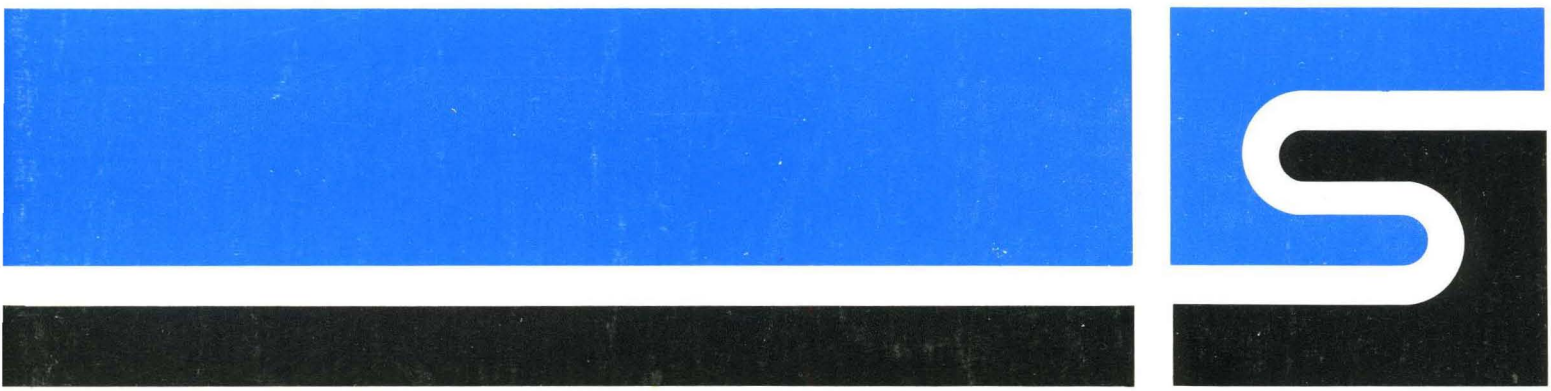

Synertek Systems Corporation

KTM-3 USER'S MANUAL

KTM-3 and KTM-3/80

REFERENCE MANUAL

SSC Pub MAN-260056-B

Fifth Printing: May, 1981

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SECTION 1

INTRODUCTION

Synertek Systems' KTM-3/40 or KTM-3/80, when combined with a video monitor, provides a low-cost, interactive display terminal. Two models are available; the KTM-3/40 which features 40 characters per line, and the KTM-3/80 which features 80 characters per line. The KTM-3/80 is functionally identical in every respect to the KTM-3/40. For this reason, throughout the remainder of this manual, KTM-3 will refer to both the KTM-3/40 and the KTM-3/80 unless otherwise noted.

The KTM-3 keyboard consists of 58 keys which generate upper and lower case, alpha, numeric, special, and control characters. With KTM-3's relative and absolute cursor addressing, characters may be placed and/or moved about on the display using a minimum of software.

The KTM-3 is available with a 115V or a 230V power transformer. The video refresh rate automatically synchronizes to 50Hz or 60Hz line frequency.

The KTM-3 keyboard is backed by a 90 day warranty provided by Synertek Systems Corporation. To maintain the validity of this warranty, please be sure to follow the instructions for inspection and installation of the KTM-3 listed in the next sections of this manual.

SECTION 2

INSTALLATION

2.1 Unpacking

The KTM-3 is packaged to protect against mechanical shock during shipping. If the shipping carton is damaged, notify the carrier for any claim adjustment. Remove the terminal from its box and inspect it for any damage incurred during shipping. If any damage is found, notify the carrier at once. The following items should be included:

- Keyboard unit with cable attached
- Wall mounting transformer with cable (check for correct unit - 115V or 230V)
- Video cable
- Warranty card
- Manual

****

WARNING: The KTM-3 must be ordered with either a 115V (60Hz) or a 230V (50Hz) transformer. The transformer MUST match the power applied to the system, or physical damage to the KTM-3 may result.

****

2.2 Connecting a Video Monitor

When connecting the video monitor, follow the manufacturer's directions. The KTM-3 video signal is the center conductor of the coax connector. The ground is the outside shield. The video monitor can be connected with the video jack provided.

****

WARNING: Never connect the KTM-3 to the inside of a modified television unless it is electrically isolated from the 115 VAC wall power by means of a transformer. Some inexpensive television sets are not isolated, and the chassis are hot (at a large electrical potential above ground). This will not only damage the KTM-3, but the user may receive severe electrical shocks. For these reasons, the KTM-3's video signal should be applied directly into a video monitor. Refer to Figure 2-1 for a partial schematic of the video circuitry.

****

The KTM-3 video signal levels are shown in Figure 2-2. The video signal is ground to 1.0V and consists of three voltage levels, sync (ground), black (also blanking), and white. When purchasing a video monitor, be sure that signal levels shown in Figure 2-2 are adequate for proper operation. For best results, it is recommended that the user try out the KTM-3 with the monitor before purchasing the monitor.

2.3 Check-out and Demonstration of Features

To verify the working condition of the KTM-3 and to familiarize yourself with some of its features prior to operation, proceed as follows:

- Connect the transformer to the power line, the transformer cable to the power connector on the KTM-3, and the video cable from the KTM-3 to the video monitor. See Figure 2-3.

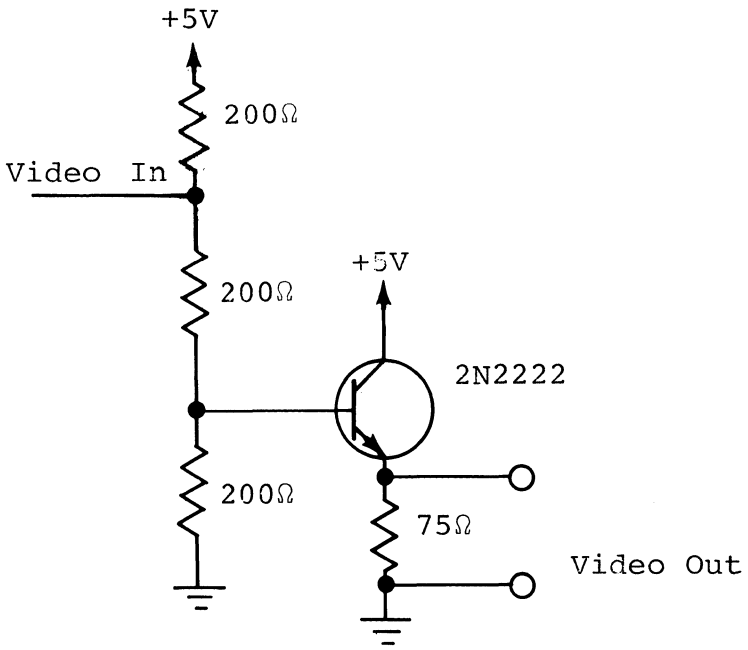


Figure 2-2. KTM-3 Video Circuitry

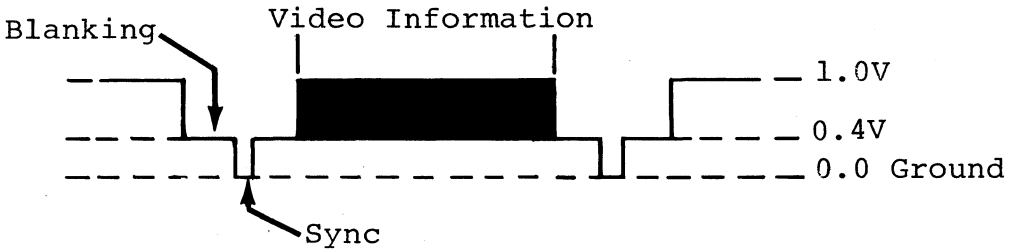


Figure 2-1. KTM-3 Video Signal Levels

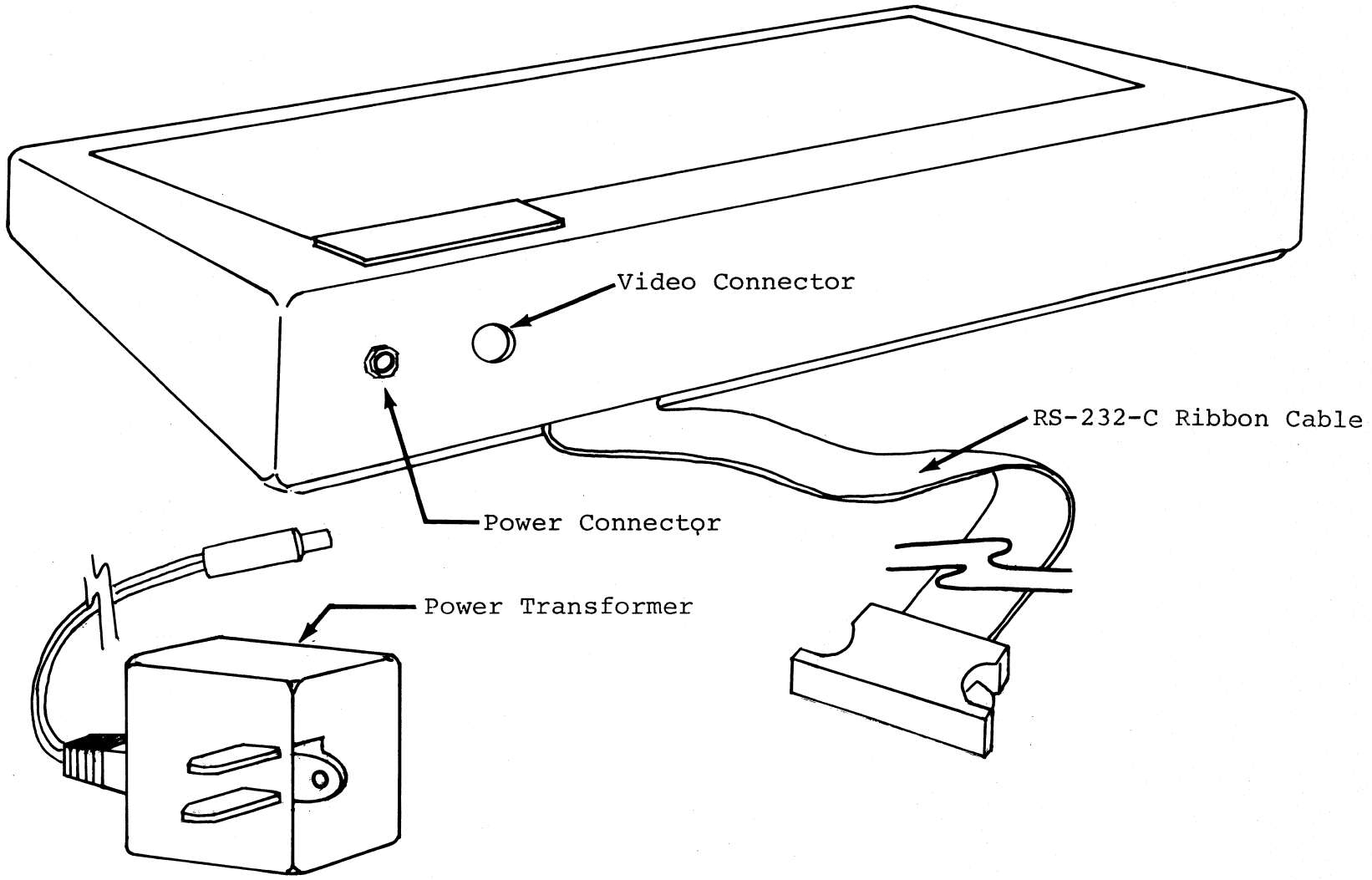


Figure 2-3. Location of Connectors

- Set all option switches in KTM-3 to OPEN position. Refer to Figures 2-4 and 2-5 for the location of the option switches.

- Refer to Figure 2-4 for the location of the KTM-3 ON/OFF switch. Turn on the KTM-3 and the video monitor. Allow approximately 30 seconds for the monitor to warm.

- Adjust vertical and horizontal hold, brightness, and contrast on the video monitor to achieve the best picture.

- Depress each alphanumeric key and observe the characters as they appear on the display.

- To return the cursor to home, depress the (CLEAR HOME) key.

- Depress and hold down the (LINE FEED) key. Observe the cursor moving to the bottom of the display, causing the characters at the top of the display to scroll off the top.

- Lock down the (CAPS LOCK) key. Type several lines of alphanumeric characters. Observe that the letters are shifted to the upper case, while the other keys are unaffected.

- Hold down the (SHIFT) key and depress the (CLEAR HOME) key. Observe that the display is cleared and the cursor returns to the extreme upper left position (home position).

- Refer to Figure 2-6 for the location and description of the KTM-3 special keys.

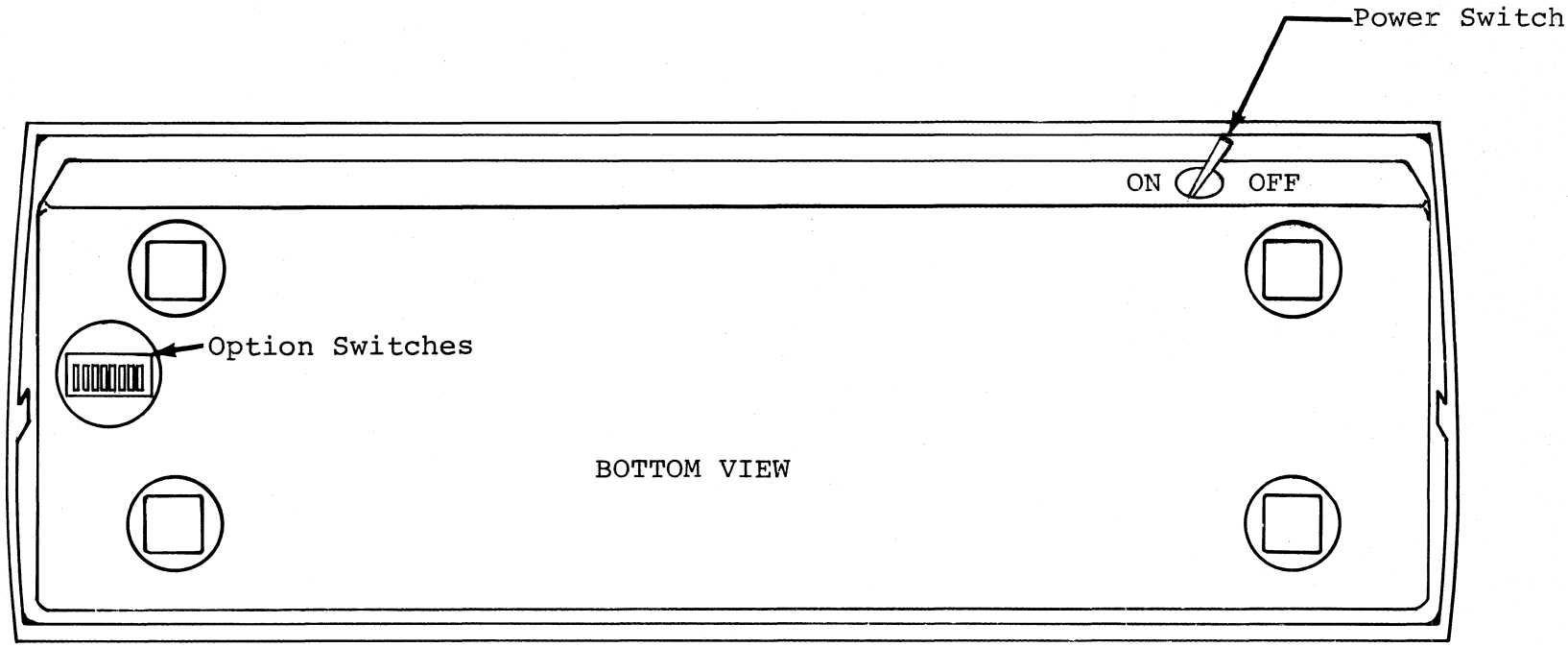
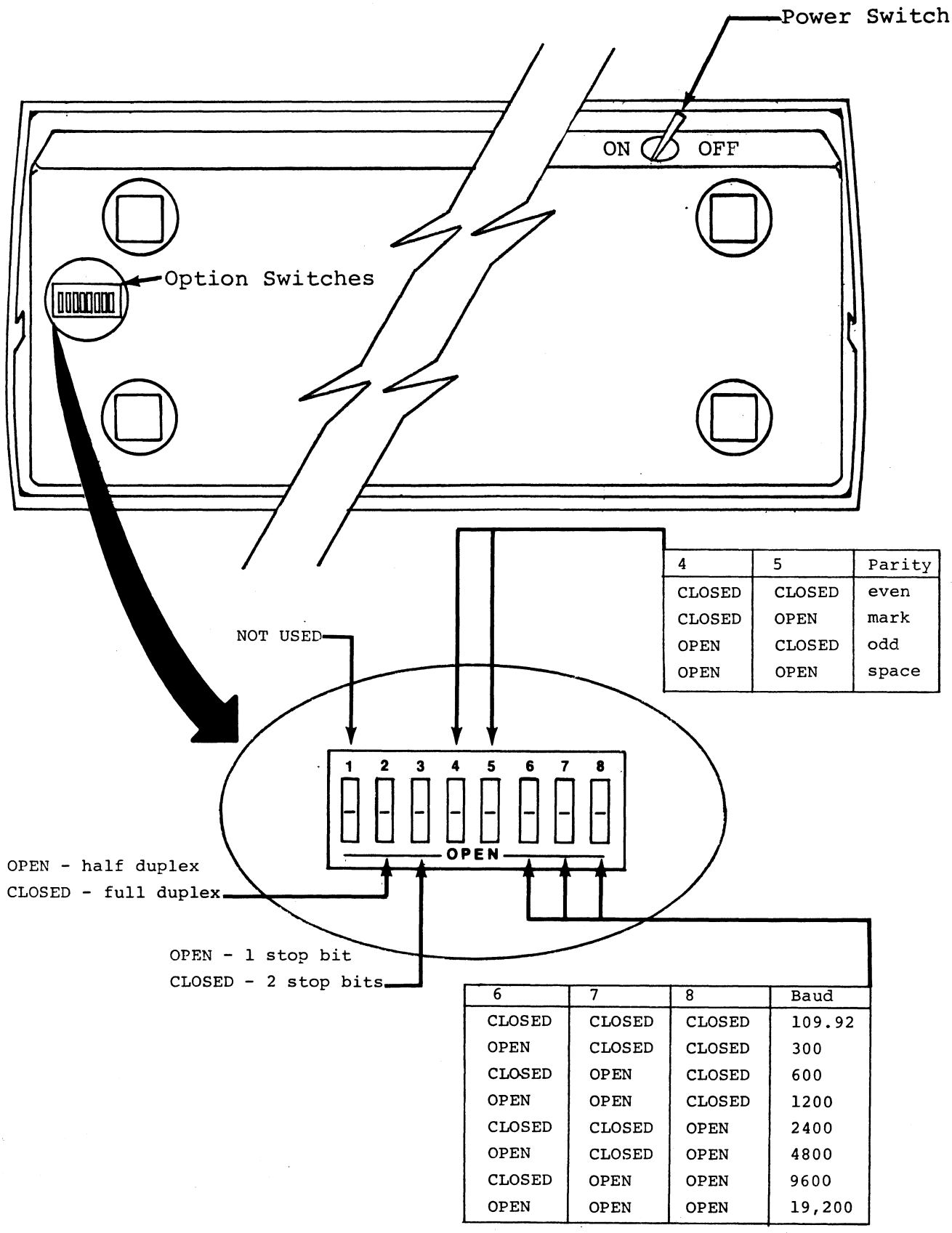


Figure 2-4. Location of Power and Option Switches



4	5	Parity
CLOSED	CLOSED	even
CLOSED	OPEN	mark
OPEN	CLOSED	odd
OPEN	OPEN	space

6	7	8	Baud
CLOSED	CLOSED	CLOSED	109.92
OPEN	CLOSED	CLOSED	300
CLOSED	OPEN	CLOSED	600
OPEN	OPEN	CLOSED	1200
CLOSED	CLOSED	OPEN	2400
OPEN	CLOSED	OPEN	4800
CLOSED	OPEN	OPEN	9600
OPEN	OPEN	OPEN	19,200

Figure 2-5. Option Switch Settings

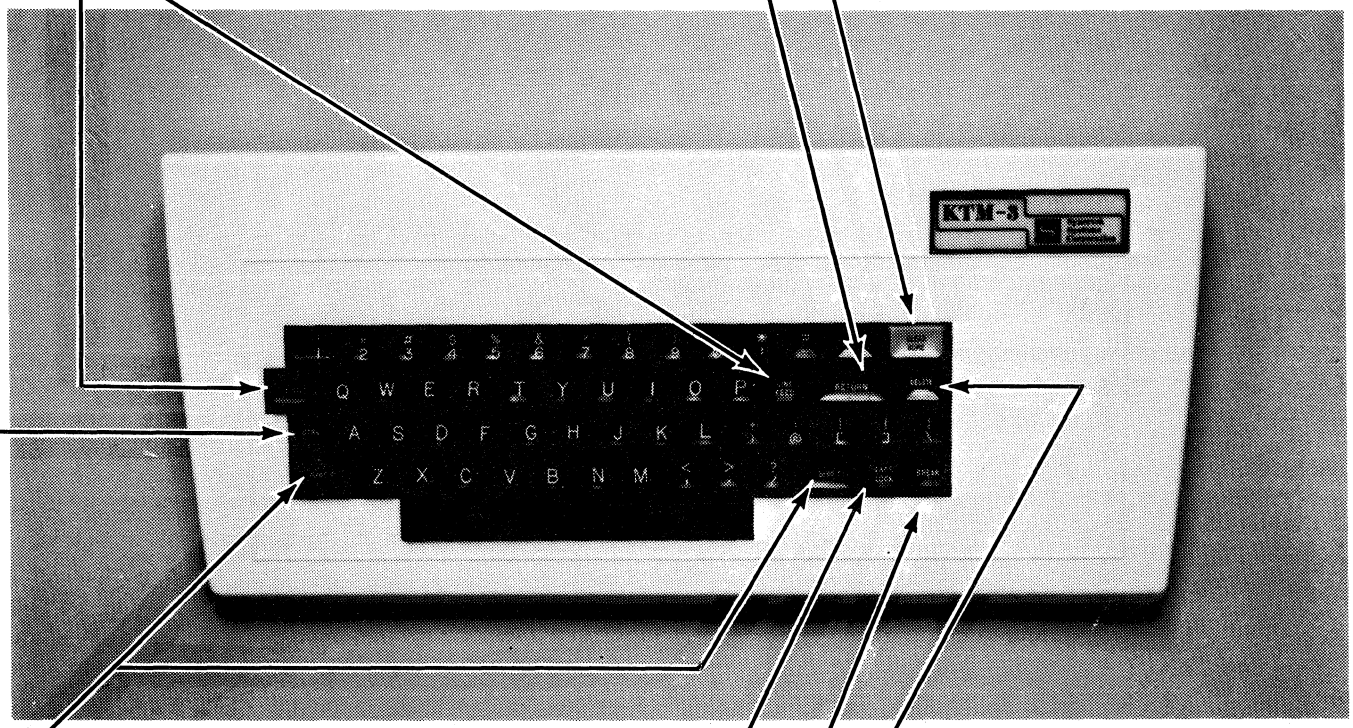
The CTRL key, when depressed simultaneously with another key, generates one of the ASCII codes in column Ø and 1 of the ASCII chart. See Table 3-1.

The RETURN key transmits the ASCII character CR, which, when received by the terminal, causes the cursor to return to the beginning of the line.

The ESC key generates the ASCII code which initiates an escape sequence.

The CLEAR/HOME key, unshifted, causes the cursor to return to the extreme upper right position of the display. Shifted, this key causes the display to be cleared before the cursor is returned home. This key will not cause a character to be transmitted.

The LINE FEED key transmits the ASCII character LF, which, when received by the terminal, causes the cursor to move down one line.



The SHIFT keys cause upper case letters or the upper key legend to be transmitted.

The DEL key transmits the ASCII character DEL. which has no effect when received by the terminal.

The CAPS LOCK key is an alternate action key. While CAPS LOCK is down, all alphabetic keys will be automatically shifted.

The BREAK key causes the serial transmit line to be maintained in the spacing state for 450 milliseconds.

Figure 2-6. KTM-3 Special Keys

2.4 Interfacing the KTM-3

Direct Wire Connections. The KTM-3 may be connected directly to a computer by connecting pins 7 (Signal Ground), 2 (Transmitted Date), and 3 (Received Data), of the EIA 25 pin connector. No wiring changes are required to simulate the presence of a modem.

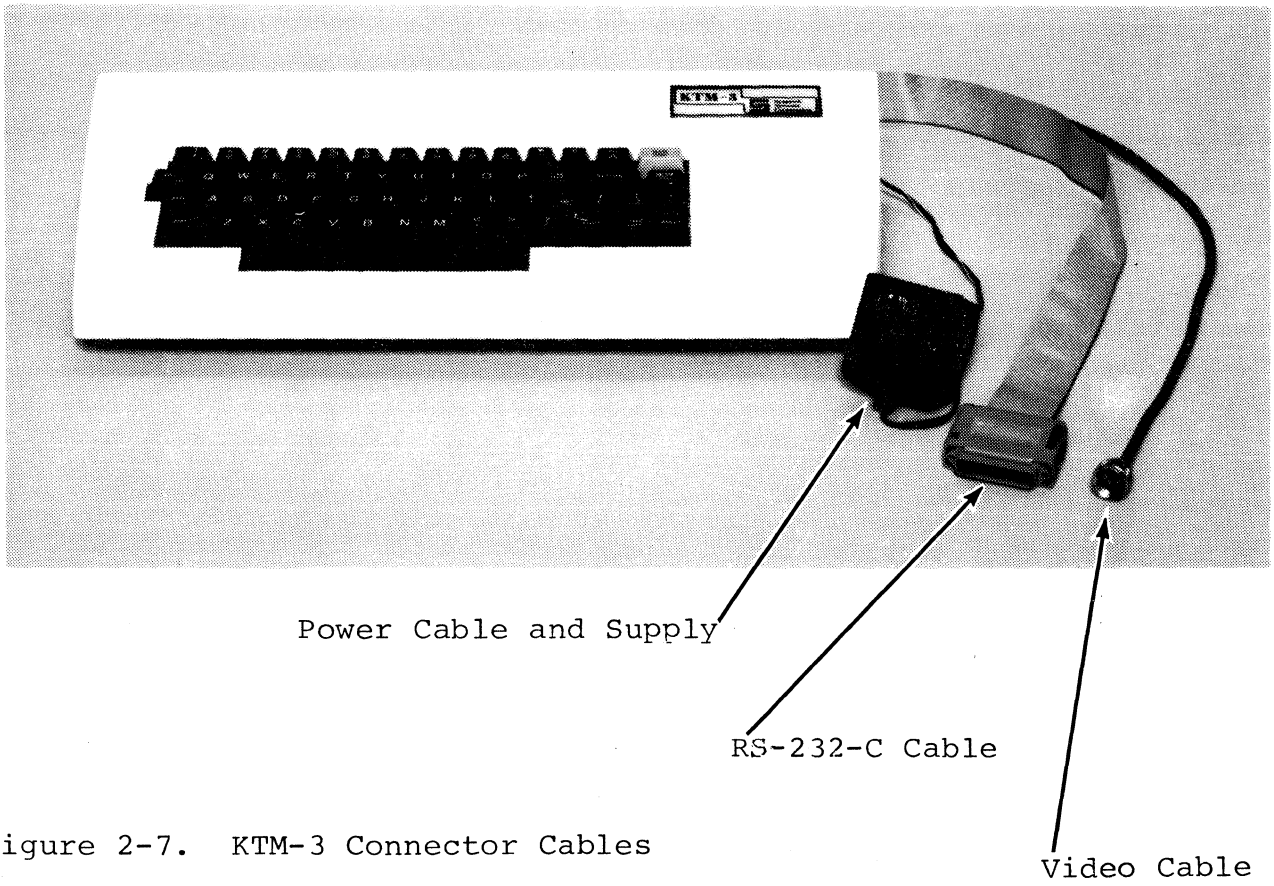


Figure 2-7. KTM-3 Connector Cables

EIA RS-232-C Interface. The standard 25 pin cable and connector located on the back of the KTM-3 provides the connection to the data set or computer. The signals conform to EIA standard RS-232-C, with the single exception that the voltage levels are 0V to +5V. EIA standard is -6V to +6V. Most modern equipment does not require full EIA voltage levels, and will operate

without difficulty at 0V - +5V. The signals and pin assignments for the EIA 25 pin connector are listed below:

Pin Number	Direction of Signal	EIA Designation	Function
1	--	AA	Protective Ground
2	From Terminal	BA	Transmitted Data
3	To Terminal	BB	Received Data
4	From Terminal	CA	Request to Send
5	To Terminal	CB	Clear to Send
6	To Terminal	CC	Not Used
7	--	AB	Signal Ground
8	To Terminal	CF	Data Carrier Detect
9	From Terminal	CD	Data Terminal Ready (always HIGH while KTM-3 is on)
10 through 25		Not Connected	

SECTION 3

GENERAL DESCRIPTION

The KTM-3 keyboard consists of 58 keys and is capable of generating all 128 ASCII characters. Every key except (CLEAR HOME), (SHIFT), (CTRL), (CAPS LOCK) and (BREAK), causes the ASCII code corresponding to the engraved legend to be transmitted when the key is depressed. (SHIFT), when held down while another key is depressed, causes the upper legend or upper case letter to be transmitted.

(CAPS LOCK) causes all alphabetic keys to be automatically shifted to upper case.

(CTRL), when held down while an alphabetic key or one of the keys ({ [), (| \), (}]), (~ ^), or (DEL _) is depressed, will force bits 5 and 6 of the transmitted character to zero. Thus the transmitted character is one of the control codes in columns 0 and 1 of the ASCII chart, Table 3-1.

(BREAK) causes the transmitted data line, EIA designation BA, to be maintained in the spacing state for 450 milliseconds.

3.1 Operation

The KTM-3 operates on a character-by-character basis. Data entered at the keyboard is transmitted across the serial port, and data received across the serial port is displayed or acted upon. Refer to Appendix A for detailed communications interface information.

****

NOTE: If the cursor ceases blinking when a key is depressed, Clear To Send (CTS) or Data Carrier Detect (DCD) is being held not-ready (LOW); the data set is not ready, or the connector is improperly wired. If CTS and DCD are left unconnected, they will remain in the ready state, and this condition will not occur.

****

3.1.1 Full Duplex Operation

Full duplex operation is usually selected when the communication system supports two-way, simultaneous transmission. Data entered at the keyboard is immediately transmitted and has no effect upon the display. In most systems, this data is then echoed by the computer or by the modem, received by the terminal, and displayed or acted upon.

3.1.2 Operation in Half Duplex

The phrase "half duplex" refers to two features. The feature usually implemented on terminals and termed half duplex should more properly be called local echo. This implies that all characters transmitted by the terminal are treated as if they were also received. This eliminates the need for the computer or modem to echo transmitted data to the terminal in order to display it. When half duplex operation is selected, the KTM-3 performs local echo.

The other feature commonly termed half duplex is used when the communication system is capable of transmission in only one direction at a time. The terminal uses the RTS wire on the EIA RS-232-C interface to control the data set, directing it to perform transmission from or transmission to the terminal, as required. When half duplex operation is selected, the KTM-3 performs this data set control function in addition to local echo. For a more complete discussion, see Appendix B, RS-232-C Handshaking (Half Duplex).

b_7 →				0	0	0	0	1	1	1	1
b_6 →				0	0	1	1	0	0	1	1
b_5 →				0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1	COL / ROW	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL (NUL)	DL (DLE)	SPACE	Ø	@	P	'	p
0	0	0	1	1	SH (SOH)	D1 (DC1)	!	1	A	Q	a	q
0	0	1	0	2	SX (STX)	D2 (DC2)	"	2	B	R	b	r
0	0	1	1	3	EX (ETX)	D3 (DC3)	#	3	C	S	c	s
0	1	0	0	4	ET (EOT)	D4 (DC4)	$	4	D	T	d	t
0	1	0	1	5	EQ (ENQ)	NK (NAK)	%	5	E	U	e	u
0	1	1	0	6	AK (ACK)	SY (SYN)	&	6	F	V	f	v
0	1	1	1	7	BL (BEL)	EB (ETB)	'	7	G	W	g	w
1	0	0	0	8	BS	CN (CAN)	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10 A	LF	SB (SUB)	*	:	J	Z	j	z
1	0	1	1	11 B	VT	EC (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	DEL

Table 3-1. ASCII Chart

3.1.3 The Cursor

The cursor is a blinking block which appears on the display in the position at which the next received character will be displayed. When a displayable character is received it is placed on the display at the cursor position, and the cursor is advanced to the next position.

3.1.4 Automatic Carriage Return/Line Feed

When the cursor is positioned at the last position of a line and a displayable character is received, the cursor is automatically moved to the first column of the next line.

3.1.5 Scrolling

When the cursor is on the last line of the display and a character is received which causes the cursor to move down a line, each line on the display is moved up one position. The top line is lost, and the cursor appears at the extreme bottom left of the display on a new, clear line.

3.1.6 Control Characters

The ASCII code includes thirty-two control characters (columns zero and one of the chart, Table 3-2, which are not meant to be displayed, but rather to instruct the terminal or communication equipment to take some action). Table 3-2 indicates the action taken by the KTM-3 upon receipt of each of these codes. All codes not recognized are ignored. The DEL character (ASCII code hexadecimal 7F) is also ignored.

CODE	ASCII MNEMONIC	TRANSMITTED CODE	ACTION WHEN RECEIVED
CTRL @	NUL	00	Fill Character
CTRL A	SOH	01	
CTRL B	STX	02	
CTRL C	ETX	03	End of Transmission in Half Duplex. (Turns line around.)
CTRL D	EOT	04	End of Transmission in Half Duplex. (Turns line around.)
CTRL E	RNQ	05	
CTRL F	ACK	06	
CTRL G	BEL	07	
CTRL H	BS	08	Backspace
CTRL I	HT	09	
CTRL J	LF	0A	Line Feed
CTRL K	VT	0B	Upline
CTRL L	FF	0C	Forward Space
CTRL M	CR	0D	Return
CTRL N	SO	0E	Unlock Keyboard
CTRL O	SI	0F	Lock Keyboard
CTRL P	DLE	10	
CTRL Q	DC1	11	
CTRL R	DC2	12	
CTRL S	DC3	13	
CTRL T	DC4	14	
CTRL U	NAK	15	
CTRL V	SYN	16	
CTRL W	ETB	17	
CTRL X	CAN	18	
CTRL Y	EM	19	
CTRL Z	SUB	1A	Clear Screen
CTRL	RCV	1B	Initiate Escape Sequence
CTRL	FS	1C	
CTRL	GS	1D	
CTRL	RS	1E	Home Cursor
CTRL __	US	1F	

Table 3-2. KTM-3 Control Codes

The KTM-3 is capable of displaying all control characters as well as the DEL character rather than performing an escape sequence. See Section 3.1.9 for a description of software trace mode.

3.1.7 Escape Sequences

The KTM-3 is capable of performing functions for which no ASCII control code is defined. ASCII allows these functions to be communicated to the terminal through the use of the escape sequence. The ESC character (ASCII hexadecimal 1B), indicates that the following character is not to be displayed but is to be interpreted as an instruction to perform a special function. All escape sequences recognized by the KTM-3, with the exception of relative and absolute cursor positioning consist of the ESC character followed by a single character. Table 3-3 summarizes the KTM-3 escape sequences are ignored.

SEQUENCE (2 Characters)	ACTION WHEN RECEIVED
ESC =	Begin absolute cursor positioning sequence
ESC /	Terminate software trace mode
ESC +	Begin relative cursor positioning sequence
ESC J	Clear from cursor to end of display (inclusive)
ESC K	Clear from cursor to end of line (inclusive)
ESC L	Lock Keyboard
ESC T	Enter software trace mode
ESC U	Unlock keyboard

Table 3-3. Escape Sequences

3.1.8 Cursor Positioning

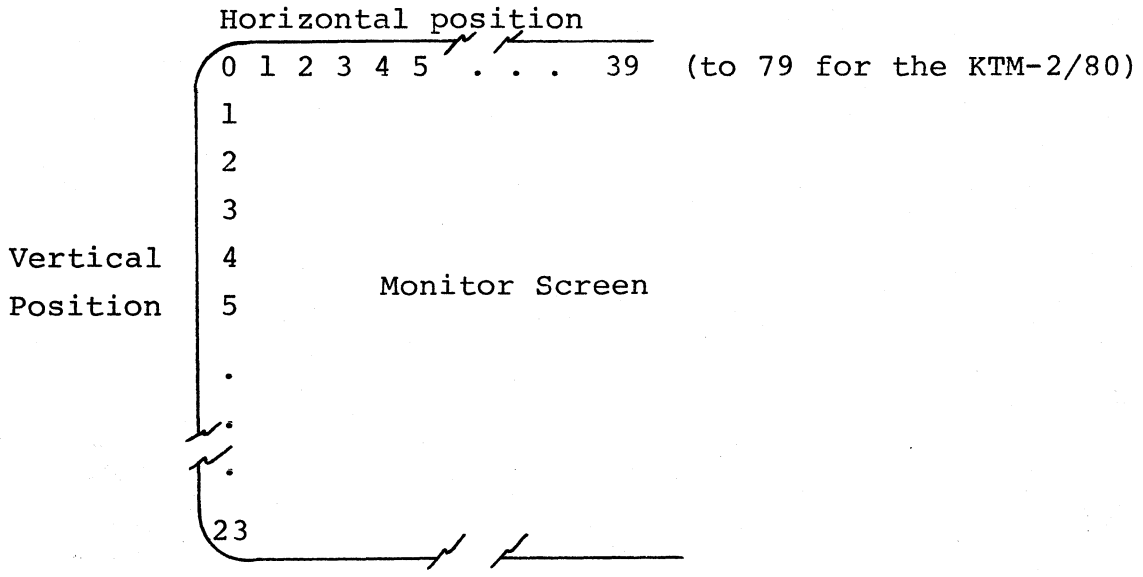
Absolute and Relative cursor positioning escape sequences allow the cursor to be placed at any desired position on the display without moving it sequentially through all of the intervening positions. Each sequence consists of four characters; ESC, + (for relative positioning) or = (for absolute positioning), one character indicating the new vertical position, and one character indicating the new horizontal position. The position implied by each ASCII character is indicated in the following table:

Absolute Positioning		Relative Positioning	
1	ESC	1	ESC
2	=	2	+
3	Vertical Position	3	Vertical Position
4	Horizontal Position	4	Horizontal Position

After reception of the ESC =, the absolute positioning sequence is started and the cursor moves to the extreme upper left position of the display, where it remains until the vertical and horizontal positions have been received. It then assumes a new position.

Relative positioning causes the vertical position to be added to the current cursor vertical position, and the horizontal position to be added to the current cursor horizontal position.

Absolute and relative positioning are implemented in wrap-around fashion. Thus, if the new position exceeds the vertical size of the display, the cursor wraps around to the top of the display, and if the new position exceeds the horizontal size of the display, the cursor wraps around to the left of the display. Cursor addressing will not cause the display to scroll. The display positions are numbered as follows:



Cursor Addressing Examples:

Sequence of Codes Received	Effect on Cursor
ESC = SP SP	Cursor to HOME
ESC + SP SP	Position unchanged
ESC + * ,	Cursor down 10 and right 12
ESC + 7 G	Cursor down 23 and right 39 (or effectively, cursor up 1 and left 1 for a 24 X 40 character display)
ESC = , 4	Cursor to line 12, column 20

Position or Displacement Value	ASCII	Position or Displacement Value	ASCII	Position or Displacement Value	ASCII
0	SPACE	27	;	54	V
1	!	28	<	55	W
2	"	29	-	56	X
3	#	30	>	57	Y
4	$	31	?	58	Z
5	%	32	@	59	[
6	&	33	A	60	\
7	'	34	B	61	]
8	(	35	C	62	^
9	)	36	D	63	_
10	*	37	E	64	`
11	+	38	F	65	a
12	,	39	G	66	b
13	-	40	H	67	c
14	.	41	I	68	d
15	/	42	J	69	e
16	ø	43	K	70	f
17	1	44	L	71	g
18	2	45	M	72	h
19	3	46	N	73	i
20	4	47	O	74	j
21	5	48	P	75	k
22	6	49	Q	76	l
23	7	50	R	77	m
24	8	51	S	78	n
25	9	52	T	79	o
26	:	53	U		

Table 3-4. Cursor Addressing Codes

3.1.9 Software Trace Mode

This mode of operation, initiated by reception at the terminal of the sequence ESC T, causes all further control characters received to be displayed only. The displayed character forms are demonstrated in Table 3-1. For example, when a CR (carriage return) character is received by the terminal, rather then returning the cursor to the first position of the line, the character $^{C}_{R}$ will be displayed and the cursor will be advanced one position. Automatic Carriage-Return/Line Feed and scrolling operate as usual. Software trace mode is terminated when the KTM-3 receives an ESC / sequence.

3.1.10 Fill Characters Required

The clear to end-of-screen operation (ESC J) requires a maximum of 16 milliseconds to be completed by the KTM-3. During this time it can receive up to 15 characters and will display them after the clear to end-of-screen operation is complete. If more than 15 characters are received, the 15th character will be changed to a "*" to indicate that some characters have been lost.

At high baud rates, fill characters (ASCII NUL) or a pause should be sent after ESC J in order to avoid losing characters. Check the table below for the length of pause or number of fill characters required.

The clear screen operation, CTRL Z (ASCII SUB), will not cause the KTM-3 to lose characters.

Baud	Fills (ASCII NUL) Required after ESC J	Maximum Pause Req'd
19.2K	17	8.5 ms
9600	1	1.0 ms
all others	none	0.0

3.1.11 Reception Errors

As the KTM-3 receives data, it examines the data for correct parity and for the presence of a stop bit (two stop bits if this option has been selected). With odd parity selected, the sum of all "one" bits of each character, including its parity bit, must be odd. With even parity, the sum must be even. With always-one or always-zero parity selected, no check is made on the parity of received data.

When a parity error or framing error (no stop bit) is detected in a received character, the character is replaced with a "?" character, which is entered on the display at the cursor position.

Additionally, certain escape sequences can be communicated to the terminal which will cause it to perform an operation which takes several milliseconds to perform. This is enough time to miss some data at the highest baud rates. When the KTM-3 detects that it has missed data, it will display a "*" character at the cursor position to indicate this fact to the operator.

APPENDIX A

COMMUNICATIONS INTERFACE

Asynchronous Serial Data. The KTM-3 communicates via the ASCII code shown in Table 3-1. The format is asynchronous, serial ASCII. Transmission and reception take place at the same baud rate. Option switches allow the selection of one of eight rates from 109.92 baud to 19.2K baud.

Each transmitted character consists of one start bit, seven bits of ASCII data, one parity bit, and one or two stop bits. Option switches allow the selection of even, odd, always-one, or always-zero parity, as well as selection of one or two stop bits. If your communication system expects no parity bits, select always-one parity. The parity bit will then be interpreted by the communication system as an additional stop bit, or idle time.

Received Data. Received data consists of a start bit, 7 bits of ASCII data, a parity bit (if even or odd parity has been selected), and at least one stop bit (at least two stop bits if this option is selected). Extra stop bits received will be interpreted as idle time.

APPENDIX B

RS-232-C HANDSHAKING

Clear to Send (CTS), Data Carrier Detect (DCD), Request to Send (RTS). The KTM-3 may be operated using only pins 7 (Signal Ground), 2 (Transmitted Data), and 3 (Received Data) of the EIA RS-232-C interface. If a data set or modem is used, however, it is desirable for the data set or modem to communicate its state of readiness to the terminal. This is accomplished via the handshake lines.

Full Duplex. In full duplex operation, the KTM-3 maintains RTS always asserted. Before each character is transmitted, the KTM-3 checks DCD and CTS. If either of these lines is not asserted (not in HIGH state), the transmission will not occur, until they are both asserted. The cursor will cease blinking to indicate that the KTM-3 is waiting for DCD or CTS to be asserted.

Half Duplex. In this mode, RTS is intended to control the direction in which the modem supports transmission. RTS is normally held in the LOW state, which allows transmission to the terminal. When the operator strikes a key, RTS is asserted, conditioning the modem for transmission from the terminal. The KTM-3 waits until both DCD and CTS are asserted by the modem, and then transmits the character. RTS will remain asserted, however, until the operator indicates the end of transmission by depressing the (RETURN) key, (CTRL) (C) (ASCII ETX), or (CTRL) (D) (ASCII EOT). The CR, ETX, or EOT will be transmitted, then RTS will become not-asserted, conditioning the modem for transmission to the terminal.

If either CTS or DCD is not used, it should be left unconnected. It will then appear to the KTM-3 to be always asserted, and will not interfere with transmission.

USER'S NOTES

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Printed in U.S.A.