PRODUCT
DESCRIPTION
MANUAL
3154-02

MINI-TEC®
DATA-SCREEN®
Terminals

Model 1401
960 Character Display, 80 characters/line, 12 lines,

Upper Case Characters

Model 2401
1920 Character Display, 80 characters/line, 24 lines,

Upper Case Characters

Model 2402
1920 Character Display, 80 characters/line, 24 lines,

Upper/Lower Case Characters

INTERACTIVE
AND BLOCK MODE

OLDEST INDEPENDENT COMMERCIAL
CRT TERMINAL MANUFACTURER

December 12, 1978

$5.00

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SECTION I
INTRODUCTION

SYSTEM COMPATIBILITY

A variety of standard interface control features are offered by MINI–TEC Terminals to assure compatibility with most systems and display requirements. These terminals provide a versatile, economical input/output station. MINI–TEC DATA–SCREEN Terminals are readily adaptable to any standard computer system and may be connected directly to the computer or located remotely. These units are compatible with, and may replace Teletype® Models KSR 33 or KSR 35.

UNPACKING

MINI–TEC Terminals are carefully packed to insure safety during shipment. A sheet was attached to the outside of the carton, requesting inspection of the carton for possible freight damage. If you have not already done so, please inspect it at this point. Note any signs of damage on the bill of lading prior to unpacking. After the equipment is unpacked, inspect for missing parts or signs of damage that may have occurred during shipment. If any damage is found, note it on the bill of lading for possible claims at a later date. Also, any equipment that was roughly handled or dropped should be noted on the bill of lading for possible claims at a later date. Also, apparent, so that if damage is discovered later it may be claimed.

NOTE: *All claims for damage incurred in transit must be filed with the carrier.*

CONFIGURATIONS

MINI–TEC Terminals are available in three configurations:

DESK MOUNTING – See Figures 1 and 36.

This configuration includes monitor, logic and power supply mounted in a desk top enclosure.

RACK MOUNTING WITH MONITOR – See Figures 2 and 36.

In this configuration, monitor, logic and power supply are attached to a 12¼" (31.1 cm) high panel (cutout to accomodate tube face) which mounts in standard RETMA 19-inch (48.3 cm) racks. If two or more units are racked on top of one another, at least 1" of space should be provided between them to allow for proper cooling.

RACK MOUNT WITHOUT MONITOR

This configuration includes the logic and power supply attached to a frame without a front panel.

The following connections are provided at the back of each of the above units.

1. Power, 2 wires & ground
2. Keyboard input
3. Communication line, modem or direct connect
4. (Optional) composite video output for remote monitor
5. (Optional) output to local printer.

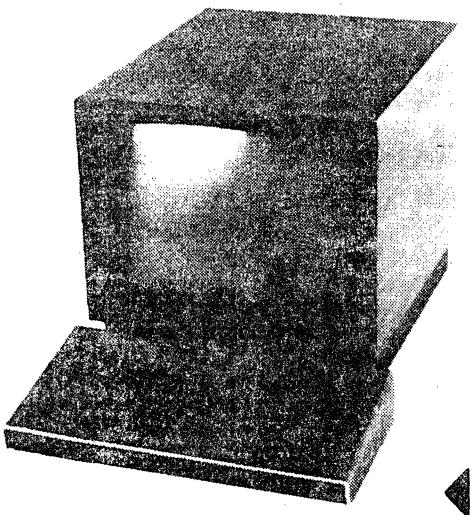


FIGURE 1. DESK TOP MODEL WITH EKA–8849

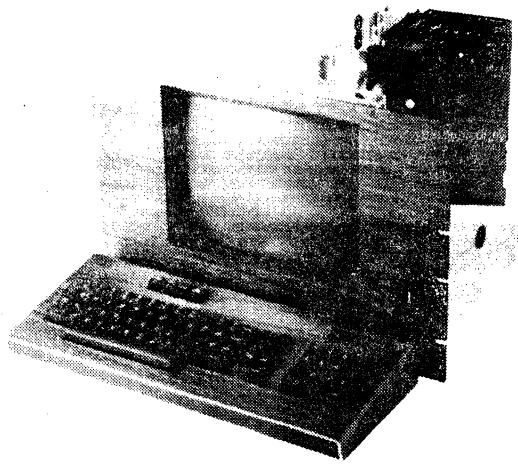


FIGURE 2: RACK MOUNT MODEL WITH EKA–8850

POWER AND SIGNAL WIRING

DATA–SCREEN Terminal wiring consists of an AC power cord which is included with the display and signal cables which are provided by the customer. For pin assignments of the I/O connector see page 8 and Figure 7 on page 9.

INSPECTION/POWER ON

Before connecting power to the terminal, perform the following checks:

1. Examine the unit for external damage.
2. Check for any remaining packing material, masking tape or any other foreign material. No packing material is used inside the desk mount terminal for shipment so it is not necessary to remove the enclosure cover. Should you wish to do so however, remove the back panel (secured with two ¼ turn fasteners, one on each side then pull back the two slide latches at the bottom rear corners, push the shroud forward, and lift straight up to remove. Remove the green ground wire secured with wing nut. [WARNING - This wire must be attached when shroud is replaced.] The rack mount version is of open construction and permits easy inspection before mounting in the rack frame. NOTE: *Power should not be connected to unit until inspection is complete.*
3. Visually inspect to assure that the unit is properly grounded via the power connector. A standard three-pin wall socket should be used. Where that is not possible, use a two-pin socket with proper ground wire attached and connected to ground.
4. Check the card rack for loose printed circuit boards.

For initial operation the following steps are required: (See Figure 4 for switch and connector locations.)

1. Depress the power switch located on the back panel to the OFF position.
2. Set 115/230 VAC selector slide switch, located on the power supply PCB to position matching power source (see Figure 4). Set 50/60 Hz selector switches on Timing Generator PCB (See Figures 10 and 11) to position matching source.
3. Plug the AC line cord into a three wire, grounded, 115 volt AC 50/60 Hz outlet.*
4. Connect the signal input cable to the 25 pin I/O connector.
5. If the unit has a keyboard, plug its connector into the 25 pin connector on the back panel.
6. Depress the power switch to the ON position. The unit will power up in either Local or Remote mode and the respective keyboard indicator will be illuminated.
7. After one minute of warm up, turn the brightness control (located under screen) clockwise until the "raster" appears, and then counter clockwise until it just disappears. If the Remote Indicator on the keyboard is illuminated depress the LOCAL key, forcing the terminal into local mode. At this time the operator will be able to enter characters onto the screen from the keyboard.

NOTE: *Leaving the brightness pot adjusted too high may result in damaging the phosphor of the CRT.*

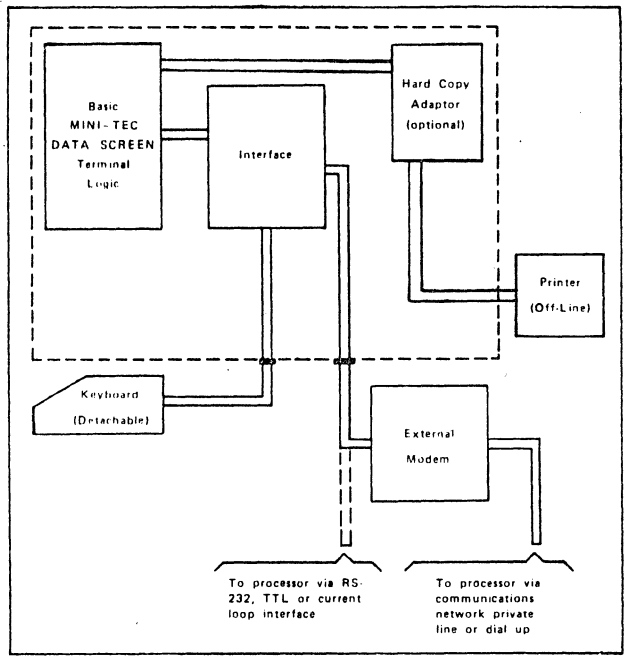
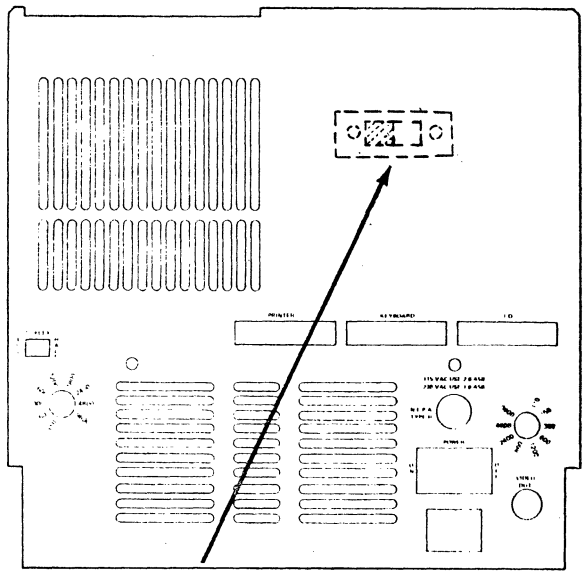


FIGURE 3. BASIC MINI–TEC TERMINAL



Removal of back panel and shroud provides access to 115/230 V selector switch which must be set to proper voltage before connecting power cord. Also see Figures 10 and 11 for switch settings on Timing Generator PCB's.

FIGURE 4. BACK PANEL CONNECTOR AND SWITCH LOCATIONS

SECTION II
OPERATING INSTRUCTIONS

KEYBOARD FAMILIARZATION

MINI–TEC DATA–SCREEN Terminals utilize the basic keyboard arrangement of a typewriter to simplify operator transition. To practice typing, turn on power, depress the LOCAL key, then depress the REPEAT key and simultaneously depress any displayable character key. Characters will appear on the screen from left to right. Near the end of a line an audible signal in the keyboard will sound (NOTE: *A switch will disable this feature if desired).* See Section III, Figure 14 and 15.

After the bottom line of the screen is filled, the cursor will return to the top line of the screen and begin writing over data on this line and the previously entered information will be lost unless Automatic Roll-Up is selected (discussed under "Line Feed," page 4).

Depress each of the standard alphanumeric keys and verify that the correct character is displayed on the screen. Depress the shift key and verify that all shiftable characters are displayed properly.

*If 230 volt operation is to be used, replace plug on power cable supplied with a listed plug for that service. Also, replace the 2-amp fuse with a 1 ampere slow-blow type.

KEYBOARD OPERATION

Most of the keys on the keyboard generate ASCII codes. These keys are classified as *character* keys or *function* keys. In order for the character to be displayed or the function performed, the code must be received by the terminal. This can be done three ways:

1. In LOCAL mode no codes are transmitted to the interface but an internal connection couples the terminal transmitter to the terminal receiver.
2. In half-duplex, the codes are sent over the interface and at the same time sent to the terminal receiver.
3. In full-duplex, the codes are sent to the interface only. The codes must be echoed back to the terminal by the processor or other device at the other end of the communication line.

Those keys which do not generate ASCII codes and their purpose are:

SHIFT KEYS – Cause keyboard circuitry to change the polarity of bit 5 of the outgoing data code if, and only if, the key is designated as a shiftable key. Shiftable keys are all keys that have two symbols on the keytop. Model 2402 provides lower case alpha characters and upper case in "shift."

CONTROL KEY – Used in conjunction with the keys that normally generate character codes, the control key causes bit 7 to be a logic Ø and therefore the code generated to be changed to those codes shown in columns Ø and 1 of the ASCII code set. This allows the keyboard to generate many additional codes. Most of the codes generated in this way are not used by the terminal, but may be used in communicating with the processor. The operator must hold down the control key simultaneously with a character key to generate a control code.

BREAK KEY – This key causes the communications line to go to the spacing level for as long as the key is depressed, if the terminal is in REMOTE mode. This key also is used to cause the optional Hard Copy Adapter to stop printing.

REPEAT KEY – When used in conjunction with another character or function key, the ASCII code for that character or function will be repeatedly transmitted (and displayed) at a maximum rate of 15 Hz. At transfer rates below 150 baud, the REPEAT function will occur as fast as the communication line allows. Data will not be transmitted when the terminal is in LOCAL mode.

LOCAL KEY – Switches the terminal to the LOCAL mode of operation. Allows data to be entered on the screen from the keyboard without being transmitted over the communication line. The transmitter and receiver external connections are disabled. An internal connection to couple terminal transmitter and receiver is enabled.

REMOTE KEY – Switches the terminal to the REMOTE condition. The transmitter and receiver external connections are enabled. If operation is in full-duplex, the internal connection between transmitter and receiver is disabled.

NOTE: All ASCII codes referred to in this manual are in hexadecimal notation. See code charts on page 9.

SHIFT LOCK – Depression of this key will lock the keyboard into "shift" mode (explained above) to release the keyboard from "lock" depress the 'shift' key.

TTY LOCK – (2402 only) Depression of this key will force the 2402 into upper case, teletypewriter mode. in 'TTY LOCK' mode the 2402 keyboard will become functionally equivalent to an EKA 8849 (or EKA 8850). See Figure 5. The special characters provided by a shifted P, K, L, N, and M on the EKA 8849 (or 8850) will likewise be provided by the EKA 8859 (or 8860) in 'TTY LOCK' mode.

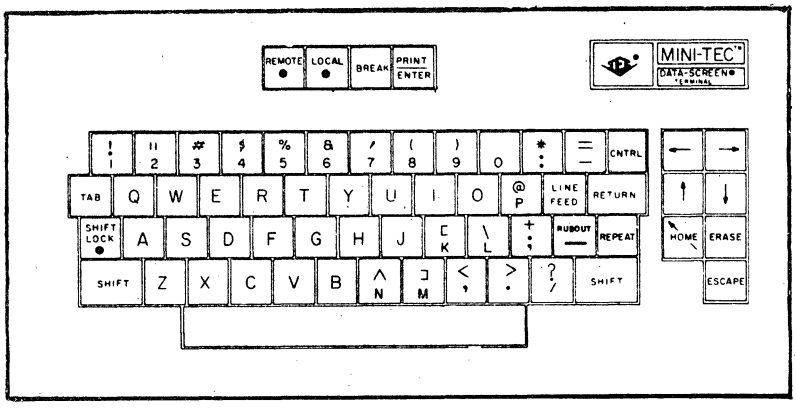


FIGURE 5 1401 & 2401 UPPER CASE MODELS – EKA 8849

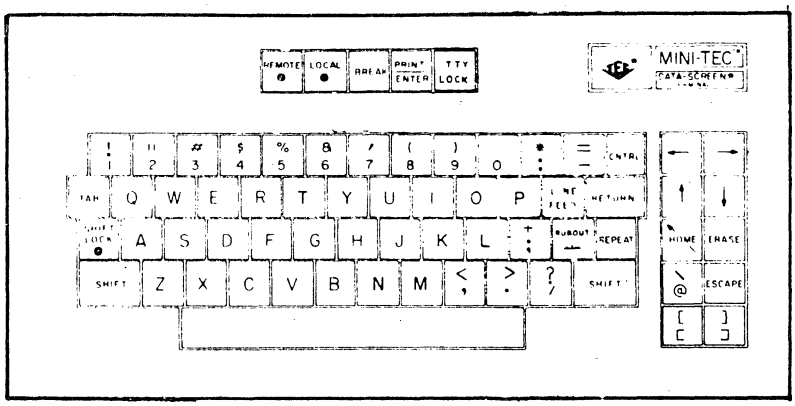


FIGURE 6. 2402 UPPER/LOWER CASE MODEL EKA–8859

CHARACTER KEYS

64 alphanumeric characters including punctuation marks and space are provided on the 1401 and 2401. These character codes are those contained in the center four columns of the ASCII code chart. 93 alphanumeric characters are provided on the 2402 and includes the 64 character set of the 1401 and 2401 in addition to the characters listed in the last two columns of the ASCII chart. (NOTE: *ASCII codes 7C, 7E & 7F on keyboard are displayed but not generated.)*

FUNCTION KEYS

Twelve function keys are provided. The function name or symbol, the ASCII code and the function description follow:

CURSOR CONTROLS – Five keys located on a pad to the right of the character keys control the movement of the cursor on the screen. The arrows on the keys indicate which direction the cursor will move when the key is depressed. The Repeat key can be used in conjunction with cursor control keys to speed cursor positioning.

HOME (code 1E)
Moves the cursor from any position on the screen to the top line far left column.

UP CURSOR ↑ (code ØB)
Moves the cursor up vertically one line, but remains in the same column. When on the top line the cursor will not move.

DOWN CURSOR ↓ (code ØA)
Same as Line Feed discussed below.

RIGHT CURSOR → (code 1F)
Moves the cursor right one character position. For various cursor wrap around applications see switch selectable features, Figure 14. When in the bottom line, extreme right column, the cursor will move to Home position, unless Automatic Roll-Up is enabled.

LEFT CURSOR ← (code Ø8)
Moves the cursor left one character position. Also functions as back space. When in the extreme left column, the cursor will not move.

RETURN KEY (code ØD)
Moves the cursor back to the beginning of the same line.

LINE FEED (same as ↓) (code ØA)
Moves the cursor down one line in the same column. If the cursor is on the bottom line, the cursor will go to the top line or, if the Roll-Up feature is selected, the cursor will not move, but all data on the screen will move up one line. Roll-Up causes the top line of data to be lost and the bottom line becomes blank. Models 2401 and 2402 MINI–TEC Terminals will roll-up at 9600 baud without the use of fill codes to allow time for the terminal to roll-up. Model 1401 MINI–TEC Terminals require fill codes to roll-up at higher baud rates. Any unused control code such as Null, Sync, Rub Out, etc. may be used as a fill. The fill codes must follow the Line Feed code to prevent loss of subsequent characters. The number of fill codes required is given in the table below:

BAUD RATE	MODEL 1401 NO. OF FILL CODES	MODEL 2401 & 2402 NO. OF FILL CODES
110	None	None
150	None	None
300	None	None
600	2	None
1200	4	None
1800	6	None
2400	8	None
4800	16	None
9600	32	None

RUB OUT (code 7F)
This code is not recognized by the terminal but may be used in communicating with the processor.

TAB (code Ø9)
Moves the cursor to the beginning of the next variable (unprotected) field. The cursor will go to the Home position if no protected field exists. A single protected character position will define a TAB stop.

ERASE (code ØC)
Will cause all unprotected characters to be erased and replaced with spaces starting at the cursor position and ending at the end of the page. The cursor will not move. Blinking format will be reset in the erased area. If LOCK is set, protected characters will also be erased.

CLEAR (code 1C)
Moves the cursor to Home and clears all data, both protected and unprotected. This code also resets start protect and start blink. The CLEAR code is the shifted erase code.

ESCAPE (code 1B)
Depressing this key instructs the terminal to interpret certain alpha codes immediately following the ESCAPE as functions. Any other code immediately following ESCAPE will be ignored. The function codes which must follow an ESCAPE are:

Lock (4C)	Start Blink (42)
Release (55)	End Blink (53)
Start Protect (50)	Load Cursor Address (46)
End Protect (43)	Read Cursor Address (52)

The two codes listed after the following functions must be received sequentially to cause that function. Example: Lock (Escape/L) is caused by receiving the Escape code followed by the "L" code. These functions are normally only performed by the computer. However, the operator may generate any of them in LOCAL mode by depressing Escape and then the proper alpha key. The functions of these codes are:

LOCK (Escape/L) forces the interface into full-duplex. This is to lock the keyboard if the computer does not echo back to the terminal. Lock also inhibits the format protect, allowing access to the protected fields.

RELEASE (Escape/U) allows half-duplex and enables protect.

START PROTECT (Escape/P) defines the beginning of protected data. All displayable characters sent to the terminal after a Start Protect will be protected even though the cursor may be repositioned during the sequence. Protected data is displayed at reduced intensity. The intensity of the protected data can be adjusted (see Switch Selectable Features, Section III).

NOTE: *If the last character in a line is protected, then during a block transmit the terminal will not transmit a CR at the end of that line. If transmit line is selected, the terminal will not stop at the end of the line. If the last character on the page is protected, the terminal will not transmit ETX.*

END PROTECT (Escape/C) terminates loading of protected data.

START BLINK (Escape/B) precedes a group of characters which will blink on the screen. All characters entered after Start Blink and before End Blink will blink even if the cursor is repositioned.

END BLINK (Escape/S) terminates the loading of blinking characters.

NOTE: Start Blink, End Blink, Start Protect, and End Protect do not occupy space in memory.

LOAD CURSOR ADDRESS (Escape/F) causes the next two codes received to be interpreted as the one's complement of the horizontal and vertical cursor address.

READ CURSOR ADDRESS (Escape/R) will cause the terminal to transmit two characters which are the one's complement of the horizontal, then the vertical cursor address.

NOTE: In Model 1401, RCA will not work in systems with either hardware or software echo-back. If you are operating in half-duplex the CPU should lock the keyboard (Escape/L), Read the address (Escape/R), then release the keyboard (Escape/U).

ENTER (code Ø2)
The ENTER key generates and transmits on the communication line the code Ø2 (ASCII STX) for use in control of the Block Transmit function. Block transmission is initiated when the terminal receives an STX (Ø2) or an EOT (Ø4). One of these two codes must be used as determined by a selector switch on the Control PCB (see Section III).

When the block transmission mode is initiated, the first character sent is the character at the cursor location. The cursor then moves to the next location and that character is sent. If two successive space codes (2Ø) are transmitted and the Space Code Delete function is selected (by a switch located on the Serial I/O PCB - see Section III) the following successive spaces on that line are skipped over and not sent, except that the last character on each line is transmitted. If the Space Code Delete function is not selected, all codes are transmitted.

Protected areas on the screen are skipped over and not transmitted unless the LOCK is set. A CARRIAGE RETURN code (ØD) is automatically inserted after the last character in a line and if the Transmit-to-End-of-Line function is selected transmission ends with the cursor located under the first character in the next line. NOTE: *If Transmit CR code at end of line is disabled Line Transmit Mode is also disabled and the terminal will be automatically forced into page or block mode. (See Figures 17 and 18).* If the Transmit-to-End-of-Page function is selected, an ETX code (Ø3) is inserted) after the last character on the last line and transmission ends with the cursor returned to Home.

Normal operation for the block transmission mode follows (See Table 1): The operator places the terminal in the local mode using the LOCAL key on the keyboard. The cursor is positioned to the desired beginning point of the message using the cursor controls. The message is typed and corrected until the operator is satisfied. The Transmit-to-End-of-Line, Transmit-to-End-of-Page switch located inside the terminal on the Motherboard PCB is set to the desired function (at the factory), and the Cursor is repositioned to the beginning of the message (usually HOME). NOTE: *Switch function may be changed on the location by removal of the back panel and shroud. When red toggle toward fan-Transmit-to-End-of-Page, when red toggle away from fan-Transmit-to-End-of-Line.* The operator initiates transmission of data by depressing the PRINT/ENTER key.

TABLE 1.

OPERATOR	TERMINAL	COMPUTER
1. Press LOCAL key	REMOTE Light Turns Off	———
2. Compose	Displays Data On Screen	———
3. Home Cursor	Displays Data On Screen	———
4. Press PRINT/ENTER key	a. REMOTE Light Turns On	———
	b. Transmits Ø2 Code*	Receives 02 Code*
5. ———	Transmits Message** (Half Duplex)	Receives Message

*If terminal is set to transmit on receipt of Ø4 code, computer must echo Ø4 code before transmission of data occurs.

**For full duplex, computer must echo Ø2 or Ø4 code depending on the terminal's configuration before transmission of data occurs.

The Block Transmit function may also occur as follows (See Table 2): The operator follows the same procedure as described above. The terminal transmits an Ø2 code when the ENTER key is depressed or the operator types a programmed instruction to the processor such as ESC, or any other code or group of codes that the keyboard can generate at the programmer's option. (See Communications Code Chart Page 9). The computer receives the Ø2 code or other prearranged query and reserves a buffer for the incoming data. When the computer is ready, it transmits either an Ø2 code or an Ø4 code (depending upon which code has been selected on the Control PCB) to the terminal. The terminal then transmits the message.

TABLE 2.

OPERATOR	TERMINAL	COMPUTER
1. Press LOCAL key	REMOTE Light Turns Off	———
2. Compose Message.	Displays Data On Screen	———
3. Home Cursor	Displays Data On Screen	———
4. Press PRINT/ENTER key or remote and prearranged code	a. REMOTE Light Turns On	Receives Code(s)
	b. Transmits Ø2 Code or Prearranged Code	
5. ———	Receives Ø2 or Ø4 Code	Reserves Buffer and Transmits Ø2 or Ø4.
6. ———	Transmits Message	Receives Message

If, in local mode, the terminal is set to transmit on STX (see switch selectable features) then the generation of STX (Control/B) from the keyboard is an invalid operation. If set to transmit an EOT, then Control/D is an invalid operation. If these codes are generated from the keyboard, in local mode, the cursor may disappear. To restore the cursor it is necessary to cycle the terminal's AC power off and on using the back panel power switch.

A number of options are available to the programmer in using the block transmission function. The computer may send a message to the operator for verification and, if needed, the operator may update it and transmit the message to the computer in its latest form using one of the sequences described above. In addition, the computer may be programmed to handle a portion of the cursor repositioning, if desired, by using the Load Cursor function.

PRINT KEY (code 12)
Generates a shifted ENTER code and causes a signal to be sent to the optional Hard Copy Adapter. If there is no printer the code is ignored. If the printer is connected and turned on, a Hard Copy of the screen display (starting at the cursor location and ending at the end of the screen) is produced.

BELL [Control/G] (code Ø7)
The computer may signal the operator by sending a BEL code to the terminal interface and causing the audible signal located in the keyboard to sound. The terminal also generates an audible signal when the cursor moves from the 68th character position to the 69th character position of any line.

CANCEL [Control/X] (code 18)
The cancel function terminates a block transmit in progress when the code is received.

NOTE: *If lower case alpha codes in columns 6 & 7 of the code chart (Figure 9) are received by the 1401 and 2401, they will be stored as the corresponding uppercase code in columns 4 & 5. The one exception is Rub Out (7F) which will be ignored. On the 2402 alpha codes in columns 6 & 7 are displayed as lowercase. Three additional keys are provided on the 2402 to generate the upper and lower case set. These keys are located in the cursor control pad (see Figure 6).*

OPERATION OF THE INTERFACE

The interface forms the communications link between the basic DATA–SCREEN Terminal, the keyboard, and a full or half duplex asynchronous communications line or modem with a speed range of 110 to 9600 baud.

FULL OR HALF-DUPLEX

Operation mode may be switch-selected by the operator to either full-duplex or half-duplex. In full-duplex the keyboard and serial transmitter serve as an independent unit driving the "transmit" side of the communications line. The serial receiver and the basic display are driven by the "receive" side of the communications line. In order to record keyboard data on the screen in full-duplex mode, the processor at the other end of the communications line must "echo" the character back via the "receive" line.

In half-duplex operation, an internal connection is made to receive directly any character transmitted as well as receive any character arriving via the communication line. Thus, any character typed will appear on the screen without "echoing" the character externally. However, if a character is generated internally at or near the same time as one is received via the communications line, the result will be garbled with the bits of both characters OR'ed together.

LOCAL–REMOTE

The operator may keyboard-select remote or local operation. In remote operation the interface operates as described previously. When the terminal is set in the local mode, all three transmitting interfaces are forced to the "Marking" condition, the external receiver line is disabled and the unit is forced into half-duplex regardless of the position of the communications-mode switch. The local condition is used primarily for checkout of the display, for operator training and for generating messages for block transmit operation.

OUTGOING SIGNAL

The interface will accept keyboard codes, serialize them, add the proper control and parity and place them on the outgoing signal lines. See the Keyboard Data Code Chart for the codes that can be generated by the keyboard and transmitted by the SERIAL I/O PCB.

The "break" key on the keyboard does not generate a code, but causes the outgoing signal to go to the "Spacing" level for as long as the key is depressed. (RS-232: +8V; TTL: +5V; Current Loop: open circuit).

BAUD RATE SWITCH FEATURE

A baud rate switch is provided which allows rapid selection of one of nine pre-set baud rates between 110 and 9600 baud. The switch is located on the back panel of desk mount and rack mount MINI–TEC DATA–SCREEN Terminal displays. See Figure 4. For adjustment procedure, see page 24.

DESCRIPTION OF THE INTERFACE

TERMINAL CONNECTORS PROVIDED AT REAR OF TERMINAL

(For the part number of the mating connectors and hoods see page 36.)

CONNECTOR/ FUNCTION	NO. OF PINS
I/O to/from CPU or Modem	25
Printer Option (Hard Copy Adapter)	25
Keyboard	25

TABLE 3

KEYBOARD CONNECTOR SIGNAL DEFINITIONS

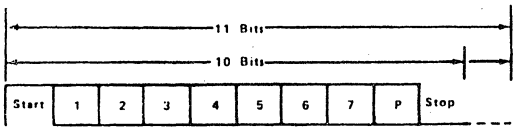
Pin assignment for keyboard connector (NC = No Connection)

PIN	NAME	PIN	NAME
1 & 2	+5V Power to Keyboard	14	$\overline{\text{TRANSMIT}}$
3	-12V Power to Keyboard	15	NC
4	EN KBD	16	$\overline{\text{BREAK KEY}}$
5	NC	17	$\overline{\text{BELL}}$
6	BIT 1	18	$\overline{\text{LOCAL}}$
7	BIT 2	19	NC
8	BIT 3	20	$\overline{\text{KBD ACK}}$
9	BIT 4	21	NC
10	BIT 5	22	NC
11	BIT 6	23	NC
12	BIT 7	24 & 25	GROUND
13	NC		

A slide-lock arrangement is provided on the keyboard cable connector for secure attachment of the keyboard cable to the keyboard connector on the rear of the terminal.

INTERFACE DATA TRANSFER BIT SEQUENCE

The following bit sequence is used for the transmitted and received data on all interfaces. Each character is composed of a 10 or 11-bit word as shown.



The bit sequence on the communications line is left to right in the diagram shown at left. The stop bit may have a minimum length of "one" or "two" bit times and the parity bit may be "even," "odd," or "mark" (bit time is dependent on) data transfer rate).

NOTE: Stop bits and parity are pre-set to customer specification, but may be field changed by moving a switch connection. See Figures 17 and 18.

Unless otherwise specified, 110 Baud units will be set for 11 bit word-length, and all other speeds will be set for 10 bit word-length at time of manufacture and final inspection.

INTERFACE CONNECTOR SIGNAL NAME AND FUNCTIONS

Pin Assignment for I/O Communications Connector (NC = No Connection)

PIN	NAME	PIN	NAME
1	Frame Ground	14	N C
2	RS-232 Transmit Data (EIA)	15	N C
3	RS-232 Receive Data (EIA)	16	N C
4	Request to Send (EIA)	17	N C
*5	Clear to Send (EIA)	18	Terminal busy (For use with HCA)
6	N C	19	N C
7	Signal Ground	20	Data Terminal Ready (EIA)
8	Carrier Detect (EIA)	21	N C
9	TTL Transmit Data	22	N C
10	TTL Receive Data	23	N C
11	+20 mA (for use with current loop interface)	24	Current loop Transmit Data (–)
12	Current loop Transmit Data (+)	25	Current loop Receive Data (–)
13	Current loop Receive Data (+)		

*If system does not provide "CTS" signal, tie pins No. 4 and 5 together.

EIA INTERFACE (RS-232-C)

Nominal specifications of the interface are:

TRANSMITTER

Voltage Levels
Marking: −8V nom.
Spacing: (Logic 0) +8V nom.

RECEIVER

Input Impedance: 5000 ohms nom.
Marking Level: +1.4 to −15
Spacing Level: +2.2 to +15V
Open circuit interpreted as mark

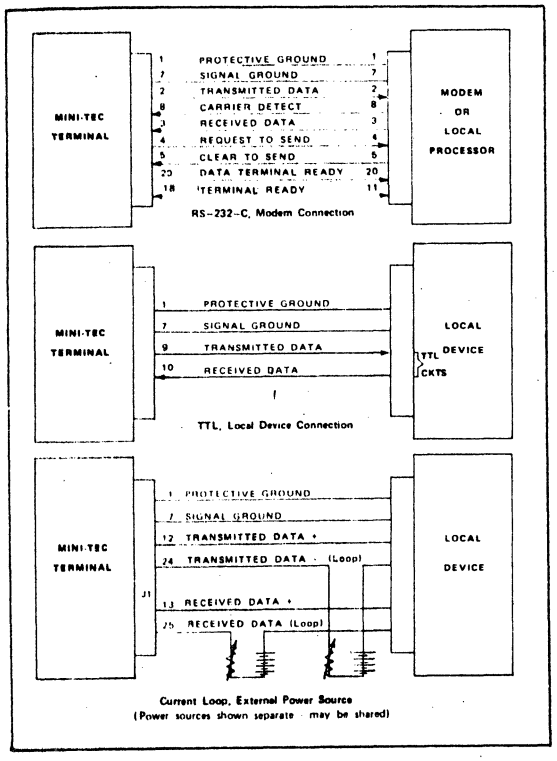


FIGURE 7 TYPICAL INTERFACE CONNECTIONS

TTL INTERFACE

The TTL interface shares the basic timing and other characteristics of the normal RS-232 interface (previous section). The voltage levels, however, are normal TTL levels:

Marking Level: 0.22V to 0.8V, +0.3V nominal
Spacing Level: +2.4 to +5V, +3V nominal

CURRENT LOOP INTERFACE

The Current Loop interface shares the basic timing and other characteristics of the normal RS-232 and TTL interfaces described above. The marking and spacing conditions, however, are not voltage levels but rather represent contact closures as follows:

		Current Min.	Current Max.
Marking Condition:	"Closed contacts"	12 mA	100 mA
Spacing Condition:	"Open contacts"	zero	0.1 mA
Voltage Drop at 20 mA:	Receiver	1.0 V typ.	
	Transmitter	1.0 V typ.	

TTL AND CURRENT LOOP INTERFACE REQUIREMENTS

When operating with a TTL or Current Loop interface the system must provide the terminal with a Clear-To-Send signal at RS-232/C voltages. If the system does not provide a CTS signal, pins 4 and 5 of the I/O connector must be tied together. This jumper ties the terminal's Request-To-Send line to the Clear-To-Send line.

CODE CHARTS

For explanation of symbols, see page 10.

b7	b6	b5	b4	b3	b2	b1	row \ column	0	1	2	3	4	5	6	7
			0	0	0	0	0	NUL	DLE	SPACE	0	@	P	\	p
			0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
			0	0	1	0	2	(STX)	(DC2)	"	2	B	R	b	r
			0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
			0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
			0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
			0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
			0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
			1	0	0	0	8	(BS)	CAN	(	8	H	X	h	x
			1	0	0	1	9	(TAB)	EOM	)	9	I	Y	i	y
			1	0	1	0	10 (A)	(LF)	SUB	*	:	J	Z	j	z
			1	0	1	1	11 (B)	(VT)	(ESC)	+	;	K	[	k	{
			1	1	0	0	12 (C)	(FF)	(FS)	,	<	L	\	l	|
			1	1	0	1	13 (D)	(CR)	GS	-	=	M	]	m	}
			1	1	1	0	14 (E)	SO	(RS)	.	>	N	^	n	~
			1	1	1	1	15 (F)	SI	(US)	/	?	O	_	o	▒

( ) indicates codes generated by Keyboard function keys

FIGURE 8 KEYBOARD HEXADECIMAL CODE CHART

b7	b6	b5	b4	b3	b2	b1	row \ column	0	1	2	3	4	5	6	7
			0	0	0	0	0			SPACE	0	@	P	\	p
			0	0	0	1	1			!	1	A	Q	a	q
			0	0	1	0	2	STX	Print	"	2	B	R	b	r
			0	0	1	1	3			#	3	C	S	c	s
			0	1	0	0	4	EOT		$	4	D	T	d	t
			0	1	0	1	5			%	5	E	U	e	u
			0	1	1	0	6			&	6	F	V	f	v
			0	1	1	1	7	BEL		'	7	G	W	g	w
			1	0	0	0	8	←	CAN	(	8	H	X	h	x
			1	0	0	1	9	TAB		)	9	I	Y	i	y
			1	0	1	0	10 (A)	LF↓		*	:	J	Z	j	z
			1	0	1	1	11 (B)	↑	ESC	+	;	K	[	k	{
			1	1	0	0	12 (C)	Erase	Clear	,	<	L	\	l	|
			1	1	0	1	13 (D)	CR		-	=	M	]	m	}
			1	1	1	0	14 (E)		Home	.	>	N	^	n	~
			1	1	1	1	15 (F)		→	/	?	O	_	o	▒

FIGURE 9 COMMUNICATIONS HEXADECIMAL CODE CHART

EXPLANATION OF SYMBOLS

Used on Keyboard and Communications Code Charts, Page 9

SYMBOL	EXPLANATION
STX	Start of Text. Sent by terminal when Print/Enter key is depressed. Starts Block Mode transmission when received if terminal is so configured (See EOT).
EOT	End of Transmission. Starts Block Mode transmission when received if terminal is so configured.
BEL	Bell Code. Sounds audible signal in keyboard when received.
BS (or ←)	Back Space. Moves the cursor left one character position. When in the extreme left column the cursor will not move when the BS Code is received.
TAB	Field Tab Code. Moves the cursor to the beginning of the next variable (unprotected) field. The cursor will go to the Home position if no protected field exists. A single protected character position will define a Tab stop.
LF (or ↓)	Line Feed Code. Moves the cursor down vertically one line, but remains in the same column. When on the bottom line, the cursor will move to the top line, same column or cause roll-up (See Roll-Up option description on page 4).
VT (or ↑)	Reverse Line Feed Code. Moves the cursor up vertically one line, but remains in the same column. When on the top line, the cursor will not move when this code is received.
FF	Erase Code. Will cause all unprotected characters to be erased and replaced with spaces starting at the cursor position and ending at the end of the page. The cursor will not move. Blinking format will be reset in the erased area. If lock is set, protected characters will also be erased.
CR	Carriage Return Code. Moves the cursor to the left column on the same line.
DC2	Print Code. Causes a signal to be sent to the optional printer interface. If there is no printer the code is ignored. If a printer is connected and turned on, a hard copy of the screen is produced.
CAN	Cancel Code. Will terminate a block transmit when the code is received.
ESC	Escape Code. Conditions the terminal to interpret certain alpha codes immediately following the Escape as functions. Any other code immediately following Escape will be ignored.
FS	Clear Code. Will erase the entire screen and the cursor will go to Home. Protected format will also be erased.
RS (or ↖)	Home Code. Moves the cursor to the first position of the top row.
US (or →)	Forward Space Code. Moves the cursor right one character position. When in the right column the cursor will move to the extreme left column of the line below. When in the bottom line extreme right column, the cursor will move to Home position.
ALPHA NUMERIC CHARACTERS	Displayable symbols in columns 2 thru 7 of the ASCII standard code chart. (Codes in columns 6 and 7, except RUBOUT, will be recognized as the corresponding upper case codes in columns 4 and 5 by the 1401 and 2401.)
RUB OUT	Rub Out or Delete Code. When key is pressed, ASCII Delete code is transmitted to communications line. No terminal display or function occurs.

SECTION III

SELECTABLE FEATURES

Model 1401 MINI–TEC Terminals have five standard printed circuit cards; Models 2401 and 2402 terminals have six standard printed circuit cards. The table below lists the PCB's for each model, their description, and the card position.

Printed Circuit Board Description	Card Position	Part Number		
		Model 1401	Model 2401	Model 2402
Timing Generator	1	930208	930310	930310
Memory	2	930171	930248-000	930248-001
Counter	3	930207	930334	930334
Control	4	930335	930335	930335
Serial I/O	5	930247-000	930247-001	930247-001
Hard Copy Adapter Parallel (Optional)	6	930201-001	930201-001	930201-001
Hard Copy Adapter Serial (Optional)	6	930201-002	930201-002	930201-002
Character Generator (2401 or 2402 Only)	7	none	930243-0X0 or 930311-0X1	930311-0X1

BACK PANEL SWITCH SELECTIONS

Six switch selectable features are located on the back of MINI–TEC Terminal. See Figure 4.

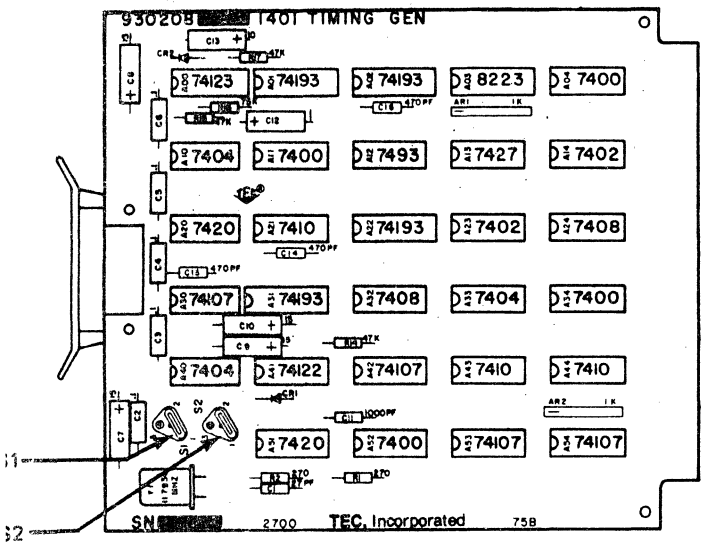
1. Power on/off rocker switch
2. Full-Duplex/Half-Duplex selector switch
3. Transmit Page/Transmit Line selector switch (red toggle on motherboard, facing monitor)
4. 115 or 230 volt selector switch (located behind back panel)
5. Baud rate selector switch, the upper of the rotary switches. This switch designates the transmit and receive baud rates.
6. Optional split baud rate/HCA baud rate selector switch. See Section IV, OPTIONAL EQUIPMENT.

PRINTED CIRCUIT BOARD SWITCH SELECTIONS

All models have the following switch selectable features:

Select 50 or 60 Hz refresh rate
Enable or disable end of line audible signal
Initiate block transmission on EOT or STX
Enable or disable space code delete
Enable or disable parity for I/O communication
Select odd or even parity for I/O communication
Select 10 or 11-bit code for I/O communication
Select RS-232, current loop or TTL receive interface
Enable or disable clear-to-send delay
Enable or disable roll-up
Enable or disable auto transmission of CR
Select cursor wrap around

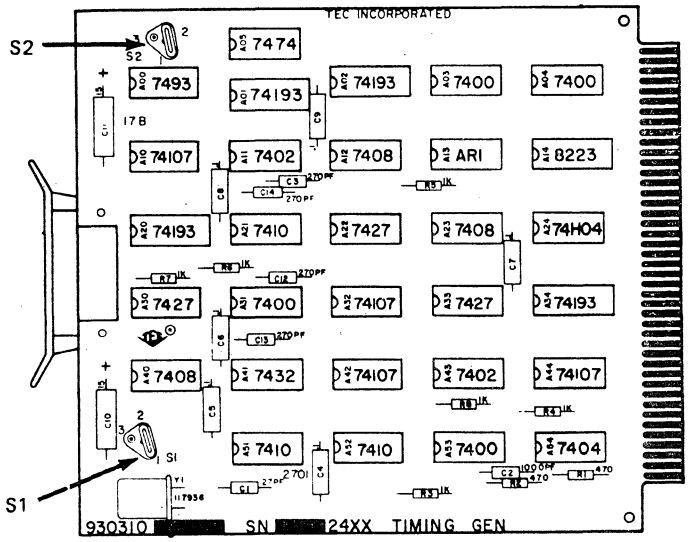
Figure 10 through 19 show the switch locations of the options on their respective Printed Circuit Boards.



SWITCH FUNCTION CHART		
SWITCH	POSITION	FUNCTION
S1 & S2	1-2	SELECT 60HZ OPERATION
	1-3	SELECT 50HZ OPERATION

FIGURE 10
SWITCH SELECTIONS ON MODEL 1401 TIMING GENERATOR PCB

Due to our continuing efforts to improve our products, our PCB assemblies are changed more often than our manuals are up-dated, therefore this figure may not exactly match your PCB although switch numbering is marked on the PCB and the selectable features are the same.



SWITCH FUNCTION CHART		
SWITCH	POSITION	FUNCTION
S1	1-2	SELECT 60HZ OPERATION
	1-3	SELECT 50HZ OPERATION
S2	1-2	SELECT UPPER CASE CHARACTERS ONLY
	1-3	SELECT UPPER AND LOWER CASE

FIGURE 11 SWITCH SELECTIONS ON MODELS 2401 AND 2402 TIMING GENERATOR PCB

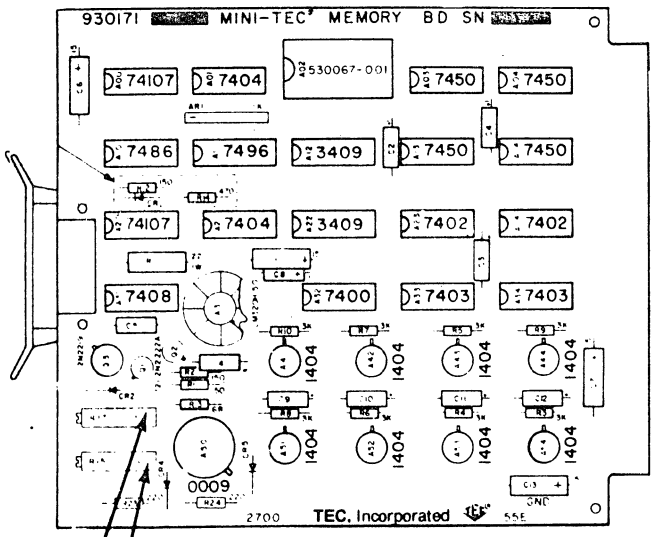
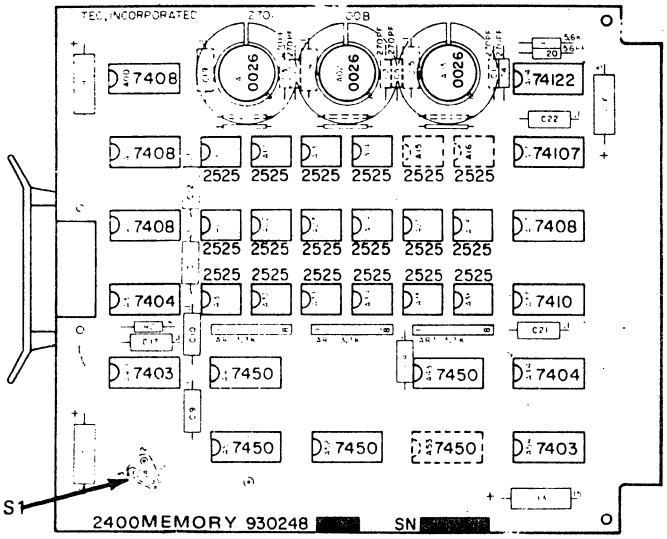
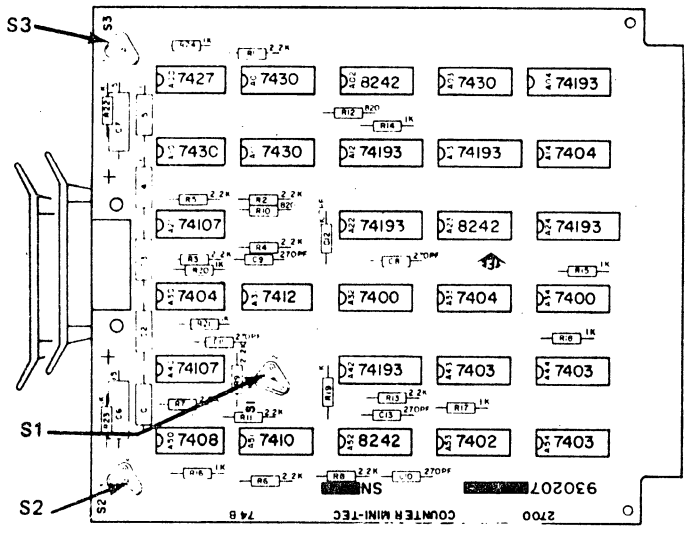


FIGURE 12 PROTECTED DATA INTENSITY ADJUSTMENT ON MODEL 1401 MEMORY PCB



SWITCH FUNCTION CHART			
SWITCH	POSITION	FUNCTION	
S1	1-2	Select Upper Case Only	FOR -001 ONLY
	1-3	Select Upper and Lower Case	

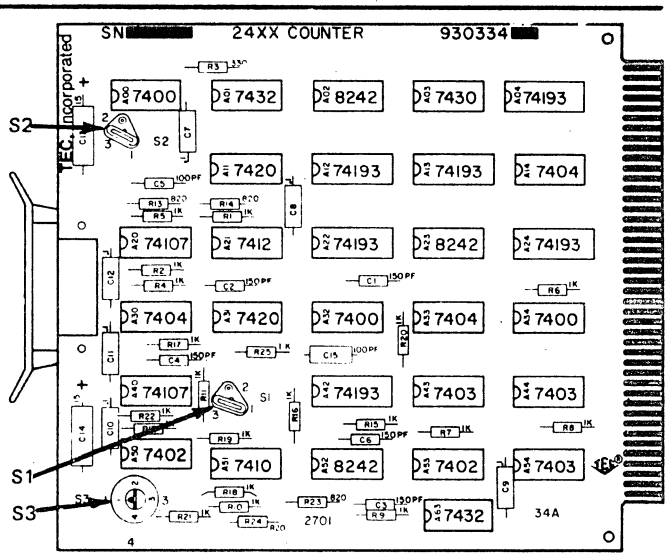
FIGURE 13 UPPER/LOWER CASE SELECTION ON 2402 MEMORY PCB (-001 ONLY)



SWITCH FUNCTION CHART			
SWITCH	POSITION	FUNCTION	
S1	1-2	DISABLE	END OF LINE AUDIBLE SIGNAL
	1-3	ENABLE	
S2	1-2	ENABLE	ROLL-UP
	1-3	DISABLE	
S3	1-2	ENABLE	CURSOR STOP AT END OF PAGE
	1-3	DISABLE	

FIGURE 14 SWITCH SELECTIONS ON MODEL 1401 COUNTER PCB

Due to our continuing efforts to improve our products, our PCB assemblies are changed more often than our manuals are up-dated, therefore this figure may not exactly match your PCB although switch numbering is marked on the PCB and the selectable features are the same.



SWITCH FUNCTION CHART			
SWITCH	POSITION	FUNCTION	
S1	1-2	DISABLE	ROLL-UP
	1-3	ENABLE	
S2	1-2	DISABLE	END OF LINE AUDIBLE SIGNAL
	1-3	ENABLE	
S3	1	DISABLE CURSOR STOP AT END OF PAGE	
	2	ENABLE CURSOR STOP AT END OF PAGE	
	3	ENABLE CURSOR STOP AT END OF LINE	
	4	NOT USED	

FIGURE 15 SWITCH SELECTIONS ON MODELS 2401 AND 2402 COUNTER PCB

Due to our continuing efforts to improve our products our PCB assemblies are changed more often than our manuals are up-dated, therefore this figure may not exactly match your PCB although switch numbering is marked on the PCB and the selectable features are the same.

SWITCH FUNCTION CHART			
SWITCH	POSITION	FUNCTION	
S1	1-2	SELECT BLOCK RECEIPT OF EOT	TRANSMIT ON (ASCII 04)
	1-3	SELECT BLOCK RECEIPT OF STX	TRANSMIT ON (ASCII 02)

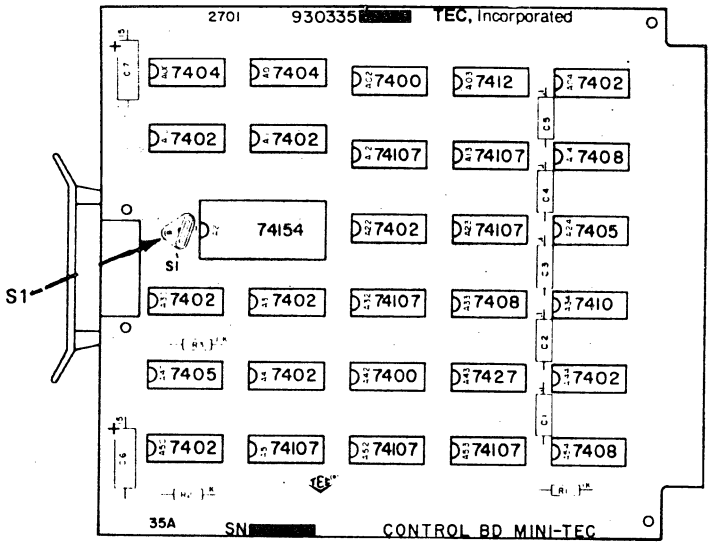


FIGURE 16 SWITCH SELECTIONS ON MODELS 1401, 2401, and 2402 CONTROL PCB

SWITCH FUNCTION CHART			
SWITCH	POSITION	FUNCTION	
S1	3	11 BIT	CHARACTER LENGTH SELECT
	4	10 BIT	
	6	DISABLE	PARITY
	7	ENABLE	
	9	EVEN	PARITY SELECT
	0	ODD	
S2	3	ENABLE	XMIT CR CODE AT END OF LINE
	4	DISABLE*	
	6	ENABLE	SPACE CODE DELETE
	7	DISABLE	
	9	ENABLE	CLEAR TO SEND DELAY
	0	DISABLE	
S3	1	RS-232	INTERFACE SELECT
	2	20-60mA CURRENT LOOP	
	3	TTL	
	4	NOT USED	
1401 - Cut foil between A & B			
240X - Jumper between A & B			

*ALSO DISABLES LINE TRANSMIT MODE.

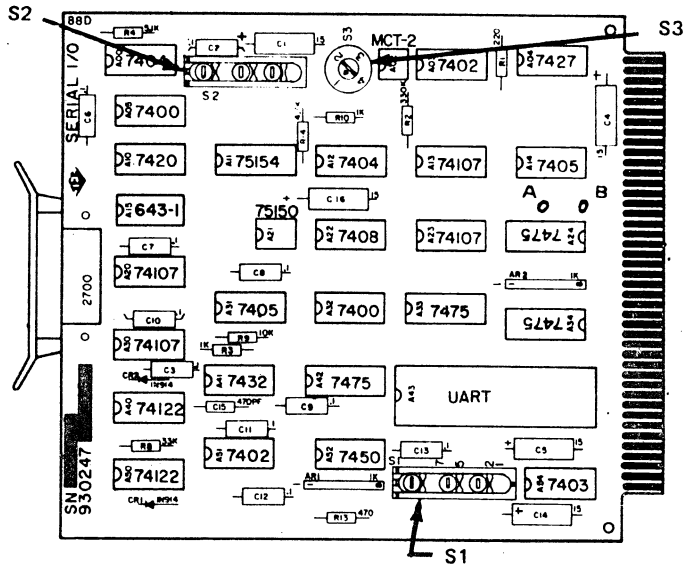
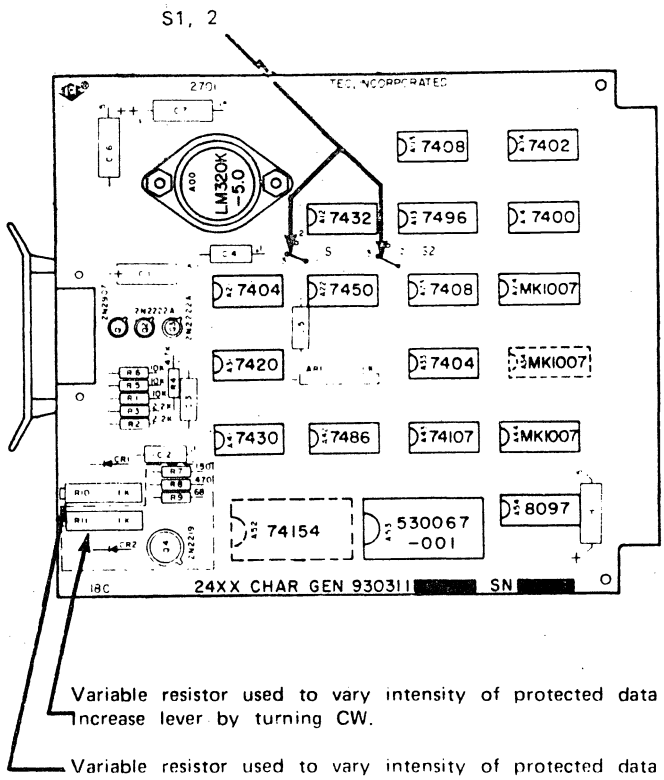


FIGURE 18 SWITCH SELECTIONS ON MODEL 2401/02 SERIAL I/O



SWITCH FUNCTION CHART			
SWITCH	POSITION	FUNCTION	
S1,2	1-2	Select Upper and Lower Case	FOR -OXI ONLY
	1-3	Select Upper Case Only	

FIGURE 19 PROTECTED DATA INTENSITY ADJUSTMENT ON MODELS 2401 AND 2402 CHARACTER GENERATOR PCB

Due to our continuing efforts to improve our products, our PCB assemblies are changed more often than our manuals are up-dated, therefore this figure may not exactly match your PCB although switch numbering is marked on the PCB and the selectable features are the same.

SECTION IV
OPTIONAL EQUIPMENT

SPLIT BAUD RATE SWITCH

The split baud rate switch is an option which may be added at any time to any MINI–TEC Terminal. Card cages provided with MINI–TEC Terminals are pre-drilled and pre-punched for the split baud-rate switch, and the back plane mother-board has provision for the cable. The back panel is also pre-drilled for the "Receive" rate switch. Retrofit may be done at the factory for an additional charge. If you desire both the split baud rate and Serial Hard Copy Adapter Options please contact TEC Sales Department.

The split baud rate switch assembly (TEC part no. 980077) is used with the standard baud rate switch to allow the terminal to transmit over the communication line at one baud rate and to receive from the communication line at a different baud rate. The use of the split baud rate option requires the terminal to operate in the full-duplex mode. The switch located below the duplex switch is used for the transmission rate, and the other switch, for the receive rate.

The optional split baud rate switch allows rapid selection of one of nine preset baud rates between 110 and 9600 for the receive baud rate. The standard baud rate switch allows rapid selection of one of nine pre-set baud rates between 110 and 9600 for the transmit baud rate. The split baud rate switch option includes: printed circuit board; switch; oscillator circuits; mounting hardware and cable to connect the assembly to the terminal's mother board wiring.

NOTE: *When installing optional split baud rate assembly, the jumper between "A" & "B" on the standard baud rate assembly must be removed.*

The following speeds are standard:

POSITION		BAUD RATE	POSITION		BAUD RATE
ccw	1.	110		6.	1800
↑	2.	150	↓	7.	2400
	3.	300		8.	4800
	4.	600	cw	9.	9600
	5.	1200			

The baud rate oscillator circuits are discussed under Theory of Operation, page 24.

OPTIONS

KEYBOARDS WITH 15 KEY PAD (EKA–8850 AND EKA–8860)

An expanded version of the standard keyboard containing a 15-key pad (10 numeric keys, four symbol keys and one function key) is available as an option on MINI–TEC DATA–SCREEN Terminals.

The 15-key pad is arranged much like a 10-key adding machine to allow quick and simple entry of numerical data by the operator.

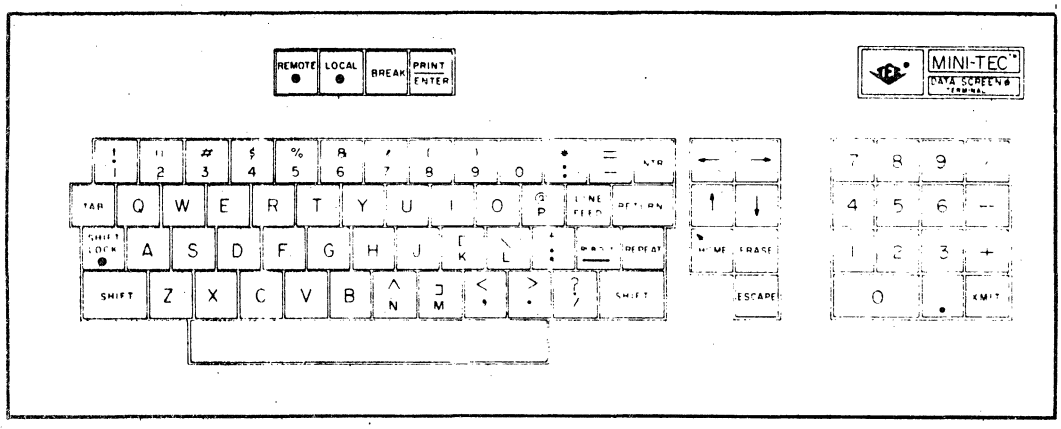


FIGURE 20 EKA 8850 - (UPPER CASE VERSION FOR MODELS 1401 AND 2401.)

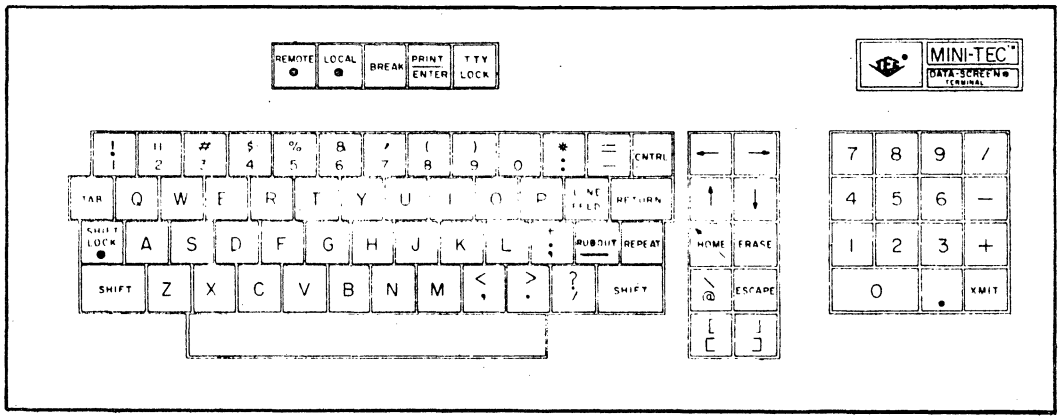


FIGURE 21 EKA 8860 - (UPPER AND LOWER CASE VERSION FOR MODEL 2402.)

OPTIONS

COMPOSITE VIDEO OUTPUT

A second video circuit is available to drive a remote monitor. This driver combines the serial video data with cursor video, the protect memory bit (for reduced intensity,) and with vertical and horizontal syncs to produce NTSC composite video and sync for a remote monitor. The composite video is provided at a BNC connector on the rear panel.

If the composite video output feature is not specified when the unit is ordered, a kit, part number 980079 for the 1401 and number 980073 for the 2401 and 2402, is available to add this feature later.

OPTIONS

HARD COPY ADAPTER INTERFACE DESCRIPTION

There are two Hard Copy Adapter (HCA) options available for the MINI–TEC Terminal; A parallel HCA (Assembly No. 980074) which is compatible with most printers using a "Ready/Strobe" type interface; and a Serial HCA (Assembly No. 980075) used with RS-232C, current loop, or TTL interfacing.

The Serial HCA uses an additional outboard oscillator assembly which allows the printer baud rate to be readily adjustable from the back panel of the terminal. The split baud rate option and the serial hard copy adaptor cannot be specified together without deviating from standard mechanical design. If both Serial HCA and Split Baud Rate options are required, contact TEC's Sales Department.

The HCA initiates printing upon receipt of the print command (ASCII 12) from the keyboard or from the communications line and halts when the CRT screen has been outputed or when the BREAK key is depressed.

On receipt of the print code the HCA sends signals to other areas in the terminal, disabling the keyboard and communications line inputs, and also disabling protect which allows all data appearing on the screen (protected or unprotected) to be printed.

The HCA also provides an RS-232C signal called Terminal Ready to the communications connector pin 18. This signal goes to a positive level when the HCA is outputting to the printer.

The following paragraphs on Parallel & Serial operation assume that all inputs and outputs to and from the printer and the HCA are "true high." However, most of the inputs and outputs to and from the HCA are polarity selectable by switch.

NOTE: The hard copy adapter must be ordered with the MINI–TEC or installed at the factory because of the fixturing necessary to install the connections.

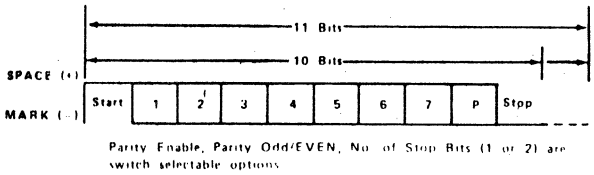
PARALLEL OPERATION

If the Parallel/Serial selector switch is in the Parallel position and ACK and PRINTER READY are "true," and if printer BUSY and the optional print inhibit line are false, the strobe line will be pulsed presenting the first character to the printer, upon receipt of the Print Command. The first character outputed will be an ASCII carriage return followed immediately by an ASCII line feed followed by the character appearing in the present cursor location. The cursor will then advance through the data on the CRT screen at a rate determined by the data ACK line. A carriage return code and a line feed code will be sent at the end of each line of data. After the whole page has been transmitted to the printer the cursor will return to the Home position, and the keyboard and communication line and protected data will be enabled.

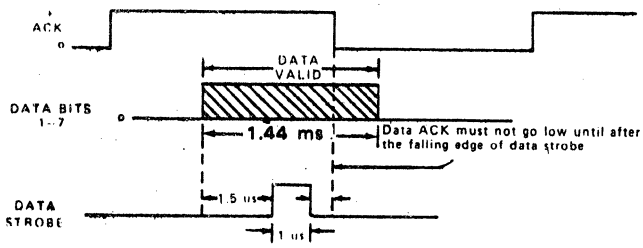
The strobe generated by the HCA can be self-terminating or interactive, see Figure 22 and 23 below. The self terterminating or interactive strobe are offered as switch options.

SERIAL OPERATION

If the Parallel/Serial selector switch is in the serial position; "Printer Ready" is true, and "Printer Busy" and the optional print inhibit line are false, ASCII data will be outputed from the serial data ports (RS-232, Current Loop, TTL), upon receipt of the Print Command. The first character outputed will be a carriage return followed by a line feed, followed by the character appearing in the present cursor location. The cursor will then advance through the data on the CRT screen at the selected baud rate - (110 to 9600). A carriage return and line feed code will be outputed at the end of every line up to and including the last line. After the whole page has been transmitted to the printer the cursor will return to the home position, and the keyboard and communication line and protected data will be enabled. The Data Set Ready and Carrier Detect control signals are held at an RS-232C "True" level all the time. Also, the Printer may interrupt data-flow by exercising the Printer Busy input.

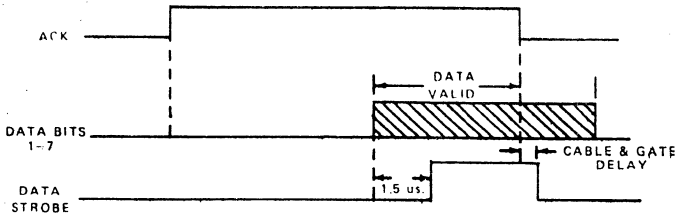


Parity Enable, Parity Odd/EVEN, No. of Stop Bits (1 or 2) are switch selectable options



Minimum of 1.44 ms between data strobes, this is the time required as a minimum, but it may be greater depending on printer print rate.

FIGURE 22 SELF TERMINATING STROBE

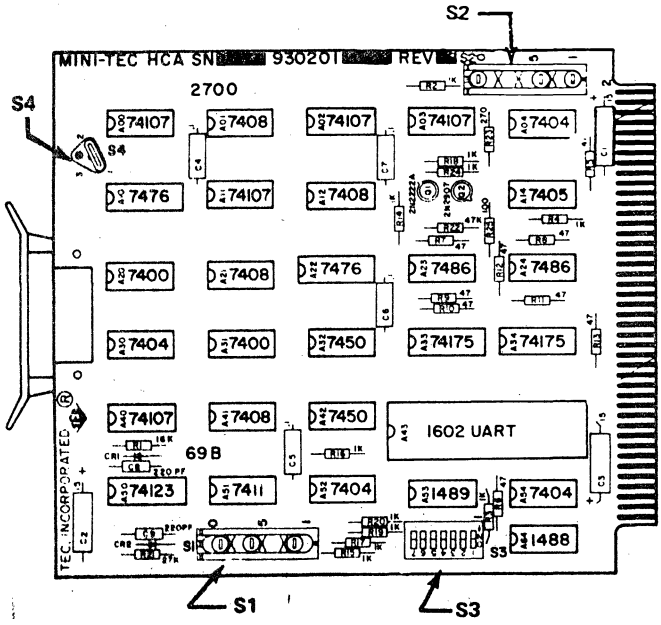


1.44 ms is the maximum transfer rate. Data Strobe will remain high until ACK falls.

FIGURE 23 INTERACTIVE STROBE

MINI–TEC TERMINAL PARALLEL/SERIAL INTERFACE CONNECTOR

CONNECTOR	SIGNAL NAME	SOURCE	SIGNAL DESCRIPTION
PIN 1	FRAME GND	HCA	SIGNAL GND
PIN 2	TRANSMITTED DATA RS-232-C	HCA	(–V) is a MARK (+V) is a SPACE
PIN 4	TTL DATA	HCA	(+V) is a MARK (0V) is a SPACE
PIN 5	TTL DATA	HCA	(0V) is a MARK (+V) is a SPACE
PIN 6	DATA SET RDY	HCA	Held at a (+V) RS-232-C level.
PIN 7	SIGNAL GND	HCA	SIGNAL GND
PIN 8	Carrier DETECT	HCA	Held at a +V RS-232-C level.
PIN 9	DATA BIT 1	HCA	DATA BITS 1-7 are TTL outputs driving through a 47 ohm resistor. Polarity switch selectable.
PIN 11	PRINTER BUSY	PRINTER	RS-232-C or TTL level when true halts HCA output until BUSY goes FALSE.
PIN 12	20 mA Current Loop	HCA	Current flowing = MARK No current flow = SPACE
PIN 13	DATA BIT 2	HCA	See DATA BIT 1
PIN 14	PRINTER RDY	PRINTER	RS-232-C or TTL level Polarity selectable at HCA
PIN 15	DATA BIT 3	HCA	See DATA BIT 1
PIN 16	HCA INHIBIT	PRINTER	Rs-232-C or TTL level Polarity selectable at HCA. Inhibits Print Command. Will not stop print after printing initiated. i.e. cannot be used as a busy input.
PIN 17	DATA BIT 4	HCA	See DATA BIT 1.
PIN 18	HCA RDY	HCA	TTL level true when HCA outputting.
PIN 19	DATA BIT 5	HCA	See DATA BIT 1.
PIN 21	DATA BIT 6	HCA	See DATA BIT 1.
PIN 22	ACKNOWLEDGE	PRINTER	INPUT pulled up to +5V with 1K Resistor See Parallel interface description. Polarity selectable at HCA.
PIN 23	DATA BIT 7	HCA	See DATA BIT 1.
PIN 24	DATA STROBE	HCA	TTL Level driving through a 47 ohm resistor Polarity selectable at HCA. See Parallel interface description.



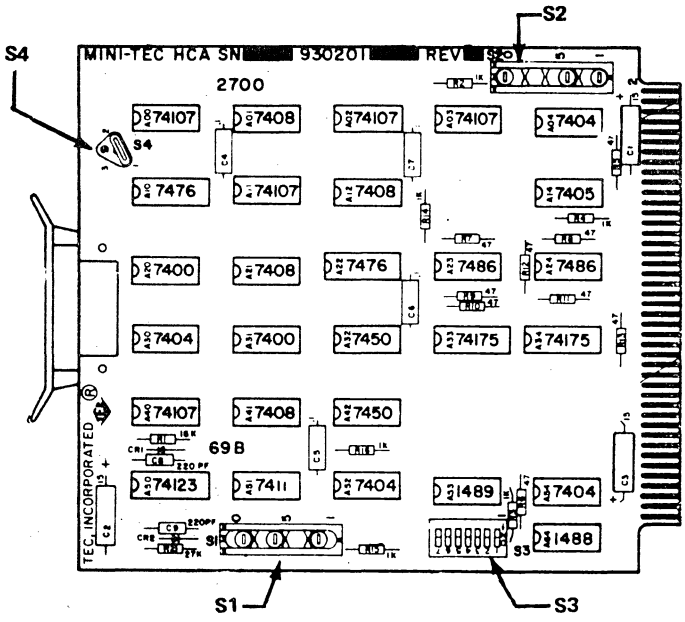
SWITCH SETTINGS
(Serial only)

SWITCH FUNCTION CHART				
SWITCH	POSITION		FUNCTION	
S1*	1		PRINTER READY NEGATIVE	
	2		PRINTER READY POSITIVE	
	6		BUSY NEGATIVE	
	7		BUSY POSITIVE	
	9		OPTIONAL DISABLE NEGATIVE	
	0		OPTIONAL DISABLE POSITIVE	
S2*	1		ACK POSITIVE	PARALLEL OPERATION ONLY
	2		ACK NEGATIVE	
	4		DATA STROBE POSITIVE	
	5		DATA STROBE NEGATIVE	
	9		INTERACTIVE STROBE	
	0		SELF TERMINATING STROBE	
S3	1	ON	SERIAL INTERFACE	
	1	OFF	PARALLEL INTERFACE	
	2	ON	DISABLE CARRIAGE RETURN LINE FEED	
	2	OFF	ENABLE CARRIAGE RETURN LINE FEED	
	3	ON	TRANSMIT PAGE	
	3	OFF	TRANSMIT LINE	
	4	ON	NEGATIVE DATA	PARALLEL OPERATION ONLY
	4	OFF	POSITIVE DATA	
	5	ON	ENABLE PARITY	
	5	OFF	DISABLE PARITY	
	6	ON	1 BIT STOP	
	6	OFF	2 BIT STOP	
	7	ON	PARITY ODD	
	7	OFF	PARITY EVEN	
S4	1-2		DISABLE	REPLACEMENT OF LINE FEED CODE WITH FORM FEED CODE ON LAST LINE
	1-3		ENABLE	

*NOTE: Do not remove red stops in S1 & S2 - turn rotors to select function.

Baud rate is selectable from the back panel. Switch positions not specified in table may be in any position for serial operation.

FIGURE 24 SERIAL HARD COPY ADAPTER



SWITCH SETTINGS
(Parallel only)

SWITCH FUNCTION CHART				
SWITCH	POSITION		FUNCTION	
S1*	1		PRINTER READY NEGATIVE	
	2		PRINTER READY POSITIVE	
	6		BUSY NEGATIVE	
	7		BUSY POSITIVE	
	9		OPTIONAL DISABLE NEGATIVE	
	0		OPTIONAL DISABLE POSITIVE	
S2*	1		ACK POSITIVE	
	2		ACK NEGATIVE	
	4		DATA STROBE POSITIVE	
	5		DATA STROBE NEGATIVE	
	9		INTERACTIVE STROBE	
	0		SELF TERMINATING STROBE	
S3	1	ON	SERIAL INTERFACE	
	1	OFF	PARALLEL INTERFACE	
	2	ON	DISABLE CARRIAGE RETURN LINE FEED	
	2	OFF	ENABLE CARRIAGE RETURN LINE FEED	
	3	ON	TRANSMIT PAGE	
	3	OFF	TRANSMIT LINE	
	4	ON	NEGATIVE DATA	
	4	OFF	POSITIVE DATA	
	5	ON	ENABLE PARITY	SERIAL OPERATION ONLY
	5	OFF	DISABLE PARITY	
	6	ON	1 BIT STOP	
	6	OFF	2 BIT STOP	
	7	ON	PARITY ODD	
	7	OFF	PARITY EVEN	
S4	1-2		DISABLE	REPLACEMENT OF LINE FEED CODE WITH FORM FEED CODE ON LAST LINE
	1-3		ENABLE	

*NOTE: Do not remove red stops in S1 & S2- turn rotors to select function.

All switch positions not specified in table may be in any position for parallel operation.

FIGURE 25 PARALLEL HARD COPY ADAPTER

Due to our continuing program to improve our products our PCB assemblies are changed more often than our manuals are up-dated, therefore this figure may not exactly match your PCB although switch numbering is marked on the PCB and the selectable features are the same.

SECTION V

THEORY OF OPERATION & TROUBLE SHOOTING GUIDE

NOTE: All ASCII codes referred to in this manual are in hexadecimal notation. See code charts in Section II.

INTRODUCTION

MINI–TEC DATA–SCREEN Terminals are general purpose CRT display terminals designed for use in data processing, process control and data communications systems. Interface options allow direct connection to a processor or various types of remote connections.

The basic MINI–TEC Terminal consists of cathode ray tube and associated circuitry, power supply, and printed circuit board card cage. The card cage accomodates up to seven printed circuit boards, one of which is used for the optional Hard Copy Adapter. The Model 1401 MINI–TEC Terminal uses five standard PCB's, and Models 2401 and 2402 use six standard PCB's

The five basic Model 1401 boards are: Timing Generator, Memory, Counter, Control, and Serial I/O.

The six basic Model 2401 and 2402 boards are: Timing Generator, Memory, Counter, Control, Serial I/O, and Character Generator.

The TIMING GENERATOR board contains a basic oscillator and several counter-type frequency dividers. It provides timing signals to the rest of the display.

The MEMORY board stores the entire page of data. Its contents can be read and selectively altered through the interface, which includes keyboard and communications line inputs.

The COUNTER board consists of two counter circuits. These are, in effect, address registers containing the current addresses of the memory and cursor.

The CONTROL board decodes incoming data and loads it into the proper place in the memory or performs the function requested.

The SERIAL I/O board contains the keyboard interface and the communications line interface circuitry for the serial interface.

The CHARACTER GENERATOR board on Models 2401 and 2402 stores one row (80) characters and converts the ASCII code to the 5 x 7 dot pattern for display. On the Model 1401 these circuits are located on the Memory board.

The following discussion gives a functional description of the individual PCB's. The theory of operation for the control and serial I/O PCB's for the 1401, 2401, and 2402 are the same. For this reason these two PCB's are only discussed in the Model 1401 PCB description.

MODEL 1401
THEORY OF OPERATION

PRINTED CIRCUIT BOARD ASSEMBLY FUNCTIONS

TIMING GENERATOR - Board 1. See Functional Diagram, Figure 26.

BASIC OSCILLATOR

The oscillator frequency is determined as follows:

50	Hz	60	Hz	Refresh rate
x 312		x 260		No. of horizontal scans per frame
15.60	KHz	15.60	KHz	
x 108		x 108		No. of character times per scan
1.6848	MHz	1.6848	MHz	
x 7		x 7		No. of dot times per character
11.7936	MHz	11.7936	MHz	

DOT COUNTER

The Dot Counter divides the oscillator frequency by seven. Dot counts 1 thru 5 are the displayed character and dots 6 and 7 are blanks. The count is octal 1 thru 7.

CHARACTER COUNTER

The 1.6 MHz (approx.) character rate is divided by 108 in this 8-stage binary counter. Decoded outputs at count 0 and 79 turn the Line Memory clock on and off providing 80 pulses during each scan. The other 28 counts are horizontal retrace time. Horizontal Sync for the TV monitor(s) begins at count 84.

SCAN COUNTER

This 4-stage binary counter is driven at 15.6 KHz by a decoded output pulse from the character counter during counts 80 thru 99. The counter is reset to zero after the count of twelve and therefore divides by thirteen. Each scan counter cycle represents one line of display characters. The scans are used thus:

Scan Count	Binary	Function	Display
0	0000	None	Blank
1-7	0xxx	Display	Characters
8	1000	None	Blank
9	1001	Display	Cursor
10	1010	Load Line Memory	Blank
11	1011	None	Blank
12	1100	None	Blank

ROW COUNTER

This counter consists of a divide-by-10 for 60 Hz or 12 for 50 Hz counter preceded by a divide by two stage. The outputs are vertical sync for the monitor at 60 Hz (or 50 Hz), and a blanking signal during vertical retrace.

BLINK RATE

The 60 (50) Hz is divided by 16 to provide a cursor blink rate of about 4 (3) Hz. This is divided by two to provide the character blink rate for use in the blink sequences (See Blink Function, Section II).

PAGE MEMORY CLOCK GATING

The Page Memory clock is gated such that between two successive scan 10 counts (during a valid display area on the screen) the Page Memory is clocked 1104 times. This keeps the Page Memory in step with the row counter and insures that each row of data in the Page Memory is loaded into the Line Memory in the proper sequential order.

MEMORY - Board 2 (80 x 12 format) See Functional Diagram, Figure 27.

PAGE MEMORY

The Page Memory consists of eight 1024 bit MOS serial shift registers connected bit-parallel, character-serial, along with input/recirculate gates and clock drivers. The switching of the input gates is controlled by the control board. Six bits are used to store the ASCII code (less bit 6) for displayable characters. The 7th identifies protected data and the 8th, blinking characters.

LINE MEMORY

This section consists of two MOS dynamic shift registers, each 4 x 80, operated in a bit-parallel, character-serial mode. Also included are input or recirculate gates and load control circuits. The Line Memory (LM) stores one line of characters (80) while being displayed.

During refresh the Line Memory is loaded with a line of characters from the Page Memory during each Scan 10. These are then recirculated during the next 12 scans and displayed during scans 1 thru 7. A blink bit is forced into the LM when the Cursor compare and Cursor Blink Rate signals are both present. The blink bit inhibits the display and the result is an alternating character or cursor (at a 4 Hz rate) at the cursor location.

CHARACTER GENERATOR

The Character Generator circuits convert the ASCII code stored in the Line Memory to the 5 x 7 dot matrix pattern for display on the CRT. The standard 64 ASCII displayable symbols (upper case alpha, numbers and punctuation marks), hex codes 20 thru 5F, are converted by a Bipolar Read Only Memory. This ROM has nine address inputs. Six of these are the ASCII code coming from the Line Memory, and the remaining three addresses are the three low order bits of the Scan Counter. The ROM is inhibited if the blink bit is true, or if the Scan Counter is not on a displayable scan. The five outputs are the dot pattern for that ASCII character in that Scan. This data is loaded in parallel into a five bit register and shifted serially at the basic oscillator frequency to form the video signal for the monitor.

VIDEO DRIVER

A video driver circuit combines the serial video data with cursor video and with the protect memory bit (to produce reduced intensity) to generate the video signal for the monitor.

A second video driver (optional) combines the serial video data with cursor video, the protect memory bit (for reduced intensity), and with vertical and horizontal syncs to produce NTSC composite video and sync for use with a remote monitor. This composite video is provided at a BNC connector (VIDEO OUT) on the rear panel.

COUNTER - Board 3. See Functional Diagram, Figure 28.

This board contains two binary counters and one comparator. All counters are organized by column and line; i.e., 80 counts horizontally and 12 counts vertically.

PAGE MEMORY COUNTER

This is a count-up only counter which is advanced one count each time the Page Memory is clocked. It therefore contains the address of the character currently being read from and loaded into the Page Memory.

CURSOR COUNTER

This is a count-up, count-down and directly presettable counter. It contains the address of the cursor position on the screen. Count-down roll over from 0 to 79 horizontal and 0 to 11 vertical is inhibited by detecting the borrow outputs and independently resetting the horizontal counter and vertical counter to zero. Invalid addresses are detected and the Load Cursor Address function is inhibited. An invalid address is ignored.

A signal is generated when the horizontal section goes from 67 to 68. This signal goes to the keyboard to operate the keyboard audible signal device.

COMPARATOR

The cursor comparator indicates coincidence between the Page Memory Counter and the Cursor Counter for loading the page memory and for displaying the cursor.

CONTROL - (1401, 2401 & 2402) See Functional Diagram, Figure 29.

All codes received by the terminal from the interface or the keyboard are sent from the I/O to the control board. The code is examined to determine whether it is data or a function code. Data codes are loaded into the Page Memory at the present cursor address and the cursor is advanced one position. Function codes are decoded and the function is performed. Codes which are recognized neither as data nor function for this terminal are "dumped".

INPUT SECTION

Bits 6 & 7 of each character code coming from the I/O are examined to determine if the code is data, (columns 2 through 7) or a function, (columns 0 and 1) of the ASCII Code Chart. The Load Register pulse from the I/O is then gated to set the Data flip-flop or Function flip-flop. If either flip-flop is set, the terminal is "busy" and no new data can be entered into the Data Bit Register in the interface.

FUNCTION DECODER

This decoder is enabled when the Function flip-flop is set. The input of a four to 1-of-16 decoder indicates which row on the ASCII chart, 0 thru F, the code is in and this combined with ASCII chart column information, forms a discrete signal for each function. Refer to the ASCII code chart.

ERASE FUNCTIONS

The CLEAR function (ASCII Code 1C) sends the cursor to the Home position where the erase begins. Format protect functions are inhibited so that the entire memory is erased. The function flip-flop is cleared and the erase terminated by the End of Memory signal. The ERASE function (ASCII ØC) begins the erase at the present cursor position. The Function flip-flop is cleared and the erase terminated at the End of Memory signal.

LOAD CURSOR ADDRESS FUNCTION

When the LCA sequence of codes (Escape/F) are received, a control flip-flop is set which steers the one's complement of the next code received to the horizontal section of the cursor counter. At that time the first control is cleared and a second control is set. The one's complement of the next code goes to the vertical section of the cursor counter and the second control is cleared. When either control flip-flop is set, codes received cannot be interpreted as data or functions.

READ CURSOR ADDRESS FUNCTION

When the RCA sequence of codes (Escape/R) are received, a control flip-flop is set which causes the terminal to transmit the one's complement of the cursor's horizontal address. At that time the first control flip-flop is cleared and a second control flip-flop is set which causes the terminal to transmit the one's complement of the cursor's vertical address.

BLOCK TRANSMIT

When the block transmission code (switch selectable between an STX code and an EOT code) is received, the read control flip-flop is set. This flip-flop causes the terminal to transmit the memory data, excluding protected data, from the cursor's location to the end of the line or the end of the page, depending upon which function is selected. (The space code delete function is performed on the Serial I/O board.) The read control flip-flop is reset at the completion of the transmission operation.

PROTECT & BLINK CONTROL

A Protect Bit flip-flop is set on the Control Board when a Start Protect sequence of characters is decoded. It is cleared when the End Protect sequence is decoded. While this flip-flop is set each displayable character received is loaded into memory with a protect bit.

A flip-flop on the control board is set when the Start Blink sequence of codes is decoded. While this flip-flop is set, each displayable character received is loaded into memory with a blink bit. The End Blink sequence resets the blink flip-flop on the control board. The characters containing a blink bit are blinked on and off at a two Hz rate.

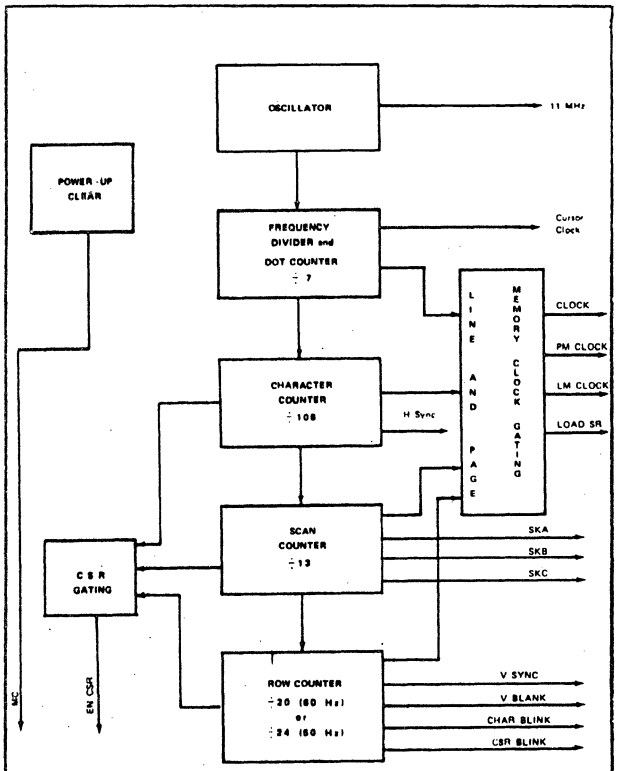


FIGURE 26 FUNCTIONAL DIAGRAM MODEL 1401 TIMING GENERATOR PCB

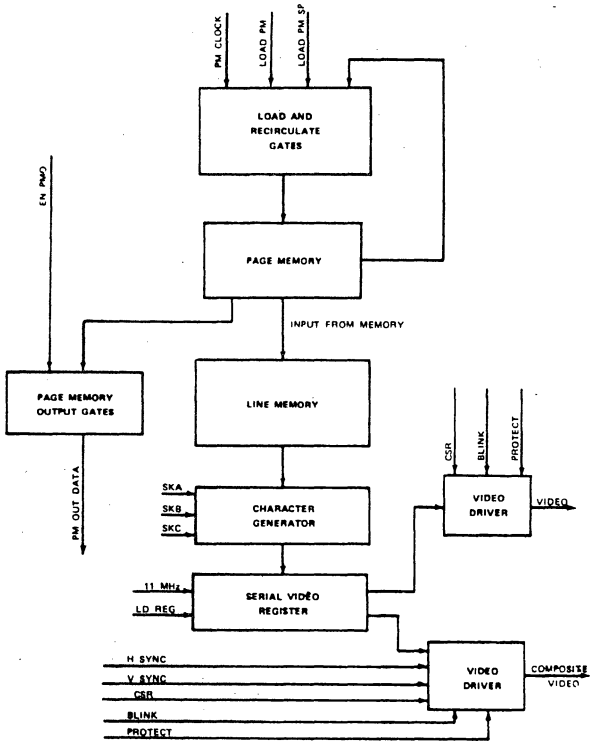


FIGURE 27 FUNCTIONAL DIAGRAM MODEL 1401 PAGE MEMORY PCB

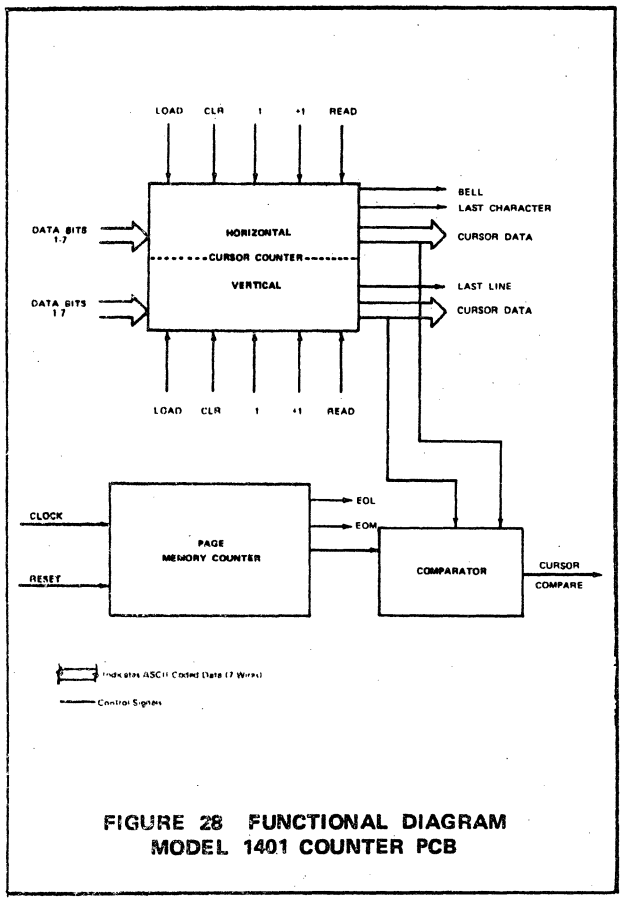


FIGURE 28 FUNCTIONAL DIAGRAM MODEL 1401 COUNTER PCB

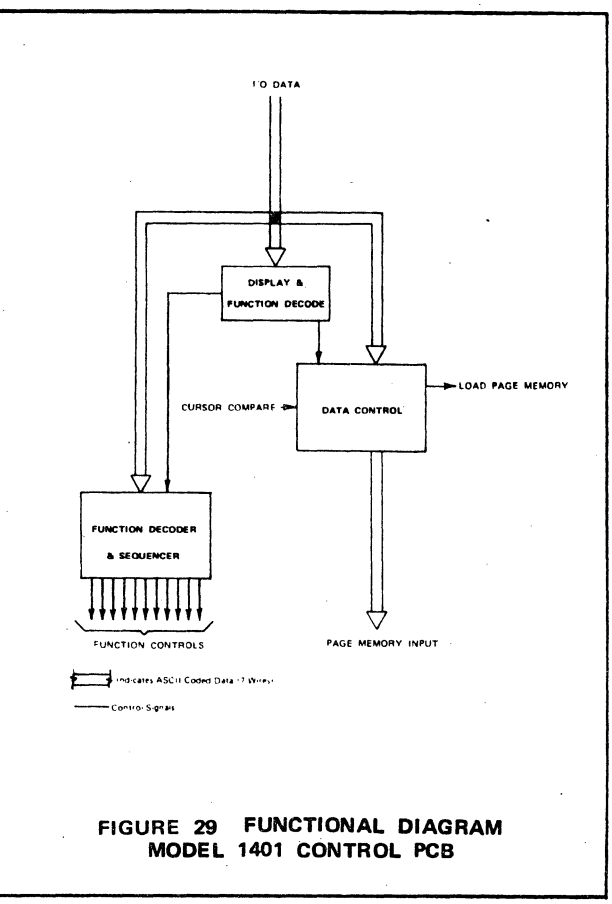


FIGURE 29 FUNCTIONAL DIAGRAM MODEL 1401 CONTROL PCB

SERIAL I/O - Board 5. (1401, 2401 & 2402) See Functional Diagram, Figure 30.

The interface is an electronic simulation of the mechanical and electrical hardware present in modern teletypewriters. It is compatible with teleprinters and computer systems using full or half-duplex TTY's. In most cases the MINI–TEC Terminal replaces TTY's without requiring major system reprogramming or the use of additional interface hardware.

The serial interface physically consists of one printed circuit board, an I/O connector mounted on the back of the terminal for connection to external modems or current loop systems, and a keyboard connector. See Figure 7 for more detail on modem and keyboard connectors, and Table 3 for specification of connector types.

The interface performs these functions:

1. Transfers character sequences from a processor to the basic DATA–SCREEN Terminal.
2. Transfers data from the terminal keyboard and memory to the processor.
3. Provides an EIA (RS-232C,) 20 to 60 mA current loop or TTL interface for convenient attachment to a processor.
4. Provides an asynchronous 10 or 11-bit character format; start bit (space), 7-bit USASCII code, parity bit (odd, even or mark) and stop bits (one or two marks).
5. Provides for transfer rates of 110 thru 9600 baud. The I/O oscillator may be set to any speed within the range indicated for special transfer rates.

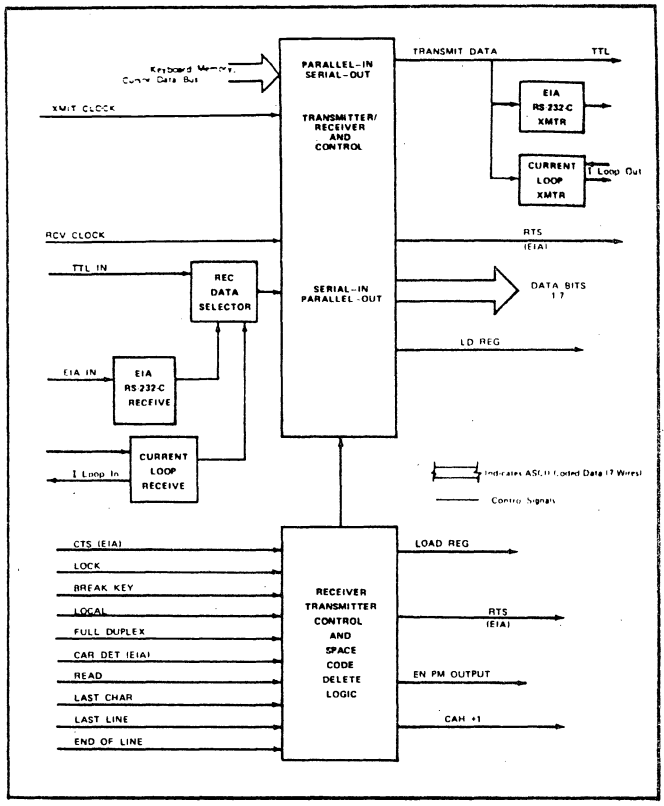


FIGURE 30 FUNCTIONAL DIAGRAM – SERIAL I/O PCB

6. Provides the ability, in direct connect applications, to delay internally receipt of the clear to send signal by approx. 18 msec., which simulates the CTS delay provided by some modems **(See Figure 25).**

For connector description and keyboard connector signal definition see page 7.

INTERFACE DATA TRANSFER RATE

The I/O oscillator is pre-set at the baud rate specified by the customer. However, the rate may be field changed (within a 110 to 9600 baud range) by a single rotary switch located on the rear of the terminal. Refer to baud rate adjustment instructions below.

OPERATION TIMING

The highest data rate accepted by the terminal is 9600 baud or 104 microseconds per bit, using a 10-bit character time of 1.04 milliseconds on the communications line. The slowest operation performed by the interface and the basic DATA–SCREEN Terminal is the roll-up operation. Models 2401 and 2402 MINI–TEC Terminals will roll-up at 9600 baud without the use of fill codes. Model 1401 MINI–TEC Terminals require fill codes after the LF code to allow time for the terminal to roll-up. For the exact number of fill codes refer to the table on page 4. Above 4800 baud it is also recommended that ERASE, CLEAR and Tab be followed by a single Rubout or NUL character.

BAUD RATE SWITCH FEATURE

A baud rate switch is provided which allows rapid selection of one of nine pre-set baud rates between 110 and 9600 baud. The switch is located on the back panel of desk mount and rack mount MINI–TEC DATA–SCREEN Terminal displays. See Figure 4.

The following speeds are standard:

			TEST POINT 1		TEST POINT 2	
POSITION		BAUD RATE	TIME/CYCLE	CYCLES/SEC	TIME/CYCLE	CYCLES/SEC*
ccw	1.	110	8.87 uSec.	112,640	568.2 uSec.	1760
	2.	150	6.52	153,600	416.7	2400
	3.	300	↓	↓	208.3	4800
	4.	600	↓	↓	104.2	9600
	5.	1200	↓	↓	52.1	19,200
	6.	1800	8.68	115,200	34.7	28,800
	7.	2400	6.52	153,600	26.0	38,400
	8.	4800	↓	↓	13.04	76,800
cw	9.	9600	↓	↓	6.52	153,600

* = 16 times the baud rate

TABLE 4

Setting of the three trimmer resistors located on the baud rate switch assembly PCB can be checked as follows:

Place a frequency counter probe on test point 1 (closest to switch) and set baud rate switch to position 1 (for 110 baud). Test points are identified on the switch assembly. Set trimmer R1 (closest from switch) so that count is 112,640 cycles per second. (Alternately, measure time per cycle at 8.87 uSec.) Set baud rate switch to position 2 (for 150 baud). Set trimmer R2 (middle one of three) so that count is 153,600 cycles per second. (Alternately, measure time per cycle at 6.52 uSec.)

Set baud rate switch position 6 (for 1800 baud). Set trimmer R3 (furthest to switch) so that count is 115,200 cycles per second (Alternately, measure time cycle at 8.68 uSec.) The counts may be verified at test point 2 by cycling through all nine positions of the switch. In each case, the count will be 16 times the desired baud rate. (See Table 4).

As with any analog circuit, certain errors may result due to drift with respect to temperature. The warm-up drift may be anticipated to be between 2% and 3% of the initial frequency. In addition, extended operation may result in an additional drift of $\pm$1%. Since most asynchronous circuits will tolerate a frequency error over a 10% frequency band (5% above and 5% below nominal, generally), the baud-rate oscillator can easily be tuned to remain in tolerance from turn-on through continuous 24 hour per day operation. Less tolerant circuits, however, may require minor trimming of the baud rate oscillator after warm-up.

SPACE CODE DELETE

During Block Mode transmissions, which are controlled by the Control PCB, the Serial I/O Board checks the data being transmitted for space codes. When a space code is detected, a control flip-flop is set (if the space code delete option is selected). If the next character transmitted is not a space code, the control flip-flop is reset. However, if it is a space code a second control flip-flop is set. With this flip-flop set, successive space codes are skipped over and not sent, except that the last character on each line is transmitted.

Both control flip-flops are reset at the end of each line, or by a non-space character and the search for two successive space codes starts again.

If the Space Code Delete option is not selected, the two control flip-flops are inhibited and all space codes are transmitted.

MODELS 2401 & 2402
THEORY OF OPERATION

PRINTED CIRCUIT BOARD ASSEMBLY FUNCTIONS

TIMING GENERATOR - Board 1. See Functional Diagram, Figure 31.

BASIC OSCILLATOR

The oscillator frequency is determined as follows:

50	Hz	60	Hz	Refresh rate
x 312		x 260		No. of horizontal scans per frame
15.60	KHz	15.60	KHz	
x 108		x 108		No. of character times per scan
1.6848	MHz	1.6848	MHz	
x 7		x 7		No. of dot times per character
11.7936	MHz	11.7936	MHz	

DOT COUNTER

The Dot Counter divides the oscillator frequency by seven. Dot counts 1 thru 5 are the displayed character and dots 6 and 7 are blanks. The count is octal 1 thru 7. Clocks for the Page Memory and the Line Memory are generated from Dot Counter signals.

CHARACTER COUNTER

The 1.6 MHz (approx.) character rate is divided by 108 in this 8-stage binary counter. Decoded outputs at count 0 and 79 turn the Line Memory clock on and off providing 80 pulses during each scan. The other 28 counts are horizontal retrace time. Horizontal Sync for the TV monitor(s) begins at count 84.

SCAN COUNTER

This 4-stage binary counter is driven at 15.6 KHz by a decoded output pulse from the character counter during counts 80 thru 99. The counter is reset to zero after the count of nine and therefore divides by ten. Each scan counter cycle represents one line of displayed characters. The scans are used thus:

Scan Count	Binary	Function	Display
0	0000	None	Blank
1-7	0xxx	Display	Characters
8	1000	Display	Cursor
9	1001	Load Line Memory	Blank

ROW COUNTER

This counter consists of a divide-by-26 for 60 Hz or 31 for 50 Hz operation. The outputs are vertical sync for the TV monitor at 60 Hz (or 50 Hz), and a blanking signal during vertical retrace.

BLINK RATE

The 60 (50) Hz is divided by 16 to provide a cursor blink rate of about 4 (3) Hz. This is divided by two to provide the character blink rate for use in the blink sequences (See Blink Function, Section III).

PAGE MEMORY CLOCK GATING

A 4 MHz (approx.) clock rate is generated by dividing the oscillator frequency by three. This Page Memory clock is gated such that between two successive scan 9 counts, (during a valid display area on the screen) the Page Memory is clocked 2128 times. This keeps the Page Memory in step with the row counter and insures that each row of data in the Page Memory is loaded into the Line Memory in the proper sequential order.

MEMORY - Board 2 (80 x 24 format) See Functional Diagram, Figure 32.

MEMORY

The Memory consists of two 1K x 8 recirculating shift registers. A decoded 2-bit binary counter provides the required 4 phase clocks and the output multiplex control. The load/recirculate multiplexer on the input is controlled by a signal from the Control PCB. Six bit positions store the ASCII codes (less bit 6), the 7th identifies protected data and the 8th, the blinking characters.

COUNTER - Board 3. See Functional Diagram, Figure 33.

This board contains two binary counters and one comparator. All counters are organized by column and line i.e., 80 counts horizontally and 24 counts vertically.

PAGE MEMORY COUNTER

This is a count-up only counter which is advanced one count each time the Page Memory is clocked. It therefore contains the address of the character currently being read from and loaded into the Page Memory.

CURSOR COUNTER

This is a count-up, count-down and directly presettable counter. It contains the address of the cursor position on the screen. Count-down roll over from 0 to 79 horizontal and 0 to 23 vertical is inhibited by detecting the borrow outputs and independently resetting the horizontal counter and vertical counter to zero. Invalid addresses are detected and the Load Cursor Address function is inhibited. An invalid address is ignored.

A "Bell" code is generated when the horizontal section goes from 67 to 68 and causes the keyboard audible signal to sound.

COMPARATOR

The cursor comparator indicates coincidence between the Page Memory Counter and the Cursor Counter for loading the page memory and for displaying the cursor.

CONTROL - Board 4. See Theory of Operation, Page 22.

SERIAL I/O - Board 5. See Theory of Operation, Page 24.

CHARACTER GENERATOR - Board 7. See Functional Diagram, Figure 34.

This section consists of two MOS dynamic shift registers, each 4 x 80, operated in a bit-parallel, character-serial mode. Also included are input or recirculate gates and load control circuits. The Line Memory (LM) stores one line of characters (80) while it is being displayed.

The Line Memory is loaded with a line of characters from the Page Memory during each scan 9. These are then recirculated during the next 9 scans and displayed during scans 1 thru 7. A blink bit is forced into the LM when the Cursor Compare and Cursor Blink Rate signals are both present. The blink bit inhibits the display and the result is an alternating character and cursor (at a 4 Hz rate) at the cursor location.

CHARACTER GENERATOR

The Character Generator circuits convert the ASCII code stored in the Line Memory to the 5 x 7 dot matrix pattern for display on the CRT. The standard 64 ASCII 94 for Model 2402) displayable symbols (upper case alpha, lower case alpha on 2402 only, numbers and punctuation marks), hex codes 20 thru 7F are converted by a Bipolar Read Only Memory. This ROM has nine address inputs. Six of these are the ASCII code coming from the Line Memory, and the remaining three addresses are the three low order bits of the Scan Counter. The ROM is inhibited if the blink bit is true, or if the Scan Counter is not on a displayable scan. The five outputs are the dot pattern for that ASCII character in that Scan. This data is loaded in parallel into a five bit register and shifted serially at the basic oscillator frequency to form the video signal for the monitor.

VIDEO DRIVER

A video driver circuit combines the serial video data with cursor video and with the protect memory bit (to produce reduced intensity) to generate the video signal for the monitor.

A second video driver (optional) combines the serial video data with cursor video, the protect memory bit (for reduced intensity), and with vertical and horizontal syncs to produce NTSC composite video and sync for use with a remote monitor. This composite video is provided at a BNC connector (VIDEO OUT) on the rear panel.

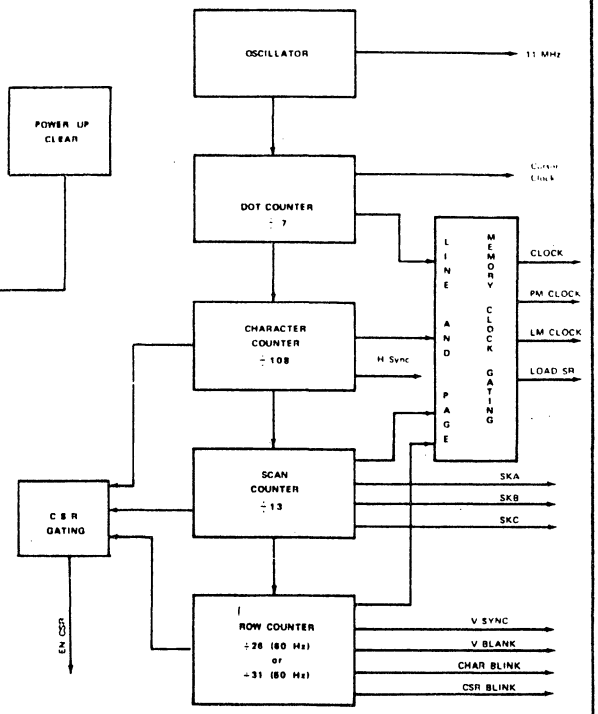


FIGURE 31 FUNCTIONAL DIAGRAM
MODELS 2401 AND 2402 TIMING GENERATOR PCB

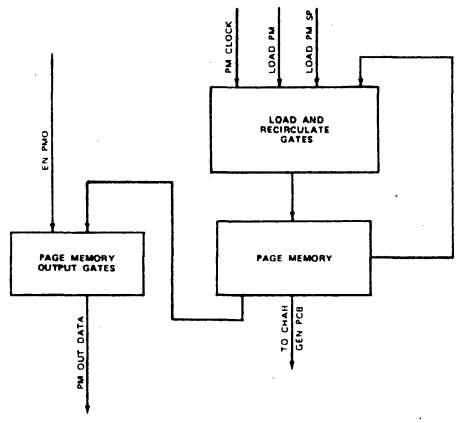


FIGURE 32 FUNCTIONAL DIAGRAM
MODELS 2401 AND 2402 MEMORY PCB

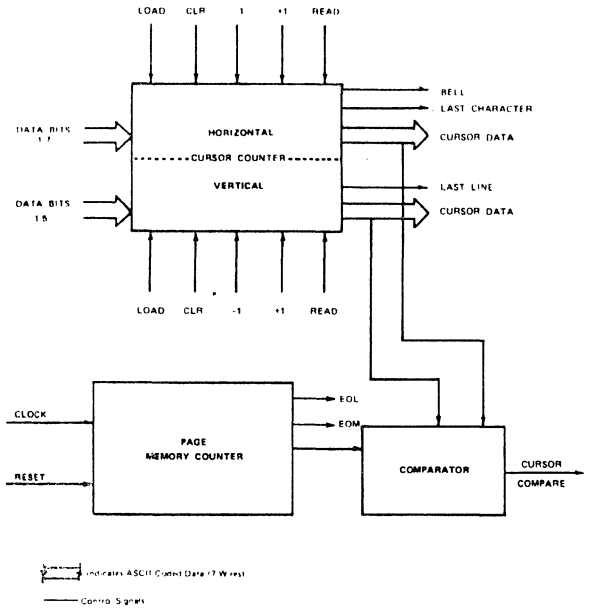


FIGURE 33 FUNCTIONAL DIAGRAM
MODELS 2401 AND 2402 COUNTER PCB

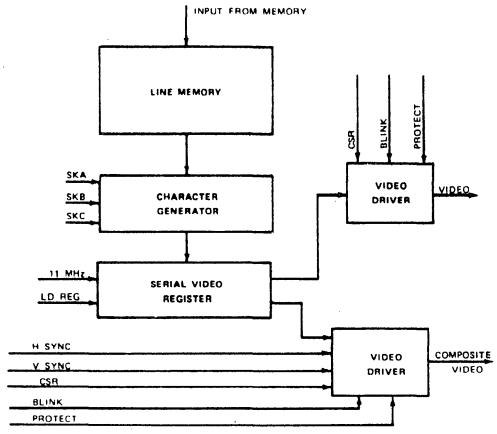


FIGURE 34 FUNCTIONAL DIAGRAM
MODELS 2401 AND 2402 CHARACTER GENERATOR PCB

TROUBLESHOOTING GUIDE

TEC's DATA–SCREEN Terminals have proved exceptionally reliable in field use. It is possible, however, that failure can occur in one of the thousands of interconnections or components used in these complex devices. To reduce terminal downtime to a minimum, this section provides a suggested PCB and subassembly replacement sequence based on malfunctions visible on the screen.

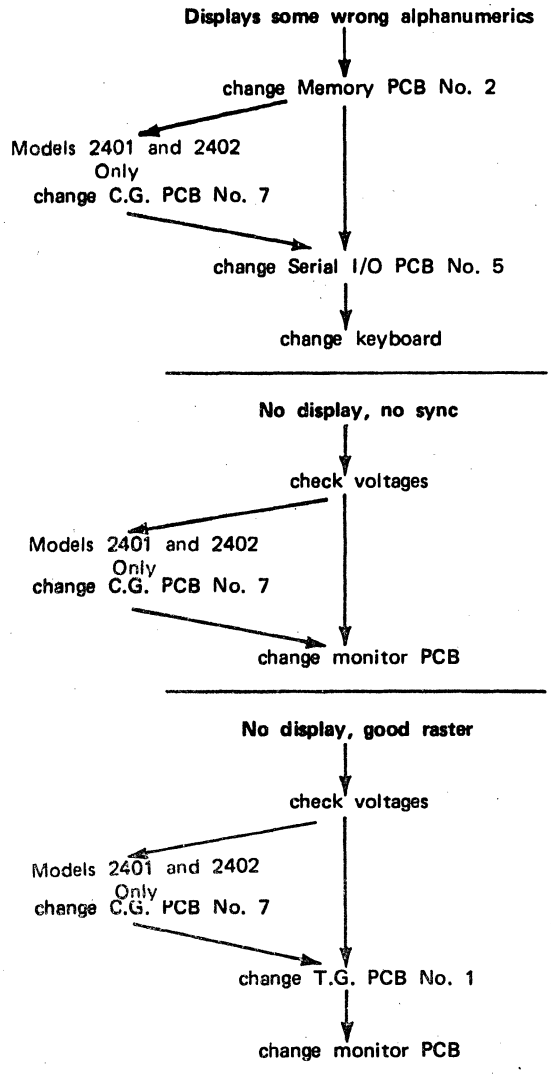
Most problems are caused by failures in one printed circuit board. Such failures do not normally cause "chain reaction" failures of other components on the affected PCB, or on other PCB's in the terminal. By maintaining a spare set of PCB's, the great majority of problems can be repaired in a matter of minutes. Suspect PCB's can be returned to TEC for replacement on an "exchange" plan (see Parts List page 36).

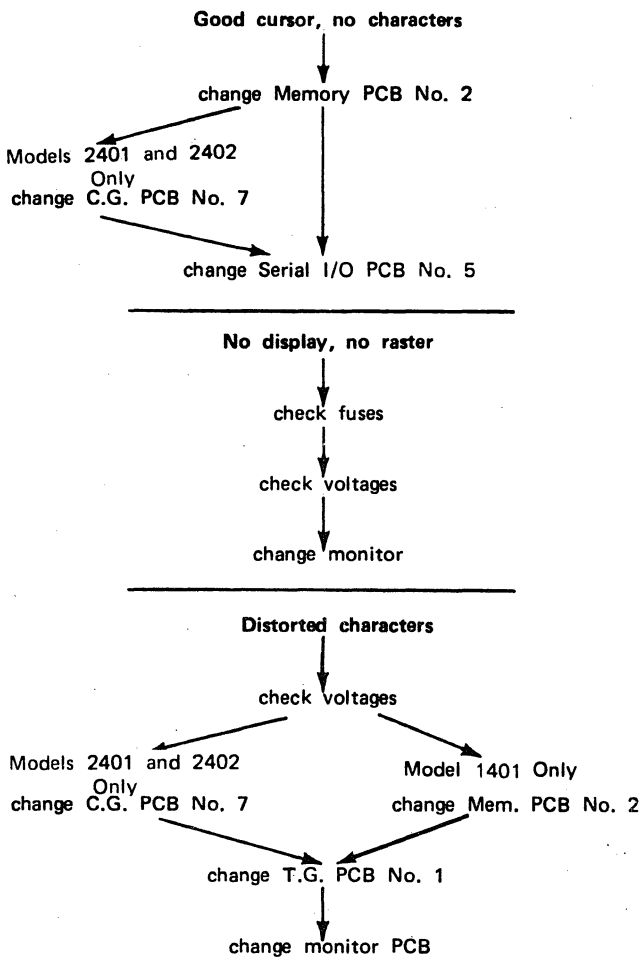
NOTE: Good troubleshooting practice requires that supply voltages be checked to avoid damaging replacement PCB's. The Model 1401, 2401, and 2402 nominal power supply voltages are shown in the table below.

Voltage to be	Connector pin on* Board 3 to measure
+5V	P3 - 1, 2
+12V	P3 - 81, 82
–12V	P3 - 83, 84

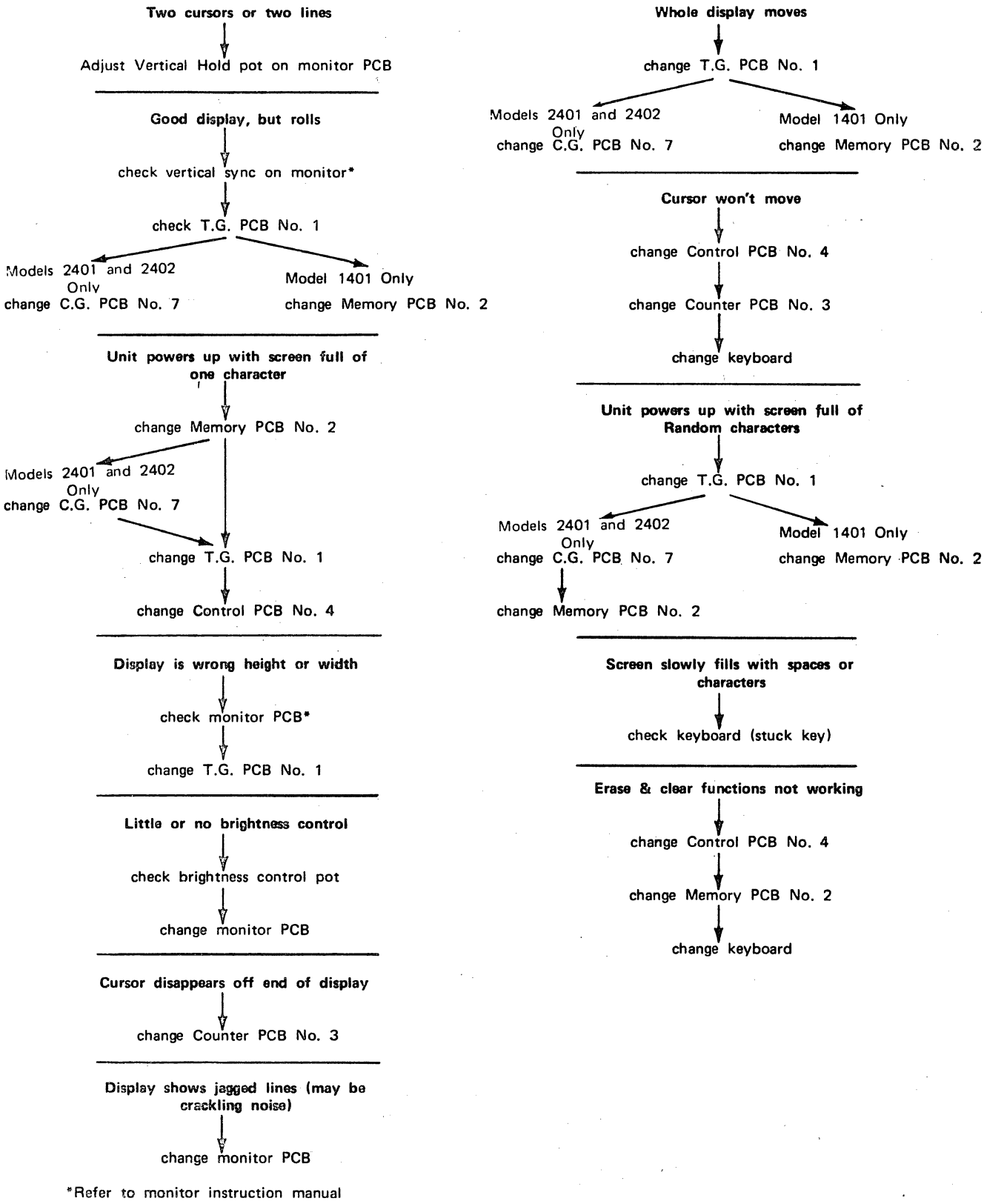
*P3 - 85, 86 should be used as ground reference for voltage measurements.

DISPLAY PROBLEMS





DISPLAY PROBLEMS (Cont'd)



*Refer to monitor instruction manual

INPUT/OUTPUT PROBLEMS

No input or output with CPU

change Serial I/O PCB No. 5

change Control PCB No. 4

change Memory PCB No. 2

change baud switch PCB

Cursor won't move on input from keyboard

change Control PCB No. 4

change Counter PCB No. 3

change Serial I/O, PCB No. 5

change keyboard

One particular character won't enter from keyboard

change keyswitch

change keyboard

Protect or blink functions won't work

change Control PCB No. 4

change Memory PCB No. 2

Models 2401 and 2402 Only
change C.G. PCB No. 7

change T.G. PCB

Voltages low or high

check fuses

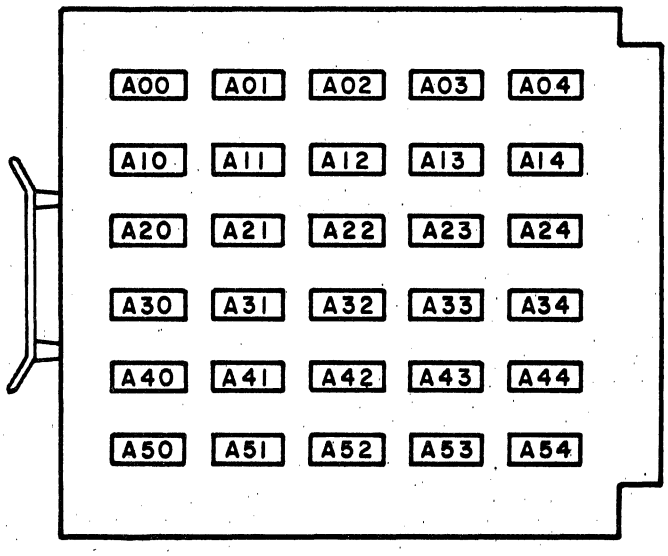
Pull all PCBs & recheck voltages

Still Bad

change Power Supply

Good

Re-insert PCB's one at a time until voltages go bad. Last PCB inserted is bad.



I–C MODULE SEQUENCE

MIRATEL MONITOR ADJUSTMENT
(SILICON MONITOR)

On occasion, due to component aging or hard shipments the monitor may require minor adjustments. If such adjustments are required, we recommend it be done by qualified personnel, and that EXTREME CAUTION BE USED since HAZARDOUS VOLTAGES ARE PRESENT! The following procedures are used to adjust the monitor.

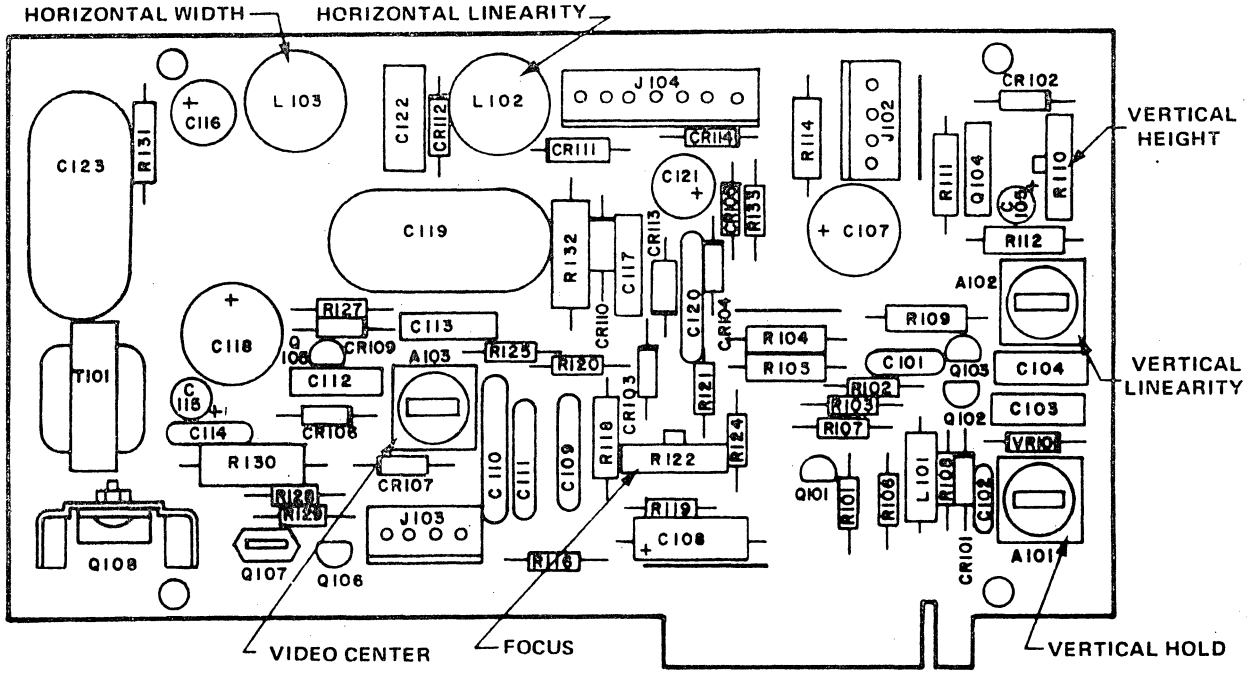


FIGURE 35 MONITOR MAIN CHASSIS PCB

1. Remove the shroud assembly from the DATA–SCREEN® Terminal and locate the Main Chassis PCB shown above.
2. Apply power to the DATA–SCREEN Terminal, CAUTION -- LETHAL VOLTAGES PRESENT! In "Local" Mode, use the Repeat key in conjunction with any character key to fill the screen.
3. Rotate the potentiometer (pot) marked Vertical Hold in one direction until the screen just begins to roll, then turn it in the oppowite direction until the screen begins to roll in the other direction, making note of how far the pot had to be turned.
4. Set the pot to a point half way between the points where the picture began to roll. (NOTE: *This pot has a definite effect on vertical size which will be discussed below).*
5. Next adjust the pot marked Vertical Height until the proper display height of 6 inches (15 cm) is attained. If proper height cannot be attained with this pot, you may have to slightly adjust the Vertical Hold pot described above.
6. If characters at the top of the screen are larger than the ones at the bottom of the screen, or vice versa, adjust the pot marked Vertical Linearity until characters at the top and bottom of the screen are the same size.
7. If the characters appear blurred, adjust the pot marked focus until they are sharp and claer.
8. If the screen display is not centered horizontally, adjust the pot marked Video Center. If characters on left edge fold over, readjust Video Center and use centering rings in yoke for final centering.
9. If the first 10 or 20 characters on the left side are larger or smaller than those at screen display center, use a fiber or plastic tool and turn the slug in the coil marked Horizontal Linearity until left side characters and center characters are the same size.
10. If the screen display is too wide or too narrow, use a fiber or (plastic) tool and turn the slug in the coil marked Horizontal Width until a width of 9 inches (23 cm) is obtained.

SPECIFICATIONS

GENERAL

Display	Model 1401	Model 2401/2402
CRT Size	12 in.	12 in.
Viewing Area	54 sq. in.	54 sq. in.
Scan Method *	Raster	Raster
Refresh Rate	60 Hz or 50 Hz	60 Hz or 50 Hz
Screen Capacity	960 Char.	1920 Char.
Characters per Line	80	80
Lines per Page	12	24
Character Size (h x w-inches)	.20 x .08	.20 x .08
Character Generation	5 x 7 Dot Matrix	5 x 7 Dot Matrix
Character Set	63 + space	63 + space/92 + space
Character Codes	ASCII	ASCII
Display Protected Data at Reduced Intensity	STD	STD
Format Control Features		
Field TAB	STD	STD
Blink Characters	STD	STD
Protect Characters	STD	STD
Auto Roll-up (Bottom Line Entry)	Selectable	Selectable
Edit Control Features		
Display Cursor Symbol	STD	STD
Load Cursor Address	STD	STD
Position Cursor (Keyboard or Processor)	STD	STD
Read Cursor Address (Processor)	STD	STD
Repeat Character/function (Keyboard)	15 Hz rate	15 Hz rate
Erase to End of Page (unprotected areas)	STD	STD
Clear Memory (entire screen)	STD	STD

Man/Machine Features	Models 1401, 2401 & 2402
Remote Indicator (Display ON—line)	STD
Local Indicator (Display OFF—line)	STD
End of Line Audible Signal	SELECTABLE
Brightness Control	STD
Non-Glare Tube (Etched Face)	STD
Baud Rate	SELECTABLE
Detachable Keyboard	STD
Memory	
Type	MOS Shift Register
Capacity	Model 1401 1024 Model 2401/2402 2048
Processor Interface	
Data Format	11/10 Bit Serial
Data Transfer Rate	110 to 9600 baud
TTL Drivers/Receivers	15 ft. max. (4.57 m)
RS—232 Drivers/Receivers	1000 ft. max. (305 m)
Current Loop Drivers/Receivers	1000 ft. max. (305 m)
Parity Check Odd, Even or None	STD
Parity Generate, Odd, Even, or Mark	STD

*Monitor resolution: Minimum resolution is 750 lines at the center of the CRT Screen and 650 lines at the corners as measured in accordance with EIA RS-375.

Parallel Printer Interface (Hard Copy Adapter - Optional)

Data Format	7-Bit Parallel
Data Transfer Rate	Up to 4600 characters per second
Distance	6 ft.

Serial Printer Interface (HCA - Optional)

Data Format	11/10-Bit Serial
Data Transfer Rate	110 to 9600 Baud
TTL Drivers/Receivers	6 ft. max. (1.8 m)
RS–232 Drivers/Receivers	50 ft. max. (15 m)
Current Loop Drivers/Receivers	1000 ft. max. (305 m)
Parity Generate, Odd, Even, or Mark	STD

Options

Composite Video Output	YES
Desk Mount with Monitor	YES
Rack Mount with Monitor	YES
Rack Mount W/O Monitor	YES
Keyboard with 15-Key Pad (EKA 8850 or EKA 8860)	YES
Slave Monitors	YES
Hard Copy Adapter (parallel or serial)	YES
Split Baud Rate Switch Kit	YES
Finishes:	
Walnut Woodgrain Vinyl	YES
White Goatskin Vinyl	YES
Classic Shroud	YES

Display Controls

ON–OFF Switch	STD
Brightness	STD

Power Requirements

115/230 VAC, 50/60 Hz, 100 watts nom.	STD, Switch Sel.

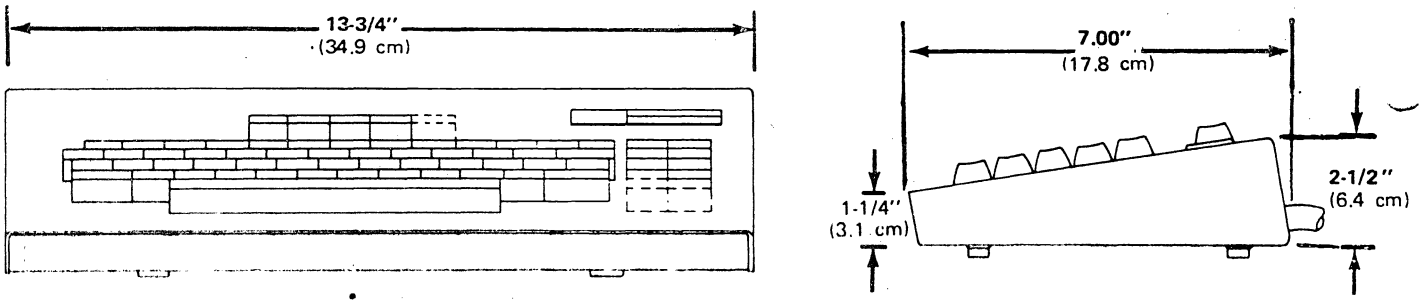
MINI–TEC Terminals will tolerate a 10% variation above and below a nominal power line voltage of 115 VAC or 230 VAC. It will operate at line frequencies between 47 Hz and 400 Hz, however, any deviation from the selected refresh rate of 50 Hz or 60 Hz, will cause a wiggle on the screen at a rate equal to the difference between the refresh rate and the power line frequency.

Physical Specifications

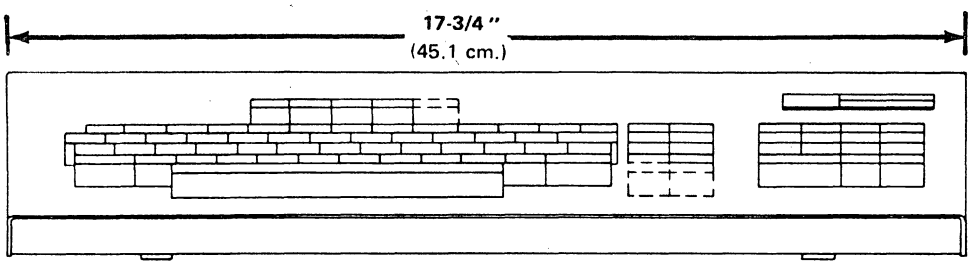
Dimensions – See Figure 36.
Standard Finish – Blue Armorhide Paint or Unfinished (Corrosion Protected)
Operating Temperature: +50°F to +104°F
(+10°C to +40°C)
Storage Temperature: –104°F to 149°F
(–40°C to +65°C)
Shipping Weights –
Desk Mount with Monitor & Keyboard – 45 lbs. (20 Kgm)
Rack Mount with Monitor & Keyboard – 50 lbs. (22.4 Kgm)
Keyboard – 5 lbs. (2.4 kgm)
Shipping carton with internal padding – 5 lbs. (2.4 Kgm)
Humidity: 5 to 80% non-condensing
Altitudes up to 10,000 ft (3,050 m)

All specifications subject to change without notice.

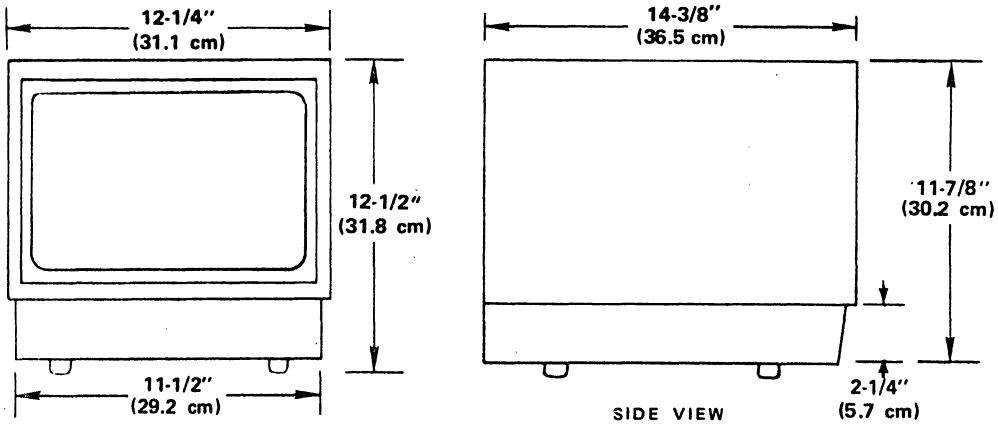
All specifications subject to change without notice.



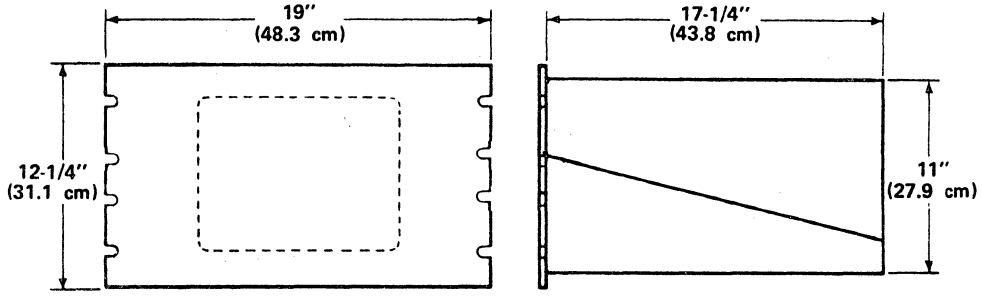
STANDARD KEYBOARD (EKA–8849 & EKA–8859)



EXTENDED KEYBOARDS WITH 15–KEY PAD (EKA–8850 & EKA–8860)



DESK TOP MODEL



RACK MOUNT MODEL

FIGURE 36. PHYSICAL DIMENSIONS

	SPARE PARTS DESCRIPTION		MODEL 1401 PART NUMBER	MODEL 2401 PART NUMBER	MODEL 2402 PART NUMBER
†	TIMING GENERATOR (TG) PCB*	(Card position 1)	930208	930310	930310
†	PAGE MEMORY (PM) PCB*	(Card position 2)	930171	930248-000	930248-001
†	COUNTER PCB*	(Card position 3)	930207	930334	930334
†	CONTROL PCB*	(Card position 4)	930335	930335	930335
†	SERIAL I/O PCB*	(Card position 5)	930247-000	930247-001	930247-001
†	CHARACTER GENERATOR*	(Card position 7)	---	930243-0X0 930311-0X0	930311-0X1
	PARALLEL HARD COPY ADAPTER KIT parallel PCB* Only is 930201-001		980074	980074	980074
	SERIAL HARD COPY ADAPTER KIT Serial PCB* Only is 930201-002		980075	980075	980075
	EXTENDER PCB		930169	930169	930169
	SPLIT BAUD RATE SWITCH KIT		980077	980077	980077
	KEYBOARD** With 3' cable & connector (XXX = K/B color) -008 Unfinished -116 Walnut Woodgrain Vinyl -054 Armorhide Blue -131 White Goatskin Vinyl	w/o 15 key pad	EKA-8849-XXX	EKA-8849-XXX	EKA-8859-XXX
		with 15 key pad	EKA-8850-XXX	EKA-8850-XXX	EKA-8860-XXX
	KEYBOARD EXTENSION CABLE (xxx = length in inches		930353-XXX	930353-XXX	930353-XXX
	REPLACEMENT KEYBOARD SWITCH		880031-001	880031-001	880031-001
	MATING CONNECTOR FOR: I/O and Printer Connector (Cinch DB-25P) Hood for above (Cinch DB-51226-1) Keyboard Connector (Cinch DB-25S) Hood for above (Cinch DB-51212-1)		 781013-003 741184-000 781014-003 742806-002	 781013-003 741184-000 781014-003 742806-002	 781013-003 741184-000 781014-003 742806-002
†	POWER SUPPLY WITH REGULATOR PCB		930342	930342	930342
	COOLING FAN		740066-001	740066-001	740066-001
	MIRATEL MONITOR ASSEMBLY KIT with: P-4 Cathode Ray Tube (White Phosphor, etched face) P-31 Cathode Ray Tube (Green Phospor, etched face)		 920001-012 920001-014	 920001-012 920001-014	 920001-012 920001-014
	CATHODE RAY TUBE only, P4 (White Phosphor, etched face P31 (Green Phosphor, etched face		900026-002 900026-004	900026-002 900026-004	900026-002 900026-004
†	Monitor Main Chassis PCB		920006	920006	920006
†	Low Voltage Power Supply PCB		920011	920011	920011
	PRODUCT DESCRIPTION MANUAL (additional copies)		3154-02	3154-02	3154-02
	SHIPPING CARTON (with internal padding)		210078-000	210078-000	210078-000
	SCHEMATIC SET – XXX refers to following: -001 Blue line -003 Mylar -002 Black line -004 Vellum (Sepia)		965035-XXX	965035-XXX	965035-XXX

Specifications subject to change without notice.

*TEC's Printed Circuit Board exchange program permits return of defective, out of warranty PCB's for 50% credit toward the purchase of an exchange PCB of the same type, provided the board returned is not over 12 months old and is returned within 30 days of shipment date on exchange PCB. Exchange PCB's carry the same 90 day warranty from the date of shipment as new PCB's. Warranty is void on any PCB new or exchange, if TEC inspection reveals customer attempts to repair or alter the function of the PCB. Contact TEC Peripheral Products Marketing Services Department for board exchange and repair information.

**Keyboard repair – TEC will repair DATA–SCREEN Terminal keyboards provided that the keyboard has not been subjected to excessive shock, heat or other abuse, or if liquids, harmful vapors or abrasive matter have not penetrated the interior to an excessive degree, or if attempts to repair or modify the keyboard's function, or operate it outside its electrical design parameters are not evidenced. Only keyboard parts and components replaced in the repair operation will be warranted for 90 days. Contact TEC Peripheral Products Marketing Services Department for keyboard repair information.

NOTE: TEC's decision as to the condition of parts returned for exchange or repair will be final.

† TEC recommends maintaining one of each as a spare for every 10 terminals per location.
†† TEC Recommends maintaining five of each as a spare for every 10 terminals per location.

WARRANTY

The Seller agrees, represents, and warrants that the equipment delivered hereunder shall be free from defects in material and workmanship. Such warranty shall not apply to accessories, parts or material purchased by the Seller unless they are manufactured pursuant to Seller's design, but shall apply to the workmanship incorporated in the installation of such items in the complete equipment.

Seller's obligations under said warranty are conditioned upon the return of the defective equipment, transportation charges prepaid, to the Seller's factory, and the submission of reasonable proof to Seller prior to return of the equipment that the defect is due to a matter embraced within Seller's warranty hereunder. Any such defect in material and workmanship must have become apparent and Buyer must have notified Seller thereof within ninety (90) days after delivery, or ninety (90) days after installation if the installation was accomplished by the Seller.

The extent of Seller's liability under said warranty is limited to the repair or replacement of any defective accessory, part or material with a similar item free from defect, and the correction of any defect in workmanship. Returns are considered F.O.B., factory only, and all transportation charges are the responsibility of the buyer. Said warranty does not extend to loss of use or consequential damages.

Said warranty shall not apply if the equipment shall not have been operated and maintained in accordance with the Seller's written instructions applicable to such equipment, or if such equipment shall have been repaired or altered or modified without Seller's written approval, provided, however, that the foregoing limitations of warranty insofar as it relates to repairs, alterations or modifications shall not be applicable to routine preventive and corrective maintenance which normally occurs in the operation of the equipment.

TEC®

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