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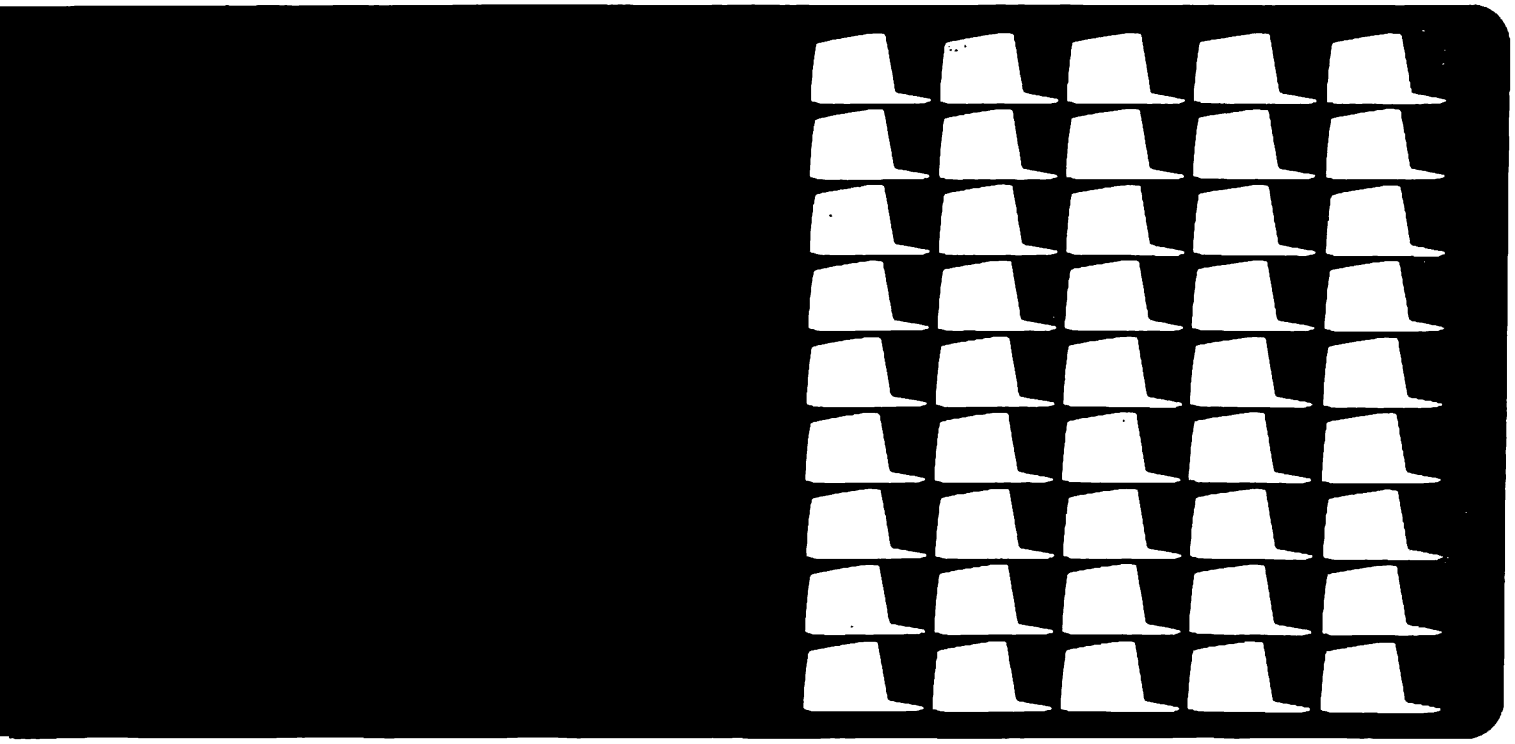
MODEL 100
VT-52 EMULATION
User's Manual

General Terminal Corporation



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MODEL 100
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1.0 INTRODUCTION

The I-100 VT-52 Emulator Data Display Terminal is a rugged design, high reliability terminal that employs a powerful Z-80 microprocessor to achieve a new standard of functional capability (functionality) in low priced terminals.

The terminal includes a solid state keyboard with numeric pad, cursor control keys and eight function keys, two industry-standard asynchronous serial interfaces, a 12-inch high resolution, low-glare display monitor, and rugged steel packaging.

When configured with the VT-52 option, the I-100 terminal will act as the functional equivalent of the DEC VT-52* Data Display Terminal. The emulation is complete except that the DEC VT-52 is capable of transmitting and receiving at different baud rates, and the emulator does not support this feature. Also, the baud rates available on the DEC VT-52 and the emulator vary slightly.

The emulator provides the following terminal enhancements not found on the DEC VT-52 Data Display Terminal.

- A LOCAL Key that gives the operator the ability to select either local or on-line operation from the keyboard.

- A 25th Status Line under operator control that displays certain terminal status information when the STATUS Key is depressed. The information displayed on the status line is detailed in Appendix C.

- The FIFO buffer used in the VT-52 has a storage capacity of 13 codes. The FIFO buffer used for Hold Screen Mode in the emulator has a storage capacity of 256 codes, (See Section 8.0).

- To send out a single code repetitively from the VT-52 requires the operator to depress the repeat key in conjunction with the key whose code is to be sent repetitively. There is no need for a repeat key on the I-100 since the keyboard is "typamatic". Depressing a single key and keeping it depressed, will cause its code to be sent out at a rate of 15 times per second or at the data rate, whichever is slower.

- The VT-52 has three blank keys on the numeric keypad which transmit the following escape sequence codes when depressed:

  ESC P
  ESC Q
  ESC R

*DEC VT-52 is a registered trademark of the Digital Equipment Corporation.

The I-100 is configured with a row of eight special function keys labeled F1 through F8 which will transmit the following escape sequence codes when depressed:

KEY LABEL	SEQUENCE GENERATED
F1	ESC P
F2	ESC Q
F3	ESC R
F4	ESC S
F5	ESC T
F6	ESC U
F7	ESC N
F8	ESC O

2.0 START-UP PROCEDURES

At the start of operation the following procedures should be followed prior to operating the terminal on-line:

- Turn the POWER Switch to the ON position. A 30-second warm-up period is required, after which the blinking cursor will appear on the screen. The terminal will be "on-line". Depress the LOCAL Key in conjunction with the SHIFT Key for "local" operation.

- Set rear panel switches for the desired mode of operation (See Section 4.0). Set STATUS and CAPS ONLY Keys on the keyboard for desired operation.

NOTE

TAKE UNIT OFF-LINE BEFORE CHANGING ANY REAR PANEL SWITCHES.

- Adjust CONTRAST Control as required. The control knob is located on the rear panel (See Figure 4-3).

- Type a message to see that it is correctly written on the screen. Exercise functional keys (i.e, RETURN, LINE FEED, TAB, etc.) to ensure proper operation.

- Depress the LOCAL Key in conjunction with the FUNCTION or SHIFT Keys for on-line operation.

3.0 SPECIFICATIONS/CHARACTERISTICS

The following paragraphs summarize the basic features of the I-100 Display Terminal:

3.1 Terminal Components

3.1.1 Keyboard

The terminal uses a keyboard which is permanently attached to the terminal. The keyboard uses solid-state capacitively-coupled keys for high reliability and long life.

The keyboard is illustrated in Figure 5-1

Depressing a key on the keyboard will cause a code to be sent out on the communication interface if the terminal is on-line. Holding a repeatable key down will cause the key code to be repetitively sent out at the speed of the interface or 15 characters per second, whichever is slower.

The keyboard consists of four sets of keys:

- A 57-key main keyboard section,
- A 14-key numeric keypad,
- An 8-key special function key section, and
- A 5-key cursor control section, which when used jointly with the FUNCTION or SHIFT Keys, will also access the functions described on the upper half of these keys.

3.1.2 Video Monitor

The video display used in the terminal is a high quality, high resolution, 12-inch display using P4 white phosphor and a non-interlaced raster scanning method which provides clear and accurate character reproduction with low glare. Characters are produced using a 7 x 9 dot-matrix for upper-case characters and a 9 x 9 dot-matrix for lower case.

The display has a screen capacity of 1920 characters, organized in 24 lines of 80 characters each. An additional 25th line is used for the display of terminal status information. Status display is under operator control from the keyboard.

3.1.3 Communications Interface

The terminal provides two separate industry-standard interfaces to allow simple connection to a variety of equipment. The terminal has a standard 20-milliampere passive current-loop interface with current supplied by the Host equipment. This interface allows simple direct connection to most equipment.

The terminal also has a second serial interface that complies with EIA RS-232-C and CCITT V/24 specifications. This interface provides all required control and sequencing signals for connection to local equipment, or to remote equipment through a modem.

The two interfaces are switch selectable from the rear panel.

The I-100 also allows the selection of eight data rates and four parity options through switch settings on the rear panel. Possible data rates include: 110, 200, 300, 1200, 2400, 4800, 9600, and 19200 bits per second. Parity choices include mark, space, odd and even parity.

In addition to the primary communications interface which uses a standard 25-pin EIA connector, the terminal provides a transmit-only auxiliary interface to allow attachment of local hard-copy units.

3.2 Physical Characteristics

The terminal is packaged in a rugged steel enclosure which gives the terminal increased EMI and RFI shielding. Physical characteristics of the terminal are as follows:

SIZE		WEIGHT
Height	14-1/8 inches	45 lbs.
Width	17-1/2 inches	
Depth	22-1/2 inches	

TEMPERATURE	HUMIDITY
Operating: 5° to 40° C	5 to 80%, non-condensing
Storage: -30° to 65° C	

3.3 Engineering Highlights

The I-100 provides the following advances in terminal technology:

- Z-80 microprocessor control.
- 4 kilobytes of dynamic RAM memory.
- Extensive use of large scale integration for video control.
- Direct microprocessor control of keyboard scanning for versatility, lower cost and high reliability.
- Steel packaging for ruggedness, noise immunity, increased EMI and RFI shielding and heat dissipation.
- Vertically mounted, single PC board design for integral mounting with TV chassis and improved cooling.
- Convection cooled, no-fan design for improved reliability and silent operation.

4.0 REAR PANEL CONTROLS

The terminal is provided with two sets of eight miniature switches, two 25-pin EIA connectors, a CONTRAST Control and a circuit breaker on the rear panel. The two sets of miniature switches, labeled S2 and S3, (See Figure 4-1 for label template), provide for selection of the terminal functions described in this section. Figure 4-3 shows the controls found on the rear panel of the terminal.

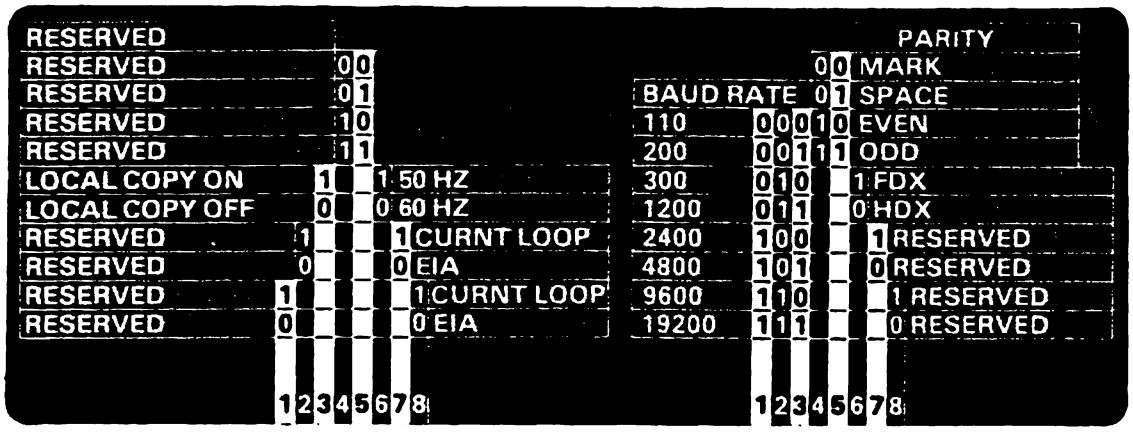

Figure 4-1 I-100 VT-52 Emulator Rear Panel Controls

Switch S2-1 - Auto New Line Selection

This switch determines whether or not the cursor performs an automatic CR and LF after the 80th character position of any line. In the ON position the cursor executes a CR and LF operation without generating any control codes. In the OFF position the cursor will move until it is positioned in the 80th character position then further typing will result in over typing of the 80th character.

Switch S2-2

Reserved for future use.

Switch S2-3 - Local Copy Selection

This switch determines whether or not data entered from the keyboard will appear on the screen when on-line. In the ON position data entered from the keyboard will be "echoed" locally, appear on the screen and be transmitted to the Host Computer. In the OFF position data entered from the keyboard will be transmitted to the Host Computer and will appear on the screen only if "echoed" back by the Host or modem. This switch should be set to the OFF position, if the Host or modem has this "echo" capability, to avoid double characters on the screen.

Switch S2-4

Reserved for future use.

Switch S2-5

Reserved for future use.

Switch S2-6 - 50/60 Hz Selection

50 or 60 Hz refresh-rate capability is built into the basic unit and is determined by this switch. In the ON position 50 Hz is selected. In the OFF position 60 Hz is selected.

Switches S2-7, S2-8 - Interface Selection

These two switches determine whether the communication interface operates in EIA RS-232-C mode, or in 20-milliampere current loop mode. Loop current is supplied by the host equipment. If both switches are ON the 20-ma current loop interface is selected. See Figure 4-2 for current loop-pin polarity designation. If both switches are OFF the EIA RS-232-C interface is selected. See Table 4-1 for EIA RS-232-C signal definitions and connector pins.

Switches S3-1, S3-2 and S3-3 - Data Rate Selection

S3-1	S3-2	S3-3	Baud Rate	Stop Bits
OFF	OFF	OFF	110	2
OFF	OFF	ON	200	1
OFF	ON	OFF	300	1
OFF	ON	ON	1200	1
ON	OFF	OFF	2400	
ON	OFF	ON	4800	
ON	ON	OFF	9600	1
ON	ON	ON	19200	1

Switches S3-4 and S3-5 - Parity Selection

These switches determine how the parity bit will be set in each character. If even or odd parity is selected and a parity error is detected on a received character, a question mark will appear on the screen in place of the character.

S3-4	S-5	Parity		
OFF	OFF	MARK	-	Generated on transmit, not checked on receive.
OFF	ON	SPACE	-	Generated on transmit, not checked on receive.
ON	OFF	EVEN	-	Generated on transmit, checked on receive.
ON	ON	ODD	-	Generated on transmit, checked on receive.

Switch S3-6 - HDX/FDX Selection

THIS SWITCH MUST ALWAYS BE SET TO THE ON POSITION FOR FULL DUPLEX OPERATION.

Since the VT-52 does not operate in half duplex mode, the I-100 VT-52 Emulator does not either.

In full duplex, data may be sent and received at the same time, and the terminal will permanently raise the Request to Send (RTS) signal on the EIA interface.

Switch S3-7

Reserved for future use.

Switch S3-8

Reserved for future use.

Pin No.	Function	
21	OUT +	TRANSMIT
25	OUT -	
18	IN +	RECEIVE
19	IN -	

NOTE:

Rear panel switches must be set, and full 20-milliamperes of loop-current must be supplied by the host equipment.

Figure 4-2 20-Milliampere Current Loop Polarity

Table 4-1

I-100 EIA RS-232-C Signal Definitions and Connector Pins

EIA RS-232-C Name	CCITT V/24 Name	Description	Printer Interface Pin No.	Data-Line Interface Pin No.	Comments
BA	103	Data transmitted from terminal	-	2	Logical "1" = OFF = -12V Logical "0" = ON = +12V 300-ohm source impedance.
CA	105	Request to send signal from terminal	-	4	Goes high (+12V) when the terminal is ready to transmit.
CB	106	Clear to send signal to terminal	-	5	Must be high to allow terminal to send is supplied by a modem.
BB	104	Data transmitted to terminal	-	3	Logical "1" = OFF = -5V to -25V Logical "0" = ON = +5V to +25V 6.8K ohm load impedance
CF	109	Carrier present signal to terminal	-	8	Must be high to allow terminal to receive; is supplied by a modem.
CD	108.2	Data terminal ready signal from terminal	-	20	Goes high (+12V) when terminal is on LINE; is low when terminal is in LOCAL mode.
		External clock input at TTL logic level	-	-	For use with RECEIVE RATE selector switch in EXT position.
AB	102	Signal ground	7	7	
CC	107	Data set ready		6	Must be high to allow terminal to operate; is supplied by a modem.
BB	104	Data to printer	3	-	Optional print data
CB	106	Clear to send	5	-	These signals are connected to the printer's data terminal ready signal.
CC	107	Data set ready	6	-	
CF	109	Carrier present	8	-	
CD	108.2	Data terminal ready	20	-	

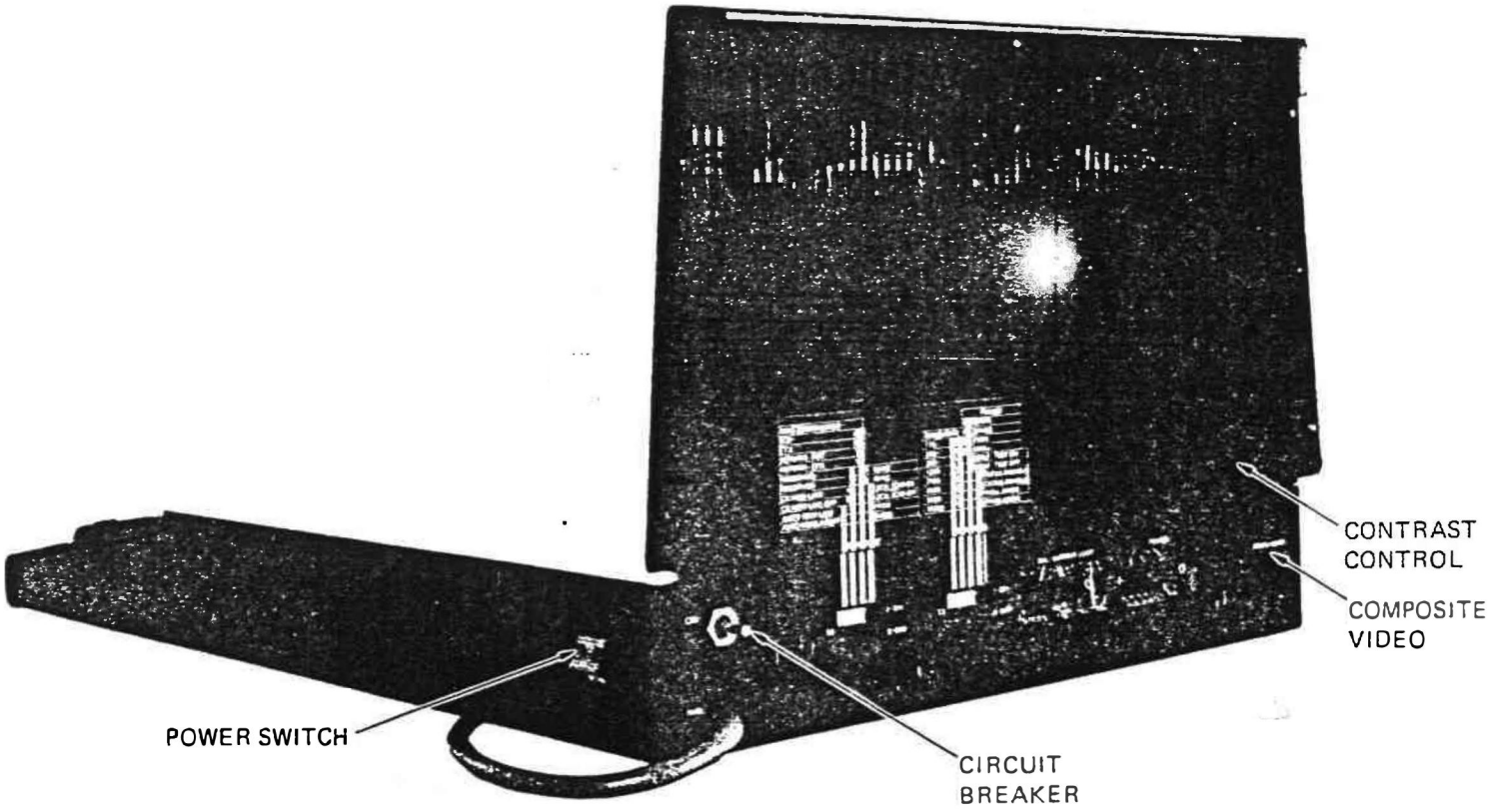

Figure 4-3 I-100 Rear Panel Controls

5.0 KEYBOARD CONTROLS

The terminal keyboard can be thought of as consisting of four sections of keys: a 57-key main key section, a 14-key numeric keypad, a 5-key cursor control and mode control section, and a row of eight function keys. Figure 5-1 illustrates the I-100 VT-52 Emulator keyboard.

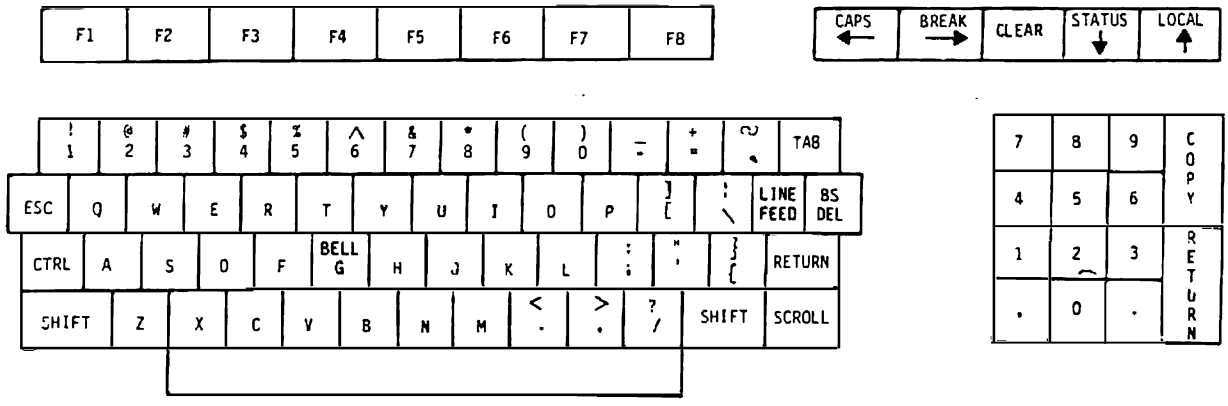

Figure 5-1 I-100 VT-52 EMULATOR KEYBOARD LEGEND

5.1 MAIN KEY SECTION

The following is a list of keys located in the main key section of the keyboard, and their associated functionality.

ESC	Depressing the ESC Key located to the left of the main keyboard, causes the terminal to send the escape code (octal 033). This code is used in the terminal to initiate multicode control sequences. For example, ESC I moves the cursor up one line. See Section 6.0 for a detailed description of these sequences.
CTRL	The CTRL (control) Key located to the left of the main keyboard, does not produce a code by itself. This key is used in conjunction with other keys on the keyboard to generate the control codes described in Section 7.0.
SHIFT	The SHIFT Key does not produce a code by itself. This key causes the terminal to send only upper case alphabetic characters or the characters whose symbols appear in the upper portion of the key being depressed. For operator convenience, two SHIFT Keys are on the keyboard. Each of these keys has the same effect on the data.
SCROLL	The SCROLL Key is operational only when operating in Hold Screen Mode and allows the operator to control the rate at which data on the display changes. (See Section 8.0). When depressed this key allows one new line of data to be displayed. When depressed in conjunction with the SHIFT Key, this key allows for one new screen (24 lines) of data to be displayed.
LINE FEED	Depression of the LINE FEED Key causes the ASCII LF code to be transmitted (octal 012). This key will also cause the cursor to move down one line.
RETURN	Depression of the RETURN Key causes the ASCII CR code to be transmitted (octal 015). This key will also cause the cursor to move to the first column of the present line.

5.1 MAIN KEY SECTION (continued)

TAB — Depression of the TAB Key causes the ASCII HT code to be transmitted (octal 011). This key will also cause the cursor to advance to the next tab stop.

NOTE

Tab stops are fixed every 8 columns of a line, (i.e., columns 9, 17, 25, 33, 41, 49, 57, 65, and 73).

BSP DEL — When depressed this key transmits the ASCII DEL code (octal 177). When depressed in conjunction with the SHIFT Key, this key will transmit the ASCII BS code (octal 010) and cause the cursor to move one position to the left.

SPACE — This bar when depressed will generate the ASCII SP code (octal 040). This bar will also erase any character previously at the cursor location and advance the cursor one position to the right.

ALPHA KEYS — Depression of any alpha key on the keyboard will cause transmission of the corresponding lower case alpha code. Depression of any alpha key in conjunction with the SHIFT Key (or when CAPS ONLY Mode is in effect) will cause transmission of the corresponding upper case alpha code. The depressed alpha character will also appear on the screen at the position marked by the cursor.

NUMERIC/SYMBOL KEYS — Depression of a numeric/symbol key on the keyboard will cause transmission of the character code whose number/symbol appears on the bottom half on the key. Depression of these keys in conjunction with the SHIFT Key will cause transmission of the character code whose symbol appears on the upper half of the key. The depression of numeric/symbol keys will also cause these characters to appear on the screen at the position marked by the cursor.

5.2 Numeric Keypad

The following is a list of keys located on the 14-key numeric keypad and their associated functionality.

RETURN	The RETURN Key causes the same action as the RETURN Key on the main keyboard section, as previously described.
COPY	When depressed, the COPY Key will send the X-OFF control code to the Host to stop transmission, and cause the contents of the screen to be transferred to an attached Printer with a Carriage Return at the end of each line. The transfer will occur at the speed of the communication interface. When the screen has been printed the X-ON control code will be sent to the Host CPU to resume transmission. If the COPY Key is depressed jointly with a SHIFT Key, the terminal will enter Auto Print Mode. In this mode data received from the Host Computer is sent to the terminal Printer simultaneously. Subsequent depressions of the COPY Key with the SHIFT Key will alternately disable and enable Auto Print Mode.
NUMERIC KEYS	Cause the same action as the numeric keys on the main keyboard section, as previously described.

NOTE

The RETURN, COPY, and numeric keys on the numeric keypad will transmit escape sequences when depressed if the terminal is placed in Alternate Keypad Mode. (See Appendix A).

5.3 Cursor Control and Mode Selection

The following is a listing of keys located in the 5-key cursor control and mode control section, and their associated functionality.

CAPS

←

When depressed this key will transmit the Cursor Left escape sequence, ESC D. This key will also cause the cursor to move left one position. (Provided the cursor is not positioned in the 1st column of a line, in which case it will not move). This key when depressed in conjunction with the SHIFT Key will cause only capital alphas to be transmitted upon depression of alpha keys. Subsequent depressions of this key in conjunction with the SHIFT Key will alternately enable and disable the Caps Only Mode. The terminal will be in Caps Only Mode upon power-up.

BREAK

→

When depressed this key will transmit the Cursor Right escape sequence, ESC C. This key will also cause the cursor to move right one position. (Provided the cursor is not positioned in the last column of the line, in which case it will not move). This key when depressed jointly with a SHIFT Key will cause the terminal to send a measured Break signal (a space condition on the data-line) of 200 milliseconds. A Break signal will also cause the terminal to exit from Hold Screen Mode, (See Section 8.0).

CLEAR

When depressed, the CLEAR Key causes the screen to be erased and the cursor to be positioned in the home position.

STATUS

↓

When depressed this key will transmit the Cursor Down escape sequence, ESC B. This key will also cause the cursor to move down one position. (Provided the cursor is not positioned on the bottom line of the display, in which case it will not move). This key when depressed in conjunction with the SHIFT Key will cause certain terminal status information to be displayed on the 25th status line. The status information displayed is detailed in Appendix C.

LOCAL
↑

When depressed this key will transmit the Cursor Up escape sequence, ESC A. This key will also cause the cursor to move up one position. (Provided the cursor is not on the top line of the display, in which case it will not move). This key when depressed in conjunction with the SHIFT Key will enable "local" mode of operation, if the terminal was previously on-line. If the terminal had been in a local mode of operation the depression of this key with SHIFT Key will enable "on-line" operation. When the terminal is powered-up it will be on-line. When the terminal is on-line the Data Terminal Ready (DTR) lead on the EIA interface is asserted and the terminal can send and receive data from the host.

NOTE

Going from on-line to local will exit the terminal from Hold Screen Mode. When the terminal is placed in a local mode of operation, the DTR lead is dropped, and the terminal is off-line (local). In this condition data entered at the keyboard is not transmitted to the Host Computer but is echoed back to the display automatically.

NOTE

The SPACE BAR, LINE FEED, RETURN, TAB AND BSP Keys, as well as the cursor-positioning and alpha-numeric keys, will all transmit codes when depressed. The actions associated with these keys will occur on the screen ONLY if the code is "echoed" back to the terminal. "Echoing" is sometimes provided by the Host Computer or a modem. Echoing can also be accomplished by the terminal if LOCAL ECHO Switch, S2-3 on the rear panel, is set to the ON position.

5.4 Function Keys

The eight function keys, labeled F1 through F8, transmit a predetermined escape sequence when depressed. These sequences, when received by the Host Computer, are typically interpreted by an applications program, and reduce the number of operator key strokes necessary for commonly used functions.

Key Depressed	Sequence Generated
F1	ESC P
F2	ESC Q
F3	ESC R
F4	ESC S
F5	ESC T
F6	ESC U
F7	ESC N
F8	ESC O

6.0 ESCAPE SEQUENCE FUNCTIONS

The terminal will decode and respond to the following Escape Sequence Functions when received by the terminal.

SEQUENCE	OCTAL EQUIVALENT	ACTION
ESC A	033 101	Moves the cursor up one line. If the cursor is positioned on the top line no action will occur.
ESC B	033 102	Moves the cursor down one line. If the cursor is positioned on the bottom line, no action will occur.
ESC C	033 103	Moves the cursor right one position. If the cursor is positioned in the last column of a line, no action will occur.
ESC D	033 104	Moves the cursor left one position. If the cursor is positioned in the first column of a line, no action will occur.
ESC F	033 106	Places the terminal in Graphics Mode so that the received ASCII caracters, a through z (lower case alphas) and the symbols { , | , } , and ~ , (octal 173, 174, 175, and 176), are interpreted as graphic characters. See Appendix B for a chart detailing the special-graphics character set.
ESC G	033 107	Exits the terminal from Graphics Mode.
ESC H	033 110	Moves the cursor to the home position (upper left-hand corner of the display).
ESC I	033 111	Moves the cursor up one line. If the cursor is positioned on the top line, the contents of the screen will scroll down one line.
ESC J	033 112	Erases the screen from the cursor position to the end of the screen.

6.0 ESCAPE SEQUENCE FUNCTIONS (continued)

SEQUENCE	OCTAL EQUIVALENT	ACTION
ESC K	033 113	Erases from the cursor position to the end of the line on which the cursor resides.
ESC Z	033 132	Requests the terminal to verify that it is switched on, connected to the Host Computer and responding to commands. If this is the case, the terminal will respond with ESC / K.
ESC [	033 133	Places the terminal in Hold Screen Mode. In this mode the terminal will refuse to scroll unless instructed to do so by the Operator (See Section 8.0).
ESC \	033 134	Exits the terminal from Hold Screen Mode.
ESC =	033 075	Places terminal in Alternate Keypad Mode so that 1 Key through 9 Key, Period (.) Key, and numeric-pad RETURN Key, will transmit special escape sequences, as opposed to the regular codes. Appendix A details these sequences.
ESC >	033 076	Exits the terminal from Alternate Keypad Mode.
ESC Y	033 131	This sequence is used for absolute cursor positioning (cursor addressing). The next two codes following this sequence will be interpreted as the line and column position of the line, respectively. (See Appendix E for cursor addressing code chart). If the line value ("Y") is out of bounds, no movement will occur. If the column value ("X") is out of bounds the cursor will move to the right-most column of the screen.

6.0 ESCAPE SEQUENCE FUNCTIONS (continued)

SEQUENCE	OCTAL EQUIVALENT	ACTION
ESC W	033 127	Places the terminal in Pinter Controller Mode. In this mode data transmitted from the Host computer will be sent to an attached local hard copy device (printer) at the speed of the communication interface. No data will go to the terminal.
ESC X	033 130	Exits the terminal from Printer Controller Mode.
ESC ^	033 136	Places the terminal in Auto Print Mode. In this mode data transmitted from the Host Computer will be sent to the terminal and an attached local hard copy device (printer) at the same time. Data will arrive at the printer at the speed of the communications interface.
ESC -	033 137	Exits the terminal from Auto Print Mode.
ESC]	033 135	When this code sequence is received, the terminal will send the X-OFF control code to the Host Computer (to stop it from transmitting) and transfer the contents of the screen, with a Carriage Return automatically included at the end of each line, to an attached printer at the speed of the communications interface. When the Print Screen function is completed, the terminal will send the X-ON control code to the Host CPU (to resume transmission).

SEQUENCE	OCTAL EQUIVALENT	ACTION
ESC V	033 126	When this code sequence is received the terminal will send the X-OFF control code to the Host Computer (to stop it from transmitting) and transfer the contents of the line on which the cursor resides to an attached printer at the speed ~~of the~~ communications interface. When the Print Line function is completed, the terminal will send the X-ON control code to the Host Computer (to resume transmission).

NOTE

The commands to print a line, and print the screen both cause the X-OFF control code to be sent to the Host computer to suspend transmission. The Host's response to X-OFF will be immediate, but it will take a finite period of time for the X-OFF code to travel to the Host to stop transmission. Therefore, if the Host had been transmitting before it had a chance to respond to X-OFF, a few characters would be lost in transit to the terminal.

7.0 CONTROL CODES

This section describes how the I-100 responds to control codes received over the communications interface. Control codes may be generated directly by the computer which is controlling the terminal or they may be echoed back to the terminal from the keyboard. It is important to note that no control code entered from the terminal keyboard can have any effect unless it is echoed back to the terminal. The terminal only interprets received control codes in On-Line Mode.

The following control codes will be recognized by the I-100 "VT-52 Emulator" when received by the terminal:

ASCII CHARACTER	OCTAL EQUIVALENT	ACTION
BEL (Control G)	007	Rings bell.
BS (Control H)	010	Backspaces cursor.
HT (Control I)	010	Advances cursor to next tab stop.*
LF (Control J)	012	Moves cursor down one line.
CR (Control M)	015	Moves cursor to first position of present line.
ESC (Control [ )	033	Initiates escape sequence functions.
DC1 (Control Q)**	021	Signals the Host Computer to start transmission. (X-ON).
DC3 (Control S)**	023	Signals the Host Computer to stop transmission. (X-OFF).

*Tab stops are fixed every eight positions of a line, (i.e., in columns 9, 17, 25, 33, 41, 49, 57, 65 and 73). If the cursor is positioned in columns 73 through 79, receipt of the HT control code will cause the cursor to advance one position. If the cursor is positioned in the last position of a line (80th column), no action will occur upon receipt of the HT control code.

**These control codes are usually transmitted, as opposed to received, by the terminal.

8.0 HOLD SCREEN MODE

While operating in Hold Screen Mode the operator can control the rate at which displayed data changes. When this mode is in effect, the terminal will refuse to scroll new lines of data onto the screen unless instructed to do so by the operator. The operator requests a new line of data from the Host Computer by depressing SCROLL Key.

When Hold Screen Mode is not in effect, new lines of data entered on the bottom line of the display will cause the contents of the display to scroll up one line. Thus, the Host, not the operator, is controlling the rate at which displayed data changes.

When Hold Screen Mode is in effect, any commands that would normally cause scrolling (i.e., receipt of a Line Feed code when cursor is on the last line of display) will instead be stored in a 256-character FIFO buffer, and the terminal will send a signal to the Host CPU to stop it from transmitting. This signal is a control code called X-OFF. Any characters transmitted by the Host before it responds to the X-OFF signal will also be stored in the FIFO buffer. When ready to see a new line of data, simply depress the SCROLL Key. If the terminal processes all the characters stored in the buffer without encountering another line feed character (which would cause scrolling), it will transmit a signal to the Host to tell it that the terminal is again ready to receive data. This signal is a control code called X-ON. If the terminal encounters another line feed character in the FIFO buffer, the operator must again depress the SCROLL Key to allow the terminal to process the line feed, and thus scroll one more new line of data onto the display. The operator can also request a new screen of data (as opposed to a new line of data) by depressing the SCROLL Key in conjunction with the SHIFT Key. When this happens the terminal will perform 24 scrolls before sending X-OFF to the Host.

The Host can place the terminal in Hold Screen Mode by transmitting the sequence ESC [. The terminal can exit Hold Screen Mode by:

- Receiving the sequence ESC \ , or
- Depressing the BREAK Key in conjunction with SHIFT Key, or
- Switching from on-line to local operation.

If one wishes to exit Hold Screen Mode via the sequence ESC \ , the FIFO buffer must be empty; otherwise this sequence will be stored in the buffer awaiting its turn to be scrolled onto the display by the operator.

If one exits Hold Screen Mode via the BREAK Key or by going from on-line to local, the contents of the buffer will be automatically released to the screen before exiting from the mode.

9.0 INTERFACING WITH A PRINTER

A serial printer can be connected to the terminal by means of the auxiliary EIA printer interface located on the rear of the terminal. This connection can be made through the use of an optionally supplied printer cable.

Once a printer is connected to the terminal there are three ways to obtain hard copy:

1. Depressing the COPY Key on the numeric keypad, or depressing the COPY Key jointly with a SHIFT Key.

2. Remote commands from the Host Computer.

3. Placing the terminal in Auto Print Mode or Printer Controller Mode.

In all three cases, data arrives at the printer at the same speed as the communications interface, and trailing spaces are supressed.

The following chart illustrates the various ways to obtain hard copy:

ACTION	RESULT ON TERMINAL AND PRINTER
Operator depresses the COPY Key	X-OFF code is sent to Host Computer to stop transmission. Contents of terminal screen are transferred to the printer. X-ON code is sent to Host Computer to resume transmission once the COPY function is completed.
Operator depresses COPY Key in conjunction with SHIFT Key	Places terminal in Auto Print Mode. Data transmitted from the Host Computer is displayed on the screen and is printed on the printer simultaneously.

NOTE

Subsequent depressions of the SHIFT and COPY Keys will alternately disable and enable Auto Print Mode. The terminal will power-up with Auto Print Mode OFF.

APPENDIX A

Alternate Keypad Mode

In this mode, depression of keys on the numeric keypad will send special escape sequences to the host as follows:

Key Depressed	Sequence Generated
0	ESC ? p
1	ESC ? q
2	ESC ? r
3	ESC ? s
4	ESC ? t
5	ESC ? u
6	ESC ? v
7	ESC ? w
8	ESC ? x
9	ESC ? y
	ESC ? n
RETURN	ESC ? M

APPENDIX B

Graphic Character Set

When the terminal is operating in Graphics Mode, receipt of the following ASCII characters will result in display of the following corresponding graphic characters:

ASCII Character	Graphic Character	Description
a		Solid rectangle
b		Numerator
c		Numerator
d		Numerator
e		Numerator
f		Degrees
g		Plus or minus
h		Right arrow
i		Ellipsis
j		Divide by
k		Down arrow
l		Bar at scan 0
m		Bar at scan 1
n		Bar at scan 2
o		Bar at scan 3
p		Bar at scan 4
q		Bar at scan 5
r		Bar at scan 6
s		Bar at scan 7

Graphic Character Set (continued)

ASCII Character	Graphic Character	Description
t		Subscript 0
u		Subscript 1
v		Subscript 2
w		Subscript 3
x		Subscript 4
y		Subscript 5
z		Subscript 6
{		Subscript 7
|		Subscript 8
}		Subscript 9
~		Paragraph

APPENDIX C

Status Line Indicators

STATUS LINE INDICATORS	MEANING
CAPS N	CAPS ONLY Mode is not in effect.
CAPS Y	CAPS ONLY Mode is in effect.
PRINT N	Terminal is not transmitting data to an attached hard copy device.
PRINT Y	Terminal is transmitting data to an attached hard copy device.
GRAPHICS N	Graphics Mode is not in effect.
GRAPHICS Y	Graphics Mode is in effect.
HOLD - SCRN N	Hold Screen Mode is not in effect.
HOLD - SCRN Y	Hold Screen Mode is in effect.
ALT - KYPAD N	Alternate Keypad Mode is not in effect.
ALT - KYPAD Y	Alternate Keypad Mode is in effect.
LOCAL N	Terminal is on-line.
LOCAL Y	Terminal is in local mode of operation.
AUTO-PR N	Terminal is not in Auto Print Mode.
AUTO-PR Y	Terminal is in Auto Print Mode.
PR-CTL N	Terminal is not in Printer Controller Mode.
PR-CTL Y	Terminal is in Printer Controller Mode.

APPENDIX E

Cursor Addressing Code Chart

OCT	ASCII Char	Char Pos. X	Line No. Y
040	SP	0	0
041	!	1	1
042	"	2	2
043	#	3	3
044	$	4	4
045	%	5	5
046	&	6	6
047	'	7	7
050	(	8	8
051	)	9	9
052	*	10	10
053	+	11	11
054	,	12	12
055	-	13	13
056	.	14	14
057	/	15	15
060	0	16	16
061	1	17	17
062	2	18	18
063	3	19	19
064	4	20	20
065	5	21	21
066	6	22	22
067	7	23	23
070	8	24	
071	9	25	
072	:	26	
073	;	27	
074	<	28	
075	=	29	
076	>	30	
077	?	31	
100	@	32	
101	A	33	
102	B	34	
103	C	35	
104	D	36	
105	E	37	

Cursor Addressing Code Chart (continued)

OCT	ASCII Char	Char Pos. X	Line No. Y
106	F	38	
107	G	39	
110	H	40	
111	I	41	
112	J	42	
113	K	43	
114	L	44	
115	M	45	
116	N	46	
117	O	47	
120	P	48	
121	Q	49	
122	R	50	
123	S	51	
124	T	52	
125	U	53	
126	V	54	
127	W	55	
130	X	56	
131	Y	57	
132	Z	58	
133	[	59	
134	\	60	
135	]	61	
136	^	62	
137	_	63	
140	@	64	
141	a	65	
142	b	66	
143	c	67	
144	d	68	
145	e	69	
146	f	70	
147	g	71	
150	h	72	
151	i	73	
152	j	74	
153	k	75	
154	l	76	
155	m	77	
156	n	78	
157	o	79	