TERMIFLEX, INC.
A WPI Group Company

HT™/40

Reference Manual

HT/40

Reference Manual

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Warranty

The HT/40 is warranted to the original purchaser against defective materials and workmanship for a period of two years from the date of purchase. This warranty shall be voided if the product has been damaged by accident, misuse, or abuse, or if the product's serial number has been altered or removed, or if the product has been serviced or modified by an agent other than an authorized representative of WPI Termiflex, Inc. This is the entire warranty made by WPI Termiflex, Inc. WPI Termiflex, Inc. makes no other warranties, either expressed, implied, or statutory.

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The equipment described herein generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the guidelines set forth in this document, this equipment may cause interference to radio communications. The equipment has been tested and found to comply with the limits set for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference which the user will be required to correct at the user's own expense.

WPI Termiflex, Inc.

WPI Termiflex, Inc. has been the leading independent manufacturer of handheld Control Display Units (CDUs) since the company was founded in 1973. WPI Termiflex, Inc. offers a wide variety of CDUs and customization for industrial and military uses. For information on our complete product line, please contact the Applications Engineering Group at:

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Chapter 1. General Operation and Installation

This chapter covers the power requirements, pinouts and testing of the HT/40. This will provide the necessary information to power up the HT/40 and verify its operation. Also included is a description of the self-test which the unit runs each time the unit is turned on.

1.1 Power Requirements

The HT/40 operates on either a regulated +5 volt dc supply or, if ordered, it can optionally operate on up to +24 Vdc. In either case, should this voltage drop below the minimum +4.75 volts, operation of the terminal will be compromised. Symptoms of low voltage include the display no longer displays characters and the transmitter may not transmit.

1.1.1 +5 Volt Operation

Voltage: +5 Vdc ± 5% (+4.75 Vdc to +5.25 Vdc)

Current:	Interface	Typical @ +5 Vdc	With Backlighting
	Simplified RS-232	12 mA	47 mA
	RS-232-C	15 mA	50 mA
	RS-422 (10K Termination)	22 mA	57 mA
	20 mA Current Loop	13 mA	48 mA

Figure 1.1 - Power Consumption

Keep in mind that a long run of cable between the unit and power supply will affect the voltage level at the terminal. For instance, a #22 AWG copper conductor of length 62 feet will have a 1 ohm resistance. If using long lengths of wire, the subsequent voltage drop must be considered when choosing cable. The following are typical values of resistance for various sizes of wires.

AWG	Ohms/100 ft.
22	1.02
24	1.61
26	2.57

Figure 1.2 - Wire Resistance

1.1.2 Optional Wide Range Voltage Input

When ordered, this option allows the HT/40 to operate within the following range:

Voltage +4.75 Vdc to +24 Vdc

The typical current ratings listed in Figure 1.1 need to be increased when this option is installed. The ratings should be increased as follows:

Input Voltages +4.75 Vdc to +6.0 Vdc
Increase listed rating by: 30 mA

Input Voltage +6.0 Vdc to +24 Vdc
Increase listed rating by: 5 mA

The increase can be added to the listed rating since the current has been calculated based on the regulated +5 Vdc output of the internal dc/dc converter.

1.2 Circuit Reset

When power is applied, a circuit reset must first take place before the unit becomes functional. This reset takes approximately 3.5 seconds. The HT/40 will then enter the self-test mode, which requires an additional 4 seconds. The unit will not transmit during this period and it will not display or respond to received characters. The display test part of the self-test can be disabled, reducing the start-up time to 4.5 seconds.

1.3 Power Up Self-Test

The HT/40 self-test begins immediately after the hardware reset and verifies its integrity by means of 6 different tests. As it enters a different test, a message will appear on the display. If one of these messages remains on the display, then the unit failed during that test. If this occurs, contact the Applications Engineering Group at the factory. The HT/40 tests the following features:

	MESSAGE
INTERRUPT – Internal CPU vectors and interrups are tested. If failure occurs, then unit operations stop. No cursor will appear.	IRQ TEST
CPU – The flags and registers of the CPU are tested. If failure occurs, then unit operations stop. No cursor will appear.	CPU TEST
ROM – A checksum is done on all program memory locations. If failure occurs, then unit operations stop. No cursor will appear.	ROM TEST
RAM – the microprocessor RAM (192 bytes) is tested for failures. If failure occurs, then unit operation stops. No cursor will appear.	RAM TEST
NVRAM – A specific EEPROM location is read and compared to a stored value. If failure occurs, the message will appear in the display and normal operation will begin using the default parameters found in Chapter 5.	NVR TEST DEFAULTS USED NVRAM ERROR
DISPLAY – All 35 elements of each parameter are exercised. This is done by displaying the characters "M", "I", and "#" sequentially. Failure determination must be done visually. The display test lasts 3 seconds and can be turned off by using the escape command sequence specified in Chapter 5.	

The tests listed above verify most of the HT/40 operations. If any failures do occur during the self-test, the unit will need to be returned to the factory for repair. Other failures or apparent failures can occur. If you have any questions, please contact our Applications Engineering Group.

1.4 Pinouts

The pin connections for the HT/40 are shown in Figure 1.3.

Signal Description				Pinout			Cable
Simplified RS-232	RS-232-C	RS-422	20 mA Current Loop	DB-25P	DA-15P	9 Pin* Twist Lock	Conductor Color
Tx Data	Tx Data	Tx Data	Tx Data (Loop Out)	2	2	2	YEL
Rx Data	Rx Data	Rx Data	Rx Data (Loop In)	3	3	3	GRY
N/C	DTR	Tx Data	Loop Out Return	4	4	4	BRN
N/C	CTS	Rx Data	Loop in Return	5	5	5	WHT
GND	GND	GND	GND	7	7	7	BLK
V_{in}	V_{in}	V_{in}	V_{in}	9	15	9	RED

*The 9 pin Twist-Lock connector is an AMP #206486-01

Figure 1.3 Pin Connections

1.5 Installation and Testing

If Sections 1.0 through 1.4 have not yet been reviewed, please do so prior to installing or testing the HT/40. Once done, the following is recommended to assure proper operation:

1. Remove the unit and associated accessories from the shipping container and examine for evidence of physical damage in transit.
2. Identify the type of interface, cable connector, and input voltage for the unit. Hook the unit up for an off-line test as shown in Figures 1.4 through 1.6.
3. With the appropriate voltage applied, verify that the self-test completes without fault. Next, operate each key and check the display to see that each character appears in the display.
4. Install the unit in its intended application and verify correct operation.

Simplified RS-232 and RS-232-C Units	
Description	DB-25P Connections*
Xmit Data	2
Recv Data	3
GND	7 — Ground
V_{in}	9 — +V

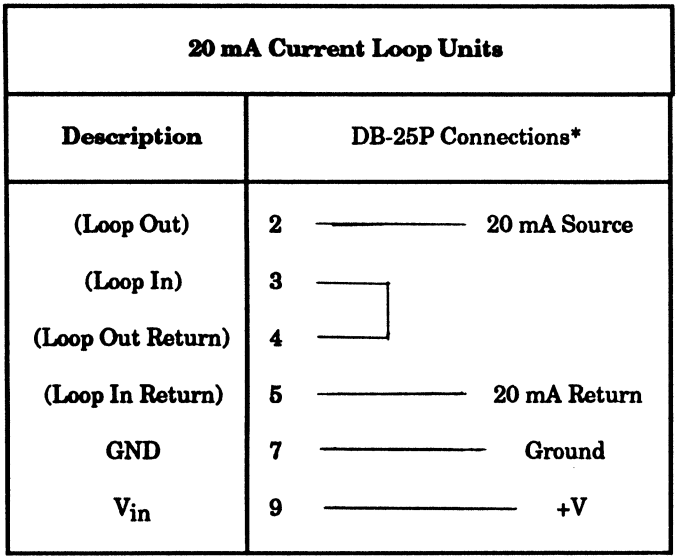
*For equivalent connections for other connectors, refer to Figure 1.3

Figure 1.4 - Simplified RS-232 and RS-232-C Off-Line Test Connections

RS-422 Units	
Description	DB-25P Connections*
Xmit Data	2
Recv Data	3
Xmit Data	4
Recv Data	5
GND	7 — Ground
V_{in}	9 — +V

*For equivalent connections for other connectors, refer to Figure 1.3

Figure 1.5 - RS-422 Off-Line Test Connections



*For equivalent connections for other connectors, refer to Figure 1.3

Figure 1.6 - 20 mA Current Loop Off-Line Test Connections. Loop Out is transmit, Loop is in receive.

If there is ever a question as to the correct operation of a unit, the off-line test procedure is a good way to verify that the unit is transmitting and receiving properly.

Chapter 2. Interface

The HT/40 is available with a choice of interfaces. Currently available are simplified RS-232, RS-232-C, RS-422, and 20 mA Current Loop. The required interface must be known when the unit is ordered since is cannot be field-modified. This chapter discusses the specifications and use of each of the interfaces.

2.1 Simplified RS-232

This interface is a derivation of the EIA standard RS-232-C. Also referred to as TTL, this interface transmits voltage levels of 0 v to +5 v. However, the receiver will accept EIA standard levels, or the 0 to +5 v levels. We have chosen to develop this as the HT/40 primary interface because many EIA standard RS-232-C interfaces are designed to correctly interpret 0 to +5 v levels. (See Figure 2.1 below.)

Data Logic States:
Mark (Idle State) = Logic 1 = Low output voltage
Space (Break State) = Logic 0 = High output voltage

Electrical Characteristics				
Parameter	**Condition**	**Value**		**Unit**
		Min.	**Max.**	
V_{ih} High Level Input Voltage (Space)		2.0		V
V_{il} Low Level Input Voltage (Mark)			.8	V
V_{oh} High Level Output Voltage (Space)	I_{oh} = MAX	2.4		V
V_{ol} Low Level Output Voltage (Mark)	I_{ol} = MAX		.4	V
I_{ih} High Level Input Current	V_{ih} = 2.4 v		.3	mA
I_{il} Low Level InPut Current	V_{il} = .4 v		.03	mA
Maximum Range				
I_{oh} High Level Output Current			-.4	mA
I_{ol} Low Level Output Current			16	mA

Figure 2.1 - Simplified RS-232 Electrical Characteristics and Maximum Ratings.

2.2 EIA RS-232-C

The HT/40 RS-232-C interface complies with the Electrical Signal Characteristics portion of this Electronics Industries (EIA) standard. Termiflex has implemented a subset of the interchange circuits. This set is:

Transmitted Data
Received Data
Clear to Send
Data Terminal Ready
Signal Ground

This interchange circuit deals with serial binary signals, from 0 to 20K baud with all signals having a common ground.

DATA LOGIC STATES – ACTIVE LOW:
Mark (Idle State) = Logic 1 = Negative Voltage
Space (Break Status) = Logic 0 = Positive Voltage

CONTROL LOGIC STATES – ACTIVE HIGH:
Clear to Send = Positive Voltage
Data Terminal Ready = Positive Voltage

DRIVERS:
High: +5 to +15 v
Low: -5 to -15 v Load with 3K-7K 2500 pf

RECEIVERS
High: +3 v to + 25 v
Low: -3 v to -25 v

Input impedance shall be between 3K and 7K ohms.
Shunt capacitance shall not exceed 2500 pf.
There shall be no inductive load components.

The HT/40 meets the above specification. The nominal open circuit voltage at the transmit pin are +9 volts and -8 referenced to logic ground pin.

2.3 20 mA Current Loop

This interface type dates back to when teletype units were the only form of data terminal equipment available. It was principally designed to switch mechanical relays at a baud rate of 110. As systems became more refined and baud rates increased, other types of interfaces surfaced. The current loop, however, still remained popular for compatibility reasons. The HT/40 is available with a 20 mA passive current loop interface. This interface is considered passive because the current sources must be supplied externally, either by the data communications equipment (DCE or Modem), the host, or external supplies (e.g. Termiflex Model #PS/1A).

The Termiflex units are constructed with independent transmit and receive circuitry. This allows the system to be configured as a two or four wire loop. Typical voltage drops and simplified schematics of the transmit and receive circuits are shown in Figures 2.2 and 2.3. Optical isolation is provided in both circuits to minimize noise problems and to permit voltages of up to +150 v to drive current loops. Some typical two and four wire loop systems are shown in Figures 2.2 through 2.7.

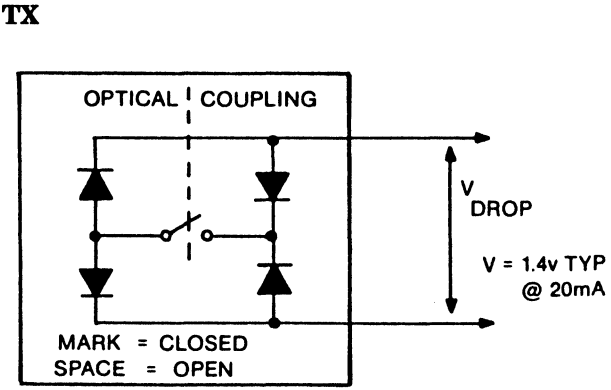


Figure 2.2 Simplified schematic and DC parameters of 20 mA Transmit Circuit.

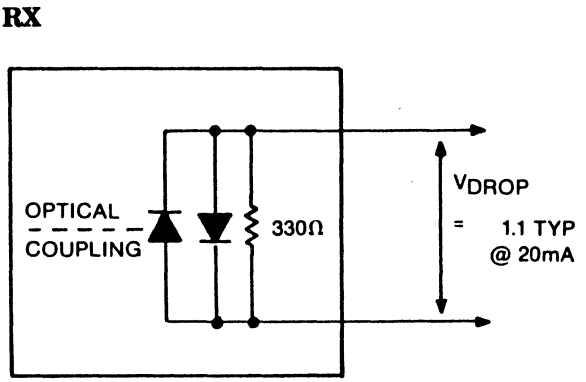


Figure 2.3 Simplified Schematic and DC parameters of 20 mA Receive Circuit.

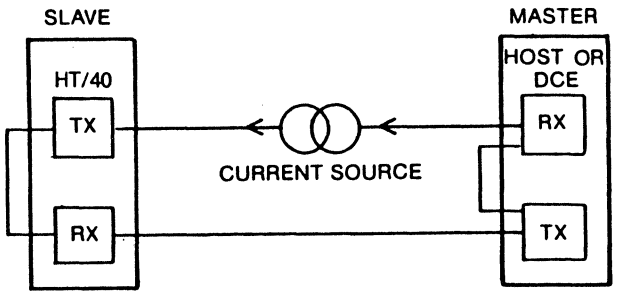


Figure 2.4 Wire Loop System with One Remote Termiflex Unit. (Only one unit may transmit at a time. Both units receive transmitted data.)

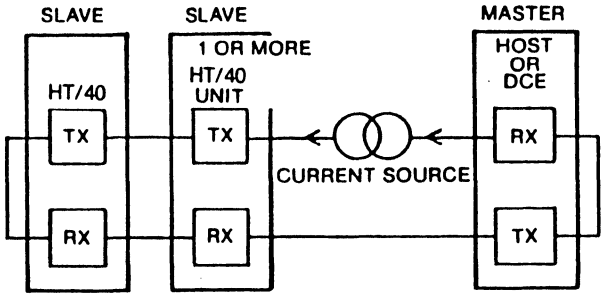


Figure 2.5 Wire Loop System with Two or More Remote Termiflex Units. (Only one unit may transmit at a time. All units receive transmitted data.)

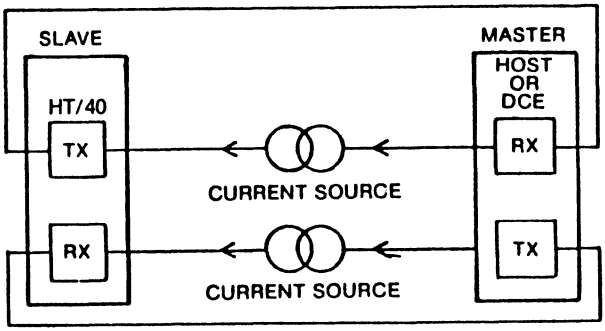


Figure 2.6 Four Wire Loop System with One Remote Termiflex Unit. (Both units may transmit simultaneously.)

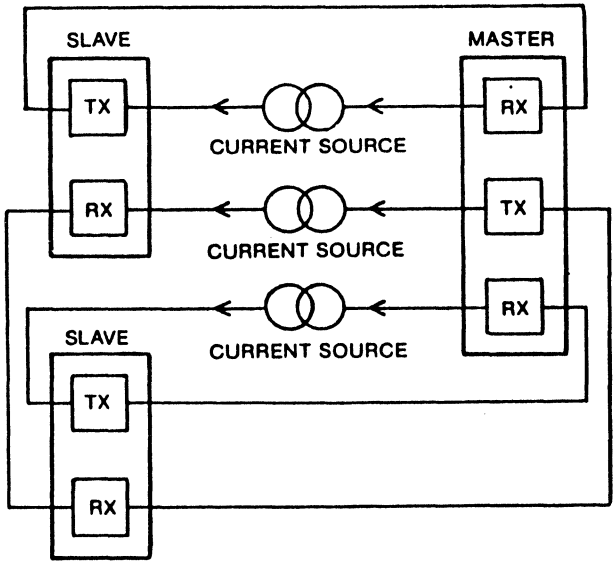


Figure 2.7 Modified 4 Wire Loop System with Two Remote Termiflex Units. (Both slaves receive what the master transmits. Only the master receives what the slaves transmit. All units can transmit simultaneously.)

For current loop systems, a mark or idle state is indicated by current flow. A space or break state is indicted by no current flow in the loop. Because of this convention, an unpowered HT/40 in the loop, or a break in the loop, such as a disconnected unit, indicates a space or break condition.

2.4 RS-422

The Electronic Industries Association developed this standard in 1975. This standard specifies the electrical characteristics of a balanced voltage digital interface circuit. These characteristics are specified in terms of required voltage, current and resistance values, and are described below in brief. For complete information on the electrical characteristics, refer to a copy of the EIA RS-422 standard, April, 1975.

LOGIC LEVELS
The non-inverting terminal of the transmitter shall be negative with respect to the inverting terminal for a marking condition.

DRIVER

The magnitude of the open circuit voltage between the two outputs, or from either output to ground, shall not exceed +6 volts. With a 100Ω load across the output, the voltage across the load shall not be less than +2.0 volts or 50% of the open circuit differential voltage, whichever is greater. Short circuit output current shall not exceed 150 milliamperes.

RECEIVER

With common mode voltage from -7 to +7 volts, the correct binary state shall be assumed for input differential voltage range of +200 millivolts to +6 volts. The receiver shall tolerate 12 volt differential input without damage. Input impedance shall be > 4KΩ.

SIGNAL LIMITATIONS

With 100Ω load across the outputs, there shall be no glitches in transition region (area between .1 and .9 of the steady state output voltage). Transition time shall be less than 10% of the bit time.

Chapter 3. Keyboard

This chapter covers both the operation of the keyboard and the preparation of custom keyboard graphics. There are two transmission modes that the user can select for the HT/40. Because of this, we provide overlays which allow the user to have the appropriate legends for the particular transmission mode. These two modes are the Simplified keyboard and Full ASCII keyboard.

3.1 Simplified Keyboard–24 ASCII Character Transmission

In this mode, set by using the downline commands specified in Chapter 5, the keyboard will transmit one character per key, 24 total. There is a default set of characters for the Simplified keyboard and there is a user-select mode which allows a different, user-specified, group of characters to be transmitted.

3.1.1 Default Keyboards

Figure 3.1 shows the legends, in bold, for the default simplified keyboard. In parenthesis below each is the ASCII code in hexidecimal. Please note that you have an overlay for the keyboard which matches this configuration. Each time a key is pressed, a character is transmitted. Auto Key Repeat and Maximum Key Repeat can be enabled for this mode and apply to all the keys. Please refer to Section 3.3 for detailed information on the Repeat functions.

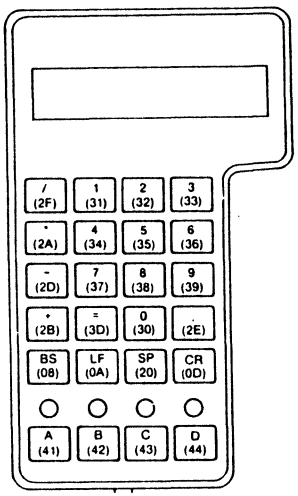


Figure 3.1 Simplified Keyboard Default Codes Hex codes in ( ).

3.1.2 User-Selected Keycodes

The user may optionally set the character to be transmitted by each key for the Simplified Keyboard mode. This is done by using the commands specified in Chapter 5 for downline loading. All the characters will be ASCII codes and may be any of the 128 character set. The Auto Key Repeat or Maximum Key Repeat may be enabled but is done on a key-by-key basis at the same time that the code is chosen. If neither is enabled for a specific key, then that key will transmit one character per keystroke. Please refer to Section 3.3 for more information on the Repeat functions.

3.2 Full ASCII Keyboard – 128 ASCII Character Transmission

In this mode 19 of the 24 keys will transmit an ASCII character. The remaining five keys are used to modify the transmission of the keys to allow generation of the entire 128 character set. The key legends are shown in Figure 3.2 for this configuration. The four bottom keys are shift keys and operate as described in the following section. The key marked CTRL is the control key and lower case key. This is described in Section 3.2.2.

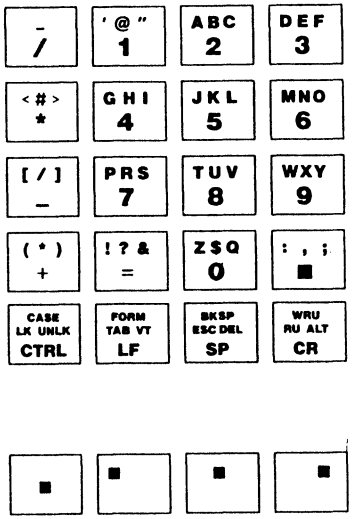


Figure 3.2 Full ASCII Keyboard Legends

3.2.1 Shift Keys

The bottom row of keys in Figure 3.2 are shift keys which modify the 19 transmitting keys. The shift key also affects the shape of the cursor as shown in Figure 3.3. The Normal Cursor, for instance, corresponds with the unshifted mode. The unshifted mode is the initial condition at power up and can be obtained at any time by pressing the leftmost shift key, the shift cancel. Any time a shift key (left middle or right) is used, it will remain active for one following keystroke, after which the keyboard will revert back to the unshifted mode. The left shift key, second key from the left, will access characters such as A, D, etc., when the user presses the left shift followed by the A key. The middle and right shift keys operate in a similar fashion.

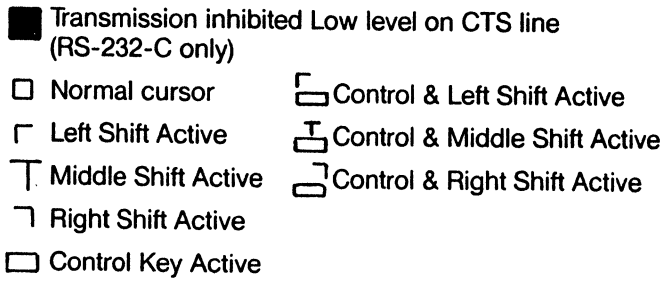
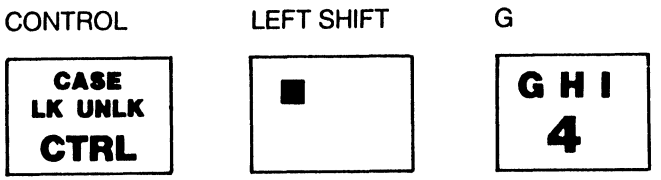


Figure 3.3 - HT/40 Cursor

3.2.2 CTRL, CASE, LK, UNLK

This key, in conjunction with the shift keys, allows access to all control characters and lower case characters. To generate a control character with the unit in the unshifted mode, the user would press CTRL followed by a shift key followed by the appropriate keyboard legend key. For example:



Transmits a HEX 07 (Bel) character. All other control characters are generated in a similar way.

LK and UNLK refer to locking the keyboard into upper case mode. LK is the normal default. Unlocking the unit allows only lower case characters to be transmitted. LK will put the unit back into upper case mode.

To generate a single upper case character, when locked into lower case, press the left shift, followed by this key (CASE), followed by the appropriate alpha character. After transmitting, the unit will revert back to the lower case mode. The cursors for CTRL and SHIFT are shown in Figure 3.3.

3.3 Auto Key Repeat, Maximum Key Repeat

The Auto Key Repeat or Maximum Key Repeat can be enabled by using the downline loading sequence found in Chapter 5.

Auto Key Repeat works much the way typewriter keys operate. When pressed, a key will transmit one character. If it is continuously held down, then there will be about a 1/2 second pause followed by retransmission of the character at about 7 characters a second. The transmission stops when the key is released.

Maximum Key Repeat allows the user to transmit a continuous character stream as soon as a key is pressed. The rate of transmission is dependent on the baud rate of the unit. The rates are as follows:

Baud	Max Key Repeat Speed (Characters/Sec)
110	11
150	15
300	30
600	40
1200	40
4800	40
9600	40

3.4 Keyboard Overlays-KB/Kit

If you purchased an HT/40 from stock, you will have a packet which contains a tactile overlay, 3 flat layers, a transfer lettering kit and a piece of glazed paper. First you will need to select which of the flat legend overlays you want.

By now you have reviewed the different options for Full ASCII and Simplified ASCII keyboard operations. Please note that there is a flat layer for each of these in addition to the blank layer. If you want your own legends, the blank layer can be written on, have transfer letters applied, or even silkscreened, if you wish. Keep the legends within the .5 x .6 central portion of the key. Assembly is as described in 3.4.1 and 3.4.2.

NOTE: Once assembled, the overlays are permanent.

3.4.1 Assembling Flat Layer to Tactile Layer.

Place the tactile layer upside down on a hard surface.

Peel off the upper half of the protective backing that covers the keyboard portion of the textile layer. (This will require ripping the backing in two pieces). DO NOT remove the backing from the window area or from the bottom half of the keyboard area.

Cover the exposed adhesive with the glazed paper. Place the flat layer legend side down onto the faceplate. Line up the flat layer carefully with the key ares. Holding the assembly together and turning over makes this easier. Hold the two firmly together, slide the glazed paper out and press the flat layer smoothly onto the tactile layer.

Complete the assembly by removing the bottom portion of the protective backing and pressing the two pieces together, smoothing from top to bottom.

3.4.2 Assembling the Completed Faceplate to the HT/40 Case.

Remove the protective backing from the window portion of the faceplate.
Place the glazed paper over the window portion of the case. Place the faceplate assembly onto the case, position it, pull out the glazed paper, and press the window portion of the faceplate onto the case top.

Complete the assembly by removing the protective layer from the back of the faceplate and firmly press it down onto the case top, working from the top to the bottom.

3.5 Custom Overlays - KB/500

Termiflex can manufacture special multicolor overlays for you and ship the units with this overlay already on the case. There is a limit of five colors for a keyboard.

To generate the artwork, Termiflex will send you a 2X master form for you to put your art on. This can consist of legends and logos located anywhere within the tolerances specified on the instruction sheet that will come with the form. All colors specified must be called out as a PMS number.

Chapter 4. Display

The HT/40 display consists of two lines of 16-character liquid crystal display. The unit is capable of displaying 95 ASCII characters as shown in Figure 4.1, as well as four user-defined symbols. The unit has full cursor movement and erasing features as described in Section 4.3.

Octal	Parity	Hex	Character	Alternates
040	Odd	20	SP	SPACE, BLANK
041	Even	21	!	
042	Even	22	"	
043	Odd	23	#	
044	Even	24	$	
045	Odd	25	%	
046	Odd	26	&	
047	Even	27	'	APOSTROPHE
050	Even	28	(	
051	Odd	29	)	
052	Odd	2A	*	
053	Even	2B	+	
054	Odd	2C	,	COMMA
055	Even	2D	-	MINUS
056	Even	2E	.	
057	Odd	2F	/	
060	Even	30	0	NUMBER ZERO
061	Odd	31	1	NUMBER ONE
062	Odd	32	2	
063	Even	33	3	
064	Odd	34	4	
065	Even	35	5	
066	Even	36	6	
067	Odd	37	7	
070	Odd	38	8	
071	Even	39	9	
072	Even	3A	:	
073	Odd	3B	;	
074	Even	3C	<	LESS THAN
075	Odd	3D	=	
076	Odd	3E	>	GREATER THAN
077	Even	3F	?	

Octal	Parity	Hex	Character	Alternates
100	Odd	40	@	SHIFT P
101	Even	41	A	
102	Even	42	B	
103	Odd	43	C	
104	Even	44	D	
105	Odd	45	E	
106	Odd	46	F	
107	Even	47	G	
110	Even	48	H	
111	Odd	49	I	LETTER I
112	Odd	4A	J	
113	Even	4B	K	
114	Odd	4C	L	
115	Even	4D	M	
116	Even	4E	N	
117	Odd	4F	O	LETTER O
120	Even	50	P	
121	Odd	51	Q	
122	Odd	52	R	
123	Even	53	S	
124	Odd	54	T	
125	Even	55	U	
126	Even	56	V	
127	Odd	57	W	
130	Odd	58	X	
131	Even	59	Y	
132	Even	5A	Z	
133	Odd	5B	[	SHIFT K
134	Even	5C	/	SHIFT L
135	Odd	5D	]	SHIFT M
136	Odd	5E	^	↑ SHIFT N
137	Even	5F	_	←, SHIFT O

Octal	Parity	Hex	Character	Alternates
140	Even	60	`	ACCENT GRAVE
141	Odd	61	a	
142	Odd	62	b	
143	Even	63	c	
144	Odd	64	d	
145	Even	65	e	
146	Even	66	f	
147	Odd	67	g	
150	Odd	68	h	
151	Even	69	i	
152	Even	6A	j	
153	Odd	6B	k	
154	Even	6C	l	
155	Odd	6D	m	
156	Odd	6E	n	
157	Even	6F	o	
160	Odd	70	p	
161	Even	71	q	
162	Even	72	r	
163	Odd	73	s	
164	Even	74	t	
165	Odd	75	u	
166	Odd	76	v	
167	Even	77	w	
170	Even	78	x	
171	Odd	79	y	
172	Odd	7A	z	
173	Even	7B	{	
174	Odd	7C	|	VERTICAL SLASH
175	Even	7D	}	ALT MODE
176	Even	7E	~	(ALT MODE)

Figure 4.1 Displayable ASCII Characters

4.1 General Display Operation

The HT/40 display will display any of the 95 ASCII characters shown in Figure 4.1. In addition, there are four user-defined characters which have a dot configuration defined via the downline command specified in Chapter 5. The HT/40 will display these special symbols when it receives the appropriate control character as defined in Figure 4.2. This figure also defines all control characters which the HT/40 will respond to. All other control characters are ignored.

In normal operation the HT/40 will fill the bottom line of the display with received characters from left to right. When the 17th character is received, the bottom line will scroll up and the 17th character will appear on the bottom line in the leftmost position. When the display is full (32 characters), the cursor will alternate with the last character in the display (bottom line, rightmost position).

Control Code (Hex)			Response
Carriage Return	CR	(OD)	Cursor returns to leftmost position.
Line Feed	LF	(OA)	Information scrolls up one line when next displayable character is received. If cursor is in top line, it moves to the bottom row, leftmost.
Backspace	BS	(08)	Cursor moves back one position in current line.
Enquiry	ENQ	(05)	Unit responds with an ACK (Hex 06).
Substitute	SUB	(1A)	Starts a flashing sequence.
Cancel	CAN	(18)	Terminates a flashing sequence.
Escape	ESC	(1B)	Prepares terminal for a following command.
File Separator	FS	(1C)	Displays #1 user-defined character.
Group Separator	GS	(1D)	Displays #2 user-defined character.
Record Separator	RS	(1E)	Displays #3 user-defined character.
Unit Separator	US	(1F)	Displays #4 user-defined character.

Figure 4.2 - HT/40 Response to Valid Control Characters

4.2 Backlighting Option

The HT/40 is available with a backlight option. If you purchased this option, your unit will draw approximately 35 mA more current at +5 Vdc. Typical values of current are shown in Figure 1.1.

ESC (Hex 1B)	Q (Hex 51)	Backlight ON
ESC (Hex 1B)	R (Hex 52)	Backlight OFF

There is no control over the intensity of the backlight.

4.3 Cursor Movement and Display Commands

The List of ESCAPE commands specified in Figure 4.3 gives all the controls for movement of the cursor and screen erasing. Definitions of the commands are included.

Cursor Up	• Moves the cursor up one row. No change in horizontal position. When the cursor is in the up row of the display, the command is ignored.
Cursor Down	• Moves the cursor down one row. No change in horizontal position. When the cursor is in the bottom row, the command is ignored.
Cursor Right	• Moves the cursor to the right one position. Vertical position is unchanged. When at far right, the command is ignored.
Cursor Left	• Moves the cursor to the left one position. Vertical position is unchanged. When at the far left, the command is ignored.
Cursor Home	• Places the cursor in the bottom row, leftmost character position.
Cursor Home Up	• Places the cursor in the top line, leftmost character position.
Erase to End of Line	• Erase all characters from the cursor position to the end of the line. Cursor position is unchanged.
Erase to End of Screen	• Erase all characters from the cursor position to the end of the display. Cursor position is unchanged.
Direct Cursor Positioning	• Moves the cursor to a specific location on the display.

Figure 4.3 ESCAPE Commands

Code	Sequence	Function
ESC (1B)	A (41)	Cursor Up
ESC (1B)	B (42)	Cursor Down
ESC (1B)	C (43)	Cursor Right
ESC (1B)	D (44)	Cursor Left
ESC (1B)	H (48)	Cursor Home
ESC (1B)	L (4C)	Cursor Home Up
ESC (1B)	K (4B)	Erase to End of Line
ESC (1B)	J (4A)	Erase to End of Screen
ESC (1B)	Y (row)(column) (59)	Direct Cursor Positionng row = (Hex 20) Sp for Row 1, (Hex 21)! for row 2 column = (Hex 20 Sp to (Hex 2F)/ Row 1 to Row 16 respectively
ESC (1B)	M (4D)	Display Message Buffer
ESC (1B)	N (4E)	Restore Message Buffer
ESC (1B)	Q (51)	Backlight ON
ESC (1B)	R (52)	Backlight OFF
ESC (1B)	E (parameter) (45)	Define User Characters (refer to Ch. 5)
ESC (1B)	G (parameters) (47)	Define Operation Parameters (refer to C.h. 5)
ESC (1B)	I (keycodes) (49)	Define Keyboard Configuration (refer to Ch. 5).

Figure 4.3 ESCAPE Commands (Continued)

4.4 Message Buffer

A 16-character message can be stored in the HT/40 without using the display. By using the ESC F command shown on Chapter 5, this message will be stored in the special buffer. The buffer may be interchanged with the bottom line of the display through use of two other Escape commands. When this is done, no display information is lost, but rather temporarily replaced with the message buffer. The previously displayed information can be restored. To use this buffer, transmit to the HT/40 the following commands:

ESC M – Display Message Buffer

ESC N – Restore Message Buffer

If characters are received while the message buffer is being displayed, the unit will overwrite the message starting at the previous cursor position. The contents of the message buffer, when restored, will not have been changed. When power is turned off, the message buffer will be cleared.

Chapter 5. Terminal Set-up

The HT/40 has the ability to retain a user-selected configuration even when power to the unit has been interrupted. The selections that can be made must all be done through the serial data line. These selections include configuring:

Communications Parameters
Keyboard Parameters
User-Defined Characters
User-Defined Keycodes, and
Display Parameters.

These configuration options are detailed in the following sections.

NOTE: Be sure to read Section 5.5 on writing to non-volatile memory.

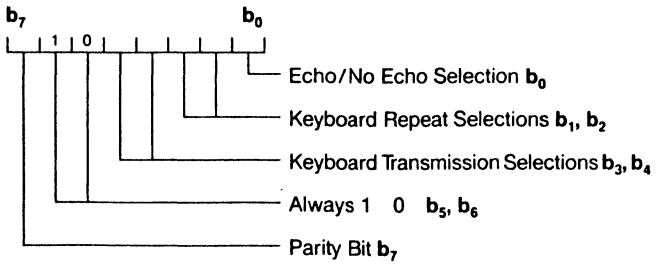
5.1 Keyboard, Communications and Display Parameters

The following escape command, transmitted to the HT/40, will set up the following parameters:

ESC G (Keyboard Byte) (Communications Byte) (Display Byte)

where each of the three variables is a bit mapped byte defining terminal characteristics.

5.1.1 Keyboard Byte



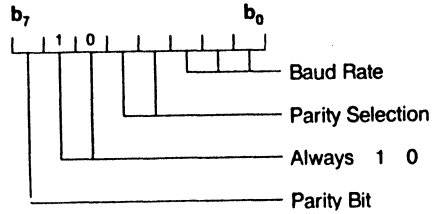
Echo/No Echo	b_0
Echo =	1
No Echo =	0

Keyboard Repeat Selections	b_2	b_1
No Repeat =	0	0
Auto Repeat =	0	1
Max Repeat =	1	X (X = Don't Care)

Keyboard Transmission Selections	b_4	b_3
Shift Enabled	0	0
Shift Disabled, Default Keycodes	0	1
User-Defined Keycodes	1	X (X = Don't Care)

Default Keyboard Settings: No Echo, No Repeat, Shift Enabled

5.1.2 Communications Byte



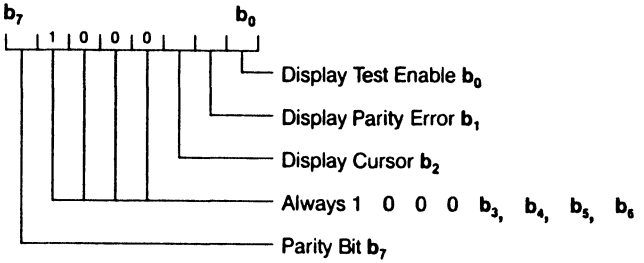
Baud Rate	b_2	b_1	b_0
110	0	0	0
150	0	0	1
300	0	1	0
600	0	1	1
1200	1	0	0
2400	1	0	1
4800	1	1	0
9600	1	1	1

Parity	b_4	b_3	
EVEN	0	0	
ODD	0	1	
MARK	1	0	Also called 7 bit No Parity
SPACE	1	1	Also called 8 bit No Parity

Default Communication Settings are: 1200 Baud, EVEN PARITY

NOTE: The high order bit (b_7) is the parity for the byte to be transmitted and is not part of the user selections and must agree with the current parity setting.

5.1.3 Display Byte



Display Test Enable	b_0
Enable	1
Disable	0

Display Parity Error	b_1
Enable	1
Disable	0

Display Cursor	b_2
Visible	1
Invisible	0

Default Display Settings are: Display Test Enabled, Display Parity Error Enabled, Cursor Visible.

NOTE: The high order bit (b_7) is the parity for the byte to be transmitted and is not part of the user selections and must agree with the current parity setting.

5.2 Message Buffer Programming

To use the message buffer as specified in Chapter 4, it first must be programmed. To do this, the following string must be transmitted to the HT/40:

ESC	F	(message)
(Hex 18)	(Hex 46)	

where (message) is a string of 16 ASCII characters.

The message buffer is only retained for as long as power is applied to the HT/40, therefore, it must be reprogrammed at each new power up.

Default Setting: None.

5.3 Define Keyboard Configuration

To rearrange which keys transmit which characters, this feature must be used in conjunction with the ESC G sequence called out in Section 5.1. That ESC G sequence will enable the unit to use the keycode table that the following command will set up.

ESC	I	(k1. . . .k24)
(Hex 1B)	(Hex 49)	

Where (k1...k24) are each a pair of ASCII characters, Byte 1 of the pair is the character to be assigned to that key. (Layout shown in Figure 5.1).

Byte 2 sets the repeat function status of that key.
ASCII 1 (Hex 31) – Repeating Function ON
ASCII 0 (Hex 30) – Repeating Function OFF
The repeating function used is determined by the keyboard setup byte shown in Chapter 5.

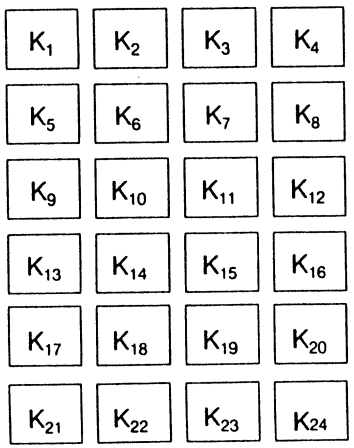


Figure 5.1 - Keycode Table Layout

5.4 Define User Characters

To use the control codes specified in Figure 4.2 to put special characters on the screen, they first must be defined. These characters are defined on a dot-by-dot basis. Each character is formed by a 5 x 7 dot matrix as follows:

ESC	E	(n)(r1)(r2)(r3)(r4)(r5)(r6)(r7)
(Hex 1B)	(Hex 45)	

where (n) is an ASCII 1, 2, 3, or 4 and (r1) through (r7) are each a bit mapped byte with the low order 5 bits of each byte representing the columns of a character in the dot matrix display.

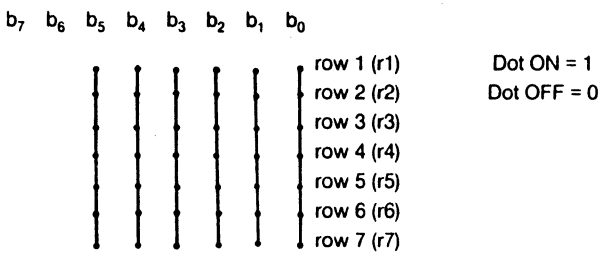


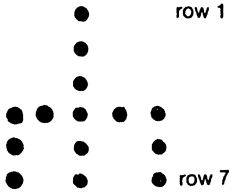
Figure 5.2. Dot Matrix Configuration

NOTE: Bits 5 and 6 are not used and may be either a logic 0 or logic 1. Bit 7 (b_7) is the parity bit.

Example:

To program the 1st user character as a ⌐┼┐ symbol, the following command would be used.

ESC	E	1	EOT	EOT	EOT	EOT	US	NAK	NAK
(1B)	(45)	(31)	(04)	(04)	(04)	(04)	(1F)	(15)	(15)



User defined characters are cleared when power is turned off.

Default Characters are:

character 1	⌐1
character 2	⌐2
character 3	⌐3
character 4	⌐4

5.5 Writing to Non-Volatile Memory

The non-volatile memory used is an EEPROM. This EEPROM can be written to approximately 10,000 times.

After storing new keyboard code configuration (Section 5.3) or new operating parameters (Section 5.1) a delay will exist before the HT/40 can transmit or receive characters.

The delays are:

Define Keyboard Configuration	500 milliseconds
Define Operation Parameters	150 milliseconds

Chapter 6. Mechanical and Environmental

This chapter gives the physical information for both the HT/40 and its accessories. The drawings in this chapter involve the mounting of the HT/40, using the brackets available from Termiflex. If other information is required, please contact the factory.

6.1 Specifications

Maximum dimensions	7.1" high x 4.2" wide x 1.5" deep
Weight	15 oz. (426 g)
Operating Temperature Range	-18°C to +50°C
Storage Temperature Range	-20°C to +70°C
Humidity	95% non-condensing

6.2 Mounting

There are two methods of mounting the HT/40. The first is to hang the unit such that it can be removed and operated in the hand. The second is to panel-mount the unit. Figures 6.1 through 6.4 give dimensions of the HT/40 case, brackets and cutouts necessary to mount the terminal using either method.

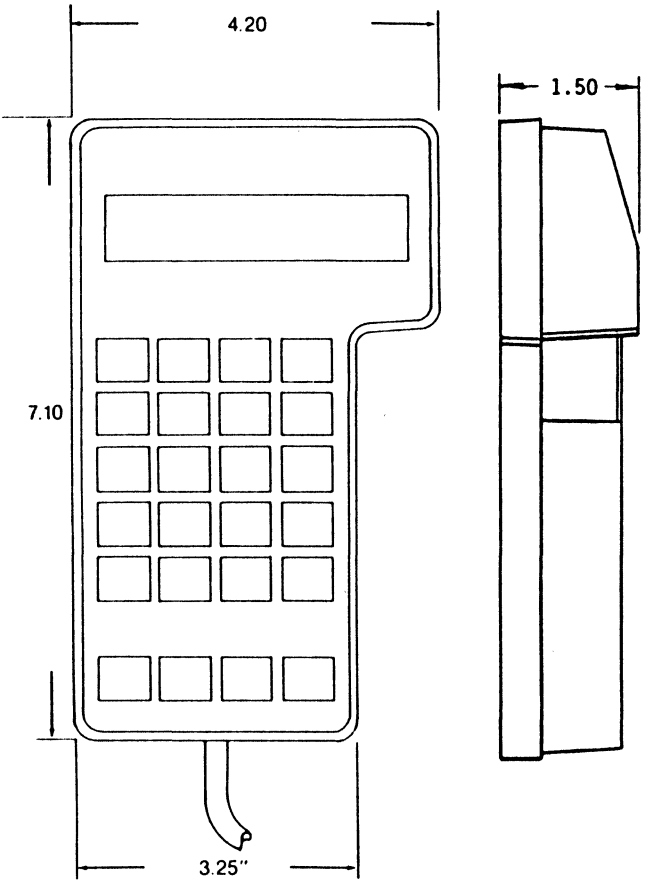


Figure 6.1 HT/40 Outline Drawing (All dimensions in inches).

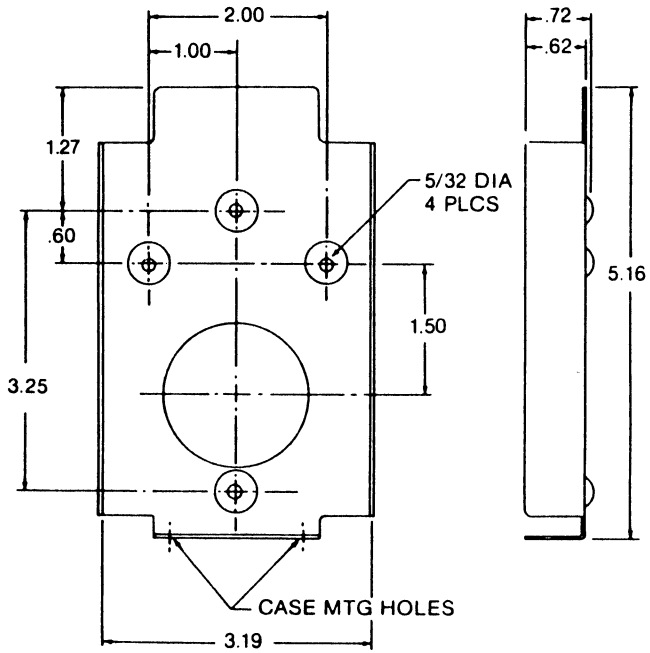


Figure 6.2 Surface Mounting Bracket Dimensions. MO/5

(All dimensions are in inches)

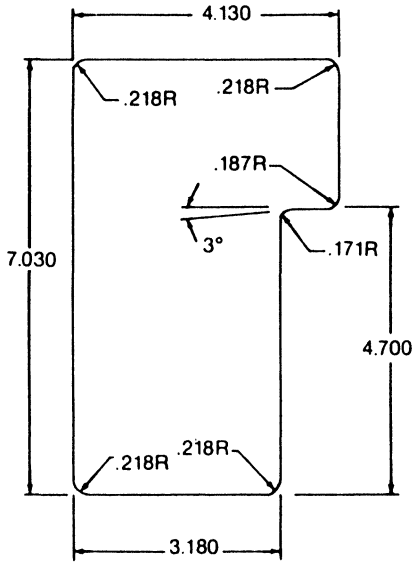


Figure 6.3 Panel Cutout Outline for Recess Mounting

(All dimensions are in inches)

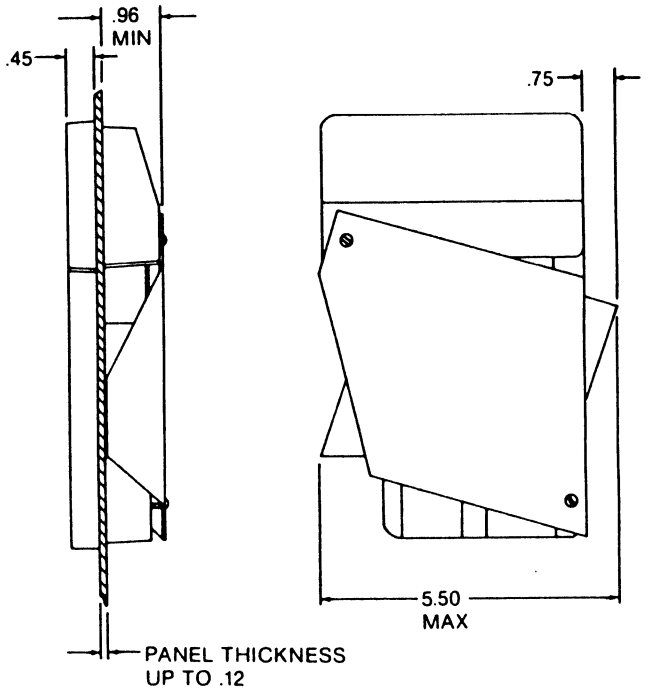


Figure 6.4 Recessed Mounting Clamp Dimensions. MO/6

-Notes-