USER OPERATOR/REFERENCE MANUAL

MODEL 82 DISPLAY

SINGER
BUSINESS MACHINES

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This manual provides pertinent user information for the Model 82 Cathode Ray Tube (CRT) Display Terminal. This includes physical descriptions, operating instructions, description of operating characteristics, and reference information essential to the programming of dialogue between the Model 82 terminal and the System Ten* processor.

* A trademark of the Singer Company.

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INTRODUCTION

The Model 82 Display Terminal is a compact, freestanding unit which may be located on top of a standard desk. As shown in Figure 1, the terminal is composed of a monitor unit and a separately housed keyboard that are interconnected with an 18-inch flexible cable.

The Model 82 is designed for installations at which the terminal is in direct hard-wired communication with a processor over a cable length separation of up to 2000 wire-feet.

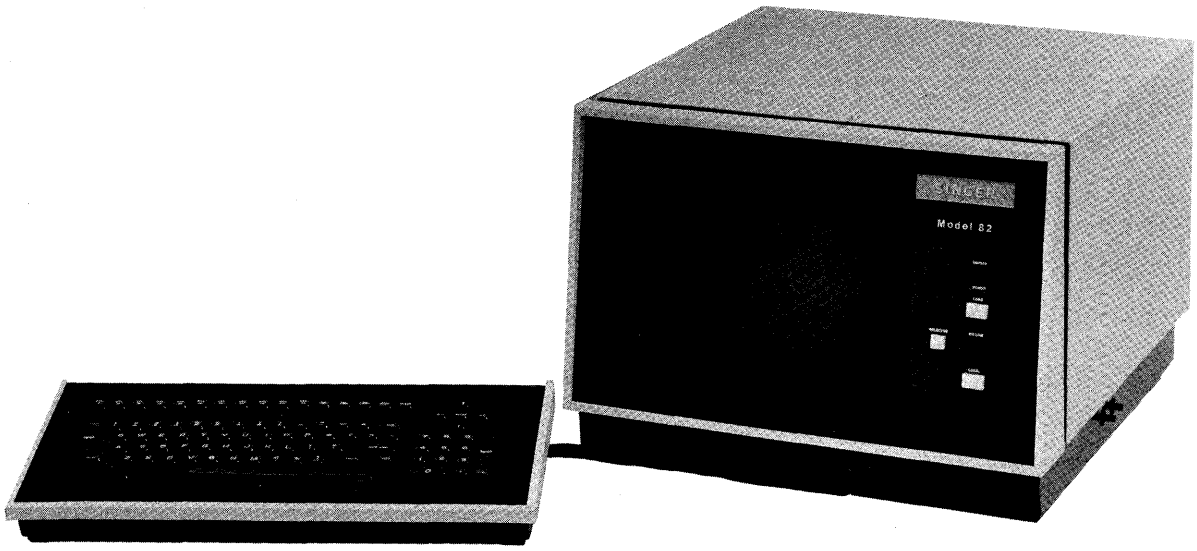

Figure 1. Model 82 CRT Display Terminal

EQUIPMENT SPECIFICATIONS

Table 1. Equipment Specifications

ITEM	SPECIFICATION	
Dimensions	Main Unit	Keyboard
Height	13.2 inches (33.6 cm)	3.5 inches (8.93 cm)
Width	18.5 inches (46.8 cm)	18.5 inches (46.8 cm)
Depth	19.75 inches (50.2 cm)	8.75 inches (22.2 cm)
Weight	70 pounds (32 kg)	13 pounds (5.9 kg)
Standard Keyboard Cable Length	18 inches (45.7 cm)	
Minimum Service Clearances:		
Front	36 inches (91.4 cm)	
Rear	24 inches (61.0 cm)	
Right Side	3 inches (7.6 cm)	
Left Side	12 inches (30.5 cm)	
Input Power Requirements	North American Units	International Variants
Voltage Range (single phase)	104 to 128 VRMS	Nominal voltage of 100V 110V, 200V, 220V, or 240V with a voltage tolerance of +10% -15% around the nominal value
Frequency	59 to 60.6 Hz	50 ±1 Hz or 60 ±1.2 Hz
Power Dissipation	200 watts	200 watts

Table 1. Equipment Specifications (Cont'd)

ITEM	SPECIFICATION
Operating Environmental Limits	
Temperature	32 to 100 degrees F (0 to 37.8 degrees C)
Relative Humidity	20% to 90% without condensation
Altitude	Up to 10,000 feet (Up to 3049 meters)
Nonoperating Environmental Limits	
Temperature	-40 to +150 degrees F (-40 to +65 degrees C)
Relative Humidity	5% to 95% without condensation
Altitude	Up to 40,000 feet (Up to 13,100 meters)
Keyboard	
Alphanumeric Block	55 keys, including 6 control keys for shift, tab, repeat, enter, new line, and space, and 49 alphanumeric keys. Included in the 49 alphanumeric keys are the numerals 0 through 9, uppercase letters A through Z, the space bar, and 27 special characters, including punctuation symbols and 6 symbols that are language/nationality dependent.
Control Block	Includes 5 (standard) or 11 (optional) program control (CTL) keys, 5 cursor positioning keys (cursor left, right, up, down, and home), and 5 editing keys (insert character, delete character, insert line, delete line, and clear).
Numeric Block (Optional)	Includes ENTER key, the numerals 0 through 9, and two special characters (period and dash).

Table 1. Equipment Specifications (Cont'd)

ITEM	SPECIFICATION
Display	
Cathode Ray Tube (CRT) Display Area	8 ±0.25 inches (20.3 ±0.64 cm) wide by 5.5 ±0.25 inches (13.9 ±0.64 cm) high. 12 (standard) or 24 (optional) lines of 80 characters each for a total of 960 (standard) or 1920 (optional) characters.
Display Symbol Repertoire	Cursor symbol plus 64 alphanumeric symbols. Included in the alphanumeric symbols are space (blank), uppercase letters A through Z, numerals 0 through 9, 21 special symbols (including punctuation symbols) common to all configurations, and 6 symbols that are language/nationality dependent.

KEYBOARD

There are four keyboard configurations available for the Model 82 terminal. The maximum configuration option is illustrated in Figure 2.

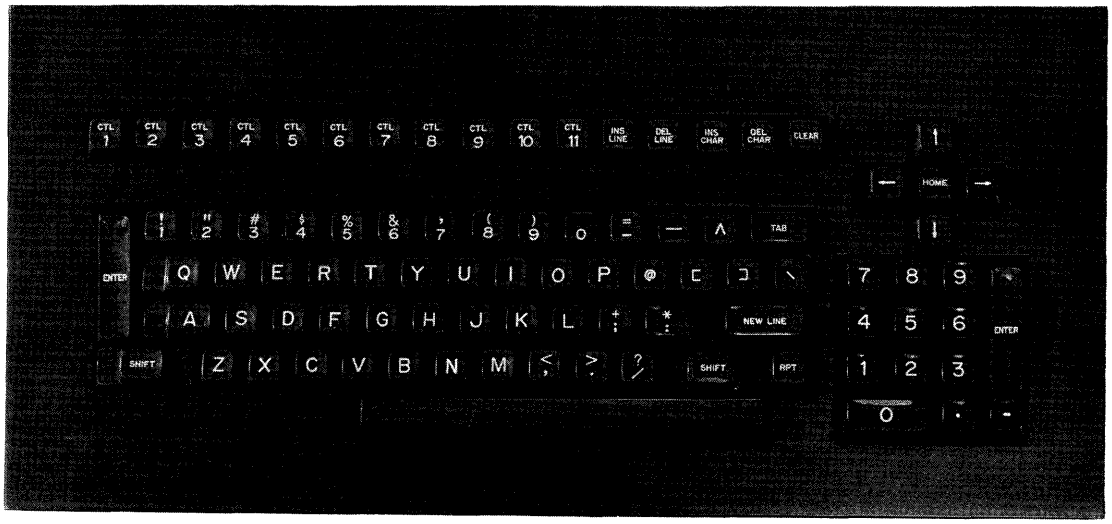

Figure 2. Model 82 Display Terminal Keyboard

Available keyboard options include a calculator-type numeric key pad and/or an expanded block of eleven control keys instead of the five provided in the standard configuration. The standard and optional configurations are illustrated in Figure 3.

A. Standard Keyboard.

B. Numeric Key Pad Option.

C. Eleven Control Key Option.

D. Combined Eleven Control Key And Numeric Key Pad Options.

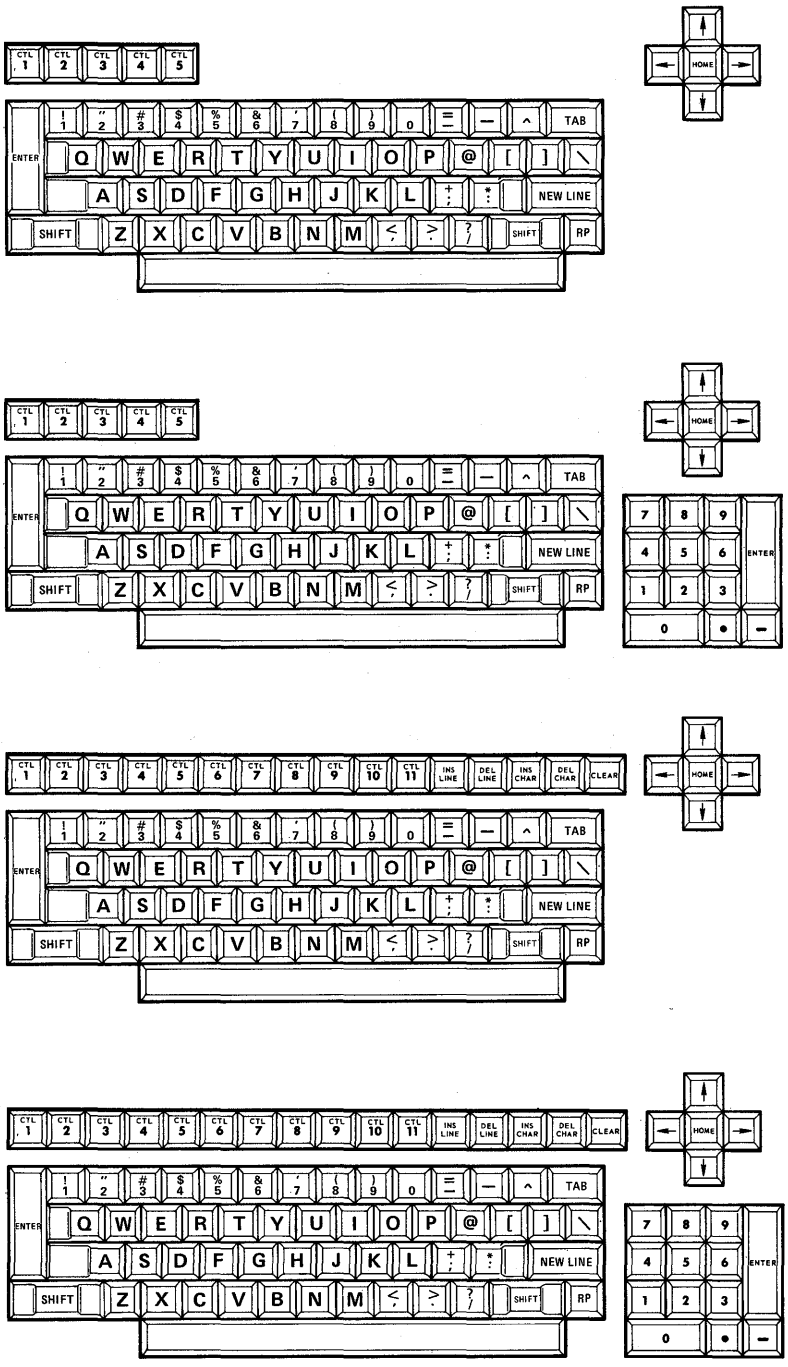

Figure 3. Model 82 Keyboard Configuration Options

The keyboard is functionally subdivided into four blocks; Alphanumeric, Display Edit Control, Program Control, and Numeric, as shown in Figure 4. For purposes of description, the alphanumeric keys are shown with reference numbers instead of their actual markings.

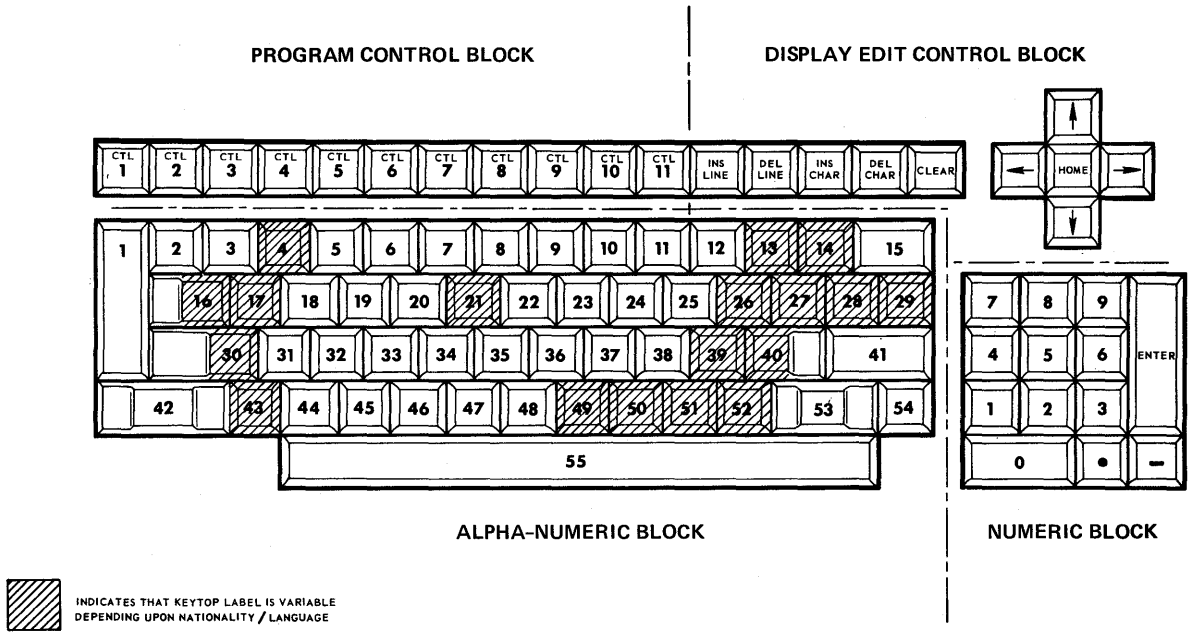

Figure 4. Model 82 Keyboard Functional Layout

Alphanumeric Block

This block contains 55 keys similar or identical to those appearing on a conventional typewriter keyboard. Of these, 49 have alphanumeric keytop labels. Of the 49 alphanumeric keys, 18 are subject to changes in keytop label configuration, depending on nationality/language. These may occur in one of the following nine configurations (see Table 2):

U. S. A.	Denmark/Norway
Germany/Austria/Switzerland	Sweden/Finland
France/Belgium	Spain/Latin America
United Kingdom/Netherlands	Portugal/Brazil
Italy	

Table 2. International Keyboard Character Variations

Alphanumeric Block Key No.	U.S.A.	Germany/ Austria/ Switzerland	France/ Belguim/	U.K./ Netherlands	Italy	Denmark/ Norway	Sweden/ Finland	Spain/ Latin America	Portugal/ Brazil
4	3 #	3 £	3 £	3 £	3 £	3 £	3 £	3 £	3 £
13	— —	± ±	— —	— —	— —	◇ ◇	◇ ◇	@ @	@ @
14	^ ^	o o	^ ^	^ ^	^ ^	‰ ‰	‰ ‰	^ ^	^ ^
16	Q Q	Q Q	A A	Q Q	Q Q	Q Q	Q Q	Q Q	Q Q
17	W W	W W	Z Z	W W	Z Z	W W	W W	W W	W W
21	Y Y	Z Z	Y Y	Y Y	Y Y	Y Y	Y Y	Y Y	Y Y
26	@ @	Ü Ü	@ @	@ @	@ @	Å Å	Å Å	]]	Õ Õ
27	[[	; +	[[	[[	[[	; +	; +	; +	; +
28	]]	: *	]]	]]	]]	: *	: *	: *	: *
29	\ \	— —	\ \	\ \	\ \	— —	— —	— —	— —
30	A A	A A	Q Q	A A	A A	A A	A A	A A	A A
39	; +	Ö Ö	M M	; +	M M	Æ Æ	Ä Ä	Ñ Ñ	Ç Ç
40	: *	Ä Ä	: *	: *	; +	ϕ ϕ	Ö Ö	[[	Ã Ã
43	Z Z	Y Y	W W	Z Z	W W	Z Z	Z Z	Z Z	Z Z
49	M M	M M	, <	M M	, <	M M	M M	M M	M M
50	, <	, <	. >	, <	. >	, <	, <	, <	, <
51	. >	. >	/ ?	. >	/ ?	. >	. >	. >	. >
52	/ ?	/ ?	; +	/ ?	: *	/ ?	/ ?	/ ?	/ ?

The remaining six keys in the alphanumeric block perform character entry control functions:

SHIFT — There are two of these keys, either of which provide access to a secondary character.

TAB — This key moves the cursor to the first position following the next protected field. If no such position exists between the present cursor position and the end of the screen, the cursor will move to the first unprotected position on the screen. Protected fields are further discussed in the Operating Procedures and Characteristics section of this manual.

RPT — This key is used for repeated entry of a particular character or for repeated movement of the cursor in any direction. The action is accomplished by depressing and holding the RPT key and then pressing (momentarily) the character or cursor control key.

NEW LINE — This key moves the cursor to the first unprotected position of the next lower display line. If the cursor is initially in the bottom line, and the terminal is in the PAGE mode, the top line is considered to be the next lower line. If the cursor is in the bottom line and the terminal is in the SCROLL mode, all lines on the display move up one line, old data contained in the top time is lost, and the cursor moves to the first position in the new bottom line which contains all spaces. The PAGE and SCROLL modes are further discussed in the Operating Procedures And Characteristics section of this manual.

ENTER — This key locks the keyboard from any further entry by the operator, and initiates reading of keyed data by the processor. In LINE READ mode, this includes all unprotected data from the first position of the line containing the cursor, to the character to the left of the cursor position. In a BLOCK READ mode, all unprotected characters from the first position of the first line to the character to the left of the cursor position are read. LINE and BLOCK modes are further discussed in the Operating Procedures And Characteristics section of this manual.

Program Control Block

Keys labeled CTL 1 through CTL 11 provide a capability for initiating eleven different programmed processor functions such as file record data retrieval, record add, record update, record delete, file record scan, etc. In addition, each of these keys performs an ENTER function in the same manner that the ENTER key does.

Display Edit Control Block

This block of keys provides the capability for controling the entry of data characters onto the CRT display. A blinking cursor is provided to indicate the character position that will be affected by the next entry from the keyboard.

Protected Display Fields

Any character position on the display screen may be protected against changes by the operator by preventing the cursor from stopping at that position. This is accomplished by means of use of appropriate format control codes in the program that generates the display. All protected characters are displayed at a lower intensity than unprotected characters.

Cursor Movement Controls

This group of keys permits movement of the cursor without affecting the current display of characters.

HOME — Moves the cursor to the first unprotected character position on the display.

→ — This is the CURSOR RIGHT key, which moves the cursor to the next unprotected position to the right of the present position. If there is no unprotected position to the right in the current line, the cursor moves to the first unprotected position in the next line below. If there are no unprotected fields in any succeeding lines, or if the current line is the bottom line of a display, the cursor moves to the first unprotected character position of the display.

←

This is the CURSOR LEFT key which normally moves the cursor to the next position to the left of the present position.

If the cursor is in the first position of a line, the next position to the left is the last position of the next line above. If the cursor is in the first position of the first line, the next position to the left is the last position of the bottom line. If the position to which the cursor would move is protected, the cursor position remains unchanged.

↑

This is the CURSOR UP key, which normally moves the cursor to the corresponding position in the next line above the present line. If the present line is the top line, the bottom line is considered to be the next line up. If the position to which the cursor would move is protected, the cursor tabs forward (right) to the next unprotected position.

↓

This is the CURSOR DOWN key, which normally moves the cursor to the corresponding position in the next line below the present line. If the present line is the bottom line, the top line is considered to be the next line down. If the position to which the cursor would move is protected, the cursor tabs forward (right) to the next unprotected position.

Display Edit Controls

These keys facilitate change or removal of data contained in unprotected fields of a display.

CLEAR

This key erases all unprotected data from the screen and moves the cursor to the first unprotected position on the screen. If a LOAD condition has been set (LOAD, LOCAL, and SELECTED indicators lit), or if the unit is in FORMAT mode, all protected and unprotected characters are erased and the cursor is moved to the leftmost position of the top line (HOME position).

INS LINE The INS LINE key causes all characters from the cursor position to the next protected field or the end of the bottom line on the screen (whichever occurs first) to move 80 positions to the right. As a character passes the end of a line, the first position of the next lower line is considered to be the next position to the right. Any characters which attempt to move into a protected field or off the end of the bottom line on the screen are lost. After character movement is finished, up to 80 positions (starting with the cursor position) contain spaces. The actual number of positions depends upon where the next protected field is located in relation to the cursor.

DEL LINE The DEL LINE key causes all characters from the cursor position to the next protected field, or the end of the bottom line on the screen (whichever occurs first), to move 80 positions to the left. As a character passes the first position in a line, the final position in the next higher line is considered to be the next position to the left. Any characters which attempt to move past the cursor position are lost. After character movement is finished, the end character positions involved (80 or less) contain spaces.

INS CHAR The INS CHAR key causes the character in the cursor position and all characters to the right, to the next protected field or the end of the line (whichever occurs first), to move one position to the right. The character originally in the rightmost affected position is lost. After the character movement is finished, the cursor position contains a space.

DEL CHAR The DEL CHAR key causes all characters to the right of the cursor, to the next protected field or the end of the line (whichever occurs first), to move one position to the left. The character originally in the cursor position is lost. After the character movement is finished, the rightmost affected position contains a space.

Numeric Block

The keys in this block are duplicates of numeric keys contained in the alphanumeric block. The numeric block facilitates entry of large quantities of numeric data since the keys are arranged in a pattern that is the same as the keyboard arrangement used on most adding machines and calculators.

During normal terminal operation, the keys in this block and their duplicates in the alphanumeric block may be used interchangeably. None of the keys in the numeric block are affected by the SHIFT key.

OPERATOR CONTROL PANEL

This panel (see Figure 5) is located on the front of the Model 82 monitor unit, and to the right of the display screen. It contains basic power and operating mode control switch/indicators, and certain status indicators.

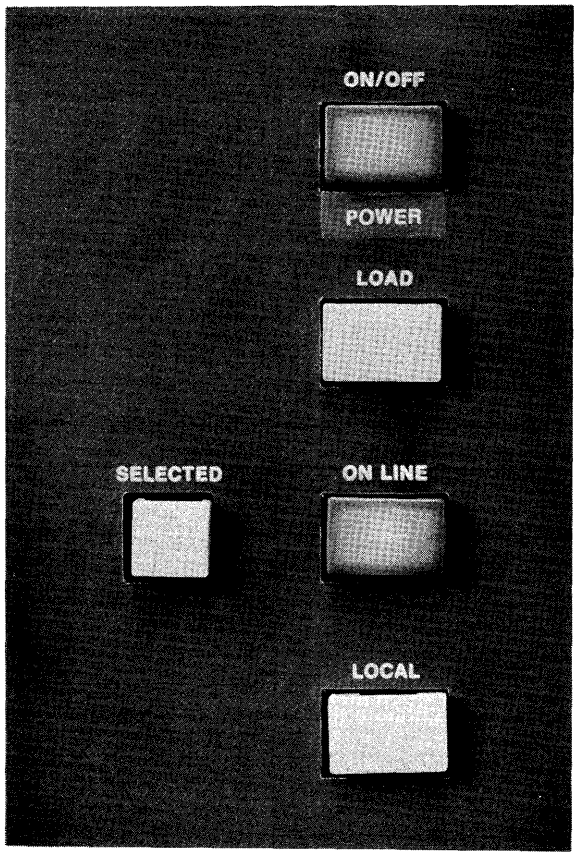

Figure 5. Operator Control Panel

Control/Indicator Descriptions

POWER ON/OFF — This is an alternate action switch and green indicator. The switch controls terminal power, and the indicator is lit when power is ON.

ON LINE — This is a momentary switch that includes a green indicator. When pressed, the switch establishes the terminal in the ON LINE mode so that communication with a processor can be conducted. The indicator is lit when the terminal is in the ON LINE mode.

LOCAL — This is a momentary switch that includes a white indicator. If the unit is in the ON LINE mode, pressing this switch will put the unit in the LOCAL mode, cause the ON LINE indicator to extinguish, and cause the LOCAL indicator to light.

LOAD — This is a momentary switch that includes a yellow indicator. It is pressed simultaneously with the LOCAL switch to initiate loading of a ten character program instruction into processor memory. The indicator is lit while the LOAD condition is set. The LOAD capability is restricted to terminals assigned to device address zero.

SELECTED — This is a yellow indicator which lights when the terminal is in communication with the processor for sending or receiving a message.

MISCELLANEOUS CONTROLS

Several operator accessible controls are located on the lower right side of the monitor unit frame and on the lower rear of the monitor unit frame (See Figure 6).

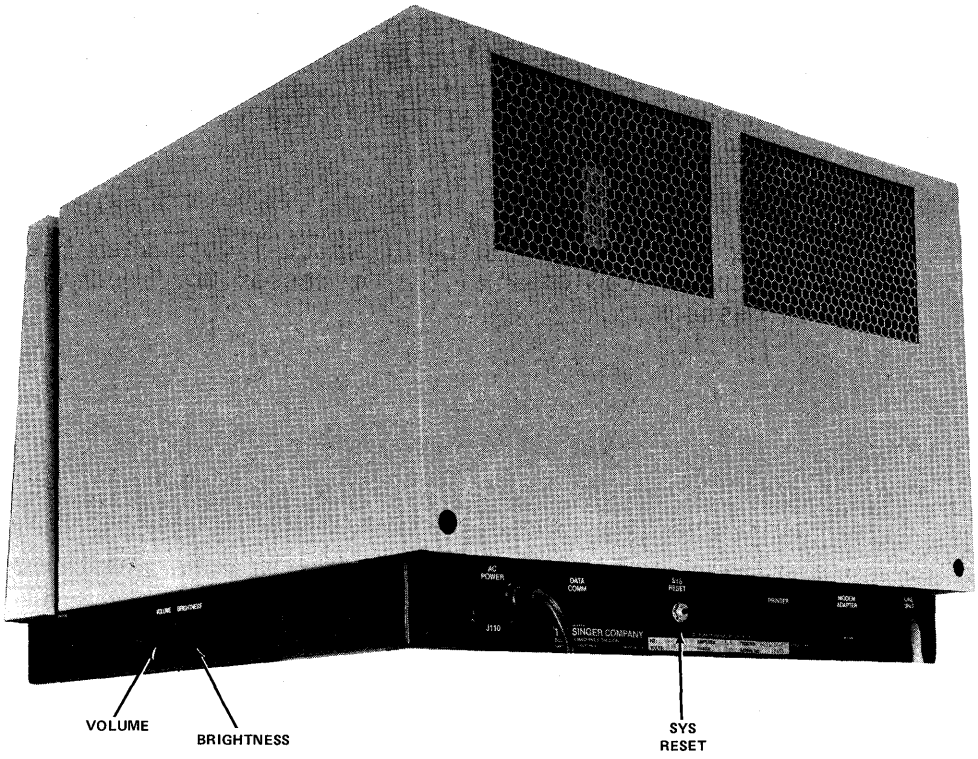

Figure 6. Miscellaneous Controls

VOLUME — Adjusts the volume of the error tone which sounds for one second when a keyboard entry is attempted while the keyboard is locked. This tone is also sounded in response to a control command issued by the processor.

BRIGHTNESS — Adjusts the intensity of all CRT display characters (protected and unprotected alike).

SYS RESET — This is a momentary switch that re-initializes the unit as though power had just been applied without erasing the CRT display. The keyboard becomes unlocked and the unit is placed in the LOCAL mode.

TYPICAL OPERATION SEQUENCES

The following paragraphs provide a general description of operations and procedures involved in a typical operating cycle for the Model 82 display terminal.

Power Turn-On

Power is applied to the terminal by pressing the POWER ON/OFF switch. The unit is initialized, the CRT display is blank with the exception of a blinking cursor in the HOME position, and the LOCAL indicator on the control panel is lit.

Establishment Of Terminal - Processor Communication

Direct communication with the processor is established by pressing the ON LINE switch.

Keyboard Data Entry And Transmission

Data intended for transmission to the processor is entered, via the block of alphanumeric keys and/or the special numeric key block, onto the CRT display. Arrangement of the display of data characters entered is accomplished by use of the keys in the display control block. Processing operations to be performed on data appearing in the display is initiated by pressing the ENTER key or one of the keys in the program control block. This intiates a request to the processor to read the data entry, and causes the keyboard to be locked against any further entry until READ has been completed.

Data Entry Formats

In normal usage, the arrangement of data displayed on the CRT screen is controlled by the processor program that is activated by the Model 82 terminal operator. In a WRITE operation, the processor program utilizes Model 82 terminal character and control codes to generate a CRT display in much the same manner as it is done from the keyboard. The general practice, therefore, is to have the program activated by the terminal operator generate a display that gives the operator detailed instructions as to what data to enter and how to enter it.

These instructions may take the form of a simple text message to state requirements and/or a display of data titles that is formatted to quide entry by the operator as required by subsequent processing. In arranging these input display formats, the generating program may make use of the PROTECT feature built into the Model 82 terminal. This feature prevents the display cursor from stopping at pre-designated character position on the display screen, such as those positions occupied by data entry field titles, message text areas, or any other area that the programmer wishes to protect from operator access.

Data Transmission

The dialogue between the processor and the display terminal is basically conducted in terms of the character and control code repertoire built into the terminal. This dialogue exchange takes place in direct fashion and without any special transformation of character and control codes of which the message is composed, and is conducted over direct cable connection of distances up to 2000 cable-feet.

MODES OF OPERATION

Communication Status Modes

During power turn-on, the Model 82 terminal comes up in LOCAL mode. In the course of operation, the terminal may be placed ON LINE or back to the LOCAL mode by means of switches on the control panel. When the SYS RESET switch at the rear of the terminal is pressed, the terminal will go to the LOCAL mode.

Local Mode

In this mode, the LOCAL indicator on the operator control panel lights and the terminal is normally prevented from sending or receiving text messages. Character entries for the display may be made from the keyboard, but these entries cannot be transmitted while the unit is in LOCAL.

On Line Mode

In this mode, the ON LINE indicator on the operator control panel is lit, the LOCAL indicator is extinguished, and the terminal can send or receive all messages.

Data Input/Output Modes

This category of operating modes is directly associated with the exchange of data between the terminal and the processor.

Keyboard Entry Mode

The terminal must be in this mode in order to enter data for transmission to the processor. If the terminal is in LOCAL, alphanumeric characters may be entered and displayed on the CRT. However, control commands intended for the initiation of data exchange with the processor will not be generated unless the terminal is ON LINE. When the ENTER key or one of the CTL keys are pressed, the keyboard locks and the terminal goes into the READ mode.

Read Modes

When the ENTER key or a CTL key is pressed, READ mode is established. The keyboard is locked and internal logic for the terminal is set to give a positive response to next Select Interrogation from the processor. At that point the data and/or control characters that make up the message text to be transmitted are transmitted to the processor. While the data transfer is in process, the SELECTED indicator is lighted. Upon completion, the SELECTED indicator extinguishes, the keyboard unlocks, and the cursor moves to the first unprotected position on the line below the last line of text transmitted from the display. The Model 82 terminal is capable of performing either a LINE READ or a BLOCK READ.

Line Read Mode. This is the normal mode of text transmission. The unit is placed in this mode at power turn-on, or when the SYS RESET switch is pressed. Only unprotected characters on the same line of the display as the cursor are transmitted. All unprotected characters between the beginning of this line and the character to the left of the cursor position are transmitted in sequence. The character at the cursor position is not transmitted.

Block Read Mode. In this mode, all unprotected characters from the home position to the character at the left of the cursor are transmitted in sequence. The character at the cursor position is not included. At the completion of the transmission, the unit is restored to the LINE READ mode. The terminal is normally placed in the BLOCK READ mode by means of a control command from the processor. It can also be accomplished via the terminal keyboard by simultaneously pressing the LOCAL switch, the ON LINE switch, and the CTL 7 key.

Write Mode

The Model 82 is placed in a WRITE mode when it accepts and processes the text that follows a Select Request from the processor. In this mode, the SELECTED indicator on the operator control panel is lit, and the keyboard is locked. Control commands are acted upon and data characters are displayed on the CRT screen. When the text transmission is completed, the SELECTED indicator is extinguished, and the keyboard is unlocked (provided that a KEYBOARD LOCK command was not sent by the processor.

Bootstrap Instruction Load

This mode is used by a display terminal operator to load, for immediate execution, a ten-character processor instruction. It may only be used at a terminal that is assigned the device address of zero. The instruction data entered is usually a command to the processor directing it to read input from some other input/output device such as a card reader, disc pack, or tape unit. The procedure for issuing the LOAD command is as follows:

Press the LOAD and LOCAL switches simultaneously.

Press the ON LINE switch.

Enter the instruction into the first ten positions of a line.

Press the ENTER key to initiate reading of the instruction by the processor and its subsequent response to that command.

Display Modes

These modes determine how data characters entered from the keyboard, or received in a text message from the processor, are displayed on the CRT screen. The two modes that control this are the SCROLL and PAGE modes.

Scroll Mode

At power turn-on and subsequently each time a Clear All command is received, the Model 82 is placed in the SCROLL mode. When character entries have been completed on the last line of the display, all data on the display moves up one line, the bottom line is made blank, and the cursor moves to the beginning of the bottom line where the next line of characters begins. The original top line of characters is deleted from the screen.

Page Mode

The PAGE mode is entered whenever one or more protected fields appear on the display and is continued until a CLEAR ALL command is received, or power is turned off. When character entries have been completed on the last line of the display, the cursor moves to the first unprotected character position in the top (first) line of the display where the next display line of new character entries commences.

Format Mode

This mode is used for the purpose of establishing a display of protected characters. It can be utilized either under processor control or via the terminal keyboard.

Under processor control, the mode is entered by means of FORMAT ON command. The beginning and end of a sequence of protected display characters are defined by PROTECT ON and PROTECT OFF commands, respectively.

At the keyboard, the mode is entered by simultaneously pressing the LOCAL switch, the ON LINE switch, and the CTL 2 key. The cursor is then moved to the first character position of the sequence to be protected. At that position, PROTECT ON is established by entering a left parenthesis character. This character is not displayed, but all subsequent character entries are displayed at diminished intensity. To delineate the right end of the protected field, PROTECT OFF is established by entering a right parenthesis character (which is not displayed). The FORMAT mode is terminated by simultaneously pressing the ON LINE switch, the LOCAL switch, and the CTL 6 key.

Error Tone

The Model 82 produces an audible error tone of one second duration. This tone occurs whenever a key on the terminal keyboard is depressed while the keyboard is locked.

GENERAL

This section provides information pertinent to the design of System Ten processor programs that maintain a dialogue with the Model 82 terminal.

CHARACTER SET

The set of ASCII codes that are applicable to the Model 82 terminal are given in Table 3, which shows six columns of information, and each column

Table 3. Model 82 Terminal ASCII Code Chart

BITS b7 b6 b5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1
b4	b3	b2	b1	ROW \ COLUMN	0	1	2	3	4	5
0	0	0	0	0			SP	0	@	P
0	0	0	1	1		DC1 (KBD LOCK)	!	1	A	Q
0	0	1	0	2		DC2 (BLOCK ON)	"	2	B	R
0	0	1	1	3		DC3 (FORMAT ON)	#	3	C	S
0	1	0	0	4		DC4 (KBD UNLCK)	$	4	D	T
0	1	0	1	5			%	5	E	U
0	1	1	0	6			&	6	F	V
0	1	1	1	7	BEL		'	7	G	W
1	0	0	0	8	BS (←)	CAN (CLEAR ALL)	((PROTECT ON)	8	H	X
1	0	0	1	9	HT (TAB)	EM (→)	) (PROTECT OFF)	9	I	Y
1	0	1	0	10	LF (NEW LINE)		*	:	J	Z
1	0	1	1	11			+	;	K	[
1	1	0	0	12	FF (CLEAR)	FS (↑)	,	<	L	\
1	1	0	1	13		GS (↓)	–	=	M	]
1	1	1	0	14		RS (HOME)	.	>	N	^
1	1	1	1	15		US	/	?	O	—

composed of sixteen levels. Within the System Ten computer, the only codes transferred in I/O operations are those shown in Columns 2, 3, 4, and 5, and all characters are represented by a six-bit derivation subset of the ASCII codes.

The System Ten six-bit character set is derived from the ASCII set by eliminating bit 6 (b6). This is illustrated below in the comparison of the ASCII code for the character "4" with the System Ten derivation:

ASCII							SYSTEM TEN					
b7	b6	b5	b4	b3	b2	b1	b7	b5	b4	b3	b2	b1
0	1	1	0	1	0	0	0	1	0	1	0	0

MESSAGE DIALOGUE

The Text message is composed of a series of data characters and appropriate display terminal control characters. In terminal-to-processor messages (READ operations), the text is composed almost entirely of display character codes. In Processor-to-terminal Transmission (WRITE operations), the text is composed of data character codes plus appropriate control codes which specify the physical arrangement of displayed characters. In terms of processor language, display data is specified by means of WRITE commands, while terminal control is specified by means of WRITE CONTROL commands.

In normal READ and WRITE operations, the codes for the characters shown in Columns 2, 3, 4, and 5 of the ASCII chart (Table 3) are directly translated as the characters they represent. The exception to this occurs when a WRITE CONTROL is executed. In this case, the codes for characters shown in columns 4 and 5 of the ASCII chart are converted to the ASCII codes for the control symbols which are listed in columns 0 and 1, respectively.

Whenever the terminal is in the FORMAT mode, the "(" and ")" characters are translated as PROTECT ON and PROTECT OFF commands, respectively. These commands are used in establishing protected fields in a CRT display.

Messages between the Model 82 terminal and the processor are handled by a Multi-terminal Input/Output Controller (MTIOC), which also handles communications with other peripheral input/output devices. In this environment, communications between the processor and the peripherals is conducted on a sequential service request interrogation basis. When, in the course of this "polling", a terminal with a service request is encountered, the processor response is a SELECT of the requesting terminal to READ the message text. Similarly, if the processor has a message for a terminal, it will SELECT that terminal for a WRITE operation.

Read Operation

If the terminal is in ON LINE mode, and is not currently in communication with the processor, a READ request may be initiated by pressing the ENTER key or one of the CTL keys. The keyboard is locked (electronically inhibited) to prevent further data entry, and the data in the Model 82 buffer is made available for transmission.

If the ENTER key is used to initiate the READ request, a Unit Separator (US) code is deposited in the buffer position occupied by the cursor, and the cursor is moved back to the first unprotected position in the line (if LINE mode) or screen (if BLOCK mode). The US code is not displayed.

If a CTL key is used to initiate the READ request, a special CTL key identifier is deposited in the buffer position occupied by the cursor, and a US code is deposited in the next sequential buffer position. Upon completion of the READ, Status Code 3 (FLAG) is passed to the processor. The CTL identifier codes are shown in Table 4. Neither the US code nor the CTL key code is displayed.

Table 4. CTL Key Identifier Characters

CTL Key	Identifier Character
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	:
11	;

During the READ operation, the character at the cursor position is transmitted to the IOC and the cursor then moves one position to the right. This is repeated until the position containing the US code is reached. The code is sent to the IOC and the READ is terminated. The US code is not passed to the READ instruction input area. Any unused locations in the READ instruction input area are filled with spaces, unless the READ instruction specifies NON-FILL.

If the processor READ instruction does not ask for enough characters from the Model 82 display buffer, the US code will not be cleared from the buffer. To insure that this does not happen, all READ instructions in the LINE mode must always ask for 80 characters, and all READ instructions in the BLOCK mode must always ask for 960 characters (12-line display) or 1920 characters (24-line display).

A processor READ instruction may be used by itself to directly initiate a READ operation, or the instruction may be used in conjunction with a BRANCH ON SERVICE REQUEST instruction. The first is referred to as a "program initiated" READ, and the latter is referred to as an "operator initiated" READ. The only difference between the two is that the program initiated READ is performed completely at the discretion of the processor program. Whereas an operator initiated READ cannot be performed until a READ request is initiated at the Model 82 terminal.

WRITE Operations

The transfer of message text from the processor to the Model 82 is accomplished by means of processor WRITE and WRITE CONTROL instructions. The WRITE instruction is used to transfer the actual data characters that are to be displayed. The WRITE CONTROL instruction also transmits character codes, but these are limited to a special set which the Model 82 interprets as control commands. These WRITE CONTROL codes are listed and described in Table 5.

Several WRITE CONTROL operations may be accomplished by a single instruction. For example, to clear the entire screen and position the cursor to start a protected field display at the tenth position of the top line, the following string of characters would be sent to the Model 82 by one WRITE CONTROL instruction:

XYYYYYYYYYS

If the actual characters to be displayed in this protected field were to be SINGER BUSINESS MACHINES, then the next instruction would be a WRITE instruction which carried the following character string:

(SINGER BUSINESS MACHINES)

Upon completion of the WRITE operation, the Model 82 automatically terminates the FORMAT mode established by the "S" character in the WRITE CONTROL instruction.

Table 5. Model 82 Write Control Command Information

Command Symbol	WRITE Control Character	Description
DC1	Q	Lock Keyboard.
DC2	R	Enable BLOCK mode.
DC3	S	Enable setting of protected fields. (FORMAT ON). Mode is automatically terminated when WRITE operation is completed.
DC4	T	Unlock Keyboard.
CAN	X	Clear screen of all protected and unprotected characters, clear all tabs, and remove print or print inhibit commands. Move cursor to HOME.
PROTECT ON	(	Sent via WRITE instruction during the FORMAT ON mode. Indicates first character of a protected field.
PROTECT OFF	)	Sent via WRITE instruction during the FORMAT ON mode. Follows the last character of a protected field.
BS	H	Cursor Left. Same as ← on keyboard.
EM	Y	Cursor Right. Same as → on keyboard.
FS	\	Cursor Up. Same as ↑ on keyboard.
GS	]	Cursor Down. Same as ↓ on keyboard.
RS	^	Cursor HOME function.
HT	I	Cursor TAB function.
LF	J	Cursor NEW LINE function.
FF	L	CLEAR unprotected data function.
	?	Local Query. Used to determine if the Model 82 is ON LINE. When this code is sent to a terminal that is not ON LINE, status codes 4 and 1 (Fault) are reported to the processor.

NOTE: For detailed descriptions of the functions effected by these codes, refer to Section 2 - Operator Controls And Indicators. The BLOCK READ mode and the FORMAT mode are described in Section 3 - Operating Procedures And Characteristics.

Bootstrap Instruction Load Operation

As described in Section 3, a LOAD condition can be initiated at a Model 82 terminal (whose device address is zero) by simultaneously pressing the LOAD and LOCAL switches on the Operators Control Panel.

The processor continously performs a periodic interrogation of address zero devices for a LOAD REQUEST. When the processor receives an acknowledgement to this interrogation from an address zero terminal, the processor responds with a READ CONTROL command to that terminal. At this point, the LOAD and LOCAL indicators are lit, and the cursor is moved to the first unprotected position on the screen.

When the terminal has been placed ON LINE, and the ENTER key or a CTL key is pressed, all characters to the left of the cursor (to a maximum of ten characters are read into locations 0000 through 0009 of the associated processor partition memory. Any of the ten locations that does not receive a character is filled with a zero.

The processor executes the bootstrapped instruction and, if the instruction does not include a branch, proceeds to location 0010 for the next instruction.

System Initiated Load Condition

When an ACU CHECK occurs, the processor automatically issues a READ CONTROL command to the address zero terminal, placing it into the LOAD condition. The operator responds to this as though the LOAD were initiated at the terminal. The terminal is placed ON LINE, the appropriate instruction is keyed into the display, and the ENTER or a CTL key is pressed. The bootstrap instruction used depends upon the particular software package in use.

Abnormal Load Request Situations

If a LOAD sequence is initiated at the Model 82 terminal while a READ operation is in progress, the READ is terminated, a FAULT status is posted, and the LOAD operation is performed.

If a LOAD sequence is initiated while the Model 82 terminal is in LOCAL and SELECTED for a READ, the READ is terminated, a FAULT status is posted, and the LOAD operation is performed.

Status Code Transmission

The Model 82 terminal transmits four status codes to the processor; 1 (Error), 2 (Normal), 3(Flag), 1 and 4 (Fault).

Error Status

This code is transmitted under any of the following conditions:

The display is filled with protected characters. When this occurs, the screen is cleared. If it occurs during a WRITE operation, characters received after the screen is cleared may be displayed starting at the HOME cursor position.

The ENTER or a CTL key is pressed setting a service request for the terminal, but the terminal is selected for a READ or WRITE operation before receiving a Service Request Poll. The terminal service request is cleared and the selected operation is executed.

The operator has initiated a READ operation, but the unit is selected for a WRITE instead of a READ following reception of the Service Request Poll and clearing of the unit's service request.

The terminal is in the PAGE mode and, during a READ operation, the cursor moves from the bottom line to the first unprotected position on the screen.

Flag Status

This code is transmitted under any of the following conditions:

One of the CTL 1 through CTL 11 keys has been pressed to initiate a READ operation.

The terminal is in the PAGE mode, and the cursor moves from the bottom line to the first unprotected position on the screen during a WRITE operation or because of a TAB, NEW LINE, CURSOR RIGHT, or CURSOR DOWN command in a Write Control instruction.

Fault Status

This code is transmitted under any of the following conditions:

While in the LOCAL mode, the terminal receives a "?" when selected for a Write Control operation.

A READ operation is terminated as part of a LOAD sequence.

SINGER
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