A14
CONTROL BOARD ASSEMBLY

SIG	FROM	CONNECTOR
AUX PTT	J10	J2
AUX CW	J10	J2
PTT KEY	A13A3	J7
CW KEY	A13A3	J7

SIG	FROM	CONNECTOR
PLL 1 LOCK	A6	J5
PLL 4 LOCK	A9	J5
800 KHZ DET	A12	J5
1 MHZ DET	A12	J5
40 MHZ DET	A12	J5
PLL 2 LOCK	A7	J6
PLL 2 SER CHK	A7	J6
A4 SER CHK	A4	J9
PLL 3 LOCK	A8	J10
PLL 3 SER CHK	A8	J10
PLL 5 LOCK	A10	J12
PLL 5 SER CHK	A10	J12
A5 SER CHK	A5	J13
A11 45 MHZ LOCK	A11	J14
A11 LOCK DET 1	A11	J14
A11 LOCK DET 2	A11	J14
A11 SER CHK 1	A11	J14
A11 SER CHK 2	A11	J14

SIG	FROM	CONNECTOR
FILTER I.D.	A19	J3
A1 OUTPUT DET	A1	J4
A2 BITE DET	A2	J5
IF ENVELOPE	A4	J9
COMBINER I.D.	A4	J9
USB ALC BITE	A5	J13
LSB ALC BITE	A5	J13
USB IF BITE	A5	J13
LSB IF BITE	A5	J13
A11 BITE DET	A11	J14

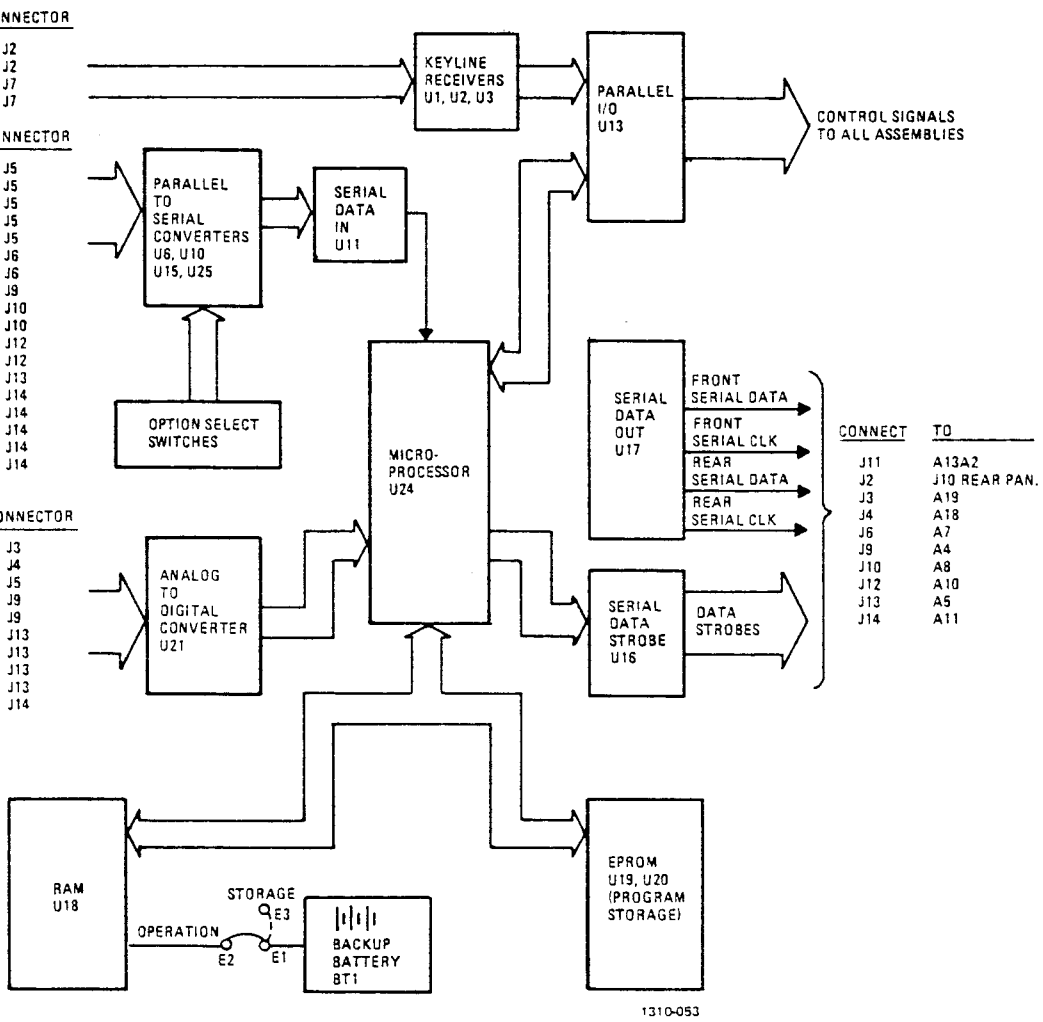


TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (Cont.)

CONTROL BOARD ASSEMBLY A14

1. GENERAL DESCRIPTION

Control Board Assembly A14 contains the 8085AH-2 CPU and associated peripheral circuits, serial data transmission circuits, parallel-to-serial reception circuits, parallel I/O circuits, keyline processing circuits, and analog-to-digital converter circuitry. The A14 assembly controls the RF-1310, accepts input from the front panel and exciter assemblies, and generates the digital signals necessary to control the exciter. Software contained within two, 8K byte EPROMs is executed to supervise, control, and in the BITE process, test the display, control, and signal generating circuitry. Random access read/write memory (RAM) is used to temporarily store the software program and store battery-backed exciter setups and programmed channels. Figure 1 shows the location of this assembly.

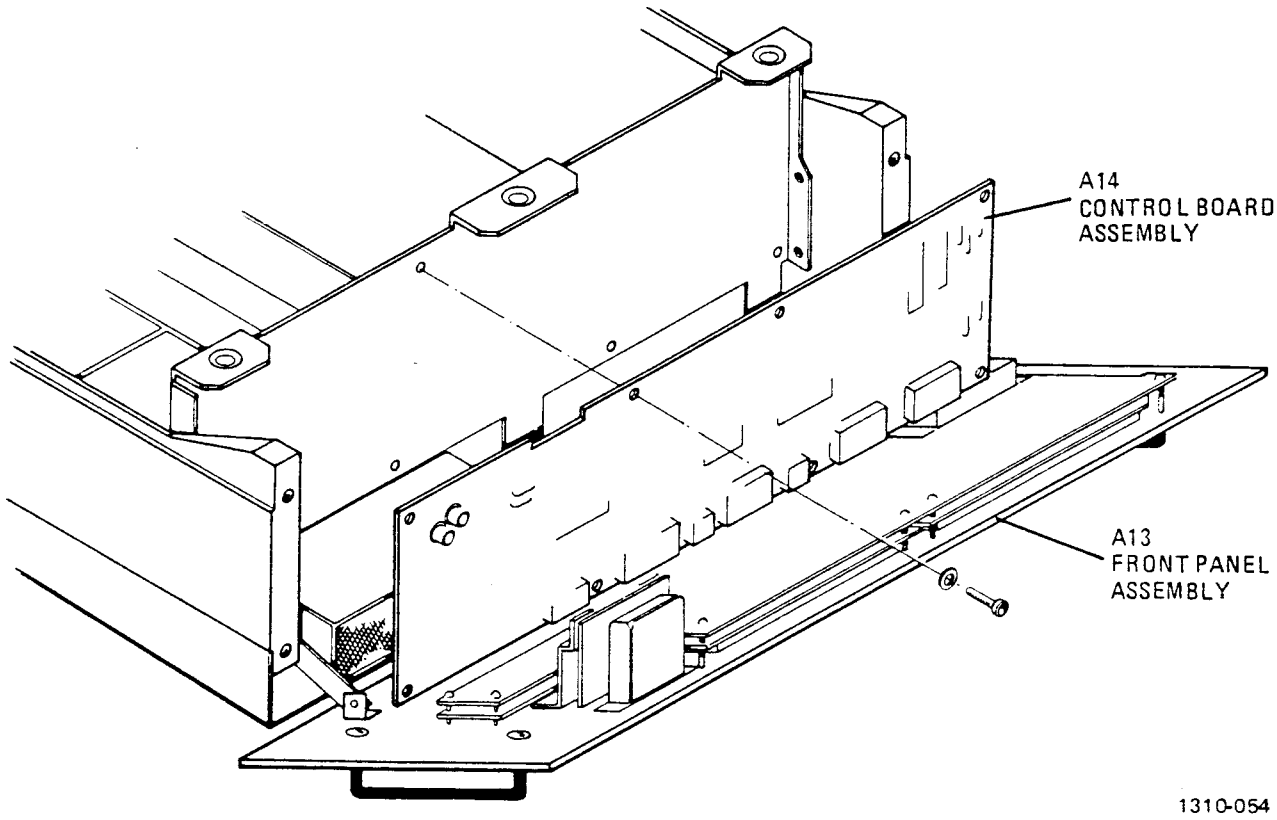


Figure 1. Control Board Assembly Exploded View

2. INTERFACE CONNECTIONS

All Control Board Assembly A14 interface connections are shown in table 1 and on the schematic diagram.

Table 1. RF-1310 Control Board Interface Lines

Connector	Function	To	From
A14J1	NC	----	----
A14J1-2	INDEX	----	----
A14J1-3	CONTROL +5 V	----	A15J3-21
A14J1-4	DISPLAY +5 V	----	A15J3-9
A14J2-1	AUXILIARY PTT KEY	----	J10-7
A14J2-2	AUXILIARY CW KEY	----	J10-9
A14J2-3	SPARE	----	----
A14J2-4	REMOTE IN 0	----	J10-20
A14J2-5	PRI FAIL	J10-9	----
A14J2-6	REMOTE OUT 0	J10-16	----
A14J2-7	REMOTE OUT 1	J10-31	----
A14J2-8	REMOTE IN 1	----	J10-5
A14J2-9	FAULT	J10-4	----
A14J2-10	NC	----	----
A14J2-11	REAR SERIAL CLOCK	J10-3	----
A14J2-12	REAR SERIAL DATA	J10-1	----
A14J2-13	BUFFERED SERIAL ENABLE 1	J10-18	----
A14J2-14	BUFFERED SERIAL ENABLE 2	J10-32	----
A14J3-1	SPARE	----	----
A14J3-2	FILTER, ID	----	A19J1-2
A14J3-3	SPARE	----	----
A14J3-4	SPARE	----	----
A14J3-5	SPARE	----	----
A14J3-6	INDEX	----	----
A14J3-7	EXTERNAL MUTE	----	A19J1-7
A14J3-8	SERIAL ENABLE	A19J1-8	----
A14J3-9	REAR SERIAL DATA	A19J1-9	----
A14J3-10	REAR SERIAL CLOCK	A19J1-10	----
A14J4-1	CW KEY	A18J2-1	----
A14J4-2	PTT KEY	A18J2-2	----
A14J4-3	RESET	A18J2-3	----
A14J4-4	GROUND	A18J2-4	----
A14J4-5	FSK SHIFT	----	A18J2-5
A14J4-6	PRI FAIL	----	A18J2-6
A14J4-7	IF ENVELOPE	A18J2-7	----
A14J4-8	REAR SERIAL CLOCK	A18J2-8	----
A14J4-9	REAR SERIAL DATA	A18J2-9	----
A14J4-10	SPARE	----	----

Table 1. RF-1310 Control Board Interface Lines (Cont.)

Connector	Function	To	From
A14J4-11	SERIAL ENABLE	A18J2-11	----
A14J4-12	SERIAL DATA IN	----	A18J2-12
A14J4-13	SPARE	----	----
A14J4-14	INTERNAL KEY	A18J2-14	----
A14J4-15	BUSY	----	A18J2-15
A14J4-16	A1 OUTPUT DETECT	----	A18J2-16
A14J4-17	READ SELECT	A18J2-17	----
A14J4-18	ATTNC	----	A18J2-18
A14J4-19	PPC CONTROL	----	A18J2-19
A14J4-20	BUFFERED APC	----	A18J2-20
A14J5-1	A2 BITE DET	----	A2J6-1
A14J5-2	NC	----	----
A14J5-3	A6 PLL 1 LOCK	----	A16A3J1-1
A14J5-4	INDEX	----	----
A14J5-5	A9 PLL 4 LOCK	----	A16A3J1-3
A14J5-6	A12 800 KHZ BITE DET	----	A16A3J1-4
A14J5-7	A12 1 MHZ BITE DET	----	A16A3J1-5
A14J5-8	A12 40 MHZ BITE DET	----	A16A3J1-6
A14J6-1	REAR SERIAL DATA	A7J1-10	----
A14J6-2	REAR SERIAL CLOCK	A7J1-9	----
A14J6-3	INDEX	----	----
A14J6-4	PLL 2 SERIAL CHECK	----	A7J1-7
A14J6-5	SERIAL ENABLE	A7J1-6	----
A14J6-6	PLL 2 LOCK	----	A7J1-5
A14J6-7	GROUND	A7J1-4	A7J1-5
A14J6-8	SPARE	----	----
A14J7-1	CW KEY	----	A13A3J1-1
A14J7-2	INDEX	----	----
A14J7-3	PTT KEY	----	A13A3J1-3
A14J7-4	SPARE	----	----
A14J7-5	BUFFERED APC	A13A3J1-5	----
A14J7-6	GROUND	A13A3J1-6	----
A14J7-7	A1 OUTPUT DET	A13A3J1-7	----
A14J7-8	SPARE	----	----
A14J8-1	POWER SUPPLY BITE	----	A15J3-22
A14J8-2	SPARE	----	----
A14J8-3	+ 15 V REGULATED	----	A15J3-23
A14J8-4	-15 V REGULATED	----	A15J3-11
A14J8-5	INDEX	----	----
A14J8-6	+ 5 V UNREGULATED	----	A15J3-12
A14J8-7	GROUND	----	A15J3-25
A14J8-8	GROUND	----	A15J3-13

Table 1. RF-1310 Control Board Interface Lines (Cont.)

Connector	Function	To	From
A14J9-1	REAR SERIAL DATA	A4J6-1	----
A14J9-2	REAR SERIAL CLOCK	A4J6-2	----
A14J9-3	A4 SERIAL CHECK	----	A4J6-3
A14J9-4	SERIAL ENABLE	A4J6-4	----
A14J9-5	IF ENVELOPE	----	A4J6-5
A14J9-6	PPC CONTROL	A4J6-6	----
A14J9-7	INTERNAL KEY	A4J6-7	----
A14J9-8	GROUND	A4J6-8	----
A14J9-9	INDEX	----	----
A14J9-10	COMBINER ID	A4J6-12	----
A14J9-11	SPARE	----	----
A14J9-12	NC	----	----
A14J10-1	REAR SERIAL DATA	A8J4-10	----
A14J10-2	REAR SERIAL CLOCK	A8J4-9	----
A14J10-3	INDEX	----	----
A14J10-4	PLL 3 SERIAL CHECK	----	A8J4-7
A14J10-5	SERIAL ENABLE	A8J4-6	----
A14J10-6	PLL 3 LOCK	----	A8J4-5
A14J10-7	GROUND	A8J4-4	----
A14J10-8	SPARE	----	----
A14J11-1	NC	----	----
A14J11-2	FRONT SERIAL DATA	A13A2J1-2	----
A14J11-3	NC	----	----
A14J11-4	FRONT SERIAL CLOCK	A13A2J1-4	----
A14J11-5	NC	----	----
A14J11-6	-15 V	A13A2J1-6	----
A14J11-7	DISPLAY +5 V	A13A2J1-7	----
A14J11-8	POWER SUPPLY BITE	A13A2J1-8	----
A14J11-9	PB3	A13A2J1-9	----
A14J11-10	KEYBOARD STROBE	A13A2J1-10	----
A14J11-11	PB2	A13A2J1-11	----
A14J11-12	FAULT	----	A13A2J1-12
A14J11-13	PB1	A13A2J1-13	----
A14J11-14	DISPLAY STROBE	A13A2J1-14	----
A14J11-15	PB0	A13A2J1-15	----
A14J11-16	RESET	A13A2J1-16	----
A14J11-17	NC	----	---
A14J11-18	GROUND	A13A2J1-18	----
A14J11-19	+5 V UNREGULATED	A13A2J1-19	----
A14J11-20	GROUND	A13A2J1-20	----
A14J12-1	REAR SERIAL DATA	A10J1-10	----
A14J12-2	REAR SERIAL CLOCK	A10J1-9	
A14J12-3	INDEX	----	----
A14J12-4	PLL 5 SERIAL CHECK	----	A10J1-7
A14J12-5	SERIAL ENABLE	A10J1-6	----

Table 1. RF-1310 Control Board Interface Lines (Cont.)

Connector	Function	To	From
A14J12-6	PLL 5 LOCK	----	A10J1-5
A14J12-7	GROUND	A10J1-4	----
A14J12-8	SPARE	----	----
A14J13-1	REAR SERIAL DATA	A15A1J3-24	----
A14J13-2	REAR SERIAL CLOCK	A15A1J3-23	----
A14J13-3	A5 SERIAL CHECK	----	A5A1J3-22
A14J13-4	SERIAL ENABLE	A5A1J3-21	----
A14J13-5	SPARE	----	----
A14J13-6	USB ALC BITE DET	----	A5A1J3-19
A14J13-7	USB IF BITE DET	----	A5A1J3-18
A14J13-8	LSB ALC BITE DET	----	A5A1J3-17
A14J13-9	LSB IF BITE DET	----	A5A1J3-16
A14J13-10	REM LINE AUDIO GRD	A5A1J3-15	----
A14J13-11	SPARE	----	----
A14J13-12	REMOTE LINE AUDIO	A5A1J3-13	----
A14J13-13	SPARE	----	----
A14J13-14	VOX KEYLINE	A5A1J3-11	----
A14J13-15	GROUND	A5A1J3-10	----
A14J13-16	FM AUDIO	A5A1J3-9	----
A14J13-17	SPARE	----	----
A14J13-18	-15 V	A5A1J3-7	----
A14J13-19	INTERNAL KEY	A5A1J3-6	----
A14J13-20	+ 15 V	A5A1J3-5	----
A14J13-21	SPARE	----	----
A14J13-22	CLIP ENABLE	A5A1J3-3	----
A14J13-23	SPARE	----	----
A14J13-24	SPARE	----	----
A14J14-1	GROUND	A11J3-1	----
A14J14-2	SPARE	----	----
A14J14-3	A11 BITE DET	----	A11J3-3
A14J14-4	REAR SERIAL DATA	A11J3-4	----
A14J14-5	SERIAL ENABLE 1	A11J3-5	----
A14J14-6	REAR SERIAL CLOCK	A11J3-6	----
A14J14-7	A11 45 MHZ LOCK	----	A11J3-7
A14J14-8	FSK SHIFT	A11J3-8	----
A14J14-9	INTERNAL KEY	A11J3-9	----
A14J14-10	FM AUDIO	A11J3-10	----
A14J14-11	A11 LOCK DET 1	----	A11J3-11
A14J14-12	SPARE	----	----
A14J14-13	SERIAL ENABLE 2	A11J3-13	----
A14J14-14	A11 SERIAL CHECK 1	----	A11J3-14
A14J14-15	A11 LOCK DET 2	----	A11J3-15
A14J14-16	A11 SERIAL CHECK 2	----	A11J3-16
A14J15-1	+ 5 V UNREGULATED	A17J1-1	----

Table 1. RF-1310 Control Board Interface Lines (Cont.)

Connector	Function	To	From
A14J15-2	+ 5 V UNREGULATED	A17J1-2	----
A14J15-3	RESET OUT	A17J1-3	----
A14J15-4	HOLD	----	A17J1-4
A14J15-5	REMOTE LINE AUDIO	A17J1-5	----
A14J15-6	HLDA	A17J1-6	----
A14J15-7	REMOTE LINE AUDIO GROUND	A17J1-7	----
A14J15-8	CLOCK OUT	A17J1-8	----
A14J15-9	+ 15 V	A17J1-9	----
A14J15-10	GROUND	A17J1-10	----
A14J15-11	READY	----	A17J1-11
A14J15-12	-15 V	A17J1-12	----
A14J15-13	RST 5.5	----	A17J1-13
A14J15-14	IO/M	A17J1-14	----
A14J15-15	INTR	----	A17J1-15
A14J15-16	S1	A17J1-16	----
A14J15-17	WR	A17J1-17	----
A14J15-18	RD	A17J1-18	----
A14J15-19	INTA	A17J1-19	----
A14J15-20	ALE	A17J1-20	----
A14J15-21	NC	----	----
A14J15-22	NC	----	----
A14J15-23	AD0	A17J2-3	BIDIRECTIONAL
A14J15-24	NC	----	BIDIRECTIONAL
A14J15-25	AD1	A17J2-5	BIDIRECTIONAL
A14J15-26	A15	A17J2-6	----
A14J15-27	AD2	A17J2-7	BIDIRECTIONAL
A14J15-28	A14	A17J2-8	----
A14J15-29	AD3	A17J2-9	BIDIRECTIONAL
A14J15-30	A13	A17J2-10	----
A14J15-31	AD4	A17J2-11	BIDIRECTIONAL
A14J15-32	A12	A17J2-12	----
A14J15-33	AD5	A17J2-13	BIDIRECTIONAL
A14J15-34	A11	A17J2-14	----
A14J15-35	AD6	A17J2-15	BIDIRECTIONAL
A14J15-36	A10	A17J2-16	----
A14J15-37	AD7	A17J2-17	BIDIRECTIONAL
A14J15-38	A9	A17J2-18	----
A14J15-39	GROUND	A17J2-19	----
A14J15-40	A8	A17J2-20	----

3. FUNCTIONAL DESCRIPTION

3.1 CPU and Interface

Figure 2 is a functional block diagram of the Control Board Assembly A14. The U24 8085AH-2 microprocessor executes the application program. The 6.0 MHz frequency of crystal Y1 is divided-by-two within U24 to yield

the 3.0 MHz processor timing (333 nanosecond cycle time). This 3.0 MHz signal is further divided by binary counter U8 and divide-by-12 counter U9 to produce the real time clock frequency of 977 Hz and the A-to-D clock frequency of 750 kHz. The high order address bits of the CPU are inputs to address decoder U28, producing one of four active low chip selects to peripheral circuits, as well as two additional selects. These two additional selects are in turn fed into a dual one-to-four decoder U30 to produce four additional selects that are related to the RD and WR pulses. The multiplexed low address/data (AD) bus from U24 is input to low address latch U22 and to the data bus transceiver U23.

The control lines RD and WR are buffered by two gates of U26, with highest address line A15 and interrupt lines gated through U29 to control the enabling of U23. As mentioned earlier, the RD and WR signal are combined with several of the enable outputs of U30 as well as U26 to produce chip selects for various chips and control serial data operations. The major outputs of the microprocessor are also run to connector J15 for access to the installed remote, with R31, R32, R36, and R37 holding the lines at their proper logic levels. Lines of address and data busses are pulled up through resistor pack R25 and R26, respectively. The active high interrupt line of the CPU are dedicated as follows:

- RST 7.5 uses the real-time clock
- RST 6.5 is used by the system interface assembly
- RST 5.5 is used by the remote control option

3.2 Reset and Trap

When the power is turned on, the RC network (formed by R38 and C31) holds the processor RESET IN input low for about 100 milliseconds. This allows the power supplies time to stabilize before the CPU starts running. Diode CR9 and Q4 detect a falling + 5 V supply and pull the RESET IN input low to avoid spurious operation on exciter power down or loss. At such times, the chip select to the CMOS RAM U18 is disabled (FET Q2), before the RAM enters its battery-backed condition.

The reset can be initiated manually by pressing pushbutton S3. Pressing S3 grounds the RESET IN input.

During normal program execution, the microprocessor SOD output sends a low active pulse to the retriggerable one-shot U27 every millisecond. If the CPU is affected by noise on the busses or some other failure, the one-shot will time out and restart the microprocessor through the 8085AH-2 TRAP input. Components C34 and R43 set this one-shot timeout to 50 milliseconds. The one-shot is also reset on powerup.

3.3 Memory

The firmware program is stored in two, 2764 8K byte EPROMs, U19 and U20. The program steps and data contained in these devices are accessed by the chip selects from U28 to each EPROM, gated onto the data bus with an output enable from the RD signal.

The information stored in the EPROMs is part of the RF-1310 software and cannot be altered by the customer.

CAUTION

EPROMs are ultraviolet erasable over extended periods of exposure to fluorescent light or sunlight which can erase the memory information. Do not remove the opaque protective shield on these devices.

The 6116 2K byte static CMOS RAM (U18) contains the channel storage. A fully charged battery, BT1, in the backup power supply should maintain channel storage for one month. In normal exciter operation, the trickle charge circuit will recharge a dead battery in 24 hours. Terminals E1-E2, left unjumpered, isolate the battery from the board circuitry for prolonged storage without maintaining channel memory to prevent battery discharge. However, E1 and E2, must be connected prior to operating the exciter to provide the battery backup provision, and to avoid damage to U18.

3.4 Parallel Input/Output

The 8255A U13 provides 22 lines of interface through two output ports and one input port which handle a variety of exciter controls and functions. The functions and modules associated with each port are shown in table 2.

Table 2. 8255A Port to Module Correlation

Port	Associated Module
PA OUTPUT	Post Selector, Rear Panel, System Interface, Carrier Generator, Combiner, Audio Assembly, and A14 Serial Data Generation Circuitry.
PB INPUT	Rear Panel, System Interface, A14 Keyline Circuitry, and A14 A-to-D Converter (U21).
PC OUTPUT	Rear Panel and A14 Parallel/Serial Conversion Circuitry.

3.5 Parallel/Serial Conversions

Four, 4021 type parallel-to-serial converters, U6, U10, U15, and U25 handle the parallel-to-serial conversions that take place on Control Board Assembly A14. When one group of eight parallel inputs needs to be read in, the appropriate converter is selected by multiplexer U11. A pulse is then generated through U17 to that converter to latch the parallel information into its buffers. The front serial clock is then used to clock the eight bits of information from that 4021 into the processor through the CPU SID line. Converters U6, U15, and U25 are used to read in BITE status lines and U10 reads in the options select switch S2. (See paragraph 4.) Table 3 lists the modules affected by each parallel-to-serial converter.

3.6 Serial Output

Most of the control signals within the RF-1310 Exciter are sent serially from the A14 assembly. The serial data transmission circuitry consists of U12, U13, and U17. The data to be written out is loaded into U17 and clocked out as either front data or rear data by a clock generated through an output port on U13. Front serial data and clock signals control the front panel and display assembly functions. All other assemblies are controlled by the rear serial data and clock. All assemblies controlled by each serial control line receive the same data simultaneously. Address signals and strobe pulses generated by U16 are used to gate the data into the individual assemblies.

3.7 Analog Inputs

Analog-to-digital (A/D) converter U21 handles all the analog inputs to the A14 assembly. With a few exceptions, the majority of these inputs are used for BITE testing. Most are generated on the assemblies involved with audio and RF signal processing and reflect the signal level at the output of the individual

Table 3. Parallel/Serial Converter Modules

Converter	Module Affected
U10	Options Switch S2
U15	Front Panel Signals, PB0 through PB4 Combiner, Serial Check, and PLL 3 - Serial Check/Lock
U6	PLL 1 Lock, PLL 4 Lock Reference Generator 800 kHz, 1 MHz, 40 MHz Locks PLL 2 Serial Check/Lock
U25	Carrier Generator - 45 MHz Lock/Lock 1 Lock 2 Serial Check 1/Serial Check 2 Audio Assembly/Serial Check PLL 5 Serial Check/Lock

assemblies. Two other lines are used as a postselector indicator line and a line which indicates the combiner assembly option as installed. In order to maintain a high degree of accuracy, the A/D converter is powered off its own + 5 volt reference VR1. The EOC line of the A/D converter is read back through an input port of the 8255A U13 and is used during BITE to verify the conversion time of the A/D converter.

4. PROGRAMMABLE OPTIONS SELECTIONS

Automatic Level Control (ALC), Voice Activated Keying (VOX), and the desired FSK shift are selected at the options selection switch S2. S2 is located near the top edge of the A14 assembly. The desired selections are then programmed into the exciter via pushbutton switch S1. S1 is located near the bottom edge of the A14 PWB between J8 and J9. ALC operation is enabled or disabled individually at S2 for each of the six audio inputs. ALC Hangtime is programmed for VOICE (one second) or DATA (fifty milliseconds) on AUX 1 and AUX 2. VOX operation is available for USB, AM, AFSK, and 2ISB. The FSK shift can be set for 85 Hz, 170 Hz, 425 Hz, or 850 Hz.

The options are selected by setting the individual switches of S2 to the desired positions as described in the following tables and example procedure. The selected parameters are retained in the exciter's CMOS RAM. Memory protection is provided by a back up battery.

Switch S2, positions 1 and 2 are used to select the ALC, ALC Hangtime/VOX or FSK frequency shift option group as summarized in table 4. When programming the ALC option group, positions 3 through 8 of S2 are used to select ALC on or off for each of the audio inputs as listed in table 5. For ALC Hangtime/VOX option, positions 4 and 5 select VOICE or DATA operation for AUX 1 and/or AUX 2 inputs. VOX operation for all USB audio inputs is turned on or off at S2 position 8, as shown in table 6. To select the desired FSK frequency shift, S2 positions 3 and 4 should be set as shown in table 7. (NOTE: For all frequency shift options, S2 positions 5 through 8 are in the closed position.)

Table 4. General Options Available

Options Group	S2 Positions		Description
	S2-1	S2-2	
ALC	C	C	When the ALC option group is selected, switches S2-3 through S2-8 control whether the ALC operation for a particular audio input is on or off.
ALC HANGTIME/VOX	C	O	Switches S2-4 and S2-5 select an ALC HANGTIME for VOICE or DATA operation on inputs AUX 1 and AUX 2 (Closed = DATA; Open = VOICE). S2-8 enables or disables the VOX option for all USB audio inputs. (S2-8; Closed = VOX OFF; Open = VOX ON)
FSK FREQUENCY SHIFT	O	C	S2 positions -3, and -4 select FSK Freq. Shift option per Table 7.

O = Switch section in open position
C = Switch section in closed position

Table 5. ALC Options

Note: S2-1 and S2-2 closed

Switch Position	S2-3	S2-4	S2-5	S2-6	S2-7	S2-8
O = ALC OFF C = ALC ON	AUX 3	AUX 2	AUX 1	LSB	USB	MIC

O = Switch section in open position
C = Switch section in closed position

Table 6. ALC Hangtime (Aux 1 and Aux 2)/VOX Options (All USB Inputs)

Note: S2-1 Closed, S2-2 Open

Switch Position	S2-3	S2-4	S2-5	S2-6	S2-7	S2-8
O = VOICE C = DATA	----	AUX 2	AUX 1	----	----	VOX available for all Audio Inputs: On = Open Off = Closed

O = Switch section in open position
C = Switch section in closed position

Table 7. FSK Frequency Shift

Note: S2-1 Open, S2-2 Closed

Switch Position	S2-3	S2-4	S2-5	S2-6	S2-7	S2-8
Shift Frequency						
85 Hz (± 42 Hz)	C	C	C	C	C	C
170 Hz (± 85 Hz)	O	C	C	C	C	C
425 Hz (± 212 Hz)	C	O	C	C	C	C
850 Hz (± 425 Hz)	O	O	C	C	C	C

O = Switch section in open position
C = Switch section in closed position

4.1 Programming Options

4.1.1 Programming for ALC Operation:

a. Close S2-1 and S2-2. This will place you in the ALC mode.

b. Select desired audio inputs. Close or open the applicable switch(es) per table 5.

S2-3 = AUX 3
S2-4 = AUX 2
S2-5 = AUX 1
S2-6 = LSB
S2-7 = USB
S2-8 = MIC

c. Depress S1 to enter the selection into memory.

4.1.2 Programming ALC Hangtime/VOX Operation:

a. To set the ALC Hangtime on Aux 1 and Aux 2, position S2-1 to the closed position and open S2-2.

b. Select ALC Hangtimes required for programming:

VOICE (1 second = switch position open)
DATA (50 milliseconds = switch position closed)
Close or open the applicable switch positions per table 6.

AUX 1 = S2-5
AUX 2 = S2-4

Note: VOX operation is available for USB, AM, AFSK, and 2ISB.

c. Select VOX operation on the above selected audio inputs;

S2-8 open = VOX on
S2-8 closed = VOX off

d. Depress S1 to enter the selection into memory.

4.1.3 Setting the FSK Frequency Shift Options:

a. Position S2-1 open and S2-2 closed.

b. Using table 7, determine the desired shift frequency and position S2-3 and S2-4 to the proper settings.

Note: S2-5, -6, -7, and -8 should be in the closed position when setting frequency options.

c. Depress S1 to enter the selection into memory.

NOTE

If data in the CMOS RAM is lost or corrupted, all options should be reprogrammed to ensure desired selections are used.

5. MAINTENANCE

CAUTION

Battery BT1 is in the circuit. Shorting this battery could result in severe circuit damage.

5.1 Alignment

Control Board Assembly A14 requires no adjustment to properly operate.

5.2 Troubleshooting

Although most of the circuitry on this assembly is controlled directly or indirectly by the microprocessor, a practice of standard digital troubleshooting methods alone will isolate most faults to the component level. A logic high is the level between 3 and 5 volts, and a proper logic low is typically between 0 and 1 volt. The circuit area involved in minor faults can be determined by BITE fault codes or by using paragraph 3 of this subsection. More general or major failures are best handled by following the instructions outlined in the following paragraphs.

5.2.1 CPU

If the microprocessor is running, it is capable of debugging several circuits on the A14 assembly by itself. However, first determine if the 8085AH-2 is operating.

These CPU input signals must be present in order for the device to run:

- U24-1, 2 Crystal inputs - 6 MHz

- U24-36 Reset input - High
- U24-6 Trap input - Low
- U24-35 Ready - High
- U24-39 Hold - Low

The A14 assembly + 5 volt supply should be between + 4.75 and + 5.1 volts. The following CPU outputs should be present:

- U24-37 Clock Out 3 MHz square wave
- U24-3 Reset out low
- U24-31 Write active-low pulses
- U24-32 Read active-low pulses
- U24-30 Address latch enable active-high pulses
- U24-4 SOD active-low pulses at 1 millisecond intervals

When the CPU is running and executing the application software, its outputs will only be active a portion of each millisecond. The rest of the time it will stop, waiting for a real-time clock interrupt from U9.

5.2.2 Trap and Reset Circuits

The trap circuit is provided to restart the CPU in the software if the device loses synchronization due to high noise levels on its busses. One-shot U27 is retriggered before timeout from U24, pin 4, the SOD output. The software will generate a low-active pulse every millisecond if it is working properly and if it gets the real-time clock interrupt. Low voltage on the + 5 supply to this board will cause the processor to reset due to the reset circuit Q2-Q5.

5.2.3 Device Selection

Address decoders U28 and U30 aid the access of devices through the data bus by outputting low-active chip enable signals corresponding to the address on the high-order bits of the CPU. During normal operation, the enables from U28 and U29 should be seen on pin 20 of U19, U20, U18, and U13-6.

5.2.4 Memory Circuits

It can be very difficult to troubleshoot memory problems if the 8085AH-2 is not operating. If the CPU is running, it can find some problems itself. If the BITE routine indicates a PROM checksum fault, the fact that it is running indicates that the data bus buffers are operating and the PROMs are accessed. However, invalid data in these devices would require replacement of PROMs U19 and U20.

If the BITE routine indicates a CMOS RAM fault, check that the enable pulse is getting to RAM U18, and check the voltage on U18-24. FET Q2 is driven by an enable from U30 as a switch to select U18. The chip enable should put the U2 gate at + 5 V unregulated to turn on the switch. The CMOS RAM is not connected directly to the + 5 V supply, and E1-E2 must be jumpered to avoid damaging the RAM when the power is turned on.

5.2.5 Real-Time Clock

The real time clock circuitry originates from the 3 MHz clock output of CPU U24-37. This is first divided down to 11.72 kHz by counter U8, then fed into U9 to reach the final frequency of 977 Hz. This 977 Hz has become the real time clock and is fed back to the processor as an interrupt through U24-7. Any problems with the real time clock operation can be isolated to a check of this circuitry.

5.2.6 Serial Out

The A14 assembly communicates with the display control board through its serial output circuit (U12, U13, and U17). If this circuit fails, the display will light up but will never change from its power up lamp test.

When the A14 assembly is operating normally, it will attempt to update the complete display once every second. Every second there will be a burst of 64 bytes to the display control board. (2 bytes of serial data sent every millisecond for a 32 millisecond total duration). Following every 2 bytes will be a strobe pulse to the display control board from U16-13.

The BITE routine tests the serial output circuit by sending a test pattern to the four PLLs and the two carrier generator PLLs, and then reading back a test bit from each. If it can set (high) and reset (low) all these test bits, it assumes that the serial output circuit on the A14 assembly is operating. If any one test bit cannot be set and reset, it assumes a problem with that PLL. Table 8 lists the serial data transmission circuit signals.

Table 8. Serial Data Transmission Circuit Signals

Signal	Description
U12-6	Rear serial clock
U12-11	Front serial clock
U13-17	Clock Frequency (software generated)
U13-38	Serial clock select: • High when sending rear serial data • Low when sending front serial data
U17-7, U12-8	Rear serial data
U17-9	Front serial data
U16-4 through 19	Assembly serial strobes, narrow active high pulses clock data on to the assembly being controlled

5.2.7 Serial In

All parallel/serial conversions take place through U6, U10, U16, U25, U11, U13, and U24. Converter U10 is used to read the options select switch, and the remaining converters are used to read in the BITE lines. If any of the logic lines that are read on the parallel sides of these converters end up showing as an error in BITE and are correct as inputs, then this parallel/serial conversion circuitry can be suspected. Signals involved in this circuitry are listed in table 9.

Table 9. Serial In Signals

Signal	Description
U11-9, 10, 11	MUX select - Active high determines which converter will be read in
U6-10, U15-10, U25-10, U10-10	Front serial clock - Clocks data out of converters and into MUX
U6-9, U15-9, U25-9, U10-9	Read line - Active high latches parallel information into 4021 buffers
U6-3, U15-3, U25-3, U11-2, U11-12, U11-14	Serial data in - 8 bits of serial data corresponding to parallel information

5.3 Keylines

All exciter keylines are handled through optoisolators U1 and U3, gate U2, and U13. No signals in the circuitry will be observed unless one of the keylines external to the exciter is activated. If a specific keyline has failed, its corresponding diode CR1 through CR4 should be checked. From there, a low on the opto output should be observed, and then the proper level on the corresponding output gate of U2, followed all the way into U13. If none of the keylines are functioning, there may be a problem with the internal keyline, making U13 suspect.

5.4 Parallel I/O

Parallel I/O is centralized through the ports on U13. If there is a BITE or operation problem concerning the modules controlled by the lines from these parallel circuits, but the module in question is not at fault, there may be a failure in the ports. Failure of proper A/D conversions or lack of any Internal Key signals are just a few signs that could indicate a defective U13.

5.5 Analog Conversions

A/D converter U21 is used primarily during BITE to read in and test the analog output levels of individual signal path assemblies. Starting any conversion consists of two writes to U21, narrow high-active pulses on U21-16. Ten microseconds (or less) later, the end-of-conversion (EOC) line will go low. It will stay low for 100 microseconds and after it goes high again there will be one narrow high-active pulse on U21-21. At that point, the digital version of the input signal read will be transferred on the data bus to the CPU. The above is true for all the other analog inputs sampled during the execution of BITE. Table 10 lists signals of the analog input circuit.

5.6 BITE Detected Faults

The faulting areas on the A14 assembly detectable through BITE are listed in table 11.

6. PARTS LIST, COMPONENT LOCATIONS, AND SCHEMATIC DIAGRAM

All replaceable components of Control Board Assembly A14 are listed in table 12. Component locations are shown in figure 3. Figure 4 is a schematic of the control board circuit.

Table 10. Analog Input Circuit Signals

Signal	Description
U8-1	Clock in - 3 MHz TTL square wave
U8-4	Clock Out - 750 kHz TTL square wave
U21-22	Clock in - 750 kHz TTL square wave
U21-16, 32	Start conversion - Two narrow high going pulses, every time a conversion is initiated
U21-13	End of Conversion - 85 microseconds low, at the completion of a conversion
U21-21	Output enable - narrow high going pulse.
U21-15, 18	Multiplexer out, comparator in

Table 11. BITE Detected Faults

Fault	Description
Fault 01	PROM failure: The binary checksum calculated from the contents of programmed U19 and U20 do not match the value programmed by the factory. Validity of firmware is doubtful, and after some initial checks, consideration should be given to replacing both devices.
Fault 02	Parallel/Serial conversion error: Error was detected in the reading in and shift of the test level (0 Vdc) at pin 8 of U6, U10, U15, and U25. Check these and U11 and U13.
Fault 03	CMOS RAM failure: Errors are found in the ability to store and retrieve data in U18. Check U18, check E1-E2 jumpering, BT1, Q2, and associated circuits.
Fault 04	Serial data input failure: Faulty serial input is detected. Check U12, U13, and U17.
Fault 05	Keyline logic failure: Error reading in the proper keyline closure. Check U1, U2, U12, and U13.
Fault 06	I/O Failure: Error detected in controlling U13. Replace U13.
Faults 07, 08, and 09	A/D failure: Failure in correctly making A-to-D conversions. Check U21, VR1, and U13. Check that all analog inputs to U21 are between 0 volts and 5 volts.

Table 12. Control Board Assembly A14 Parts List

Ref. Desig.	Part Number	Description
A14	10121-2800	CONTROL BOARD ASSEMBLY
	10121-8502	SOFTWARE KIT
	J65-0008-103	PLUG SHORTING 2-PIN FEM
	J46-0042-103	JUMPER HEADER
BT1	B41-0009-004	BATTERY
C1	C26-0010-221	CAP 220UF 20% 10V TANT
C2	M39014/02-1310	CAP .1UF 10% 100V CER-R
C3	C26-0010-221	CAP 220UF 20% 10V TANT
C4	C26-0010-221	CAP 220UF 20% 10V TANT
C5	C26-0010-221	CAP 220UF 20% 10V TANT
C6	M39014/02-1310	CAP .1UF 10% 100V CER-R
C7	M39014/02-1310	CAP .1UF 10% 100V CER-R
C8	M39014/02-1310	CAP .1UF 10% 100V CER-R
C9	M39014/02-1310	CAP .1UF 10% 100V CER-R
C10	M39014/02-1310	CAP .1UF 10% 100V CER-R
C11	M39014/02-1310	CAP .1UF 10% 100V CER-R
C12	M39014/02-1310	CAP .1UF 10% 100V CER-R
C13	M39014/02-1310	CAP .1UF 10% 100V CER-R
C14	M39014/02-1310	CAP .1UF 10% 100V CER-R
C15	M39014/02-1310	CAP .1UF 10% 100V CER-R
C16	M39014/02-1310	CAP .1UF 10% 100V CER-R
C17	M39014/02-1310	CAP .1UF 10% 100V CER-R
C18	C26-0010-680	CAP 68UF 20% 10V TANT
C19	C26-0010-680	CAP 68UF 20% 10V TANT
C20	C26-0010-680	CAP 68UF 20% 10V TANT
C21	M39014/02-1310	CAP .1UF 10% 100V CER-R
C22	M39014/02-1310	CAP .1UF 10% 100V CER-R
C23	M39014/02-1310	CAP .1UF 10% 100V CER-R
C24	M39014/02-1310	CAP .1UF 10% 100V CER-R
C25	M39014/02-1310	CAP .1UF 10% 100V CER-R
C26	M39014/02-1310	CAP .1UF 10% 100V CER-R
C27	M39014/02-1310	CAP .1UF 10% 100V CER-R
C28	M39014/02-1310	CAP .1UF 10% 100V CER-R
C29	C25-0001-313	CAP 100UF 20% 20V TANT
C30	C26-0035-159	CAP 1.5UF 20% 35V TANT
C31	C26-0016-150	CAP 15UF 20% 16V TANT
C32	C26-0050-479	CAP 4.7UF 20% 50V TANT
C33	C26-0050-479	CAP 4.7UF 20% 50V TANT
C34	C26-0050-109	CAP 1.0UF 20% 50V TANT
CR1	1N4454	DIODE 200mA 75V SW
CR2	1N4454	DIODE 200mA 75V SW
CR3	1N4454	DIODE 200mA 75V SW
CR4	1N4454	DIODE 200mA 75V SW
CR5	1N4454	DIODE 200mA 75V SW
CR6	1N4454	DIODE 200mA 75V SW

Table 12. Control Board Assembly A14 Parts List (Cont.)

Ref. Desig.	Part Number	Description
CR7	1N4454	DIODE 200mA 75V SW
CR8	1N4454	DIODE 200mA 75V SW
CR9	1N4454	DIODE 200mA 75V SW
CR10	1N4454	DIODE 200mA 75V SW
J1	J46-0032-004	CONN, 4 PIN
J2	J46-0013-014	CONN, 14 PIN
J3	J46-0032-010	HEADER, 10 PIN DISCRETE
J4	J46-0013-020	HEADER, PROTECTED, 20 PIN
J5	J46-0032-008	CONN,8 PIN
J6	J46-0034-008	CONN, 8 PIN
J7	J46-0032-008	CONN,8 PIN
J8	J46-0034-008	CONN, 8 PIN
J9	J46-0034-012	CONN, 12 PIN
J10	J46-0034-008	CONN, 8 PIN
J11	J46-0031-020	CONN 20 PIN
J12	J46-0034-008	CONN, 8 PIN
J13	J46-0031-024	CONN,24 PIN
J14	J46-0031-016	CONN, 16 PIN
J15	J46-0013-040	HDR PROTECTED 40 PIN
JMP1	MP-1142	CIRCUIT JUMPER
L1	10073-7034	INDUCTOR, 440UH
L2	10073-7034	INDUCTOR, 440UH
L3	10073-7029	INDUCTOR, FILTER CHOKE
L4	L-0644	COIL 220UH 10% FXD RF
L6	10073-7034	INDUCTOR, 440UH
Q1	2N2222A	XSTR SS/GP NPN TO-18
Q2	3N170	XSTR MOSFET
Q3	2N2907A	XSTR SS/GP PNP TO-18
Q4	2N2907A	XSTR SS/GP PNP TO-18
Q5	2N2222A	XSTR SS/GP NPN TO-18
R1	R65-0004-561	RES,560 5% 1/2W CAR FILM
R2	R65-0004-331	RES,330 5% 1/2W CAR FILM
R3	R65-0004-331	RES,330 5% 1/2W CAR FILM
R4	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R5	R65-0004-331	RES,330 5% 1/2W CAR FILM
R6	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R7	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R8	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R9	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R10	R65-0003-102	RES,1.0K 5% 1/4W CAR FILM
R11	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R12	R50-0010-104	RES,10SIP,100K,2.0%, 9RES
R13	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R14	R65-0003-512	RES,5.1K 5% 1/4W CAR FILM
R15	R65-0003-154	RES,150K 5% 1/4W CAR FILM
R16	R65-0003-512	RES,5.1K 5% 1/4W CAR FILM

Table 12. Control Board Assembly A14 Parts List (Cont.)

Ref. Desig.	Part Number	Description
R18	R50-0010-103	RES,10SIP, 10K,2.0%, 9RES
R19	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R20	R65-0003-184	RES,180K 5% 1/4W CAR FILM
R21	R65-0003-184	RES,180K 5% 1/4W CAR FILM
R22	R65-0003-512	RES,5.1K 5% 1/4W CAR FILM
R23	R50-0010-104	RES,10SIP,100K,2.0%, 9RES
R24	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R25	R50-0010-103	RES,10SIP, 10K,2.0%, 9RES
R26	R50-0010-103	RES,10SIP, 10K,2.0%, 9RES
R27	R65-0003-223	RES,22K 5% 1/4W CAR FILM
R28	R65-0003-223	RES,22K 5% 1/4W CAR FILM
R29	R65-0003-223	RES,22K 5% 1/4W CAR FILM
R30	R50-0010-104	RES,10SIP,100K,2.0%, 9RES
R31	R50-0010-103	RES,10SIP, 10K,2.0%, 9RES
R32	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R33	R65-0003-473	RES,47K 5% 1/4W CAR FILM
R34	R65-0003-333	RES,33K 5% 1/4W CAR FILM
R35	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R36	R65-0003-272	RES,2.7K 5% 1/4W CAR FILM
R37	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R38	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R39	R65-0003-473	RES,47K 5% 1/4W CAR FILM
R40	R65-0003-122	RES,1.2K 5% 1/4W CAR FILM
R41	R65-0003-204	RES,200K 5% 1/4W CAR FILM
R42	R65-0003-243	RES,24K 5% 1/4W CAR FILM
R43	R65-0003-114	RES,110K 5% 1/4W CAR FILM
S1	S06-0002-100	SW PB SPST NO MOM BLK PCT
S2	S50-0001-008	SW SPST 8SEC .1A SLD DIP
S3	S06-0002-100	SW PB SPST NO MOM BLK PCT
U1	I75-0007-000	IC MCT6 OPTOCOUPLER 8P
U2	I01-0000-012	IC 4023B PLASTIC CMOS
U3	I75-0007-000	IC MCT6 OPTOCOUPLER 8P
U6	I01-0000-153	IC 4021B PLASTIC CMOS
U7	I05-0000-004	IC 74LS04 PLASTIC TTL
U8	I05-0000-393	IC 74LS393 PLASTIC TTL
U9	I05-0000-092	IC 74LS92 PLASTIC TTL
U10	I01-0000-153	IC 4021B PLASTIC CMOS
U11	I05-0000-151	IC 74LS151 PLASTIC TTL
U12	I05-0000-000	IC 74LS00 PLASTIC TTL
U13	I59-0008-001	IC 8255 PLASTIC
U14	I05-0000-004	IC 74LS04 PLASTIC TTL
U15	I01-0000-153	IC 4021B PLASTIC CMOS
U16	I01-0000-202	IC 4514B PLASTIC CMOS
U17	I05-0000-165	IC 74LS165 PLASTIC TTL
U18	I26-0010-001	IC STATIC RAM CMOS 2048X8

Table 12. Control Board Assembly A14 Parts List (Cont.)

Ref. Desig.	Part Number	Description
U19	SEE NOTE	PROM, PROGRAMMED
U20	SEE NOTE	PROM, PROGRAMMED
U21	I40-0010-001	IC ADC0817 PLASTIC CMOS
U22	I05-0000-373	IC 74LS373 PLASTIC TTL
U23	I05-0000-245	IC 74LS245 PLASTIC TTL
U24	I27-0006-001	IC 8085A MICRO 8-BIT PLA
U25	I01-0000-153	IC 4021B PLASTIC CMOS
U26	I01-0017-000	IC 7432 PLASTIC TTL
U27	I05-0000-122	IC 74LS122 PLASTIC TTL
U28	I05-0000-138	IC 74LS138 PLASTIC TTL
U29	I05-0000-000	IC 74LS00 PLASTIC TTL
U30	I05-0000-139	IC 74LS139 PLASTIC TTL
VR1	I12-0006-005	IC VR 78L05A +5V .10A 4%
VR2	1N5223B	DIODE, 2.7V 1/2W
XU19	J77-0008-006	SKT IC MACH 28 PIN
XU20	J77-0008-006	SKT IC MACH 28 PIN
XU24	J77-0008-007	SKT IC MACH 40 PIN
Y1	Y15-0004-060	CRYSTAL, 6MHZ

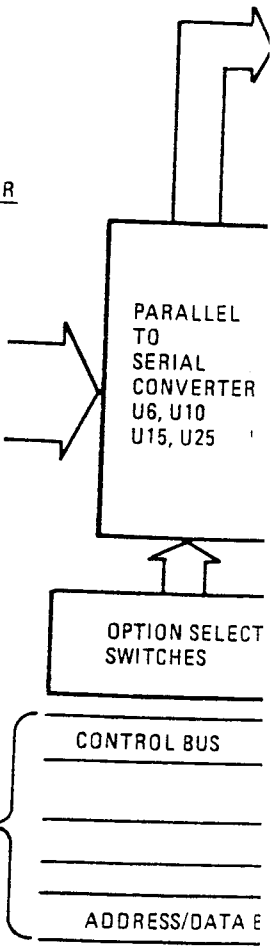
NOTE

Part numbers for U19 and U20 are 10121-8XXX-X where XXX-X is the four character software kit code found on the PROM label. For example, if the code is 501C, the part number for the programmed PROM is 10121-8501C. The kit includes both PROMS.

SIG	FROM	CONNECTOR
AUX PTT	J10	J2
AUX CW	J10	J2
PTT KEY	A13A3	J7
CW KEY	A13A3	J7

SIG	FROM	CONNECTOR
FILTER I.D.	A19	J3
A1 OUTPUT DET	A1	J4
A2 BITE DET	A2	J5
IF ENVELOPE	A4	J9
COMBINER I.D.	A4	J9
USB ALC BITE	A5	J13
LSB ALC BITE	A5	J13
USB IF BITE	A5	J13
LSB IF BITE	A5	J13
A11 BITE DET	A11	J14

SIG	FROM	CONNECTOR
PLL 1 LOCK	A6	J5
PLL 4 LOCK	A9	J5
800 KHZ DET	A12	J5
1 MHZ DET	A12	J5
40 MHZ DET	A12	J5
PLL 2 LOCK	A7	J6
PLL 2 SER CHK	A7	J6
A4 SER CHK	A4	J9
PLL 3 LOCK	A8	J10
PLL 3 SER CHK	A8	J10
PLL 5 LOCK	A10	J12
PLL 5 SER CHK	A10	J12
A5 SER CHK	A5	J13
A11 45 MHZ CHK	A11	J14
A11 LOCK DET 1	A11	J14
A11 LOCK DET 2	A11	J14
A11 SER CHK 1	A11	J14
A11 SER CHK 2	A11	J14



SIG	FROM	CONNECTOR
AUX PTT	J10	J2
AUX CW	J10	J2
PTT KEY	A13A3	J7
CW KEY	A13A3	J7

SIG	FROM	CONNECTOR
FILTER I.D.	A19	J3
A1 OUTPUT DET	A1	J4
A2 BITE DET	A2	J5
IF ENVELOPE	A4	J9
COMBINER I.D.	A4	J9
USB ALC BITE	A5	J13
LSB ALC BITE	A5	J13
USB IF BITE	A5	J13
LSB IF BITE	A5	J13
A11 BITE DET	A11	J14

FROM	CONNECTOR
A6	J5
A9	J5
A12	J5
A12	J5
A12	J5
A7	J6
A7	J6
A4	J9
A8	J10
A8	J10
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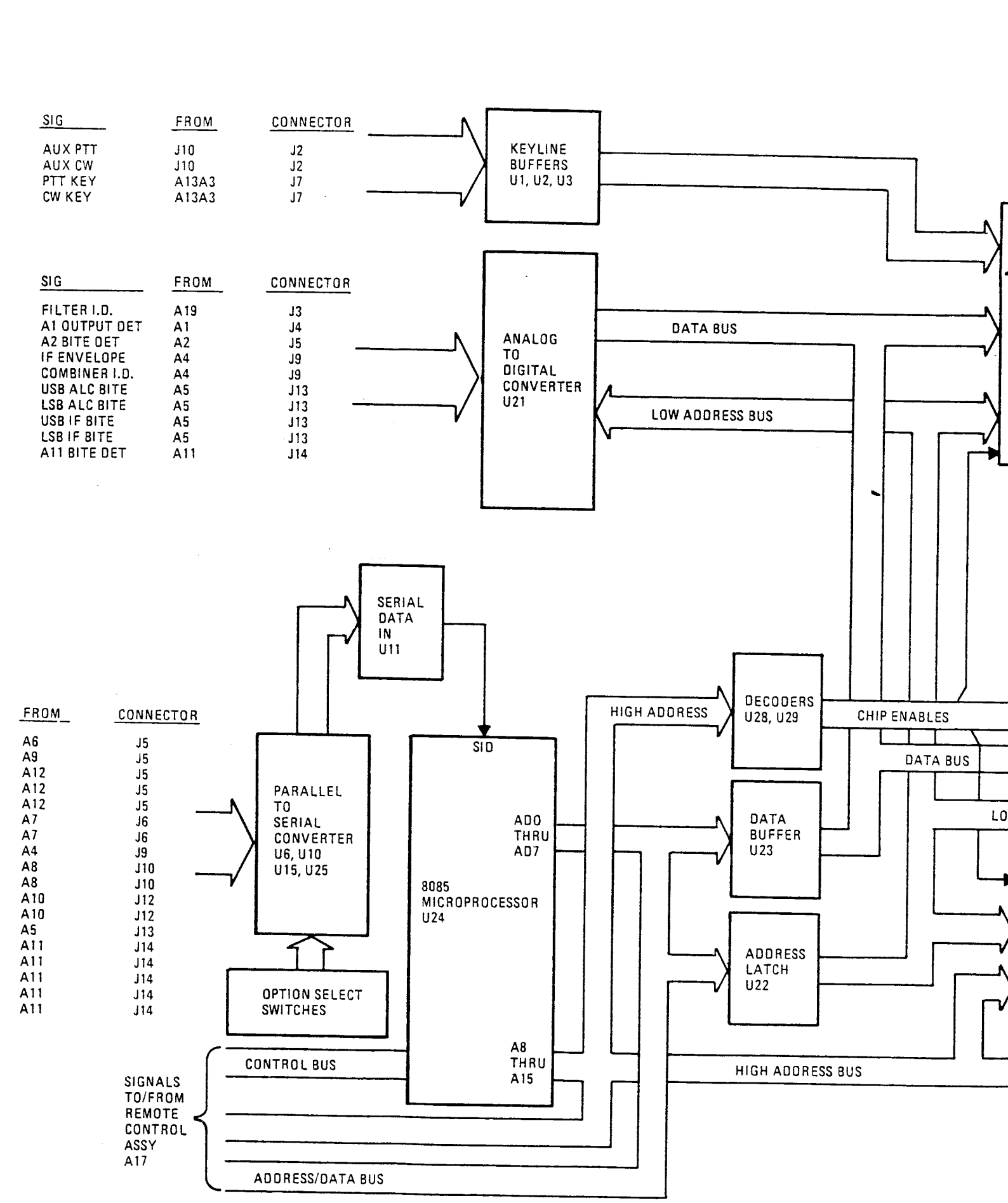
A11	J14
A11	J14



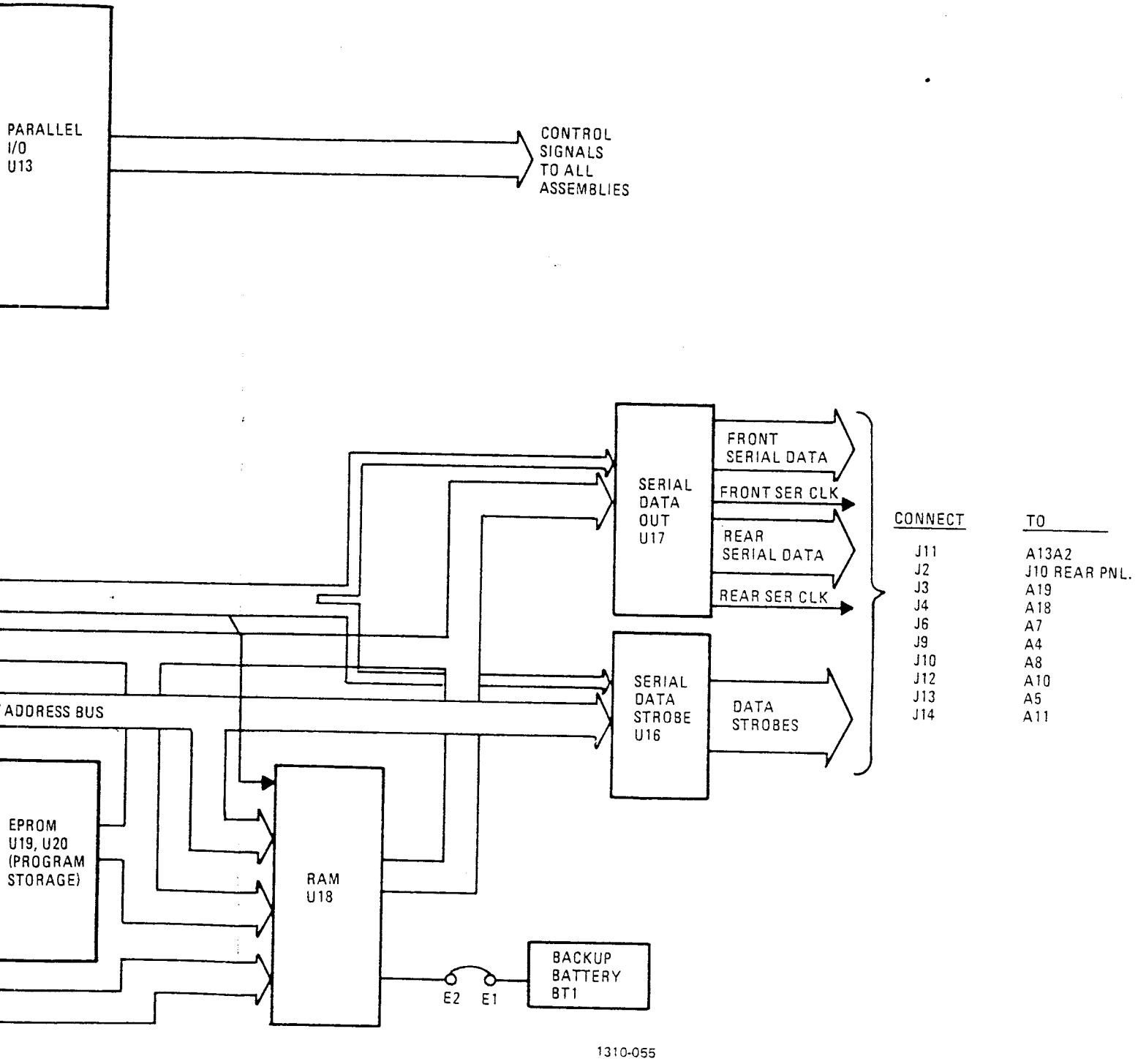
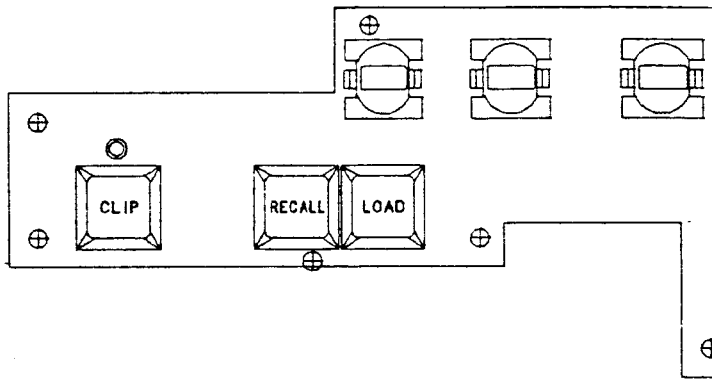
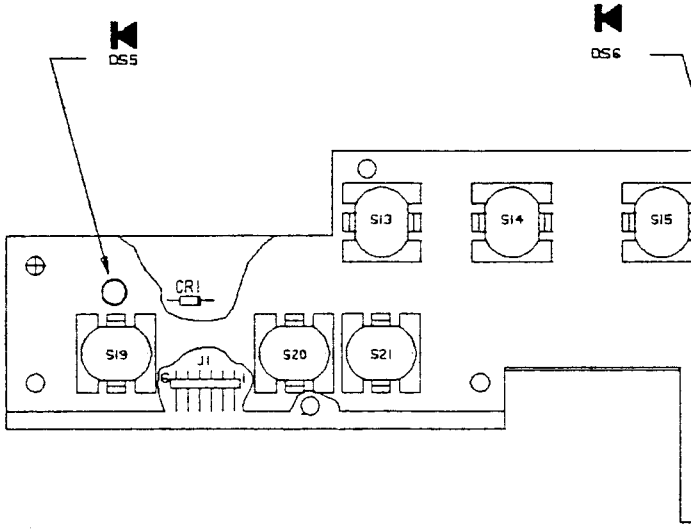
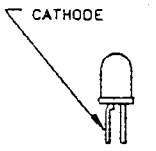


Figure 2. Control Board Assembly A14 Functional Block Diagram







VIEW I
NO SCALE

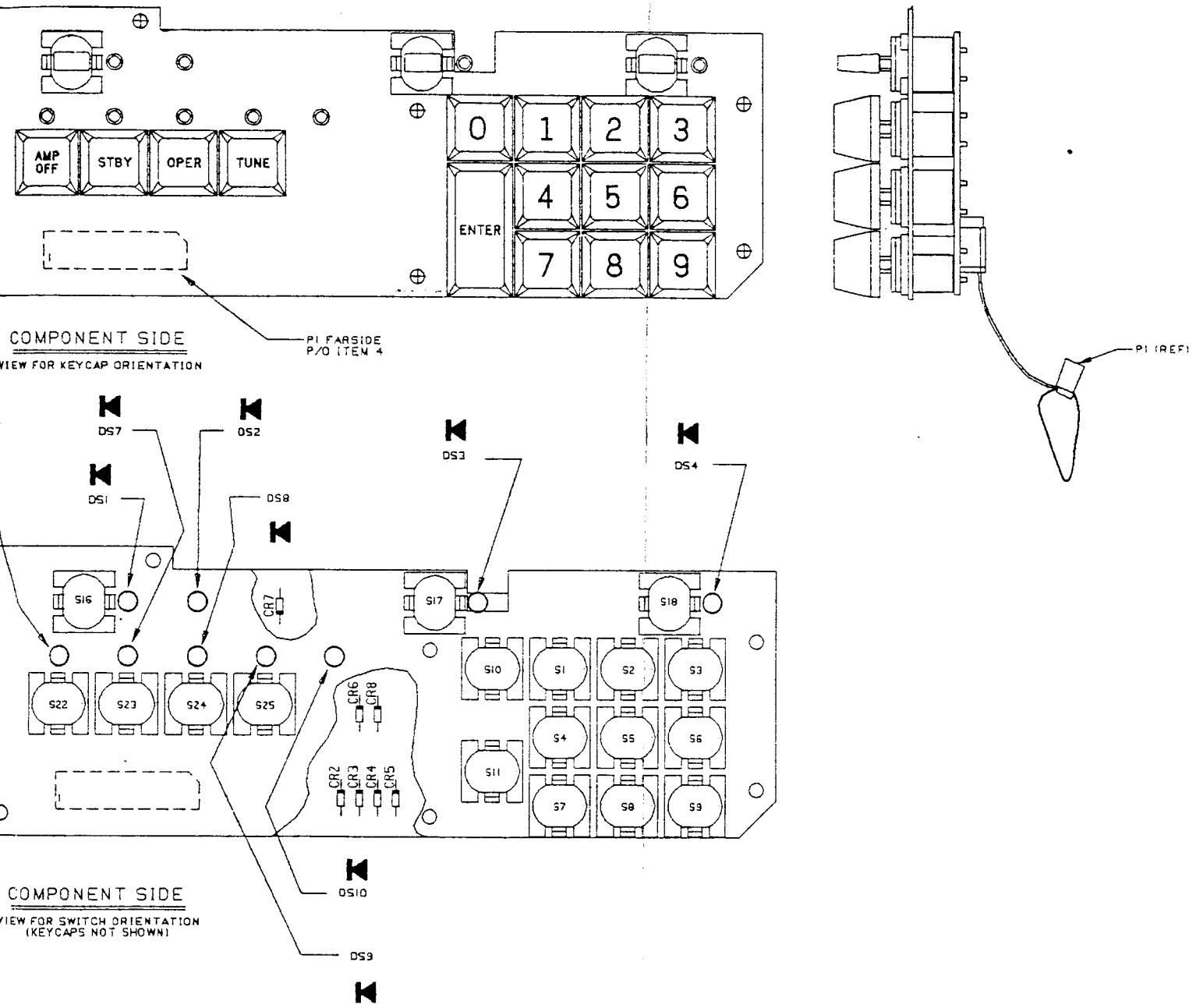
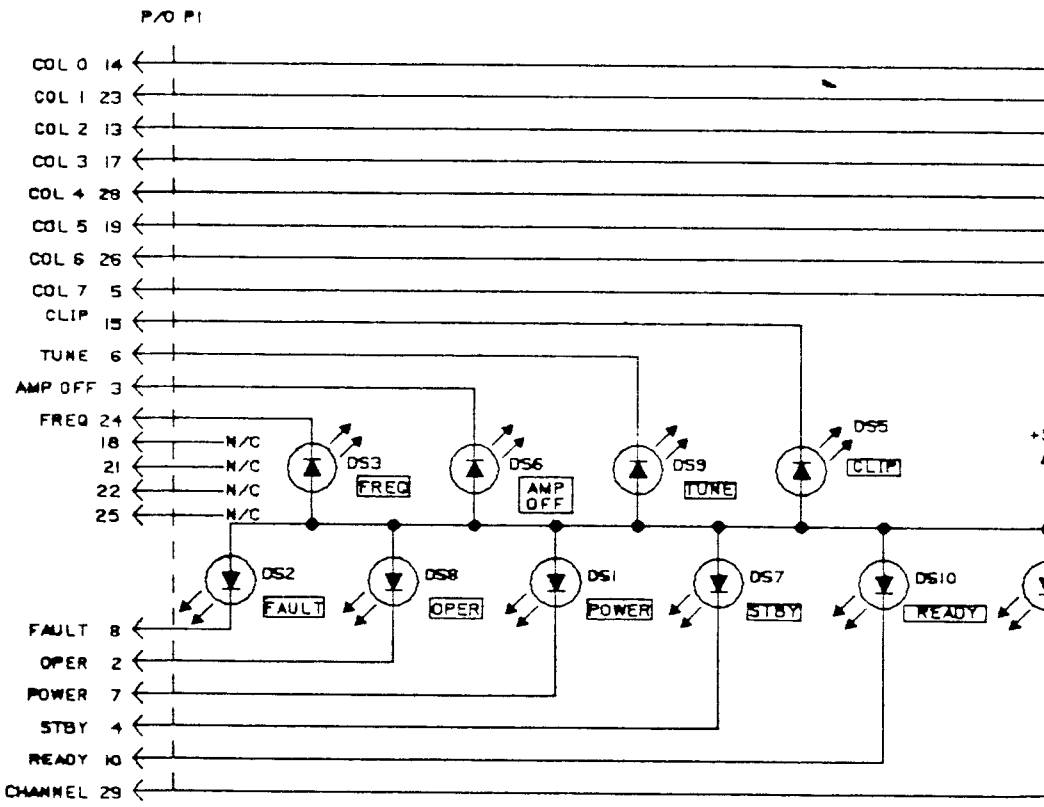


Figure 4. Front Panel Switchboard Assembly A13A1 Component Location Diagram (10121-2100)

NOTE: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR A COMPLETE DESIGNATION, PREFIX WITH UNIT NO. AND/OR ASSEMBLY NO. DESIGNATION.
2. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY. COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST.
3. ☐ INDICATES FRONT PANEL MARKING.
4. CR1-CR8 ARE IN4454.



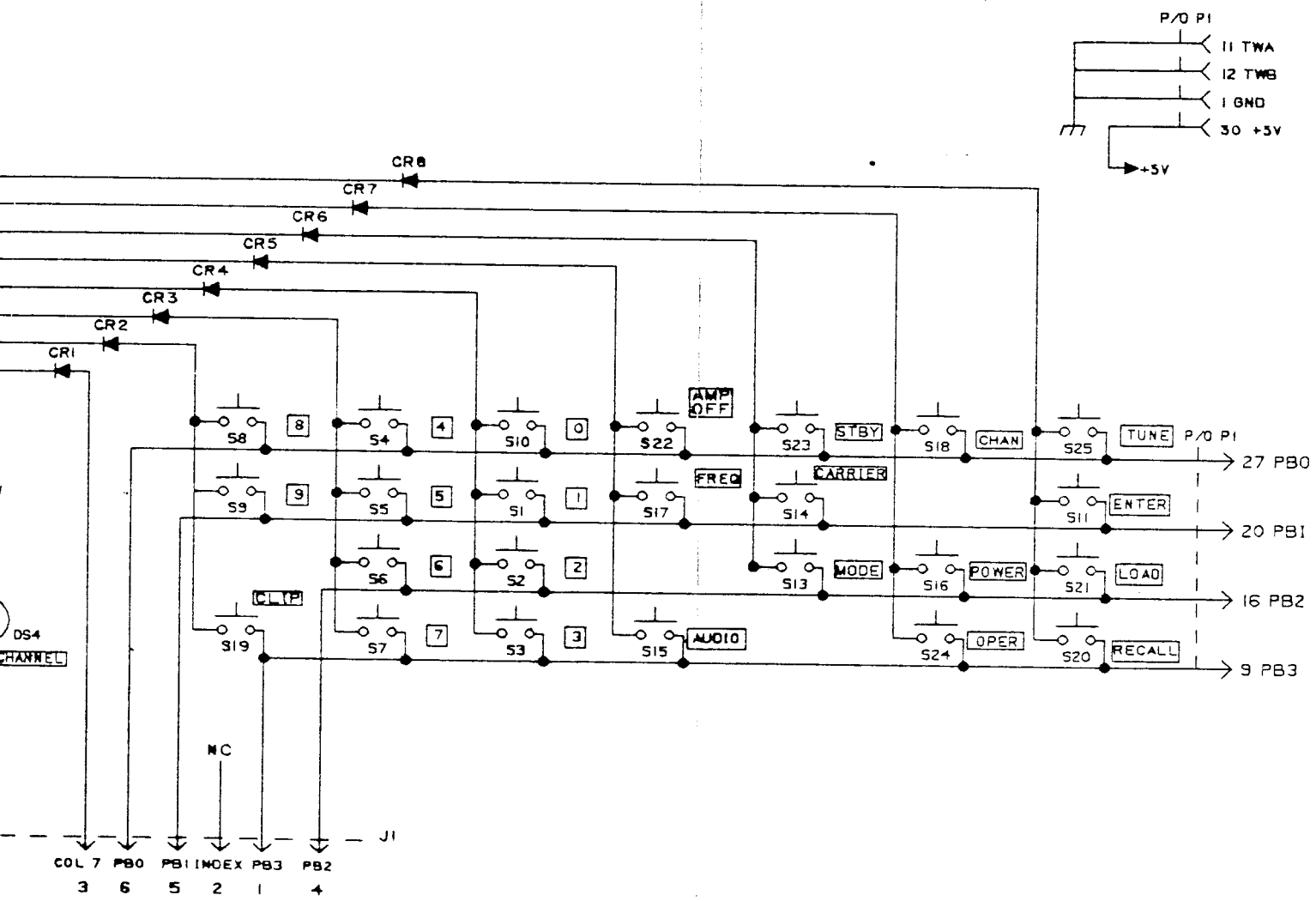


Figure 5. Front Panel Switchboard Assembly A13A1 Schematic Diagram (10121-2101 Rev. A)

3. FRONT PANEL DRIVER BOARD A13A2

3.1 General Description

Front Panel Driver Board A13A2 serves three basic front panel control functions. It generates the drive signals for the vacuum fluorescent displays, drives the discrete LED displays, and routes the signals to the front panel switchboard. Figure 6 is a block diagram of the A13A2 assembly.

The Driver Board controls the vacuum fluorescent displays by providing them with filament voltages, display segment information, and digit select information. The filament voltages are generated in Display Converter Assembly A13A6 and routed to the display connectors. The Driver Board multiplexes the VF displays by providing information for the segments to be lit within a character while enabling that character. This is done at a rapid rate to give the appearance of continuous illumination. The information to be displayed is provided to Driver Board A13A2 by Control Board Assembly A14 in serial fashion, using the Front Serial Data, Front Serial Clock, and Display Strobe signals on pins P3-2, P3-4, and P3-14, respectively.

The discrete LED displays of the front panel are lit by the Driver Board using information provided by the Control Board.

Driver Board Assembly A13A2 outputs eight column strobes to the switches in the front panel and inputs four row lines from the switches. The row lines are routed to the Control Board where a switch closure is detected as a connection from a column to a row.

3.2 Interface Connections

Table 5 summarizes the A13A2 interface connections.

3.3 Circuit Description

3.3.1 Microprocessor Operation

The heart of Front Panel Driver Board A13A2 operation is the U12 8035 microprocessor. The execution of the software program stored in the 2716-type EPROM (U16) causes the microprocessor to perform the display update functions described in paragraph 2. To execute the program, the microprocessor must continuously get instructions from U16 and process them. To accomplish this, the microprocessor (at the start of an instruction cycle) outputs the address of the instruction to be obtained into its address/data bus at pins U12-12 to U12-19. The address latch (U13) latches it to the EPROM. The U16 EPROM outputs the instruction to the data bus which is read by the microprocessor and executed. The microprocessor uses the Address Latch Enable (ALE) active high signal to indicate the presence of a valid address on the bus. The Program Store Enable (PSEN) signal is used to enable the EPROM to output the obtained instruction while the RD (read) and WR (write) signals are used to read from, and write to, other external devices. The RD signal is used to read display data sent by Control Board Assembly A14 from shift registers U14 and U15, while the WR signal is used to write the display information to VF display segment latches U8, U9, and U23. These functions are explained in greater detail below.

3.3.2 Display Data Input

Front Panel Driver Board A13A2 lights all LEDs and all segments of the vacuum fluorescent displays when the exciter is turned on. After completion of the power on self test, the display is updated to the last setting used before the exciter was turned off using display data provided by Control Board Assembly A14. The Control Board provides the information for all display updates to the Driver Board in serial fashion via P3-2. This information is clocked into serial shift registers U14 and U15 to be read in parallel by microprocessor U12. The clock signal is provided by the Control Board P4, and routed to the shift registers at pin 3. When the shift

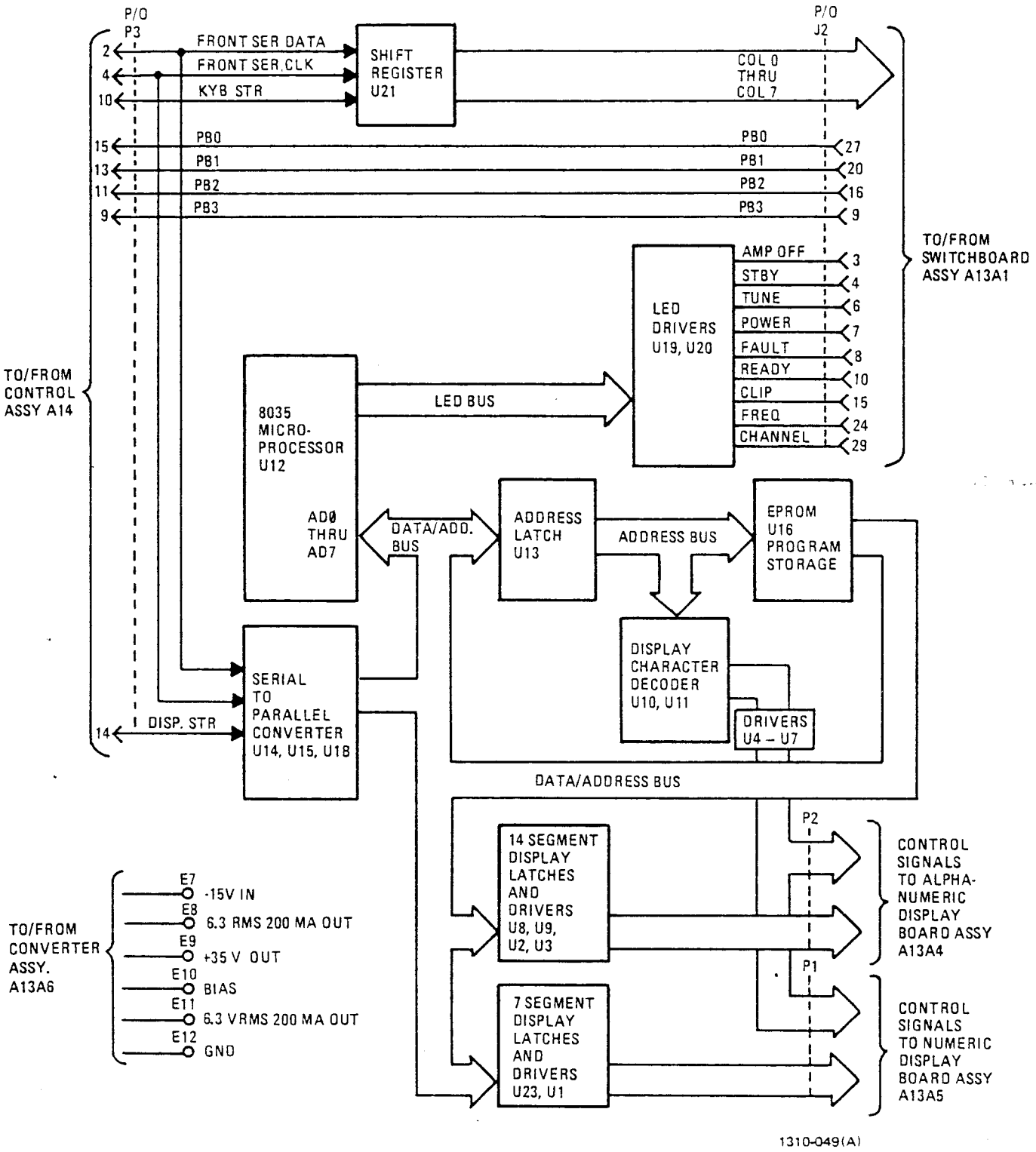


Figure 6. Front Panel Driver Board Assembly A13A2 Block Diagram

Table 5. Front Panel Driver Board Assembly A13A2 Interface Connections

Connector	Name	Description
P3 from A14 via W18		
P3-1	N/C	
P3-2	Front Serial Data	Serial display data from Control Board
P3-3	N/C	
P3-4	Front Serial CLK	Clock for display from Control Board
P3-5	N/C	
P3-6	-15 V	
P3-7	+ 5 V Display	
P3-8	Power Supply BITE	Power supply fault indicator
P3-9	PB3	Switch row readback to Control Board
P3-10	KYB STR	Keyboard strobe from Control Board
P3-11	PB2	Switch row readback to Control Board
P3-12	Fault Out	Output to rear panel (via Control Board)
P3-13	PB1	Switch row readback to Control Board
P3-14	DISP STR	Display strobe from Control Board
P3-15	PB0	Switch row readback to Control Board
P3-16	Reset	
P3-17	Spare	
P3-18	Ground	
P3-19	+ 5 V Unreg.	
P3-20	Ground	
J2 to/from A13A1		
J2-1	Ground	
J2-2	Oper	
J2-3	AMP OFF	
J2-4	STBY	
J2-5	COL 7	
J2-6	TUNE	

Table 5. Front Panel Driver Board Assembly A13A2 Interface Connections (Cont.)

Connector	Name	Description
J2-7	POWER	
J2-8	Fault	
J2-9	PB3	
J2-10	Ready	
J2-11	N/C	
J2-12	N/C	
J2-13	COL 2	
J2-14	COL 0	
J2-15	CLIP	
J2-16	PB2	
J2-17	COL 3	
J2-18	N/C	
J2-19	COL 5	
J2-20	PB1	
J2-21	N/C	
J2-22	N/C	
J2-23	COL 1	
J2-24	Freq	
J2-25	N/C	
J2-26	COL 6	
J2-27	PB0	
J2-28	COL 4	
J2-29	Channel	
J2-30	+ 5 V	
J3 to/from A13A4		
P2-1	a Segment	
P2-2	b Segment	
P2-3	c Segment	

Table 5. Front Panel Driver Board Assembly A13A2 Interface Connections (Cont.)

Connector	Name	Description
P2-4	d Segment	
P2-5	M Segment	
P2-6	N Segment	
P2-7	e Segment	
P2-8	f Segment	
P2-9	J Segment	
P2-10	k Segment	
P2-11	g Segment	
P2-12	h Segment	
P2-13	. Segment	
P2-14	, Segment	
P2-15	N/C	
P2-16	G1 Digit	
P2-17	P Segment	
P2-18	R Segment	
P2-19	G2 Digit	
P2-20	G3 Digit	
P2-21	G20 Digit	
P2-22	G4 Digit	
P2-23	G5 Digit	
P2-24	G6 Digit	
P2-25	G19 Digit	
P2-26	G7 Digit	
P2-27	G8 Digit	
P2-28	G9 Digit	
P2-29	G18 Digit	
P2-30	G10 Digit	
P2-31	G11 Digit	

Table 5. Front Panel Driver Board Assembly A13A2 Interface Connections (Cont.)

Connector	Name	Description
P2-32	G12 Digit	
P2-33	G17 Digit	
P2-34	G13 Digit	
P2-35	G14 Digit	
P2-36	N/C	
P2-37	G16 Digit	
P2-38	G15 Digit	
P2-39	Filament	
P2-40	Filament	
P1 to/from A13A5		
P1-1	G11 10 MHz Digit	
P1-2	G10 1 MHz Digit	
P1-3	G9 100 kHz Digit	
P1-4	G3 1/2 Digit	
P1-5	G7 1 kHz Digit	
P1-6	G8 10 kHz Digit	
P1-7	Filament	
P1-8	Decimal Point	
P1-9	G5 10 Hz Digit	
P1-10	G6 100 Hz Digit	
P1-11	N/C	
P1-12	Comma	
P1-13	G4 1 Hz Digit	
P1-14	c Segment	
P1-15	G2 CH10 Digit	
P1-16	G1 CH1 Digit	
P1-17	b Segment	
P1-18	a Segment	
P1-19	g Segment	

Table 5. Front Panel Driver Board Assembly A13A2 Interface Connections (Cont.)

Connector	Name	Description
P1-20	Filament	
P1-21	Underline Segment	
P1-22	d Segment	
P1-23	e Segment	
P1-24	f Segment	
E7	-15 V In	
E8	5.8 V_{rms} 200 mA Output	
E9	+ 35 V Out	
E10	Bias	
E11	5.8 V_{rms} 200 mA Output	
E12	Ground	

registers have been loaded with display data, the Control Board generates an interrupt to the U12 Driver Board microprocessor using the signal display strobe at P3-14. The display strobe pulse serves to trigger monostable multivibrator U24, which in turn generates the interrupt, causing the microprocessor to read the display data from shift registers U14 and U15. U18 buffers the display data onto the microprocessor data bus. The act of reading the shift registers causes resetting of the interrupt by the microprocessor read control line at U24-3 which is the reset in to the monostable.

3.3.3 Vacuum Fluorescent Display Drive

Display data read in from the Control Board is converted by microprocessor U12 into formats required for driving the VF displays. The displays are driven in multiplexed fashion so that only one character is driven at a given time. Each character in the VF displays has a unique address which is output by the microprocessor to the bus and latched into the U13 address latch during a display character update. The address is decoded by U10 or U11 into a character enable pulse. During the output instruction, the segment information for the character to be lit is latched into U23 for seven-segment characters or into U8 and U9 for 14-segment characters. Each character is enabled for approximately 640 microseconds after which, the microprocessor processes the next character in a similar manner.

3.3.4 LED Drive

The discrete LEDs on the front panel are driven from the parallel ports on microprocessor U12. These outputs are buffered by U19 and U20 and are routed to the switchboard via J2. An LED is lit by an active low output. The information to be written to the LEDs originates in Control Board Assembly A14 and is input to the Driver Board in the manner described in paragraph 3.3.2.

3.3.5 Pushbutton Circuitry

The Driver Board primarily routes the signals associated with detecting pushbutton activity to and from the Control Board and switchboards. The switches are arranged in a matrix of eight columns by four rows. Switch activity is detected by sensing a closure between a column line and a row line. The column outputs are written serially from the Control Board to the Driver board via P3-2, clocked via P3-4, and latched into shift register U21 by the signal KYB STR (keyboard strobe) at P3-10. The parallel outputs of the shift register are routed to the switchboard via J2 signals COL 0 through COL 7. The rows are routed back to the Control Board as signals PB0 to PB3 on pins P3-5, P3-13, P3-11, and P3-9 respectively.

3.4 Maintenance

3.4.1 Adjustments

The only adjustment on Front Panel Driver Board Assembly A13A2 is the VF display brightness, single-turn potentiometer R29, located at the top center of the PWB. Turn clockwise for brighter displays.

3.4.2 Troubleshooting

To make a quick assessment of Driver Board functions, the four test points should be checked with an oscilloscope.

- TP1 Microprocessor Write Line. Should be active low pulses repeated approximately every 600 to 700 microseconds.
- TP2 Character Strobe to U10. Active high pulse every 600 to 700 microseconds indicates display is being updated.
- TP3 Character Strobe to U11. Same as TP2. Also indicates display being updated. Both signals are required.
- TP5 Interrupt to microprocessor from Control board. Active low approximately 50 microseconds pulse every 1 second.

If the above signals are incorrect, more fundamental checks are indicated. Perform the checks in the following order.

a. Verify + 5 V at P3-7 and -15 V at P3-6.

b. Verify display converter voltages at E7-E12 of Driver Board and integrity of connections to converter module according to table 6.

c. Verify integrity of connections E1 through E6. The 10073-2400 alphanumeric display module requires connections E1 to E2 and E5 to E4.

d. Verify 6 MHz clock at U12-2 and U12-3.

e. Verify approximately + 5 V at U12-4. (Microprocessor reset in.)

f. Verify ALE signal, approximately 60-40 duty cycle square wave at U12-11.

g. Verify activity on bus AD0-AD7 (zero to five volt random square waves).

Table 6. Converter Voltages

Driver	Converter	Function
E7	C1	-15 Vdc
E8	C5	5.8 V_{rms}
E9	C3	+ 35 Vdc
E10	C4	Bias approximately 6 Vdc
E11	C2	5.8 V_{rms}
E12	E1	GND

h. Verify that all socketed ICs are installed correctly with no pins bent underneath the IC.

3.5 Parts List, Component Locations, and Schematic Diagram

Table 7 is the Front Panel Driver Board Assembly A13A2 parts list. Figures 7 and 8 are the Front Panel Driver Board Assembly A13A2 component location diagram and schematic diagram, respectively.

Table 7. Front Panel Driver Board Assembly A13A2 Parts List

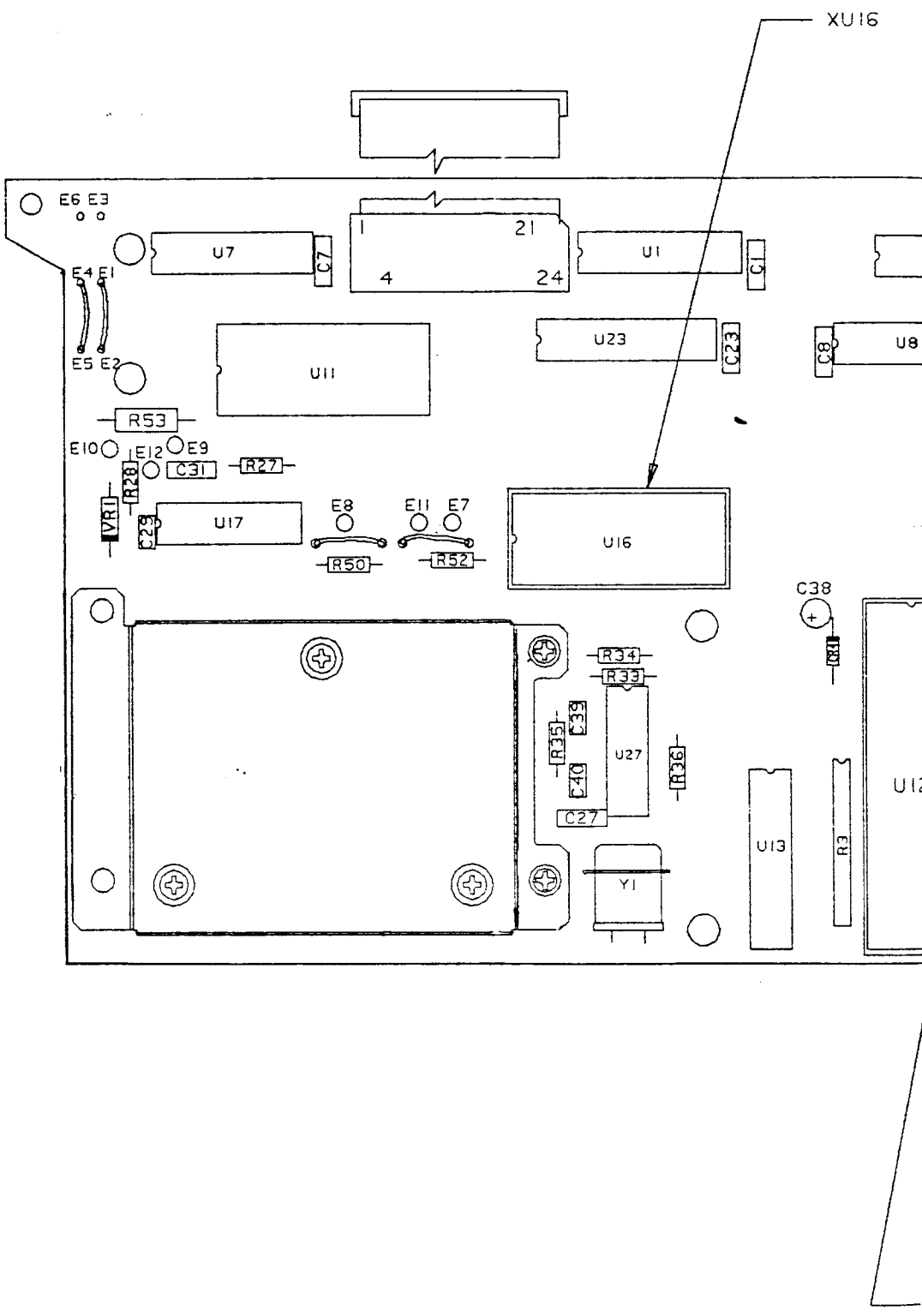
Ref. Desig.	Part Number	Description
A13A2	10073-2200	FRONT PANEL DRIVER BOARD ASSEMBLY
C1	M39014/02-1310	CAP .1UF 10% 100V CER-R
C2	M39014/02-1310	CAP .1UF 10% 100V CER-R
C3	M39014/02-1310	CAP .1UF 10% 100V CER-R
C4	M39014/02-1310	CAP .1UF 10% 100V CER-R
C5	M39014/02-1310	CAP .1UF 10% 100V CER-R
C6	M39014/02-1310	CAP .1UF 10% 100V CER-R
C7	M39014/02-1310	CAP .1UF 10% 100V CER-R
C8	M39014/02-1310	CAP .1UF 10% 100V CER-R
C10	M39014/02-1310	CAP .1UF 10% 100V CER-R
C12	M39014/02-1310	CAP .1UF 10% 100V CER-R
C14	M39014/02-1310	CAP .1UF 10% 100V CER-R
C15	M39014/02-1310	CAP .1UF 10% 100V CER-R
C19	M39014/02-1310	CAP .1UF 10% 100V CER-R
C22	M39014/02-1310	CAP .1UF 10% 100V CER-R
C23	M39014/02-1310	CAP .1UF 10% 100V CER-R
C24	M39014/02-1310	CAP .1UF 10% 100V CER-R
C25	M39014/02-1310	CAP .1UF 10% 100V CER-R
C26	M39014/02-1310	CAP .1UF 10% 100V CER-R
C27	M39014/02-1310	CAP .1UF 10% 100V CER-R
C29	CK05BX103M	CAP .01UF 20% 100V CER
C31	M39014/02-1310	CAP .1UF 10% 100V CER-R
C32	CK05BX102M	CAP 1000PF 20% 200V CER

Table 7. Front Panel Driver Board Assembly A13A2 Parts List (Cont.)

Ref. Desig.	Part Number	Description
C37	C26-0025-470	CAP 47UF 20% 25V TANT
C38	C26-0050-479	CAP 4.7UF 20% 50V TANT
C39	CK05BX330M	CAP 33PF 20% 200V CER
C40	CK05BX330M	CAP 33PF 20% 200V CER
CR1	1N4454	DIODE 200mA 75V SW
CR2	1N4454	DIODE 200mA 75V SW
CR3	1N4454	DIODE 200mA 75V SW
CR4	1N4454	DIODE 200mA 75V SW
J2	J46-0013-030	HEADER, PROTECTED, 30 PIN
P1	10073-7050	RIBBON CABLE, 24 COND
P2	10073-7051	RIBBON CABLE, 40 COND
P3	10073-7053	RIBBON CABLE, 20 COND
R3	R50-0010-472	RES,10SIP,4.7K,2.0%, 9RES
R14	R65-0003-224	RES,220K 5% 1/4W CAR FILM
R15	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R16	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R17	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R18	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R22	R51-0010-121	RES, PACK
R23	R51-0010-121	RES, PACK
R25	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R26	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R27	R65-0003-204	RES,200K 5% 1/4W CAR FILM
R28	R65-0003-393	RES,39K 5% 1/4W CAR FILM
R29	R-2232	RES,VAR,PCB 100K .5 20%
R33	R65-0003-471	RES,470 5% 1/4W CAR FILM
R34	R65-0003-471	RES,470 5% 1/4W CAR FILM
R35	R65-0003-471	RES,470 5% 1/4W CAR FILM
R36	R65-0003-471	RES,470 5% 1/4W CAR FILM
R37	R65-0003-161	RES,160 5% 1/4W CAR FILM
R38	R50-0008-103	RES,8 SIP, 10K,2.0%, 7RES
R50	R65-0003-100	RES,10 5% 1/4W CAR FILM
R52	R65-0003-100	RES,10 5% 1/4W CAR FILM
R53	R65-0003-332	RES,3.3K 5% 1/4W CAR FILM
TP1	J-0392	TP PWB BRN RA SIDE ACCESS
TP2	J-0387	TP PWB RED RA SIDE ACCESS
TP3	J-0390	TP PWB ORN RA SIDE ACCESS
TP5	J-0389	TP PWB GRN RA SIDE ACCESS
U1	I75-0009-001	IC NE594 DISPLAY DRIVER
U2	I75-0009-001	IC NE594 DISPLAY DRIVER
U3	I75-0009-001	IC NE594 DISPLAY DRIVER
U4	I75-0009-001	IC NE594 DISPLAY DRIVER
U5	I75-0009-001	IC NE594 DISPLAY DRIVER
U6	I75-0009-001	IC NE594 DISPLAY DRIVER
U7	I75-0009-001	IC NE594 DISPLAY DRIVER

Table 7. Front Panel Driver Board Assembly A13A2 Parts List (Cont.)

Ref. Desig.	Part Number	Description
U8	I07-0013-001	IC 74C373 PLASTIC CMOS
U9	I07-0013-001	IC 74C373 PLASTIC CMOS
U10	I01-0000-202	IC 4514B PLASTIC CMOS
U11	I01-0000-202	IC 4514B PLASTIC CMOS
U12	IC-0374	IC 8035 MICRO 8-BIT
U13	I07-0013-001	IC 74C373 PLASTIC CMOS
U14	I01-0000-156	IC 4094B PLASTIC CMOS
U15	I01-0000-156	IC 4094B PLASTIC CMOS
U16	10073-8302	SOFTWARE KIT
U17	I05-0001-000	IC 4098B PLASTIC CMOS
U18	I05-0000-244	IC 74LS244 PLASTIC TTL
U19	I05-0000-244	IC 74LS244 PLASTIC TTL
U20	I05-0000-244	IC 74LS244 PLASTIC TTL
U21	I01-0000-156	IC 4094B PLASTIC CMOS
U22	I05-0000-074	IC 74LS74 PLASTIC TTL
U23	I07-0013-001	IC 74C373 PLASTIC CMOS
U24	I05-0001-000	IC 4098B PLASTIC CMOS
U25	I01-0056-001	IC 74C02 PLASTIC CMOS
U26	I05-0000-027	IC 74LS27 PLASTIC TTL
U27	I02-0015-000	IC 7404 PLASTIC TTL
U28	I18-0006-001	IC 74C14 PLASTIC CMOS
VR1	1N5234B	DIODE 6.2V 5% .5W ZENER
XU12	J77-0008-007	SKT IC MACH 40 PIN
XU16	J77-0008-005	SKT IC MACH 24 PIN
Y1	Y15-0004-060	CRYSTAL, 6MHZ


XU16
E6 E3
E4 E1
E5 E2
U7
C7
1
21
4
24
U1
C1
U11
U23
C23
C8
U8
R53
E10
E12
E9
C31
R27
R28
VR1
C29
U17
E8
E11
E7
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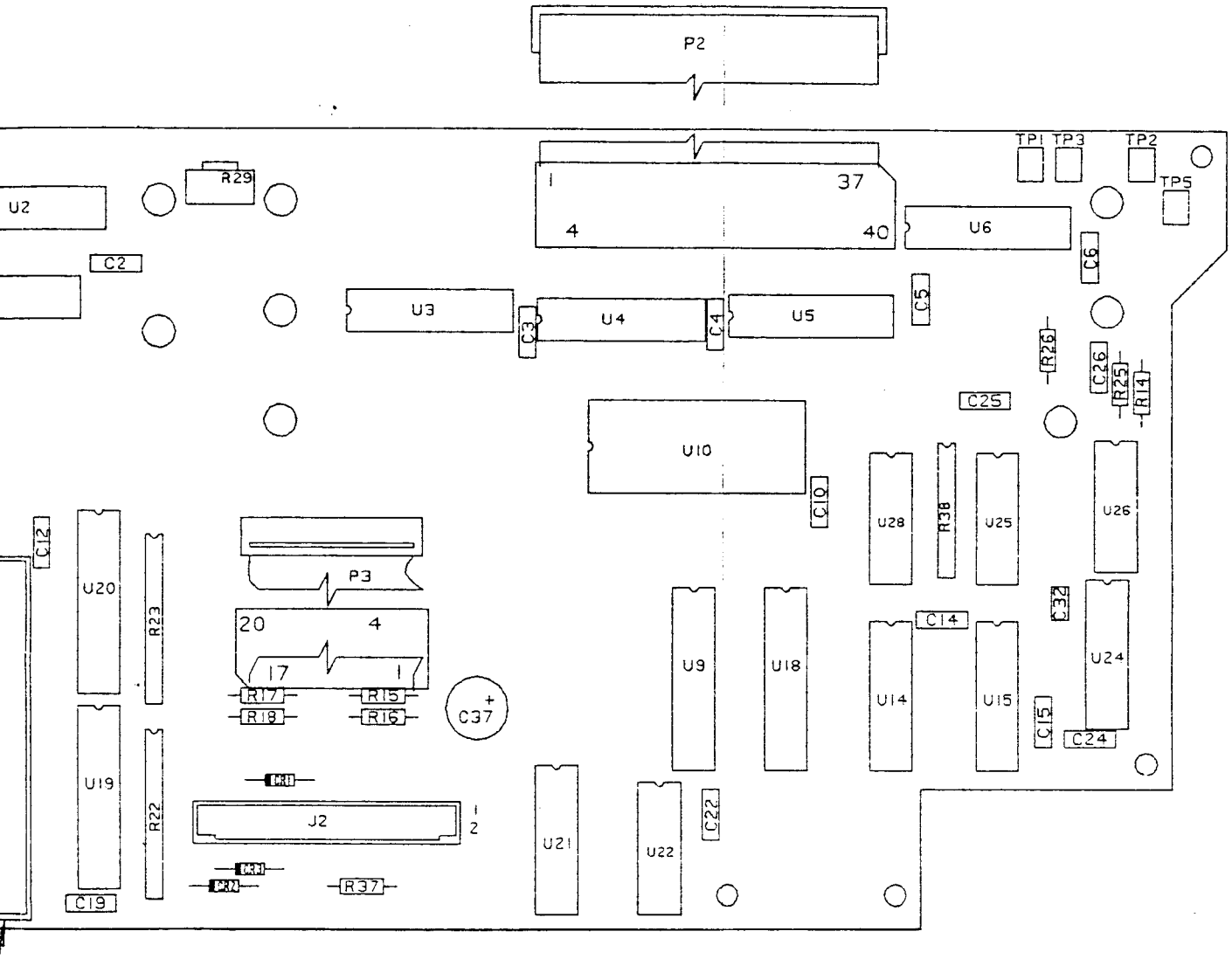
C40
U27
R36
C27
U13
R3
Y1



XU12

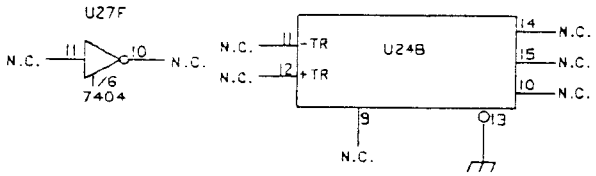
Figure 7. Front Panel Driver Board Assembly A13A2 Component Location Diagram (10073-2200)

NOTE: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR A COMPLETE DESIGNATION, PREFIX WITH UNIT NO. AND/OR ASSEMBLY NO. DESIGNATION.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±5%.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.
4. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY. COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST.
5. CONNECT E4 TO E5 AND E1 TO E2 FOR FUTABA ALPHANUMERIC DISPLAY (P/N 10073-2400).
6. SIGNALS ARE PRODUCT SPECIFIC FOR THE FOLLOWING PINS:

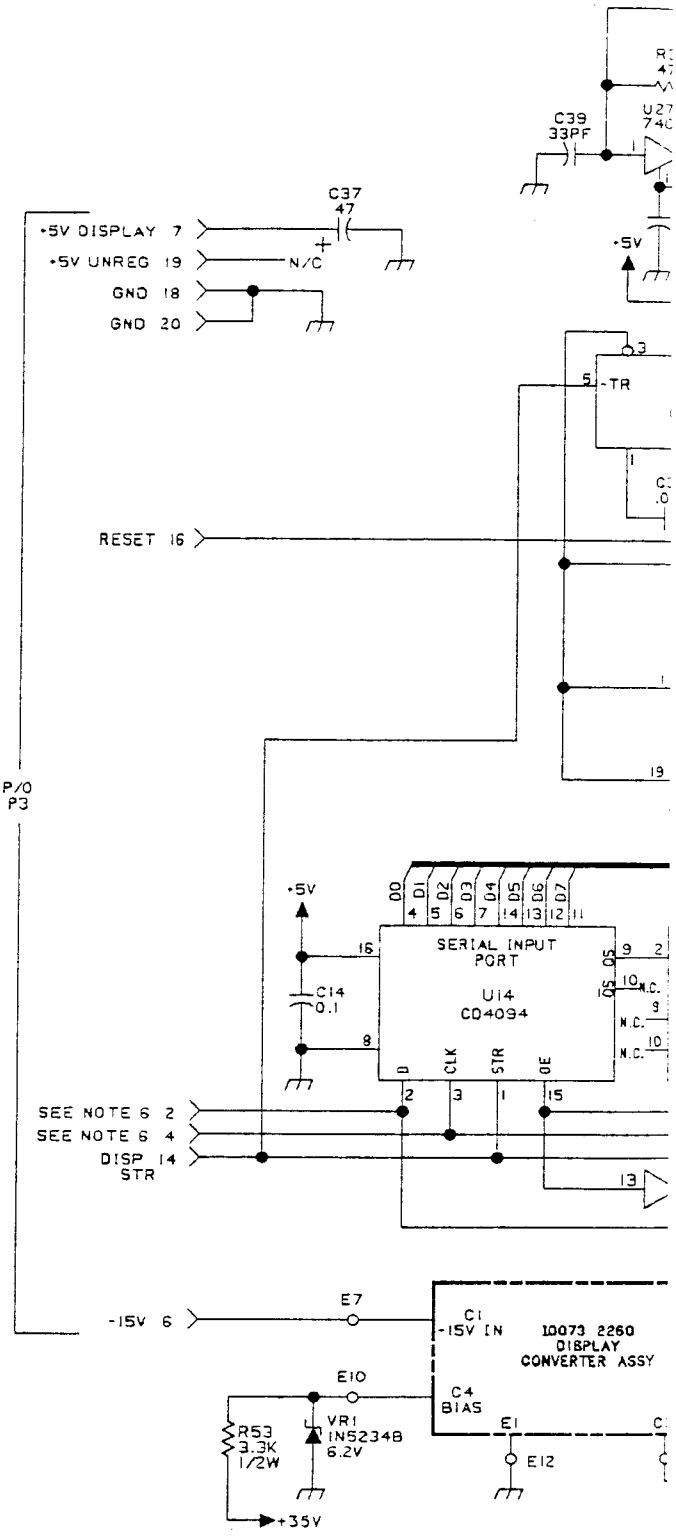
PIN	RF-590	RF-1310
P3-1	TUNE WHL INT	N/C
P3-2	DATA	FR SER DATA
P3-3	DIR	N/C
P3-4	CLK	FR SER CLK
J2-2	SCAN	OPER
J2-3	TEST	AMP OFF
J2-4	PROG	STBY
J2-6	RCV	TUNE
J2-7	BFO	POWER
J2-10	REMOTE	READY
J2-15	TUNE	CLIP
J2-25	NOISEBLANK	N/C

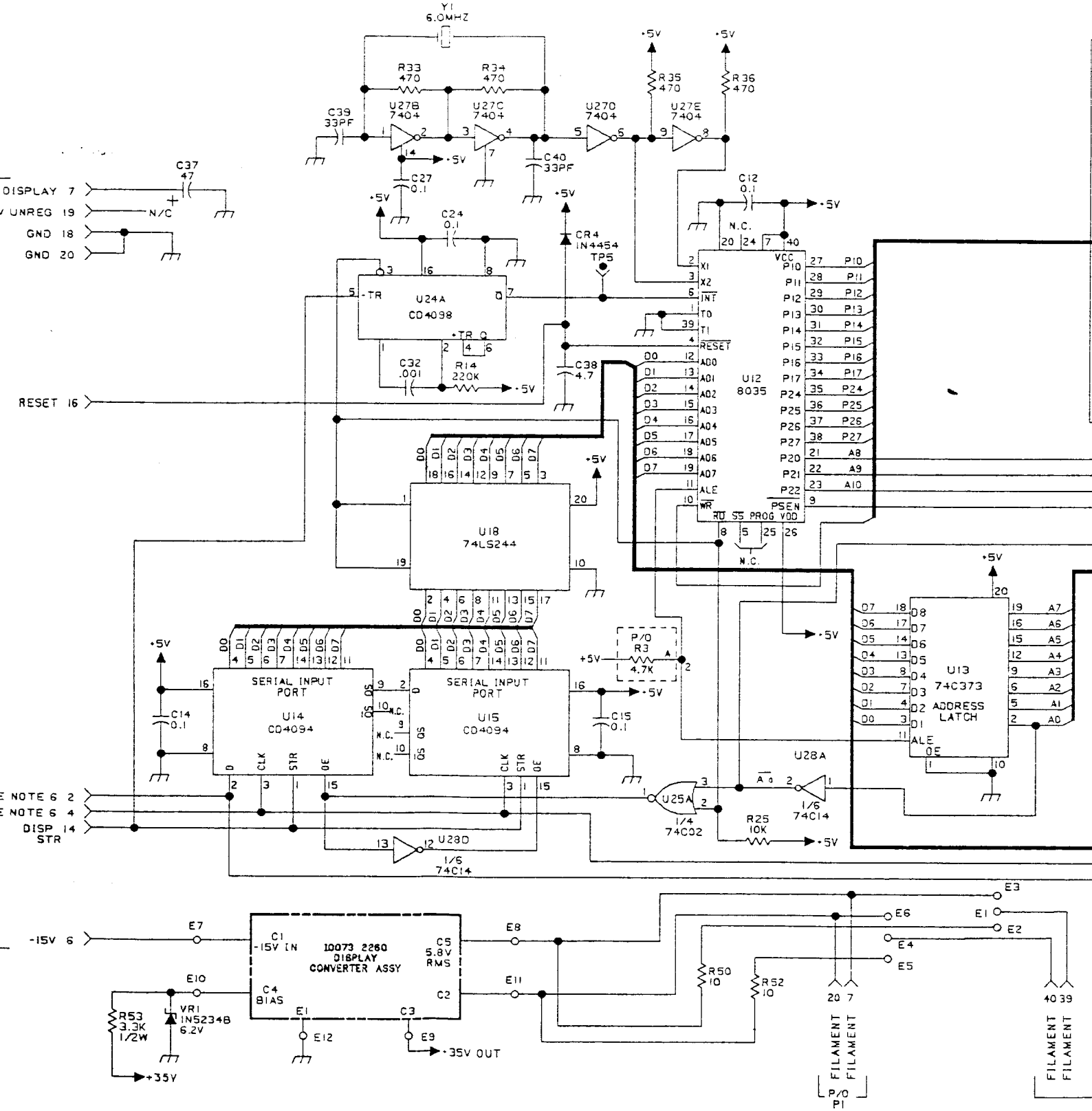
UNUSED GATES



TEST POINT	
TP1 PROCESSOR WRITE LINE	
TP2 DIGIT STROBE TO V10	
TP3 DIGIT STROBE TO V11	
TP5 INTERRUPT FOR DISPLAY UPDATE	

DISPLAY CONVERTER CONNECTIONS		
PCB	CONVERTER	FCN
E7	C1	-15V IN
E8	C5	6.3 OUT
E9	C3	+35V OUT
E10	C4	BIAS
E11	C2	6.3 OUT
E12	E1	GND




Y1
6.0MHZ
R33
470
R34
470
R35
470
R36
470
U27B
7404
U27C
7404
U27D
7404
U27E
7404
C39
33PF
C40
33PF
C27
0.1
C24
0.1
C12
0.1
C37
47
CR4
IN4454
TP5
U24A
CD4098
C32
.001
R14
220K
C38
4.7
U12
8035
U18
74LS244
U14
CD4094
SERIAL INPUT
PORT
U15
CD4094
SERIAL INPUT
PORT
C14
0.1
C15
0.1
P/O
R3
4.7K
U13
74C373
ADDRESS
LATCH
U28A
U25A
1/4
74C02
U28D
1/6
74C14
R25
10K
DISPLAY 7
UNREG 19
N/C
GND 18
GND 20
RESET 16
NOTE 6 2
NOTE 6 4
DISP 14
STR
-15V 6
E7
E8
E10
E11
E1
E12
E9
E3
E6
E2
E4
E5
C1
-15V IN
10073 2260
DISPLAY
CONVERTER ASSY
C5
5.8V
RMS
C4
BIAS
C2
C3
R53
3.3K
1/2W
VR1
IN5234B
6.2V
+35V
+35V OUT
R50
10
R52
10
FILAMENT
FILAMENT
P/O
P1
FILAMENT
FILAMENT

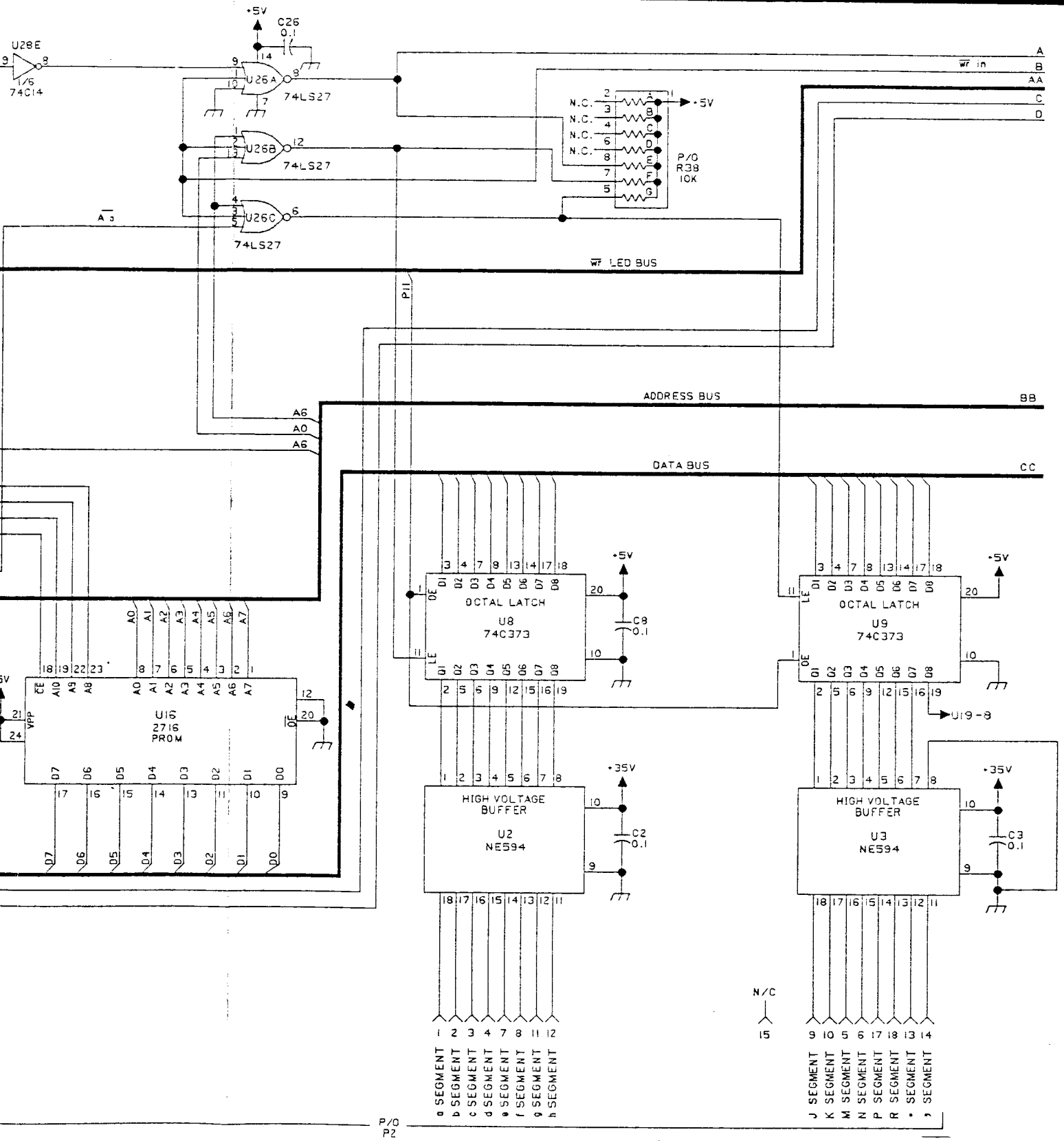
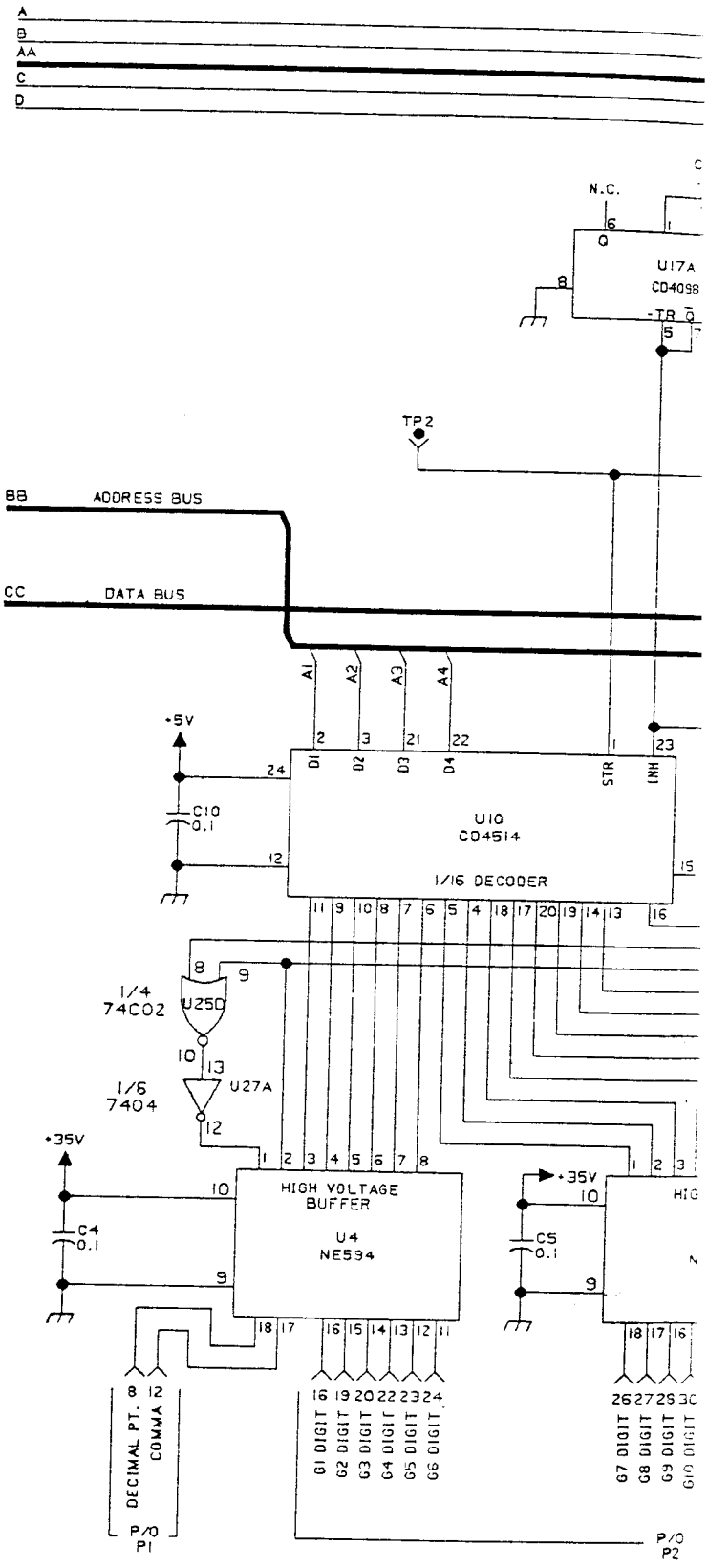
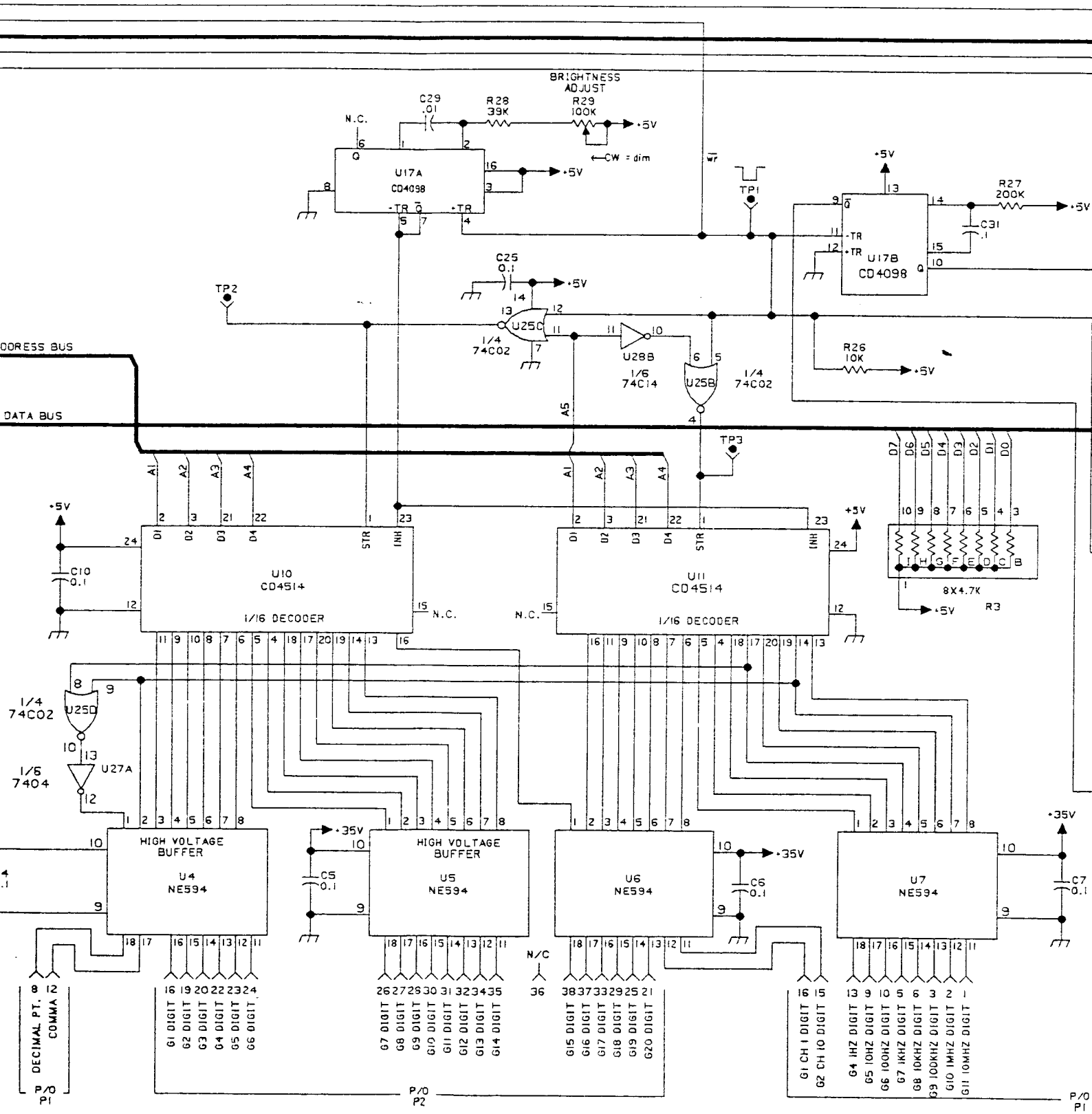


Figure 8. Front Panel Driver Board Assembly A13A2 Schematic Diagram (10073-2201 Rev. J) (Sheet 1 of 2)


A
B
AA
C
D
N.C.
U17A
CD4098
TP2
BB ADDRESS BUS
CC DATA BUS
A1
A2
A3
A4
+5V
D1
D2
D3
D4
STR
INH
C10
0.1
U10
CD4514
1/16 DECODER
1/4
74C02
U25D
1/6
7404
U27A
+35V
HIGH VOLTAGE
BUFFER
U4
NE594
C4
0.1
C5
0.1
DECIMAL PT.
COMMA
P/O
P1
P/O
P2


BRIGHTNESS ADJUST
C29 .01
R28 39K
R29 100K
+5V
N.C.
CW = dim
U17A CD4098
wr
TP1
R27 200K
C31 .1
U17B CD4098
C25 0.1
TP2
U25C 1/4 74C02
U28B 1/6 74C14
U25B 1/4 74C02
R26 10K
ADDRESS BUS
DATA BUS
A5
TP3
D7 D6 D5 D4 D3 D2 D1 D0
A1 A2 A3 A4
U10 CD4514 1/16 DECODER
U11 CD4514 1/16 DECODER
STR
INH
N.C.
C10 0.1
8X4.7K R3
1/4 74C02 U25D
1/6 7404 U27A
HIGH VOLTAGE BUFFER U4 NE594
HIGH VOLTAGE BUFFER U5 NE594
U6 NE594
U7 NE594
+35V
C5 0.1
C6 0.1
C7 0.1
N/C
DECIMAL PT.
COMMA
P/O P1
P/O P2
G1 DIGIT
G2 DIGIT
G3 DIGIT
G4 DIGIT
G5 DIGIT
G6 DIGIT
G7 DIGIT
G8 DIGIT
G9 DIGIT
G10 DIGIT
G11 DIGIT
G12 DIGIT
G13 DIGIT
G14 DIGIT
G15 DIGIT
G16 DIGIT
G17 DIGIT
G18 DIGIT
G19 DIGIT
G20 DIGIT
G1 CH 1 DIGIT
G2 CH 10 DIGIT
G4 1HZ DIGIT
G5 10HZ DIGIT
G6 100HZ DIGIT
G7 1KHZ DIGIT
G8 10KHZ DIGIT
G9 100KHZ DIGIT
G10 1MHZ DIGIT
G11 10MHZ DIGIT

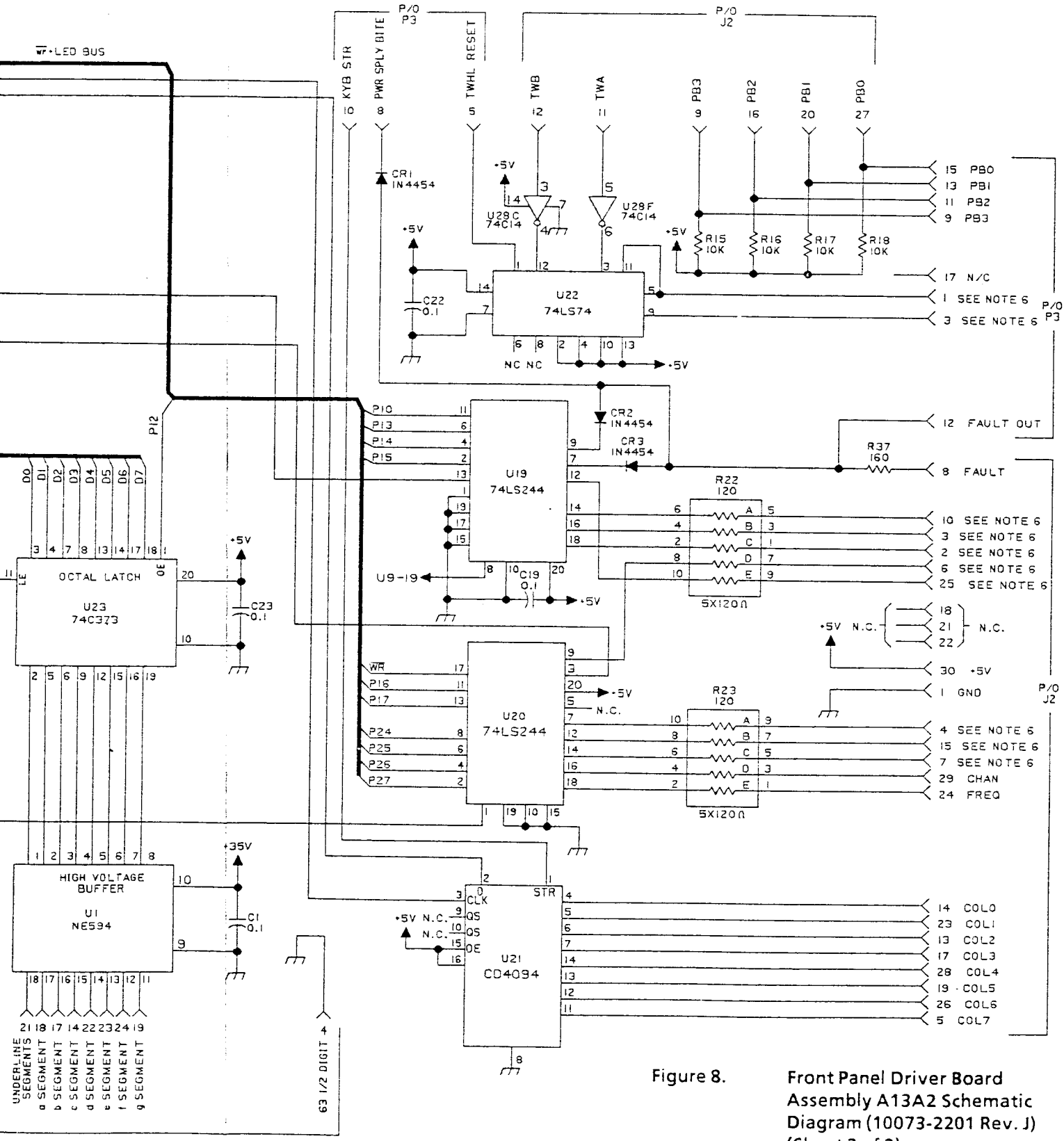


Figure 8. Front Panel Driver Board Assembly A13A2 Schematic Diagram (10073-2201 Rev. J) (Sheet 2 of 2)

4. FRONT PANEL METER BOARD ASSEMBLY A13A3

4.1 General Description

Front Panel Meter Board Assembly A13A3, shown in figure 9, contains the circuitry required to select and monitor RF and AF signals on the M1 front panel meter. The following signals may be selected for measurement via front panel pushbuttons.

- USB Audio In
- LSB Audio In
- Exciter RF Output
- PA RF Output

The USB and LSB audio signal levels are adjustable from the A13A3 assembly. Potentiometers for adjusting these levels are mounted on A13A3 and are accessible through holes in the front panel. The access holes are located next to the USB and LSB meter select switches. A13A3 is also used to route the CW KEY and PTT KEY signals from the front panel microphone jack to Control Board Assembly A14.

4.2 Interface Connections

Table 8 summarizes the A13A3 assembly interface connections.

4.3 Circuit Description

4.3.1 Meter Control

Dc signals representing the levels of RF output signals of the exciter (A1 OUTPUT DET) and power amplifier (BUFF APC) are routed to A13A3 via the Control Board Assembly A14. Likewise, USB and LSB audio signal levels are represented by dc signals that come from Audio 1 Assembly A5A1 and are labeled USB Meter Dc and LSB Meter Dc.

The signals are input to a switch network that applies one signal at a time to the front panel meter. The signals representing the exciter and PA output levels are routed directly to the meter when they are selected. When the USB or LSB switch is engaged, the USB meter dc or LSB meter dc signal is routed back to the A5A1 assembly as the Log Amp input signal. The signal is processed by a metering logarithmic amplifier on the A5A1 assembly. The A5A1 assembly returns the log amp output signal that is compatible with the front panel meter. This signal is routed through the switch network to the meter. The meter is zeroed for the audio signal level measurement by adjusting R99 on A5A1.

4.3.2 Audio Signal Level Adjustment

Potentiometers R4 and R5 on the Meter Board are used to adjust the USB and LSB audio signal levels, respectively. Both potentiometers can be accessed through holes in the front panel. The access holes are located adjacent to the USB and LSB meter select switches. Adjusting R4 or R5 will increase or decrease the gain of the first stage of the USB or LSB audio amplifier on A5A1.

4.3.3 CW KEY and PTT KEY

The CW KEY and PTT KEY signals are passively routed from the front panel microphone jack to Control Board Assembly A14 by the Meter Board.

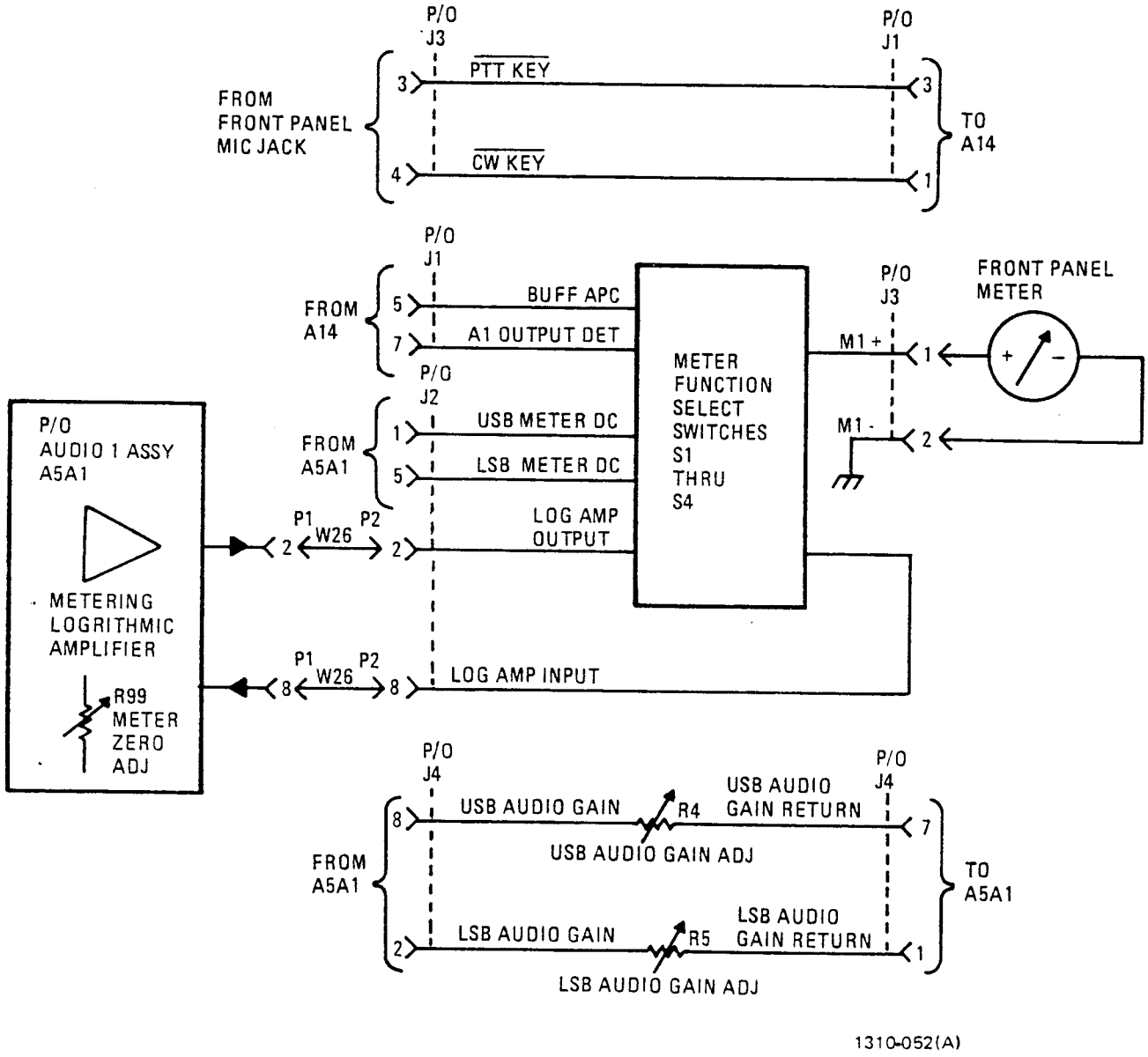


Figure 9. Front Panel Meter Board Assembly A13A3 Block Diagram

Table 8. Front Panel Meter Board Assembly A13A3 Interface Connections

Pin	Signal	Description
J1-1	CW KEY	CW KEY signal from front panel microphone jack to A14.
J1-2	INDEX	Not connected.
J1-3	PTT KEY	PTT key signal from front panel microphone jack to A14.
J1-4	Spare not connected	
J1-5	BUFF APC	PA RF output signal level to A13A3S3 (dc signal).
J1-6	GND	Ground
J1-7	A1 OUTPUT DET	RF output signal level from A1 to A13A3S1 (dc signal).
J1-8	Spare not connected	
J2-1	USB METER DC	USB audio signal level to A13A3S1.
J2-2	LOG AMP OUTPUT	
J2-3	INDEX	Not connected.
J2-4	Spare not connected	
J2-5	LSB METER DC	LSB audio signal level to A13A3S4.
J2-6	GND	Ground
J2-7	Spare not connected	
J3-1	M1 (+)	Dc signal to meter.
J3-2	M1 (-)	Meter return-ground.
J3-3	PTT KEY	PTT key signal from microphone jack.
J3-4	CW KEY	CW key signal from microphone jack.
J3-5	GND Ground	
J3-6	Spare not connected	
J4-1	LSB AUDIO GAIN RETURN	LSB audio gain control signal to A5 assembly (ground).
J4-2	LSB AUDIO GAIN	LSB audio gain control signal from A5 assembly.
J4-3	GND	Ground
J4-4	INDEX	Not connected.
J4-5	Spare not connected	
J4-6	GND	Ground
J4-7	USB AUDIO GAIN RETURN	USB audio gain control signal to A5 assembly (ground).
J4-8	USB AUDIO GAIN	USB audio gain control signal from A5 assembly.

4.4 Parts Lists, Component Locations, and Schematic Diagram

Table 9 is the Front Panel Meter Board Assembly A13A3 parts list. Figures 10 and 11 are the Front Panel Meter Board Assembly A13A3 component location diagram and schematic diagram.

Table 9. Front Panel Meter Board Assembly A13A3 Parts List (10121-2300)

Ref. Desig.	Part Number	Description
A13A3	10121-2300	METER PWB ASSEMBLY
	10073-2313	SW DPDT 4SEC INTLOCKING
J1	J46-0032-008	CONN,8 PIN
J2	J46-0032-008	CONN,8 PIN
J3	J46-0032-006	HEADER, 6 PIN DISCRETE
J4	J46-0032-008	CONN,8 PIN
R1	RN55D2432F	RES,24.3K 1% 1/8W MET FLM
R2	RN55D5492F	RES,54.9K 1% 1/8W MET FLM
R3	RN55D5622F	RES,56.2K 1% 1/8W MET FLM
R4	R30-0001-102	RES,VAR,1K 3/4W 20%
R5	R30-0001-102	RES,VAR,1K 3/4W 20%

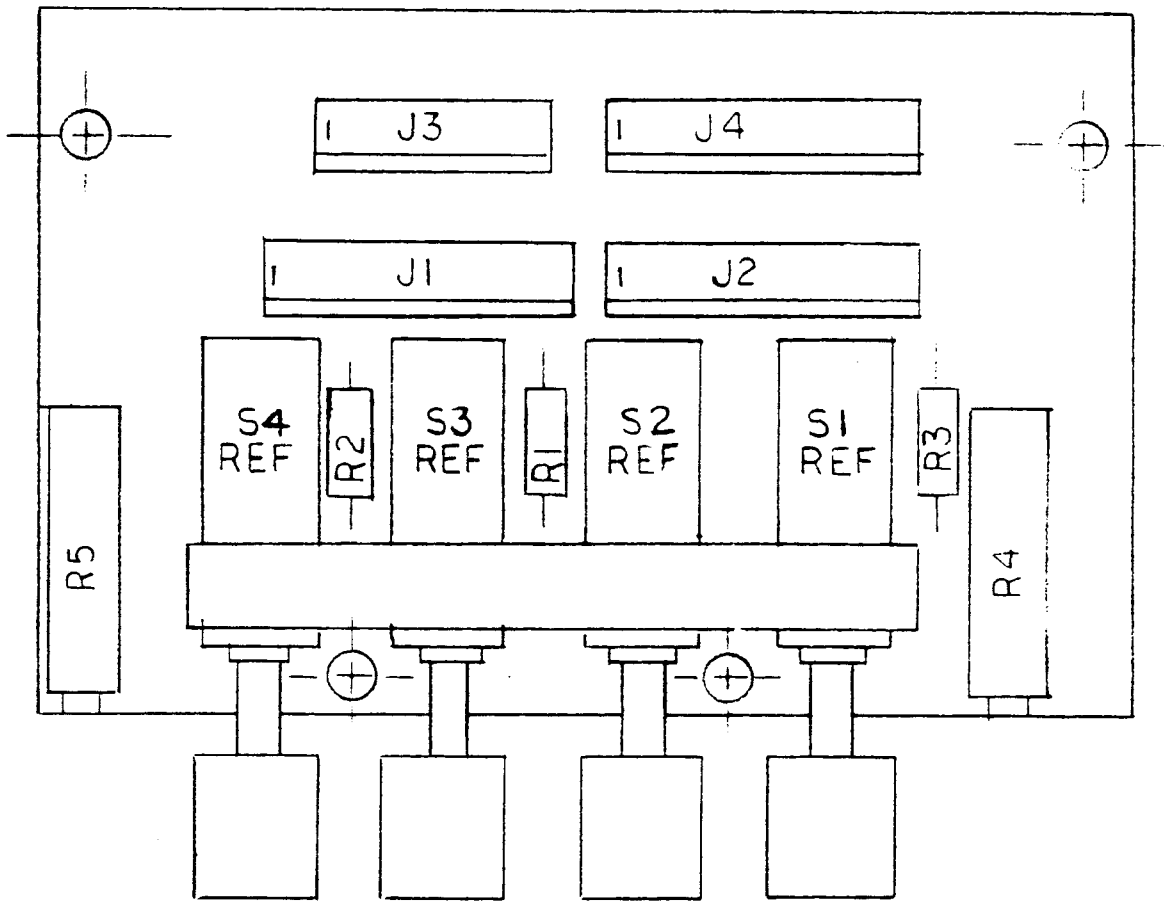


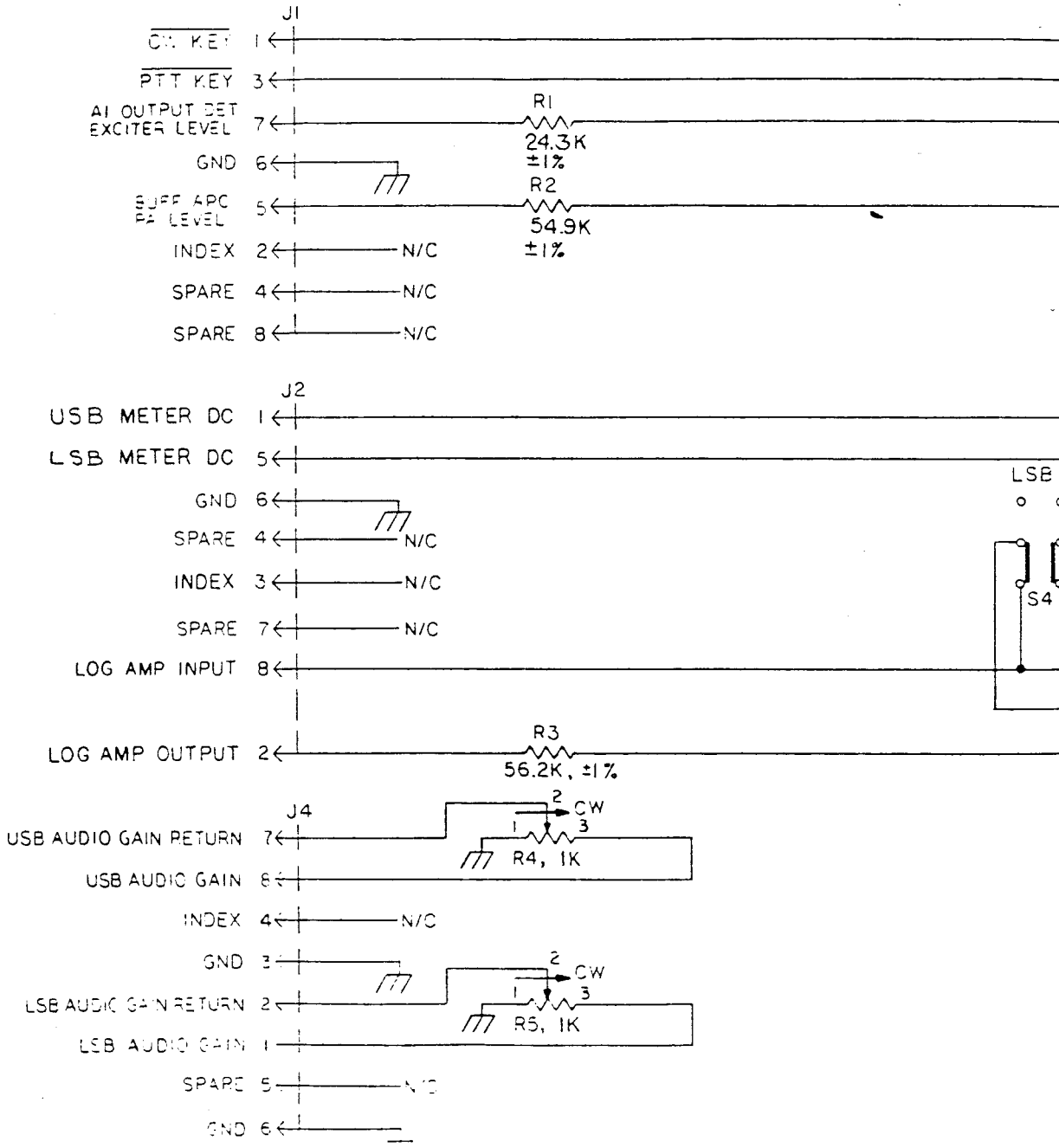
Figure 10. Front Panel Meter Board Assembly A13A3 Component Location Diagram (10121-2300)

NOTE: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR A COMPLETE DESIGNATION, PREFIX WITH UNIT NO. AND/OR ASSEMBLY NO. DESIGNATION.

2. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±5%.

3. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY. COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST.



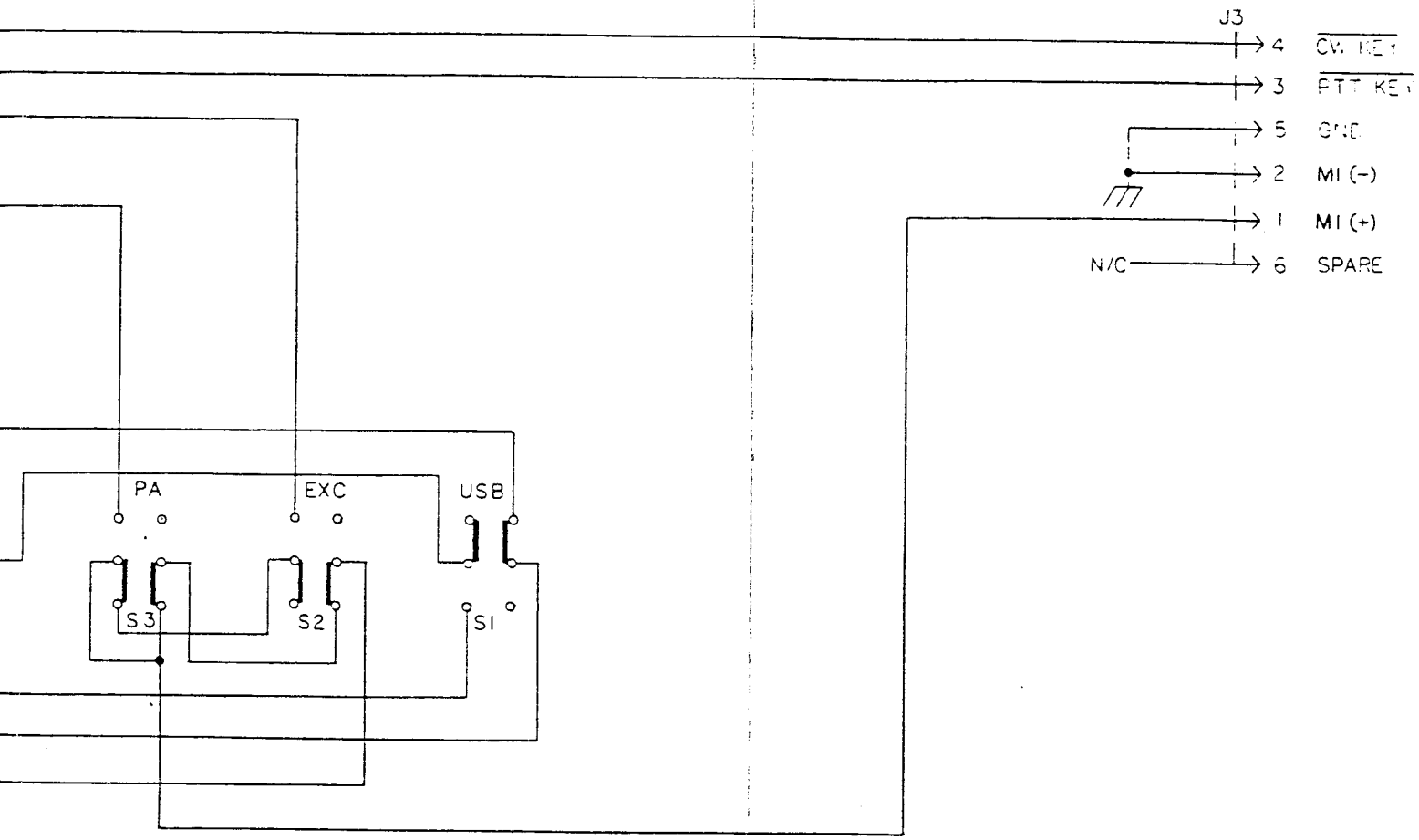


Figure 11. Front Panel Meter Board Assembly A13A3 Schematic Diagram (10121-2301 Rev. D)

5. FRONT PANEL ALPHANUMERIC DISPLAY ASSEMBLY A13A4

5.1 General Description

Front Panel Alphanumeric Display Assembly A13A4 consists of a single vacuum fluorescent display which contains twenty, fourteen-segment (British flag) characters. The alpha display provides indications of mode, carrier attenuation, audio source, and RF power attenuation. Additionally, the alphanumeric display is used to provide fault indications, if any, at the completion of the BITE test.

5.2 Interface Connections

Table 10 lists the A13A4 assembly interface connections.

Table 10. Front Panel Alphanumeric Display Assembly A13A4 Interface Connections

Connector	Description
J1 to/from A13A2	
J1-1	a Segment
J1-2	b Segment
J1-3	c Segment
J1-4	d Segment
J1-5	m Segment
J1-6	n Segment
J1-7	e Segment
J1-8	f Segment
J1-9	J Segment
J1-10	k Segment
J1-11	g Segment
J1-12	h Segment
J1-13	Decimal Point
J1-14	Comma
J1-15	N/C
J1-16	G1 Digit
J1-17	p Segment
J1-18	r Segment
J1-19	G2 Digit

Table 10. Front Panel Alphanumeric Display Assembly A13A4 Interface Connections (Cont.)

Connector	Description
J1-20	G3 Digit
J1-21	G20 Digit
J1-22	G4 Digit
J1-23	G5 Digit
J1-24	G6 Digit
J1-25	G19 Digit
J1-26	G7 Digit
J1-27	G8 Digit
J1-28	G9 Digit
J1-29	G18 Digit
J1-30	G10 Digit
J1-31	G11 Digit
J1-32	G12 Digit
J1-33	G17 Digit
J1-34	G13 Digit
J1-35	G14 Digit
J1-36	N/C
J1-37	G16 Digit
J1-38	G15 Digit
J1-39	Filament
J1-40	Filament

5.3 Functional Description

The alphanumeric vacuum fluorescent display is very similar in principle to the vacuum tube. Front Panel Driver Board A13A2 provides all required voltages and timing to properly drive the display. The 10073-2400 twenty-character VF display requires a 4.7 Vac filament voltage and 35 Vdc grid and anode voltages. The grids (20 of them) are essentially character enable signals which are driven in multiplexed fashion, enabled one at a time as the segment data for that character is provided to the anode pins. The anode pins are inputs for the 14 segments plus dot and comma signals. Figure 12 shows the display's segment location. See paragraphs 3.1 and 3.3.3 for additional details.

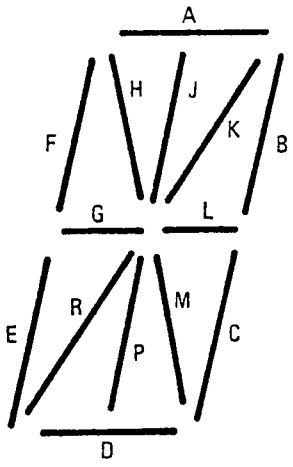


Figure 12. Alphanumeric Display Segment Location

5.3.1 Parts List and Schematic Diagram

Table 11 is the Front Panel Alphanumeric Display Assembly A13A4 parts list. Figures 13 and 14 are the Front Panel Alphanumeric Display Assembly A13A4 component location diagram and schematic diagram.

Table 11. Front Panel Alphanumeric Display Assembly A13A4 Parts List (PL 10073-2400)

Ref. Desig.	Part Number	Description
A13A4	10073-2400	ALPHANUMERIC DISPLAY ASSEMBLY
	P05-0004-001	TAPE,FM,CL CELL,1/8 X1
	H50-1006-409	SPCR 3/16HEX SS 4-40X.562
DS1	N50-0006-001	DSPL FLR VAC 14SEG 20-DIG
J1	J46-0031-040	CONN,40 PIN

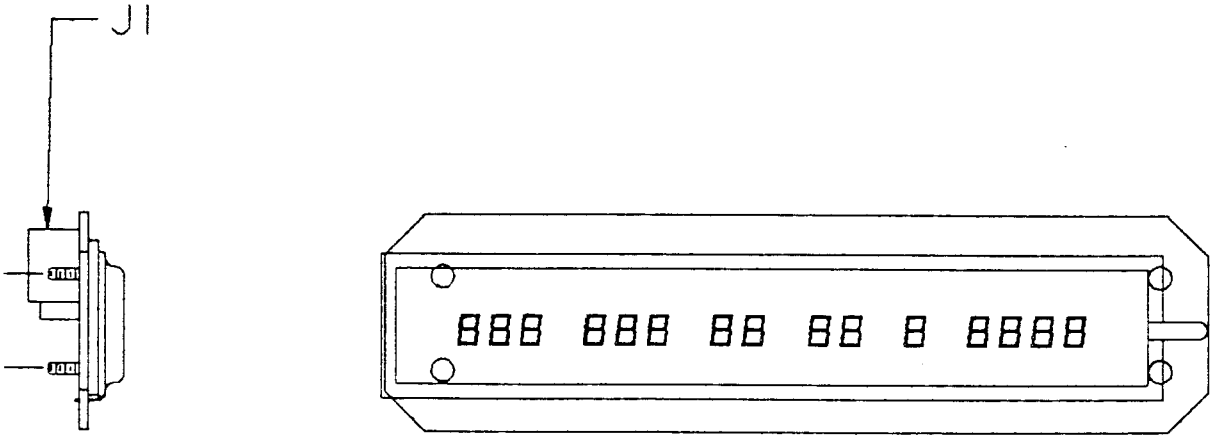


Figure 13. Front Panel Alphanumeric Display Assembly A13A4 Component Location Diagram (10073-2400)

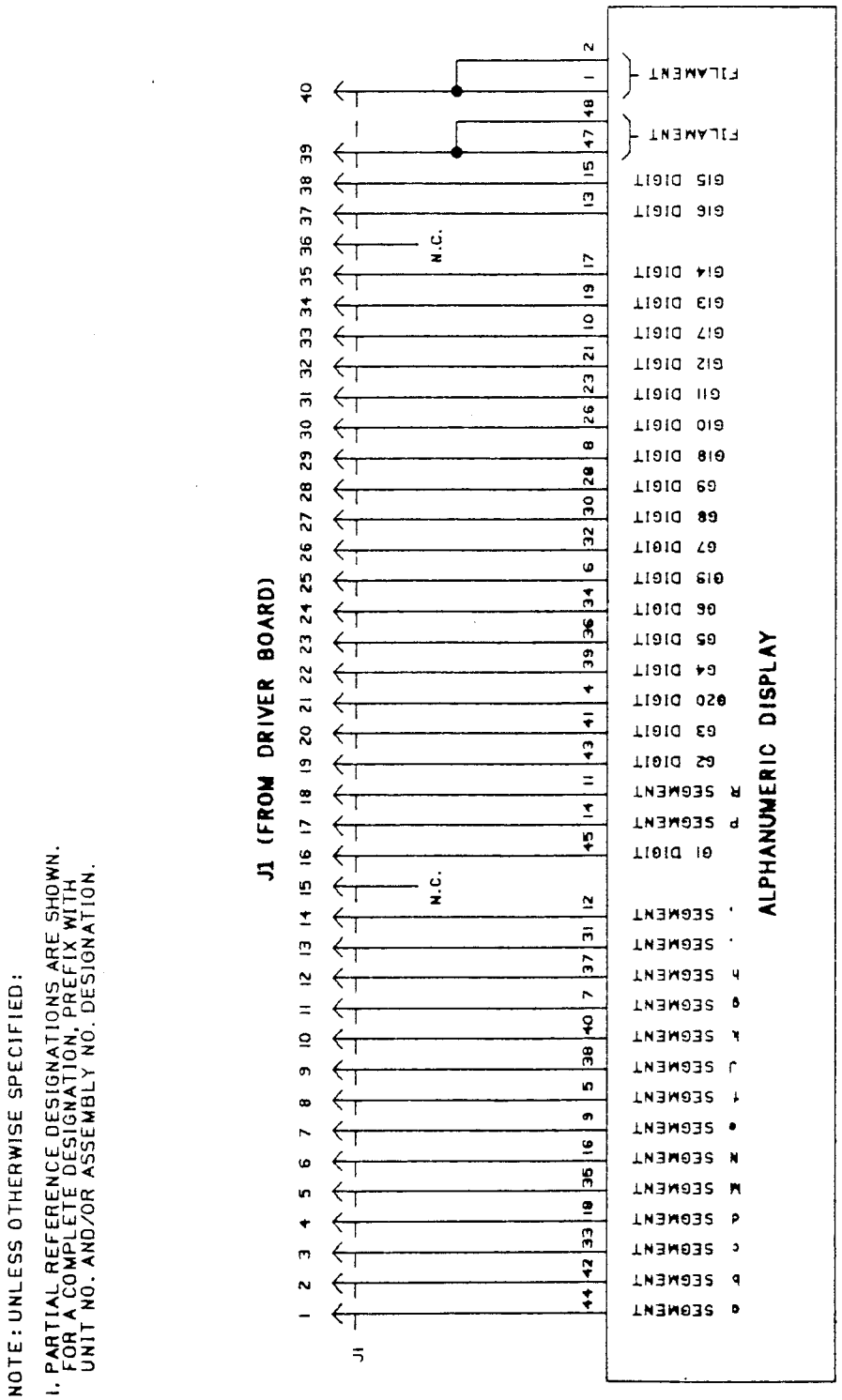


Figure 14. Front Panel Alphanumeric Display Board A13A4 Schematic Diagram (10073-2401 Rev. B)

6. FRONT PANEL NUMERIC DISPLAY ASSEMBLY A13A5

6.1 General Description

Front Panel Numeric Display Assembly A13A5 consists of a single vacuum fluorescent display which contains eight, seven-segment characters used for frequency display and two, seven-segment characters used for the channel display.

6.2 Interface Connections

Table 12 lists the A13A5 assembly interface connections.

Table 12. Front Panel Numeric Display Assembly A13A5 Interface Connections

Connector	Description
J1 to/from A13A2	
J1-1	G11 10 MHz Digit
J1-2	G10 1 MHz Digit
J1-3	G9 100 kHz Digit
J1-4	G3 1/2 Segments
J1-5	G7 1 kHz Digit
J1-6	G8 10 kHz Digit
J1-7	Filament
J1-8	Decimal Point
J1-9	G5 10 Hz Digit
J1-10	G6 100 Hz Digit
J1-11	N/C
J1-12	Comma
J1-13	G4 1 Hz Digit
J1-14	c Segment
J1-15	G2 CH10 Digit
J1-16	G1 CH1 Digit
J1-17	b Segment
J1-18	a Segment
J1-19	g Segment

Table 12. Front Panel Numeric Display Assembly A13A5 Interface Connections (Cont.)

Connector	Description
J1-20	Filament
J1-21	Underline Segments
J1-22	d Segment
J1-23	e Segment
J1-24	f Segment

6.3 Functional Description

The numeric vacuum fluorescent display is very similar in principle to the vacuum tube. Front Panel Driver Board A13A2 provides all required voltages and timing signals to properly drive the display. The 10073-2500 VF display operates by using a 5.8 Vac filament voltage and 35 Vdc grid and anode voltages. The grids (eleven of them; nine are used) are character enable signals which are driven in a multiplexed fashion. The grids are enabled one at a time as the seven segment data plus underline, if required, are provided to the anode pins. Each digit is enabled for approximately 600 to 700 microseconds. Figure 15 shows the display's segment's location.

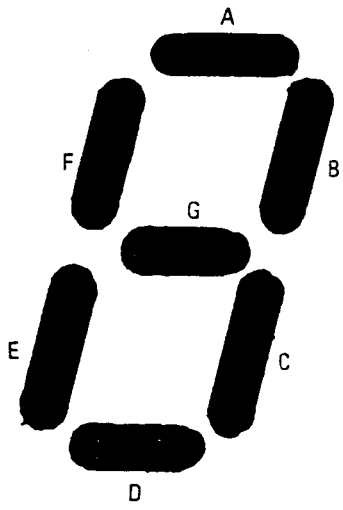


Figure 15. Numeric Display Segment Location

6.3.1 Parts List and Schematic Diagram

Table 13 is the Front Panel Numeric Display Assembly A13A5 parts list. Figures 16 and 17 are the Front Panel Numeric Display Assembly A13A5 component location diagram and schematic diagram.

Table 13. Front Panel Numeric Display Assembly A13A5 Parts List (PL 10073-2500)

Ref. Desig.	Part Number	Description
A13A5	10073-2500	NUMBERIC DISPLAY ASSEMBLY
	P05-0004-001	TAPE,FM,CL CELL,1/8 X1
	H50-1006-409	SPCR 3/16HEX SS 4-40X.562
DS1	N50-0005-001	DSPL FLR VAC 7SEG 11-DIG
J1	J46-0031-024	CONN,24 PIN

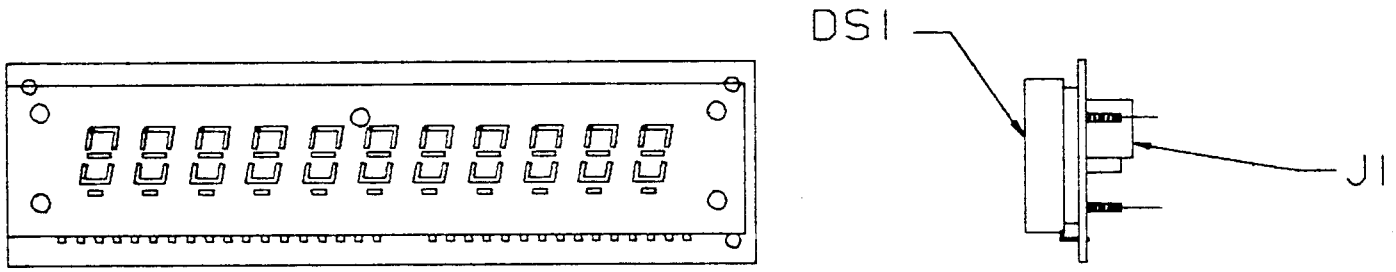


Figure 16. Front Panel Numeric Display Board A13A5 Component Location Diagram (10073-2500)

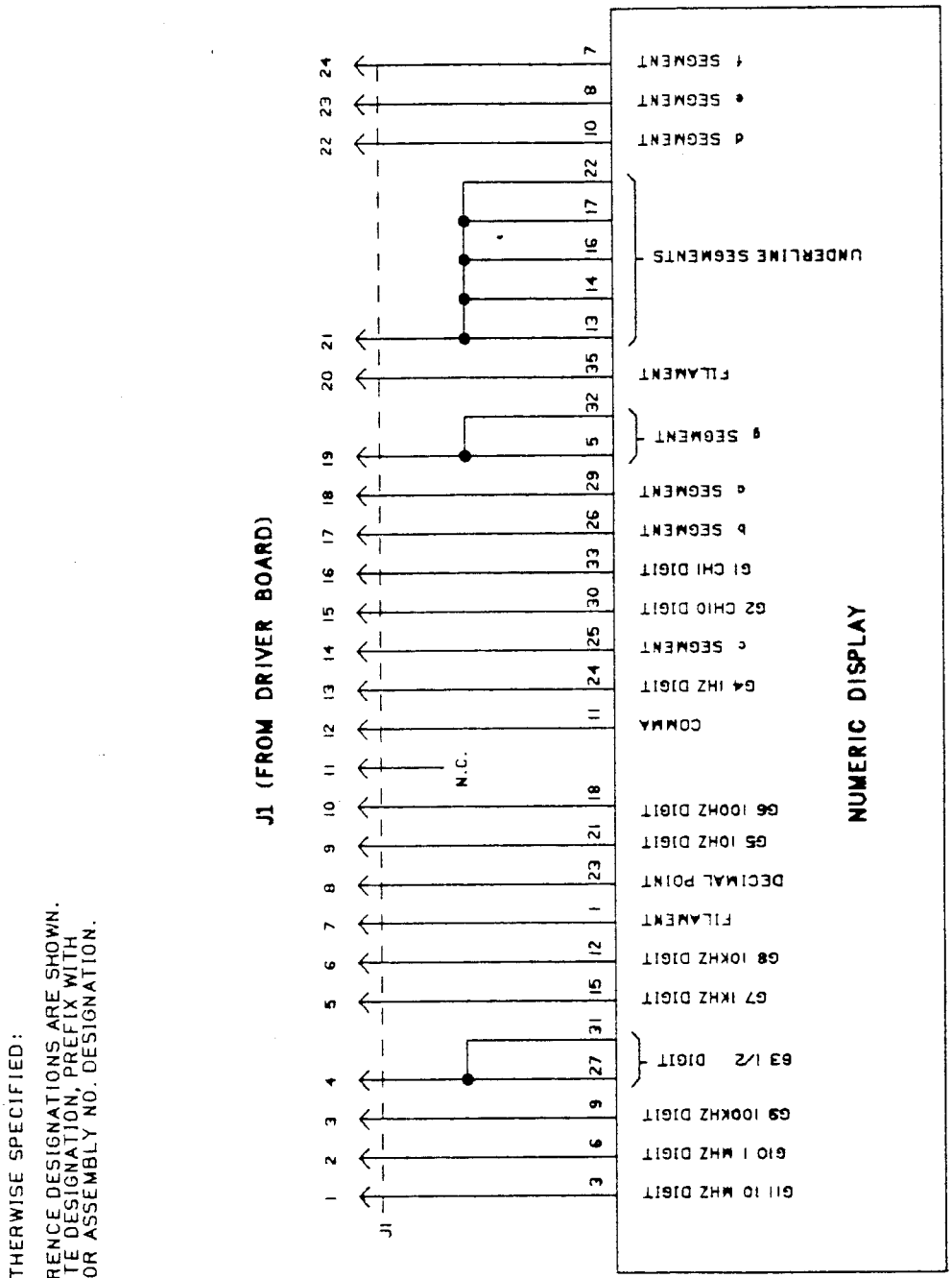


Figure 17. Front Panel Numeric Display Assembly A13A5 Schematic Diagram (10073-2501 Rev. B)

7. FRONT PANEL DISPLAY CONVERTER ASSEMBLY A13A6

7.1 General Description

Front Panel Display Converter Assembly A13A6 is a self contained dc-to-dc converter type power supply. It supplies anode and filament voltages to the A13A4 and A13A5 front panel vacuum fluorescent displays from the available -15 Vdc supply. Anode voltage output is 35 Vdc at 100 mA, and filament output voltage is 5.8 Vac at 200 mA.

The A13A6 assembly is a sealed unit (to provide EMI protection). Input/output connections to the internal A13A6A1 PWB is via feedthrough capacitors.

7.2 Circuit Description

The -15 Vdc is applied to push/pull square wave oscillator Q1 and Q2 operating at approximately 15 kHz. T1 is a saturating transformer used to provide feedback and two output voltages. One output is rectified by fullwave bridge CR2-CR5 and filtered by pi-network C2-L1-C3 to provide 35 Vdc at 100 mA for display anode power. The second output is filtered by L2, C5, T2, and C6 to provide 5.8 Vac at 200 mA for display filament power. A bias voltage of approximately 6 Vdc is also supplied to the filaments. This bias voltage originates on Front Panel Driver Board Assembly A13A2 and is applied via a center tap at T2.

7.2.1 Parts List and Schematic

Table 14 is the Front Panel Display Converter Assembly A13A6 parts list. Figure 18 is the Front Panel Display Converter Assembly A13A6 component location diagram. Table 15 is the Display Converter Board Assembly A13A6A1 parts list. Figure 19 is the Display Converter Board Assembly A13A6A1 component location diagram, and figure 20 is the A13A6 and A13A6A1 schematic diagram.

Table 14. Front Panel Display Converter Assembly A13A6 Parts List (PL 10073-2250)

Ref. Desig.	Part Number	Description
A13A6	10073-2250	CONVERTER MODULE ASSEMBLY
	10073-2256	COVER, CONVERTER
	10073-2255	CASE, CONVERTER
A1	10073-2260	PWB ASSY, CONVERTER
C1	10073-7035	CAP,FEED-THRU 100
C2	10073-7035	CAP,FEED-THRU 100
C3	10073-7035	CAP,FEED-THRU 100
C4	10073-7035	CAP,FEED-THRU 100
C5	10073-7035	CAP,FEED-THRU 100
E1	E58-0004-000	LUG SLDR RIGHT ANGLE

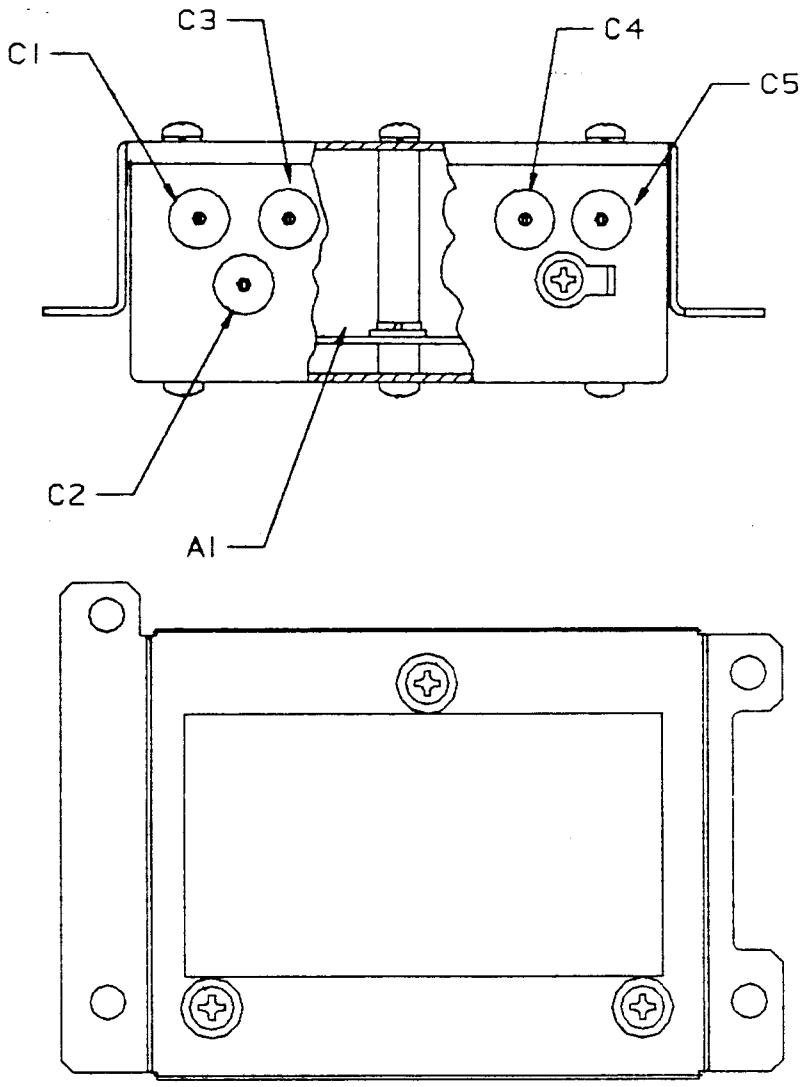


Figure 18. Front Panel Display Converter Assembly A13A6 Component Location Diagram (10073-2250)

Table 15. Display Converter Board Assembly A13A6A1 Parts List (PL 10073-2260)

Ref. Desig.	Part Number	Description
A13A6A1	10073-2260	CONVERTER ASSEMBLY
C1	CK06BX473K	CAP .047UF 10% 100V CER
C2	C26-0050-100	CAP 10UF 20% 50V TANT
C3	C26-0050-100	CAP 10UF 20% 50V TANT
C4	C18-0025-101	CAP 100UF 25V ELEC
C5	M39014/02-1318	CAP .33UF 10% 50V CER-R
C6	M39014/02-1318	CAP .33UF 10% 50V CER-R
C7	C26-0025-680	CAP 68UF 20% 25V TANT
CR1	1N4007	DIODE 1A 1000V RECT GP
CR2	D22-0007-002	DIODE 1A 100V RECT GP
CR3	D22-0007-002	DIODE 1A 100V RECT GP
CR4	D22-0007-002	DIODE 1A 100V RECT GP
CR5	D22-0007-002	DIODE 1A 100V RECT GP
CR6	D22-0007-002	DIODE 1A 100V RECT GP
CR7	D22-0007-002	DIODE 1A 100V RECT GP
L1	MS90538-12	COIL 100UH 5% FXD RF
L2	10073-7029	INDUCTOR, FILTER CHOKE
L3	10073-7029	INDUCTOR, FILTER CHOKE
Q1	2N5193	XSTR POWER PNP TO-205AA
Q2	2N5193	XSTR POWER PNP TO-205AA
R1	R65-0003-272	RES,2.7K 5% 1/4W CAR FILM
R2	R65-0003-270	RES,27 5% 1/4W CAR FILM
R3	R65-0003-101	RES,100 5% 1/4W CAR FILM
R4	R65-0003-223	RES,22K 5% 1/4W CAR FILM
T1	10073-7027	TRANSFORMER, POWER
T2	10073-7028	TRANSFORMER, RF, FIXED

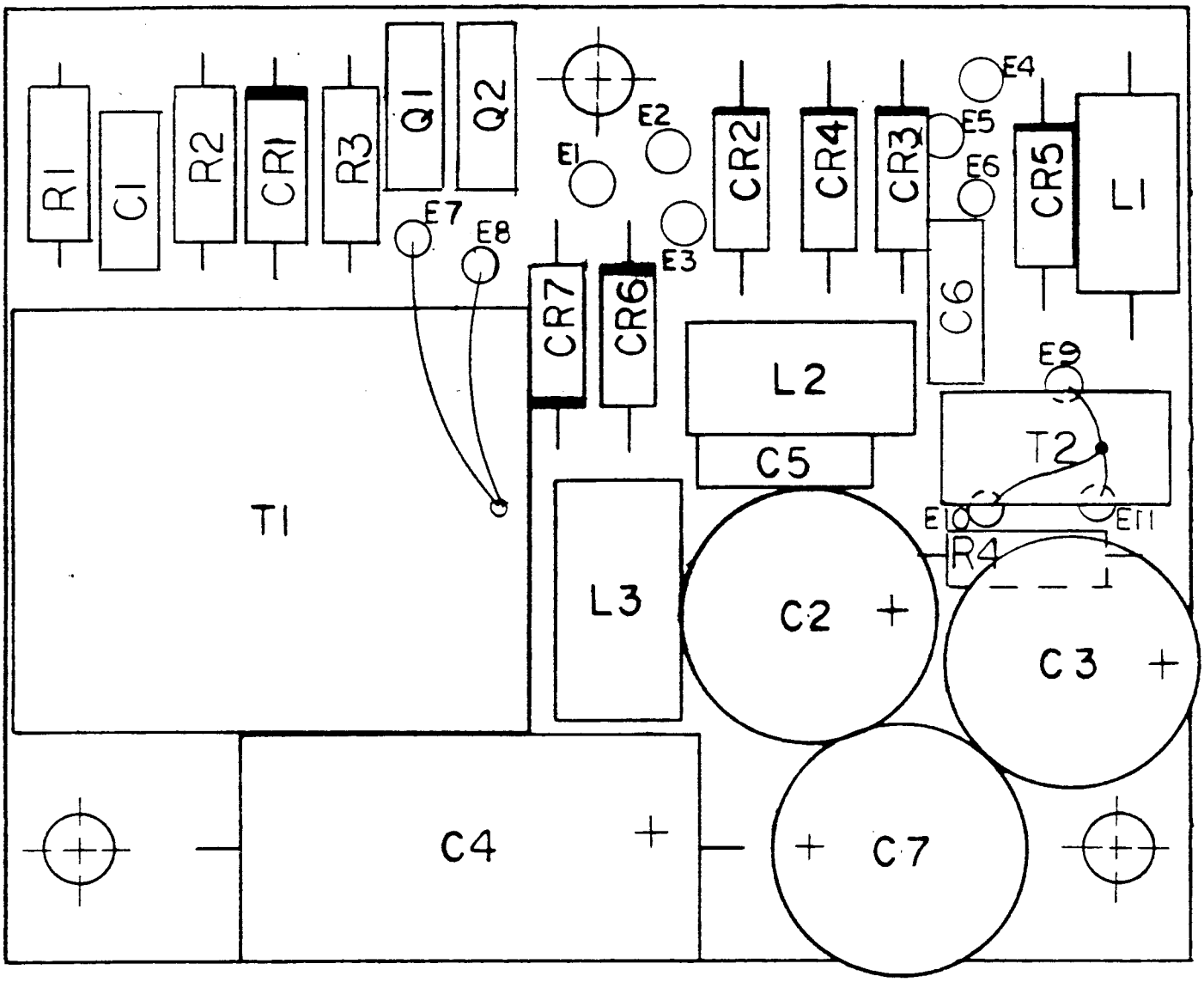
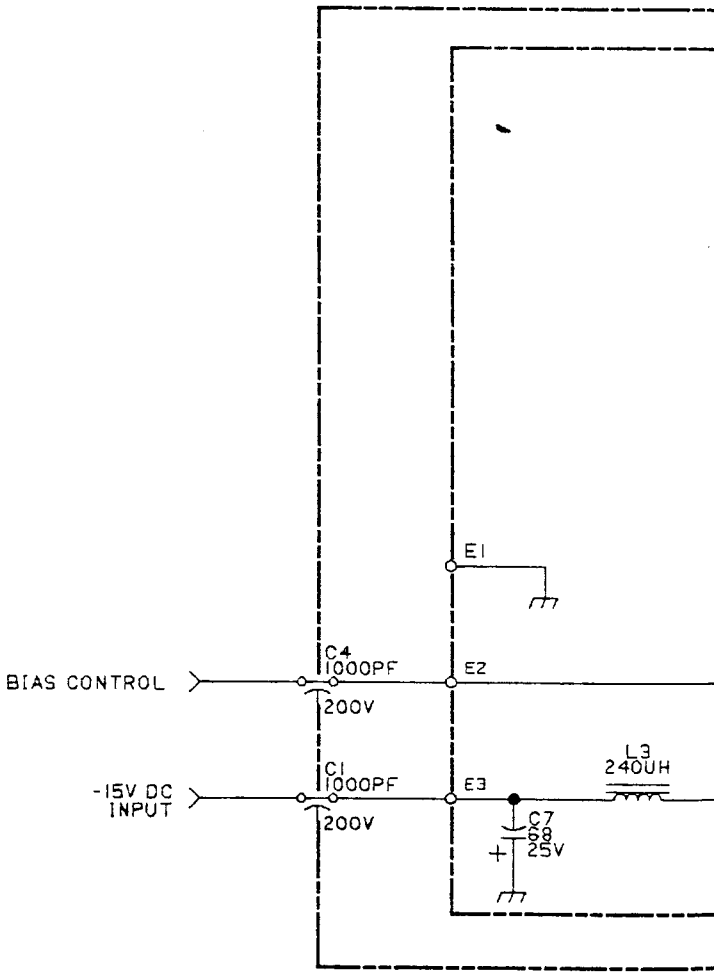


Figure 19. Display Converter Board Assembly A13A6A1 Component Location Diagram (10073-2260)

NOTE: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR A COMPLETE DESIGNATION, PREFIX WITH UNIT NO. AND/OR ASSEMBLY NO. DESIGNATION.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±5%.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.
4. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY. COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST.



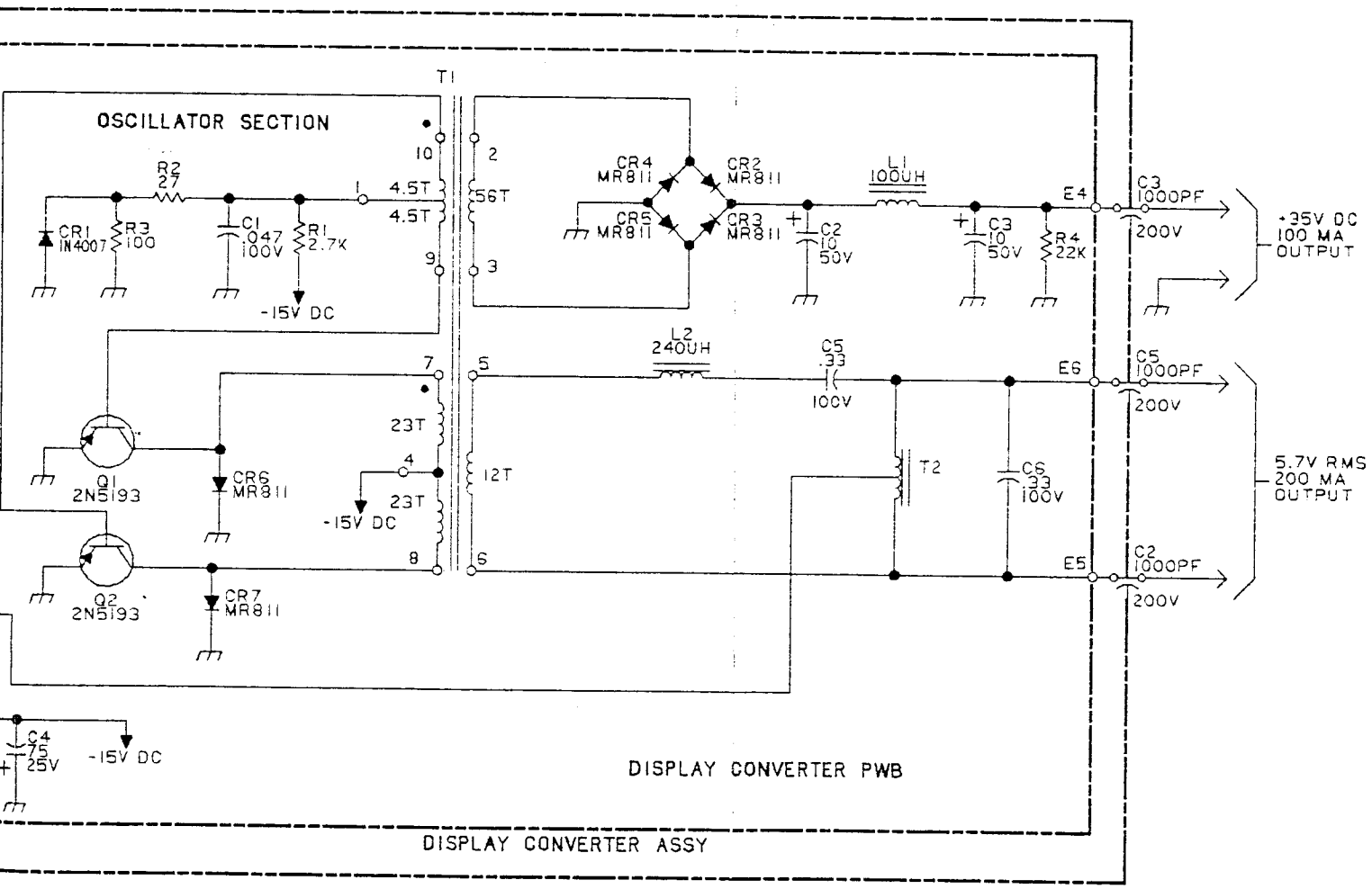


Figure 20. Front Panel Display Converter Assembly A13A6 and Display Converter Board Assembly A13A6A1 Schematic Diagram (10073-2251 Rev. F)

8. MICROPHONE ASSEMBLY A13A7

8.1 General Description

Microphone Assembly A13A7 includes the front panel microphone jack and three simple LC filter circuits. Filtering is provided for the AUDIO, CW KEY, and PTT signals. Two connectors on the PWB accept cables that carry the AUDIO signal to the A5A1 assembly and the CW KEY and PTT signals to the A13A3 assembly.

8.2 Interconnection

The interconnections of the A13A7 assembly with the other assemblies in the exciter are summarized in table 16.

Table 16. Microphone Assembly A13A7 Interconnections

Connector and Pin	Signal Name	Description
J1-A	GND	Ground
J1-B	N/C	Not connected
J1-C	PTT	PTT key signal
J1-D	AUDIO	Microphone audio in
J1-E	CW KEY	CW key signal
J1-F	N/C	Not connected
J2-1	GND	Ground
J2-2	INDEX KEY	Connector alignment key
J2-3	CW KEY	CW key signal to Meter Board
J2-4	PTT	PTT key signal to Meter Board
J3-1	AUDIO	Audio to A5A1 assembly (-56 dB nominal)
J3-2	AUDIO KEY	Audio ground
J3-3	INDEX KEY	Connector alignment key

8.3 Circuit Description

Microphone Assembly A13A7 circuit includes three separate LC filters; one each for the AUDIO, CW KEY, and PTT signals.

8.4 Parts List, Component Locations, and Schematic Diagram

All replaceable components of the microphone Assembly A13A7 are listed in table 17. Component locations are shown in figure 21. The Microphone Assembly schematic diagram is shown in figure 22.

Table 17. Microphone Assembly A13A7 Parts List

Ref. Desig.	Part Number	Description
A13A7	10121-2900	MICROPHONE ASSEMBLY
C1	M39014/02-1310	CAP .1UF 10% 100V CER-R
C2	M39014/02-1310	CAP .1UF 10% 100V CER-R
C3	M39014/02-1310	CAP .1UF 10% 100V CER-R
J1	J-0339	CONN AUDIO 6 PIN
J2	J46-0032-004	CONN,4 PIN
J3	J46-0032-004	CONN,4 PIN
L1	MS75085-8	COIL 120UH 10% FXD RF
L2	MS75085-2	COIL 39UH 10% FXD RF
L3	MS75085-2	COIL 39UH 10% FXD RF

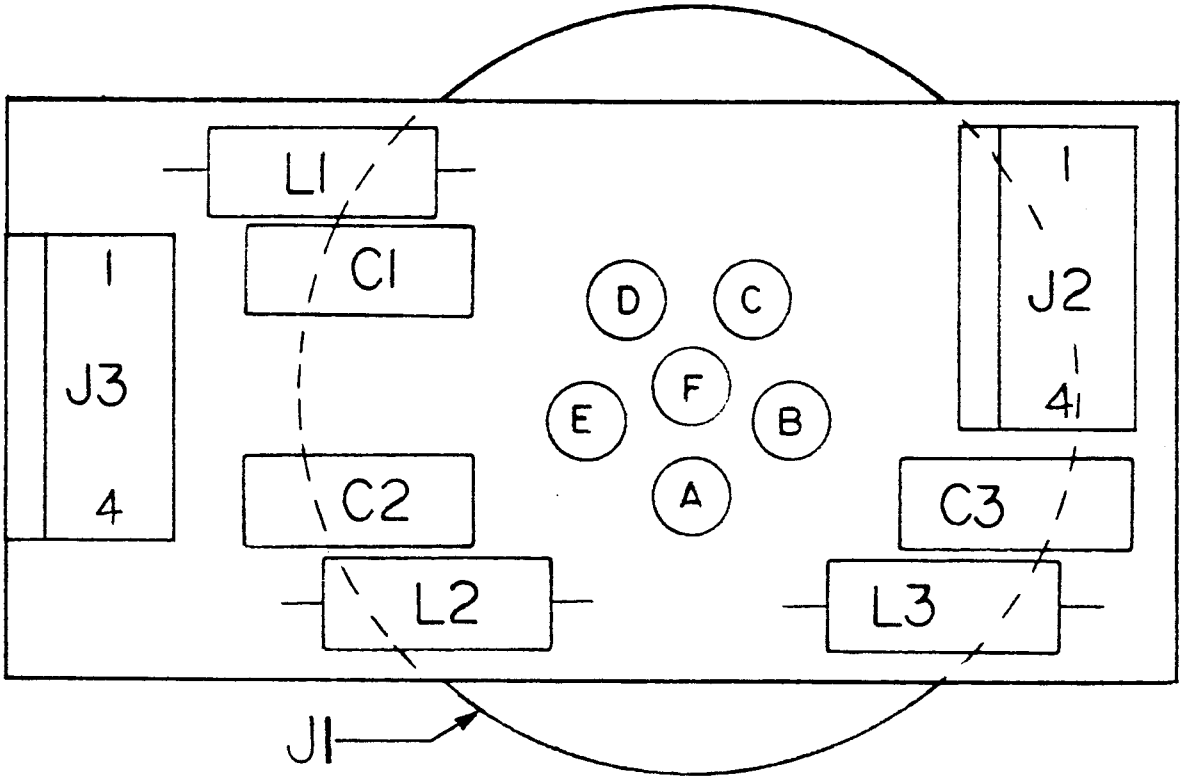


Figure 21. Microphone Assembly A13A7 Component Locations Diagram (10121-2900)

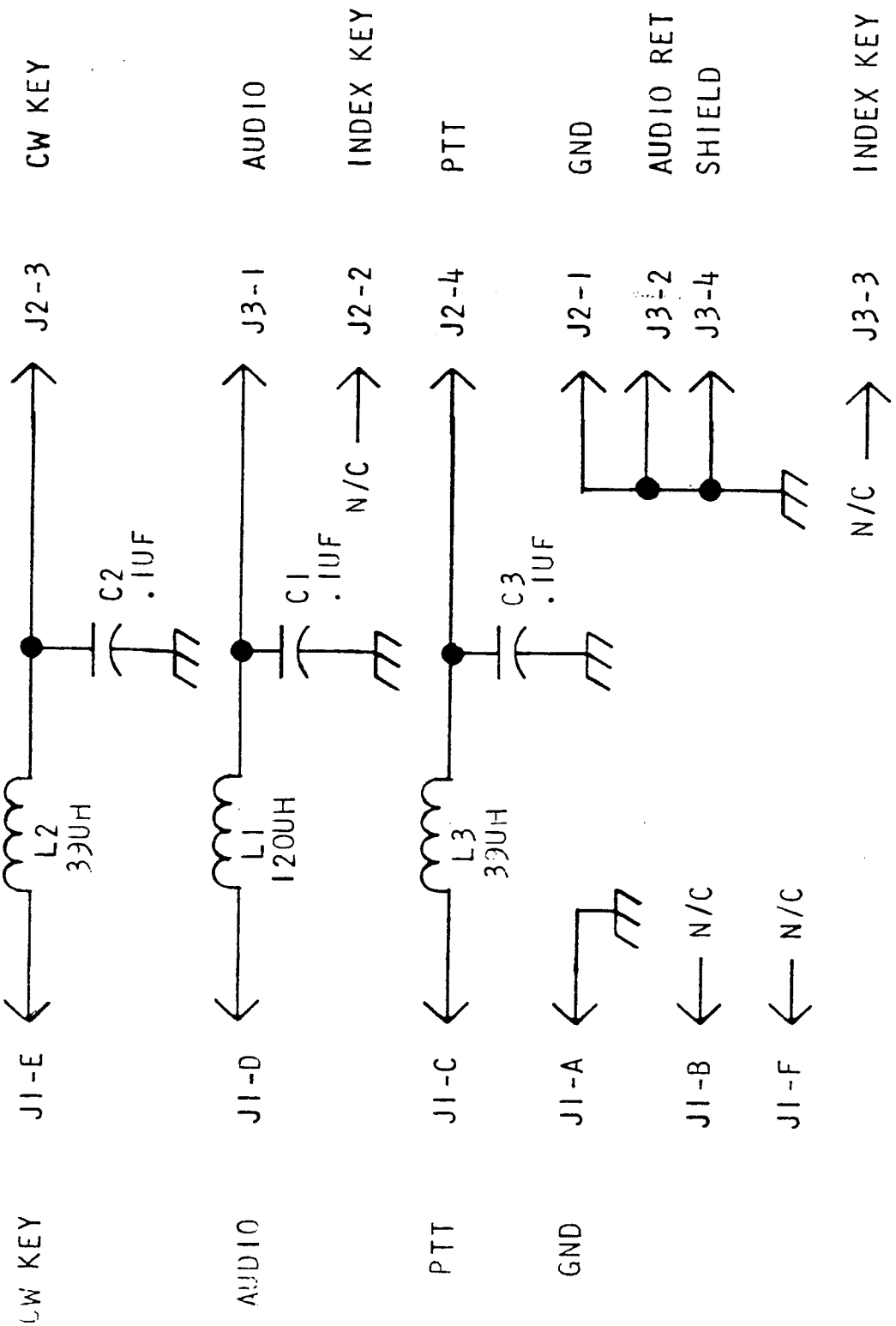


Figure 22. Microphone Assembly A13A7 Schematic Diagram (10121-2901 Rev. B)