OPERATING AND SERVICE MANUAL

2615A

TERMINAL

Serial Numbers Prefixed: 1337

Manual part no. 02615-90004

Microfiche part no. 02615-90007

Printed: APR 1975

HEWLETT hp PACKARD

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Options Covered

This manual covers option 015 in addition to the standard HP 2615A Terminal.

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FOREWORD

This manual contains operation, installation, and service information for the Hewlett-Packard 2615A Terminal. Model number HP 2615A is the HP designation for the Minibee Computer Terminal manufactured by Beehive Medical Electronics Incorporated, Salt Lake City, Utah.

Sections one, two, portions of three, and seven of this manual were prepared by Hewlett-Packard. The remainder was prepared by Beehive Electronics.

For replaceable parts information, refer to the *HP 2615A Terminal Illustrated Parts Breakdown Manual,* HP part no. 02615-90013.

The following option for the HP 2615A Terminal is:

Option 015: Standard HP 2615A Terminal requiring a 230-volt, 50/60-Hertz power source.

STANDARD CONFIGURATION FOR HP2615A TERMINAL

FUNCTION	KEY BOARD	BACK PANEL	TERMINAL LOGIC PCB	VIDEO BOARD	INTERNAL
POWER OPTION					Jumper Lug 1-2 } Lug 3-4 } 115V ____ Lug 2-3 230V ____
DISPLAY FORMAT			12 line ____ 25 line __X__		
STOP BIT 1/2 SELECT			Strap In __X__ (1) Out ____ (2)		
PARITY CHECK			Strap in __X__ (inact) Out ____ (act)		
PARITY SELECT			Strap In ____ (odd) Out __X__ (even)		
HALF/FULL DUPLEX		Switch Half __X__ Full __X__			
I/0 BAUD RATE SELECT		Switch 8 __X__ 1 __X__ 16 __X__ 2 __X__ 32 __X__ 3 __X__ 64 __X__			
I/0 BAUD RATE MULTIPLIER		Switch 110 __X__ 150 __X__			
8 x CLOCK			Strap In __X__ Out ____		

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SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

This manual is furnished to provide detailed instructions concerning the cathode-ray tube (CRT) terminal. It contains illustrations and information pertaining to the unit itself, as well as interfacing requirements for the unit when operating in conjunction with other equipment. This section contains a general description, discussion and basic information regarding the purpose, function specifications, and performance characteristics of the CRT terminal. (See figure 1-1.)

1-2. EQUIPMENT SUPPLIED

Included with the CRT terminal is a power cord, HP part no. 8120-1348, and a terminal cable, HP part no. 5060-8363. The keyboard portion of the CRT terminal is a separate unit. A connecting cable allows it to be placed up to 30 inches (75 cm) from the main part of the CRT terminal.

1-3. IDENTIFICATION

The terminal model number is marked on the front of the terminal, in the upper right corner.

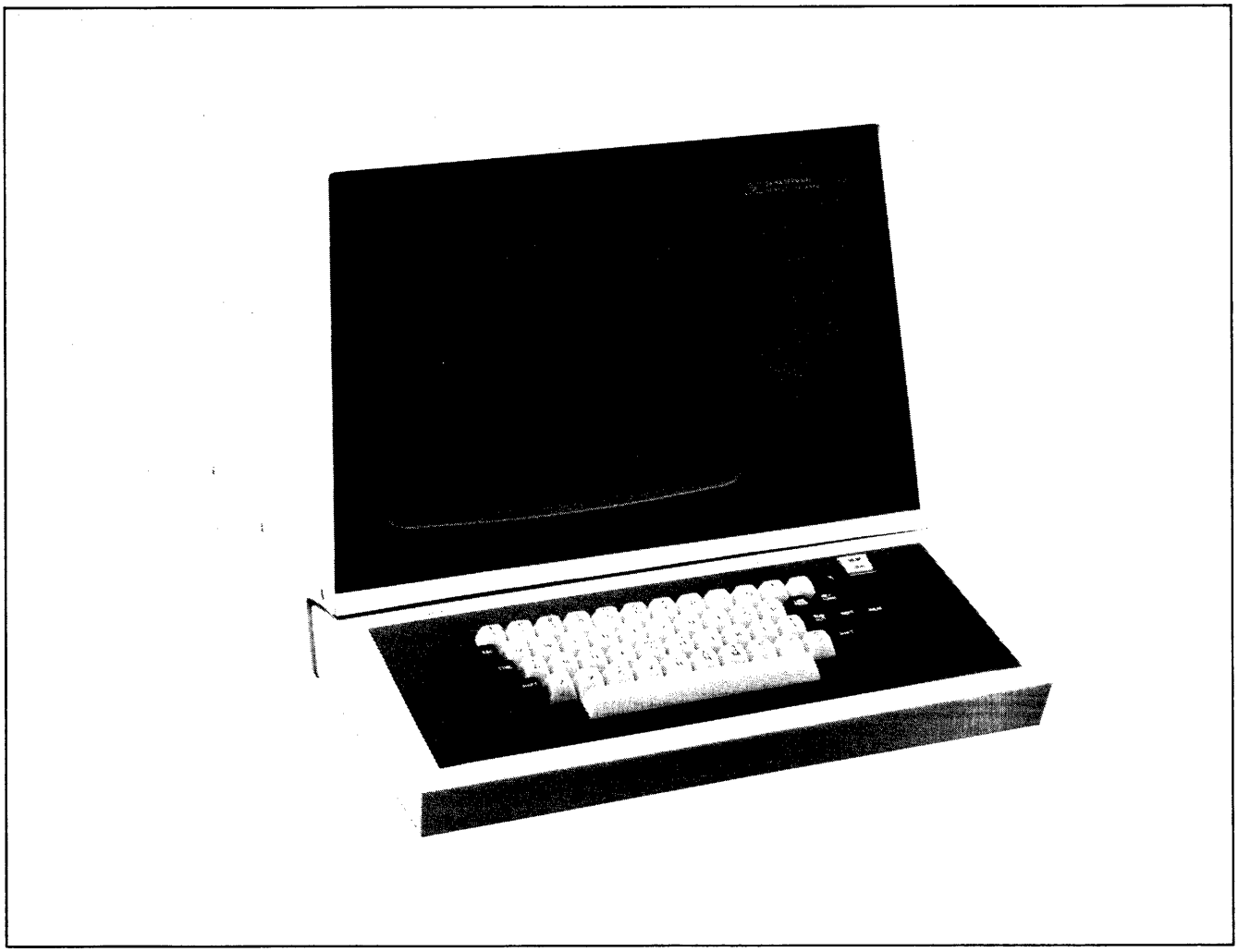

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Figure 1-1. CRT Terminal

Additionally, the model number, together with a serial number, appear on a label at the back of the terminal. In any correspondence with the factory, always refer to the model number and the serial number to ensure correct identification.

1-4. PURPOSE OF TERMINAL

The CRT terminal provides a means for displaying computer inputs and outputs, and for entering commands and data into the computer system.

1-5. OPERATING CHARACTERISTICS

1-6. DISPLAY CHARACTERS

The keyboard allows numbers, letters, and punctuation marks to be entered into the computer system. As these *display characters* are acquired by the computer, they appear as lines of text on a cathode-ray tube in the CRT terminal.

As well as displaying characters entered at the keyboard, the CRT terminal displays outputs from the computer. As with the keyboard inputs, these output displays appear as letters, numbers, and punctuation marks presented in the form of lines of text.

Each letter, digit, or punctuation mark is transferred between the CRT terminal and the computer in the form of a 7-bit *character code.* These character codes are described in paragraph 7-2.

A short double line, referred to as the *cursor,* underlines the position at which the next display character will appear on the CRT. The cursor blinks continually, allowing its position to be easily located. Each time a new display character is placed on the CRT by the keyboard or by the computer, the cursor moves to the next position to the right. Upon reaching the end of a line, the cursor moves to the beginning of the next line.

1-7. CONTROL CHARACTERS

The keyboard can be used for entering *control characters* into the computer system. Each control character is represented by a 7-bit code. Four of the control characters affect the CRT terminal. They are *line feed, return, backspace,* and *bell.* The line feed code moves the cursor down one line. The return code moves the cursor to the left side of the CRT. The backspace code moves the cursor one position to the left. The bell code results in the issue of a momentary audible tone from the CRT terminal. These four control characters produce similar results at certain other I/O devices if forwarded to them by the computer.

As well as being produced by the keyboard, the four control characters described above can originate at a different I/O device. When forwarded to the CRT terminal by the computer, they produce the same effect as when generated at the keyboard.

The keyboard can produce additional control characters which do not affect the CRT terminal. These bring about a control (non-display) effect in other I/O devices when forwarded to them by the computer.

Paragraph 7-3 provides further information on the control character codes.

1-8. ESCAPE SEQUENCES

A third function of the keyboard is the production of escape sequences. Each of these consists of two 7-bit codes; they move the cursor up, down, or sideways, or they erase part or all of the CRT display. The escape sequence codes can be forwarded to the CRT terminal from other I/O devices, bringing about the same results. Similarly, escape sequences entered at the CRT terminal can be sent to other I/O devices by the computer, bringing about cursor movement or display erasure at the other I/O device.

The escape sequence codes are further described in paragraph 7-4.

1-9. REMOTE OPERATION

Through the use of a modulator-demodulator (modem), the CRT terminal can be connected to the computer through a public or private telephone system.

1-10. SPECIFICATIONS

Table 1-1 lists the principal operating specifications of the CRT terminal.

1-11. SUPPLIES

The CRT terminal requires no operating supplies other than cleaning materials. These are described in paragraph 2-14.

Table 1-1. Specifications,* CRT Terminal

Display Characters:	64 display characters (table 7-2). The display character codes conform with ASCII Standard X3.4-1968. Lower case ASCII codes are displayed in upper case form.
Control Characters Generated by Keyboard:	33 control characters in conformity with ASCII Standard X3.4-1968 (Table 7-3).
Escape Sequences:	8 escape sequences (Table 7-4).
Display Characters per Line:	80
Lines Displayed:	25
Display Size:	8-1/2 in x 6-1/2 in. (215 cm x 165 cm).
Audio Alarm:	The computer program can produce a momentary audible tone from the terminal as a means of attracting the operator's attention.
Baud Rate:	110, 150, 220, 300, 440, 600, 880, 1200, 1760, 2400, 3520, 4800, 7040, and 9600.
Height:	13-1/2 in. (35 cm)
Width:	16-1/2 in. (42 cm)
Depth with Keyboard:	21-1/2 in. (55 cm)
Depth without Keyboard:	15 in. (39 cm)
Depth of Keyboard:	9-3/4 in. (25 cm)
Weight (without keyboard or cables):	45 lbs (20.5 kg)
Weight of Keyboard:	8 lbs (3.6 kg)
Length of Signal Cable:	5 ft (1.5 metres).
Length of Power Cord:	7-1/2 ft (2.3 metres). An optional power cord for Continental Europe has a length of 2 metres. **WARNING** If the power cord is replaced, or if an extension cord is used, safety requires that the third (earth) conductor be retained.

*Dimensions and weights are approximate.

Table 1-1. Specifications,* CRT Terminal (Continued)

Power Consumption:	140 watts, maximum.
Power Source:	115 volts ±10%, 47-66 Hz.
Air Conditioning:	Temperature: +5° to 40°C (41° to 104°F). Relative Humidity: 50 to 90% (non-condensing). Heat Dissipation: 470 BTU's (120 kilocalories) per hour.

*Dimensions and weights are approximate.

SECTION II
OPERATION

2-1. INTRODUCTION

This section describes the controls and indicators on the CRT terminal. Instructions for using the controls are also provided.

2-2. OPERATOR CONTROLS AND INDICATORS

The controls and indicators are in two groups. One group is on the keyboard (figure 2-1); the other is on the rear panel (figure 2-2).

On the keyboard, the blank key in the top row performs no function.

When referring to a control, key, or indicator, this manual uses the actual name marked on or near the item. The name is quoted in capital letters, indicating that it is an equipment marking.

On the keyboard, note the ESC (escape), CTRL (control), REPT (repeat), and SHIFT keys. When using these keys, you must bear the following in mind:

- The ESC key is pressed and released, after which a second key is pressed and released.
- The CTRL, REPT, or either SHIFT key must be pressed and held; then, while it is being held, a second key must be pressed. Either key can be released first, or both can be released simultaneously.

2-3. UTILITY CONTROLS AND INDICATORS

The utility controls are used for turning the CRT terminal on and off, and for establishing basic operating conditions. The controls, together with associated indicators, are described in table 2-1.

2-4. DISPLAY CHARACTER KEYS

Table 2-2 explains the keys which produce 7-bit display characters. In the table it is assumed that the CRT terminal is on-line, with the echo function in effect. The "XX(XXX)" numerical notations in the table are decimal (octal) codes relating to specific characters. This notation is used throughout the manual.

The term *roll up* is used in table 2-2. Roll up makes a new line available at the bottom of the CRT display. When this takes place the entire display moves up one line; the top line is discarded.

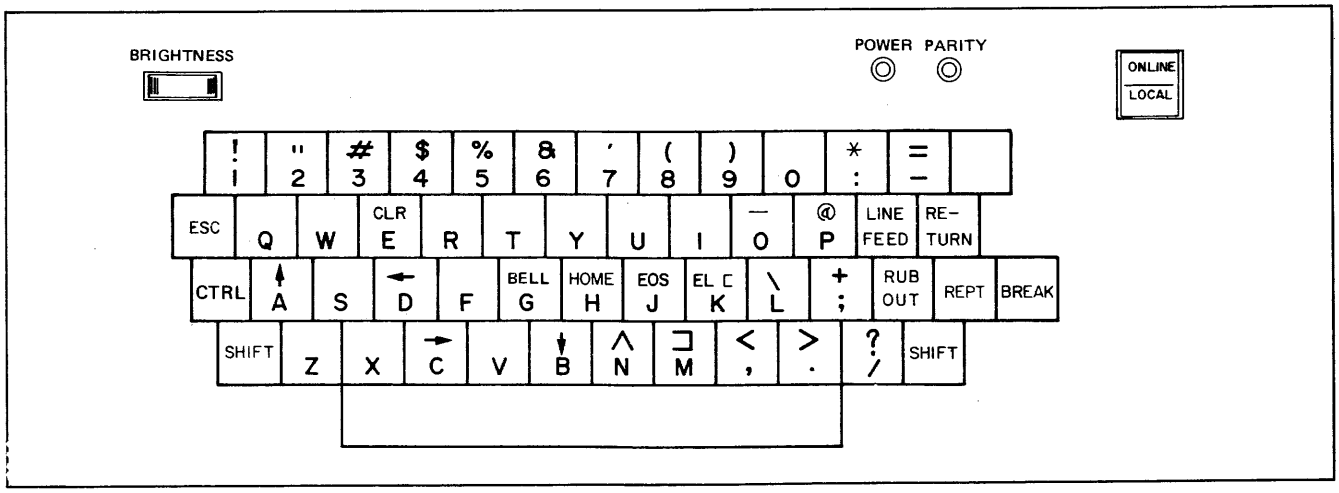

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Figure 2-1. Keyboard

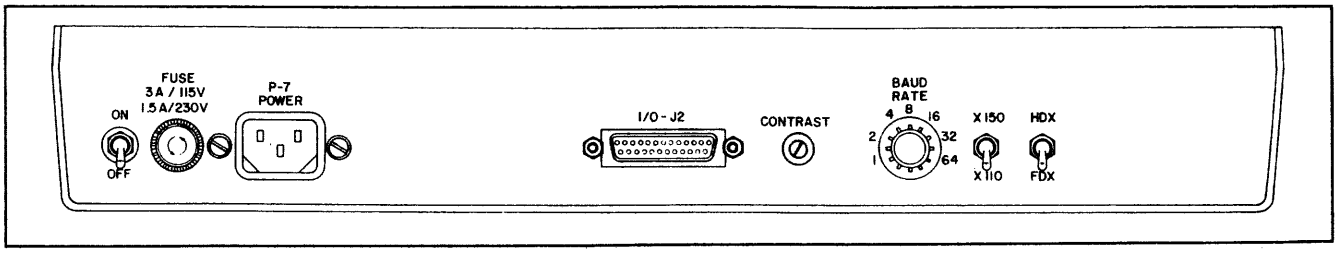

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Figure 2-2. Rear Panel

2-5. CONTROL CHARACTER KEYS

Table 2-3 explains the keys which produce 7-bit control codes. Four of these codes (return, line feed, bell, and backspace) produce an effect on the CRT terminal. When operating on-line, the computer must be echoing to permit these four codes to act on the CRT terminal.

The REPT key (table 2-2) can be used with any key in table 2-3 to repeat the control character code. When this is done with the CTRL key (table 2-3), the REPT and CTRL keys must both be held down while a third key is pressed. The third key should be the last pressed and the first released.

2-6. ESCAPE SEQUENCE KEYS

The escape sequence is generated using the ESC key and a designated alpha key. Refer to table 2-4. The escape sequence is started by pressing and releasing the ESC key and then pressing the appropriate alpha key. Each escape sequence consists of two 7-bit character codes.

2-7. BREAK KEY

The break key is not explained in tables 2-1, 2-2, 2-3, or 2-4. This key does not produce a character code. When pressed, it sends a signal to the computer which can be detected by a multiplexer.

2-8. OPERATING PROCEDURES

CAUTION

Cooling air passes through openings in the bottom and rear of the CRT terminal. To ensure adequate air circulation, maintain at least two inches (5 cm) of clearance at the rear and sides of the CRT terminal. Do not place the CRT terminal on spongy or thick carpeted material; this will restrict circulation.

2-9. PREPARATION FOR USE

To prepare the CRT terminal for use, proceed as follows:

a. Ensure that the computer system is ready for use.

b. At the rear of the CRT terminal, set the ON/OFF switch to on. The cursor appears in about one minute; the CRT terminal is then ready for use. If necessary, adjust the BRIGHTNESS knob to make the cursor visible or to eliminate background light. While waiting for the cursor to appear, complete steps *c* through *f* below.

c. At the rear of the CRT terminal, ensure that the BAUD RATE switch and the X110/X150 switch are at the correct position.

d. At the rear of the CRT terminal, ensure that the FDX/HDX switch is at the FDX position.

e. Set the ON LINE/LOCAL switch to the desired position. When using the keyboard for test purposes or practice be sure this switch is at LOCAL, otherwise data and programs in the computer may be destroyed.

f. When the cursor appears, the CRT terminal is ready for use.

g. If a modem is used, turn it on and establish contact with the computer.

h. Follow the appropriate log-on procedure for your operating system and/or application program.

2-10. COMPUTER-SUPPLIED CHARACTER CODES

Character codes are described from an operational viewpoint in these paragraphs. For binary and octal codes relating to specific characters, refer to Programming, section VII.

2-11. COMPUTER-SUPPLIED DISPLAY CODES. Display character codes received from the computer produce the same display symbol as when the code is generated at the keyboard. For display codes which cannot be generated at the keyboard, symbols displayed are as follows:

- If character codes for lower case letters are received from the computer, they are displayed as the corresponding upper case letters.
- If character codes are received for the symbols { } ¦ ~ they are displayed as [ ] \ ^ respectively.

2-12. COMPUTER-SUPPLIED CONTROL CODES. Control codes supplied by the computer produce the same function as when generated at the keyboard.

If the rub-out character code (ASCII DEL, delete) is received from the computer, it is ignored. The ASCII *space* (blank) character code is used to delete a character from the CRT.

2-13. COMPUTER-SUPPLIED ESCAPE SEQUENCES. Escape sequences supplied by the computer produce the same function as when generated at the keyboard.

2-14. ESCAPE SEQUENCES PRODUCED AT THE KEYBOARD

When an escape sequence is initiated at the keyboard, one or more pairs of character codes are generated. In some instances, escape sequences are generated for local use only. Under these conditions, the computer program does not anticipate these character codes and an error will result when further keyboard entries are made. To avoid this type of error, set the ON LINE/LOCAL switch to LOCAL before entering the escape sequence. Return the switch to ON LINE after completing the escape sequence. This procedure should be used when clearing the screen.

2-15. OPERATOR MAINTENANCE

The only maintenance required is an occasional light cleaning of the exterior of the CRT terminal. Before starting always unplug the unit from the power outlet, and during cleaning do not allow liquid to drip inside the CRT terminal.

Clean the CRT screen with a liquid plastic cleaner and wipe dry. Use only very soft paper or a clean cloth for this purpose. Hard paper or grit will scratch the screen.

To clean the keys, dip a cotton swab in clear alcohol and apply to the keys. Be careful that alcohol does not run inside the keyboard, or get on the CRT screen.

For the remaining exterior surfaces, use soap and water or a mild detergent solution.

Table 2-1. Utility Controls and Indicators

CONTROL OR INDICATOR	FUNCTION
ON/OFF switch (Figure 2-2)	In the up position, this switch applies power to the CRT terminal.
POWER lamp (Figure 2-1)	This indicator is lighted when power is applied.
BAUD RATE knob and X110/X150 switch (Figure 2-2)	These controls establish the baud rate of the CRT terminal. The baud rate (bits per second) is a multiple of the rate of character transfer between the CRT terminal and the computer. If a modem is used, the baud rate of the CRT terminal must equal that of the modem. The baud rate is either 10 or 11 times the character transfer rate, depending on the transfer rate selected. The 110/150 switch sets the number of stop bits transmitted to 2 or 1 per character; thus, the total number of bits transmitted per character is 11 or 10, respectively. The BAUD RATE knob and the X110/X150 switch are positioned so that when their settings are multiplied together, the result equals the baud rate. For instance, for a baud rate of 2400 (240 characters per second), the knob is set at 16 and the switch is set at x150. Listed below are the settings for the baud rates which can be selected.

Baud Rate	Position of 110/150 Switch	Position of Baud Rate Knob	Characters/ Second	Stop Bits
110	X110	1	10	2
150	X150	1	15	1
220	X110	2	20	2
300	X150	2	30	1
440	X110	4	40	2
600	X150	4	60	1
880	X110	8	80	2
1200	X150	8	120	1
1760	X110	16	160	2
2400	X150	16	240	1
3520	X110	32	320	2
4800	X150	32	480	1
7040	X110	64	640	2
9600	X150	64	960	1

Table 2-1. Utility Controls and Indicators (Continued)

CONTROL OR INDICATOR	FUNCTION
ON LINE/LOCAL switch (Figure 2-1)	This switch selects the on-line or local operating condition. In the on-line condition, display characters, control characters, and escape sequences entered at the keyboard are acquired by the computer. Display characters, control characters, and escape sequences supplied by the computer are accepted by the CRT terminal, and bring about the same result as when entered at the keyboard. In local operation, display characters, control characters, and escape sequences entered at the keyboard act on the CRT terminal, but are not acquired by the computer. Display characters, control characters, and escape sequences sent by the computer are ignored. Local operation is used for terminal test purposes and keyboard practice.
FDX/HDX switch (Figure 2-2)	This switch is of significance only when operating on-line. The switch selects full duplex (FDX) or half duplex (HDX) operation. In full duplex, and when the computer's echo function is in effect, all 7-bit character codes generated at the keyboard are returned to the CRT terminal immediately upon receipt by the computer. The characters bring about a display, control, or escape-sequence function at the terminal. (Some control codes are ignored by the terminal.) The result at the terminal verifies that the character codes have been correctly received and stored by the computer. The computer makes further use of the character codes as directed by programming. This switch is normally set to the FDX position. In half duplex operation, character codes and escape sequences are acquired by the computer, but are not returned to the CRT terminal.
BRIGHTNESS knob (Figure 2-1)	This knob controls the brightness of the CRT display. The knob can also be adjusted to slightly illuminate the entire display area; this reveals the position of the cursor with respect to the display area boundary. (For instance, it can be seen whether the cursor is in the bottom line.)

Table 2-1. Utility Controls and Indicators (Continued)

CONTROL OR INDICATOR	FUNCTION
CONTRAST screwdriver adjustment (Figure 2-2)	This control adjusts the contrast of the CRT display.
PARITY lamp (Figure 2-1)	The parity lamp is operative when the CHK PAR jumper is installed on the circuit board assembly in the CRT terminal. The CRT terminal is supplied by Hewlett-Packard without this jumper. When the CHK PAR jumper is in place, the PARITY lamp lights when there is a parity error in a character code produced by the CRT terminal or supplied by the computer. The lamp is extinguished by pressing any character key on the keyboard.

Table 2-2. Display Character Functions

KEY	FUNCTION
Alphabet keys, number keys, punctuation keys, and space bar. (Figure 2-1)	Each of these generates the display character code for the symbol marked on the key. If two or more symbols are marked on the key, the code produced is for the lower character. Each display character appears on the CRT at the position indicated by the cursor. If there is a character at that position on the CRT, it is replaced by the new character. The character codes produced are those in table 7-2 which correspond to the key pressed, and which do not exceed 90 (132). The space bar produces the blank character code.
SHIFT keys (Figure 2-1)	While either SHIFT key is being pressed, it modifies the function of display character keys which are marked with two black symbols. The modified function produces the character code for the uppermost of the two black symbols. As an exception, the SHIFT key does not affect the G key. The modified character codes are those in table 7-2 which correspond to the upper black symbol on the key, and which do not exceed 95 (137). Both SHIFT keys produce the same result. The SHIFT keys do not themselves produce a character code. They merely modify the code produced by another key.
REPT key (Figure 2-1)	While the REPT (repeat) key is held down, pressing any character key produces the character code for the second key repeatedly. The REPT key may also be used with the space bar to repeat the blank character code. The repeated character codes are acquired by the computer. The character is also repeated on the CRT if it is a display character. The repeat feature is inoperative for the escape sequences, but can be used with any control character key. The repeat rate is 20 characters per second if the baud rate setting is 20 characters per second or more. If the baud rate setting is less than 20, the repeat rate is the same as the baud rate. The REPT key does not itself produce a character code.

Table 2-3. Control Character Functions

KEY	FUNCTION
RETURN key (Figure 2-1)	Moves the cursor to the leftmost position in the line (position 1) and transmits the RETURN code.
LINE FEED key (Figure 2-1)	Moves the cursor down one line and transmits the LINE FEED code. If the cursor is initially in the bottom line, roll up occurs. When operating on-line, the cursor also moves to position 1 in the new line.
RUB OUT key (Figure 2-1)	Key produces the rub-out (delete) character code. The code has no effect on the CRT terminal.
CTRL key (Figure 2-1)	While the CTRL (control) key is pressed, certain other display-character keys provide a modified character code. In all cases a 7-bit control code is produced; these are listed in table 7-3. The CTRL key itself does not produce a character code. Two of the modified character codes affect the CRT terminal; other modified codes are ignored. The two which are effective are CTRL-G and CTRL-H. These are produced by holding down the CTRL key and pressing the G or H key. The CTRL-G character code produces a momentary audible tone from the CRT terminal. The CTRL-H character code brings about a backspace function. The cursor is moved one character position to the left. If the cursor is in the leftmost character position in the line (position 1), it moves to the rightmost (80th) position in the line above. If the cursor is in the home position, it moves to the 80th position in the bottom line. The operating system or application program may recognize the above mentioned or other control codes. See the appropriate manual.

Table 2-4. Escape Sequence Functions

KEY	FUNCTION
ESC key (Figure 2-1)	The ESC (escape) key produces the ESC character code (table 7-3). After the key has been pressed and released, another key must be pressed to provide the complete escape sequence. Both codes in the sequence are transmitted. Eight escape sequences affect the CRT terminal. They are produced by the ESC key and one of the following display-character keys: A, B, C, D, E, H, J, K. The resulting character codes are listed in table 7-4. The eight keys which produce an effect on the CRT terminal are each marked with a red symbol. The function of these escape sequences are described below.
↑ sequence (ESC A) (Figure 2-1)	This escape sequence moves the cursor up one line. If the cursor is in the top line, it moves to the bottom line. The cursor retains its character position in the new line. (That is, there is no side movement.)
↓ sequence (ESC B) (Figure 2-1)	This escape sequence moves the cursor down one line. If the cursor is in the bottom line, it moves to the top line. The cursor retains its character position in the new line.
→ sequence (ESC C) (Figure 2-1)	The ESC C sequence moves the cursor one character position to the right. If the cursor is in the 80th (last) character position in the line, it moves to the first position in the line below. If the cursor is in the 80th position in the bottom line, it moves to the home position. (The home position is the first position in the top line.)
← sequence (ESC D) (Figure 2-1)	This escape sequence moves the cursor one character position to the left. If the cursor is in the first character position in the line, it moves to the 80th position in the line above. If the cursor is in the home position, it moves to the 80th position in the bottom line.
CLR (ESC E) (Figure 2-1)	This escape sequence clears all displayed characters from the CRT, and moves the cursor to the home position.
HOME (ESC H) (Figure 2-1)	This escape sequence moves the cursor to the home position.
EOS (ESC J) (Figure 2-1)	The EOS (erase to end of screen) sequence erases all characters on the same line as the cursor and all characters below the cursor.
EL (ESC K) (Figure 2-1)	The EL (erase line) sequence erases all characters on the same line as the cursor.

SECTION III
INSTALLATION

3-1. INTRODUCTION

3-2. This section contains information for unpacking, initial inspection, connection of the communications interface, physical placement of the terminal, and preliminary selection of functional control settings for the specific requirements of a given user.

3-3. UNPACKING

3-4. The CRT terminal is ready for operation after removal from its shipping container. There are no tiedowns or packing materials inside the unit which need to be removed. Store the carton for future use during relocation or reshipment.

3-5. INSPECTION FOR IN-SHIPMENT DAMAGE

3-6. The terminal is carefully inspected and tested prior to shipment from the factory. Upon receipt, carefully remove all components from the shipping container and check each item against the packing slip to ensure completeness of your order. Visually inspect all items for any possible shipping damage. All shipping containers have been custom engineered to protect their contents and special care has been taken to prevent damage under normal shipping conditions. Damage to the contents should not occur unless the package has been mishandled. Mishandling should be evident upon inspection of the shipping container and, if damage is found after visual inspection, care should be taken not to destroy the evidence. Take pictures of the damaged container and contact the transport carrier as soon as possible.

3-7. PLACEMENT FOR OPERATION

CAUTION: The terminal relies on air flow for cooling through its perforated bottom panel and slots in the rear of the terminal case. Therefore it is important that the terminal never be placed in a position where free air circulation is restricted. To maintain efficient air circulation, maintain at least two inches of clearance at the rear and on the sides of the terminal. Avoid placing the terminal on plush carpet or on soft or spongy material where the bottom plate might come in contact with the mounting surface and shut off or restrict air circulation.

3-8. The terminal is fully self-contained and can be moved and relocated to alternate operating positions without removing or altering any hard wiring. Select a convenient level surface and place the terminal where the power cable and data I/O cables will not be in the way of the operator. Route the cables in such a manner that they will not be inadvertently pulled, or disturbed by nearby personnel. Rotate the terminal until it is conveniently oriented for operator viewing. The cable which attaches the keyboard to the terminal is flexible which allows the keyboard to be placed in almost any position within a 30-inch distance of the viewed terminal.

3-9. DATA INTERFACE CONNECTION

3-10. All data source interconnections are made through the rear panel RS232C type I/O connector J2. The I/O connector mates with ITT Cannon solder pin connector, Part No. DM-25P or Amphenol Part No. 17-20250-1. Table 3-1 contains a list of pin assignments for I/O connector J2.

Table 3-1. Connector J2 Pin Assignments

Pin No.	Signal Description	RS232 Circuit	Signal		Signal Function
			in	out	
1	Frame Ground	AA			
2	Transmitted Data	BA		→	Serial Data Out
3	Received Data	BB	←		Serial Data In
4	Request to Send	CA		→	On-line and transmitting
5	†Clear to Send	CB	←		Enables transmission
7	Signal Ground	AB			Signal reference
8	†Received Line Signal Det.	CF	←		Enables reception
16	X8 Terminal Data Clock (TTL Level)	*		→	Clock for I/O card
20	Data Terminal Ready	CD		→	Terminal power on

*Not RS232

†Enabled if there is no connection to pin

Two conditions are required for the terminal to receive and react to incoming data. The terminal must be ON LINE and CF(Received Line Signal Detector) must be driven to the "ON" condition, or not be connected so that the line is biased to the "ON" condition.

When the terminal is ON LINE and a key is depressed on the keyboard, the I/O will place circuit CA(Request-to-Send) in an "ON" condition. If a modem or other device interfaced to the terminal utilizes circuit CB(Clear-to-Send), transmission of the keyed character will be ineffective until this line is driven to the "ON" condition, or not be connected so that the line is biased to the "ON" condition. If Clear-to-Send is not used, the data will be transmitted immediately.

The terminal interface complies with the electrical requirements of RS232. All voltages are measured at the connector with respect to AB. The output line delivers between -12v and +15v into a resistance of 3000 ohm. The input circuit will respond to voltages between 3v and 25v.

Frame Ground (AA)

This conductor, where used, is electrically bonded to the machine frame.

Transmitted Data (BA)

This circuit transfers data from the terminal to the data set for transmission to the external device. The terminal holds circuit BA in the mark condition during anytime interval between characters or words, or when no signals are to be transmitted.

Received Data (BB)

This circuit transfers data from the data set to the terminal. Signals on this circuit are generated by the data set in response to data signals received from the external device. The data set holds this line in the mark condition when the line is idle or the carrier is not detected.

Request To Send (CA)

Signals on this circuit are generated by the terminal to condition the local data set to transmit. The "on" condition is maintained whenever the terminal has information ready for transmission or being transmitted. The terminal transmits data on circuit BA (Transmitted Data) only when the "on" condition is maintained on circuits CA, CB and CD. In half-duplex service, the "off" conditions holds data set in the Receive Data condition, and the "on" condition holds the data set in the Transmit Data condition.

Clear To send (CB)

Signals on this circuit are generated by the data set to indicate that it is prepared to transmit data. The "on" condition on circuit CA (Request to Send) is delayed as long as may be required to establish a connection to a external device. If CB is not used but allowed to float, CB will go high and create an "ON" condition.

Signal Ground (AB)

This conductor established the common ground reference for all interface lines.

Data Terminal Ready (CD)

Data Terminal Ready is high whenever the terminal power is on.

Received Line Signal Detector (CF)

The signal on this line indicates that the data set has established the carrier and the data set is about to input data to the terminal. If CF is not used, but allowed to float, CF will go high and create an "ON" condition.

X 8 Clock

An internal clock signal is available (at TTL levels) on pin 16 of the I/O connector. This clock is 8 times the baud rate of the terminal and allows a computer or modem to use these signals for its external clock.

3-11. SPECIAL PRECAUTIONS

CAUTION: If the terminal is to be operated in conjunction with a data phone or data modem, special care should be taken to ensure that the interfaces are per EIA Specification RS232C. The logic levels required by this specification may cause serious damage to communication interfaces designed strictly for standard DTL or TTL integrated circuit logic levels. The same precaution should be made when connecting hard wire to any communications I/O.

WARNING: To protect operating personnel, this unit is equipped with a detachable, three-conductor, shielded power cable that grounds the unit. The unit should be operated only with this or a similar type grounded power cable.

3-12. PREPARATION FOR USE

3-13. REAR PANEL SWITCH SELECTIONS (Refer to Figure 2-2.)

3-14. Set rear panel switches as follows:

a. Set the HDX/FDX toggle switch to the desired mode of operation.

b. Set the BAUD RATE toggle switch and rotary switch in accordance with Table 2-2. The terminal will operate under any condition at 2400 baud or less with no timing considerations.

3-15. TERMINAL LOGIC CARD STRAP SELECTION LOCATION

3-16. Refer to Figure 3-1 for location and strap selections. The X8 clock strap applies a TTL signal to pin 16 of the RS 232C interface connector. This signal is eight time the baud rate frequency.

A parity error light is provided to indicate an error for the received data if the terminal is strapped for parity check. A check will be made according to the even/odd parity strap. (See figure 3-1.) The parity error light is reset when a key on the keyboard is depressed with the exception of the break key. The strap must be changed only by Hewlett-Packard service personnel. The parity strapping configurations are listed in table 3-2.

Table 3-2. Parity Strapping

	Output (Parity Generated)		Input (Parity Checked)		
	Even	Odd	Even	Odd	Ignored
As shipped	X				X
Other Combinations	X		X		
		X		X	
		X			X

Asynchronous word structure consists of a start bit, seven data bits, a parity bit and one or two stop bits depending on the configuration of the stop bit option strap (See figure 3-1 and 3-2). The strap must be changed only by Hewlett-Packard service personnel. The stop-bit strapping configuration is 10-bit word length when shipped from the factory. It may be restrapped for 11-bit configuration. Character throughput rate (characters/second) is equal to the baud rate (bits/second) divided by the word length (bits/character).

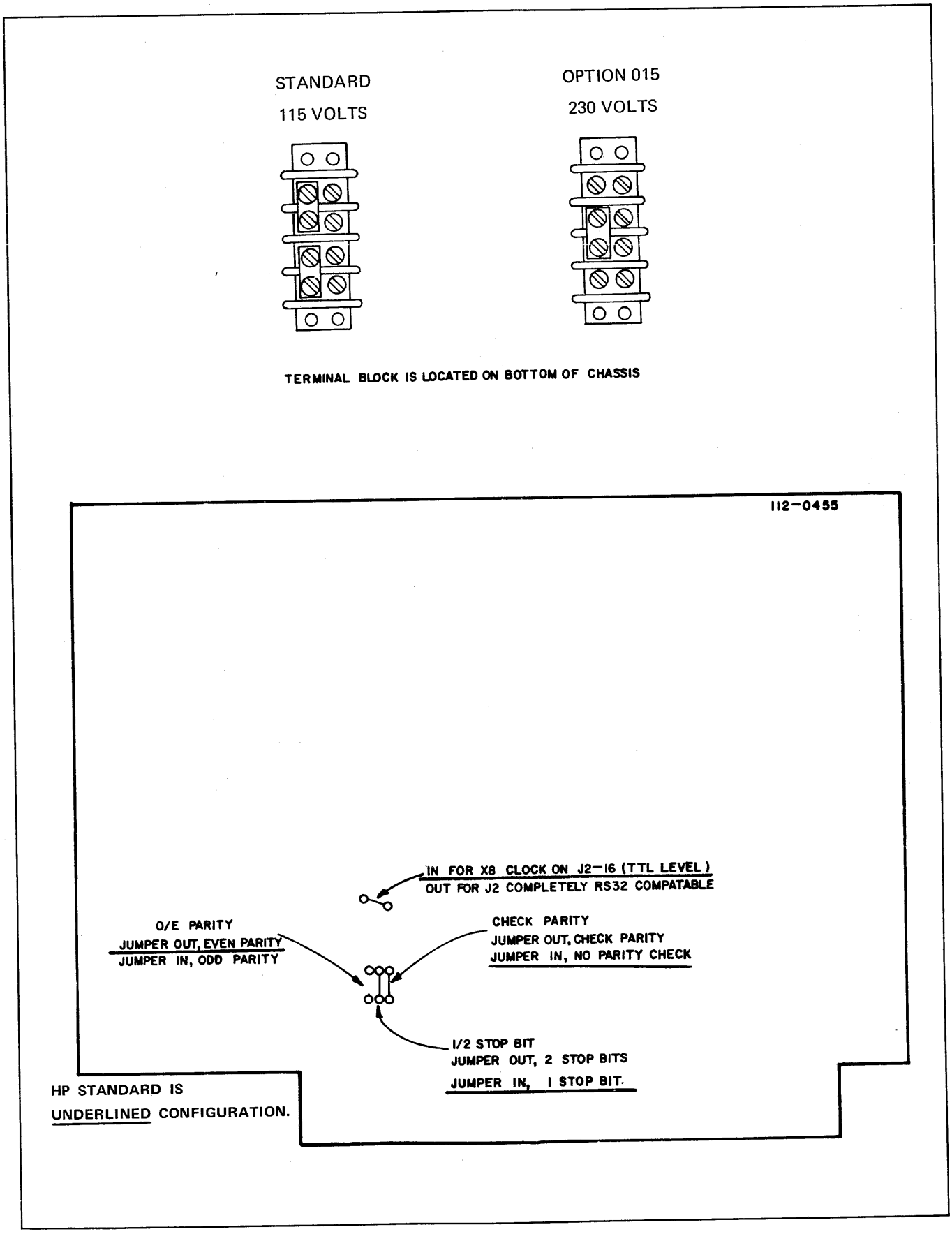


Figure 3-1. CRT Terminal Logic Card Strap Selections

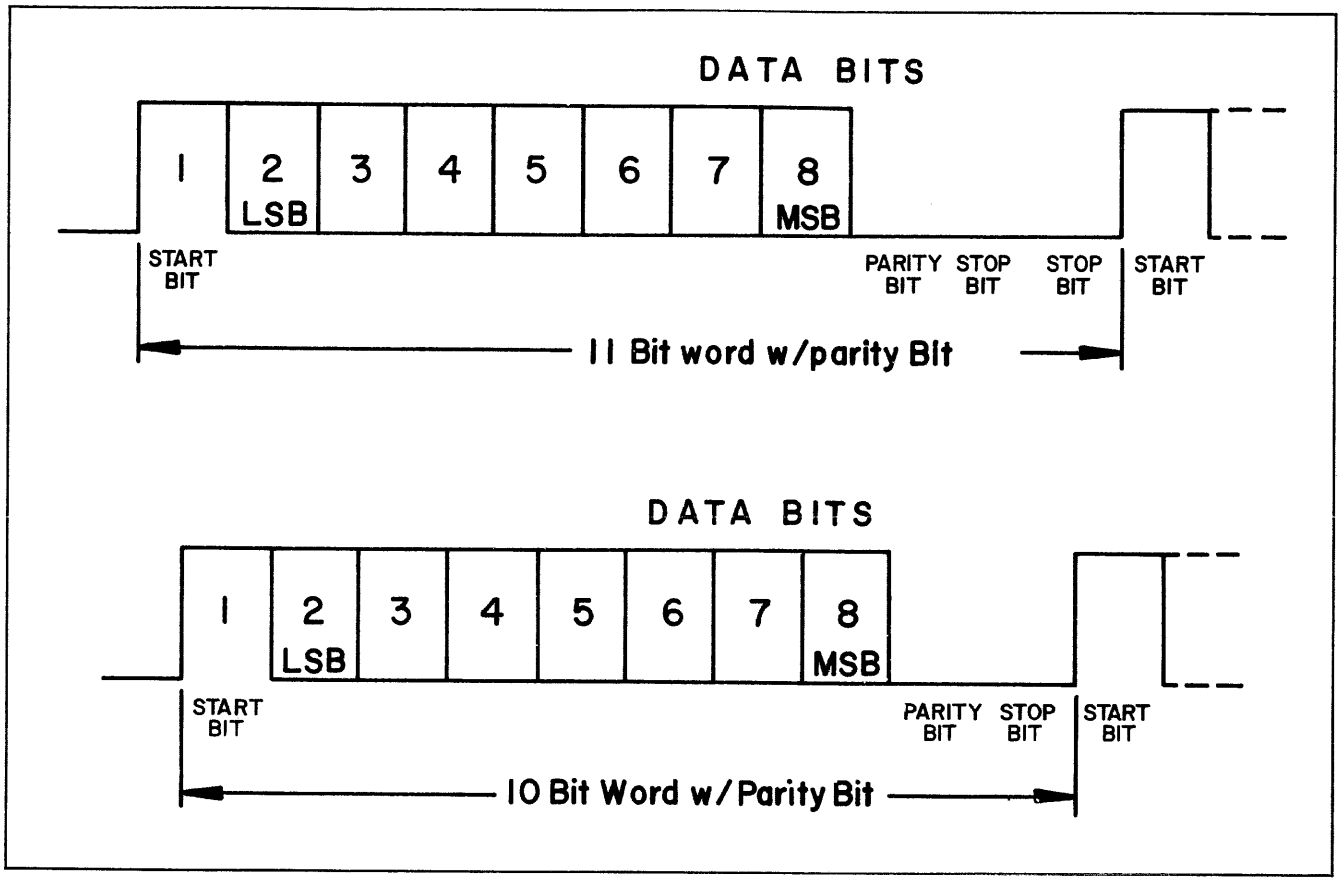


Figure 3-2. Input/Output Word Structure

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION

4-2 This section contains the theory of operation for the MINI BEE computer terminal.

4-3. GENERAL DISCUSSION

4-4. The MINI BEE is a stand-alone CRT terminal composed of the four basic blocks shown in Figure 4-1. The interaction of these blocks provide the capabilities of the terminal. Individual operation of these blocks is discussed in paragraphs 4-5 through 4-12. Figure 4-2 is a basic functional flow diagram of the MINI BEE and shows the relationship of the major operations performed by the terminal.

4-5. POWER SUPPLY

4-6. The power supply block contains the necessary transforming, rectifying and solid state controlling circuitry to provide the other major assemblies, through the MINI BEE LOGIC CARD, with the proper D.C. potentials for their operation. The power may be either the Elexon or Scintilloncs power supply.

4-7. MONITOR

4-8. The monitor block contains a 12'' T.V. type CRT screen and its supporting solid state circuitry. The monitor is controlled by the vertical and horizontal synchronization signals developed on the MINI BEE LOGIC CARD and the video output signal to produce a full screen of information consisting of either 25 lines, or 12 lines of 80 characters each.

4-9. KEYBOARD

4-10. The keyboard block contains the key switches and supporting solid state logic circuitry to generate the appropriate control signals and ASCII characters utilized in the MINI BEE. It also contains indicators and receives signals for the indicators and logic circuitry from the MINI BEE LOGIC CARD.

4-11. MINI BEE LOGIC CARD

4-12. The main logic block consists of the major functioning and controlling circuits in the MINI BEE. It receives the various output voltage from the POWER SUPPLY and distributes the proper voltages to their respective destinations in the other main assemblies and within itself. As a product of the timing and synchronization considerations, control signals are impressed upon the MONITOR to present an organized pictorial of the data under consideration. The MINI BEE LOGIC CARD also receives 7 bit encoded data words and several control signals from the KEYBOARD, which it scrutinizes and then reacts accordingly. It also supplies the KEYBOARD with signals to control the operator monitored indicators. In addition, it controls the reception and transmission of data between the MINI BEE and any external equipment.

4-13. DETAILED DISCUSSION

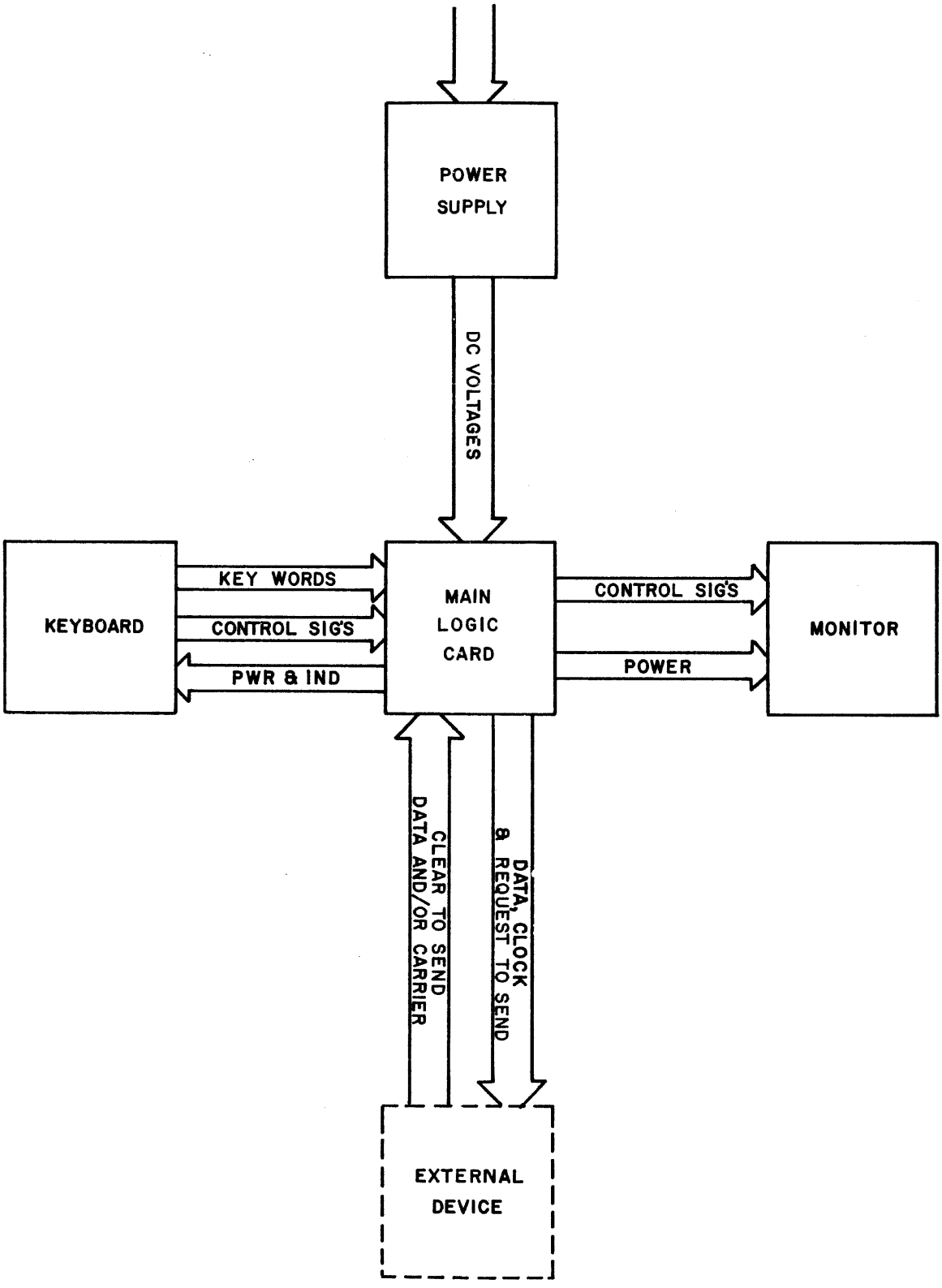
4-14. A detailed discussion of the MINI BEE terminal operation is contained in paragraphs 4-13 through 4-87. A detailed block diagram of the terminal is shown in Figure 4-3. Schematic diagrams of the MINI BEE terminal are contained in the Diagrams section of this manual (Section VI).

4-15. POWER SUPPLY

4-16. The POWER SUPPLY has the capability of being connected to either 115 VAC or 230 VAC ± 10% at 50/60 Hz with propor strapping of the terminal block (Refer to Figure 3-1.)

4-17. TRANSFORMER

4-18. Once power is applied to the POWER SUPPLY the voltage is stepped down by the transformer (refer to Figure 4-1).



MINI BEE BASIC BLOCK DIAGRAM

Figure 4-1. Basic Block Diagram

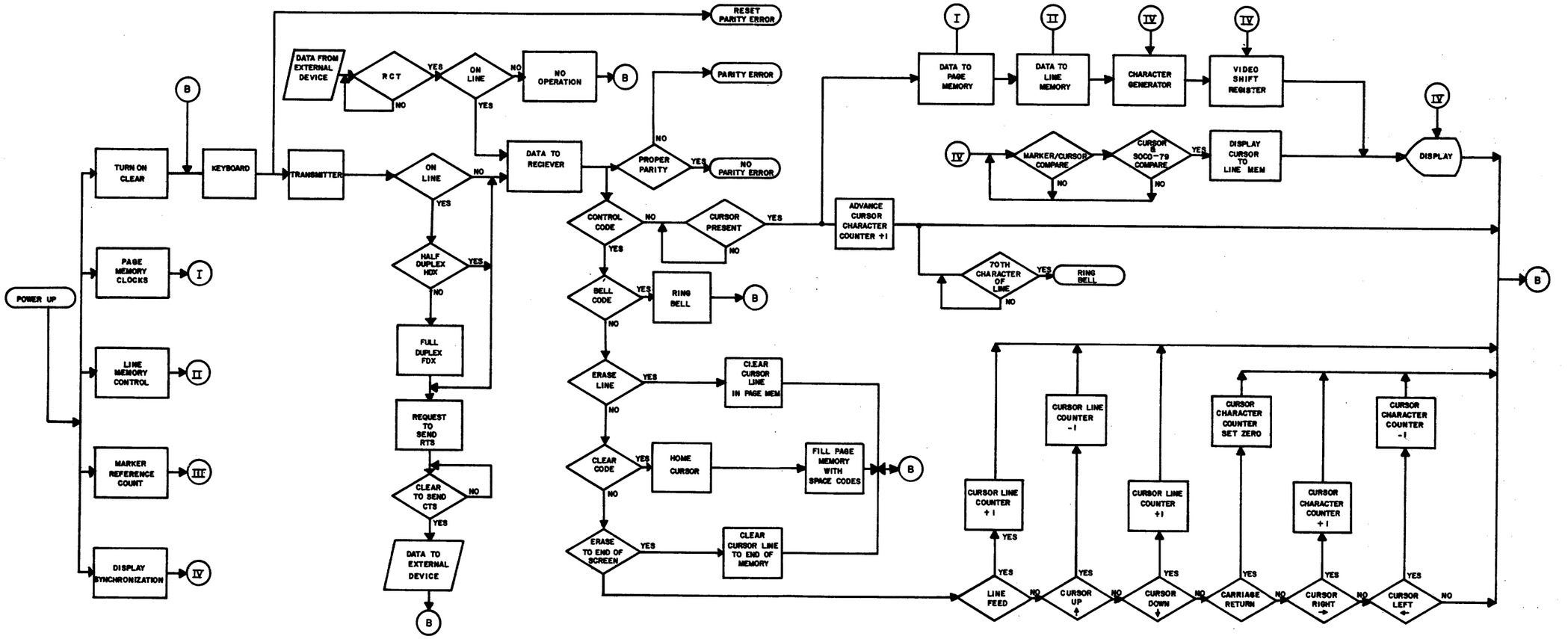
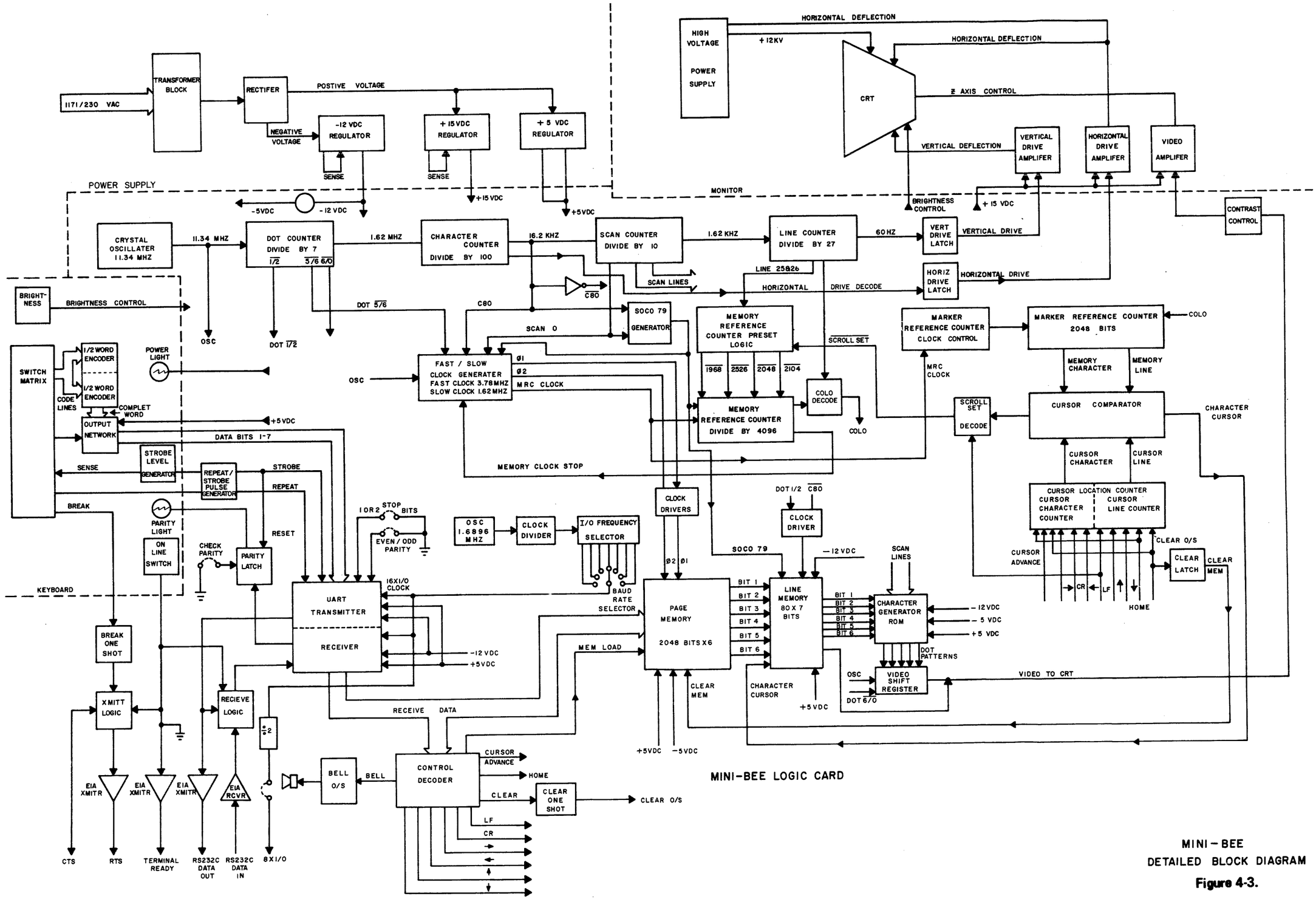


Figure 4-2. Basic Functional Flow Diagram



MINI-BEE LOGIC CARD

MINI-BEE
DETAILED BLOCK DIAGRAM

Figure 4-3.

4-19. RECTIFIER

4-20. The Transformed voltages are rectified in the rectifier block. The output from the rectifier and filter supplies provide power to the +5VDC, +15VDC, and −12VDC regulator circuits.

4-21. +5VDC, +15VDC, −12VDC REGULATION CIRCUITS

4-22. The Voltage received from the rectifier and filter circuit is applied to an IC regulating Chip, a pre-regulator transistor, and a series pass transistor to provide regulated voltages. In addition voltages are applied to the current sense and over voltage protect circuit for short circuit and over voltage protection.

4-23. MONITOR

4-24. The function of the monitor is to display data on the face of the CRT in an organized manner determined by the design of the logic driving the monitor and requires three separate signals to cause proper operation. These signals are:

1. Vertical synchronization.
2. Horizontal synchronization.
3. Video information.

Positive 15 VDC is applied through the MINI BEE LOGIC CARD from the POWER SUPPLY to the various amplifying circuits for their low voltage operating potential.

4-25. VERTICAL SYNCHRONIZATION

4-26. Vertical synchronization is applied to the vertical oscillator and triggers it at the vertical refresh rate as determined by the driving logic. The vertical frequency is stabilized by the vertical frequency control, which determines the point of oscillation. The output pulse of the vertical oscillator is applied to the driver amplifier which shapes the pulse and is controlled by the vertical linearity control. The output of the driver amplifier is applied to the vertical driver, by way of the height control. The vertical drivers output pulse is applied to the yoke of the CRT and causes vertical deflection.

4-27. HORIZONTAL SYNCHRONIZATION

4-28. The horizontal synchronization pulses are applied to the horizontal amplifier where they are amplified and applied to the horizontal driver. The output of the horizontal drive is applied through the width coil to the yoke, where it causes the horizontal deflection. The horizontal deflection signal is also applied to the flyback transformer. The horizontal deflection signal is stepped-up to approximately +12KV where it is then rectified, filtered, and applied to the anode cap of the CRT to provide the high voltage required.

4-29. VIDEO INFORMATION

4-30. The video information is applied to the video amplifier by way of the contrast control, external to the monitor. From the video amplifier, the signal is applied to the cathode of the CRT gun to cause an on/off condition corresponding to light patterns on the screen.

The brightness control is external to the monitor and varies the voltage on the acceleration grid of the CRT gun. The focus control varies the voltage on the focusing grid of the CRT gun.

4-31. KEYBOARD

4-32. The keyboard enables the operator to manually input information to the terminal and is comprised of the following assemblies:

1. Key-switch matrix
2. Two ½ word (4 bit) encoders
3. Output Network
4. Strobe Level Generator
5. On Line/Local Switch
6. Indicators

4-33. KEY-SWITCH MATRIX

4-34. The KEY-SWITCH MATRIX is sensed by the STROBE LEVEL GENERATOR for the operation of any key. Depressing a key raises the level of the proper output code lines which are fed to the ½ (one half) word encoders.

4-35. ½ (ONE HALF) WORD ENCODERS

4-36 The code lines are processed by the two ½ WORD ENCODERS which are 4 bits wide each and are assembled into the proper ASCII code for the key that was exercized and sends it to the OUTPUT NETWORK.

4-37. OUTPUT NETWORK

4-38. Once in the OUTPUT NETWORK the assembled data word is scrutinized and assigned the desired parity. The OUTPUT NETWORK is also responsive to a control code line from the KEY-SWITCH MATRIX to identify control codes. The completed data word is then sent to the MINI BEE LOGIC CARD with the appropriate strobe level.

NOTE: The eight bit (parity) is provided by the OUTPUT NETWORK, but not used in the MINI BEE.

4-39. STROBE LEVEL GENERATOR

4-40. The STROBE LEVEL GENERATOR senses the execution of any key. As a product of sensing key operation, the proper strobe level is then generated and is sent to the MINI BEE LOGIC CARD with one exception; when a two key roll-over condition exists, i.e. two keys depressed at one time, the strobe level reverts to its idle state and only the first key struck will be processed.

4-41. ON LINE/LOCAL SWITCH

4-42. The output of the ON LINE/LOCAL SWITCH is directly coupled to the MINI BEE LOGIC CARD where it is applied to the appropriate logic to execute one of the two major modes of the MINI BEE terminal.

4-43. INDICATORS

4-44. The POWER ON INDICATOR tells the operator that the MINI BEE terminal has power applied and is in an operational state.

4-45. When the Check Parity Strap is out, the PARITY INDICATOR makes the operator cognizant of the reception of a character from an external device having improper parity assignment. The ON condition can be reset by operating any key on the KEYBOARD with the exception of the break key. If the Check Parity Strap is in, the does not check parity.

4-46. MINI BEE LOGIC CARD

4-47. The MINI BEE LOGIC CARD is the logical and operational heart of the MINI BEE terminal. It controls and initiates all of the major functions as well as distributes operating potentials. The following paragraphs explain the major functions carried on within the MINI BEE LOGIC CARD.

4-48. DISPLAY ORGANIZATION

4-49. The main timing chain (Oscillator, Dot Counter, Character Counter, Scan Counter, and Line Counter) defines the configuration of the display on the CRT. There are 27 lines, two of which are used for vertical retrace and 25 of which are used to display characters. The 27 lines are composed of ten scans each, each scan being composed of 100 characters, 80 for display and 20 for horizontal retrace, each character being composed of a 5 x 7 character dot matrix (refer to Figure 4-4).

4-50. OSCILLATOR

4-51. The Oscillator is a standard crystal oscillator with a frequency of 11.34 MHZ. Two 7404's are connected in series by a .002 microfarad capacitor. Each 7404 is biased with a 1Kohm resistor connected from their input to their output. A 11.34 MHz crystal is connected from the input of the first 7404 to the output of the second 7404. The output of the oscillator is inverted and feed to the dot counter.

4-52. DOT COUNTER

4-53. The Dot Counter defines each of the seven dots required to compose one character. The Dot Counter is a shift register that operates as a ring counter. The Dot Counter has available on any output a low which is two dots wide. The outputs are labeled 6 and 0, 0 and 1, 1 and 2, etc. The divide-

DOT MATRIX

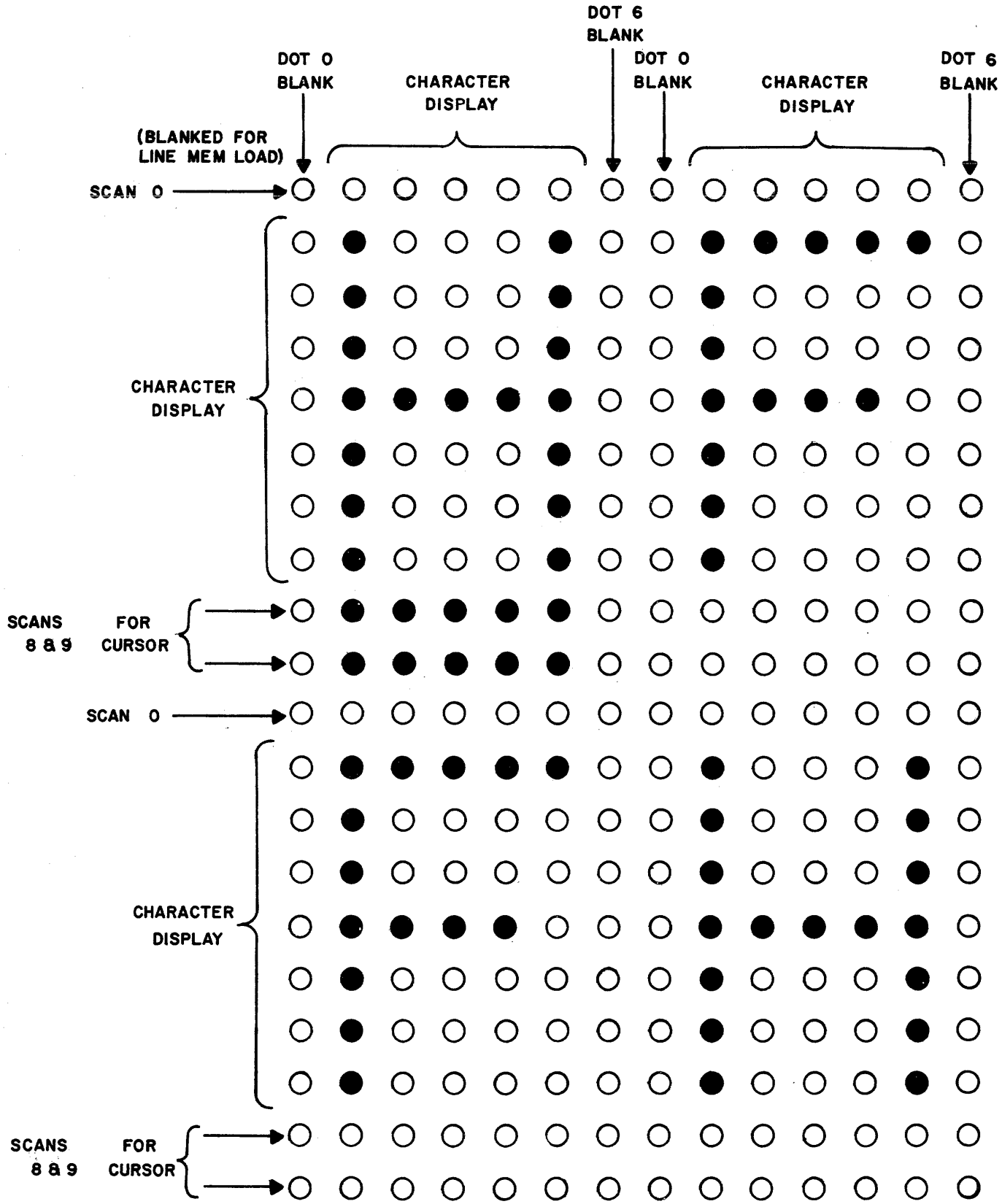


Figure 4-4. Character Dot Matrix

by-seven Dot Counter's output is applied to the Character Counter.

4-54. CHARACTER COUNTER

4-55. The Character Counter is composed of two decade counters that define 100 character times, each being seven dots wide. The output of the Character Counter is applied to the Scan Counter.

4-56. SCAN COUNTER

4-57. The Scan Counter is a standard decade counter that defines 10 scans of 100 characters each, with each character being seven dots wide. The output of the Scan Counter is applied to the Line Counter.

4-58. LINE COUNTER

4-59. The Line Counter (a combination of A72, a 4-bit decode counter and A60, a flip-flop) is a standard 5-bit binary counter preset to the count of five and overflows at the count of 32, which is a modulus of 27.

4-60. SCAN 0 CHARACTER 0 TO 79 (SOCO-79)

4-61. Signal SOCO-79 represents the first eighty characters of SCAN 0 and this signal is used to generate slow clocks to transfer the Page Memory information to the Line Memory. This is generated by way of a latch and gating which comes off the Scan Counter and indicates the receipt of the first eighty characters of the Scan Counter.

4-62. FAST/SLOW CLOCK GENERATOR

4-63. The page memory makes in excess of one revolution per line. Slow clocks are applied during SOCO-79 and fast clocks are applied during the remaining scans until the memory has made a revolution, at which time the memory stops and waits for Scan 0. The 11.34 MHz signal from the Oscillator is also applied to a circuit which divides down to the clocking signals required for the fast clock and the slow clock. This is broken down into Phase 1 and Phase 2 clocks and applied to the Memory Clock Drivers to provide the clocking signals needed to drive the clock at the appropriate MOS interfacing.

4-64. HORIZONTAL AND VERTICAL DRIVE

4-65. The Horizontal drive latch is set by a count of 84 from the Character Counter. The Character Counter counts from 84 to 99 and overflows to Ø and continues to count. At the count of 20 the Horizontal Drive latch is reset. This generates a high level Horizontal Drive pulse which causes horizontal retrace in the monitor.

4-66. The Vertical Drive is derived by the count of 24/30 from the Line Counter (depending on 12/25 line configuration). This causes Vertical Drive which is reset by the Line Counter going to zero.

4-67. MEMORY REFERENCE COUNTER

4-68. The Memory Reference Counter counts from a preset value determined by the line counter and the scroll latch to 4096 and identifies each location in memory. This counter overflow indicates that the memory has completed a revolution and denotes the time which the memory should stop to wait for the housekeeping to be finished on the display so that the memory and the display are again in synchronization. The reset of the main timing chain is gated with the Memory Reference Counter overflow and is designated COLO which signifies CHARACTER O LINE O or that one page has been written on the screen. The same signal that clocks the Memory Reference Counter also clocks the Marker Reference Counter.

4-69. MARKER REFERENCE COUNTER

4-70. The Marker Reference Counter is broken up to indicate the character and the line that the memory is now on. The Counter will count to 2048 in increments of 80 counts (to define one line) for 25 lines with 48 undefined locations. It has the capability of identifying each of the 2000 locations on the screen.

4-71. CURSOR LOCATION COUNTER

4-72. The Cursor Location Counter identifies the location of the cursor. This is a count made up of the location of the Cursor Line Number and the Cursor Character Number. The Cursor

Location Counter is compared with the Marker Reference Counter and, when the compare is true, the output signal is designated the Character Cursor signal. Also associated with the Cursor Location Counter is the appropriate circuitry to move the cursor up, down, right, left, home, etc. The capability of doing a line feed or a carriage return also exists as a function of altering this counter.

4-73. UART (RECEIVER)

4-74. Data can be received by the MINI BEE from one of two modes; from the EIA RS232C interface into the UART or from the Keyboard through the transmit side of the UART to the receive side of the UART. The interface has a clock which has the capability of transfer rates between 110 baud and 9600 baud. This is composed of an oscillator running at 1.6896 MHz into a counter which has a 110/150 switch. This goes into a counter which act as dividers to provide 16 times the I/0 rate. This clock is applied to the receive side of the UART and the UART has the circuitry to take the 16 times and baud rate and break it down to the baud rate. The EIA line receiver can receive data at EIA levels and gate them into the UART when the MINI BEE is On-Line. Through the same gating, data is brought in from the transmit side of the UART. Also monitored through an EIA line receiver is the carrier detect from the modem. The data is brought into the UART and the UART converts it to parallel data on a data buss (seven bits). The UART also does VRC parity checks. The data from the data buss is applied to two points. It is applied to a series of decoders which decode the data to check if it is a control code or a printable character. It is applied first to the input of the Page Memory. If the data is a printable character, the associated circuitry generates the signal Mem Load. As the character is decoded, a Mem Load is generated as well as a Cursor Advance which makes the cursor move one character to the right.

4-75. PAGE MEMORY

4-76. The Page Memory holds all 2000 characters possible to display onto the screen. These are transferred 80 at a time to the Line Memory for display. In order to write data into the Page Memory, the Character Cursor comes up and, if this is a displayable character, the signal Mem Load is generated. Upon generating Mem Load, the UART is reset and is now capable of receiving the next character. The new character to be loaded into the Page Memory is applied to the Memory Input Multiplexer. The signal Mem Load switches the multiplexer, inhibits the recirculate path for the Page Memory, and enables the new character to be loaded into the next clock. This corresponds to the proper location in the Cursor Location Counter. The character that is applied to the Page Memory is then loaded into the Page Memory and is recirculated. The Page Memory is organized as a 2048 x 6 bit recirculating shift register. Every SOCO-79 the Page Memory has slow clocks applied to it and is now running at the same rate as the Line Memory for data transfer.

4-77. LINE MEMORY

4-78. The Line Memory holds eighty characters and recirculates them nine times while applying them to the Character Generator. The Line Memory's recirculate path is disabled by SOCO-79, and 80 characters of new information are loaded into the Line Memory. At the end of SOCO-79, the Line Memory's internal recirculate path is enabled, fast clocks are again applied to the Page Memory, and it resumes its fast clock rate. The information now in the Line Memory is recirculated nine more scans and, during these nine scans, is applied to the Character Generator.

4-79. CHARACTER GENERATOR

4-80. The Character Generator is a read-only-memory (ROM) that is addressed by the character (in ASCII) and the scan configuration. The binary scan codes indiates the present scan configuration and the character indicates the pattern desired on that scan. At this point, five-bit dot patterns are generated which are representative of a portion of a character. The output of the Character Generator is applied to the Video Shift Register.

4-81. VIDEO SHIFT REGISTER

4-82. The video shift register is loaded with data by dot 6/0 and is clocked by the oscillator.

The dots are shifted out, mixed with cursor information, and blanking signals and applied to the MONITOR through the contrast control as video information.

4-83. CONTROL DECODER

4-84. If a defined control code is decoded, it is executed. The Control Decoder can decode Cursor Up, Cursor Down, Cursor Right, Cursor Left, Home, Clear, Bell, Line Feed, Carriage Return, Erase Line, Erase-to-End-of-Screen, and Back Space. In the event that a bell is decoded, a one-shot is set which enables Scan 4 (a tone of approximately 2 kiloHertz) to be applied to a speaker. The other side of the speaker is wired to +5 volts. The bell is enabled on the 70th character of each line or on receipt at a Control G.

4-85. PARITY ERROR

4-86. Parity is based on the use of an additional bit to the ASCII code, known as a "Parity Bit," or "Parity-Check Bit," in each code group or data word. The parity bit associated with each code group in an even-parity-bit checking system has such a value that the total number of 1's or true bits, in each code group plus the parity bit is always even. An odd-parity-bit checking system has a parity bit such that the sum of the 1's or true bits, in each code group plus the parity bit is always an odd number.

In the event the MINI BEE is strapped to check parity and the terminal receives a code having an erronious total of high bits, the parity error light located on the keyboard is illuminated and the code is acted upon by the terminal. The parity error light may be reset by depressing any key (with the exception of the break key).

4-87. UART (TRANSMIT)

4-88. The Keyboard data lines bit 1-7 are applied to the transmit side of UART. Also coming from the Keyboard is Keyboard Strobe and Keyboard Repeat which, together, enable the repeat oscillator which retriggers the UART and retransmits the character being generated. As the UART receives the character from the Keyboard, it performs the appropriate parity generation, considers one or two stop bits for a 10- or 11-bit word, and, by having a 16 times the baud rate clock applied to it, breaks down the clock and transmits the character. The character is applied through an EIA RS232C interface to the computer. Also coming from the UART is output data at a TTL level which is applied to the receive side of the UART through the previously mentioned logic. Also generated to the EIA output interface is a Terminal Ready signal which indicates the status of the MINI BEE to the computer and a Request to Send signal which indicates a desire to transmit data to the computer. The Clear to Send line coming from the computer is monitored at the EIA RS232 interface levels. It is received by a line receiver which converts it to TTL levels and applies it to the UART as a consideration for enabling transmission. The 16x baud rate clock is also applied to the computer interface and, if required, a clock which is at 8 times the baud rate (TLL levels). The BREAK key on the keyboard fires a one shot which holds the RS232 interface to a mark position for approximately 500 milliseconds.

SECTION V
MAINTENANCE

5-1. INTRODUCTION

5-2. This section contains information to aid in the maintenance of the MINI BEE CRT Terminal. Preventive and corrective maintenance procedures are specified as well as troubleshooting aids and techniques.

5-3. PREVENTIVE MAINTENANCE

5-4. There is no scheduled periodic maintenance; however, there are several things that could be done should the need arise.

5-5. Care should be exercised to see that there is proper air circulation for the fan. The unit should not be set on a shag carpet or other soft surface that could impede the air entrance to the fan. Also, the degree of dust density in the air should be considered because there is a possibility of foreign matter clogging up the fan filter. In the event that this should occur, the filter must be vacuumed out. The dust can be sucked out of the filter while still in the unit. In more severe instances, the fan filter can be replaced. This is done by first taking off the main cover of the unit, removing four screws, taking out the fan and filter guard, then the filter itself.

5-6. The absite coating makes the plexi-glass highly scratch resistant. It may be wiped with a soft cloth.

5-7. The interior of the unit may be wiped free of dust. Accumulation of dirt causes overheating and component breakdown. Dirt acts as an insulating blanket and prevents efficient heat dissipation. A small brush is very useful for dislodging dirt; a cotton-tipped applicator is good for narrow or hard to get places.

5-8. TROUBLESHOOTING AIDS

5-9. The following is a list of the troubleshooting aids that are provided in this manual to assist in the troubleshooting of functional failures.

- Circuit Schematics
- Basic Block Diagram
- Detail Block Diagram
- Functional Flow Diagram
- Interconnect Diagram
- Timing Diagrams
- Glossary of Terms
- Troubleshooting Flow Diagrams
- Disassembly/Assembly Procedures
- Adjustment Procedures
- ASCII Code Sheet
- Configuration/Strapping Information
- Character Dot Matrix
- Pictures of Wave Shapes

5-10. TROUBLESHOOTING EQUIPMENT

5-11. The following is a list of tools and standard equipment required to repair a MINI BEE terminal:

- V/O Multimeter
- Oscilloscope
- Assorted Electronic Hand Tools

5-12 FULL DUPLEX ECHOPLEX TEST

5-13. A specially wired connector may be assembled which mates with J2 (See Figure 5-1). This connector tester allows the terminal to be operated and tested independent of an external data device. The basic set-up for the test is as follows:

- FDX (Full Duplex Mode)
- On-line
- Baud Rate - Any Setting

Enter data from the keyboard as you would if you were on-line to a computer. If data is displayed on the screen properly, then the MINI BEE is transmitting and receiving data properly.

The test connector is wired as follows: (Refer to Figure 5-1.)

- Connects Transmitted Data Line out of the terminal to received data line into the terminal. Pin 2 to Pin 3 of J2.

- Connects Request to Send control line out of the terminal to Clear-to-send line into the terminal Pin 4 to Pin 5 of J2

- Connects Receive Line Signal Detector line into Data Terminal Ready. Pin 8 to Pin 20 of J2

5-14. CORRECTIVE MAINTENANCE

5-15. This section provides corrective maintenance information to aid in servicing the MINI BEE terminal. It is suggested that the configuration sheet and the turn-on procedure be consulted before performing the corrective maintenance described here.

5-16. TROUBLESHOOTING PRELIMINARY CONSIDERATIONS

5-17. The most common problems occuring in MINI BEE are switch, control, and operation-related. A simple procedure may be followed to help determine if the problem is control and/or operation-related or internal circuitry related by checking the following:

- Illegal Operation (Refer Section II)
- Improper Baud Rate Setting
- Wrong Transmit or Receive Mode (HDX/FDX)
- Loose Interconnect Cable

NOTE: Because the POWER SUPPLY output voltages may affect the terminal in various ways, manifesting itself differently each time, it is suggested that the output voltages be verified good in accordance with the POWER SUPPLY adjustment procedures.

5-18. HOW TO USE TABLE 5-1

5-19 A list of trouble shooting flow diagrams is given in Table 5-1. This index lists apparent failure and refers the user to the proper flow diagram. To derive the maximum benefit from Table 5-1, the following procedure is recommended:

1. Find the apparent trouble in the Troubleshooting Flow Diagram Index.

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

3. 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.

4. Reference is made to Timing Diagrams and Wave Shapes which are contained in the Diagrams Section (Section VI) of this manual (refer to Table 5-1).

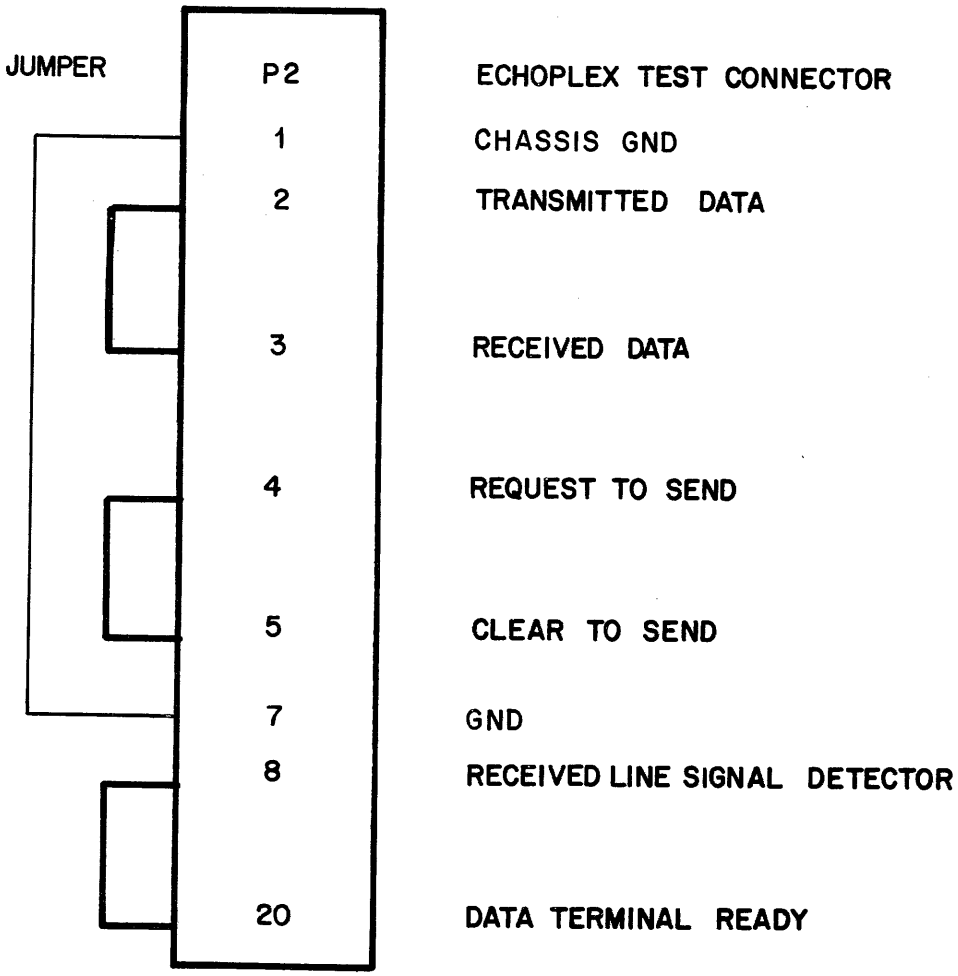


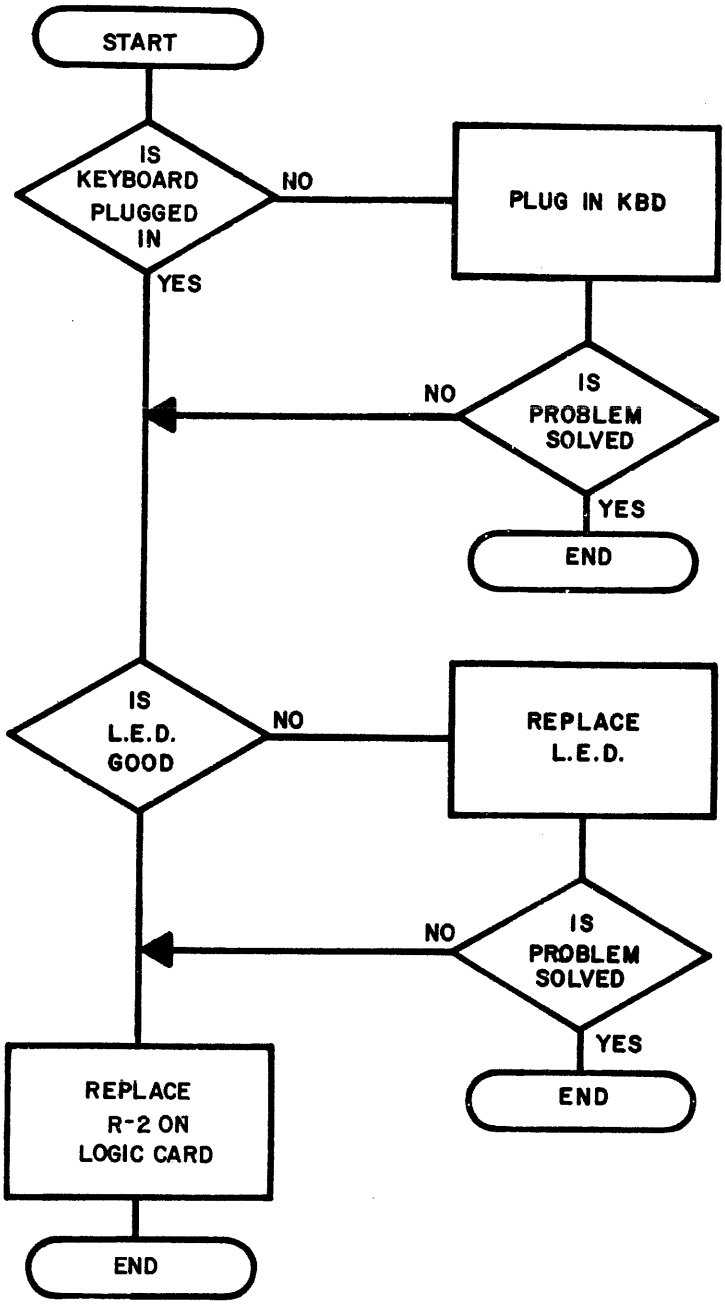
Figure 5-1. Echoplex Connector

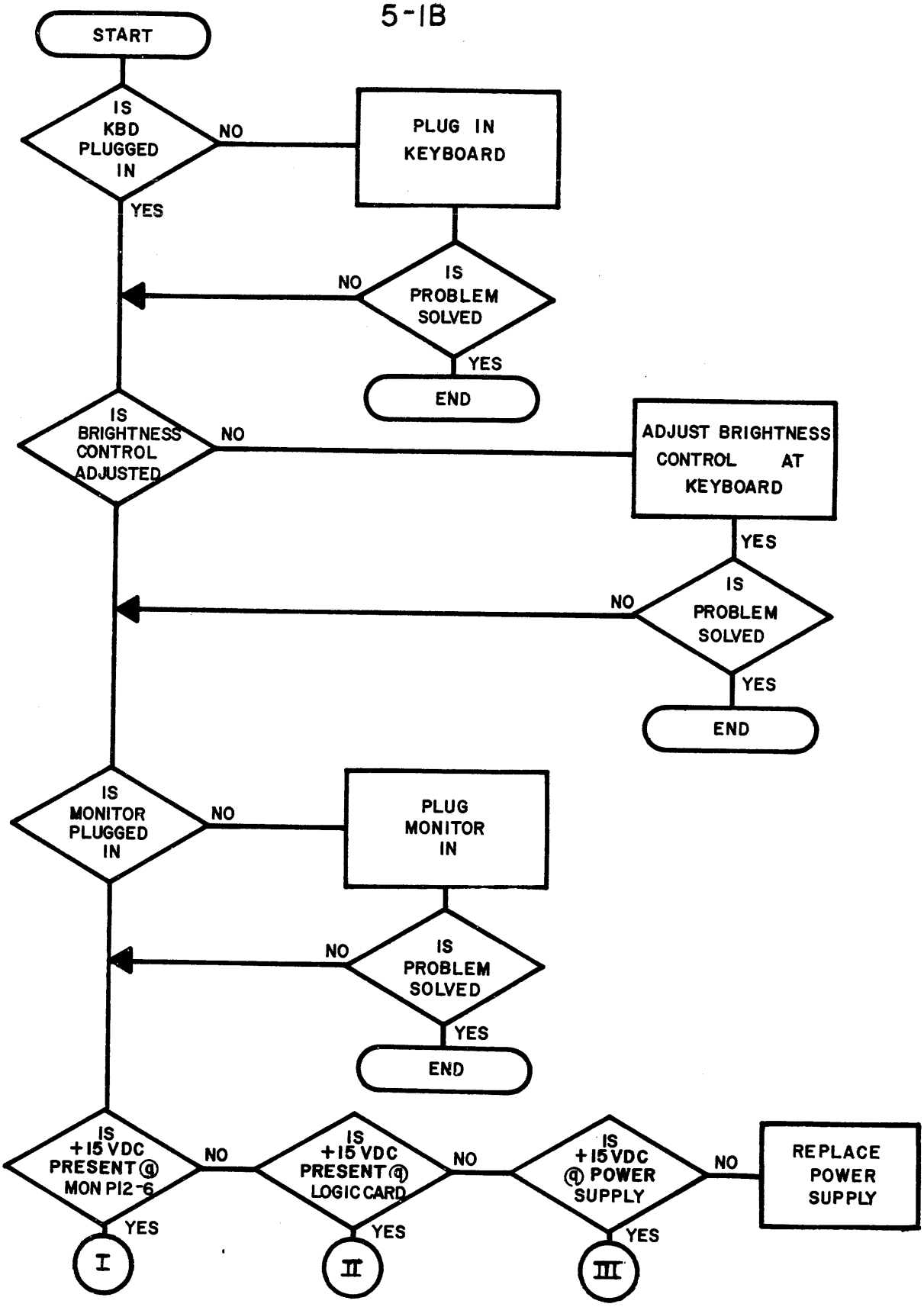
Table 5-1. Troubleshooting Flow Diagram Index

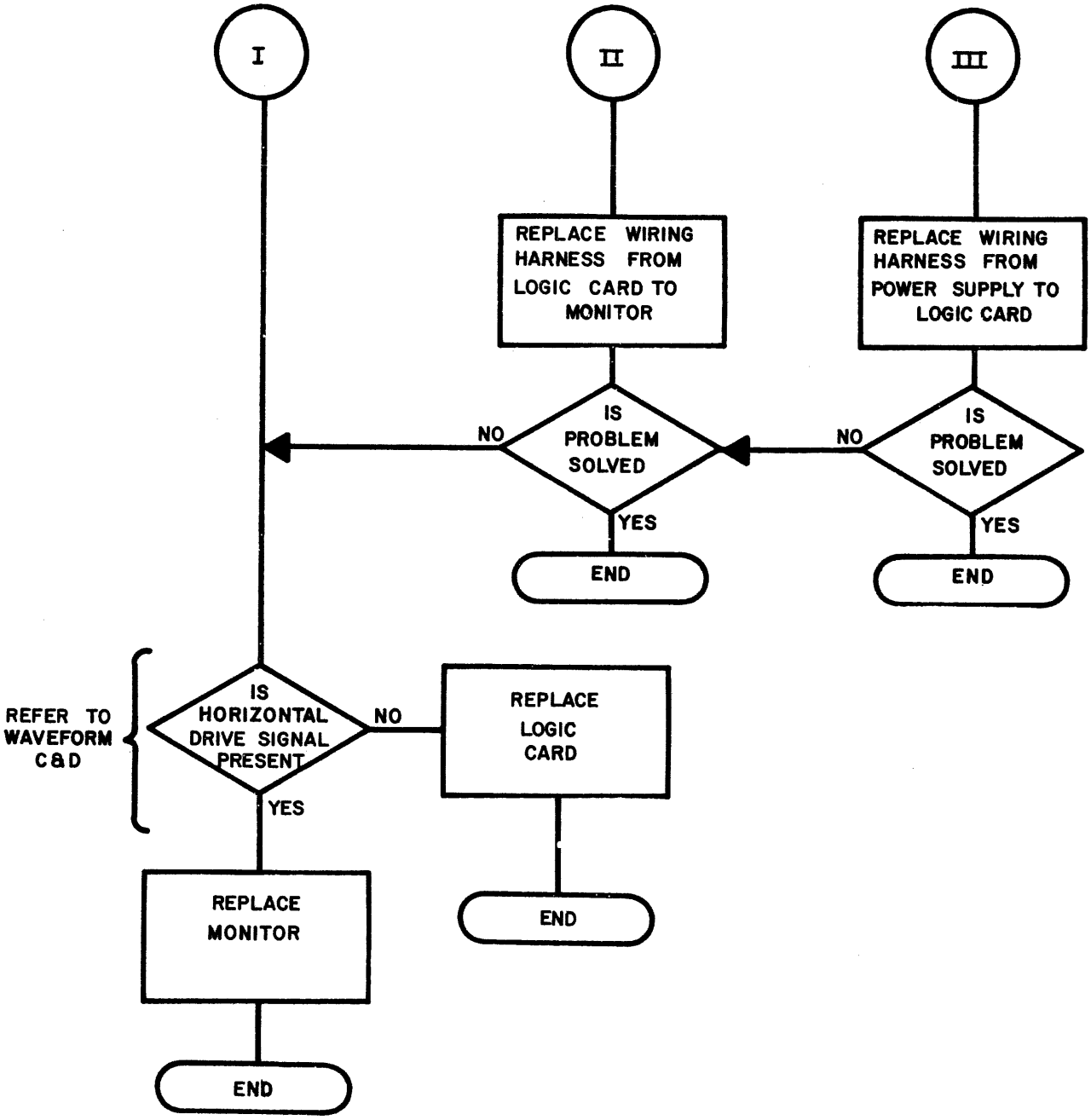
Apparent Failure	Troubleshooting Flow Diagram
GENERAL	
1. Power indicator off, but raster present on CRT screen	5-1A
2. No raster present, but power indicator on	5-1B
3. No raster present and power indicator off	5-1C
OFF LINE	
1. Cursor either absent, multiple cursors, cursor not in home position or screen filled with video blocks	5-2A
2. No character displayed when written non cursor advance	5-2B
3. Wrong character displayed	5-2C
4. No escape functions	5-2D
5. No control functions	5-2E
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	5-3D
5. No break function	5-3E
6. No parity error light reset	5-3F
DISPLAY	
1. All displayed characters out of focus	5-4A
2. Rolling display	5-4B
3. Display too tall/short for screen size	5-4C
4. Height of displayed characters uneven	5-4D

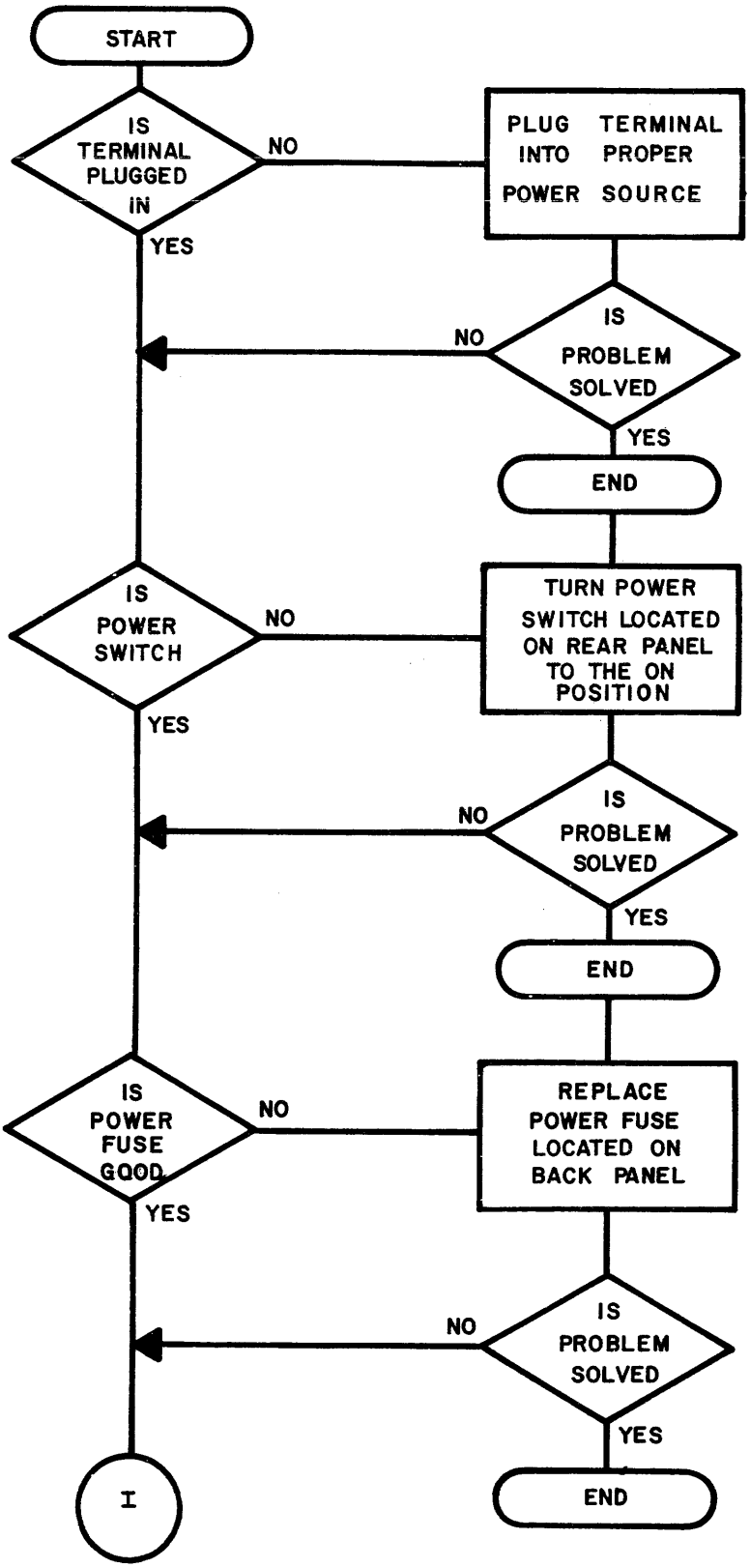
Table 5-1 (continued)

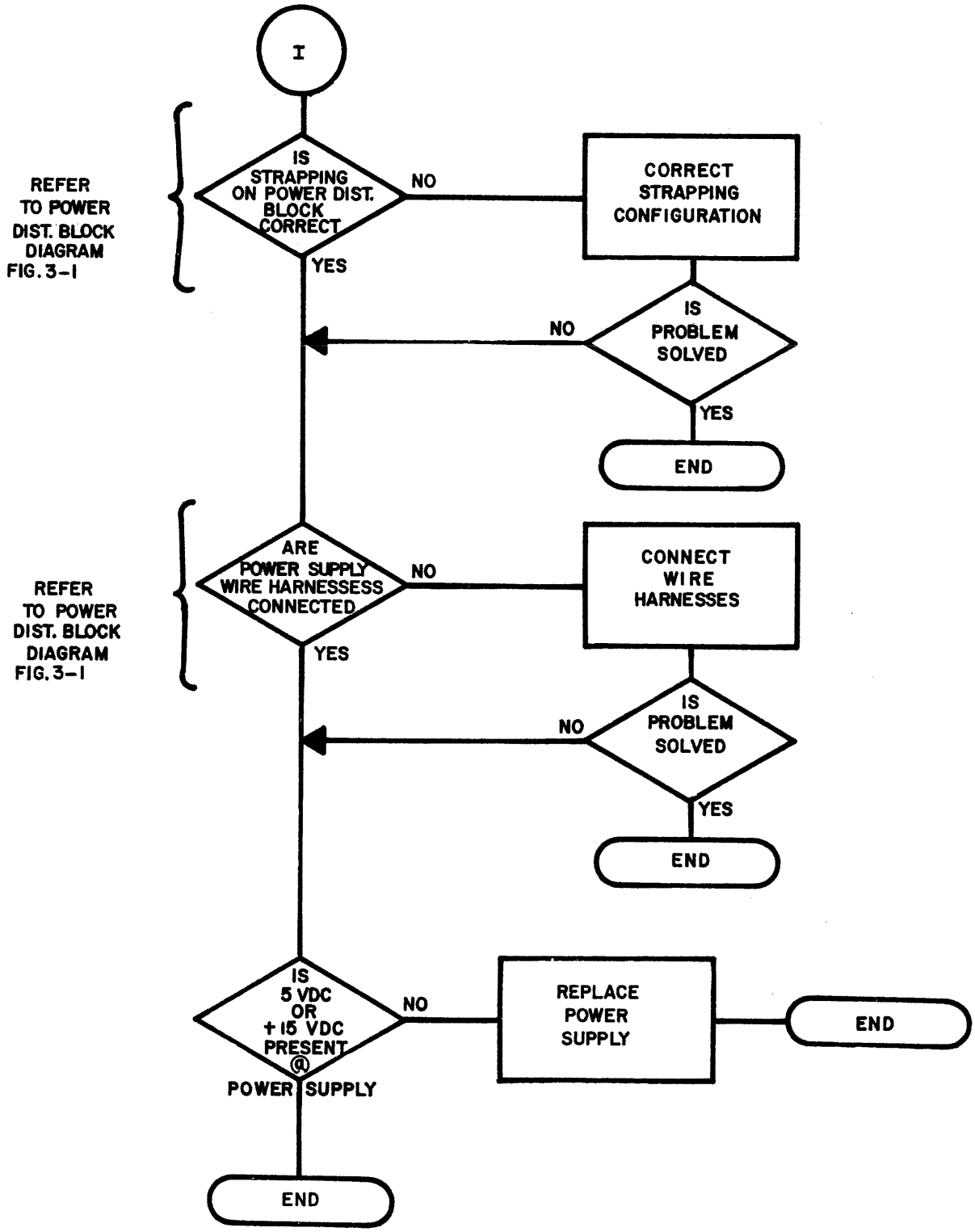
Apparent Failure	Troubleshooting Flow Diagram
5. Display too wide/narrow for screen size	5-4E
6. Display not centered	5-4F
7. Tilted display	5-4G
8. Others	5-4H
A. Single vertical line	
B. Physical damage	
C. Dot in center of screen	
D. Uneven intensity/focus	
E. Burned phosphor	
F. Uneven display dimensions	
G. Excessive H.V. Arching	


START
IS KEYBOARD PLUGGED IN
NO
PLUG IN KBD
YES
NO
IS PROBLEM SOLVED
YES
END
IS L.E.D. GOOD
NO
REPLACE L.E.D.
NO
IS PROBLEM SOLVED
YES
END
REPLACE R-2 ON LOGIC CARD
END

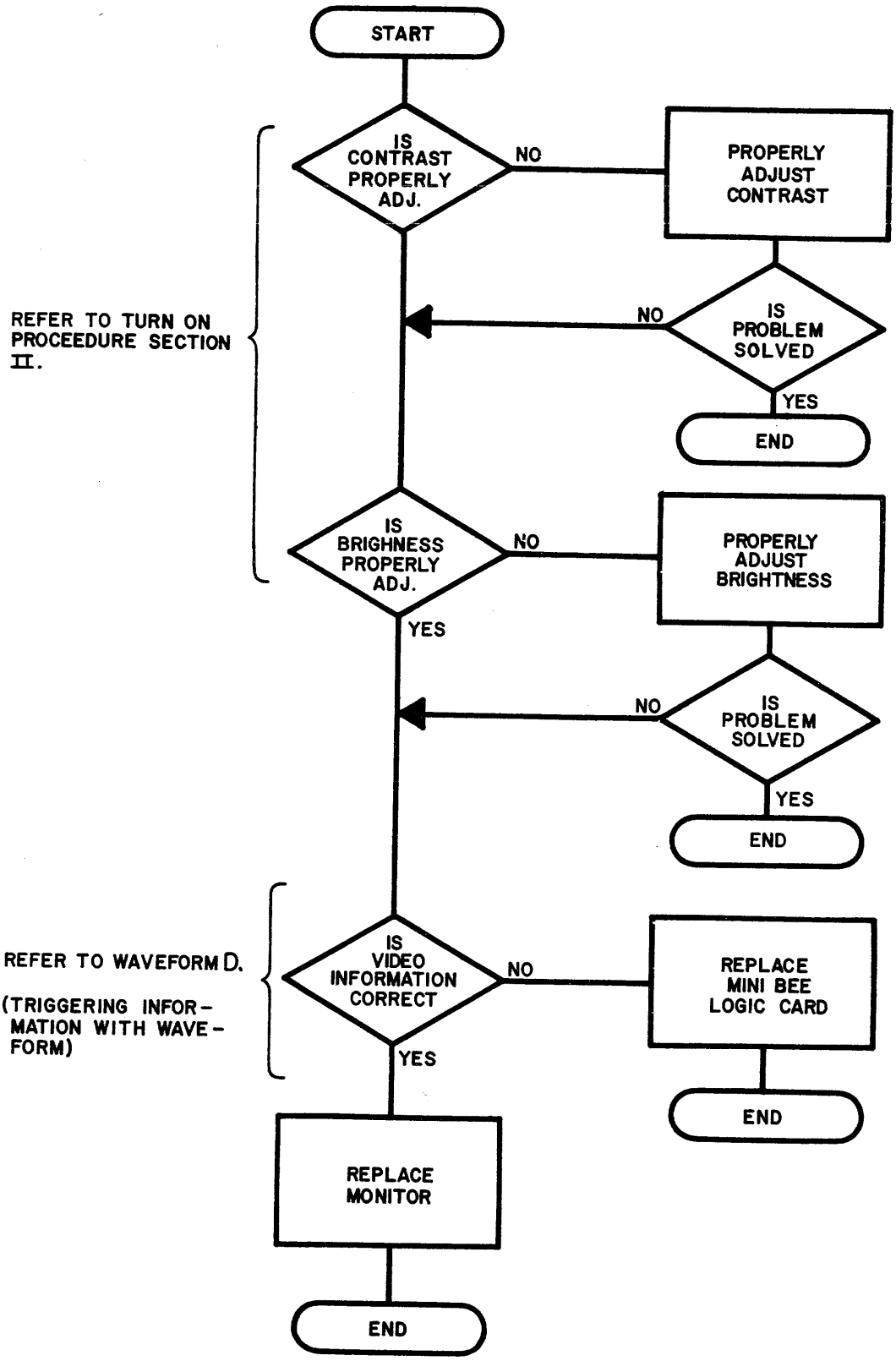

START
IS KBD PLUGGED IN
NO
PLUG IN KEYBOARD
YES
NO
IS PROBLEM SOLVED
YES
END
IS BRIGHTNESS CONTROL ADJUSTED
NO
ADJUST BRIGHTNESS CONTROL AT KEYBOARD
YES
NO
IS PROBLEM SOLVED
YES
END
IS MONITOR PLUGGED IN
NO
PLUG MONITOR IN
NO
IS PROBLEM SOLVED
YES
END
IS +15 VDC PRESENT @ MON P12-6
NO
IS +15 VDC PRESENT @ LOGIC CARD
NO
IS +15 VDC @ POWER SUPPLY
NO
REPLACE POWER SUPPLY
YES
I
YES
II
YES
III


I
II
III
REPLACE WIRING HARNESS FROM LOGIC CARD TO MONITOR
REPLACE WIRING HARNESS FROM POWER SUPPLY TO LOGIC CARD
IS PROBLEM SOLVED
NO
YES
END
IS PROBLEM SOLVED
NO
YES
END
REFER TO WAVEFORM C&D
IS HORIZONTAL DRIVE SIGNAL PRESENT
NO
REPLACE LOGIC CARD
YES
REPLACE MONITOR
END
END

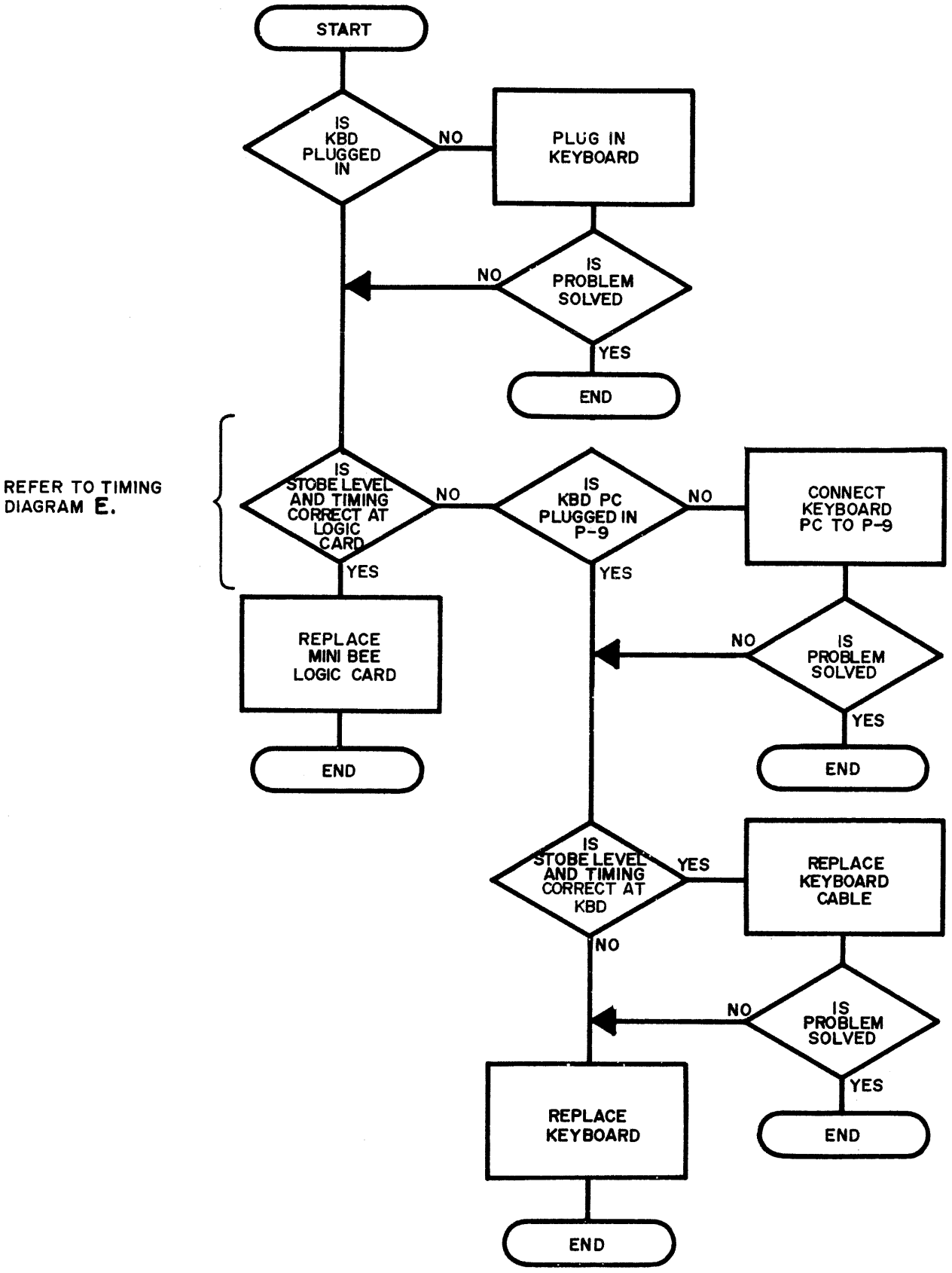

START
IS TERMINAL PLUGGED IN
NO
PLUG TERMINAL INTO PROPER POWER SOURCE
YES
IS PROBLEM SOLVED
NO
YES
END
IS POWER SWITCH
NO
TURN POWER SWITCH LOCATED ON REAR PANEL TO THE ON POSITION
YES
IS PROBLEM SOLVED
NO
YES
END
IS POWER FUSE GOOD
NO
REPLACE POWER FUSE LOCATED ON BACK PANEL
YES
IS PROBLEM SOLVED
NO
YES
END
I


I
REFER TO POWER DIST. BLOCK DIAGRAM FIG. 3-1
IS STRAPPING ON POWER DIST. BLOCK CORRECT
NO
CORRECT STRAPPING CONFIGURATION
YES
IS PROBLEM SOLVED
NO
YES
END
REFER TO POWER DIST. BLOCK DIAGRAM FIG. 3-1
ARE POWER SUPPLY WIRE HARNESSESS CONNECTED
NO
CONNECT WIRE HARNESSES
YES
IS PROBLEM SOLVED
NO
YES
END
IS 5 VDC OR +15 VDC PRESENT @ POWER SUPPLY
NO
REPLACE POWER SUPPLY
END
END

5-2A

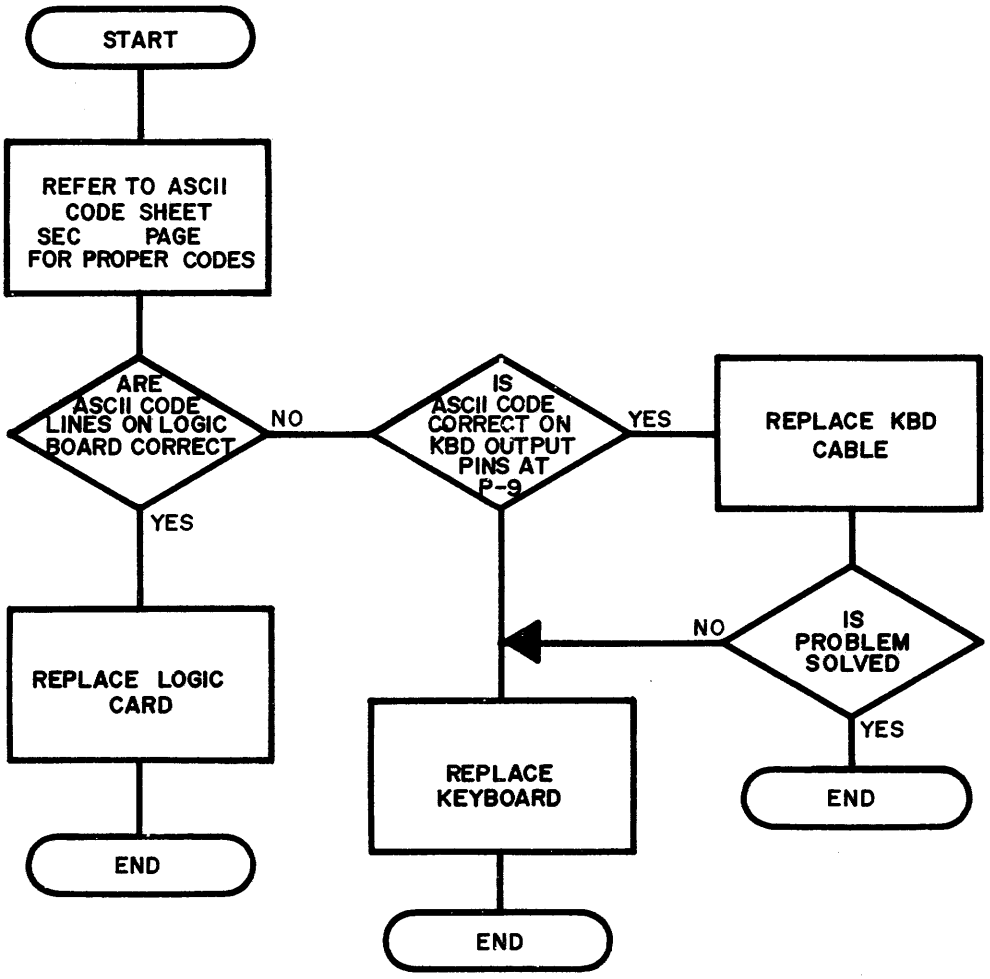

START
IS CONTRAST PROPERLY ADJ.
NO
PROPERLY ADJUST CONTRAST
NO
IS PROBLEM SOLVED
YES
END
REFER TO TURN ON PROCEEDURE SECTION II.
IS BRIGHNESS PROPERLY ADJ.
NO
PROPERLY ADJUST BRIGHTNESS
YES
NO
IS PROBLEM SOLVED
YES
END
REFER TO WAVEFORM D.
(TRIGGERING INFORMATION WITH WAVEFORM)
IS VIDEO INFORMATION CORRECT
NO
REPLACE MINI BEE LOGIC CARD
YES
END
REPLACE MONITOR
END

5-2B


START
IS KBD PLUGGED IN
NO
PLUG IN KEYBOARD
IS PROBLEM SOLVED
NO
YES
END
REFER TO TIMING DIAGRAM E.
IS STOBE LEVEL AND TIMING CORRECT AT LOGIC CARD
NO
IS KBD PC PLUGGED IN P-9
NO
CONNECT KEYBOARD PC TO P-9
YES
YES
REPLACE MINI BEE LOGIC CARD
END
NO
IS PROBLEM SOLVED
YES
END
IS STOBE LEVEL AND TIMING CORRECT AT KBD
YES
REPLACE KEYBOARD CABLE
NO
NO
IS PROBLEM SOLVED
YES
REPLACE KEYBOARD
END
END

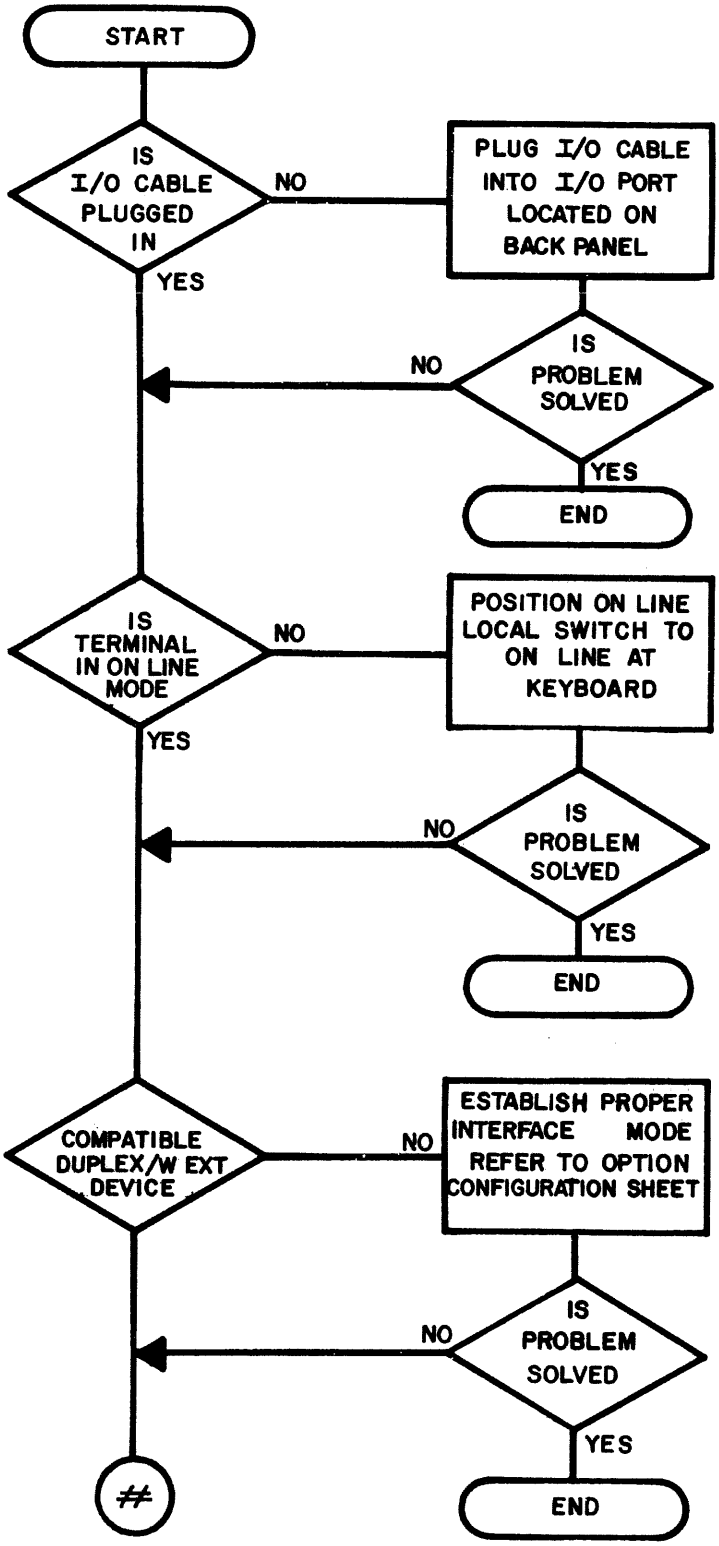
5-2C, 5-2D & 5-2E

PREREQUISITE FOR 5-2D & 5-2E: VERIFY PROPER DISPLAY OF ALFA-NUMERIC CHARACTERS.

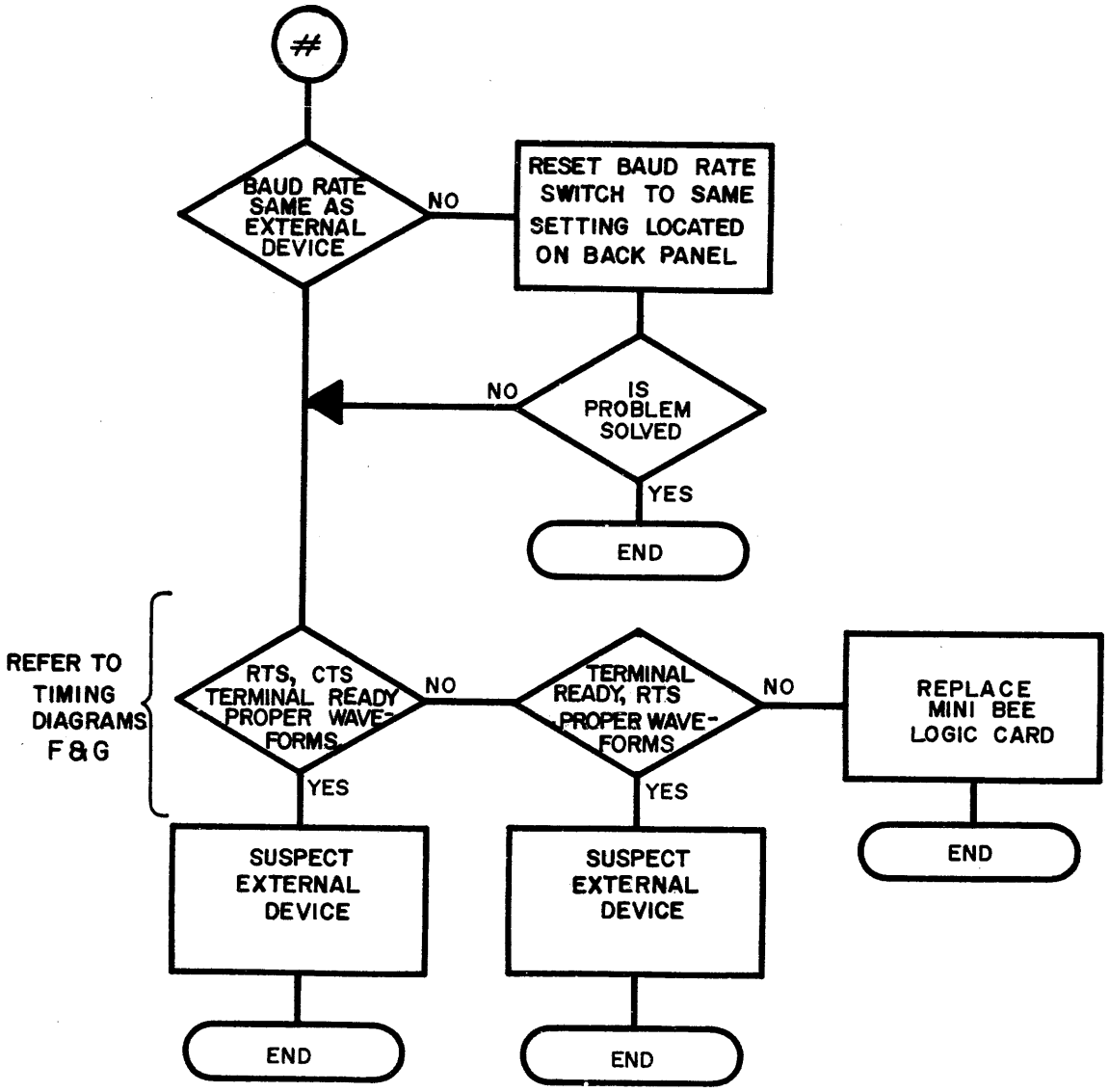


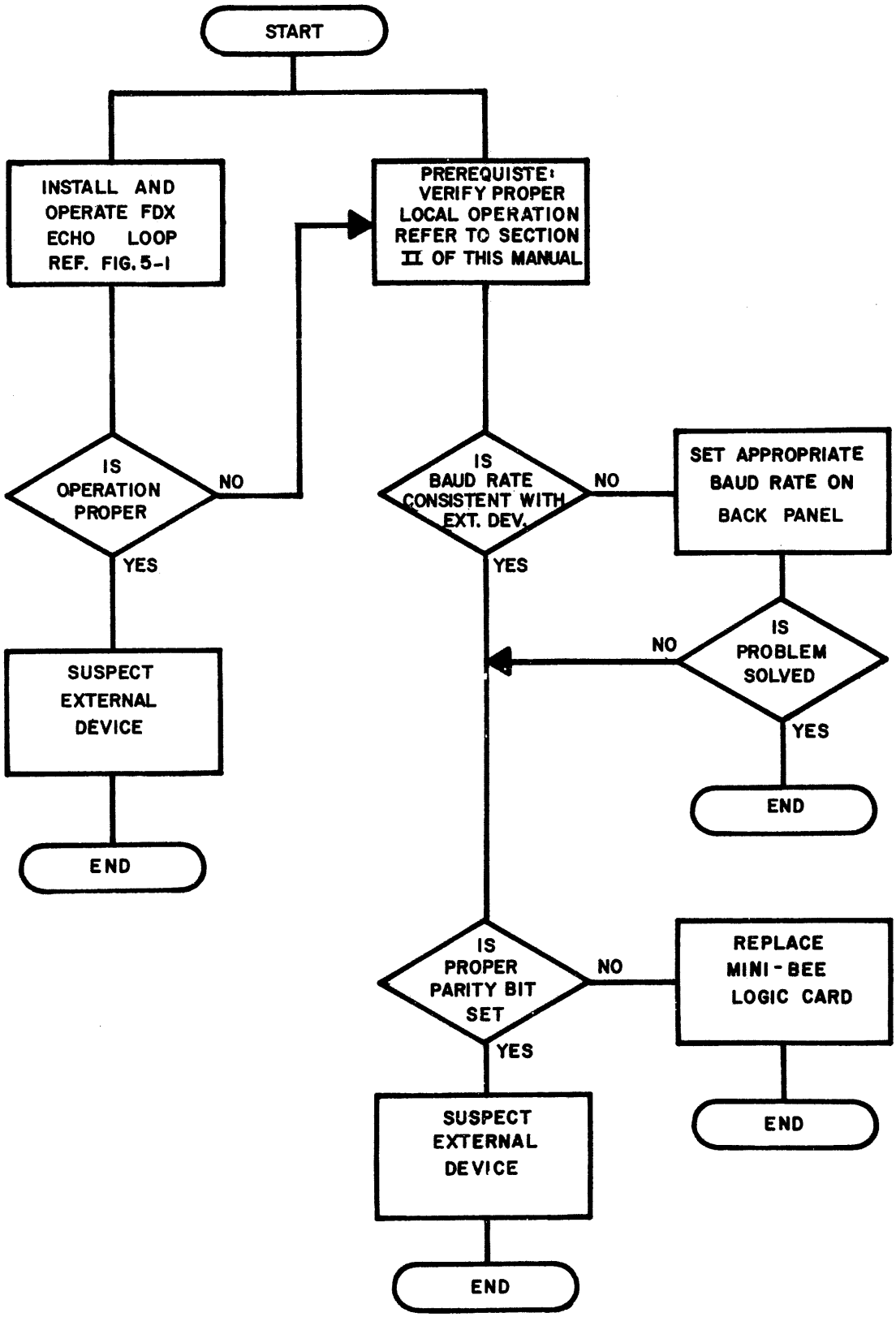
5-3A

PREREQUISITE: VERIFY PROPER OPERATION OF TERMINAL IN LOCAL MODE. REFER TO SECTION II OF THIS MANUAL.

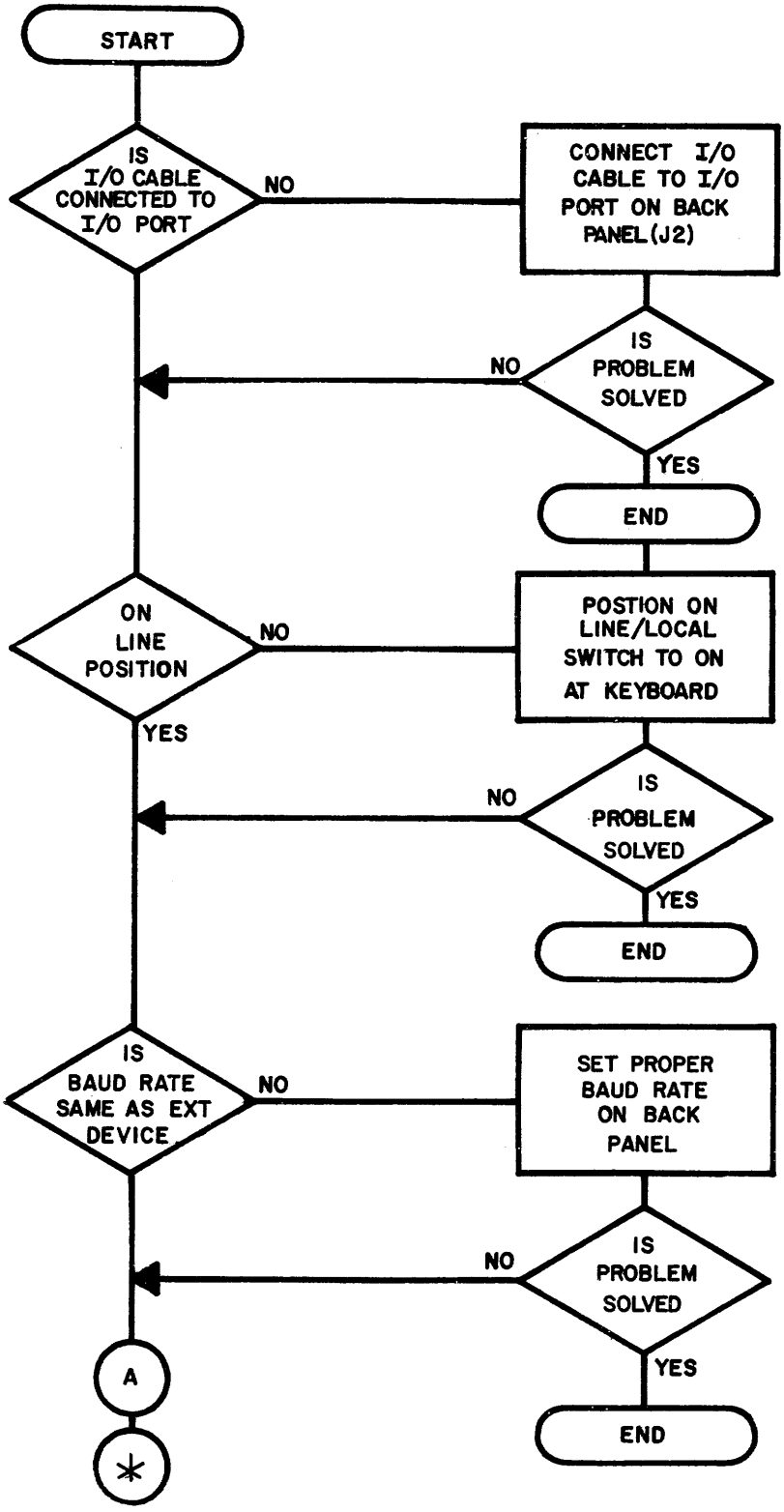


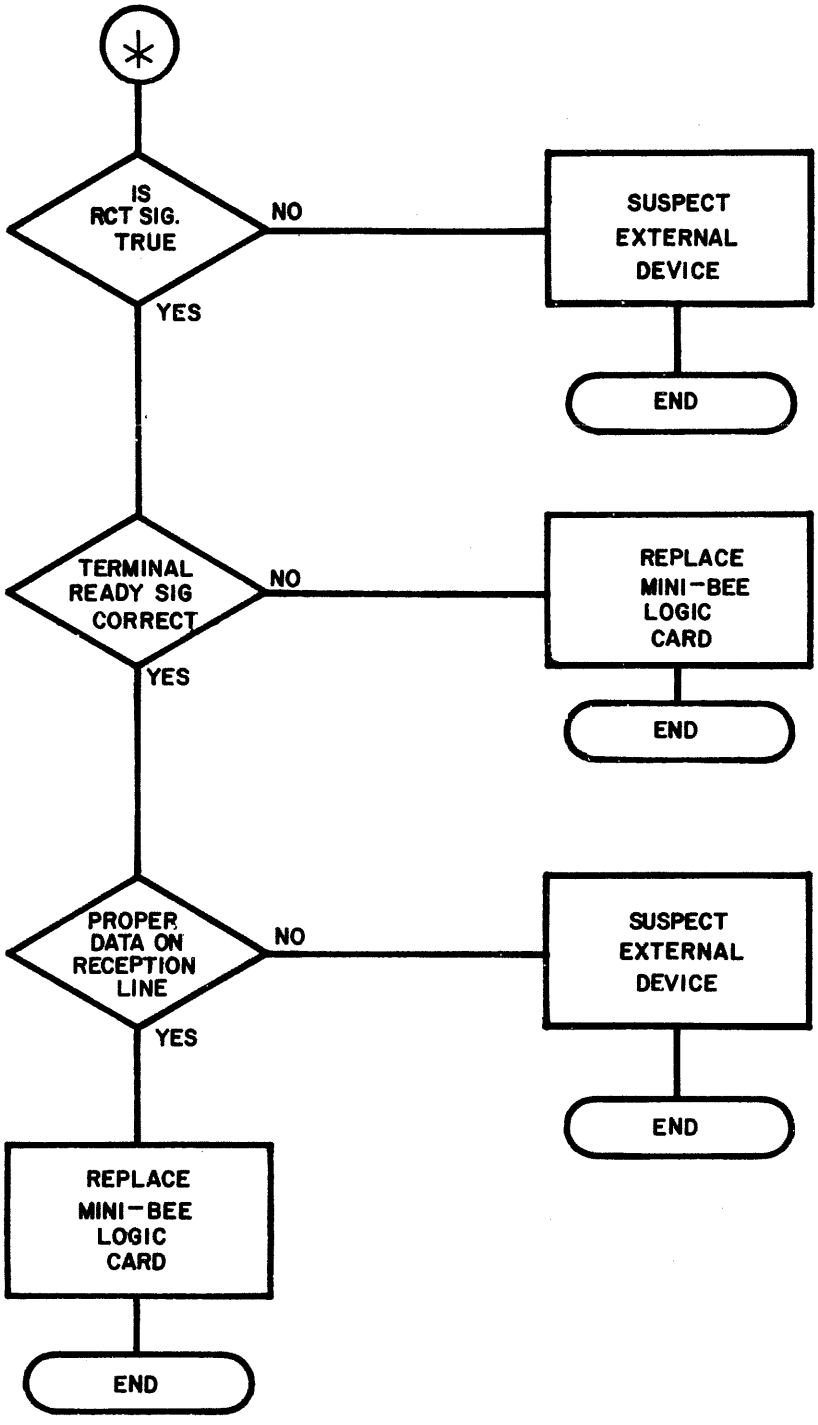
NOTE: EXTERNAL DEVICE I/O CONFIGURATION MUST BE KNOWN AND CONSISTENT WITH TERMINAL CONFIGURATION


#
BAUD RATE SAME AS EXTERNAL DEVICE
NO
RESET BAUD RATE SWITCH TO SAME SETTING LOCATED ON BACK PANEL
NO
IS PROBLEM SOLVED
YES
END
REFER TO TIMING DIAGRAMS F & G
RTS, CTS TERMINAL READY PROPER WAVE-FORMS
NO
TERMINAL READY, RTS PROPER WAVE-FORMS
NO
REPLACE MINI BEE LOGIC CARD
END
YES
SUSPECT EXTERNAL DEVICE
END
YES
SUSPECT EXTERNAL DEVICE
END

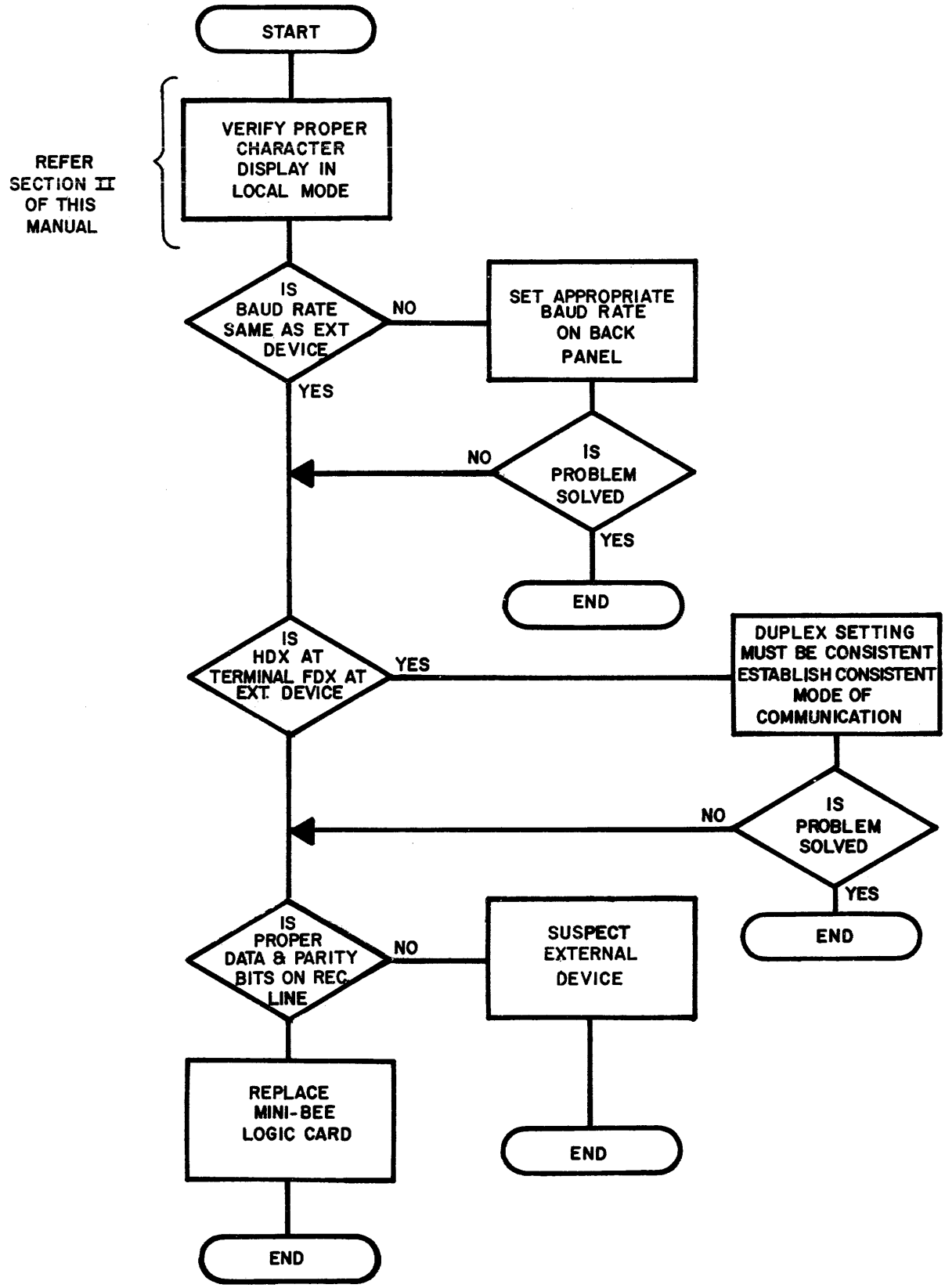

START
INSTALL AND OPERATE FDX ECHO LOOP REF. FIG. 5-1
PREREQUISTE: VERIFY PROPER LOCAL OPERATION REFER TO SECTION II OF THIS MANUAL
IS OPERATION PROPER
NO
YES
SUSPECT EXTERNAL DEVICE
END
IS BAUD RATE CONSISTENT WITH EXT. DEV.
NO
SET APPROPRIATE BAUD RATE ON BACK PANEL
YES
IS PROBLEM SOLVED
NO
YES
END
IS PROPER PARITY BIT SET
NO
REPLACE MINI-BEE LOGIC CARD
YES
SUSPECT EXTERNAL DEVICE
END
END

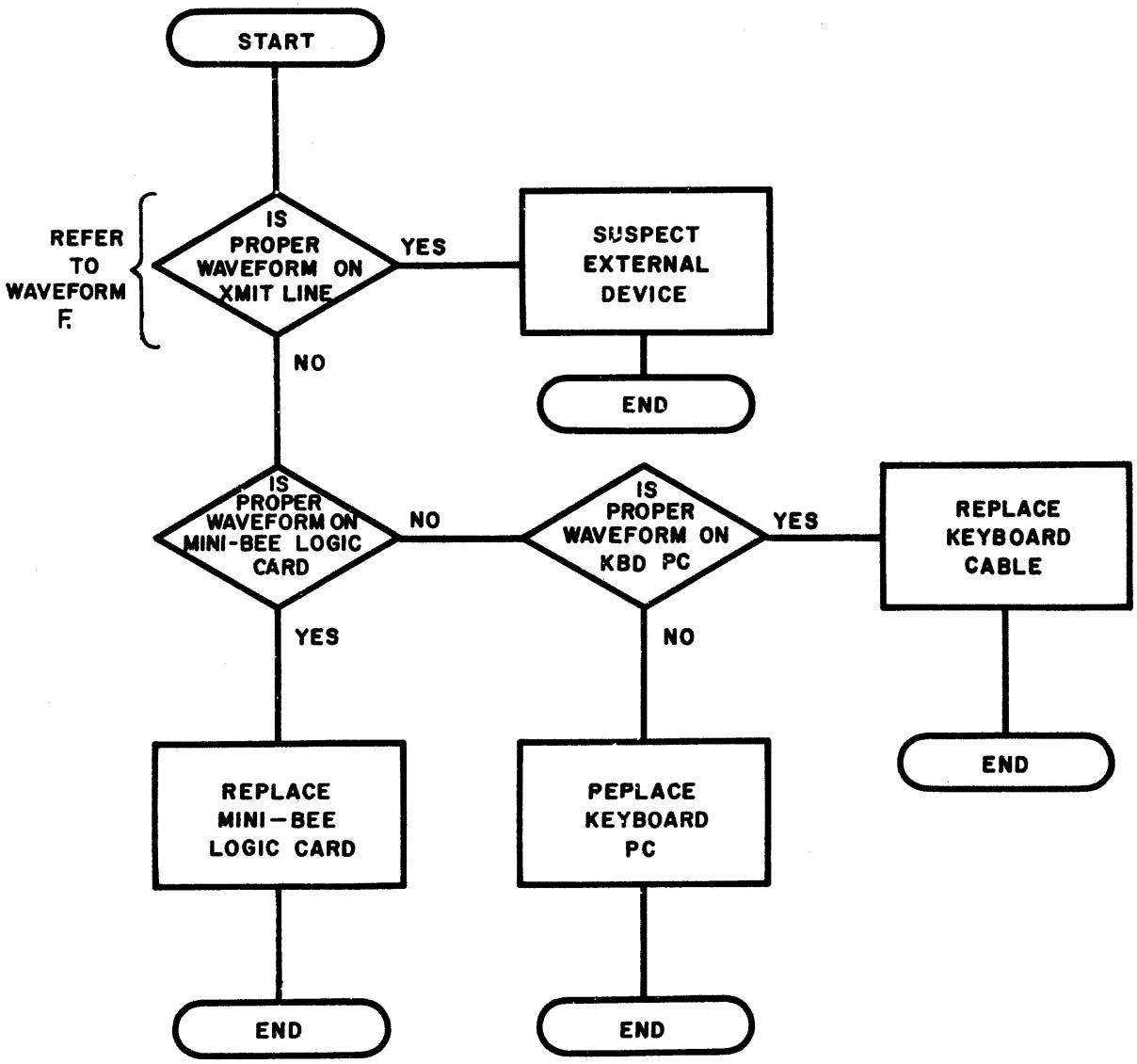
PREREQUISTE: VERIFY PROPER OPERATION IN TERMINAL IN LOCAL MODE. REFER TO SECTION II OF THIS MANUAL.

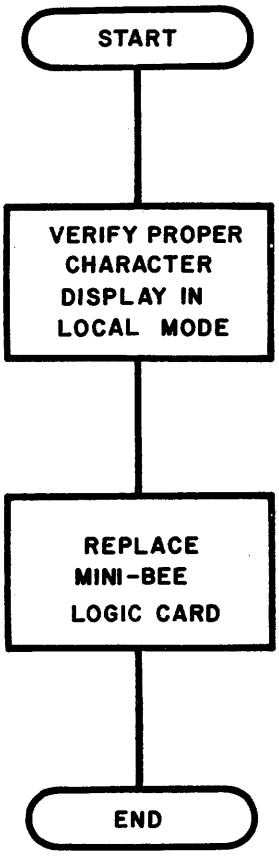


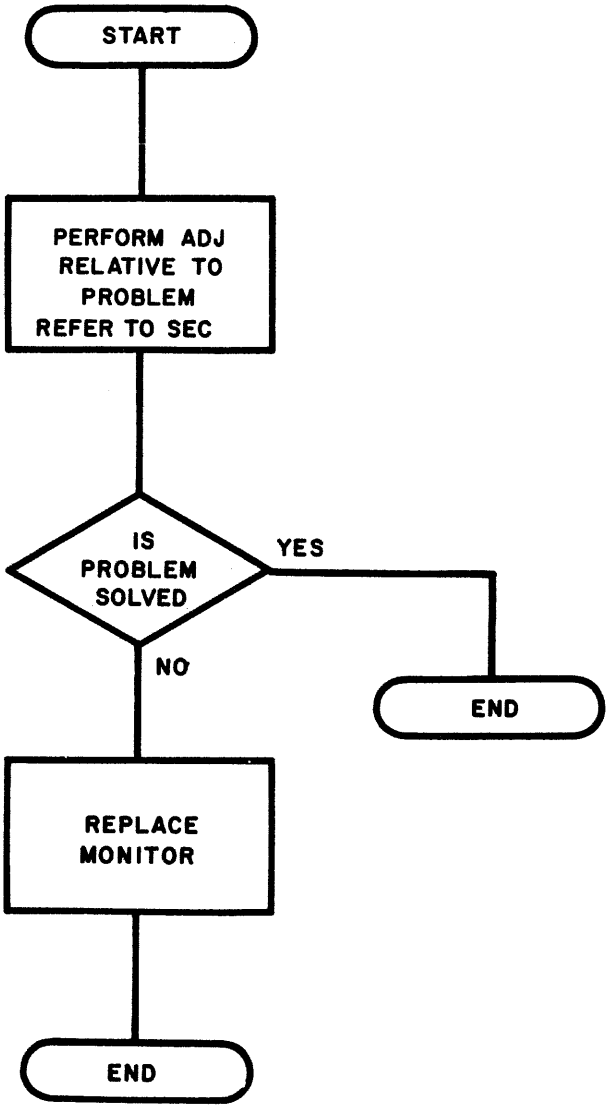


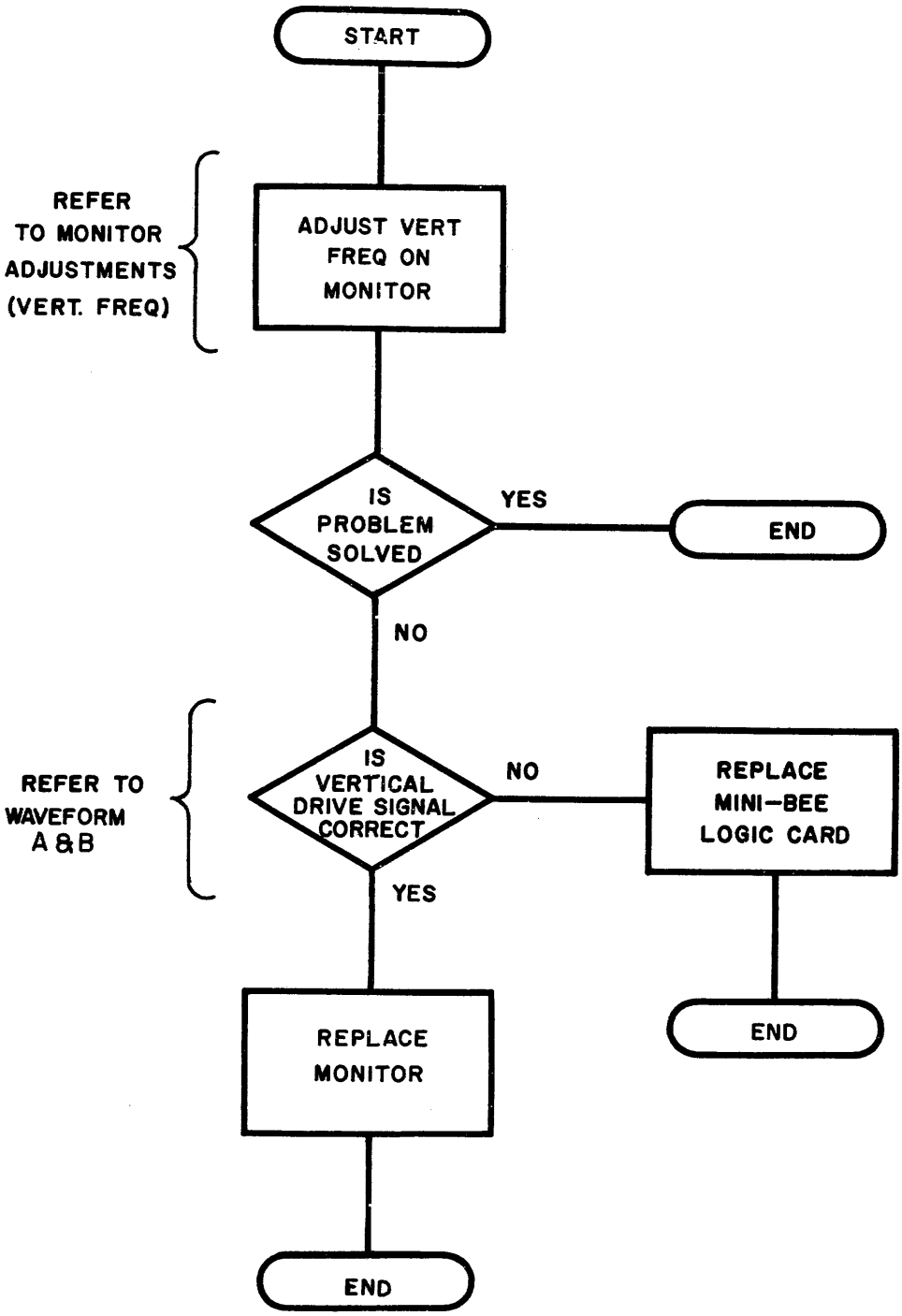
(A) — IF MINI-BEE CLOCK IS NECESSARY FOR EXTERNAL DRIVING CLOCK, CHECK CLOCK, REFER TO TIMING DIAGRAM F.


START
REFER SECTION II OF THIS MANUAL
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 AT TERMINAL FDX AT EXT. DEVICE
YES
DUPLEX SETTING MUST BE CONSISTENT ESTABLISH CONSISTENT MODE OF COMMUNICATION
NO
IS PROBLEM SOLVED
YES
END
IS PROPER DATA & PARITY BITS ON REC. LINE
NO
SUSPECT EXTERNAL DEVICE
REPLACE MINI-BEE LOGIC CARD
END
END

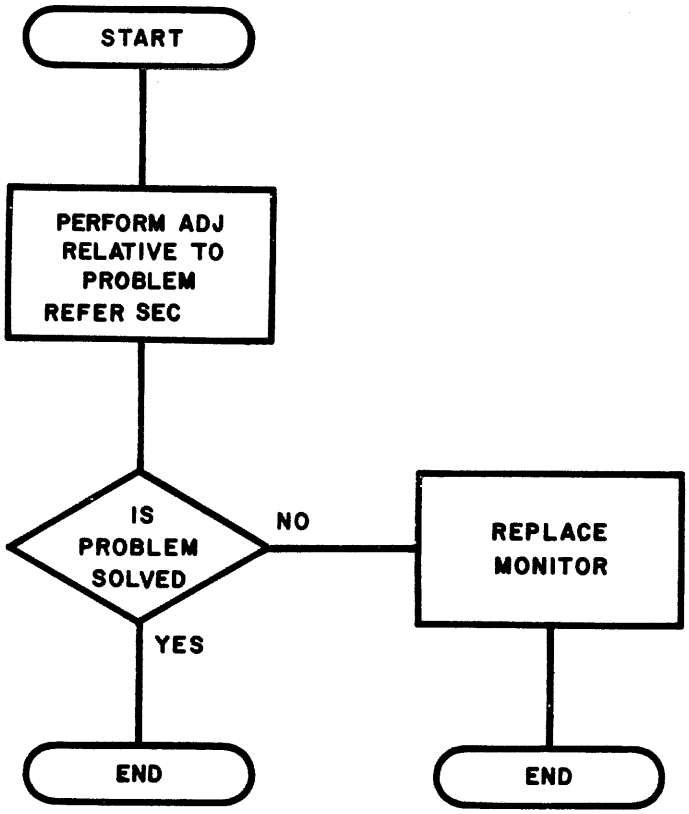

START
REFER TO WAVEFORM F.
IS PROPER WAVEFORM ON XMIT LINE
YES
SUSPECT EXTERNAL DEVICE
END
NO
IS PROPER WAVEFORM ON MINI-BEE LOGIC CARD
NO
IS PROPER WAVEFORM ON KBD PC
YES
REPLACE KEYBOARD CABLE
END
YES
NO
REPLACE MINI-BEE LOGIC CARD
PEPLACE KEYBOARD PC
END
END

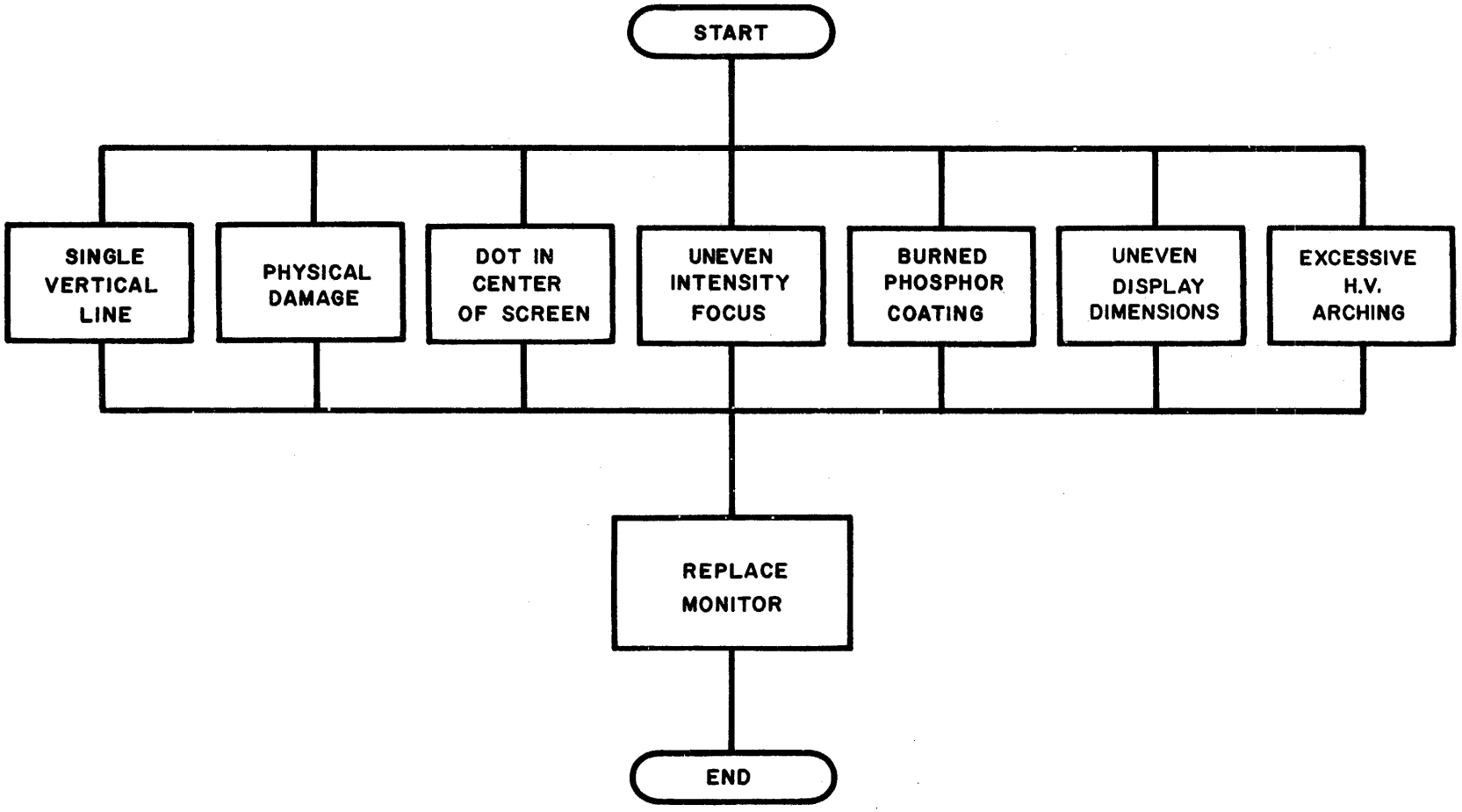

START
VERIFY PROPER CHARACTER DISPLAY IN LOCAL MODE
REPLACE MINI-BEE LOGIC CARD
END


START
PERFORM ADJ RELATIVE TO PROBLEM REFER TO SEC
IS PROBLEM SOLVED
YES
NO
END
REPLACE MONITOR
END


START
REFER TO MONITOR ADJUSTMENTS (VERT. FREQ)
ADJUST VERT FREQ ON MONITOR
IS PROBLEM SOLVED
YES
END
NO
REFER TO WAVEFORM A & B
IS VERTICAL DRIVE SIGNAL CORRECT
NO
REPLACE MINI-BEE LOGIC CARD
END
YES
REPLACE MONITOR
END

5-4C, 5-4D, 5-4E, 5-4F, 5-4G




START
SINGLE VERTICAL LINE
PHYSICAL DAMAGE
DOT IN CENTER OF SCREEN
UNEVEN INTENSITY FOCUS
BURNED PHOSPHOR COATING
UNEVEN DISPLAY DIMENSIONS
EXCESSIVE H.V. ARCHING
REPLACE MONITOR
END

5-20. POWER SUPPLY ADJUSTMENTS

5-21. The MINI BEE is produced using power supplies manufactured by various companies. All are the same in form, fit and function. Adjustment of all power supply units are monitored by connecting a volt meter at the test points (A through D) indicated on Figure 5-2. Adjustments should be made to assure the output levels are as follows:

Nominal	Minimum	Maximum
−12	−11.8	−12.2
+15	−14.8	+15.2
+5	+4.8	+5.2

Adjustment of each power supply is described in the following paragraphs. On the Elexon, Scintillonics and early Datapower power supplies, clockwise rotation of the potentiometers (looking at the component side of the circuit board) increases the output voltage and counter clockwise rotation decreases the output voltages. In the later Datapower power supply configurations, adjustment of the potentiometers can be made from the solder side of the circuit board also, reversing the rotation to increase/decrease.

5-22. ELEXON POWER SUPPLY (Figure 5-3)

The +5 VDC output should be checked and adjusted first. To adjust the +5 VDC voltage level the meter should be connected between the GRND and +5 VDC test points on the Logic Card (see Figure 5-2). The voltage at this point should be +5 VDC ± .2v. If it is not, rotating the adjustment lug on R7 (see Figure 5-4, point A) should bring the voltage within specified limits.

To adjust the +15 VDC voltage level connect the meter between the +15 VDC and GRND test points (see Figure 5-2). The voltage at this point should be +15 VDC ± .2v. If it is not, rotating the adjustment lug on R17 (see Figure 5-4, point B) should bring the voltage within specified limits.

To adjust the −12 VDC voltage level connect the meter between the −12 VDC and GRND test points (Figure 5-2). The voltage at this point should be −12 VDC ± .2v. If it is not, rotating the adjustment lug on R27 (see Figure 5-4, point C) should bring the voltage within specified limits.

The overload protection adjustment is aligned and clamped at the factory and should not be changed. However, adjustment can be made by connecting the meter between point D and a good chassis ground and should read approximately 3 VDC. The desired setting should be obtainable by rotating the lug on R33, point E.

5-23. SCINTILLONICS POWER SUPPLY (Figure 5-5)

The Powerbee PC board is shown in Figure 5-6 and the schematic included in Section VI.

The +5V output is adjustable from approximately +4.8V to +5.2V or until OVP threshold is reached through turning the potentiometer, R2, clockwise (CW). A meter should be connected between the GRND and +5 VDC test points on the Logic Card (see Figure 5-2). The voltage at this point should be +5 VDC ±.2V. If not, rotate R2 (Figure 5-6, point A) to bring the voltage to within specified limits.

To adjust the +15V output, the meter should be connected between the GRND and +15 VDC test points (Figure 5-2). The +15 V output can range from +14.8V to +15.2V. If not, adjust R22 (Figure 5-6, point B) to bring the voltage to within specified limits.

To adjust the −12 VDC output, connect the meter between the GRND and −12 VDC test points (Figure 5-6). The voltage at this point should be −12 VDC ± .2V. If not, adjust R42 to bring the voltage to within specified limits. The −12 VDC output can range from −11.8 to −12.2 VDC.

5-24. DATAPOWER POWER SUPPLY (Figure 5-7)

To adjust the +5 VDC voltage level, the meter should be connected between the GRND and +5 VDC test points (see Figure 5-2). If the voltage at this point is not + 5 VDC, adjust by rotating potentiometer R11 (Figure 5-8, point A) until voltage is within specified limits.

Adjustment of the +15 VDC voltage level is made by connecting the meter between the GRND and +15 VDC test points on the Logic Board (Figure 5-2). If the voltage does not read +15 VDC ± .2V, rotation of the potentiometer R23 (Figure 5-8, point B) will bring the level to within specified limits.

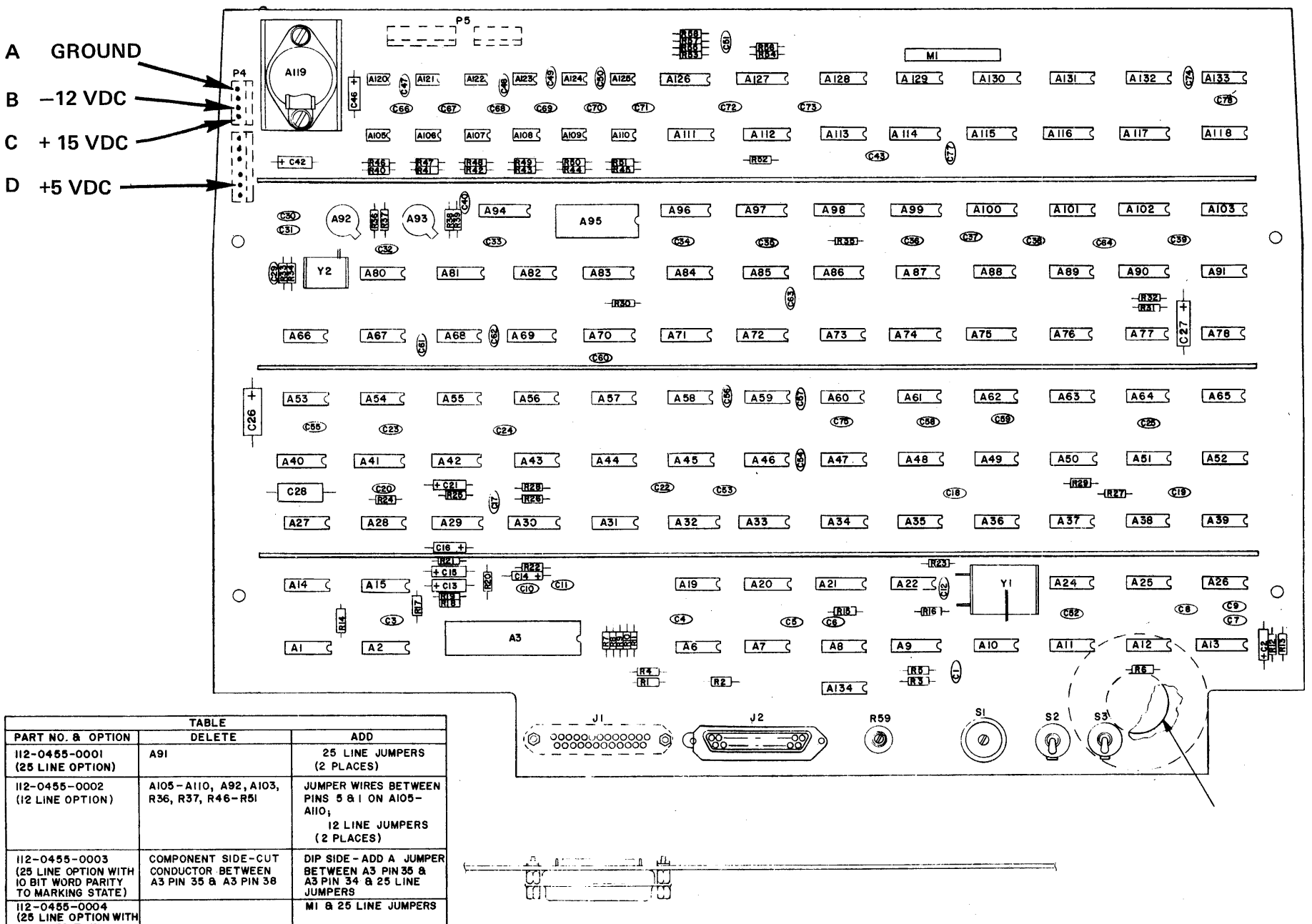
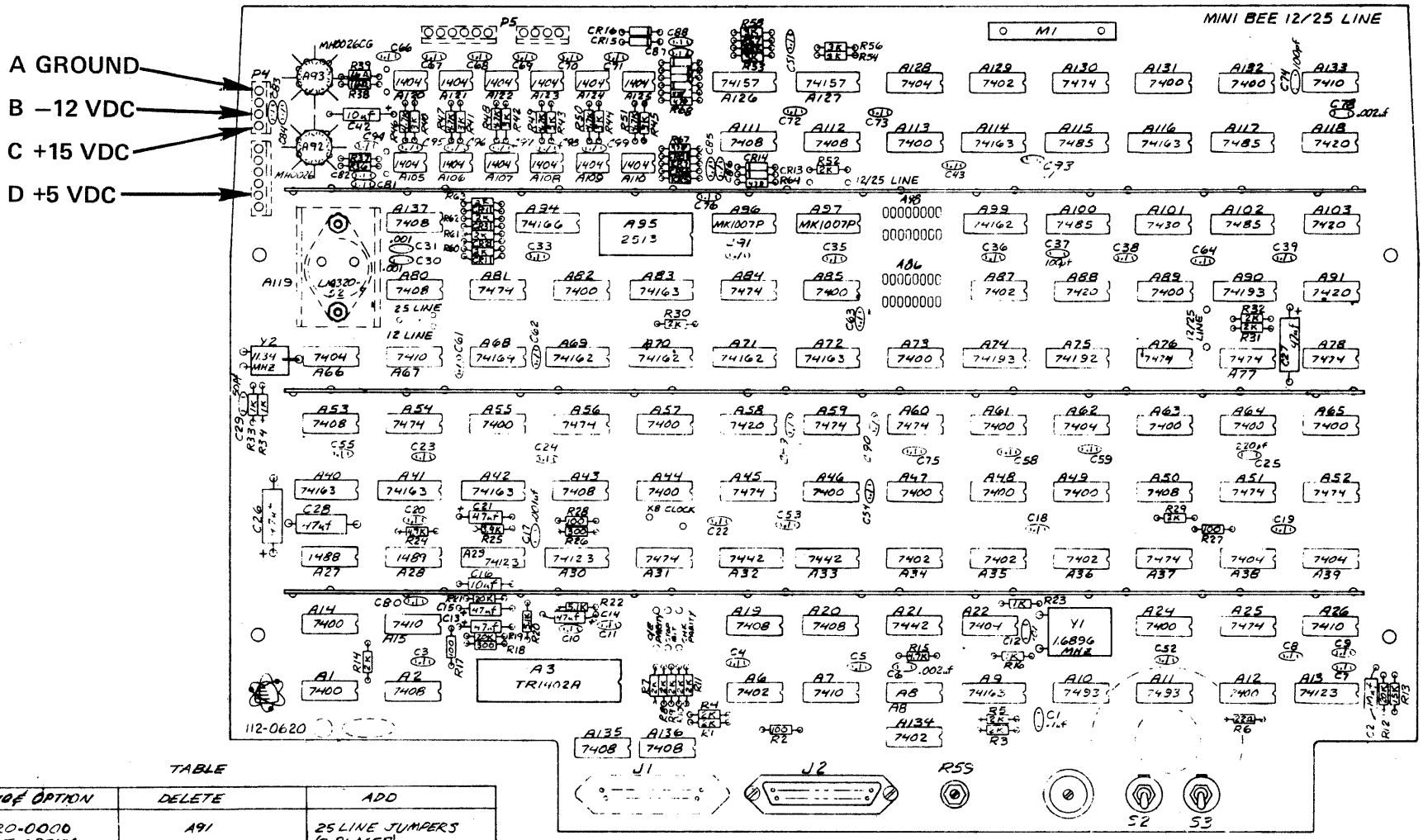


TABLE		
PART NO. & OPTION	DELETE	ADD
112-0455-0001 (25 LINE OPTION)	A91	25 LINE JUMPERS (2 PLACES)
112-0455-0002 (12 LINE OPTION)	A105–A110, A92, A103, R36, R37, R46–R51	JUMPER WIRES BETWEEN PINS 5 & 1 ON A105–A110; 12 LINE JUMPERS (2 PLACES)
112-0455-0003 (25 LINE OPTION WITH 10 BIT WORD PARITY TO MARKING STATE)	COMPONENT SIDE–CUT CONDUCTOR BETWEEN A3 PIN 35 & A3 PIN 38	DIP SIDE – ADD A JUMPER BETWEEN A3 PIN 35 & A3 PIN 34 & 25 LINE JUMPERS
112-0455-0004 (25 LINE OPTION WITH ELAPSED TIME METER)		M1 & 25 LINE JUMPERS

Figure 5-2. Mini Bee Logic Card 112-0455



TABLE

PART NO & OPTION	DELETE	ADD
112-0620-0000 25 LINE OPTION	A91	25 LINE JUMPERS (2 PLACES)
112-0620-0001 25 LINE OPTION WITH ELAPSE TIME METER	A91	M1 & 25 LINE JUMPERS (2 PLACES) EVEN PARITY JUMPER NO PARITY JUMPER 10 BIT JUMPER
112-0620-0002 12 LINE OPTION	A105-A110, A92, A103 R36, R37, R46-R51	JUMPER WIRES BETWEEN PINS 5 & 1 ON A105-A110 12 LINE JUMPERS (2 PLACES)
112-0620-0003 25 LINE OPTION WITH 10 BIT WORD PARITY TO MARKING STATE	COMPONENT SIDE CUT CONDUCTOR BETWEEN A3 PIN 35 & A3 PIN 38	JUMPER WIRE BETWEEN A3 PIN 35 & A3 PIN 34 25 LINE JUMPERS

Figure 5-2A. Mini Bee Logic Card 112-0620

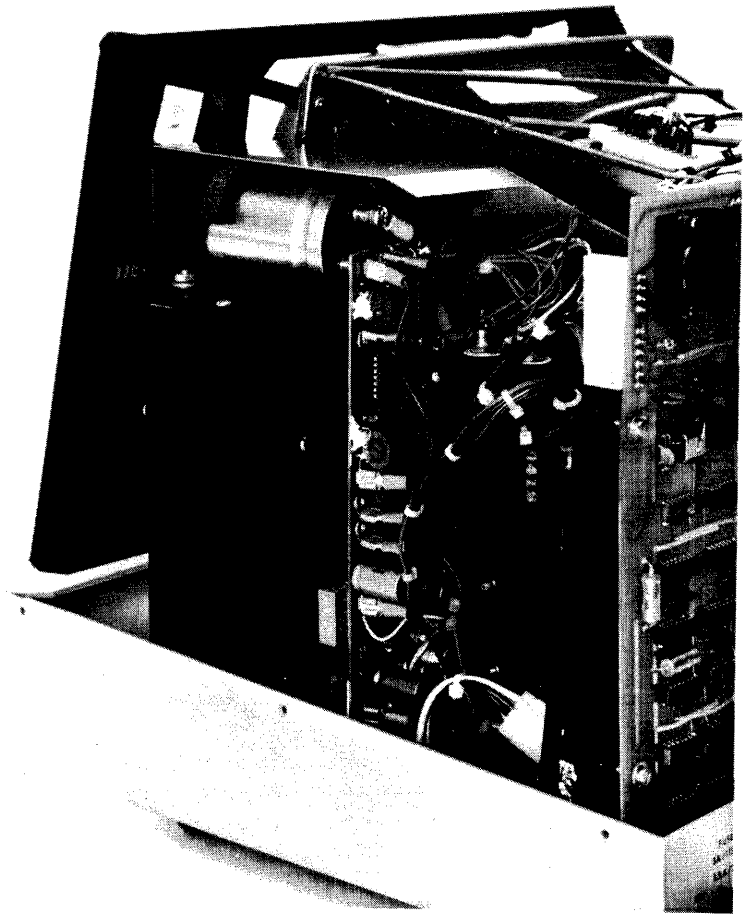


Figure 5-3. Elexon Power Supply

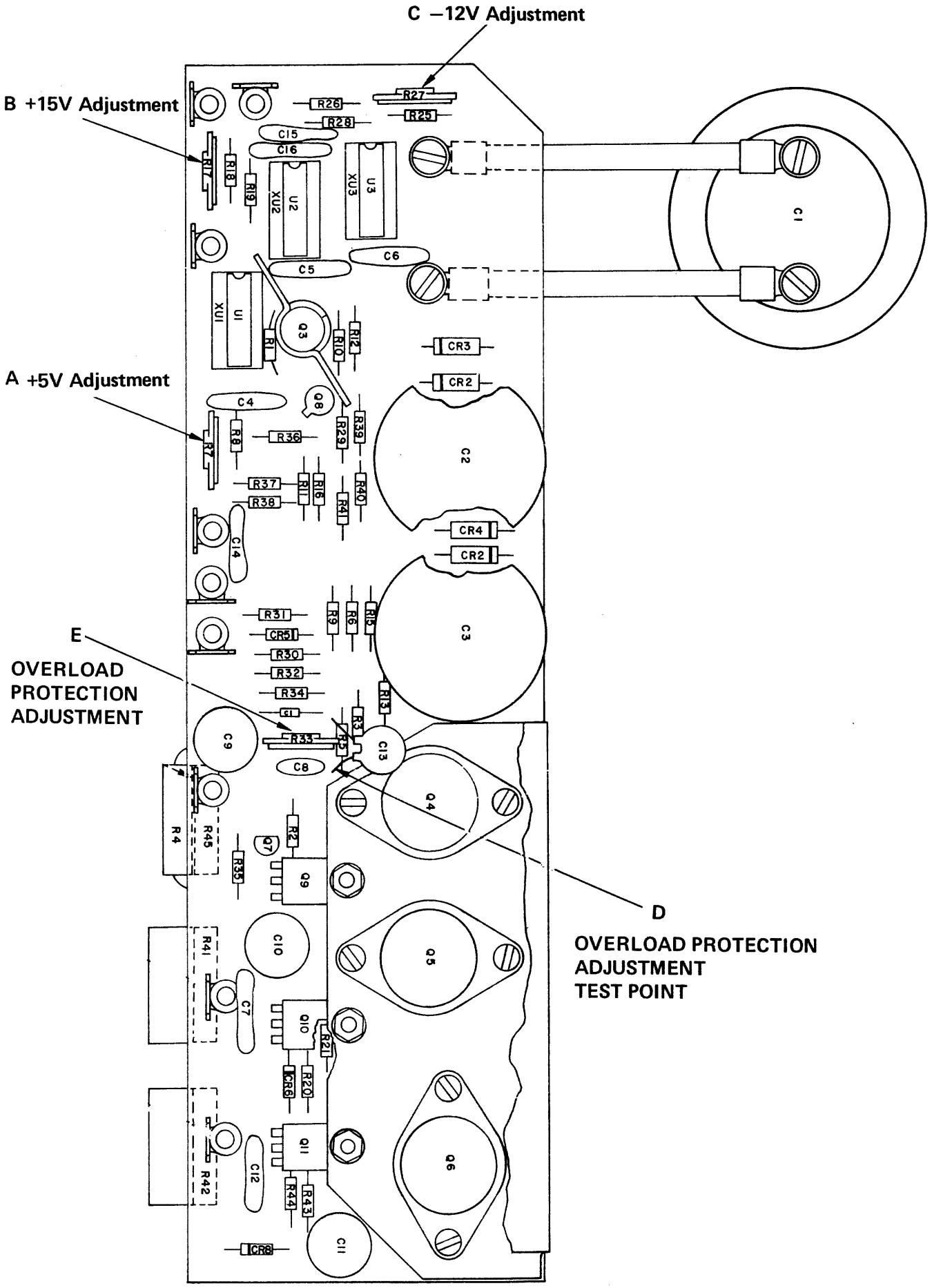


Figure 5-4. Elexon Power Supply Adjustments

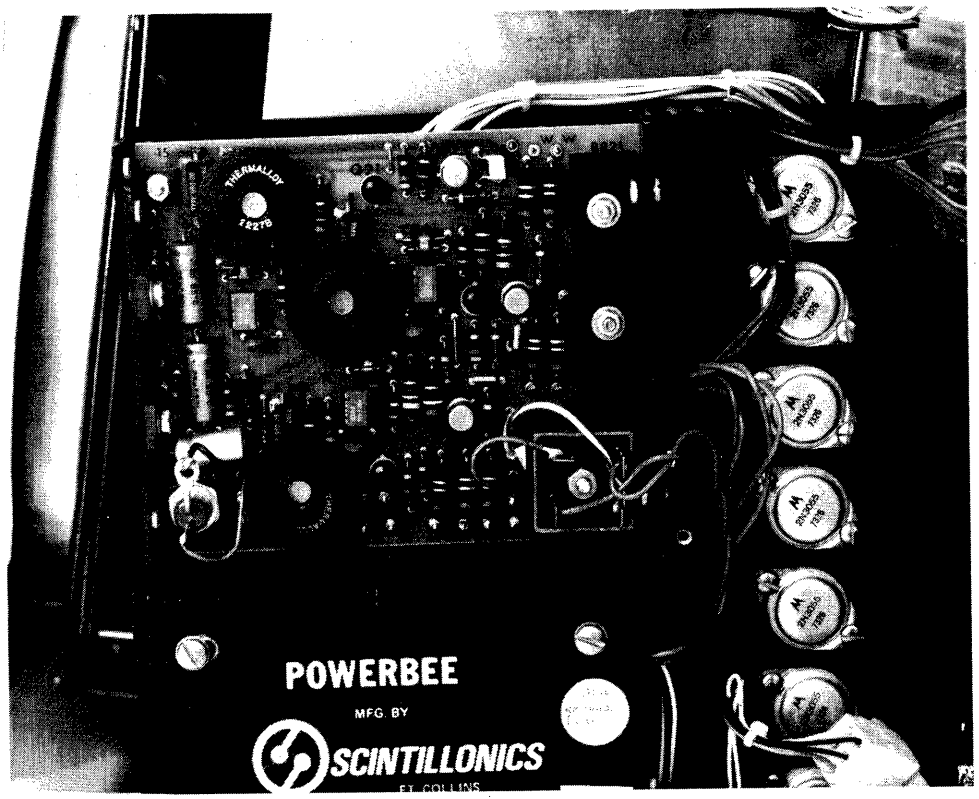


Figure 5-5. Scintillonics Power Supply

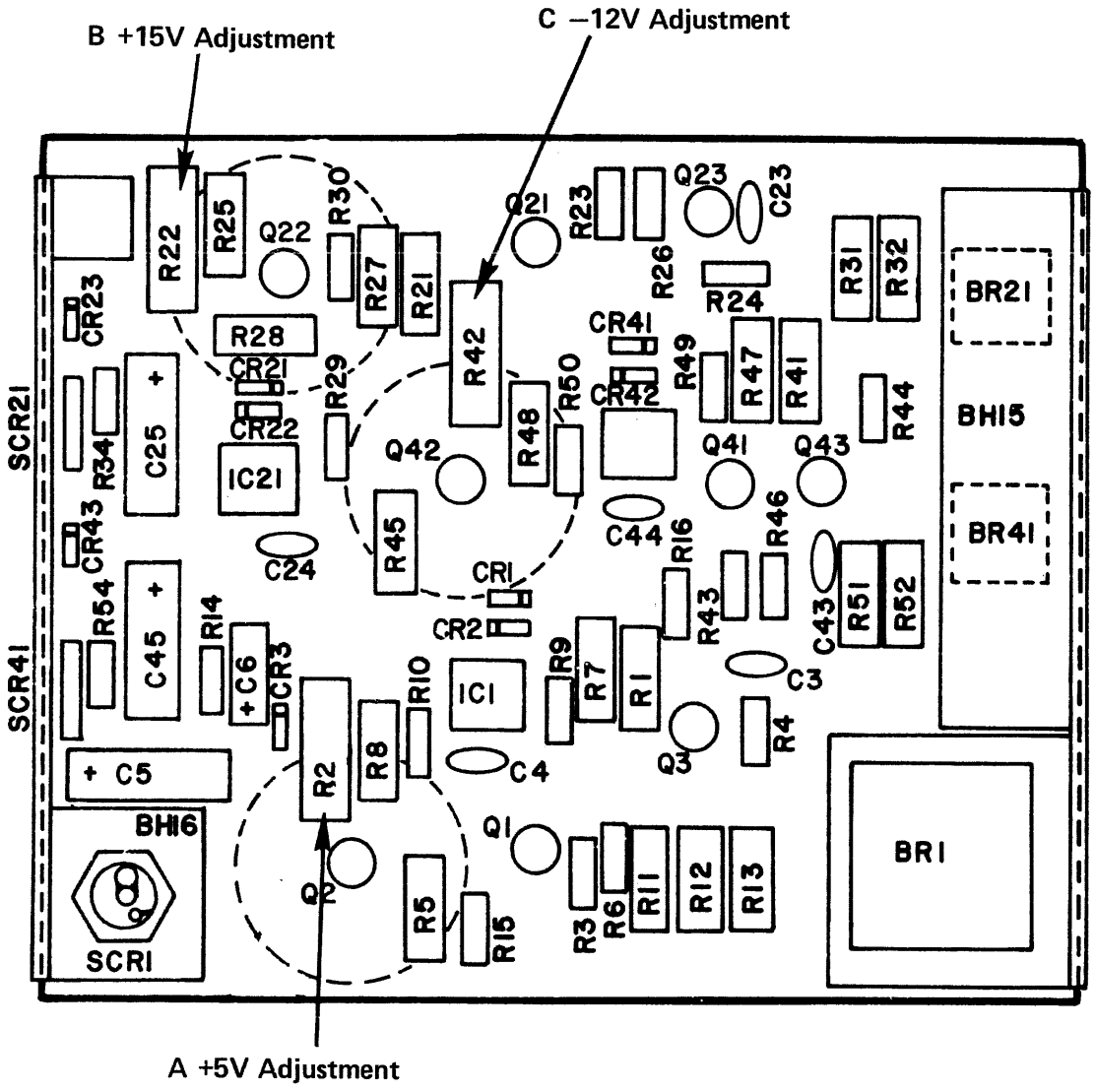


Figure 5-6. Scintillonics Power Supply Adjustments

NOT USED WITH HP 2615A

Figure 5-7. **Datapower Power Supply**

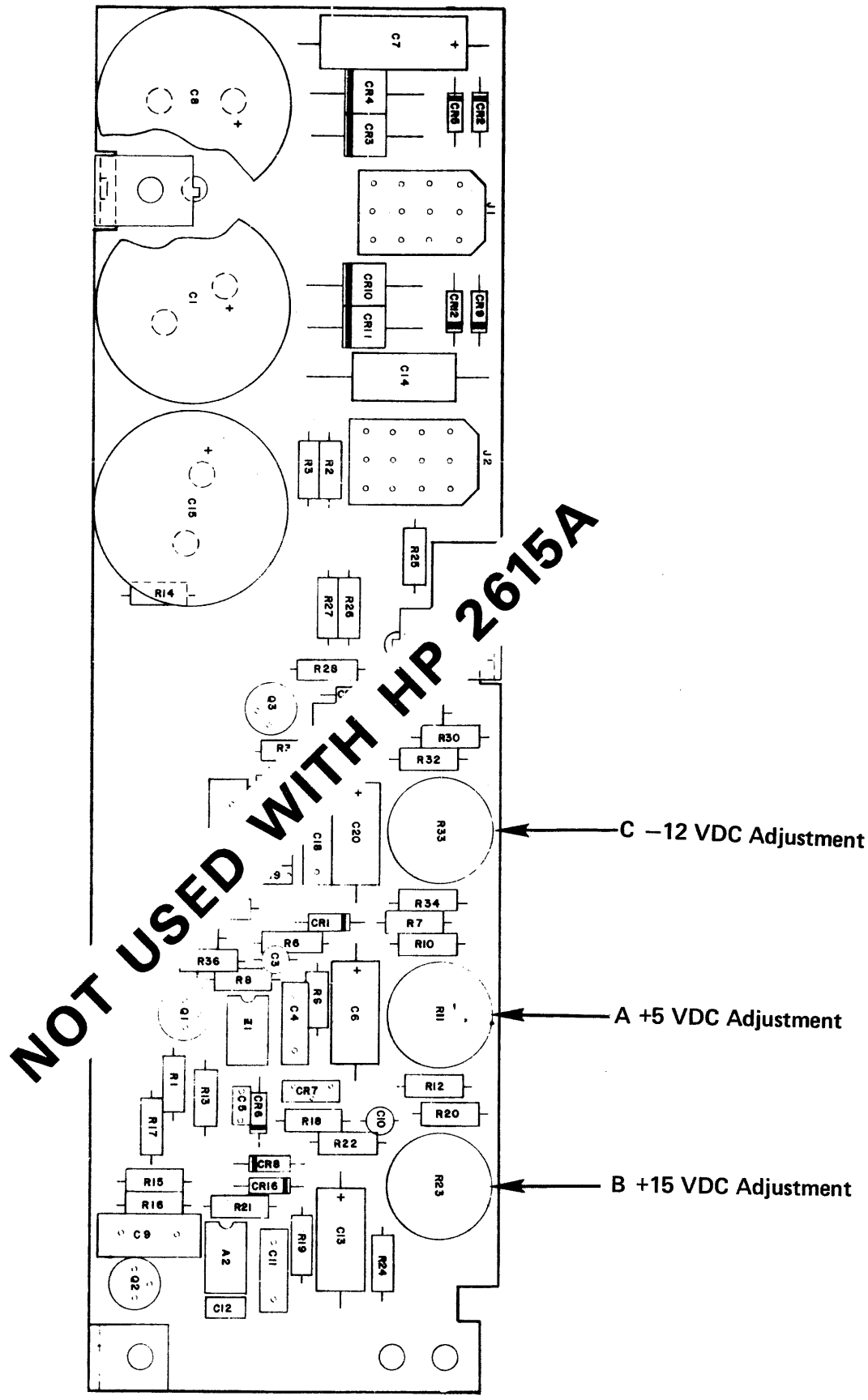


Figure 5-8. Datapower Power Supply Adjustments

The −12 VDC output level is checked by connecting the meter between the GRND and −12 VDC test points on the board (Figure 5-2). The output level at this point should be −12 VDC ± .2V. If not, adjust by rotating R33 (Figure 5-8, point C) to bring the level to within specified limits.

5-25. MONITOR ADJUSTMENTS

5-26. The following adjustments should be made while the monitor is in the MINI BEE terminal. The adjustments described here are in reference to Figures 5-9,5-10 and 5-11, and consist of the following sections:

- BRIGHTNESS
- CONTRAST
- VERTICAL ADJUSTMENTS
- HORIZONTAL ADJUSTMENTS
- FOCUS
- CENTERING

Figure 5-9 shows the location of the MONITOR PC board, CRT and shield cone. Figure 5-10 shows the physical location of the specific adjustments on the MONITOR PC board. Figure 5-11 shows the location of the CONTRAST adjustment, while Figure 5-12 shows the CRT mounted adjustments.

WARNING: The MONITOR employs high voltages. Care should be used in making any adjustments as power will be applied to the MONITOR and could be dangerous to the operator. Care should be taken to determine that all leads are secure before attempting to adjust the MONITOR.

5-27. The BRIGHTNESS control (located on the MINI BEE KEYBOARD assy) should be positioned to a point where the white raster on the CRT is extinguished.

5-28. The vertical frequency control R 116 Fig. 5-10 is set to approximately its mechanical mid-point initially. This adjustment will correct for a rolling display and should be adjusted to correct that symptom alone. No discrete measurement is necessary, except for a visual observation as to the steadiness of the display.

5-29. Fill the screen of the CRT with characters from the KEYBOARD (i.e., all E's). The CONTRAST control is located on the Logic Board. Adjustment access is gained through the opening in the back panel marked CONTRAST. Using a screwdriver, adjust the CONTRAST control for the sharpest display in the upper left hand side of the screen (See Figure 5-11).

5-30. Fill the screen once again with characters, if none exist. The vertical height control R 124, Figure 5-10, should be adjusted for 6.5 inches from the top of the characters on the first row to the bottom of the characters on the last row.

5-31. The vertical linearity control Figure 5-10 should be adjusted so the characters on the first row are equally as tall as the characters on the last row. Their height should be approximately 0.18 inches.

5-32. If the screen is blank, fill it with a character and adjust the horizontal width coil L 101 Fig. 5-10 for 8.4 inches from the left margin to the right margin of the displayed characters.

5-33. If BRIGHTNESS or CONTRAST controls are turned up too high, focus can be distorted. Adjust the FOCUS control R 107 Figure 5-10 for the best over-all display focus. It may be necessary to readjust the CONTRAST control and repeat this step.

5-34. Adjustment relative to focus, centering and linearity require separating the two halves of the tube shield or removal of the tube shield from the CRT. The tube shield causes the display size to be compressed. The size of the display may be adjusted to size (refer to para. 5-30 through 5-32) after removal and replacement of the shield. Removal is described in the disassembly procedures in Section 5-49. The horizontal linearity is adjusted to correct for the compression of the display on the left-hand side of the screen. To correct this, loosen the clamp securing the yoke and slide the cardboard or mylar sleeve (horizontal linearity sleeve), refer Figure 5-12 (point D) in or out to give uniform width to the characters onthe right and left-hand borders of the display.

5-35. Centering of the display is accomplished by rotating the tabbed ring magnets on the CRT behind the deflection yoke, refer to Figure 5-12 points A and B. If the display as a whole is tilted, correction may be accomplished by rotating the entire yoke, point C.

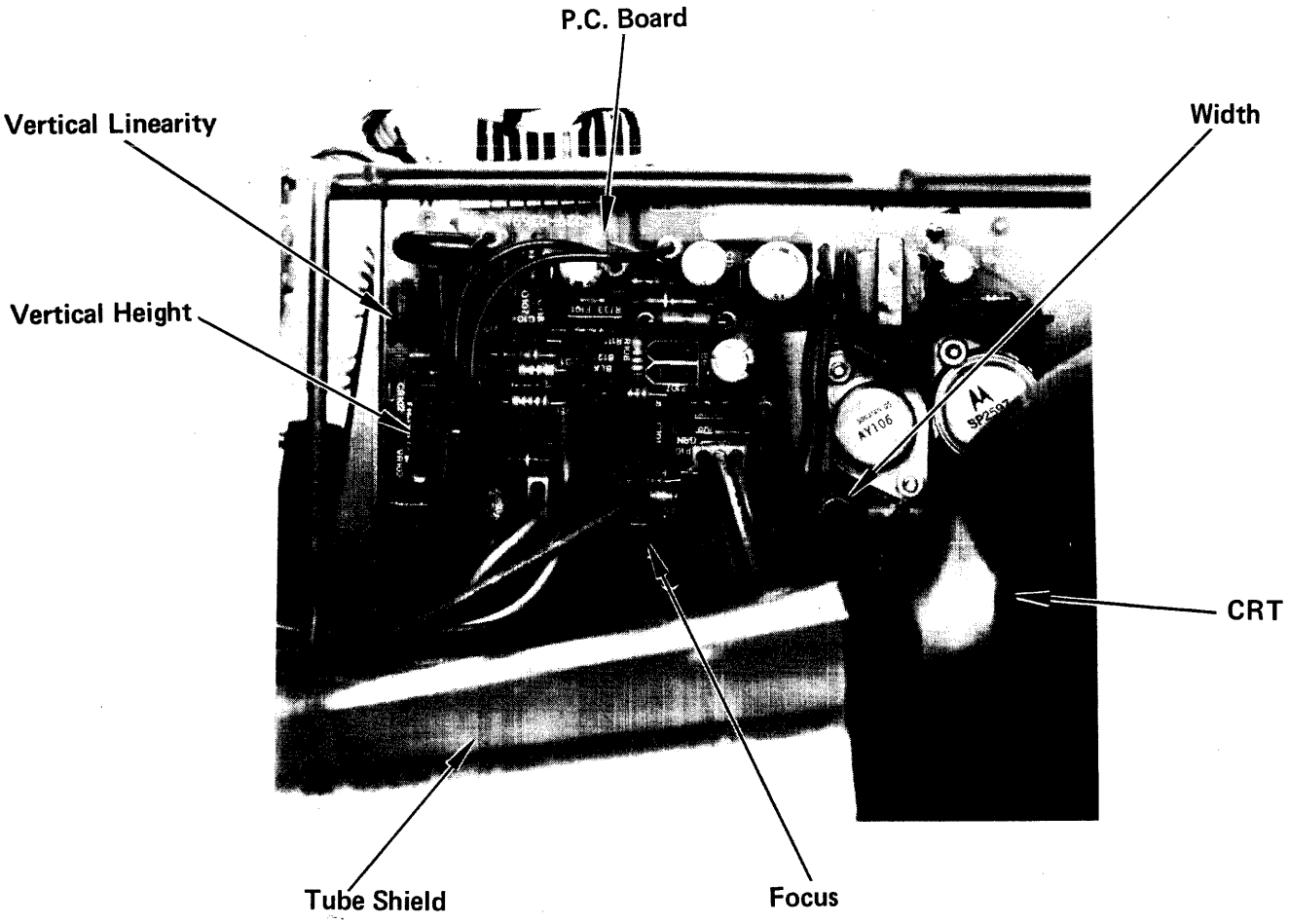


Figure 5-9. Monitor PC Board, CRT and Tube Shield

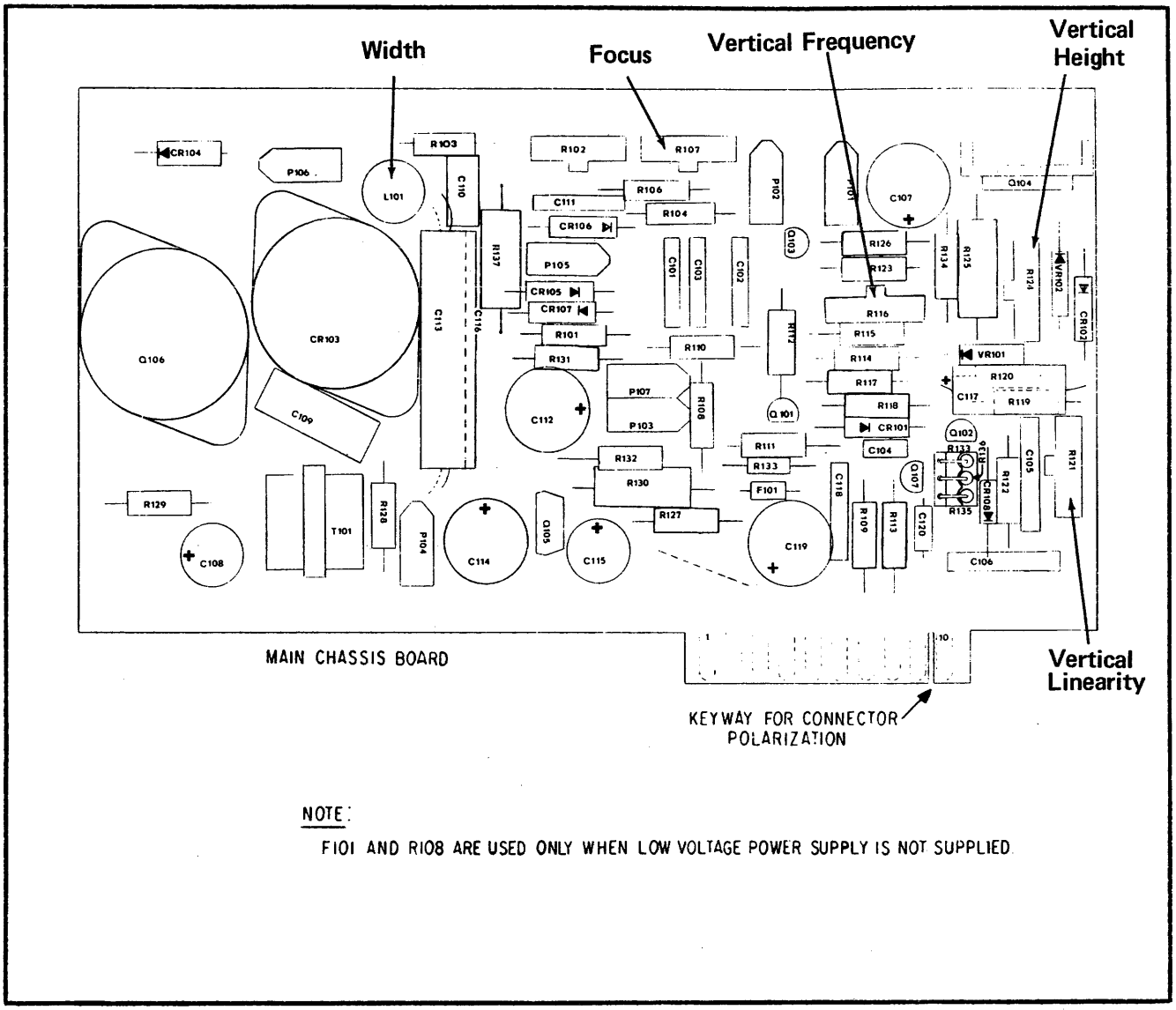


Figure 5-10. Monitor P.C. Card Adjustments

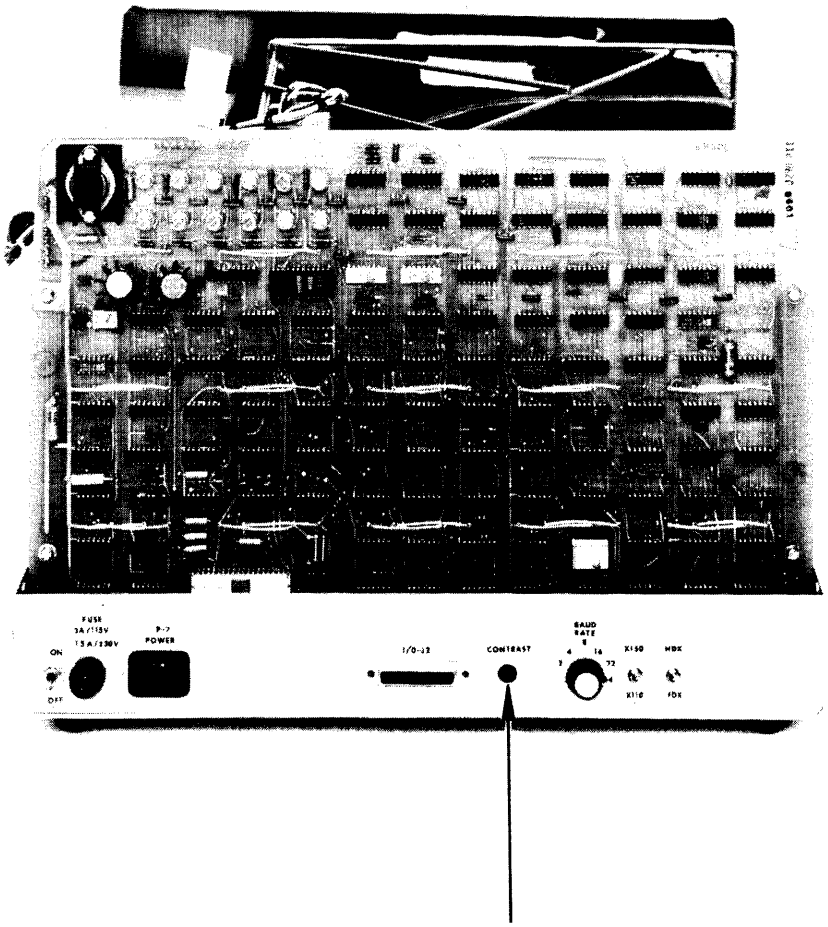


Figure 5-11. Contrast Control Adjustment

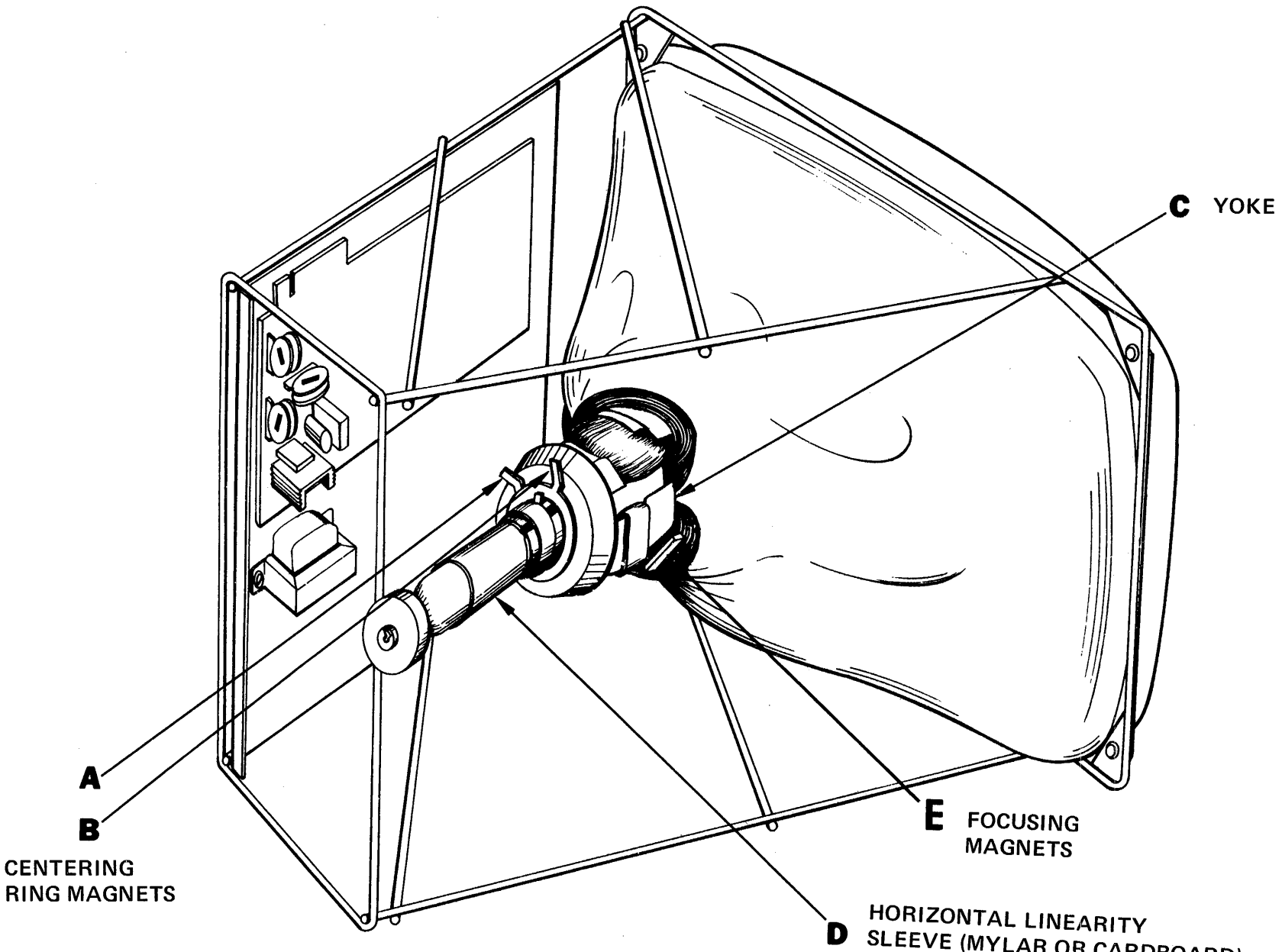


Figure 5-12. Monitor Yoke Adjustments

Replacement of the yoke or CRT may cause problems with adjustment of the display which require the installation of small ceramic bar magnets, 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 will be 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 adjustment rechecked before proceeding.

Place a small magnet on the flared end of the yoke coil near the CRT (see Figure 5-12, point E). Note the effect the magnet exerts on the display. Alignment of the magnet with or against the magnetic field will cause 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 adesive is used to secure the magnet(s) in position.

5-36. KEYBOARD ADJUSTMENT

5-37. The keyboard contains the MONITOR BRIGHTNESS control.

The keyboard requires no other adjustment. If there is an apparent failure, refer to Section 5-14.

5-38. MINI BEE LOGIC CARD

5-39. The LOGIC CARD includes the MONITOR CONTRAST adjustment control. The only other adjustable components on the MINI BEE LOGIC CARD are associated with the specific operation to be performed by the MINI BEE terminal, i.e., baud rate.

5-40. REMOVAL AND REPLACEMENT PROCEDURES FOR THE MINI BEE TERMINAL

5-41. The procedures presented here are disassembly steps. To assemble the MINI BEE these procedures should be executed in the reverse order.

WARNING: These procedures should not be attempted with any electrical power connected, or terminal circuits energized.

5-42. REMOVAL OF THE OUTER COVER

5-43. The outer cover, or skin has six flat head no. 6 screws holding it to the lower base assembly; three on the right and three on the left.

a. Remove the six screws to free the outer covering.

b. Lift the upper shell up and off the terminal.

5-44. REMOVAL OF THE POWER SUPPLY

5-45. The removal procedure for the all power supply designs is the same. With the cover removed:

a. Remove the J4 connector on the upper left hand corner of the MINI BEE LOGIC CARD. This is accomplished by placing the tip of a standard screw driver in the gap between the logi card and the connector and prying the connector off. (Use caution not to break the connector.)

b. Disconnect the connector (P10) that connects to the AC power outlet and is located in the rear, bottom left-hand corner of the terminal near the power supply.

c. Tip the terminal on its side so the power supply is at the bottom.

d. Remove the front bottom foot.

e. Remove the three large (No. 10) bolts located on the bottom that secure the POWER SUPPLY to the terminal base (see Figure 5-13).

f. Lift the terminal away from the power supply.

WARNING: The power supply is very heavy and care must be taken not to allow it to fall away from the terminal.

5-46. REMOVAL OF THE KEYBOARD P.C. CARD

5-47 Care must be used in removing the P.C. card to prevent damage to the components.

a. Unplug the keyboard from the terminal.

b. Tip the keyboard upside down on a protected surface (i.e.mat, carpet, etc.). You will find three large holes on the bottom front edge of the keyboard.

c. Remove the nuts located in the holes and lift the front of the keyboard housing up. The keyboard insert assembly should fall away from the housing. If not, push it through by pushing it with a small screw driver from the center hole on

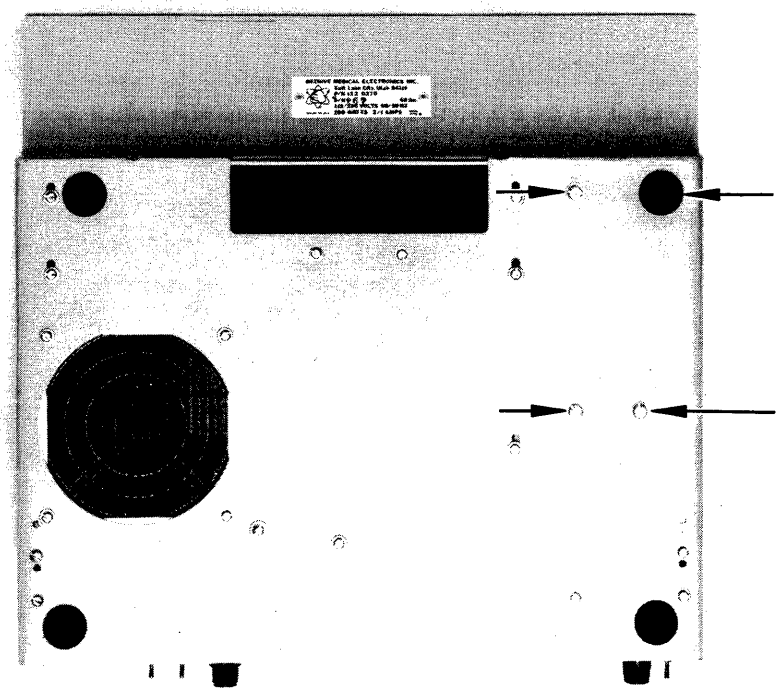


Figure 5-13. Power Supply Assembly Mounting Bolts

the bottom side.

d. Turn the keyboard right side up and completely remove the keyboard insert assembly.

e. Remove the connector in the left hand corner of the keyboard P.C. assembly.

f. Remove the four nuts and washers securing the P.C. card to the keyboard insert assembly located on either side of the P.C. assembly.

g. Remove the P.C. assembly using care not to snag any of the wires or components.

Note: Care must be used not to lose spacers between P.C. assembly and insert.

h. Remove the two nuts and four washers attaching the BRIGHTNESS control to the keyboard panel and remove the control.

i. With keyboard panel upside down, locate the bottoms of the LEDs. Using sharp instrument (e.g., small screwdriver, knife, etc.) gently pry the black collar up and off the LED mount. Squeeze LED mount edges together and press through holes.

j. Gently pull LED straight up and out of LED mount.

Note: For reassembly, the LED with 3 red leads is the POWER indicator (connect the black band on red lead to cathode) and LED with one red and one green is the PARITY indicator (connect the green lead to cathode). Cathode of LED is indicated by notch in red case and double width leg.

k. With the keyboard panel upside down, cut the three leads to the ON-LINE/LOCAL switch.

Note: For reassembly, place the switch such that when looking at the bottom of the switch the "A" mark is on the left and the "2" is on the right. Run the three leads from the bottom through and out the top of the panel. After stripping the leads and adding 1/2 inch of shrink tube, solder leads to right side ("2" side) of the switch. Blue to the bottom (nearest you), black to center and black stripe on white on top.

l. Separate keyboard panel from keyboard assembly.

m. To remove the cable, turn the keyboard housing upside down, locate and remove six (No. 6) screws attaching cable housing to keyboard housing.

n. Pull cable out of cable housing.

o. Cut the cable tie attaching cable to cable housing.

p. Separate and remove cable from cable housing.

5-48. REMOVAL OF THE MONITOR

5-49 Use extreme caution in handling the MONITOR to prevent damage to the CRT tube neck and connector pins. Striking the face of the CRT or dropping the CRT may cause the tube to implode.

a. Remove the edge (J12) connector from the MONITOR P.C. card located on the top of the MONITOR assembly by removing the holding clamp at the end of the connector and pull the connector away. Look inside the edge (J12) connector and ensure the polarity key is intact and in position.

b. Turn terminal so the face is toward you.

c. Remove the window assembly from the MINI BEE by pulling it directly out from the terminal separating the hedlocks.

d. Remove the four bolts which connect the bezel frame to the MONITOR, remove the frame and spacers. Bolts should be retightened to secure the CRT to frame unless the tube is to be removed from the monitor assembly.

e. With the front of the terminal to your right, locate and remove two bolts in bottom edge of the MONITOR frame . These bolts attach the MONITOR to the MONITOR mount.

f. Lift the MONITOR directly away from the terminal.

5-50. REMOVAL OF TUBE SHIELD

Adjustment and centering of the display may require the removal of the tube shield.

Early models of MINI BEE are equipped with a one-piece tube shield. Removal of the shield is as follows:

Note: If the shield is to be removed while the MONITOR is in the chassis, the LOGIC PC CARD must be removed first.

a. Remove the CRT pin connector.

b. Loosen the shield screws and slide shield off tube neck.

Later models of MINI BEE use a tube shield consisting of two halves. Removal of the shield is described by the following steps:

a. Loosen three screws along the top half edge of tube shield. (When reassembling, replace screws with heads out and away from MONITOR PC board.)

b. Move half of tube shield out and down to expose CRT yoke and adjustments.

c. To remove shield, remove screw attaching strap, and remove strap from monitor frame. Rotate shield around the CRT neck until free and remove.

5-51. REMOVAL OF MONITOR PC CARD

To remove the MONITOR PC CARD from the chassis:

a. Disconnect the CRT pin connector.

b. Disconnect the following connections from the board:

(1) J-12 edge connector,

(2) P104 - red and black, P105 - yellow, orange and green, P106 - red and blue, P101 - yellow and black, P102 - yellow and green.

Note: P107 and P103 are not used in this application.

c. Disconnect 3 single pin connectors - all black.

d. Place forefinger under edge of the PC card and lift until card is free of mounting pins.

e. Remove PC board from chassis.

5-52. REMOVAL OF THE FAN

5-53. Removal of the fan may be required in whole or in part, to remove the Logic Card on earlier MINI BEE models, refer Figure 5-14.

a. Position the terminal so the terminal is facing your right. (Terminal front to your right).

b. Remove the four bolts holding the fan deflection cover to the fan housing.

c. Disconnect fan cable from terminal block on early models or disconnect fan connector on later models.

d. Turn Terminal on its side, and locate and remove four bolts attaching fan to base (see Figure 5-15)

e. Turn Terminal right side up and remove fan housing, finger guard and screen.

5-54. REMOVAL OF THE MINI BEE LOGIC BOARD

5-55 When removing the LOGIC CARD, care must be used to protect the components on the board.

a. Turn the terminal so the back is facing you.

Note: The fan may inhibit the removal of the logic board on early terminal models. (Refer to para. 5-52).

b. If fan has not been removed entirely and is necessary, remove the two outer bolts and the rear inner bolt that secures the fan to the terminal base leaving the remaining bolt to hold the fan to the terminal.

c. Rotate the fan counter-clockwise.

d. Disconnect the P5 connector from the upper left-hand corner by placing the tip of a standard screwdriver in the gap between the logic card and the connector and prying the connector off. (This should require only moderate force, and should not damage the logic card.)

e. Remove the P4 connector located adjacent to the P5 connector in the same manner.

f. Remove the black rotary baud switch knob with a 1/16th inch Allen wrench.

Note: Before removing the baud rate knob, turn to position 1. The knob must be placed in exactly the same position when all parts are replaced.

g. Remove the three nuts holding the HDX/FDX switch, the 110/150 selector switch, and the rotary selector baud rate switch with a 5/16th inch wrench.

h. Remove the two bolts on both sides of the I/O connector (J2) with a 3/16th inch wrench or nut driver.

i. Tip the MINI BEE so it rests on the side of the terminal on a protected surface.

j. Remove the four bolts at the right rear and left rear of the terminal base that hold the upright supports for the MINI BEE LOGIC CARD to the chassis (see Figure 5-16). Care should be taken to support the LOGIC CARD so no damage will occur when it is freed in the terminal.

k. Return the terminal to its upright position with the back of the terminal facing you.

l. Tilt the top of the LOGIC CARD toward you.

m. Remove the two bolts connecting the keyboard (PI) extension cable connector to the logic card and disconnect their coupling.

n. Carefully lift the MINI BEE LOGIC CARD with the upright supports attached out of the terminal.

o. Remove the four bolts securing the upright support brackets to the Logic Card and remove the brackets.

The LOGIC CARD assembly can be removed without removing the mounting brackets by completing the following steps.

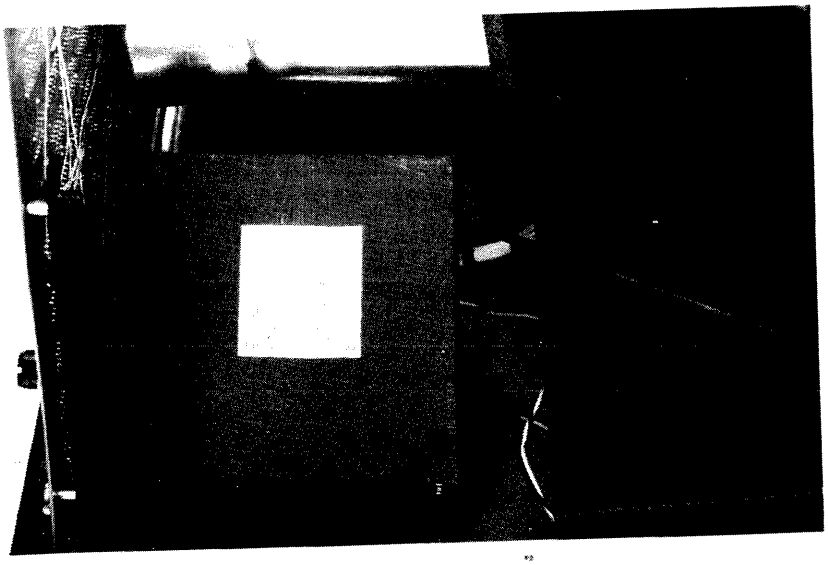
a. Complete above steps a through h.

b. Remove four bolts securing the LOGIC CARD to the support brackets.

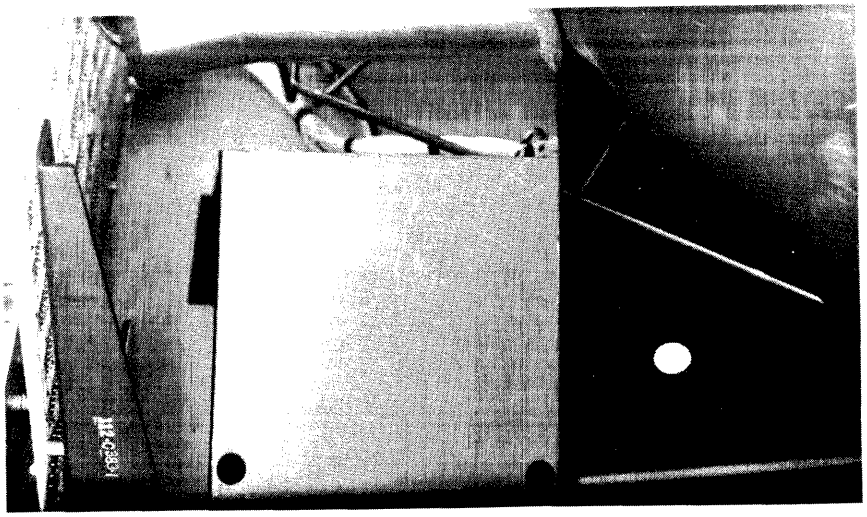
c. Complete steps l and m above.

d. Remove LOGIC CARD from terminal.

Note: When reinstalling the LOGIC CARD, ensure that the external stops on the baud rate switch are located in the proper position so that the baud rate knob is pointing to position 1 when the shaft is turned fully counterclockwise.



a. Fan Position - Removal Required



b. Fan Position - Removal Not Required

Figure 5-14. Fan Assembly Location

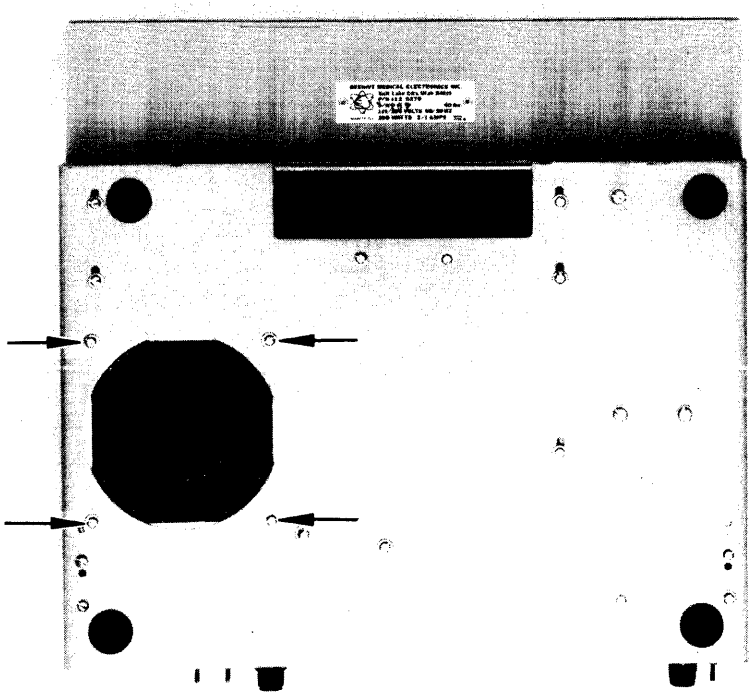


Figure 5-15. Fan Assembly Mounting Bolts

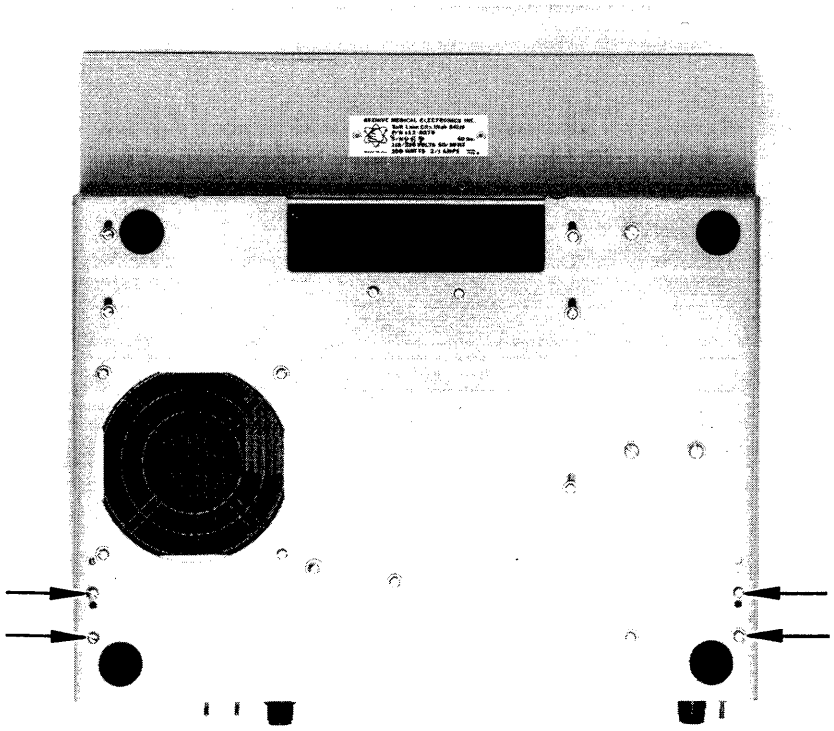


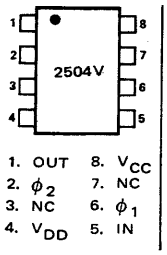
Figure 5-16. Logic Card Assembly Mounting Bolts

SECTION VI
DIAGRAMS

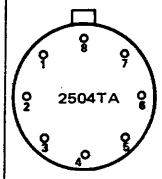
IC DESCRIPTION

The pin assignments, name and type of all integrated circuit used in Mini Bee are shown in the following pages.

1404 (2504)



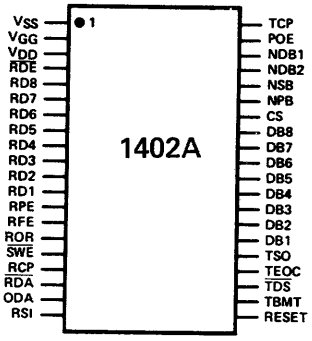
1. OUT
2. ϕ_2
3. NC
4. V_{DD}
8. V_{CC}
7. NC
6. ϕ_1
5. IN



1. NC
2. IN
3. $\phi 1$
4. V_{CC}
5. OUT
6. NC
7. $\phi 2$
8. V_{DD}

Shift Register Memory

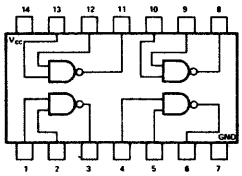
1402A (AY-5-1013)



UART

N7400

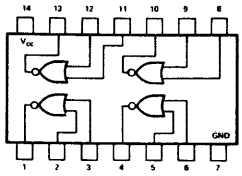
A,F PACKAGE



Quadruple 2-Input Positive
Nand Gate

N7402

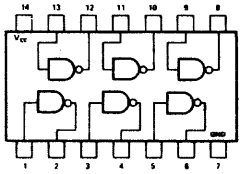
A,F PACKAGE



Quadruple 2-Input
Positive Nor Gate

N7404

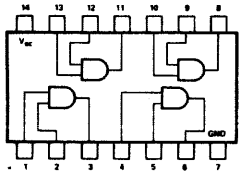
A,F PACKAGE



HEX Inverter

N7408

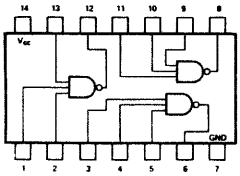
A PACKAGE



Quadruple 2-Input
Positive And Gates

N7410

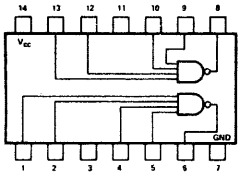
A,F PACKAGE



Triple 3-Input
Positive Nand Gate

N7420

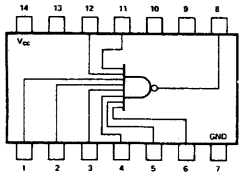
A,F PACKAGE



Dual 4-Input
Positive Nand Gate

N7430

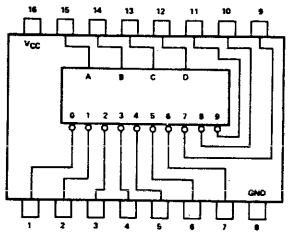
A,F PACKAGE



8-Input Positive Nand Gate

N7442

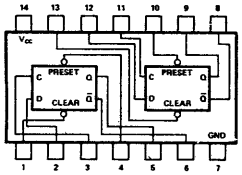
B,F,W PACKAGE



8CD-To-Decimal Decoder

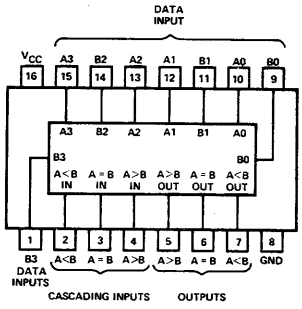
N7474

A,F PACKAGE



Dual D-Type Edge-Triggered Flip-Flop

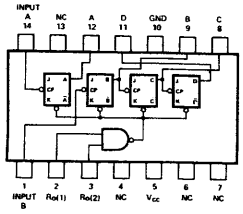
N7485



4-Bit Magnitude Comparators

N7493

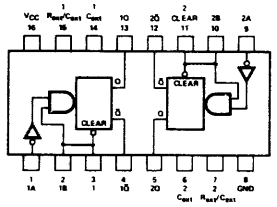
A,F PACKAGE



4-Bit Binary Counter

N74123

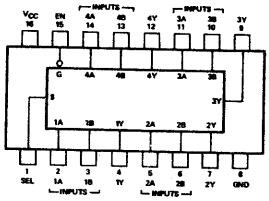
74122 A,F PACKAGE



Retriggerable Monostable Multivibrator with Clear

N74157

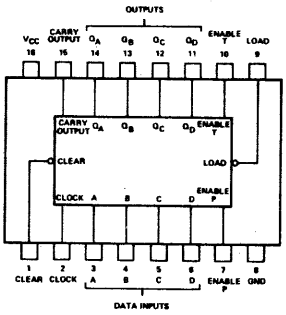
B,F,W PACKAGE



Quadruple 2-Input Data Selector/Multiplexer

N74163

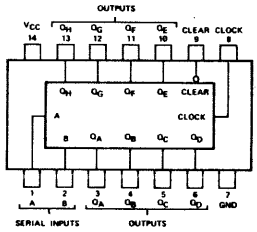
B,F,W PACKAGE



Synchronous 4-Bit Counter

N74164

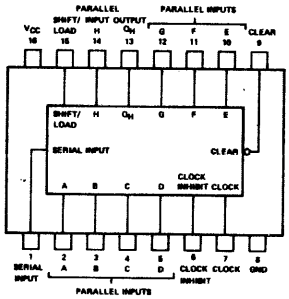
A,F PACKAGE



8-Bit Parallel-Out Serial Shift Registers

N74166

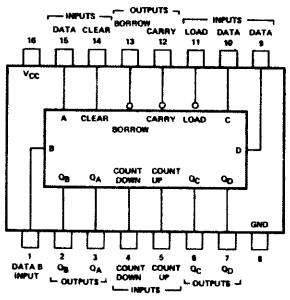
B,F,W PACKAGE



8-Bit Shift Register

N74192

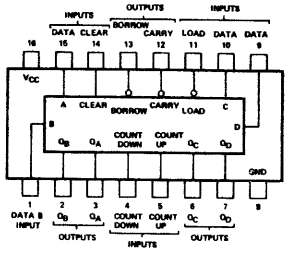
B,F PACKAGE



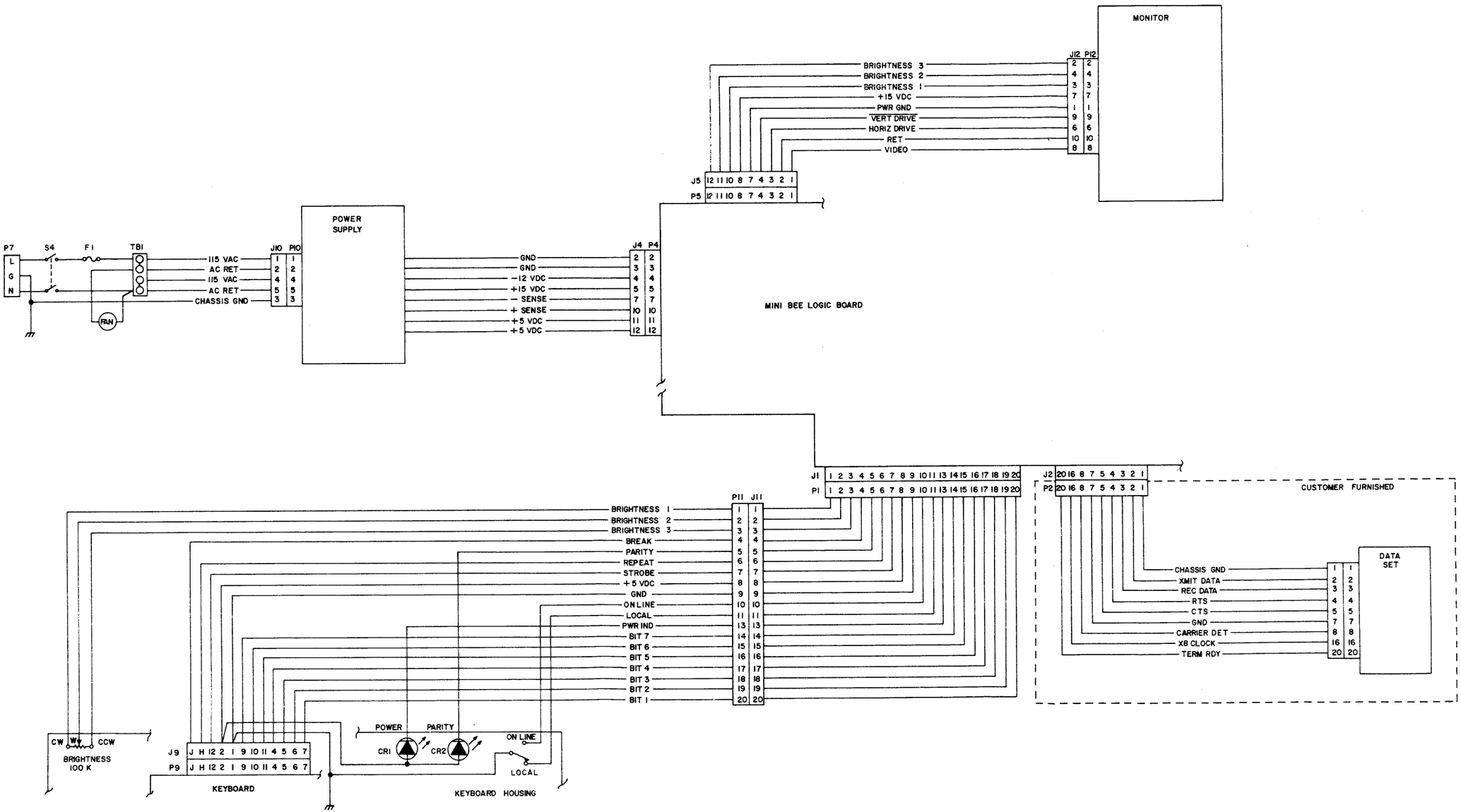
Synchronous Decade Up/Down Counter with Preset Inputs

N74193

B,F PACKAGE



Synchromous 4-Bit Binary Up/Down Counter with Preset Inputs



MINI BEE
INTERCONNECTION DIAGRAM

6-5/6-6

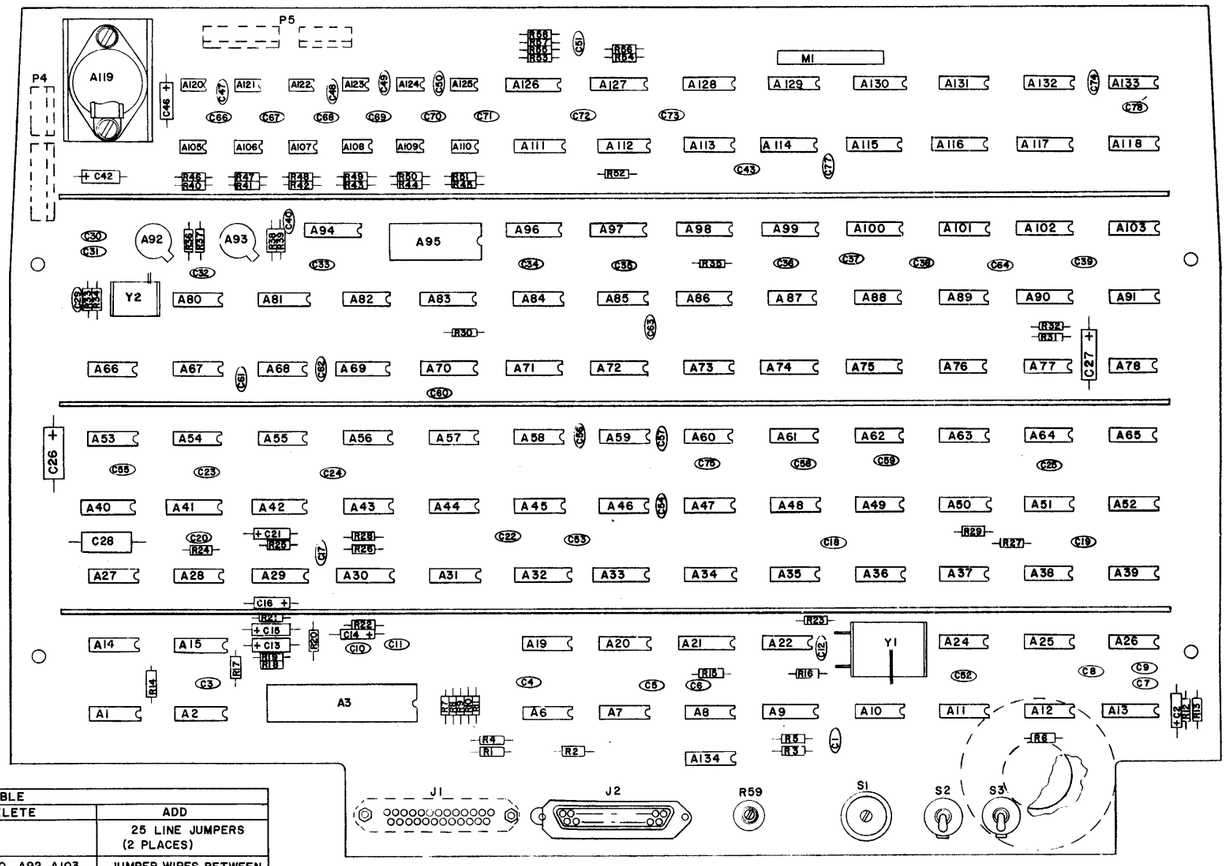
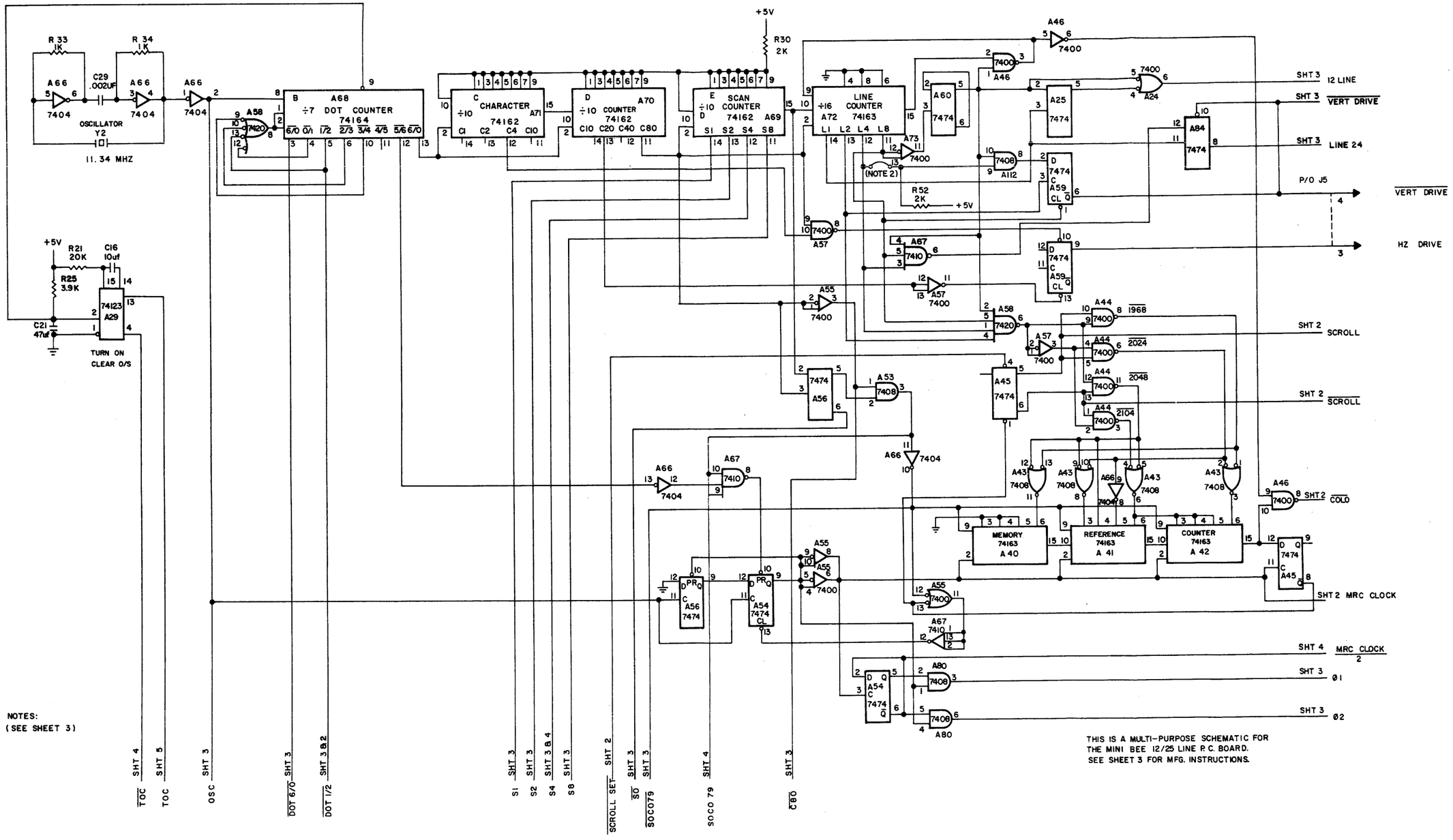


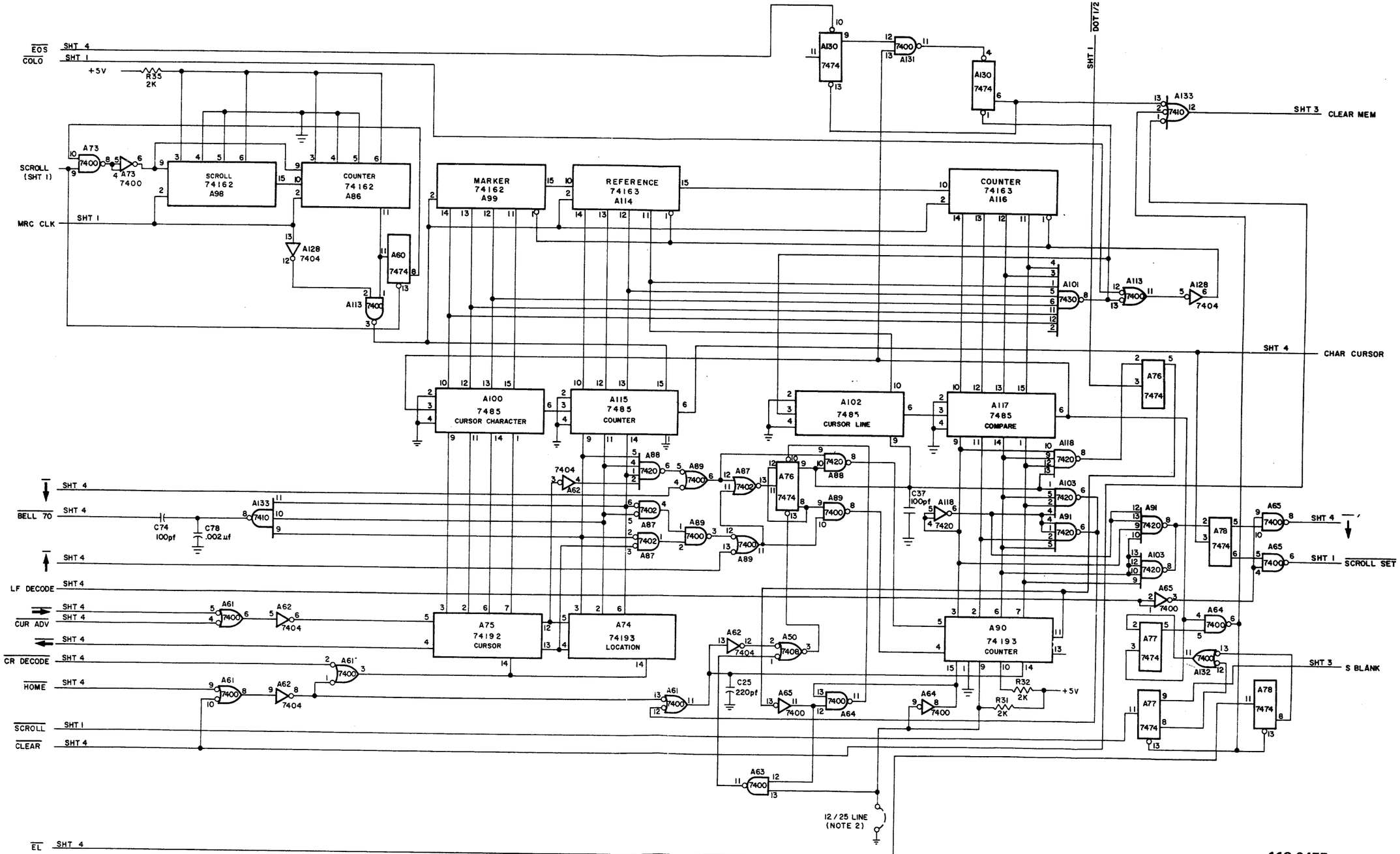
TABLE		
PART NO. & OPTION	DELETE	ADD
112-0455-0001 (25 LINE OPTION)	A91	25 LINE JUMPERS (2 PLACES)
112-0455-0002 (12 LINE OPTION)	A105-A110, A92, A103, R36, R37, R46-R51	JUMPER WIRES BETWEEN PINS 5 & 1 ON A105-A110; 12 LINE JUMPERS (2 PLACES)
112-0455-0003 (25 LINE OPTION WITH 10 BIT WORD PARITY TO MARKING STATE)	COMPONENT SIDE-CUT CONDUCTOR BETWEEN A3 PIN 35 & A3 PIN 38	DIP SIDE-ADD A JUMPER BETWEEN A3 PIN 35 & A3 PIN 34 & 25 LINE JUMPERS
112-0455-0004 (25 LINE OPTION WITH ELAPSED TIME METER)		M1 & 25 LINE JUMPERS



Mini Bee Logic Card 112-0455

Sheet 1 of 5

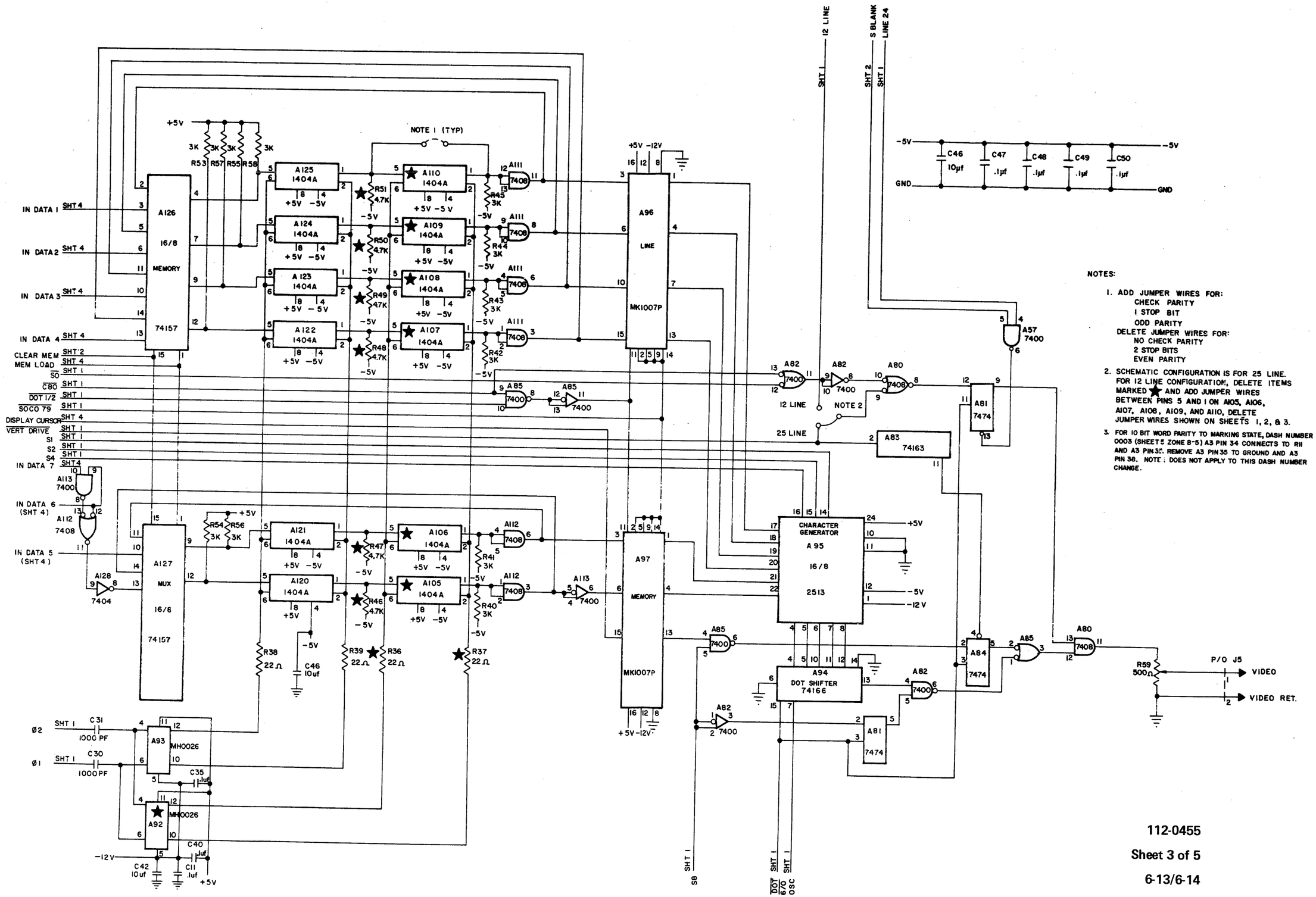
6-9/6-10



112-0455

Sheet 2 of 5

6-11/6-12



NOTES:

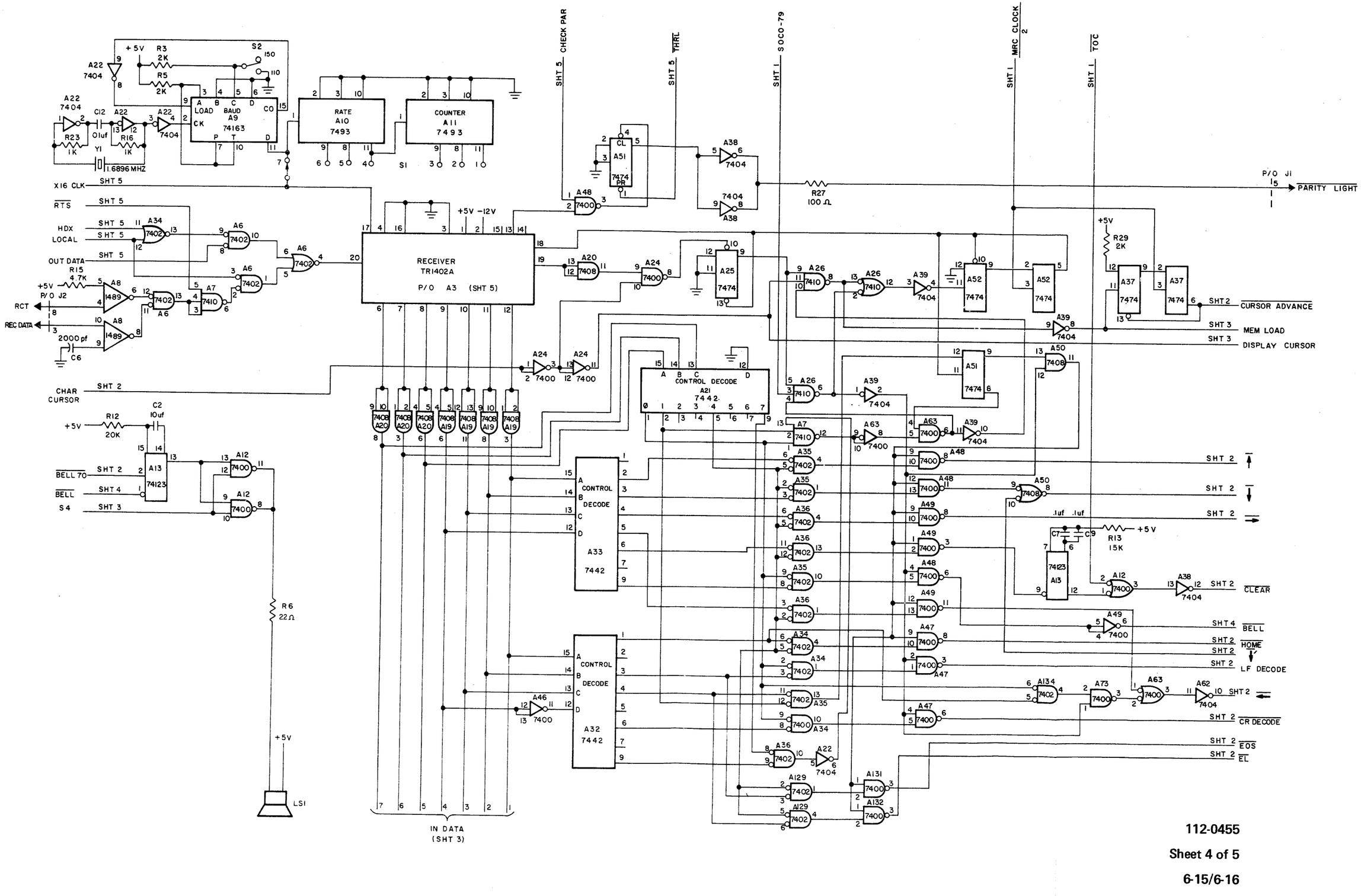
1. ADD JUMPER WIRES FOR:
   - CHECK PARITY
   - 1 STOP BIT
   - ODD PARITY

   DELETE JUMPER WIRES FOR:
   - NO CHECK PARITY
   - 2 STOP BITS
   - EVEN PARITY
2. SCHEMATIC CONFIGURATION IS FOR 25 LINE. FOR 12 LINE CONFIGURATION, DELETE ITEMS MARKED ★ AND ADD JUMPER WIRES BETWEEN PINS 5 AND 1 ON A105, A106, A107, A108, A109, AND A110, DELETE JUMPER WIRES SHOWN ON SHEETS 1, 2, & 3.
3. FOR 10 BIT WORD PARITY TO MARKING STATE, DASH NUMBER 0003 (SHEET 5 ZONE B-5) A3 PIN 34 CONNECTS TO R11 AND A3 PIN 37. REMOVE A3 PIN 35 TO GROUND AND A3 PIN 38. NOTE 1 DOES NOT APPLY TO THIS DASH NUMBER CHANGE.

112-0455

Sheet 3 of 5

6-13/6-14



112-0455

Sheet 4 of 5

6-15/6-16

P/O J1 WIPER CW CCW KBD STRB KBD RPT

P/O P5
WIPER
CW
CCW
+15V

+5V −12V

POWER INC

THRL SHT 4

KBD 7 KBD 6 KBD 5 KBD 4 KBD 3 KBD 2 KBD 1 KBD BRK

ON LINE LOCAL SW

P/O J1

R4 2K +5V
R1 2K +5V

R28 100Ω
R22 5.1K C14 47uf
A30 74123 REPEAT PULSE GENERATOR
R26 300Ω
R20 5.1K C17 .001uf
A30 74123 STROBE PULSE GENERATOR

R2 100Ω

A31 7474
SHT 4 LOCAL

GND
GND
5V SENSE −
5V SENSE +
+5VDC
+5VDC
−12 VDC
+15VDC
+5V
+15V
A119 LM320 VOLTAGE REGULATOR
−5V

R19 20K C15 47uf C13 47uf

R17 100Ω
R18 300Ω
A29 74123 BREAK O/S

+15V A27 1488 P/O J2 20 TERM READY −12V

R7 2K R9 2K R10 2K R8 2K R11 2K

CHECK PAR SHT 4
CHECK PARITY
1/2 STOP BIT
ODD/EVEN PARITY
(NOTE 1)

TRANSMITTER
C5
NB2
NO PARITY
2 STOP BITS
EVEN PARITY
NB1
XR
TRC
TRO
THRE
TRE
TR1402A
P/O A8 (SHT 4)

A2 7408 A1 7400 A14 7400 A27 1488 −12V
OUT DATA
XMIT DATA

SHT 4 RTS
P/O J2 4 RTS

X16 CLK SHT 4
TOC SHT 1
P/O J2 CTS 5
R24 4.7K
A28 1489
A15 7410
A15 7410
A2 7408

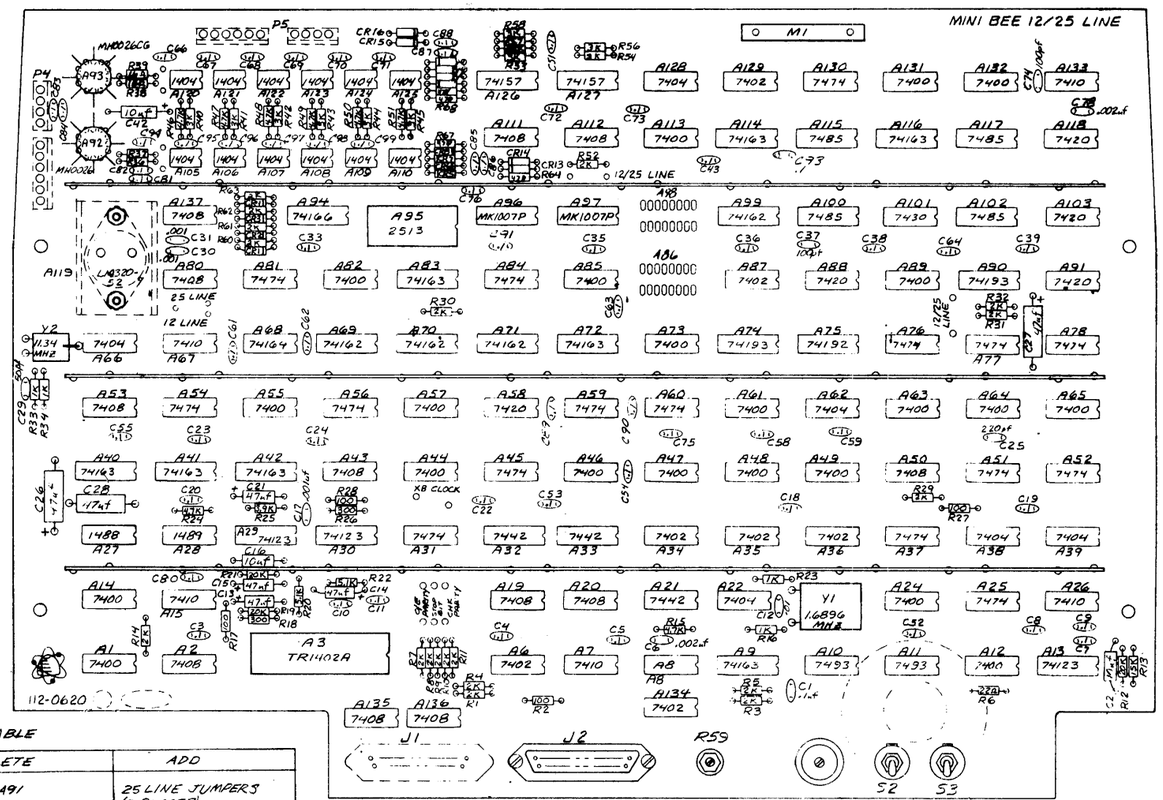
FDX S3
HDX

A31 −2 7474

P/ J2 16 X8 CLK

+5V R14 2K A14 SHT 4 HDX

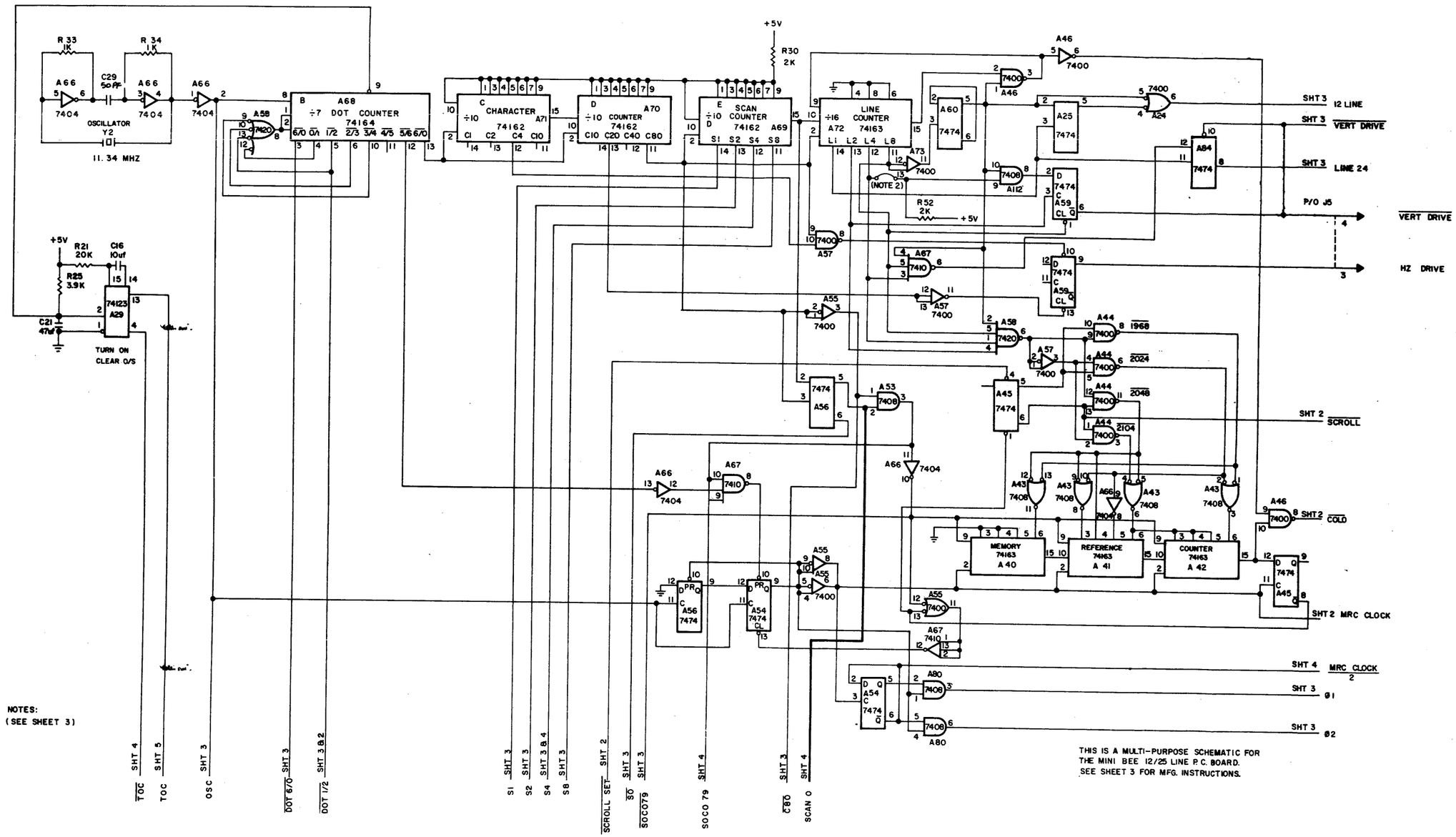
112-0455
Sheet 5 of 5
6-17/6-18



TABLE

PART NO & OPTION	DELETE	ADD
112-0620-0000 25 LINE OPTION	A91	25 LINE JUMPERS (2 PLACES)
112-0620-0001 25 LINE OPTION WITH ELAPSE TIME METER	A91	M1 # 25 LINE JUMPERS (2 PLACES) EVEN PARITY JUMPER NO PARITY JUMPER 10 BIT JUMPER
112-0620-0002 12 LINE OPTION	A105-A110, A92, A103 R36, R37, R46-R51	JUMPER WIRES BETWEEN PINS 5 # 1 ON A105-A110 12 LINE JUMPERS (2 PLACES)
112-0620-0003 25 LINE OPTION WITH 10 BIT WORD PARITY TO MARKING STATE	COMPONENT SIDE: CUT CONDUCTOR BETWEEN A3 PIN 35 # A3 PIN 38	JUMPER WIRE BETWEEN A3 PIN 35 # A3 PIN 34 25 LINE JUMPERS

Mini Bee Logic Card 112-0620



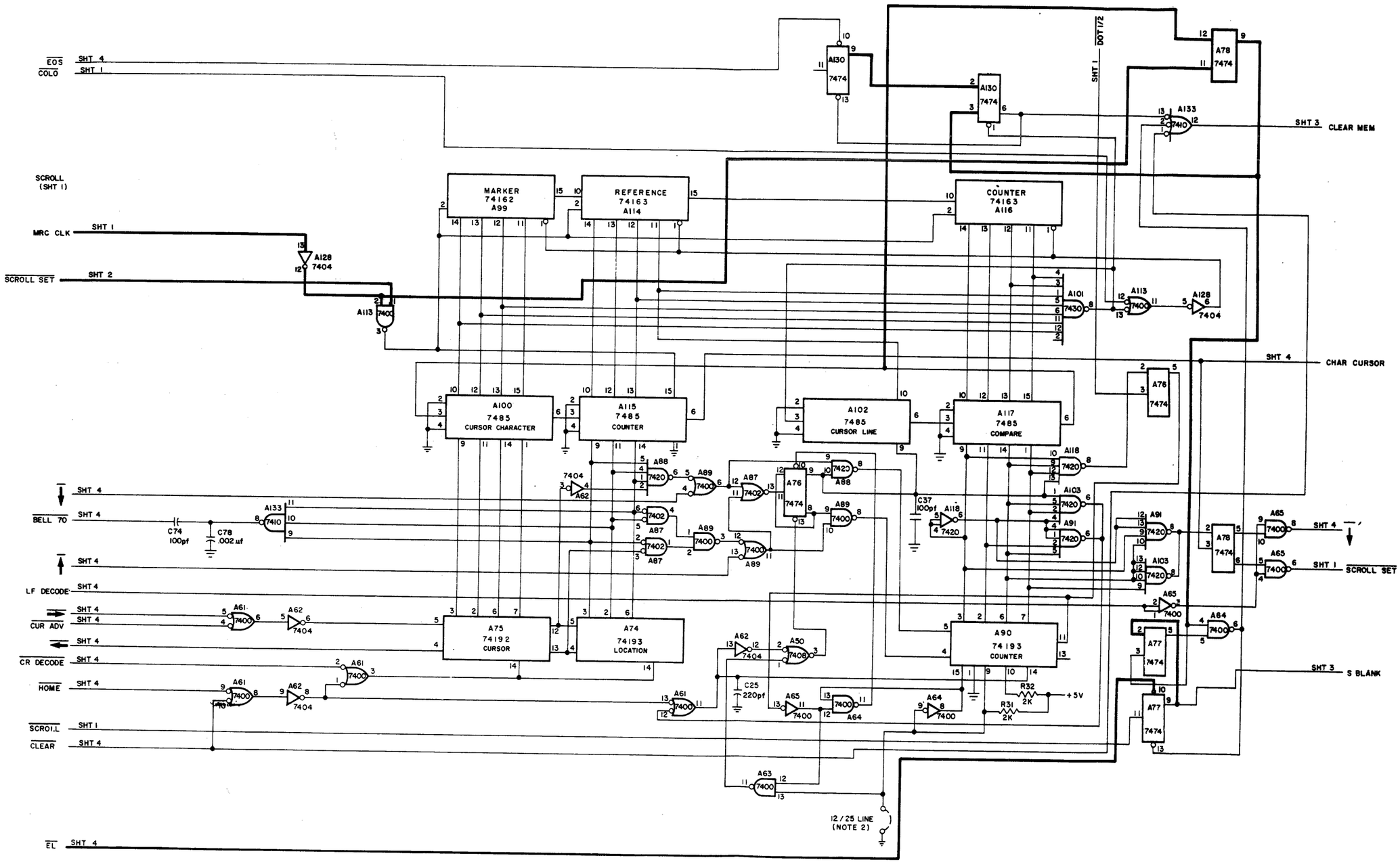
NOTES:
(SEE SHEET 3)

THIS IS A MULTI-PURPOSE SCHEMATIC FOR THE MINI BEE 12/25 LINE P.C. BOARD. SEE SHEET 3 FOR MFG. INSTRUCTIONS.

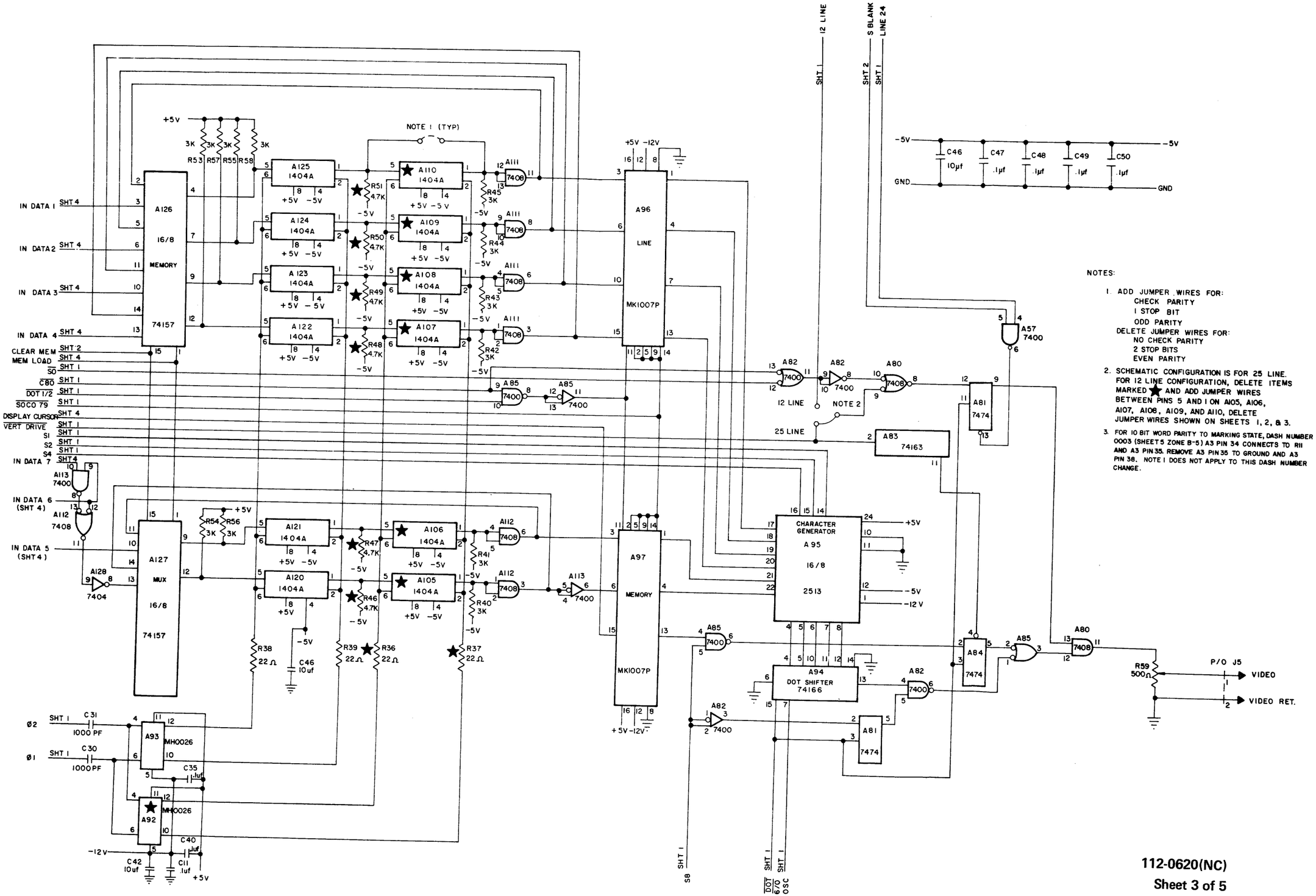
Mini Bee Logic Card — 112-0620(NC)

Sheet 1 of 5

6-21/6-22



112-0620(NC)
Sheet 2 of 5
6-23/6-24



NOTES:

1. ADD JUMPER WIRES FOR:
   CHECK PARITY
   1 STOP BIT
   ODD PARITY
   DELETE JUMPER WIRES FOR:
   NO CHECK PARITY
   2 STOP BITS
   EVEN PARITY
2. SCHEMATIC CONFIGURATION IS FOR 25 LINE. FOR 12 LINE CONFIGURATION, DELETE ITEMS MARKED ★ AND ADD JUMPER WIRES BETWEEN PINS 5 AND 1 ON A105, A106, A107, A108, A109, AND A110, DELETE JUMPER WIRES SHOWN ON SHEETS 1, 2, & 3.
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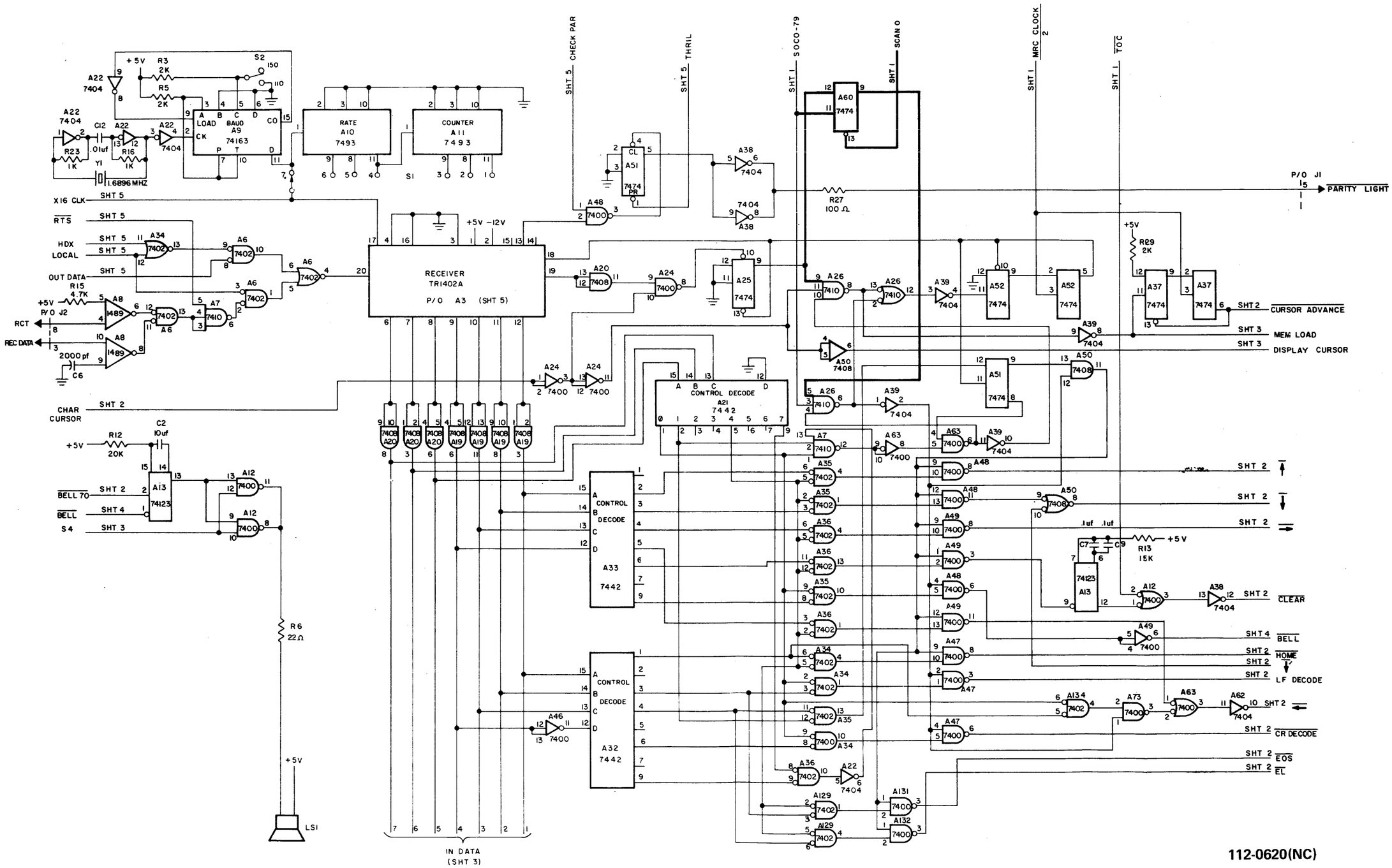
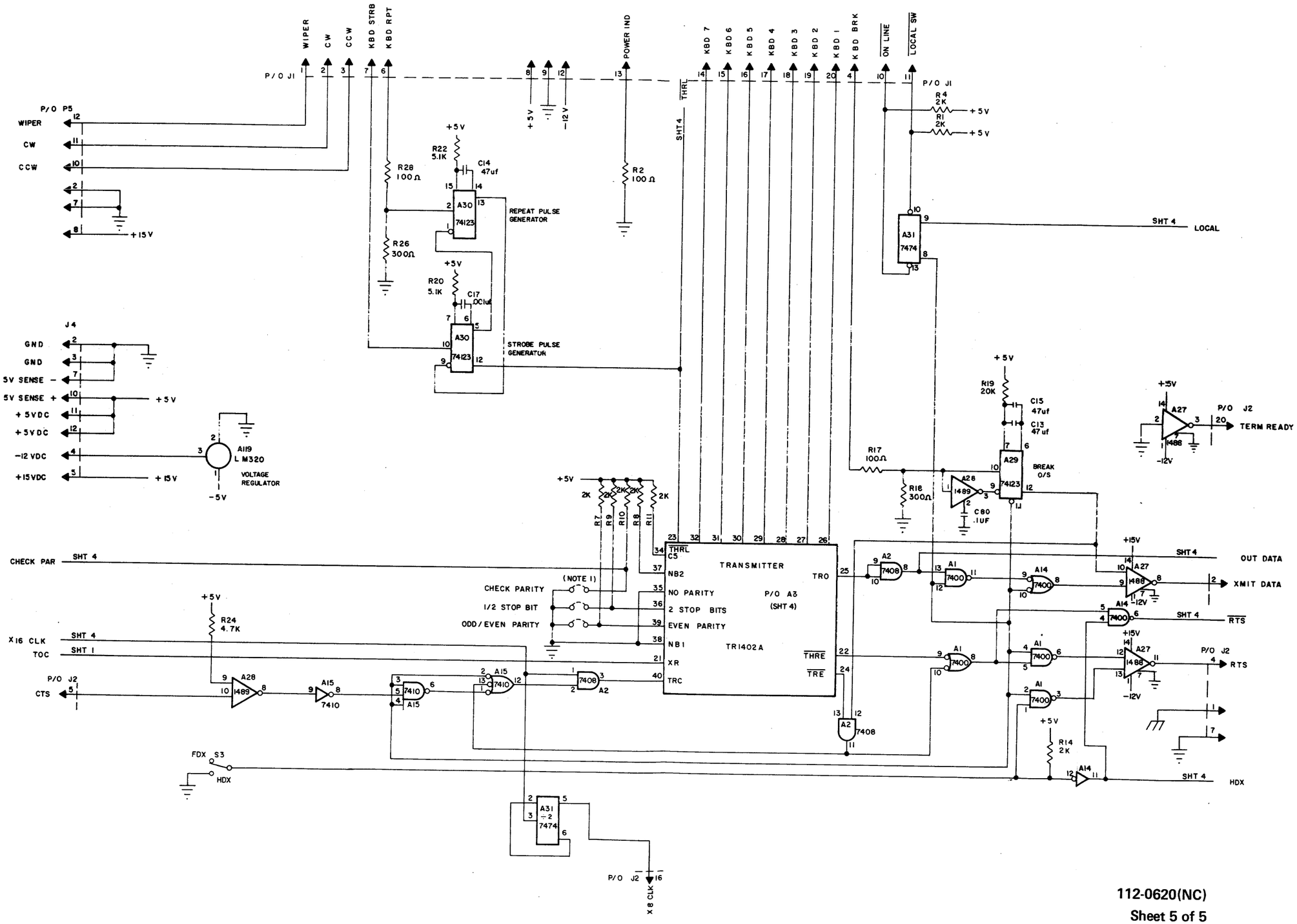


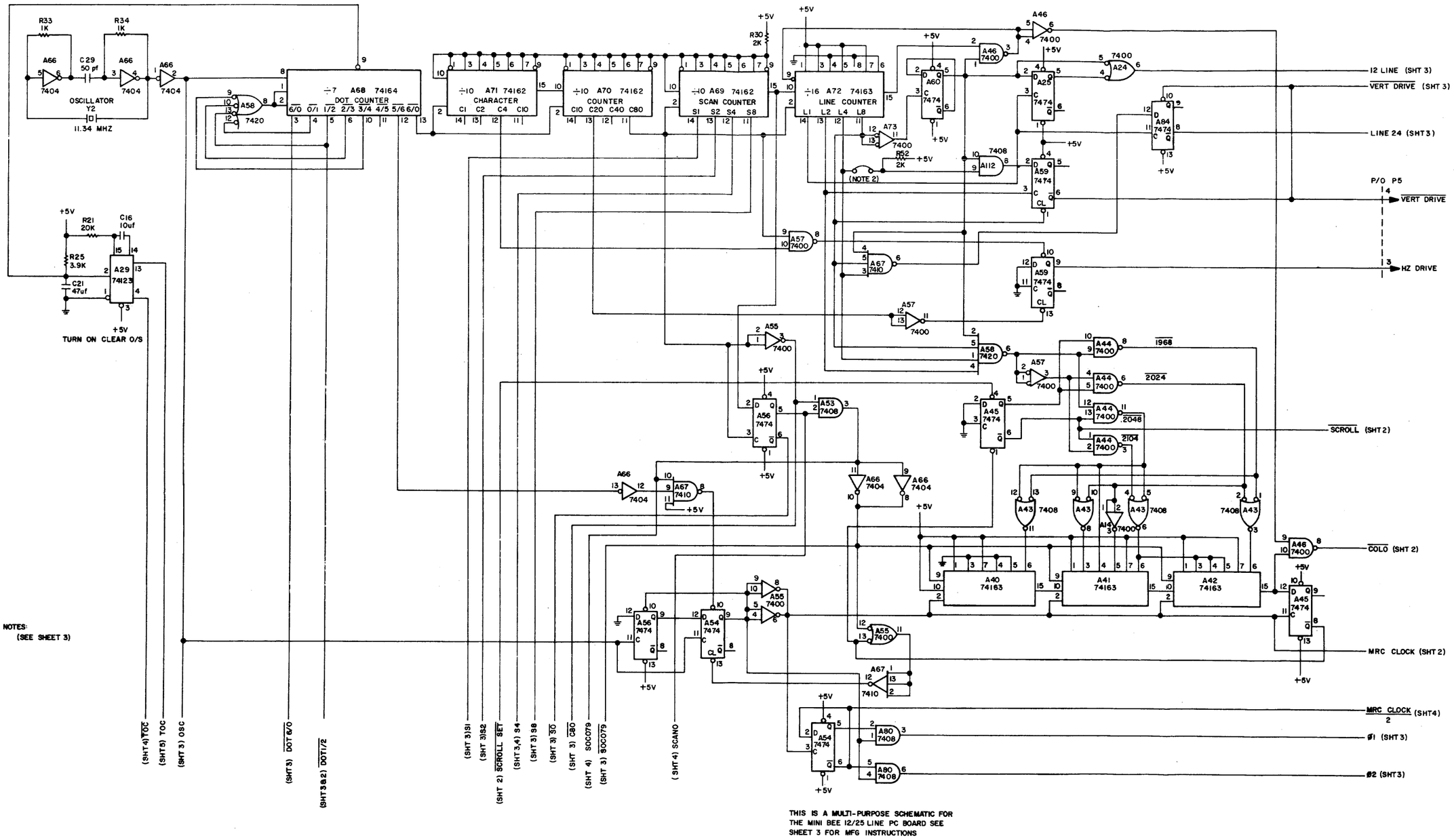
112-0620(NC)

Sheet 4 of 5

6-27/6-28



112-0620(NC)
Sheet 5 of 5
6-29/6-30

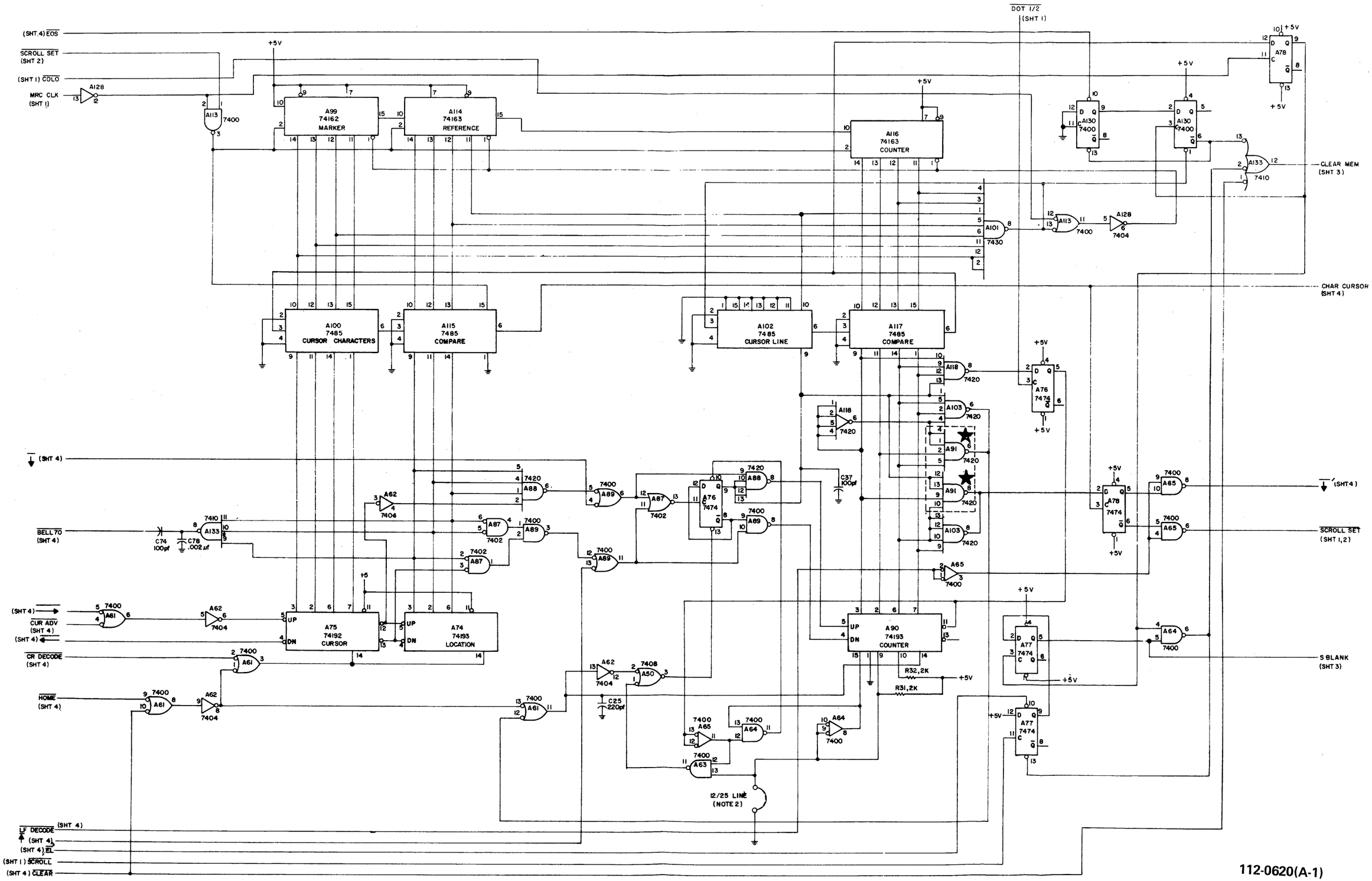


NOTES:
(SEE SHEET 3)

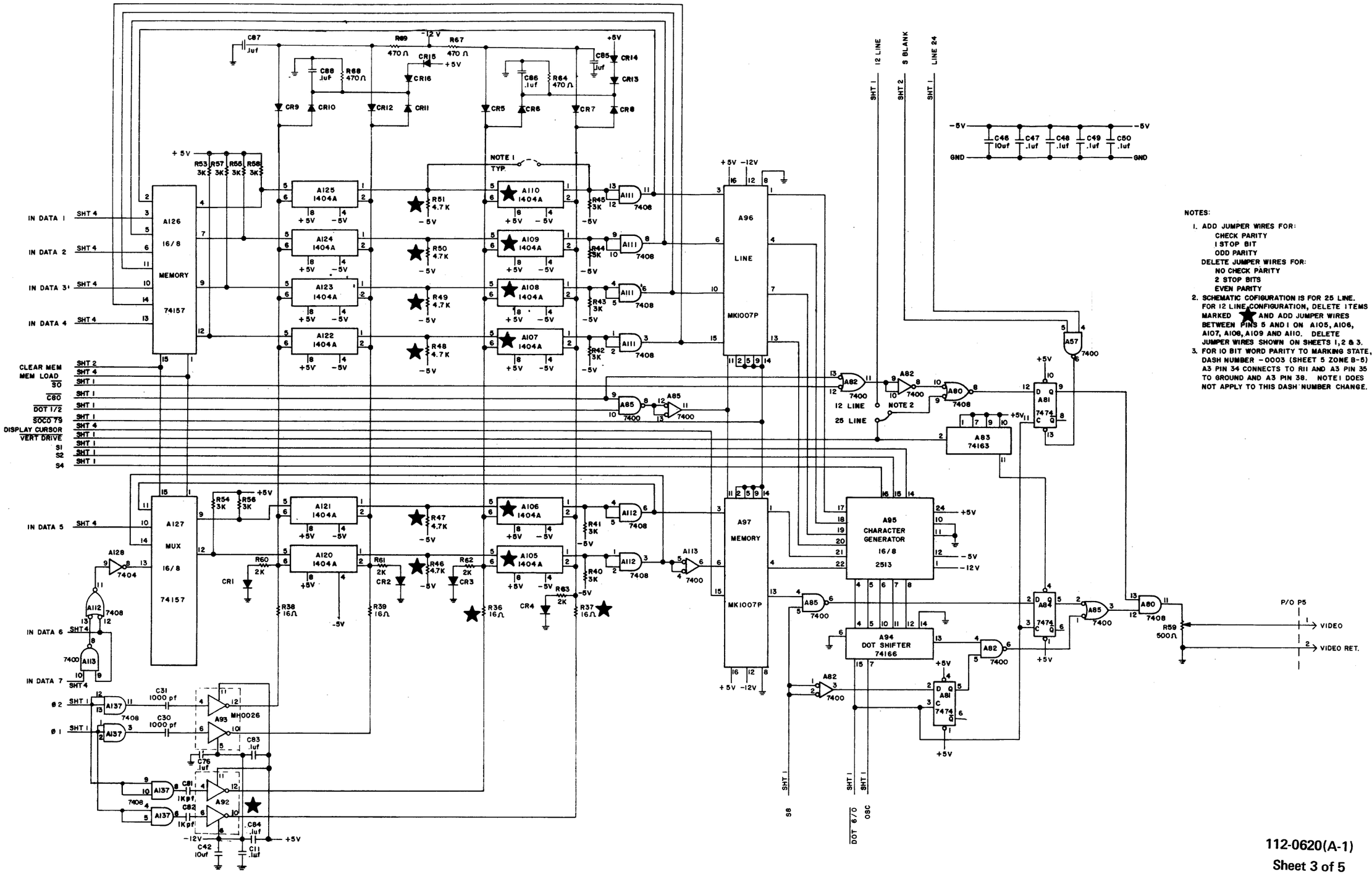
THIS IS A MULTI-PURPOSE SCHEMATIC FOR THE MINI BEE 12/25 LINE PC BOARD SEE SHEET 3 FOR MFG INSTRUCTIONS

Mini Bee Logic Card — 112-0620(A-1)
Sheet 1 of 5

6-31/6-32



112-0620(A-1)
Sheet 2 of 5
6-33/6-34

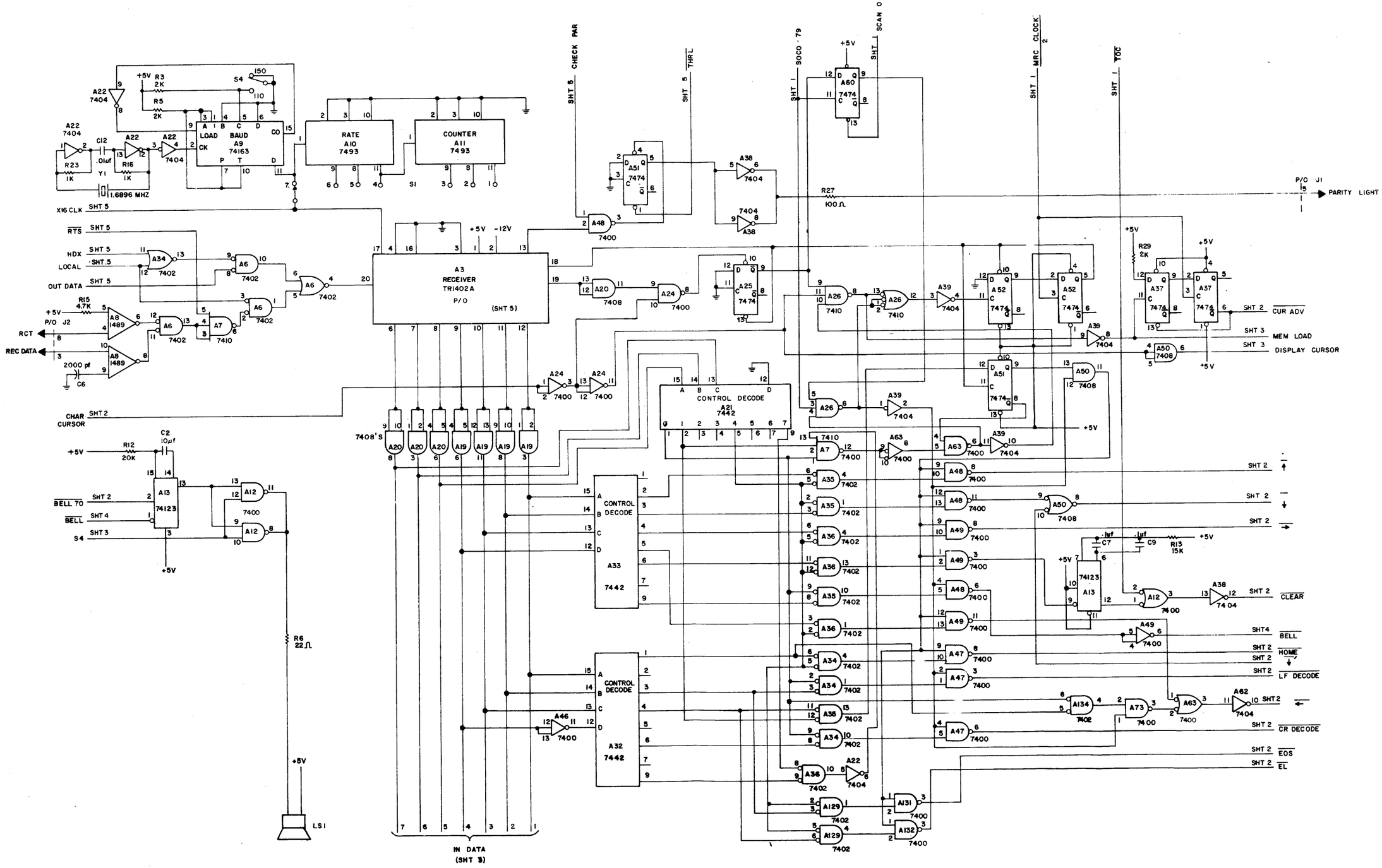


NOTES:

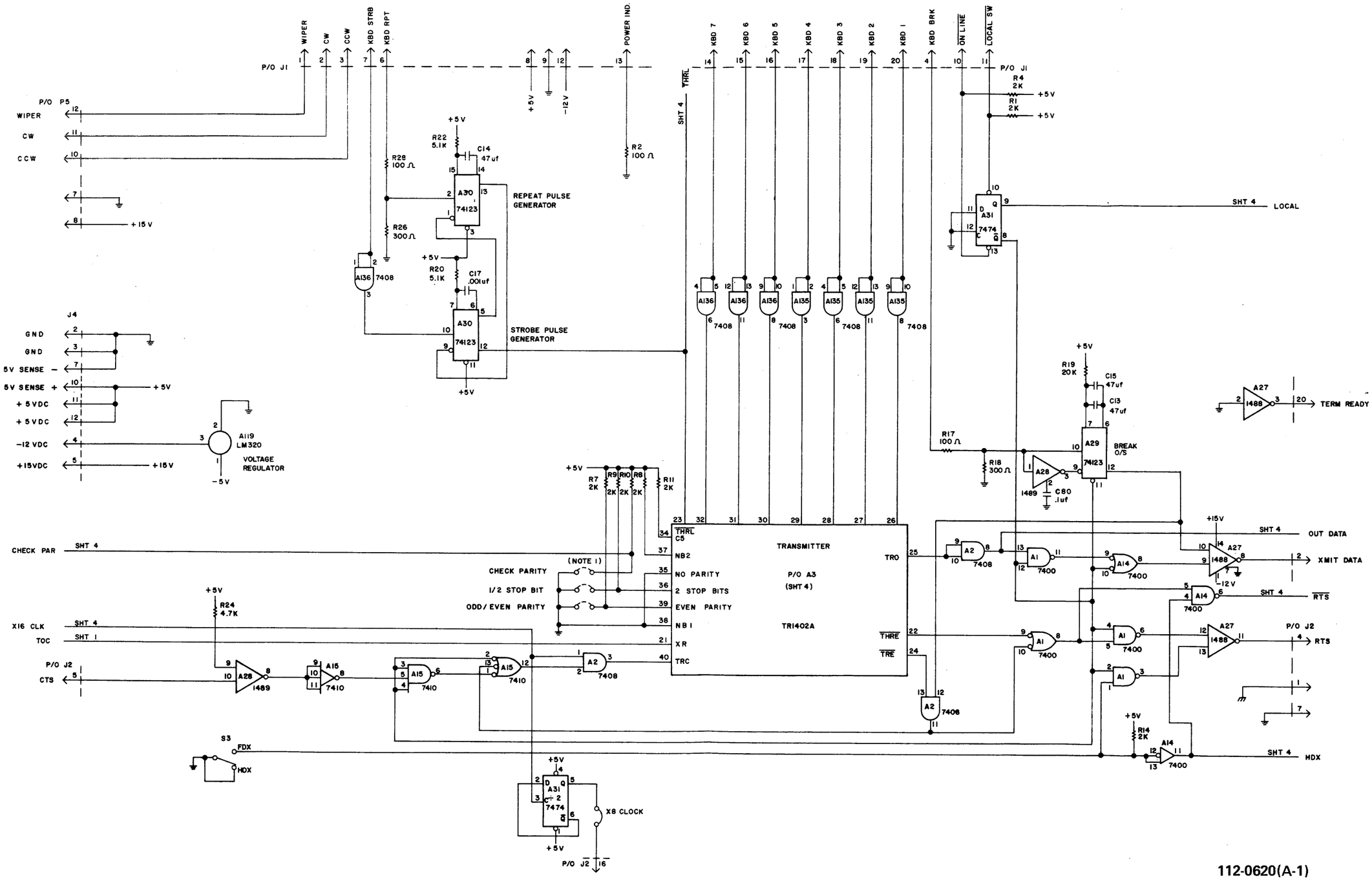
1. ADD JUMPER WIRES FOR:
   - CHECK PARITY
   - 1 STOP BIT
   - ODD PARITY

   DELETE JUMPER WIRES FOR:
   - NO CHECK PARITY
   - 2 STOP BITS
   - EVEN PARITY
2. SCHEMATIC COFIGURATION IS FOR 25 LINE. FOR 12 LINE CONFIGURATION, DELETE ITEMS MARKED ★ AND ADD JUMPER WIRES BETWEEN PINS 5 AND 1 ON A105, A106, A107, A108, A109 AND A110. DELETE JUMPER WIRES SHOWN ON SHEETS 1, 2 & 3.
3. FOR 10 BIT WORD PARITY TO MARKING STATE, DASH NUMBER -0003 (SHEET 5 ZONE B-5) A3 PIN 34 CONNECTS TO R11 AND A3 PIN 35 TO GROUND AND A3 PIN 38. NOTE 1 DOES NOT APPLY TO THIS DASH NUMBER CHANGE.

112-0620(A-1)
Sheet 3 of 5
6-35/6-36

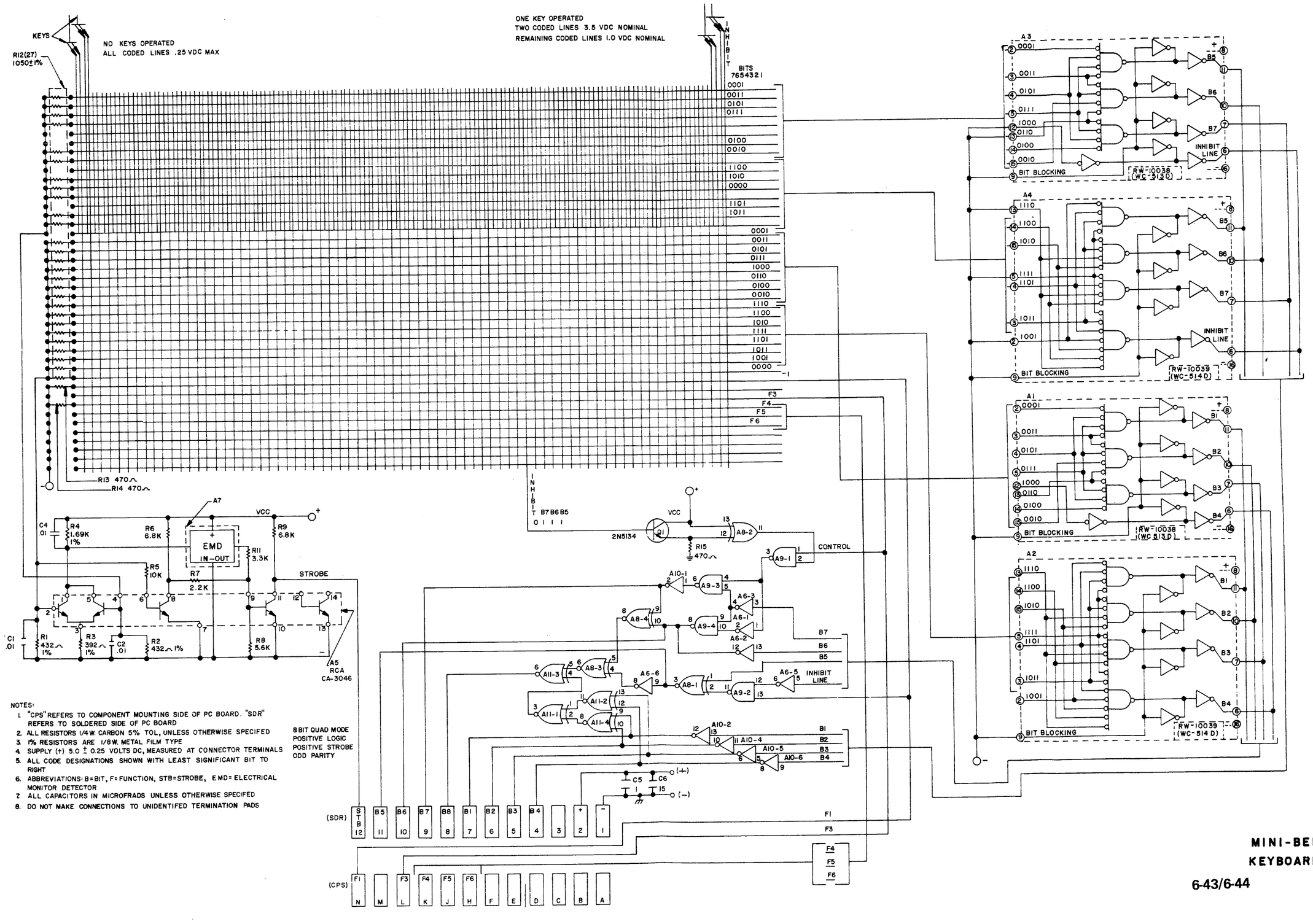


112-0620(A-1)
Sheet 4 of 5
6-37/6-38



112-0620(A-1)
Sheet 5 of 5
6-39/6-40

Circuit Board (SW10259) Keyboard Assembly



NOTES:

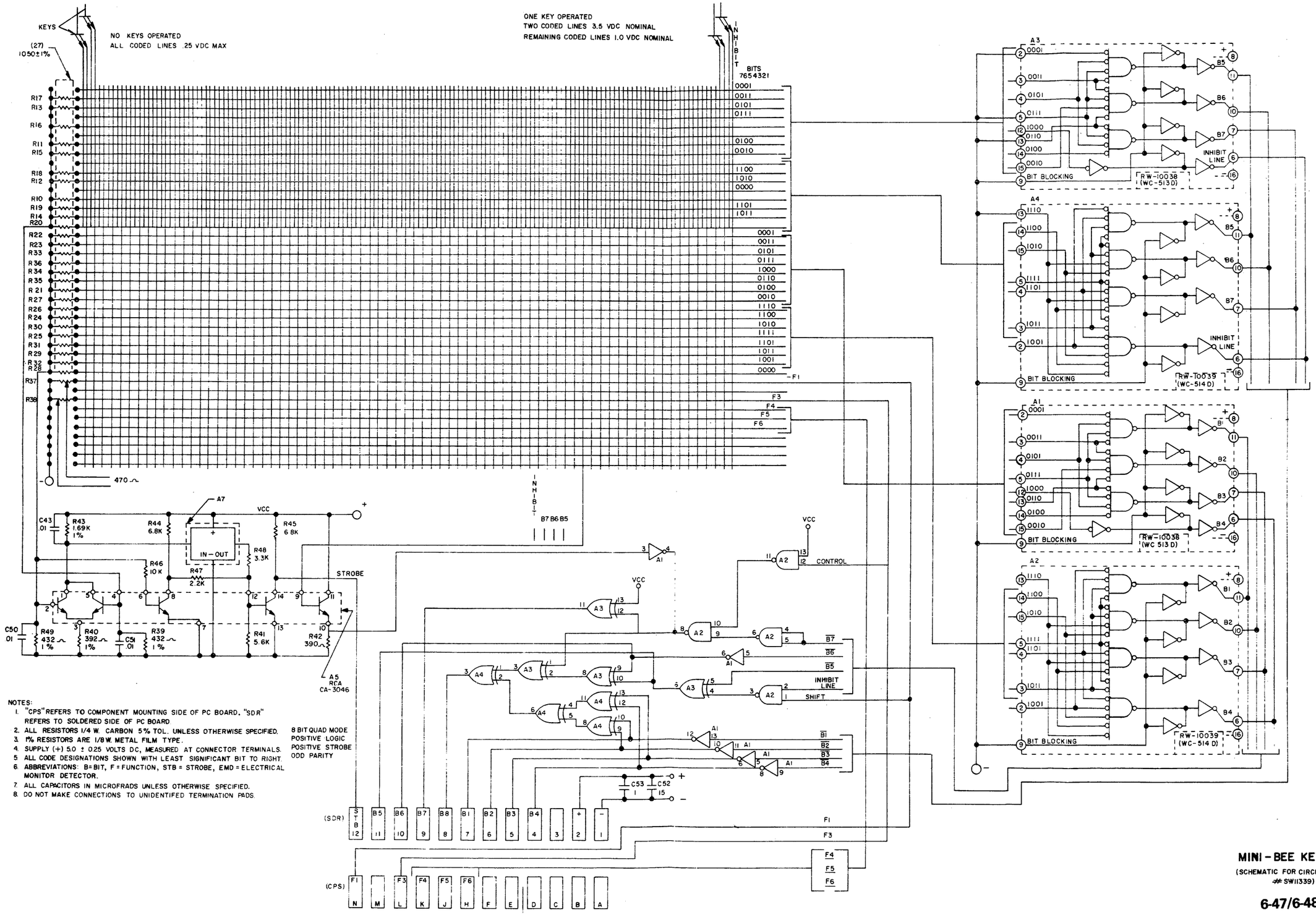
1. "CPS" REFERS TO COMPONENT MOUNTING SIDE OF PC BOARD. "SDR" REFERS TO SOLDERED SIDE OF PC BOARD
2. ALL RESISTORS 1/4W. CARBON 5% TOL, UNLESS OTHERWISE SPECIFIED
3. 1% RESISTORS ARE 1/8W. METAL FILM TYPE
4. SUPPLY (+) 5.0 ± 0.25 VOLTS DC, MEASURED AT CONNECTOR TERMINALS
5. ALL CODE DESIGNATIONS SHOWN WITH LEAST SIGNIFICANT BIT TO RIGHT
6. ABBREVIATIONS: B=BIT, F=FUNCTION, STB=STROBE, EMD=ELECTRICAL MONITOR DETECTOR
7. ALL CAPACITORS IN MICROFRADS UNLESS OTHERWISE SPECIFED
8. DO NOT MAKE CONNECTIONS TO UNIDENTIFED TERMINATION PADS

8 BIT QUAD MODE
POSITIVE LOGIC
POSITIVE STROBE
ODD PARITY

MINI-BEE
KEYBOARD

6-43/6-44

Circuit Board (SW11339) Keyboard Assembly



NOTES:

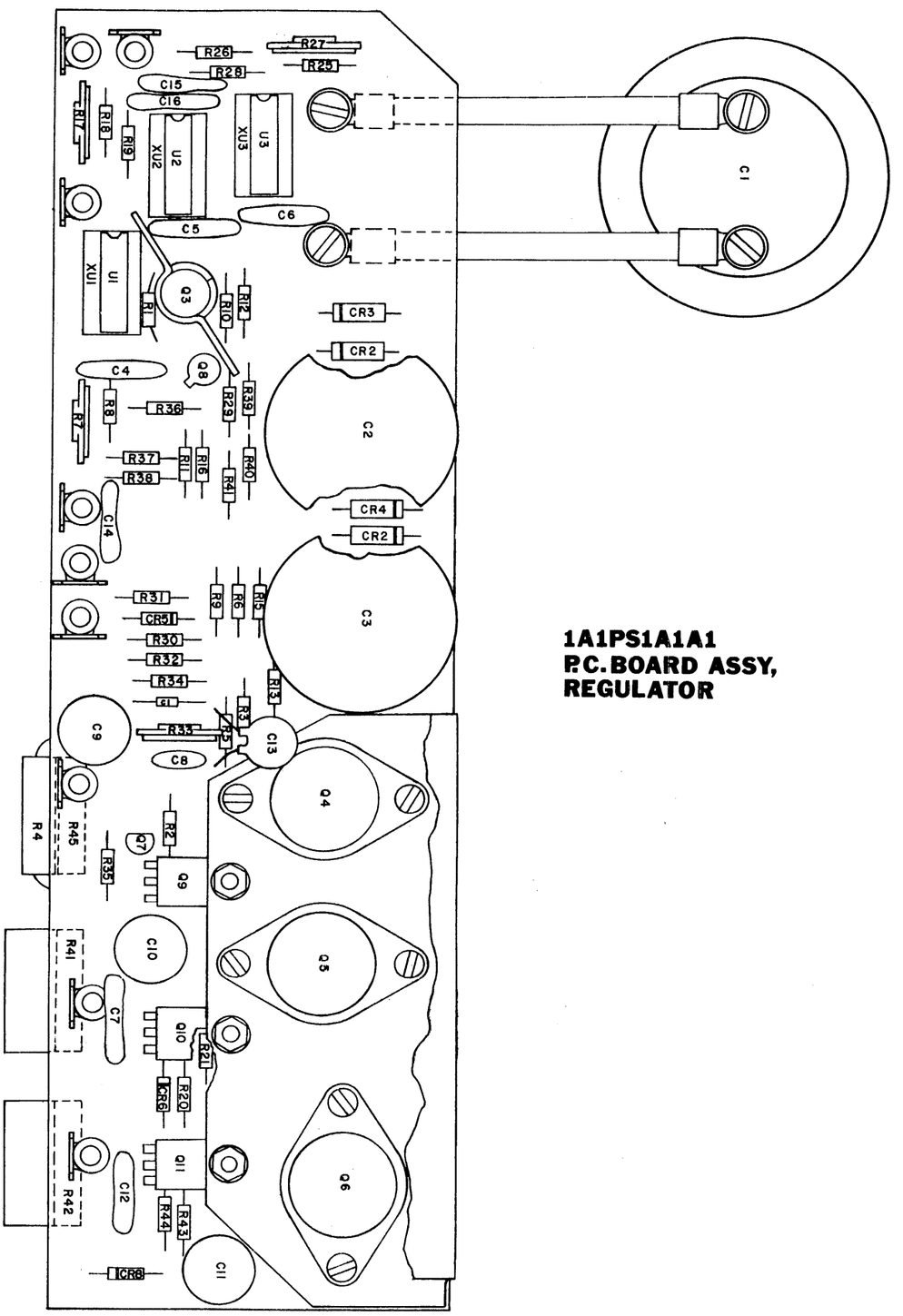
1. "CPS" REFERS TO COMPONENT MOUNTING SIDE OF PC BOARD. "SDR" REFERS TO SOLDERED SIDE OF PC BOARD
2. ALL RESISTORS 1/4 W. CARBON 5% TOL. UNLESS OTHERWISE SPECIFIED.
3. 1% RESISTORS ARE 1/8 W. METAL FILM TYPE.
4. SUPPLY (+) 5.0 ± 0.25 VOLTS DC, MEASURED AT CONNECTOR TERMINALS.
5. ALL CODE DESIGNATIONS SHOWN WITH LEAST SIGNIFICANT BIT TO RIGHT.
6. ABBREVIATIONS: B=BIT, F=FUNCTION, STB=STROBE, EMD=ELECTRICAL MONITOR DETECTOR.
7. ALL CAPACITORS IN MICROFRADS UNLESS OTHERWISE SPECIFIED.
8. DO NOT MAKE CONNECTIONS TO UNIDENTIFED TERMINATION PADS.

8 BIT QUAD MODE
POSITIVE LOGIC
POSITIVE STROBE
ODD PARITY

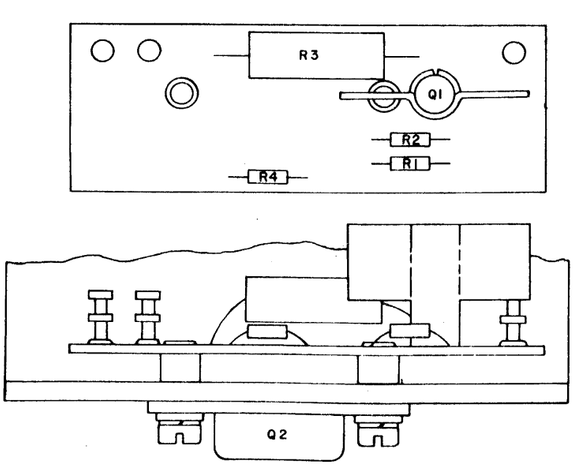
MINI-BEE KEYBOARD

(SCHEMATIC FOR CIRCUIT BOARD #SW11339)

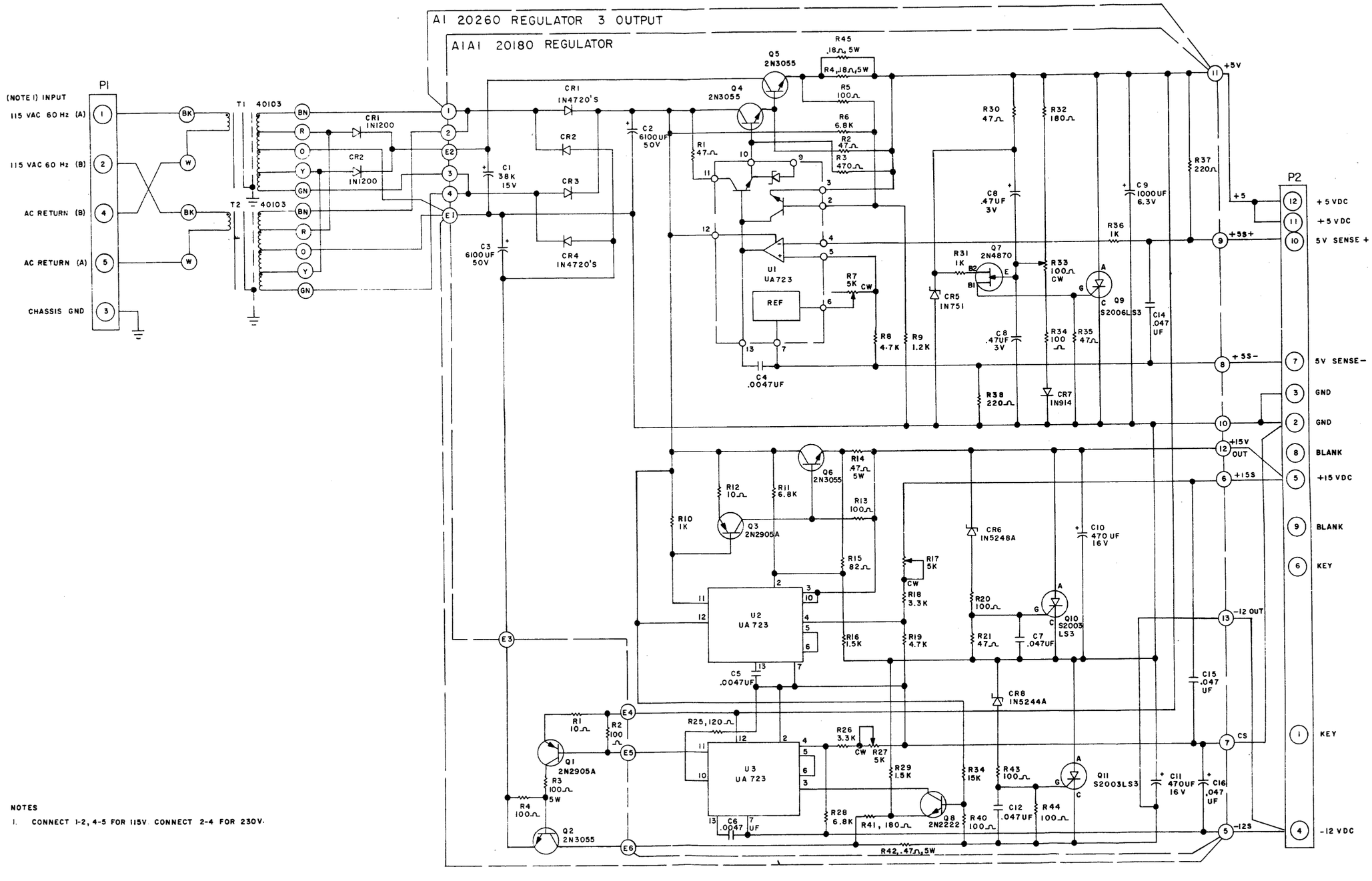
6-47/6-48



1A1PS1A1A1
P.C. BOARD ASSY,
REGULATOR

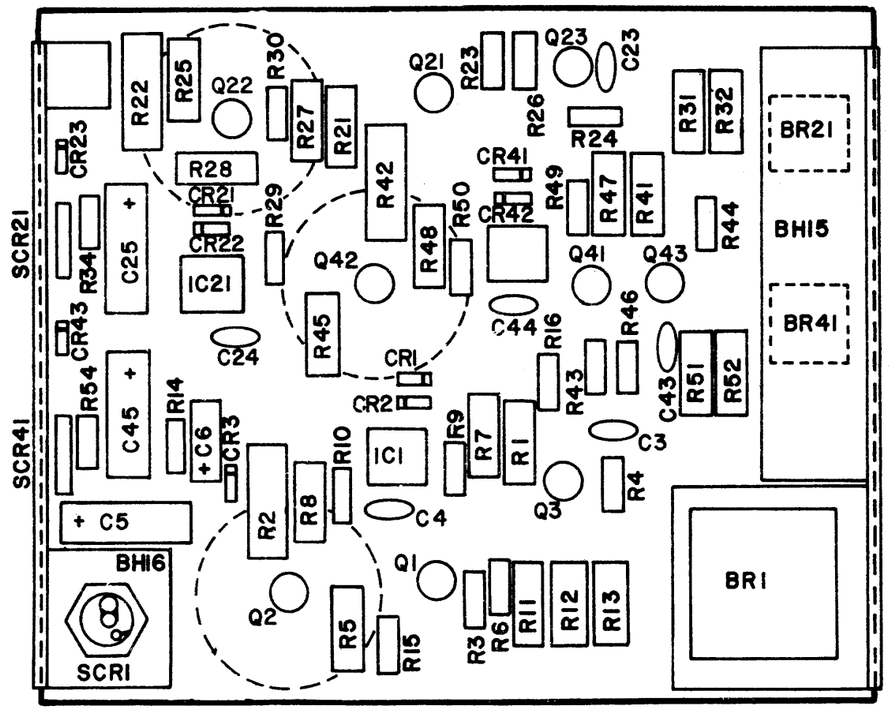


1A1PS1A1
REGULATOR,
3 OUTPUT

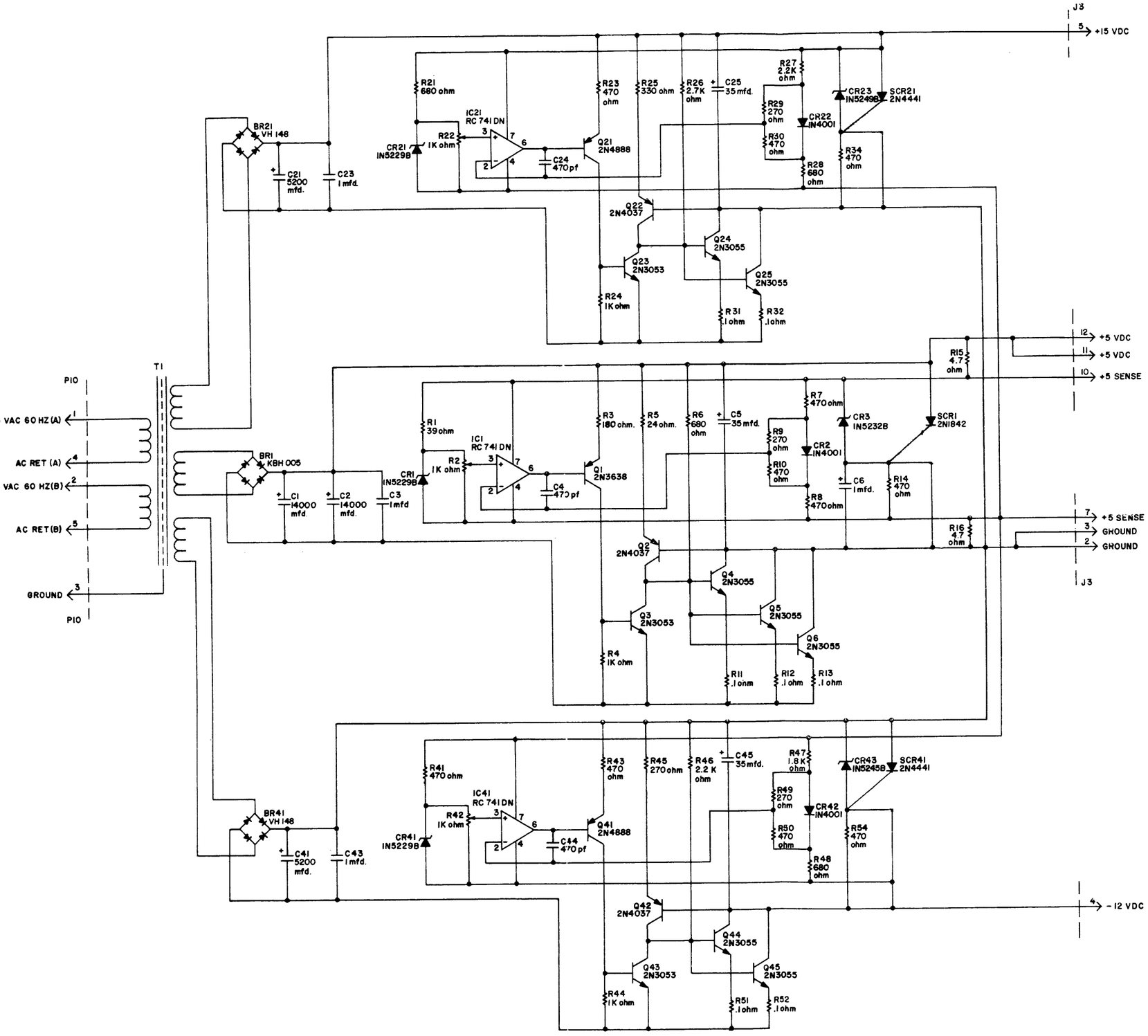


NOTES

1. CONNECT 1-2, 4-5 FOR 115V. CONNECT 2-4 FOR 230V.

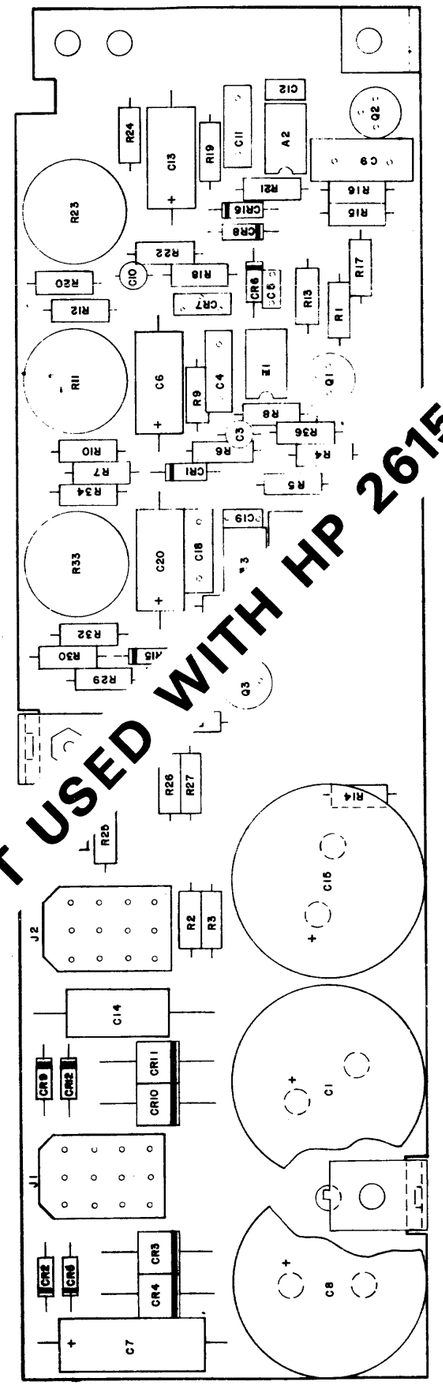


Scintillonics Power Supply PC Board

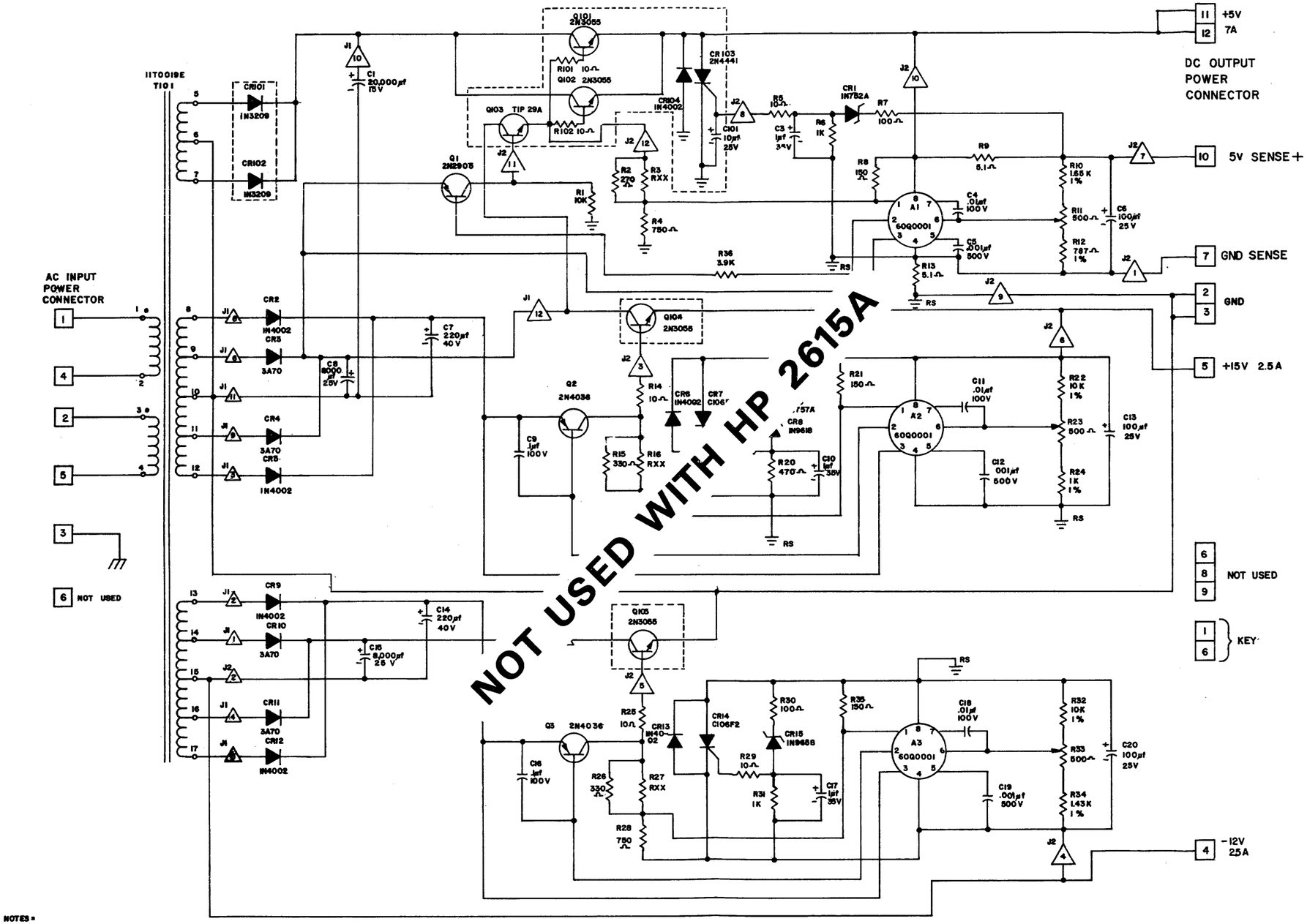


Scintillonics Power Supply Schematic

6-55/6-56



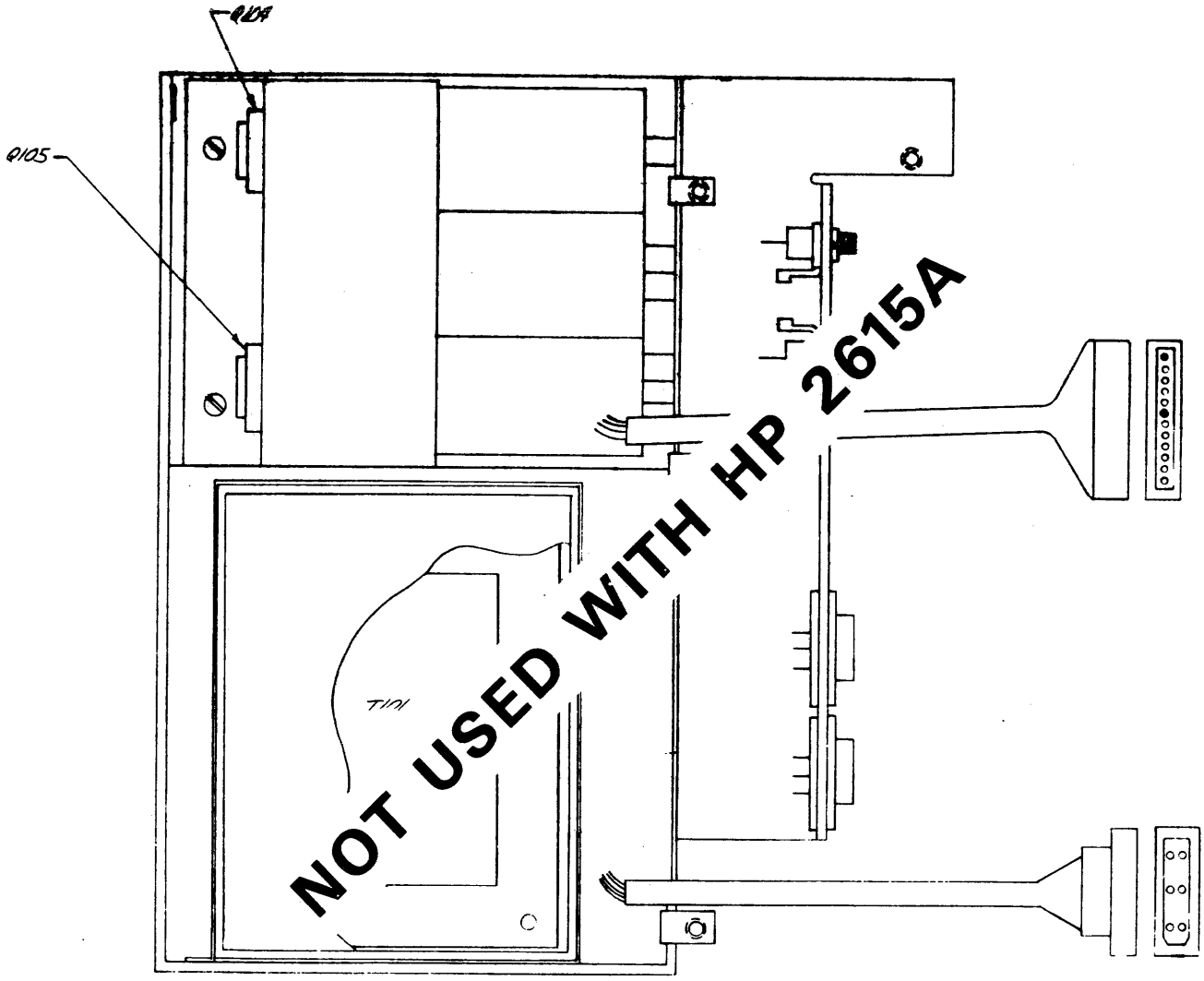
Datapower Power Supply
P.C. Board



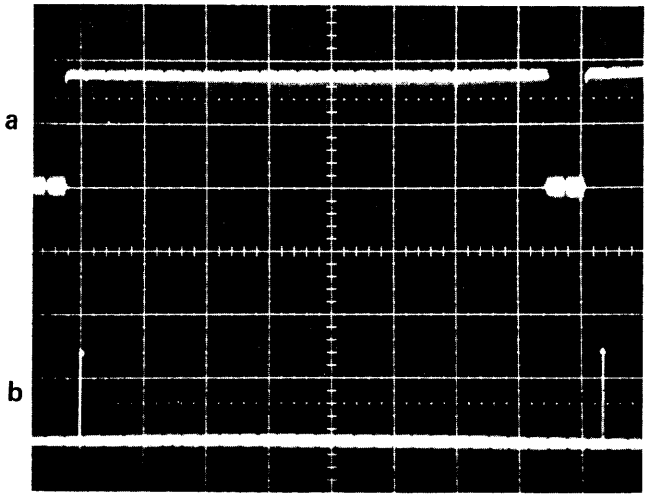
NOTES:

1. ALL RESISTORS ARE 1/2 W, 5% TOL. UNLESS OTHERWISE SPECIFIED.
2. RXX INDICATES FACTORY SELECT.
3. △ INDICATES PINS ON INTERNAL CONNECTORS

Datapower Power Supply Schematic

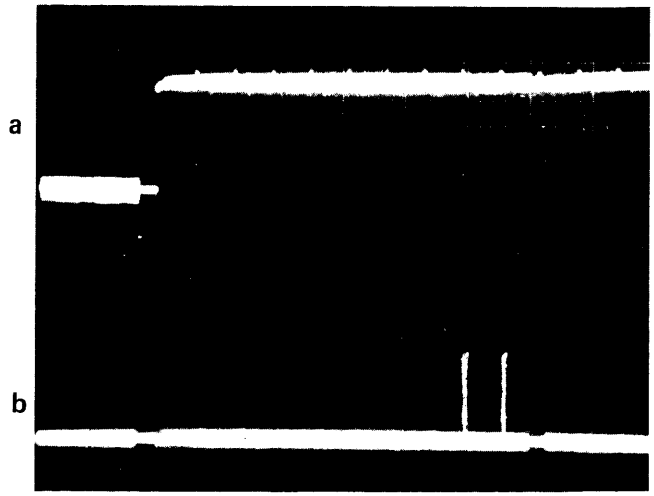


Datapower Power Supply Assembly



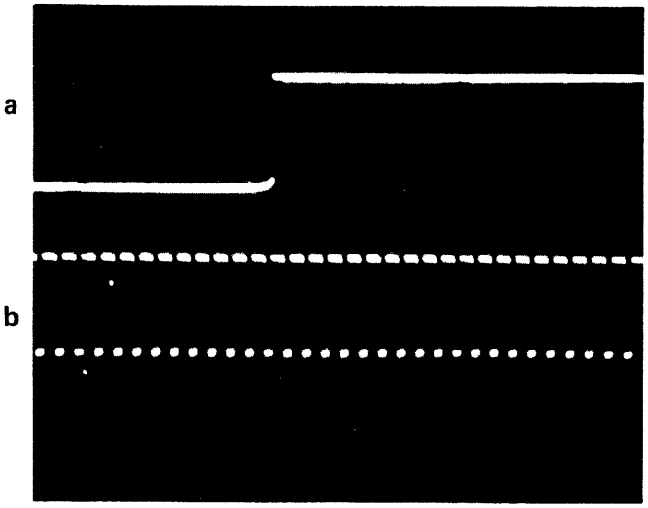
WAVEFORM A

a. $\overline{\text{Vert. Drive}}$ – taken at A59 pin 6
b. Video – taken at A80 pin 11
2 M Sec/Div
.2 Volts/Div (with X-10 probe)
Trigger $\overline{\text{Vert. Drive}}$ Negative
Taken with screen clear and
cursor in home position.



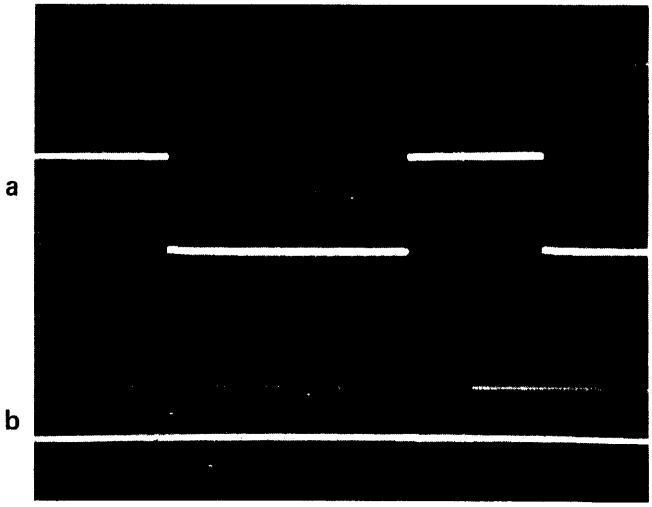
WAVEFORM B

a. $\overline{\text{Vert. Drive}}$ – taken at A 59 pin 6
b. Video – taken at A80 pin 11
1 Micro Sec/Div
.2 Volts/Div (with X-10 probe)
Trigger COLO A46 pin 8
Taken with screen clear and
cursor in home position.



WAVEFORM C

a. Horizontal Drive – taken at A59 pin 9
b. Vertical Drive – taken at A59 pin 6
.2 M Sec/Div
.2 Volts/Div (with X-10 probe)
Trigger $\overline{\text{Vert. Drive}}$ Negative

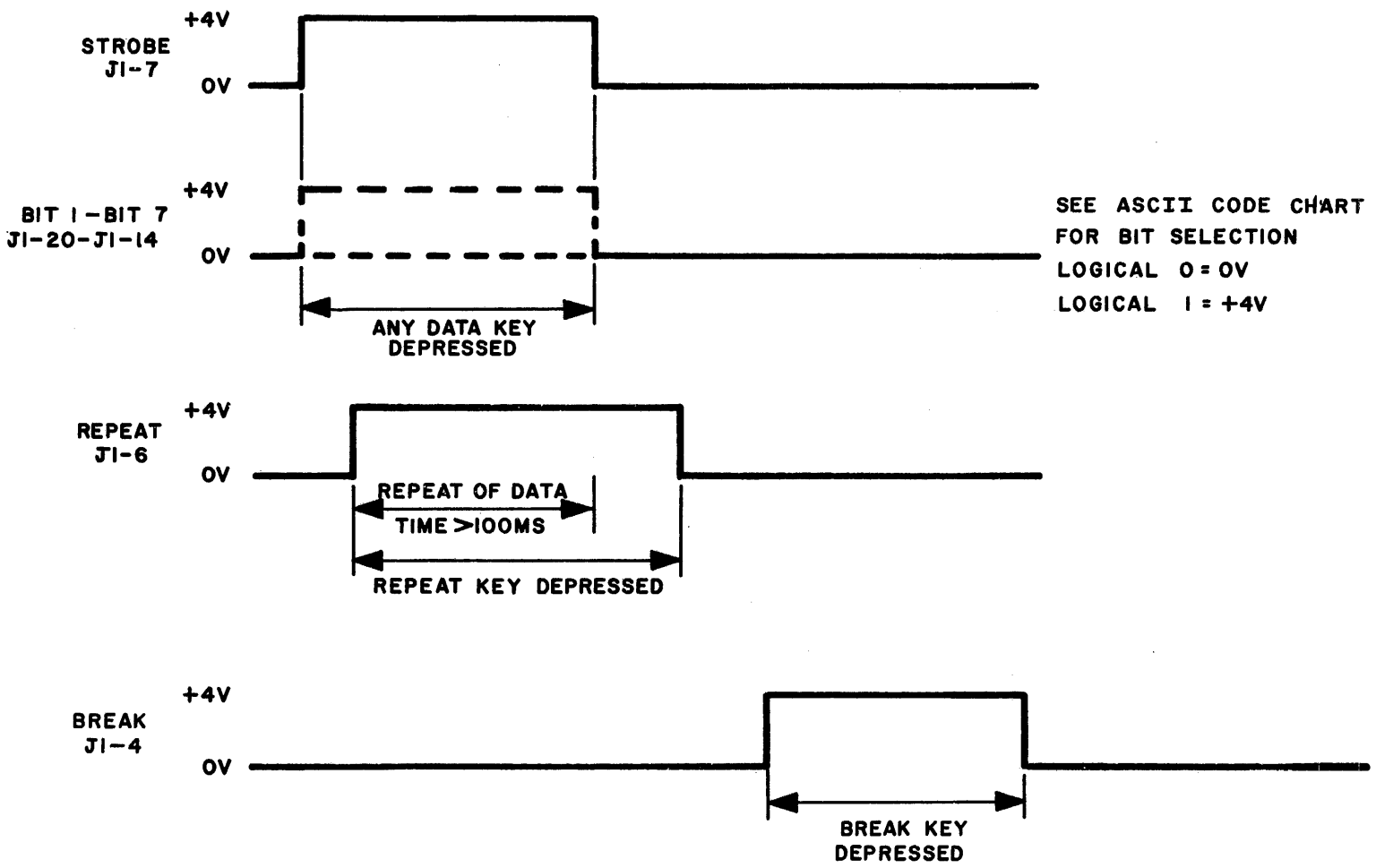


WAVEFORM D

a. Horizontal Drive – taken at A59 pin 9
b. Random Video – taken at A80 pin 11
10 Micro Sec/Div
.2 Volts/Div (with X-10 probe)
Trigger Horizontal Drive Positive
Taken with data on screen.

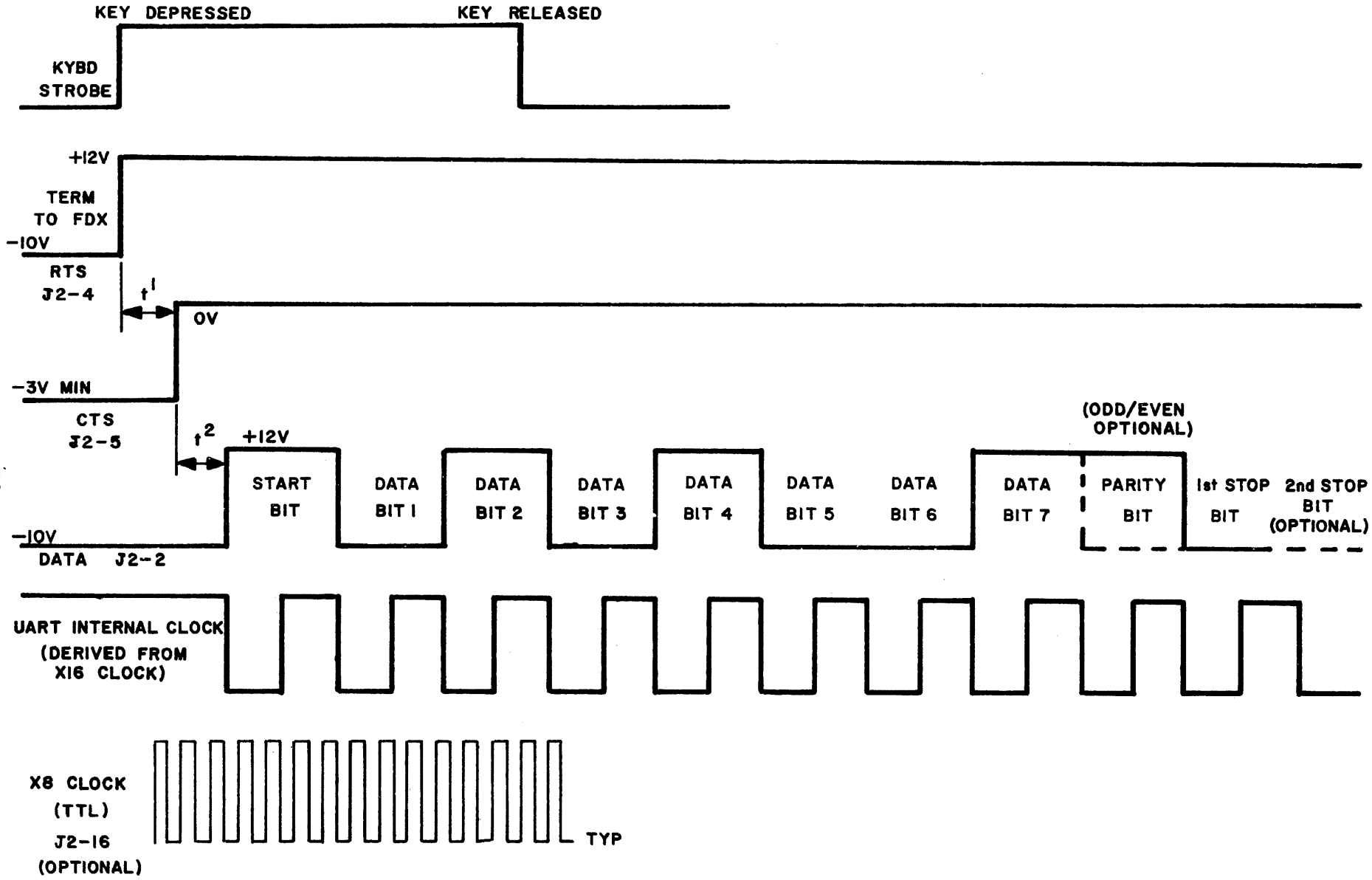
WAVEFORMS WERE TAKEN WITH:
HP 1707B OSCILLOSCOPE

KEYBOARD INTERFACE TIMING DIAGRAM



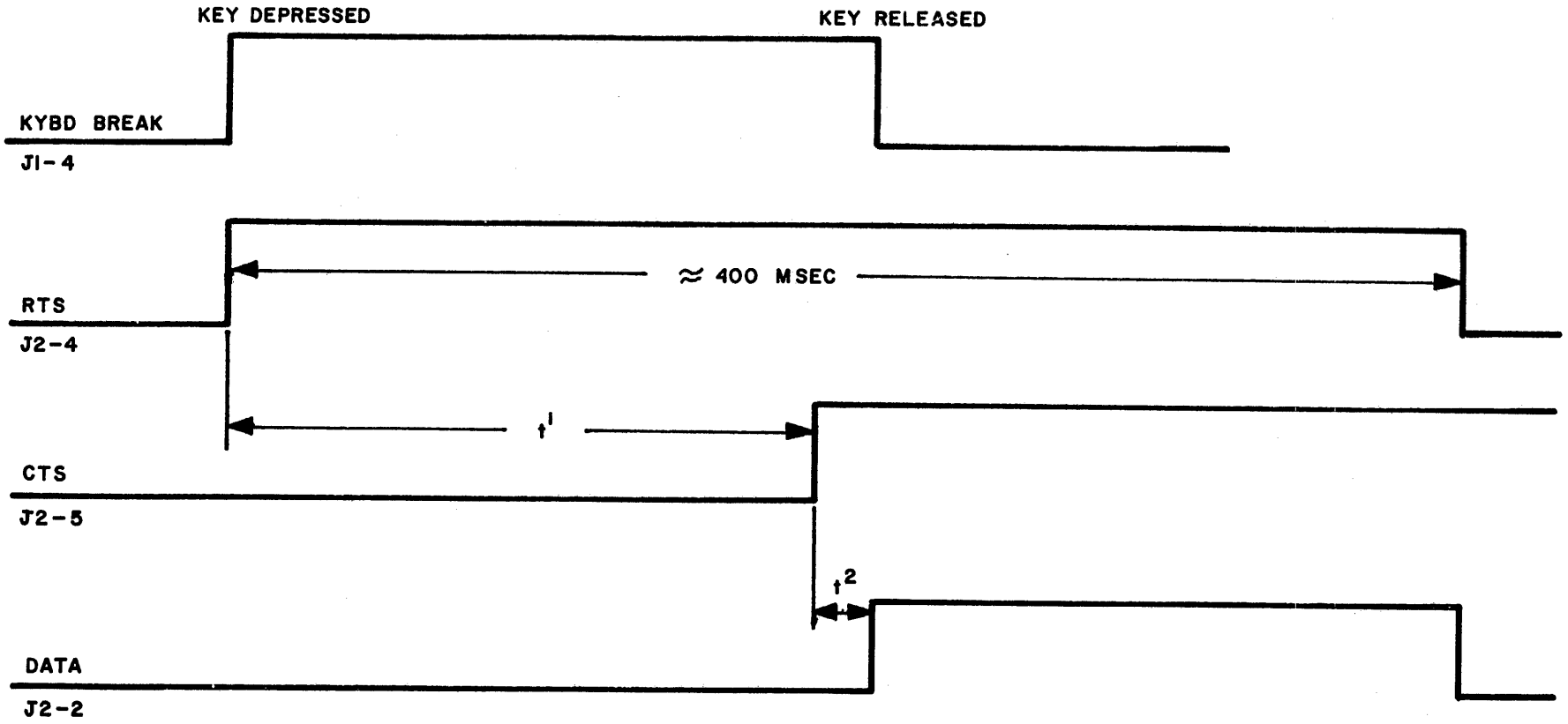
TIMING DIAGRAM
E

NOTE: VOLTAGES INDICATED ARE NOMINAL AND MAY VARY ±1.0 VOLTS.



TERMINAL IN FDX
t^1 = DETERMINED BY MODEM ≈ 200 MSEC
t^2 = 0 MIN 9MSEC MAX
DATA = THE NUMBER FIVE

TRANSMIT DATA TIMING REQUIREMENTS - BY THE WORD
F



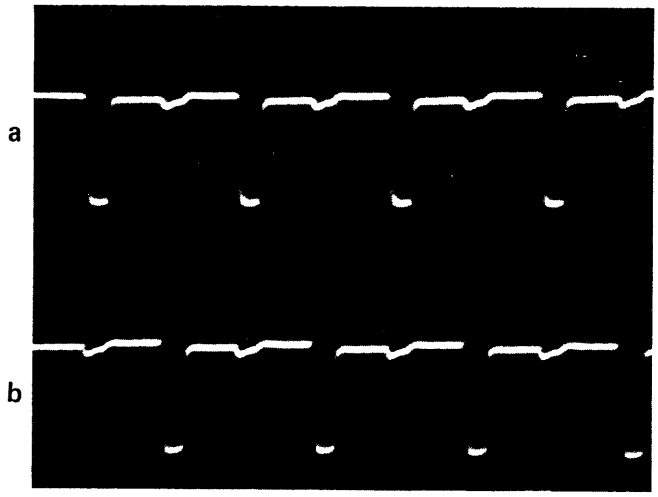
TERMINAL IN HDX AND ONLINE

TRANSMIT DATA TIMING REQUIREMENTS - BY THE BIT

G

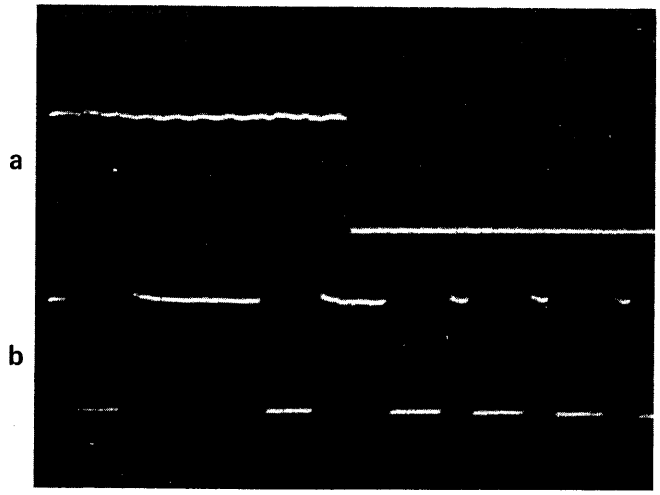
t^1 = ≈ 200 MSEC (DETERMINED BY MODEM)

t^2 = 0 SEC TO 9 MSEC (DETERMINED BY UART INTERNAL CLOCK)
BAUD RATE



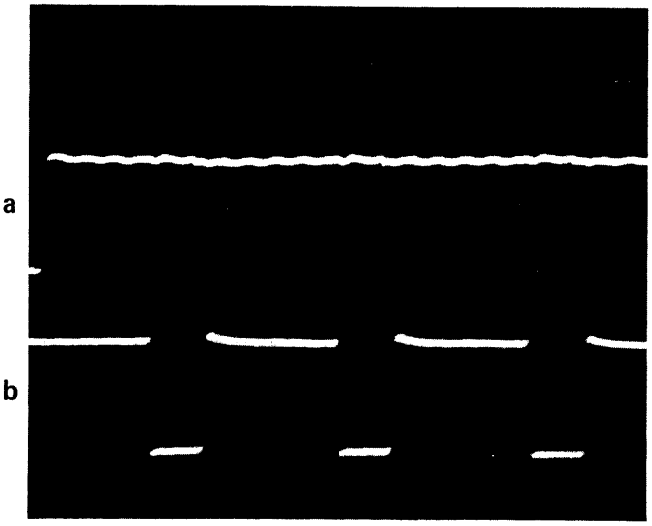
WAVEFORM H

a. 01 Clock – taken at A93 pin 12
b. 02 Clock – taken at A93 pin 10
.5 Micro Sec/Div
1 Volts/Div (with X-10 probe)
Trigger 01 Clock Positive



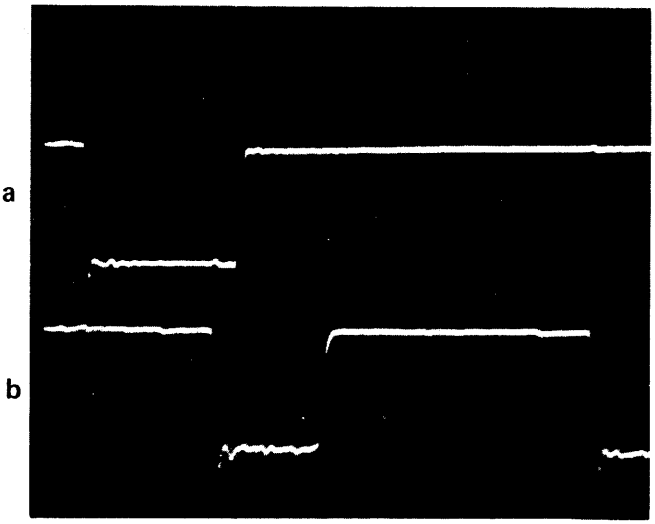
WAVEFORM I

a. Soco - 79 – taken at A53 pin 3
b. MRC CLK – taken at A42 pin 2
Slow to Fast Clock Rate Transition
.2 Micro Sec/Div
.2 Volts/Div (with X-10 probe)
Delayed Sweep – Delay 50 Micro Sec/Div
Trigger MRC Clock



WAVEFORM J

a. Soco - 79 – taken at A53 pin 3
b. MRC Clock (Slow) – taken at A42 pin 2
.2 Micro Sec/Div
.2 Volts/Div (with X-10 probe)
Trigger Soco - 79 Positive



WAVEFORM K

a. $\overline{\text{COLO}}$ – taken at A46 pin 8
b. Dot 6/0 – taken at A68 pin 3
.1 Micro Sec/Div
.2 Volts/Div (with X-10 probe)
Delayed Sweep – Delay 10 Micro Sec/Div
Trigger Dot 6/0

WAVEFORMS WERE TAKEN WITH:
HP 1707B OSCILLOSCOPE

SECTION VII
PROGRAMMING

7-1. INTRODUCTION

Programming for the terminal requires familiarity with the operating system in use. See the appropriate operating system and programming language manuals before writing programs for this terminal.

The binary and octal equivalents of the character codes and escape sequences are described below. This is followed by an explanation of programming methods.

7-2. NUMERICAL EQUIVALENTS OF DISPLAY CODES

Table 7-1 shows the character codes and code sequences. All upper-case display characters in the table can be generated at the keyboard and displayed on the CRT. Lower-case display characters cannot be generated at the keyboard, and if received from the computer the upper-case equivalent is displayed on the CRT. Table 7-2 shows the characters displayed for each code; the codes are indicated in decimal form, with octal equivalents in parentheses. The "CMPTR" column shows the character displayed when the code is received from the computer. The "KYBD" column shows the character displayed when the code is generated at the keyboard. Regardless of the source of the code, the displayed character is the same, except that the keyboard cannot generate the decimal codes 96 through 126 (lower-case letters and certain punctuation marks).

7-3. NUMERICAL EQUIVALENTS OF CONTROL CODES

All control codes in table 7-1 can be generated at the keyboard. Only the four codes indicated can produce a control effect on the CRT terminal. In addition, the ESC code is used in conjunction with a display code to produce escape sequences which affect the CRT terminal. All other control codes in table 7-1 are ignored by the CRT terminal, whether produced at the keyboard or received from the computer. Table 7-3 provides the decimal and octal equivalent of each control code, and provides additional information on the codes themselves.

7-4. NUMERICAL EQUIVALENTS OF ESCAPE SEQUENCES

Table 7-4 shows the numerical equivalent of the escape sequences which affect the CRT terminal.

7-5. FILL CHARACTERS

At baud rates above 2400, certain functions require more than one character transmission time for completion. If the appropriate fill characters are not inserted after a function is given, the terminal will ignore any characters transmitted until the function has been completed. For example, the EOS operation takes up to 1.8 milliseconds to be completed. If the sequence ESC, J, H, P is sent to the terminal at 9600 baud (1.04 milliseconds between characters) it is likely that the sequence HP would not be written on the display- only the letter P. To get the sequence HP written properly, the character sequence should be ESC, J, fill, fill, H, P.

Any control character except CR, LF, BS and BEL can be used as a fill character. The null (all zeros) is the character generally used as a fill character. A null may be generated on the keyboard by holding down CTRL and SHIFT- then pressing the P key.

Table 7-5 lists the functions and number of fill characters required for different baud rates. Other functions do not require fill characters.

The appropriate driver manual should be consulted to determine whether fill characters are required in your application program. In general, drivers provide nulls for only the Line Feed character. Thus, the application program must have fill characters after any EL, EOS, or CLEAR sequences.

7-6. LINE LENGTH AND CURSOR MOVEMENT

The maximum line length for the terminal is 80 characters. If a character is entered in the 80th position of the bottom line by the keyboard or by the computer, the cursor moves to the home position; roll up does not occur. New display characters will then replace old characters in the top line, possibly leaving old characters at the right-hand end of the line. To prevent this, and to ensure that the newest line is the lowest line displayed, restrict line length for computer outputs to less than 80 characters. (Control characters and escape sequences are not included in the 80-character count.)

When a display character or a space (blank) is entered from the keyboard in the 70th position in a line, a momentary tone warns that the line end is approaching.

The cursor can be moved through any displayed character without affecting the character.

The space bar function and the cursor-right (→) escape sequence both move the cursor one position. However, only the space bar function replaces (with a space character code) a displayed character at the initial cursor position.

Table 7-1. Character Codes

BIT 7 6 / 4 3 2 1 5	CONTROL CHARACTERS		DISPLAYABLE CHARACTER						ESCAPE SEQUENCE					
	0_{0_0}	0_{0_1}	0_{1_0}	0_{1_1}	1_{0_0}	1_{0_1}	1_{1_0}	1_{1_1}	0_{1_0}	0_{1_1}	1_{0_0}	1_{0_1}	1_{1_0}	1_{1_1}
0000	NUL @	DLE P	SP	0	@	P								
0001	SOH A	DC1 Q	!	1	A	Q					↑ A			
0010	STX B	DC2 R	"	2	B	R					↓ B			
0011	ETX C	DC3 S	#	3	C	S					→ C			
0100	EOT D	DC4 T	$	4	D	T					← D			
0101	ENQ E	NAK U	%	5	E	U					CLR E			
0110	ACK F	SYN V	&	6	F	V								
0111	BEL G	ETB W	'	7	G	W								
1000	BS H	CAN X	(	8	H	X					HOME H			
1001	HT I	EM Y	)	9	I	Y								
1010	LF J	SUB Z	*	:	J	Z					EOS J			
1011	VT K	ESC [	+	;	K	[					EOL K			
1100	FF L	FS \	,	<	L	\								
1101	CR M	GS]	-	=	M	]								
1110	SO N	RS ^	.	>	N	^								
1111	SI O	US -	/	?	O	_								

Note: 1. Lower case code will display upper case characters.
2. Terminal will initiate all control codes, but act on only those specified in table 2-3 (shaded boxes on this table).

Table 7-2. Display Character Codes

CODE	CHARACTER SOURCE		CODE	CHARACTER SOURCE		CODE	CHARACTER SOURCE	
	CMPTR	KYBD		CMPTR	KYBD		CMPTR	KYBD
32 (040)	(BLANK)	(BLANK)	64 (100)	@	@	96 (140)	@	^
33 (041)	!	!	65 (101)	A	A	97 (141)	A	
34 (042)	"	"	66 (102)	B	B	98 (142)	B	
35 (043)	#	#	67 (103)	C	C	99 (143)	C	
36 (044)	$	$	68 (104)	D	D	100 (144)	D	
37 (045)	%	%	69 (105)	E	E	101 (145)	E	
38 (046)	&	&	70 (106)	F	F	102 (146)	F	
39 (047)	'	'	71 (107)	G	G	103 (147)	G	
40 (050)	(	(	72 (110)	H	H	104 (150)	H	
41 (051)	)	)	73 (111)	I	I	105 (151)	I	
42 (052)	*	*	74 (112)	J	J	106 (152)	J	
43 (053)	+	+	75 (113)	K	K	107 (153)	K	
44 (054)	,	,	76 (114)	L	L	108 (154)	L	
45 (055)	-	-	77 (115)	M	M	109 (155)	M	
46 (056)	.	.	78 (116)	N	N	110 (156)	N	
47 (057)	/	/	79 (117)	O	O	111 (157)	O	
48 (060)	0	0	80 (120)	P	P	112 (160)	P	
49 (061)	1	1	81 (121)	Q	Q	113 (161)	Q	
50 (062)	2	2	82 (122)	R	R	114 (162)	R	
51 (063)	3	3	83 (123)	S	S	115 (163)	S	
52 (064)	4	4	84 (124)	T	T	116 (164)	T	
53 (065)	5	5	85 (125)	U	U	117 (165)	U	
54 (066)	6	6	86 (126)	V	V	118 (166)	V	
55 (067)	7	7	87 (127)	W	W	119 (167)	W	
56 (070)	8	8	88 (130)	X	X	120 (170)	X	
57 (071)	9	9	89 (131)	Y	Y	121 (171)	Y	
58 (072)	:	:	90 (132)	Z	Z	122 (172)	Z	
59 (073)	;	;	91 (133)	[	[	123 (173)	[	
60 (074)	<	<	92 (134)	\	\	124 (174)	\	
61 (075)	=	=	93 (135)	]	]	125 (175)	]	
62 (076)	>	>	94 (136)	^	^	126 (176)	^	
63 (077)	?	?	95 (137)	_	_			v

CANNOT BE GENERATED BY THE KEYBOARD

Table 7-3. Control Character Codes

CODE DECIMAL (OCTAL)	KEY*	CONTROL CHARACTER AND DESCRIPTION	FUNCTION
0 (000)	@	NUL, Null	No operation
1 (001)	A	SOH, start of heading	Communications control
2 (002)	B	STX, start of text	Communications control
3 (003)	C	ETX, end of text	Communications control
4 (004)	D	EOT, end of transmission	Communications control
5 (005)	E	ENQ, enquiry	Communications control
6 (006)	F	ACK, acknowledge	Communications control
7 (007)	†G	BEL, attention signal	
8 (010)	†H	BS, backspace	Format control
9 (011)	I	HT, horizontal tabulation or punched card skip	Format control
10 (012)	†LINE FEED	LF, line feed	Format control
11 (013)	K	VT, vertical tabulation	Format control
12 (014)	L	FF, form feed	Format control
13 (015)	†RETURN	CR, carriage return	Format control
14 (016)	N	SO, shift out	
15 (017)	O	SI, shift in	
16 (020)	P	DLE, data link escape	Communications control
17 (021)	Q	DC1, device control 1	Special, to suit device
18 (022)	R	DC2, device control 2	Special to suit device
19 (023)	S	DC3, device control 3	Special to suit device
20 (024)	T	DC4, device control 4	Special to suit device
21 (025)	U	NAK, negative acknowledge	Communications control
22 (026)	V	SYN, synchronous idle	Communications control
23 (027)	W	ETB, End of transmission block	Communications control
24 (030)	X	CAN, cancel	
25 (031)	Y	EM, end of medium	
26 (032)	Z	SUB, substitute	
27 (033)	ESC	ESC, escape	
28 (034)	\	FS, file separator	Information separator
29 (035)	]	GS, group separator	Information separator
30 (036)	^	RS, record separator	Information separator
31 (037)	_	US, unit separator	Information separator
127 (177)	RUB OUT	DEL, delete	

*For any single-character key in this column, the CTRL key must be held down while the key is pressed.

†Only these four character codes are recognized and control the terminal when transmitted from a computer. Conversely, all characters listed in the KEY column can be transmitted from the terminal.

Table 7-4. Escape Sequence Codes

FUNCTION*	KEY SEQUENCE	CODE SEQUENCE	
		DECIMAL	OCTAL
↑	ESC, A	27, 65	033, 101
↓	ESC, B	27, 66	033, 102
→	ESC, C	27, 67	033, 103
←	ESC, D	27, 68	033, 104
CLR	ESC, E	27, 69	033, 105
HOME	ESC, H	27, 72	033, 110
EOS	ESC, J	27, 74	033, 112
EL	ESC, K	27, 75	033, 113

*Entries in this column correspond to red markings on keys. Refer to table 2-4 for the affect on the CRT terminal.

Table 7-5. Fill Characters

FUNCTIONS		FILL CHARACTERS REQUIRED				
CHARACTER	NAME	110 TO 2400 BAUD	3520 BAUD	4800 BAUD	7040 BAUD	9600 BAUD
LF	Line Feed*	0	1	2	2	3
EL	Erase Line	0	0	1	1	2
EOS	Erase to end of Screen	0	1	1	2	2
CLR	Clear	0	1	1	2	2

*If Line Feed will never result in a Roll-Up, no nulls are required at any baud rate.

SECTION VIII

GLOSSARY OF TERMS

$\overline{\text{ADVANCE}}$

Advance (Not) is a low going pulse moving the cursor one position to the right on the CRT screen. It is derived from the MEM LOAD SIGNAL.

$\overline{\text{BELL}}$

Bell (Not) is a low going signal, decoded from a control G, and triggers the bell one shot.

$\overline{\text{BELL 70}}$

Bell 70 (Not) is a low going pulse, decoded from character 70. It is a low to high transition that triggers the bell one shot.

BREAK ONE SHOT

Break One Shot is triggered by a positive level from the keyboard break key and develops a 400 M sec. signal which is transmitted on the data and RTS EIA lines.

C80

C80 is a high going pulse from the Character Counter that defines character 80 to character 100 time.

$\overline{\text{C80}}$

C80 (Not) is the inverse of C80 used to inhibit the clock of the line memory.

CCW

Counter-clockwise

CHARACTER COUNTER

The Character Counter is made up of two decade counters with a modulus of 100, and it defines the characters on the line. Each character is 7 dots wide.

CHARACTER CURSOR

Character Cursor is a high going signal when a compare is made between the cursor location counter and the marker reference counter.

CHECK PAR

Check Parity enables a parity check on incoming data when low no parity check is made.

$\overline{\text{CLEAR}}$

Clear (Not) is a low going signal used to clear the screen and move the cursor home, made up of TURN ON CLEAR or the decode of escape E.

CLEAR MEM

Clear Memory is a positive going signal used to clear all or part of the screen derived from clear or EOS (decode of escape J) or EL (escape K) or during a scroll. To clear the screen, space codes are loaded into the memory in the required locations.

$\overline{\text{COLO}}$

Character Zero Line Zero (Not) is a low going signal derived from coincidence between the rollover of the memory reference counter and the overflowing of the main timing chain. Character 0 line 0 signifies that the memory and the display are coincidence at the Home position.

$\overline{\text{CONTROL DECODER}}$

Control Decoder (Not) decodes a control character when the sixth and seventh bits are zeros.

CURSOR COMPARITOR

Cursor Comparitor compares the marker reference counter outputs to the cursor location counter outputs. The compare signal is called the Character Cursor.

CURSOR LOCATION COUNTER

Cursor Location Counter has the cursor location stored in it. Both line and character are stopped and are modified by home, advance, $\overline{\rightarrow}$ $\overline{\leftarrow}$ $\overline{\downarrow}$ $\overline{\uparrow}$ etc.

CW

Clockwise

DISPLAY CURSOR

Display Cursor signal is generated by inverting Character Cursor twice for buffering. It is applied to the line memory, loaded into the line memory when it is coincident with SOCO-79, and then displayed as a blinking double underscore on scans 8 and 9.

DOT COUNTER

Dot Counter is a divide-by-7 ring oscillator having outputs which are two dots wide labeled $\bar{6}$ and $\bar{0}$, $\bar{0}$ and $\bar{1}$, $\bar{1}$ and $\bar{2}$, etc.

DOT $\overline{6/0}$

Dot 6/0 (Not) is an output from the dot counter that is 2 dots wide and used to clock the dot shifter.

DOT $\overline{1/2}$

Dot 1/2 (Not) is an output from the dot counter two dots wide, and used in conjunction with C80 to clock the line memories.

EIA RCVR

Used to receive data at EIA levels transform them to TTL levels

EIA XMTR

Used to raise the outgoing data from TTL to EIA levels.

EL

Erase Line signal is generated by decoding an escape K and is used to erase the entire line the cursor is on.

EOS

Erase to end of screen is a signal generated from escape J and used to erase the screen beginning with the line the cursor is on.

HDX

Half-Duplex is a mode of communication in which the data entered from the keyboard is displayed on the screen and transmitted. The terminal will receive through the I/O connector, but not at the same time it is transmitting.

$\overline{\text{HOME}}$

Home (Not) is a signal used to reset the cursor location counters which sets the cursor to the first location on the first line.

HZ DRIVE

Horizontal Drive to monitor is used for sync and to develop high voltage for the CRT. It is generated by decoding count 84 of the Character Counter and reset by count 20.

IN DATA 1

Buffered bit 1 parallel data from UART. Applied to decoders and memory.

IN DATA 2

Buffered bit 2 parallel data from UART. Applied to decoders and memory.

IN DATA 3

Buffered bit 3 parallel data from UART. Applied to decoders and memory.

IN DATA 4

Buffered bit 4 parallel data from UART. Applied to decoders and memory.

IN DATA 5

Buffered bit 5 parallel data from UART. Applied to decoders and memory.

IN DATA 6

Buffered bit 6 parallel data from UART. Applied to decoders and memory.

IN DATA 7

Buffered bit 7 parallel data from UART. Applied to decoders and memory.

KBD BRK

Keyboard Break is a function from the keyboard and stays in a high or binary '1' state while the key is depressed. (Terminal outputs break signal for 500ms max.)

KBD STRB

Keyboard Strobe is a high level from the keyboard occuring when any keys, except function, are depressed.

KBD RPT

Keyboard Repeat is a function key and stays high while 'REPT' key is depressed on keyboard in conjunction with another key.

KBD 1

Bit 1 from keyboard is set to a logic 1 or 0 when a key is depressed on the keyboard and remains until the key is released.

KBD 2

Bit 2 from keyboard is set to a logic 1 or 0 when a key is depressed on the keyboard and remains until the key is released.

KBD 3

Bit 3 from keyboard is set to a logic 1 or 0 when a key is depressed on the keyboard and remains until the key is released.

KBD 4

Bit 4 from keyboard is set to a logic 1 or 0 when a key is depressed on the keyboard and remains until the key is released.

KBD 5

Bit 5 from keyboard is set to a logic 1 or 0 when a key is depressed on the keyboard and remains until the key is released.

KBD 6

Bit 6 from keyboard is set to a logic 1 or 0 when a key is depressed on the keyboard and remains until the key is released.

KBD 7

Bit 7 from keyboard is set to a logic 1 or 0 when a key is depressed on the keyboard and remains until the key is released.

LF DECODER

Line Feed decodes a control J which is used to move the cursor to the next line down. If the cursor is on the bottom line, the terminal will scroll everything up one line and the top line will be lost.

LINE MEMORY

The line memory is used to synchronize the page memory with the monitor display. 80 characters are shifted into the line memory and then applied to the character generator at a different rate.

$\overline{\text{MEM LOAD}}$

Memory Load (Not) signal is generated when any printable character is received from the keyboard or I/0 port. It switches the multiplexer on the page memory from its usual recirculate path so that new data can be loaded.

LOCAL

The terminal uses this mode of operation for operator familiarization only. Characters are entered into memory and displayed, but not transmitted, from the keyboard. Also, anything received at the I/0 port is ignored.

$\overline{\text{LOCAL SWITCH}}$

Local Switch (Not) toggle switch located on the keyboard housing switches the terminal between online and local mode.

MARKER REFERENCE COUNTER

Marker Reference Counter will count to 2,048 in increments of 80 to define 25 line with 48 undefined locations. It identifies each of the 2,000 locations of the screen.

MRC CLK

Memory Reference Counter Clock is made up of slow and fast pulses used to clock the page memory shift registers.

ON LINE

In On Line mode of operation, the terminal transmits and receives data via and EIA RS232 I/0 connector.

OSC

The Oscillator Signal is generated by a 11.34 MHTZ crystal oscillator and buffered by a 7404.

PAGE MEMORY

Page Memory is a 2,048 x 6 bit recirculating shift register. It defines the 2,000 character locations on the screen with 48 left over.

PARITY LIGHT

The Parity Light located on the keyboard housing is illuminated by receiving a parity error and is resetable by depressing any alphnumeric key on the keyboard.

RCT

Carrier Signal Detect is an EIA RS232 signal. It must be high to receive data and is usually used with a modem. It indicates suitability of the signal presented to the data communications equipment.

RECEIVER

Circuitry dedicated to converting a serial word into parallel data, also included in this section, would be the parity checking circuit, CTS & RTS circuits.

REC DATA

Received Data is an EIA RS232 line that transfers data to the terminal. It is held in a marking condition when the line is idle.

RTS

Request to Send is an EIA RS232 line that informs the external device that information is ready to be transmitted from the terminal. It is held in an on condition when in FDX.

SCAN COUNTER

Scan Counter has a modulus of ten, thus defining 10 scans per line.

SCROLL

Scroll signal is generated by the scroll latch and is used to modify MRC clock and scroll the display up one line when it is true.

SCROLL SET

Scroll Set (Not) signal is generated and used to set the scroll latch when line 24 and a line feed are decoded at the same time.

$\overline{\text{SOCO-79}}$

Scan O, Character O to 79 (Not) represents the first 80 characters of scan 0. It is used to generate slow clocks in MRC clock to transfer the page memory information into the line memory and is also used as timing signal for received control and escape codes after they leave the UART.

SOCO-79

Inverse of SOCO-79 and used as load signal on the line memories.

S1, S2, S4 and S8

Outputs of the scan counter are applied to the character generator to define the scans in the character matrix.

TERM READY

Terminal Ready is an EIA RS232 line that goes high when the terminal is turned on.

THRE

Transmitter Holding Register Empty is a high level indicating that the transmitter holding register is empty and may be loaded with a new character.

TOC

Turn on Clear is a signal generated by power up initiated by the UART.

$\overline{\text{TOC}}$

Turn on Clear (Not) is a signal used on power up to clear the screen and home the cursor.

$\overline{\text{THRL}}$

Transmitter Holding Register Load (Not). When this signal is low, a character is entered into the transmitter holding register of the UART, and on a low to high transition the character is moved to the transmitter register.

TRC

Transmitter Register Clock is 16 x Baud rate.

TRE

Transmitter Register Empty stays low while transmitting a character and goes high when completed.

TRO

Transmitter Register Output. The start bit, data bits, parity bit, and stop bit(s) are serially shifted out this line. It remains at a high level when no data is

being transmitted.

TRANSMITTER

The Transmitter circuitry is dedicated to converting parallel data into a serial word complete with start bit, data bits, parity bit and stop bit(s); also, RTS, terminal ready, are included in this section.

UART

Universal Asynchronous Receiver/Transmitter, MOS/LSI Device. The transmitter section converts parallel data into a serial word which contains a start, parity, and stop bits. The receiver section converts a serial word into parallel data and checks parity.

VERT DRIVE

Vertical Drive (Not) signal is derived by decoding count 30 from the line counter and the reset signal at count 32. It is used for synchronization in the monitor and blanking of the video signal.

VIDEO

Data from the dot shifter with blanking added, that is, applied to the monitor. A low level yields a dark screen and a high level yields a bright screen.

VIDEO RET

Video Return is the signal ground line for the monitor.

XMIT DATA

Transmit Data is an EIA RS232 line used for transferring data from the terminal to the EXTERNAL DEVICE and held to a mark condition during idle time.

X8 CLK

Times 8 Clock is a TTL signal required by some external equipment and is eight times the baud rate frequency. It is available at the I/O connector if strapped.

X16 CLK

Times 16 Clock is required by the UART and is sixteen times the baud rate frequency.

1/2 STOP BIT

One or Two Stop Bit is a strap that enables the UART to attach one or two stop bits to a data word.

Ø1, Ø 2

Phase 1, Phase 2 are clocks used to clock the page memory, derived from MRC Clock and level shifted with drivers to swing from -5V to +10V levels.

5V SENSE–
5V SENSE+

5 Volt Sense Negative and 5-Volt Sense Postive are lines used by the power supply to regulate the voltage at a remote point. These lines must be tied to the power supply voltage in order for the power supply to regulate properly.

$\overline{\downarrow}$

Cursor Down (Not) is a signal generated by the decode of an escape B or an LF decode and is applied to the cursor location counter to move the cursor to the next line down.

$\overline{\uparrow}$

Cursor Up (Not) is a signal generated by an escape decode and is applied to the cursor location counter to move the cursor to the left one character position.

$\overline{\leftarrow}$

Cursor Left (Not) is a signal generated by the decode of an escape D or a control H decode and applied to the cursor location counter to move the cursor to the left one character position.

$\overline{\rightarrow}$

Cursor Right (Not) is a signal generated by the decode of an escape C and is applied to the cursor location counter to move the cursor one character position to the right.

APPENDIX
A
BALL
MONITOR
(TVB 12)

Section 1
GENERAL INFORMATION

1.1 MONITOR DESCRIPTION

The TV monitor is a solid-state unit for use in industrial and commercial installations where reliability and high quality video reproduction are desired.

The monitor features printed circuit board construction for reliability and uniformity. All circuits of the TV monitor are transistorized. The synchronization circuits have been custom designed to accept vertical and horizontal drive signals thus enabling the interfacing of this monitor with industrial or simple sync sources. This feature simplifies the user's sync processing and mixing and allows the unit to operate without requiring composite sync. The electronic packaging has been miniaturized for compatibility with small volume requirements.

Section 2
THEORY OF OPERATION

2.1 VIDEO AMPLIFIER

The video amplifier consists of Q101 and its associated circuitry.

The incoming video signal is applied to the monitor through the contrast control through R109 to the base of transistor Q101.

Transistor Q101 and its components comprise the video output driver with a gain of about 17. Q104, operating as a class B amplifier, remains cutoff until a DC-coupled, positive-going signal arrives at its base and turns on the transistor.

R111 adds series feedback which makes the terminal-to-terminal voltage gain relatively independent of transistor variations as well as stabilizes the device against voltage and current changes caused by ambient termperature variations.

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

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

2.2 VERTICAL DEFLECTION

Transistor Q102 is a programmable unijunction transistor, and together with its external circuitry, forms a relaxation oscillator operating at the vertical rate. Resistor R115, variable resistor R116 and capacitors C105 and C106 form an RC network providing proper timing.

When power is applied, C105 and C106 charge exponentially through R115 and R116 until the voltage at the junction of R116 and C105 equals the anode "A" firing voltage. At this time, one of the unijunction's diodes that is connected between the anode and anode gate "G" becomes forward biased allowing the capacitors to discharge through another diode junction between the anode gate and the cathode "K" and on through R120.

R117 and R118 control the voltage at which the diode (anode-to-anode gate) becomes forward biased. This feature "programs" the firing of Q102 and prevents the unijunction from controlling this parameter. Therefore, the changing of firing points from one device to another, together with the temperature dependency of this parameter, is no longer a problem as it can be with conventional unijunction transistors.

The vertical oscillator is synchronized externally to the vertical interval from the vertical drive pulse at R113. At the time of the vertical interval, an

external negative pulse is applied through R113, C104, and CR101 to the gate of Q102, causing the firing level of the unijunction to decrease.

The sawtooth voltage at the anode of Q102 is directly coupled to the base of Q103. Q103 is a driver amplifier and has two transistors wired as a darlington pair; their input and output leads exit as a three-terminal device. This device exhibits a high input impedance to Q102, and thereby maintains excellent impedance isolation between Q102 and Q104.

The output waveform from the unijunction oscillator is not suitable, as yet, to produce a satisfactory vertical sweep. Such a waveform would produce severe stretching at the top of the picture and compression at the bottom. C105 and C106 modify the output waveform to produce satisfactory linearity. The sawtooth waveform output at Q103 is coupled through R122, the vertical linearity control R121, and on to C106 where the waveform is shaped into a parabola. This parabolic waveform is then added to the oscillator's waveform and changes its slope. Slope change rate is determined by the position of the variable resistor R121.

Q103 supplies base current through R123 and R124 to the vertical output transistor, Q104. Height control R124 varies the amplitude of the sawtooth voltage present at the base of Q104 and, therefore, varies the size of the vertical raster on the CRT.

The vertical output stage, Q104, uses a power type transistor which operates as a class A amplifier. No output transformer is required since the output impedance of the transistor permits a proper impedance match with the yoke connected directly to the collector. C107 is a DC-blocking capacitor which allows only AC voltages to produce yoke current. L1 is a relative high impedance compared to the yoke inductance. During retrace time, a large positive pulse is developed by L1 whcih reverses the current through the yoke and moves the beam from the bottom of the screen to the top. Resistor R126 prevents oscillations by providing damping across the vertical deflection coils.

2.3 HORIZONTAL DEFLECTION

To obtain a signal appropriate for driving Q106, the horizontal output transistor, a driver stage consisting of Q105 and T101,is used. The circuitry associated with Q105 and Q106 has been designed to optimize the effeciency and reliability of the horizontal deflection circuits.

A positive going pulse is coupled through R127 to the base of Q105. The amplitude and duty cycle of this waveform must be as indicated in the electrical specifications (Section 1.2) for proper circuit operation.

The driver stage is either cut off or driven into saturation by the base signal. The output signal appears as a rectangular waveform and is transformer-coupled to the base of the horizontal output stage. The polarity of the voltage at the secondary of the driver transformer is chosen such that Q106 is cut off when Q105 conducts and vice versa.

During conduction of the driver transistor, energy is stored in the coupling transformer. The voltage at the secondary is then positive and keeps Q106 cut off. As soon as the primary current of T101 is interrupted due to the base signal driving Q105 into cut off, the secondary voltage changes polarity. Q106 starts conducting, and its base current flows. This gradually decreases at a rate determined by the transformer inductance and circuit resistance.

The horizontal output stage has five main functions: to supply the yoke with the correct horizontal scanning currents; develop a "C" VDC supply voltage for use with the CRT; develop a "B" VDC supply voltage for the video output stage; and develop a "D" VDC for the CRT bias.

Q106 acts as a switch which is turned on or off by the rectangular waveform on the base. When Q106 is turned on, the supply voltageplus the charge on C113 causes yoke 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 positive voltage on its base 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 yoke's inductance and the primary of T2. The peak magnetic energy which was stored in the yoke during scan time is then transferred to C109 and the yoke's distributed capacity. During this cycle, the beam is returned to the center of the screen.

The distributed capacity now discharges into the yoke and induces a current in a direction opposite to the current of the previous part of the cycle. The magnetic field thus created around the yoke moves the scanning beam to the left of the screen.

After slightly more than half a cycle, the voltage across C109 biases the damper diode CR103 into conduction and prevents the flyback pulse from oscillating. The magnetic energy that was stored in the yoke from the discharge of the distributed capacity is released to provide sweep for the first half of scan and to charge C113 through the rectifying action of the damper diode. The beam is then at the center of the screen. The cycle will repeat as soon as the base voltage of Q106 becomes negative.

C113, in series with the yoke, also serves to block DC currents through the yoke 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 describe the same arc.

L101 is an adjustable width control placed in series with the horizontal deflection coils. The variable inductive reactance allows a greater or lesser amount of the deflection current to flow through the horizontal yoke and, therefore, varies the width of the horizontal scan.

The negative flyback pulse developed during horizontal retrace time is rectified by CR104 and filtered by C110. This produces approximately "D" VDC which is coupled through the brightness control to the cathode of the CRT (V1).

This same pulse is transformer-coupled to the secondary of transformer T2 where it is rectified by CR2, CR106, and CR105 to produce rectified voltages of approximately 12 KV (9 and 12 inches) or 9 kV (5 inches), "C" VDC, and "B" VDC respectively. 12kV or 9 kV is the anode voltage for the CRT, and "C" VDC serves as the source voltage for grids No. 2 and 4 (focus grid) of the CRT The "B" VDC potentail is the supply voltage for the video output amplifier, Q101.

Section 3
PRELIMINARY ADJUSTMENTS

3.1 SYNCHRONIZATION AND DRIVE SIGNALS

Apply horizontal and vertical drive signals to the horizontal and vertical drive terminals as indicated on your schematic. Adjust their levels to a nominal +4 V peak-to-peak. The duty cycle of each signal must be adjusted as described in Section 1.2.

The horizontal drive signal is required to initiate horizontal scan and high voltage, and should be connected before applying power to the monitor.

3.2 BRIGHTNESS

Normally, the monitor will be used to display alphanumeric or other black and white information. Moreover, the video polarity is usually white characters on a black background.

The brightness control should be adjusted at a point where the white raster is just extinguished. The CRT will then be at its cutoff point, and a maximum contrast ratio can be obtained when a video signal is applied.

3.3 VIDEO CONTRAST

Q101 is designed to operate linearly when a +2.5 V signal is applied to its base. Some models incorporate a 500 ohm external contrast control to maintain this level of +2.5 V peak-to-peak when measured at the video input terminal of the printed circuit board edge connector. (Refer to the schematic.)

In all cases, the output DC impedance of the video signal source must be 500 ohms, or less.

3.4 VERTICAL ADJUSTMENTS

There is a slight interaction among the vertical frequency, height, and linearity controls. A change in the height of the picture may affect linearity.

(1) Apply video and synchronization signals to the monitor.

(2) Set the vertical frequency control, R116, near the mechanical center for its rotation.

(3) Adjust the vertical height control, R124, for desired height.

(4) Adjust the vertical linearity control, R121, for best vertical linearity.

(5) Remove the vertical drive signal from the unit. Or, alternatively, use a short jumper lead, and short the vertical drive input terminal of the printed circuit card edge connector to ground.

(6) Readjust the vertical frequency control, R116, until the picture rolls up slowly.

(7) Restore vertical drive to the monitor.

(8) Recheck height and linearity.

3.5 HORIZONTAL ADJUSTMENTS

Raster width is affected by a combination of the low voltage supply, width coil L101, and the horizontal linearity sleeve located on the neck of the CRT beneath the yoke.

(1) Apply video and synchronization signals to the monitor. insert the horizontal linearity sleeve about 2/3 of its length under the yoke. (If you received a monitor from the factory in which the placement of the linearity sleeve has been determined, make a mark on the sleeve and reinsert the sleeve to this mark when removal of the yoke and linearity sleeve are required.) If the linearity sleeve is inserted farther than necessary, excessive power will be consumed, and the horizontal output circuitry could be overstressed.

(2) Adjust the horizontal width coil, L101, for the desired width

(3) Insert the linearity sleeve farther under the yoke to obtain the best linearity. Although this adjustment will affect

the raster width, it should not be used solely for that purpose. The placement of the linearity sleeve should be optimized for the best linearity.

(4) Readjust L101 for proper width.

(5) Observe final horizontal linearity and width, and touch up either adjustment if needed.

No horizontal hold control is used in this monitor. The raster should be properly locked and centered when the horizontal drive signals as described in Section 1.2 are used.

3.6 FOCUS ADJUSTMENT

The focus control, R107, provides an adjustment for maintaining best overall display focus. However, because of the construction of the gun assembly in the CRT, this control does not have a large effect on focus.

3.7 CENTERING

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 it would degrade the resolution of the display.

If the picture is tilted, rotate the entire yoke.

Section 4

TROUBLESHOOTING AND MAINTENANCE

4.1 TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE REMEDY
1. Screen is dark	Check "A" bus Q106, Q105, CR2
2. Loss of video	CR105, Q101
3. Power consumption is to high	Check horizontal drive waveform; Check proper placement of horizontal linearity sleeve; Q105, Q106

The voltage waveforms are shown in Fig. 1, and Fig. 2 is the interconnecting cabling diagram. Figure 3 shows the circuit board component locations.

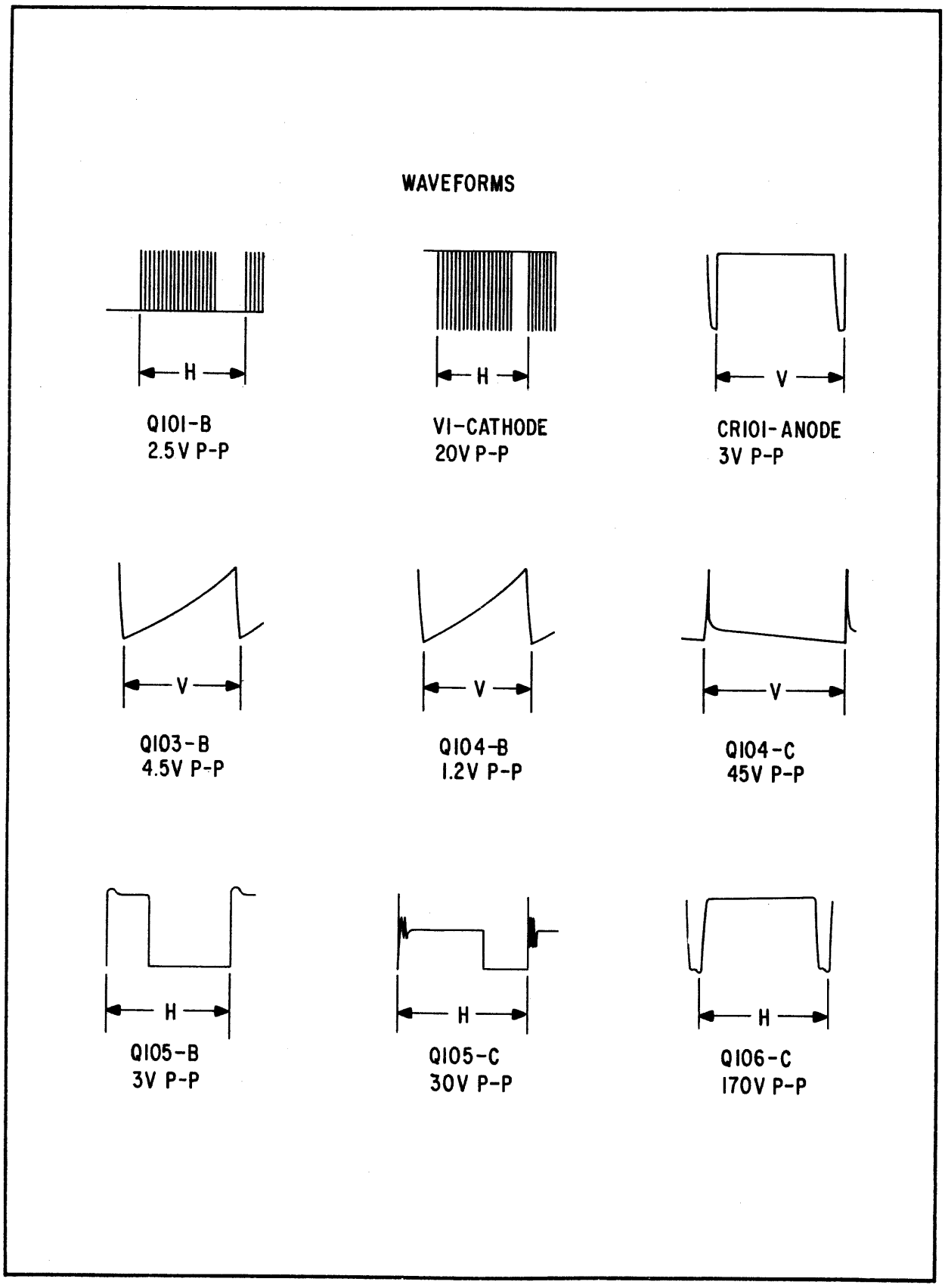


Fig. 1 Voltage Waveform

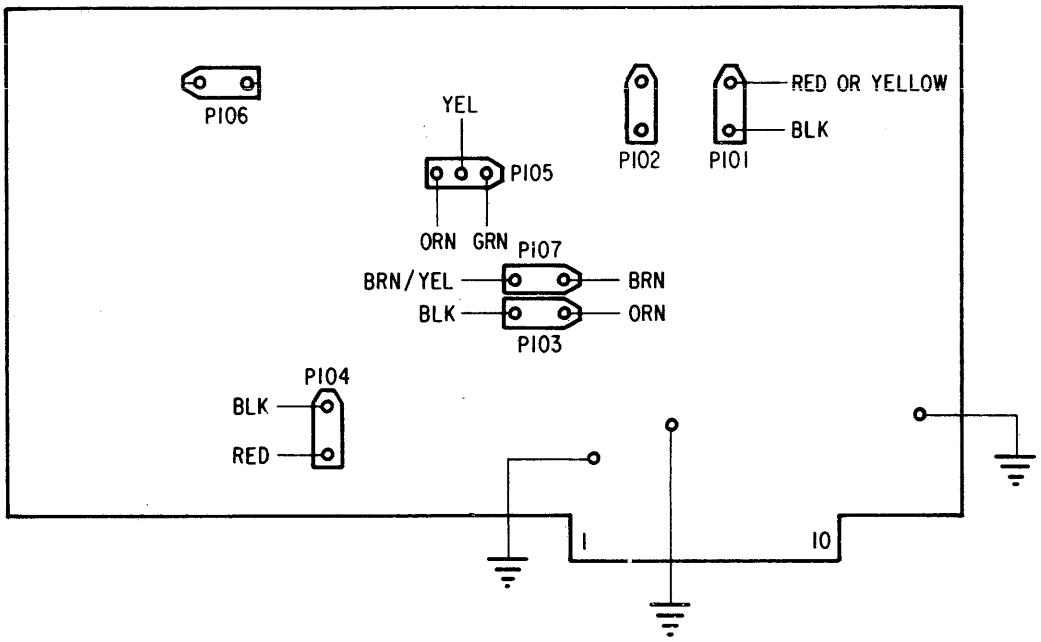
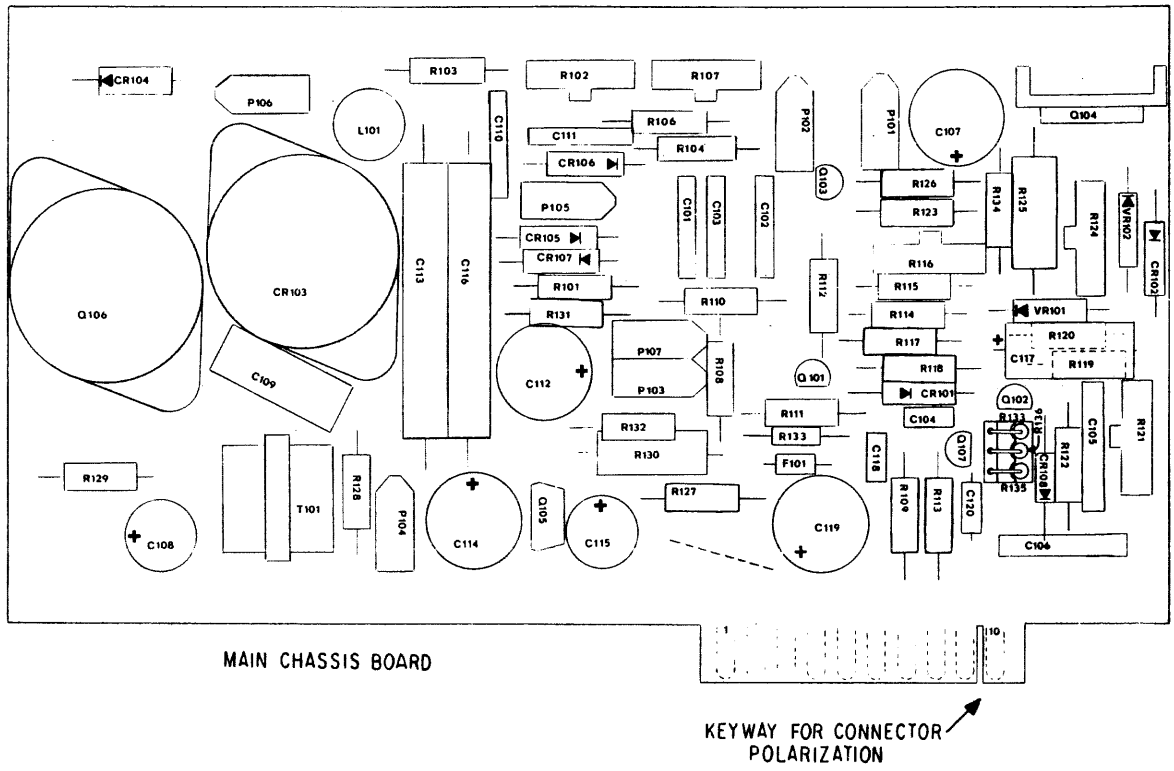
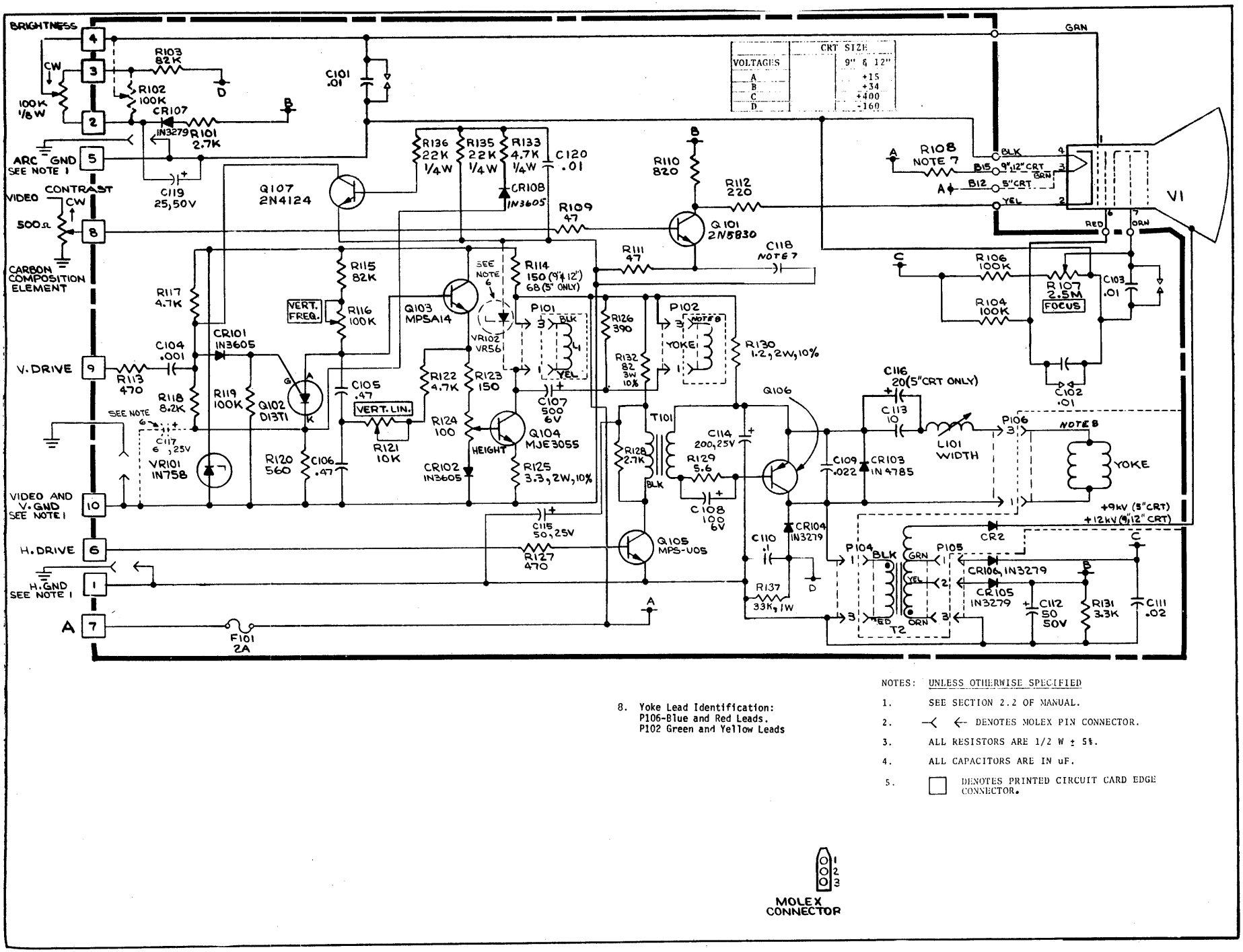


Fig. 2 Interconnecting Cabling Diagram



F101 AND R108 ARE USED ONLY WHEN LOW VOLTAGE POWER SUPPLY IS NOT SUPPLIED.

Fig. 3 Circuit Board Components Location



VOLTAGES	CRT SIZE 9" & 12"
A	+15
B	+34
C	+400
D	-160

8. Yoke Lead Identification:
   P106-Blue and Red Leads.
   P102 Green and Yellow Leads

NOTES: UNLESS OTHERWISE SPECIFIED

1. SEE SECTION 2.2 OF MANUAL.
2. ⊣≺ ← DENOTES MOLEX PIN CONNECTOR.
3. ALL RESISTORS ARE 1/2 W ± 5%.
4. ALL CAPACITORS ARE IN uF.
5. □ DENOTES PRINTED CIRCUIT CARD EDGE CONNECTOR.

Fig. 4 TV5, 9 and 12 Without Power Supply

TECHNICAL INFORMATION AND THEORY OF OPERATION
POWERBEE

MANUFACTURER: Scintillonics, Inc.
P.O. Box 701
600 Industrial Park
Fort Collins, Colorado 80521

Phone: (303) 482-4752

Scintillonics, Inc. P/N: 1172-01

Beehive Medical Electronics, Inc. P/N: 610-0318-02

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1. GENERAL

Powerbee is a series regulated multiple output power supply with overload and overvoltage protection. It is designed to operate without forced air cooling and features all silicon semiconductors. The components are mounted in a black anodized aluminum chassis.

2. THEORY OF OPERATION

The following description is for the +5 VDC supply, but can be applied directly to the +15 V and -12 V supplies.

Powerbee is built around three equivalent circuits, each one with its own raw filter supply consisting of a rectifier bridge, BR1, and filter capacitors (computer grade). A ceramic disc capacitor, C3, is used to bypass high frequency noise and transients. The positive output terminal is taken directly from the filter capacitors, C1 and C2, and fed to the load, which leaves the negative side with the series pass transistors, Q4, Q5 and Q6.

An operational amplifier, IC1, is used to compare the sampled output voltage with the reference voltage provided by zener diode, CR1. The sensor and temperature compensating block (ref. block diagram) consists of R7, R8, R9, R10 and CR2. CR2 is used forward biased and is in thermal equilibrium with zener diode CR1. R9 and R10 determine the rate of compensation. Output voltage adjustment is done with potentiometer R2 which divides the zener voltage of CR1. R1 is a biasing resistor. The output from IC1 is fed into an amplifier, Q1, which provides the base drive for the current regulator Q3. The constant current source and Q3 combined provide the driving element for the pass transistors.

The constant current source and the output current limit function are accomplished by resistor R5 and PNP transistor Q2. R5 determines the foldback point of the output current and together with Q2 supplies the base of Q4, Q5, Q6, and collector Q3, with a constant current.

In short circuit mode, Q2 is off and R6 supplies the base current to the pass transistors.

An electrolytic capacitor, C5, is connected across the output to prevent high frequency oscillations. The SCR crowbar, except for the zener diode CR3 which is connected to the + sense for the +5 V supply, is also tied directly across the output.

3. SPECIFICATIONS

Powerbee conforms to the Super Bee Power Supply specifications specified by B.M.E.I.

3.1 INPUT POWER

Voltage: 103 - 127 VAC at 47 to 66 Hz

or 207 - 253 VAC at 47 to 66 Hz

3.2 OUTPUT POWER

Positive 5 VDC @ 7.0 A
Positive 15 VDC @ 2.5 A
Negative 12 VDC @ 2.5 A

3.3 TYPICAL OUTPUT PARAMETERS

Monitored at output (DC) connector.

Output	+5VDC	+15VDC	-12VDC
Load regulation, 0-100%	1.5 mV	18.0 mV	18.0 mV
Line regulation, ±10%	1.0 mV	1.0 mV	1.0 mV
Ripple peak-to-peak	2.0 mVpp	2.0 mVpp	2.0 mVpp
Overvoltage protection trigger level	6.1 V	19.2 V	15.6 V
Short circuit current	1.3 A	1.2 A	1.1 A

3.4 DIMENSIONS

Powerbee conforms to Scintillonics drawing no. 1172-201.
The maximum physical size is 9.50" L X 10.00" H X 3.25" W.

4. MOUNTING

Powerbee is provided with two (2) sets of mounting holes, of which one set is used for the Mini Bee terminal and the other set for all other applications.

5. CONNECTIONS

As per B.M.E.I. drawing 610-0318-02 witn AC input (connector 1, plug), and DC output (connector 2, receptacle).

Connector 1	
Pin	Function
1	115 VAC (A)
2	115 VAC (B)
3	Chassis ground
4	AC return (A)
5	AC return (B)

Connector 2	
Pin	Function
1	Key
2	Ground
3	Ground
4	-12 VDC
5	+15 VDC
6	Key
7	5 VDC Sense -
8	Blank
9	Blank
10	5 VDC Sense +
11	+ 5 VDC
12	+ 5 VDC

To connect for 230 VAC operation, connect Pin 2 to Pin 4, and connect 230 VAC high side to Pin 1 and AC return to Pin 5.

6. OPERATION

6.1 SENSE CONNECTION

Powerbee can not be operated without remote sensing.

Failure to connect sense will result in an output voltage of approximately 0.9 V at +5 V output pins. This is also a double test that the +5 V OVP circuit (overvoltage protection circuit) operates normally.

6.2 VOLTAGE ADJUSTMENTS

All outputs operate independently of each other and can be adjusted separately. The +5 V output is adjustable from approximately 4.7 V to maximum 6.5 V or until the OVP threshold is reached, through turning the potentiometer, R2, clockwise (CW). The +15 V output has a voltage range from 11.0 V to 16.0 V (potentiometer R22). The -12 V output is decreased from approximately -9.0 V to -14.0 V when adjusting R42 CW.

6.3 OVERVOLTAGE PROTECTION

Each output is protected with a SCR crowbar overvoltage protection (OVP) circuit with preset threshold voltages, typical values are in section 3.3.

In triggered condition, the OVP circuit reduces the output voltage to approximately 0.9 V and the output ripple increases to approximately 5 mV peak-to-peak.

Test procedure: Determination of trigger level for the +5 V output is accomplished simply through adjusting R2 CW until SCR1 triggers. On the +15 V (-12 V) output, adjust R22 (R42) CCW for an output voltage of approximately 13.0 V (-10.0 V). A 2.2K ohm resistor is thereafter paralleled with R28 (R48). The voltage will increase to approximately 16.5 V (decrease to -12.5 V). R22 (R42) can now be adjusted CW until the SCR's trigger and the threshold voltages measured.

NOTE: It is important to keep load current constant during test. If not kept constant, the foldback current limt circuit will reduce the output voltage which then will never reach threshold value.

6.4 OVERLOAD PROTECTION

The output current is limited to 150% or less of rated load current, by a current limit foldback circuit. The foldback point (FB) is set by R5, R25 and R45. These resistor values are a function of the pass transistors gain and are determined in test by SCINTILLONICS, INC.

Short circuit protection is accomplished with the same FB circuit and the short circuit current is approximately 1.0 A.

Overload or short circuit operation over an extended period of time will not effect the power supply and the supply will recover instantly to normal operating mode when the overload conditions are removed.

7. MAINTENANCE

The power supply is a long lasting supply designed to be maintenance free other than the general precautionary practices.

It should be noted, however, that as mechanical shock may damage the transformer shielding effectiveness, careful handling is of importance.

8. CORRECTIVE MAINTENANCE

A malfunction will normally be detected at the output of the power supply by output parameters which are sub-standard to the power supply specifications.

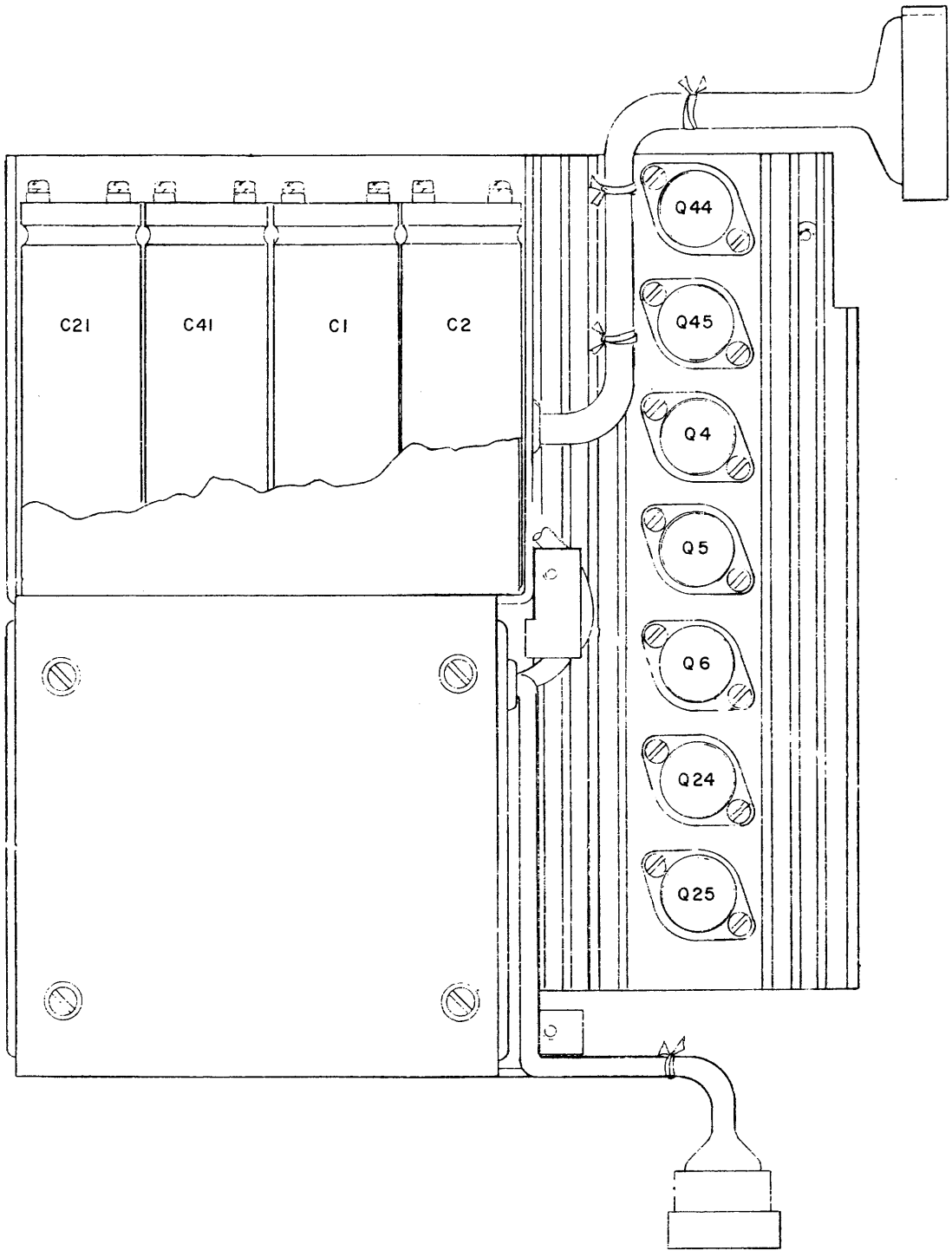


Figure B-1. Powerbee Power Supply

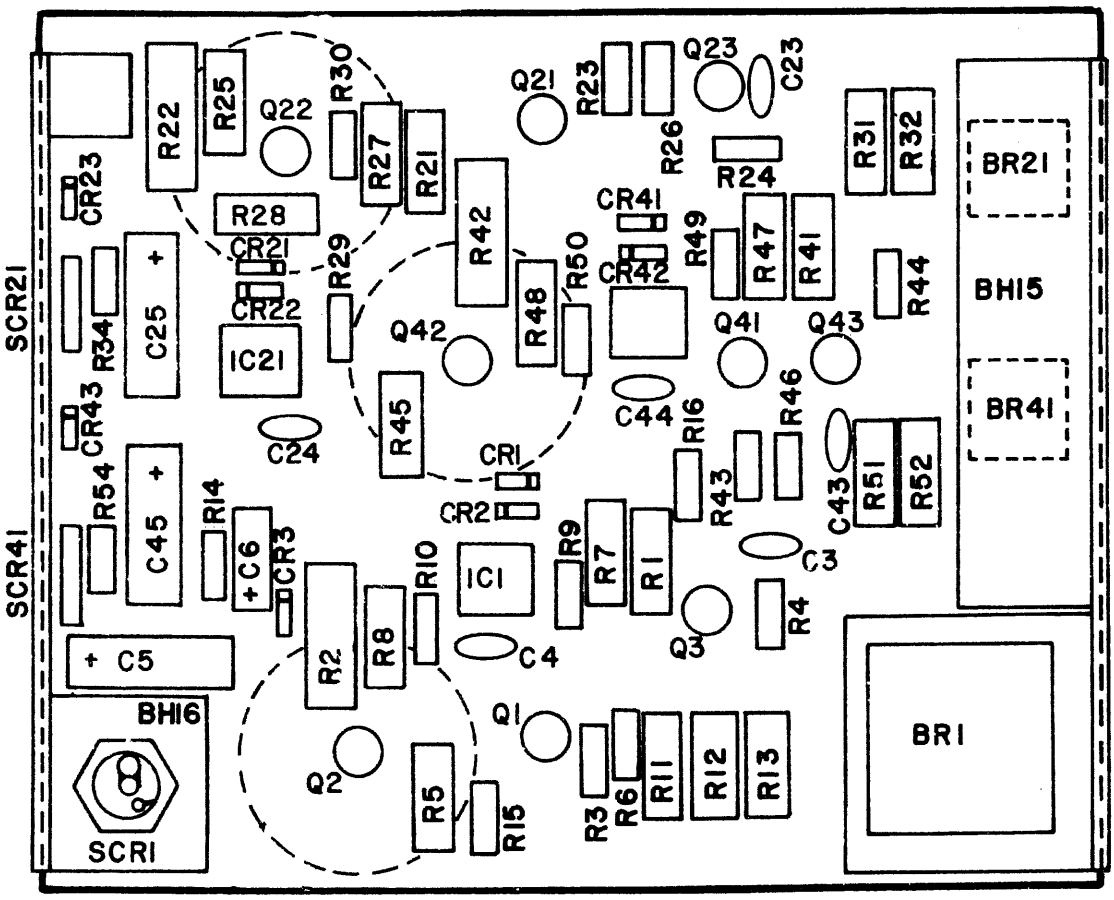


Figure B-2 Powerbee P.C. Board Assembly

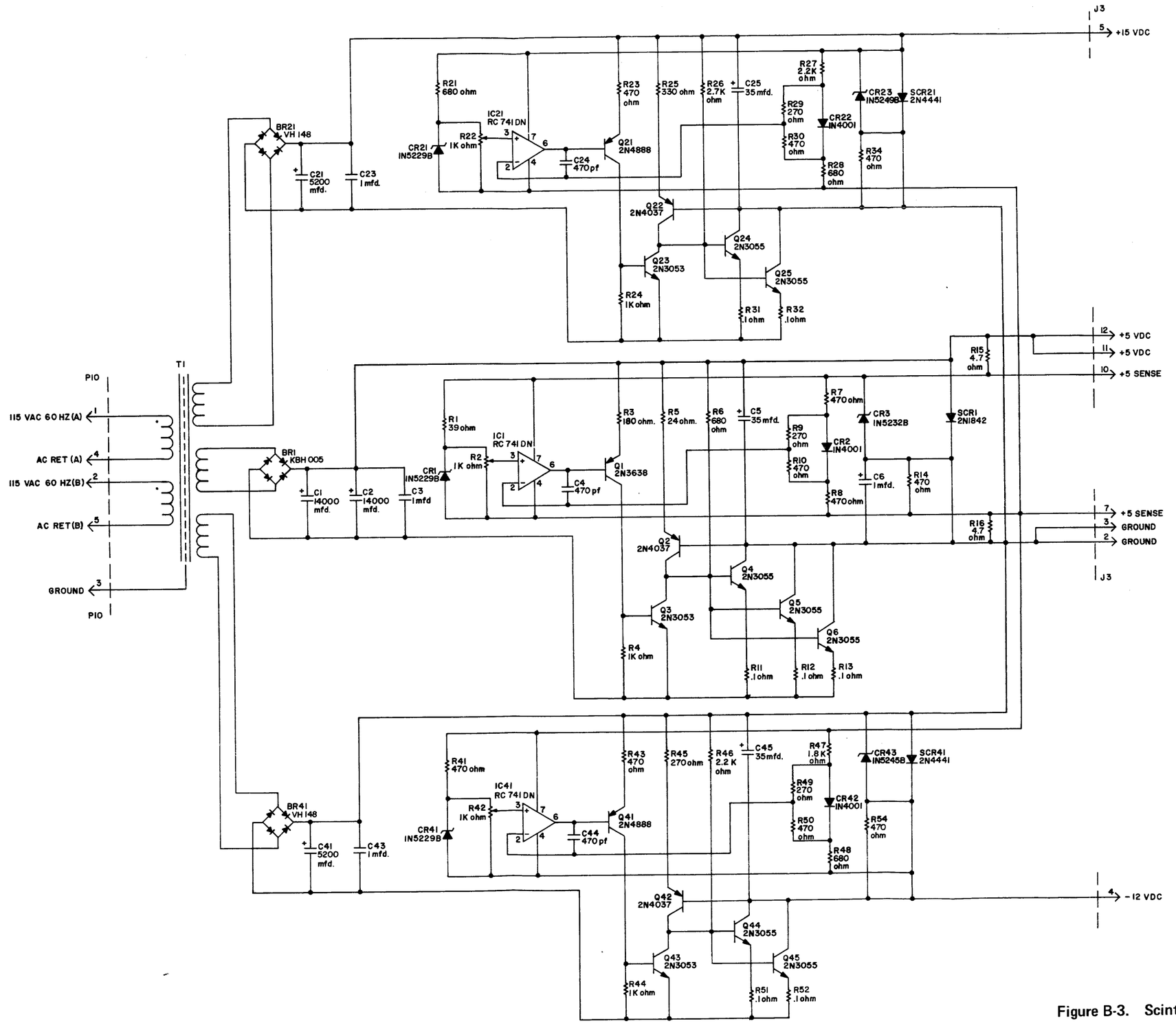


Figure B-3. Scintillonics Powerbee

THEORY OF OPERATION A[illegible]
ADJUSTMENT PROCED[illegible]

FOR

DATAPOWER PO[illegible] PLY

NOT USED WITH HP 2615A

Manufacturer: Datapower
Santa Ana, CA
Part No. 15A00430

Beehive Part No. 610-0325

DATAPOWER POWER SUPPLY DESCRIPTION

Beehive Medical Electronics computer terminals are presently being produced with power supply assemblies produced by three different manufacturers: Elexon, Scintillonics and now Datapower. This section describes the theory of operation and adjustment procedure for the Datapower Power Supply. Figure B-4 shows a simplified block diagram of the assembly. Figure B-5 shows the assembly. Figure B-6 shows the printed circuit board and Figure B-7 is the schematic.

THEORY OF OPERATION

The Datapower power supplies three output DC voltages from an input AC source. The three outputs (+5VDC at 7 amps, +15VDC at 2.5 amps and -12VDC at 2.5 amps) are regulated to ±.01% for line and load change, current limited to protect against overcurrenting or short circuiting, and overvoltage protected to prevent any of the outputs exceeding a given level. Each of the three outputs are identical in theory; therefore, the following description details only on the +5V circuit.

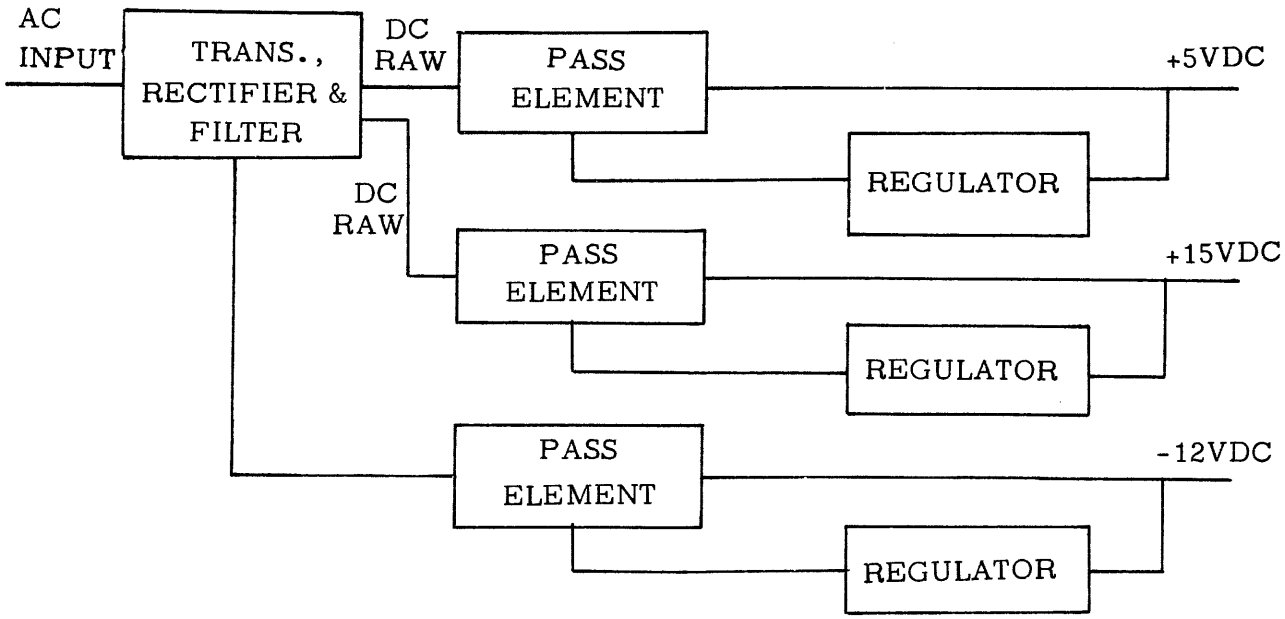


Figure B-4. Power Supply Block Diagram

In Figure B-4 the input AC voltage is passed thru the transformer, changed in voltage and isolated to supply raw voltage to each of three regulators. The transformed AC voltage is then DC rectified and filtered. This voltage is always a greater voltage than the desired output so that the pass element will subtract what is needed from the raw to generate the required output (10V raw voltage -5V across pass element equals 5 volt output). The pass element consists of Q1, Q101, Q102 and Q103. Q1 and Q103 are the driver transistors which drives Q101, Q102 which are in parallel to share the power. The regulator section consists of Z1 which is an integrated circuit regulator. This regulator compares the output voltage to an internal reference and modulates the driven transistors to assure this occurs. Current limiting is achieved by monitoring the current on the output thru R101, R102. If this current becomes greater than a given level set by R2, R3, R4 and the internal reference of Z1, it will shut down the output. The overvoltage protection circuit monitors the output voltage and when exceeds a specific level set by CR1 and CR103 the SCR turns on and clamps the output to approximately 1VDC.

ADJUSTMENT PROCEDURE

Each of the three outputs are adjustable by potentiometers mounted in the printed circuit board. The readjustment of the setlines should be only done by authorized personnel. When making a change in the voltage setting, the monitoring of the output voltage has to be done at the nearest point to the power supply to prevent too much wire voltage drop. If the voltage is adjusted too high it will cause the over voltage protection circuit to clamp the output. If this occurs the potentiometer must be readjusted back to the center position and the power supply be recycled off (for one minute period) and then back on. The potentiometer nearest the edge of the unit is the +15V adjustment, the center one is the +5V adjustment and the last one is the -12V adjustment. (See Figure B-6).

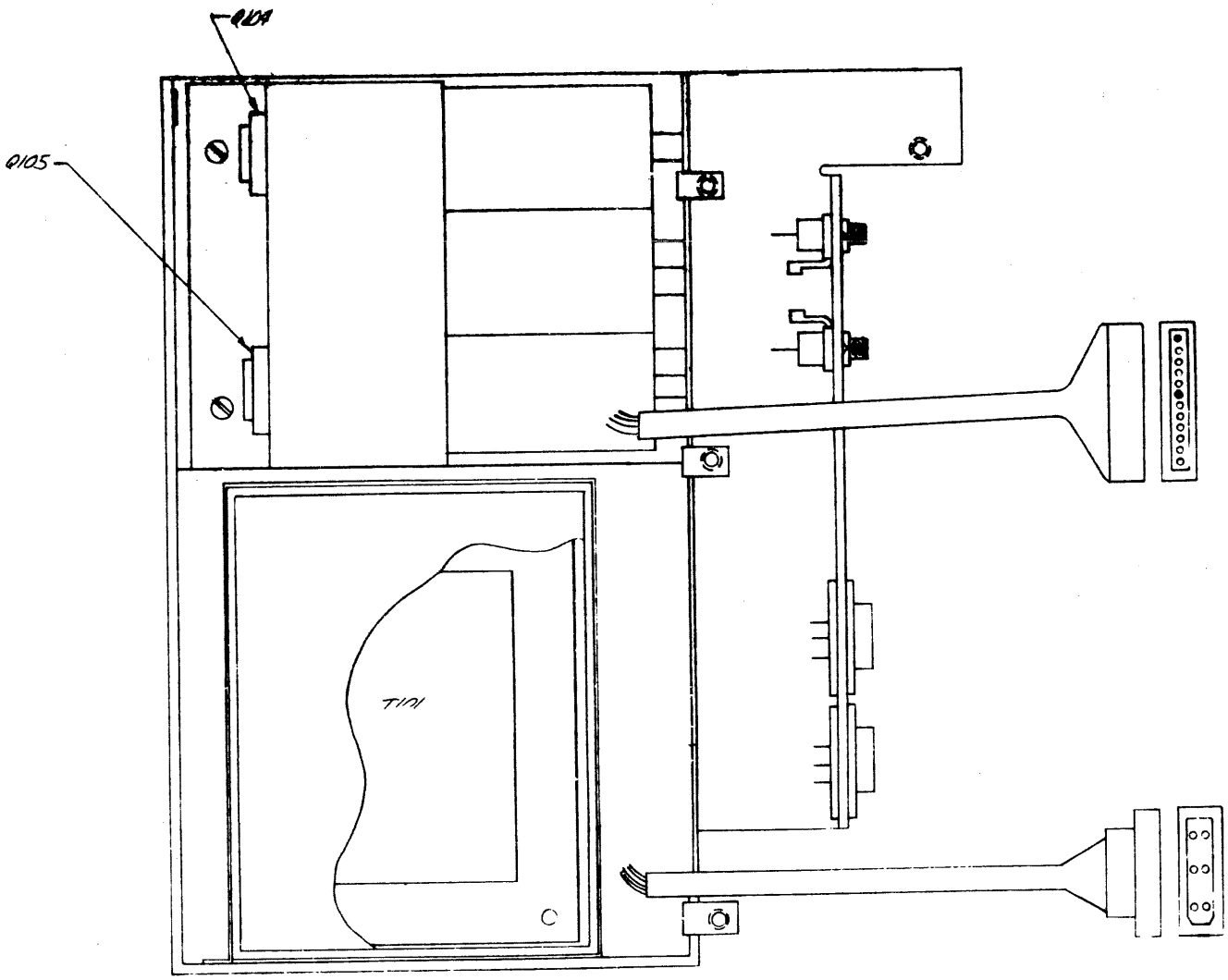


Figure B-5. Datapower Power Supply

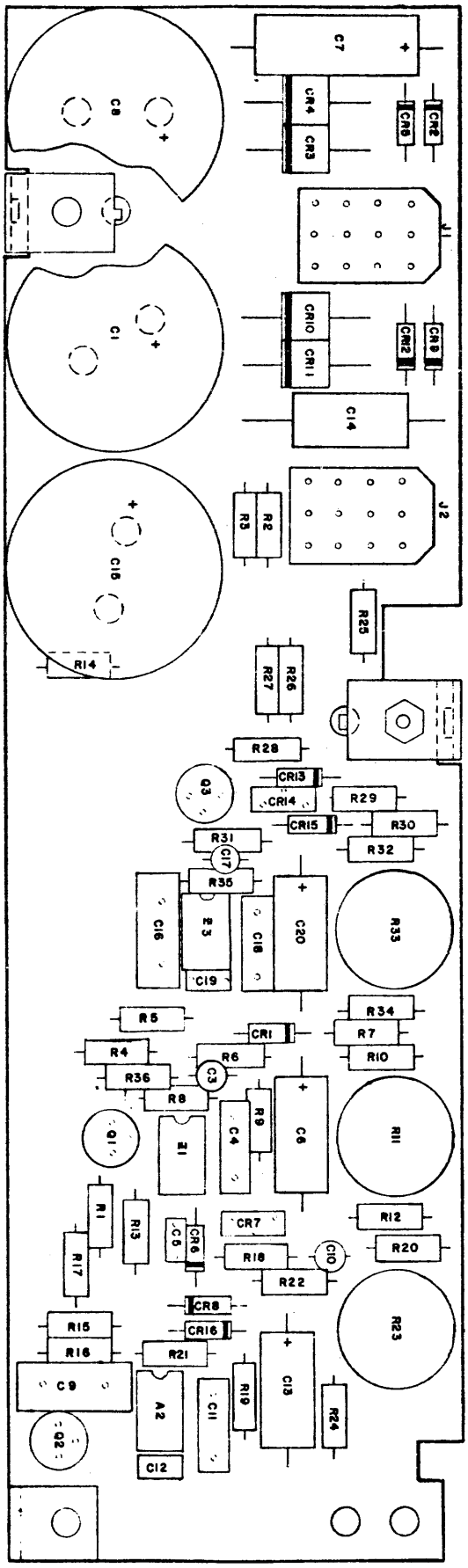
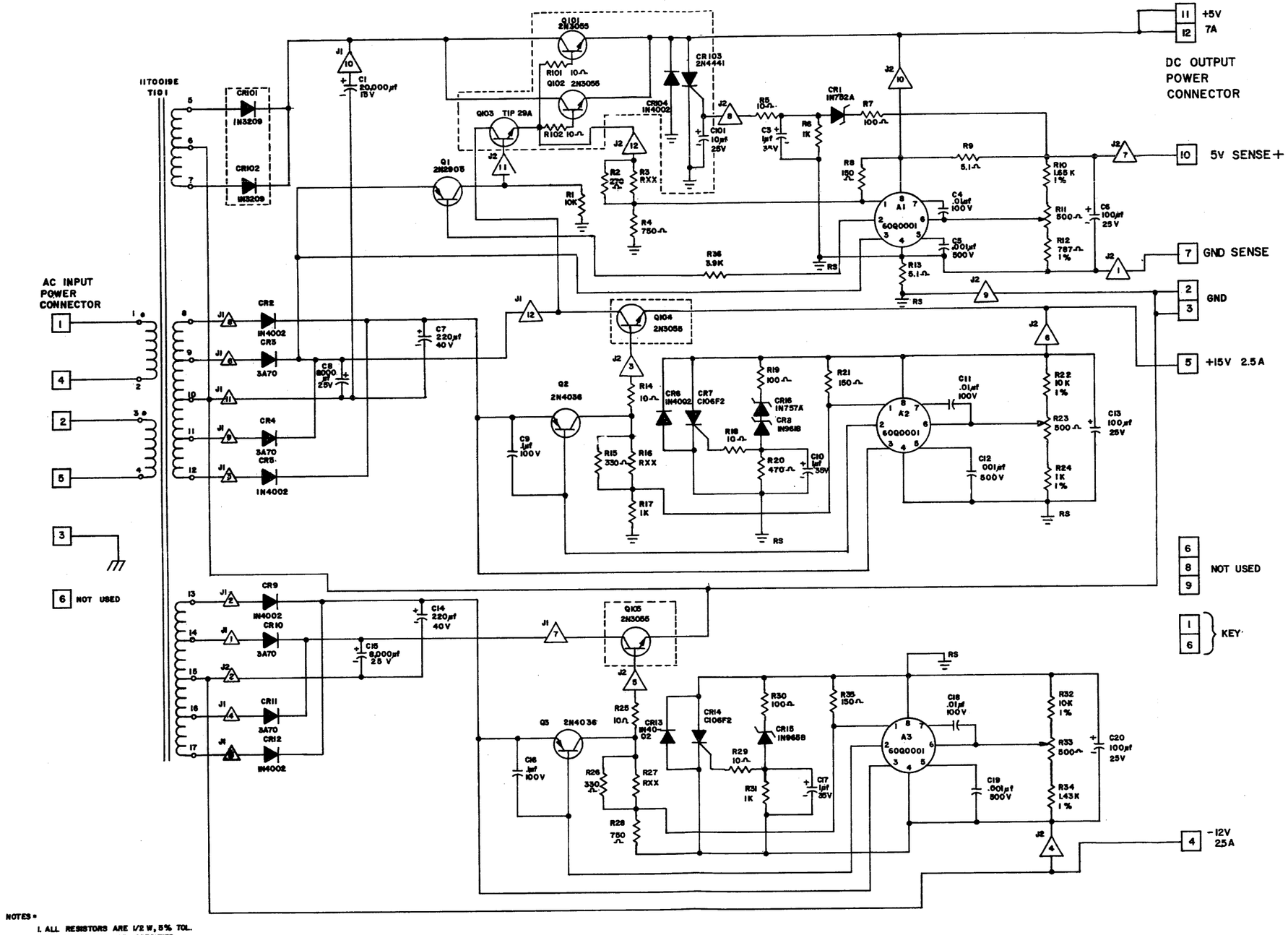


Figure B-6. Datapower Power Supply

P.C. Board Assembly



NOTES:

1. ALL RESISTORS ARE 1/2 W, 5% TOL. UNLESS OTHERWISE SPECIFIED.
2. RXX INDICATES FACTORY SELECT.
3. △ INDICATES PINS ON INTERNAL CONNECTORS

Figure B-7. Datapower Schematic