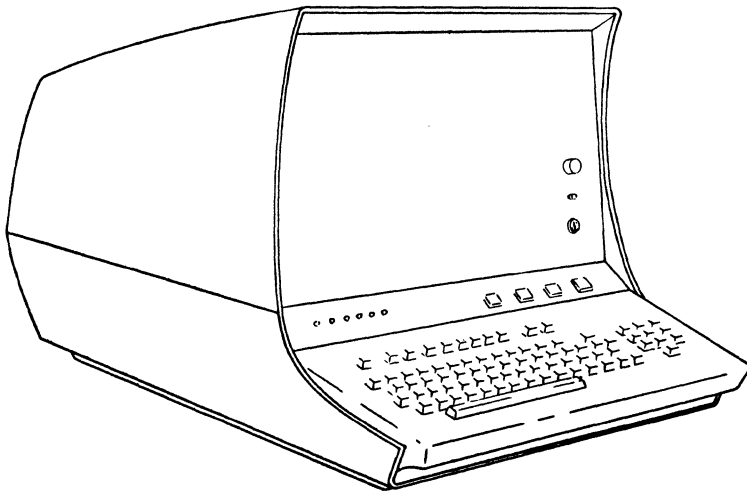


CONTROL DATA[®]

713-10 CONVERSATIONAL DISPLAY TERMINAL



- CC535-A
- CC535-B

713-10
CONVERSATIONAL DISPLAY TERMINAL
HARDWARE PROGRAMMING MANUAL

SECTIONS IN THIS MANUAL:

- Section I — General Description
Section II — Operation
Section III — Programming

Any comments concerning this
publication should be addressed to:

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2401 North Fairview Avenue
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Publication No. 62033400
June 1972

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Printed in USA

713-10
CONVERSATIONAL DISPLAY TERMINAL
HARDWARE PROGRAMMING MANUAL

REVISION RECORD	
REVISION	DESCRIPTION
PD-0	Preliminary Draft (Prerelease) 3-10-71
PD-1	Preliminary Draft (Prerelease) 4-23-71
01-0	Preliminary Release 4-30-71
02-0	Preliminary Release 6-23-71
03-0	Preliminary Release 2-29-72
A-0	Final Release 6-28-72 (Includes ECO 356-8 & 504)



FOREWORD

This Hardware Programming Manual applies to the 713-10 Conversational Display Terminal. Basically, this terminal is the 120 volt, 60 Hz type defined as equipment CC535-A or it is the 208/230 volt, 50 Hz type defined as equipment CC535-B. Both of these two types are functionally identical and may include the following options:

<u>PRODUCT</u>	<u>NAME</u>
711-100	Expanded Memory Kit (Internal)
713-120	Non-Impact Printer, 60 Hz (External)
713-120	Non-Impact Printer, 50 Hz (External)

The terminal acts as a remote message I/O station operating primarily within a central processor controlled telecommunications system. The terminal provides standard teletypewriter I/O functions and as such may serve as a replacement for teletypewriter remote terminals. An output channel is contained in the terminal to enable use of an optional printer to obtain hardcopy of displayed messages.

This manual contains three sections. Section I defines the equipment functions and specifications. Section II explains the controls available to the operator and describes basic operating procedures. Section III contains information pertaining to programming including receive data and transmit data message formats, communications word format and codes, and communications modes.

Expanded Memory optional equipment is described in this manual. Internal Modem and Acoustic Coupler options described herein have been discontinued as options for the 713-10. A separate manual (713-11 Receive-Only Non-Impact Printer Station, Hardware Programming Manual) applies for the optional external printer.

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SECTION I

GENERAL DESCRIPTION

The Conversational Display Terminal (Figure 1-1) is configured to operate as a video display, telecommunication, remote terminal capable of transmitting and receiving messages on either leased or dial telephone lines. It is designed primarily for telecommunications under program control of a central processor. The terminal provides an operator with composition versatility not possible with conventional teletypewriter terminals and operates quickly and relatively noise-free as compared to a teletypewriter terminal. The Conversational Display Terminal is expressly designed for telecommunications system and program compatibility. The basic equipment (see foreword) is ready for immediate use at any terminal location which provides an EIA Standard RS-232-C modem (modulator/demodulator) equivalent to the AT&T 103 series asynchronous modem. Options available to the basic configuration allow connection directly to a Manual CDT Data Access Arrangement or acoustically to any telephone (see "Options"). Transmit and receive telecommunications with the terminal are performed via the modem in a bit-serial, character-by-character fashion without block message transfers. Figure 1-2 shows a typical terminal/central processor communications link.

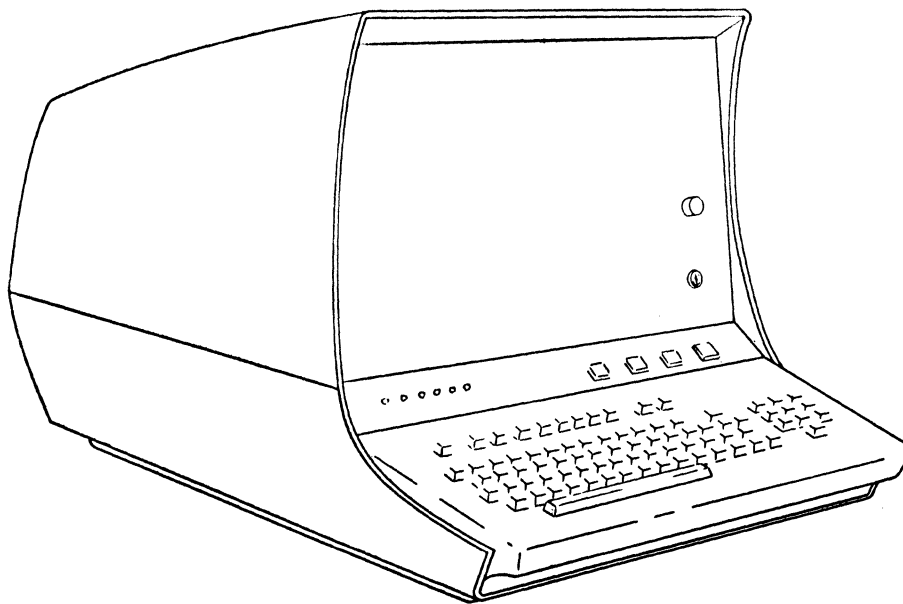


Figure 1-1. Conversational Display Terminal

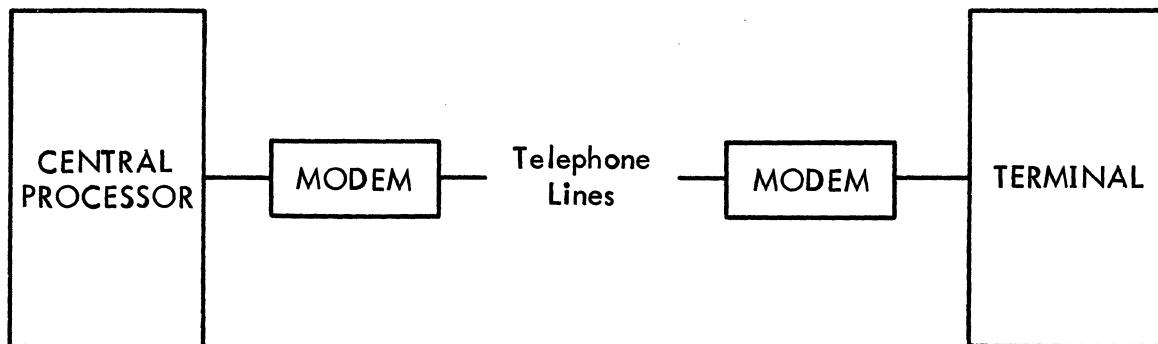


Figure 1-2. Typical Terminal/Processor Communications System

FEATURES.

The Conversational Display Terminal provides the following important features:

- Common teletypewriter keyboard layout with simplified tri-level operation (instead of typical 4-level teletypewriter keyboards) and additional convenience keys.
- Clatter-free, reliable magnetic-reed-switch keyboard.
- 96 USASCII * alphanumeric (displayable characters).
- 32 USASCII * control codes.
- Scroll and page format.
- Blinking cursor (dash underline) highlighting the data entry point.
- Cursor control for up, down, left, right, and home.
- Inverse video (black on white) where desired.
- Display character size 1/4 inch high by 1/8 inch wide (nominal) formed by 5 x 9 dot matrix using standard television raster scan.
- 8 lines of 80 characters (640 characters) with built-in expansion capability to 16 lines of 80 characters (see "Optional Features").
- 60 Hz display refresh rate.
- Metal oxide semi-conductor memory (MOS).

* USA Standard Code for Information Interchange per American National Standards Institute X3.4-1968.

- RS-232-C interface (CCITT V 24 compatible) capable of asynchronous, serial, data transmission at 75, 110, 150, and 300 BPS.
- Switch selections for: Full or Half duplex; Odd, Even, or no parity; Keyboard lockout; Remote or Local; Scroll or Page format; selectable Baud rate, Printer on/off line.
- Output channel for optional hardcopy printer.
- Modular construction for quick field repair.

OPTIONAL FEATURES.

- Modular display memory expansion of additional 640 characters - easy field installation.
- Internal modem.
- Acoustic coupler (requires Internal Modem).
- Hardcopy receive-only printer.

FUNCTIONAL DESCRIPTION.

The Conversational Display Terminal contains seven basic functional areas (see block diagram in Figure 1-3) located within four modular subassemblies as shown in Figure 1-4.

- 1) TV display module with associated drive circuits.
- 2) 640 character read/write memory with 640 character add-on capability.
- 3) Control logic.
- 4) Data entry keyboard.
- 5) Asynchronous modem interface with internal modem add-on capability.
- 6) Serial output channel for an optional hardcopy printer.
- 7) Internal power supply.

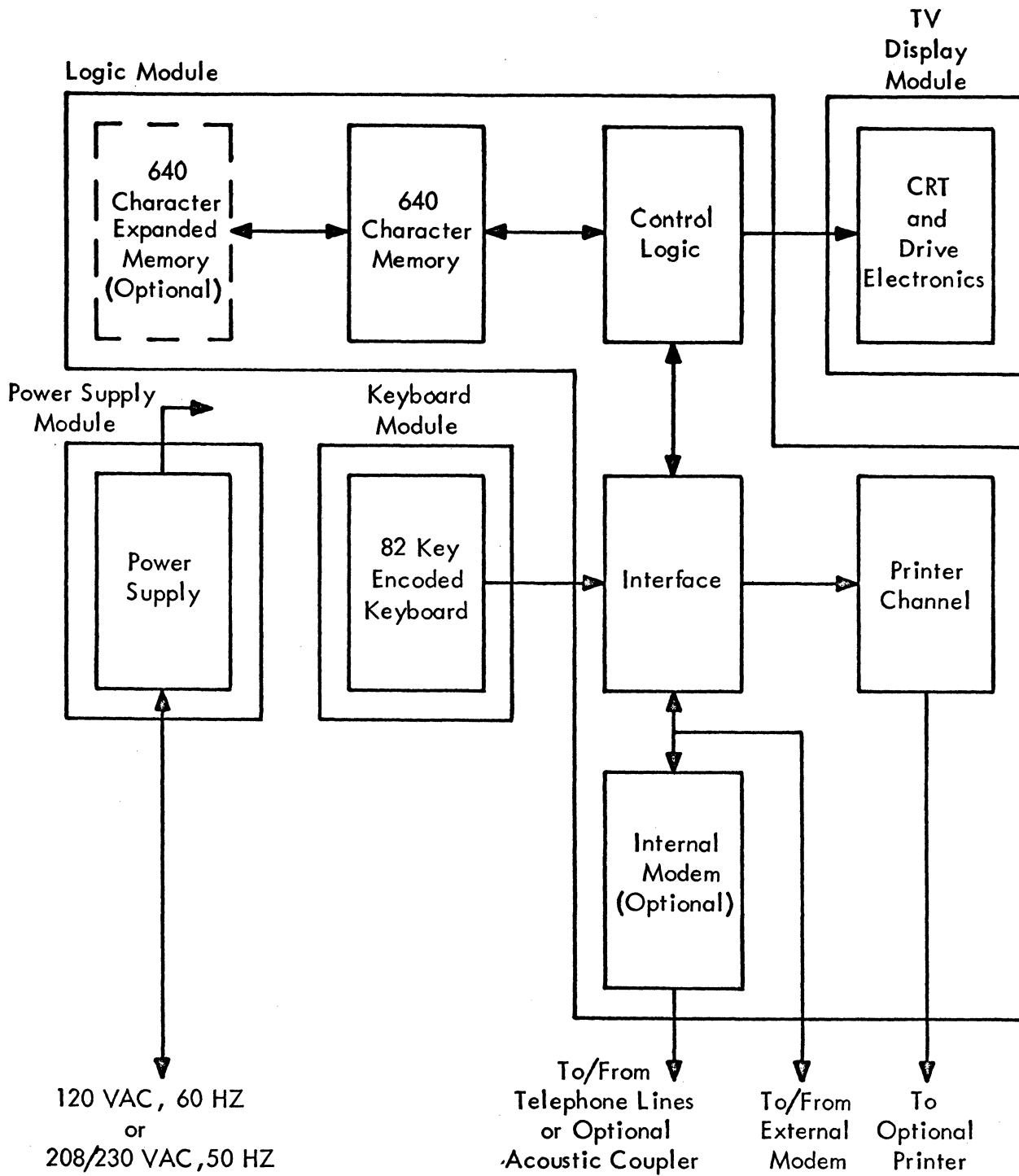


Figure 1-3. Conversational Display Terminal Functional Block Diagram

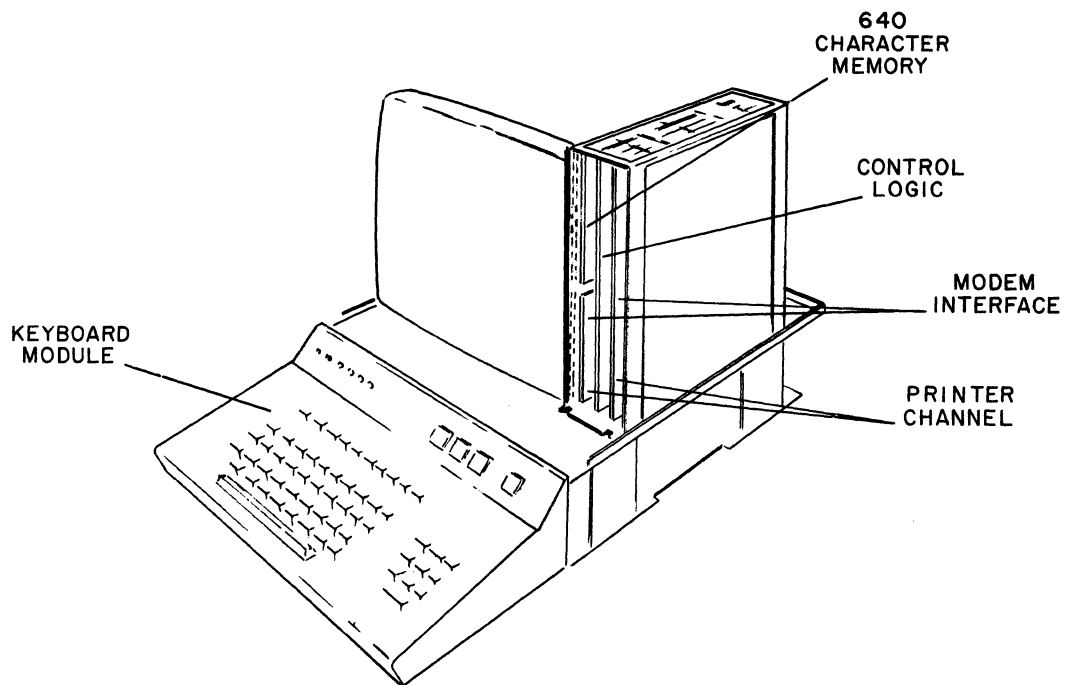
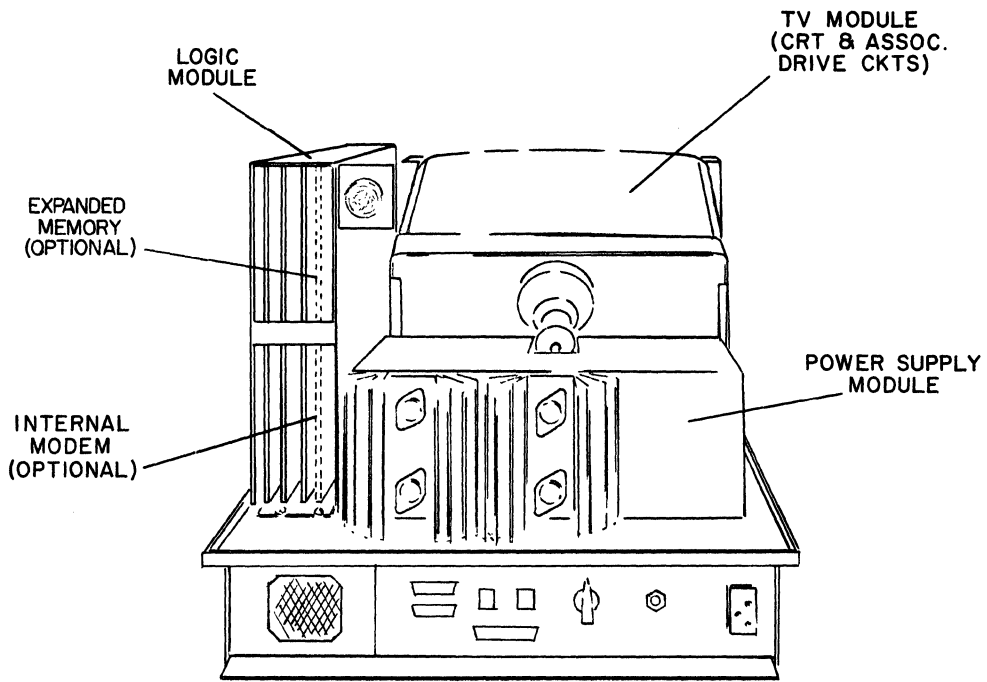


Figure 1-4. Module and Function Locations

TV DISPLAY MODULE.

The display portion of the terminal consists of a field replaceable, high resolution, television display module which accepts composite video from the character memory and associated control logic. The basic machine displays 8 lines of 80 characters on a 15-inch (38 cm) diagonal, rectangular CRT within a view screen area approximately 8-inches (20 cm) high by 10-inches (25 cm) wide. An expanded character memory option (see "Options", this section) provides 16 lines of 80 characters. Display repertoire is the USASCII X3.4-1968 compatible set of 96 characters plus three characters generated from function codes (see Table 1-1). Characters appearing on the display screen are dot formed by selectively unblanking positions within a 5 x 9 dot matrix-during a normal television raster scan of 262 horizontal lines. Nominally, the characters appear on the display 1/8 inch (0.3 cm) wide and 1/4 inch (0.6 cm) high. A cursor (entry marker) appears on the display screen as a blinking underline dash to indicate the position where a character will display on the screen. A full display of 8 or 16 lines of 80 characters occupies approximately a 5 inch (13 cm) high and 9 inch (23 cm) wide area of the viewing screen. The display refresh rate is 60 Hz.

640 CHARACTER MEMORY.

A modular, metal oxide semiconductor (MOS) memory contained on one circuit card within the logic module stores 640, 7-bit character codes for display refresh and input/output data storage. The circuits are designed to accept an additional 640 character memory card as a plug-in module (see "Options", this section). The basic 640 character memory provides storage for 8 lines of 80 characters on the display screen.

CONTROL LOGIC.

Controlling the internal functions of the terminal is the control logic that, in addition to timing and sequencing circuits, includes a 256 word, 10-bit, MOS read only memory (ROM) which is programmed with the necessary beam blank/unblank dot patterns for video formation of all displayable characters on the display screen.

KEYBOARD.

The keyboard is the operator input device for the terminal. It is a functionally complete module which supplies 7-bit USASCII codes and operator control signals to the terminal's interface circuits. The keys are the magnetic reed type. When any

TABLE 1-1. DISPLAYABLE CHARACTER REPERTOIRE

<u>CHARACTER</u>	<u>CHARACTER</u>	<u>CHARACTER</u>	<u>NAME</u>
A	5		Space
B	6	!	Exclamation Point
C	7	"	Quotation Marks (Diaeresis)
D	8	#	Number Sign
E	9	\$	Dollar Sign
F	a	%	Percent
G	b	&	Ampersand
H	c	'	Apostrophe (Closing Single Quotation
I	d		Mark; Acute Accent)
J	e	(	Opening Parenthesis
K	f	)	Closing Parenthesis
L	g	*	Asterisk
M	h	+	Plus
N	i	,	Comma (Cedilla)
O	j	-	Hyphen
P	k	.	Period (Decimal Point)
Q	l	/	Slant
R	m	:	Colon
S	n	;	Semicolon
T	o	<	Less Than
U	p	=	Equals
V	q	>	Greater Than
W	r	?	Question Mark
X	s	@	Commercial At
Y	t	[	Opening Bracket
Z	u	\	Reverse Slant
0	v	]	Closing Bracket
1	w	^	Circumflex
2	x	_	Underline
3	y	`	Grave Accent (Opening Single
4	z		Quotation Mark)
		{	Opening Brace
		|	Vertical Line
		}	Closing Brace
		~	Equivalent or Similar
		■	Rub Out or Parity Error
		▲	ETX
		◀	Start Inverse Video
		▶	End Inverse Video
			} Control Function Characters

one of the character or control function keys are depressed, the 7-bit code for that particular key travels in parallel to the interface circuits which control data input routing. Tables 2-3 and 2-4 show the code repertoires available from the keyboard. The keyboard contains a common teletypewriter key layout for displayable characters and control functions except for added operator convenience features:

- 1) 10-key adding machine type numeric cluster in addition to basic numeral row.
- 2) Common teletypewriter function codes available by CNTRL + key depression.
- 3) Frequently used communications and edit functions available from their own key in addition to basic CNTRL + key operation.

Section II of this manual describes keyboard data entry and function operations in detail.

INTERFACE.

The asynchronous interface circuits control all data routing within the terminal and between the terminal and the communications modem. These circuits are contained on two circuit cards within the logic module.

The interface is designed to operate with communications signals compatible to EIA Standard RS-232-C such as the AT&T 103 series data sets, or equivalent. These type modems communicate word-by-word with 8-bit serial data words (including parity). The interface communicates at manually adjustable transmission rates of 75, 110, 150, and 300 bits-per-second. The circuits do all serial-to-parallel and parallel-to-serial conversion, perform all modem control, and during transmission perform the data-clocking function and parity checking (if any).

Data and control function routing performed by the interface between the keyboard, modem, control, and printer channel depends on the settings of the transmission and printer control switches described in Section II.

PRINTER OUTPUT CHANNEL.

An output channel contained on the interface circuit card allows use of a printer to produce hardcopy of displayed messages. Either page printout or instantaneous printout of data as it is displayed character-by-character is available by the printer controls included in the terminal. These controls are described in Section II.

A printer may be used exclusively by one terminal or up to eight terminals may share a single printer. This is possible since the printer output channel contains printer-in-use recognition circuits and operator indicators which signify if another terminal is using the printer.

POWER SUPPLY.

The power supply circuits in equipment CC535-A use 120 VAC, 60 Hz primary power to supply internal required power of +5 VDC, - 12 VDC, +12 VDC, +73 VDC, and 6.3 VAC. The power supply of the CC535-B equipment uses 208/230 volt, 50 Hz primary power to provide the same internal power requirements.

ELECTRICAL AND PHYSICAL CHARACTERISTICS.

POWER REQUIREMENTS.

Equipment CC535-A: 120 volts, 60 Hz., 1.5A max.

Equipment CC535-B: 208/230 volts, 50 Hz., 0.85 max.

ENVIRONMENT.

Operating Temperature: +40°F to +120°F (+4°C to +49°C)

Storage Temperature: - 30°F to +150°F (- 34°C to +66°C)

Operating Humidity: 10% to 90% - no condensation

Storage Humidity: 5% to 95% - no condensation

Operating Altitude: - 1000 ft. to +10,000 ft. (- 305 met. to 3048 met.)

Storage Altitude: - 1000 ft. to 15,000 ft. (- 305 met. to 4572 met.)

HEAT DISSIPATION.

700 BTU/HR (176 kilogram-calories)

DIMENSIONS.

Height: 18 in. (46 cm.)

Width: 18 in. (46 cm.)

Depth 29 in. (74 cm.)

Weight: 75 lb (34 kg.)

INTERNAL COMPOSITION.

Modular - containing: TV Module
(see Figure 1-5) Logic Module

Keyboard Module
Power Supply

OPTIONS.

The terminal may use the following options:

- OPTION #1: 16 line x 80 character display format.
- OPTION #2: Internal Modem. *
- OPTION #3: Acoustic Coupler (requires Internal Modem). *
- OPTION #4: Hardcopy Receive-Only Printer.

* Discontinued Option

16 x 80 DISPLAY FORMAT OPTION.

The terminal is designed to accept a character memory expansion of 640 additional characters thus enabling 16 lines of 80 characters on the video display as compared with the basic version with 8 lines of 80 character spaces. This expansion is merely a "plug-in" printed circuit card addition of a second character memory card with interconnecting cable (Expanded Memory Kit, see Foreword). If this option is used, the two character memory cards, being identical, are fully interchangeable. This expansion is easily added as an on-site change if ordered by a customer after receiving the basic Terminal.

INTERNAL MODEM OPTION.

The Internal Modem Kit option supplies a communications modem within the terminal and provides a connector panel which allows connection either directly to a Manual CDT Data Access Arrangement or connection to an optional Acoustic Coupler (see "Acoustic Coupler Option"). The Internal Modem provides Bell 103 A, E, and F compatible operation in the Originate mode on switched telephone lines. This modem kit consists of a "plug-in" printed circuit card with terminal connector panel and required interconnecting cables (see Foreword). Figure 1-5 shows a typical communications system with Internal Modem in use with a Data Access Arrangement.

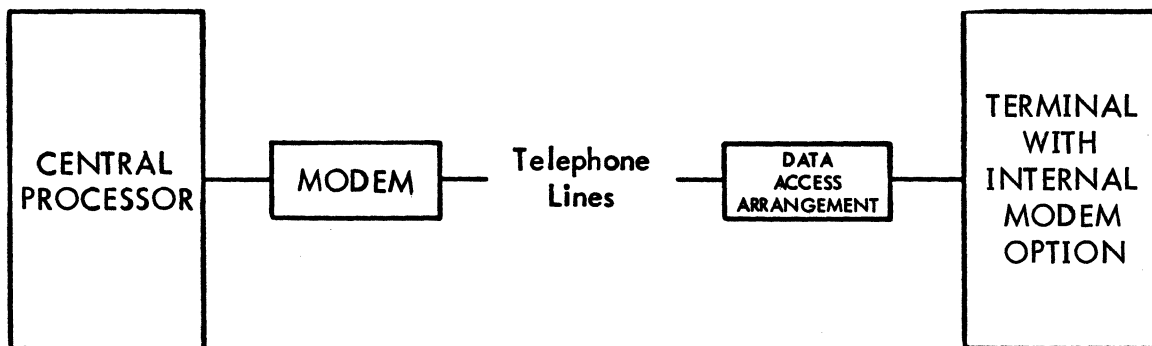


Figure 1-5. Using a Terminal With Internal Modem

ACOUSTIC COUPLER OPTION.

An optional Acoustic Coupler (see Foreword) may be used to establish communications via any standard telephone. The Acoustic Coupler requires use of the Internal Modem option in the terminal. Figure 1-6 illustrates Acoustic Coupler use.

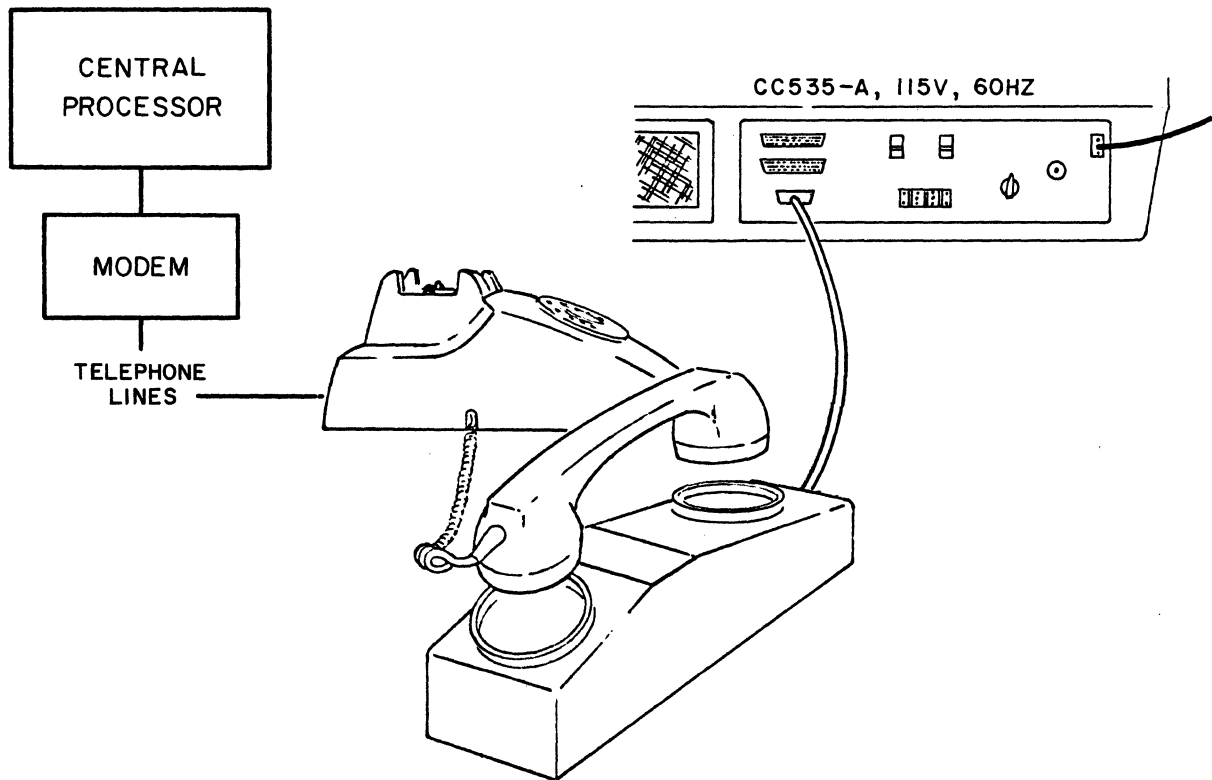


Figure 1-6. Using a Terminal With Acoustic Coupler

HARDCOPY RECEIVE-ONLY PRINTER OPTION.

The terminal contains a channel which allows operating an optional receive-only printer to provide for hardcopy of displayed data. Information concerning the printer is contained in separate manuals for the specific printer used. This manual's Foreword identifies the printer recommended for use with this terminal.



SECTION II
OPERATION

The Conversational Display Terminal contains controls and indicators typical of keyboard operated, video terminal, communications equipment. With operator convenience in mind, operator data entry and control tasks are simple and easy to perform. This section describes the use of the controls, indicators, and data entry keyboard.

OPERATOR CONTROLS AND INDICATORS.

Table 2-1 describes the operator controls and indicators provided with the terminal. Figures 2-1 and 2-2 locate each of them.

TABLE 2-1. OPERATOR CONTROLS AND INDICATORS

CONTROL OR INDICATOR	TYPE	LOCATION	FUNCTION
POWER	Pushbutton Switch/Ind.	Operator Control Panel	Applies primary power to terminal when illuminated. Application of primary power sets all logic elements to initial or starting condition.
Brightness	Rotary Potentiometer Switch	Front Panel	Allows adjustment of video intensity used in the display. CCW: Reduces intensity CW: Increases intensity
Keylock Switch	Key-Operated Lock-Switch	Front Panel	Allows manual disable to lock out the keyboard from generating input codes. Transmit function of terminal disabled when keyboard locked out, however, receive and print functions stay active. See Keylock Indicator.

TABLE 2-1. OPERATOR CONTROLS AND INDICATORS (CONT)

CONTROL OR INDICATOR	TYPE	LOCATION	FUNCTION
Keylock Indicator	Indicator Light	Front Panel (Above Keylock Switch)	Illuminated when keyboard disabled by Keylock Switch.
LOCAL	Pushbutton Switch/Ind.	Operator Control Panel	Disables transmit circuits of terminal when illuminated. Keyboard data then automatically passes to memory for display. Data from communications modem still allowed and takes precedence over keyboard originated data. Local mode is commonly used when testing the terminal.
FULL/HALF Duplex	2-position Slide Switch	Connector Panel	<p>FULL: All keyboard generated codes routed directed to communications modem. Codes not stored in memory or displayed unless returned from remote equipment depending on remote equipment programming. LOCAL mode disables this function.</p> <p>HALF: Keyboard generated codes route to the modem and the display memory for subsequent display if no information incoming from computer. LOCAL mode disables transmit to the modem, but allows display.</p>
SCROLL DISABLE	Pushbutton Switch/Ind.	Operator Control Panel	Disables display line scroll operation when indicator is illuminated (see Figure 2-3, Display Scroll Operation).

TABLE 2-1. OPERATOR CONTROLS AND INDICATORS (CONT)

CONTROL OR INDICATOR	TYPE	LOCATION	FUNCTION
DSR	Indicator Light	Operator Control Panel	Illuminated when terminal modem indicates it has power on and is in the data mode. Must be on to receive data. For maintenance use to check presence of useable carrier signal from terminal.
CTS	Indicator Light	Operator Control Panel	Illuminated when modem activates "clear-to-send" line. Must be on to start transmit. For maintenance use to check modem condition for transmit to modem.
BAUD RATE	4-position Rotary Switch	Connector Panel	Allows operator to select data transfer/receive rates between terminal and communications line. 75, 110, 150, and 300 bits-per-second available.
PARITY	3-position	Connector Panel	<p>EVEN: Data words transmitted with even parity and checked for even parity when received.</p> <p>ODD: Data words transmitted with odd parity and checked for odd parity when received.</p> <p>Center Position: Parity disregarded.</p>
Bell Tone	Audible Tone	Internal	<p>Sounds when cursor enters 73rd character position of any display line to indicate approaching end of line.</p> <p>Sounds if Bell code (007_g) generated from keyboard or received from communications line.</p>

TABLE 2-1. OPERATOR CONTROLS AND INDICATORS (CONT)

CONTROL OR INDICATOR	TYPE	LOCATION	FUNCTION
Circuit Breaker	2-position Pushbutton	Connector Panel	Depressing this red pushbutton resets the internal circuit breaker if it opened due to overload.
Keyboard Keys	Magnetic-Reed, Momentary-Contact Switches	Keyboard Panel	Enable operator data entry and message composition on the display screen. Also enable teletypewriter special communications functions. See Data Entry Keyboard, this section, for details.
PRINTER ON LINE	Pushbutton Switch/Ind.	Operator Control Panel	For use with hardcopy printer. Illuminated position activates hardcopy printer channel. All communications printed as displayed if printer is connected with terminal. When not on (light out), PRINT key on keyboard must be depressed to obtain desired hardcopy of displayed data.
PRTR BSY	Indicator Light	Operator Control Panel	For use with hardcopy printer. When illuminated, indicates printer is busy with this terminal or another one sharing printer (8 terminals may share 1 printer). If PRINT key or PRINTER ON LINE key is depressed while PRTR BSY is lit, new print operation will not occur until after PRTR BSY extinguishes.
PRTR ACT	Indicator Light	Operator Control Panel	For use with hardcopy printer. Illuminated only when terminal is transferring data to printer or has exclusive control of printer via the printer-on-line mode.

TABLE 2-1. OPERATOR CONTROLS AND INDICATORS (CONT)

CONTROL OR INDICATOR	TYPE	LOCATION	FUNCTION
PRINT Key	Magnetic-Reed, Momentary-Contact Switch	Keyboard Panel	For use with hardcopy printer. With printer off-line and not busy (see afore), depressing PRINT key sets cursor to start of displayed video page and advances cursor through entire display. During this time, entire page displayed transfers to printer. This print operation disables any data entry operations from keyboard and disables transmit to modem. Receiving data aborts the print operation.
Voltage Range Select	2-position Rotary	Connector Panel	NORMAL: For 210 to 256 VAC, 50 Hz power source. LOW LINE: For 187 to 230 VAC, 50 Hz power source.

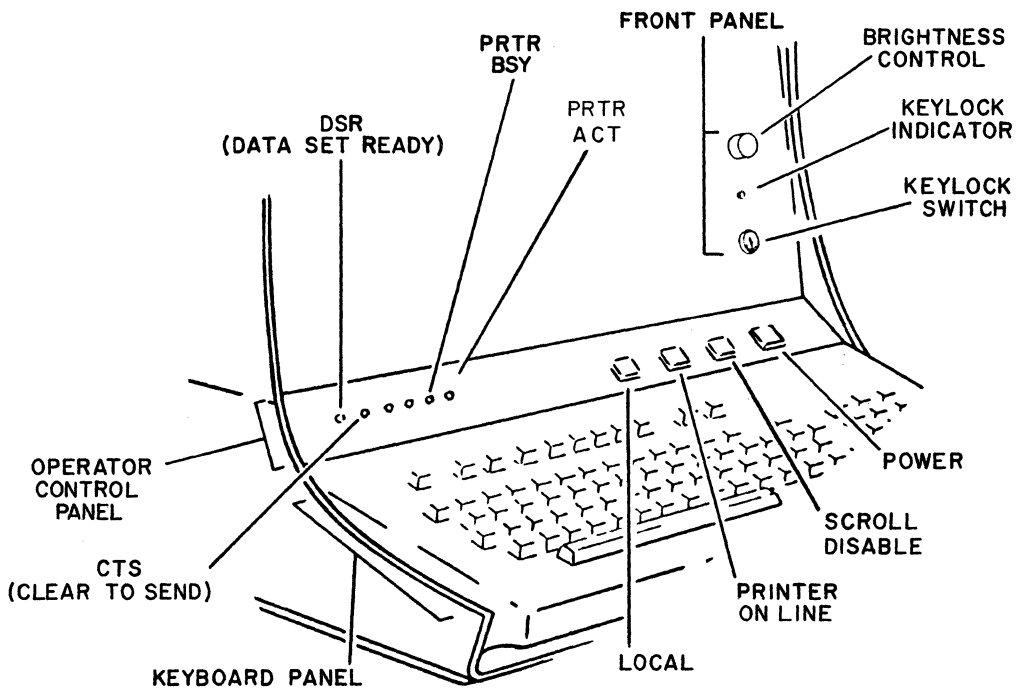


Figure 2-1. Front, Operator Control, and Keyboard Panels

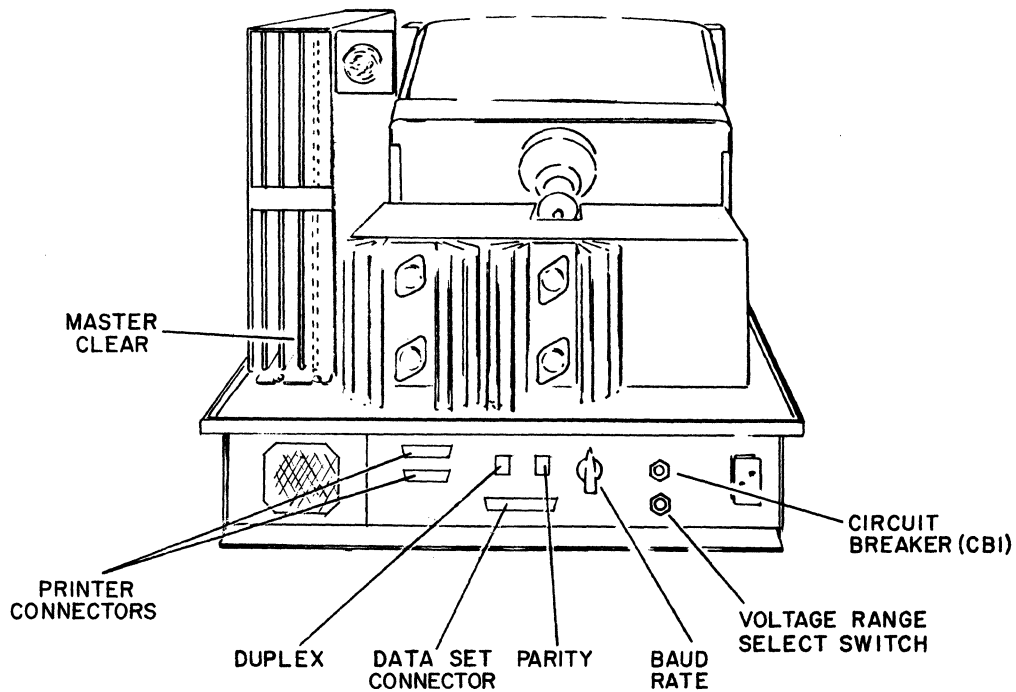


Figure 2-2. Connector Panel (Basic Machine, 50 Hz)

MAINTENANCE CONTROLS AND INDICATORS.

Table 2-2 describes terminal controls and indicators provided for maintenance use. Figures 2-1 and 2-2 locate them.

TABLE 2-2. MAINTENANCE CONTROLS AND INDICATORS

CONTROL OR INDICATOR	TYPE	LOCATION	FUNCTION
DSR	Indicator Light	Operator Control Panel (see fig. 2-1)	Illuminated when terminal modem indicates it has power on and is in the data mode.
CTS	Indicator Light	Operator Control Panel (see fig. 2-1)	Illuminated when modem activates clear-to-send line (see Modem Interface, this section).
MASTER Clear	Pushbutton Switch	Interface Card (see fig. 2-2)	Depressing clears internal circuits to initial or starting logic condition.

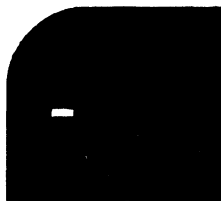
APPLYING POWER TO TERMINAL.

To apply power to the terminal, use the following procedure.

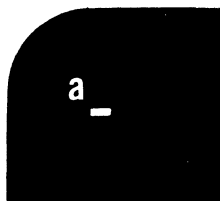
- 1) Depress the POWER switch/indicator (it should light).
- 2) Wait 30 seconds for cursor to appear on the viewing screen.
- 3) If brightness of viewing screen is too bright/dim adjust Brightness knob as necessary (terminal should not operate with excessive display screen brightness or displayed information will be distorted and the life of the CRT display tube may be shortened).
- 4) With keyboard unlocked, and LOCAL mode set, depress several alphanumeric keys to check display.
- 5) If the cursor does not appear after checking brightness per step 3 above, push the red circuit breaker on the connector panel, re-apply power. If the cursor still does not display or if key depressions for characters or cursor controls fail to display, contact the equipment serviceman or refer to the On-Site Maintenance Manual.

DATA ENTRY CURSOR.

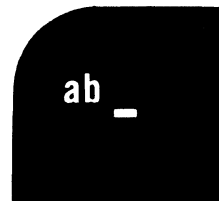
The display screen contains a cursor (position marker) that indicates where the next character will display on the screen. The cursor is a blinking underline below a character position and it blinks at approximately four times a second. In typical operation, when a character key is depressed, the character shown on the key displays above the cursor on the display screen. The cursor then advances to the next character position to show where the next character will display.



Blank display
with cursor



display after
depressing character
A key



display after
depressing A and B
character keys

NOTE

The cursor and displayed characters appear as white forms on a black background unless contained in an inverse video field (see Inverse Video, this section).

In a typical operation (with display screen cleared), the cursor is under the first character position in the top line. As each character is entered from the keyboard, the cursor moves one character position to the right. As the cursor is advanced from the 72nd position of any line to the 73rd, an audible tone will sound indicating the proximity of the end of the line. When the end of the line is reached (80 characters), the cursor automatically moves to the first character position of the next line down. This process may continue until the last character position of the last line (line 8 in basic machine and line 16 in expanded option) is reached. At this time, if the machine is not in scroll format mode, when the last character position of the last line is used, the cursor automatically returns to the first character position of the top line. If the machine is in scroll format mode, an additional input causes all lines on the display screen to move up one line position. The top line on the screen disappears and the cursor moves to the beginning of the new blank bottom line (see Figure 2-3). This is called a scroll effect. When the last character position of the bottom line is reached again, the scroll effect occurs again. Remember this is only an example of operation. The cursor may be moved up, down, forward, and backward from the keyboard without displaying data. The display screen may be cleared at any time to display new data. The various keys available for displaying data, moving the cursor, clearing the screen, etc. are described in Data Entry Keyboard, this section.

INVERSE VIDEO.

A specific coding allows for inversion of video (generating black characters on a white background) in selected areas of a displayed message. A special code to start inverse video field and one to end the field can be generated from the keyboard or received from remote equipment via the communications modem. That portion of the displayed data that includes these start and end codes appears as black symbols on a white field. There are no limitations as to the location, number of inverse video areas, or to the total area that may be inverted. The start inverse video code (016_g) is generated from the keyboard by depressing the CNTRL key in conjunction with the N character key. The end inverse video code (017_g) is generated from the keyboard by using the CNTRL key with the letter "O" character key. Inverse video fields are bracketed on the display with the start inverse video character (◀) and the end inverse video character (▶).

REQUEST FILE RECORDS FOR 0800 THROUGH 1000 FOR ANY A102309

REQUEST FILE RECORDS FOR 0800 THROUGH 1000 FOR ANY A102309, A102343, OR A102440.

FILE NAME: GOODROE

RECORD 1	A102309	CODE M,N
RECORD 2	A102343	CODE NONE
RECORD 3	A102440	CODE M.N.T.Y

ALSO LIST ANY OTHER ITEMS PERTAINING TO THIS FILE OR CODE.

CLASSIFICATION: NONE

REMARKS: SEND HASLO

CURSOR

SCROLL MODE + DEPRESS



Note: Any Key Input Which Advances the Cursor from Last Position in Last Line.

FILE NAME: GOODROE

RECORD 1	A102309	CODE M,N
RECORD 2	A102343	CODE NONE
RECORD 3	A102440	CODE M.N.T.Y

ALSO LIST ANY OTHER ITEMS PERTAINING TO THIS FILE OR CODE.

CLASSIFICATION: NONE

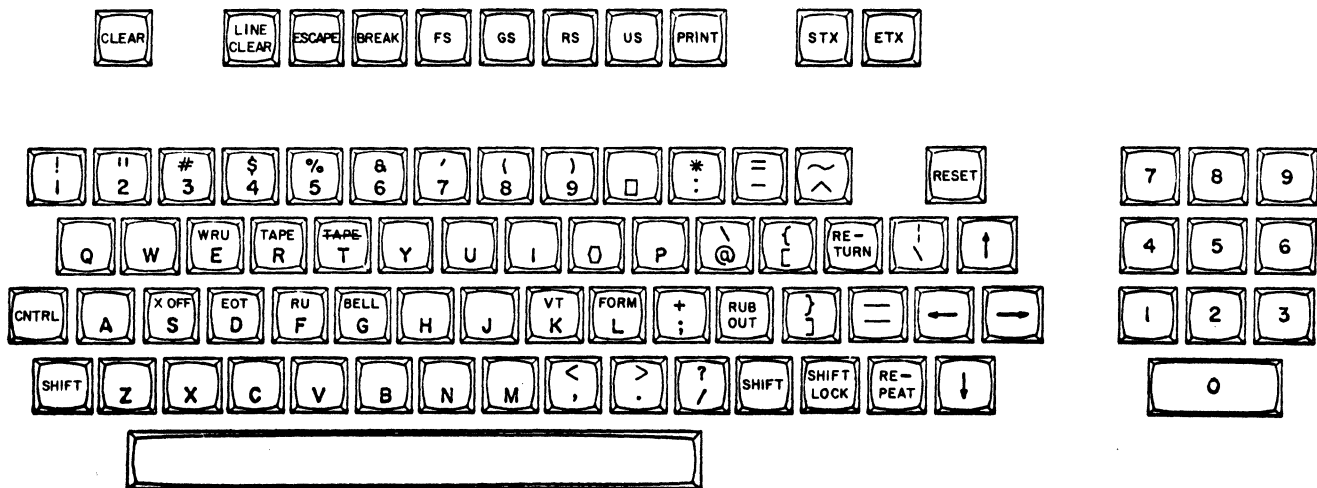
REMARKS: SEND HASLO

CURSOR

Figure 2-3. Display Scroll Operation (8 Line Basic Display)

DATA ENTRY KEYBOARD.

The keyboard contains 48 alphanumeric/symbol keys, a cluster of 10 numeric keys, 5 keyboard control keys, and nineteen special function keys. Depressing any character or function key causes generation of a unique 7-bit USASCII-X3.4-1968 compatible code assigned by hardware to that key (see Tables 2-3 and 2-4). If a second character or function key is depressed while one key is still down, the second key does not interfere with the first key. The second key produces its code only after the first key is released.



The various keys available for displaying data, moving the cursor, clearing the screen, etc. are described in detail in the Operator's Guide for this terminal. A brief description of their operation is provided in the following paragraphs.

LOCAL OPERATION.

Whenever the terminal is set for LOCAL operation (LOCAL indicator/switch illuminated), regardless of the Duplex mode setting (HALF or FULL), all codes generated by key depressions flow through the interface circuits to the control circuits. The control circuits hold the beam blank/unblank information necessary to display each character. They also keep track of all displayable data entry points and the location of the cursor. If a displayable character or function key entry is made, the control circuits direct the TV module with the correct video pulses for display entry or change. The LOCAL operation mode provides a convenient method to check

operation of the keyboard and video display independent of the communications system that the terminal interfaces with. However, it should be kept in mind that the terminal will still receive data from the modem while operating in the LOCAL mode.

REMOTE OPERATION, HALF DUPLEX.

If the terminal is set in Remote operating mode (LOCAL indicator extinguished) and the Duplex mode switch is set for HALF, all codes generated by key depressions travel to control logic and the TV module for possible display as described in the preceding paragraph, however, the codes also transmit via the interface circuits to the modem for communication to remote equipment (eg; central processor). The terminal will receive data in this operating condition also.

REMOTE OPERATION, FULL DUPLEX.

When the terminal is set for Remote operation and the Duplex switch is set for FULL, all keyboard initiated codes transmit via the interface circuits directly to the communications modem for presentation at remote equipment. In this communications condition, no display operation occurs unless display affecting character codes or control codes are returned to the terminal from remote equipment. Only the eleven control codes noted in Table 2-4 and the Bell code will affect the terminal. All other control codes are ignored by the terminal when received.

DISPLAYABLE CHARACTER REPERTOIRE KEYS.

The displayable character producing keys provided by the keyboard are arranged similar to common usage teletypewriter keyboards. An added cluster of ten numeric keys is provided on the right side of the keyboard to enable rapid numeric data entry. Table 2-3 shows the codes produced by depressing the displayable character keys. The following paragraphs describe operation of the SHIFT, SHIFT LOCK, Space Bar, RUB OUT, and REPEAT keys.

SHIFT and SHIFT LOCK Keys.

The two SHIFT keys and the SHIFT LOCK key enable selection of the upper case characters on the double-character keys. Depressing SHIFT LOCK key locks the keyboard in upper case position, and depressing the adjacent SHIFT key releases the keyboard from upper case operation.

TABLE 2-3. DISPLAYABLE CHARACTER REPERTOIRE

OCTAL CODE	CHARACTER	OCTAL CODE	CHARACTER
040	(Space)	120	P
041	! (exclamation point)	121	Q
042	" (quotation mark)	122	R
043	# (number or pounds)	123	S
044	\$ (dollar sign)	124	T
045	% (percent)	125	U
046	& (ampersand)	126	V
047	' (apostrophe)	127	W
050	((left parentheses)	130	X
051	) (right parentheses)	131	Y
052	* (asterisk)	132	Z
053	+ (plus)	133	[(left bracket)
054	, (comma)	134	\ (reverse slant)
055	- (hyphen or minus)	135	] (right bracket)
056	. (period)	136	^ (circumflex)
057	/ (slant)	137	_ (underline)
060	0	140	^ (left single quote mark)
061	1	141	a
062	2	142	b
063	3	143	c
064	4	144	d
065	5	145	e
066	6	146	f
067	7	147	g
070	8	150	h
071	9	151	i
072	: (colon)	152	j
073	; (semicolon)	153	k
074	< (less than)	154	l
075	= (equals)	155	m
076	> (greater than)	156	n
077	? (question mark)	157	o
100	@ (commercial at)	160	p
101	A	161	q
102	B	162	r
103	C	163	s
104	D	164	t
105	E	165	u
106	F	166	v
107	G	167	w
110	H	170	x
111	I	171	y
112	J	172	z
113	K	173	{ (left brace)
114	L	174	| (vertical line)
115	M	175	} (right brace)
116	N	176	~ (equivalent or similar)
117	O	177	■ (rub out or parity error)
			FUNCTIONS
		003	▲ (ETX)
		016	◀ (Begin Inverse)
		017	▶ (End Inverse)

Space Bar.

Depressing the Space Bar causes a space to display above the cursor. The cursor moves forward one character position in the same manner as with any displayable character entry. If a character is displayed above the cursor, a space replaces it on the display when the Space Bar is depressed.

RUB OUT.

The RUB OUT key may have varied programmed usage such as providing space between records or files of serially entered data, etc. Depressing this key produces the symbol (■) above the cursor and the cursor moves ahead one character position as with all other displayable character entries.

This same symbol (■), may appear on the display screen in a character position within a message received from the central processor. This indicates that an error (parity error) in the transmission of the character intended for that character position may have occurred. Terminal operator response to this situation also depends upon the particular communications system programming.

REPEAT Key.

Depressing the REPEAT key in conjunction with any code producing key or combination of keys causes the particular character or control code for that key(s) to be generated and displayed/transmitted, as applicable, at approximately 12 times per second. The key is an operator convenience for entering repeated characters.

CONTROL FUNCTION REPERTOIRE KEYS.

The terminal keyboard will generate 32 control function codes commonly used with telecommunications input devices. Table 2-4 shows the keyboard operations required to generate these codes from the Conversational Display Terminal. Note that several often used communication codes and edit function codes are available from their own separate key in addition to the familiar CNTRL + character key combination typical of teletypewriter operations. This single key availability is for operator convenience with these frequently used functions.

Teletypewriter keyboards often require depression of CNTRL + SHIFT + character key to generate control functions. These type keyboards are referred to as four-level keyboards. The Conversational Display Terminal uses a three-level keyboard. This allows generation of all 32 control functions without using the SHIFT key, however, depressing the SHIFT key in conjunction with CNTRL + key operation does not interfere with the desired function shown in Table 2-4.

Only eleven of the control function codes cause a display operation (eg; a cursor move or change in displayed data). One additional code (Bell) causes a sonic alert tone in the terminal. The eleven display affecting codes are noted in Table 2-4 and the pages following in this section describe display response to these control functions used for message editing and data entry cursor control. These descriptions are followed by descriptions of assigned special functions which the terminal provides in addition to the 32 common control functions.

Space is provided at the end of these descriptions for notes concerning use of those 20 remaining communications control functions which are capable of variable use depending on the particular user's communications system programming (these are those other than the 12 noted above).

TABLE 2-4. CONTROL FUNCTION REPERTOIRE

Mnemonic	Octal Code	Keyboard Operation		Mnemonic	Octal Code	Keyboard Operation	
		CNTRL + Key	Separate Key			CNTRL + Key	Separate Key
NUL	000	CNTRL + @		DLE	020	CNTRL + P	
SOH	001	A		DC1	021	Q	
STX	002	B	STX	DC2	022	R	
• ETX	003	C	ETX	DC3	023	S	
EOT	004	D		DC4	024	T	
ENQ	005	E		• Skip	025	U	→
ACK	006	F		• Line Clear	026	V	LINE CLEAR
BELL	007	G		EBT	027	W	
• BS	010	H	←	• Clear	030	X	CLEAR
HT	011	I		• Reset	031	Y	RESET
• LF	012	J	↓	• Cursor Up	032	Z	↑
VT	013	K		ESC	033	[	ESCAPE
FF	014	L		FS	034	\	FS
• CR	015	M	RETURN	GS	035	]	GS
• SO	016	N		RS	036	^	RS
• SI	017	CNTRL + O		US	037	CNTRL + -	US

- Causes the assigned display operation when entered from separate key (except SO & SI which always must be entered by CNTRL + key). Causes the assigned display operation when received from a remote device (receive includes echoed data when operating in FULL DUPLEX mode). All other control codes are ignored by the terminal when received from remote equipment, except BELL which causes a sonic alert tone.

CLEAR Key (or CNTRL + X).

When the display receives this function code (030_g), it removes all displayed data from the screen. If the terminal is in scroll format mode, the cursor resets to the first character position of the last line. If the machine is in page mode, the cursor resets to the first character position of the top line.

LINE CLEAR Key (or CNTRL + V).

When the display receives this function code (026_g), it removes all displayed data from the cursor position to the end of the line only when the terminal is in page format mode. The cursor does not move and only the line with the cursor is affected. Scroll mode disables this function.

RETURN Key (or CNTRL + M).

The RETURN function does not affect data. When the display receives this function code (015_g), the cursor resets to the first character position of the line it is in regardless of the format mode.

RESET Key (or CNTRL + Y).

The RESET function does not affect displayed data. When the display receives this function code (031_g), if the terminal is in scroll format mode, the cursor resets to the first character position of the last line. If the machine is in page mode, the cursor resets to the first character position of the top line.

Backspace (←) Key (or CNTRL + H).

When the display receives this function code (010_g), it moves the cursor back one character position without affecting displayed data. If the cursor is in the first character position of a line when the key is depressed, it automatically moves to the last character position in the preceding line. If the cursor is in the first character position of the top line, it moves to the last character position in the bottom line.

Skip (→) Key (or CNTRL + U).

When the display receives this function code (025_g), it advances the cursor one character position. If the cursor is in the last character position of any line except last line when the skip function is enabled, the cursor automatically moves to the first character position of the next line. If the cursor is in the last character position of the bottom line and scroll mode is active, all data moves up one line position, the top line disappears from the viewing screen; and the cursor moves to the first character position in the new blank bottom line. When the cursor is in the last character position of the bottom line and page mode is active, the cursor moves to the first character position in the top line.

Up (↑) Key (or CNTRL + Z).

When the display receives this function code (032_g), it moves the cursor up one line. The cursor does not reset to the beginning of the line and displayed data is not affected. If the cursor is in the top line when the key is depressed, the cursor moves to the same relative position in the bottom line.

Down (↓) Key (or CNTRL + J).

When the display receives this function code line feed (012_g), it moves the cursor to the same relative character position in the next line down. Displayed data is not affected unless scroll mode is active and the cursor is in the last line. If the key is used when the cursor is in the bottom line and scroll is active, all data moves up one line, the top line disappears from view on the display screen, and the cursor returns to the first character position in the new last line. This operation provides a "carriage return" and "line feed" function when scroll mode is active and the cursor is in the bottom line. When the cursor is in the bottom line and page mode is active, the cursor moves to the same relative character position in the top line.

Start Inverse Video, CNTRL + N.

See Inverse Video, this section.

End Inverse Video, CNTRL + O.

See Inverse Video, this section.

ETX Key (or CNTRL + C).

When the display receives this function code (003_g), it displays the End of Text character (▲) at the cursor position. This function is useful to mark the end of text of multiple messages appearing on the view screen. The terminal recognizes and performs this function when entered from the keyboard or when it arrives in a receive message just as it recognizes the ten control functions described in the preceding paragraphs.

BREAK Key.

The BREAK key is an assigned special function key. Depressing this key when the terminal is in Remote operating condition (LOCAL indicator/switch extinguished) transmits a "break" signal on the telecommunications lines. This is a common telecommunications signal, however, its usage depends upon your communications system. Space is provided below for you to place notes concerning your use of this function.

The terminal has no meaningful reaction if it receives a break condition on the receive data line.

Software Dependand Spare Control Functions.

Space is provided below for notes concerning use of the remaining separate key functions (STX, ESCAPE, FS, GS, RS, and US) and the CNTRL + key functions not described in the preceding text. These remaining functions (see Table 2-4) are available for special use depending on the particular telecommunications system.

STX (or CNTRL + B). _____

ESCAPE (or CNTRL + [). _____

FS (or CNTRL + \). _____

GS (or CNTRL +]). _____

RS (or CNTRL + ^). _____

US (or CNTRL + _). _____

OPTIONS.

This portion of the manual describes operation of the terminal for each of the options that may be used. If the equipment does not use an option, disregard this portion of this manual. Options available are:

OPTION 1 16 line x 80 character Display Format

OPTION 2 Internal Modem *

OPTION 3 Acoustic Coupler *

OPTION 4 Hardcopy Receive-Only Printer

* Discontinued Option

These options do not affect operation of the basic terminal as described in the preceding part of this section.

16 x 80 DISPLAY FORMAT OPTION.

This option allows the operator to receive and compose up to 16 lines of 80 characters per display screen image (see Figure 2-4).

INTERNAL MODEM OPTION.

With an internal modem, the terminal operator may establish connection in either of two ways.

- 1) Connection via a Manual CDT Data Access Arrangement.
- 2) Acoustic Coupler audio connection via any standard telephone handpiece.

ACOUSTIC COUPLER OPTION.

With this option, the terminal operator may establish communications connections via any standard telephone as follows:

1. Using a standard telephone, dial desired communications number.
2. Listen for audio tone.
3. When audio carrier arrives, place phone handpiece in acoustic coupler cradle as per marking on coupler ("CORD END" designates cord end of handpiece).

REQUEST FILE RECORDS FOR 0800 THROUGH 1000 FOR ANY A102309, A102343, OR A102440.

FILE NAME: GOODROE

RECORD 1	A102309	CODE M,N
RECORD 2	A102343	CODE NONE
RECORD 3	A102440	CODE M,N,T,Y

ALSO LIST ANY OTHER ITEMS PERTAINING TO THIS FILE OR CODE.

CLASSIFICATION: NONE

REMARKS: SEND HASLO_

Standard 8x80 Display

REQUEST FILE RECORDS FOR 0800 THROUGH 1000 FOR ANY A102309, A102343, A102440
A103147, A103200, OR A104339

FILE NAME: GOODROE

RECORD 1	A102309	CODE M,N
RECORD 2	A102343	CODE NONE
RECORD 3	A102440	CODE M,N,T,Y
RECORD 4	A103147	CODE T,Y
RECORD 5	A103200	CODE NONE
RECORD 6	A104339	CODE NONE

ALSO LIST ANY OTHER ITEMS PERTAINING TO THIS FILE OR CODE.

CLASSIFICATION:	RECORDS 1,2	4A
	RECORD 3	2A
	RECORD 4	NONE
	RECORD 5	2A
	RECORD 6	NONE

REMARKS: SEND HASLO_

Optional 16x80 Display

Figure 2-4. Optional 16 x 80 Display

4. Note CTS (Clear to Send) indicator and DSR (Data Set Ready) indicators (both on terminal operator panel) illuminate when acoustic connection is established.
5. Begin communications entries.

PRINTER OPTION.

The optional hardcopy printer may operate either on-line or off-line with the terminal.

Printer On-Line Mode.

The common use of an "on-line" printer with the terminal is to provide an automatic, permanent copy of incoming messages. The operator must observe the following items when placing the terminal on line with an associated printer.

1. Check that PRTR BSY indicator is extinguished.
2. Depress PRINTER ON LINE switch (this switch should illuminate, the PRTR BSY indicator should come on, and PRTR ACT illuminates).

When the printer is on line with the terminal, all received or composed displayable characters appearing on the display screen will transmit to the printer for printout. The control functions of Backspace, Return, and Line Feed also result in printer operations, however, all other control functions are ignored for printout operation.

Printer Off-Line Mode.

Normally the printer should be "off-line" (PRINTER ON LINE indicator extinguished) when the operator is composing messages with the terminal. This in effect allows the operator to make a "rough draft" of messages and perform any necessary corrections without the printer recording each character as it is entered and/or changed within a message. When a message is complete, if a printer copy of it is desired, the operator must observe the following items.

1. Check that PRTR BSY indicator is extinguished.
2. Depress PRINT key (PRTR ACT indicator should illuminate while the displayed message transfers to the printer). During this message transfer, the keyboard is locked out to insure correct hardcopy of the displayed message, however, an incoming message from external equipment (eg; central processor) will enter the terminal and abort the PRINT operation.



SECTION III PROGRAMMING

This section supplies programming information for the Conversational Display Terminal. Figure 3-1 shows a terminal's relationship within a telecommunications system. For information regarding the hardware involved, refer to Section I, General Description and Section II, Operation. Interface characteristics, word format, message formats, displayable character codes, display station control codes, telecommunication control codes, message responses, station assignments, and memory size are described in this section.

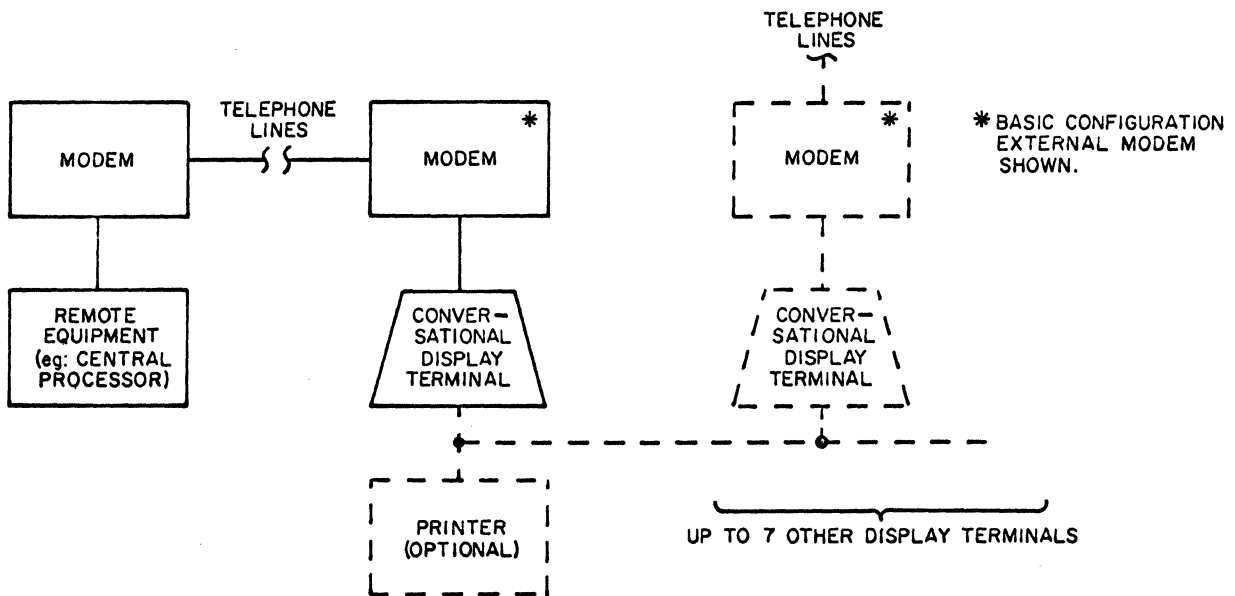


Figure 3-1. Typical Terminal Telecommunications System

INTERFACE CHARACTERISTICS.

Telecommunications with the terminal occur between a remote communications device and a single-station terminal (see Figure 3-1). The terminal is designed for asynchronous telecommunications operation via modems (modulator/demodulators) conforming to EIA Standard RS-232-C and CCITT recommendation V24. This means the interface is compatible with AT&T 103 Series data sets (or equivalent) with data transfer rates of 75, 110, 150, and 300 baud. Communication is half-duplex, non-simultaneous, send and receive, 2-wire mode, serial, via time-shared or standard telephone lines. Each terminal operates as a single-station in that it communicates directly to/from its own modem which accesses the telephone lines.

The remote device with which telecommunication occurs may be a communications oriented central processor which both sends and receives messages, or it may be telecommunications send/receive stations.

WORD FORMAT.

Communications messages between the terminal and central processor are bit serial, word serial. Each communications word is 8 bits including one parity bit as shown in Figure 3-2. A bit is transmitted and received as either a 1 or a 0. Bit 2^0 is received and transmitted first. Bits 2^0 through 2^6 enable a total of 128 different codes compatible with the USASCII X3.4-1968 code set (see Tables 3-2, 3-3, and 3-4). Bit 2^7 of each code presents parity for bits 2^0 through 2^6 .

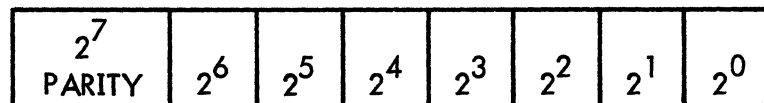


Figure 3-2. Word Format

A manual switch setting allows odd, even, or no parity selection (see Parity Switch, Section II). The transmitting circuits count the number of 1's in bits 2^0 through 2^6 of a generated word. Parity for words coming from the terminal keyboard is even and is inverted if odd parity is selected. For odd parity setting; when the number of data bit 1's is even, a 1 is sent for bit 2^7 making the total number of 1's odd and if the number is odd, a 0 is sent for bit 2^7 leaving the total number of 1's odd. For even parity setting; when the number of 1's in bits 2^0 through 2^6 is even, a 0 is sent for bit 2^7 leaving the total number of 1's even and if the number is odd, a 1 is sent for bit 2^7 making the total number of 1's even. With no parity setting, parity is disregarded. The receiving circuits use the parity bit to determine correct receipt of the word. Upon receipt, the receiving circuits count the number of 1's

in all bit positions. When odd parity is set; the receiving circuits accept the word when the number of 1's is odd and generates a parity error character (■) for display if the number of 1's is even. When even parity is set; the receiving circuits accept the word when the number of 1's is even and generates a parity error character for display if the number of 1's is odd. Since generating and checking the parity bit is not a programming function but is controlled by the transmitting and receiving circuits, octal codes shown in this section do not include the parity bit.

MESSAGE FORMATS.

The terminal communicates with remote equipment using control sequences as defined in following paragraphs. Messages are received and sent by the terminal on asynchronous data-word-by-data-word basis.

A group of data words received or sent comprises a message. The format for receiving data words in a message differs from that for sending message words. Table 3-1 shows the message formats for receive data and send data.

TABLE 3-1. RECEIVE AND SEND MESSAGE FORMATS

Receive Data Word From CPU Modem	Send Data Word to CPU Modem

* Receive data requires at least one stop bit between data words and transmitted data has at least two stop bits between data words.

TYPES OF MESSAGES.

The terminal does not use control sequence messages such as poll, alert, or acknowledge, therefore, all messages, either received or transmitted, are considered as data messages and are merely a series of data words. Each data word is received or transmitted as shown in Table 3-1.

Transmitted messages leave the terminal data-word-by-data-word in a bit-serial fashion as each keyboard input is made by the operator. The transfer rate will be 75, 110, 150, or 300 baud, depending on the terminal's BAUD RATE switch setting.

A transmitted message may contain control codes such as Start of Text, Start of Heading, FS, US, etc. These control codes are considered part of the data message and may be used by the receiving device to identify beginning and ending of messages and to perform formatting operations.

Receive messages take precedence in the terminal. Received messages will enter the terminal at whatever rate the BAUD RATE switch is set at. The BAUD RATE switch must be set to match rates used in the communications system.

CODE REPERTOIRE.

The code repertoire is compatible with USASCII X3.4-1968. For programming purposes these codes are divided into three basic groups; displayable character codes, terminal control codes, and telecommunication control codes. The following paragraphs describe each group.

DISPLAYABLE CHARACTER CODES.

The character repertoire includes the alphabet in uppercase and lowercase, arabic numerals 0 through 9, punctuation marks and special characters. Table 3-2 shows the displayable character repertoire used in communications with the terminal.

TABLE 3-2. DISPLAYABLE CHARACTER REPERTOIRE

OCTAL CODE	CHARACTER	OCTAL CODE	CHARACTER
040	(Space)	120	P
041	! (exclamation point)	121	Q
042	" (quotation mark)	122	R
043	# (number or pounds)	123	S
044	\$ (dollar sign)	124	T
045	% (percent)	125	U
046	& (ampersand)	126	V
047	' (apostrophe)	127	W
050	((left parentheses)	130	X
051	) (right parentheses)	131	Y
052	* (asterisk)	132	Z
053	+ (plus)	133	[(left bracket)
054	, (comma)	134	\ (reverse slant)
055	- (hyphen or minus)	135	] (right bracket)
056	. (period)	136	^ (circumflex)
057	/ (slant)	137	_ (underline)
060	0	140	¯ (left single quote mark)
061	1	141	a
062	2	142	b
063	3	143	c
064	4	144	d
065	5	145	e
066	6	146	f
067	7	147	g
070	8	150	h
071	9	151	i
072	: (colon)	152	j
073	; (semicolon)	153	k
074	< (less than)	154	l
075	= (equals)	155	m
076	> (greater than)	156	n
077	? (question mark)	157	o
100	@ (commercial at)	160	p
101	A	161	q
102	B	162	r
103	C	163	s
104	D	164	t
105	E	165	u
106	F	166	v
107	G	167	w
110	H	170	x
111	I	171	y
112	J	172	z
113	K	173	{ (left brace)
114	L	174	| (vertical line)
115	M	175	} (right brace)
116	N	176	~ (equivalent or similar)
117	O	177	■ (rub out or parity error)
			FUNCTIONS
		003	▲ (ETX)
		016	◀ (Begin Inverse)
		017	▶ (End Inverse)

TERMINAL CONTROL CODES.

Table 3-3 defines the terminal control code repertoire. Each of these codes will cause a terminal operation, when received in a message, and they are available to the operator by keyboard entry (see Control Function Repertoire, Section II) to place within messages to remote stations to cause them to respond likewise. See Control Function Repertoire Keys, Section II for complete descriptions of these terminal control codes.

TABLE 3-3. TERMINAL CONTROL CODES

NAME	7-BIT OCTAL TRANSLATION	PURPOSE
NUL	000	No-op, provides timing per telecommunication requirements.
ETX	003	Enters the ETX character at the cursor position in display memory.
BS (←)	010	Moves cursor to preceding character position.
LF (↓)	012	Advances cursor one line down, same character position.
RETURN	015	Resets cursor to beginning of line.
START INVERSE	016	Enters Start Inverse character at the cursor position in display memory.
END INVERSE	017	Enters End Inverse character at the cursor position in display memory.
SKIP (→)	025	Advances cursor one character position.
LINE CLEAR	026	Enters spaces at cursor position and to end of line in display memory. Scroll disabled.
CLEAR	030	Enters spaces in entire display memory.
RESET	031	Resets cursor to first data entry position in display. Page mode: first character, top line. Scroll mode: first character, bottom line.
CURSOR UP (↑)	032	Moves cursor to preceding display line, same character position.
BELL	007	When received, causes sonic tone to alert operator of a communications condition depending on the system.

TELECOMMUNICATIONS CONTROL CODES.

Table 3-4 shows the telecommunications control codes available from the terminal keyboard. Operator use of these codes is dependant on the type of communications system that the terminal is used in an also dependant on the type of remote devices being communicated with (eg: central processor, receive-only teletypewriter, etc.). This is information available only to the terminal user and therefore is not included in this text.

TABLE 3-4. TELECOMMUNICATIONS CONTROL CODES

MNEMONIC	OCTAL CODE	USASCII CONTROL FUNCTION
NUL	000	No-op, provides timing per telecommunications requirements
SOH	001	Start of heading
STX	002	Start of text
ETX	003	End of text
EOT	004	End of transmission
ENQ	005	Enquiry
ACK	006	Acknowledge
BEL	007	Alert
HT	011	Horizontal tab
VT	013	Vertical tab
FF	014	Form feed
DLE	020	Data link escape
DC1	021	Device control 1
DC2	022	Device control 2
DC3	023	Device control 3
DC4	024	Device control 4
EBT	027	End of transmission block
ESC	033	Escape
FS	034	File separator
GS	035	Group separator
RS	036	Record separator
US	037	Unit separator

MESSAGES RESPONSES.

All terminal message transmissions to remote equipment are at the discretion of the terminal operator. Remote parties (other telecommunication station operators or a telecommunications central processor) may send a message to the terminal,

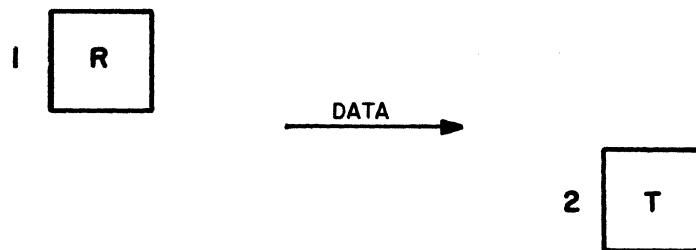
which when read by the terminal operator, may request a response. The response may be either in the form of a return reply message or a telecommunications system assigned control function key response (eg: one of the telecommunications control functions).

Remote party responses from operator controlled telecommunications stations are at the discretion of the operator of that station.

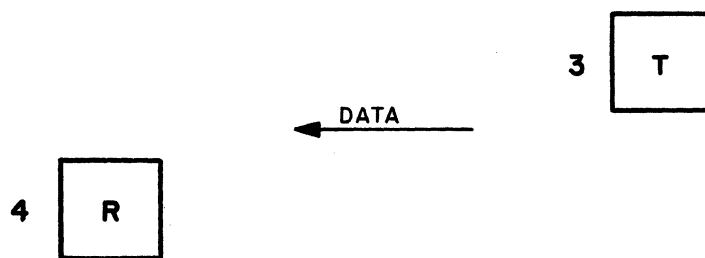
If a terminal operator is communicating with a telecommunications central processor, and requests information which that processor can supply from it's own capability, the terminal will receive a response data character, terminal control code, or message according to the programmed capability of the central processor.

SEQUENCE OF REMOTE PARTY/TERMINAL MESSAGES.

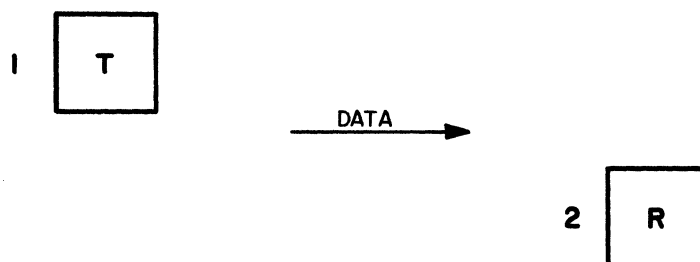
Remote party (R) composes and sends message to terminal (T) requesting information.



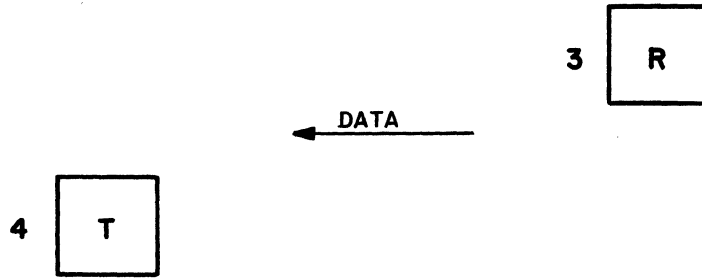
Terminal operator composes and transmits response.



Terminal operator (T) composes and transmits message to Remote party (R) requesting information.

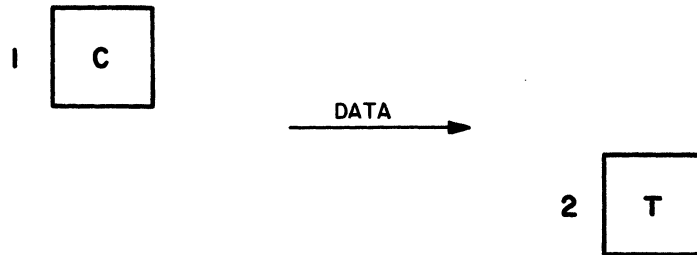


Remote operator composes and sends response .

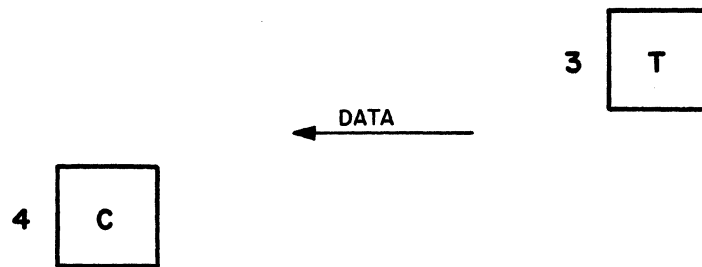


SEQUENCE OF CENTRAL PROCESSOR/TERMINAL MESSAGES.

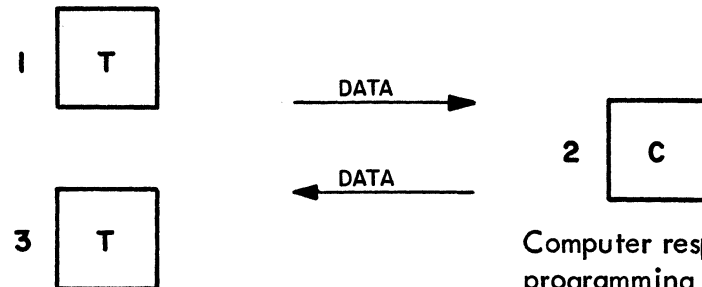
Computer (C) sends message requesting information from terminal (T).



Terminal operator composes and transmits response message .



Terminal operator (T) composes and transmits message requesting information from Computer (C).



Computer responds according to programming with data. This is a typical character-by-character data path when the terminal is operating in FULL DUPLEX mode with a central processor.

STATION ASSIGNMENTS AND MEMORY SIZES.

As shown in Figure 3-1, the Conversational Display Terminal is designed to communicate directly with remote equipment via an AT&T 103 series modem (or equivalent). Each terminal utilizes its own modem and operates as a single station communications device. Therefore, the only station assignment associated with a terminal is a telephone number assigned to the associated telephone line/terminal modem.

The terminal basic read/write refresh memory accepts 8 lines of 80 characters message data. With the expanded memory kit option (see Foreword), the terminal accepts 16 lines of 80 characters. Therefore, the limit on memory size for any message received by or transmitted from a terminal is either 640 or 1280 characters (depending on option presence). If the terminal is operating in Scroll format mode (see Section II), the entry of the 640th or 1280th character causes the scroll operation when the cursor moves to the next character position. Thus, to avoid Scroll loss of top display line data, it is best not to use the last character position of the bottom display line for data entry. Storable (displayable) codes only (see Table 3-2) count toward filling memory during a receive message. Non-storable terminal control codes (eg: Bell, Clear, etc.) may be used in a message from the central processor in addition to the 640 or 1280 storable codes, without overflowing memory.

Any message originating at a remote device which is larger than terminal memory can accommodate, must be transferred in blocks. A long message divided into two or more blocks may require terminal operations between blocks (eg: a print operation, or operator response message). Communications system programming and operating procedures must accommodate such operations and time required.

Of course, any message originating at a terminal is limited to the 8 line, 80 character or 16 line, 80 character size of the display memory. The terminal operator must be aware of message size limitations (if any) of remote receiving devices and compose messages intended for transmission accordingly.

NOTES.

Since the Conversational Display Terminal is designed with capability for varied telecommunications applications, operations in addition to those described in this section may apply (eg: specific use of various control function keys to gain access to a central processors files, specific remote teletypewriter calling procedures, etc.). The following space is provided for user notes regarding any additional programming requirements.



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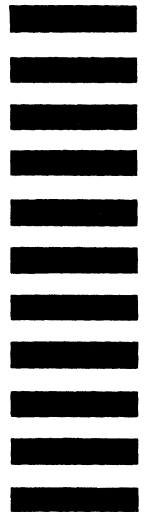
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