Cromemco

3102 VIDEO TERMINAL

TECHNICAL MANUAL

CROMEMCO, Inc.
280 Bernardo Avenue
Mountain View, CA 94043

Part no. 023-6001

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SECTION I
INTRODUCTION

This manual provides a general description and operating instructions for the Beehive Micro Bee 2 video terminal. Included are sufficient diagrams, tables and descriptive text to provide an understanding of the operational characteristics of the equipment. Three general sections are included:

- Section I provides a brief description of the Micro Bee 2 terminal and a specifications listing on Table 1-1.
- Section II describes the installation and initial checkout of the terminal.
- Section III describes operational characteristics and functions of the terminal. Basic operator instructions are provided first, followed by a detailed operating description.

Beehive International's Micro Bee 2 (see Figure 1-1) is an 8085A microprocessor-controlled buffered video display terminal offering the latest advances in technology and human engineering. Its numerous features are tailored to address both interactive and batch mode markets. Specific product enhancements formerly found only in more sophisticated and expensive terminals are designed into the Micro Bee 2, giving it superior cost/performance value.

Among the Micro Bee 2 features is the Memory Lock, which allows the operator or host computer to lock a position of the display while retaining the capability to enter or receive data in the unlocked portion of the display memory. The invisible Memory Address Pointer is used to read and write to and from the display memory independent of visible screen functions. Standard visual attributes include normal, reverse, blink, underline, and half-intensity video levels. These are further enhanced by the addition of logical attributes which include protected data fields, numeric only fields, alpha only fields, constant fields and modified data field transmission.

Line 25 of the Micro Bee 2 display is a "status" line which the system firmware uses to indicate modes of operation, error messages, communications protocol information, and to convey terminal status messages. The self-diagnostic results are also selectively displayed for the operator or field technician using this reserved display area.

The most predominant video characteristic is found in the terminal display memory organization. The display format is based upon 24 lines of data with 96 characters in each line. Eighty of the character positions are displayable, which leaves sixteen nondisplayable character cells available for field attributes. Finally, the line drawing graphics capability allows for the creation of forms on the display, using the vertical and horizontal line feature.

The Micro Bee 2 keyboard is designed with particular attention being given to combining TTY and typewriter layouts. The shape and positioning of the "Return" key, as well as the additional field termination control keys associated with the numeric pad, complete the user-oriented design when they are included with autorepeat, two-key rollover, and the highly reliable reed switch features. The half-size keys located above the standard keyboard layout include programmed function keys, editing, cursor and system mode/control keys.

The Micro Bee 2 is designed to address the most demanding operational mode requirements found in the communications market. Data transmission can be selectively defined as Conversational, Line, Message or Page. Operational characteristics are enhanced by the addition of Local and Line Monitor modes. The Forms mode allows the operator to prepare a form with specific visual and logical attributes on the display screen and then transmit it to a host computer or auxiliary device.

The expanded characteristics of the Micro Bee 2 include a bidirectional buffered serial auxiliary port, X-Y addressing, read cursor address, read terminal status, time-of-day clock, and 128 ASCII characters with descenders on lower case characters.

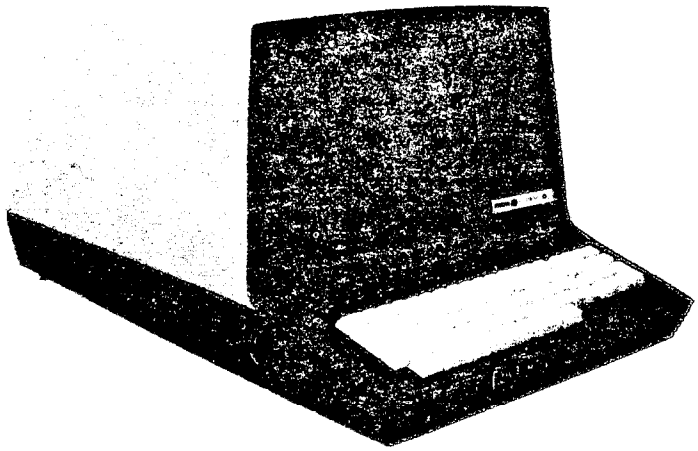


Figure 1-1 Micro Bee 2 Video Display Terminal

Table 1-1 Specifications

DISPLAY FORMAT
24 lines x 80 characters

STATUS LINE
25th line of display

DISPLAY SIZE
6.5" high x 8.5" wide

CRT SIZE
12" measured diagonally

CHARACTER SIZE
Approximately 0.2" high x 0,1" wide

CHARACTER TYPE (Alphanumeric)
128 displayable ASCII characters, each formed within an 8 x 8 dot matrix. Descenders on lower case characters.

CHARACTER TYPE (Line Drawing)
Eleven graphic symbols for drawing forms and contiguous lines.

CHARACTER GENERATION
MOS ROM

REFRESH RATE
50 Hz – 60 Hz (programmable)

CHARACTER DISPLAY
Light characters on a dark background or dark characters on a light background (switch selectable).

VISUAL ATTRIBUTES
Normal, reverse, blink, underline, and half intensity security fields

LOGICAL ATTRIBUTES
Protected, numeric only, modified data transmission, alpha/alphanumeric, must fill, total fill, constant fields.

TABULATION
Fixed tab stops occur each eight character positions

CURSOR
Non-destructive blinking block

MEMORY LOCK
The display area above the line the cursor is currently on is frozen on the screen.

LINE LOCK
The host CPU may selectively designate reserved display lines.

MEMORY ADDRESS POINTER
An invisible cursor that is used to read and write to and from the display memory independent of visible screen functions

CURSOR CONTROL
Up, down, left, right, home, carriage return, line feed

CURSOR SENSE
Cursor position is transmitted to the host upon request

CURSOR ADDRESSING
Direct X–Y cursor positioning by line and column

MEMORY POINTER DATA SENSE
ASCII value of the character located at the memory address pointer

READ TERMINAL STATUS
A 30-byte status message reflecting switch setting, diagnostic results, communication protocol, etc.

SCROLL
When display is filled, screen data scrolls upward. Wraparound with top down overwrite is also selectable.

EDITING OPERATIONS
Insert/Delete character or line plus tab, back tab, backspace and character overwrite. The clear entry (CE) operation will erase the field the cursor is in and position it at the beginning of the same field while in a protected mode of operation.

ERASE FUNCTIONS
Erase to end of page
Erase to end of field
Erase to end of line
Clear variable data
Clear all data

COMMUNICATION INTERFACE
Serial RS232C or 20 ma CLA

TRANSMISSION RATE
Switch selectable 110 to 9600 baud (EIA)
Switch selectable 110 to 9600 baud (CL)
Switch selectable to 19200 baud under X-ON/X-OFF protocol.

PARITY
Switch selectable, odd, even, mark or space

COMMUNICATION MODE
Selectable for X-ON/X-OFF protocol
Full duplex
Half duplex
Echoplex
Asynchronous only

OPERATIONAL MODES
Conversational: Character by character transmission
Line: Line at a time transmission
Page: Full or partial page transmission
Forms: Allows for operator building of formatted display
Local: Off line display data entry
Line Monitor: Displays all ESC codes and control code sequences

TERMINATION CHARACTER
Switch selectable CR, EOT, CR-LF, and ETX

TIME-OF-DAY CLOCK
A real time clock that may be set by the host CPU or operator

CPU MESSAGE DEPOSIT
An 80 character message buffer holds host CPU data and prints "MSG WAIT" on status line for operator recovery

READ CURSOR CHARACTER
Character at cursor position is transmitted to host upon request.

BELL
Audible alarm upon receipt of Control G or as the cursor passes through the 72nd character location when data is being entered from keyboard. The continuous alarm on/off feature is included.

KEYBOARD
A 61-key ANSI compatible, TTY/Typewriter compatible layout featuring autorepeat, two key rollover, alpha lock and lower case inhibit. Also includes a 14-key numeric pad with associated field termination control keys. The sixteen programmed function keys, cursor control keys, and system mode control keys are included.

AUXILIARY INTERFACE
A serial bidirectional interface that has a character buffer on both the send and receive lines. Transparent printing, communications control, as well as independent baud rates are standard.

SELF TEST
Either through host CPU control, operator initiated, or upon power-up.

INPUT VOLTAGE AND FREQUENCY
115Vac ± 10% 50/60 Hz
230Vac ± 10% 50/60 Hz

ENVIRONMENTAL SPECIFICATIONS
Altitude: Sea level to 10,000 feet
Temperature: 0°C to 40°C
Humidity: 0 to 80% (noncondensing)

TERMINAL SIZE
18" W x 13" H x 22.5" D

TERMINAL WEIGHT
43 lbs. (approximate)

TERMINAL FINISH
Textured vinyl

OPTION
20 ma current loop

SECTION II

INSTALLATION

2.1 INTRODUCTION

This section contains information on unpacking, receiving inspection, connection of the communications interface, physical placement of the terminal and preliminary functional control settings for the specific user requirements.

2.2 UNPACKING

The following items are furnished with each Micro Bee 2 terminal:

a. The display terminal with keyboard

b. Technical User Manual

There are no tie-downs or packing materials inside the unit that need to be removed.

2.3 INSPECTION FOR IN-SHIPMENT DAMAGE

Upon receipt, carefully check components for any signs of shipping damage. All shipping containers have been specially designed to protect their contents and special care has been taken to prevent damage under normal shipping conditions. Mishandling should be evident upon inspection of the shipping container. If damage is found after visual inspection, take care not to destroy the evidence. If necessary, document the damage with photographs and contact the transport carrier as soon as possible.

2.4 IDENTIFICATION

An identification plate located on the bottom cover of the terminal provides the model number, part number, serial number, weight, voltage and current requirements, and frequency/power classifications.

2.5 INSTALLATION

2.5.1 Placement for Operation

The terminal is fully self-contained and easily relocated to alternate operating positions without removing or altering any wiring. Select a convenient, level surface and place the terminal where the power cable and data I/O cables are not in the way of the operator. Route the cables in such a manner that they are not inadvertently pulled or disturbed by minor changes in terminal position or by the operator. Position the terminal so that operator use is as convenient as possible.

CAUTION: Do not place the terminal on any surface that blocks cooling air from the back of the cabinet. The terminal is provided with an internal fan for cooling. Air enters through a fan grill protected hole in the back and leaves through spacing at the bottom sides between the cover and terminal frame. To maintain efficient air circulation, keep at least three-and-one-half (3½) inches of clearance at the rear and on the sides of the terminal (see Figure 2-1).

2.5.2 Power Connection

The terminal is shipped with a three-conductor power cord which grounds the instrument through the offset pin. The safety feature of this ground should always be preserved by grounding the terminal to the outlet box or other earth ground. If it is necessary to use an adapter, ground the pigtail.

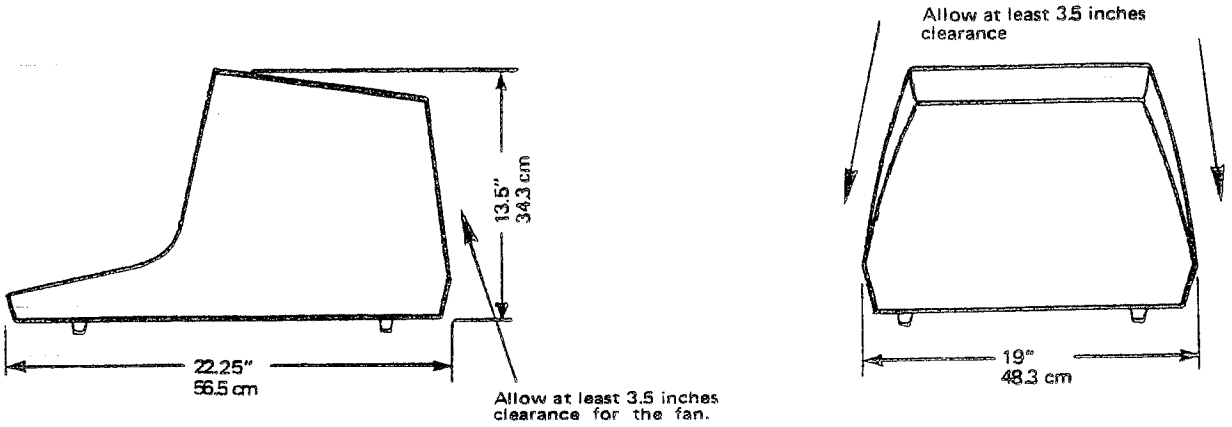


Figure 2-1 Mounting Requirements

2.5.3 Current Loop Interface (Optional)

The Current Loop Interface is a 20 mA constant current device which allows the terminal to be used up to 2000 feet (608 m) from the computer. If shielded, twisted pairs are used, the terminal may be located up to 6000 feet (1.8km) away if utilized at slower baud rates.

Data transmission without the current loop interface is normally limited to 50 feet. The current loop converts the TTL logic signals into current signals at one end of the loop, transmits the pattern, reconverts the pattern to TTL logic signals at the other end, and delivers it to the computer or terminal. The current loop connections are contained within the RS232C I/O connector and do not interfere with normal RS232C signals required for asynchronous operation. Figure 2-2 illustrates four common interfacing schemes for simplex and full duplex operation using current loop.

2.5.4 Data Interface Connection

Signals used in communicating with the Micro Bee 2 conform to the requirements of EIA specification RS232C. In particular, output voltage swings from −10 V to +10 V, while the receivers present a minimum of 3K ohms impedance to the line. The receiver circuits employed in the Micro Bee 2 switch at approximately +10 V with 0.1 V of hysteresis. The input resistance is approximately 4K ohms. The driver circuits current limit at 10 ma on both source and sink. All data source interconnections are made via the rear panel Input/Output connector (refer to Figure 2-3). A 25-pin miniature D-type ITT Cannon connector (DM-25S or equivalent) is used for connecting to the computer. Pin assignments are defined in Table 2-1.

When using a minimum main port interface configuration (Send, Receive and Ground), it is necessary to externally jumper together pins 6, 8 and 20 of the connector to ensure correct terminal operation. A minimum Aux port configuration requires that connector pins 20 and 6 be jumpered.

2.5.5 PC Board-Mounted Control Switches

Three switch blocks are mounted on the printed circuit board. Two are located at the rear of the PC board and are accessible through an external opening for repositioning. The other switch block is located near the center of the PC board and is only alterable by removing the cover. These switches are illustrated in Figure 2-4 (External Switch Block) and Figure 2-5 (Internal Switch Block).

2.6 INITIAL TURN-ON PROCEDURE

The proper turn-on procedure for the terminal is described in 3.2.2.

2.7 REAR PANEL SWITCH USE

The operating configuration of the Micro Bee 2 is defined by rear panel and internal switch positions as described below. Whenever any of these switches is changed, it is necessary to reset the terminal, using CONTROL RESET to ensure that all new switch positions are scanned by software.

(continued on Page 2-6)

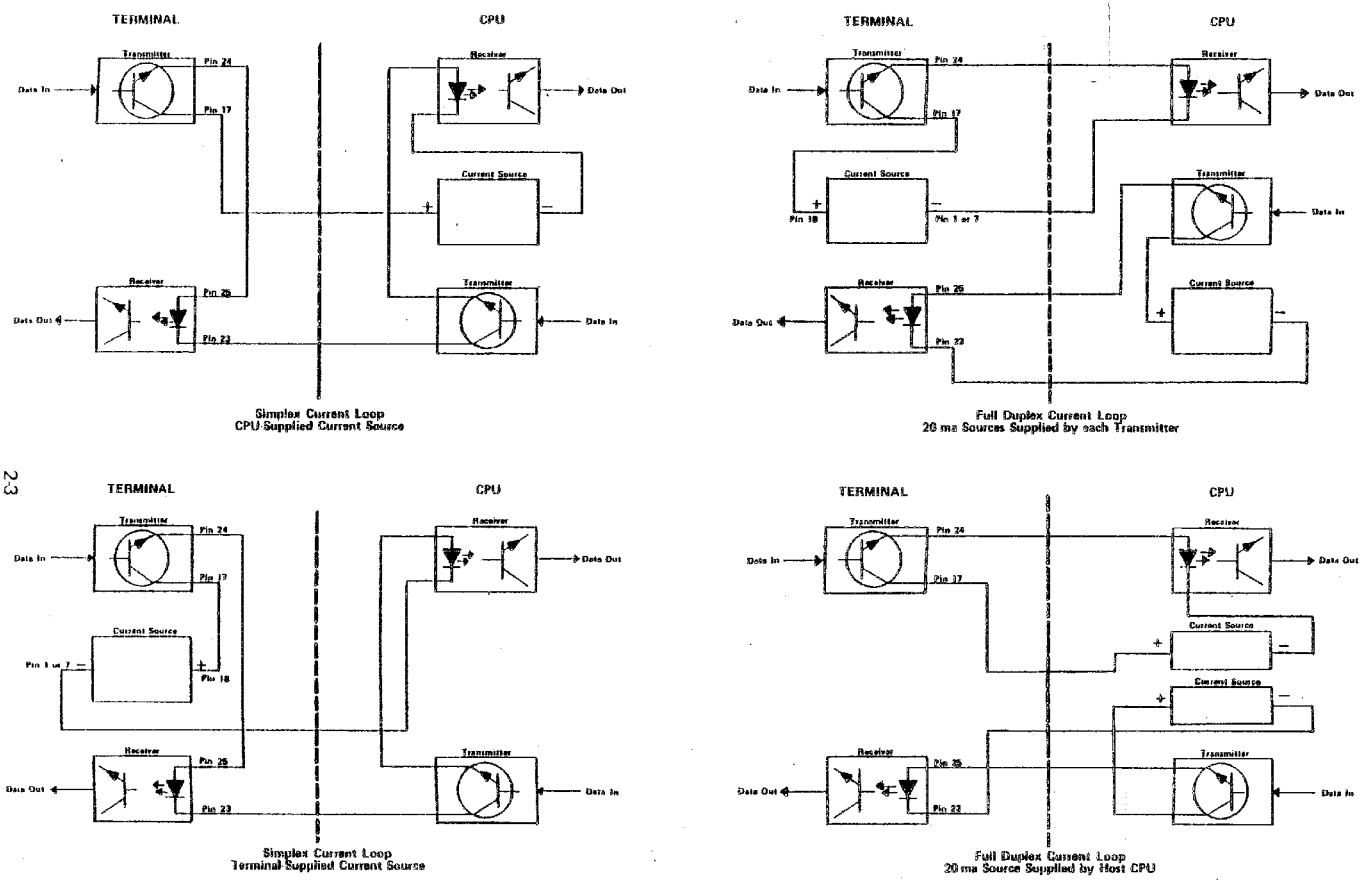


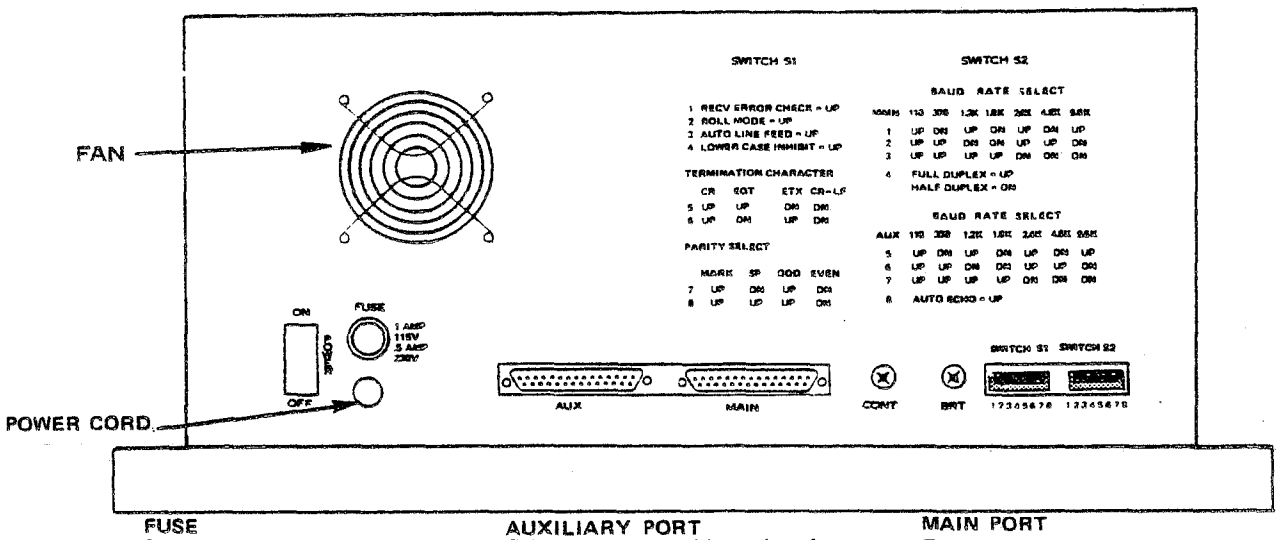
Figure 2-2 Current Loop Cabling

Table 2-1 I/O and Auxiliary Port Pin Assignments

PIN NO.	RS232-C	DESCRIPTION	SIGNAL DIRECTION	ASSIGNMENTS
MAIN PORT				
1	AA	Frame Ground	—	Chassis ground; electrically bonded to frame.
2	BA	Transmitted Data	MCB2 → Data Set	Transmitted data; Pin 2 will be in the mark condition with no output signal.
3	BB	Received Data	MCB2 ← Data Set	Received data or terminal input.
4	CA	Request to Send	MCB2 → Data Set	When off line, RTS is held low; when on line in full duplex, it is kept high. In half duplex on line, it will remain low until data transmission. It goes high during transmission and drops low upon completion.
5	CB	Clear to Send	MCB2 ← Data Set	When Clear to Send is high, the transmission is enabled. When CTS is held low, the transmitter is disabled.
6*	CC	Data Set Ready	MCB2 ← Data Set	Indicates the host data set is ready.
7	AB	Signal Ground	—	Same potential as chassis ground (pin 1).
8*	CF	Carrier Detect	MCB2 ← Data Set	Indicates the host data set is ready.
20	CD	Data Terminal Ready	MCB2 → Data Set	This pin is high when terminal is On.
AUXILIARY PORT				
1	AA	Frame Ground	—	Chassis ground; electrically bonded to frame.
2	BA	Transmitted Data	MCB2 ← Auxiliary device	Data input to terminal.
3	BB	Received Data	MCB2 → Auxiliary device	Data output to auxiliary device.
4	CA	Request to Send	MCB2 ← Auxiliary device	Ignored by MCB 2; does not evoke terminal response.
5	CB	Clear to Send	MCB2 → Auxiliary device	When high, indicates Auxiliary port enabled and ready to receive data.
6	CC	Data Set Ready	MCB2 → Data Set	Remains on at all times.
7	AB	Signal Ground	—	Same potential as pin 1.
8	CF	Carrier Detect	MCB2 → Auxiliary device	Same as CC (pin 6). High at all times.
20†	CD	Data Terminal Ready	MCB2 ← Auxiliary device	High indicates Auxiliary device ready to receive data. Low indicates Auxiliary device busy and unable to receive data.

* Note: When connected to DCE equipment not providing these signals, external jumpering must be provided on the terminal interface connector between 6, 8 and 20.

† Note: When the auxiliary equipment being used does not provide this signal, external jumpering must be provided on the Auxiliary port between pins 6 and 20.



FUSE
Prevents damage to circuitry during voltage/current overload

AUXILIARY PORT
This connector provides an interface for peripheral device, such as disks, printers, tape drives, etc.

MAIN PORT
This port provides data source interface for the terminal, RS232C or current loop interface.

Figure 2-3 Micro Bee 2 Rear Panel

SWITCH S1	SWITCH S2
1 RECV ERROR CHECK = UP 2 ROLL MODE = UP 3 AUTO LINE FEED = UP 4 LOWER CASE INHIBIT = UP	BAUD RATE SELECT

MAIN	110	300	1.2K	1.8K	2.4K	4.8K	9.6K	*19.2K
1	UP	DN	UP	DN	UP	DN	UP	DN
2	UP	UP	DN	DN	UP	UP	DN	DN
3	UP	UP	UP	UP	DN	DN	DN	DN

4 FULL DUPLEX = UP
HALF DUPLEX = DN

BAUD RATE SELECT

AUX	110	300	1.2K	1.8K	2.4K	4.8K	9.6K	*19.2K
5	UP	DN	UP	DN	UP	DN	UP	DN
6	UP	UP	DN	DN	UP	UP	DN	DN
7	UP	UP	UP	UP	DN	DN	DN	DN

8 AUTO ECHO = UP

SWITCH S1				
TERMINATION CHARACTER	CR	EOT	ETX	CR-LF
5	UP	UP	DN	DN
6	UP	DN	UP	DN

PARITY SELECT	MARK	SP	ODD	EVEN
7	UP	DN	UP	DN
8	UP	UP	DN	DN

*Note: Only valid under X-On/X-OFF protocol command (see Section 3.3.12). This selection is not labeled on the rear panel.

Figure 2-4 External Switches

ON	SWITCH	OFF
Go on line after block send	1	Remain off line after block send
All single key ESC sequences are performed locally only	2	All single key ESC sequences are transmitted
Display programmed for 50 Hz	3	Display programmed for 60 Hz
X-Suppress On	4	X-Suppress Off
System reset and program restart	5	Normal operation
Visual attribute is half intensity	6	Visual attribute is normal
Black character on white field	7	White character on black field
Enables Current Loop	8	Disables current loop

Figure 2-5 Internal Switches

Note: The MCB2 is shipped with all internal switches off

(continued from Page 2-2)

2.7.1 Receiver Error Check (S1-1)

When Receiver Error Check is selected (S1-1 up), an ASCII substitute (S_B) is displayed if the receiver frame, overrun or parity error is detected. Only even or odd parity are checked as selected by switches S1-7 and S1-8. With it disabled, data are written to the display as they are received and all errors are ignored.

2.7.2 Roll Mode (S1-2)

When Roll Mode is enabled (S1-2 up), data scrolls upward if the cursor is in the bottom line and a Line Feed code is received. As a result of the upward scroll, all data on the page move up by one line, with data previously on the top line being lost and a new blank line appearing at the bottom of the page. This simulates the line feed action of a teletypewriter.

If the ROLL is disabled, the display page does not scroll. A command which attempts to move the cursor down from the bottom line (a Line Feed) causes the cursor to appear in the top line rather than causing the data to scroll. Thus, the non-Roll mode of operation corresponds to a "wrap-around" action of the cursor in the vertical direction. Depression of the RETURN key causes the data to be erased from the cursor position to the end of the present line and the return (or return, line feed) is executed according to the setting of S1-3.

2.7.3 Auto Line Feed Mode(S1-3)

In Auto Line Feed mode (S1-3 up), the RETURN key transmits Carriage Return-Line Feed codes and performs a return and line feed locally. With Auto Line Feed mode off, the key transmits and performs only a carriage return.

2.7.4 Inhibit Lower Case (S1-4)

With the switch in the Up position, all alpha characters a-z are forced to the upper case regardless of the condition of Shift or Shift Lock. No other codes are affected. With the switch down, all keys are fully shiftable. Received data remain unaffected by this switch setting.

2.7.5 Termination Character (S1-5, S1-6)

The user may select the termination character which is transmitted by the ENTER key in an on-line mode and is the last character sent after a block, line transmit, or function key sequence. The choices are ETX, EOT, CR or CR-LF.

2.7.6 Parity (S1-7, S1-8)

The parity selection allows for an odd or even parity bit, or a mark or space parity bit to be generated following the data in the serial data word. Mark or space parity is generated by transmitting an 8-bit data word and forcing the eighth bit low or high. The switches also select the parity condition to be checked if switch S1-1 is up (receiver error check).

2.7.7 Main Baud Rate (S2-1, S2-2, S2-3)

The Main Baud Rate change is accomplished thru switch selection on the back panel of the terminal. The user may select the following rates: 110, 300, 1200, 1800, 2400, 4800, 9600 or 19,200 baud. The switch settings are defined in Figures 2-3 and 2-4. For host CPU selection of both main and Aux baud rates, a three-code escape sequence is used (see Figure 2-6).

Figure 2-6 Remote Baud Rate Selection

	110	300	1200	1800	2400	4800	9600	19200
MAIN BAUD RATE ESC, 7,	0	1	2	3	4	5	6	7
AUX BAUD RATE ESC, 5	0	1	2	3	4	5	6	7

2.7.8 Full/Half Duplex (S2-4)

The Full/Half Duplex (FDX/HDX) switch setting (Figure 2-3) determines how data originating from the keyboard are routed within the terminal when operating on-line and in conversational mode. In half duplex mode, data entered via the terminal keyboard are sent to the I/O port and the display memory simultaneously. In full duplex mode, data entered via the terminal keyboard are sent to the I/O port only. Data must be received to be displayed. In full duplex mode, RTS (Request to Send) is raised any time the terminal is on line. In half duplex, RTS is raised only when transmission occurs.

The Full/Half Duplex switch setting (Figure 2-3) determines how data originating from the keyboard

are routed within the terminal when operating on-line and in conversational mode. In half duplex mode, data entered via the terminal keyboard are sent to the I/O port and the display memory simultaneously. In full duplex mode, data entered via the terminal keyboard are sent to the I/O port only. Data must be received to be displayed. In full duplex mode, RTS (Request to Send) is raised any time the terminal is on line. In HDX RTS is raised only when transmission occurs.

2.7.9 Auxiliary Baud Rate (S2-5, S2-6, S2-7)

The Auxiliary Baud Rate change is accomplished through switch selection on the back panel of the terminal. The user may select the following rates: 110, 300, 1200, 1800, 2400, 4800, 9600, or 19,200 baud.

2.7.10 Auto Echo (S2-8)

With the Auto Echo switch on, the terminal displays and operates on all data transmitted over the main EIA serial port in conversational mode. With the switch set off, no automatic echo occurs. This switch is only effective in full duplex and allows full duplex communications without need for echo from the host CPU.

2.8 INTERNAL SWITCH USE

2.8.1 Go On Line (S3-1)

With the switch on, the terminal goes On Line after a block or line transmit or page dump function via either the auxiliary port or main port. With the switch off, the terminal remains off line.

2.8.2 Inhibit Escape Codes (S3-2)

With the switch on, all single key escape code sequences are performed locally without transmission, regardless of half or full duplex modes. The ESC key remains unaffected and operable.

With the switch off, single key escape code sequences obey the normal rules of HDX and FDX.

2.8.3 50/60 Hz (S3-3)

This switch is used to program the display to 50 or 60 Hz. To avoid beat interference, the display rate should match the power line frequency.

2.8.4 X-Suppress (S3-4)

Suppresses transmission of X-ON/X-OFF sequences during buffer overflow conditions. Alters response to received X-ON/X-OFF commands as per Section 3.3.12.

2.8.5 Reset (S3-5)

This switch performs a system reset and self-test exactly like powering the terminal down and up again.

NOTE: Screen data is lost due to initialization of the CRT circuitry and system self test diagnostics.

2.8.6 Normal/Half Intensity (S3-6)

This switch reverses the meaning of normal and half intensity visual attributes. With switch on, normal data becomes half intensity and half intensity data becomes highlighted.

2.8.7 Normal/Reverse (S3-7)

This switch reverses the meaning of normal and reverse video attributes. With the switch on, characters are black on white and reverse video attributes cause data to be displayed white on black. Brightness and contrast must be adjusted for proper screen display.

2.8.8 Current Loop (S3-8)

This switch must be on if the current loop option is selected for use.

SECTION III

OPERATION

3.1 INTRODUCTION

This section provides both basic and detailed operating instructions for the Micro Bee 2. Section 3.2 is a simplified operating guide which explains in nontechnical language how to turn on the terminal and use it for most data communications tasks. Operating modes and other terminal features are explained and examples are given where necessary. Section 3.3 provides more detailed operating information which is necessary for the programmer or technician who must install and interface the terminal with other data communications equipment.

3.2 BASIC OPERATION DESCRIPTION

3.2.1 General

The Micro Bee 2 is not a difficult device to operate and, with sufficient practice, any typist can master this very versatile machine. The keyboard bears close resemblance to a standard typewriter and also includes features found in teletype equipment. The big difference, however, is the CRT (picture tube) display. Unlike printed paper output, video data can be easily altered and corrected by the operator before transmission to an auxiliary device, printer, or host computer.

3.2.2 Turn-On Procedure

Before the Micro Bee 2 is used, it must be properly installed and set up in accordance with Section II of this manual. This should be attempted only by qualified personnel.

An identification plate located on the bottom cover of the terminal specifies the electrical power requirements of the Micro Bee 2. When moving the terminal to an alternate operating position, make sure that the selected power outlet is properly grounded and supplies the correct operating voltage/frequency. Get technical assistance, if necessary, in making this determination.

The proper turn-on procedure for the terminal is as follows:

a. Set the rear panel POWER ON/OFF switch to ON (see Figure 2-3); allow a warm-up period of about a minute and ensure that the cursor and Status line have appeared on the screen. If both the cursor and Status line do not appear, check the Brightness and Contrast adjustments, as explained in b.

b. Turn the Brightness control (located on the rear panel; see Figure 2-3) until a raster is faintly visible on the screen. Write several characters on the screen with the terminal in half duplex (see Section 2.7.5), using both high and low intensity. Use the half intensity visual attribute as described under ASET in Table 3-2 for an accurate half-intensity level. Reduce the brightness until the background raster is extinguished. Adjust the Contrast control (another rear panel component) until the difference between full and half intensity characters is easily distinguished.

c. Any time power is applied to the Micro Bee 2, it performs a display memory test and a system operation test. Because of the CRT warm-up time, there is no visible effect on the screen. If the unit is turned off and back on, a slight display flicker occurs while the test is run. When the self test is successfully completed, "SYSTEM RDY" appears on the Status line. In the event of a test failure, "ERR CK" appears, followed by an indication of which test portion failed. Self test may also be initiated from the keyboard as described under TEST in Table 3-2, or it may be initiated by the host computer.

3.2.3 Rear Panel Switches

Switch blocks 1 and 2 (S1 and S2) on the rear panel enable/disable certain operating features of Micro Bee 2. There are a total of 16 miniature switches, eight on each switch block. Most rear panel switches

require no operator attention because they must be properly set when the terminal is installed. Section 2.7 describes how to change a switch and the reset procedure which must be used following each switch change.

3.2.4 Keyboard Controls

The Micro Bee 2 keyboard is shown in Figure 3-1. The keyboard's main function is to generate standardized digital electronic codes (ASCII codes) which the terminal uses to display information and communicate with other equipment. The keyboard produces three main types of codes:

a. Character codes - For example, striking the "a" key causes the displayable character code for the letter "a" to be produced. Depending on the mode of operation selected, the "a" will be transmitted, displayed on the screen, or both.

b. Control Character codes - These are not displayed, but cause specific functions to occur. To generate a control character code, depress **and hold down** the CONTROL key while simultaneously typing the required alphanumeric key. Example: CONTROL G rings the bell.

c. Escape sequence codes - These are also non-displayed and cause specific functions to occur. To perform an Escape operation, depress and release the ESC key, followed by the designated alphanumeric key. Example: ESC E clears the screen. If the CONTROL key is held down with the ESC key, the Escape sequence will take place within the terminal only and will not affect other equipment.

Table 3-1 is an ASCII chart which the operator may use in determining what keyboard sequence to use in performing a given Control or Escape function. Note that the chart has three columns: Control Characters, Displayable Characters, and Escape Sequences. Using the chart is best explained by giving examples: If the operator wants a Line Feed (LF) to occur, the sequence CONTROL J is used; to initiate the self test, the sequence ESC f is used.

Table 3-2 is a listing of all keyboard keys on the Micro Bee 2. Each is described in sufficient detail to enable the operator to use it effectively. A technical approach to this information which is considerably more detailed and complete is included in Section 3.3.

3.2.5 Communication Modes

The Micro Bee 2 terminal is capable of operating Off Line (Local) or On Line. Two operational modes of communication are provided when the unit is On Line: Full Duplex (FDX) and Half Duplex (HDX). "LOCAL" or "ONLINE" is displayed in Field A of the Status line, depending on the mode selected.

Local - Data communication takes place between the keyboard and display memory only. No data transmission occurs unless the SEND or ASEND functions are used for block transmission. See Table 3-2.

(continued on Page 3-6)

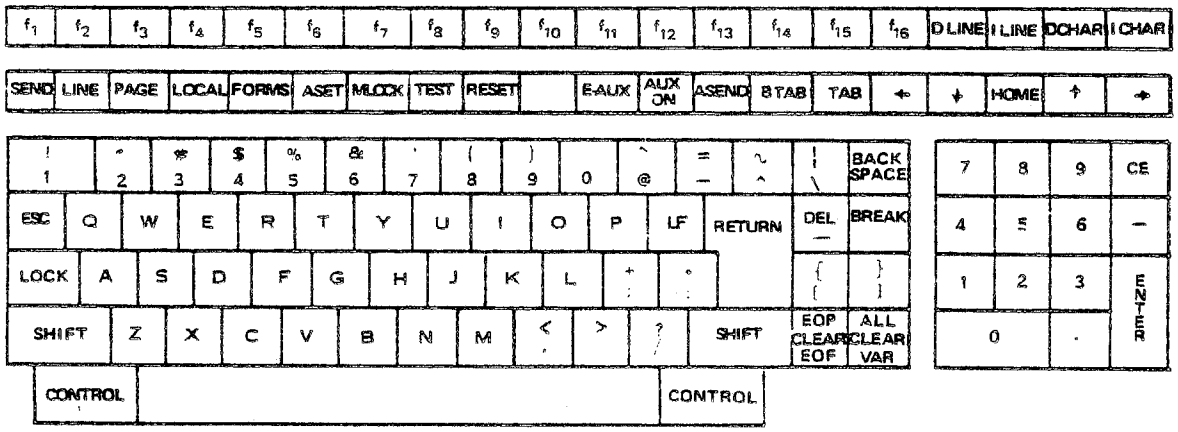


Figure 3-1 Micro Bee 2 Keyboard

Table 3-1 ASCII Code Chart

BIT 7 6 / 4 3 2 1	CONTROL CHARACTERS 0_0	CONTROL CHARACTERS 0_1	DISPLAYABLE CHARACTER 0_1	DISPLAYABLE CHARACTER 1_0	DISPLAYABLE CHARACTER 1_1	ESCAPE SEQUENCE 0_1	ESCAPE SEQUENCE 1_0	ESCAPE SEQUENCE 1_1
0000	NUL @	DLE P	SP	@	P	SET CLOCK SP	INSERT CHARACTER OFF @	LINE DELETE CHARACTER P
0001	SOH A	DC1 Q X-ON	!	A	a	PAGE MODE !	↑ A	LINE INSERT ON Q
0010	STX B	DC2 R	"	B	b	BOOT LD RUN "	↓ B	GRAPHIC MODE ON R
0011	ETX C	DC-3 S X-OFF	#	C	c	LINE MODE #	→ C	GRAPHIC MODE OFF S
0100	EOT D	DC-4 T	$	D	d	$	← D	MODIFIED MODE ON T
0101	ENQ E	NAK U	%	E	e	START CONSTANT FIELD %	CLEAR E	MODIFIED MODE OFF U
0110	ACK F	SYN V	&	F	f	FORMS BUILD &	CURSOR ADDRESS F	RESET V
0111	BEL G	ETB W XMIT	'	G	g	SEND ENTER CODE '	READ CURSOR CHARACTER G	FORMS MODE ON W
1000	BS H	CAN X	(	H	h	AUX ON (	HOME H	FORMS/ FORMS BLD OFF X
1001	HT I	EM Y	)	I	i	AUX OFF)	PAGE SEND I	CURSOR ADDRESS Y
1010	LF J	SUB Z	*	J	j	LINE MONITOR OFF *	CLEAR EOP J	CURSOR DISPLAY ON/OFF Z
1011	VT K	ESC [	+	K	k	START FIELD SPECIAL +	CLEAR EOL K	START UN-PROTECTED FIELD [
1100	FF L	FS \	,	L	l	CLEAR ENTRY (CE) ,	INSERT LINE L	CURSOR SENSE \
1101	CR M	GS]	-	M	m	-	DELETE LINE M	START PROTECTED FIELD]
1110	SO N	RS ^	.	N	n	.	OFF LINE (LOCAL) N	SET MEM POINTER ^
1111	SI O	US _	/	O	o	AUX PAGE DUMP /	READ TERMINAL STATUS O	READ DATA AT MEMORY POINTER _

BIT 7 6 / 4 3 2 1	1_1
0000	p
0001	q
0010	r
0011	s
0100	t
0101	u
0110	v
0111	w
1000	x
1001	y
1010	z
1011	{
1100	|
1101	}
1110	~
1111	RUB OUT

1_1
F1 p
F2 q
F3 r
F4 s
F5 t
F6 u
F7 v
F8 w
F9 x
F10 y
F11 z
F12 {
F13 |
F14 }
F15 ~
F16 RUB OUT

ESCAPE SEQUENCE 1_0	ESCAPE SEQUENCE 1_1
AUX SEND #	PAGE DELETE CHAR \
DISPLAY MESSAGE ON 1	PAGE INSERT ON a
DISPLAY MESSAGE OFF 2	KEYBOARD ENABLE b
AUX PAGE SEND 3	KEYBOARD DISABLE c
AUX LINE SEND 4	ATTRIBUTE SET d
AUX BAUD RATE SET 5	ATTRIBUTE DELETE e
WRITE CONTROL MODE 6	SELF TEST f
MAIN BAUD RATE SET 7	MEMORY LOCK ON g
CONTINOUS ALARM ON 8	MEMORY LOCK OFF h
CONTINOUS ALARM OFF 9	LINE SEND i
LINE MONITOR ON :	ENABLE AUX PORT j
CPU MESSAGE DEPOSIT ;	DISABLE AUX PORT k
LINE LOCK <	START BLINK l
LINE UNLOCK =	NORMAL VIDEO m
BACK TAB >	ON LINE n
UNLOCK ALL LINES ?	PAGE DUMP o

I/O FUNCTIONS ONLY

Table 3-2 Keyboard Functions

KEY	FUNCTION
CE	The CE (Clear Entry) key only works when the terminal is in Forms mode. Depressing this key moves the cursor to the beginning of the current unprotected field and erases to the end of the field. Forms mode is described later in this table and in Section 3.3.9.
(-) (Minus)	The Minus key generates the same code as in the typewriter array.
ENTER	The ENTER key generates the termination character selected by the rear panel switches. If CR (Carriage Return) or CR LF (Cursor Return-Line Feed) are selected, the terminal performs these functions when the ENTER key is depressed. If EOT (End of Transmission) or ETX (End of Text) are selected, the terminal transmits these codes but no visible display functions occur.
(.) (Decimal Point)	The decimal point key generates the same code as the period on the typewriter array. This key is included on the numeric pad as a convenience feature.
0-9 keys (Numeric pad)	These are stand-alone numeric entry data keys. Numeric pad keys are not affected by the SHIFT, LOCK, or CONTROL keys.
BACK SPACE	This key is equivalent to the ← key, except that the ASCII back space code is transmitted when on line. CONTROL H is the ASCII back space (BS) code.
BREAK	The CONTROL BREAK sequence may be used to interrupt transmission from the host CPU. Actuation of the BREAK key alone causes no operation.
ALL CLEAR VAR	When this key is used with the CONTROL key, the entire screen contents are erased and the cursor is positioned to Home. The interlocking of the two keys is a safety feature to prevent accidental erasure.
EOP CLEAR EOF	When interlocked with the CONTROL key, this key causes erasure of all displayed data from the current cursor position to the end of memory. When actuated alone, data from the current cursor position to the end of the line is erased.
DEL/_ (Delete/ underline)	This key normally produces an underline character (_). When shifted, a rub-out code (•) is produced. Both these displayable characters overwrite any existing data.
RETURN (Carriage Return)	This key causes the cursor to move to first position of the current line while not in Auto Line Feed mode (Switch S1-3 down). If Auto Line Feed is on, the cursor advances to the beginning of the following line.
LOCK	The LOCK key is more accurately described as a "caps lock" because it affects the alpha characters (A-Z) only. It is a toggle key also. This means striking the key once causes it to assume a detent position (the key remains depressed) and upper case characters only may be produced. Striking the key again releases it from the detent position, enabling lower case characters to be produced.
SHIFT	Nonalpha displayable keys such as !/1 are manipulated with the SHIFT keys. When entering an alpha character with the LOCK on and a SHIFT depressed, a double shift occurs which results in a lower case character being displayed.
SPACE BAR	The space bar is not labeled because its location and operation are very similar to the equivalent typewriter key. Its basic function is to move the cursor right one character position. After the cursor reaches the last character position of the currently-occupied line, it moves to the next line down. When the cursor reaches the last character position on the bottom display line, further movement causes it to return to Home and begin its left-to-right excursion again on the first line of display. If Roll mode has been selected (see Section 2.7.2) and the cursor is in the last position of the bottom display line, further cursor movement results in the entire display contents being shifted vertically one line. The top line of display is lost from view (and display memory) and the cursor occupies the first position of the bottom line.
ESC	Depression of ESC, followed by an alphanumeric or symbol key, causes the terminal to perform an Escape function as described in part c of 3.2.4 and as listed on the ASCII Code chart, Table 3-1.
Alphanumeric Keys (A-Z, punctuation, and shiftable numeric keys	The remaining keys, which are arranged and like the familiar standard typewriter keyboard, function as such. When used in conjunction with SHIFT/LOCK keys, the associated letter, number, symbol or punctuation mark is displayed and/or transmitted.
CONTROL	Depression of either CONTROL key followed by an alphanumeric or symbol key causes the terminal to perform a Control function as described in part b of 3.2.4 and as listed on the ASCII Code chart, Table 3-1.
SEND	The SEND key initiates a block transmission out the Main port when the terminal is in a Local mode. In the Page mode "PAGE" is displayed in Field B of the Status line and the following events occur when the SEND key is struck: 1) "Ex" is displayed at the current cursor position; 2) the cursor backsearches through the screen until it encounters another Ex symbol or the Home position (top left corner of the display); 3) each character of each line is then transmitted (with spaces to the end of line suppressed) and the line is followed by a CR LF or a CR only in the case of a completely full 80 character line. When the cursor reaches the original position, it halts. The operator must move the cursor to the end of the next data block if another block send of subsequent material is desired. During data transmission, the Status line indicates MAIN SEND in Field E and the keyboard is disabled. In Line mode, "LINE" is displayed in Field B of the Status line. The cursor returns to the start of the present line before transmission and only the cursor-occupied line (minus trailing spaces) is sent. No Ex character is written on the screen and the cursor appears in the first position of the following line after transmission.

Table 3-2 Key Functions (continued)

KEY	FUNCTION
LINE and PAGE	When the LINE key is depressed, the terminal enters the Line mode and "LINE" appears in Field B of the Status line. Actuation of the SEND key causes data transmission on a Line basis as described under SEND in this table. When the PAGE key is depressed, the terminal enters the Page mode and "PAGE" appears in Field B of the Status line. Actuation of the SEND key causes data transmission to occur on a Page basis, as described under SEND in this table.
LOCAL	Depression of the LOCAL key alternately toggles the terminal from Local to On Line modes. The host computer (CPU) can place the terminal on line with an ESC N sequence and in Local mode with an ESC n. "LOCAL" or "ON LINE" appears in Field A of the Status line, depending on the mode selected.
FORMS	This key puts the terminal in Forms mode or when interlocked with the CONTROL key, the Forms Build mode is entered. "FORMS" or "FORMS BLD" appears in Field G of the Status line, depending on which mode is selected. The Forms mode is usually used when the operator must deal with a preconstructed form which is transmitted to the terminal by the CPU for the operator to complete. Such a form usually contains protected data which in the Forms mode the operator is unable to alter. Other areas of the form are unprotected fields which are reserved for operator entry of such information as name, address, telephone number, zip code, etc. The Forms mode is often automatically entered when a form is presented to the operator for completion. The cursor is positioned to the beginning of the first unprotected field. The exit requirements of that field must be met before the operator may proceed to the next field. If an error is made while completing an unprotected field, the operator is notified of this by a message which appears in the Status line in reversed blinking video. The error must be corrected before the opeator can continue on to the next field. The completed form may then be transmitted by the operator using the SEND key. The Forms Build mode is used to generate forms locally for eventual transmission to the host computer. This mode is not commonly used by most operators. Forms and Forms Build are explained in detail in Section 3.3.9.
ASET	The ASET key when depressed causes the next entry to be interpreted as a visual attribute according to Table 3.4. Other keys are ignored. Example: ASET Q causes the screen to become Half Intensity Reversed Video from the cursor position to the end of the screen (or until another attribute is set). See Section 3.3.10.
MLOCK	This toggle key alternately enables/disables the Memory Lock function. When enabled (on depression of key or receipt of ESC g), the display area above the cursor-occupied line is locked from operator access, but the area below this line functions normally. Any depression again of the MLOCK key or receipt of ESC h disables the Memory Lock function and the entire display screen is returned to normal operation. MEM LOCK on the Status line indicates this mode is being used. See Section 3.3.11.
TEST	The CONTROL TEST keyboard sequence causes the system self test to be run. Successful completion of the test results in "SYSTEM RDY" being displayed on the Status line. In the event of a test failure, "ERR CK" appears, followed by an indication of which test portion failed. See part c of 3.2.2.
RESET	The CONTROL RESET sequence causes the terminal to revert to the initial "power on" condition, except that the screen contents remain undisturbed.
Blank Key	The blank key located in the bottom, half-size function key row is not used.
E-AUX	This key is analogous to the LOCAL key because it alternately enables/disables full communications between the keyboard, screen and auxiliary device. When E-AUX is on, it will be reflected by the "AUX RDY/BSY" message in Field D of the Status line. See Section 3.3.8.
AUX ON	The AUX ON key is a toggle function also which logically connects/disconnects the Main I/O port and Auxiliary I/O port. In this way, the CPU may communicate directly with the Auxiliary device. If the terminal is on line, incoming data from the CPU is displayed on the screen. "AUX ON" is present in Field D of the Status line when this mode is selected. See 3.3.8 for more information. NOTE: Do not use combinations of On Line, Aux On and Aux Enable. Unwanted data paths resulting in multiple characters and other problems may occur.
ASEND	The ASEND key is the equivalent of the SEND key except that transmission is out the Aux port to the Auxiliary device.
BTAB	Depressing the BTAB key causes the cursor to move to the previous tab location to the left. When the cursor reaches the first tab position on a line, it then moves to the last tab position of the previous line. The cursor remains at the Home position when back-tabbed there and does not wrap around to the last line.
TAB	The TAB key moves the cursor to the next tabulation position. Fixed tab locations occur each eight character positions, e.g., position 0, 8, 16, etc. Tabs cannot be set by the operator. Selection of Roll or non-Roll mode also effects TAB key operation. In non-Roll, TAB key actuation will advance the cursor to the next available tabulation stop. When the cursor is at the last tab stop of line 24, the next TAB key actuation will return the cursor to HOME. In Roll mode, the cursor is also positioned from tab stop to tab stop when the TAB key is pressed. However, when the cursor is in the last position of line 24, TAB key actuation has no effect on cursor position except to move it around in line 24. Further rolling cannot be forced using the TAB key.
LF	Depression of this key causes the cursor to move down one line while occupying the same character position.
← (Cursor Left)	Depression of this key or ESC D moves the cursor to the left. If the cursor is at the first character position on a line, the cursor moves to the last character on the line above and upon reaching Home, moves to the last position on the last line.

Table 3-2 Key Functions (concluded)

KEY	FUNCTION
↓ (Cursor Down)	Depression of this key or ESC B moves the cursor to the same character position on the next line down. If on the last line, the cursor moves to the same character position on the first line.
HOME	Depression of this key or ESC H moves the cursor to the first character position on the first line.
↑ (Cursor Up)	Depression of this key or ESC A moves the cursor to the same character position in the next line above. Upon reaching the top line, the cursor moves to the same character location in the bottom line.
→ (Cursor Right)	Depression of this key or ESC C moves the cursor to the next character position. When the cursor reaches the last character position on the line, it moves to the first position on the next line down. When the cursor reaches the last position on the last line, it moves to the Home position.
F1-F16 (Special Function keys)	The operation of the special function keys is determined by the user. Depression of any of these keys causes transmission of the codes indicated on Table 3-1. The CPU responds to these codes as determined by local programming. Seek local technical advice when necessary in determining what functions (if any) have been assigned to these keys.
DLINE	The DLINE key causes the cursor-occupied line to be deleted and the remaining lines below to move up one line.
I LINE	Depressing the ILINE key causes data from the cursor-occupied line on down to be moved one line lower. The cursor is positioned to the beginning of the blank line which is created and data may then be entered in that line as desired by the operator.
DCHAR	The DCHAR key causes the character at the current cursor position to be deleted. The remaining data from the cursor position to the end of the line moves one character position left for each deleted character. Spaces for each deleted character are added at the end of the line. The CONTROL DCHAR sequence causes characters to be deleted on a Page basis, with all data past the cursor to the end of the display moving left. As before, spaces are inserted at the end of display for each deleted character.
ICHAR	Depression of this key initiates the Insert Character mode. All data on the current line move one character position right of the cursor as new characters are inserted at the cursor location. Data at the end of the line are lost. The CONTROL ICHAR sequence initiates the Page Insert mode. As characters are entered at the cursor location, all data to the right of the cursor are moved one position to the right for each character entered. Characters are deleted as they reach the end of the page.

(continued from Page 3-2)

On Line - Data are entered into memory, displayed and transmitted to the CPU. Transmission of the data to the CPU takes place in either full duplex or half duplex.

a. Full duplex - Data sent from the keyboard through the I/O port go to the CPU only and are not displayed. Only data received from the CPU are displayed by the teminal.

b. Half duplex - Keyboard entered data are displayed and transmitted to the CPU simultaneously.

3.2.6 Transmission Modes

When the Micro Bee 2 is On Line, transmission occurs in a character-by-character fashion as the keys are depressed. This is called a "conversational" mode and is used by the terminal to communicate with both the CPU and auxiliary devices. When the terminal is in the Local mode, the screen contents may be transmitted in block send fashion a line or a page at a time. The SEND key initiates such transmissions out the Main I/O and the ASEND performs a similar job for the auxiliary port. See Table 3-2.

3.2.7 Additional Operating Features

Many of the following Micro Bee 2 capabilities are not readily apparent when looking at the keyboard. Some are implemented using Control and Escape functions and others occur as an end result of the terminal operating program.

Subcharacter Display —When using the Micro Bee 2 in communication with a CPU in full duplex and a receiver error occurs on either a transmitted or received message, the S_B character will be displayed and a simultaneous audible alarm will occur.

Audible Alarm —The CONTROL G sequence (BELL character) causes **momentary** action of the audible alarm. This is usually a result of the cursor passing the 72nd character position with the alarm sounding to warn the operator of the approaching line end. The momentary alarm also occurs when an

illegal keyboard entry is attempted or a receiver error is detected. The CPU may gain the attention of the operator using the **continuous** alarm feature (ESC 8). The operator can end a continuous alarm by striking any keyboard key.

Clock – A 24-hour clock which can be used to indicate elapsed time or time of day can be made to appear in the Status line by using the procedure outlined in Section 3.3.16.

Graphics – The construction of line drawings and forms may be accomplished using the terminal's Graphics mode. Eleven characters are available to make graphs, charts, etc., which can be transmitted to the CPU for storage and recall at a later date. See Section 3.3.10.

Read Terminal Status – The ESC O sequence may be used by the operator to promote a 27-character Status line message which summarizes the current terminal operating configuration (baud rates, duplex setting, rear panel switch positions, etc.). The message appears in the Status line and is interpreted using Section 3.3.19 and Tables 3-10 and 3-11.

Line Lock – The CPU may designate display lines as reserved for its exclusive use. The operator has no control over this, but "LINE LOCK" appears on the Status line when such has occurred. The operator may enter data in any unprotected area of display that remains.

3.3 DETAILED OPERATION DESCRIPTION

3.3.1 General

This section provides detailed functional information on the Micro Bee 2. It is assumed that the reader has some background in digital communications and is familiar with some of the terminology involved. To understand all terminal capabilities thoroughly, the user must read this section because it covers terminal functions which are interdependent and behave differently in different modes. While none of the following material is difficult, the user must be acquainted with it to realize maximum efficiency from the Micro Bee 2.

3.3.2 Keyboard Operation

Control Functions

To perform a Control operation, depress the CONTROL key and **hold this key down** while simultaneously typing the alphanumeric key. The CONTROL key is used to modify the meaning (and code) of certain other keys. When held down during action of any displayable character key (columns 2-7 of ASCII Code Chart), bits 6 and 7 of the code are forced to zero so that the codes from rows 0 and 1 of the chart can be produced from the keyboard. It is also used as a safeguard for functions like Clear, Break, Reset and others so that the accidental striking of these keys does not destroy screen contents or disrupt communications. CONTROL does not affect the 16 special function keys or the numeric pad.

Escape Functions

To perform an Escape operation, depress and release the ESC key, followed by the designated alphanumeric key. Be careful that any commas or dashes appearing in the explanation of an Escape or Control operation are actually part of the intended sequence before entering them as part of the sequence. Often the punctuation is included in the text only to help clarify the explanation of a multiple entry keyboard operation. The ASCII Code chart is the best place to verify Control or Escape sequences.

The Escape key is used as the first code in a multiple code sequence. It must be pressed and released before the second key is struck

On Line: ASCII ESC is transmitted.

The CONTROL ESC sequence allows local action of escape code sequences. The codes will not be transmitted even if On Line. This sequence overrides full duplex and all other switch settings. For example, setting the clock as described in 3.3.16 and using the CONTROL key in conjunction with this operation would result in a clock displayed on the terminal screen with no clock information being being transmitted out the I/O.

On Line: Nothing is sent for the entire sequence.

SHIFT and LOCK

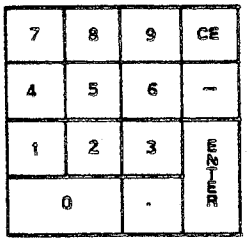
The SHIFT and LOCK keys are used to generate upper case codes and are operated the same as the equivalent typewriter keys, except as follows:

The LOCK key (also called the Alpha Lock key) affects alpha characters (A-Z, upper and lower case) only, so the SHIFT key must be used to manipulate the other displayable keys such as !/1. When enter-

ing an alpha character with the LOCK on and the SHIFT depressed, a double shift occurs which results in lower case characters being displayed. The SHIFT keys do not affect special function keys or numeric pad keys.

3.3.3 Numeric Pad Functions

The numeric pad keys shown below, when depressed, cause the associated character to be displayed and/or transmitted. The numeric pad includes a CE, Minus, and ENTER key. This group is a stand-alone numeric data entry key pad, not affected by the SHIFT, LOCK, or CONTROL keys.



The ENTER key generates the termination character designated by the rear panel switches (see Section 2.7.5). If a CR or CR-LF is the selected termination character and the ENTER key is struck while in Local or half duplex, the terminal activates the code locally and transmits it if in On Line. There is no visible screen response to EOT or ETX, but these codes are transmitted. The Minus key in the numeric pad generates the same code as the typewriter Minus key. The CE (Clear Entry) feature is operational **only while in the FORMS mode** and positions the cursor to the beginning of the current unprotected field, erasing to the end of the field. If On Line in the Forms mode, the CE key generates ESC , (comma).

3.3.4 Edit Functions

The edit function keys are shown below.

Delete Line (DLINE)

Keyboard action of the Delete Line key (DLINE) causes the current cursor line to be deleted. The remaining display lines are each moved up one line and a blank line is inserted at the end of the display. The cursor is positioned to the beginning of the line it currently occupies. If DLINE is used on a line where an attribute is set, the attribute is also deleted, even if the attribute affects multiple lines.

Forms Mode: Illegal; rings bell.

Keyboard Operation: DLINE or ESC M.

I/O Operation: Receipt of ESC M.

Transmitted Code: ESC M.

Insert Line (ILINE)

Keyboard action of the Insert Line key (ILINE) causes all data to be moved down one line, starting from and including the cursor-occupied line. A blank line is inserted at the original cursor line position and the cursor is positioned to the beginning of the new blank line. Any data in the last display line (line 24) are lost.

Forms Mode: Illegal; rings bell.

Keyboard Operation: ILINE or ESC L.

I/O Operation: Receipt of ESC L.

Transmitted Code: ESC L.

Delete Character – On a Line Basis (DCHAR)

Keyboard action of the Delete Character (DCHAR) key causes the current cursor character to be deleted. All data to the end of the line is moved left one position and a space is inserted at the end of the line.

Forms Mode: Character deletion is on a field basis.

Keyboard Operation: DCHAR or ESC P.

I/O Operation: Receipt of ESC P.

Transmitted Code: ESC P.

Delete Character – On a Page Basis (CONTROL DCHAR)

Keyboard action of the Delete Character key in conjunction with the Control key (CONTROL DCHAR) causes character deletion on a page basis. All data to the end of the page is moved and wrapped around to the left with a space inserted at the end of the display.

Forms Mode: Illegal; rings bell.

Keyboard Operation: CONTROL DCHAR or ESC ^.

I/O Operation: Receipt of ESC ^.

Transmitted Code: ESC ^.

Insert Character — On a Line Basis (ICHAR)

Keyboard action of the Insert Character key (ICHAR) initiates the Insert Character mode and the message "LINE INSRT" appears in Field F of the Status line. All data in the current line is moved to the right, from and including the character at the cursor, as new characters are entered. The cursor moves to the right as each character is inserted, indicating the location of the next inserted character. Data are lost at the end of the line. Striking the ICHAR key a second time resets the Insert Character mode.

Forms Mode: Character insertion is on a field basis.

Keyboard Operation: ICHAR or ESC Q sets mode on.
ICHAR or ESC @ sets mode off.

I/O Operation: Receipt of ESC Q sets mode on
Receipt of ESC @ sets mode off.

Transmitted Code: ESC Q when mode on
ESC @ when mode off

Insert Character — On a Page Basis (CONTROL ICHAR)

Keyboard action of the Insert Character key in conjunction with the CONTROL key intiates the Page Insert mode. "PAGE INSRT" appears in Field F of the Status line and all data to the end of the page is moved and wrapped around to the right as characters are inserted at the cursor position. Characters are lost at the end of the display. Striking the ICHAR key resets this mode.

Forms Mode: Illegal; rings bell.

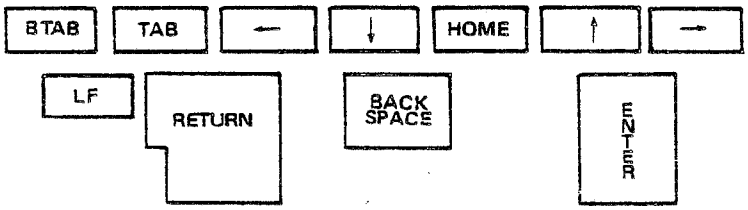
Keyboard Operation: CONTROL ICHAR or ESC a sets mode on;
ICHAR or ESC @ sets mode off.

I/O Operation: Receipt of ESC a sets mode on;
Receipt of ESC @ sets mode off

Transmitted Code: ESC a when mode on
ESC @ when mode off

3.3.5 Cursor Movement

The cursor movement keys are shown in below.



Home (HOME)

Action of the HOME key moves the cursor directly to the Home position, Line 1 column 1.

Forms Mode: The cursor moves to the first location of the first unprotected field on the screen.

Memory Lock/Line Lock: When portions of the memory are locked, the cursor moves to the first unlocked location available (moving from the top of the screen down).

Keyboard Operation: HOME or ESC H.

I/O Operation: ESC H.

Transmitted Code: ESC H.

Cursor Left (←)

Action of the ← key advances the cursor one position to the left. On reaching column 1 of a line, it wraps to column 80 of the previous line. On reaching Home, it wraps to column 80 of line 24.

Forms Mode: The cursor moves within an unprotected field and to an immediately adjacent field, provided exit parameters of the currently occupied field are met.

Memory Lock/Line Lock: On reaching an area of "Memory Lock", the cursor wraps to column 80 of line 24. On reaching a locked line, the cursor wraps from column 2 to column 80 of the first unlocked line above. If no further unlocked lines remain before reaching Home, the cursor wraps to column 80 of line 24.

Keyboard Operation: ← or ESC D.

I/O Operation: Receipt of ESC D.

Transmitted Code: ESC D.

Cursor Right (→)

Action of the → key advances the cursor one position right. On reaching line end, it wraps to column 1 of the next line below. On reaching column 80 of line 24, it wraps to Home.

Forms Mode: The cursor moves within an unprotected field to an immediately adjacent field provided the exit parameters of the current field are met.

Memory Lock/Line Lock: On reaching an area of "Memory Lock" while wrapping from column 80 line 24, the cursor advances to the first available unlocked location of the screen. On reaching a locked line, the cursor advances to column 2 of the first unlocked line available, wrapping through Home, if required.

Keyboard Operation: → or ESC C.

I/O Operation: Receipt of ESC C.

Transmitted Code: ESC C.

Cursor Up (↑)

Action of the ↑ key advances the cursor up one line; on reaching the Home line, it wraps through to line 24.

Forms Mode: The cursor moves within a field that extends through multiple lines.

Memory Lock/Line Lock: On reaching an area of "Memory Lock", the cursor advances and wraps to line 24. On reaching a lock line, it advances to the first free unlocked line, wrapping through line 1, if necessary.

Keyboard Operation: ↑ or ESC A.

I/O Operation: Receipt of ESC A.

Transmitted Code: ESC A

Cursor Down (↓)

Action of the ↓ key advances the cursor down one line. On reaching line 24, it wraps back to line 0.

Forms Mode: The cursor moves within a field that extends through multiple lines.

Memory Lock/Line Lock: On reaching a "Memory Locked" area, the cursor advances to the first unlocked line. On reaching a locked line, the cursor advances to the next unlocked line, wrapping through line 1, if necessary.

Keyboard Operation: ↓ or ESC B.

I/O Operation: ESC B.

Transmitted Code: ESC B.

Line Feed (LF)

Action of the Line Feed key causes the cursor to advance to the next line. On reaching line 24, if the terminal is in the Roll mode (switch S1-2 up), action of the Line Feed key causes scrolling to occur. Line 1 is lost and the data moves to create a new line 24. If the terminal is in the non-Roll mode (switch S1-2 down), the cursor wraps to line 1 of the display.

Forms Mode: The cursor moves within a field extending through multiple lines.

Memory Lock/Line Lock: In non-Roll mode, encountering a locked area advances the cursor to the first unlocked line available, wrapping, if necessary. In Roll mode, memory-locked areas are not encountered because of scrolling; however, on reaching a locked line, the cursor skips that line, forcing a scroll of all unlocked lines, if necessary.

Keyboard Operation: LF or CONTROL J.

I/O Operation: Receipt of CONTROL J (LF)

Transmitted Code: CONTROL J (LF)

Carriage Return (RETURN)

Action of the RETURN key causes the cursor to move to column 1 of the current line while not in the Auto Line Feed mode (switch S1-3 down). If Auto Line Feed is on, the cursor advances to column 1 of the following line.

Forms Mode: The cursor returns to the first unprotected location of the current field.

Roll Mode: If the Auto Line Feed mode is selected, the Micro Bee 2 display scrolls if the cursor is on the bottom line.

Non-Roll Mode: If the Auto Line Feed mode is on, the cursor wraps to Home if the RETURN key is struck while the cursor occupies the bottom line. **Note: In non-roll mode, action of the Return key causes erasure to the end of the current line from current cursor position.**

Enter Key (ENTER)

If the selected termination character is CR or CR-LF (see Section 2.7.5), action of the ENTER key causes cursor movement. See Carriage Return and Line Feed section 3.3.5 for relevant details.

Tabulate (TAB)

Action of the Tab key causes the cursor to advance to the right and halt at the next tab stop location. Tab stops are fixed at locations 0, 8, 16, 24, 32, 48, 56, 64, and 72 of each line. The Tab key automatically wraps at the end of each line.

Forms Mode: Action of the Tab key moves the cursor sequentially to each unprotected field start delimiter on the screen provided the exit parameters of the current field have been met. Attempts to tab when exit parameters are not met sound the alarm and the cursor does not move. Tabbing from the last field on the screen advances the cursor to the first unprotected field on the screen.

Roll Mode: In Roll mode, action of the Tab key advances the cursor sequentially until it reaches the end of the display. Tabbing beyond line 24 causes rolling to occur.

Non-Roll Mode: In Non-Roll mode, the cursor wraps to Home when it reaches line 24, column 80.

Keyboard Operation: TAB or CONTROL I (HT)

I/O Operation: Receipt of CONTROL I (HT)

Transmitted Code: CONTROL I (HT)

Back Tab (BTAB)

Action of the BTAB causes the cursor to back up to the previous tab loation, wrapping as necessary. On reaching Home, the cursor halts. Memory and Line Locked areas are tabbed around, not through.

Forms Mode: The BTAB key causes the cursor to reverse to the beginning of the field it currently occupies. Action of the BTAB key a second time reverses the cursor to the start of the previous field, provided exit conditions for the current field are met. BTAB stops on reaching the Home location in the first field.

Back Space (BACK SPACE)

This key is equivalent to the ← key except that the ASCII back space code is transmitted when on line. Local effects are identical to ←.

3.3.6 Screen Erasure

The screen erase associated keys are shown below.

Clear Screen (CONTROL–CLEAR ALL VAR)

Action of the Clear All Variables key in conjunction with the CONTROL key causes erasure of all data in memory, the cursor returning to the Home position. The Clear All Variables key actuated without the CONTROL key causes no action. This is a safety feature to prevent accidental erasure.

Forms Mode: The Clear Screen function causes the erasure of all unprotected data to the Null codes, the cursor returning to the first unprotected location of the first field.

Memory Lock/Line Lock: The Clear Screen function causes erasure of all unlocked areas of memory while allowing lo locked areas of data to remain. The cursor moves to the first unlocked location of the screen.

Keyboard Operation: CONTROL CLEAR ALL VAR or ESC E.

I/O Operation: Receipt of ESC E.

Transmitted Code: ESC E

Erase to End of Line (CLEAR EOP/EOF)

Action of this key causes erasure of displayed data from the current cursor position to the end of the line.

NOTE: If forms delimiters are present in memory but Forms mode is not currently selected, these delimiters are not altered by using the Erase to End of Page function.

Forms Mode: Erases all unprotected data to the Null codes from the current cursor position to the end of memory.

Keyboard Operation: Action of the CLEAR EOP/EOF KEY OR ESC K.

I/O Operation: Receipt of ESC K.

Transmitted Code: ESC K.

Erase to End of Page (CONTROL–CLEAR EOP/EOF)

Action of the CLEAR EOP/EOF key in conjunction with the CONTROL key erases all displayed data from the current cursor position to the end of memory.

NOTE: If forms delimiters are present in memory but Forms mode is not currently selected, these delimiters are not altered by using the Erase to End of Page function.

Forms Mode: Erases all unprotected data from the current cursor position to the end of memory.

Keyboard Operation: Action of CONTROL-CLEAR EOP/EOF or ESC J.

I/O Operation: Receipt of ESC J.

Transmitted Code: ESC J

Clear Entry (CE)

The CE key is operable only while in the Forms mode. Action of this key causes total erasure of the current unprotected field and the cursor to be placed in the first location of that field.

Keyboard Operation: CE or ESC ,

I/O Operation: Receipt of ESC ,

Transmitted Code: ESC ,

3.3.7 Communications–Main Port

The Main Port communications associated keys are shown below.

Send

In Local mode, the SEND key initiates a block transmission to the Main Port.

In Page mode, an ETX (E_X) is displayed at the current cursor position. An STX code is transmitted and the cursor backsearches through the screen until it encounters another ETX symbol or the Home position (top left corner of the display). Each character of each line is then transmitted (with spaces to the end of line suppressed) and the line is followed by CR-LF. A CR code only is transmitted after an 80–character line. When the cursor reaches its original position, the termination character is transmitted (see Section 2.7.5) and the terminal remains in the Local mode. During data transmission, the Status line indicates MAIN SEND in Field E and the keyboard is disabled. (Internal switch 1, when enabled, allows the terminal to go On Line after a block transmission.) All applicable RS232C control signals are active during a block transmission.

In Line mode, the cursor returns to the start of the present line before transmission and the whole line (minus trailing spaces) is transmitted. No ETX character is written on the screen and the cursor appears at column 1 of the following line after transmission of the termination character. If Internal switch 1 is enabled, the terminal goes On Line at the end of line transmission. Again, all applicable RS232C control signals are active during the transmission.

Forms Mode & Page Mode: Regardless of cursor position, in the Page mode, all of the unprotected fields of data are transmitted with an ASCII HT code between fields. There is no displayed ETX, and any constant field is transmitted first.

Forms + Modified Mode: If the Modified mode is on, only the fields which have been altered are transmitted with HT codes replacing unmodified fields.

Forms + Line Mode: In the Line mode, only the current field is transmitted and the cursor skips to the next field, if exit requirements of the current field have been met. All characters of the variable field are transmitted, including all spaces in the field.

On Line: The ETB code is transmitted by the SEND key in either the Page or Line mode. The Send function cannot be initiated from the keyboard when On Line unless the ETB code is echoed to the terminal by the CPU.

NOTE: Receipt of X-OFF code disables transmission until X-ON is received (see Section 3.3.12).

Keyboard Operation: The SEND key or ETB (CONTROL W) initiates a Page Send or a Line Send, according to the current mode selected.

I/O Operation: Receipt of an ETB code causes either a Line Send or a Page Send, according to the mode selected.

Receipt of an ESC I code forces a Page Send to be initiated, regardless of the current mode selected. The original mode is assumed when transmission is complete.

Receipt of ESC i similarly forces a Line Send to occur, the original mode again being assumed upon completion.

Transmitted Code: CONTROL W (ETB)

Line Mode

The LINE key changes the terminal mode from Page to Line mode. In Line mode, the SEND key initiates a Line Send function. An STX code is transmitted and the cursor backsearches through the screen until it encounters another ETX symbol or the Home position (top left corner of the display). Each character of each line is then transmitted with spaces to the end of the line suppressed. A CR-LF sequence is transmitted at the end of each line of data when spaces are suppressed. A CR code only is transmitted after an 80-character line. When the cursor reaches it original position, the selected termination character is transmitted (see Section 2.7.5) and the terminal remains in the Local mode. (Internal switch 1 when enabled allows the terminal to go On Line after a transsion.)

On Line: ESC # is transmitted.

Forms Mode: If the terminal is in Forms mode and a Line Send is initiated, then only the field the cursor presently occupies is sent.

Modified Mode: If the terminal is in a Modified mode and a Line Send is initiated, then only a cursor-occupied field in which the data have been modified may be sent. The exit parameters of the field must be met and the selected termination character is included.

Keyboard Operation: LINE key or ESC #.

I/O Operation: Receipt of ESC #.

Transmitted Code: ESC =.

Page Mode

The PAGE key returns the terminal to Page mode from Line mode. In Page mode, the SEND key initiates a block or page transmission. An STX code code is transmitted and the cursor backsearches through the screen until it encounters another ETX symbol or the Home position (top left corner of the display). Each character of each line is then transmitted with spaces to the end of line suppressed. A CR-LF sequence is transmitted at the end of each line of data when spaces are suppressed. A CR code only is transmitted after an 80-character line. When the cursor reaches its original position, the selected termination character is transmitted (see Section 2.7.5) and the terminal remains in the Local mode. (Internal switch 1 when enabled allows the terminal to go On Line after a block transmission.)

Forms Mode: A constant field (if present) plus all unprotected fields is sent when the SEND key is struck, but no STX is sent. An ASCII HT is sent between fields. After sending the last field, the termination character (switch selectable) is transmitted and the terminal remains in Local mode.

Modified Mode: If the terminal is in Modified mode and a Page Send is initiated, then only modified fields are sent. In place of unmodified fields, an HT is sent.

Keyboard Operation: PAGE key or ESC !.

I/O Operation: Receipt of ESC !.

Transmitted Code: ESC !.

Local Mode

The LOCAL key is a toggle function; it alternately switches the terminal from On Line to Local and vice versa. In the On Line mode, all alphanumeric characters are transmitted through the main I/O port when keys are struck. All control keys (such as RETURN) send their associated control code. All function keys send their associated two-code sequence if enabled by the appropriate internal switch. (See Section II.) If the switch is disabled, the code is performed locally only.

In the Local mode, the keyboard is connected directly to the display and any key activated only

affects the display; no transmission occurs. The terminal must be in the Local mode before a block transmission may be initiated. The receiver is only partially disabled while in Local mode. It continues to monitor for the receipt of certain code sequences that may be performed while the terminal is in a Local mode. These sequences are:

GO ON LINE
AUX-ON
AUX-OFF
SET MEM ADD POINTER
CPU MSSGE DEPOSIT

Keyboard Operation: LOCAL or ESC n for On Line
LOCAL or ESC N for Local

I/O Operation: Receipt of ESC n for On Line
Receipt of ESC N for Local

Transmitted Code: ESC n for On Line
ESC N for Local

Line Monitor Mode

The Line Monitor mode allows the entry of received Control code and Escape sequences into a display memory. Remote command execution is inhibited and all codes are displayed. Control codes and Escape codes are generated on the keyboard and written to display memory without command execution.

Keyboard Operation: On with ESC : and Off with ESC *.

I/O Operation: Receipt of ESC : for On or ESC * for Off.

Transmitted Code: ESC : for On or ESC * for Off.

Page Dump

The Page Dump feature allows the user to send the entire screen contents (including graphics, visual and logical attributes) to the CPU for later retrieval and recomposing. To perform a Page Dump from the keyboard, the terminal must be in Local mode and not in Forms or Forms Build mode. Page Dump is initiated with an ESC o. After this sequence is entered, an ESC E (Clear Screen) is transmitted, followed by the entire screen contents including visual attributes (see Section 3.3.10) and associated codes. Codes necessary to build forms are also sent. These include the cursor address to position the cursor to the beginning of a field, the Escape sequence and logical attributes associated with that field (see Table 3-2), the field-ending cursor address, and the Escape sequence to end the field. Graphical information is similarly transmitted as a sequence of graphic on/off commands. This enables exact representation of the original screen contents at a later time.

3.3.8 Communications - Aux Port

Auxiliary Send (ASEND)

The ASEND key is the equivalent of the SEND key except that data transmission is out the Auxiliary port (not the Main port) and is routed to the Auxiliary device. All lines are followed by a CR-LF sequence regardless of line length. Transmission of data while in the Forms mode via the Auxiliary port causes all protected data to be transmitted as space codes. If a constant field is present, it is transmitted first ahead of the unprotected data. Space suppression is performed as required, page format being maintained. The ASEND functions in both Line and Page modes are similar to SEND while obeying the Go On Line switch (Internal switch 1) after the transmission is completed. If the terminal is Aux enabled when an Auxiliary Send is activated, and ESC 0 is transmitted to the auxiliary device and no action occurs unless the code is echoed. While doing a block transmit out the Auxiliary port, AUX SEND appears in Field E of the Status line.

Note: Transmission to the auxiliary port while in modified mode is an illegal operation.

Line Mode: With the Micro Bee 2 in Local and Line modes, the action of an AUX SEND causes transmission a line at a time to occur. No STX is sent and an ETX does not appear on the terminal screen. A CR-LF is sent following the line.

Page Mode: When the ASEND key is actuated in the Page mode, an ETX is printed at the present cursor location. The cursor then backsearches to Home or the next previous ETX and transmission occurs from that point until another ETX is encountered.

Keyboard Operation: ASEND or ESC 0 (zero)

I/O Operation: Receipt of ESC 0 (zero)

Transmitted Code: ESC 0 (zero)

Auxiliary On (AUX ON)

The AUX ON key logically connects the Main I/O

port to the Auxiliary I/O port in a daisy chain configuration. Communication may be bidirectional and data transfer does not interfere with terminal keyboard and screen operations. When the terminal is in LOCAL mode, all keys operate locally without transmission to either port. Baud rate settings on the two ports need not be the same. Each port is buffered and the terminal may optionally control data flow in a way that no overrun or data loss occurs (see Section 3.3.12). If the terminal is unable to accept more data from the main port, an X-OFF code is sent to the host to stop data flow. When the buffer is sufficiently empty, an X-ON code is sent to restart the flow of data without loss. If the terminal is unable to accept more data from the Aux port, the CTS signal (pin 5, Clear to Send) is dropped to inhibit data flow until the buffers can accept more data. If the terminal is placed On Line or Aux Enabled, the screen monitors data from the port selected and the keyboard codes are routed to that port. When AUX ON is selected, it is indicated in Field D of the Status line.

Keyboard Operation: AUX ON or ESC (for Aux On; AUX ON or ESC) for Aux Off - (AUX ON is a toggling key)

I/O Operation: Receipt of ESC (for Aux On; receipt of ESC) for Aux Off.

Transmitted Code: ESC) when Aux On
ESC (when Aux Off

NOTE: Combinations of ON LINE, AUX ON, and AUX ENABLE are provided primarily for line diagnostic purposes and therefore may produce multiple characters on the screen or unwanted multiple paths for data. All three modes should not typically be used simultaneously.

Auxiliary Enable (E-AUX)

This key has a function similar to the Local key. It puts the terminal On Line with the auxiliary I/O port and full communications are enabled between the keyboard, screen, and auxiliary device. All communications are half duplex only, regardless of main port switch settings. (Echoed characters appear double on screen.) The terminal controls incoming data by dropping and raising pin 5 (CTS) on the auxiliary port. The aux port is disabled when the E-AUX key is struck a second time. When E-AUX is on, it is reflected by the AUXRDY/BSY message in Field D of the Status line.

Keyboard Operation: E-AUX or ESC j enables AUX
E-AUX or ESC k disables Aux (E-AUX is a toggling key.)

I/O Operation: Receipt of ESC j enables Aux; Receipt of ESC k disables Aux.

Transmitted Code: ESC j or ESC k.

NOTE: If On Line and Aux Enabled, keyboard data goes to both ports and the screen, and each port has access to the screen. If either device echoes, multiple characters appear on the screen. The terminal may also be Aux On and Aux Enabled simultaneously. Under these conditions, data from the main receiver passes directly to the auxiliary device without appearing on the screen. Data from the keyboard appears on the screen and is passed to the auxiliary device. Data from the auxiliary device appears on the screen and is passed to the main port transmitter. Under this condition, the Status line Field D indicates AUX-ON, since it has priority over AUXRDY.

Auxiliary Page Dump

This function is similar to Page Dump described in 3.3.7, except that data transmission occurs from the Auxiliary port to the Auxiliary device. ESC / initiates the dump. Again, the Micro Bee 2 may not be in Forms or Forms Build mode. The terminal responds to the Go-On-Line switch (Internal switch 1) following transmission.

Keyboard Operation: ESC / initiates the Auxiliary Page Dump.

I/O Operation: Receipt of ESC /.

Transmitted Code: ESC /.

3.3.9 Formatting Modes

Keys associated with the Forms and Forms Build modes are shown below.

Forms Mode (FORMS)

Action of the FORMS key selects the Forms mode and the message "FORMS" is reflected in Field G of the Status line.

Selection of this mode causes previously entered attributes to be asserted, defining areas of protected and unprotected data upon the screen. At-

tempts to select Forms mode without previously entering field attributes aborts and the alarm sounds.

Field delimiting attributes are invisible and occupy no space in memory. A range of attributes allows selection of various field types designed to limit the type of data being entered by the operator (see Table 3-3 for field type definitions).

NOTE: When data are being entered in Forms mode via the I/O, fields do not automatically overflow; a horizontal tab (HT) is required to advance the cursor between fields.

Defining Forms—Forms may be built via the I/O or the keyboard. A special method permitting local definition of Forms data is described next under Forms Build Mode.

With no field delimiters entered, the screen is considered to be totally protected. Thus, in defining a form, it is necessary to define the unprotected data fields. Data entered directly to the screen from the keyboard or I/O without setting attributes is considered protected when the Forms mode is asserted. To define an unprotected area, enter the code sequence defining the starting delimiter for that field, i.e., ESC [defines a regular unrestricted entry field. The cursor must be positioned to the required ending location for that field by means of cursor addressing or by any movement instruction desired, and the Start Protect delimiter entered (ESC] for all field types). Data entered between fields again becomes protected. Unprotected fields may be located at any position on the screen and may be built in random order. Data may be entered into unprotected areas during definition and remain displayed but unprotected when Forms mode is asserted.

Operator Entry—Once a form has been defined and Forms mode initiated, the form is ready for operator entry. The action of turning on the Forms mode positions the cursor to the first unprotected character position from the Home position. Since field definitions are not displayed, the areas to be entered may be defined to the operator by containing data, visual attributes, or by entering a clear

Table 3-3 Logical Field Attributes

3-code Sequence	Field Definition (Unprotected)		Graphic Symbol
ESC, +, 0	Must Enter	Alphanumeric	⌐¬
ESC, +, 1	Must Enter	Alpha only	
ESC, +, 2	Must Enter	Numeric only	L
ESC, +, 3	Must Enter	Alphanumeric	⌟
ESC, +, 4	Total Fill	Alphanumeric	⊤
ESC, +, 5	Total Fill	Alpha only	⊣
ESC, +, 6	Total Fill	Numeric only	⊢
ESC, +, 7	Total Fill	Alphanumeric	⊥
ESC, +, 8	Normal	Alphanumeric	—
ESC, +, 9	Normal	Alpha only	|
ESC, +, :	Normal	Numeric only	+
ESC, [	Normal	Alphanumeric	—
ESC,]	Start Protect (End of Field) used after all fields		
ESC, %	Start Constant field		

Definitions:

Alphanumeric — All characters accepted in field entry.

Alpha Only — All characters except the digits 0-9.

Numeric Only — All characters less than A, hexadecimal.

Normal — Fields may be skipped or entered without restriction.

Must Enter — At least one valid character must be entered into field before cursor may advance to next field.

Total Fill — Field must be totally filled (specified length) before cursor may advance to the next field.

Constant — One field may be defined with identification data which is not accessible or alterable in the FORMS mode but which will be transmitted before the unprotected fields in a Page Send.

NOTE: If more than one constant field is set up on the screen, only the last one defined is valid.

screen code sequence, the unprotected areas becoming defined by delete codes throughout their length (◦ ◦ ◦ ◦ ◦).

The operator may now proceed to enter data as required. If the field definitions are for normal fields, on reaching the last character of an unprotected field, the cursor automatically tabs to the first character position of the next unprotected field. Again in normal fields, action of the tab key automatically advances the cursor to the next field.

Tab stops may be set within unprotected fields by the inclusion of additional start unprotect delimiters at the requisite positions during form construction. During eventual transmission, these additional

start delimiters appear as additional Horizontal Tabs.

On reaching a field having a total fill definition, any attempt to advance from the field before every location is completed sounds the bell and displays a message indicating the error in the Status line Field G. This error message identifies the field type and the error, i.e., ALP/NUM TOTAL
ALPHA TOTAL
NUMERIC TOTAL

Fields defined as Must Enter require the entry of at least one character before attempts are made to leave the field. If at least one character is not entered, an error message is produced and the alarm sounds. In this case, the error message indicates the field type plus MUST, i.e., ALPHA MUST.

Fields specifically defined as alpha or numeric only again refuse entry illegal codes and provide an alarm and a status message indicating the error, i.e., Alpha Total, etc.

Editing is permissible within any unprotected field (see Section 3.3.4 for definition).

Having reached the completion of the entry, the operator may transmit the entered data under the following rules.

a. SEND Key Operation in Forms and Page Modes:

Striking the SEND key causes all unprotected data to be transmitted with ASCII HT codes inserted between fields. No space suppression occurs and any delete codes present are transmitted as spaces. If a constant field is present upon the screen, it is transmitted first, regardless of its position on the screen.

Under these conditions, activating the SEND key does not write an ETX on the screen and the cursor position is irrelevant, since all unprotected data present are transmitted. The terminal finishes by transmitting the selected termination character and finally responding to the Go-On-Line switch (Internal switch 1), if selected.

b. SEND Key Operation in Forms and Line Modes:

Striking the SEND key causes the current field in which the cursor resides to be transmitted. If the exit requirements of that field have been met, the cursor advances to the next sequential field. Constant fields are ignored in these modes and are not transmitted. The selected termination character is transmitted at the end of the data and the terminal then references the Go-On-Line switch.

c. ASEND Key Operation in Forms and Page Modes:

Striking the ASEND key causes transmission of the entire page of data via the auxiliary port. The constant field, if present, is transmitted as it appears on the screen. Protected data are transmitted as spaces, with trailing space suppression permitted, provided the Page format is maintained. In this way, a complete representation of the format page may be passed to a printer to enter onto a preprinted form.

d. ASEND Key Operation in Forms and Line Modes:

Striking the ASEND key causes the transmission of the current cursor field via the auxiliary port. Constant fields are not transmitted in Line mode.

Forms Build Mode

The Forms Build mode (FBM) is entered by simultaneously activating the FORMS and CONTROL keys (or ESC &) and is reflected by the message FORMS BLD in Field G of the Status line.

The mode is specifically designed to allow the normally invisible logical field attributes to become visible and thus allow the user to generate forms locally for eventual transmission to the host device (via Page Dump).

Having entered FBM, fields may be entered in any sequence on the screen since at this time they are being held as visual data. The screen is generally considered a protected area and therefore all unprotected fields must now be specified. Entry of a start unprotected attribute (see Table 3-3 for available codes) causes display of a half-intensity blinking graphics symbol marking the first unprotected location. The cursor may now be moved to the required ending location of the field by means of the space bar, cursor movement keys or any other method. Entry of the start protect attribute (ESC]) causes the area between the two attributes to fill with delete codes, thus visually defining

the extent of the field, the graphics character at the first location remaining visible to permit identification of the field type.

All data entered into areas not defined as unprotected is treated as protected data when the form is retransmitted by the terminal.

One exception to the field definition is the "constant field". Entry of an ESC % produces no graphic display; data may be entered for the duration of the field and terminated by ESC]. These data are treated as a constant when the form is in use; that is, the operator may not alter it as it is truly protected, but during transmission it is sent as a prefix to all unprotected data regardless of its position on the screen. It is possible to enter multiple constant fields in a display page; however, only the last one entered is effective, as each prior constant field is relegated to being normal, protected data upon receipt of an additional constant field.

While in FBM, full editing facilities remain operable, thus permitting movement and adjustment of field sizes and data content. In this way, existing forms data may be received from the I/O in Forms Build mode, modified via the edit routines and retransmitted to the host via Page Dump.

NOTE: **Visual attributes may be used in building a form. However, a graphics character (delimiter) immediately following visual attribute appears as an ASCII character. When FBM is exited, the field will be valid, since the graphics character only marked the location of the field during the building of the form.**

Modified Mode

When using the Forms mode, a Modified mode may be set such that any unprotected fields which are changed in any way from the keyboard (written, erased, inserted, deleted, etc.) are flagged as modified. When the page is transmitted (all unprotected fields), only those that were modified are transmitted in their entirety. Fields not altered are replaced by a single horizontal tab code in the data stream to indicate their position among modified fields. Aux Page Send sends all fields as described in Section 3.3.8.

Keyboard Operation: ESC T turns modified mode on; ESC U turns it off.

I/O Operation: Receipt of ESC T turns modified mode on; receipt of ESC U turns it off.

Transmitted Code: ESC T or ESC U.

3.3.10 Visual Attributes

Associated keys are shown below.

Attribute Set (ASET)

The ASET key sets up the terminal so that the next key is interpreted as a visual attribute according to Table 3-4. Other keys are ignored.

Example: ASET Q causes the screen to become Half Intensity Reverse Video from the cursor position to the end of the screen (or until another visual attribute code is found). There is a limit of 16 visual attributes allowed per line. An attribute may not be set in the 80th column of the screen. However, to stop a video field at the end of a line, another attribute may be set at column 1 of the next line. In Non-Roll mode, a video attri-

Table 3-4 Visual Attributes

Key (ASCII Code)	Visual Attributes
@	Normal (Stop Visual Attribute)
A	Half Intensity
B	Blinking
C	Half-Blink
P	Reverse-Video
Q	Reverse-Half
R	Reverse-Blink
S	Reverse-Half-Blink
`	Underline-Normal
a	Underline-Half
b	Underline-Blink
c	Underline-Half-Blink
p	Underline-Reverse
q	Underline-Reverse-Half
r	Underline-Reverse-Blink
s	Underline-Reverse-Half-Blink
$	Security (Invisible)
4	Reverse-Security
5	Half-Reverse-Security
6	Blinking-Reverse-Security
7	Blinking-Half-Reverse-Security

bute in column 0 cannot be followed immediately by a CR; a code such as a space code must be entered before the CR. Attributes may not be followed immediately by graphics characters.

Forms Mode: ASET is not allowed while in Forms mode. The audible alarm sounds. Attributes may be set prior to entering the Forms mode.

The ASET key in conjunction with the CONTROL key causes an attribute delete function to occur. An attribute may be overwritten with another attribute; however, the maximum total per line is 16.

Keyboard Operation: Enter mode with ASET or ESC d followed by desired attribute ASCII Code from Table 3-4
Exit mode (i.e., generate a delete attribute function) with CONTROL-ASET or ESC e. A normal attribute (@) may be entered in lieu of deletion.

I/O Operation: ESC d followed by the appropriate ASCII Code from Table 3-4 sets an attribute

Graphics

Eleven graphic characters are available and may be displayed in normal video, half intensity, blinking or blinking half intensity. The graphic mode is turned on by entering an ESC R sequence and turned off with an ESC S sequence. To enter the Graphic mode, use the following procedure:

a. Turn on Graphic mode with an ESC R.
b. Move the cursor to where the graphic character is to start. At least one character must separate a graphics character and any preceding ASET.
c. Then key the ASCII character required for the given graphic symbol as shown on Table 3-5.
d. Repeat steps b and c as needed.
e. Exit the graphic mode with ESC S.

While in graphics mode, the 44 characters listed in Table 3-5 appear on the screen as corresponding graphics characters. All other codes are interpreted normally.

Table 3-5 Graphic Characters

SYMBOL	NORMAL	ASCII EQUIVALENT HALF	ASCII EQUIVALENT BLINK	HALF BLINK
	@	A	B	C
	D	E	F	G
	H	I	J	K
	L	M	N	O
	P	Q	R	S
	T	U	V	W
	X	Y	Z	[
	\	]	^	_
	`	a	b	c
	d	e	f	g
	h	i	j	k

Keyboard Operation: ESC R sets graphics mode on
ESC S turns graphics mode off

I/O Operation: ESC R sets graphics mode on
ESC S turns graphics mode off

Transmitted Codes: ESC R
ESC S

3.3.11 Display Locking

Associated key:

MLOCK

Portions of the display memory may be selectively locked from operator access under the control of Memory Lock or Line Lock functions.

Memory Lock (MLOCK)

The MLOCK key causes the display memory above the cursor line to be locked from operator access or scrolling. The display area below the locked portion of the screen functions normally. The cursor position is not affected by Memory Lock. Data in the locked portion of the screen cannot be altered by the operator but remain available for CPU control and data entry using the Memory Address Pointer. Memory Lock is not operable beyond line 23. A Status Message of "MEM LOCK" appears in this mode in Field E.

NOTE: The operator cannot accidentally lock out a whole page. Memory Lock is not allowed when the CPU has locked lines on the screen.

Forms Mode: Illegal; rings bell.

NOTE: Entering Forms mode cancels MEM LOCK condition.

Keyboard Operation: MLOCK or ESC g activates Memory Lock.
MLOCK or ESC h deactivates Memory Lock.
MLOCK toggles the Micro Bee 2 in and out of Memory Lock.

I/O Operation: ESC g for Memory Lock On;
ESC h for Memory Lock Off.

Transmitted Codes: ESC g and ESC h.

Line Lock

By way of the remote command ESC < , followed by a line address, the host CPU may selectively designate display lines as reserved for exclusive CPU use. When lines are so locked, keyboard and received data and terminal functions have no effect on those lines. The terminal does not allow cursor positioning in locked lines; the cursor moves down to the next available unlocked line. Clear screen and roll functions operate normally except that locked lines are left unaffected and fixed in display position. A Status Message of "LINE LOCK" appears in Field E while in this mode.

NOTE: Memory Lock is not allowed when the CPU has locked lines on the screen. The CPU cannot lock all lines on the screen.

Forms Mode: Illegal; rings bell.

NOTE: Entering Forms mode unlocks all lines.

Keyboard Operation: None.

I/O Operation: ESC < locks, ESC = unlocks
These Escape sequences must be followed by a third code which specifies which line is to be locked or unlocked. These codes are specified in Table 3-8.

Example: ESC < + locks line 12.
ESC ? is a CPU-entered code which unlocks all lines.

3.3.12 Transmit On and Transmit Off (X-ON/X-OFF)

The Micro Bee 2 is provided with a switch-selectable full duplex line protocol. Designed to allow full control of both data transmission and reception by the terminal, it enables the user to gain the maximum permissible data throughput on any full duplex system. The use of the full protocol is limited to full duplex systems because of the requirement to simultaneously transmit and receive data.

The terms X-On and X-Off as used herein mean Transmit On (CONTROL Q) and Transmit Off (CONTROL S), respectively. They are ASCII Control Codes used in data communications to interrupt transmission and reception when necessary to prevent data loss.

The protocol which is described below accomplishes X-On and X-Off automatically. This automatic, periodic suppression of the transmit function is called "X Suppress," an acronym for "Transmit Suppress," and is controlled by Internal switch No. 4.

The protocol is subdivided into two major areas:
(1) Control of data output from the terminal and
(2) Control of data received by the terminal.
Each is discussed in detail.

Internal switch 4 governs the automatic assertion of Transmit Suppress.

When switch 4 is on, X-Suppress is also on. The terminal will not transmit X-On or X-Off codes unless these control codes have been generated as valid data. The terminal responds to receipt of X-On and X-off only if it is currently transmitting.

When switch 4 is off, X-Suppress is also off. The terminal transmits X-On and X-Off codes and responds to the receipt of X-On and X-Off in all transmission modes.

Terminal Output Control

The control of data output from the terminal via protocol exchange depends on the setting of Internal switch 4.

Switch 4 On (X-Suppress On) —Under this condition, any time the terminal is performing a block transmission (i.e., Page Send/Dump, Line Send, etc.), the receiver is enabled and is monitoring for the reception of an X-Off Control Code (CONTROL S). Upon detecting an X-Off, transmission ceases within two character times. The terminal then enters an idle state until such time as an X-On (CONTROL Q) is received. At this time, data trans-

mission recommences without data loss and is maintained until such time as transmission is completed or a subsequent X-Off is received.

In this manner, a host device having a specific input block size requirement may control the terminal's transmission without the need for manual intervention.

The following constraints apply when controlling terminal output with X-Suppress On: (1) The terminal must be operating in a full duplex environment to permit simultaneous data transmission and reception. (2) The terminal must be currently performing a block transmit when the X-Off code is received. X-Off received at any other time is ignored.

Switch 4 Off (X-Suppress Off)—With X Suppress Off, the terminal reacts exactly as in X Suppress On except that receipt of an X-Off is valid at any time. Even if the terminal is in a conversational mode, receipt of an X-Off halts the output of transmitted data. In this mode, the bell sounds for each individual key struck after the receipt of an X-Off. These characters, however, are being placed into the output buffer at this time and up to 256 may be entered sequentially. Receipt of an X-On command releases the contents of this buffer for immediate transmission. If output is halted because of receipt of an X-Off and keyboard entry continues (once 256 characters are received), the system will prevent further acceptance of keyboard characters until the output is released by receipt of an X-On.

The following constraints apply when controlling terminal output with X Suppress Off: (1) The terminal must be operating in a full duplex environment to enable simultaneous transmission and reception. (2) Receipt of an X-Off always halts data transmission, regardless of mode.

Auxiliary Output Control

Reception of the X-On/X-Off protocol is also valid while the terminal is transmitting data from an auxiliary source in the Aux On mode. Under this condition, receipt of the X-Off code again halts the transmission of the data within two characters. However, once data output has ceased, the auxiliary device is halted only when the terminal's auxiliary buffer has become full. The auxiliary device is halted by the lowering of the auxiliary Clear-to-Send circuit. When an X-On is subsequently received, data output recommences and as soon as buffer space is available, the CTS circuit is raised to permit passing of further data from the auxiliary device.

Auxiliary output control must be accomplished under the following constraints: (1) The terminal Main port must be operating in a full duplex environment. (2) The Auxiliary device must be capable of observing the Clear to Send circuit. (3) X-On and X-Off commands received on the Main port while outputting from the auxiliary device are also passed through to the auxiliary device. (4) With the X-Suppress switch on, transmission must be in progress when the X-Off is received. With the X-Suppress off, it may be received at any time to halt output.

Terminal Input Control

A separate X-On/X-Off protocol controlling data input to the terminal is available under switch selection (Internal switch 4).

With the switch in the On position, the protocol is disabled and the terminal is reliant upon the host computer to ascertain and compensate for any timing requirements within data streams. (Since certain functions of the terminal require time to perform, pad codes such as Null or Delete must be inserted to allow the operations to be completed. With the switch off and the protocol enabled, the host can permit the terminal to command its own data reception rate and thus take no consideration of pad times.

The terminal has a receiver buffer of 254 characters length and the function of the protocol is controlled by the state of this buffer. When data is being received at a high rate, the terminal is normally able to remove data from the buffer at sufficient speed to prevent a potential buffer overrun condition. However, if a number of codes are included in a long data stream which requires time to perform, incoming data begins to stack up on the buffer. On reaching a condition of being 80% full (205 unprocessed characters received), the terminal issues an X-Off command via the Main port to halt the host CPU. After the issuance of the first X-Off, additional

characters received cause an X-Off to be transmitted for each received character. The terminal continues to process data from the buffer and reduce the number of unprocessed characters during this time. When the buffer content has been reduced such that it is 20% full (approximately 51 unprocessed characters), the terminal issues an X-On command to the host, calling for data to recommence.

Since the terminal is effectively controlling its own reception rate, it is therefore possible to permit communications at 19200 baud while the protocol is enabled. The terminal's transmitter will maintain 19200 baud operation without difficulty.

The following are terminal input control operating considerations: (1) The terminal Main port must be operating in a full duplex environment to permit transmission of codes while receiving data. (2) The host device must be able to receive and respond to X-On/X-Off protocol commands. Further, upon receipt of an X-Off command, the CPU receives further X-Off commands for each code transmitted prior to the receipt of an X-On. Theoretically, the host may send up to approximately 50 additional characters after receipt of the initial X-Off prior to a buffer overrun occurring and data being lost at the terminal. (3) Switch No. 4 must be off to permit X-ON/X-OFF transmission.

Auxiliary Input Control

The switch selectable protocol when enabled is also applicable to received data being passed to the auxiliary device. Thus, if the terminal is in an Aux On mode and data is being received at a high rate (for example, 19200 baud) but the auxiliary device is operating at 1200 baud, then the protocol can control this situation.

The auxiliary port has a similar but separate structure to the receiver Main Port buffer. Thus, if data is being received faster than it can be released to the auxiliary device, the buffer again stacks up and commences issuing X-Off/X-On commands as the buffer load permits. If the terminal is On Line and Aux On simultaneously, such that all received data is being both displayed and passed to the auxiliary device, the slower of the two operations commands the data rate. Thus, if a slow speed printer is connected, the terminal does not request additional data until both buffers are able to receive additional characters.

The following are the Auxiliary Input Control operating considerations: (1) Terminal Main Port must be operating in a full duplex environment. (2) While Aux On is enabled and the terminal remains Off line, normal keyboard operations are maintained. The operator may therefore continue to prepare data for eventual block transmission while the communications circuit is effectively timeshared to permit passing of data in either direction to an auxiliary device. It should be noted that when operating in an Aux On mode with both ports selected for high speed, keyboard operations causing a heavy processor load, such as Page Mode Insert, degrades the overall operating speed between the Main and Auxiliary ports. This will not cause any data loss but increases the incidence of X-Off transmissions while the processor is unable to clear the buffers as fast due to a temporary high throughput. (3) Operating speed of the auxiliary device is immaterial due to full buffering in both directions. If the speed of the auxiliary device is higher than that selected for the main port, then the data received does not cause any issuance of protocol commands. (4) Should the auxiliary device become "not ready" and drop pin 20 of the Auxiliary port low, the auxiliary buffer again fills if data reception is maintained and X-Off is transmitted until the device is again able to receive data. If the system is Aux-On and On Line simultaneously, the auxiliary device becoming "not ready" also causes data reception to the screen to halt until the device is again ready.

3.3.13 Special Function Keys (F1-F16)

These keys transmit a 4- or 5-code sequence according to Table 3-6. Example: F1 when depressed transmits

STX ESC p TERM

(where TERM = the termination character selected by the rear panel switches. [See 2.7.5] The choices are CR, EOT, ETX, or CR-LF.) If the terminal is in a Local mode, it obeys the Go-On-Line switch (Internal switch 1) setting after the transmission occurs (with the terminal remaining On-Line) regardless of switch settings. Under no conditions is the function key to be sent via the Auxiliary port.

Local: Associated codes are transmitted.

Line Monitor Mode: Code sequence is displayed. Example: S_X E_C q C_R No data is written to display by the function keys except in Line Monitor mode.

On Line: Code sequence is transmitted.

Table 3-6 Function Key Table

FUNCTION KEY	CODE TRANSMITTED
F1	STX, ESC, p, TERM
F2	STX, ESC, q, TERM
F3	STX, ESC, r, TERM
F4	STX, ESC, s, TERM
F5	STX, ESC, t, TERM
F6	STX, ESC, u, TERM
F7	STX, ESC, v, TERM
F8	STX, ESC, w, TERM
F9	STX, ESC, x, TERM
F10	STX, ESC, y, TERM
F11	STX, ESC, z, TERM
F12	STX, ESC, { TERM
F13	STX, ESC, | TERM
F14	STX, ESC, } TERM
F15	STX, ESC, ~ TERM
F16	STX, ESC, DEL, TERM

3.3.14 Other Key Operations

Associated keys:

Break (CONTROL BREAK)

When the terminal is on line, this key generates a 250 (±10%) ms. break ("spacing" condition) on the transmit data line (pin 2, main I/O). The BREAK key is interlocked with the CONTROL key. This key is inoperative in the Off Line or Local mode. Actuating BREAK by itself causes no operation.

Keyboard Operation: CONTROL BREAK

I/O Operation: None

Delete (DEL/—)

This key normally produces the underscore character (_). When shifted, this key produces the delete (rub out) code (•).

Transmitted Codes: Underscore is sent when unshifted; delete (rub out) is sent when shifted.

Test (CONTROL TEST)

The TEST key in conjunction with the CONTROL key causes the system self test to be run. This is the same test that runs at power-up. The self test puts the terminal in a Local mode and destroys screen data.

On Line: Receipt of ESC f initiates the self test

Transmitted Code: None

Reset (CONTROL RESET)

Execution of the Reset sequence (CONTROL RESET or ESC V) causes the terminal to be set to its initial state without altering the display memory. Reset functions the same as power-on, except the display memory is not altered and the power-on diagnostic is not invoked. A reset cannot be executed from the keyboard if the keyboard is in Lock mode. The Reset sequence must be executed if any rear panel switches are changed to ensure these changes have been read into the software.

3.3.15 I/O Functions

Keyboard Locking

- The ESC b sequence causes the keyboard to be enabled (data can be entered from the keyboard).
- The ESC c sequence causes the keyboard to be disabled (data cannot be entered from the keyboard). A message indicating KEYBD LOCK blinks in Field E of the status line.
- The keyboard cannot be enabled/disabled from the keyboard

Keyboard Operation: None

I/O Operation: Receipt of ESC b enables the keyboard and ESC c disables the keyboard.

Control Code Handling

When in normal operating modes, the ASCII control codes, NUL and Delete codes and ESC codes sequences that are valid terminal remote commands as listed in Table 3-1 are not written in display memory. Received control codes and ESC code sequences that are not listed in Table 3-1 are ignored. Control code display symbols are listed on Table 3-7. Line Monitor mode (see Section 3.3.7) allows display of all received codes.

The majority of the ASCII Control Codes listed on Table 3-1 (from 00 through 1F Hex) are not

acted upon. The following codes are operational:

NUL (00 Hex) — Used as a pad code
BEL (07 Hex) — Sounds the audible alarm
BS (08 Hex) — Back space
HT (09 Hex) — Horizontal Tab
LF (0A Hex) — Line Feed
CR (00 Hex) — Return
DC1 (11 Hex) — X-On
DC3 (13 Hex) — X-Off
ETB XMIT (17 Hex) — Performs a block transmit if the terminal is on line.
SUB (1A Hex) — Used to indicate a received error.
ESC (1B Hex) — First part of an Escape sequence
GS (1D Hex) — Terminates CPU messages

All Control codes are displayed in Line Monitor mode. (See Table 3-7 for the displayable symbols and Section 3.3.7 for an explanation of Line Monitor mode.)

Table 3-7 Control Code Symbols

A – S_H	I – H_T	Q – D_1	Y – E_M
B – S_X	J – L_F	R – D_2	Z – S_B
C – E_X	K – V_T	S – D_3	[– E_C
D – E_T	L – F_F	T – D_4	\ – F_S
E – E_Q	M – C_R	U – N_K	] – G_S
F – P_K	N – S_O	V – S_Y	^ – R_S
G – 🔔	O – S_I	W – E_B	_ – U_S
H – B_S	P – D_L	X – C_N	@ – •

Cursor Addressing

Cursor addressing allows the cursor to be positioned by sending a four-code sequence. The cursor may be addressed from the keyboard or from the I/O port. Cursor addressing uses absolute addressing and not relative addressing. The current cursor location has no effect on cursor addressing. The cursor is addressed by receiving the following four-character sequence:

ESC, F or Y, line address, column address

For example, to position the cursor to line 15 and character position 41, send the following sequence:

ESC, F, period, H or
ESC, Y, period, H

Table 3-8 gives the character and line location ASCII characters required to address any position on the display. If either the line or column address is out of bounds, the whole sequence is ignored.

Table 3-8 CURSOR ADDRESS CODES

ABSOLUTE CURSOR POSITIONING

LINE OR COLUMN	ASCII CODE	LINE OR COLUMN	ASCII CODE	LINE OR COLUMN	ASCII CODE
1	SPACE	28	;	55	V
2	!	29	(	56	W
3	"	30	-	57	X
4	#	31	)	58	Y
5	$	32	*	59	Z
6	%	33	@	60	[
7	&	34	A	61	\
8	'	35	B	62	]
9	(	36	C	63	^
10	)	37	D	64	_
11	*	38	E	65	`
12	+	39	F	66	a
13	,	40	G	67	b
14	-	41	H	68	c
15	.	42	I	69	d
16	/	43	J	70	e
17	0	44	K	71	f
18	1	45	L	72	g
19	2	46	M	73	h
20	3	47	N	74	i
21	4	48	O	75	j
22	5	49	P	76	k
23	6	50	Q	77	l
24	7	51	R	78	m
25	8	52	S	79	n
26	9	53	T	80	o
27	:	54	U		

Cursor Sense

The Cursor Sense feature provides for the transmission of the current cursor location to the host processor. An ESC \ command causes the cursor position to be transmitted by line and column as shown in the cursor addressing scheme, Table 3-8.

Cursor Sense is an I/O function only and is not operable from the keyboard. When the terminal receives this command, it replies with ESC F followed by the line and column coordinates of the current cursor position. This allows the CPU or other I/O to store away the cursor address and later reposition the cursor to its original location. For example, if the cursor is on line 5 at character position 34, the response is ESC F $ A.

Keyboard Operation: None

I/O Operation: Receipt of the ESC \ sequence causes the terminal to transmit the current cursor location.

Read Cursor Character

The Read Cursor character feature provides for the transmission of the character at the current cursor location to the host processor. An ESC G command causes the character to be transmitted to the host CPU. Graphics characters are sent as ASCII characters from Table 3-5.

Keyboard Operation: Illegal, rings bell.

I/O Operation: Receipt of ESC G causes cursor character to be transmitted.

Memory Address Pointer

The Memory Address Pointer is an I/O-controlled, invisible cursor that is used to read and write to and from the display memory, independent of visible screen functions. The Memory Address Pointer is positioned just like the cursor but only by the I/O. The sequence is: ESC, Λ, Line Address, Character Address. If an invalid row or column address is sent, the sequence is ignored (see Table 3-8).

After the Memory Address Pointer is set, the data to be written in display are entered. Attempts to write characters beyond column 80 of the current line cause automatic wrap to the beginning of the next line. On reaching column 80 of line 24, the data entered via the Memory Address Pointer automatically wraps to Home, regardless of Roll or Non-Roll mode selection. Any control or attribute characters (with the exception of a group separator [GS]) cannot be acted upon and are only displayed. The GS (CONTROL) terminator must be used when the data to be entered at the pointer are complete. To reposition the Memory Address Pointer without sending data, the sequence ESC, Λ, line, column, GS is used.

The CPU may write in locked areas of the display by using the Memory Address Pointer.

The Memory Address Pointer may be positioned and data entered while the terminal is Off Line without interference to the operator.

Keyboard Operation: None

I/O Operation: Terminal responds to codes as explained above.

Data Read at Memory Address Pointer

Using the sequence ESC _ (Escape, underscore), data located at the Memory Address Pointer are transmitted out of the I/O port. If, for example, the Memory Address Pointer is at position 10 of a given line, the character there is transmitted. After a read, the MAP will automatically increment to the next location, thus allowing sequential reading of screen data.

Keyboard Operation: None

I/O Operation: Receipt of ESC _ causes the data at the Memory Address Pointer to be transmitted.

Read Terminal Status

The Terminal Status message (displayed in Fields F and G of line 25 [see 3.19]) is generated in response to the code ESC 0. When this code is entered from the keyboard, no communication occurs to the I/O but the Terminal Status Message appears in line 25. When ESC 0 is received from the I/O, the terminal status along with the clock (if set) is transmitted back in response, but the message is not displayed. See Section 3.3.19 for an explanation of the Status Line and Section 3.3.16 for an explanation of the clock

Keyboard Operation: ESC 0 causes the Status Message to be displayed.

I/O Operation: Receipt of ESC 0 causes the Status Message to be transmitted.

Transmitted Code: ESC 0

CPU Message Deposit

The procedure for the host CPU to deposit data into the Message Waiting buffer is the code sequence ESC, ;, message, GS—the last characters being the control code GS or "Group Separator" (CONTROL]). The operator is notified of the message deposit by "MSG WAIT", which appears in Field D of the Status line in reversed blinking video. When the operator simultaneously depresses and holds down either the right or left pair of SHIFT and CONTROL keys, the message on deposit is displayed on line 25 in half-intensity reversed video, replacing the original status message. This new message remains as long as the selected SHIFT/CONTROL key pair is held down. On releasing the keys, the original Status line reappears. The CONTROL ESC 1 keyboard sequence also places CPU message in line 25. It remains there until removed by the CPU or the keyboard sequence CONTROL ESC 2. If no message is present, the Status line appears blank and nonreversed.

The function of displaying the deposited message may be controlled via the I/O by use of the ESC 1 sequence. This causes the message to remain displayed until the normal Status line is displayed on receipt of an ESC 2 sequence.

The customer therefore has the ability to force an alternate status line and gain additional system information.

The following constraints apply to data which is to be held as a waiting message:

a. A maximum of 80 characters can be stored. Overflow will overwrite in character position 80.

b. Attribute codes and control codes are not recognized. For example, sending CR-LF to the Message Waiting buffer results in "CR-LF" being displayed in the data stream as control code symbols.

c. The GS terminator (CTRL]) must be used at all times. For example, if a 10-character message is sent to the MESSAGE WAITING buffer and it is followed by a GS, any data past that point reverts to normal display memory.

The CPU Memory Deposit Function is operable whether the terminal is in On Line or in Local mode.

NOTE: Status line can be made to disappear by sending ESC ; GS ESC 1 (zero length message followed by display message command).

Self Test

A self-testing firmware is invoked at power-up. This may also be initiated by the operator or through CPU intervention with the sequence ESC f. This performs a memory test throughout the terminal's RAM, a loop-back I/O check, and an LRC check of the internal ROM memory. Successful completion of the test and correct terminal operation is verified by the appearance of "SYSTEM RDY" on the Status line. Failure to perform the test correctly promotes an "ERR CK" message in Field E of the Status line, followed by "RAM", "ROM", or "I/F", indicating the area of the failure. ("I/F" denotes interface.)

Keyboard Operation: CONTROL TEST or ESC f invokes the self test.

I/O Operation: Receipt of ESC f causes the Self Test to be invoked.

Send Enter Code

This is similar to the function performed by the ENTER key. On receipt of ESC ', the terminal responds by sending the selected termination character (see 2.7.5). This Escape sequence may be received over the I/O or entered from the keyboard. The ENTER key evokes the same terminal response.

Keyboard Operation: ESC ' or ENTER key

I/O Operation: Receipt of ESC '.

Transmitted Code: Selected termination character.

Baud Rate Setting

Baud rates for either the Main or Auxiliary port may be set over the I/O or via the keyboard to any data rate selectable by the rear panel switches. A three-part Escape sequence is used as outlined in Table 3-9 .

Table 3-9 Remote Baud Rate Selection

	110	300	1200	1800	2400	4800	9600
MAIN BAUD RATE ESC, 7,	0	1	2	3	4	5	6
AUX BAUD RATE ESC, 5	0	1	2	3	4	5	6

Example: To set the Main baud rate at 1800, the sequence ESC 7 3 is used.

Example: To set the Auxiliary baud rate at 4800, the sequence ESC 5 5 is used.

Write Control Mode

Receipt of the Write Control code sequence (ESC 6) from the receiver or the keyboard causes the next received Control or Escape sequence to be written into memory without execution. The terminal then reverts to the previous operating condition prior to the receipt of the sequence.

Keyboard Operation: ESC 6 causes the mode to be entered.

I/O Operation: Receipt of ESC 6 causes the mode to be entered.

Page Send

With the terminal On Line and upon receipt of ESC I, the terminal performs a block send to the Main port in accordance with the constraints of Page mode (as outlined in 3.3.7) without altering the Page/Line mode.

Keyboard Operation: ESC I initiates Page Send

I/O Operation: Receipt of ESC I

Auxiliary Page Send

With the terminal On Line and upon receipt of ESC 3, the terminal performs a block Aux send

to the Aux port in accordance with the constraints of Aux Send (3.3.8) without altering the Page/Line mode.

Keyboard Operation: ESC 3 initiates Aux Page Send

I/O Operation: Receipt of ESC 3.

Line Send

With the terminal On Line and upon receipt of ESC i, the terminal performs a Line Send to the Main port in accordance with the constraints of Line Mode (in Section 3.3.7) without altering the Page/Line mode.

Keyboard Operation: ESC i initiates Line Send

I/O Operation: Receipt of ESC i

Auxiliary Line Send

With the terminal On Line and upon receipt of ESC 4, the terminal performs an Aux Line Send in accordance with the constraints of Aux Send (in Section 3.3.8) without altering the Page/Line mode.

Keyboard Operation: ESC 4 initiates Aux Line Send

I/O Operation: Receipt of ESC 4.

Cursor On/Off

If ESC Z is received or performed from the keyboard, the cursor becomes blanked and invisible. All cursor functions are still available, however. The cursor can be made to reappear in its correct screen location with another ESC Z.

Keyboard Operation: ESC Z is a toggle function which causes the cursor to alternately appear and disappear.

I/O Operation: Receipt of ESC Z.

3.3.16 Special Keyboard Functions

Clock

A 24-hour clock which provides time of day or indicates elapsed time can also be made to appear on the status line using the keyboard sequence ESC, space bar, hours, minutes. For example, to set the time at 06:45, the keys ESC, space bar, 0, 6, 4, and 5 are struck. The colons are inserted automatically and the seconds begin counting when the last minute digit is entered. Erasing the clock from the status line can be accomplished with the RESET sequence ESC V. If a clock-setting mistake is made, the operator must complete the erroneous entry until all clock digits are filled, then key ESC, space bar again and reenter the correct time. A correct clock setting sequence must contain any initial or trailing zeros and consist of four digits.

Keyboard Operation: ESC, space bar, hours, minutes

I/O Operation: Receipt of ESC, space bar, hours, minutes

Read Terminal Status

The terminal Status Message is generated in response to the ESC 0 keyboard sequence. When this code is entered from the keyboard, no communications occur to the I/O but the Status Message appears in line 25. See Section 3.3.19 and Table 3-11 for further information.

Keyboard Operation: ESC 0 displays the Status Message.

I/O Operation: Receipt of ESC 0 transmits the Status Message.

Self Test

A firmware self-testing is invoked at power-up. This may also be initiated by the operator or through CPU intervention with the sequence ESC f. This performs a memory test throughout the terminal's RAM, a loop-back I/O check, and an LRC check of the internal ROM memory. Successful completion of the test and correct terminal operation is verified by the appearance of "SYSTEM RDY" on the Status line. Failure to perform the test correctly promotes an "ERR CK" message on the Status line, followed by "RAM", "ROM", or "I/F" indicating the area of the failure. ("I/F" denotes interface.) The primary value of self-test as a keyboard function is that the operator can at any time verify correct terminal operation.

Keyboard Operation: ESC f initiates self test

I/O Operation: Receipt of ESC f

Display CPU Message

The operator is notified of a CPU-deposited message by "MSG WAIT", which appears on the Status

line in reversed blinking video. When the operator simultaneously depresses and holds down either the right or left pair of SHIFT and CONTROL keys, the message on deposit is displayed on line 25 in half-intensity reversed video, replacing the original status message. This new message remains as long as the selected SHIFT/CONTROL key pair is held down. On releasing the keys, the original Status line reappears. The CONTROL ESC 1 keyboard sequence also places CPU message in line 25. It remains there until removed by the CPU or the keyboard sequence CONTROL ESC 2. If no message is present, the Status line appears blank and nonreversed.

The function of displaying the deposited message may be controlled via the I/O by use of the ESC 1 sequence. This causes the message to remain displayed until the normal status line is displayed on receipt of an ESC 2 sequence.

The user, therefore, has the ability to force an alternate status line and gain additional system information.

Keyboard Operation: Depressing and holding the SHIFT and CONTROL keys down down or depressing CONTROL ESC 1 promotes display of a waiting CPU message.

Releasing the SHIFT/CONTROL pair or depressing CONTROL ESC 2 removes the message. sage.

I/O Operation: Receipt of ESC 1 displays message, if present. Receipt of ESC 2 causes Status line to reappear.

Baud Rate Setting

A complete description of how to set Main and Auxiliary baud rates from the keyboard is contained in Section 3.3.15.

Write Control Mode

A complete description of how to enter the Write Control mode via the keyboard is contained in Section 3.3.15.

3.3.17 Boot Load

The Boot Load sequence, ESC ", allows loading of 8085 Machine Code programs directly into the RAM memory area. A program can be entered either from the keyboard or over the I/O port. The load address and program data are loaded using ASCII characters of 0 through 9 and A through F representing their hex value. Two sequential characters are used to form an 8-bit byte. The program load operation is terminated by either an @ or # character code. An @ character causes the programs just loaded to be executed, starting at the defined load address. A # character saves the program (allowing its later execution) and returns the terminal to normal operation

A program is loaded and executed in the following manner:

a. ESC " initiates the Boot Load.

b. The first four characters are used as the high-low load address.

c. Subsequent bytes are storedsequentially, starting at the load address.

d. All codes other than ASCII 0 through 9, A through F, @ or # are ignored.

e. The program load is terminated by either an @ or a #.

f. An @ character terminates the load sequence and starts execution of the loaded program starting at the load address.

g. A # character terminates the load sequence and returns the terminal to normal operation, allowing for later execution of the program

h. An ESC " allows the execution of a previously loaded program. The next four bytes are assumed to be the starting address. The program is executed from that address.

3.3.18 Audible Alarm

An audible tone is sounded in the terminal if the BELL (Control G) character is received. This is consistent with the bell control of teletypewriters. When data entry from the keyboard causes the cursor to pass through the 72nd position of a line, an audible alarm will sound. The bell rings when illegal keys are struck or when other error conditions exist, such as numeric entry in an

Alpha Only field, attempting to lock memory when lines are locked, etc.

The **continuous** alarm feature allows the host processor to gain the attention of the terminal operator. The continuous alarm is turned on with an ESC 8 sequence from the keyboard or over the main I/O port. The alarm can be turned off by either striking any key on the keyboard or by receiving an ESC 9 sequence on the main I/O port.

3.3.19 Status Line

The status line occupies the 25th display line of the CRT and is displayed in half intensity reverse video. The breakdown of the status line display fields is outlined in Tables 3-10 and 3-11.

Should the user require display of an alternate status line or no status line at all, this may be accomplished by use of the CPU Message Deposit function. In order to inhibit display of status line, the sequence ESC ; GS ESC 1 is employed. This causes no message to be deposited and forces the status line to be displayed in normal video with no data present. The 25th line remains inaccessible to the operator. In order to display an alternate status line, the complete CPU Message Deposit sequence is followed (see Section 3.3.15).

An additional status line for host CPU system information can be implemented through the use of the CPU Line Lock feature.

Following is an explanation of messages which may appear in Status Line fields A through H:

Field A – reflects the status of the main port either being on line or in local mode.

Field B – reflects the terminal being either in monitor mode or conditioned to provide a page or line send if a block send is implemented.

Field C – indicates the status of the data set ready line of the main I/O port, DSR indicating true, blank indicating false.

Field D – indicates the status of the aux port.
Blank = Disabled
AUX ON = Aux connected to main on line
AUX BSY/RDY = Aux enabled from keyboard to aux; BSY/RDY indicates status of aux pin 20

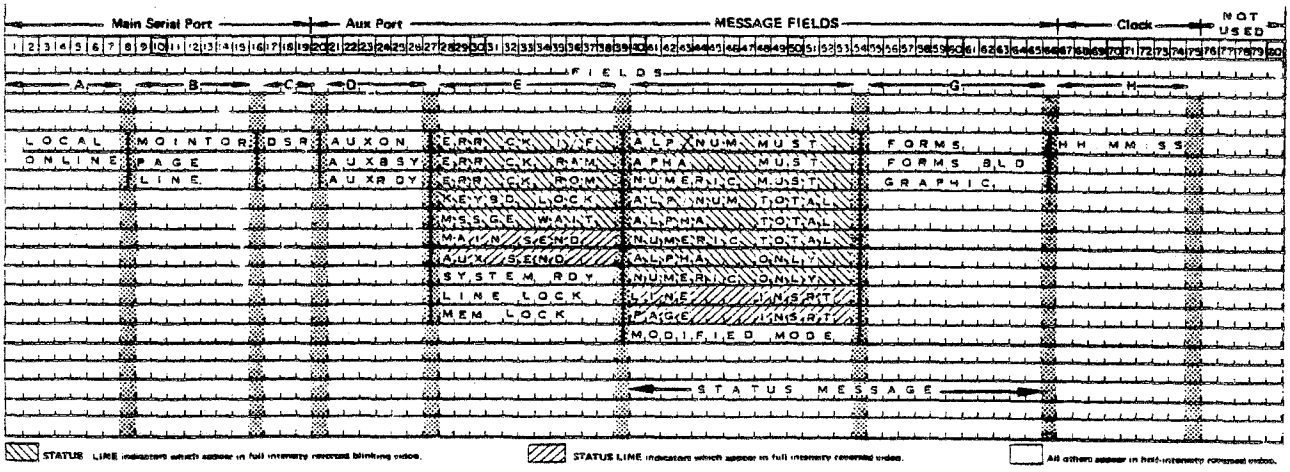
Field E –Indicates main message sequences on a proprietary basis.

Priority
1 = Error Check, RAM, ROM or I/F
2 = Main Send
3 = Aux Send
4 = Keyboard Lock
5 = Message Wait
6 = Line Lock
7 = Memory Lock
8 = System Ready

Field F – indicates status messages of terminal operation.

1. ALPHA – Displayed if illegal entry attempted to an alpha only format field.
2. NUMERIC – Displayed if illegal entry attempted to a numeric only format field.

Table 3-10 Status Line Display Fields



3. TOTAL/MUST – In conjunction with above further qualifies entry error or if blank in alpha or numeric field indicator, indicates error on an alphanumeric field.

4. INSERT – Indicates insert mode selected; qualified by line or page to further identify mode.

5. MODIFIED MODE – Indicates modified mode selected while in format mode to limit data transmission.

Field G – indicates terminal is in either form - Forms Build or Graphics mode.

Field H – contains the 24-hour clock in an hours: minutes:seconds format.

A 27-character terminal status message appears in character positions 39 through 65 (Fields F and G) in response to ESC 0. This action is initiated by the CPU or operator and contains information which pertains to the current terminal operating configuration.

This message supersedes existing display and remains until any keyswitch is pressed. At that time, the 27-character message disappears and the status line returns to its former condition.

Table 3-11 is a key to aid the operator in decoding this numeric message.

Table 3-11 Status Line Indicators

CHARACTER POSITION	CHARACTER DISPLAYED	FEATURE CONVEYED	MESSAGE CONVEYED
39	1 - 7	Main Baud Rate	5 = 4800 6 = 9600 4 = 2400 3 = 1800 1 = 300 2 = 1200 0 = 110
40	1 - 7	Auxiliary Baud Rate	Same as above
41	0 - 3	Termination Character	0 = CRLF 1 = ETX 2 = EOT 3 = CR
42	0 - 3	Parity Select	0 = Even 1 = Space 2 = Odd 3 = Mark
43	0 - 3	Self-diagnostics	0 = No fault 1 = ROM fault 2 = RAM fault 3 = I/O fault
44	0 - 1	Receiver Error Check	0 = Off 1 = On
45	0 - 1	Roll Mode	0 = Off 1 = On
46	0 - 1	Auto Line Feed	0 = Off 1 = On
47	0 - 1	Lower Case Inhibit	0 = Off 1 = On
48	0 - 1	Duplex Mode	0 = Half Duplex 1 = Full Duplex
49	0 - 1	Auto Echo	0 = Off 1 = On
50	0 - 1	Screen Display	0 = Off 1 = On
51	0 - 1	Main Port	0 = On Line 1 = Local
52	0 - 1	Aux Port	0 = Off 1 = On
53	0 - 1	Graphics Mode	0 = Off 1 = On
54	0 - 1	Line Lock	0 = Off 1 = On
55	0 - 1	Memory Lock	0 = Off 1 = On
56	0 - 1	Keyboard Lock	0 = Off 1 = On
57	0 - 1	Error Check	0 = No error 1 = Diagnostic error detected
58	0 - 1	CPU Message Wait	0 = No message waiting 1 = Message waiting
59	0 - 1	ESC Code Suppression	0 = Off 1 = On
60	0 - 1	Main Baud Reset	0 = Under rear panel switch command 1 = Under software command
61	0 - 1	Aux Baud Reset	0 = Under rear panel switch command 1 = Under software command
62	Various	Software version	Reflects ROM revision level
63	Various	Software version	Reflects ROM revision level
64	Various	Software version	Reflects ROM revision level
65	Blank	Reserved	-

TYPICAL TRANSMITTED MESSAGE: STX-27 - character string - clock (HH-MM-SS) - selected termination character.
The clock digits appear only when the clock is properly set.

Service Manual

MICRO B

Covers Micro Bee, Micro Bee 1, Micro Bee 1A, Micro Bee 1S and Micro Bee 2

JANUARY 1979

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TM68-MCB-3

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SECTION IV

THEORY OF OPERATION

4.1 INTRODUCTION

This section contains the theory of operation for the Micro Bee series of microprocessor-controlled video display terminals. A general functional description is followed by detailed descriptions of each assembly with appropriate block diagrams.

4.2 GENERAL FUNCTIONAL DESCRIPTION

The Micro Bee consists of four major assemblies as shown is Figure 4-1: the power supply, monitor, keyboard and logic board. Figure 4-2 illustrates the basic flow of terminal logic signals between components.

LSI (large-scale integration) semiconductor devices are used extensively in Micro Bee, resulting in fewer components, smaller circuit board area, lower power consumption, cooler operation, greater reliability and significantly expanded terminal capabilities. Further savings result from the terminal's easy-to-service logic board which is readily accessible under the tilt-over Monitor assembly (see Figure 4-3). The Micro Bee 's expanded capabilities are made possible by programmable devices. The heart of the controlling circuitry is the 8085A microprocessor which allows considerable built-in terminal intelligence. Nearly all terminal functions are defined by software loaded into ROM. Limited additional programming may be accomplished using the Boot Load procedure described in the Micro Bee Technical User Manual.

WARNING – **The logic board contains devices sensitive to static electricity which should be protected during servicing by using a conductive work station. The 3M Velostat® type 8005 is portable and easy to use. It consists of a folding work surface which connects to electrical ground through a 1 meg resistor (to minimize shock hazard). A wrist strap connects the working surface and technician, keeping both at the same potential.**

Additional precautions include keeping non-conductive static carriers like styrofoam coffee cups, cellophane tape or carpeting away from the board and rolling up sleeves on polyester clothing.

In the following pages, this symbol is used to warn the technician of static-sensitive components:

4.2.1 Power Supply

The power supply provides +5, +12 and -12 volts to the terminal assemblies. The power transformer input to the power supply is strappable to either 115Vac or 230V ac, 50/60 Hz.

4.2.2 Keyboard

The keyboard is the main input device used by the operator to communicate with the terminal, the CPU, and any peripheral devices. Keyboard switches and supporting circuitry on the Logic Board generate the control signals and ASCII characters used in information interchange. The keyboard assembly consists of reed-switch keys connected in a conventional matrix and mounted on a single circuit board. These sealed, magnetically operated switches are the only components on the circuit board. A flat ribbon cable connector interfaces the keyboard and logic board.

4.2.3 Logic Board

All Micro Bee function and control circuits are contained on a single logic board which mounts horizontally on standoff insulators directly beneath the CRT monitor assembly. The monitor tilts to one side, allowing power-on access to the logic board (see Figure 4-3). Logic board activities can be summarized as follows:

a. The generation of data and control signals for the CRT monitor.

b. The reception and transmission of data between the Micro Bee and external devices.

c. The implementation of terminal functions as defined in ROM and directed by the microprocessor.

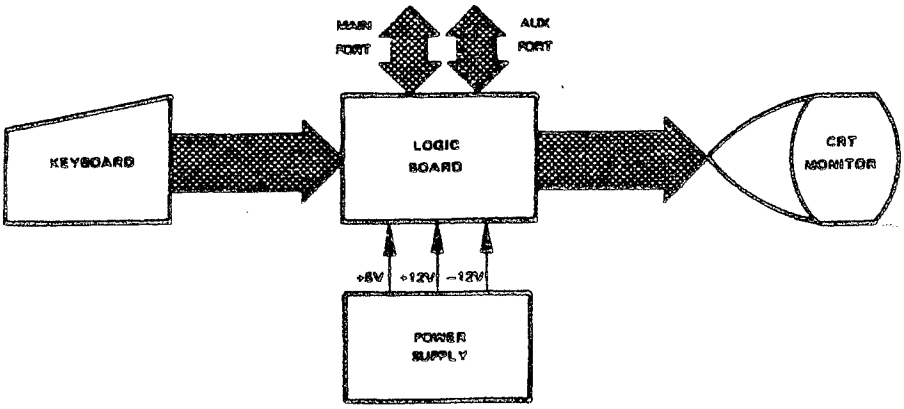


Figure 4-1 System Block Diagram

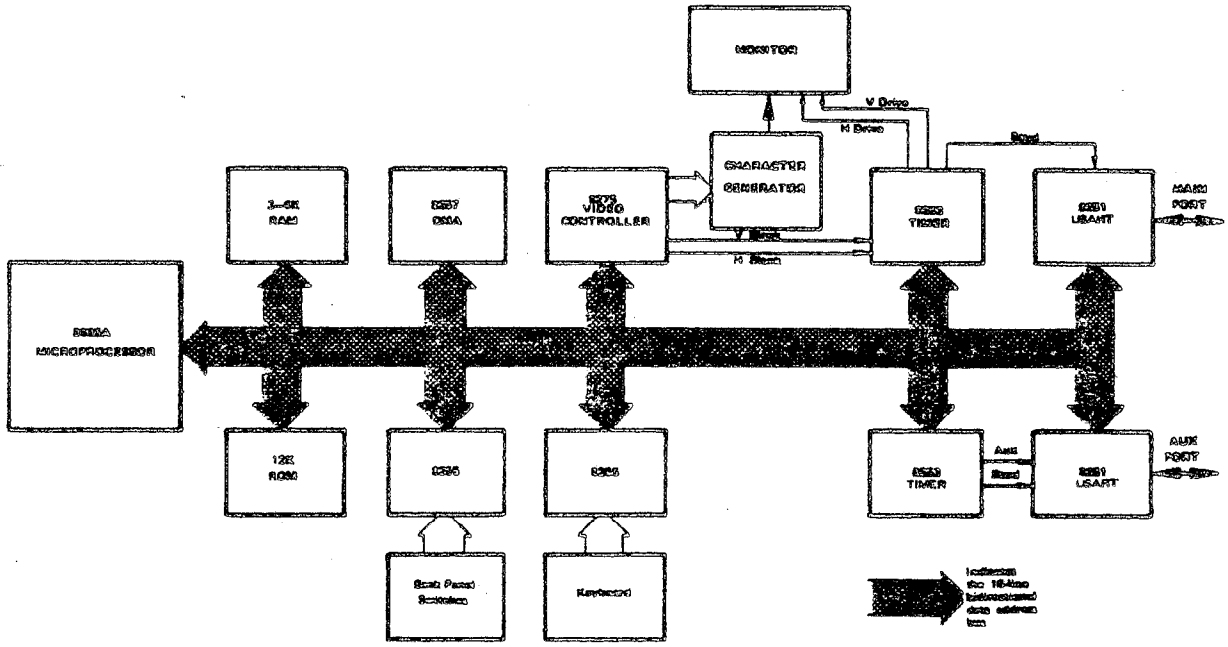


Figure 4-2 Basic Function Flow Diagram

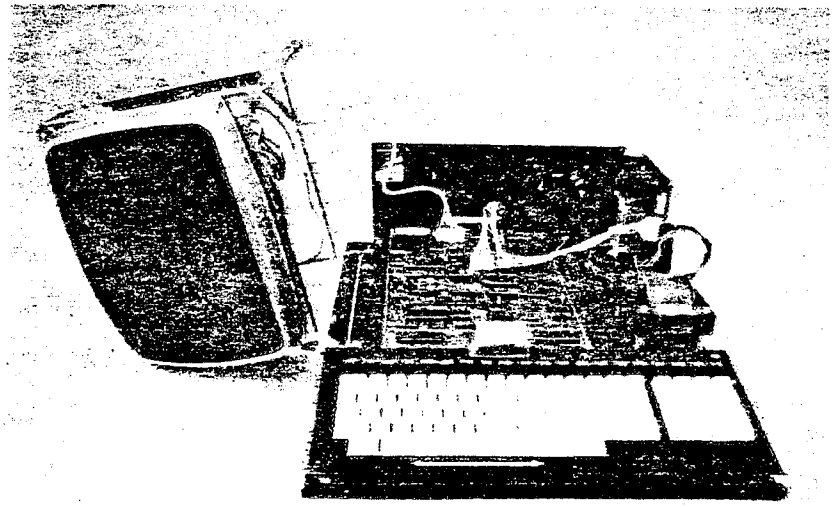


Figure 4-3 Micro Bee Chassis

4.2.4 Monitor

The monitor assembly includes a 12-inch (diagonal measure) cathode ray tube (CRT) and supporting solid-state circuitry. The monitor is controlled by the vertical and horizontal synchronization signals and the video output signals generated on the logic board. A full screen of displayed information consists of 25 lines of 80 characters each.

4.3 DETAILED FUNCTIONAL DESCRIPTION

The following paragraphs present a more comprehensive discussion of the Micro Bee power supply, monitor, keyboard and logic board. The logic board is explored at an intermediate level to give the reader a grasp of interdependent logic functions and major LSI chip functions. Appendix A contains chip-level information.

4.3.1 Power Supply

The power supply's function is to convert AC line voltage to the three DC voltage levels required to operate the terminal. The voltages produced by the power supply are:

a. +5V at 3.5 amps maximum

b. +12V at 2 amps maximum

c. -12V at 300 ma maximum

The +5V supply has overvoltage protection which trips at 5.3V. The +5 and +12V supplies current limit at the values stated above. Line regulation is ±.05% for a 10% change in line voltage. Load regulation is ±.05% for a 50% change in load. The power supply is rated for full output at 55°C. The total power required from the AC line is typically 40W. Power distribution within the terminal is shown in Figure 4-4. Cabling details are shown in Figures 4-5a and 4-5b.

Strapping for 115V 60Hz/50Hz

The power transformer strapping is done on commoning block TB1 with pin assignments as follows and as shown in Figure 4-5a.

IN	1	Black - Power input
	6	White - Return/Neutral input
OUT	2	Orange - Pin 1 of transformer
	3	Fan
	4	Blue - Pin 3 of transformer
	5	Polarity Pin
	7	Fan
	8	Red - Pin 2 of transformer
	9	Brown - Pin 4 of transformer
	10	Polarity Pin

Select 50 or 60 Hz, using internal switch S3-3 (On = 50 Hz, Off = 60 Hz).

Strapping for 230V 60 Hz/50 Hz

The power transformer strapping is done on commoning block TB1. Pin assignments are as follows and as described in Figure 4-5b.

IN	1	Black - Power input
	9	White - Neutral/Return input
OUT	2	Orange - Pin 1 of transformer
	3	Fan
	4	Polarity Pin
	5	Blue - Pin 3 of transformer
	6	Red - Pin 2 of transformer
	7	Fan
	8	Polarity Pin
	10	Brown - Pin 4 of transformer

Select 50 or 60 Hz, using internal switch S3-3 (On = 50 Hz, Off = 60 Hz).

4.3.2 Logic Board

The primary function of the logic is to conduct data input/output and to refresh the display. The 8085A microprocessor coordinates the transfer of information to and from the terminal peripheral devices and external devices. The display is refreshed by controlling the periodic transfer of information from display memory to the CRT screen. A direct memory access (DMA) device is required in the system to ensure the necessary memory-to-screen data transfer rate.

When information from an external device is received by the terminal, the microprocessor performs character recognition and handling functions, display memory management functions and cursor control functions. The 8085A also interrogates the keyboard. If a key depression is detected, the microprocessor responds by transmitting the ASCII character representing the key to the terminal serial output line via the serial communication device and the display memory if in HDX or FDX auto echo.

Figure 4-2 is a generalized block diagram which shows the major interconnections and signal lines between the 8085A and the peripheral LSI chips used on the logic board. The following paragraphs describe each of these chips, including the microprocessor. Additional information is provided in Appendix A.

8085A — The Intel® 8085A microprocessor, a new generation, complete 8-bit parallel CPU, is the heart of the Micro Bee system. The multiplexed 16-bit address data bus from the 8085A drives the ROM and RAM select circuitry directly. This allows the microprocessor to address the ROMs and RAMs which contain the system program and define the terminal's operating characteristics.

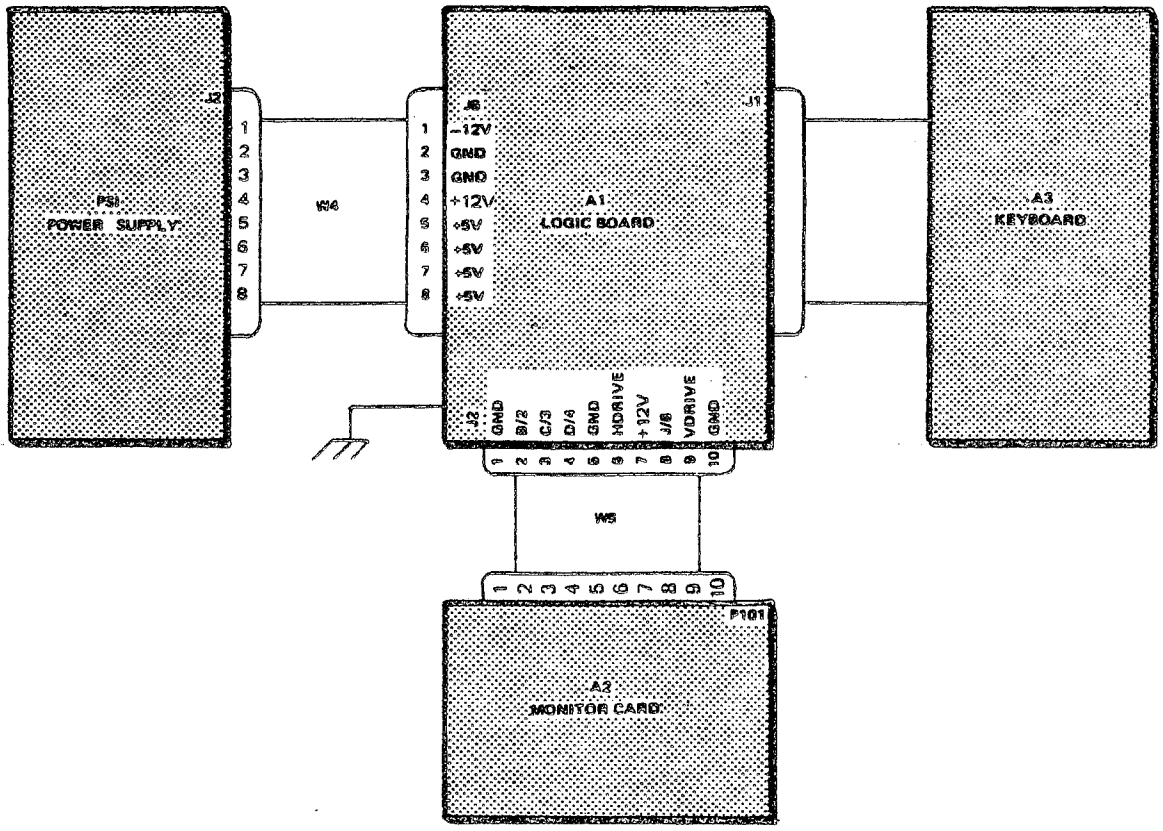


Figure 4-4 Power Distribution

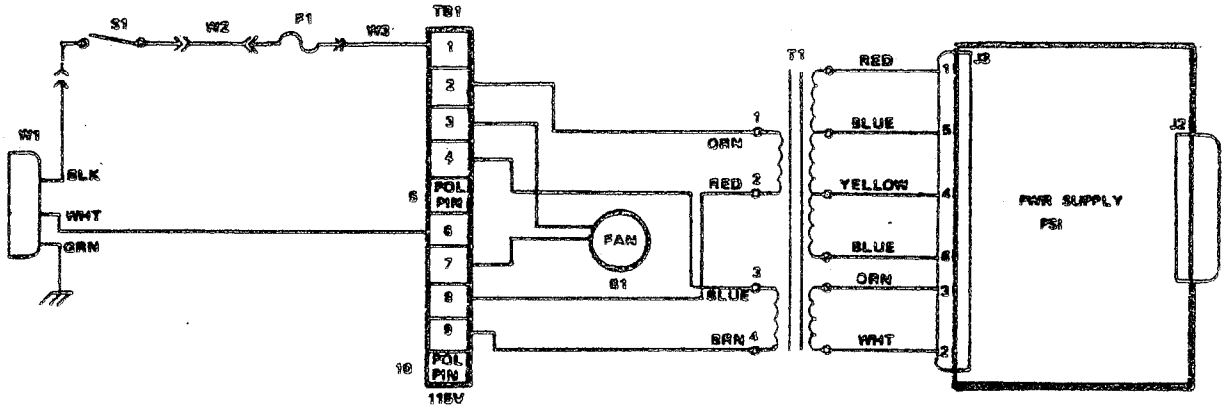


Figure 4-5a 115V Power Cabling

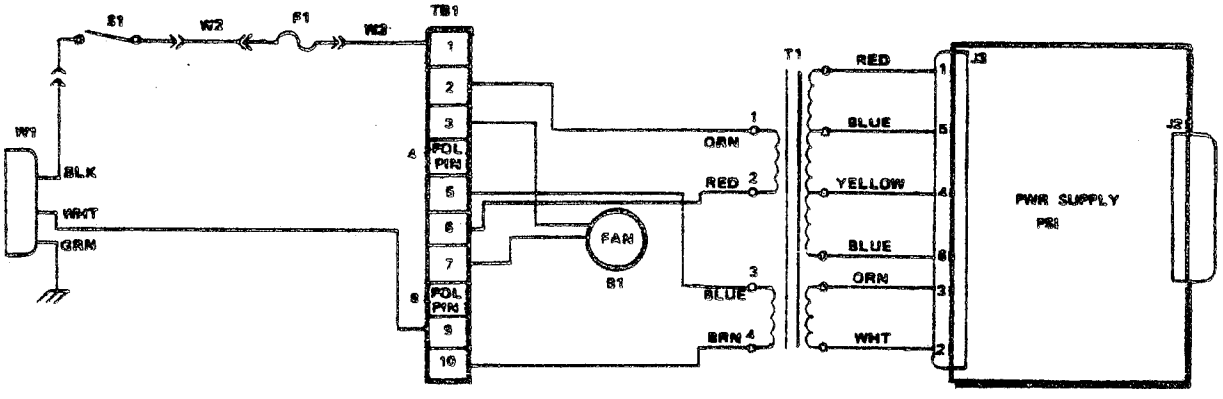


Figure 4-5b 230V Power Cabling

Memory — Six masked 2K x 8 bit ROMs comprise the standard memory configuration for the terminal program. The Micro Bee operating characteristics are defined by this software which has been thoroughly tested and optimized. The RAM memory is used for display storage, scratch pad and buffers. The standard configuration is eight 2142 1024 x 4-bit static RAM s.

Figure 4-6 is a memory map which references memory locations (given in hexadecimal) to individual RAM and ROM chips. To find each chip's physical location on the logic board, the reader should refer to the logic board assembly drawing in Section VI.

LOCATIONS (HEX)	ASSOCIATED CHIP(S)
0000 – 07FF	ROM 1 (A37)
0800 – 0FFF	ROM 2 (A42)
1000 – 17FF	ROM 3 (A41)
1800 – 1FFF	ROM 4 (A36)
2000 – 27FF	ROM 5 (A45)
2800 – 2FFF	ROM 6 (A46)
3000 – 7FFF	Not used
8000 – 83FF	RAM 0 (A63, A64)
8400 – 87FF	RAM 1 (A61, A62)
8800 – 8BFF	RAM 2 (A56, A57)
8C00 – 8FFF	RAM 3 (A53, A54)
9000 – 93FF	RAM 4 (A47, A48)
9400 – 97FF	Not used
9800 – FFFF	Not used

Figure 4-6 Memory Map

8255 — This programmable peripheral interface is a general purpose I/O device with three 8-bit I/O ports which may be individually programmed or used in two groups of twelve. They may also be used in three major modes of operation. Two 8255 chips are used in the standard Micro Bee configuration, one for the keyboard and one for the back panel controls.

8253 — This device is a programmable counter/timer. It is organized as three independent 16-bit counters, each with a count rate of up to 2 MHz. All modes of operation are software programmable by the 8085A.

8251A — The 8251A is a universal synchronous/asynchronous receiver/transmitter (USART) chip designed for data communications in microcomputer systems. The USART is used as a peripheral device and is programmed by the microprocessor to operate using virtually any serial data transmission technique. The USART accepts data characters from the microprocessor in parallel format and then converts them into a continuous serial data stream for transmission. It can simultaneously receive serial data streams and convert them into parallel data for the microprocessor. The USART signals the microprocessor whenever it can accept a new character for transmission or whenever it receives a character for the CPU. The microprocessor can read the complete status of the USART at any time.

8257 — The 8257 is a four-channel direct memory access (DMA) controller. Its primary function is to generate, upon peripheral request, a sequential memory address which allows the peripheral to read or write data directly to or from memory. Acquisition of the system bus is accomplished via the 8085A's HOLD function.

8275 — This CRT controller is a programmable device which is designed to provide an interface for microcomputers to a large variety of CRT character displays. The chip provides the display with row buffering, raster timing, cursor timing and visual attribute decoding. It is programmable to a large number of different display formats. The controller can be interfaced to standard character generator ROMs for dot matrix decoding.

The controller can generate a screen format size of 1 to 80 characters per row, 1 to 64 rows per screen, and 1 to 16 horizontal lines per character row.

The 8275 has seven character code address bits allowing 6 or 7-bit ASCII compatability, or it can be used with other 7-bit codes to generate up to 128 characters.

System Operation

The 8085A microprocessor initializes each peripheral to the appropriate mode of operation following system reset or power-up. Upon receiving a character from a remote device, the 8251 USART issues an interrupt to the microprocessor. The microprocessor calls the interrupt service subroutine, which polls both 8251's to determine the source of the interrupt. Having determined which 8251 issued the interrupt, the microprocessor reads the USART character and stores it in the buffer memory. The character recognition subroutine is called next. This routine determines whether the character is a displayable character, a control character, or a character in an escape sequence. Assuming the character is displayable, it is placed in display memory at the location corresponding to the present cursor position. The microprocessor advances the cursor, modifies the display memory pointers and, if required, performs the operations necessary for rolling. If the received character is a control character or escape sequence character requiring cursor and display memory pointer changes, these

functions are carried out. Escape sequences which involve erasing a portion of the display are also handled via the appropriate subroutines.

In order to place characters contained in display memory on the CRT display screen, the 8275 CRT controller must request data on a row-by-row basis from the 8257 DMA controller. It should be noted the 8257 DMA controller is required to achieve the data transfer rate necessary for CRT refreshing. Display characters are then transferred from the 8275 row buffers to the character code outputs CC0-CC6. Character code outputs are applied to the character generator address lines A4-A10. Line count outputs LC0-LC3 from the 8275 are applied to character generator address lines A0-A3.

The 8275 displays character rows one line at a time. The line count outputs are utilized to determine which line of the character selected by A4-A10 will be displayed. Following the transfer of the first line to the dot timing logic, the line count is incremented and the second line of the character row is selected. The process continues until the last line of the row under consideration is transferred to the dot timing logic.

The row-by-row transfer of character data from display memory to the 8275 continues until the beginning of the last display row. At this time, the 8275 issues an interrupt to the CPU. Having determined that the interrupt originated with the 8275, the CPU calls the 8275 interrupt subroutine. The 8275 interrupt subroutine reinitializes the 8275 DMA controller starting address and terminal count parameters.

4.3.3 Keyboard

The Micro Bee keyboard features 61 TTY/typewriter-compatible terminal operation keys, a numeric pad, and a two-row array of special function, user-defined function, and cursor control keys. Each key's operation is described in Section III of the Micro Bee Technical User Manual.

All keys actuate magnetically operated reed switches on a single circuit board which contains no active devices or logic. An 8-column by 16-row matrix is used in which one row line is connected to one column line as each key switch closes.

In addition to the matrix lines, there are five special key lines which are activated by the right and left SHIFT keys, the right and left CONTROL keys, and the LOCK key. The keyboard matrix is scanned by the 8085A microprocessor through the 8255 programmable peripheral interface. From the connection detected on the matrix lines, the microprocessor determines what key is being pressed. It does this by checking all possible row and column combinations at a rate specified by system software. The software limits multiple key closure and provides for two-key rollover, when necessary. Software also provides for autorepeat of any key where it is meaningful.

4.3.4 Monitor

The Micro Bee uses the Beehive B-12 monitor or the Ball Brothers TV-120 monitor interchangeably as the alphanumeric display device. The following description applies to either monitor. Specific information on each monitor is contained in Appendix B.

The image which appears on the terminal's CRT is the result of an electron beam striking the screen's interior phosphor coating. The electron beam which is generated by the CRT electron gun is swept across and down the screen to form parallel scanning lines. The horizontal and vertical sweep rates are determined by the logic board circuitry which drives the monitor.

Typically, the electron beam starts in the upper left hand corner of the display, moving from left to right and top to bottom to "paint" a series of horizontal lines on the screen. Two independent circuits operating simultaneously control the horizontal and vertical movement of the beam.

As the electron beam moves across the face of the CRT, a third circuit controls the intensity of the beam so that the screen phosphor can be made to light in any desired manner — from a simple on-off dot pattern to a complex grey scale arrangement for black and white displays.

When the beam reaches the end of the line, it is brought back to the beginning of the next line at a faster rate than it moved to generate the preceding line. During this "retrace" period, the electron beam is shut off (blanked) so a retrace line does not appear on the CRT.

As the beam is moved horizontally, it is also moved slightly downward. As a result, each successive line starts below the previous line. When the beam reaches the bottom of the screen, it blanks and retraces vertically at high speed back to the first line. The network of lines that are traced on the CRT screen is called a raster.

Although most data displays have been standardized at 15.75KHz on the horizontal sweep frequency (63.5 microseconds per line), this can be varied by 10% for most applications. Vertical sweep will usually vary between 45 and 65 Hz, the most common being 60Hz for domestic and 50Hz for European application. However, in many terminal systems, the

power supplies are the cause of some line frequency modulation of the raster.

Ideally, the sweep rate should be equal to the power line frequency for the best display. If the sweep is not synchronized, the raster will appear to "breathe" at the difference of the two frequencies. If the two frequencies are equal, this variation cannot be detected because the stroboscopic effect freezes the motion.

When the B-12 sweep circuits are not driven, the display becomes free-running and a raster will still appear on the screen. This is not the case with the TV-120, however. No raster is one indication of faulty or missing sweep signals in that particular monitor.

Properly synchronized display in the Micro Bee is accomplished with the 8275 video controller, the 8253 timer and the character generator ROM.

SECTION V

MAINTENANCE

5.1 INTRODUCTION

This section contains information to aid in the maintenance of the Micro Bee terminal. Preventive and corrective maintenance procedures are specified, as well as troubleshooting aids and techniques.

WARNING — This device contains static-sensitive semiconductors. If in doubt about which components are sensitive, treat all parts as sensitive devices. Handle only in a static-free environment as described in Section 4.2.

5.2 PREVENTIVE MAINTENANCE

Scheduled periodic maintenance of the terminal is not required. However, some simple maintenance procedures can do much to extend its life.

It is most important that the terminal's fan be operational and cooling air unobstructed at all times to prevent overheating and component damage.

The interior of the unit may be vacuumed or wiped free of dust. Accumulation of dirt acts as an insulating blanket, prevents efficient heat dissipation, and causes overheating and component breakdown. A cotton-tipped applicator is good for dislodging dirt in narrow or hard-to-get places.

The CRT screen may require periodic cleaning. It should be wiped clean with a soft cloth.

5.3 CORRECTIVE MAINTENANCE

This section provides corrective maintenance information to aid in servicing the Micro Bee terminal. It is suggested that the technician become familiar with proper terminal operation and installation, as described in the Micro Bee Technical User Manual before attempting to diagnose apparent hardware malfunctions.

5.3.1 Troubleshooting Aids

The following troubleshooting aids are provided in this manual to assist in correcting functional failures:

- Circuit Schematics
- Block Diagram
- Functional Flow Diagram
- Interconnect Diagram
- Troubleshooting Flow Diagrams
- Disassembly/Assembly Procedures
- Adjustment Procedures
- Configuration/Strapping Information
- Waveforms

5.3.2 Troubleshooting Equipment

The following standard equipment is required to repair a Micro Bee terminal:

- Multimeter
- Oscilloscope
- Assorted Hand Tools, Electronic

5.3.3 Preliminary Troubleshooting Considerations

The most common problems occurring in the Micro Bee terminal are switch, control or operator-related. Before assuming a circuitry-related problem, check for the following operating errors:

- Illegal Operation
- Improper Baud Rate Setting (see Section 2.7 in the Technical User Manual)
- Wrong Transmit or Receive mode (HDX/FDX)
- Loose Interconnect Cable
- Improper RS 232C connection

Faulty power supply operation can result in a variety of seemingly complex symptoms. When attempting to diagnose a malfunction, be sure to check for proper supply voltages as outlined in Table 5-1.

Echoplex Test

A full duplex echoplex test connector may be prepared to enable verification of Micro Bee's FDX capabilities without having to connect the terminal to the CPU or any other external data device.

The test connector is a 25-pin miniature D-type Cannon connector (DM-25S or equivalent) which has been jumpered according to Figure 5-1.

After jumpering the connector, the terminal must be set up as follows:

- Power on
- FDX (full duplex) enabled
- On Line
- Baud rate at any setting
- Echoplex connector inserted in main I/O port

The operator then enters data from the keyboard as if the terminal were on line to a computer. If the terminal displays keyboard-entered data correctly, it is communicating properly in full duplex.

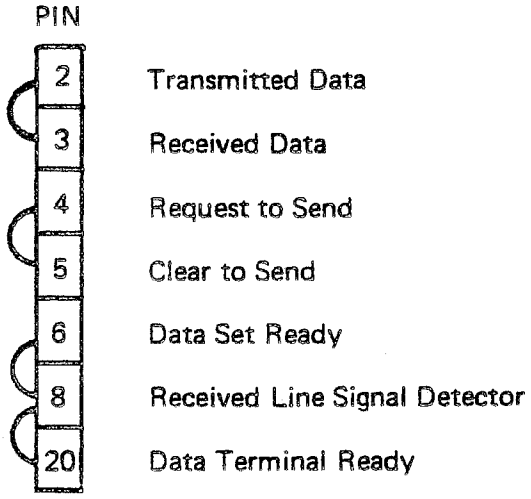


Figure 5-1 Echoplex Connector

Jumpers

Current Loop Test

It is possible to verify correct current loop operation on the Micro Bee by performing an echo-back self test using a specially prepared connector as described below:

1. Obtain a 25-pin miniature D-type ITT Cannon connector (DM-25S or equivalent). This connector must mate with the main port on the terminal (J-3).
2. Jumper the following pins on the connector:
   - Pin 24 to Pin 25
   - Pin 17 to Pin 18
   - Pin 23 to Pin 1
   - Pins 6 & 8 to Pin 20
3. Enable the current loop option by turning on internal switch 8.
4. Plug in the jumpered connector to the main port (J-3).
5. Ensure that the terminal is powered up, on line, and in full duplex (S2-4 up) with auto-echo off (S2-8 down).
6. Depress any displayable alphanumeric key. If the current loop is functioning properly, the correct character will be displayed.

Several current loop configurations for both simplex and full duplex operation are described in Section II of the Micro Bee Technical User Manual.

Troubleshooting Diagrams

An index of troubleshooting flow diagrams is given in Table 5-1. This index lists the apparent failures and refers the reader to the proper flow diagram. To derive the maximum benefit from Table 5-1, the following procedure is recommended:

a. Find the symptom in the Troubleshooting Flow Diagram Index.

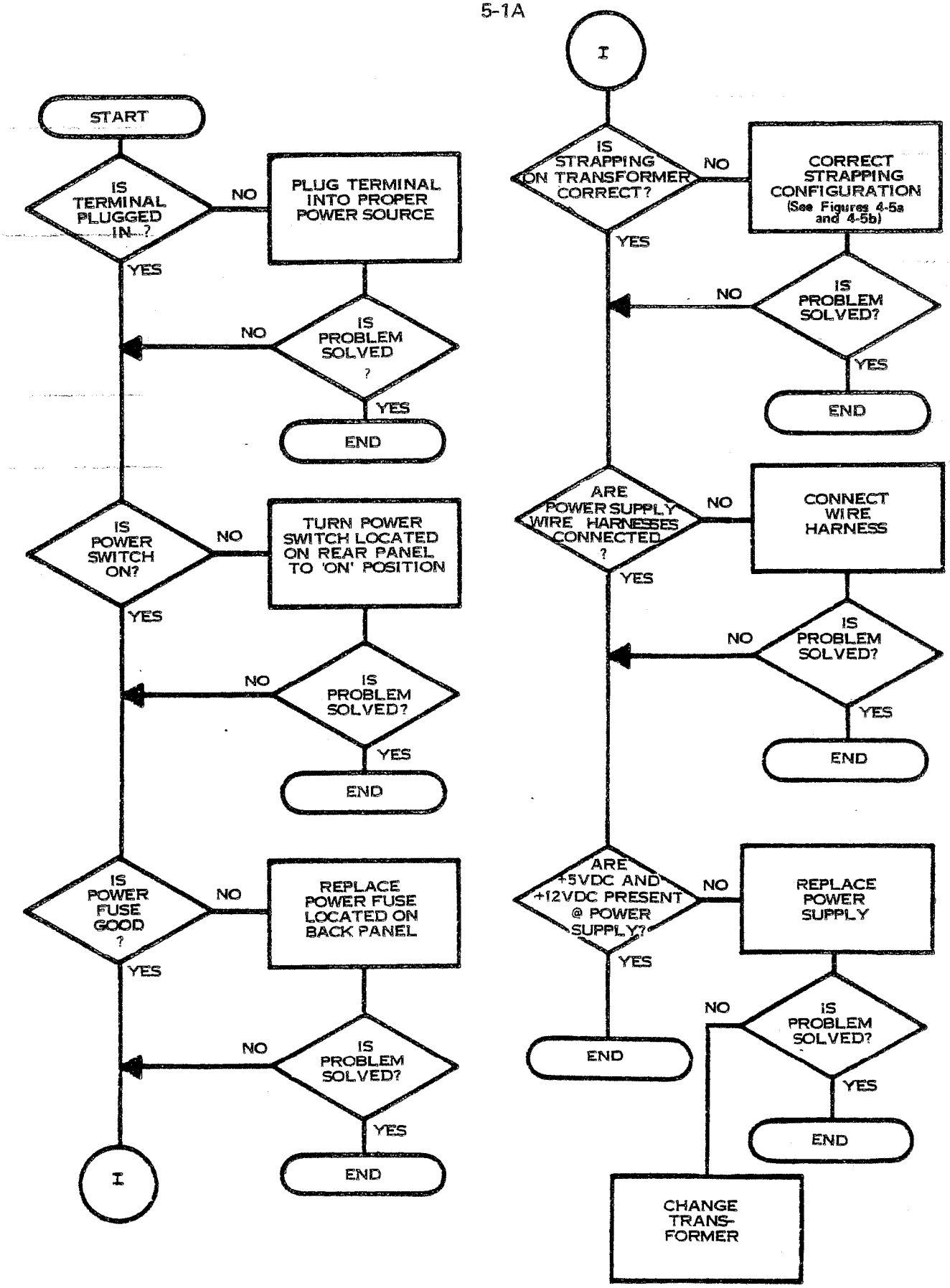
b. Proceed to the specified troubleshooting flow diagram in the diagram section and begin the troubleshooting procedure.

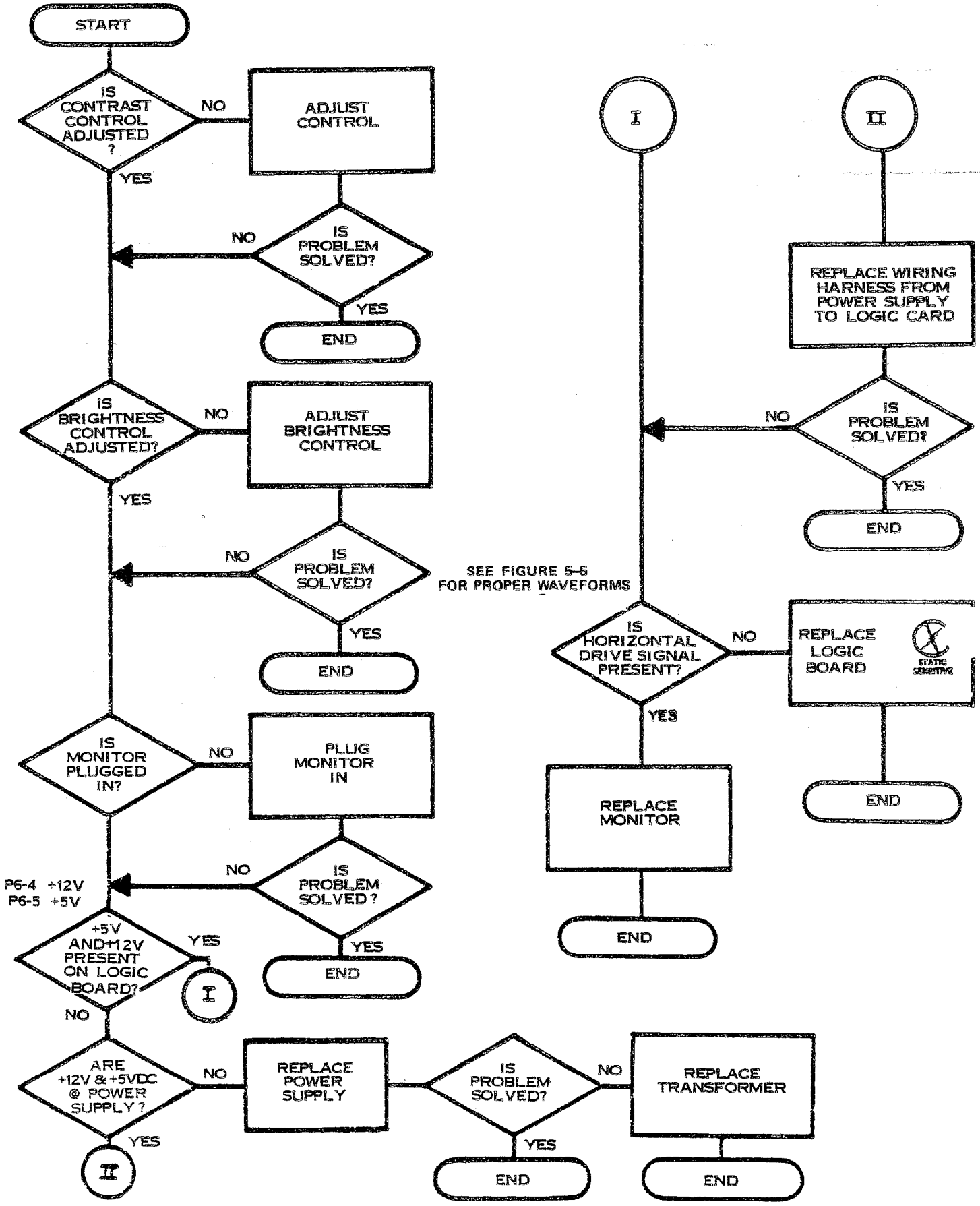
c. If an adjustment procedure is referenced in the troubleshooting flow diagram, perform the adjustment and return to the flow diagram to complete the troubleshooting process.

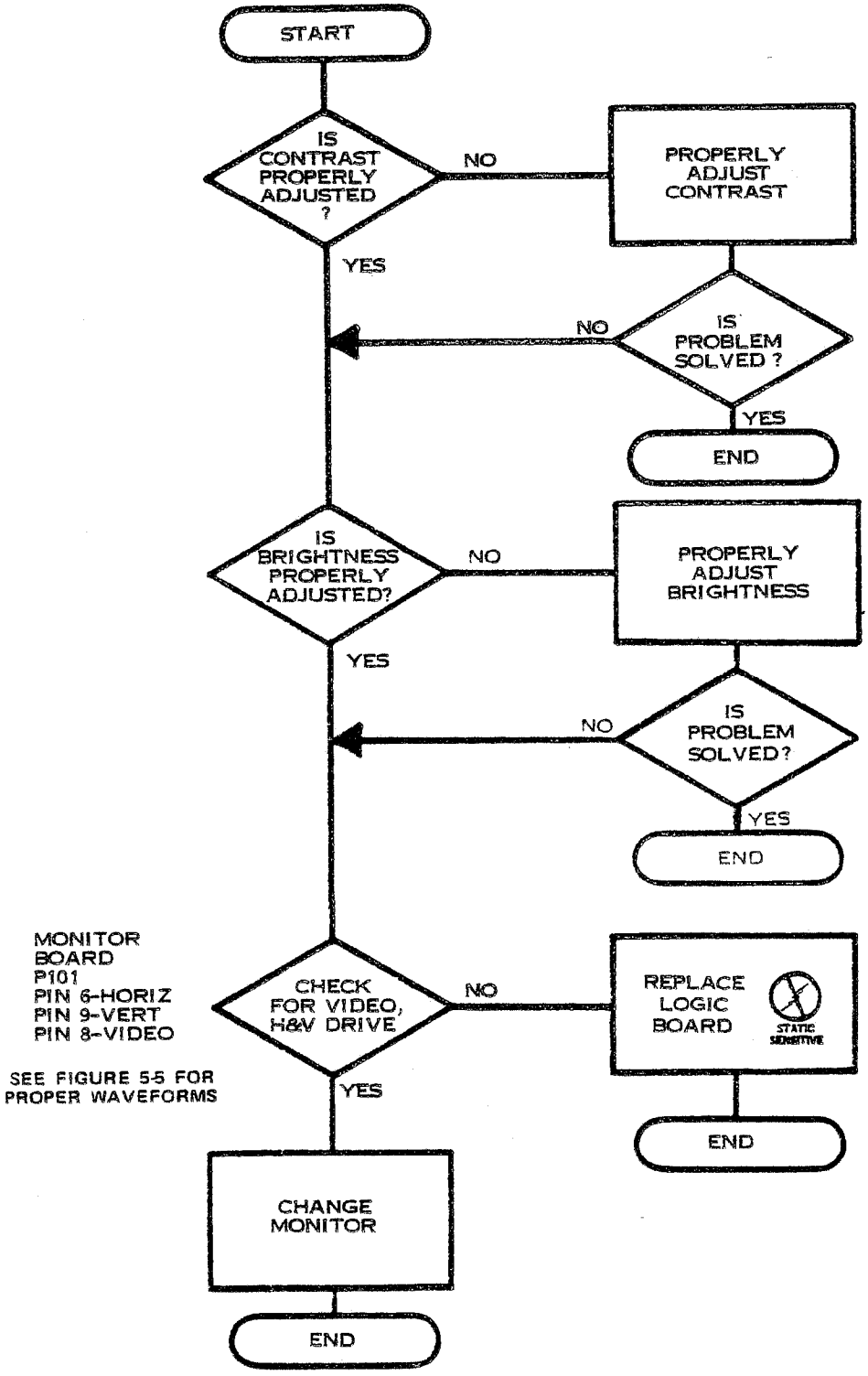
d. Reference is made in the Flow Diagrams to waveforms which appear in Figure 5-5.

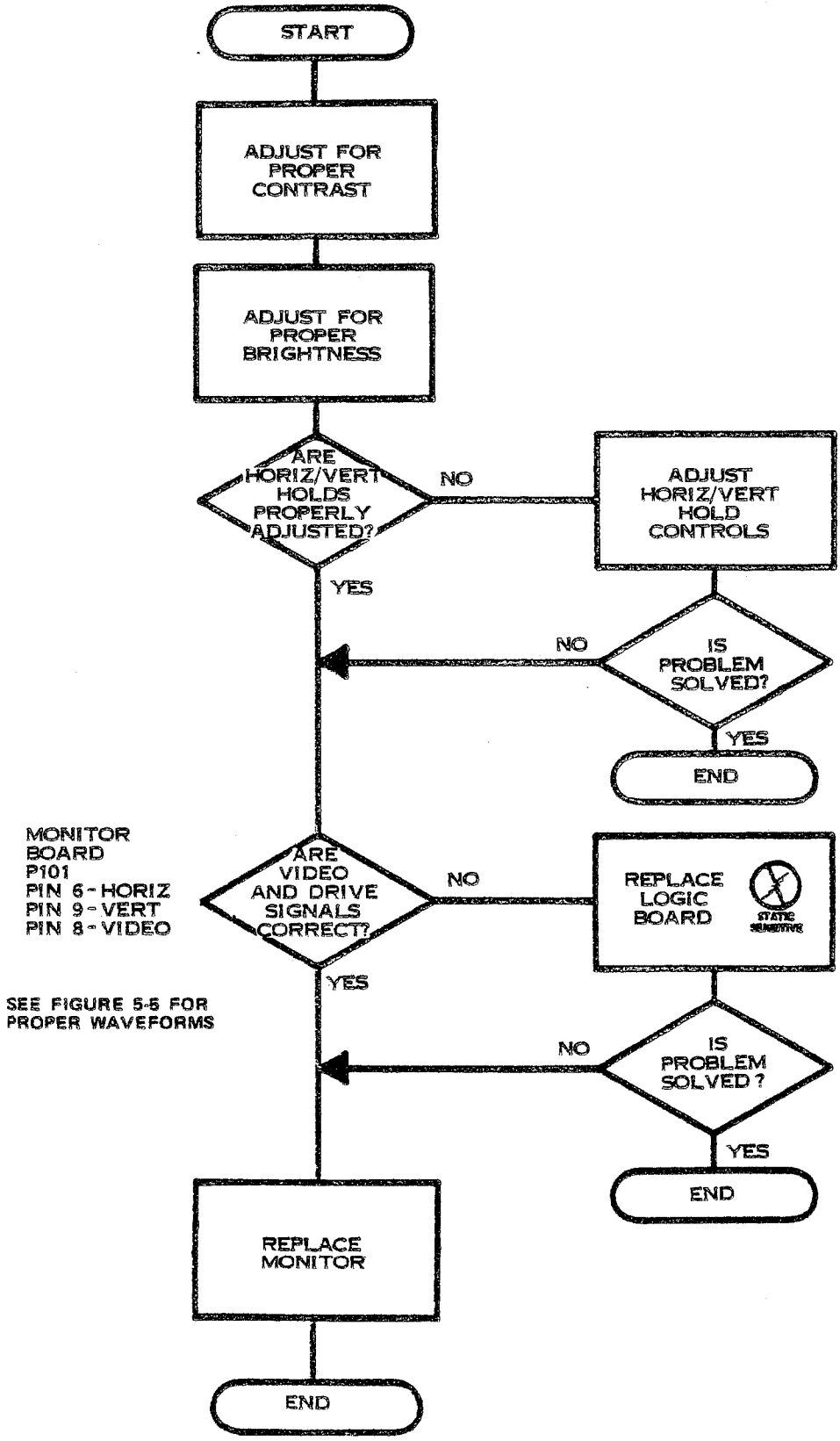
Table 5-1 Troubleshooting Flow Diagram Index

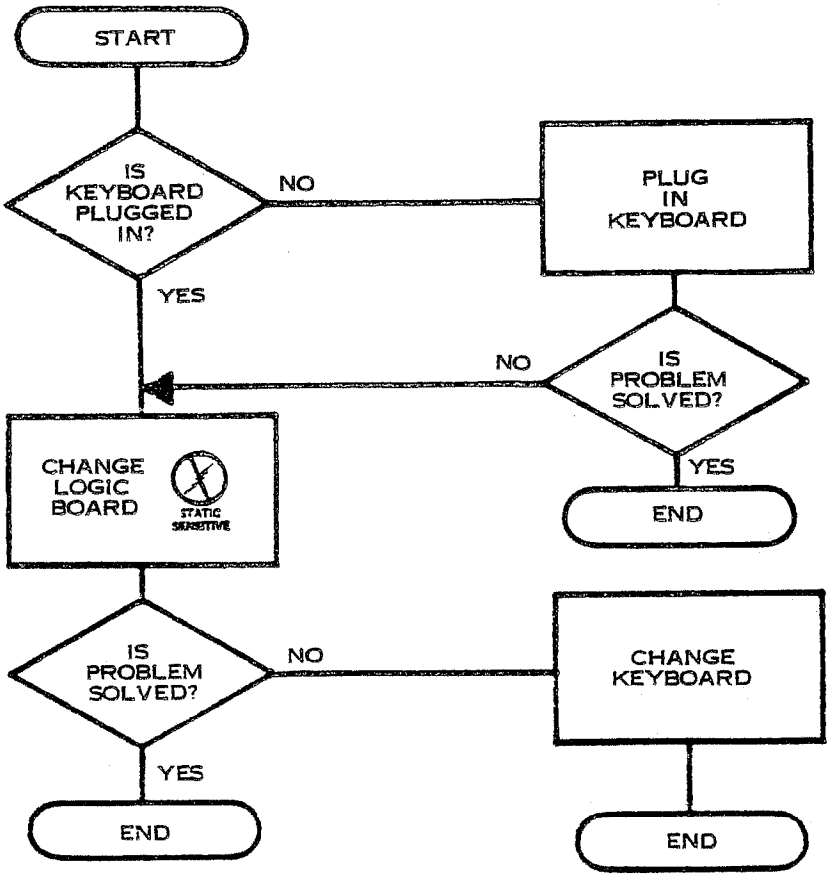
	APPARENT FAILURE	TROUBLE SHOOTING
	GENERAL	
1.	Fan off, no raster present on CRT	5-1A
2.	No raster present, but fan on	5-1B
3.	Raster, but no cursor or status line	5-1C
	OFF LINE	
1.	Cursor and status line multiple or not in correct position	5-2A
2.	No character displayed when written; no cursor advance	5-2B
3.	Wrong character displayed	5-2C
4.	Screen not clear when unit turned on, or no status line	5-2D
	ON LINE	
1.	No data being transmitted	5-3A
2.	Transmits invalid data	5-3B
3.	No reception	5-3C
4.	Receives invalid data and/or improper parity (ERR CHECK status message appears and audible alarm sounds)	5-3D
5.	No break function	5-3E
	DISPLAY	
1.	All displayed characters out of focus	5-4A
2.	Rolling display	5-4B
3.	Display too short for screen size	5-4C
4.	Height of display characters uneven	5-4C
5.	Display too wide/narrow for screen size	5-4D
6.	Display not centered	5-4E
7.	Tilted display	5-4F
8.	Others A. Physical damage B. Uneven intensity/focus C. Burned phosphor D. Uneven display dimensions E. Excessive H.V. arcing	5-4G


START
IS TERMINAL PLUGGED IN ?
NO
PLUG TERMINAL INTO PROPER POWER SOURCE
YES
NO
IS PROBLEM SOLVED ?
YES
END
IS POWER SWITCH ON?
NO
TURN POWER SWITCH LOCATED ON REAR PANEL TO 'ON' POSITION
YES
NO
IS PROBLEM SOLVED?
YES
END
IS POWER FUSE GOOD ?
NO
REPLACE POWER FUSE LOCATED ON BACK PANEL
YES
NO
IS PROBLEM SOLVED?
YES
END
I
I
IS STRAPPING ON TRANSFORMER CORRECT?
NO
CORRECT STRAPPING CONFIGURATION (See Figures 4-5a and 4-5b)
YES
NO
IS PROBLEM SOLVED?
YES
END
ARE POWER SUPPLY WIRE HARNESSES CONNECTED ?
NO
CONNECT WIRE HARNESS
YES
NO
IS PROBLEM SOLVED?
YES
END
ARE +5VDC AND +12VDC PRESENT @ POWER SUPPLY?
NO
REPLACE POWER SUPPLY
YES
END
NO
IS PROBLEM SOLVED?
YES
END
CHANGE TRANS-FORMER

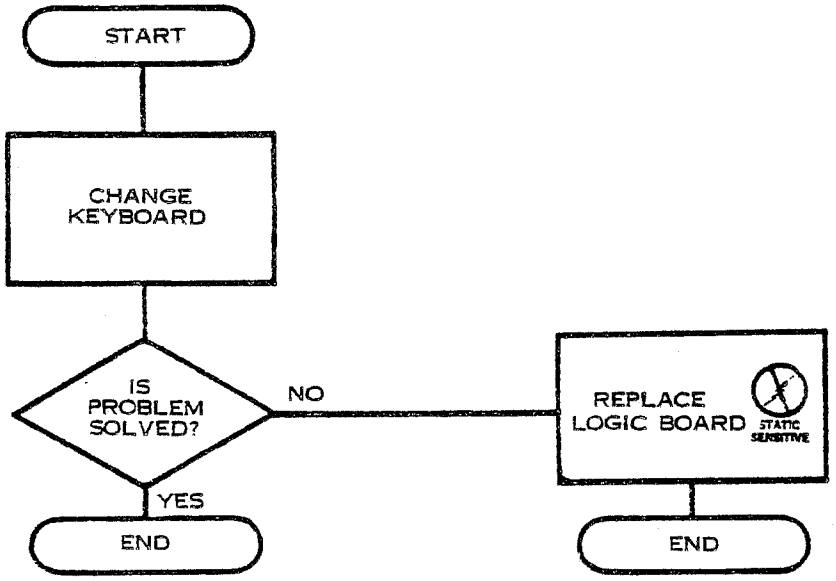

START
IS CONTRAST CONTROL ADJUSTED ?
NO
ADJUST CONTROL
YES
NO
IS PROBLEM SOLVED?
YES
END
IS BRIGHTNESS CONTROL ADJUSTED?
NO
ADJUST BRIGHTNESS CONTROL
YES
NO
IS PROBLEM SOLVED?
YES
END
SEE FIGURE 5-6 FOR PROPER WAVEFORMS
IS MONITOR PLUGGED IN?
NO
PLUG MONITOR IN
NO
IS PROBLEM SOLVED?
YES
END
P6-4 +12V
P6-5 +5V
+5V AND+12V PRESENT ON LOGIC BOARD?
YES
I
NO
ARE +12V & +5VDC @ POWER SUPPLY?
NO
REPLACE POWER SUPPLY
IS PROBLEM SOLVED?
NO
REPLACE TRANSFORMER
YES
II
YES
END
END
I
IS HORIZONTAL DRIVE SIGNAL PRESENT?
NO
REPLACE LOGIC BOARD
STATIC SENSITIVE
YES
REPLACE MONITOR
END
END
II
REPLACE WIRING HARNESS FROM POWER SUPPLY TO LOGIC CARD
NO
IS PROBLEM SOLVED?
YES
END

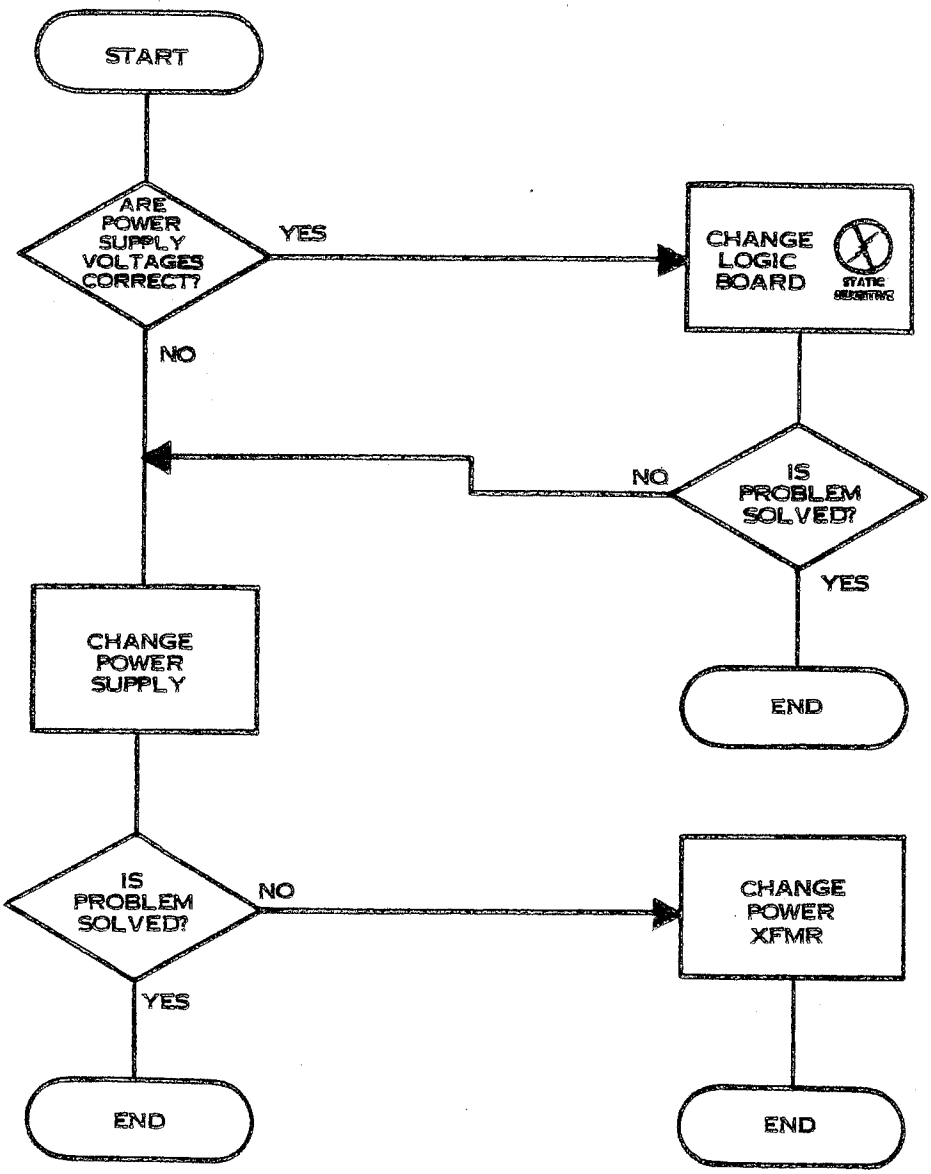

START
IS CONTRAST PROPERLY ADJUSTED ?
NO
PROPERLY ADJUST CONTRAST
YES
NO
IS PROBLEM SOLVED ?
YES
END
IS BRIGHTNESS PROPERLY ADJUSTED?
NO
PROPERLY ADJUST BRIGHTNESS
YES
NO
IS PROBLEM SOLVED?
YES
END
MONITOR BOARD P101 PIN 6-HORIZ PIN 9-VERT PIN 8-VIDEO
SEE FIGURE 5-5 FOR PROPER WAVEFORMS
CHECK FOR VIDEO, H&V DRIVE
NO
REPLACE LOGIC BOARD
STATIC SENSITIVE
YES
END
CHANGE MONITOR
END


START
ADJUST FOR PROPER CONTRAST
ADJUST FOR PROPER BRIGHTNESS
ARE HORIZ/VERT HOLDS PROPERLY ADJUSTED?
NO
ADJUST HORIZ/VERT HOLD CONTROLS
YES
NO
IS PROBLEM SOLVED?
YES
END
MONITOR BOARD P101 PIN 6 - HORIZ PIN 9 - VERT PIN 8 - VIDEO
ARE VIDEO AND DRIVE SIGNALS CORRECT?
NO
REPLACE LOGIC BOARD
STATIC SENSITIVE
YES
SEE FIGURE 5-6 FOR PROPER WAVEFORMS
NO
IS PROBLEM SOLVED ?
YES
END
REPLACE MONITOR
END

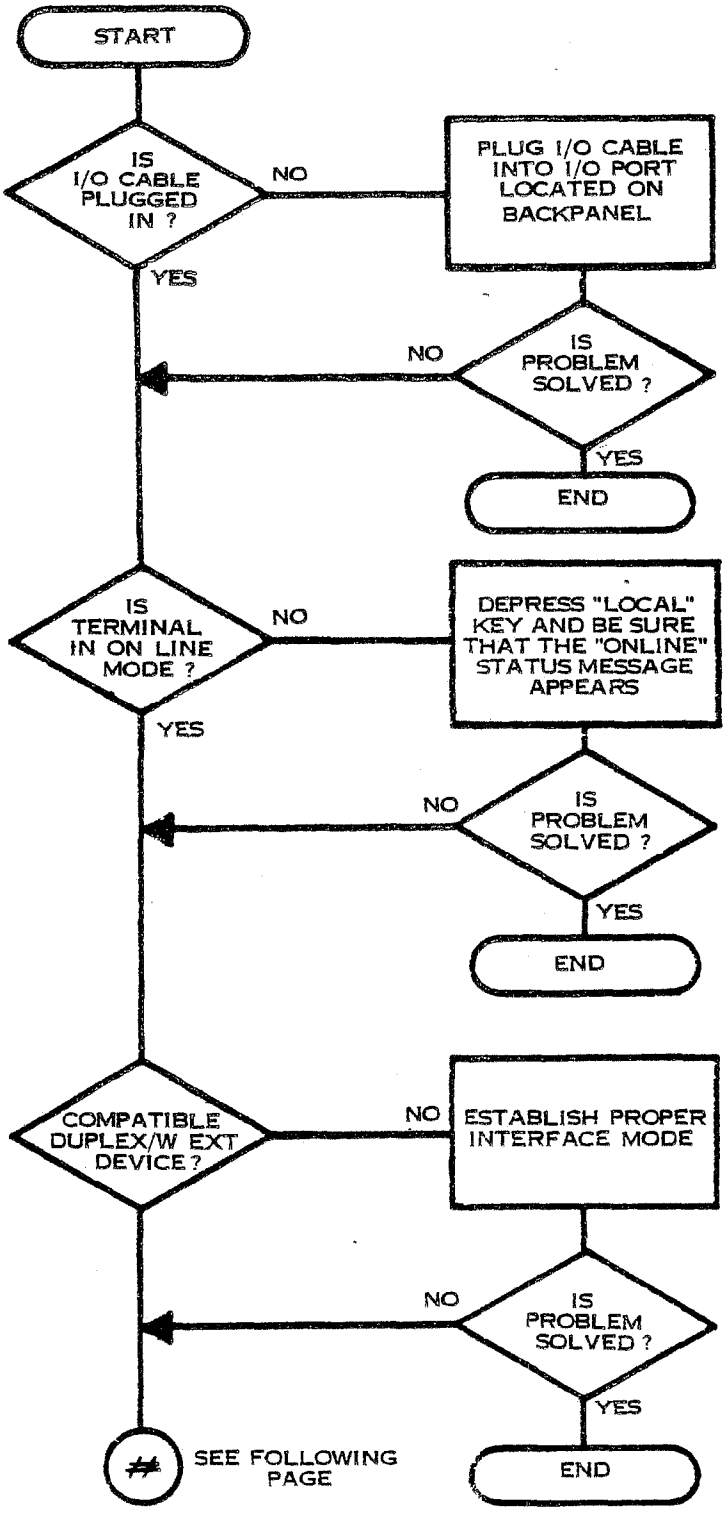

START
IS KEYBOARD PLUGGED IN?
NO
PLUG IN KEYBOARD
YES
NO
IS PROBLEM SOLVED?
YES
END
CHANGE LOGIC BOARD
STATIC SENSITIVE
IS PROBLEM SOLVED?
NO
CHANGE KEYBOARD
YES
END
END

5-2C

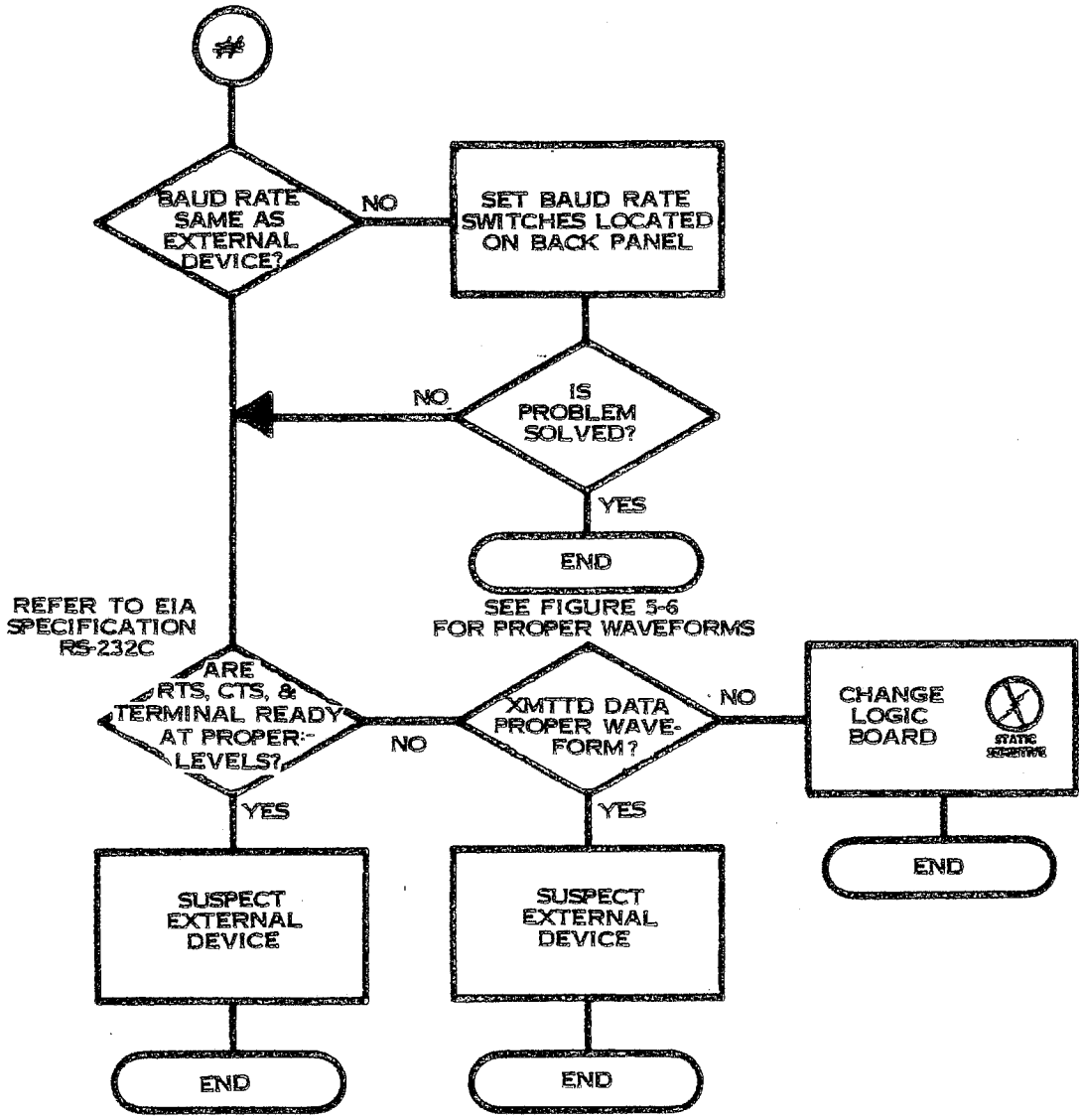

START
CHANGE KEYBOARD
IS PROBLEM SOLVED?
NO
REPLACE LOGIC BOARD
STATIC SENSITIVE
YES
END
END

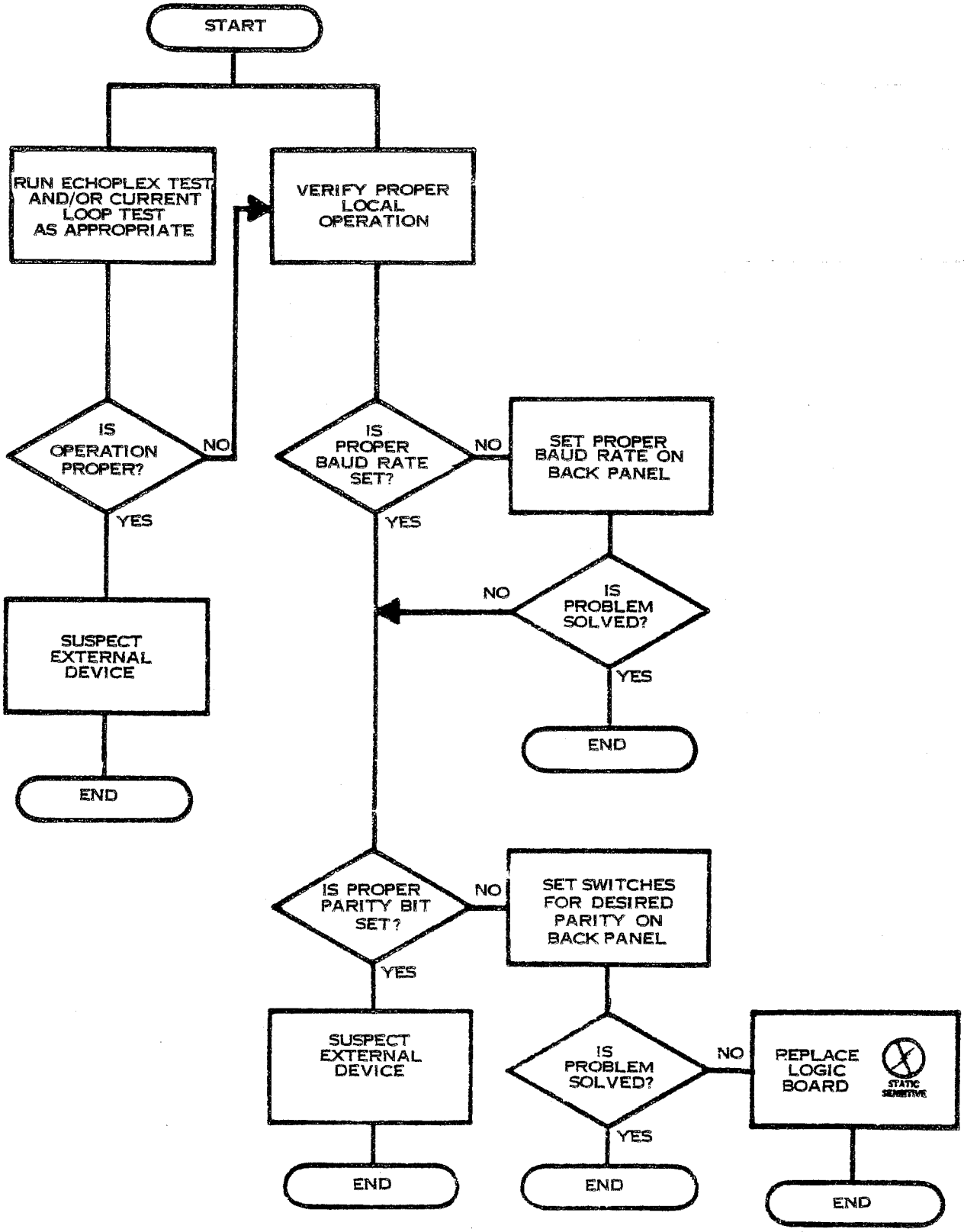

START
ARE POWER SUPPLY VOLTAGES CORRECT?
YES
NO
CHANGE LOGIC BOARD
STATIC SENSITIVE
IS PROBLEM SOLVED?
NO
YES
END
CHANGE POWER SUPPLY
IS PROBLEM SOLVED?
NO
YES
END
CHANGE POWER XFMR
END

PREREQUISITE: VERIFY PROPER OPERATION OF TERMINAL IN LOCAL MODE.

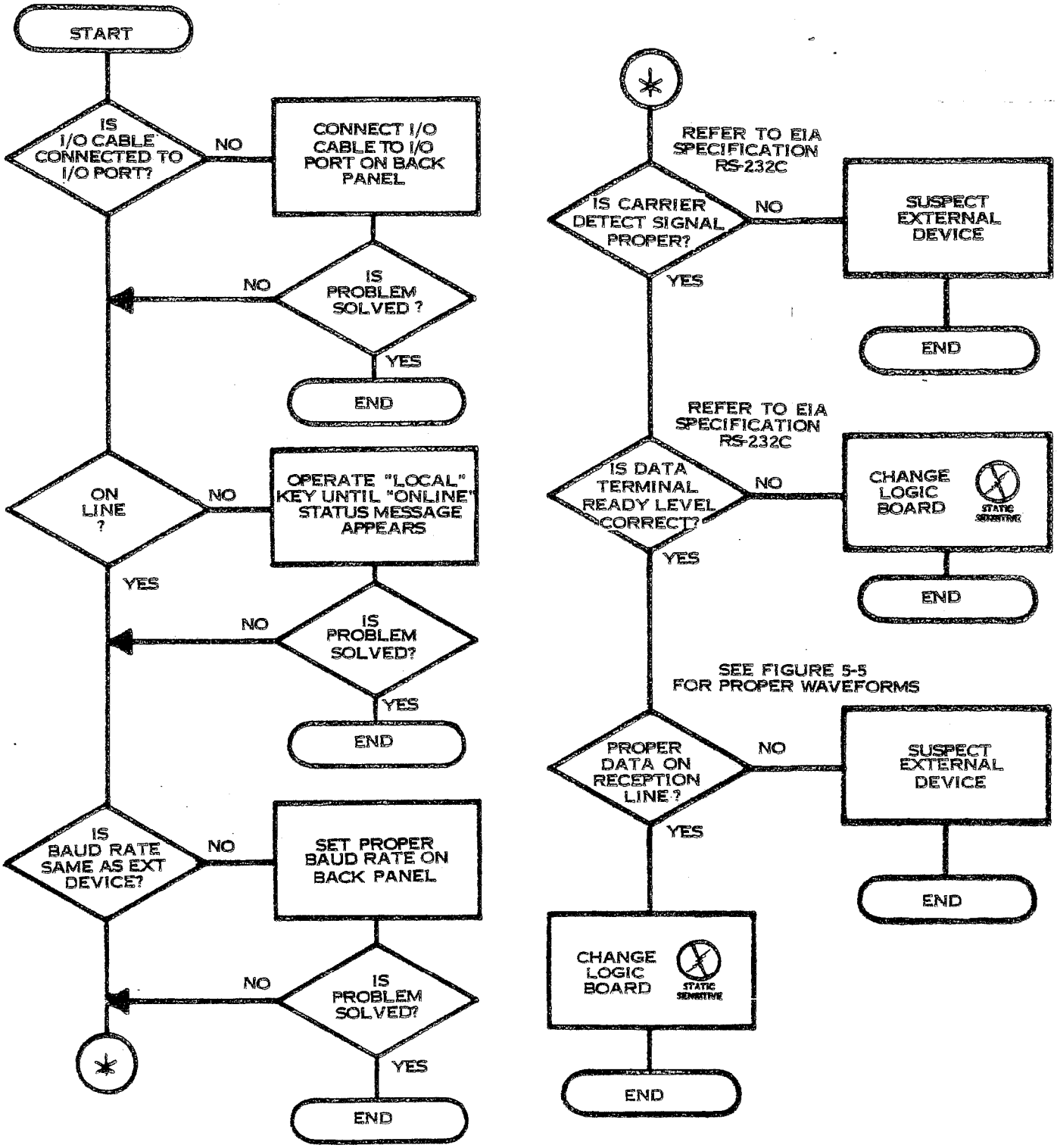


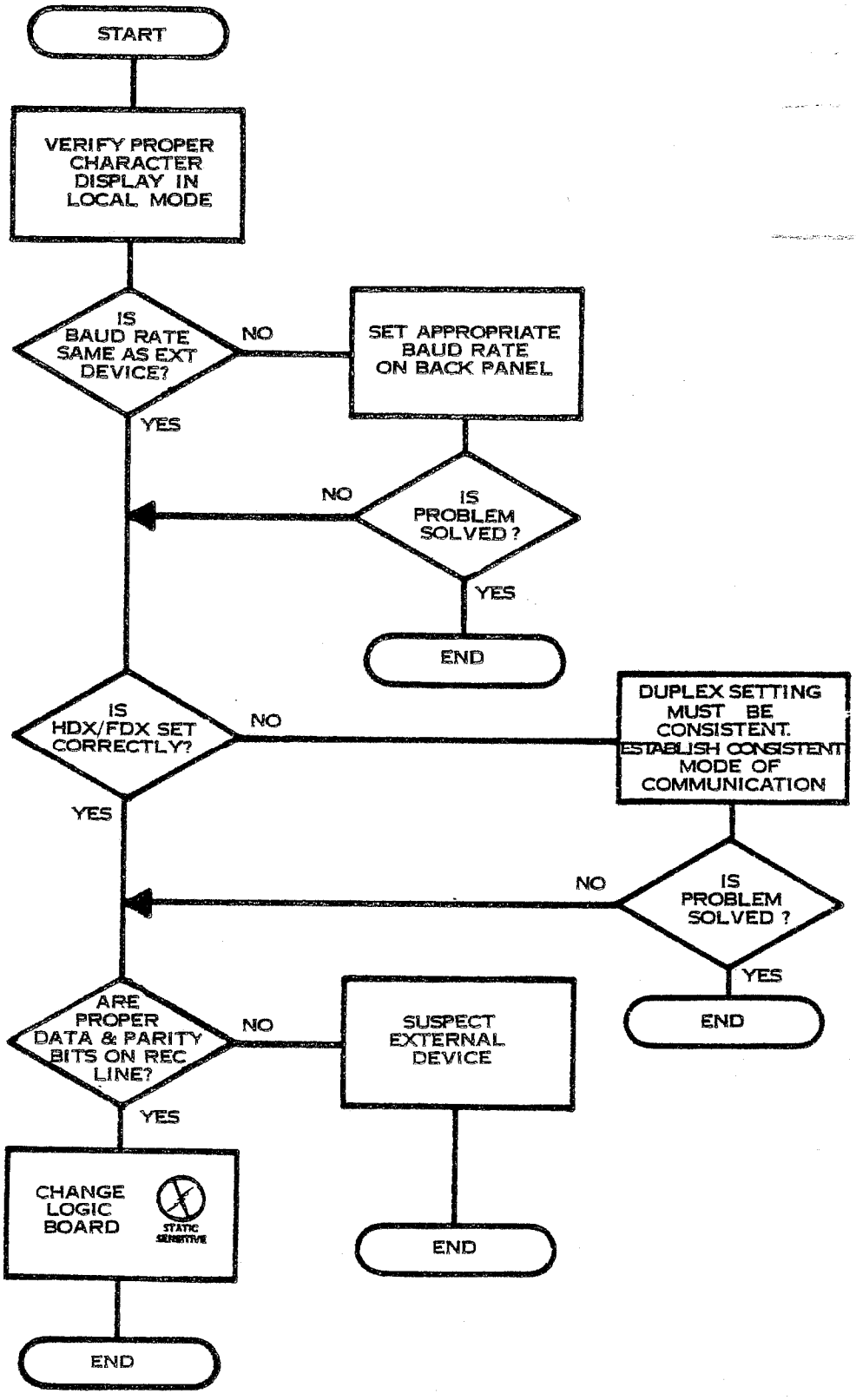
NOTE: EXTERNAL DEVICE I/O CONFIGURATION MUST BE KNOWN TO BE CONSISTENT WITH TERMINAL CONFIGURATION

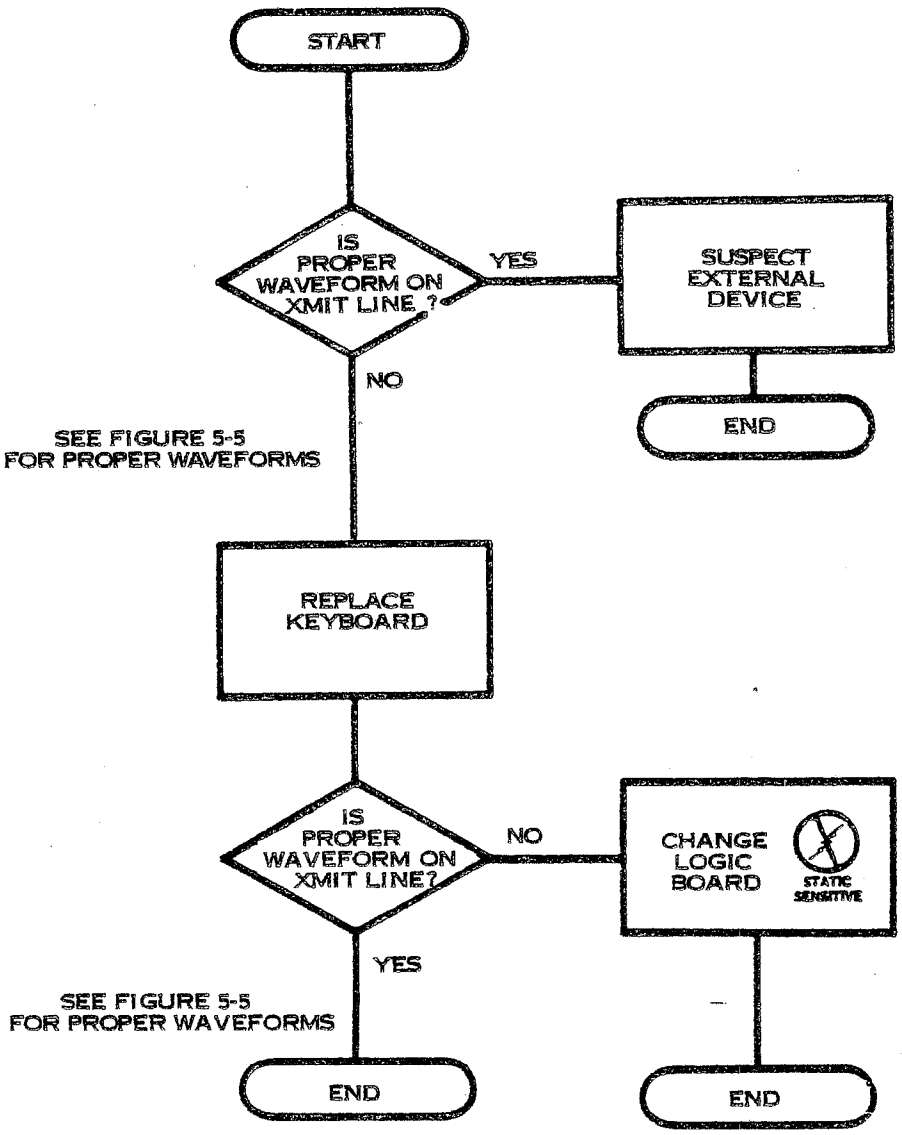

BAUD RATE SAME AS EXTERNAL DEVICE?
NO
SET BAUD RATE SWITCHES LOCATED ON BACK PANEL
NO
IS PROBLEM SOLVED?
YES
END
REFER TO EIA SPECIFICATION RS-232C
SEE FIGURE 5-6 FOR PROPER WAVEFORMS
ARE RTS, CTS, & TERMINAL READY AT PROPER LEVELS?
NO
XMTTD DATA PROPER WAVE-FORM?
NO
CHANGE LOGIC BOARD
STATIC SENSITIVE
YES
YES
END
SUSPECT EXTERNAL DEVICE
SUSPECT EXTERNAL DEVICE
END
END


START
RUN ECHOPLEX TEST AND/OR CURRENT LOOP TEST AS APPROPRIATE
VERIFY PROPER LOCAL OPERATION
IS OPERATION PROPER?
NO
YES
IS PROPER BAUD RATE SET?
NO
SET PROPER BAUD RATE ON BACK PANEL
YES
NO
IS PROBLEM SOLVED?
YES
SUSPECT EXTERNAL DEVICE
END
END
IS PROPER PARITY BIT SET?
NO
SET SWITCHES FOR DESIRED PARITY ON BACK PANEL
YES
SUSPECT EXTERNAL DEVICE
IS PROBLEM SOLVED?
NO
PEPLACE LOGIC BOARD
STATIC SENSITIVE
YES
END
END
END

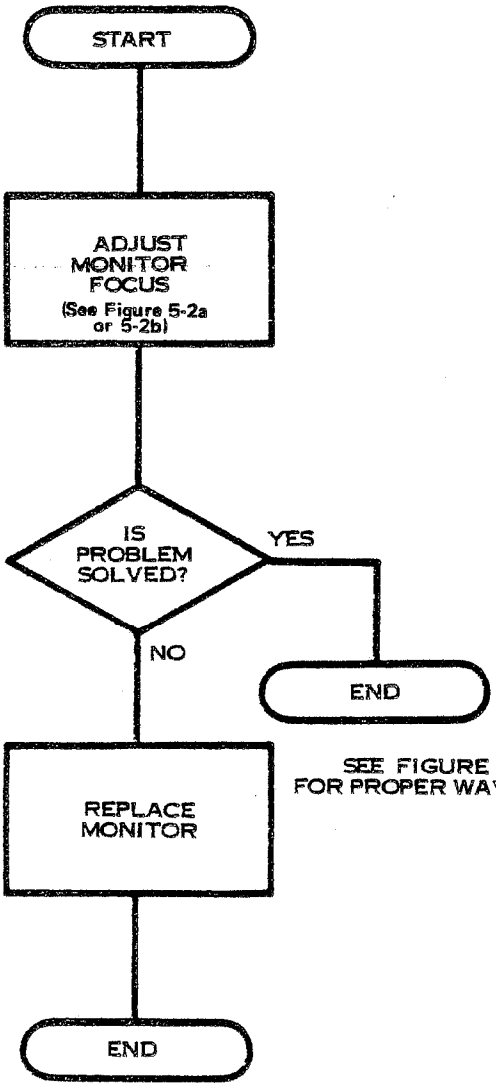
PREREQUISITE: VERIFY OPERATION OF TERMINAL IN LOCAL MODE




START
VERIFY PROPER CHARACTER DISPLAY IN LOCAL MODE
IS BAUD RATE SAME AS EXT DEVICE?
NO
SET APPROPRIATE BAUD RATE ON BACK PANEL
YES
NO
IS PROBLEM SOLVED ?
YES
END
IS HDX/FDX SET CORRECTLY?
NO
DUPLEX SETTING MUST BE CONSISTENT. ESTABLISH CONSISTENT MODE OF COMMUNICATION
YES
NO
IS PROBLEM SOLVED ?
YES
END
ARE PROPER DATA & PARITY BITS ON REC LINE?
NO
SUSPECT EXTERNAL DEVICE
YES
CHANGE LOGIC BOARD
STATIC SENSITIVE
END
END

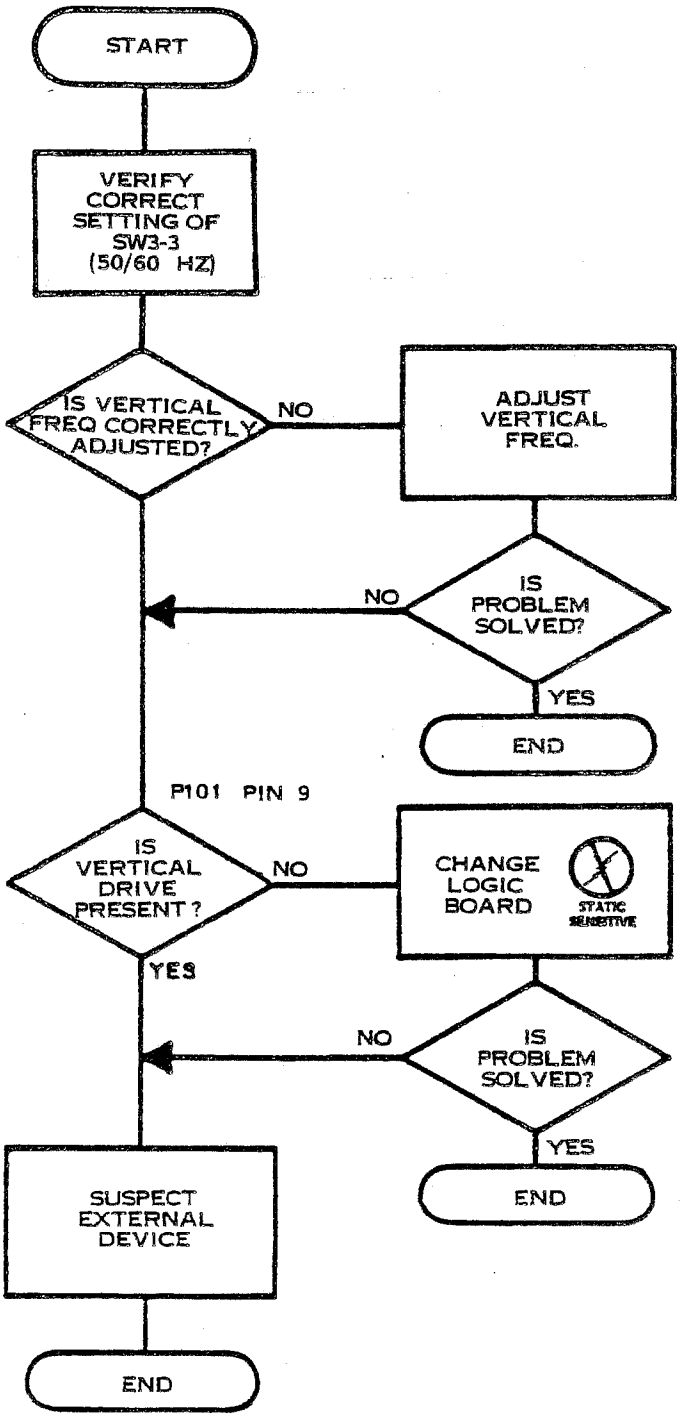

START
IS PROPER WAVEFORM ON XMIT LINE ?
YES
SUSPECT EXTERNAL DEVICE
END
NO
SEE FIGURE 5-5 FOR PROPER WAVEFORMS
REPLACE KEYBOARD
IS PROPER WAVEFORM ON XMIT LINE?
NO
CHANGE LOGIC BOARD
STATIC SENSITIVE
YES
SEE FIGURE 5-5 FOR PROPER WAVEFORMS
END
END

5-4A

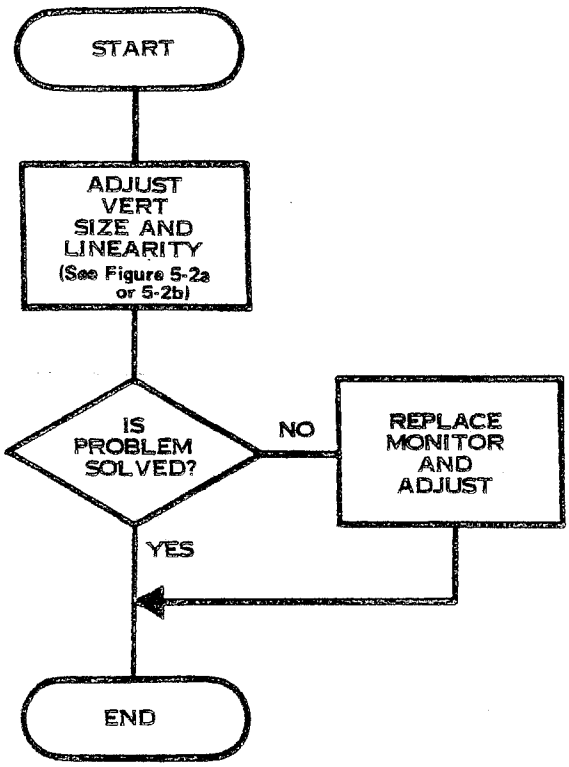


SEE FIGURE 5-5
FOR PROPER WAVEFORMS

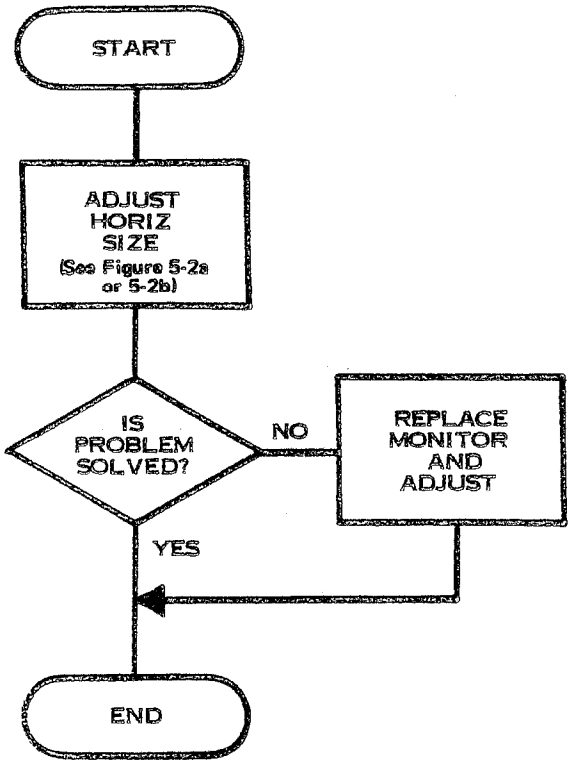
5-4B



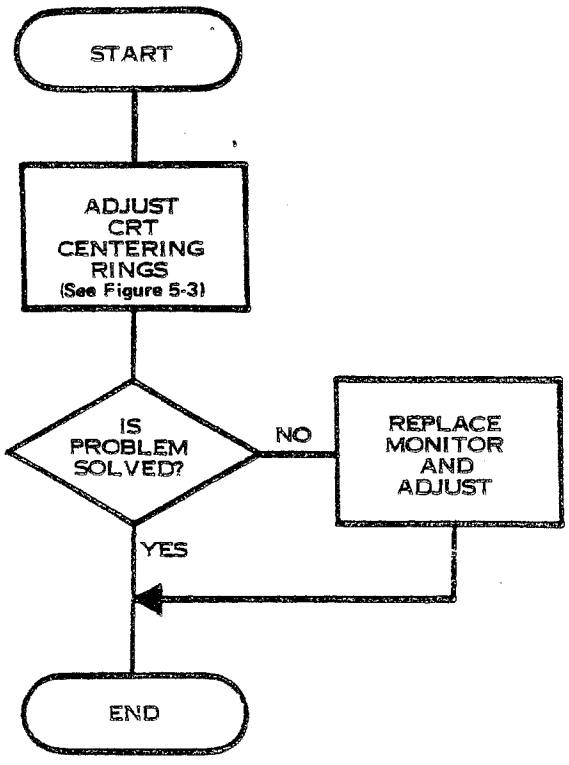
5-4C



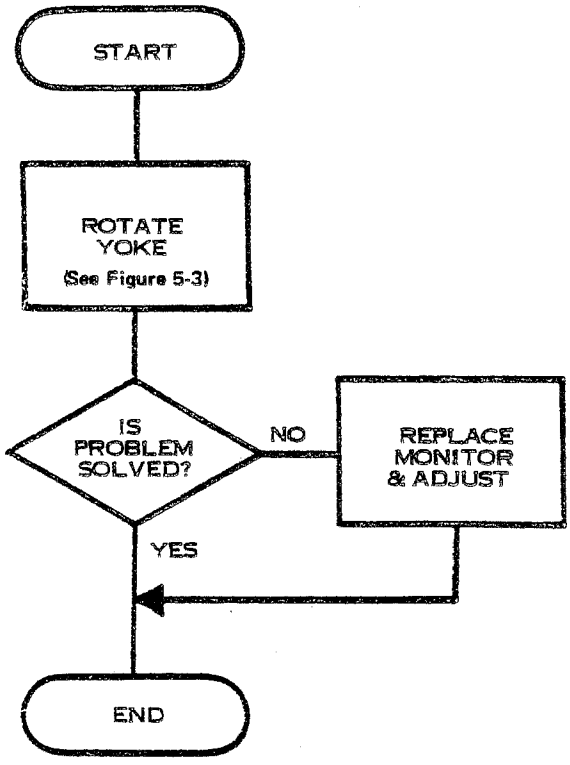
5-4D

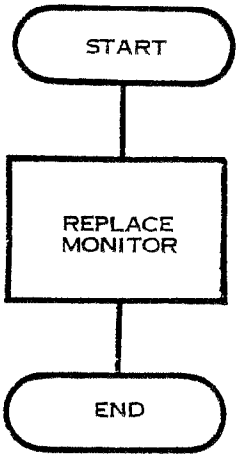


5-4E



5-4F




START
REPLACE MONITOR
END

5.3.4 Adjustment Procedures

Monitor Adjustments

The Micro Bee is equipped with a 12" CRT which is designed especially for alphanumeric display. It is carefully adjusted at the factory while mounted in the terminal and should receive any field adjustments or repairs without removing it from the terminal.

Figures 5-2a and 5-2b show the physical location of the specific adjustments on the monitor PC board, while Figure 5-3 shows the CRT-mounted adjustments.

The Micro Bee uses either a Beehive B-12 or a Ball Brothers TV-120 monitor. Each type of monitor uses a standard television type CRT employing a horizontal-flyback system to generate the anode high-voltage potential. The horizontal drive, vertical drive and video signals are obtained from the logic board.

WARNING — Even though the monitor is powered by +12V, it generates much higher voltages to operate the CRT. As with any monitor, the +15,000V anode potential can remain on the CRT after the unit is powered down. Care should be taken to discharge this voltage to the monitor frame with the power off before handling the anode lead, flyback transformer or the CRT itself. The technician should also use proper nonmetallic alignment tools and caution when adjusting the monitor with the power on. Be careful of loose leads and use one hand to do the work.

The only operator-accessible monitor controls are BRIGHTNESS and CONTRAST, which are located on the rear panel. Proper brightness adjustment is the point at which the white raster on the CRT is barely extinguished. Correct contrast adjustment results in the sharpest display of normal, reversed and half intensity characters. Check these controls first when servicing the monitor.

When aligning the monitor, it is highly recommended that a crosshatch or other type of video pattern generator be used in conjunction with a clear, double-etched plexiglass plate over the face of the CRT. Optimum results can be obtained by etching both sides of the plexiglass plate with the pattern contained in Figure 5-4. The two patterns should coincide when the plate is viewed from a position perpendicular to the plate and a few feet away. Using this type of alignment tool eliminates alignment problems caused by parallax.

The **height** (vertical size) of the raster can be adjusted by R37 on the B-12 or R110 on the TV-120. The optimum display height is 6.5 inches (see Figure 5-4).

The **vertical linearity** control is used to achieve uniform character height throughout the display. It is optional on the B-12 as R602 and is standard on the TV-120 as A102.

The B-12 monitor needs no **vertical hold** adjustment. The TV-120 may require some adjustment of A101 to lock in the picture after major adjustments or repairs.

If the raster is not properly centered, reposition it by rotating the ring magnets behind the deflection yoke (see Figure 5-3). When the proper adjustment is found, it is a good idea to apply a little RTV adhesive to prevent accidental rotation of these magnets. The ring magnets should not be used to offset the raster from its center position because this degrades resolution and focusing. It may also cause corners of the display to be shadowed by the neck. If the picture is tilted, rotate the entire yoke.

Horizontal centering on the TV-120 may be accomplished more quickly with A103, the "video centering" control.

L3 controls **horizontal linearity** on the B-12. It is factory set and requires no adjustment. L102 is the equivalent control on the TV-120. Proper horizontal linearity ensures that characters on each display line are of uniform width.

Use L4 on the B-12 and L103 on the TV-120 to adjust for desired picture **width**. The optimum display width is 8.4 inches as shown in Figure 5-4.

CAUTION: Adjustment of the vertical size beyond the displayable limits of the cathode ray tube may result in damage to the monitor.

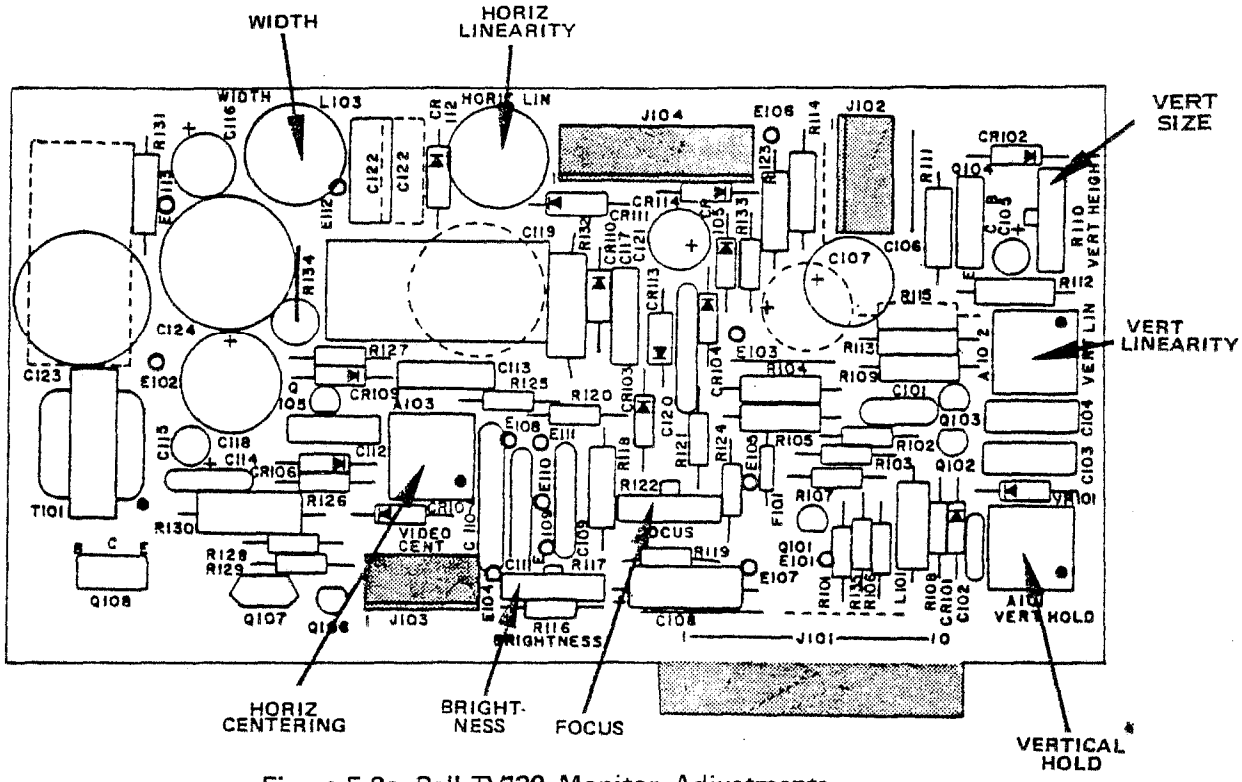


Figure 5-2a Ball TV120 Monitor Adjustments

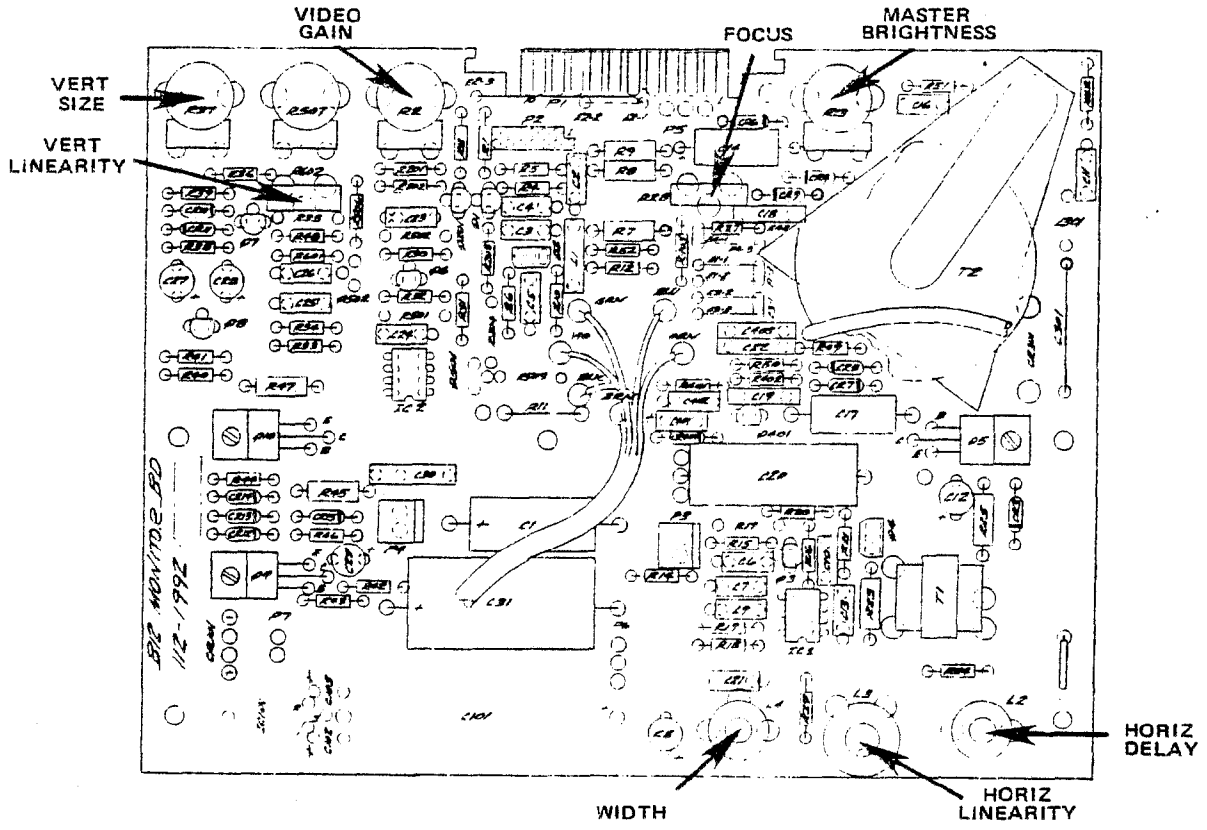


Figure 5-2b Beehive B-12 Monitor Adjustments

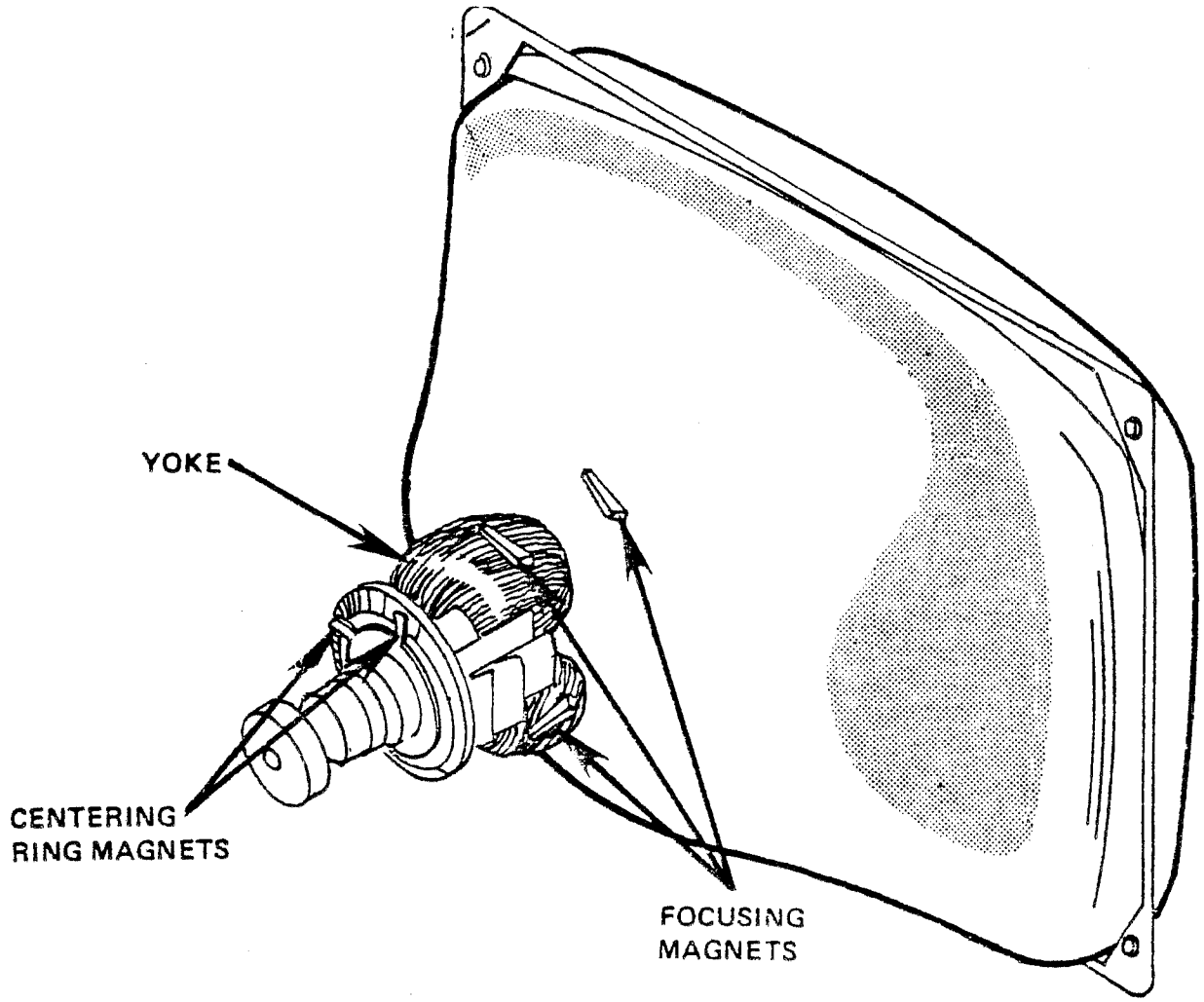


Figure 5-3 Monitor Yoke Adjustments

Adjust the **Focus** control (R28 on the B-12 and R122 on the TV-120) when necessary to achieve better overall display clarity. It may also be necessary to readjust the contrast and brightness controls. Too high a setting on either brightness or contrast can adversely affect the focus.

R13 is the **master brightness** control on the B-12. If the rear panel brightness control does not cover the required brightness range, "center" it by using R13.

The B-12 **video gain pot**, R2, has a similar centering effect on the contrast control.

Replacement of the yoke or CRT may cause problems with adjustment of the display which are best corrected with the installation of small ceramic bar magnets (see Figure 5-3). The vertical and horizontal linearity, vertical, height, horizontal width and focus adjustment should be checked first. Then, if the actual display is not square with straight lines and sharp corners, additional adjustment using the magnets is required. If the monitor has a number of magnets already in place and the display is still not square, these magnets may need to be removed and the adjustment rechecked before proceeding.

Place a small magnet on the flared end of the yoke coil near the CRT. Note the effect the magnet exerts on the display. Alignment of the magnet with or against the magnetic field causes the line or corner to move up or down. Move the magnet around the CRT until the best possible alignment is achieved. Additional magnets or various-sized magnets may be required to correct a single distortion problem or other problems on the display. When the number, size and location of the magnets has been determined, RTV adhesive is used to secure them in position.

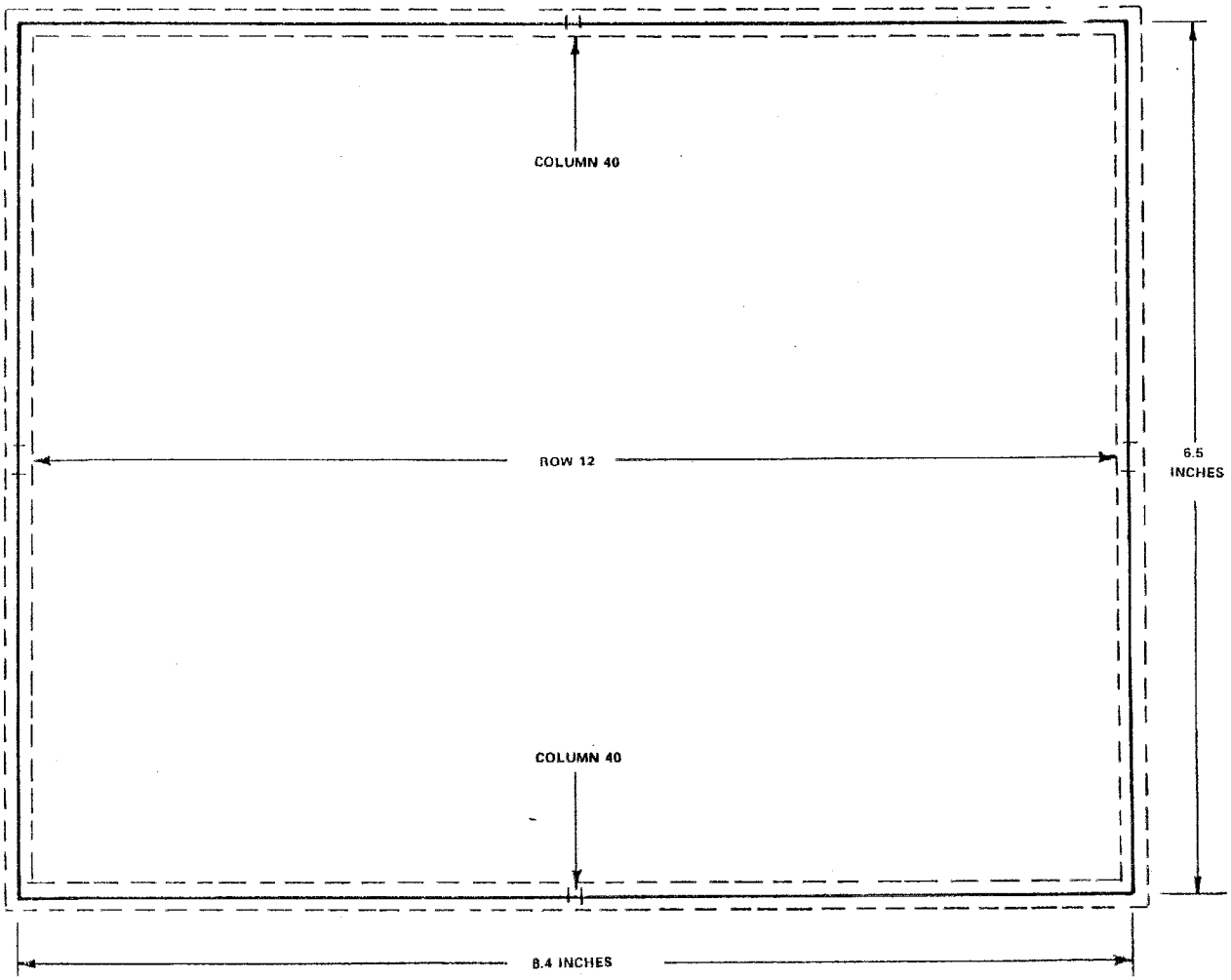
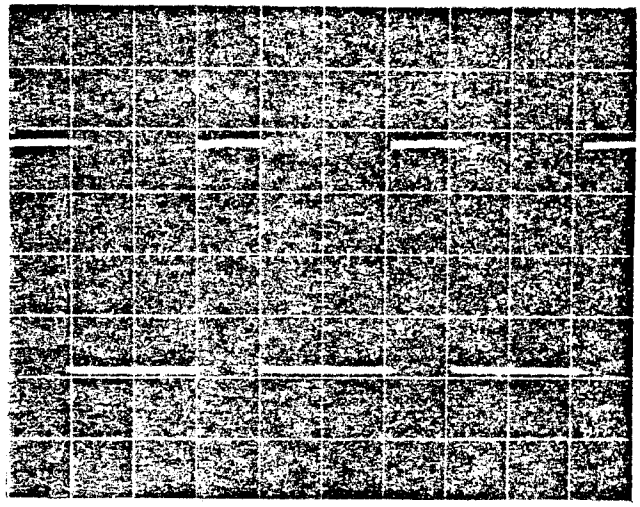


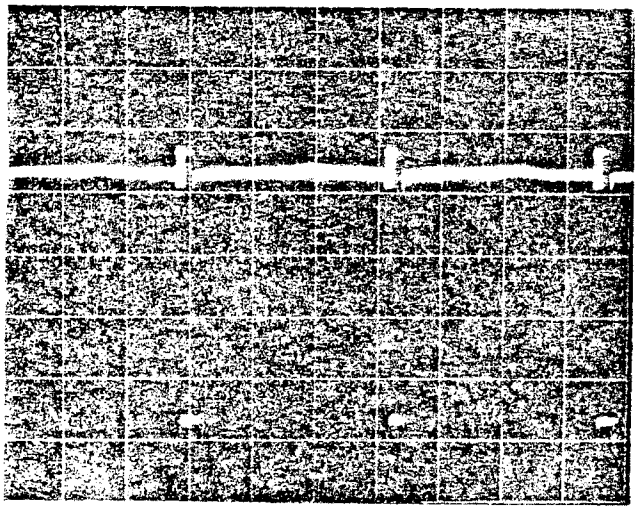
Figure 5-4 Monitor Alignment Template

Figure 5-5 Waveforms

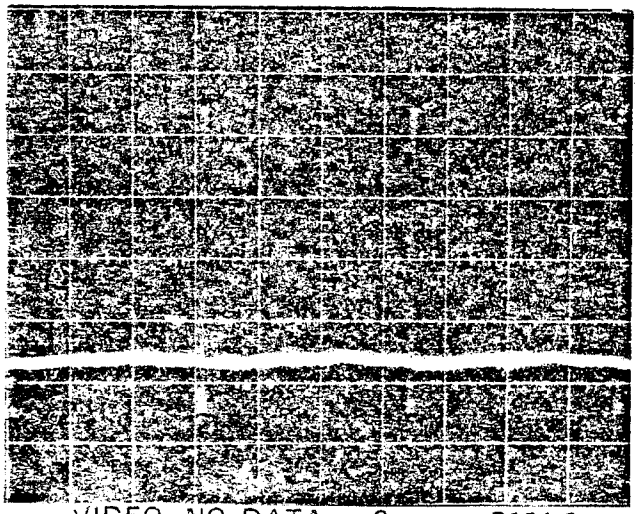
NOTE: Unless otherwise indicated, these waveforms were recorded with no data on the terminal screen except cursor and Status Line. If waveforms are not visible at P101 on the Monitor, check further back past the cabling before assuming a Logic Board malfunction.



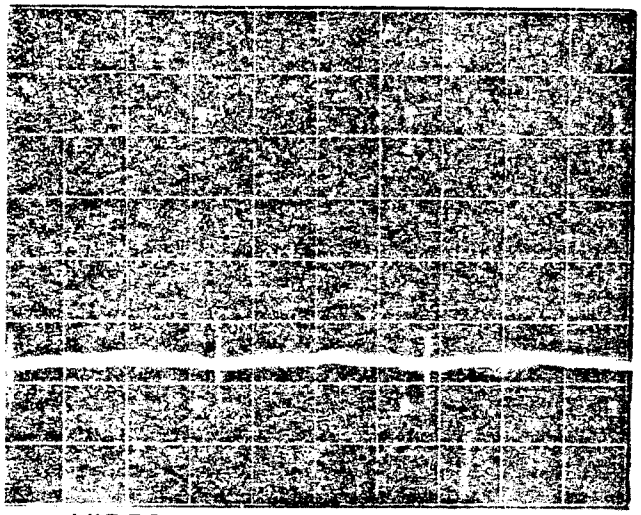
HORIZONTAL DRIVE – Seen on P101-6 with scope at 1v/cm and 20μs/cm



VERTICAL DRIVE – Seen on P101-9 with scope at 1v/cm and 5ms/cm

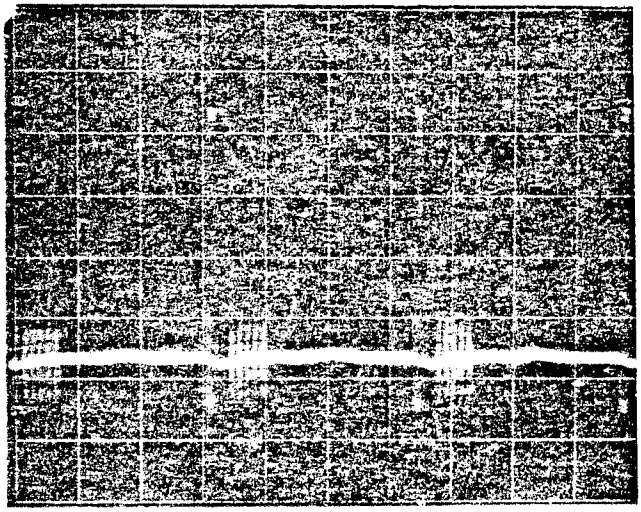


VIDEO–NO DATA – Seen on P101-8 with scope at 1v/cm and 5ms/cm

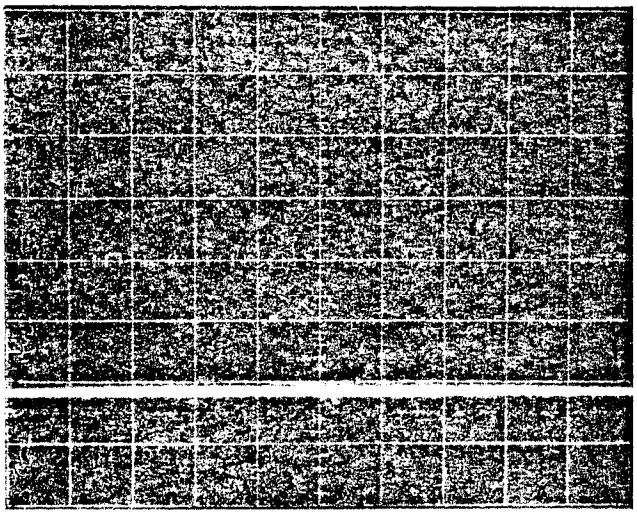


VIDEO–ONE ROW OF "A" – Seen on P101-8 with scope at 1v/cm and 5ms/cm

Figure 5-5 Waveforms (concluded)

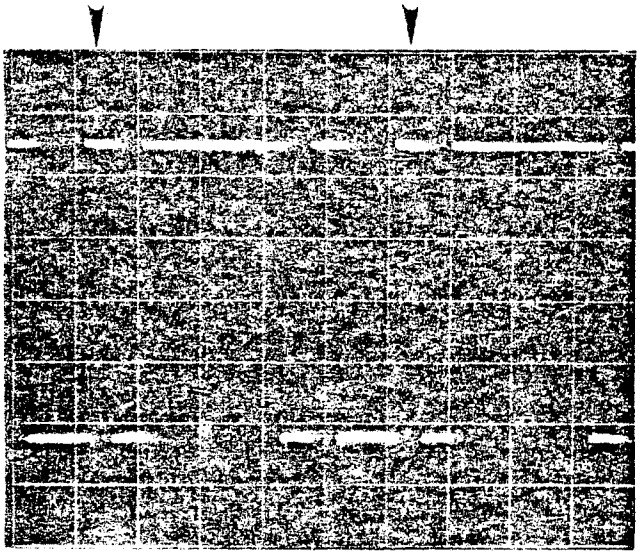


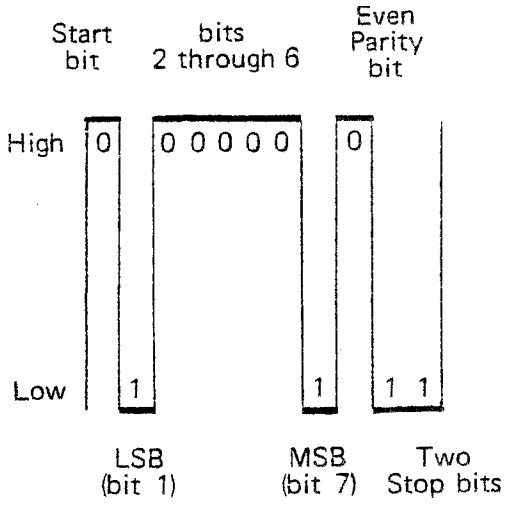
VIDEO—5 ROWS OF "A" — Seen on P101-8 with scope at 1v/cm and 5ms/cm



XMIT DATA — Seen on J3-2 with no information being transmitted. Scope settings were 5V/cm and 20ms/cm.

Character "A" is shown below. Refer to clarifying diagram at the right to identify individual bits.





XMIT DATA — seen on J3-2 with the "A" key in autorepeat, the terminal operating at 110 baud, and even parity selected. The sequence is start bit, data bits LSB to MSB (least significant bit to most significant bit), parity bit and stop bits. (The number of stop bits varies with the transmission rate.) The character "A" can be seen between the points indicated on the photograph and in the clarifying diagram. Note the use of negative logic.

5.3.5 Disassembly/Assembly Procedure

The following paragraphs describe the disassembly procedure for the Micro Bee. To assemble, reverse the step sequence. During disassembly, the logic board must be protected from static discharge and handled in a static-free environment. The power cable must be disconnected from the AC outlet before disassembly is started.

Cover

Remove the two screws and finish washers from the front edge of the cover. Remove the four screws and finish washers from the rear of the cover around the back panel. Lift the cover directly up and away from the terminal.

Monitor

Before any monitor disassembly is attempted, the CRT anode should be discharged to prevent severe electrical shock. With all power to the terminal off, connect one end of a well-insulated test lead to the monitor frame and the other end to the blade of a plastic-handled screwdriver. Touching only the plastic handle of the screwdriver, carefully place its blade under the flexible insulating cover of the CRT anode connector. Touching the connector gently with the screwdriver blade, drain off any remaining static charge. A healthy spark, accompanied by a "pop", sometimes occurs, depending on the amount of residual charge.

To swing the monitor assembly away from the logic board:

a. Place the terminal with the keyboard facing toward you.

b. Remove the two screws attaching the monitor frame plate and one screw attaching the monitor frame mounting clip to the chassis (right side only).

c. Swing the monitor assembly up and away from the logic board. (See Figure 4-3)

If the monitor assembly is to be completely removed (e.g., for replacement), complete steps a, b, and c above, then:

d. Disconnect monitor cable (W5) from molex connector (J2) on the logic board.

e. Remove the remaining screws attaching the two frame mounting clips to the chassis.

NOTE: During assembly, be certain the ground strap from the monitor frame is reattached to the monitor chassis.

f. Lift the monitor assembly away from the terminal.

g. Place the monitor on a protected surface away from further disassembly.

CAUTION: Extreme care must be used in removing and handling the monitor to protect the CRT face and neck from damage. Any rupture of the glass shell results in possible implosion of the tube shell and certain destruction of the CRT.

If the monitor circuit board is to be removed, place the assembly on a protected surface with the CRT facing away and the circuit board to your left.

h. Disconnect the monitor cable (W5) from the connector (J101) on the logic board. Make sure that the connector polarization key remains in the proper position (between pins 9 and 10) in the connector plug (P101).

i. Disconnect the tube socket from the CRT.

j. Disconnect the four leads to the yoke (white = 1, red = 2, blue = 3, and brown = 4) by pulling the bayonet plugs out from the jacks.

k. Disconnect the tube ground (green lead) in-line connector by pulling the two ends of the connector apart.

l. Disconnect the flyback transformer by removing the molex connector (P104) plug from the connector jack (J104) on the circuit board.

m. Disconnect the choke leads by pulling the molex connector plug (P102) from the connector jack (J102) on the circuit board.

n. Depress the center clip on each nylon standoff post and gently pull the board away from the post as it becomes free. A standoff is located near each corner of the board.

To remove the CRT:

o. Place the CRT facing you and loosen the four screws attaching the bezel to the frame.

p. While supporting the CRT with one hand, remove the screws and bezel.

q. Using both hands, move the CRT toward you and out of the frame.

CAUTION: Care must be used to protect the tube from damage. Extreme care must be used to protect the tube neck.

Fan

To remove the fan, with rear panel facing you:

a. Disconnect the two wire leads from the terminal block (pin 3 and pin 7).

b. Cut cable ties and separate the wires.

c. Remove the four bolts attaching the fan to the rear panel, one bolt in each corner of the finger guard.

d. Remove the fan and finger guard from the rear panel.

Logic Board

Before removing the logic board, follow all antistatic procedures outlined on page 4-1. With the terminal facing away from you:

a. Remove the two screws near the left side of the back panel (one just right of switches and one to the left of the contrast potentiometer).

b. Remove the ground wire (B1) at the corner of the board near connector J-4.

c. Beginning with the nylon standoff posts near the rear panel, depress the center clip and gently lift the logic board up; there are two standoff posts near the front edge and two near the center edges of the board.

d. Carefully remove the keyboard cable from the logic board by disengaging connector J1.

e. With all four standoff posts released, lift the end nearest the keyboard up and slide the board away from the rear panel and away from the terminal.

Power Supply

To remove the power supply:

a. Disconnect the power supply cable (W4) molex connector from the logic board (J6).

b. Remove the screw attaching the "L"-shaped power supply bracket to the chassis.

c. Lift the power supply board up out of the card guides and away from the chassis.

Keyboard

With the keyboard facing you:

a. Remove the six screws accessible through the holes in the keyboard plate.

b. Move the keyboard toward you slightly and disconnect the keyboard ribbon cable from connector (J1) on the logic board.

c. Place the keyboard assembly on a protected surface away from further disassembly.

To remove key switches:

d. Place the keyboard upside down on a protected surface.

e. Locate the switch lead, using switch numbers.

f. Heat solder around each lead and remove the melted solder by using a solder sucker.

g. Extract the switch from the circuit board by applying pressure to the switch leads on the back of the keyboard and pulling on the switch plunger on the front.

Transformer

To remove the transformer:

a. Disconnect the transformer leads from the terminal commoning block (TB1) (orange = pin 2, black = pin 4, red = pin 8, brown = pin 9).

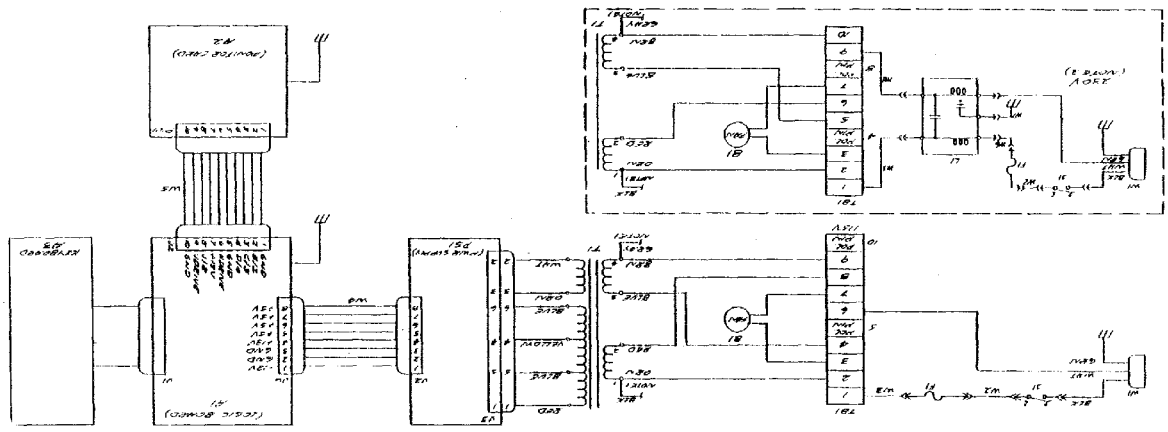
NOTE: Reassembly can be simplified by marking or recording the pin positions.

b. Disconnect the transformer cable from the molex connector (J3) on the power supply board.

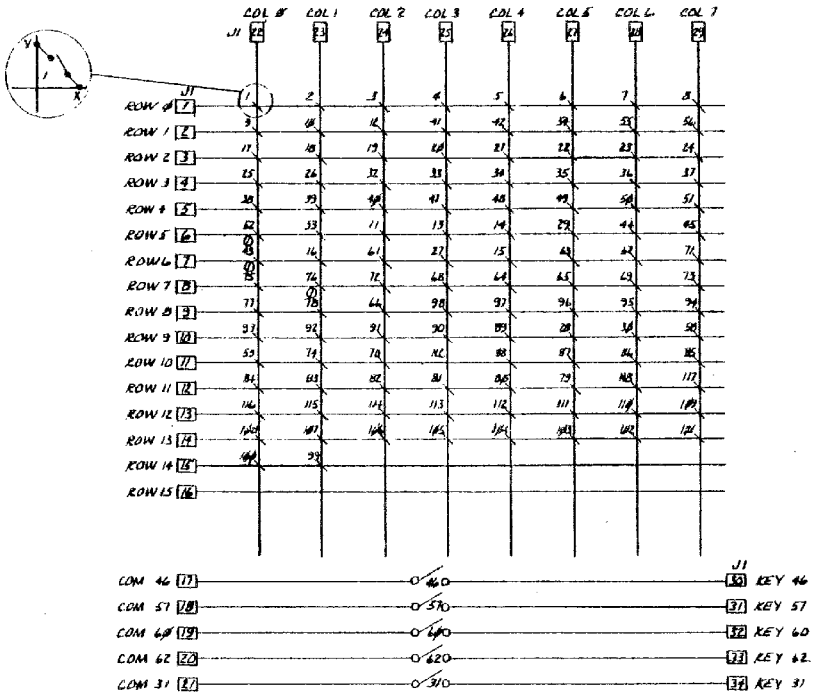
c. Remove the four screws from the transformer and lift the assembly up and away from the chassis.

SECTION VI

DRAWINGS



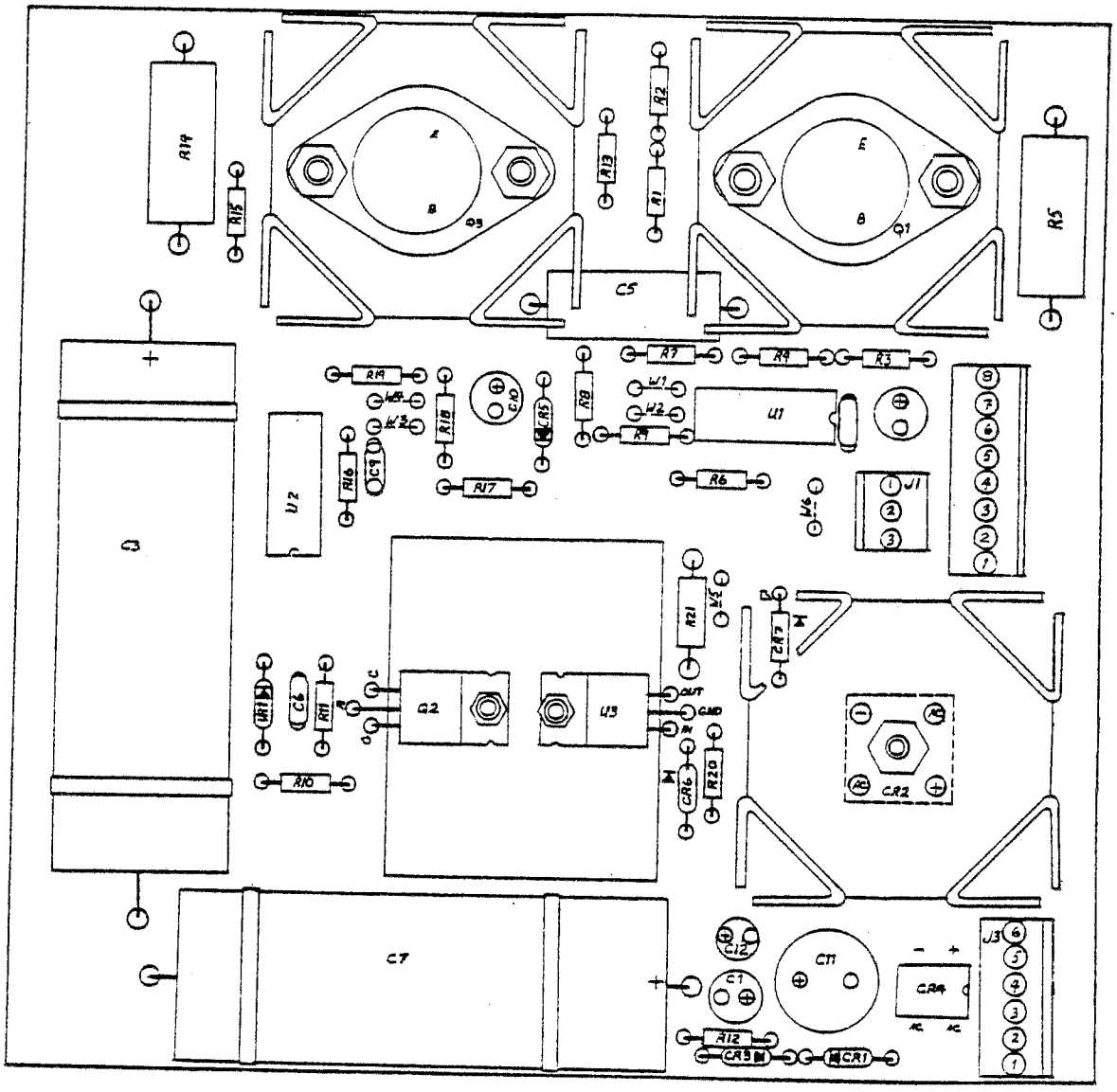
Terminal Schematic
(112-1998)



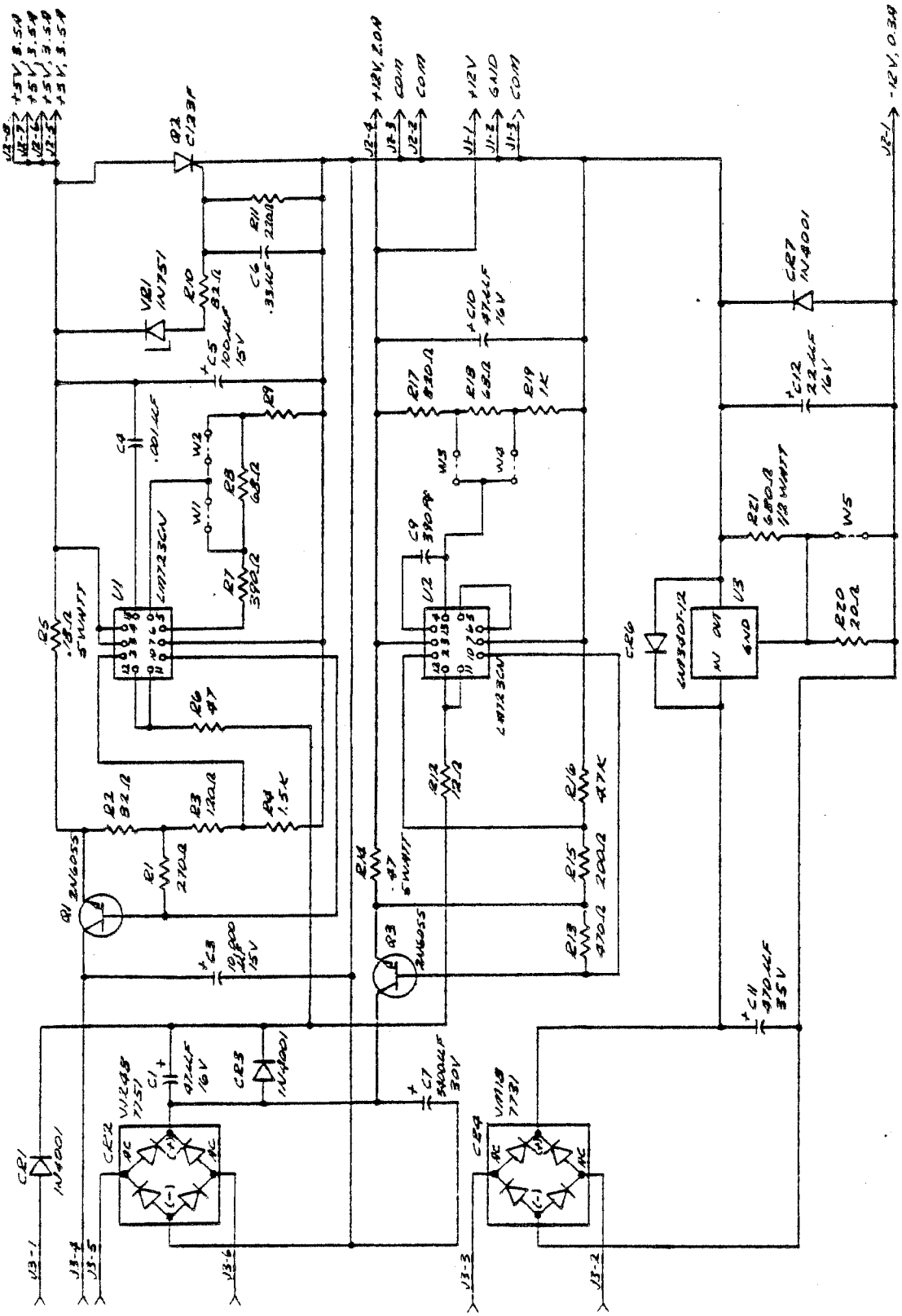
NOTES:

(1) THE FOLLOWING KEYS ARE DUMMY KEYSWITCHES (NON-OPERATING).
KEY NO. 43
KEY NO. 75
KEY NO. 78

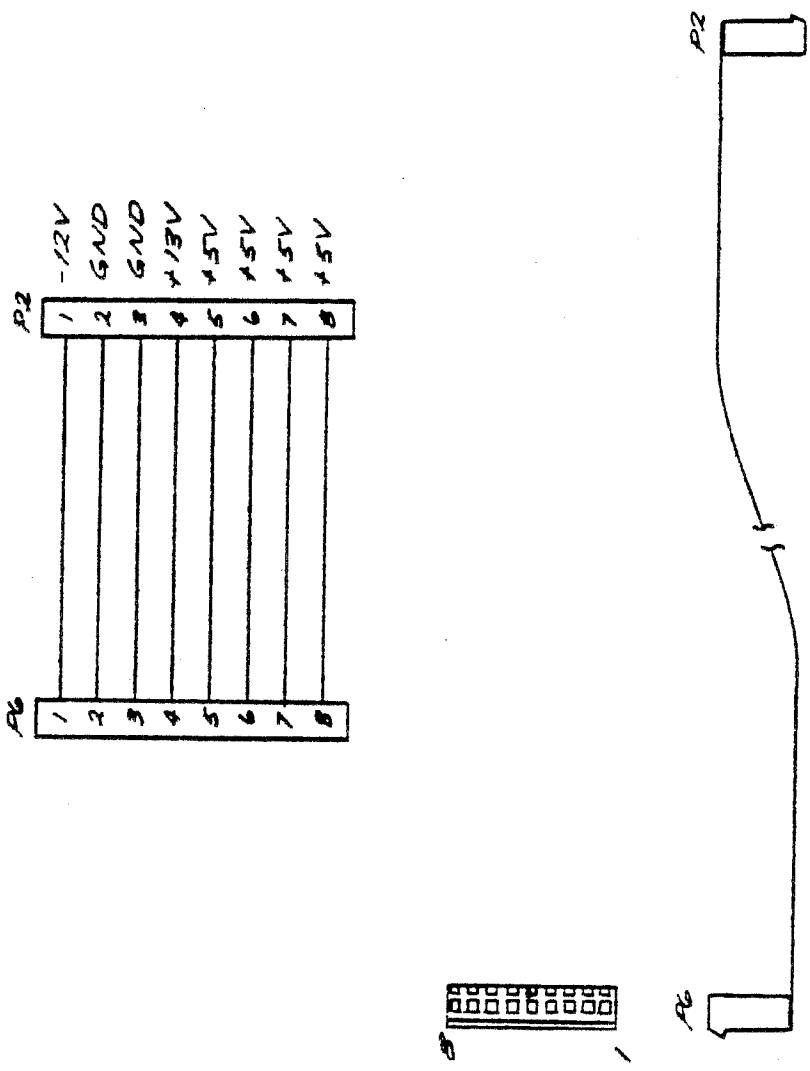
Keyboard Schematic
(112-1956)
6-2



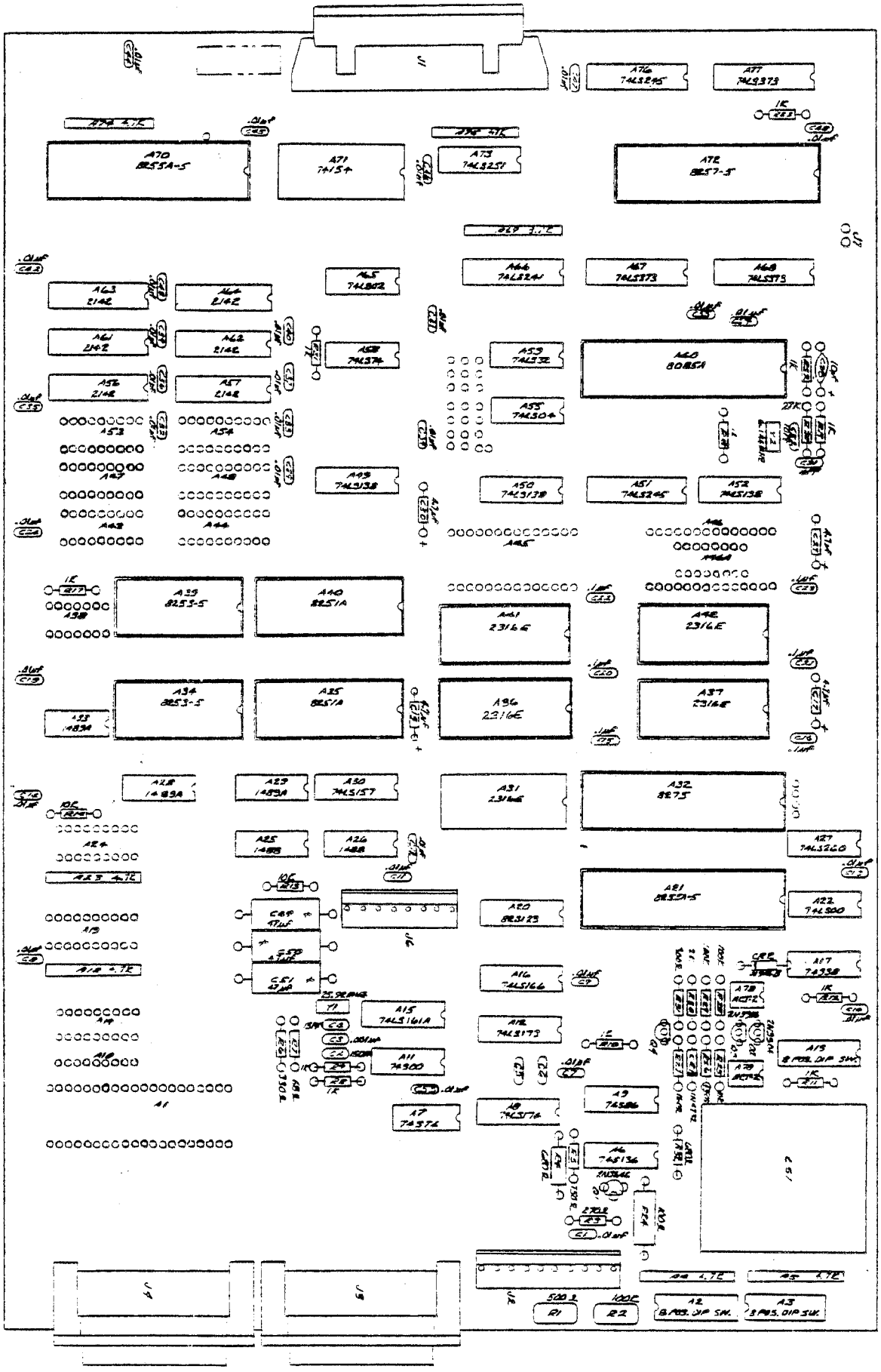
Power Supply (Assembly)



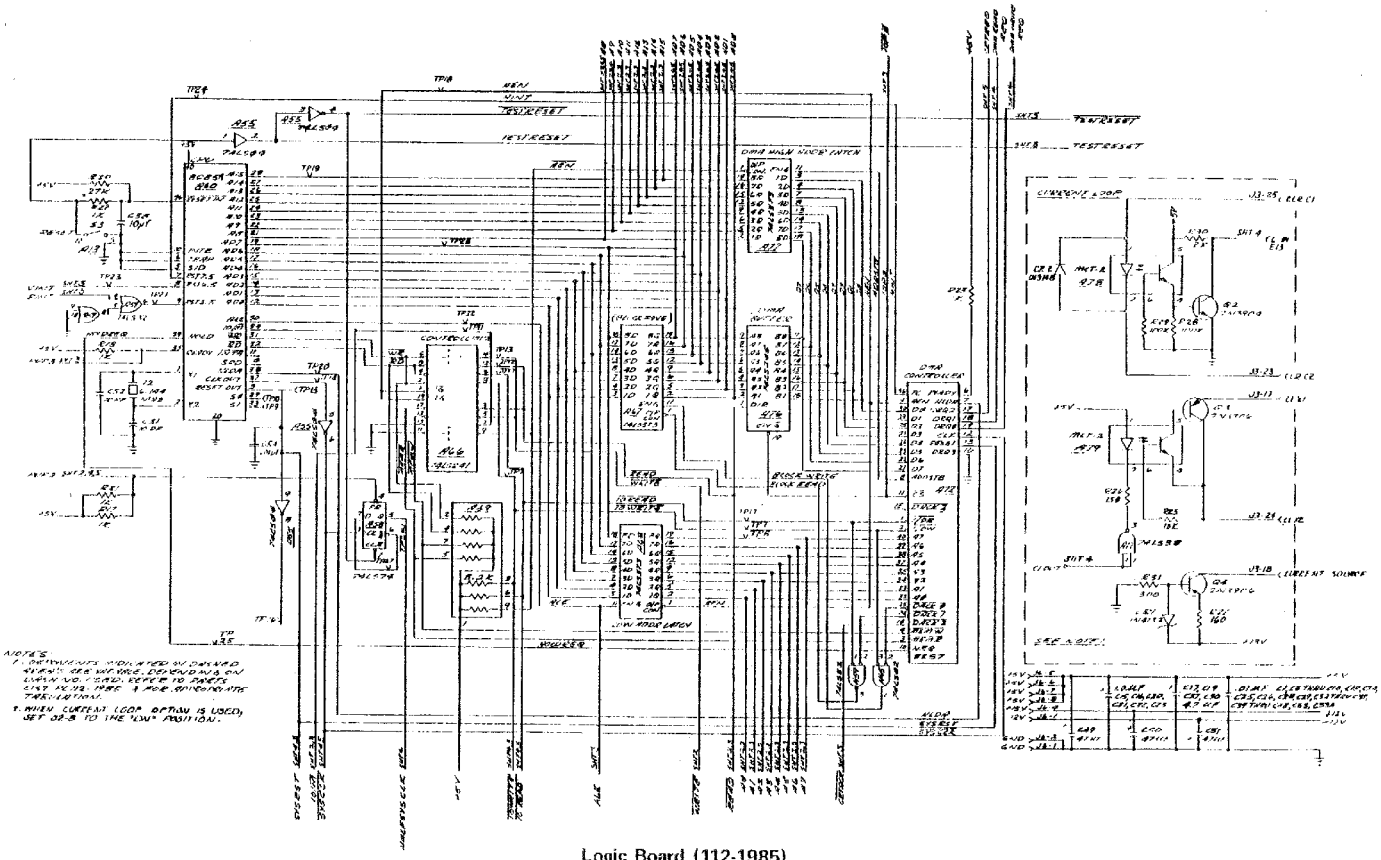
Power Supply
(703-0682-0001)



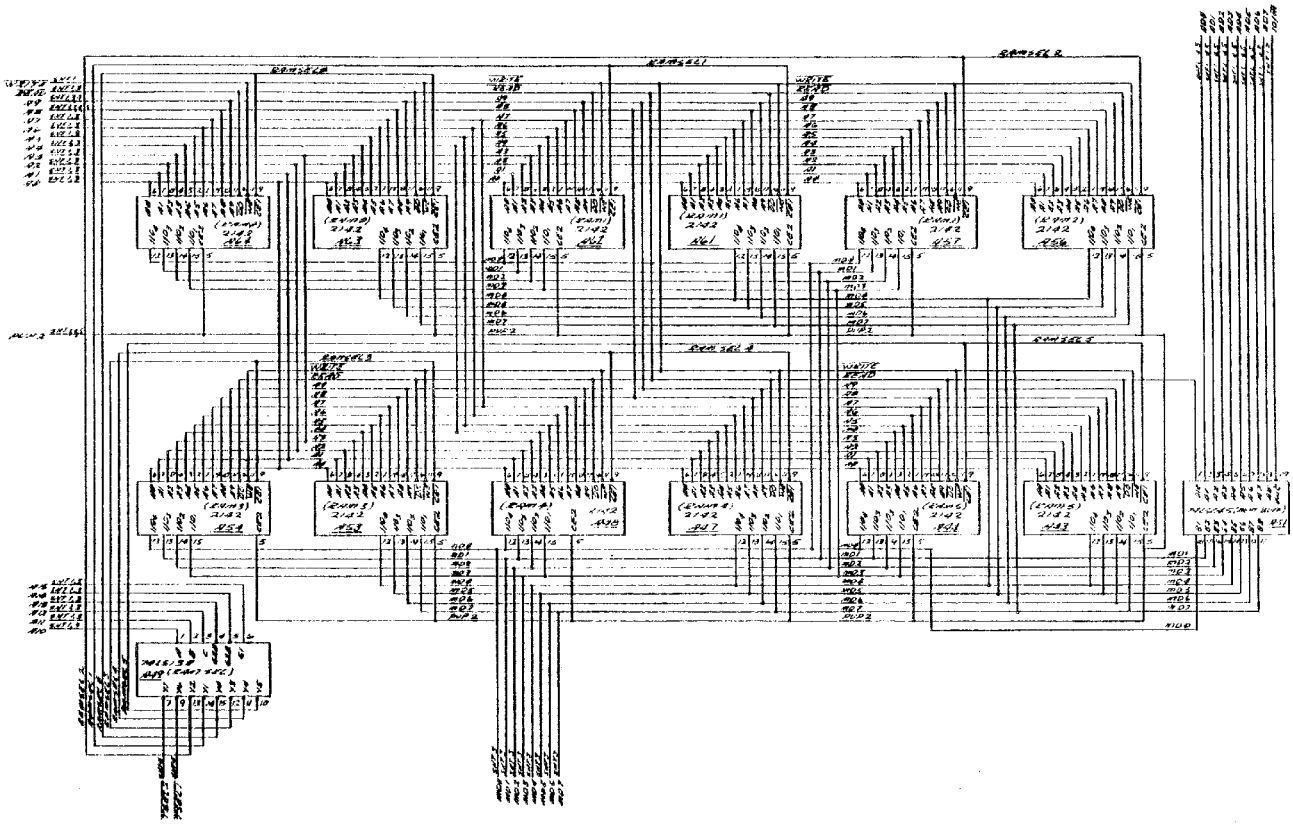
Power Supply Cable
(112-2006-0000)



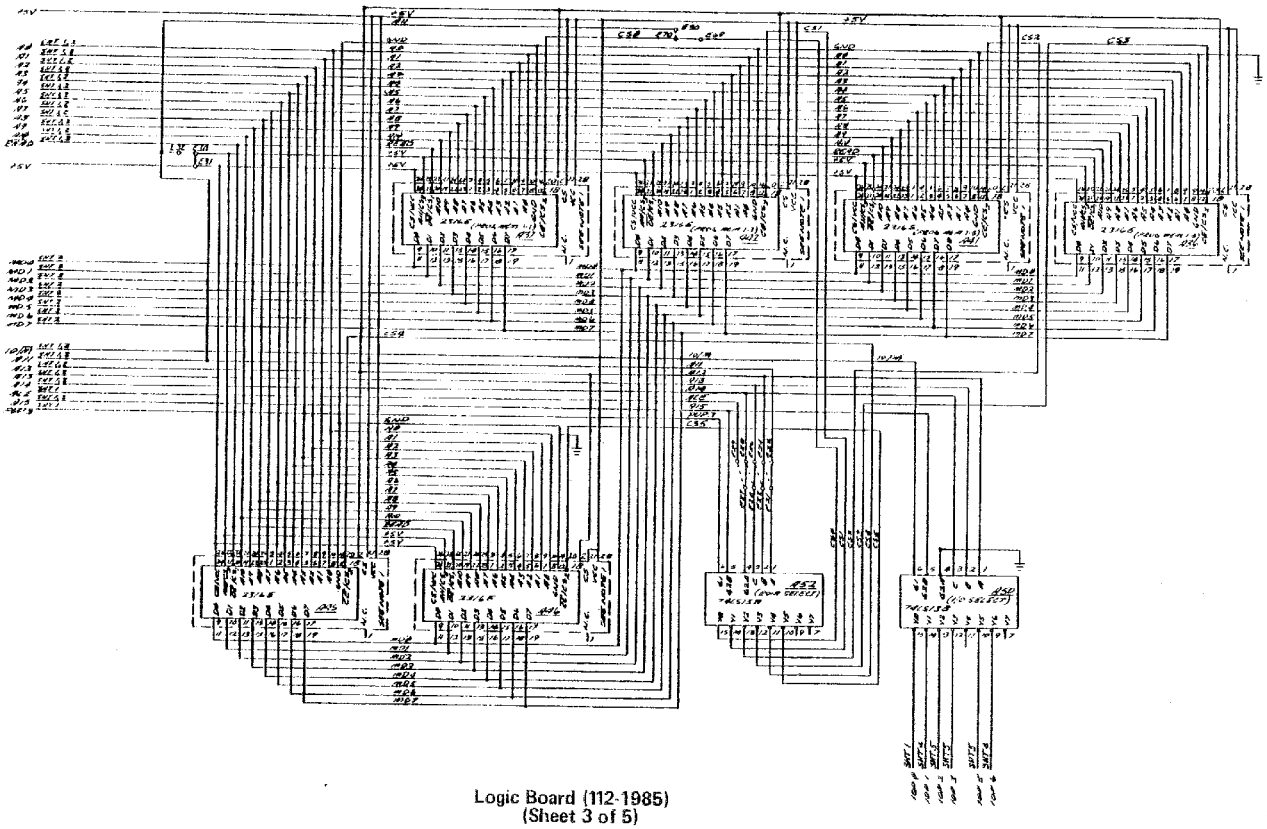
Logic Board (Assembly) (112-1985)



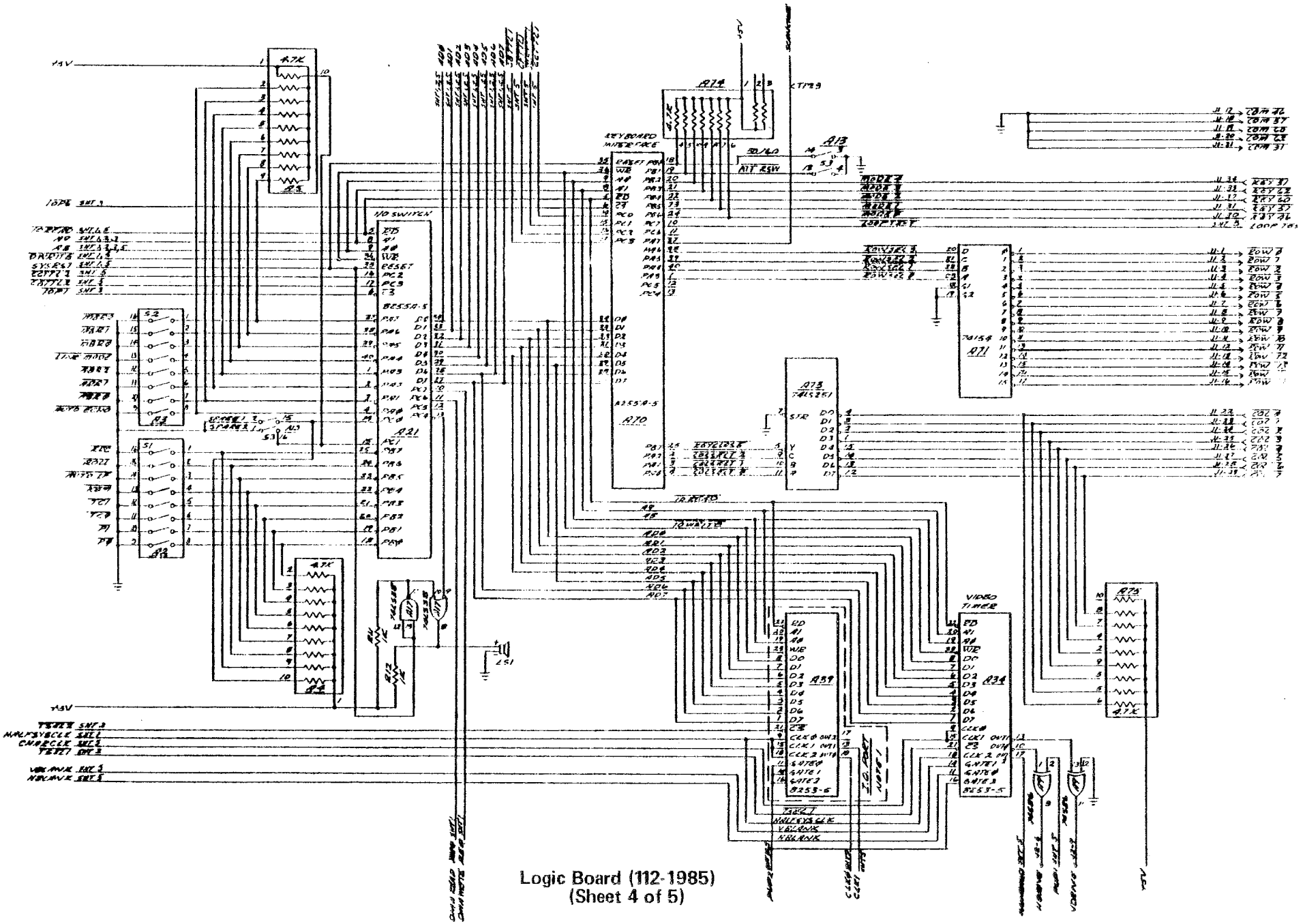
Logic Board (112-1985)
(Sheet 1 of 5)



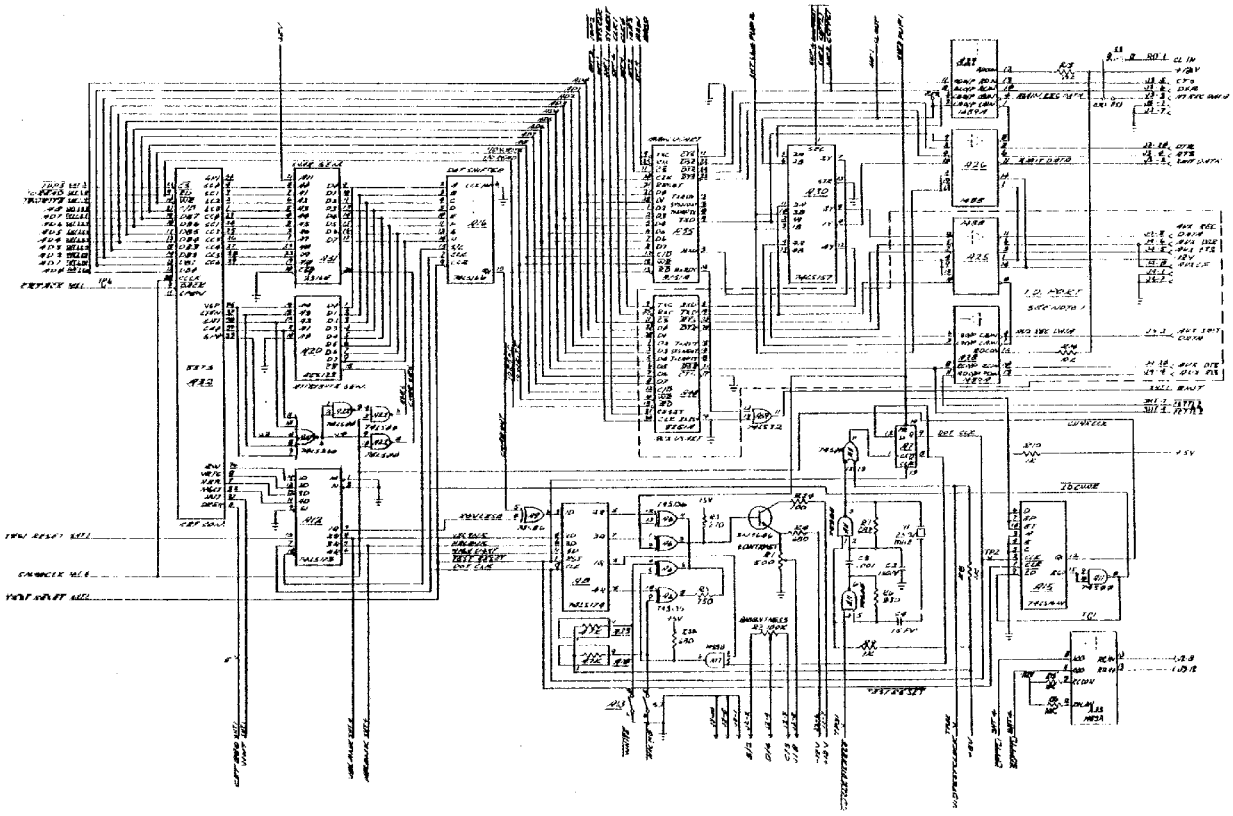
Logic Board (112-1985)
(Sheet 2 of 5)



Logic Board (112-1985)
(Sheet 3 of 5)



Logic Board (112-1985)
(Sheet 4 of 5)



Logic Board (112-1985)
(Sheet 5 of 5)

APPENDIX B

MONITORS

SECTION I

BALL BROTHERS TV-120 MONITOR

1.1 GENERAL DESCRIPTION

The TV-120 monitor is a raster scan display designed specifically for data terminals. It is designed for high quality display of alphanumeric dot characters.

The data monitor accepts video, horizontal drive and vertical drive as separate TTL level signals, eliminating stripping circuits in the data display unit as well as mixing circuits in the external logic interface.

The 100% solid state silicon circuitry of the PWA provides cool operation and high reliability. The electronic package has been miniaturized for compatibility with small volume requirements.

1.2 THEORY OF OPERATION

1.2.1 Video Amplifier

The video amplifier consists of Q101 and its associated circuitry. The incoming video signal is applied to the monitor through J101-8 and R101 to the base of Q101.

Transistor Q101 has a nominal gain of 15 and operates as a class B amplifier. Q101 remains cut off until a DC-coupled, positive-going signal arrives at its base and turns it on. R103 provides series feedback which makes the terminal-to-terminal voltage gain relatively independent of transistor parameters and temperature variations. R102 and C101 provide emitter peaking to extend the bandwidth to 12MHz.

The negative-going signal at the collector of Q101 is direct-coupled to the CRT cathode. The class B biasing of Q101 allows a large video output signal to modulate the CRT's cathode and results in a maximum available contrast ratio.

The overall brightness at the screen of the CRT is also determined by the negative potential at its grid which is varied by the brightness control.

1.2.2 Vertical Deflection

Q102 is a thyristor used as programmable unijunction and together with its external circuitry forms a relaxation oscillator operating at a vertical rate. The sawtooth forming network consists of A101, C103 and C104. These capacitors charge exponentially until the voltage at the anode of Q102 exceeds its gate voltage, at which time Q102 becomes essentially a closed switch, allowing a rapid discharge through L101. The rate of charge or frequency is adjustable by A101. The oscillator is synchronized by a negative pulse coupled to its gate from the vertical drive pulse applied externally at J101-9.

A divider network internal to A101 sets the free-running frequency by establishing a reference voltage at the gate. This programs the firing of Q102 and amounts to resistive selection of the intrinsic standoff ratio. The frequency is controlled by passive components only. CR101 provides temperature com-

pensation for Q102 while controlling the gate impedance to allow easy turn on and off of Q102. L101 forms a tuned circuit with C103 and C104 during conduction of Q102 which provides a stable control on the dropout time of Q102 to assist in maintaining interlace. Q103 collector-to-base forward diode clamping action prevents the voltage from swinging too far negative during this flywheel action.

The sawtooth at the anode of Q102 is direct-coupled to the base of Q103. This stage functions as a Darlington pair emitter follower driver for the output stage Q104. It presents an extremely high impedance in shunt with A101 and prevents the beta-dependent input impedance of Q104 from affecting the frequency of the sawtooth-forming network.

Linearity control of the sawtooth is accomplished by coupling the output at Q103 emitter resistively back into the junction of C103 and C104. This provides integration of the sawtooth and inserts a parabolic component. The slope change rate of the sawtooth at Q103 output is controlled by the setting of A102. The output at Q103 is coupled into a resistive divider.

Height control R110 varies the amplitude of the sawtooth voltage applied to the base of Q104 and controls the vertical raster size on the CRT. C105 is used to limit the amplitude of the flyback pulse at Q104 collector.

The vertical output stage Q104 uses an NPN power transistor operating as a class AB amplifier. The output is capacitively coupled to the yoke. L1 provides a DC connection to B+ for Q104; it has a high impedance compared to the yoke inductance which causes most of the sawtooth current of Q104 to appear in the yoke. R114 prevents oscillations by providing damping across the vertical yoke coils.

1.2.3 Low Level Horizontal Deflection Stages

The purpose of Q105 and Q106 is basically to process the incoming horizontal drive signal into a form suitable to drive the output stage Q108. The duty cycle of Q108 becomes essentially independent of the amplitude and pulse width of the drive pulse. This is a necessary condition to assure stability and reliability in the output stage. In addition, these stages provide a horizontal video centering adjustment by delaying retrace with respect to the horizontal drive pulse. See Figure 1-1.

The drive pulse is presented to Q105 via J101-6. The base circuit of Q105 includes a clamp and a differentiator which makes Q105 output insensitive to drive pulse amplitude and width changes. The only requirement is that pulse amplitude be of 2.5V minimum and pulse width should be 10-40μs. Q105 together with Q106 functions as a monostable multivibrator with Q107 being a slave that provides a positive feedback. Specifically, when Q105 is turned on by the drive pulse, it discharges C112 at a rate determined by the setting of A103. When C112 is discharged to 2.75V, Q106 turns off. This change of state turns Q107 on and the base drive to Q106 from R128 is shunted through Q107. Q106/Q107 remains in this state for nominally 25μs until C112 recharges through A103 to 8.25V. At this time, Q106 is biased on again by the current through A103. The multivibrator is now in a state that Q106 is on and Q105/Q106 is off. It will remain in this state until the next drive pulse occurs or power is turned off. C112 is the only timing capacitor in the circuit and has two time constants associated with it. Primarily, the charge path between pin 1 and pin 3 of A103 determines the on time of Q107 while the discharge path through the video centering control and Q105 determines the delay between application of the drive pulse and start of retrace (turn on of Q107).

1.2.4 High Level Horizontal Deflection Stages

These stages consist of Q107 driving the output stage, Q108 and its associated circuitry through T101. Q107 is an inverting slave of Q106 and is driven alternately into saturation and cutoff as are all stages in the horizontal circuit. Q107 output is transformer-coupled to the output stage with phasing of T101 chosen such that Q108 turns off when Q107 turns on. This allows Q108 to turn off quickly, thus minimizing dissipation. A careful review will show that Q108 turns off at a variable delay time after receipt of the drive pulse. This action causes retrace to begin.

During conduction of the driver transistor, energy is stored in the coupling transformer. The polarity at the secondary is then phased to keep Q108 cut off. As soon as the primary current of T101 is interrupted due to the base signal driving Q107 into cutoff, the secondary voltage changes polarity. Q108 now saturates due to the forward base current flow. This gradually decreases at a rate determined by the transformer inductance and circuit resistance. However, the base current is sufficient to keep Q108 in saturation until the next polarity change of T101.

The horizontal output stage has two main functions: 1) to supply the deflection coil with the correct horizontal scanning currents; 2) to develop high voltage for the CRT anode and DC voltage for the CRT bias, focus and accelerating grids as well as the DC voltage for the video output stage.

Q108 acts as a switch which is turned on or off by the rectangular waveform on the base. When it is turned on, the supply votage plus the charge on C123 causes deflection current to increase in a linear manner and moves the beam from near the center of the screen to the right side. At this time, the transistor is turned off by a polarity change of T101 which causes the output circuit to oscillate. A high reactive voltage in the form of a half cycle negative voltage pulse is developed by the deflection coil inductance and the primary of T2. The peak magnetic energy which was stored in the deflection coil during scan time is not transferred to C122 and the deflection coil distributed capacity. During this cycle, the beam is returned to the center of the screen.

The charged capacitances now discharge into the deflection coil and induce a current in a direction opposite to the current of the previous part of the cycle. The magnetic field thus created around the coil moves the scanning beam to the left of the screen.

After slightly less than half a cycle, the decreasing voltage across C122 biases the damper diode CR111 into conduction and prevents the flyback pulse from further oscillation. The magnetic energy that was stored in the deflection coil from the discharge of the distributed capacity is now released to provide sweep for the left half of scan and to charge C123 through the rectifying action of the damper diode. The beam is now at the center of the screen. The cycle will repeat as soon as the base of Q108 becomes positive with respect to its emitter.

C123 serves to block DC current from the deflection coil and to provide "S" shaping of the current waveform. "S" shaping compensates for stretching at the left and right sides of the picture tube because the curvature of the CRT face and the deflected beam do not follow the same arc.

L103 is an adjustable width control placed in a series with the horizontal deflection coils. The variable inductance allows a greater or lesser amount of deflection current to flow through the horizontal yoke and varies the width of the horizontal scan.

Linearity control is provided by modifying the deflection coil voltage. During retrace, an auxiliary winding on the flyback transformer supplies a pulse which charges C119 through rectifier diode CR112 and L102. This voltage is then applied in series with the deflection coil when the damper diode turns on at the start of trace. The voltage is sawtooth shaped and has the effect of decreasing the deflection coil current as a function of the sawtooth shape. This compensates for the stretch normally found on the left side of the screen due to the deflection coil and system RL time constant. Linearity is optimized by adjustment of L102 which acts as an impedance to the pulse from T2.

The negative flyback pulse developed during horizontal retrace time is rectified by CR110 and filtered by C117. This produces approximately −130 VDC which is coupled through the brightness control R117 to G1 of the CRT.

This same pulse is transformer-coupled to the secondary of T2 where it is rectified by CR2, CR113 and CR114 to produce rectified voltage of approximately 12KV, 400V, and 32V, respectively. 12KV is the anode voltage for the CRT, while 32V is used for the video output stage, and the 400V source is used for G2 and G4 voltages for the CRT.

1.3 PRELIMINARY ADJUSTMENTS

1.3.1 Horizontal Adjustments

With a crosshatch signal applied, adjust video centering control A103 to center the video within the raster horizontally. Adjust L102 for best horizontal linearity. Do not adjust L102 core out farther than necessary as this causes excessive power to be consumed.

Adjust L103 for desired width.

1.3.2 Vertical Adjustments

With the crosshatch signal applied, adjust vertical hold control A101 to lock in the picture.

Adjust vertical linearity control A102 for best overall linearity. This control affects the vertical frequency slightly and might require a readjustment of the hold control. Adjust vertical height control R110 for desired height.

1.3.3 Focus Adjustments

Adjust focus control R122 for best overall focus of the picture. Usually, the center and corners of the screen do not focus at the same setting and a compromise must be made.

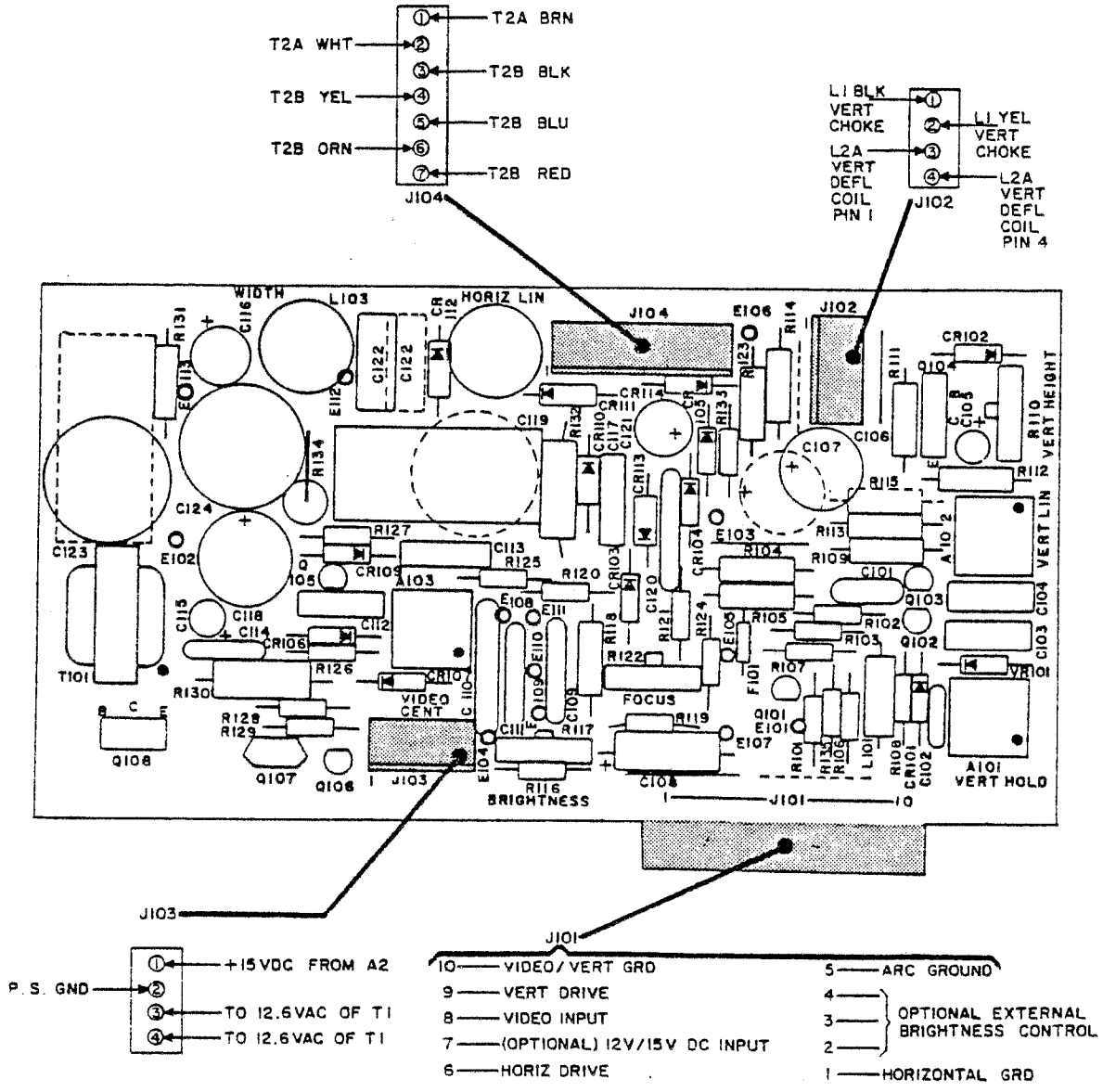
1.3.4 Centering Adjustments

If the raster is not properly centered, it may be repositioned by rotating the ring magnets behind the deflection yoke. The ring magnets should not be used to offset the raster from its nominal center position because this degrades the focus and resolution of the display and may cause neck shadow.

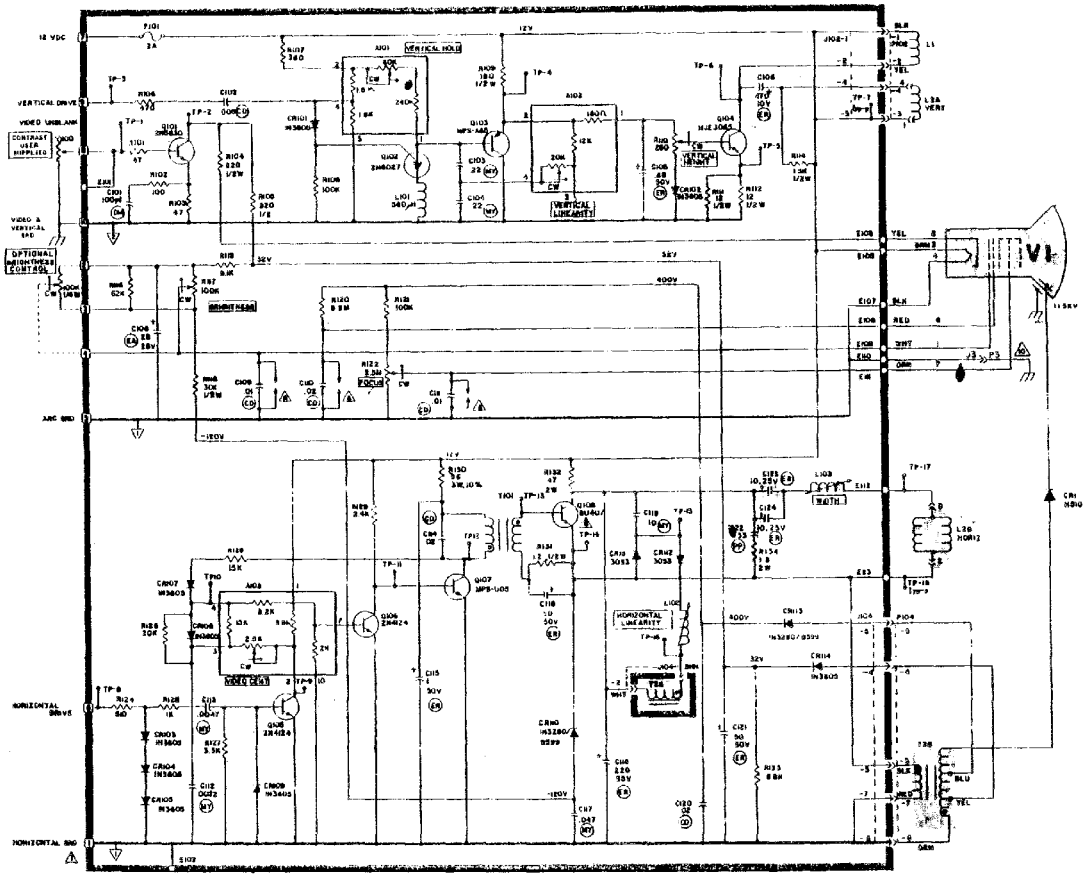
If the picture is tilted, rotate the entire yoke.

1.4 TROUBLESHOOTING GUIDE

	Symptom	Possible Remedy
1.	Screen is dark	Check 12V bus, Q108, Q107, CR2, CR113
2.	Loss of Video	CR114, Q101
3.	Power consumption is too high	Check horizontal drive waveform; adjust horizontal linearity coil; Q107, Q108
4.	Low voltage bus incorrect (for units with a low voltage supply)	A1, A2 **NOTE: Low voltage supply will indicate low or "0" volts if an abnormal load is evident on the 15 volt line.**



Ball TV-120 Monitor Circuit Board



Ball TV-120 Monitor Schematic

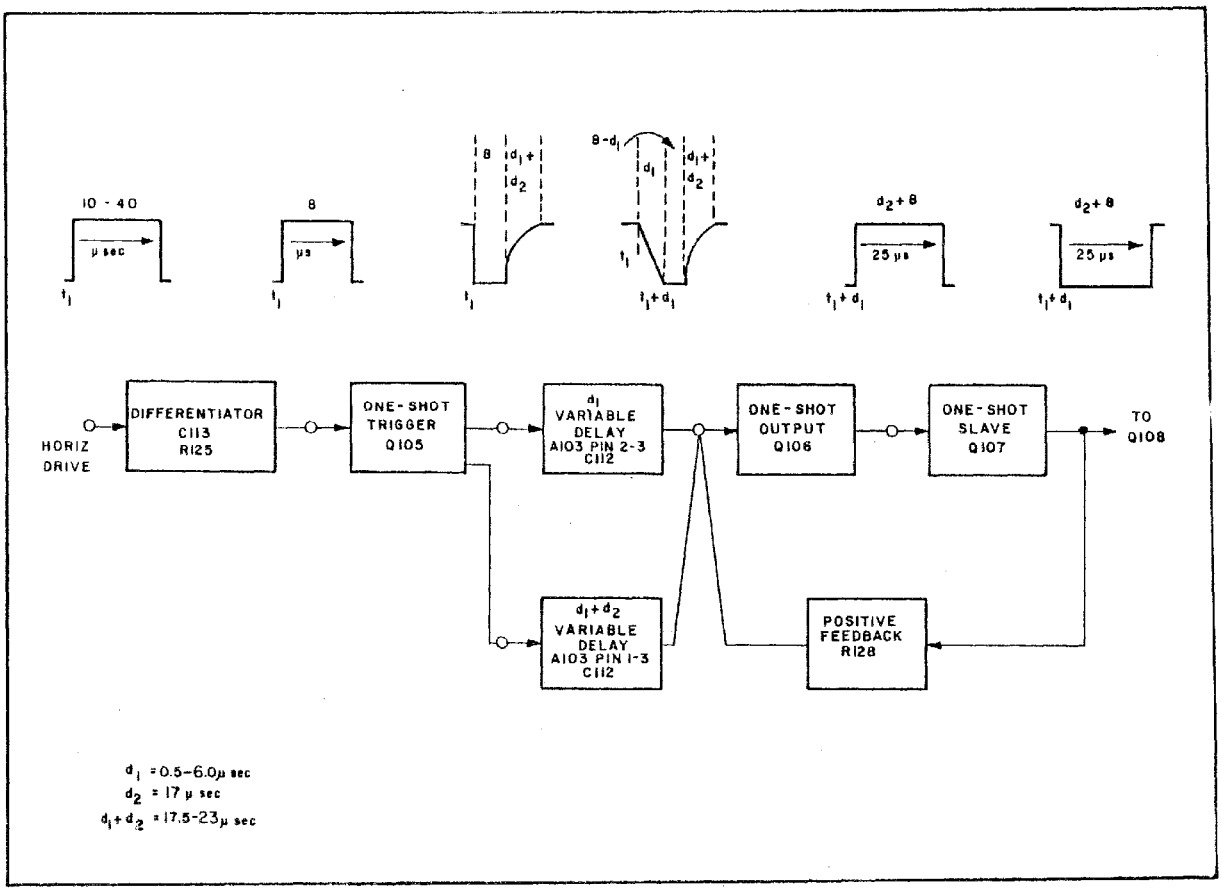


Figure 1-1 Horizontal Drive Processing and Timing Chart

SECTION II

BEEHIVE B-12 MONITOR

2.1 INTRODUCTION

Beehive International's new B-12 is a custom data display monitor specifically designed to legibly display a maximum amount of data on a screen. This monitor is available in a kit version, mounted on a wire frame, or as the display device in Beehive International terminals. It features the latest in solid state technology and design with single board construction.

2.2 OPERATING DATA

This section of the service manual provides information concerning the specifications and operation of the B-12 data display monitor.

2.2.1 General Description

The B-12 is a 12-inch CRT display unit designed for use as an alphanumeric display device in data terminals. The raster-scanned CRT display is built up by generating many lines across the face of the CRT. Typically, the electron beam starts in the upper left hand corner of the display, moving from left to right and from top to bottom to "paint" a series of zigzag lines on the screen. Two independent circuits operating simultaneously control the horizontal and vertical movement of the beam.

As the electron beam moves across the face of the CRT, a third circuit controls the intensity of the beam so that the phosphor can be made to light in any desired pattern from a simple on-off pattern to a complex gray-scale arrangement for black-and-white displays.

When the beam reaches the end of the line, it is brought back to the beginning of the next line faster than it moved to generate the previous line. During this retrace period, the electron beam is shut off (blanked) so the retrace line does not appear.

As the beam is moved horizontally, it is also moved slightly downward. As a result, each successive line starts below the previous line. When the beam reaches the bottom of the screen, it retraces vertically at high speed back to the first line. The network of lines that are traced on the CRT screen is called a raster.

Although most data displays have been standardized at a frequency of 15.75 KHz on the horizontal sweep frequency (63.5 µs/sec) , this can be varied by 10% for most applications. Vertical sweep will usually vary between 45 and 65 Hz, the most common being 60Hz for domestic and 50Hz for European applications. However, in many terminal systems, the power supplies are poorly filtered and shielded, which causes some line-frequency modulation of the raster. Ideally, the sweep rate should be equal to the power line frequency for the best display. If the sweep is not synchronized, the raster will appear to move or "breathe" at the difference of the two frequencies. If the two frequencies are equal, this motion cannot be noticed because a stroboscopic effect freezes the motion.

The internal sweep of the CRT display system is free-running; that is, it is not synchronized to any master timing circuit. However, to obtain a meaningful display, the sweep must be synchronized to an external controller. The controller must generate the horizontal, vertical and video signals to the CRT display and meet the design parameter of the display. (See Timing Charts.)

All input signal connections to the B-12 CRT display will be via a single 10 pin card edge connector and include Video (Data), Horizontal Drive and Vertical Drive .

The input connector should be one of the following:

Viking – 2VK10S/1-2
Amphenol – 225-21031-101
Cinch – 250-10-30-170

or equivalent.

2.2.2 Specifications

1. Video Input: 4.0 V pk. to pk. ±1.5 positive going pulse
2. Video Input Impedance: Greater than 1KΩ
3. Horizontal Drive: $4.0\ V_{pp}$ ±1.5 positive going pulse
   pulse width 25 to 40 usec
   frequency 15.75 KHz ±500 Hz
4. Horizontal Input Impedance: Greater than 4K ohms
5. Vertical Drive: $4.0V_{pp}$ ±1.5 positive going pulse
   pulse width 200 usec to 1.5 msec
   frequency 55Hz ±8 Hz
6. Vertical Input Impedance: Greater than 8 K ohms
7. Signal Level: Low: 0 ± 0.4V
   High: 4 ±1.5V
8. Power Supply: 12V ± 2Vdc @ 1.5 amps
   15Vdc optional
9. Ambient Temperature: 0° to 55° C (operating)
   –30° to 65° C (storage)
10. Humidity: 10 to 90% (non-condensing)
11. CRT: 12-inch, 90° deflection; 20mm neck; P-4
12. X-ray Radiation: Less than 0.5mr/h
13. Weight: 12 lbs or 5.4 kg (without power supply option)
14. Inside Controls: Brightness, Focusing, Video gain
    Vertical size, Horizontal size
    Vertical linearity, Horizontal delay

2.2.3 Characteristics

1. Video Band Width: –30MHz ± 3 dB
2. Rise Time and Fall Time: Video ≈ 35 nsec
   Vertical ≈100 nsec
   Horizontal ≈50 nsec
3. Horizontal Retrace Time: Approximately 9µsec
4. Horizontal Deflection Delay: Approximately 4µsec

5. Vertical Retrace Time: Approximately 200μsec
6. Resolution: Center → 900 @ 40fl
   Corner → 750 @ 40fl
7. Raster Distortion: 2% or less
8. Horizontal Deflection Linearity: ±10% or less
9. Vertical Deflection Linearity: ±10% or less
10. MTBF: Approximately 20,000 hours

2.3 ADJUSTMENT AND ALIGNMENT

To check the raster and correct abnormalities proceed as follows: First, apply horizontal and vertical drive signals to 10-pin edge connector of the circuit board. Next, apply +12Vdc to the 10-pin edge connector. A picture should be obtained in 15 seconds or so. Adjust R13 for desired brightness.

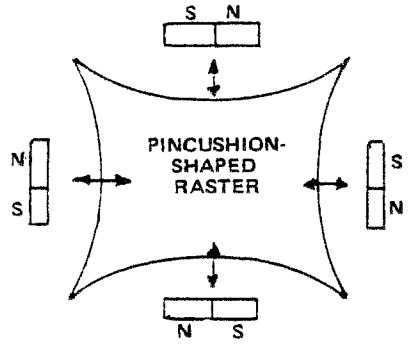
When the horizontal data display size is not as desired or the recommended 8.4 inches, adjust the core of the horizontal size coil L4 to adjust the display width. Also adjust the horizontal delay coil L2 such that the leading edge of the data is within the raster showing no wraparound.

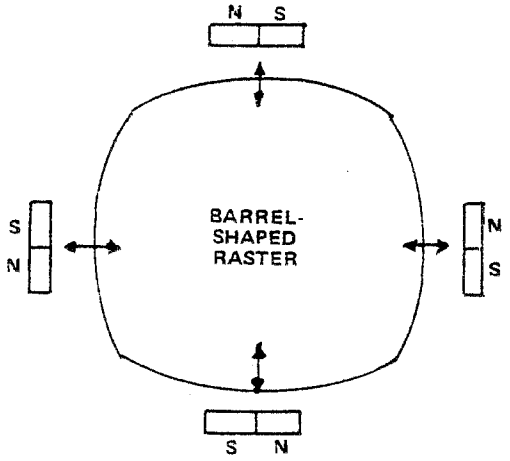
When the vertical size (height) of data is not as desired or the recommended 6.5 inches, adjust the vertical size dot (R37) for the proper size of 6.5 inches.

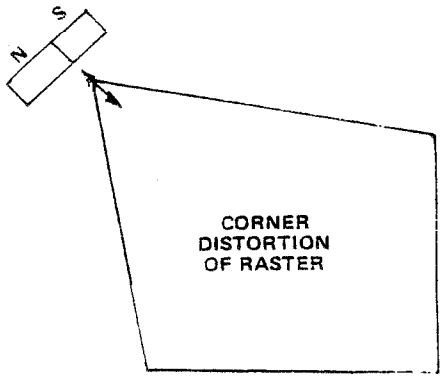
When vertical linearity of data is not good, adjust the vertical linearity pot (R602) such that uniform character height is obtained.

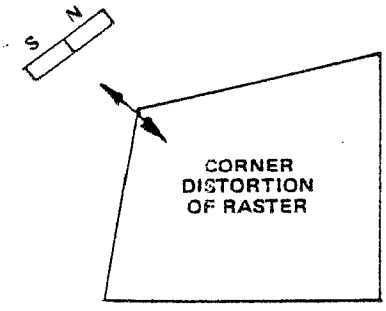
To correct raster deviation or centering, adjust the two centering magnets on the yoke such that the raster is centered within the screen of the CRT. Apply lock paint or RTV to hold the magnets in place.

Raster Distortion can be compensated for by applying small magnets to the deflection yoke as follows:





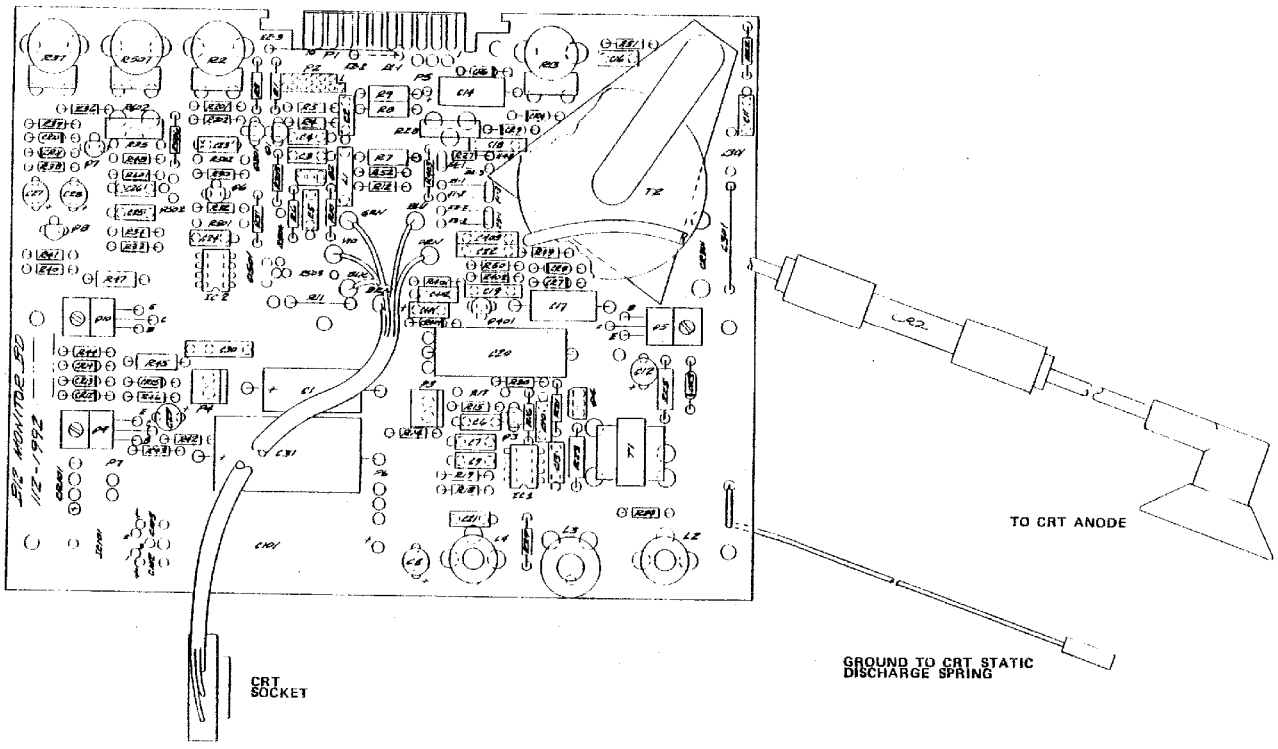




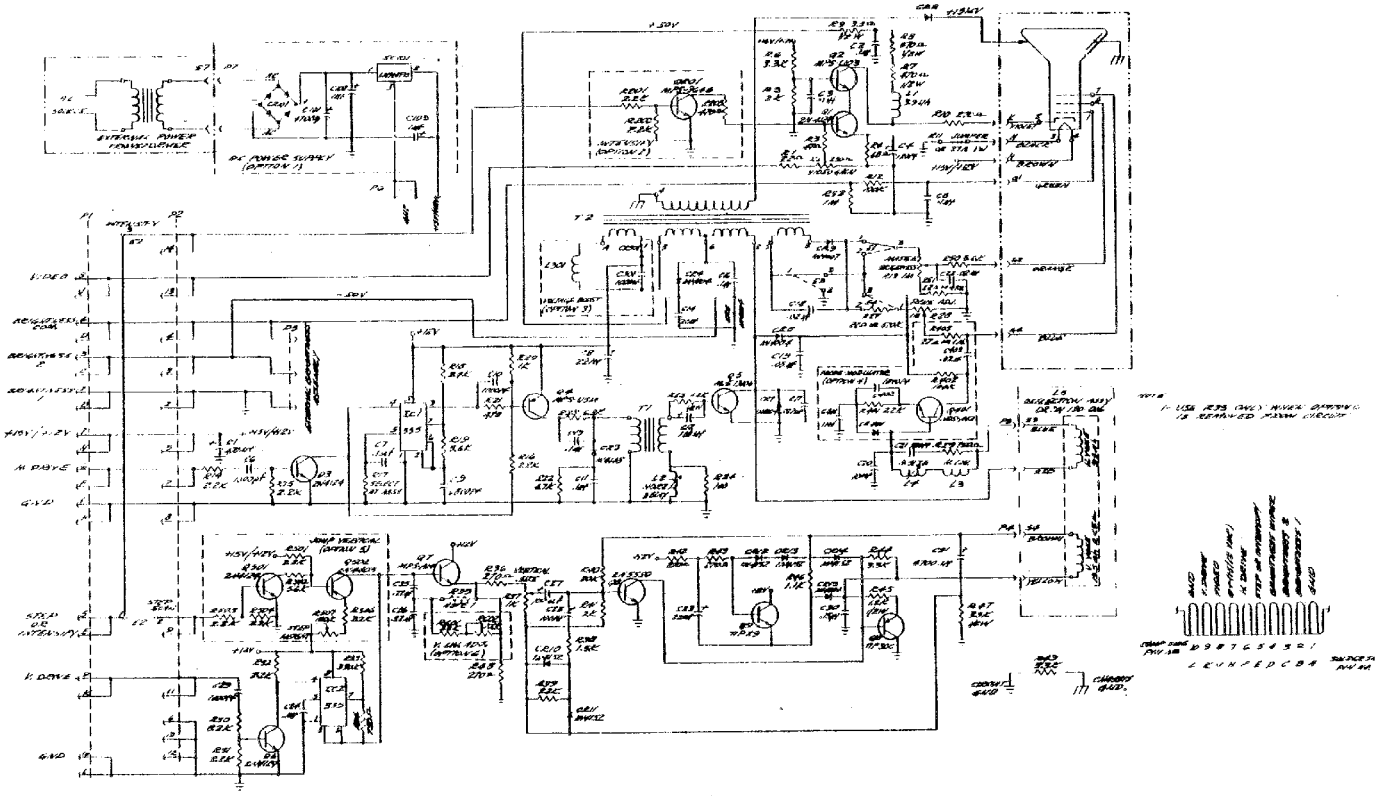
When data is not focused satisfactorily, adjust the focus pot R28 such that the focusing of the entire data screen is at an optimum.

When the characters of data are too light, set the input signal at the proper level and adjust the video gain pot R2 to the desired level.

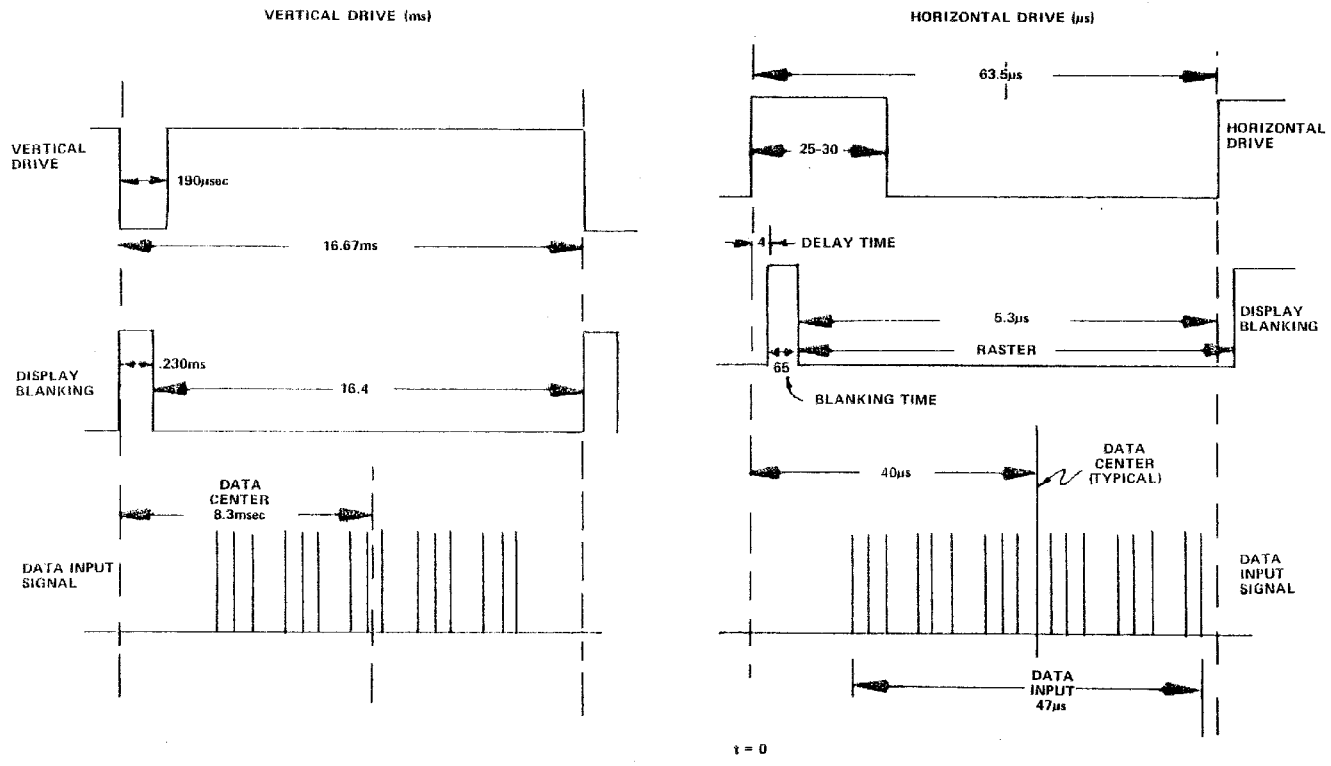
To "center" the operator's brightness control, set it to midrange and adjust the master brightness control R13 to an optimum brightness level.



B-12 Monitor Circuit Board



B-12 Monitor Schematic



TIMING CHARTS (TYPICAL) AT 15.75KHz

PARTS BREAKDOWN MANUAL

MICRO 8 2

OCTOBER 1978

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BEEHIVE INTERNATIONAL

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SECTION I

Micro Bee PARTS INFORMATION

GENERAL INFORMATION

1.1 INTRODUCTION

This Illustrated Parts Breakdown Manual (IPB) contains component-by-component parts information for Micro Bee terminal users.

The Micro Bee terminal was designed around four simple assemblies: the keyboard, the logic board, the power supply, and the monitor. This manual first treats these assemblies as they combine to make a complete Micro Bee (see Table 2-2) and then breaks the four assemblies into individual components (see Tables 3-1, 3-2, 3-3 and 3-4).

1.2 OPTION LIST

The Option List provided gives the user necessary information regarding the specific assembly part numbers and any terminal options (see Table 1-2).

Basically, the option list uses the **terminal serial number** to identify individual terminal characteristics. The serial number is found on the terminal bottom.

1.3 MAJOR ASSEMBLY PARTS LIST

Table 2-2 in Section II breaks the Micro Bee terminal into chassis components and minor assemblies. A variables list is provided at the end of each major assembly list to identify parts that differ per specific terminal serial numbers. All parts relate to a drawing by Item Number.

1.4 TERMINAL ASSEMBLIES

Section III contains parts information for the logic board, the keyboard, monitor assembly, and power supply found in the Micro Bee. All parts relate to a drawing by Item Number or Reference Designator number.

1.5 LIST ORGANIZATION

The columns in the Parts List give the following information:

Column 1 — Gives the item number and is used to identify the parts on the exploded drawings.

Column 2 — Lists a military-type reference designation number that shows the component level in the overall terminal.

Column 3 — Shows the Beehive Part Number.

Column 4 — Shows the quantity or the total number of parts used for each application. The term "A/R" is used to indicate "As Required."

Column 5 — Gives the part description.

At the end of a major Assembly Parts List, all items that are variable in the terminal will be listed under an option number. To find a terminal's particular option number, use the terminal's serial number and refer to the Option List in Section II.

1.6 COMPONENT REFERENCE DESIGNATION

Table 1-1 defines the component reference designation abbreviations. The Reference Designation indicates the position or level of a part or subassembly in relation to the terminal as a whole.

Table 1-1 Reference Designation to Name

A =	Assembly, Subassembly, Integrated Circuit	P =	Connector (male)
B =	Fan	Q =	Transistor
C =	Capacitor	R =	Resistor, Potentiometer
CB =	Circuit Breaker	S =	Switch
CR =	Diode, Diode Bridge	T =	Transformer
E =	Misc. Electrical Part	TB =	Terminal Block, Commoning Block
J =	Connector (female)	W =	Cable Assembly
LS =	Loud Speaker	X =	Socket, Securing Device
MP =	Misc. Mechanical Part	Y =	Crystal
		Z =	Integrated Circuit

1.7 ORDERING PARTS

When it is necessary to order spare or replacement parts from Beehive International, include the parts description, part number, model and serial number from the serial number plate (located on the bottom of the terminal), and, if applicable, the part reference description number. Orders for parts should be sent to:

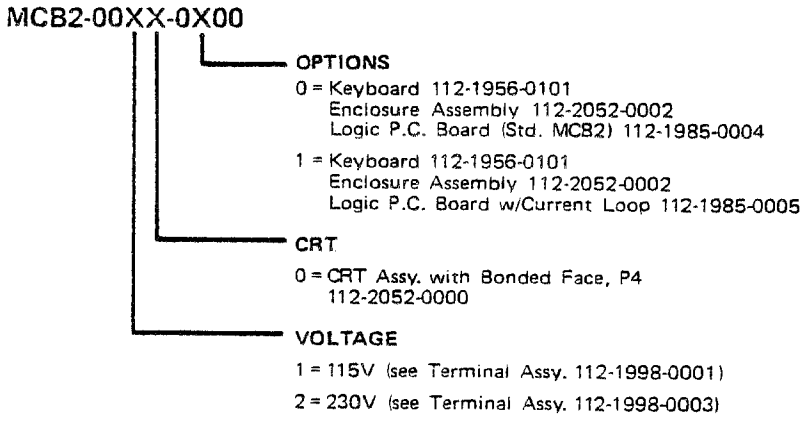
Beehive International
4910 Amelia Earhart Drive
Post Office Box 25668
Salt Lake City, Utah 84125

For emergency service, contact Field Engineering

Telephone (801) 364-4606
(801) 355-6000

TWX 910-925-5271

Table 1-2 Micro Bee OPTION LIST



SECTION II

MAJOR ASSEMBLIES
PARTS LIST

Table 2-1 Main Assembly (Rev. E)

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	DESCRIPTION
1	1	See Serial No.		Micro Bee Terminal, complete
2	1A1	112-2013-0100	1	Enclosure
3	1A1MP1	See Option List Figure 2-1	1	Cutout, Keyboard
4		701-0501-0001	4	Nut tinnerman—C22144-017
5		112-1054-0001	1	Nameplate
6		701-0016-0SS6	6	Washer, finish, #6
7		701-0034-0045	6	Screw, oval, #8-32 x .5 lg
8	1A2	112-1998-*	-	Terminal assembly, complete w/o case
9	1A2A1MP1	112-1811-0000	1	Chassis
10	1A2A1MP2	112-1989-0000	1	Support Bracket
11		701-0008-0045	2	Screw, PH, 8-32 x .5 lg
12		701-0006-0008	2	Washer, starlock #8
13	1A2A1B1	610-0210-8270	1	Fan
14		610-0211-6143	1	Guard, fan
15		701-0008-0030	4	Screw, PH, 6-32 x .5 lg
16		701-0004-0006	4	Washer, lock, #6
17		701-0003-0006	4	Washer, flat, #6
18		701-0001-0006	4	Nut, #6-32
19	1A2A1W1	Variable (See list at end of table)	1	Cord, power
20		703-0350-0019	1	Strain relief
21	1A2A1F1	611-1109-0001	1	Fuse Holder
22		Variable (See list at end of table)	1	Fuse, slo blo
23	1A2A1W2	112-2031-0000	1	Cable, Switch-to-Fuse
24	1A2A1S1	607-0453-12WB	1	Switch, Power
25		Variable (See list at end of table)	1	Terminal, 250 Faston
26	1A2A1W3	112-2032-0000	1	Cable, to Terminal Block
27	1A2A1SB1 & SB2	Variable (see list at end of table)		Shield
28	1A2A1L1	Variable (see list at end of table)		Line Filter
29	1A2A1W6	Variable (see list at end of table)		Cable, fuse to line filter
30	1A2A1W7	Variable (see list at end of table)		Cable, filter to ground
31	1A2A1W8	Variable (see list at end end of table)		Cable, filter to terminal block
32		704-0160-T002	1	Terminal Ring
33	1A2A1MP3	703-0067-0001	3	Bracket
34		701-0008-0045	3	Screw, PH, 8-32 x .5 lg
35		701-0003-0008	3	Washer, flat #8

* Part number not complete without the dash number. See the Variables List, page 2-4, for these variations.

(continued)

Table 2-1 Main Assembly (Rev. E)

(continued)

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	DESCRIPTION
36	1A2A1T1	610-0482-0000	1	Transformer, PS
37		703-0136-0000	4	Spacer
38		701-0008-0055	4	Screw, PH, 8-32 x 2.5 lg
39		701-0004-0008	4	Washer, lock, #8
40		701-0003-0008	4	Washer, flat, #8
41	1A2A1TB1	606-2019-7101	1	Commoning Block
42		701-0008-0017	2	Screw, PH, 4-40 x .5 lg
43		701-0004-0004	2	Washer, lock, #4
44		701-0003-0004	2	Washer, flat, #4
45		606-2019-1461	2	Polarizing Key
46		Variable (See list at end of table)	7	Terminal
47		112-2056-0000	2	Grounding Cable
48		701-0001-0006	3	Nut, #6-32
49		703-0058-0F6G	4	Foot
50		701-0008-0030	4	Screw, PH, 6-32 x .5 lg
51		112-2044-0000	2	Bracket
52		701-0415-0045	2	Screw, self tap
53	1A2A2	See Figure 2-1, Option List		CRT Assembly (see Section IV for a complete parts breakdown)
54		701-0008-0045	2	Screw, PH, 8-32 x .5 lg
55		112-2054-0000	2	Clamp Tube
56		701-0008-0045	2	Screw, PH, 8-32 x .5 lg
57		701-0004-0008	2	Washer, lock, #8
58		701-0003-0008	2	Washer, flat, #8
59		703-0057-S324	1	Clip, Tube
60		701-0008-0045	2	Screw, PH, 8-32 x .5 lg
61		701-0004-0008	2	Washer, lock, #8
62		701-0003-0008	2	Washer, flat, #8
63	1A2A2W5	112-2003-0000	1	Monitor Cable
64	1A2A3	See Option List Figure 2-1		Keyboard
65		703-0135-0000	4	Standoff
66		701-0039-30C1	8	Washer, flat
67		701-0004-0006	8	Washer, lock, #6
68		701-0008-0028	8	Screw, PH, 6-32 x .37 lg
69	1A2A4			Power Supply (see Section IV for a complete parts breakdown)
70		703-0682-0001	1	Power Supply P.C. Board
71		703-0605-4125	2	Guide
72		703-0066-7500	2	Bracket
73		701-0008-0017	2	Screw, PH, 4-40 x .5 lg
74		701-0004-0004	2	Washer, lock, #4
75		701-0003-0004	2	Washer, flat, #4
76		112-2055-0000	1	Washer, tab
77		701-0008-0030	1	Screw, RH, 6-32 x .5 lg
78		701-0004-0006	1	Washer, lock, #6
79		701-0003-0006	1	Washer, flat, #6

(continued)

Table 2-1 Main Assembly (Rev. E)

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	DESCRIPTION
80	1A2A4W4	112-2006-0000	1	Cable, P.S.
81	1A2A5	See Option List Figure 2-1	1	Logic Board (see Section IV for a complete parts list)
82		701-0008-0028	3	Screw, PH, 6-32 x .37 lg
83		701-0004-0006	3	Washer, #6
84		701-0001-0006	3	Nut, #6-32
85		703-0129-BS4N	5	Board Clip
		Variables List		
1	1	112-1998-0002	-	Micro B 2, 115 V
19	1A2W1	601-0606-2103	1	Power Cord
22		611-0001-0001	1	Fuse, Slo Blo
25		704-0169-9778	1	Terminal, .250 Faston
46		606-2019-0002	7	Terminal
1	1	112-1998-0003	1	Micro B 2, 230 V
19	1A2W1	601-0607-2108	1	Power Cord
22		611-0001-0600	1	Fuse, Slo Blo
28	1A2L1	610-0007-0000	1	Line Filter
27	1A2SB1	112-2060-0000	1	Shield - 3-sided
27	1A2SB2	112-2066-0000	1	Transformer Shield
25		704-0169-9778	2	Terminal, .250 Faston
31	1A2W8	112-2032-0001	1	Cable, Line Filter to Terminal Block
29	1A2W6	112-2031-0001	1	Cable, Fuse to Line Filter
30	1A2W7	112-2067-0000	1	Cable, Fuse to Ground
46		606-2019-0002	6	Terminal

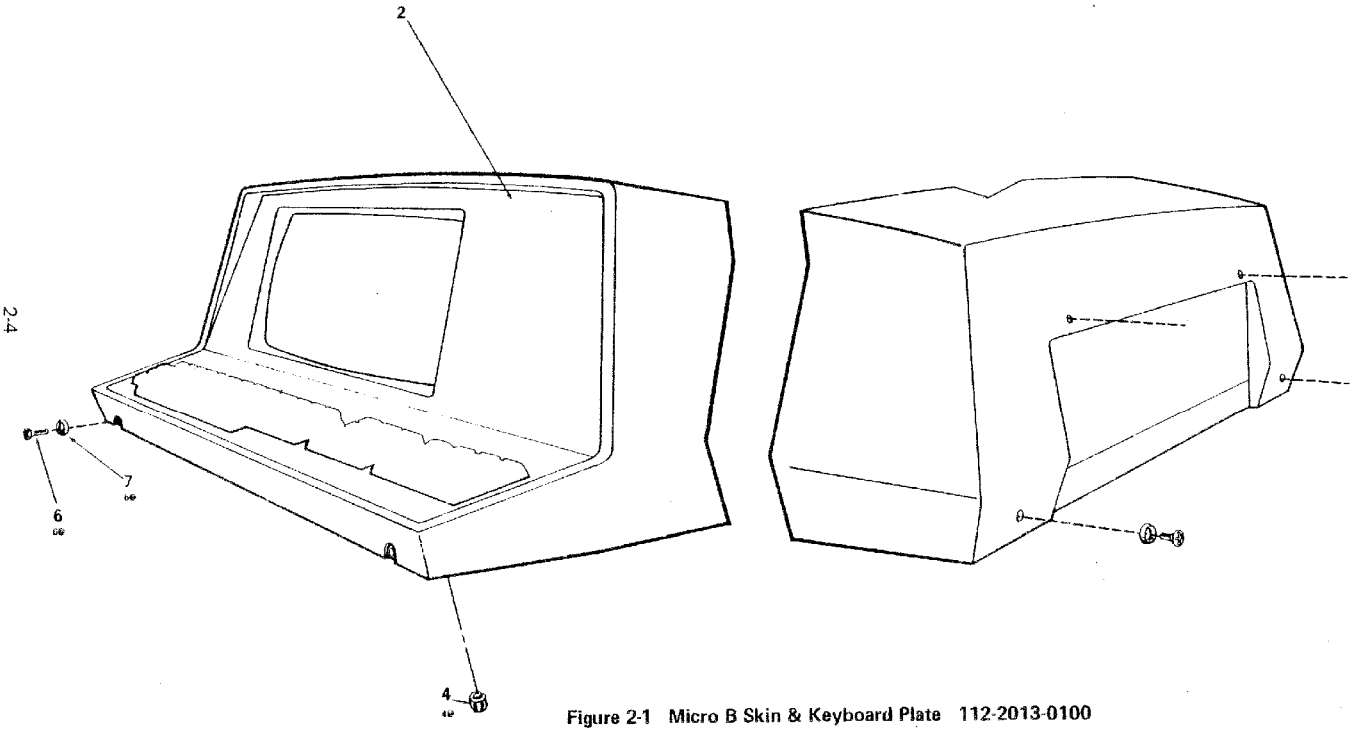


Figure 2-1 Micro B Skin & Keyboard Plate 112-2013-0100

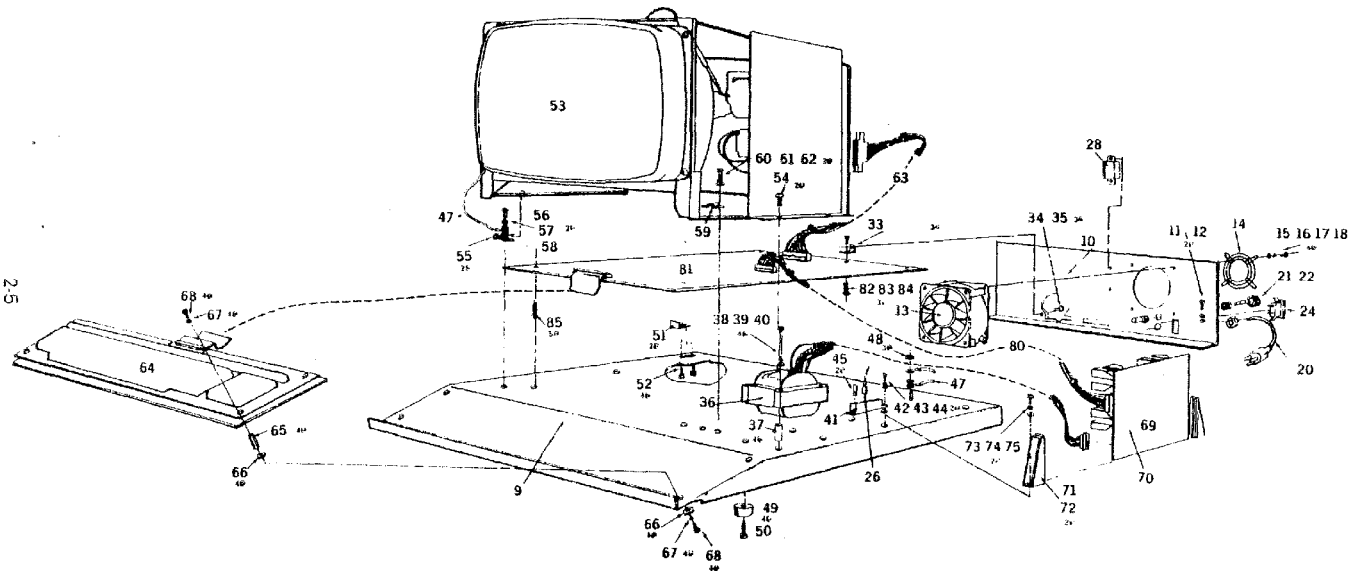


Figure 2-2 Terminal Assembly (Rev. E) 112-1998- *

SECTION III

SUBASSEMBLIES
PARTS LIST

Table 3-1 Logic Board Subassembly (Rev. F) 112-1985-*

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	DESCRIPTION
1	1A2A5--	112-1985-* (*see Figure 1-2 for appropriate dash number)		Logic Board
		Integrated Circuits		
2	1A2A5A6	604-74SO-0136	1	I.C. 74S136
3	A7	604-74SO-0074	1	I.C. 74S74
4	A8	604-74AS-0174	1	I.C. 74LS174
5	A9	604-74SO-0086	1	I.C. 74S86
6	A11	604-74SO-0000	1	I.C. 74SO0
7	A12	604-74AS-0173	1	I.C. 74LS173
8	A15	604-74AS-0161	1	I.C. 74LS161A
9	A16	604-74AS-0166	1	I.C. 74LS166
10	A17	604-74SO-0038	1	I.C. 74S38
11	A20	604-82SO-0123	1	I.C. 82S123
12	A21	604-82NW-0055	1	I.C. 8255A-5
13	A22	604-74AO-0000	1	I.C. 74LS00
14	A25	604-140E-0088	1	I.C. 1428
15	A26	604-140E-0088	1	I.C. 1488
16	A27	604-74AO-0260	1	I.C. 74LS260
17	A28	604-140E-089A	1	I.C. 1485A
18	A29	604-140E-089A	1	I.C. 1489A
19	A30	604-74AS-0157	1	I.C. 74LS157
20	A31	604-V00U-0001	1	I.C. 2316E Char. Gen.
21	A32	604-82NW-0075	1	I.C. 8275
22	A33	604-140E-089A	1	I.C. 1489A
23	A34	604-82MU-0053	1	I.C. 8253-5 Timer
24	A35	604-82NV-0051	1	I.C. 8251A USART
25	A36	604-V00U-0014	1	I.C. 2316E Prog Mem 1-4
26	A37	604-V00U-0011	1	I.C. 2316E Prog Mem 1-1
27	A39	604-82MU-0053	1	I.C. 8253-5
28	A40	604-82NV-0051	1	I.C. 8251A
29	A41	604-V00U-0013	1	I.C. 2316E Prog Mem 1-3
30	A42	604-V00U-0012	1	I.C. 2316E Prog Mem 1-2
31	A49	604-74AS-0138	1	I.C. 74LS138
32	A50	604-74AS-0138	1	I.C. 74LS138
33	A51	604-74A2-0245	1	I.C. 74LS245
34	A52	604-74AS-0138	1	I.C. 74LS138
35	A53	604-RAM2-2142	1	I.C. 2142 RAM Mem
36	A54	604-RAM2-2142	1	I.C. 2142 RAM Mem
37	A55	604-74AO-0004	1	I.C. 74LS04
38	A56	604-RAM2-2142	1	I.C. 2142 RAM
39	A57	604-RAM2-2142	1	I.C. 2142 RAM
40	A58	604-74AO-0074	1	I.C. 74LS74

(continued)

Table 3-1 Logic Board Subassembly (Rev. F) 112-1985-*

(continued)

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	DESCRIPTION
41	A59	604-74AO-0032	1	I.C. 74LS32
42	A60	604-80MW-8085	1	I.C. 8085A CPU
43	A61	604-RAM2-2142	1	I.C. 2142 RAM
44	A62	604-RAM2-2142	1	I.C. 2142 RAM
45	A63	604-RAM2-2142	1	I.C. 2142 RAM
46	1A2A5A64	604-RAM2-2142	1	I.C. 2142 RAM
47	A65	604-74AO 0002	1	I.C. 74LS02
48	A66	604-74A2-0241	1	I.C. 74LS241
49	A67	604-74A2 0373	1	I.C. 74LS373
50	A68	604-74A2 0373	1	I.C. 74LS373
51	A70	604-82NW 0055	1	I.C. 8255A-5
52	A71	604-74OU-0154	1	I.C. 74154
53	A72	604-82NW-0057	1	I.C. 8257-5
54	A73	604-74AS-0251	1	I.C. 74LS251
55	A76	604-74A2 0245	1	I.C. 74LS245
56	A77	604-74A2-0373	1	I.C. 74LS373
57	A78	604-T00C 0002	1	I.C. MCT-2
58	A79	604-T00C-0002	1	I.C. MCT-2
		Resistors		
59	R1	601-1030-0501	1	Pot, 500Ω, ½w
60	R2	601-1030-0104	1	Pot, 100K, ½w
61	R3	6RC-07GF-0271	1	270Ω, ¼w, 5%
62	R4	6RC-20GF-0681	1	680Ω, ½w, 5%
63	R5	6RC-07GF-0751	1	750Ω, ¼w, 5%
64	R6	6RC-07GF-0331	1	330Ω, ¼w, 5%
66	R8	6RC-07GF-0102	1	1K, ¼w, 5%
67	R9	6RC-07GF-0102	1	1K, ¼w, 5%
68	R10	6RC-07GF-0102	1	1K,¼w, 5%
69	R11	6RC-07GF-0102	1	1K, ¼w, 5%
70	R12	6RC-07GF-0102	1	1K, ¼w, 5%
71	R13	6RC-07GF-0103	1	10K, ¼w, 5%
72	R14	6RC-07GF-0103	1	10K, ¼w, 5%
73	R15	6RC-07GF-0103	1	10K, ¼w, 5%
74	R16	6RC-07GF-0103	1	10K, ¼w, 5%
75	R17	6RC-07GF-0102	1	1K, ¼w, 5%
76	R18	6RC-07GF-0102	1	1K, ¼w, 5%
77	R19	6RC-07GF-0102	1	1K, ¼w, 5%
78	R20	6RC-07GF-0153	1	15K, ¼w, 5%
79	R21	6RC-07GF-0102	1	1K, ¼w, 5%
80	R22	6RC-07GF-0102	1	1K, ¼w, 5%
81	R23	6RC-07GF-0102	1	1K, ¼w, 5%
82	R24	6RC-42GF-0101	1	100Ω, 2 w
83	R25	6RC-07GF-0103	1	10K, ¼w, 5%
84	R26	6RC-07GF-0151	1	150Ω, ¼w, 5%
85	R27	6RC-07GF-0161	1	160Ω, ¼w, 5%
86	R28	6RC-07GF-0104	1	100K, ¼w, 5%
87	R29	6RC-07GF-0104	1	100K, ¼w, 5%
88	R30	6RC-07GF-0202	1	2K, ¼w, 5%

(continued)

Table 3-1 Logic Board Subassembly (Rev. F) 112-1985-*

(continued)

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	DESCRIPTION
89	R31	6RC-07GF-0301	1	300Ω, ¼w, 5%
90	R32	6RC-07GF-0681	1	680Ω, ¼w, 5%
91	A4	601-AO03 -0472	1	SIP, 4.7K (10 pin)
92	A5	601-AO03-0472	1	SIP, 4.7K (10 pin)
93	A18	601-AO03-0472	1	SIP, 4.7K (10 pin)
94	A23	601-AO03-0472	1	SIP, 4.7K (10 pin)
95	A74	601-AO03-0472	1	SIP, 4.7K (10 pin)
96	A75	601-AO03-0472	1	SIP, 4.7K (10 pin)
97	1A2A5A69	601-AO03-0822	1	SIP, 8.2K (10 pin)
		Capacitors		
98	C1	620-KIDO-103M	1	.01mf, cerm, radial
99	C2	620-UB00-151M	1	150 pf, cerm, radial
100	C3	610-KIDO-102M	1	.0001 mf, cerm, radial
101	C4	620-KIDO-150M	1	15 pf, cerm, radial
102	C5	620-KIDO-103M	1	.01 mf, cerm, radial
103	C6	same	1	same
104	C7	same	1	same
105	C8	same	1	same
106	C9	same	1	same
107	C10	same	1	same
108	C11	same	1	same
109	C12	same	1	same
110	C13	same	1	same
111	C14	same	1	same
112	C15	620-KIDO-104P	1	.1 mf, cerm, radial
113	C16	same	1	same
114	C17	624-CA00-475K	1	4.7 mf, electrolytic, axial
115	C18	620-KIDO-103M	1	.01 mf, cerm, radial
116	C19	624-CA00-475K	1	4.7 mf, electrolytic, axial
117	C20	620-KIDO-104P	1	.1 mf, cerm, radial
118	C21	same	1	same
119	C22	same	1	same
120	C23	same	1	same
121	C24	620-KIDO-103M	1	.01 mf, cerm, radial
122	C27	624-CA00-475K	1	4.7 mf, electrolytic, axial
123	C28			
124	C29	620-KIDO-103M	1	.01 mf, cerm, radial
125	C30	624-CA00-475K	1	4.7 mf, electrolytic, axial
126	C31	620-UB00-100M	1	10 pf, cerm, radial
127	C32	620-KIDO-103M	1	.01 mf, cerm, radial
128	C33	same	1	same
129	C34	same	1	same
130	C35	same	1	same
131	C36	same	1	same
132	C37	same	1	same
133	C38	624-JA00-105K	1	1.0 mf, electrolytic, axial
134	C39	620-KIDO-103M	1	.01 mf, cerm, radial
135	C40	same	1	same

(continued)

Table 3-1 Logic Board Subassembly

(continued)

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	DESCRIPTION
136	C41	same	1	same
137	C42	same	1	same
138	C43	same	1	same
139	C44	same	1	same
140	C45	same	1	same
141	C46	same	1	same
142	C47	same	1	same
143	C48	same	1	same
144	C49	624-GR00-476K	1	47 mf, electrolytic, axial
145	C50	same	1	same
146	C51	same	1	same
147	1A2A5C52	620-UB00-100M	1	10pf, cerm, radial
148	C53	620-KIDO-103M	1	.01 mf, cerm, radial
149	C54	same	1	same
		Transistors/Diodes/Crystals		
150	Q1	603-739N-3646	1	Transistor, 2N3646
151	Q2	603-T92N-3904	1	Transistor, 2N3904
152	Q3	603-T92P-3906	1	Transistor, 2N3906
153	Q4	603-T92P-3906	1	Transistor, 2N3906
154	CR1	603-D410-4732	1	Diode, I N4732
155	CR2	603-D078-0914	1	Diode, IN914B
156	Y1	603-3003-2592	1	Crystal, 6.144 MHz
157	Y2	603-3003-6144	1	Crystal, 25.92 MHz
		Miscellaneous		
158	J2	606-0081-1001	1	10 pin molex conn
159	A13	607-0500-0005	1	8 pos Dip Switch (top)
160	A2	607-0501-0005	1	8 pos Dip Switch (side)
161	A3	same	1	same
162	XA34	606-1106-0019	1	I.C. Socket 24 pin
163	XA37	same	1	same
164	XA42	same	1	same
165	XA41	same	1	same
166	XA35	606-1106-NR21	1	I.C. Socket, 28 pin
167	XA21	606-1106-0025	1	I.C. Socket, 40 pin
168	XA32	same	1	same
169	XA60	same	1	same
170	XA70	same	1	same
171	XA72	same	1	same
172	XA39	606-1106-0019	1	I.C. Socket, 24 pin
173	XA36	606-1106-0019	1	I.C. Socket, 24 pin
174	XA40	606-1106-NR21	1	I.C. Socket, 28 pin
175	J1	606-013N-0001	1	Conn, 90° Header
176	XA45	606-1106-0019	1	I.C. Socket, 24 pin
177	J3	606-0027-25DS	1	Conn, EIA, 25 pin

(continued)

Table 3-1 Logic Board Subassembly (Rev. F) 112-1985-*

(concluded)

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	DESCRIPTION
178	J4	606-0027-25DS	1	Conn, EIA, 25 pin
179	J6	606-0081-0881	1	Conn, 8 pin
180		606-9203-0000	A/R	Screw lock assembly
181		112-1986-0000	1	PC Board
182	LSI	612-0001-0001	1	Audio indicator

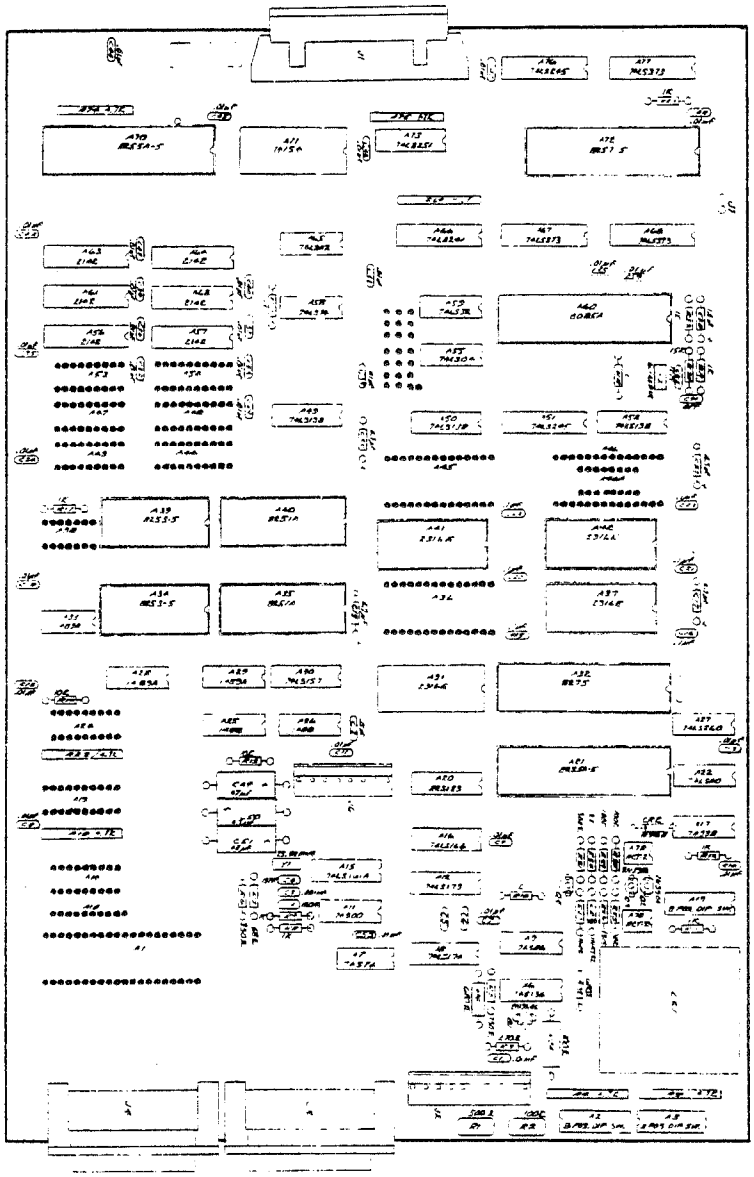


Figure 3-1 Micro Bee Logic Board Component Layout Rev. F

Table 3-2 Ball TV120 Monitor Subassembly

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	DESCRIPTION
		Miscellaneous		
1	F101	1-028-0247	1	Fuse 2A, 125V, PICO
2	J102	1-039-0146	1	Connector, 4 pin, male
3	J103	--		Not used
4	J104	1-039-0145	1	Connector, 7 pin, male
5	P3	1-034-0323	1	Connector, 1 pin, female
6	J3	1-034-0300	1	Connector, 1 pin, male
7	L1	6-003-0572	1	Coil, vertical choke
8	L2	1-023-0239	1	Coil, deflection, TV120
9	L101	1-016-0302	1	Coil, 560µh
10	L102	1-016-0328	1	Linearity Coil
11	L103	1-016-0323	1	Width Coil
12	T2	6-003-0586	1	Transformer, high voltage, TVX120
13	T101	1-017-5402	1	Transformer, horiz driver
14	--	1-022-0427	1	CRT Socket
		Transistor/Diode		
15	Q101	1-015-1172	1	2N5830
16	Q102	1-015-1157	1	2N6027
17	Q103	1-015-1186	1	MPS-A65
18	Q104	1-015-1156	1	MJE3055
19	Q105	1-015-1139	1	2N4124
20	Q106	1-015-1139	1	2N4124
21	Q107	1-015-1159	1	MPS-U05
22	Q108	1-015-1210	1	BU407
23	CR1	1-021-0424	1	H510
24	CR101	1-021-0410	1	IN3605
25	CR102	1-021-0410	1	IN3605
26	CR103	1-021-0410	1	IN3605
27	CR104	1-021-0410	1	IN3605
28	CR105	1-021-0410	1	IN3605
29	CR106	1-021-0410	1	IN3605
30	CR107	1-021-0410	1	IN3605
31	CR109	1-021-0410		IN3605
32	CR110	1-021-0403	1	IN3280/B599
33	CR111	1-021-0458	1	30S3
34	CR112	1-021-0458	1	30S3
35	CR113	1-021-0403	1	IN3280/B599
36	CR114	1-021-0410	1	IN3605
		Capacitor, Fixed, µf UNLESS NOTED		
37	C101	1-012-0300	1	100 pF ±5%, 500V, DM
38	C102	10-12-7508	1	.005 ±20%, 100V, CD
39	C103	1-012-2277	1	.22 ±10%, 100V, MY
40	C104	1-012-2277	1	.22 ±10%, 100V, MY
41	C105	1-012-2264	1	.68; 50V, E
42	C106	1-012-2158	1	470; 10V, E

(continued)

Table 3-2 Ball TV120 Monitor Subassembly

(continued)

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	DESCRIPTION
43	C107	–	-	Not used
44	C108	1-012-1380	1	25; 25V, E
45	C109	1-012-2214	1	.01 ±20%; 1000V, CD
46	C110	1-012-2217	1	.02 ±20%; 1000V, CD
47	C111	1-012-2214	1	.01±20%; 1000V, CD
48	C112	1-012-2254	1	.0022 ±10%; 630V, MY
49	C113	1-012-2279	1	.0047 ±10%; 630V, MY
50	C114	10-12-7209	1	.02± 20%; 100V, CD
51	C115	1-012-2189	1	1; 50V, E
52	C116	1-012-2157	1	50; 50V, E
53	C117	1-012-2240	1	.047 ±10%; 250V, MY
54	C118	1-012-2159	1	220; 25V, E
55	C119	1-012-2255	1	10 ±10%; 100V, MY
56	C120	1-012-0780	1	.02± 20%; 500V, CD
57	C121	1-012-2157	1	50; 50V, E
58	C122	1-012-2298	1	.033 ±10%; 250V, MY
59	C123	1-012-2273	1	10; 25V, E
60	C124	1-012-2273	1	10; 25V, E
		Resistor, Fixed, Carbon, 5%; ¼ w UNLESS NOTED		
61	R101	70-16-0470	1	47
62	R102	70-16-0101	1	100
63	R103	70-16-0470	1	47
64	R104	1-011-2254	1	220; ½w
65	R105	1-011-2268	1	820; ½w
66	R106	70-16-0471	1	470
67	R107	70-16-0361	1	360
68	R108	70-16-0104	1	100K
69	R109	1-011-2252	1	180
70	R110	70-89-0251	1	VAR; 250 ±20%; CO VERT HGT
71	R111	1-011-2224	1	12; ½w
72	R112	1-011-2224	1	12; ½w
73	R114	1-011-2274	1	1.5K; ½w
74	R116	70-16-0623	1	62K
75	R117	1-011-5435	1	VAR; 100K ±20%; CO BRT ADJ
76	R118	1-011-2305	1	30K; ½w
77	R119	70-16-0912	1	9.1K
78	R120	70-16-0825	1	8.2M
79	R121	70-16-0104	1	100K
80	R122	1-011-5566	1	VAR; 2.5M ±20%; CO FOC ADJ
81	R124	70-16-0511	1	510
82	R125	70-16-0102	1	1K
83	R126	70-16-0203	1	20K
84	R127	70-16-0332	1	3.3K
85	R128	70-16-0153	1	15K
86	R129	70-16-0242	1	2.4K
87	R130	70-16-2521	1	56 ± 10%; 3w, WW
88	R131	1-011-2520	1	1.2; ½w
89	R132	1-011-	1	.47 ±10%; 2w, WW

(continued)

Table 3-2 Ball TV120 Monitor Subassembly

(concluded)

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	DESCRIPTION
90	R133	70-16-0682	1	6.8K
91	R134	1-011-2417	1	1.8 ±5%; 2W
92	A101	1-011-8006	1	RES TRIM, 60K, VERT HOLD
93	A102	1-011-8005	1	RES TRIM, 20K, VERT LIN
94	A103	1-011-8001	1	RES TRIM, 2.5K, VIDEO CENTER

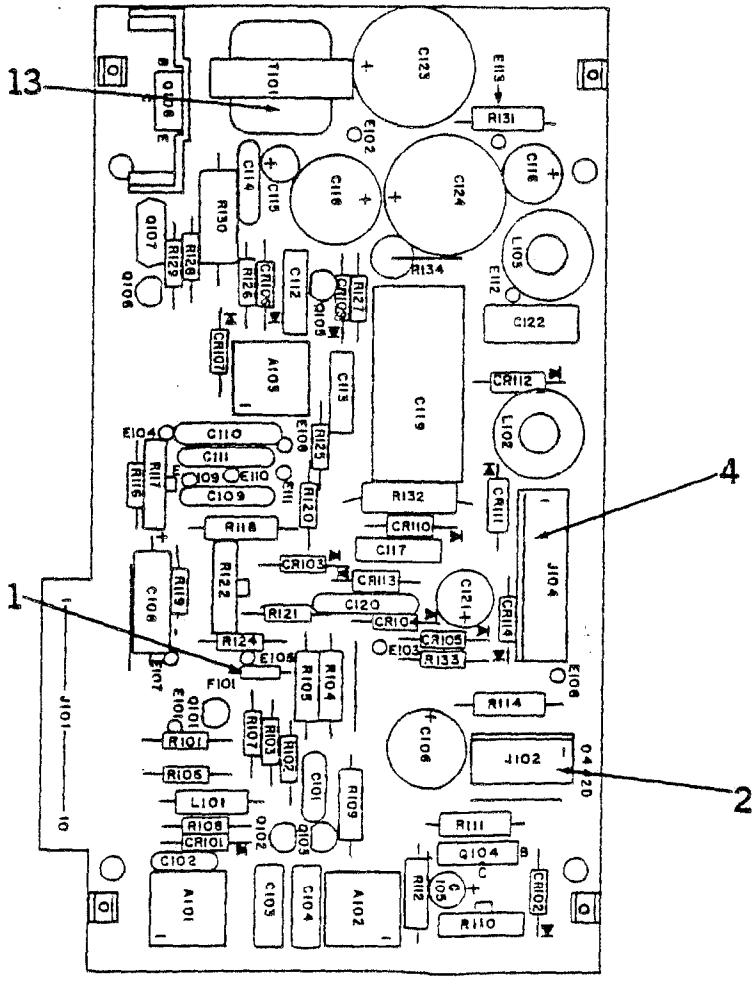


Figure 3-2 TV120 Monitor Board Component Layout

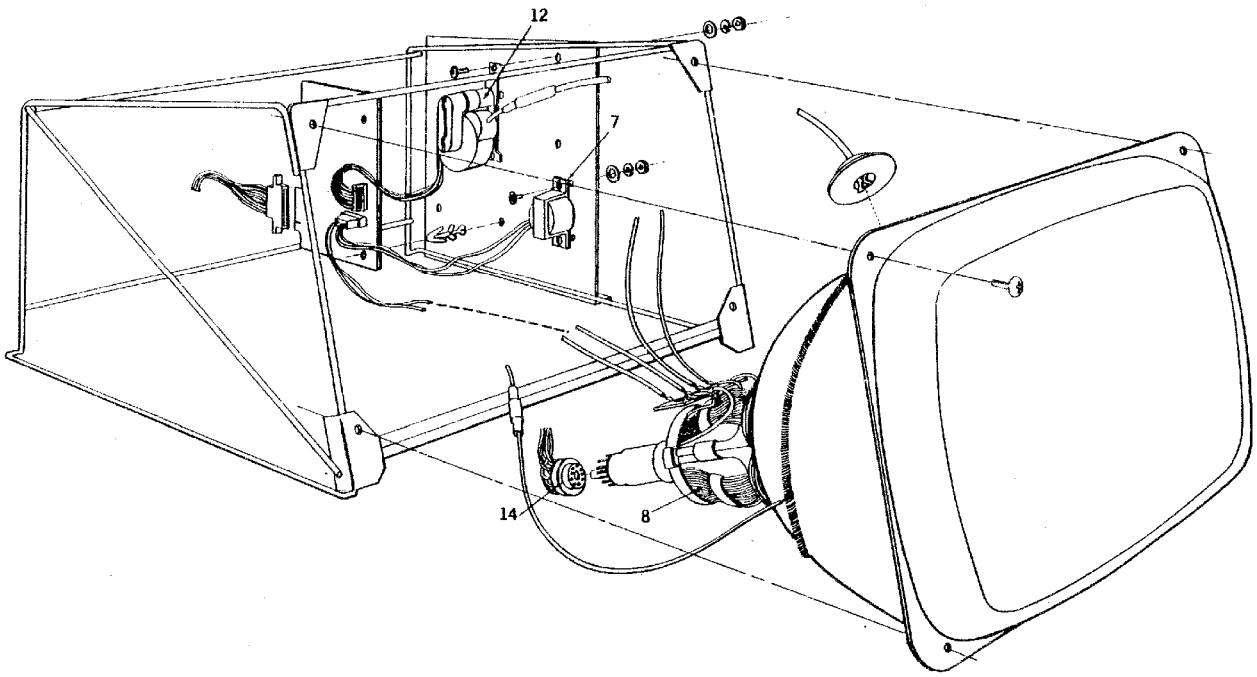


Figure 3-3 Micro B Monitor Assembly

Table 3-3 B12 Monitor Subassembly 112-1992-0000 Rev. E

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	B12 MONITOR DESCRIPTION
		Mechanical Parts		
1		112-1993-0000	1	Circuit Board
2		606-1131-07GR	1	CRT Socket Harness, 7 pin
3		606-0085-002B	1	Male Molex Connector
4		606-2006-2118	1	Molex Pin
5	P3	606-0081-0221	1	Plug, 2 pin
6	P4	606-0081-0221	1	Plug, 2 pin
7	P2-1	606-3029-0107	1	Ribbon Connector, plug, 7 pin
8	P2-2	606-3029-0106	1	Ribbon Connector, plug, 6 pin
9		606-0060-0002	1	Anode Cap Wire & Rect. Cap
10	L1	601-5008-0004	1	Coil, Video Peaking, 3.9µh PFS Type IV
11	L2	601-5008-0001	1	Coil, Horz. Size 3-2a µh
12	L3	601-5008-0001	1	Coil, Horz. Linearity
13	L4	601-5008-0001	1	Coil, Horz. Size 3-2a µh
14	T1	610-0484-0014	1	Transformer, Horz. Drive
15	T2	610-0484-0002	1	Transformer, Horz. Flyback
		Transistors/Diodes		
16	Q1	603-T92N-4124	1	Transistor 2N4124
17	Q2	603-152N-OU03	1	Transistor MPS-U03
18	Q3	603-T92N-4124	1	Transistor 2N4124
19	Q5	603-220N-3006	1	Transistor MJE-13006
20	Q6	603-T92N-4124	1	Transistor 2N4124
21	Q7	603-T92N-OA14	1	Transistor MPS-A 14
22	Q8	603-T92N-5550	1	Transistor 2N5550
23	Q9	603-220N-029C	1	Transistor TIP-29
24	Q10	603-220P-030C	1	Transistor TIP-30C
25	IC1	604-020N-M555	1	Digital Timer NE555
26	IC2	604-020N-M555	1	Digital Timer NE555
27	CR2	603-H617-0020	1	High Voltage Diode H617
28	CR3	603-D035-4148	1	Diode,W4148
29	CR4	602-D041-4114	1	Diode, IN4004
30	CR6	603-D041-4004	1	Diode, IN4004
31	CR7	Same	1	Same
32	CR8	Same	1	Same
33	CR9	603-D041-4007	1	Diode, IN4007
34	CR10	603-D041-4152	1	Diode, IN4152
35	CR11	Same	1	Same
36	CR12	Same	1	Same
37	CR13	Same	1	Same
38	CR14	Same	1	Same
39	CR15	603-D041-4004	1	Diode, IN4004
		Resistors		
40	R1	6RC-07GF-*220	1	22Ω , ¼w, 5%

(continued)

Table 3-3 B12 Monitor Subassembly 112-1992-0000 Rev. E

(continued)

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	B12 MONITOR DESCRIPTION
41	R2	601-1013-U251	1	250 Ω, 1/3w, 30% (variable)
42	R3	6RC-07GF-*470	1	47Ω ¼w, 5%
43	R4	6RC-07GF-*680	1	68Ω, ¼w, 5%
44	R5	6RC-07GF-*202	1	2KΩ, ¼w, 5%
45	R6	6RC-07GF-*332	1	3.3K Ω, ¼w, 5%
46	R7	6RC-20GF-*471	1	470Ω, ½w, 5%
47	R8	6RC-20GF-*471	1	470Ω, ½w, 5%
48	R9	6RC-20GF-*3R3	1	3.3 Ω ½w, 5%
49	R10	6RC-07GF-*271	1	270 Ω, ¼w, 5%
50	R12	6RC-07GF-*104	1	100KΩ, ¼w, 5%
51	R13	601-1013-U105	1	1M Ω, 1/3w, 30% (variable)
52	R14	6RC-07GF-*222	1	2.2KΩ, ¼w, 5%
53	R15	Same	1	Same
54	R16	Same	1	Same
55	R17			
56	R18	6RC-07GF-*242	1	2.4KΩ, ¼w, 5%
57	R19	6RC-07GF-*562	1	5.6L Ω, ¼w, 5%
58	R20	6RC-07GF-*102	1	1KΩ, ¼w, 5%
59	R21	6RC-07GF-*471	1	470Ω, ¼w, 5%
60	R22	6RC-07GF-*472	1	4.7KΩ, ¼w, 5%
61	R23	6RC-20GF-*6R8	1	6.8Ω, ½w, 5%
62	R24	6RC-07GF-*101	1	100Ω, ½w, 5%
63	R25	6RC-20GF-*1R2	1	1.2Ω, ½w, 5%
64	R27	6RC-07GF-*474	1	470KΩ, ¼w, 5%
65	R28	601-1013-0105	1	1MΩ, 1/3w, 30% (variable)
66	R29	6RC-07GF-*751	1	750Ω, ¼w, 5%
67	R30	6RC-07GF-*222	1	2.2K Ω, ¼w, 5%
68	R31	Same	1	Same
69	R32	Same	1	Same
70	R33	6RC-07GF-*334	1	330KΩ, ¼w, 5%
71	R34	6RC-07GF-*751	1	750 Ω, ¼w, 5%
72	R36	6RC-07GF-*621	1	270Ω, ¼w, 5%
73	R37	601-1013-U102	1	1KΩ, 1/3w, 30% (variable)
74	R38	6RC-07GF-* 152	1	1500 Ω, ¼w, 5%
75	R39	6RC-07GF-*222	1	2.2KΩ, ¼w, 5%
76	R40	6RC-07GF-*203	1	20KΩ, ¼w, 5%
77	R41	6RC-07GF-*202	1	2KΩ, ¼w, 5%
78	R42	6RC-07GF-*271	1	270Ω, ¼w, 5%
79	R43	6RC-07GF-*271	1	270Ω, ¼w, 5%
80	R44	6RC-07GF-*322	1	3.3KΩ, ¼w, 5%
81	R45	6RC-20GF-*1R2	1	1.2Ω, ½w, 5%
82	R46	6RC-07GF-*112	1	1100Ω, ¼w, 5%
83	R47	6RC-20GF-*3R3	1	3.3Ω, ½w, 5%
84	R48	6RC-07GF-*271	1	270Ω, ¼w, 5%
85	R49	6RC-07GF-*332	1	3.3KΩ, ¼w, 5%
86	R50	6RC-07GF-*562	1	5.6KΩ, ¼w, 5%
87	R51	6RC-07GF-*474	1	470KΩ, ¼w, 5%
88	R52	6RC-07GF-*105	1	1MΩ, ¼w, 5%

(continued)

Table 3-3 B12 Monitor Subassembly 112-1992-0000 Rev. E

ITEM NO.	REFERENCE DESIGNATOR	BEEHIVE PART NUMBER	QTY.	B12 MONITOR DESCRIPTION
		Capacitors		
89	C1	622-WEBB-477K	1	470mf, 16V, 150-10%
90	C2	621-N004-104J	1	0.1mf, 100V, 10%
91	C3	621-N004-104J	1	0.1mf, 100V, 10%
92	C4	626-SD00-121K	1	120pf, 100V, 10%
93	C5	621-N004-104J	1	0.1mf, 100V, 10%
94	C6	621-N004-102K	1	1000pf, 100V, 10%
95	C7	621-N004-104J	1	0.1mf, 100V, 10%
96	C8	624-EJ00-226K	1	22mf, 16V, 20%
97	C9	621-N004-682K	1	6800pf, 100V, 10%
98	C10	621-N004-102K	1	1000pf, 100V, 10%
99	C11	621-N004-104J	1	0.1mf, 100V, 10%
100	C12	624-EJ00-107K	1	100mf, 4V, 20%
101	C13	624-N004-104J	1	0.1mf, 100V, 10%
102	C14	622-HORR-226K	1	22mf, 100V, 100-10%
103	C16	621-N004-104J	1	0.1mf, 100V, 10%
104	C17	621-N005-223K	1	.022mf, 400V, 10%
105	C18	620-UM00-203M	1	.02mf, 1KV, 80-20%
106	C19	620-UP00-503P	1	.05mf, 500V, 80-20%
107	C20	621-N006-106K	1	10mf, 100V, 10%
108	C21	621-N004-221K	1	220pf, 100V, 10%
109	C22	620-UM00-203M	1	.02mf, 1KV, 80-20%
110	C23	621-N004-102K	1	1000pf, 100V, 10%
111	C24	621-N004-104J	1	0.1mf, 100V, 10%
112	C25	621-N003-224K	1	0.22mf, 100V, 10%
113	C26	621-N003-224K	1	0.22mf, 100V, 10%
114	C27	624-EJ00-107K	1	100mf, 4V, 20%
115	C28	624-EJ00-107K	1	100mf, 4V, 20%
116	C29	624-E100-226K	1	22mf, 16V, 20%
117	C30	621-N005-154K	1	0.15mf, 900V, 10%
118	C31	622-EG00-478K	1	4700mf, 16V, 150-10%
		Intensify Feature		
119	R201	6RC-07GF-*222	1	2.2KΩ, ¼w, 5%
120	R202	6RC-07GF-*222	1	2.2KΩ, ¼w, 5%
121	R203	6RC-07GF-*471	1	470Ω, ¼w, 5%
122	Q201	603-T92N-3646	1	Transistor, MPS-3646

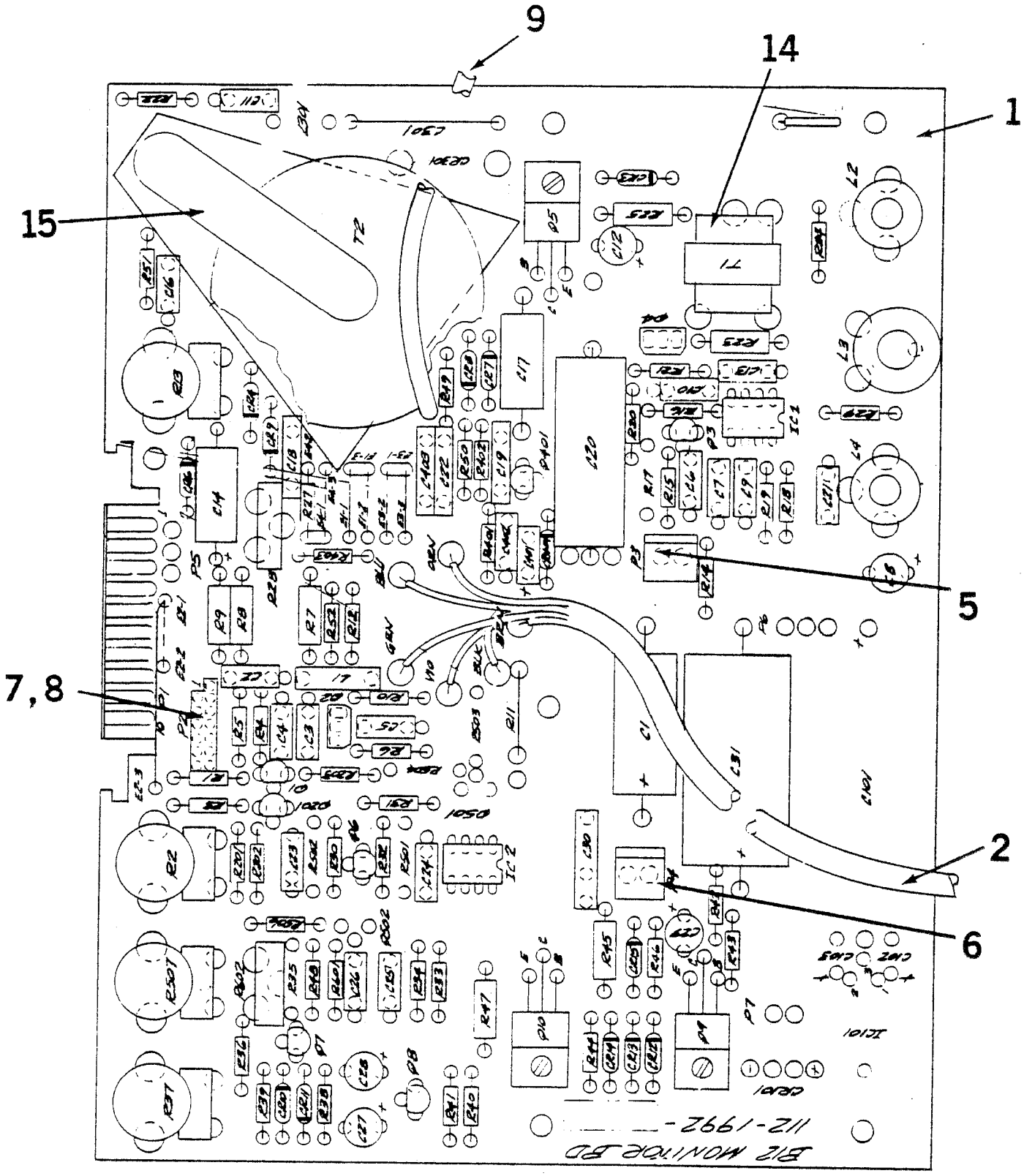


Figure 3 - 4 B12 Monitor Board Component Layout Rev. A

Table 3-4 Power Supply Subassembly

ITEM NO.	REFERENCE DESIGNATOR	VENDOR PART NUMBER	QTY.	POWER SUPPLY DESCRIPTION
1	1A2A4	Power Pac, Inc. 2297-000-90		PC Board Assembly
		Miscellaneous Mechanical Parts		
2		Power Pac, Inc. 2294-000-87	1	P.C. Board
3	for Q1	Aavid 5690B-3	1	Heat Sink
4	for CR2	Aavid 5690B	1	Heat Sink
5	for Q3	Aavid 5690B-3	1	Heat Sink
6	J1	Molex 09-65-1031	1	P.C. Bd. Pin Header (3 pcs)
7	J2	Molex 09-65-1081	1	P.C. Bd. Pin Header (8 pcs)
8	J3	Molex 09-65-1061	1	P.C. Bd. Pin Header (6 pcs)
9	XU1	Robinson Nugent ICL-143-S6-T	1	Socket
10	XU2	Same	1	Socket
		Capacitors		
11	C1	Rayrex RR	1	47µf, 16V
12	C3	Mallory TCG	1	10Kµf, 15V
13	C4	DL 5XF	1	2.2 µf,500V
14	C5	Rayrex RA	1	100µf, 16V
15	C6	DL RT3	1	0.33µf, 3V
16	C7	Mallory TCG	1	3.4K µf, 30V
17	C9	DL TCG	1	390 pf, 500V
18	C10	Rayrex RR	1	47µf, 16V
19	C11	Rayrex RR	1	470pf, 35V
20	C12	Rayrex RR	1	22µf, 16V
		Resistors		
21	R1	R-ohm R25	1	200Ω , ¼w
22	R2	R-ohm R25	1	120Ω , ¼w
23	R3	R-ohm R25	1	120Ω , ¼w
24	R4	R-ohm R25	1	1.5KΩ , ¼w
25	R5	IRC PW5	1	0.18 Ω, 5w
26	R6	R-ohm R25	1	47Ω , ¼w
27	R7	R-ohm R25	1	390 Ω, ¼w
28	R8	R-ohm R25	1	68 Ω, ¼w
29	R9	R-ohm R25	1	1.1KΩ , ¼w
30	R10	R-ohm R25	1	82Ω , ¼w
31	R11	R-ohm R25	1	220 Ω, ¼w
32	R12	R-ohm R25	1	12Ω , ¼w
33	R13	R-ohm R25	1	470 Ω, ¼w
34	R14	IRC PW5	1	0.47Ω , 5w
35	R15	R-ohm R25	1	200 Ω, ¼w
36	R16	R-ohm R25	1	4.7KΩ , ¼w
37	R17	R-ohm R25	1	680 Ω, ¼w
38	R18	R-ohm R25	1	68Ω , ¼w
39	R19	R-ohm R25	1	1.KΩ , ¼w

(continued)

Table 3-4 Power Supply Subassembly

ITEM NO.	REFERENCE DESIGNATOR	VENDOR PART NUMBER	QTY.	POWER SUPPLY DESCRIPTION
40	R20	R-ohm R25	1	22 Ω, ¼w
41	R21	AB EB	1	680Ω , ½w
		ICS/Transistors/Diodes		
42	1A2A4CR1	IN4001	1	Rectifier
43	CR2	Varo VJ248	1	Rectifier Bridge
44	CR3	IN4001	1	Rectifier
45	CR4	Varo VM18	1	Rectifier Bridge
46	CR6	IN4001	1	Rectifier
47	CR7	IN4001	1	Rectifier
48	Q1	26M6055	1	Transistor
49	Q2	GE C123F	1	SCR
50	Q3	26N6055	1	Transistor
51	U1	National LM723CJ	1	I.C.
52	U2	Same	1	I.C.
53	U3	Natl LM340T-12	1	I.C.
54	VR1	IR IN751A	1	Zener Diode

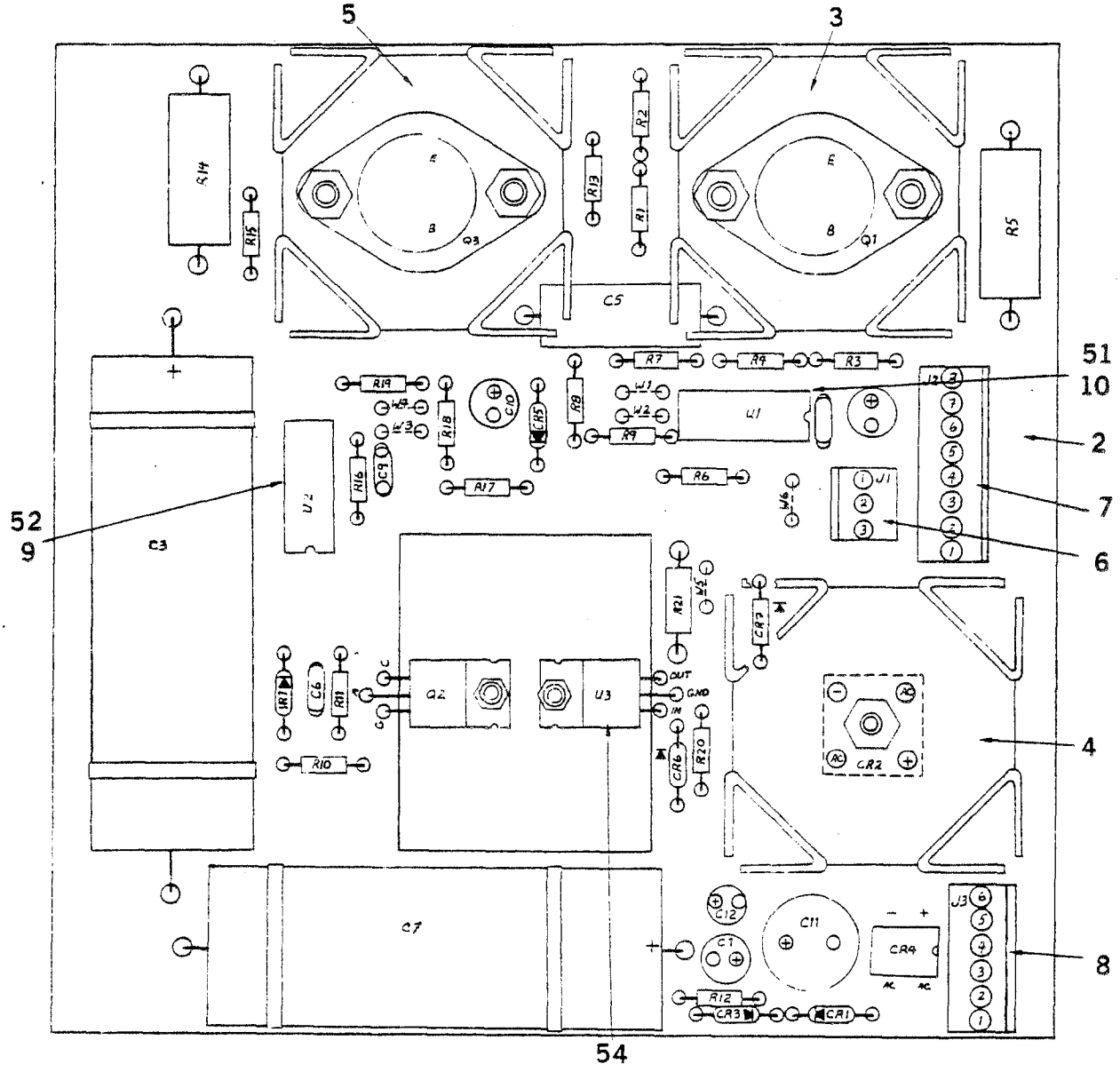


Figure 3-5 Micro B Power Supply Board