standard unit. If this extra memory is not present an error message will appear on the screen when the unit is powered-on. The error message will say that a switch is set wrong.

All displays connected to the 65190 master station must be the same screen size.

FIGURE 6 SYMBOL DOT MATRIX

Code/Displayed Symbol

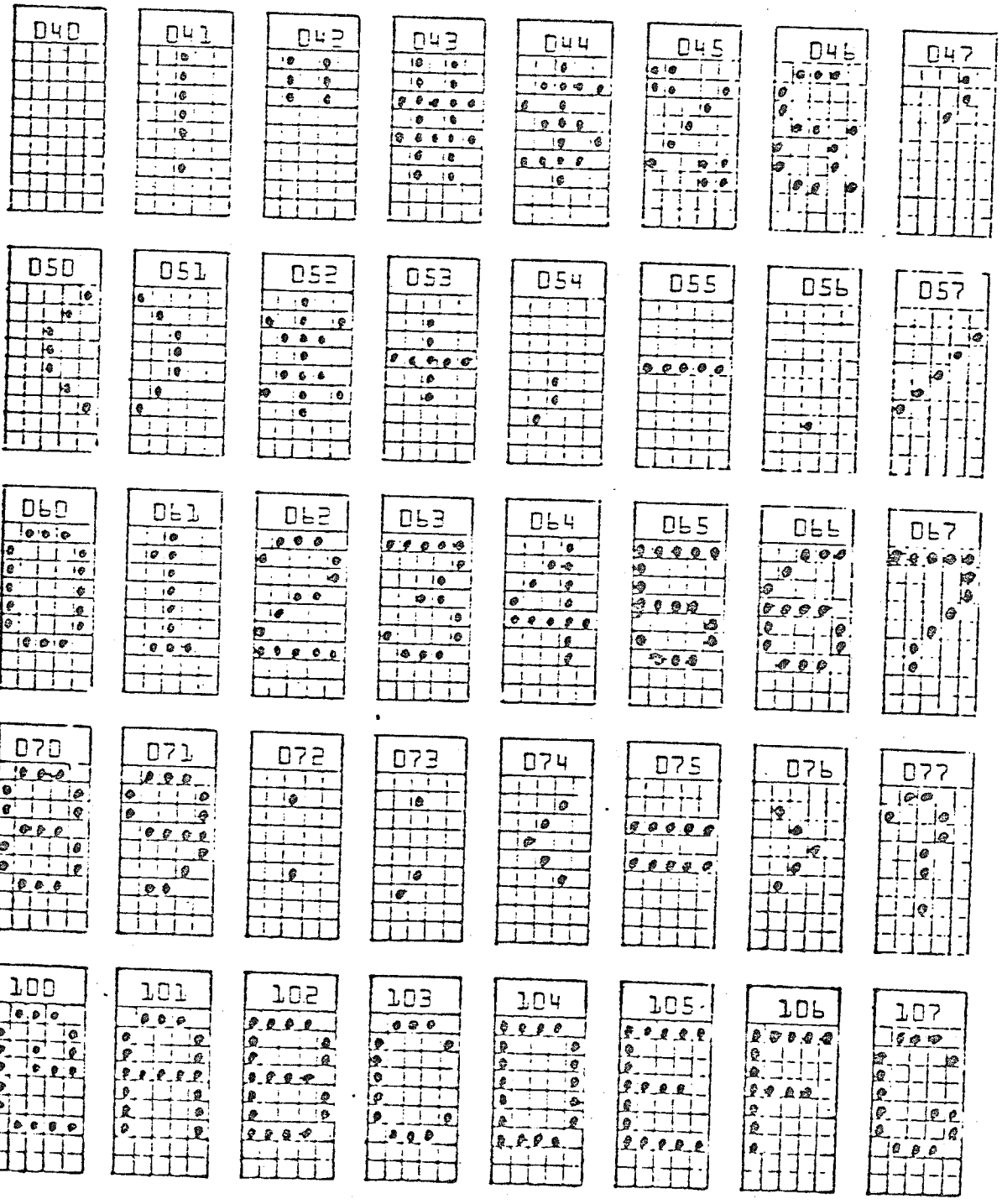


FIGURE 6 SYMBOL DOT MATRIX (Continued)

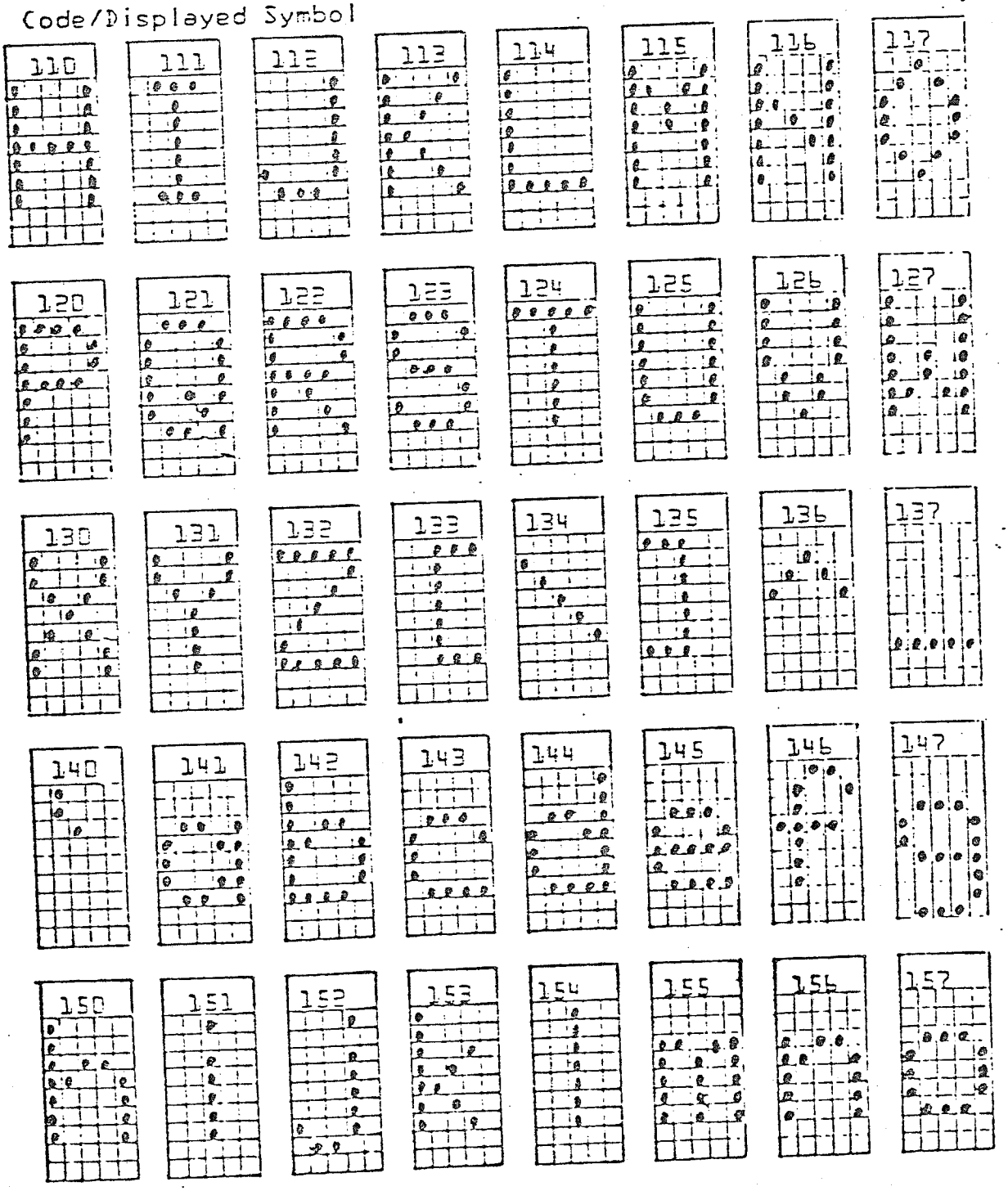
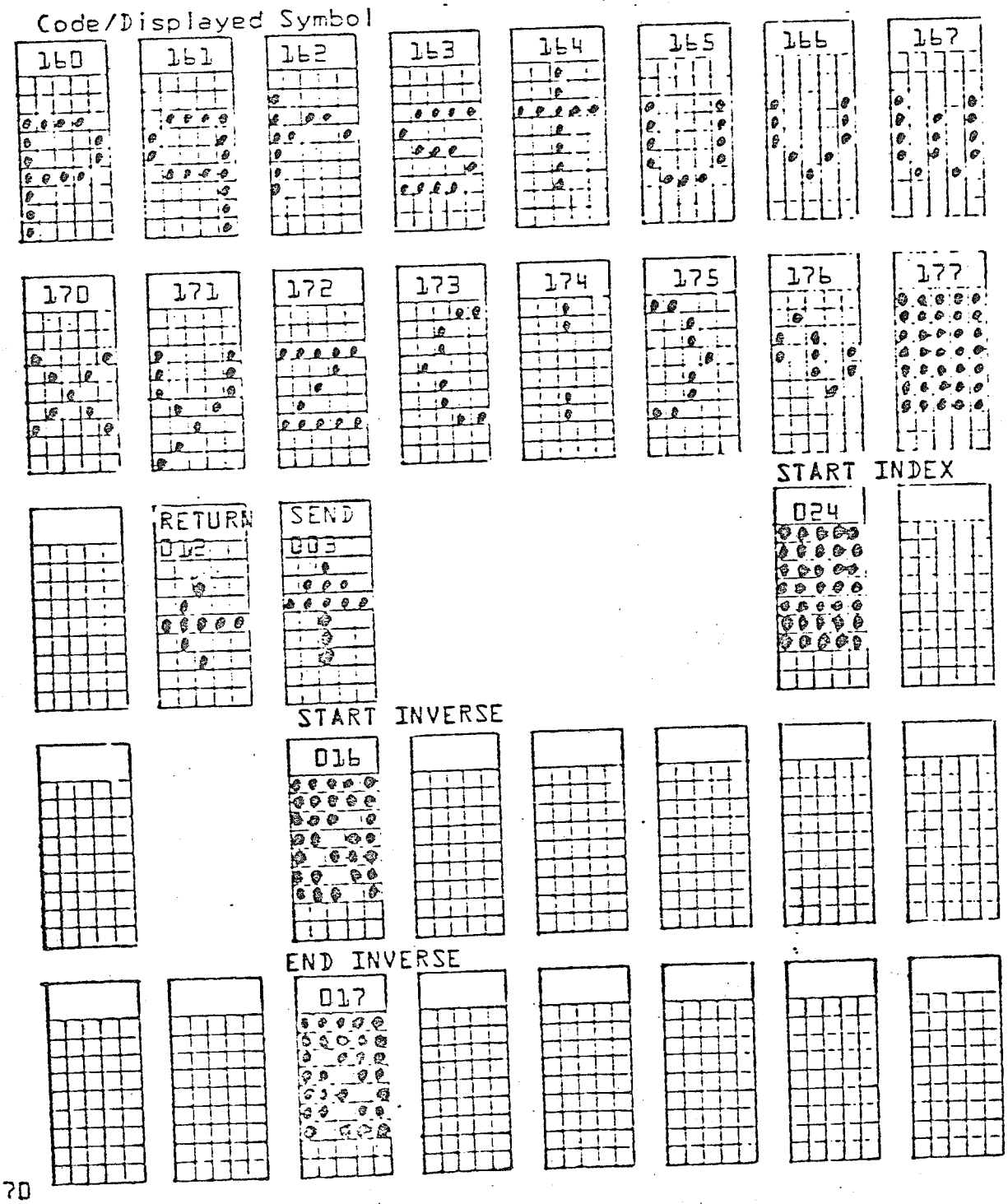


FIGURE 6 SYMBOL DOT MATRIX (Continued)



BITS				b_7 b_6 b_5 / COL	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b_4	b_3	b_2	b_1	ROW	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	*	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	↑ or ^	n	~
1	1	1	1	15	SI	US	/	?	O	← or _	o	DEL

*Symbols printed on Non-Impact Printer

TABLE 1. Symbol Codes

3.2.3 Basic Cursor Controls

The basic cursor controls are the CLEAR, LINE CLEAR, RESET, NEW LINE, Backspace, Cursor Down, Cursor Up, Skip and LINE SKIP. In addition, the SEND, START INDEX and Inverse Video are controlled with the basic cursor controls. X-Y positioning is controlled by the data source.

3.2.4 Optional Controls and Formats

Protected data is normally not written into or read from the display memory and is indicated by inverse video. The Enable Protect switch on the display allows the operator to enter protected data in the access position. The data source may access the protected areas by sending the protect access code to the display. This causes the display to go into access mode. The light is on when the terminal is in protect mode.

The display then returns to protect mode when the display receives a keyboard unlock command from the data source. Multiple write messages may be sent to a display before the keyboard is unlocked. Data control adds the capability for inserting and deleting characters and lines.

3.2.4.1 Inverse Video - Data may be displayed on the CRT in inverse video; that is, the background field is white and the displayed symbols are black. The beginning of an inverse video field is indicated by a start protect symbol and is terminated by an end protect symbol. If the station is in protect mode, the inverse video indicates protected fields.

3.3 Keyboard

The keyboard is the operator input device on the Display station. All data handling the most of the device controls are controlled offline through the Keyboard. The Keyboard is shown in Figure 7.

3.3.1 Keyboard Coding

Keyboard data coding concurs with colums 2-7 of USAS X3.4-1968. Data codes generated by the Keyboards are shown in Table 1. The Keyboard/Display Device has a switch selectable feature which allows either all 96 ASCII codes to be entered by the operator, or, in the other position, restricts the operator to entry of only the uppercase (64) codes. Control codes generated by the Keyboard are, in general, used in the Terminal and not sent over the communications link. They are described in this specification.

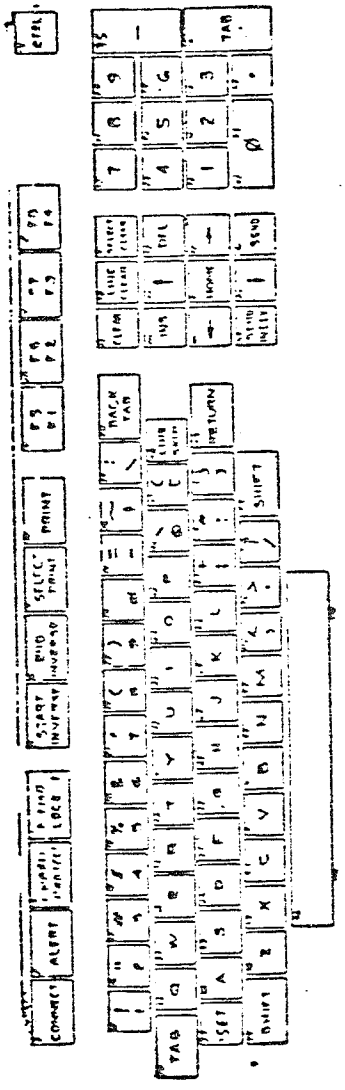


Figure 7. Keyboard Layout

3.3.1.1 Data Keys - Depression of any of the data keys including those on the numeric cluster causes the character associated with the key to appear on the display screen and is stored in the display memory. Continued depression of any key causes the character associated with that key to repeat at a rate of approximately 10 characters/second.

3.3.1.2.2 Control Keys - The control keys control the cursor movement, data handling and Terminal Control functions.

3.3.1.2.1 SHIFT - Depression of either of the shift keys in conjunction with any of the data keys causes the uppercase character associated with that key to appear on the display and to be stored in the display memory. The shift keys have no effect on the numeric cluster. The INSERT, DELETE control keys are affected by the shift keys as described in the following paragraphs.

3.3.1.2.2 CLEAR - Depression of this key erases all data, including protected data, and resets the cursor to the first position of the first line.

3.3.1.2.3 SELECT CLEAR - Depression of this key erases all data with the exception of protected data from the display and resets the cursor to position 1 of the first line. If protected data is present in position 1 of the first line, the cursor is positioned to the first unprotected position on the screen.

3.3.1.2.4 HOME - Depression of this key resets the cursor to position 1 of the first line. If protected data is present in position 1 of the first line, the cursor is positioned to the first unprotected position on the screen. Data is not affected.

3.3.1.2.5 START INDEX - This key inserts a start index code in the Display memory and displays the symbol at the cursor position. The start index code marks the beginning of a transmission from the display memory. Multiple start index codes may be present on the display. When multiple start index codes are present, data transmission begins with the first start index to the left and/or above the SEND symbol. This key repeats in the same manner as the data keys.

3.3.1.2.6 SEND - This key initiates a transmission from the Display in response to a poll message from the data source. The send symbol is written on the display screen. Transmission begins from and includes the start index or beginning of the display (if no start index is present) and terminates with and includes the send code. Protected data in the display memory is not transmitted if the data protect option is present and the display is in the protect mode. The

3.3.1.2.6 {continued}

code is written in memory. The keyboard is locked when the SEND key is depressed and unlocked upon receipt of a Write message {see Write message description for keyboard unlock conditions}.

3.3.1.2.7 LINE CLEAR - This key erases all data from the cursor position to the beginning of the first protected field to the right of the cursor on that line {indicated by inverse video} or to the end of line on the display without affecting the cursor position.

3.3.1.2.8 TAB - Depression of the Tab key moves the cursor forward to one position beyond the first end inverse symbol. If no end inverse is present between the cursor position and end of page, the cursor is reset to home position.

3.3.1.2.9 ↑ {CURSOR UP} - Depression of the ↑ key moves the cursor up one line but in the same relative position in the line without affecting data. If the cursor originally was positioned in the first line, it moves to the last line. If the cursor would be moved into a protected area when the data protect option is present it is advanced through the protected field to the same relative position on the first unprotected line. This key repeats in the same manner as the data keys.

3.3.1.2.10 ← {BACKSPACE} - Depression of the ← key moves the cursor one position to the left without affecting data. If the data protect option is present and the cursor would be placed in a protected field, the cursor is backspaced through the protected field to one position to the left of the protected field. If the cursor is in the first position of the first line, it is repositioned to the last position of the last line. This key repeats in the same manner as the data keys.

3.3.1.2.11 → {SKIP} - Depression of the → key moves the cursor one position to the right without affecting data. If the data protect option is present and the cursor would be placed in a protected field, the cursor is advanced through the protected field to one position to the right of the field. If the cursor is in the last position of the last line, it is positioned to the first position of the first line. This key repeats in the same manner as the data keys.

3.3.1.2.12 {CURSOR DOWN} - Depression of the key moves the cursor down one line, but in the same relative position in the line without affecting data. If the cursor would be moved into a protected field, with the data protect option present, it advances through the protected field to the same relative position on the first unprotected line. If the cursor was in the last line, it moves to the first line in the same relative position. This key repeats in the same manner as the data keys.

3.3.1.2.13 RETURN - Depression of the NEW LINE key enters the new line code in memory at the cursor position, displays the new line symbol at that position, clears the remainder of the line to the right of the cursor position to the beginning of the first protected field on that line {indicated by inverse video} or to the end of the line and resets the cursor to the first unprotected psotion of the next line. If the cursor was located in the last line, it is reset. This key repeats in the same manner as the data keys.

3.3.1.2.14 BACK TAB - Depression of the back tab key causes the cursor to move backward to one position to the right of the first end inverse symbol. If no end inverse is present between the cursor position and the beginning of the page, the cursor is reset to home.

3.3.1.2.15 INSERT - Depression of this key in lowercase {no shift} inserts a space at the cursor position and all data, except for protected data and all data to the right of the protected field, from the cursor position is shifted right one position. The last character in the line or the last character before a protected field is lost. Depression of this key in uppercase {shift} moves all data in the line in which the cursor is positioned and all data below, down one line. A line of spaces is inserted in the line in which the cursor is located and the cursor is reset to the first position in the line. Data in the last line is lost. This operation {line insert} is disabled in protect mode. This key repeats in the same manner.

3.3.1.2.16 DELETE - Depression of this key in lowercase {no shift} erases the character above the cursor and moves all data to the right of the cursor in that line, left one position {except protected data and data to the right of protected field}. A space is inserted in the last protected field. The cursor does not move. Depression of the key in uppercase {shift} erases the data in the line in which the cursor is positioned and moves all data below up one line. A line of spaces is inserted in the last line. If thecursor is in the last line, all data is erased in the line and the cursor is reset to the first position of the last line. This operation {line delete} is disabled in protect mode. This key repeats in the same manner as the data keys.

3.3.1.2.17 LINE SKIP - Depression of the LINE SKIP key moves the cursor down one line and resets the cursor to the first unprotected position of the next line. Data is not affected. If the cursor was in the last line, it is reset to the first unprotected position of the display. This key repeats in the same manner as the data keys.

3.3.1.3 Function Keys - Eleven function keys are located above the alphanumeric keys on the keyboard. These keys are labeled, from left to right, as follows: Enable Protect, Start Inverse, End Inverse, Slect Printer, Print, F1 thru F8 and Control {CTRL}. Specific key functions are described below.

3.3.1.3.1 ENABLE PROTECT - When the key is illuminated the terminal is in protect mode and the operator cannot access protected fields. Depressing the key will turn off the illumination of the key and will place the terminal in access mode. In access mode the operator can enter and change data inside the inverse field area. When the key is depressed to put the terminal back into protect mode the key will illuminate and the cursor will move to the first position to the right of the End Inverse code if it is located in an inverse field.

3.3.1.3.2 START INVERSE - Depression of this key causes the start inverse symbol to be displayed on the screen and moves the cursor one position to the right. The remaining portion of the screen up to the first end inverse code or the end of the display will be in inverse video. This key is disabled in the protect mode.

3.3.1.3.3 END INVERSE - Depression of the key causes the end inverse symbol to be displayed, moves the cursor one position to the right and stops the inverse video field. This character also acts as the tab set character.

3.3.1.3.4 SELECT PRINT Key - Depression of the SELECT PRINT key causes a send symbol to be displayed at the current sursor position and transfers the contents of the Display memory to the 65190. Protected areas on the display are space-filled on the Printer. Prior to the start of the data transfer, a CR and LF function is performed at the Printer. Transfer begins at the first position of the line containing the start index symbol nearest and preceeding the SEND symbol. At the conclusion of the data transfer, a CR and two LF functions are performed at the Printer. When start index is not used, transfer begins at cursor home position. Spaces at the end of lines are truncated. Truncation of trailing spaces on a line by line basis is performed. A space is substituted for the SEND symbol, start index symbol and all character positions to the left of the start index on the same line. The keyboard is loced by the Controller when the SELECT PRINT key is depressed and unlocked when the send code is read from the Display memory. When two or more Keyboard/Display Devices request the same printer while that printer is busy they are serviced in the order of increasing device address. When no Printer is associated with the Keyboard/Display Device or associated printer is not ready either before or during printing, the keyboard is unlocked and an error symbol is displayed at the current cursor position.

3.3.1.3.5 PRINT Key - Depression of the PRINT key causes a send symbol to be displayed at the current cursor position and transfers the contents of the Display memory to the 65190. Prior to the start of the data transfer, a CR and LF function is performed at the Printer. The transfer begins at the cursor home position and continues sequentially to the send symbol. All spaces at the end of a line are truncated. Truncation of trailing spaces on a line by line basis is performed. At the conclusion of the data transfer, a CR and two LF functions are performed at the Printer. Protected areas are printed. the protect symbols, start index symbols and send symbol, are replaced with spaces. The keyboard is locked by the Controller when the PRINT key is depressed and unlocked when the send code is read from the Display memory. If two or more Keyboard/Display Devices request the same Printer while the Printer is busy, they are serviced in the order of increasing device address. When no Printer is associated with the Keyboard/Display or the associated printer is not ready either before or during printing, the Keyboard is unlocked and an error symbol is displayed at the current cursor position.

3.3.1.3.6 CTRL Key - Depression of the CTRL key locks the keyboard and initiates transmission of a read message from the Display/Keyboard Station in response to a poll message from the data source. CTRL key depression causes the send symbol to be displayed at the current cursor position. Read message transmission begins at the start index symbol or beginning of the display (if no start index is present), and terminates with the CTRL code sequence at the send symbol position. The message terminates with the send code sequence and normal message termination. Protected data in the Display memory is not transmitted if the Display is in protect mode. CTRL key coding is described in Table 6. Retransmission capability and Keyboard unlock are handled in the same manner as when the SEND key is depressed. This key along with the shift key causes the quick look diagnostic to repeat until this key is depressed a second time. This combination is not functional after any other key is depressed or after the second depression. Depression of the CTRL key, shift key and the set key cause the program to restart.

3.3.1.3.7 F (Function KEYS) - Depression of any of the F keys locks the keyboard and initiates the transmission of a read message from the Keyboard/Display Device in response to a poll message from the data source. Function key depression causes the send symbol to be displayed at the current cursor position. Read message transmission begins at the start index symbol or beginning of the display (if no start index is present) and terminates with the F code sequence at the send

3.3.1.3.7 {continued}

symbol position. The message is terminated with the send code sequence and normal message termination. Protected data in the Display memory is not transmitted if the display is in the protect mode. Function key coding is described in Table 6. Retransmission capability and keyboard unlock are handled in the same manner as when the SEND key is depressed. F5 - F8 is obtained by depressing the F Key and the shift key.

3.3.1.3.8 SET KEY - This key only functions in combination with the Shift and CTRL Key. This combination causes the program to restart.

3.3.1.4 Device Controls and Indicators on the Keyboard - The following device controls and indicators are located on the keyboard.

3.3.1.4.1 CONNECT LIGHT - This indicator is located above the alphanumeric keys. It is used to indicate that communication is occurring with the terminal.

3.3.1.4.1.1 6519D CONNECT LIGHT - On the master station this light indicates that the site is being polled by the CPU and is responding to the poll. It is turned on at the start of the poll and remains on for 100 msec . Then the light is off for 100 msec and then turns on at the start of the next poll message.

3.3.1.4.1.2 6519L CONNECT LIGHT - On the slave station this light indicates that the master station is communicating with the slave. The light turns on when the message starts and is on for 100 msec. It then turns off for 100 msec and will turn on again if communication is still occuring.

3.3.1.4.2 ALERT LIGHT AND ALARM INHIBIT SWITCH - The light is illuminated and the alarm turned on when an alert message addressed to this station is correctly received. The light is extinguished and the alarm turned off upon depression of the SEND key. The alarm may be turned off without extinguishing the light by depressing the ALERT switch/indicator.

3.3.1.4.3 KEYBRD LOCKED {Keyboard Locked} LIGHT AND SWITCH - It is illuminated whenever the keyboard is locked. The light is extinguished when an offline operation is completed or upon reception of an error-free write message addressed to this Keyboard/Display Device which allows the keyboard to be unlocked. Depressing the switch will unlock the keyboard and turn off the light.

3.4 Device Controls

All device controls are shown in Figure and described herein.

3.4.1 Power

The power switch is located on the right side of the terminal.

3.4.2 Brightness

Controls the brightness of the CRT.

3.4.3 Contrast

Controls the contrast of the CRT.

3.5 Internal Switches

Two 8 position switches are located on the processor board. These switches are labeled fix 1 and fix 2 and are shown in Figure 8.

3.5.1. Fix 1 Switch Bank

3.5.1.1 The Fix 1 switch on the master unit (65190) defines the site address (160_8 to 177_8) and the printer address of the printer attached to it. If no printer is attached to the master, the printer address switches must be set to 0000. The station address of the master station is 141_8. The switch settings are as follows:

Site Address	Fix 1 Switch 4 3 2 1
160	0 0 0 0
161	0 0 0 1
162	0 0 1 0
163	0 0 1 1
164	0 1 0 0
165	0 1 0 1
166	0 1 1 0
167	0 1 1 1
170	1 0 0 0
171	1 0 0 1
172	1 0 1 0
173	1 0 1 1
174	1 1 0 0
175	1 1 0 1
176	1 1 1 0
177	1 1 1 1

3.5.1.1 {Continued}

Printer Station Address	Fix 1 Switch 8 7 6 5	
No Printer Attached	0 0 0 0	
141	Not useable reserved for master	
142	0 0 1 0	display.
143	0 0 1 1	
144	0 1 0 0	
145	0 1 0 1	
146	0 1 1 0	
147	0 1 1 1	
150	1 0 0 0	
151	1 0 0 1	
152	1 0 1 0	
153	1 0 1 1	
154	1 1 0 0	
155	1 1 0 1	
156	1 1 1 0	
157	1 1 1 1	

3.5.1.2 Slave Station

The Fix 1 switch on the slave station {65191} defines the station address {142_8 to 157_8} and the printer address of the printer attached to it. If no printer is attached the printer address switches must be set to 0000. The switch settings are as follows:

Station Address	Fix 1 Switches	
140	Unusable, Reserve for station poll Master	
141	Unusable, Reserve for Master	
142	0 0 1 0	Station
143	0 0 1 1	
144	0 1 0 0	
145	0 1 0 1	
146	0 1 1 0	
147	0 1 1 1	
150	1 0 0 0	
151	1 0 0 1	
152	1 0 1 0	
153	1 0 1 1	
154	1 1 0 0	
155	1 1 0 1	
156	1 1 1 0	
157	1 1 1 1	

3.5.1.2 Slave Station (continued)

Printer Station Address	Fix 1 Switch 8 7 6 5	
No Printer Attached	0 0 0 0	
141	Not useable reserved for master	
142	0 0 1 0	display.
143	0 0 1 1	
144	0 1 0 0	
145	0 1 0 1	
146	0 1 1 0	
147	0 1 1 1	
150	1 0 0 0	
151	1 0 0 1	
152	1 0 1 0	
153	1 0 1 1	
154	1 1 0 0	
155	1 1 0 1	
156	1 1 1 0	
157	1 1 1 1	

3.5.2 Fix 2 Switch Bank

Fix 2 Switch	Function
1	16/24 Line
2	64/96 Character Set
3	NIP/Impact
4	Scroll
5	48/4C
6	Address of Last Slaves Bit 0
7	Address of Last Slaves Bit 1
8	Address of Last Slaves Bit 2

Switches 6 through 8 are functional on the master unit

3.5.2.1 16/24 Line

This switch defines how many lines are on the display. In the 16 position the display is 16 lines by 80 characters per line for a total of 1280 characters. In the 24 position the display is 24 lines by 80 characters per line for a total of 1920 characters.

3.5.2.2 64/96 Character Select Switch — This switch defines the character set size. In the 64 position only capital letters are displayed. In the 96 position both small and capital letters are available.

3.5.2.3 NIP/Impact Switch — This switch defines which printer is connected so maximum baud rate is known. The maximum baud rate for the NIP is 300 baud. For the Impact Printer the meximum baud rate is 9600 baud. Print must be set for odd parity.

3.5.2.4 Scroll — With this switch in the enabled position data entry will start in the upper left corner and will continue down the page until the last line of the display is reached. When the 80th character is entered the cursor will reset to the beginning of the last line and all data on the screen will move 1 line up on the display. The top line will move off the screen and the data will be lost. The cursor will remain in the last line unless repositioned by one of the cursor controls. With the switch in the disabled position the cursor will reset to the home position in the upper left hand corner after the 80th character in the last line is entered. Scroll is disabled in the protect mode. Scroll only functions in 24 line mode.

3.5.2.5 Address of Last Display - These three switches define the last display address. Printer addresses above this value may exist. The use of these switches reduces the amount of wasted time by the master station polling non-existing slave stations. The switch settings are as follows:

Station Address of Last Slave Display	Fix 2 Switch 8 7 6
No Slave Devices	0 0 0
143	0 0 1
145	0 1 0
147	0 1 1
151	1 0 0
153	1 0 1
155	1 1 0
157	1 1 1

3.6 Printers

There are two printers available for use as the Receive-Only Printer. An Impact Printer shown in Figure 5 and Non-Impact Printer as shown in Figure 4. Both have RS232 interfaces.

3.6.1 Impact Printer

The impact printer is a single head Bi-directional printer with position seeking capabilities which will print at 70 to 200 lines per minute with a 7 x 7 matrix, depending upon line length. The full 96 character set can be printed. Maximum baud rate is 9600 baud.

3.6.1.1 Print Speed - at 132 columns 70 LPM ± 10%

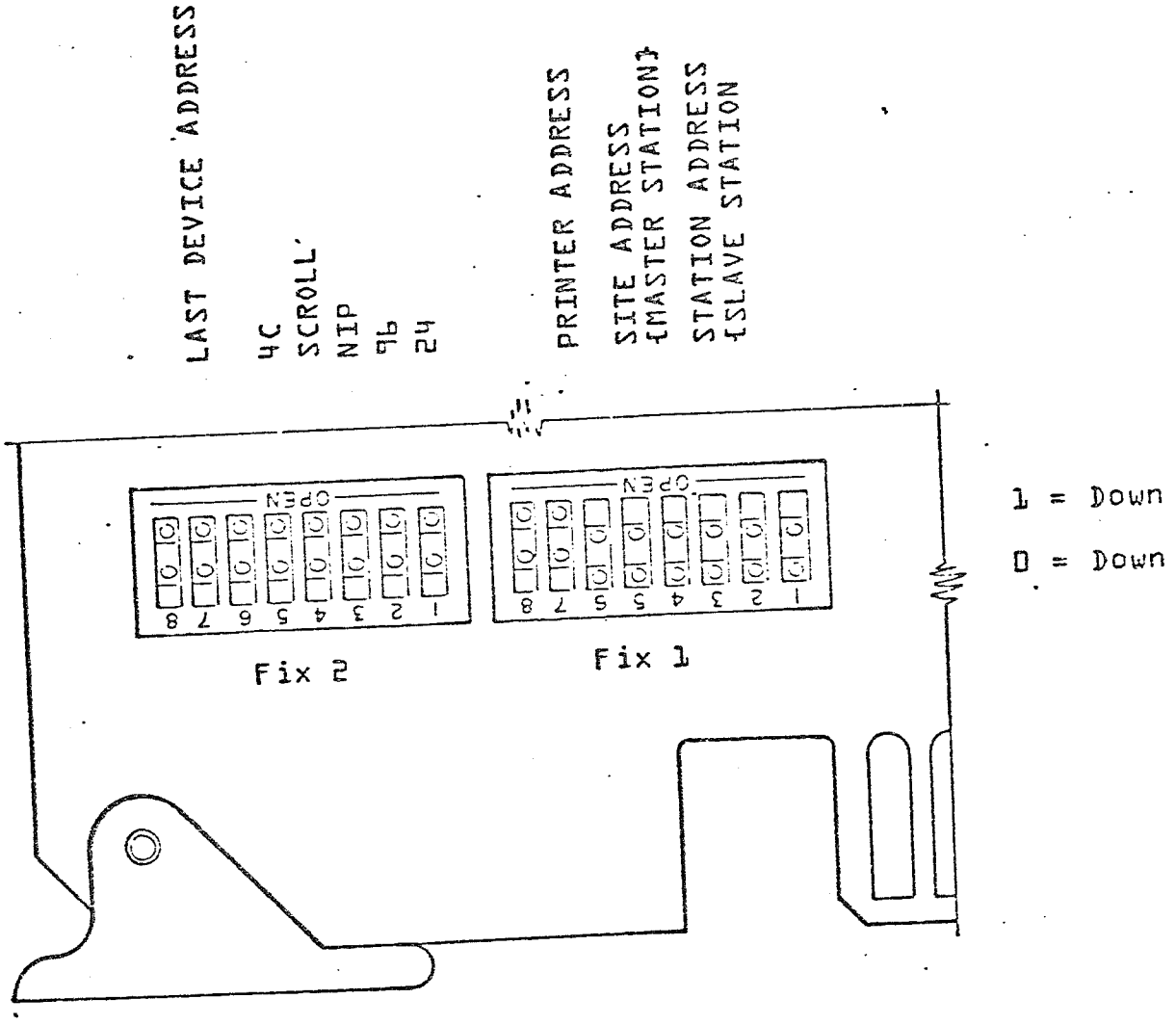


Figure 8. Fix 1 and Fix 2 Switch Location

3.6.1.2 Line Feed - Line feed requires 55 ms maximum.

3.6.1.3 Head Turn-around - Head turn-around time is 110 ms maximum.

3.6.1.4 Print Characteristics - Character size is 0.135 x 0.072 ± 0.005 inches (3.43 x 1.82 ± 0.13 mm).

3.6.1.5 Paper Requirements - The printer will handle standard continuous forms paper with feed holes on each edge, with or without marginal perforations.

The forms may be from 101.6 to 425 mm (4 to 16.75 inches) in width including margins, and 88.9 to 431.8 mm (3.5 to 17 inches) long from fold to fold. When using the output paper basket, the forms length is limited to 304.8 mm (12 inches) from fold to fold.

The forms must have sprocket holes punched along both margins 6.35 ± 0.76 mm (.25 ± .03 inch) from the paper edge to the hole centerlines. The distance between hole centerlines must be 12.7 ± 0.13 mm (.500 ± .005 inch) non-accumulative, and the diameter of the holes should be 3.96 ± 0.13 mm (.156 ± .005 inch).

The distance across the sheet between sprocket hole centerlines must be uniform within 0.38 mm (.015 inch).

3.6.1.6 Recommended Forms - Maximum: One original plus four copies with four sheets of carbon paper as follows:

	PAPER	CARBONS
Single Part	min. 56 g/m^2 (15) max. 90 g/m^2 (24)	
2 and 3 Part	min. 45 g/m^2 (12) max. 56 g/m^2 (15)	19 g/m^2 (8)
4 and 5 Part	max. 45 g/m^2 (12)	14 g/m^2 (6)

Multiple parts forms shall be suitably locked with a non-metallic locking device. Locking the right edge only is no recommended.

3.6.2 Non-Impact Printer

The Non-Impact Printer is a thermal type printer with a moving print head. All 94 printable characters are printed as shown in Table 1, columns 2-7, except for the circumflex and underline symbols which are replaced by an up arrow and a left arrow respectively. Printed characters are formed in a 5 x 7 dot matrix. Up to 80 chracters/line may be printed. Lowercase characters are printed as uppercase symbols in a 5 x 5 dot matrix and proportionally reduced in size. Maximum baud rate is 300 baud.

3.6.2.1 Performance Specifications

3.6.2.1.1 Printing Rate - The printer shall be capable of printing asynchronously at any rate up to and including 30 characters per second (33 1/3 milliseconds per character) except as constrained by carriage return and line feed functions as defined below.

3.6.2.1.2 Print Functions

3.6.2.1.2.1 Line Feed (LF) - Paper shall be advanced one or two lines depending upon the space lever setting, via friction feed. The execution of single line feed shall not exceed 33 1/3 milliseconds and double line feed shall not exceed 66 2/3 milliseconds.

3.6.2.1.2.2 Carriage Return (CR) - The printhead shall be returned to column one. If the printhead attempts to move past column 80, an automatic carriage return and line feed operation shall be performed. The head shall be capable of returning to the left hand margin stop from any column and be ready to print in not more than 200 milliseconds.

3.6.2.1.2.3 Space (SP) - The printhead shall be moved one column from left to right upon receipt of the appropriate code, not to exceed 33 1/3 milliseconds. If the printhead is in column 80 when a space code is received, an automatic (CR/LF operation will result.

3.6.2.1.2.4 Back Space (BS) - The printhead shall be moved (unless in column 1) one column from right to left upon receipt of the appropriate code, not to exceed 33 1/3 milliseconds.

3.6.2.1.2.5 Character Print - The selected printhead elements are heated. The the head is moved to the next column. Total time required to perform the complete print operation shall not exceed 33 1/3 milliseconds.

3.6.2.1.2.6 Automatic CR/LF - The printer, upon printing or spacing in the 80th column (end of line), shall attempt to move the printhead to the 81st column and as a result shall perform an automatic CR/LF operation. This total automatic CR/LF operation shall not exceed 200 milliseconds from the time that the end of the line sensor is tripped. This sensor shall be tripped a maximum of 24 milliseconds after the start of the 80th column print or space (total time from start to 80th to possible start of 1st column operation shall not exceed 224 ms). If a continuous stream of 300 baud data is received, the printer will not accept the next code (will lose regardless of what code) following the code causing an 80th column print/space operation.

3.6.2.1.2.7 No Action - All undefined codes and the null code are character codes that the printer shall take no action on whatsoever. No elements in the 5 x 7 dot matrix shall be energized, head position shall not be shifted, paper shall not be advanced, logic status shall not be changed, etc.

3.6.2.2. Media (Paper) - The printer shall operate with head-sensitive paper (thermal paper) CDC DWG 51772001, which changes colors when contacted by the heated printhead.

3.6.2.2.1 Paper-Supply Storage - The printer shall be capable of holding a 2.5-inch diameter, 8.75-inch wide, 100 foot roll of printer paper.

3.6.2.2.2 Paper Loading - It shall be possible for an untrained operator to load the printer with a new roll of paper with a minimum of effort. Loading instructions shall be affixed to the printer via a decal, or equivalent, which is visible to the operator when loading the printer with paper.

3.6.2.2.3 Paper Feed Mechanism - Line feed will be accomplished by a friction driver. Line spacing will be 6 lines-per-inch when single spaced and 3 lines-per-inch when double spaced (operator selectable).

	Mode 4B	Mode 4C
Status Request - Message Control Code	ETB {027_8}	FS {034_8}
Backspace {Kybd/Display or R.O. Non-Impact Printer} - Terminal Transmission of the Device Control Code	ESC/P {120_8}	BKSP {010_8}
Tab {Kybd/Display} - Terminal Transmission of the Device Control Code	ESC/Q {121_8}	HT {011_8}
New Line - Terminal Transmission of the Device Control Code	ESC/A {101_8}	LF {013_8}
Cursor Down {Kybd/Display} or Line Feed {R.O. Printer} - Terminal Transmission of the Device Control Code	ESC/* {043_8}	VT {013_8}
Reset {Kybd/Display} or Top of Form {R.O. Impact Printer} - Terminal Transmission of the Device Control Code	ESC/Z {132_8}	FF {014_8}
Carriage Return {R.O. Printer} - Terminal Transmission of Device Control Code	ESC/, {054_8}	CR {015_8}

TABLE 2

Mode 4B/4C Feature Differences

3.6.3 Printer Interface Physical and Electrical Requirements - The interface signals conform to EIA Standard RS-232-C and CCITT Recommendation V.24 as applied to asynchronous telecommunications. For the receive data circuit, a voltage more negative than -3 volts is provided as a marking condition; a voltage more positive than +3 volts is provided as a spacing condition. During periods of no receiver activity, the receive circuit is held to a marking condition.

For control circuits originating at the terminal, a voltage more negative than -3 volts is provided as an off condition; a voltage more positive than +3 volts is provided as an on condition. All levels are referenced to signal ground and do not exceed ± 15 volts.

For control circuits originating at the printer, a voltage more negative than -3 volts or a loss (open) of signal is interpreted as an off condition; a voltage more positive than +3 volts is interpreted as an on condition. All voltages are referenced to signal ground and must not exceed ± 15 volts.

The interface circuit assignments and origins are listed in Table 3.

The connector used is equivalent to ITT Cannon DBC-25S, CDC Part Number 53397914 and is located on the rear connector panel of the display terminal.

3.6.3.1 Printer Interface Functional Requirements

3.6.3.1.1 Protective Ground - This conductor is electrically connected to the terminal frame and to the power source protective ground through the terminal ac power system.

3.6.3.1.2 Received Data - The received data circuit is used to transfer data from the terminal to the printer. The receive data word contains in the order of transmission, a start bit (spacing), data bits 2^0 through 2^5, a parity bit and one stop bit (marking).

Within the field created by the start and stop bits, a marking condition is provided as a binary one and a spacing condition is provided as a binary zero.

3.6.3.1.3 Data Set Ready (DSR) - This signal line, when on, indicates the terminal is in the data mode. Data will not be transmitted to the printer if DSR is off.

3.6.3.1.4 Signal Ground - The signal ground establishes the common ground reference potential for the control and data circuits.

3.6.3.1.5 Received Line Signal Detector (Carrier On) - The received line signal detector is provided to the printer from the terminal.

3.6.3.1.6 Secondary Request to Send (SRTS) - The terminal will monitor this signal during the transfer of data to the printer.

If the SRTS signal is determined to be in the on condition, data will be transferred to the printer without imbedded delays. If the SRTS signal is determined to be in the off condition, no data is transferred until the signal goes back to the on condition.

3.6.3.1.7 Data Terminal Ready (DTR) - The terminal will monitor the DRT signal prior to the transfer of each word presented to the printer. If the DTR signal is in the on condition, data is transferred normally.

PIN NUMBER	CCITT	EIA	SIGNAL NAME	ORIGIN
1	101	AA	Protective Ground	Printer/Terminal
2			Reserved	
3	104	BB	Received Data	Terminal
4			Reserved	
5			Reserved	
6	107	CC	Data Set Ready {DSR}	Terminal
7	102	AB	Signal Ground	Printer/Terminal
8	109	CF	Received Line Signal Detector {CO}	Terminal
9			Reserved	
10			Reserved	
11			Reserved	
12			Reserved	
13			Reserved	
14			Reserved	
15			Reserved	
16			Reserved	
17			Reserved	
18			Reserved	
19	120	SCA	Secondary Request to Send {SRTS}	Printer
20	108	CD	Data Terminal Ready {DTR}	Printer
21			Reserved	
22			Reserved	
23			Reserved	
24			Reserved	
25			Reserved	

Table 10 - Peripheral Connector Signal Assignments

3.7 Modem Interface

Modem interface logic is located in the Controller. Modem interface signals conform to EIA Standard RS232-C and CCITT recommendation V.24. A negative voltage greater than -3 volts represents an inactive/off/logic 1 state, and a positive voltage greater than +3 volts represents an active/on/logic 0 state. Modem interface lines are shown in Table 4. Signal origins and pin numbers are also shown.

3.7.1 Protective Ground

Protective ground is furnished by the 3 wire AC power cable to the modem.

3.7.2 Transmitted Data

The transmitted data line transfers logical 1's and logical o's serially from the Controller to the modem during a transmit. Transmitted data is synchronized with the Serial Clock Transmit (SCT) signal. Data changes at the positive transition and is sampled at the negative transition of the SCT signal.

3.7.3 Received Data

The received data line transfers logical 1's and logic o's serially from the modem to the Controller. Received data is synchronized with the Serial Clock Reseive (SCR) signal. Data changes at the positive transistion and is sampled at the negative transistion of the SCR signal.

RS232-C CIRCUIT	PIN	CCITT EQUIV.	DESIGNATION	SIGNAL ORIGIN
AA	1	101	Protective Ground	Modem/AC Source
BA	2	103	Transmitted Data	Controller
BB	3	104	Received Data	Modem
CA	4	105	Request Send	Controller
CB	5	106	Clear To Send	Modem
CC	6	107	Data Set Ready	Modem
AB	7	102	Signal Ground	Modem/Controller
CF	8	109	Received Line Signal Detector	Modem
	9		Not Used	
	10		Not Used	
	11		Not Used	
	12		Not Used	
	13		Not Used	
	14		Not Used	
DB	15	114	Transmitted Signal Element Timing	Modem
	16		Not Used	
DD	17	115	Receiver Signal Element Timing (Serial Clock Receive)	Modem
	18		Not Used	
	19		Not Used	
CD	20	108.2	Data Terminal Ready	Controller
CG	21	110	Not Used	
CE	22	125	Ring Indicator	Modem
	23		Not Used	
	24		Not Used	
	25		Not Used	

TABLE 4 MODEM INTERFACE CONNECTIONS

3.7.4 Request Send (RS) - The Request Send line is made positive by the Controller to initiate a transmit operation. A negative Request Send line places the modem in the receive mode.

3.7.5 Clear to Send (CTS) - The Clear to Send line is made positive by the modem in response to the Request Send signal. It becomes positive after the Request Send signal is made positive. Time variation is due to turn-around time of modem. The Clear to Send line remains positive until the Request to Send line is made negative by the Controller.

3.7.6 Data Set Ready (DSR) - The Data Set Ready signal indicates the operational status of the modem to the Controller. A positive voltage indicates a ready status and a negative voltage indicates a not ready status. The Data Set Ready signal is made positive when the Data Terminal Ready signal is made positive if the modem power is on and the modem is in a Data Mode.

3.7.7 Signal Ground - The Signal Ground line provides the voltage base from which the control signal voltage levels are measured. This line is common to both the modem and Controller logic.

3.7.8 Received Line Signal Detector (Carrier On-CO) - The Received Line Signal Detector line indicates to the Controller that the carrier is being received by the modem. A positive voltage indicates the carrier is being received and a negative voltage indicates the absence of the carrier.

3.7.9 Transmitter Signal Element Timing - The Transmitter Signal Element Timing signal is a symmetrical square wave generated by the modem. Transmitted data is accepted by the modem during the negative transition of the signal. Each data bit is presented to the modem during the positive transition of the square wave and remains for one cycle. This signal is also referred to as Serial Clock Transmit (SCT) signal.

3.7.10 Receiver Signal Element Timing - The Receiver Signal Element Timing signal is a symmetrical square wave generated by the modem. Each new data bit is placed on the received data line by the modem at the positive transition of the timing signal. The Controller samples the data at the negative transition of the Receiver Signal Element Timing signal. This signal is also referred to as Serial Clock Receive (SCR) signal.

3.7.11 Data Terminal Ready (DTR) - The Controller makes the Data Terminal Ready positive, which prepares the modem to connect to the line and make the Data Set Ready (DSR) positive. The DTR signal is made positive when power is applied to the Terminal.

3.8 Terminal Operation

Messages between the data source and the terminal are transmitted through the modem interface in a bit serial, character serial manner. The characters are transmitted least significant bit first (b1) followed sequentially by b2 through b7. The parity bit is transmitted last and is generated so as to make the total number of 1's in the character an odd number.

Communication consists of messages originating at the data source or composed by a Terminal operator. When the Terminal recognizes its station address in a poll, configuration request, status request, alert or any write message, it performs the function requested in the control code and then transmits a message back to the data source to inform the computer of its actions.

A user at the Terminal may compose and subsequently send messages to the data source by means of the keyboard.

The codes and format processed are received via the received data line and transmitted via the transmitted data line of a data set.

3.8.1 Codes - The codes consist of communication control, device control and symbol codes. Communication control codes are used for controlling the transmission of messages. Device control codes perform functions with the addressed device. Symbol codes represent the symbols used in the formation of messages.

3.8.1.1 Communication Control Codes - Communication control codes are used for headers and trailers involved in message transmission. They are used for message control only and are not stored in the Terminal memories. (See Table 5).

BITS b_4 b_3 b_2 b_1	ROW / COL b_7 b_6 b_5	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
		0	1	2	3	4	5	6	7
0 0 0 0	0								
0 0 0 1	1		SOH		WRITE				
0 0 1 0	2				CLEAR WRITE				
0 0 1 1	3		ETX		READ DIAG. WRITE				
0 1 0 0	4								
0 1 0 1	5		POLL		ERROR				
0 1 1 0	6		ACK		SYN				
0 1 1 1	7		ALERT		STATUS REQUEST (1)				
1 0 0 0	8				REJECT CONFIG. REQUEST				
1 0 0 1	9								
1 0 1 0	10								
1 0 1 1	11								
1 1 0 0	12		RESET WRITE		STATUS REQUEST (1)				
1 1 0 1	13								
1 1 1 0	14								
1 1 1 1	15								

TABLE 5. COMMUNICATION CONTROL CODES

(1) The Mode 4 Switch (Table 3) allows the Terminal to select the receipt of the Status Request message control code as either 027_8 (Mode 4B) or 034_8 (Mode 4C).

3.8.1.1.1 Sync {Synchronization SYN} - The sync code {026} is used to ensure synchronization at the receiving modem. The sync code is transmitted four times at the beginning of each message. The sync code may be used any place before the ETX to act as a synchronous idle or as a time fill. Sync codes are ignored for purposes of message parity.

3.8.1.1.2 Start of Header {SOH} - The SOH code {001} follows the 4 transmitted sync codes and indicates that the next word in the message is the station address.

3.8.1.1.3 Station Address - The station address code is generated by either the data source or the Terminal. It designates the specific Controller to or from which the message is being transmitted {160-177 is the range}.

3.8.1.1.4 Device Address - The device address code identifies the address for a particular device. The address used on a station poll message, a reject to poll, a station status request and its response and a configuration request and its response is 140_8 or 160_8. A message addressed to or from a Keyboard/Display Device, or an R.O. Printer Device uses device addresses 141_8-157_8 or 161_8-177_8. The device address is set at 140_8 when power is applied or master clear is performed.

3.8.1.1.5 Poll {ENQ} - The poll control code {005} originates at the data source. It designates a message that requests the Controller to transmit a read message if data is ready to be sent to the data source.

3.8.1.1.6 Acknowledge {ACK} - The acknowledge code {006} is generated by the Terminal. It designates a message as an affirmative response to a correctly received reset write, write, clear write or alert message.

3.8.1.1.7 Alert {BEL} - The alert code {007}, generated by the data source, turns on the ALERT indicator and alarm at the Display/Keyboard or reserves the Printer for further communication with the data source.

3.8.1.1.8 Write {DC1} - The write code {021}, generated by the data source, designates a message containing data to be written into a Display memory or to be printed.

3.8.1.1.9 Reset Write {FF} - The reset write code {014} is generated by the data source. It designates that a reset function is to be performed by the Controller. Data immediately following the code is stored in a Display memory or printed. In the case of a Printer, a line feed/carriage return is performed before printout begins. In the case of a Keyboard/Display Device, the cursor is reset to home position before data storage begins.

3.8.1.1.10 Diagnostic Write {DC4} - The diagnostic write code {024} generated by the data source, designates that a reset function is to be performed by the Controller. Data immediately following the code is stored in a Display memory or the Printer buffer in the Controller {a diagnostic write message addressed to a Printer Device causes no printout to be initiated}. The Terminal response to a diagnostic write message is a read message. The read message is an exact retransmission of data just received by the Controller.

A word parity error code during a diagnostic write message does not enable transmission of an error message. A parity error code is stored in memory and is transmitted in the subsequent read message.

3.8.1.1.11 Clear Write {DC2} - The clear write code {022} generated by the data source, designates that a clear and reset function is to be performed by the Display or a line feed/carriage return is to be performed by the Printer. Data following the clear write code is stored in Display memory or printed on a Printer.

3.8.1.1.12 Read {DC3} - The read code {023} generated by the Terminal, indicates that a read message is being transmitted to the data source. A read message is the response to a poll message, a diagnostic write message, a status request message or a configuration request message.

3.8.1.1.13 Error {NAK} - The error code {025} generated by the Terminal, indicates to the data source that the message received was in error after detection of the correct station address. Error conditions are word parity error, message parity error, carrier removed before the end of text code is recognized, incorrect control code or incorrect device address.

3.8.1.1.14 Reject {CAN} - The reject code {030} generated by the Terminal, indicates rejection of a previously received message. A reject message is generated when the Controller is polled and no data awaits transfer to the data source or on a write, reset write, diagnostic write or clear write and the addressed device is busy.

3.8.1.1.15 End of Text {ETX} - The End of Text control code {003} indicates that the previous word in the message was the last data word. The word following the End of Text is the message parity code.

3.8.1.1.16 Message Parity - The message parity code is a check code on the total message beginning with the start of header code and ending with the End of Text code. Message parity is always odd and independent of sync codes regardless of sync code position within the message. The message parity code may be any code from octal 000 through 177 inclusive. The parity sense of the message parity code is the same as all other data codes {odd}.

3.8.1.1.17 Status Request {ETB/FS} - The status request code {027-Mode 4B or 034-Mode 4C} indicates that the data source is requesting status from the station and all devices at the station if the device address is 140_8 {or 160_8} or the addressed device. The response by the Terminal is a read, with status words as data.

3.8.1.1.18 Configuration Request {EM} - The configuration request code {031} indicates that the data source is requesting configuration of the Terminal. The device address in the Configuration Request message must be 140_8 {or 160_8}. The response by the Terminal is a read with the configuration words as data.

BITS b_4 b_3 b_2 b_1	b_7 b_6 b_5 COL / ROW	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1
		0	1	2	3	4	5
0 0 0 0	0				***CNTRL		BKSP
0 0 0 1	1				***F1	NEW*** LINE (1)	TAB
0 0 1 0	2			START*** INDEX	***F2	SEND {E1}***	LINE SKIP
0 0 1 1	3			CURSOR DOWN	***F3	PRINT CONTROL	SELECTIVE CLEAR
0 1 0 0	4			CURSOR UP	***F4		LINE CLEAR
0 1 0 1	5			Reset to Start Index	***F5	Diag. Write Control	END PROTECT ACCESS
0 1 1 0	6		SYN		***F6	Position Control	
0 1 1 1	7				***F7		Clear to End of Page
1 0 0 0	8	BKSP*		LOCK KYBD	***F8		
1 0 0 1	9	TAB *		RELEASE KEYBD			SKIP
1 0 1 0	10	NEW*** LINE (1)		INSERT LINE			RESET
1 0 1 1	11	VT{CURSOR DOWN}*	ESC	INSERT CHAR.			
1 1 0 0	12	RESET*		DELETE LINE			
1 1 0 1	13			DELETE CHAR.			PROTECT ACCESS
1 1 1 0	14			BACK TAB			END ** PROTECT
1 1 1 1	15						START*** PROTECT

TABLE 6. DISPLAY FUNCTION CODES

* May be inserted in the data block in a write message. These codes are not preceded by the ESC. All codes shown in columns 2-5 must be preceded by ESC in a write message.

** These codes are the only codes which can be returned in a read message to the CPU.

*** These codes may be contained in a read to the CPU but are not stored in Display memory.

(1) The Mode 4 Switch allows the terminal to select the transmission of New Line as either $ESC/101_8$ (Mode 4B) or 012_8 (Mode 4C). In the receive condition, either code may be received independent of the Mode 4 Switch position.

3.8.1.2 Display Function Codes - These codes, may appear in any portion of the data block. The codes shown in columns 0 and 1 of Table 6 are not preceded by an ESC code. The codes shown in columns 2-5 must be preceded by an ESC code, otherwise they are interpreted as symbol codes as shown in Table 1.

Control codes (columns 0 and 1) and escape sequences not defined in Table 6, if received by the Terminal, are treated as time-fill and are not stored or displayed.

3.8.1.2.1 Escape (ESC) - The escape code (033) is used to indicate that the character immediately following is a function code.

3.8.1.2.2 Backspace (BS or ESC/120) - This code performs the backspace function as described herein.

3.8.1.2.3 New Line (LF or ESC/101) - This code performs the new line function as described herein.

3.8.1.2.4 Cursor Down {VT or ESC/043} - This code performs the cursor down function as described herein.

3.8.1.2.5 Start Protect {ESC/137} - This code performs the start protect function as described herein. When the Terminal is in Protect mode, the start protect code must be preceded by a protect access code.

3.8.1.2.6 End Protect {ESC/136} - This code performs the end protect function as described herein.

3.8.1.2.7 Line Clear {ESC/124} - This code performs the line clear function as described herein.

3.8.1.2.8 Start Index {ESC/042} - When a start index is stored in memory and a read is initiated, the start index symbol denotes the beginning point of the message. The data portion of the message begins with and includes the start index code. This code is transformed to an escape code followed by a 042_8 code at the modem interface.

When a start index code is received in the data portion of a write message, it is stored as the start index symbol {≡}.

The start index code may exist anywhere in the data portion of a message, and there can be any number of start index codes existing in a write message.

The start index code in a write message may be used to designate the beginning of the next operator initiated read message if a send code does not follow the start index code in the write message.

3.8.1.2.9 Skip {ESC/131} - This code performs the skip function as described herein.

3.8.1.2.10 Tab {HT or ESC/121} - This code performs the forward tab function as described herein.

3.8.1.2.11 Back Tab {ESC/056} - This code performs the back tap function as described herein.

3.8.1.2.12 Line Skip {ESC/122} - This code performs the line skip function as described herein.

3.8.1.2.13 Select Clear {ESC/123} - This code performs the select clear function as described herein.

3.8.1.2.14 Reset {FF or ESC/132} - This code performs the reset function as described herein.

3.8.1.2.15 Protect Access {ESC/135} - This code permits the data source to change the mode of operation of the Display from protect to access if the data protect option is present so that the data source has access to the protected data on the display. The Display is in access mode from the time that the protect access is received until the end protect access code is received at the Display.

3.8.1.2.16 Cursor Up {ESC/044 - This code performs the Cursor Up function as described herein.

3.8.1.2.17 Insert Line {ESC/052} - This code performs the Insert Line function as described herein.

3.8.1.2.18 Delete Character {ESC/055} - This code performs the Delete Character function as described herein.

3.8.1.2.19 Insert Character {ESC/053} - This code performs the Insert Character function as described herein.

3.8.1.2.20 Line Delete {ESC/054} - This code performs the Line Delete function as described herein.

3.8.1.2.21 Lock Keyboard {ESC/050} - The lock keyboard code locks the Keyboard so that no information can be entered via the Keyboard. The Keyboard remains locked until a release keyboard code is received.

3.8.1.2.22 Release Keyboard {ESC/051} - The release keyboard code unlocks the Keyboard. The Keyboard is unlocked by a release keyboard code, reception of the next error-free write message {which does not contain a lock keyboard code} or depressing the KYBD LOCKOUT SWITCH.

3.8.1.2.23 Clear to End of Page {ESC/127} - Receipt of this code causes all data from and including the cursor position to the end of the page to be cleared, except protected data.

3.8.1.2.24 X-Y Positioning - An ESC/106 {Position Control} sequence at any point in the data portion of a write message indicates that the following two characters are X and Y position information for the cursor, respectively. The cursor is set to the coordinates specified by these characters and further data transfer begins at the new cursor location. If the indicated coordinate position is located in a protected field, the cursor is advanced to the first character position following the protected field. The Printer Device ignores all X and Y position information.

X-position information is presented as the octal codes 040 through 157 inclusive, i.e., 040 = column 1, 041 = column 2, through 157 = column 80. If a code greater than 157 is sent, X-position is set to columns 1 thru 16, i.e., 160 = column 1, 161 = column 2, through 177 = column 16. Codes less than 040 causes the X-position to be set to an indeterminate coordinate.

Y-position information is presented as a octal codes 040 through 067, inclusive, i.e., 040 = line 1, 041 = line 2, through 067 - line 24. If a code greater than 067 is sent, only the lower 5 bits of the Y-coordinate are recognized. Codes less than 040 cause the Y-position to be set to an indeterminate coordinate.

3.8.1.2.25 Reset to Start Index {ESC/045} - Receipt of this code causes the cursor to be reset to the position of the first start index symbol to the left or above the present cursor position. When a start index symbol is not present between the cursor position and the beginning of the display page, the cursor is reset to the beginning of the page. Start index symbols located to the right and below the cursor position are disregarded.

3.8.1.2.25 (Continued)

This code, when received by the Terminal in the data portion of a write message, causes a search operation to be initiated at the Display Device.

3.8.1.2.26 Send (ESC/102) - This code, if received in a write message, is displayed as a send symbol. Data terminating in a send code in a read message indicates that the data is from a Display Device. When protect access code is contained in a write message a send code must be used to terminate the message and return the display to access mode.

3.8.1.2.27 When the Print Control code (ESC/103) is received as the first data code in a write message to a Keyboard/Display Device, the control code interpretation logic at the Display Device is disabled and all subsequent data and normal control codes except X, Y, positioning are stored as data. The print control code is not stored in the Display memory.

An X Y position command will be accepted and executed. If the write message is a reset write or clear write, the first character stored in the display memory is a New Line code and it will be stored at the home position (first line, first character). If the message is a write message, data is stored beginning at the home position. The ESC/103 is ignored in a diagnostic write message. The message must terminate with the send symbol. A print request for that Keyboard/Display Device is initiated at the conclusion of the message. Offline device association rules apply to this operation. The Print Control operation is identical to addressing a message directly to a printer device with the following exceptions:

A. Start index, end protect and start protect are converted to spaces prior to transfer to the printer.

B. Display function codes which are not recognized by the printer are transferred to the printer and are ignored by the printer.

3.8.1.2.27 (Continued)

C. Space suppression is performed such that if up to 255_{10} continuous spaces are received, they will be printed (with no line formatting performed by the terminal). If 256_{10} continuous spaces are received, no spaces will be printed. The number of spaces transferred to the printer is the total number, module 256 (ex; 257_{10}, or 513_{10} spaces will result in the transfer of one space to the printer). Therefore, it is recommended that the data source control line formatting and prevent more than 80 characters (NIP) or 132 characters (IP) from being printed on any one line.

D. The read request is not activated at either the display or the printer at the conclusion of the printout.

3.8.1.2.28 When the Diagnostic Write Control code (ESC/105) is received as the first data code in a diagnostic write message to a Keyboard/Display Device, the control code interpretation logic at the station is disabled and all subsequent data and normal control codes are stored as data. The Diagnostic Write Control code is not stored in the Display memory. The remainder of the diagnostic write message processing is handled in the normal manner as described herein. This code is intended for use with the diagnostic write message. If used in conjunction with any other write message control code logic is disabled, the Diagnostic Write Control code is not stored and remainder of the write message processing is handled in the normal manner as described herein.

3.8.1.2.29 End Protect Access {ESC/125} - Receipt of this code clears the protect access contition if it exists.

3.8.1.3 Printer Function Codes - Except for the E1, E2 and E3 codes, these codes may appear at any point in the data of a write message {See Table 6}. Escape code sequences and control codes {columns 0 and 1}, not defined in Table 6, if received by the terminal, are treated as time-fill and are not stored or printed.

3.8.1.3.1 Backspace {BS or ESC/120} - This code applies to the Non-Impact Printer only. If moves the print head left one symbol position.

3.8.1.3.2 Line Feed {VT or ESC/043} - This code advances the paper one or two lines, depending on the position of the printer {1 - 2} lever on the Non-Impact Printer. On the Impact Printer, it advances the paper one line only.

BITS				$b_7b_6b_5$	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b_4	b_3	b_2	b_1	col no.	0	1	2	3	4	5	6	7
0	0	0	0	0			E2			BKSP**		
0	0	0	1	1			E3		New Line			
0	0	1	0	2					E1			
0	0	1	1	3			LINE FEED					
0	1	0	0	4								
0	1	0	1	5								
0	1	1	0	6		SYNC						
0	1	1	1	7								
1	0	0	0	8	BKSP**							
1	0	0	1	9								
1	0	1	0	10	NEW LINE					TOP OF FORM		
1	0	1	1	11	VT(LINE FEED)	ESC						
1	1	0	0	12	TOP OF FORM *		CARR. RETURN					
1	1	0	1	13	Carr. Return							
1	1	1	0	14								
1	1	1	1	15								

* Impact Printer Only ** Non-Impact Printer Only

All codes shown in colums 2-7 must be preceded by an ESC.

TABLE 9 Printer Function Codes

The BKSP, New Line, Line Feed, Top of Form and Carriage Return device control codes may be received by the terminal as either ASCII codes or as ESC sequences. In a read response to a diagnostic write, these codes are transmitted as ESC sequences if the terminal is operating in Mode 4B or as ASCII device control codes if the terminal is operating in Mode 4C.

3.8.1.3.3 Top of Form {FF or ESC/132} - This code advances the paper to the top of the next 11 inch form, on the Impact Printer only.

3.8.1.3.4 Carriage Return {CR or ESC/D54} - This code returns the print head to the left margin.

3.8.1.3.5 Escape {ESC} - This code indicates that the code following is a function code.

3.8.1.3.6 E1 - This code releases the Printer from an online condition. The ESC/E1 sequence must be a separate write message.

3.8.1.3.7 E2 - This code is used to terminate a data write message to a Printer. When it appears in a read message from the Printer, it indicates that the Printer is not ready because of paper out {also fuse fault or READY switch inactive on the Impact Printer} or the printer has become non-existant {power off or master clear at the printer} during a print operation.

3.8.1.3.8 E3 - This code, when it appears in a read message from the Printer, indicates that the Printer is ready to accept data from the data source.

3.8.1.3.9 New Line {LF or ESC/1D1} - This code causes the Printer to perform a line feed and carriage return.

3.8.2 Message Processing

Communication between the data source and the Terminal takes place as a series of poll, status, configuration, alert, read, write, clear write, reset write, acknowledge, diagnostic write, reject and error messages. Message length is variable and dependent upon the number of data words. Each transmitted message begins with four sync codes. Following two consecutive sync codes is the Start of Header {SOH} code, then the station and device addresses. The next character is the control code, specifying the type of message, followed by the message text. Messages terminate with the End of Text {ETX} code and the message parity character. A SYN character is transmitted following the MPC to insure proper operation with a variety of modems. Terminal operation is controlled by operator action and the proper exchange of messages between the Terminal and data source and does not respond unless directed to do so by the data source. See Figure 9 for a summary of message types and transmission directions.

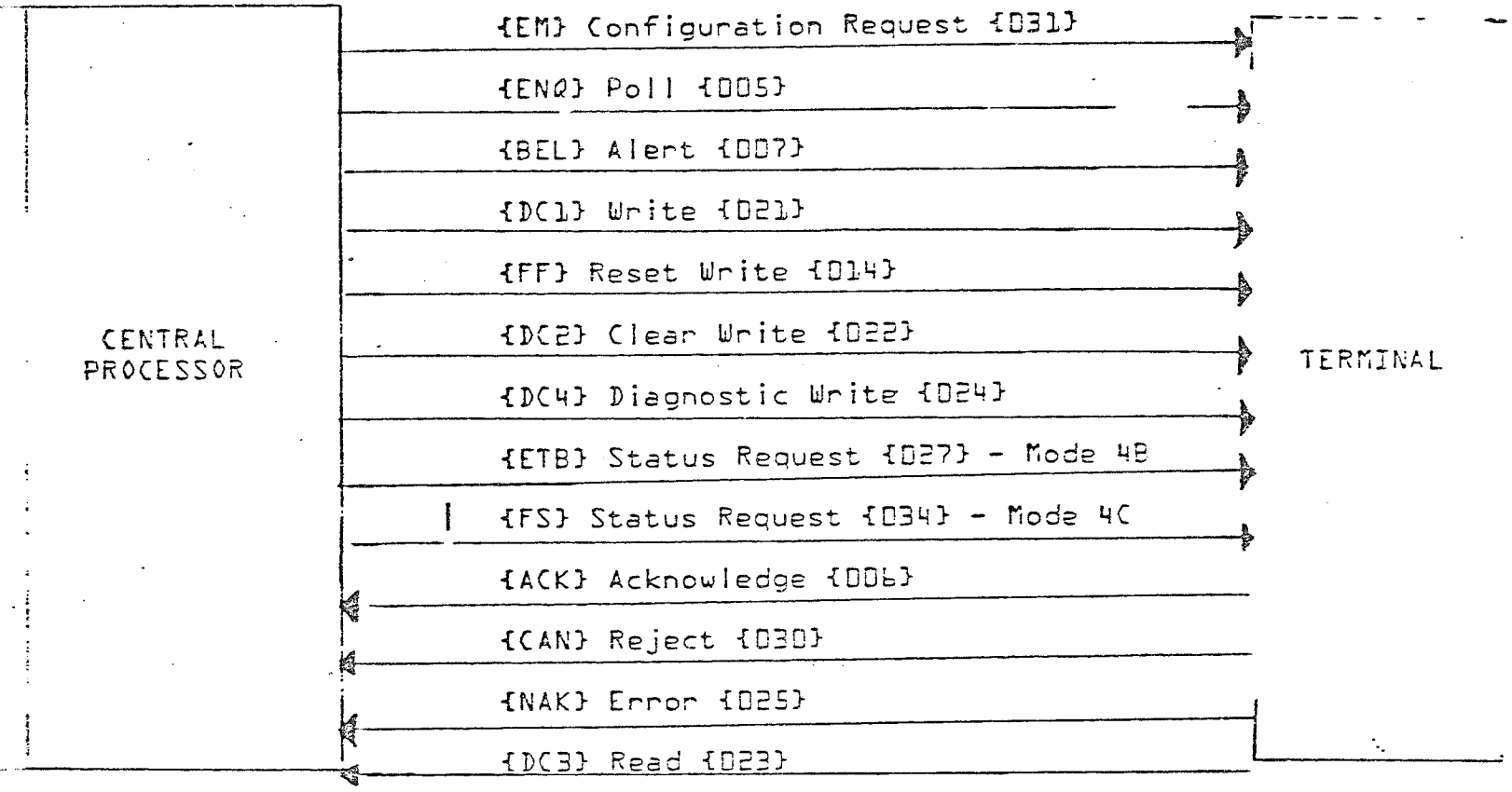


Figure 9 Message Types and Transmission Direction

3.8.2.1 Synchronization Recovery and Address Recognition - When two successive sync codes are detected, the 65190 assemblies the next 8 bits and examines the contents to detect the Start of Header (SOH) code. Unless at least two successive sync codes followed by a Start of Header code are detected, the 65190 again searches for the same pattern.

After sync is established and the SOH code is detected, the 65190 examines the site address to see if the message is addressed to the particular site. When the site addresses do not correspond, the Controller recycles to detect the next sync recover sequence. When the site address is recognized the 65190 determines if an existing device is being addressed. When the device address is 140 or 160 octal (Device 0), it is expected that the control code defines a station poll, station status request or configuration request. After receiving a valid device address of 141-157 or 161-177 octal, the control code is examined to determine if the message is an alert, write, clear write, diagnostic write, reset write, device status request or poll. If it is not address 140 or 160 octal followed by a station poll, status request, configuration control code, or a valid device, an error message is initiated.

3.8.2.2 Error Processing - This message is generated by the 65190 and indicates to the data source that the previously received message was in error. Error conditions are shown in Table 7.

ERROR CONDITION	ERROR DISABLE SWITCH NOT ACTIVE
Word Parity Error	Transmit error message instead of acknowledge message. Data not displayed.
Message Parity Error	Transmit error message instead of acknowledge message. Data not displayed.
Unrecognized Control Code	Transmit error message on end of test. Receive sequence aborts on end of test
Carrier On Signal drops before ETX	Transmit reject message instead of acknowledge message.
Illegal or Non-existent device address	Transmit error message on end of test. Receive sequence aborts on end of test.

Table 7. Errors on Receive

3.8.2.3 Messages from Data Source to Terminal

3.8.2.3.1 Poll Messages - The poll message may be a station poll if the device address is 140_8 or 160_8 (normal operation) or it may be addressed to a specific device. The poll message interrogates the Terminal or the addressed device to determine if a read request is active. The read request for a Display is initiated by depressing the SEND "F" or CTRL key. The display read request remains active until a correct write, clear write, reset write or diagnostic write message is received by the Display Device. The read request for a Printer is activited by an alert message addressed to the device and remains active until a write message containing an E1 code is received by the device.

The poll message format is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
14X or 16X	Device Address-140 or 160 indicates a station poll
005	Poll (ENQ)
003	ETX
XXX	Message Parity Character (MPC)
177	Pad

3.8.2.3.2 Status Request Message - The status request message may be a station status request if the device address is 140_8 or 160_8 or it may be addressed to a specific device. The status request message requests status from the Terminal and all devices or requests status of the addressed device.

The status request message format is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
14X or 16X	Device Address - 140 or 160 indicates a station status request
027 *	Status Request (ETB)-Mode 4B
003	ETX
XXX	Message Parity Character (MPC)
177	Pad

* 034(FS) - Status Request Control Code for Mode 4C

3.8.2.3.3 Alert Message - The alert message provides a means for informing a device at the Terminal that the data source has a write message waiting for transmission. An alert message addressed to the Display Device lights the ALERT indicator and turns on the alert alarm. Proper operator response is depression of the SEND key function key or CTRL key which activates the display read request. An alert message addressed to a Printer Device places the device in an online condition (reserve for data source) and activates the device read request.

The alert message format is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
14X or 16X	Device Address
007	Alert (BEL)
003	ETX
XXX	Message Parity Character (MPC)
177	Pad

3.8.2.4 Write Message - The write message is used to transfer data from the data source to the Terminal.

A write message addressed to a Display begins data storage at the current cursor position and continues storage sequentially. A write message stores data in the Display memory to the end of page. If additional data is received, storage begins with the nearest unprotected field after the beginning of page (if data protect is enabled).

Data continues to be stored in the Display memory until the following event occurs:

A. ASCII ETX detected - Acknowledge if no error detected.

Maximum data block size is including the send 1280/1920 characters.

Three modes of operation concerning the lock keyboard and release keyboard codes with a write message to a Keyboard/Display Device are possible:

A. A write message which does not contain either the lock keyboard or release keyboard codes automatically unlocks the keyboard if the message is received without error and the message contains either the send or start index code (or both). If the message does not contain either the send or start index codes, the keyboard will remain locked.
B. A write message which contains a release keyboard code in the data stream unlocks the keyboard at the conclusion of the message whether or not it was received without error.
C. A write message which contains a lock keyboard code in the data stream does not unlock the keyboard at the conclusion of the message. This feature allows multiple write messages to be sent to the keyboard display without the possibility of operator intervention.

A write message addressed to the Printer Device causes a print operation to begin providing the write message was error free. Maximum data block size is 1280/1920 characters. Printout begins at present print head location.

Data storage is truncated when the limit of the 1280/1920 Data character buffer is reached. If the message contains additional data and the limit of the buffer is exceeded, the message is not printed and the terminal responds with and error message at the conclusion of the receive sequence.

Paper spacing between write messages is the responsibility of the data source. It should be noted that the Terminal automatically inserts a CR and LF function at the beginning and a CR and two LF functions at the conclusion of an offline print (PRINT or SELECT PRINT) operation.

When the controller or device is busy and receives a write code, the Controller responds to the write message with a reject message. No data is stored or printed.

Incorrect word or message parity in the write message results in an error message from the Terminal.

Since the impact printer has an internal buffer once the message has been transfered to this buffer there is no status to indicate that this information was printed properly. If the printer goes not ready before this buffer is printed data will be lost if the printer has power shut off. If the printer is made ready without turning power off the remaining buffer data will be printed.

Bit 5 of the device address is used to provide the data source with information concerning correct receipt of any type of write message. Bit 5 of the device address may be a logical 0 or a logical 1. Upon completion of any write message received without error. Bit 5 of the present address is transmitted in all subsequent messages to the data source as it was received (Bit 5 is toggled). When an error is detected in a received write message or the write message is rejected, Bit 5 of the device address used prior to receiving this message is used (Bit 5 is not toggled.) Any other type of message does not store the received address as sent by the data source. The device address of any response from an alert, poll, status request or configuration request has the same Bit 5 significance in the device address as the last correctly received write message.

The data source, by alternately sending 1's and 0's in Bit 5 of the device address ensures that any type of write message is correctly received and processed by the Controller. An error-free write message unlocks the Keyboard except when a lock keyboard code is present in the data portion of the write message. The Printer, if addressed, begins printout at the print head position.

The write message format is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
14X or 16X	Device Address
021	Write {DC1}
XXX	Data
↓	↓
XXX	Data
033	Escape {If E Code is Used}
XXX	E-Code
003	ETX
XXX	Message Parity Character
177	Pad

3.8.2.3.5 Reset Write Message - The reset write message is similar to the write message with the following exceptions:

The cursor is reset prior to storing any data {display}. A line feed/carriage return is performed by the Printer.

The reset write message format is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
14X or 16X	Device Address
014	Reset Write {FF}
XXX	Data
↓	↓
XXX	Data
033	Escape {If E Code is Used}
XXX	E-Code
003	ETX
XXX	Message Parity Character {MPC}
177	Pad

3.8.2.3.6 Clear Write Message - The clear write message is similar to the write message with the following exceptions:

The cursor is reset and all unprotected data is cleared prior to the storing data.

A line feed/carriage return is performed by the printer.

The clear write message format is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
14X or 16X	Device Address
022	Clear Write (DC2)
XXX	Data
↓	↓
XXX	Data
033	Escape (If E Code is Used)
XXX	E-Code
003	ETX
XXX	Message Parity Character (MPC)
177	Pad

3.8.2.3.7 Diagnostic Write Message - The diagnostic write message is similar to a reset write message except that it requires the Terminal to transmit a read message instead of an acknowledge or error message. Data in the read message is an exact retransmission of the data received in the diagnostic write message including parity error codes in character positions that had parity errors. (See Table 6 for exceptions)

The diagnostic write, when addressed to a Keyboard/Display Device, stores data in the Display memory. The read response begins at the home position and includes all start index codes and protected data (if the display has been put into the protect access mode). If the alert light and alarm are active from a previous ALERT message, they will be inactivated when the diagnostic read response is transmitted. Control code logic in the Display Device can be disabled and all subsequent data and normal control codes are stored as data in the Display memory if the diagnostic write control code (ESC/105) is used as the first data character in the diagnostic write message.
The diagnostic write, when addressed to a Printer, stores data in the Controller memory and does not transfer the data to the addressed device. The read response derives its data from the Controller memory.

The diagnostic write message must have the sequence ESC/E1 as the last data characters.

The diagnostic write message format is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
14X or 16X	Device Address
024	Diagnostic Write (DC4)
XXX	Data
↓	↓
XXX	Data
033	Escape
102	E1
003	ETX
XXX	Message Parity Character (MPC)
177	Pad

3.8.2.3.8 Configuration Request Message - The configuration request message allows the data source to determine the configuration of a Terminal. The response to the configuration request is a read message containing the configuration data of the Terminal. The configuration codes are sent in ascending device address order, i.e., 15 codes are sent.

The configuration request message format is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
140 or 160	Device Address
031	Configuration Request (EM)
003	ETX
XXX	Message Parity Character (MPC)
177	Pad

3.8.2.4 Messages from Terminal to Data Source

3.8.2.4.1 Acknowledge Message - The acknowledge message indicates correct receipt by the Terminal of a write, reset write, clear write or alert message. Terminal may be busy printing or completing the storage of a display message after the ACK is transmitted.

The acknowledge format is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
14X or 16X	Device Address
006	Acknowledge (ACK)
003	ETX
XXX	Message Parity Character (MPC)
177	Pad

3.8.2.4.2 Reject Message - The reject message, if in response to a poll message, indicates that the Terminal has no read request active. When the reject message is in response to a write, diagnostic write, reset write or clear write message, it indicates that the addressed device is busy.

The reject message format is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
040 - 177	Station Address {160 - 177 Recommended}
14X or 16X	Device Address
030	Reject {CAN}
003	ETX
XXX	Message Parity Character {MPC}
026	SYN {Pad}

3.8.2.4.3 Error Message - The error message is the Terminal response to any message {except diagnostic write} that was received in error providing the error jumper, described in this specification, is not present. Message errors are listed in Table 7.

The error message format is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
040 - 177	Station Address {160 - 177 Recommended}
14X or 16X	Device Address
025	Error {NAK}
003	ETX
XXX	Message Parity Character {MPC}
026	SYN {Pad}

3.8.2.4.4 Read Message - The read message is the Terminal response to a poll message when a read request is active, to a status request message, to a diagnostic write message and a configuration request message. A read response generated from a Display Station may contain 1279 of data plus the send symbol. When a start index is present, the data beings with an ESC/Start Index sequence and the first data character is the character immediately to the right of the start index. Protected data is not transmitted. The data from the Display terminates with the ESC/Send Sequence. The terminal provides protection against the lack of a send symbol in the Display memory by ensuring that the read message does not contain more than 1280 characters {maximum memory size} including the send code and is properly terminated with the send code.

A read response from a Printer Device consists of only an ESC/E2 or an ESC/E3 as data.

The read message format in response to a poll or diagnostic write is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
14X or 16X	Device Address
023	Read {DC3}
XXX	Data
↓	↓
XXX	Data
033	Escape
XXX	E Code
003	ETX
XXX	Message Parity Character {MPC}
177	Pad

The read message format in response to a poll if one of the "F" keys {F1 to F8} or the CNTRL key has been depressed is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
14X or 16X	Device Address
023	Read {DC3}
XXX	Data
↓	↓
XXX	Data
033	ESC
060 - 070	Function Key {CNTRL = 060, F1-F8 = 061-070}
033	ESC
102	SEND {E1}
003	ETX
XXX	Message Parity Character {MPC}
177	Pad

The read message format in response to a configuration request is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
140 or 160	Device Address
023	Read (DC3)
XXX	15 configuration codes - one for each
↓	device address starts with station 141
XXX	through 157 (or 161 through 177)
003	ETX
XXX	Message Parity Character (MPC)
177	Pad

The configuration codes are as follows:

060_8	Display
051_8	Impact Printer
052_8	Non-Impact Printer
100_8	Non-Existent Device

The read message format in response to a station status request is as follows:

026	SYN
026	SYN
026	SYN
026	SYN
001	SOH
160 - 177	Station Address
140 or 160	Device Address
023	Read (DC3)
XXX	Station Status Word
XXX	15 device status words - one for each
↓	device address starts with 141 through
XXX	157 (or 161 through 177)
003	ETX
XXX	Message Parity Character (MPC)
177	Pad

The response to a device status request is similar except that the device address is 14X or 16X and only the status word of the addressed device is sent.

The status words are described in this specification.

3.8.3 Message Sequencing - The following paragraphs describe recommended message sequencing between the data source and the Terminal (see Figure 10). It should be noted that the Terminal is capable of receiving and responding to unsolicited write messages (Alert/Poll sequence not used) to Keyboard/Display Device at the risk of destroying operator input. Unsolicited write messages to R.O. Printers are possible, but at the risk of having the write message rejected if the the printe is busy or not printed if the Printer is not ready. E2/E3 Read responses are generated by the printer when the print sequence is not preceded by an Alert message, but the Printer Device is not reserved (off-line print messages can be interleaved with data source print messages).

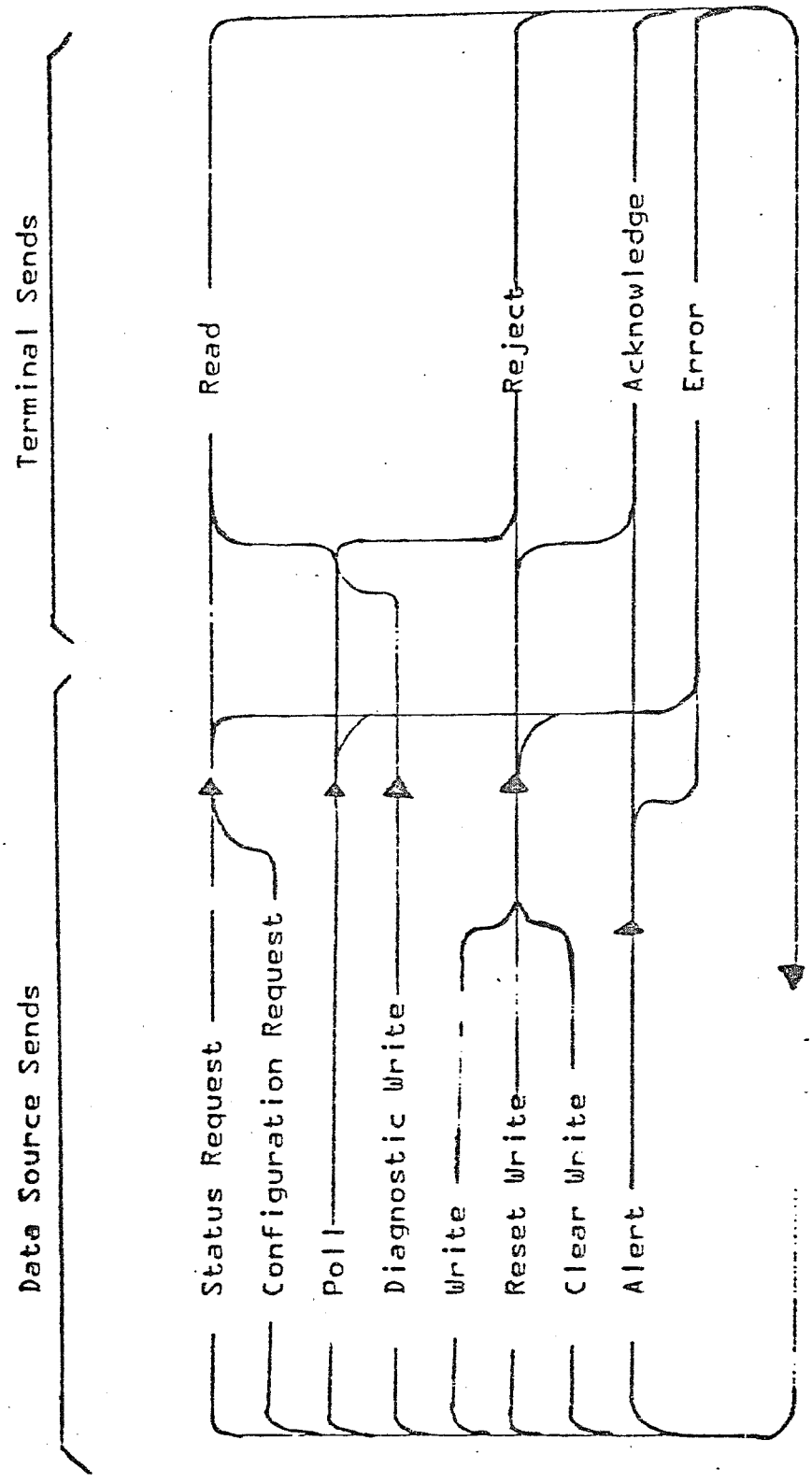


Figure 10. Message Sequencing

3.8.3.1 Message from the Data Source to the Keyboard/Display

Data Source		Terminal
Alert	⟶	
	⟵	Error - Transmission error on alert
	{or} ⟵	ACK - Turns on ALERT light and alarm which instructs operator to depress SEND. {NOTE: Customer application determines whether operator composed data is accepted and interpreted by the system}.
Device Poll*	⟶	
	⟵	Error - Transmission error on poll.
	{or} ⟵	Reject - Operator has not yet depressed SEND.
	{or} ⟵	Read {E1} - Data message from alerted Display.
Device Status Request*	⟶	
	⟵	Error - Transmission error on status request.
	{or} ⟵	Read Status - Status word of addressed Display is transferred to data source in a read message.
Write {E1}	⟶	
	⟵	Error - Transmission error on write.
	{or} ⟵	Reject - Display Device busy {not possible if device has previously been alerted - reserved}.
	{or} ⟵	ACK - Data message {write} accepted by Display and Display is released.

* Station Poll and/or Station Status Request may also be used but, in the case of Station Poll, activity from another device could result in a response from a device other than the alerted device.

3.8.3.2 Message from Data Source to R.O. Printer

Data Source		Terminal
Alert **	——→	
	←- - - - -	Error - Transmission error on alert.
	← {or}	ACK - Sets printer read request {as soon as printer becomes not busy} and reserves the printer for use by the data source.
Device Poll*	——→	
	←- - - - -	Error - Transmission error on poll.
	← {or}	Reject - Printer busy from previous operation {read request not yet set}.
	← {or}	Read E2 - Printer reserved but not ready {status message sequence must be used to determine the reason}.
	← {or}	Read E3 - Printer ready and reserved for data source use.
Write {E2}	——→	
	←- - - - -	Error - Transmission error on write.
	← {or}	Reject - Printer busy from previous write {Poll/Read E3 or Status sequence avoids this}.
	← {or}	ACK - Write message accepted and printout initiated.
Device Poll*	——→	
	←- - - - -	Error - Transmission error on poll.
	← {or}	Reject - Printer busy.
	← {or}	Read E2 - Printer not ready or non-existant ***
	← {or}	Read E3 - Printer ready for next data block.

* Station Poll may also be used but activity from another device could result in a response from a device other than the alerted device.

** Alert message is not required but is recommended to avoid the possibility of off-line print messages being interleaved with data source print messages.

3.8.3.2 {Continued}

MKM Print Error status will be active and device will continue to respond to poll with E2 read. Print error will be cleared by a alert message only. The E2 response to a poll will be cleared by a successful write or an alert.

Write {E1} ——→

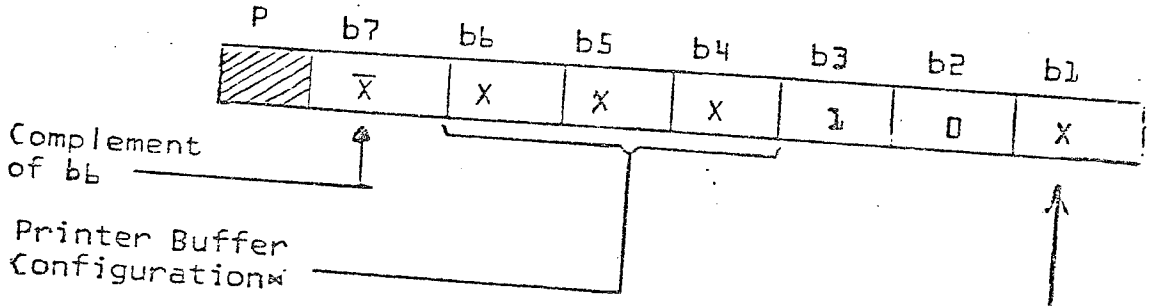
←—— Error - Transmission error on write

←— {or} —— Reject - Printer busy

←— {or} —— ACK - Printer released by data source

3.8.4 Status Words - Status words provide a means for the Terminal to inform the data source of its condition.

3.8.4.1 Station Status - The station status is defined as follows:

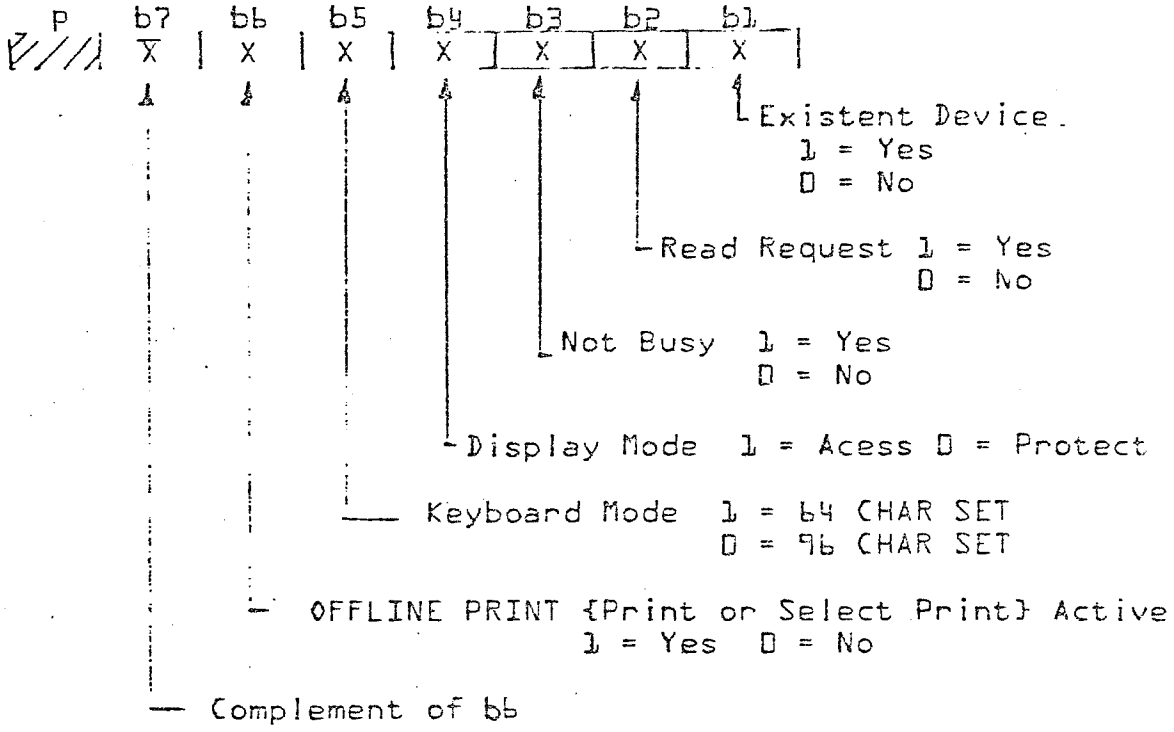


* Printer Buffer Configuration

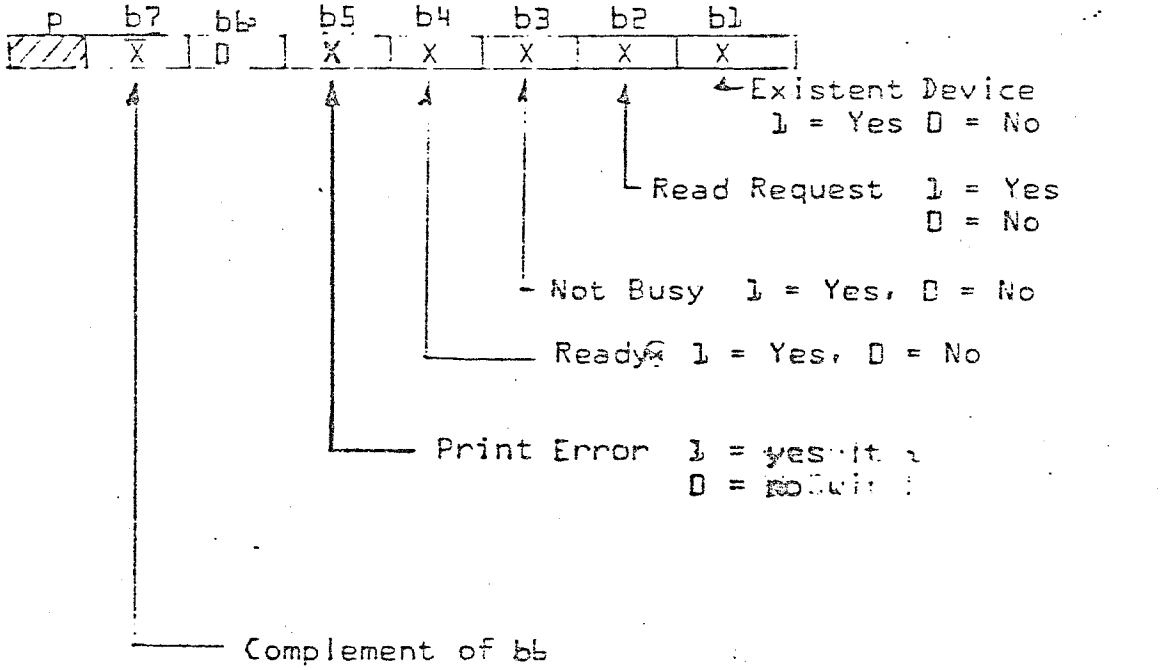
b6	b5	b4	Description
0	0	0	0 BUFFERS
0	0	1	1 BUFFERS
0	1	0	2 BUFFERS
0	1	1	3 BUFFERS
1	0	0	4 BUFFERS
1	0	1	5 BUFFERS
1	1	0	6 BUFFERS
1	1	1	7 BUFFERS

Expanded Memory
1=1920 Character
0=1280 Character

3.8.4.2 Keyboard/Display Device Status - The Keyboard/Display Device status word is defined as follows:



3.8.4.3 Printer Device Status - The Printer Device status word is as follows:



3.9 Finish

Paint on all unplated surfaces is as follows:

External: 10121202 — Textured Vinyl Coat, Bloack
10120710 — Textured Vinyl Coat, Gold

3.10 Cabling - The following cabling is required. See Appendix C for connect panel layout.

3.10.1 Power 8 - Feet long with plug to meet local codes, permanently attached to terminal. On 50Hz units no plug is required.

3.10.2 65190 Master Station - This display will be supplied with a data set cable 10 feet long, CDC P/N 61408070. Connector housing for the I/O Channel to the 65191 slave will also be supplied with each unit.

3.10.3 65190 Slave Station - This display will be supplied with a 50 foot I/O Cable, CDC P/N 61408045. This cable will have a connector on one end only. The other end will have wires with pins so it can be connected into the previous unit. Each lead will be labled for identification.

3.10.4 Printer Cabling - All cabling will be supplied with the printer.

3.11 Safety Listings - Both units, 65190 and 65191, will be UL and CSA approved by the vendor. The vendors lables will carry both UL and CSA identification. The units must meet the requirements of UL 478 and CSA C22.2 number 154.

3.12 Reliability and Serviceability

3.12.1 Mean Time Between Failure (MTBF)

A. Master Station - 3450 hr at 25°C, 1657 hr at 40°C
B. Slave Station - 4071 hr at 25°C, 2054 hr at 40°C
C. Impact Printer - 10% duty cycle 2000 hrs.
20% duty cycle 1600 hrs.
30% duty cycle 1200 hrs.
40% duty cycle 960 hrs.
50% duty cycle 800 hrs.
D. Non-Impact Printer - 4000 hr. or 40 million print cycles.

3.12.2 Mean Time To Repair (MTTR) (On-Site)

A.	Master Station	0.7 hr.
B.	Slave Station	0.7 hr.
C.	Impact Printer	1.25 hr.
D.	Non-Impact Printer	1.25 hr.

Only functional assemblies shall be replaced on site. Logic boards, power supplies, etc. are repaired at a repair center or the vendor.

3.12.3 Preventive Maintenance - Preventive maintenance will consist of cleaning the viewing screen and case as needed.

3.12.4 Special Tools and Equipment - No special tools or equipment is required for on-site maintenance. For repair centers the following is needed.

A. Master Station 65190 (modified to accept program from
B. Slave Station 65191 floppy disk)
C. Printer
D. Floppy Disk Unit
E. Diagnostics for loading from floppy disk
F. Board Extender
G. Remote Terminal Tester
H. Floppy Disk Controller

4.0 QUALITY ASSURANCE

4.1 Design Verification - Engineering, System Integration and testing, Engineering Services and Quality Assurance shall run a design verification test on this terminal. This test assures that the equipment complies with this specification.

4.2 EMI Testing - The terminal meets all the requirements of Engineering Standard 1.30.022.

4.3 Production Test - Each logic board and electrical assembly will undergo a dynamic test. After final assembly and prior to shipment, the complete terminal is tested functionally to ensure that the terminal meets this specification. Records of testing of each terminal will be maintained and made available to Control Data on request.

4.4 Variations - Any proposed changes or variations in the fit, form, function or quality assurance provisions shall be submitted to Control Data Corporation in writing. Also any changes affecting spare parts must be submitted. The proposed device shall not be substituted for the device described in this specification without prior approval from Control Data Corporation in writing in the form of the Advanced Deviation Request letter submitted by the vendor.

Information submitted shall include a complete description of the change, and the effect the change will have on all characteristics of the device. Upon request, the manufacturer shall submit samples of the proposed devices for evaluation by Control Data Corporation.

5.0 VENDOR INFORMATION

See qualified vendor list for vendor name, part number and qualification level. This information is for internal use by CDC only and is considered prioprietary.

6.0 714/711-10/216/215 FEATURE COMPARISON

Table 8 shows all features of the 714, 711-10, 216 and 215 products which differentiate these products from each other. Features which are common are not shown.

TABLE 8: PRODUCT FEATURE COMPARISONS

Message Types	714	711-10	216	215	65190
. Configuration Request	Yes	Yes	No	No	Yes
. Disconnect	No	No	No	No	No
Features					
. All Kybd Features Operable from the data source	Yes	Yes	No	OK	Yes
. Use of ANSI Col. 0 & 1 as well as ESC	Yes	Yes	No	No	Yes
. Blink	No	No	Yes	OK	NO
. Start Index	Multiple	Single	Single	OK	Multiple
. Function Keys	7 {Implemented}	6 {Implemented}	10 {Implemented}	OK	8
. Status Keys	No	No	Yes {4}	OK	No
. Code Set	64/96 ANSI	64 ANSI	64 ANSI	64 ANSI	64/96 ANSI
. Print Cont. Write to CRT	Yes	No	No	OK	Yes
. Printer Reservation	Yes	Yes	No	OK	YES
. Attended/Unattended Switch	No	No	Yes	OK	NO
. Poll Wait Switch	No	No	Yes	No	No
. Keyboard Lockout Indicator	Yes	No	Yes	N/A	Yes
. Repeat Key	No	No	Yes	N/A	No
. Select Print	Yes	Yes	No	N/A	Yes
. Tab Protect Code	No	No	Yes	OK	No
. Start Blink Code	No	No	Yes	OK	No
. EDIT Key	No	No	Yes	N/A	No
. Delete Key	Yes {1 operation}	Yes {1 oper.}	Yes {2 operations}	N/A	Yes {1 Oper.}
. Insert Key	Yes	Yes	Yes {2 oper.}	N/A	Yes
. LINE DOWN/INSERT LINE	SIMILAR	SIMILAR	SIMILAR	N/A	Similar
. LINE UP/DELETE LINE	SIMILAR	SIMILAR	SIMILAR	N/A	Similar
. Manual Release	No	No	Yes	N/A	No
. Clear to End of Page Code	Yes	No	No	OK	Yes
. Lock Keyboard Code	Yes	No	No	OK	Yes
. Release Keyboard Code	Yes	No	No	OK	Yes
. Status Request Message Code	ETB-Mode 4B FS -Mode 4C	ETB	ETB	ETB	ETB-Mode 4B FS-Mode 4C
. ASCII Device Controls {BS, HT, LF, VT, FF and CR}	ESC-Mode 4B ASCII-Mode 4C	ESC	ESC	ESC	ESC-Mode 4B ASCII-Mode 4C
. Scroll	No	YES	NO	N/A	No with 1280 char. Yes with 1120 char.

TABLE 8 (Continued)

STATUS WORDS

STATION	714	711-10	216	65190
1	0	0	Poll Wait Switch	Screen Size
2	Disable Error Message	Disable Error Message	Error Disable Switch	0
3	Comm. Mode	0	0	1
4	Printer Buffer Configuration	0	0	Printer Buffer Config.
5		0	0	
6		0	0	
7	Complement of b6	1	1	Complement b5
8	PARITY	PARITY	PARITY	PARITY

DISPLAY

1	Existent Device	Existent Station	Station Available	Same as 714
2	Read Request	Read Request	Read Request	
3	Not Busy	Busy	Kybd Status Switch 1	
4	Display Mode	Encoded Function Keys	Kybd Status Switch 2	
5	Keyboard Mode		Kybd Status Switch 3	
6	Off-Line Print Active		Kybd Status Switch 4	
7	Complement of b6	1	Complement of b6	
8	PARITY	PARITY	PARITY	

PRINTER

1	Existent Device	Existent Station	Station Available	Existent Device
2	Read Request	Read Active	Read Request	Read Request
3	Not Busy	Busy	0	Not Busy
4	Ready	Paper Out	0	Ready
5	Print Error	Print	0	Print Error
6	Off-Line Print Active	Select Print	0	0
7	Complement of b6	1	1	Complement b6
8	PARITY	PARITY	PARITY	PARITY

CONTROL DATA

EQUIPMENT SPECIFICATION DATA SHEET

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REV.
DATE
PAGE 91

Equipment Identification Number 65190/65191

ELECTRICAL CHARACTERISTICS

Terminal Identifier	Volts	Freq.	Phase	#Wires Excl. Safety Ground	A/ϕ	KVA	KW	EST.	MEAS.
CC622A	120	60	1	2	1.6	.192		X	
	208	60	3	4					
	240	60	3	3					
CC622B	220	50	1	2	0.85	.187		X	
	380	50	3	4					
	208	400	3	3					
CC623A	120	60	1	2	1.2	.144		X	
CC623B	220	50	1	2	0.65	.143		X	
	40	DC Terminator Power is required?					Yes ___	No ___	

Figures shown in above table are standard per CDC-STD 1.30.011. If some are not applicable, please cross out.

Motor Load (Name plate ratings of individual or combined motors, arranged to start together, that exceed 1 HP or 6 AMPS full load current ratings):

HP	V	FREQ.	ϕ	FLA	LRA	FUNCTION

Power Field Terminal Location:

400 Hz ____ in. above base of cabinet
50 Hz 3 in. above base of cabinet
60 Hz 3 in. above base of cabinet
Terminator Power ____ in. above base of cabinet

Number of Terminator Resistor Assemblies: None

Describe unusual starting characteristics such as disks, drum and printers:

EQUIPMENT SPECIFICATION DATA SHEET

Instructions: Complete this data sheet for each written equipment specification. Provide measured or calculated data wherever possible. Estimates of parameters are permitted if identified as such with the suffix (est.). All estimated data must be final data on release of equipment specification.

GENERAL INFORMATION

Equipment Identification Number 65190/65191

Equipment Name REMOTE TERMINAL SUBSYSTEM

Top Assembly Part Number

Is Equipment a stand alone (black box) unit? YES

PHYSICAL CHARACTERISTICS

Dimensions and Weight:

	Uncrated	Crated – Van (if known)	Crated-Air (if known)
Height	16.6''		
Width	22.5''		
Depth	24.0''		
Weight	68 lbs.		

Equipment Support:

Number of Casters None

Number of Leveling Pads 4

Area of each Pad

Vibration Limits:

Operating

Non-operating Displacement ± 0.005 inch at 5 to 60 CPS, 2 G asseleration at 60 to 5000 CPS.

LOGIC CHARACTERISTICS

Logic Cable From	Logic Cable To	Number of Cables	Terminating Connector Type	Maximum Cable Length	Distance from Cable con. to Floor
65190	modem	1	25 pin	50 ft (15.5m)	
65191	printer	1	25 pin	50 ft (15.5m)	
65190	65191	(A)	25 pin	1000 ft.	

(A) one per 65191 in system configuration.

ORIGINATOR				

Equipment Identification Number 65190/65191

ENVIROMENTAL CHARACTERISTICS

Temperature:

Operating 50 (min.) °F to 100 (max.) °F {10°C to 38°C}

Non-operating -40 (min.) °F to 160 (max.) °F {-40°C to 71°C}

Max. Temp. Gradient 20 °F per hour {11°C per hour}

Recommended Operating Temperature 70 °F {22°C}

Relative Humidity:

Operating 10 (min.) % to 95 (max.) % {no condensation}

Non-operating 5 (min.) % to 98 (max.) %

Altitude (above S.L.)

Max. Operating Altitude 8,000 feet {3,000m}

Max. Non-operating altitude 15,000 ft. {4,500m}

Heat Dissipation (BTU/Hr):

Air	CC622	650	Water	Total 650
	CC623	500		500

Type of Equipment Cooling:

	Yes	No
Natural Convection	X	
Internal Fans	X	
Rating 30 CFM		
Direct Water Cooled		X
Refrigeration System:		X
Quantity and Size of Condensing Units:		
Qty. ____ TONS ____		
Condensing Unit Location:		
Internal		X
External		X
Air Cooled Condensing Unit		X
Water Cooled Condensing Unit		X

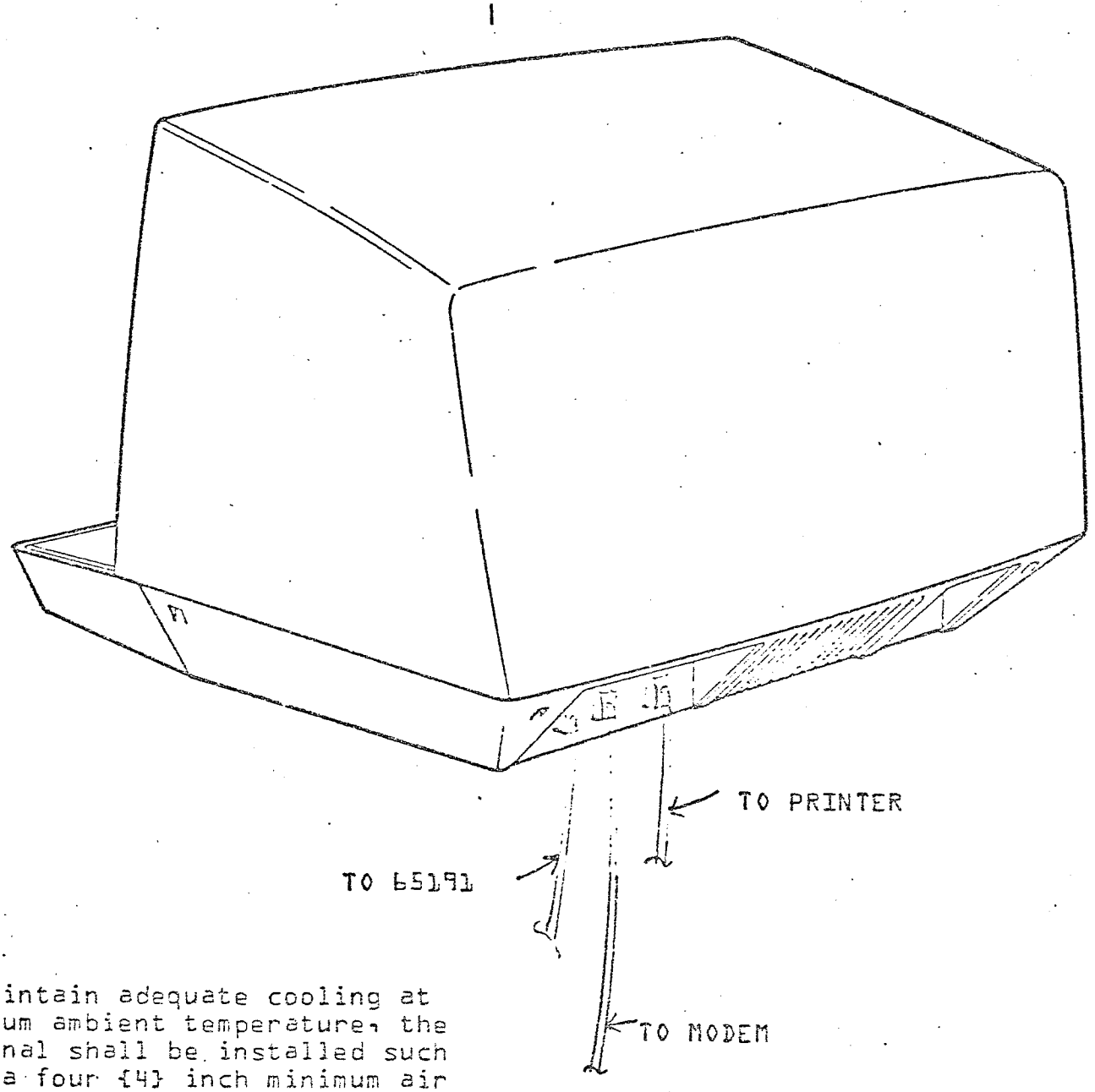
Water Supply Conditions: N/A

	Min.	Recommended	Max.
Temperature (°F)			
Flow (gallons/min.)			
Pressure Drop (psi)			

Equipment Identification Number 65190

PLAN VIEW OF EQUIPMENT

Show door swings and their space requirements, caster location, location of leveling pads, cable locations and cutouts in cabinet plenum, service clearances, refrigeration or water hose entry locations, and other items pertinent to installing this equipment.



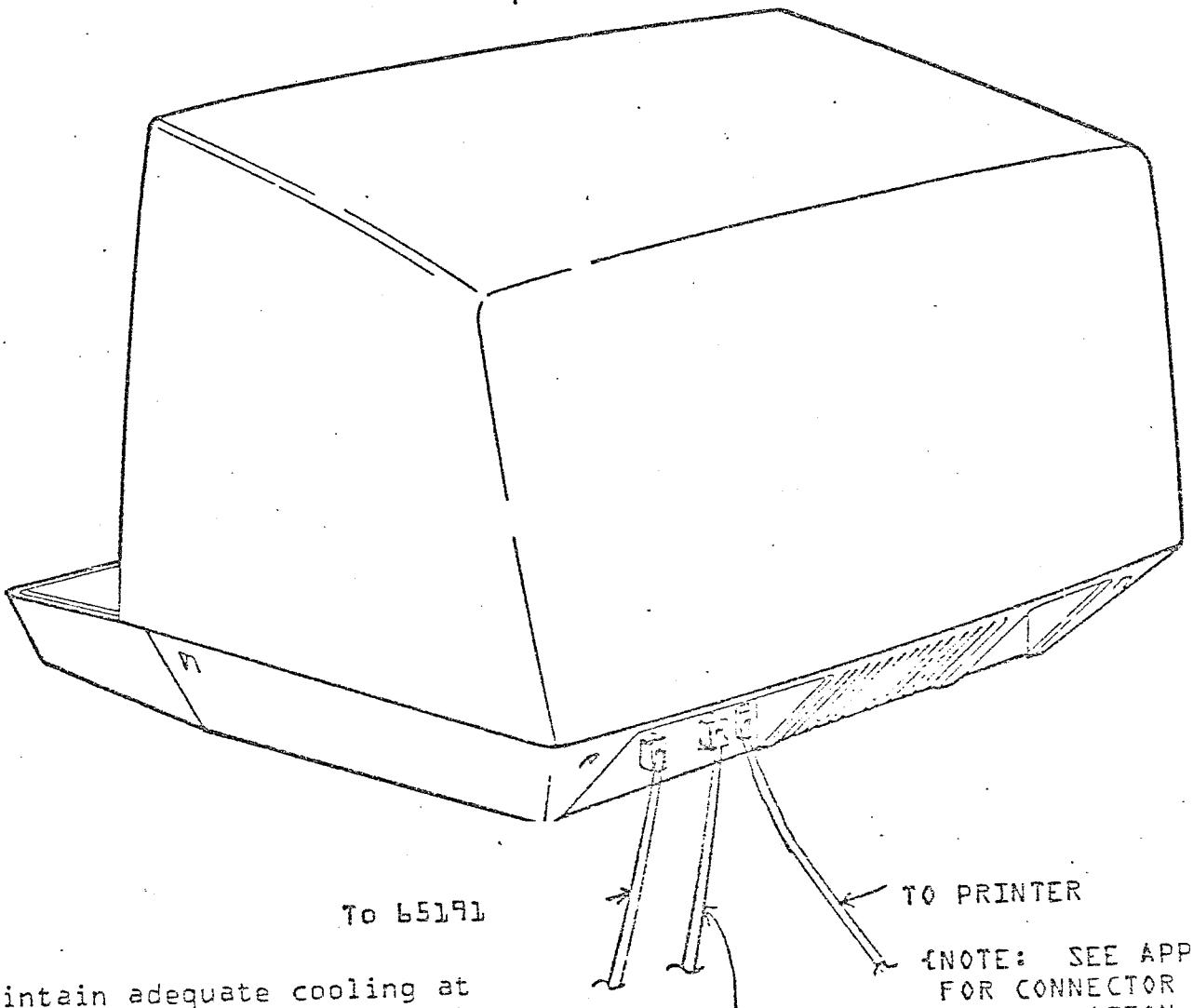
To maintain adequate cooling at maximum ambient temperature, the terminal shall be installed such that a four (4) inch minimum air space shall be maintained on the back, the sides and top.

NOTE: SEE APPENDIX C FOR CONNECTOR PANEL CONFIGURATION AND CABLING.

Equipment Identification Number 65191

PLAN VIEW OF EQUIPMENT

Show door swings and their space requirements, caster location, location of leveling pads, cable locations and cutouts in cabinet plenum, service clearances, refrigeration or water hose entry locations, and other items pertinent to installing this equipment.



To maintain adequate cooling at maximum ambient temperature, the terminal shall be installed such that a four (4) inch minimum air space shall be maintained on the back, the sides and top.

APPENDIX A
QUICK LOOK DIAGNOSTIC

{Data to be supplied at a later date}

Appendix B

LOCATION OF LABELS

B.0 Location of Labels — The following lables shall be attached to each unit. See figures B-1 & B-2 for locations.

B.1 Vendor ID Plate — The vendors ID Plate shall be located inside the display as shown in Figure B-2. This ID Plate will have the following on it:

1. Vendor Name
2. Vendor Part Number
3. Voltage Ratings
4. Current Ratings
5. U.L. Indication
6. CSA Indication

B.2 Control Data ID Plate — This ID Plate will be attached as shown in Figure B-2. This ID Plate will be supplied by Control Data to the vendor. This plate will have all required data on it before shipment to vendor.

B.3 Control Data FCO Log — This FCO log shall be installed on the logic rack inside the display. It will be supplied to the vendor by Control Data with all required data on it.

B.4 Control Data Logo — This logo shall be placed on the front of the unit below the viewing screen as shown in figure B-1.

LOCATION OF CDC LOGO

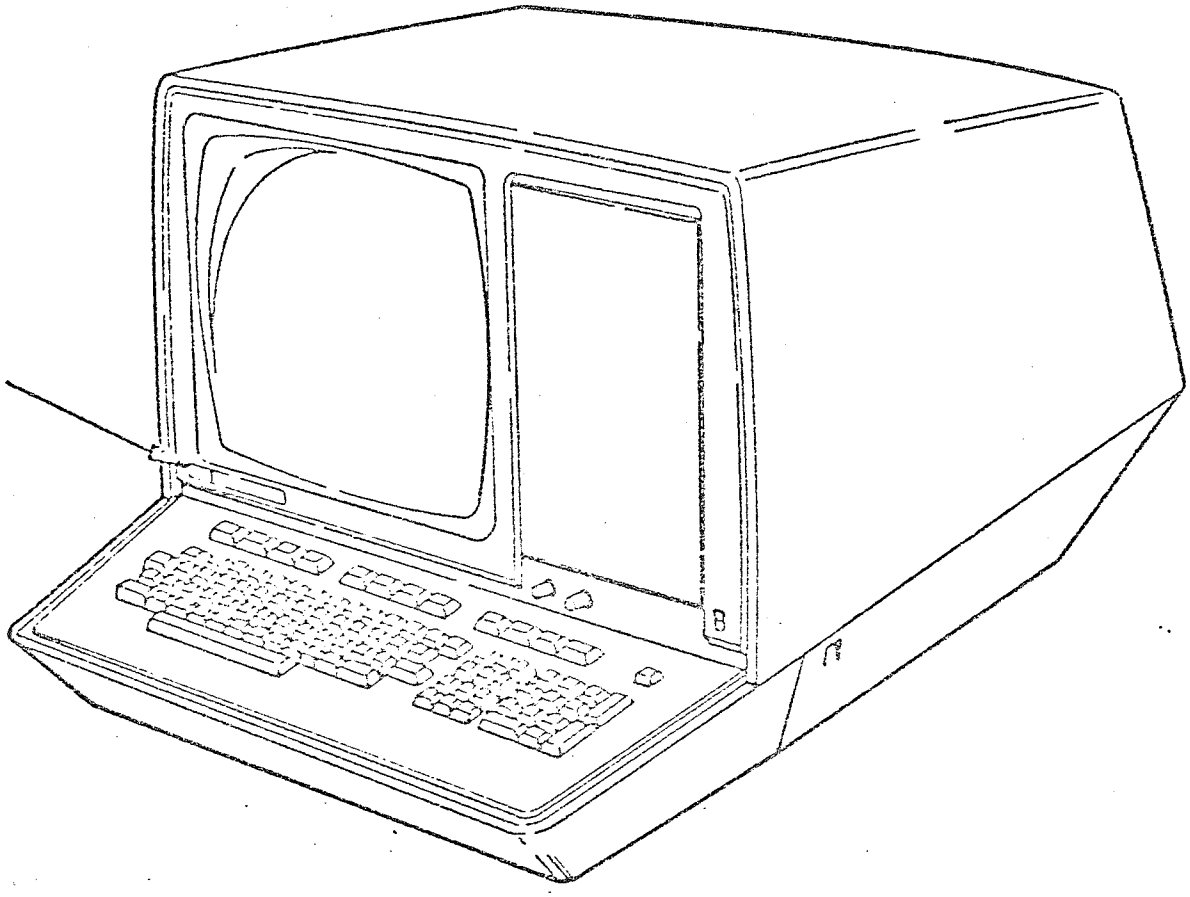


Figure B-1

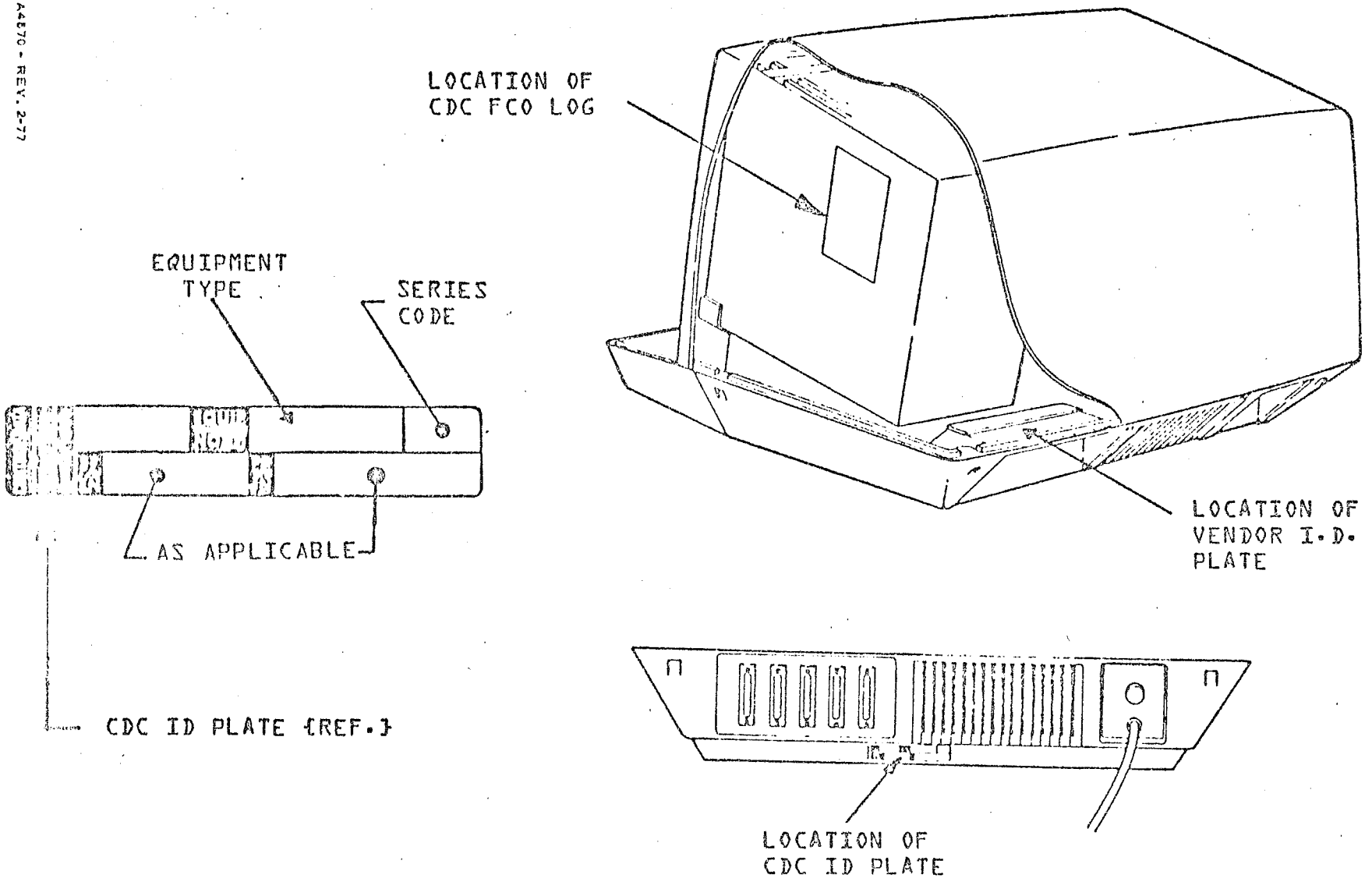

LOCATION OF
CDC FCO LOG
EQUIPMENT
TYPE
SERIES
CODE
AS APPLICABLE
CDC ID PLATE (REF.)
LOCATION OF
VENDOR I.D.
PLATE
LOCATION OF
CDC ID PLATE

Figure B-2

APPENDIX C

CABLING OF UNITS AND SYSTEM

C.1 Connector Panel

The connectors on the back panel (see Figure C-1) are assigned the following functions:

	Master	Slave
A	Printer	Printer
D1	Synchronous I/O to Modem	Not Used
D2	Asynchronous I/O to Slave	Asynchronous I/O
D3	Asynchronous I/O to Slave	Asynchronous I/O
D4	Asynchronous I/O to Slave	Asynchronous I/O

Connectors A, D1, D2 and D4 are female connectors and D3 is a male connector.

C.2 I/O Cable

The I/O Cable has 2 wires and a shield. The connections are:

Shield	Pin 1 of Cable
Logic Ground	Pin 7 of Cable
Data	Pin 4 of Cable

One end of the cable has a female connector and the other end has a male connector. This allows for one of the slaves to be removed and the two cables joined together, thereby, eliminating having to recable the system. This can be done only if the system is configured using the daisy chain connection and not the branching connection.

C.3 Cabling Layouts

Two layouts are possible with this system. The first is the normal daisy chain where the cable goes from each unit directly to the next. The second layout is the branch connection. In this layout the I/O cabling does not go directly from unit to unit but may branch at various unit into different strings. In either layout the maximum cable length cannot be greater than 1000 feet.

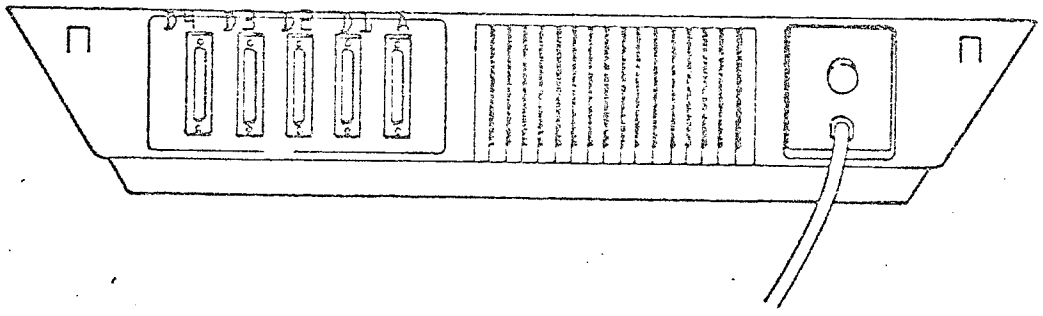
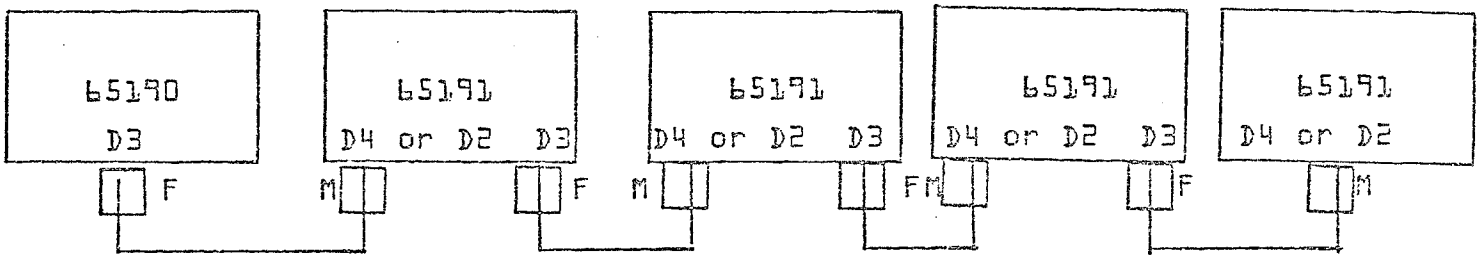


Figure C-1

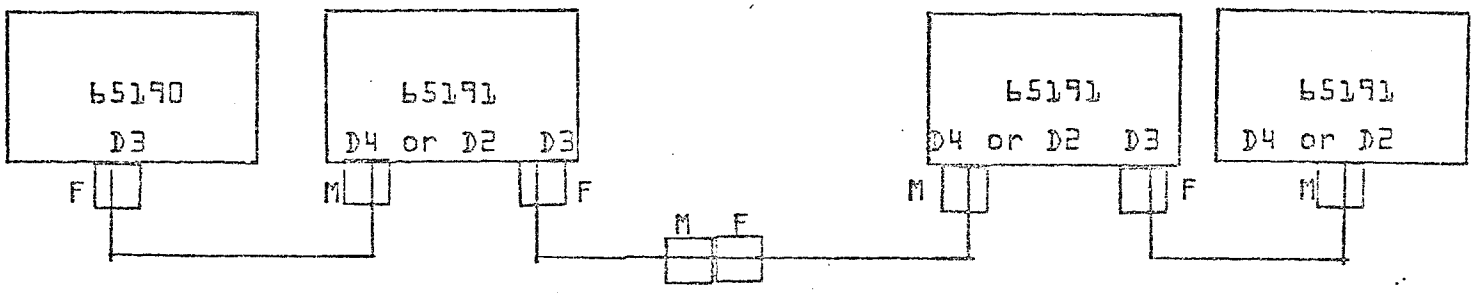
C.3.1 Daisy Chain Layout

C.3.1.1 Normal Configuration

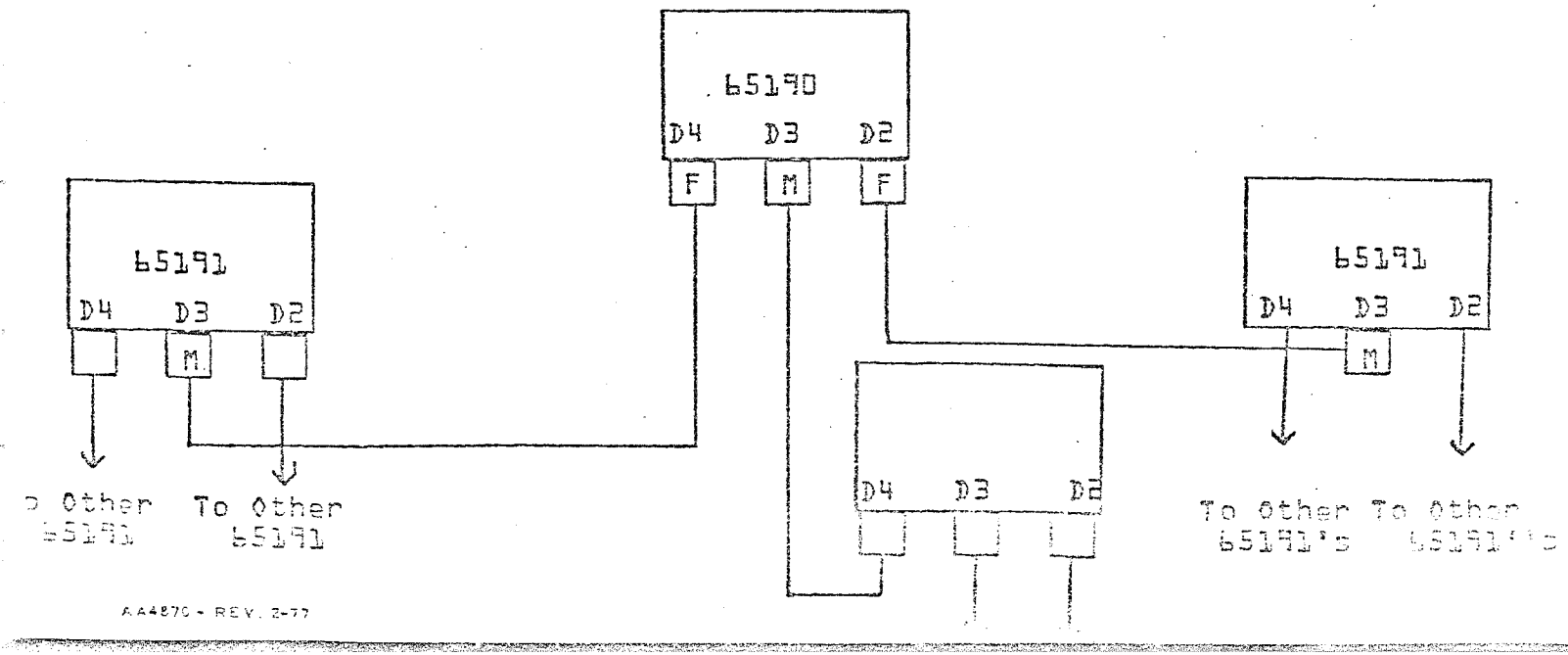


M=Male Connector F=Female Connector

C.3.1.2 One 65191 Removed



C.3.2 Branch Connection - Example of One Configuration



APPENDIX D

KEYBOARD LAYOUT AND KEYCAP COLORS

D.1 Keyboard Layout

The location of each keycap is shown in Figure D-1.

D.2 Keycap Colors

The color of each keycap is shown in Table D-1 on Figure D-1.

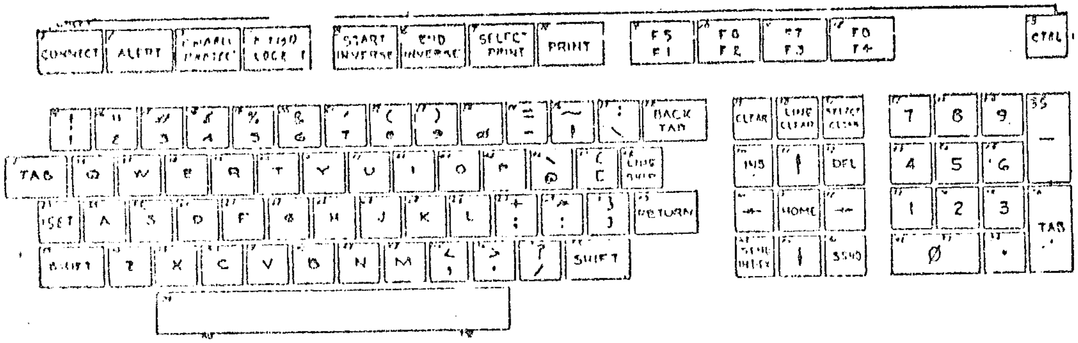


Figure D-1

TABLE D-1

QTY	POSITION #	SIZE	KEYCAP COLOR	CHERRY COLOR	NOMENCLATURE FILL COLOR
4	1,2,3 & 4	1 x 1½	WHITE (ILLUM)	C	
8	5 THRU 12	1 x 1½	WHITE	E	
46	13, 15 THRU 27, 36 THRU 47, 58 THRU 69, 78 THRU 87	1 x 1	GRAY	V	
1	96	1 x 8	GRAY	V	
5	14, 28, 49, 77 & 88	1 x 1½	BEIGE	M1	
2	48 & 57	1 x 1	BEIGE	M1	
7	22, 30, 31, 50, 52, 83 & 91	1 x 1	GOLD	Y1	
13	32, 33, 34, 51, 53, 54, 55, 70, 71, 72, 73, 74, 75, 30 & 34	1 x 1	BLUE	K	
3	35, 76 & 92	1 x 2	BLUE	K	

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