

HUNTRON TRACKER 5100DS

TECHNICAL REFERENCE MANUAL

**Part Number 21-1146
November 1989
Rev. 1, 5/91**

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CHANGE INFORMATION

P/N: 21-1219

ISSUE NO: 9 4/98

This change contains information necessary to ensure the accuracy of the following manual:

Title: **HUNTRON TRACKER 5100DS**
Print Date: **November 1989**
P/N: **21-1146**
Revision: **1**
Revision Date: **5/91**

CHANGE #1

On Page 1-2:

CHANGE: Table 1-1
FROM: "Short Circuit Current (all values are $\pm 1\%$, except Low range $\pm 2\%$)"
TO: "Short Circuit Current (all values are $\pm 1\%$, except Low range $\pm 5\%$)"

CHANGE #2

On Page 4-13:

CHANGE: 1,A2,R16
FROM: Res CF 220K, 5% 1/4W 02-2204 09021 CF 1/4 220K J
TO: Res CF 360K, 5% 1/4W 02-2349 09021 CF 1/4 360K J

On Page 5-13:

CHANGE: Value of R16 in Figure 5-4e
FROM: 220K
TO: 360K

CHANGE #3

On Page 4-16:

CHANGE: 1,A2,R25
FROM: Res WW, 25, 5% 10W 02-2313 91637 RS-10 25 5%
TO: Jumper Wire, 2.5" 08-3150 57705 08-3150

On Page 5-19:

CHANGE: Value of R25 in Figure 5-6e
FROM: 25
TO: 0 (short)

CHANGE #4

On Page 4-10:

| | | | | |
|---------|----------------------|---------|-------|---------|
| CHANGE: | 1,A1,U23 | | | |
| FROM: | IC, Dual 2/4 Decoder | 05-5048 | 27014 | 74HC239 |
| TO: | IC, Dual 2/4 Decoder | 05-5023 | 27014 | CD4555B |

On Page 5-5:

| | | | | |
|---------|---|--|--|--|
| CHANGE: | Description of U23 in Figure 5-2c (ONE PLACE) | | | |
| FROM: | 74HC239 | | | |
| TO: | 4555B | | | |

On Page 5-7:

| | | | | |
|---------|--|--|--|--|
| CHANGE: | Description of U23 in Figure 5-2e (TWO PLACES) | | | |
| FROM: | 74HC239 | | | |
| TO: | 4555B | | | |

CHANGE #5

On Page 4-8:

| | | | | |
|---------|-----------------------------|---------|-------|-------------|
| CHANGE: | 1,A1,R6 | | | |
| FROM: | Res VAR, 5K 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| TO: | Res VAR, Multiturn, 5K, 10% | 02-1051 | 30983 | RJ26FP502 |

| | | | | |
|---------|------------------------------|---------|-------|-------------|
| CHANGE: | 1,A1,R22 | | | |
| FROM: | Res VAR, 10K 25%, RA | 02-1042 | 32997 | 3306W-1-103 |
| TO: | Res VAR, Multiturn, 10K, 10% | 02-1052 | 30983 | RJ26FP103 |

| | | | | |
|---------|-----------------------------|---------|-------|-------------|
| CHANGE: | 1,A1,R29 | | | |
| FROM: | Res VAR, 1K 25%, RA | 02-1043 | 32997 | 3306W-1-102 |
| TO: | Res VAR, Multiturn, 1K, 10% | 02-1053 | 30983 | RJ26FP102 |

| | | | | |
|---------|-----------------------------|---------|-------|-------------|
| CHANGE: | 1,A1,R32 | | | |
| FROM: | Res VAR, 5K 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| TO: | Res VAR, Multiturn, 5K, 10% | 02-1051 | 30983 | RJ26FP502 |

On Page 4-9:

| | | | | |
|---------|-----------------------------|---------|-------|-------------|
| CHANGE: | 1,A1,R35 | | | |
| FROM: | Res VAR, 5K 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| TO: | Res VAR, Multiturn, 5K, 10% | 02-1051 | 30983 | RJ26FP502 |

| | | | | |
|---------|-----------------------------|---------|-------|-------------|
| CHANGE: | 1,A1,R38 | | | |
| FROM: | Res VAR, 5K 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| TO: | Res VAR, Multiturn, 5K, 10% | 02-1051 | 30983 | RJ26FP502 |

CHANGE #5 (cont.)

| | | | | |
|---------|-----------------------------|---------|-------|-------------|
| CHANGE: | 1,A1,R41 | | | |
| FROM: | Res VAR, 5K 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| TO: | Res VAR, Multiturn, 5K, 10% | 02-1051 | 30983 | RJ26FP502 |

CHANGE #6

On Page 4-15:

| | | | | |
|---------|-----------------------|---------|-------|-------------|
| CHANGE: | 1.A2.R11 | | | |
| FROM: | Res CF, 12K, 5%,1/4W | 02-2238 | 09021 | CF 1/4 12KJ |
| TO: | Res CF, 13K, 5%, 1/4W | 02-2160 | 09021 | CF 1/4 13KJ |

On Page 5-13:

| | |
|---------|-----------------------------|
| CHANGE: | Value of R11 in Figure 5-4c |
| FROM: | 12K |
| TO: | 13K |

CHANGE #7

On Page 4-10:

| | | | | |
|---------|------------------------|---------|-------|--------------|
| CHANGE: | 1,A1,U1 | | | |
| FROM: | IC, Voltage Ref., 1/2V | 05-5014 | 32293 | ICL8069DCZR |
| TO: | IC, Voltage Ref., 1.2V | 05-5102 | 64155 | LT1004CZ-1.2 |

| | |
|---------|--|
| CHANGE: | Description of U1 in Figure 5-2a (ONE PLACE) |
| FROM: | 8069 |
| TO: | LT004CZ-1.2 |

CHANGE #8

EFFECTIVITY: ALL 230V UNITS STARTING WITH S/N 251-03512.

On Page 4-2:

| | | | | |
|---------|----------------------------------|---------|-------|---------------|
| CHANGE: | 1.MP7, Final Assembly Parts List | | | |
| FROM: | Power Entry Module | 06-6057 | N/A | FN393-6-05-11 |
| TO: | Power Entry Module A*, CE | 06-6068 | 57705 | 06-6068 |

| | | | | |
|---------|---------------------------|---------|-------|-----------|
| CHANGE: | Final Assembly Parts List | | | |
| ADD: | 1,MP25 Ferrite Bead #33 | 07-5030 | N/A | SS28B2033 |
| | 1,MP26 Static Plug Set | 98-0247 | 57705 | 98-0247 |

CHANGE #9

EFFECTIVITY: ALL UNITS

On Page 3-12:

ADD: "Note: Make sure your system has been warmed up for one hour."
Before the second paragraph in Section 3-6.

CHANGE #10

EFFECTIVITY: 1/98

ON PAGE before the Table of Contents change the CONTACTING HUNTRON information to:

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USA

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CHANGE INFORMATION

P/N: 21-1219

ISSUE NO: 8 9/96

This change contains information necessary to ensure the accuracy of the following manual:

Title: **HUNTRON TRACKER 5100DS
TECHNICAL REFERENCE MANUAL**
Print date: **November 1989**
P/N: **21-1146**
Revision: **1**
Revision Date: **5/91**

CHANGE #1

On Page 1-2:

CHANGE: Table 1-1

FROM: "Short Circuit Current (all values are $\pm 1\%$, except Low range $\pm 2\%$):"

TO: "Short Circuit Current (all values are $\pm 1\%$, except Low range $\pm 5\%$):"

CHANGE #2

On Page 4-13:

CHANGE: 1.A2.R16

FROM: Res CF, 220K, 5%, 1/4W 02-2204 09021 CF 1/4 220K J

TO: Res CF, 360K, 5%, 1/4W 02-2349 09021 CF 1/4 360K J

On Page 5-13:

CHANGE: Value of R16 in Figure 5-4e

FROM: 220K

TO: 360K

CHANGE #3

On Page 4-16:

CHANGE: 1.A2.R25

FROM: Res WW, 25, 5%, 10W 02-2313 91637 RS-10 25 5%

TO: Jumper Wire, 2.5" 08-3150 57705 08-3150

On Page 5-19:

CHANGE: Value of R25 in Figure 5-6e

FROM: 25

TO: 0 (short)

CHANGE #4

On Page 4-10:

CHANGE: 1.A1.U23

| | | | |
|----------------------------|---------|-------|---------|
| FROM: IC, Dual 2/4 Decoder | 05-5048 | 27014 | 74HC239 |
| TO: IC, Dual 2/4 Decoder | 05-5023 | 27014 | CD4555B |

On Page 5-5:

CHANGE: Description of U23 in Figure 5-2c (ONE PLACE)

FROM: 74HC239
TO: 4555B

On Page 5-7:

CHANGE: Description of U23 in Figure 5-2e (TWO PLACES)

FROM: 74HC239
TO: 4555B

CHANGE #5

On Page 4-8:

CHANGE: 1.A1.R6

| | | | |
|---------------------------------|---------|-------|-------------|
| FROM: Res VAR, 5K, 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| TO: Res VAR, Multiturn, 5K, 10% | 02-1051 | 30983 | RJ26FP502 |

CHANGE: 1.A1.R22

| | | | |
|----------------------------------|---------|-------|-------------|
| FROM: Res VAR, 10K, 25%, RA | 02-1042 | 32997 | 3306W-1-103 |
| TO: Res VAR, Multiturn, 10K, 10% | 02-1052 | 30983 | RJ26FP103 |

CHANGE: 1.A1.R29

| | | | |
|---------------------------------|---------|-------|-------------|
| FROM: Res VAR, 1K, 25%, RA | 02-1043 | 32997 | 3306W-1-102 |
| TO: Res VAR, Multiturn, 1K, 10% | 02-1053 | 30983 | RJ26FP102 |

CHANGE: 1.A1.R32

| | | | |
|---------------------------------|---------|-------|-------------|
| FROM: Res VAR, 5K, 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| TO: Res VAR, Multiturn, 5K, 10% | 02-1051 | 30983 | RJ26FP502 |

On Page 4-9:

CHANGE: 1.A1.R35

| | | | |
|---------------------------------|---------|-------|-------------|
| FROM: Res VAR, 5K, 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| TO: Res VAR, Multiturn, 5K, 10% | 02-1051 | 30983 | RJ26FP502 |

CHANGE: 1.A1.R38

| | | | |
|---------------------------------|---------|-------|-------------|
| FROM: Res VAR, 5K, 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| TO: Res VAR, Multiturn, 5K, 10% | 02-1051 | 30983 | RJ26FP502 |

CHANGE #5 (cont.)

CHANGE: 1.A1.R41

| | | | |
|---------------------------------|---------|-------|-------------|
| FROM: Res VAR, 5K, 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| TO: Res VAR, Multiturn, 5K, 10% | 02-1051 | 30983 | RJ26FP502 |

CHANGE #6

On Page 4-15:

CHANGE: 1.A2.R11

| | | | |
|-----------------------------|---------|-------|-------------|
| FROM: Res CF, 12K, 5%, 1/4W | 02-2238 | 09021 | CF 1/4 12KJ |
| TO: Res CF, 13K, 5%, 1/4W | 02-2160 | 09021 | CF 1/4 13KJ |

-On Page 5-13:

CHANGE: Value of R11 in Figure 5-4c

| |
|-----------|
| FROM: 12K |
| TO: 13K |

CHANGE #7

On Page 4-10:

CHANGE: 1.A1.U1

| | | | |
|------------------------------|---------|-------|--------------|
| FROM: 1C, Voltage Ref., 1.2V | 05-5014 | 32293 | ICL8069DCZR |
| TO: 1C, Voltage Ref., 1.2V | 05-5102 | 64155 | LT1004CZ-1.2 |

CHANGE: Description of U1 in Figure 5-2a (ONE PLACE)

| |
|------------------|
| FROM: 8069 |
| TO: LT1004CZ-1.2 |

CHANGE #8

EFFECTIVITY: ALL 230V UNITS STARTING WITH S/N 251-03512.

On Page 4-2:

CHANGE: 1.MP7, Final Assembly Parts List

| | | | |
|-------------------------------|---------|-------|---------------|
| FROM: Power Entry Module | 06-6057 | N/A | FN393-6-05-11 |
| TO: Power Entry Module A*, CE | 06-6068 | 57705 | 06-6068 |

CHANGE: Final Assembly Parts List

| | | | |
|------------------------------|---------|-------|-----------|
| ADD: 1.MP25 Ferrite Bead #33 | 07-5030 | N/A | SS28B2033 |
| 1.MP26 Static Plug Set | 98-0247 | 57705 | 98-0247 |

CHANGE #9

EFFECTIVITY: ALL UNITS.

On Page 3-12:

Add the following note before the second paragraph in Section 3-6:

Note: Make sure your system has been warmed up for one hour.

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ABOUT THIS MANUAL

This manual is intended for service technicians who will be calibrating and/or troubleshooting the Tracker 5100DS. This manual assumes the reader is familiar with basic solid-state electronics and the operation of electronic test instruments.

- | | | |
|-----------|----------------------------------|--|
| Section 1 | INTRODUCTION AND SPECIFICATIONS. | Introduces the Tracker 5100DS and provides electrical, environmental, and physical specifications. |
| Section 2 | THEORY OF OPERATION. | Describes how the Tracker 5100DS works. An operational overview is given followed by descriptions of the major sections of circuitry and their respective functions. |
| Section 3 | MAINTENANCE. | Provides service information which includes disassembly/reassembly instructions, performance tests, calibration instructions, and troubleshooting information. |
| Section 4 | LIST OF REPLACEABLE PARTS. | Provides complete parts lists for the Tracker 5100DS. |
| Section 5 | SCHEMATIC DIAGRAMS. | Provides detailed schematics of the Tracker 5100DS. |

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SECTION 1

INTRODUCTION AND SPECIFICATIONS

1-1. INTRODUCTION

The Huntron Tracker 5100DS is a computer-controlled troubleshooting tool having the following features:

- Digital storage of analog signatures.
- Four impedance ranges (low, medium 1, medium 2, high).
- Range control: any or all ranges can be enabled during automatic test.
- 200 Hz test signal frequency.
- Large CRT display with easy-to-operate controls.
- Easy test connections to devices with up to 64 pins.
- Zero Insertion Force (ZIF) socket for testing loose DIP ICs with up to 40 pins.
- GPIB (IEEE-488) interface for communication with a GPIB-equipped PC/XT/AT or PS/2.

1-2. SPECIFICATIONS

The specifications for the Tracker 5100DS are listed in Table 1-1. External dimensions are shown in Figure 1-1.

**Table 1-1.
Tracker 5100DS Specifications**

ELECTRICAL

Unless otherwise noted, these specifications apply over the operating temperature range which is +15°C to +30°C.

Test Signal

Waveform sine wave (normal mode)
 triangle wave (for calibration/maintenance only)

Frequency 200 Hz \pm 1 Hz

Open Circuit Voltage (all values are \pm 0.5%):

| Range | Nominal ¹ | Triangle Wave ² | Sine Wave ² |
|----------|----------------------|----------------------------|------------------------|
| High | 60 Volts peak | 34.32 Volts RMS | 42.04 Volts RMS |
| Medium 2 | 20 Volts peak | 11.49 Volts RMS | 14.08 Volts RMS |
| Medium 1 | 15 Volts peak | 8.64 Volts RMS | 10.59 Volts RMS |
| Low | 10 Volts peak | 5.76 Volts RMS | 7.06 Volts RMS |

¹ The peak voltage is the same for both waveforms. The nominal data represents design values with an open circuit on the front panel TEST jack.

² These RMS voltages take into account the load on the TEST jack caused by a digital multimeter with 10 M Ω input impedance.

Short Circuit Current (all values are \pm 1%, except Low range \pm 2%):

| Range | Triangle Wave | Sine Wave |
|----------|---------------|--------------|
| High | 0.465 mA RMS | 0.570 mA RMS |
| Medium 2 | 0.432 mA RMS | 0.529 mA RMS |
| Medium 1 | 6.96 mA RMS | 8.54 mA RMS |
| Low | 108.8 mA RMS | 132.3 mA RMS |

**Table 1-1. (con't)
Tracker 5100DS Specifications**

ELECTRICAL (con't)

Interconnections

Overload Protection (front panel replaceable):

Signal Fuse (protects TEST line) 1/4 Amp AGC

Common Fuse (protects COMMON line) . . . 1 Amp AGC

Discrete Components:

TEST and COMMON front panel jacks are provided for use with probes.

Multiple Pin Devices:

Test Pins 64 (maximum)

Common Pins 64 (maximum)

Connectors:

20 pin IDC (for devices of 20 pins or less)

40 pin IDC (for devices of 40 pins or less)

64 pin IDC (for devices of 64 pins or less)

40 pin ZIF (for loose DIP-IC packages of 40 pins or less)

Interface

GPIB (General Purpose Interface Bus) - conforms to IEEE-488 standard.

Display

Type Monochrome CRT

Size 2.8 in. (7cm) diagonal

Acceleration Potential 1200 VDC \pm 20 VDC (regulated)

**Table 1-1. (con't)
Tracker 5100DS Specifications**

ELECTRICAL (con't)

Power Requirements

- * AC Line Voltage 100 VAC, 115 VAC, or 230 VAC
- Frequency 47 Hz - 63 Hz
- Power 32 Watts maximum
- Line Fuse 1/2 Amp AGC or GMA for 100V or 115V line
1/4 Amp AGC or GMA for 230V line

* **Note:** 115 VAC and 230 VAC are selectable via the back panel fuse tray.
100 VAC models will only work at that voltage.

ENVIRONMENTAL

- Operating Temperature +15°C to +30°C (+59°F to +86°F)
- Storage Temperature -50°C to +60°C (-58°F to +140°F)
- Humidity 0 to 50% R.H.

MECHANICAL

- Height 6.25 in. (15.88 cm)
- Width 12.06 in. (30.63 cm)
- Depth 20.25 in. (51.44 cm)
- Weight 16.5 lbs. (7.5 kg)
- Shock and Vibration withstands shock and vibration encountered in
commercial shipping and handling.

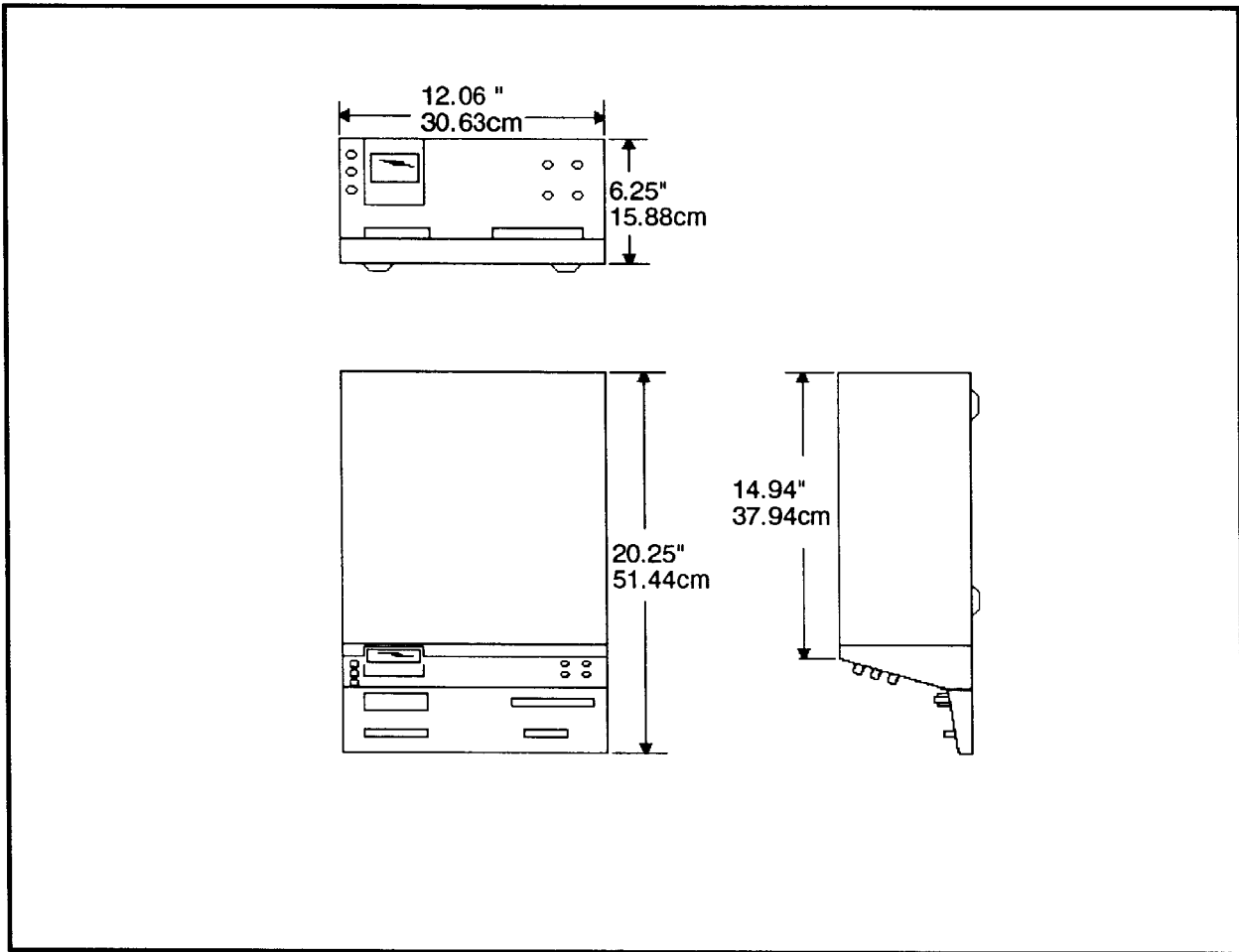


Figure 1-1. External Dimensions.

1-3. SAFETY CONSIDERATIONS

This manual contains information, cautions, and warnings the user must follow to ensure safe operation, and to keep the instrument in safe condition.

WARNING

A warning denotes a hazard. It calls attention to a procedure or practice which, if not correctly performed or adhered to, could result in personal injury.

CAUTION

A caution also denotes a hazard. It calls attention to a procedure or practice which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the instrument.

1-4. LIST OF ACCESSORIES

The following accessories are available:

| HUNTRON P/N | DESCRIPTION |
|----------------|--|
| 98-0312 | PC-PEDAL (foot switch to activate the ENTER key on PC) |
| 07-1233 | 64 Pin DIP Clip |
| 98-0027 | 64 Pin IDC Cable. |

To order any of these items, or for further information, please contact Huntron.

SECTION 2

THEORY OF OPERATION

2-1. INTRODUCTION

This section describes how the Tracker 5100DS works. An overview of operation is provided first, followed by descriptions of the major sections of the circuit and their function. Detailed schematics of the Tracker 5100DS appear in Section 5. Also for the remainder of this manual, the Tracker 5100DS will be referred to as a "5100DS".

2-2. FUNCTIONAL OVERVIEW

The circuit boards of the 5100DS are arranged in a block diagram in Figure 2-1. A brief description of each board follows.

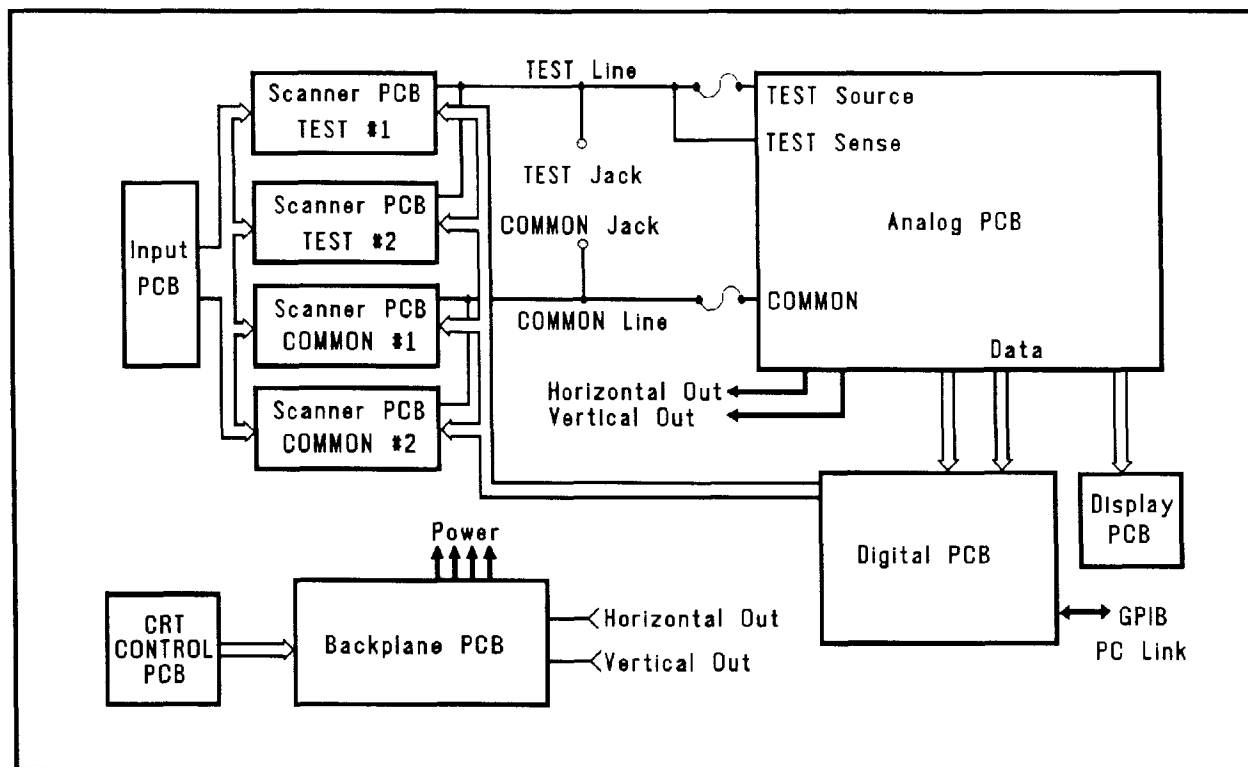


Figure 2-1. Overall Block Diagram.

- The Input PCB provides four connectors on the front panel to allow the user to test devices with different numbers of pins. Each individual pin of a given connector is tied to one of 64 input lines. Three of the connectors are for cables terminated with an "IDC" type of connector. The other connector is a "zero insertion force" (ZIF) socket which can be used for testing loose DIP integrated circuits with up to 40 pins.
- Each Scanner PCB holds 32 relays. There are a total of four scanner boards which allow any one of the 64 input lines to be connected to the TEST LINE or the COMMON LINE. All the scanners operate under the control of the Digital PCB.

- The Analog PCB is a "one channel Tracker" with the TEST and COMMON lines forming the channel. This board produces the low level AC signals (HORZ. OUT and VERT. OUT) that eventually drive the front panel CRT display. This board also digitizes the horizontal and vertical signals so that signatures can be stored and displayed by the PC.
- The main function of the Display PCB is to indicate which impedance range is currently selected on the Analog PCB.
- The Digital PCB provides control of the 5100DS hardware under direction of the external PC and the 5100DS Operating Software.
- The Backplane PCB has several functions. It contains the power supplies for the whole system, the high voltage sections for the CRT display, and the connectors for plugging in all other PCBs in the system.
- The CRT Control PCB provides the front panel adjustments for the CRT Display: Horizontal position, Vertical position, Intensity, and Trace Rotation.

All of the above circuits will be described in more detail in the remainder of this section.

2-3. Tracker Basics

This section covers the basic operating principle behind all Trackers. In essence the Tracker is a special form of semiconductor curve tracer. An AC test signal developed by an oscillator is applied across the TEST and COMMON lines (and across any device that is connected to those lines via the scanners or by the front panel test terminals). This test signal causes a current to flow through the device and causes a voltage drop across its terminals. The current flow causes a vertical deflection of the CRT display, while the voltage across the device causes a horizontal deflection. The combined effect produces the current-voltage signature of the device on the CRT display which is called an "analog signature".

Electrically, the test signal can be represented by a voltage source (V_s) with a series output impedance (Z_s). A simplified circuit of the basic Tracker is shown in Figure 2-2. The figure also shows how the terminal voltage affects the horizontal deflection plates of the CRT, and how the current through the terminals affects the vertical deflection plates through current sensing point "I".

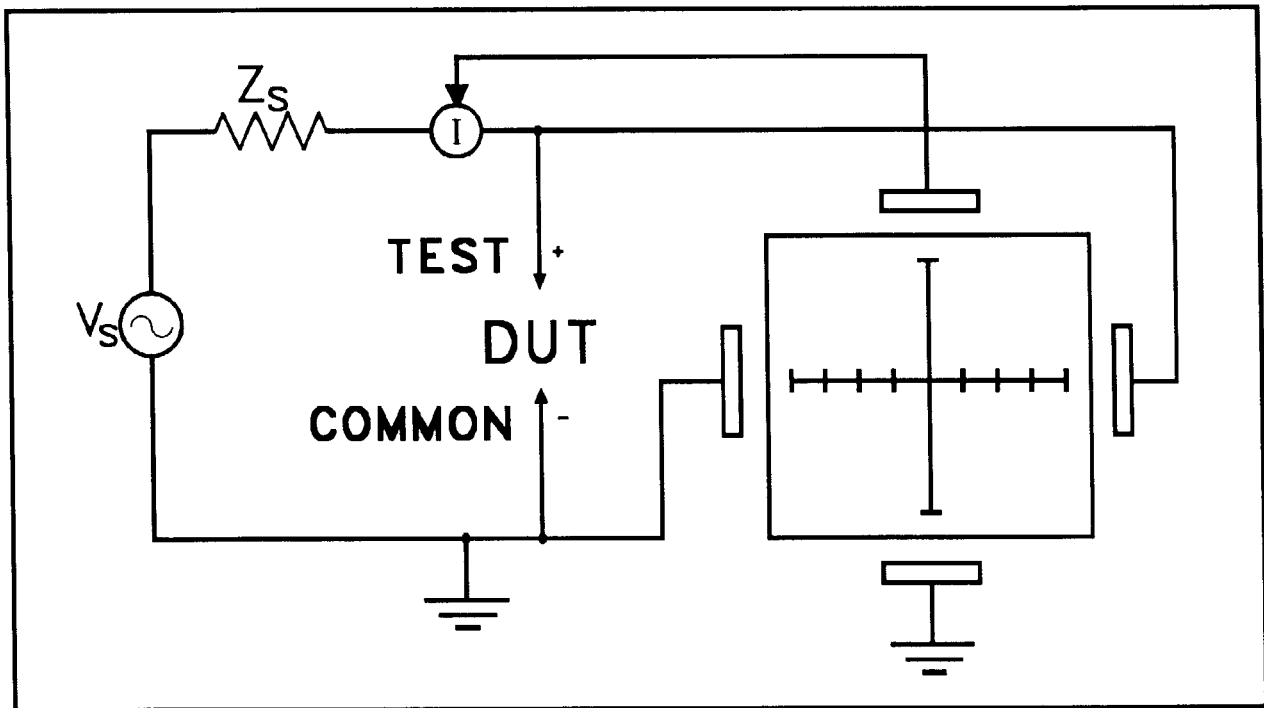


Figure 2-2. 5100DS Simplified Circuit.

The open circuit voltage and output impedance for each range are shown in Table 2-1.

Table 2-1.
Terminal Characteristics

| Range | V_s (peak volts) | Z_s |
|----------|---------------------|---------------|
| High | 60 | 74k Ω |
| Medium 2 | 20 | 27k Ω |
| Medium 1 | 15 | 1.2k Ω |
| Low | 10 | 54 Ω |

An open circuit has zero current flowing through the terminals and has maximum voltage across the terminals. In all ranges, this is represented by a horizontal trace from the left to the right of the CRT graticule (see Figure 2-3a). When the terminals are shorted, maximum current flows through the terminals and the voltage at the terminals is zero. This is indicated by a vertical trace from the top to the bottom of the CRT graticule in all ranges (see Figure 2-3b).

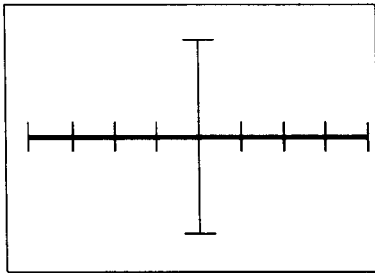


Figure 2-3a. Open Circuit Signature.

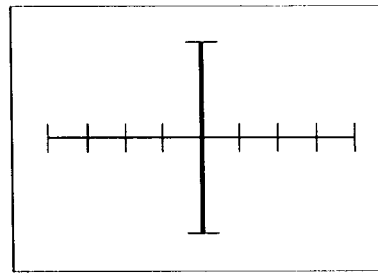


Figure 2-3b. Short Circuit Signature.

2-4. Backplane PCB/CRT Control PCB

The block diagram of the Backplane PCB and CRT Control PCB appears in Figure 2-4. This board provides the interconnections between all the other boards. The interconnections are passive, i.e. they consist only of PCB wiring traces on this board and have no active circuits. The active circuits that are on this board consist of the power supplies and the CRT display circuits.

The power supplies take AC from the secondaries of the power transformer and convert it to the various DC voltages needed by the 5100DS hardware. The high-voltage power supply provides -1200V (regulated) for the CRT acceleration voltage, +180V (unregulated) for the deflection drivers, and 6.3V(AC) for the CRT filament. The low-voltage power supply first produces +17V and -20V (both unregulated). These levels are reduced by a group of voltage regulators to the proper levels for the other boards: five regulators provide +9V, -9V, +5V, -5V, and V_{CC} (+5V) to the Analog PCB and the CRT section's low-voltage supply. A sixth regulator provides V_{SB} (+5V) to the four Scanner PCBs. The Digital PCB has its own on-board regulator that runs off the unregulated +17V supply.

The CRT display circuits consist of the CRT Deflection Drivers, the CRT High Voltage circuits, and the Trace Rotation Amp. These circuits also work in conjunction with user settings from the CRT Control PCB as shown in the block diagram.

The CRT Deflection Drivers boost the low-level outputs from the Analog PCB to the higher voltage levels needed by the deflection plates in the CRT. The drivers also accept small DC levels from the HORIZONTAL and VERTICAL controls on the CRT Control PCB to adjust the position of the signature on the CRT display.

The CRT High Voltage circuits control the brightness and clarity of the CRT display. The INTENSITY control on the CRT Control PCB is the primary means of adjusting the visual characteristics of the signature. Focus and astigmatism are internal adjustments located on the Backplane PCB that are used to provide a sharp display.

The Trace Rotation Amp is controlled by the TRACE ROTATION adjustment on the CRT Control PCB. This adjustment is used to make the open circuit horizontal signature parallel with the horizontal axis on the CRT graticule. The TRACE ROTATION adjustment is factory set, but may require user adjustment due to changes caused by the magnetic field of the Earth.

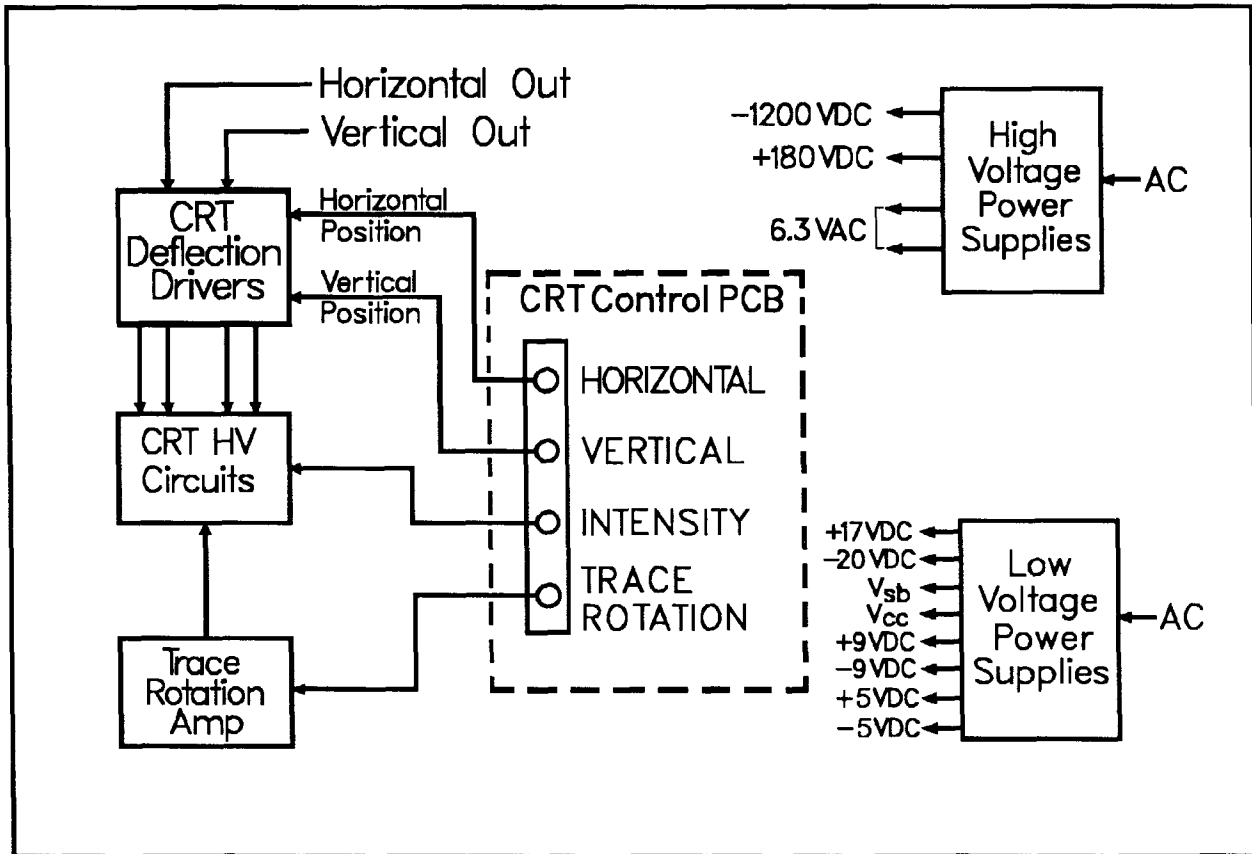


Figure 2-4. Backplane PCB and CRT Control PCB Block Diagram.

2-5. Analog PCB/Display PCB

Refer to Figure 2-5 for the Analog PCB and Display PCB block diagram.

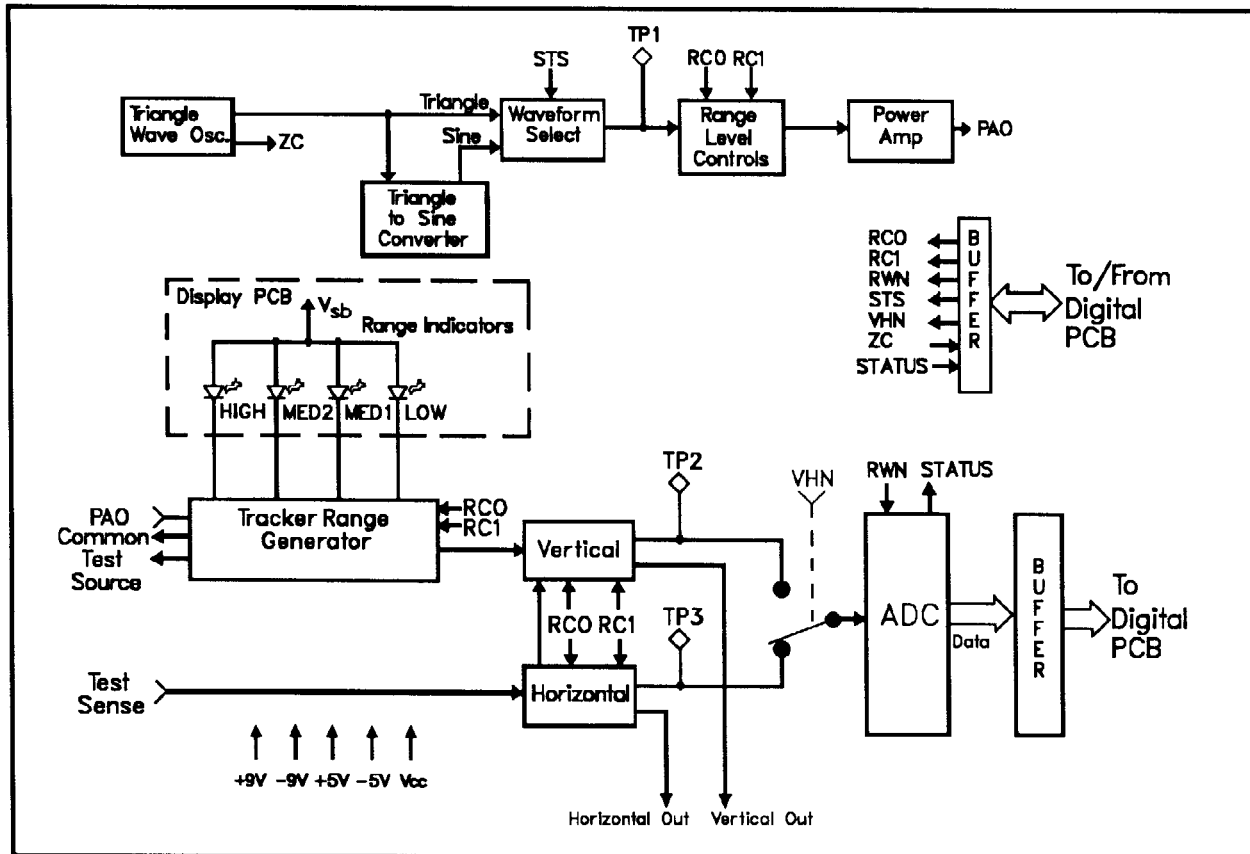


Figure 2-5. Analog PCB and Display PCB Block Diagram.

The TRIANGLE WAVE OSCILLATOR generates a low distortion triangle wave with a constant amplitude of approximately 1.2 Volts peak and a constant frequency of 200 Hz. This is called the test signal. The oscillator also generates the ZC (Zero Crossing) signal. The entire signal path followed by the test signal is non-inverting so that a positive level on the Triangle Wave oscillator output corresponds to a positive voltage on the TEST LINE with respect to the COMMON LINE. The triangle wave goes to the WAVEFORM SELECT circuit and the TRIANGLE TO SINE CONVERTER.

The TRIANGLE TO SINE CONVERTER is a wave-shaping circuit that converts the triangle wave to a sine wave with no phase difference. The output level of this circuit is adjustable so that the peak voltage of the sine wave can be adjusted to be equal to the peak voltage of the triangle wave. This is necessary so that the length of the open and short circuit signatures on the CRT are the same length regardless of which waveform is used. The output of the converter goes to the WAVEFORM SELECT circuit.

The WAVEFORM SELECT circuit simply switches between a triangle wave test signal or a sine wave test signal. It is controlled by STS (Sine Triangle Select) which is generated by the Digital PCB. The triangle wave is used only for calibration or diagnostics. The sine wave is used for all normal modes of operation to ensure compatibility with other Tracker models that use a sine wave test signal.

The test signal next goes to the RANGE LEVEL CONTROLS. This section is controlled by Digital PCB signals RC0 and RC1 (Range Control bits 0 and 1). The four states of these two lines select the four ranges of the Tracker. The range levels are adjusted during calibration to produce specific open circuit levels on the TEST LINE in each range.

The POWER AMP boosts the test signal to approximately 4 Volts peak to drive the primary of the Signal Transformer in the TRACKER RANGE GENERATOR. The power amp allows higher currents to be produced with a short circuit in the low range which is the maximum load under normal terminal conditions.

The TRACKER RANGE GENERATOR contains the Signal Transformer, four range relays plus their drivers, and the range resistors which determine the characteristics of each range. Under control of RC0 and RC1, the range relay drivers turn on one of the range relays at a time. This connects one of four secondary windings of the signal transformer (each with a different voltage level) to the TEST SOURCE line through the proper range resistor. The terminal characteristics of the four ranges are shown in Table 2-1. The relay drivers also turn on the appropriate range LED on the Display PCB. The TEST SOURCE line goes through the Signal Fuse on the front panel and then connects to the TEST LINE which goes on to the test scanners. If an external voltage source of sufficient amplitude is connected to the TEST LINE while the low range is selected, the Signal Fuse will open to protect the components in this circuit. Finally, this circuit feeds an input signal into the VERTICAL circuits.

The HORIZONTAL and VERTICAL circuits monitor the high-level inputs from TEST SENSE (which is connected to the TEST LINE) and from the Tracker Range Generator, respectively. They scale the voltage levels down to lower levels that can be handled by the circuitry. The attenuation of both circuits is controlled by RC0 and RC1 so that each range works in the following manner:

- An open circuit between TEST and COMMON produces a horizontal signal at TP3 with a peak amplitude of approximately 1 Volt, and a vertical signal with zero amplitude.
- A short circuit between TEST and COMMON produces a horizontal signal with zero amplitude, and a vertical signal at TP2 with a peak amplitude of approximately 1 Volt.

The horizontal and vertical outputs (which are scaled down from the TP3/TP2 levels) go off the Analog PCB at this point to drive the CRT circuits on the Backplane PCB.

An analog switch controlled by the VHN signal from the Digital PCB connects either the horizontal signal or the vertical signal to the input of the Analog-to-Digital Converter (ADC). When the 5100DS Operating Software issues a command for a signature to be digitized, the μ C on the Digital PCB switches the horizontal signal to the ADC input and then waits for ZC to change to the proper state. This triggers the digitizing process. Using the RWN and STATUS lines to obtain data from the ADC, the μ C takes 100 horizontal data points. Then the vertical signal is switched to the ADC input and 100 vertical data points are taken. The ADC has 8 bit resolution so each data point is one byte and the complete signature is represented by the 200 bytes gathered from the Analog PCB.

2-6. Digital PCB

The Digital PCB contains the main control circuitry in the 5100DS. Figure 2-6 shows the block diagram of the Digital PCB. This diagram logically divides the board into 6 sections which are:

- microcomputer
- memory
- watch dog
- input/output (I/O) and buffers
- communications
- power supply

The microcomputer (μ C) on the Digital PCB is an 8 bit, 80C31 type device. The μ C operates on an 11 Megahertz crystal controlled oscillator. The μ C serves as an intelligent controller and receives instructions and transmits data to the PC under control of the 5100DS Operating Software.

A ROM stores the μ C's firmware program. The firmware program takes instructions from the PC, interprets them, and initiates the appropriate response in the 5100DS. A RAM stores the digitized data from the Analog PCB. The μ C's address and data bus is multiplexed. The lower 8 bits of address are demultiplexed by a latch which is strobed by the Address Latch Enable (ALE) signal from the μ C. These outputs connect to the common address bus on the circuit board.

The 5100DS communicates with the PC via the general purpose interface bus (GPIB). This GPIB interface meets the IEEE-488 standard bus specifications. This part of the interface circuit consists of an intelligent GPIB controller IC and two input/output drivers. A DIP switch sets the GPIB device address (default = 1).

The μ C and supporting devices provide input/output (I/O) lines to other boards in the 5100DS. All I/O lines are buffered.

To read data from the Analog PCB, the μ C must wait for a ready interrupt signal. The Analog PCB's Analog-to-Digital Converter (ADC) supplies the STATUS interrupt signal. The μ C reads data from the ADC via a bi-directional 8 bit buffer.

A power-on reset circuit insures that the μ C properly starts and the firmware program starts execution correctly. Pushbutton switch S1 aids in troubleshooting by generating the reset signal manually.

The watch dog circuit operates as a sanity monitor for the μ C. During normal operation, the μ C sends a Watch Dog In (WADI) pulse signal to this circuit at regular intervals. If a malfunction occurs that causes the μ C to lose control, the watch dog circuit will detect the absence of WADI pulses. Then the watch dog out (WADO) signal forces the μ C to reinitialize and restart its program. This simple circuit makes for better and more fault tolerant operation.

The power supply on the Digital PCB provides regulated power for use on the board. This supply reduces the +17 VDC from the Backplane PCB to +5 VDC (V_{dd}).

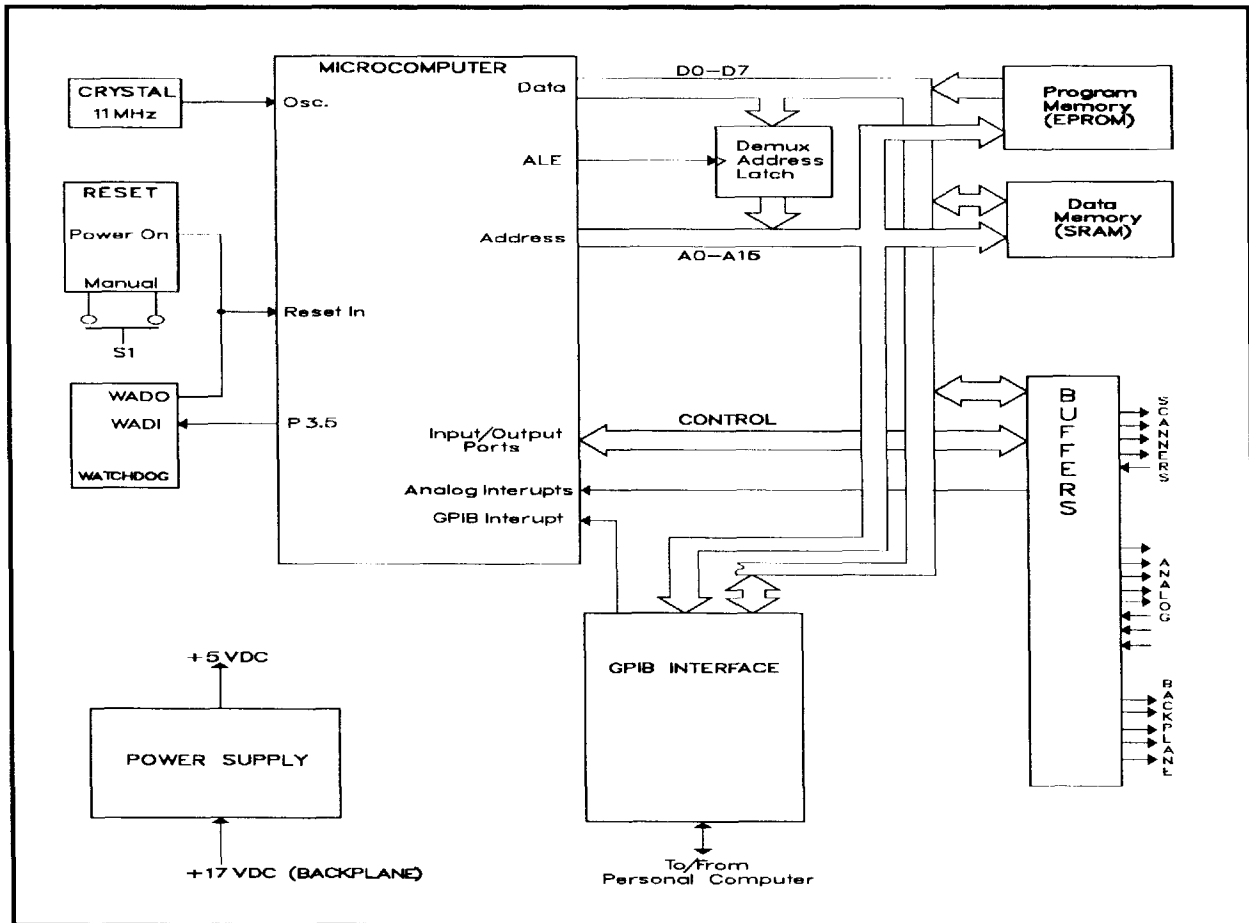


Figure 2-6. Digital PCB Block Diagram.

2-7. Scanner PCB

The 5100DS contains four Scanner PCBs. Each Scanner PCB is identical, however its particular function of either a test or common board is determined by its position in the Backplane PCB. The Scanner PCB block diagram is shown in Figure 2-7.

The Scanner PCB can be divided into three functional sections: input/output buffers, controller, and relay matrix.

The input/output buffers provide the digital signal isolation and conditioning for external interfacing.

The controller consists of a single integrated circuit that performs a variety of tasks. It receives data from the Digital PCB and sets or clears the appropriate relay(s). The data is in a serial format and a separate clock is also sent from the Digital PCB along with the data to synchronize data transfer.

The relay matrix consists of 32 single pole, single throw (SPST) relays. Each relay is individually controlled by the controller IC. One side of each relay contact is wired together in common. The other side of each relay contact is connected to the Input PCB (via the Backplane PCB) for external interfacing with the device under test.

The Scanner PCB receives regulated +5 VDC (V_{sb}) from the main power supply on the Backplane PCB.

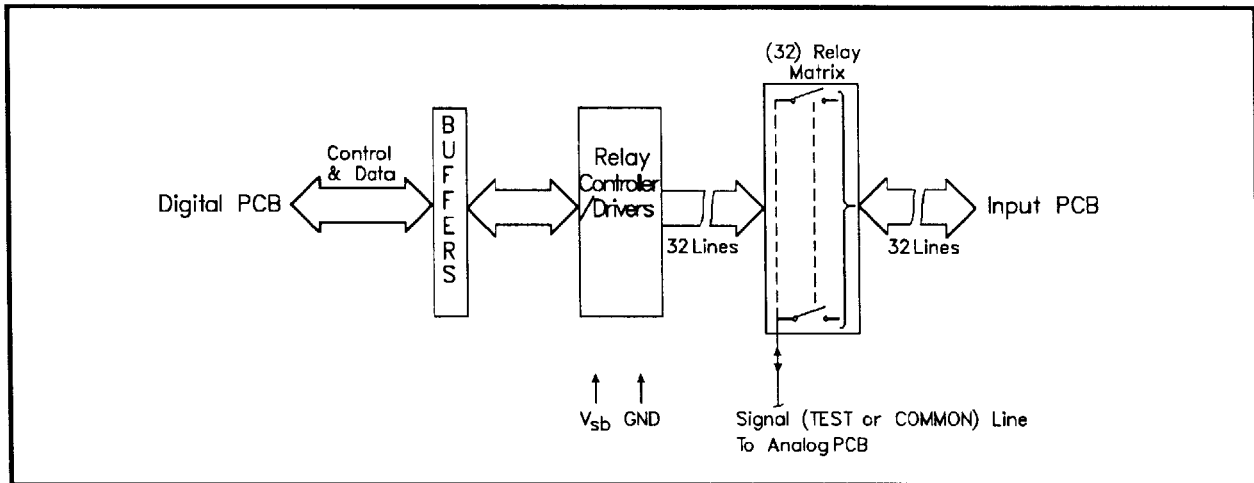


Figure 2-7. Scanner PCB Block Diagram.

SECTION 3 MAINTENANCE

WARNING

These service instructions are for use by qualified personnel only. To avoid electric shock, do not perform any procedures in this section unless you are technically qualified to do so.

3-1. INTRODUCTION

This section presents maintenance information for the 5100DS. The section includes service information, disassembly/reassembly instructions, performance tests, calibration procedures, troubleshooting, line fuses and voltage selection, external cleaning and lubrication information, and storage instructions. Test equipment recommended for performance tests, calibration procedures, and troubleshooting is listed in Table 3-1. If the recommended equipment is not available, equipment with equivalent specifications may also be used.

**Table 3-1.
Recommended Test Equipment**

| Instrument Type | Minimum Specifications | Recommended Model |
|----------------------------|--|---|
| Digital Multimeter (DMM) | 20,000 counts full scale (4 1/2 digits) 10 M Ω Input Impedance in AC Volts Accuracy DCV: +/- 0.1% ACV: +/- 0.5% @ 200 Hz ACmA: +/- 1.0% @ 200 Hz Required Ranges DCV: 20 V, 2 V ACV: 200 V, 20 V, 2 V ACmA: 2000 mA, 200 mA, 20 mA (manual ranging only) | Fluke 8060A |
| High Voltage Probe for DMM | 1000 to one attenuation 2 kV operating range | Fluke 80K-6 |
| Frequency Counter | Accuracy: +/- 0.1 Hz with 1 second gate time | Hewlett Packard 5315A or Fluke 8060A |
| Oscilloscope | General purpose, 50 MHz 2 channel with X-Y feature | Tektronix 2200 series |

3-2. SERVICE INFORMATION

The conditions of the 5100DS warranty are given at the front of this manual. Malfunctions that occur within the limits of the warranty will be corrected at no cost to the purchaser exclusive of one-way shipping costs to Huntron Instruments, Inc. Huntron service is also available for calibration and/or repair of instruments that are beyond the warranty period. In either case, please clearly describe the problem(s) encountered with the instrument.

For in-warranty or out-of-warranty factory service in the United States, call (toll-free) 800-426-9265 to obtain an RMA number and shipping instructions prior to shipment. This number must be clearly displayed on the exterior of the shipping carton. Only parcels displaying an RMA number will be accepted. In Washington State, call 206-743-3171. Outside the United States, call your local distributor for assistance or service. Huntron is also accessible by FAX at 206-743-1360 or TELEX at 152951.

When packing the unit for shipment, use the original shipping container to provide protection during transit. If original container is not available, package the unit in a box with a minimum of two inches (5 cm) of cushioning material on all sides.

3-3. CMOS HANDLING PRECAUTIONS

CAUTION

This instrument contains CMOS components which can be damaged by static discharge.

To prevent damage, take the following precautions when troubleshooting or repairing the instrument:

- Perform all work at a static-free work station.
- Do not handle components or PCB assemblies by their connectors.
- Wear static ground straps.
- Use conductive foam to store components.
- Remove all plastic, vinyl, and styrofoam from the work area.
- Use a grounded, temperature-regulated soldering iron.

3-4. DISASSEMBLY PROCEDURE

WARNING

To avoid electrical shock, remove the power cord and test leads before disassembling the instrument.

The disassembly procedure for the Tracker 5100DS should be performed in the following order: remove the case cover first, then the PCB Retaining Bar, PCB assemblies, CRT assembly, Backplane PCB Assembly, Front Control Assembly, and Input PCB Assembly.

1. Case Cover Removal (refer to Figure 3-1)

Turn unit over and place on flat surface. Remove four screws (1.MP15) from bottom. Turn unit right side up. Slide case cover (1.MP1) towards rear of unit and remove cover.

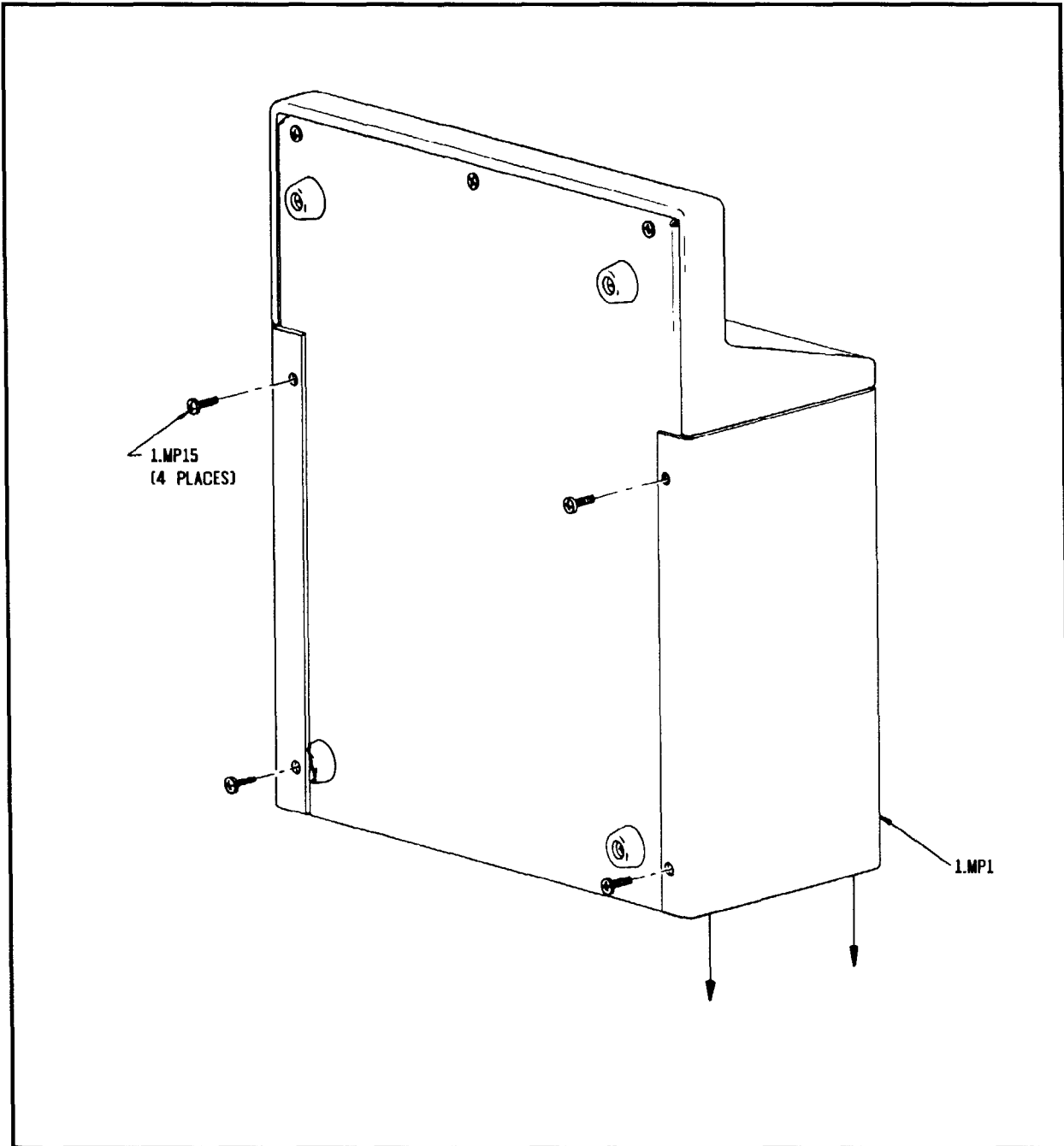


Figure 3-1. Case Cover Removal.

2. PCB Retaining Bar Removal (refer to Figure 3-2)

Remove the screws (1.MP12) from end of PCB Clamping Bar (1.MP25). Lift free end of bar upwards and unhook other end from side wall of chassis.

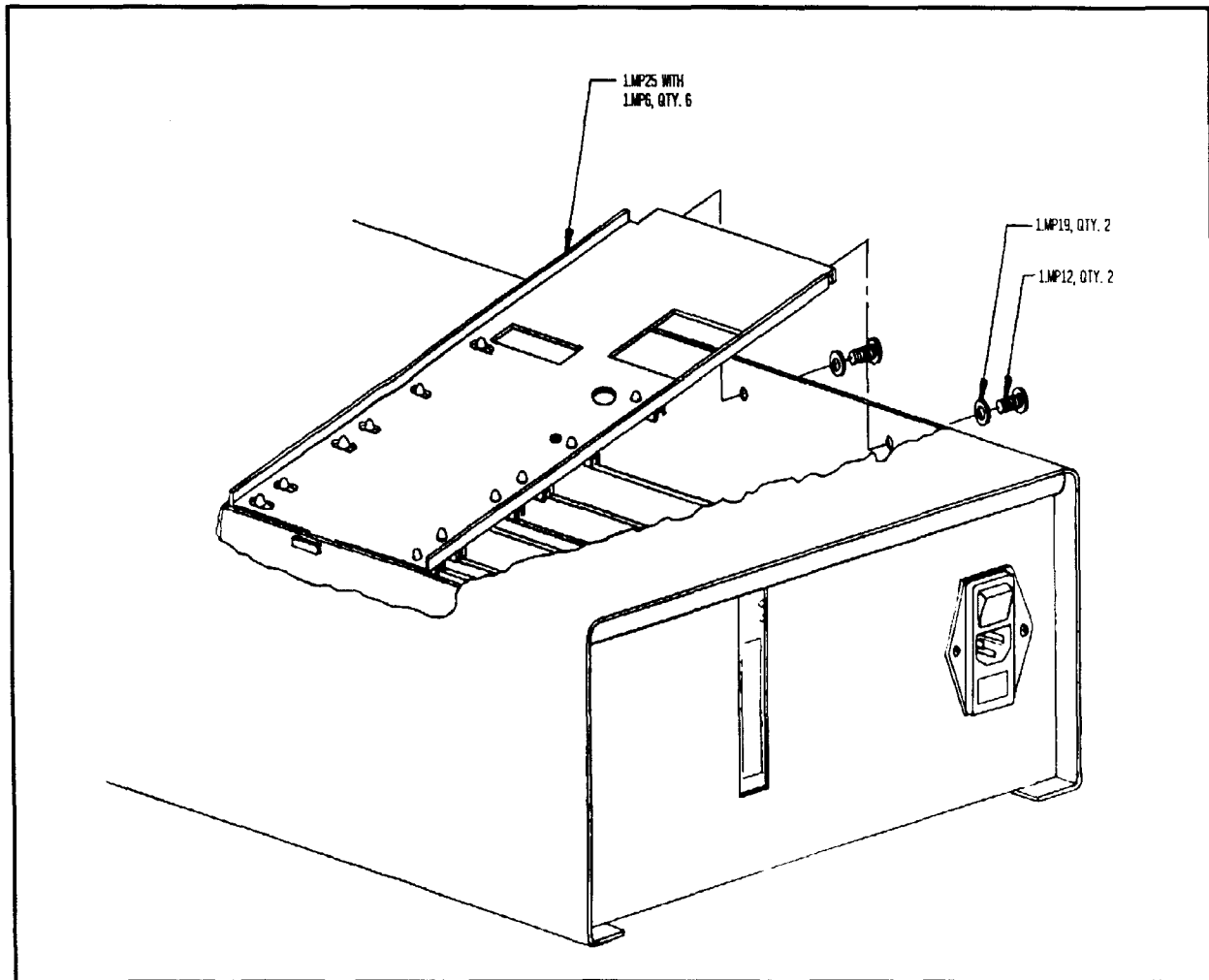


Figure 3-2. PCB Retaining Bar Removal.

3. Analog PCB Removal (refer to Figure 3-3)

Grasp Analog PCB Assembly (1.A1) carefully and firmly lift upwards to remove.

4. Digital PCB Removal (refer to Figure 3-3)

Remove screw (1.MP12) on bracket of Digital PCB Assembly (1.A3) located on back of chassis. Grasp PCB carefully and firmly lift upwards to remove.

5. Scanner PCB Removal (refer to Figure 3-3)

Grasp each Scanner PCB Assembly (1.A5) carefully and firmly lift upwards to remove.

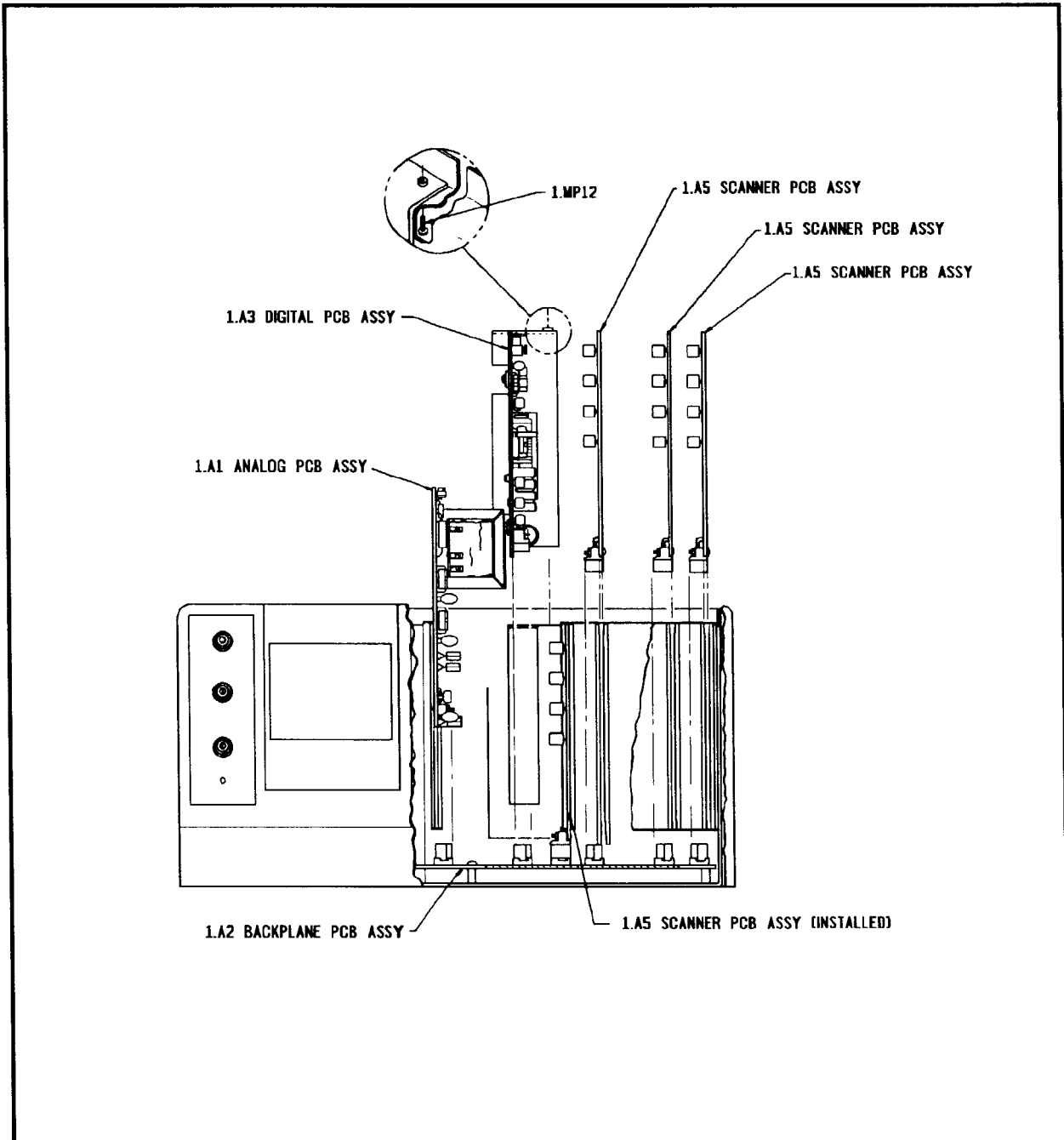


Figure 3-3. Analog, Digital, and Scanner PCB Removal.

6. CRT Assembly Removal (refer to Figure 3-4 and 3-5)

Remove two screws (1.MP15) located on the exterior side wall of the chassis nearest the CRT Assembly (1.A8). Gently grasp the CRT and pull it back away from the Front Control Assembly (1.A7). Lift the front of the CRT slightly upwards above the top and rotate front of CRT counterclockwise towards the rear of the chassis. Disconnect CRT wiring harness from Backplane PCB Assembly at connectors 1.A2.J17 (CRT) and 1.A2.J18 (FIL) (refer to Figure 3-5 if necessary). Remove CRT Assembly from unit.

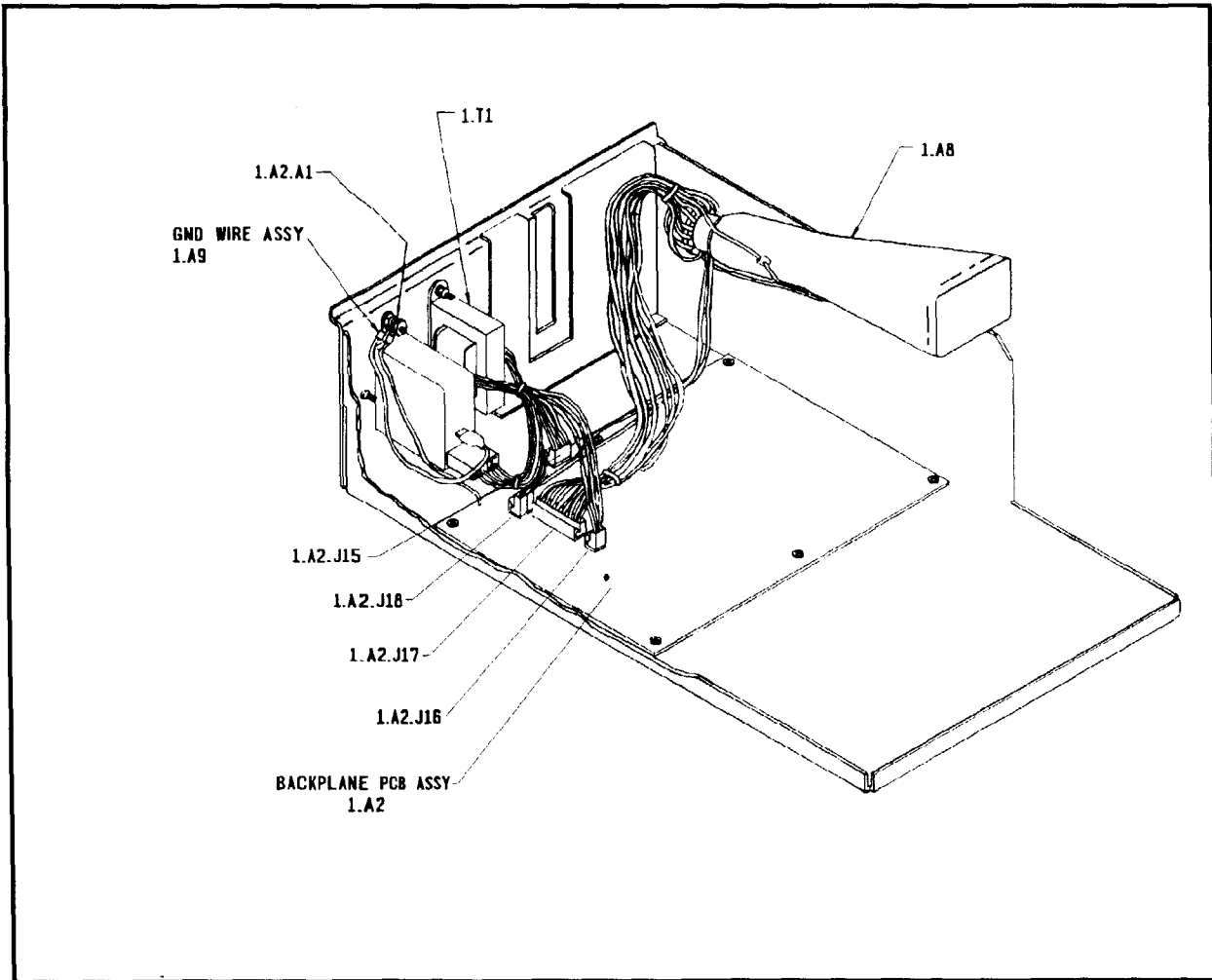


Figure 3-4. Backplane PCB Interconnections to CRT and Power Transformer.

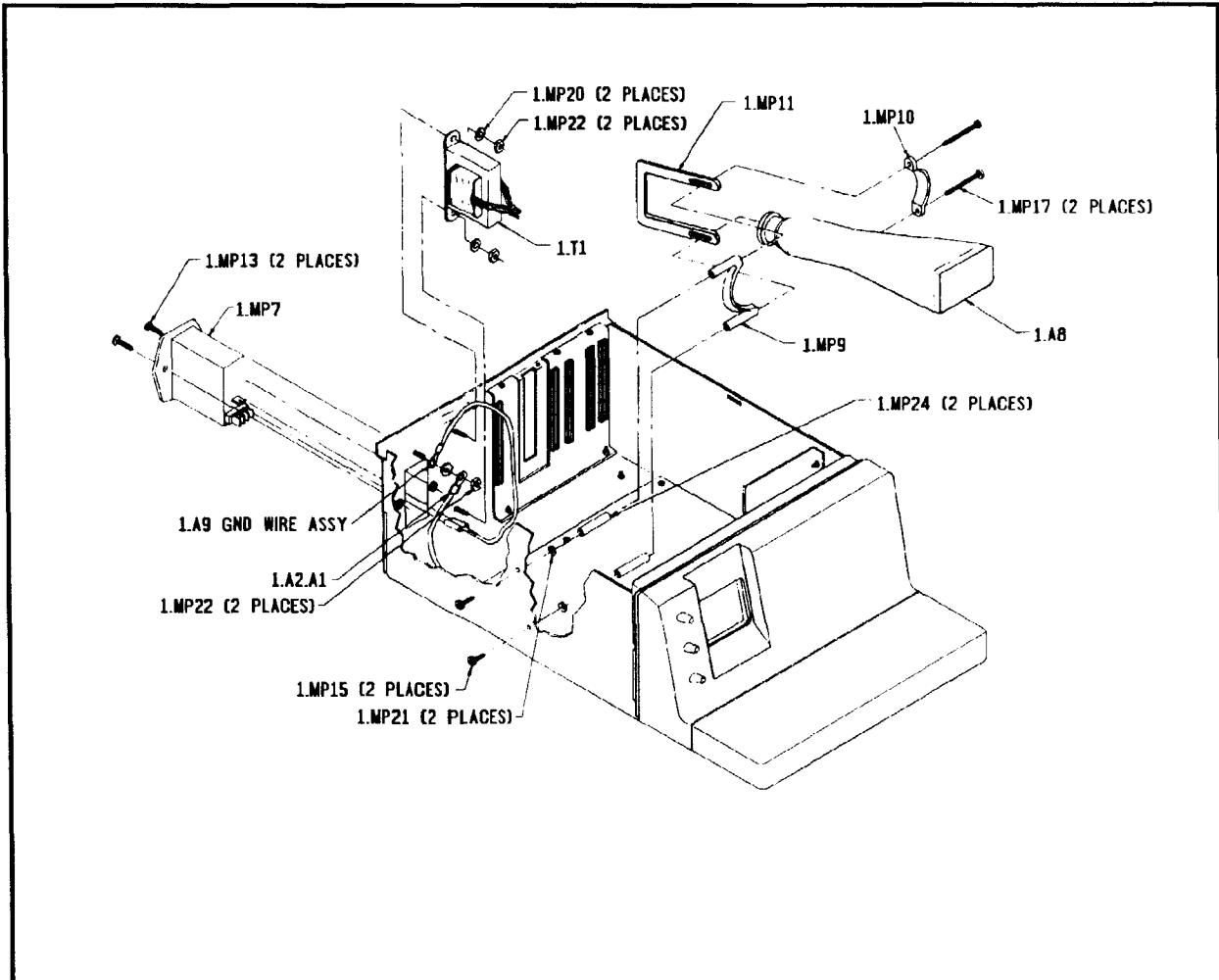


Figure 3-5. CRT Assembly, Power Transformer, and Power Entry Module Removal.

7. Backplane PCB Removal (refer to Figure 3-6)

Remove the two screws (1.MP12) from Quad PCB Support (1.MP5), if used. Take out support assembly. Disconnect wiring harness from Backplane PCB at connectors 1.A2.J15, 1.A2.J16, and 1.A2.J18 (see Figure 3-4). Disconnect green ground wire (1.A2.A1) of Backplane PCB from rear of chassis by removing nut (1.MP22) on chassis ground stud located above Power Entry Module (1.MP7). Disconnect ribbon cable (1.A10) from Input PCB Assembly (1.A4) at connector 1.A2.J11 on Backplane PCB. Disconnect wiring harness from Front Control Assembly to Backplane PCB at connectors 1.A2.J12, 1.A2.J13, 1.A2.J14, and 1.A2.J19 on Backplane PCB (see Figure 3-7). Remove three screws (1.MP12) that hold heatsink of Backplane PCB Assembly to side wall of chassis. Remove six screws (1.MP15) that retain PCB to bottom of chassis. Lift up to remove Backplane PCB Assembly (1.A2).

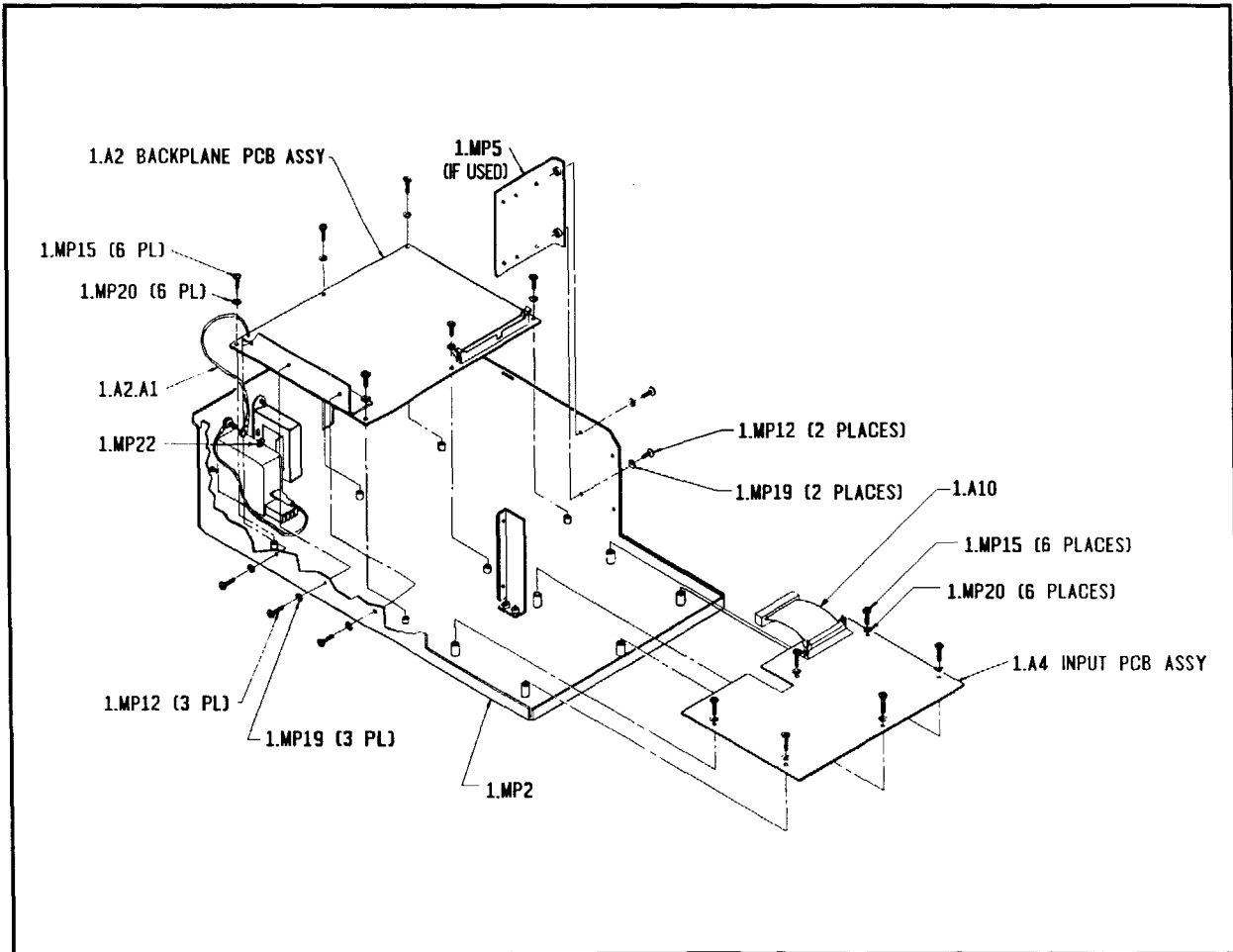


Figure 3-6. Backplane and Input PCB Removal.

8. Front Control Assembly Removal (refer to Figures 3-7 and 3-8)

Remove three screws (1.MP15) from bottom of chassis which secure Front Control Assembly (1.A7). Remove the four screws (1.MP16) that hold the assembly to the sides wall of the chassis. Remove 40 pin ZIF socket by carefully unplugging socket from front of unit. Remove Front Control Assembly by lifting forward and up away from chassis.

9. CRT Control PCB Removal (refer to Figure 3-7)

Remove three knob caps (1.A7.MP10) from front of knobs (1.A7.MP9) by carefully prying between knob and knob cap. Remove three knobs by loosening knob collet and slide knobs off control shafts. Remove two screws (1.A7.MP11) that hold CRT Control PCB (1.A7.A2) to back side of Front Control Assembly (1.A7).

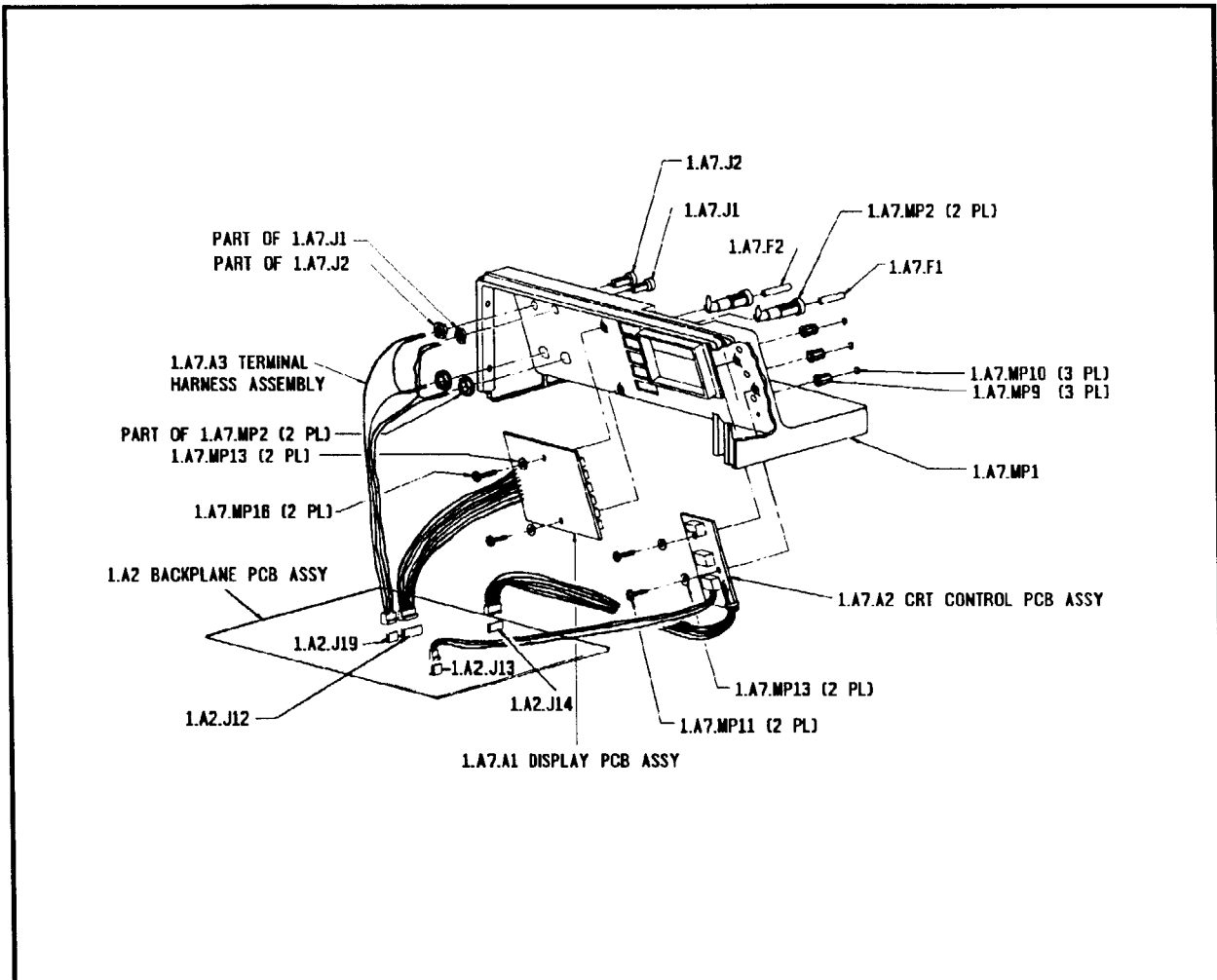


Figure 3-7. Front Control Assembly Interconnections, Display PCB Removal, CRT Control PCB Removal.

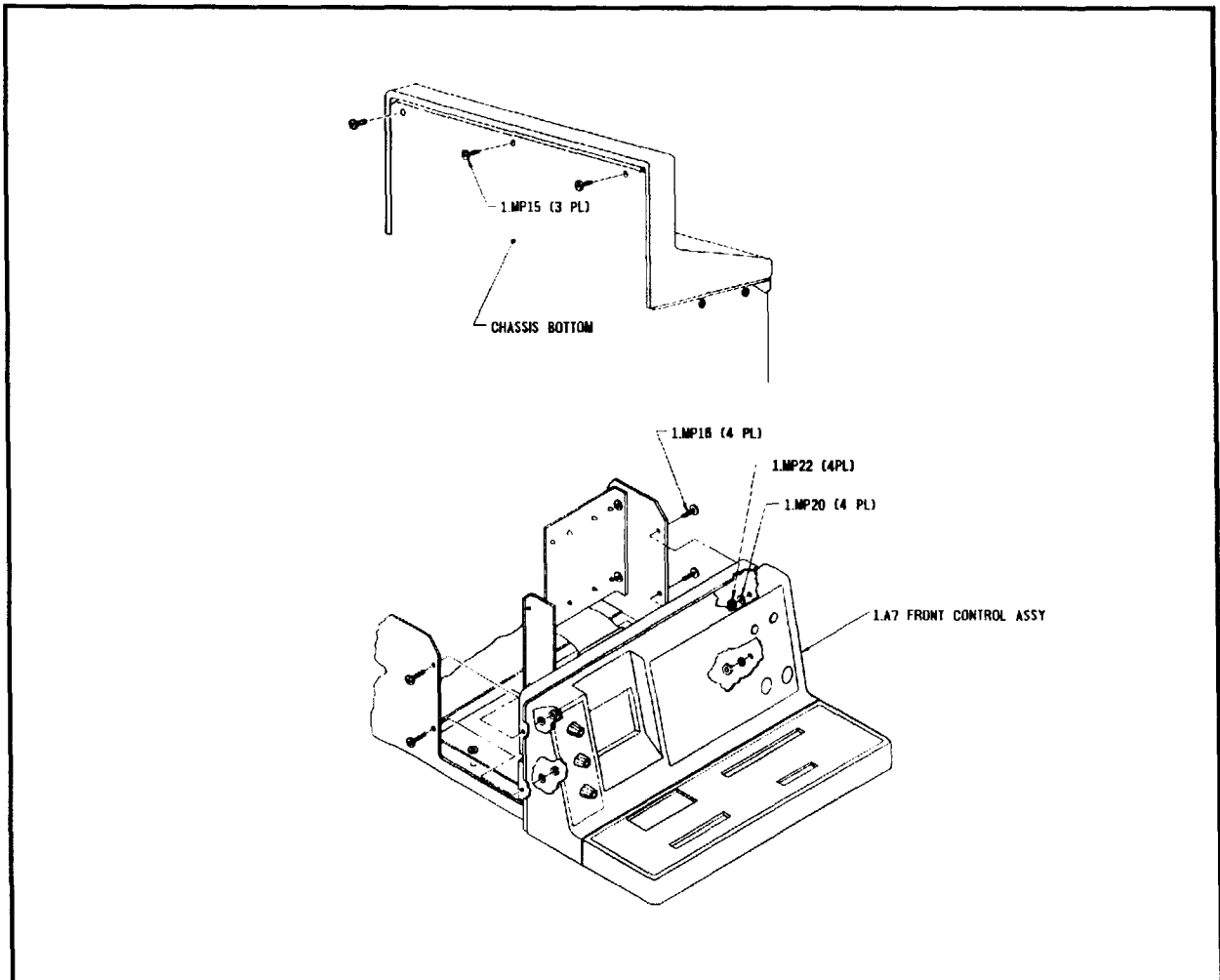


Figure 3-8. Front Control Assembly Removal.

10. Display PCB Removal (refer to Figure 3-7)

Remove two screws (1.A7.MP16) that hold Display PCB Assembly (1.A7.A1) to back of Front Control Assembly. Remove Display PCB Assembly.

11. Input PCB Removal (refer to Figure 3-6)

Remove six screws (1.MP15) that hold Input PCB Assembly (1.A4) to bottom of chassis. Lift assembly upwards and remove.

12. Transformer / Power Entry Module Removal (refer to Figures 3-4 and 3-5)

Disconnect Transformer Assembly (1.T1) wiring harness from Power Entry Module (1.MP7) by unplugging at module end. Remove two nuts (1.MP22) from chassis mounting studs of transformer. Remove transformer. Unplug Ground Wire Assembly (1.A9) from Power Entry Module at module end. Remove 2 screws (1.MP13) holding Power Entry Module to rear chassis wall. Remove Power Entry Module from back of chassis.

3-5. REASSEMBLY PROCEDURE

To reassemble the Tracker 5100DS, reverse the disassembly procedure as follows:

1. Transformer / Power Entry Module Assembly (Figures 3-4 and 3-5)

Assemble the Power Entry Module (1.MP7) to back wall of chassis with two screws (1.MP13). Connect Ground Wire Assembly (1.A9) to module at ground terminal lug. Mount power transformer (1.T1) to back wall of chassis using two nuts (1.MP22) and washers (1.MP20). Connect transformer wiring harness to Power Entry Module connector.

2. Input PCB Assembly (Figure 3-6)

Place Input PCB Assembly (1.A4) over front chassis mounting posts. Secure PCB with six screws (1.MP15) and washers (1.MP20).

3. Display PCB Assembly (Figure 3-7)

Locate Display PCB Assembly (1.A7.A1) on rear of Front Control Assembly (1.A7). Secure PCB with two screws (1.A7.MP16) and washers (1.A7.MP13).

4. CRT Control PCB Assembly (Figure 3-7)

Place CRT Control PCB Assembly (1.A7.A2) on the rear of the Front Control Assembly with the adjustment shafts protruding through the holes provided in the front panel. Mount the CRT control PCB Assembly to the Front Control Assembly with two screws (1.A7.MP11) and washers (1.A7.MP13). Place three knobs (1.A7.MP9) on shafts and tighten collets. Replace knob caps (1.A7.MP10) on knobs.

5. Front Control Assembly (Figure 3-8)

Place Front Control Assembly (1.A7) on chassis. Using two screws (1.MP16), washers (1.MP20), and nuts (1.MP22) on each side of the Front Control Assembly, fasten Assembly to chassis sides. Carefully turn chassis over and attach Front Control Assembly bottom to chassis with three screws (1.MP15). With unit upright, plug 40 pin ZIF socket in opening of Front Control Assembly and into socket of the Input PCB Assembly below. Make sure handle of ZIF socket is towards the outside of the unit.

6. Backplane PCB Assembly (Figure 3-6)

Place Backplane PCB Assembly (1.A2) in chassis over correct mounting posts. Secure PCB to chassis bottom with six screws (1.MP15) and washers (1.MP20). Secure PCB assembly heatsink bracket to side wall of chassis with three screws (1.MP12) and washers (1.MP19). Connect 64 conductor ribbon cable (1.A10) from Input PCB Assembly to connector 1.A2.J11 on Backplane PCB. Connect wiring harness from Front Control Assembly to connectors 1.A2.J12, 1.A2.J13, 1.A2.J14, and 1.A2.J19 on Backplane PCB (see Figure 3-7). Connect Power Transformer Assembly wiring harness to connectors 1.A2.J15, 1.A2.J16, and 1.A2.J18. Attach green ground wire (1.A2.A1) from Backplane PCB to chassis ground stud with nut (1.MP22). Locate Quad PCB support (1.MP5) to side of chassis and fasten with two screws (1.MP12) and washers (1.MP19).

7. CRT Assembly (Figures 3-4 and 3-5)

Place CRT Assembly inside chassis. Connect CRT Assembly wiring harness to connectors 1.A2.J17 and 1.A2.J18 on Backplane PCB. Seat front of CRT Assembly into Front Control Assembly bezel and make sure the CRT is fully up against the Front Control Assembly faceplate. Secure two standoffs (1.MP24) along with CRT Assembly to side of chassis using screws (1.MP15) and washers (1.MP21).

8. Scanner PCB Assembly (Figure 3-3)

Insert each of the four Scanner PCB Assemblies (1.A5) between the chassis card edge guides and into the Backplane PCB. Make sure each PCB is seated properly into the backplane connector.

9. Digital PCB Assembly (Figure 3-3)

Insert the Digital PCB Assembly (1.A3) into the correct position on the Backplane PCB. Make sure the PCB is seated properly into the backplane connector. Secure the Digital PCB Assembly rear bracket with a screw (1.MP12) and washer (1.MP19).

10. Analog PCB Assembly (Figure 3-3)

Insert the Analog PCB Assembly (1.A1) between the chassis card edge guides and into the Backplane PCB. Make sure the PCB is seated properly into the backplane connector.

11. PCB Retaining Bar (Figure 3-2)

Hook the end of the PCB Retaining Bar (1.A6) in the slot on side of chassis. Fasten other end of bar to other side of chassis with screw (1.MP12) and washer (1.MP19).

12. Case Cover Assembly (Figure 3-1)

Grasp case cover (1.MP1) and slide onto chassis from back to front. Turn unit over and secure cover to chassis bottom with four screws (1.MP12).

3-6. PERFORMANCE TESTS

These tests compare the performance of your 5100DS with the specifications given in Section 1. The tests are recommended as an acceptance test when the instrument is first received, and as a verification test after performing the calibration procedures. If the instrument does not pass the performance tests, calibration or repair is needed. These tests can be performed without disassembly of the instrument.

Make sure the system is in the normal operating configuration: the 5100DS and the PC are turned on, and the GPIB cable is connected between them. Next, start the Maintenance program (M51.EXE) by typing "M51" followed by ↵. Then press "P" to begin the performance test utility. The program then prompts the user with all instructions needed for the tests. The last step allows the user to print out a summary of the performance tests.

An outline of all the performance test steps is shown in Table 3-2 for reference. The digital multimeter (DMM) and frequency counter specified in Table 3-1 are the only test equipment required for the performance tests.

Table 3-2.
Performance Tests Outline

| STEP | TEST |
|------|---|
| 1 | Serial Number |
| 2 | DMM AC function |
| 3 | Test Signal Frequency, triangle wave |
| 4 | Test Signal Frequency, sine wave |
| 5 | Open Circuit Voltage, Low, triangle wave |
| 6 | Open Circuit Voltage, Low, sine wave |
| 7 | Open Circuit Voltage, Medium 1, triangle wave |
| 8 | Open Circuit Voltage, Medium 1, sine wave |
| 9 | Open Circuit Voltage, Medium 2, triangle wave |
| 10 | Open Circuit Voltage, Medium 2, sine wave |
| 11 | Open Circuit Voltage, High, triangle wave |
| 12 | Open Circuit Voltage, High, sine wave |
| 13 | Short Circuit Current, Low, triangle wave |
| 14 | Short Circuit Current, Low, sine wave |
| 15 | Short Circuit Current, Medium 1, triangle wave |
| 16 | Short Circuit Current, Medium 1, sine wave |
| 17 | Short Circuit Current, Medium 2, triangle wave |
| 18 | Short Circuit Current, Medium 2, sine wave |
| 19 | Short Circuit Current, High, triangle wave |
| 20 | Short Circuit Current, High, sine wave |
| 21 | Calibration Check |
| 22 | Print test summary (and return to Maintenance menu) |

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3-7. CALIBRATION

Periodic calibration is necessary to ensure the accuracy of the comparative testing method used by the 5100DS. The following procedures allow the user to keep each instrument properly calibrated.

If calibration is needed, it is first necessary to remove the cover of the 5100DS in order to gain access to the internal adjustments. See Section 3-4 for cover removal instructions.

All calibration locations and relevant test points in the 5100DS are shown in Figure 3-9. The user should refer to this figure when the procedures which follow state that an adjustment or test connection should be made.

While doing these procedures, if it is not possible to make an adjustment, or a verification step is not true, the user should note such discrepancies and continue with the procedures. The notes will be useful for troubleshooting.

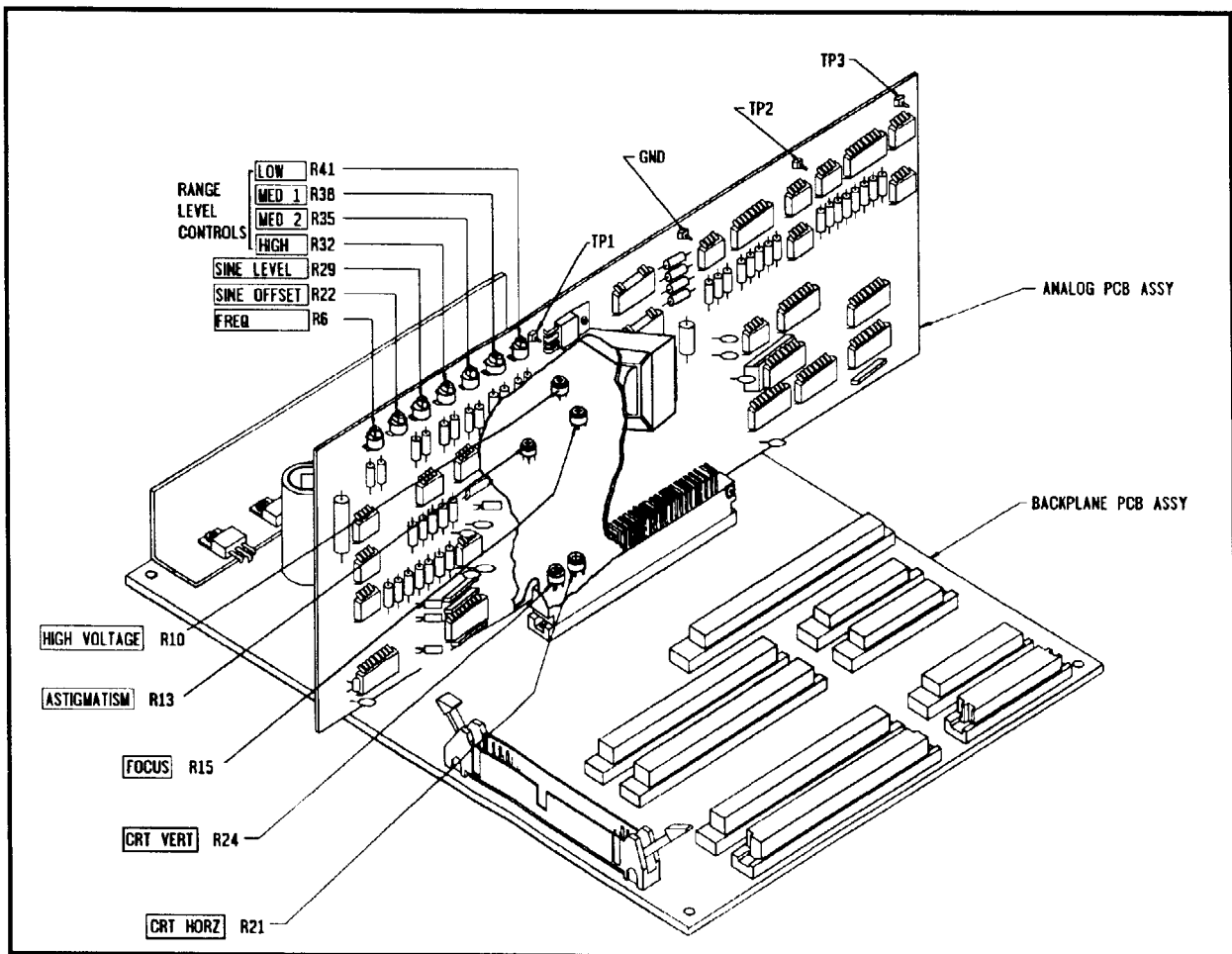


Figure 3-9. Calibration Locations.

3-8. CRT Calibration

Three adjustments in the CRT section (Backplane PCB-1.A2) are factory set and, under normal conditions, do not need to be readjusted. They are High Voltage (1.A2.R10), Astigmatism (1.A2.R13), and Focus (1.A2.R15). These adjustments affect only the sharpness and quality of the CRT display and do not affect TESTING and LEARNING accuracy.

This procedure is a manual one: it is not necessary to have the 5100DS connected to a PC via the GPIB cable.

This procedure should only be done if any of these conditions exist:

- CRT performance at normal intensity has visibly degraded (fuzzy, etc.).
- Backplane PCB repair has been performed and CRT performance is not correct.
- A troubleshooting procedure directs the user to do this procedure.

The High Voltage adjustment requires a digital multimeter (DMM) and a high voltage probe. All adjustments in this section are on the Backplane PCB (refer to Figure 3-9 for calibration locations).

WARNING

DO NOT TURN THE POWER ON UNTIL INSTRUCTED TO DO SO. Hazardous High Voltage exists on the components in this section. To avoid electric shock, do not touch any of the components mentioned below.

Procedure:

1. Plug the high voltage probe into the DMM and select the range that will measure 2000 Volts DC.
2. Connect the common lead of the high voltage probe to the COMMON jack on the front panel of the 5100DS.
3. Touch the high voltage probe to the anode of D2 on the Backplane PCB (D2 is below the CRT and to the right).
4. Turn power on.
5. Adjust 1.A2.R10 (High Voltage) until DMM reads -1200 VDC.
6. Remove the DMM and high voltage probe from the 5100DS.
7. Disconnect the common lead from the 5100DS.
8. Adjust the front panel INTENSITY control for an open circuit signature with comfortable brightness.
9. Connect the anode of a silicon diode to the front panel TEST jack and the cathode to the COMMON jack.
10. If necessary, use 1.A2.R21 (CRT Horizontal) and 1.A2.R24 (CRT Vertical) to make sure the ends of the diode signature are on the screen of the CRT (this is a coarse adjustment only).
11. Turn 1.A2.R15 (Focus) fully counterclockwise.
12. Adjust 1.A2.R13 (Astigmatism) so that the width of the signature is the same from one end to the other. Refer to Figure 3-10.

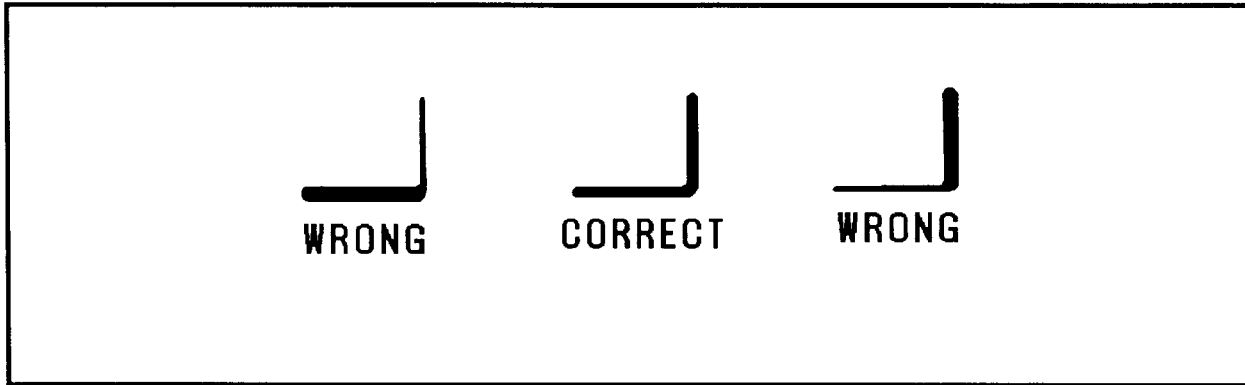


Figure 3-10. Astigmatism Adjustment Signatures.

13. Adjust 1.A2.R15 (Focus) to make the diode signature as sharp as possible.
14. Remove diode from front panel jacks.

3-9. Main Calibration

This procedure should be done when any of these conditions exist:

- One year has elapsed since the instrument was last calibrated.
- A "5100DS IS OUT OF CAL" error results when a calibration check is performed.
- The unit fails the performance tests in Section 3-6.
- Analog PCB or Backplane PCB repair has been performed.

The procedure is guided by the "Hardware Calibration" portion of the Maintenance Program (M51.EXE). Before running the program, make sure the system is in the normal operating mode with PC and 5100DS turned on and GPIB cable connected between the two. Then at the "\5100" prompt, type "M51" followed by ↵ and then press "H" to begin the hardware calibration utility.

Follow the instructions shown in each step. Table 3-3 provides an outline of all the steps in the procedure.

**Table 3-3.
Hardware Calibration Outline**

| Step | Action |
|------|---|
| 1 | General Instructions |
| 2 | Frequency Cal 1 |
| 3 | Range Level Setup and AC type selection |
| 4 | High Range Level Cal |
| 5 | Medium 2 Range Level Cal |
| 6 | Medium 1 Range Level Cal |
| 7 | Low Range Level Cal |
| 8 | Sine Offset Cal |
| 9 | Sine Level Cal |
| 10 | Frequency Cal 2 |
| 11 | CRT Horizontal Cal |
| 12 | CRT Vertical Cal |
| | End (exit to Maintenance menu) |

NOTE: After performing the Hardware Calibration procedure, a calibration check should be done. To perform a calibration check, press "C" and ↵ at the Main menu of the Maintenance Program. This utility will report whether the unit is in approximate calibration or not. To insure the unit is in absolute calibration, follow the procedures in section 3-6 Performance Tests and the main calibration in this section.

3-10. TROUBLESHOOTING

CAUTION

Static discharge can damage CMOS components. Follow the handling precautions for static-sensitive devices previously described in this section. Never remove, install, or otherwise connect or disconnect PCBs or components without first turning the instrument power off.

This troubleshooting information is supported by the schematics in Section 5. If necessary, refer to Section 2 for the theory of operation.

The troubleshooting procedures that follow refer to the location of possible defective components by assembly number:

- 1.A1 Analog PCB Assembly
- 1.A2 Backplane PCB Assembly
- 1.A3 Digital PCB Assembly
- 1.A4 Input PCB Assembly
- 1.A5 Scanner PCB Assembly
- 1.A7.A1 Display PCB Assembly
- 1.A7.A2 CRT Control PCB Assembly
- 1.A8 CRT Assembly

These are the same assembly numbers used in the list of replaceable parts in Section 4. The components referred to in these procedures are usually the major ones within a particular section of the circuit. Other miscellaneous components (e.g. diodes, resistors, and capacitors) connected to a part should also be checked for possible failure.

3-11. Initial Troubleshooting Procedure

Whenever there is a problem with the 5100DS, the user must first verify that the low voltage power supplies are working properly. Use the following steps to check the performance of these power supplies.

1. Remove the cover (refer to the disassembly procedure in Section 3-4).
2. Connect the COMMON input of a digital multimeter (DMM) to the 5100DS COMMON jack. Select the 20 VDC range on the DMM.
3. Turn the power switch of the 5100DS on. Make sure nothing is connected to the TEST jack of the 5100DS.
4. There are six voltage regulators on the Backplane PCB as shown in Figure 3-11. Use the DMM to measure the testpoints indicated in Figure 3-11 and compare the measured voltages with the limits shown in Table 3-4.
5. If all power supply voltages are within tolerance, skip to section 3-12. If any supply is out of tolerance, continue with this procedure.
6. Turn the power switch off and remove the vertical PCBs (Analog, Digital and four Scanners) using the disassembly procedure in Section 3-4.
7. Turn the power on again and remeasure any supply that was out of tolerance. If it is still out of tolerance, use Table 3-5 to locate the cause of the failure. The indicated circuitry should be repaired before continuing. Refer to the disassembly procedure in Section 3-4 for Backplane PCB removal instructions. When the repair is complete, go to Section 3-12. If all supplies are in tolerance with the vertical PCBs removed, then the Backplane PCB power supply section is presumed to be good. Proceed to step 8.
8. Replace the vertical PCBs one at a time while monitoring the supply that was out of tolerance to see which PCB affects it (be sure to turn the power off while inserting a PCB). When the offending PCB is discovered, follow the troubleshooting procedure for that board. The Digital PCB should always be replaced before any of the other boards.

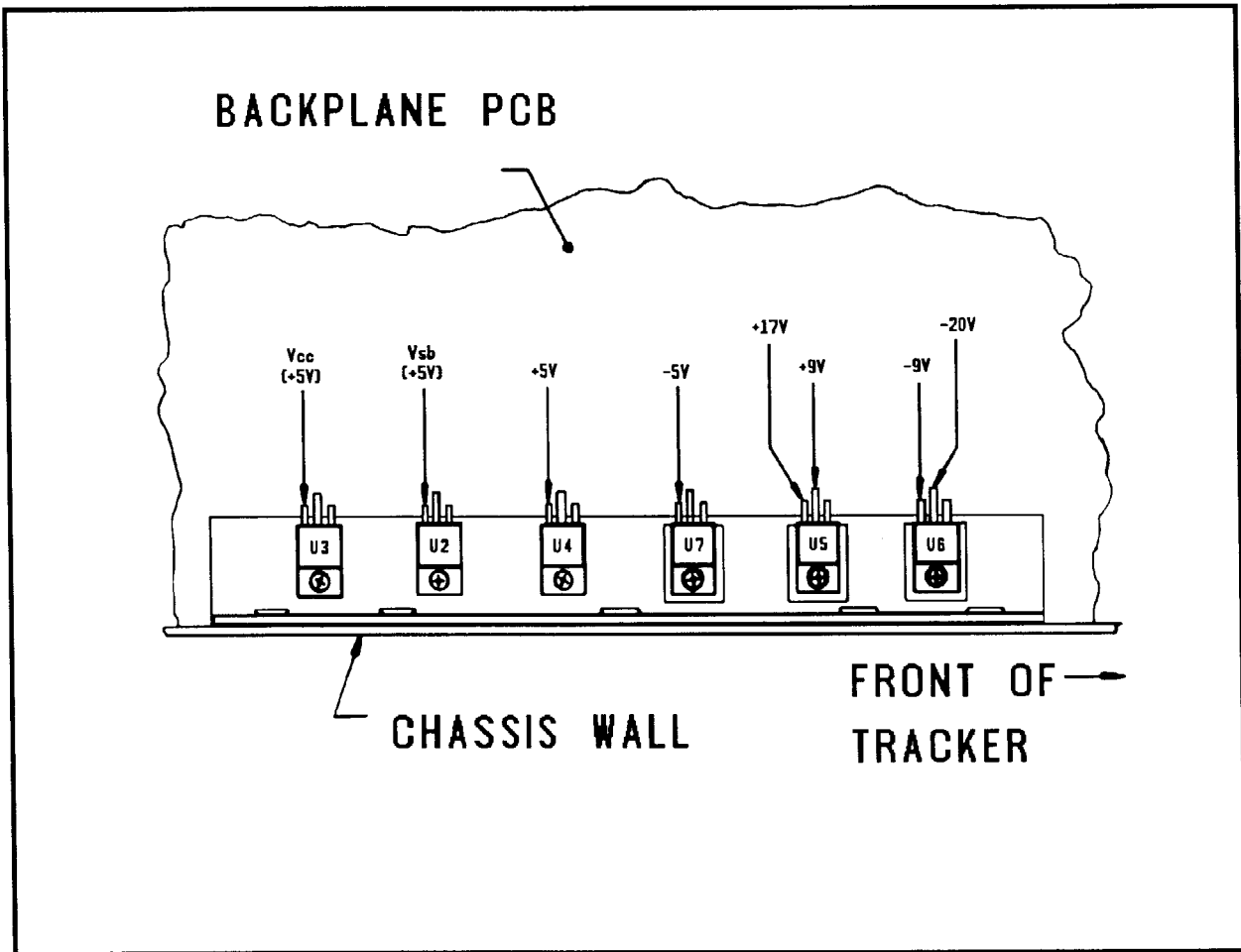


Figure 3-11. Backplane PCB Voltage Regulators and Test Points.

**Table 3-4.
Low Voltage Power Supply Limits**

| Supply | Minimum | Maximum |
|-----------------|---------|---------|
| +17V | +12V | +22V |
| -20V | -12V | -22V |
| +9V | +9V | +10V |
| -9V | -9V | -10V |
| +5V | +4.5V | +5.5V |
| -5V | -4.5V | -5.5V |
| V _{cc} | +4.5V | +5.5V |
| V _{sb} | -4.5V | -5.5V |

**Table 3-5.
Low Voltage Power Supply Troubleshooting Guide**

| Voltage out of tolerance | Probable Cause |
|-----------------------------------|-------------------------------|
| All are zero with power switch on | Check line fuse on back panel |
| +17V | 1.A2: C10, D8, D10 1.T1 |
| -20V | 1.A2: C13, D7, D9 1.T1 |
| +9V (+17V is OK) | 1.A2.U5 |
| -9V (-20V is OK) | 1.A2.U6 |
| +5V (+9V is OK) | 1.A2.U4 |
| -5V (-9V is OK) | 1.A2.U7 |
| V _{cc} (+17V is OK) | 1.A2.U3 |
| V _{sb} (+17V is OK) | 1.A2.U2 |

3-12. Digital Troubleshooting

NOTE: The following section refers to troubleshooting the digital PCB during a complete system failure. Be sure to check the AC line fuses and main DC power supplies before proceeding with this section.

POWER SUPPLY

The Digital PCB receives power from the main supply on the Main PCB. The power supply converts it down to a regulated +5 VDC (V_{dd}). Check the voltage V_{dd} at the following circuit node:

V_{dd} = 4.75 to 5.25 VDC at U20-pin 20 (74HC540)

If V_{dd} is wrong, check voltage regulator U19 (7805). This condition may be also caused by a severe overload condition due to a defective component connected to V_{dd} .

NOTE: Removing adjacent PCBs or using an extender board may make it easier to access test points when troubleshooting. Contact Huntron or your distributor for information on extender boards. Do not remove or install any PCB assembly unless power is off.

MICROCOMPUTER

Check the crystal oscillator by observing J3-21 XTAL2 using an oscilloscope and compare with Figure 3-12. If XTAL2 is wrong, troubleshoot U2 pins 18 and 19 (80C31).

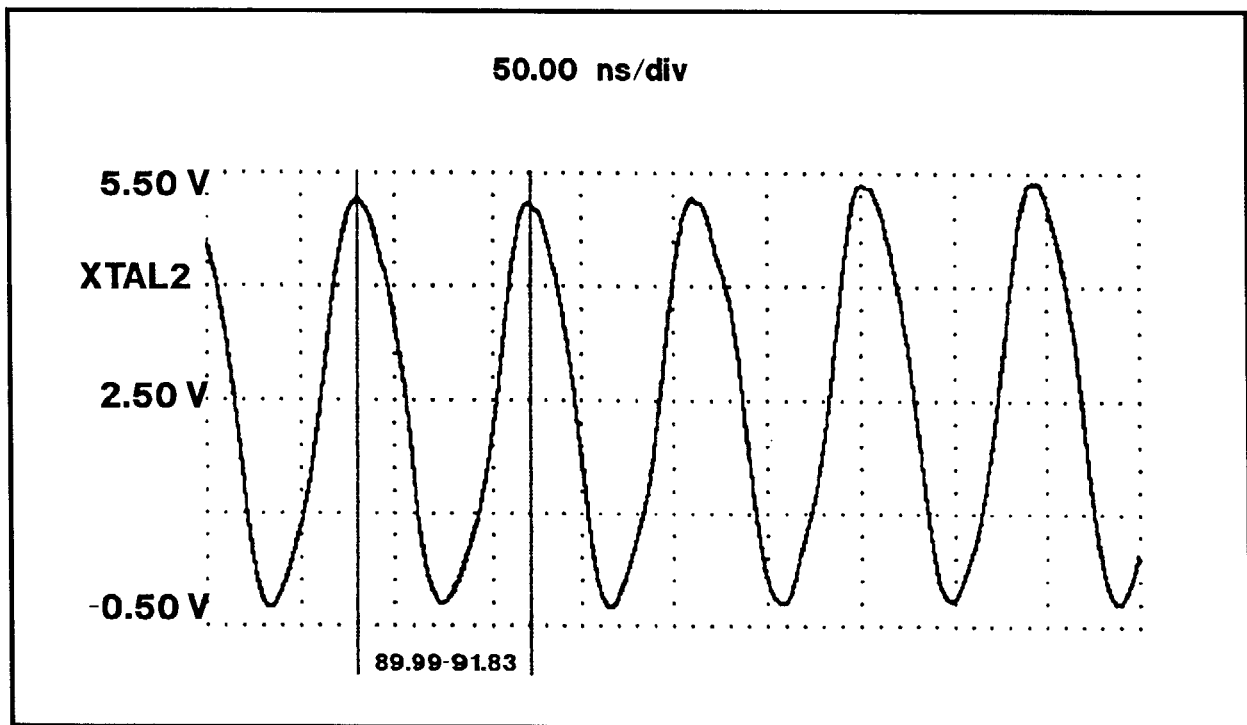


Figure 3-12. XTAL2 Clock Out.

If the XTAL2 waveform is OK, check the microcomputer's ALE output signal at J3-17. This signal controls the demultiplexing of the lower 8 bits of the address lines A0 - A7 on the address/data bus. It also strobes the tri-state buffer output enable pin of the read only memory (ROM) U4. Compare displayed waveform with Figure 3-13. If ALE is wrong, troubleshoot U2-pin 30 (80C31), U3-pin 11 (74HC573), and U4-pin 20 (27C64).

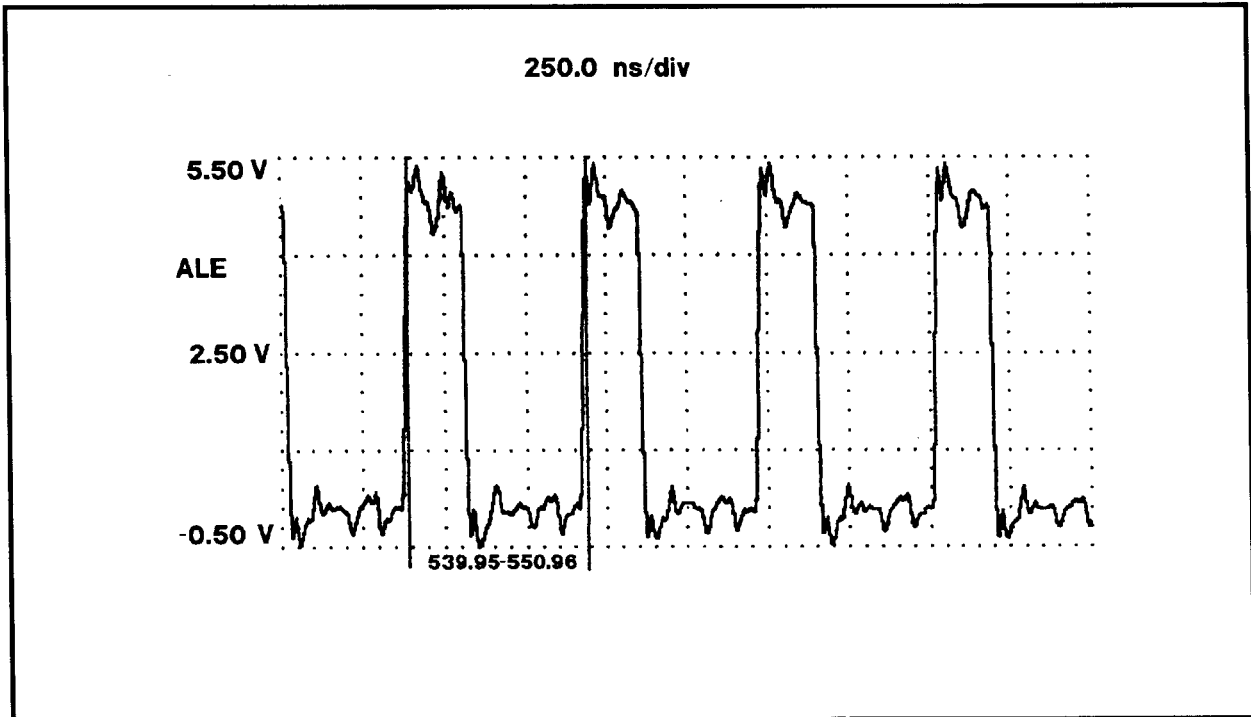


Figure 3-13. ALE-Address Latch Enable Output.

The PSEN output signal controls read operations from the ROM (U4) to the uC (U3). Observe PSEN at J3-18 PSEN and compare to Figure 3-14. If PSEN is wrong, troubleshoot U2 (80C31) output pin 29 and input pin 22 of U4 (27C64).

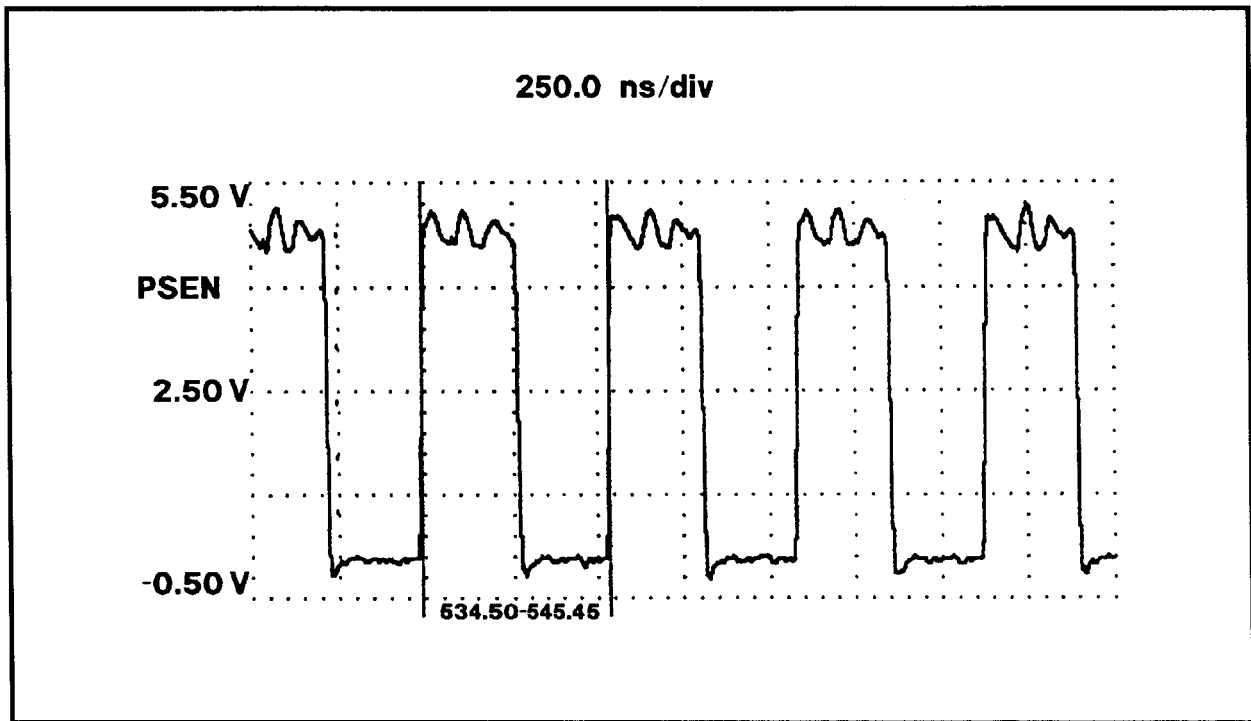


Figure 3-14. PSEN - Program Store Enable Output.

Observe the uC's reset input signal at J3-24 PRST and compare to Figure 3-15a. This signal is normally at logic 0. Turning on the power, pressing switch S1, or activating the watchdog circuit will momentarily change PRST. Its state toggles from logic 0 to logic 1. This condition forces the uC to perform a hardware and software restart. If PRST is not similar to Figures 3-15a and 3-15b, troubleshoot the reset circuit. This circuit consists of S1, C6, R21, U14, and U13. A removable jumper to disable the watchdog circuit provides a handy aid when troubleshooting. Be sure to re-install this jumper JP1 if removed during servicing.

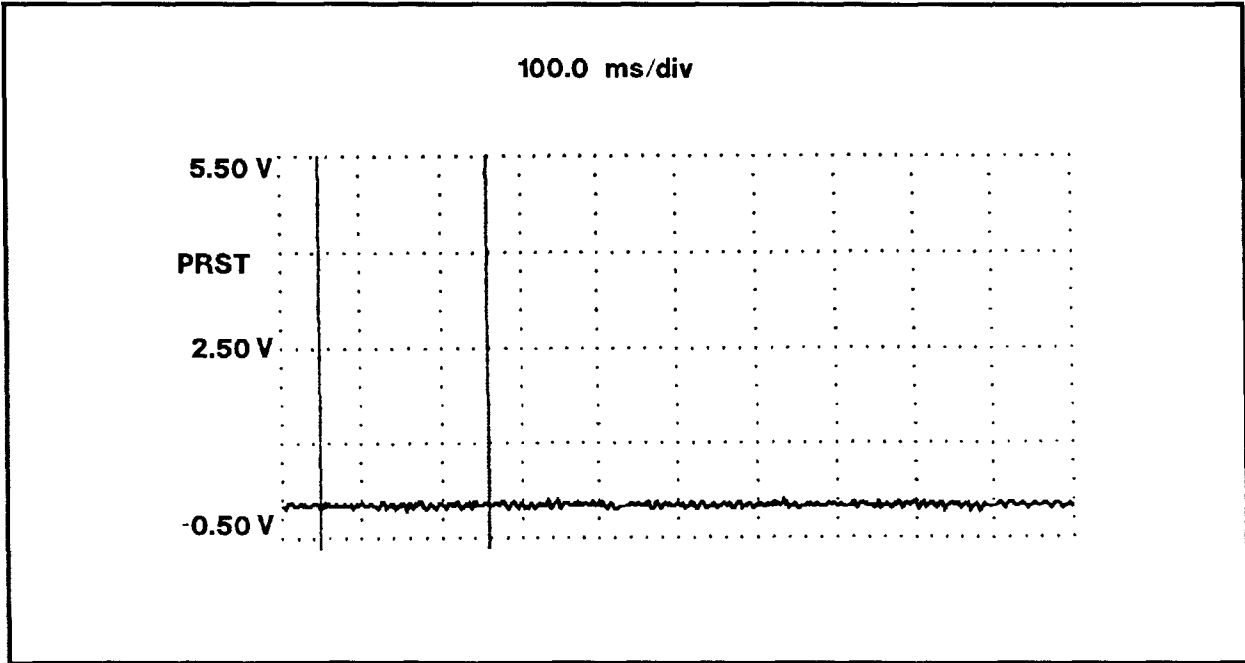


Figure 3-15a. PRST - Processor Reset, Normal State.

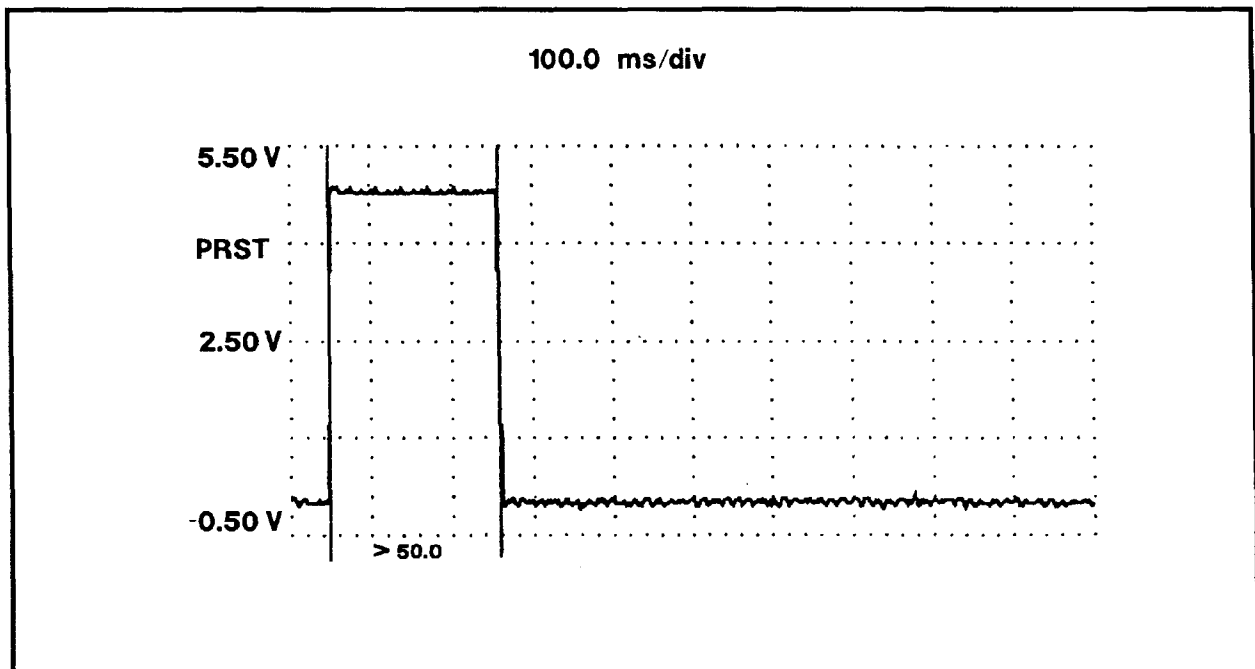


Figure 3-15b. PRST - Processor Reset, Reset State.

The watch dog circuit has a single input signal, watch dog in (WADI). The uC's output pin 12 sends the WADI signal to the watch dog circuit. WADI inhibits a reset action from the watch dog. Observe this signal at J3-pin 25 and compare to Figure 3-16. If WADI skips longer than 10 milliseconds, the watch dog circuit outputs the watch dog out (WADO) signal. WADO connects to the uC and forces a reset state to occur. As an aid to troubleshooting, processor fail (PFAIL) light emitting diode (LED) DS1 turns on also. The PFAIL LED turns off only by pushing S1 or power-on to generate a reset.

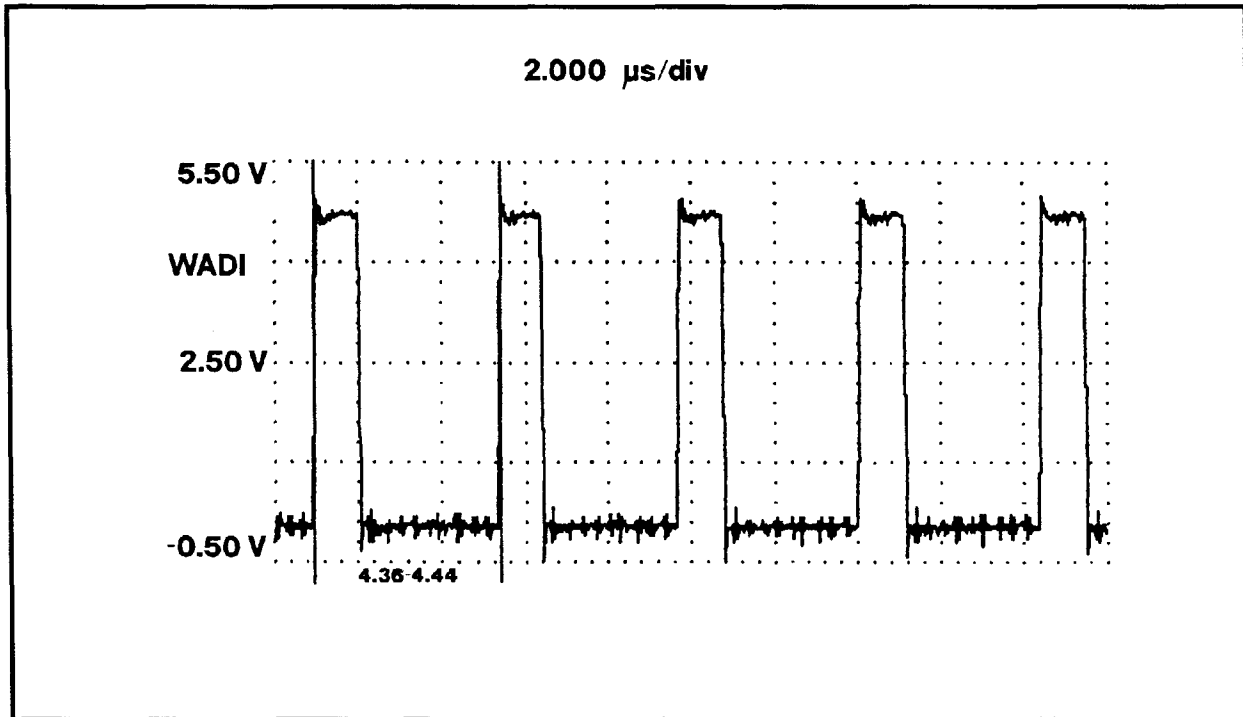


Figure 3-16. WADI, Normal condition.

ANALOG PCB INTERFACE

STATUS signals the microcomputer when data is available from the Analog PCB's analog to digital (a/d) circuit. This input signal connects to the microcomputer's interrupt input through an interrupt select logic circuit. To activate STATUS, use the ANALOG DIAGNOSTIC UTILITY of the maintenance program, M51.EXE. To start the maintenance program type "M51" and press ↵. When the main menu appears, press "A" to get the analog diagnostics. Your screen should appear as shown in Figure 3-33 (for more details on using the ANALOG DIAGNOSTIC UTILITY refer to Section 3-14). Make sure the DATA function is set to READ. If not, then press the F7 key to change the status. The 5100DS should now be continuously processing data. Observe the STATUS input signal at U13-pin 10 (74HC00) and compare to Figure 3-17. If a STATUS fault occurs, the microcomputer will be unable to read data. Troubleshoot input buffer U8 (74HC540) pins 12 and 8, and interrupt select logic U13-pin 10 (74HC00). If needed, refer to the Analog PCB troubleshooting section in this manual also.

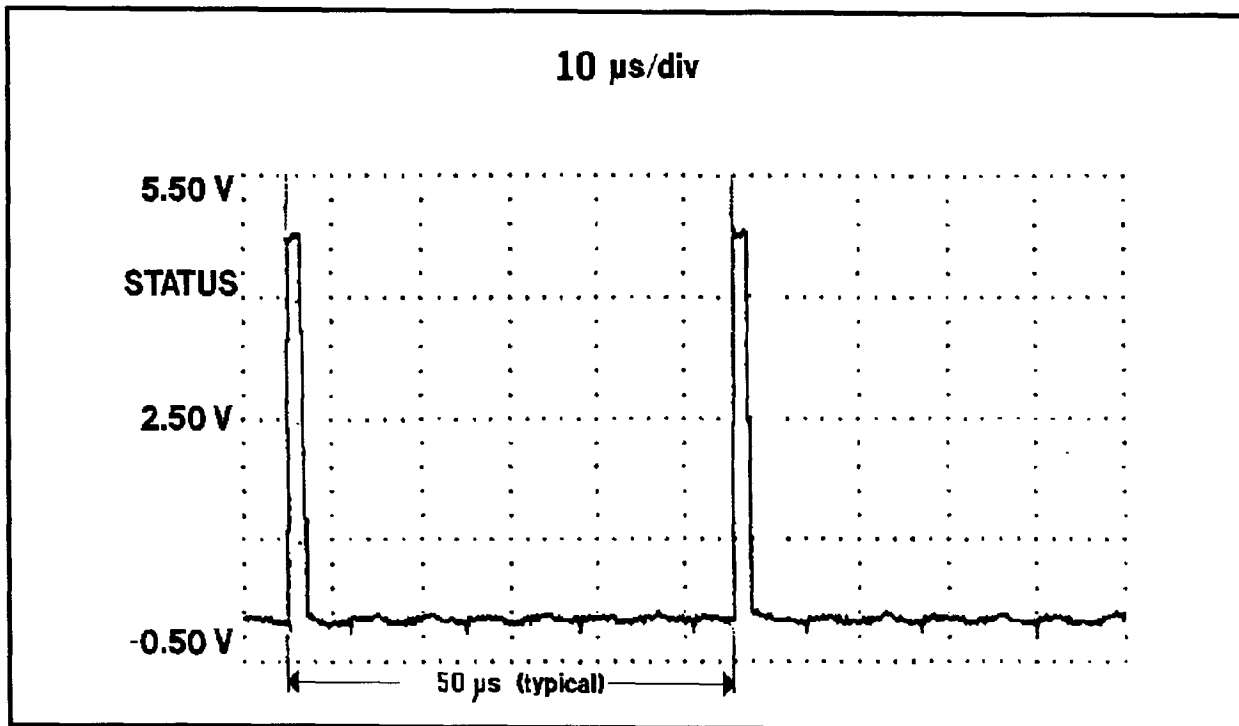


Figure 3-17. STATUS Interrupt Input.

The zero crossing (ZC) signal provides synchronization data to the microcomputer. ZC connects to the microcomputer interrupt input through the interrupt select logic. Observe the ZC input signal at U13-pin 1 (74HC00) and compare to Figure 3-18. If a ZC fault occurs, the microcomputer will be unable to read data. Troubleshoot input buffer U8-pins 11 and 9 (74HC540), and interrupt select logic U13-pin 1 (74HC00). If needed, refer to the Analog PCB troubleshooting section in this manual also.

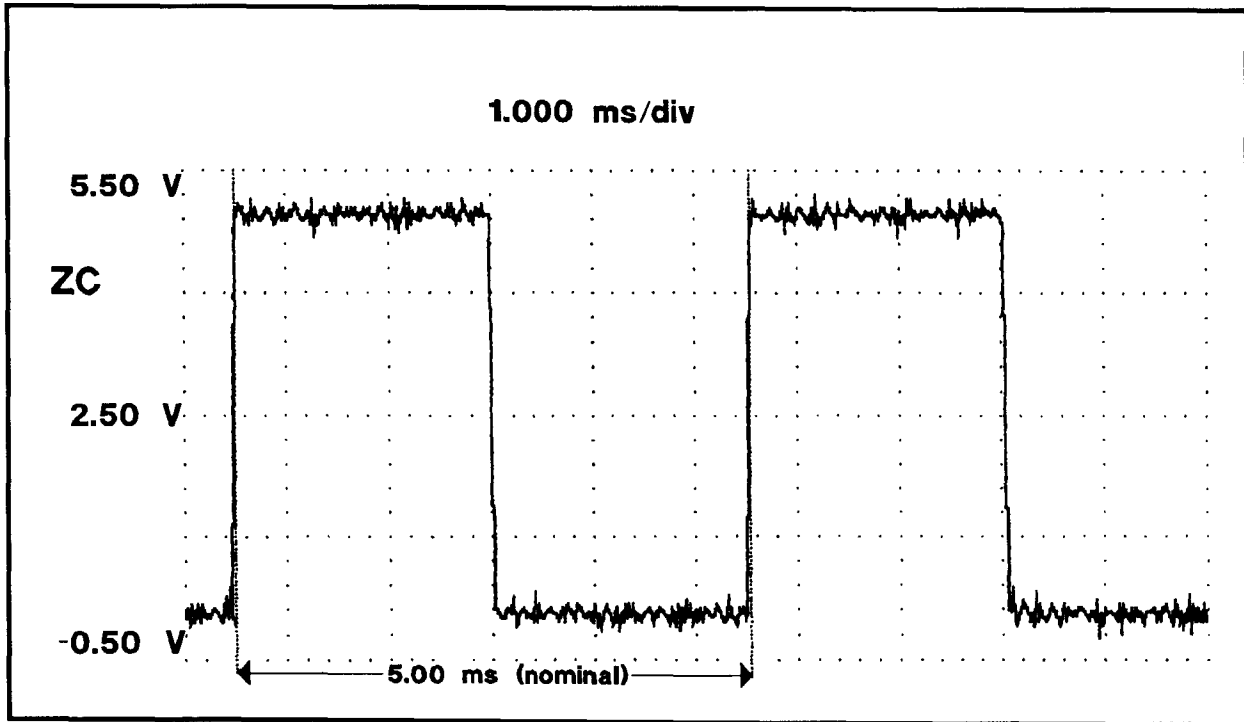


Figure 3-18. ZC Input.

Digitized data from the Analog PCB transfers to the Digital PCB on eight parallel lines DI0 - DI7. Check the data lines at buffer U6 (74HC540) and compare to Figure 3-19. If wrong, troubleshoot all pins of data buffer U6 (74HC640), and analog read control (ARD) U7-pin 11 (74HC540). If needed, refer to the Analog PCB troubleshooting section in this manual.

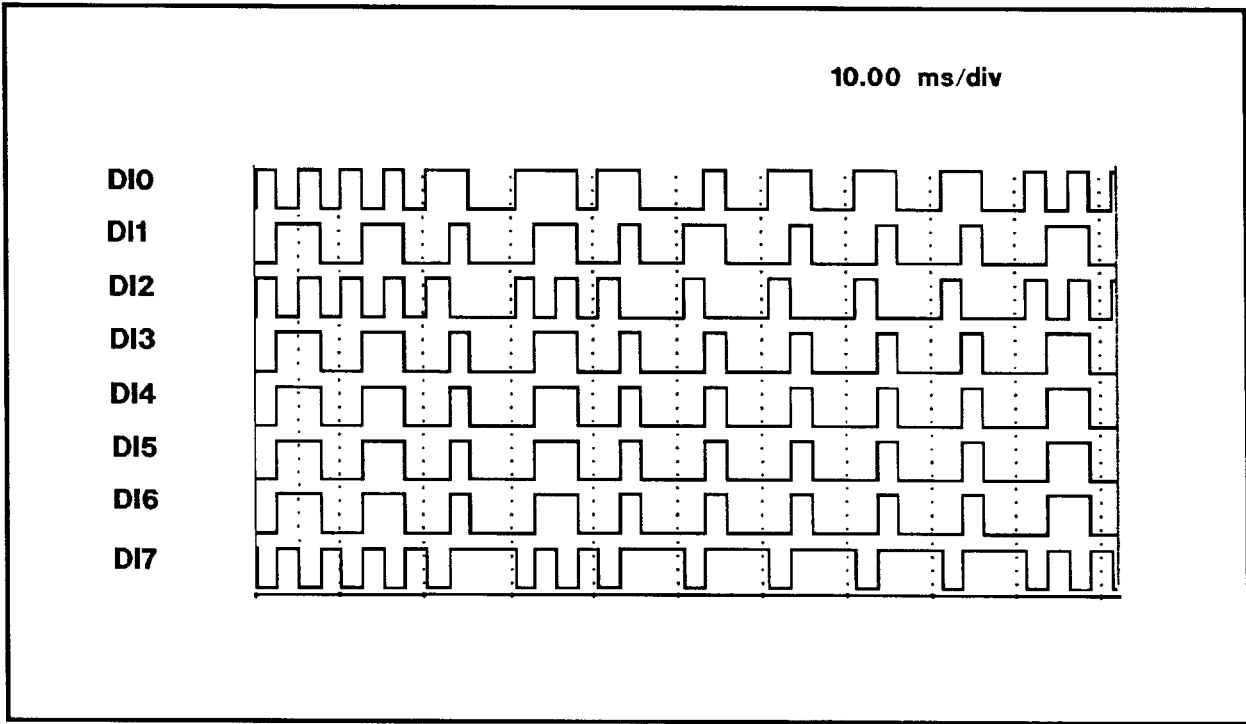


Figure 3-19. DI0-DI7 A/D Data In (typical).

Outputs RC0 and RC1 control the range selection. The power-on default range is medium 2. If the unit is able to operate with your PC, then start the 5100DS Operating software. Type "51", then at the Main Menu, choose VIEW and activate SCAN while watching the range indicators on the front panel. RC0 and RC1 cycle in a binary count. Observe range control bits RC0 at U21-pin 1 (74HC564) and RC1 at U1-pin 23. Compare these signals with Figure 3-20. If RC0 and RC1 are faulty, troubleshoot U21 pins 17 and 16. If the signal appears OK, but the range indicators do not work, refer to the Analog PCB troubleshooting section in this manual.

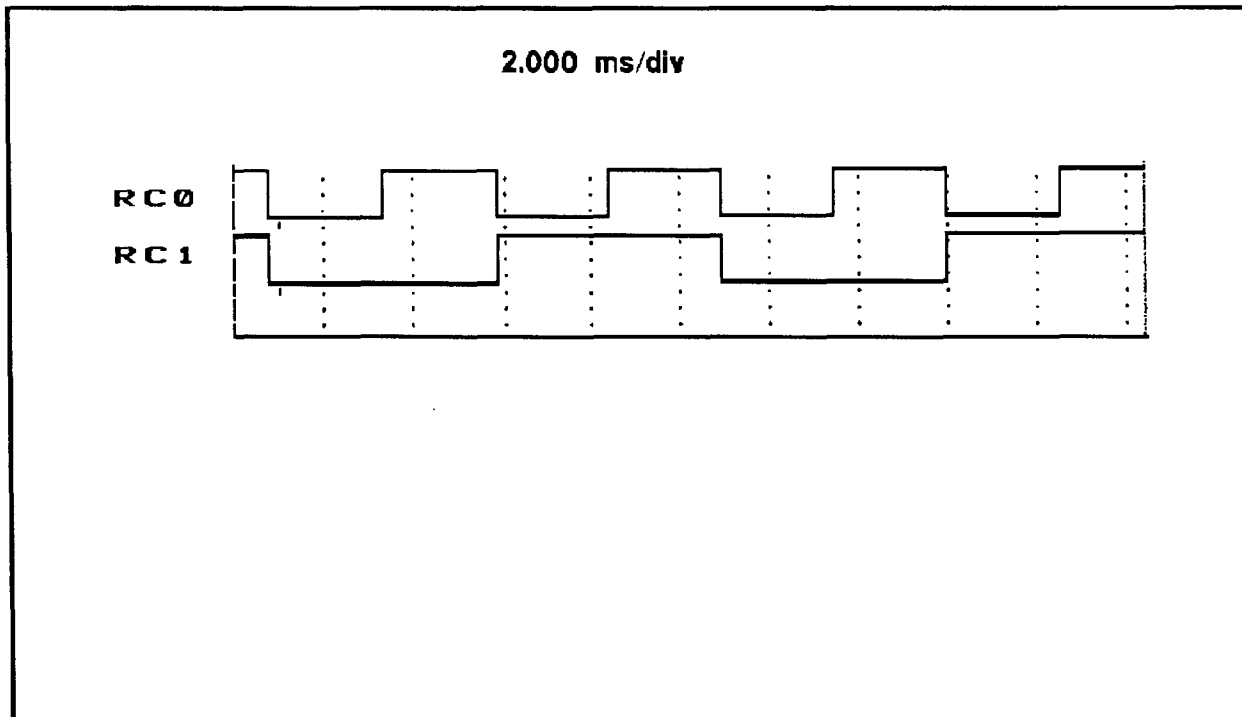


Figure 3-20. RC0, RC1 - Range Control Outputs.

SCANNER CONTROL INTERFACE

The microcomputer generates the relay output enable (ROE) signal that runs to each scanner PCB when a relay turns on or off. If the 5100DS is able to operate with your PC, then start the 5100DS Operating software. Type "51", then at the Main Menu, choose VIEW and change the component package size to a 64 pin DIP type. Activate SCAN and observe ROE on the Digital PCB U7-pin 12 (74HC540). Compare to Figure 3-21 in View Mode. If the waveform is wrong, then troubleshoot U7-pins 8 and 12, and U2-pin 3 (80C31). If the waveform appears OK but there is still a scanner fault, refer to the scanner troubleshooting section in this manual.

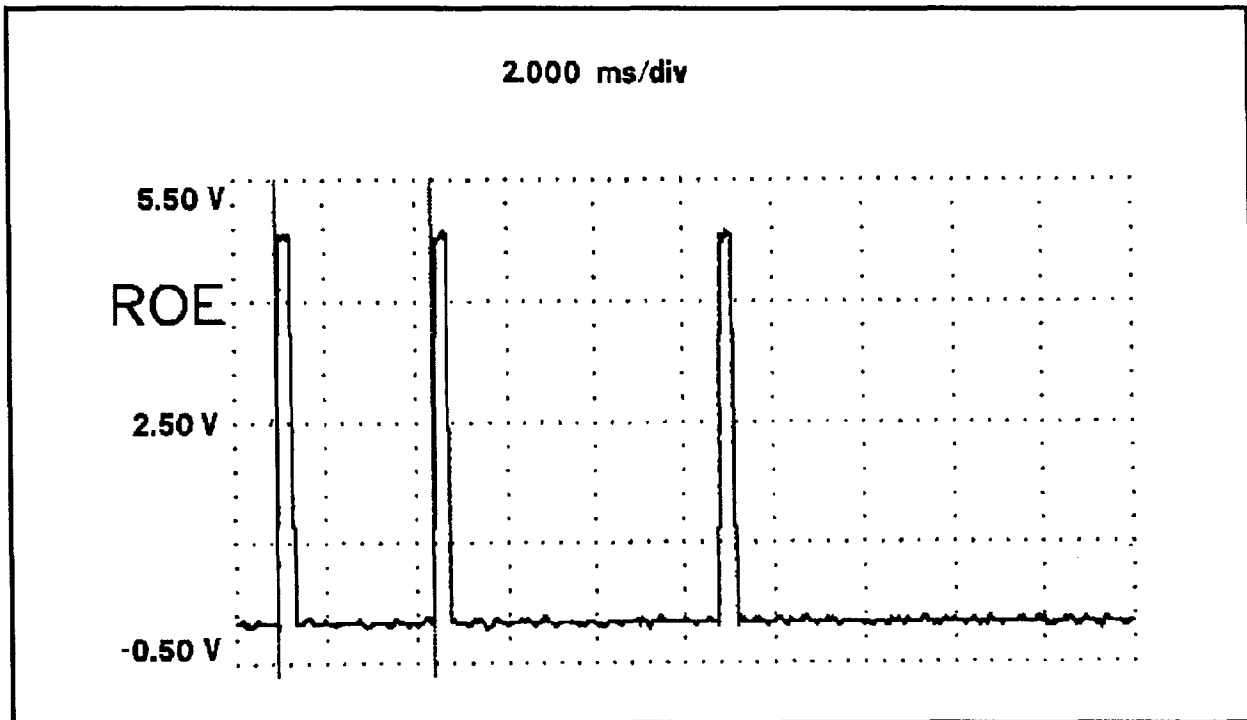


Figure 3-21. ROE - Relay Output Enable (typical).

The microcomputer outputs the relay strobe (RSTROBE) signal to each of the four scanners cards. RSTROBE strobes the relay controller output latches when activating a relay. If the 5100DS is able to operate with your PC, then start the 5100DS Operating software. Type "51", then at the Main Menu, choose VIEW and change the component package size to a 64 pin DIP type. Activate SCAN and observe RSTROBE on the Digital PCB U7-pin 13 (74HC540). Compare the waveform to Figure 3-22 in View Mode. If the waveforms do not appear similar, then troubleshoot U7-pins 7 and 13, and U2-pin 4 (80C31). If the waveforms appear OK, but there is still a scanner fault, refer to the scanner troubleshooting section in this manual.

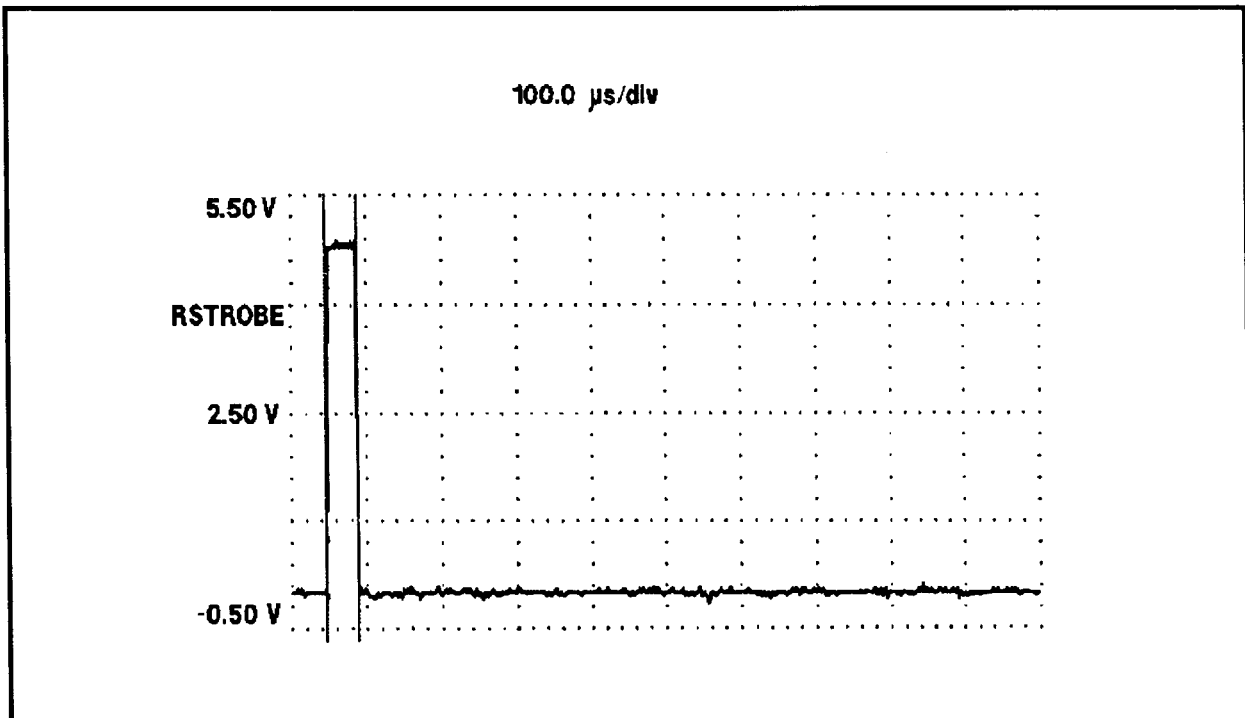


Figure 3-22. RSTROBE - Relay Strobe Output (typical).

The microcomputer controls the scanner relays by a separate data and clock serial interface. There is one serial data and clock for the test scanners and another pair for the common. When selecting a test or common relay, the microcomputer first sets or resets the serial data line. Next, the microcomputer toggles the serial clock line. The number of clock pulses corresponds to the relay selected. The serial clock moves data through each relay controller's shift register on the scanner PCB. If the 5100DS is able to operate with your PC, then start the software. Type "51", then at the Main Menu, choose VIEW and change the component package size to a 64 pin DIP type. Activate SCAN to cycle the relays.

Observe on the Digital PCB TSDI (test serial data in) at U7-pin 17 (74HC540) and TCLK (test serial clock) at U7-pin 18. Compare them to Figure 3-23 in View Mode. If these signals are wrong, then troubleshoot TSDI at U2-pin 7 (80C31), U7-pins 5 and 17 (74HC540). Troubleshoot TCLK at U2-pin 8 and U7-pins 2 and 18. If these signals appear OK, but the relays are still non-operational, refer to scanner troubleshooting section in this manual.

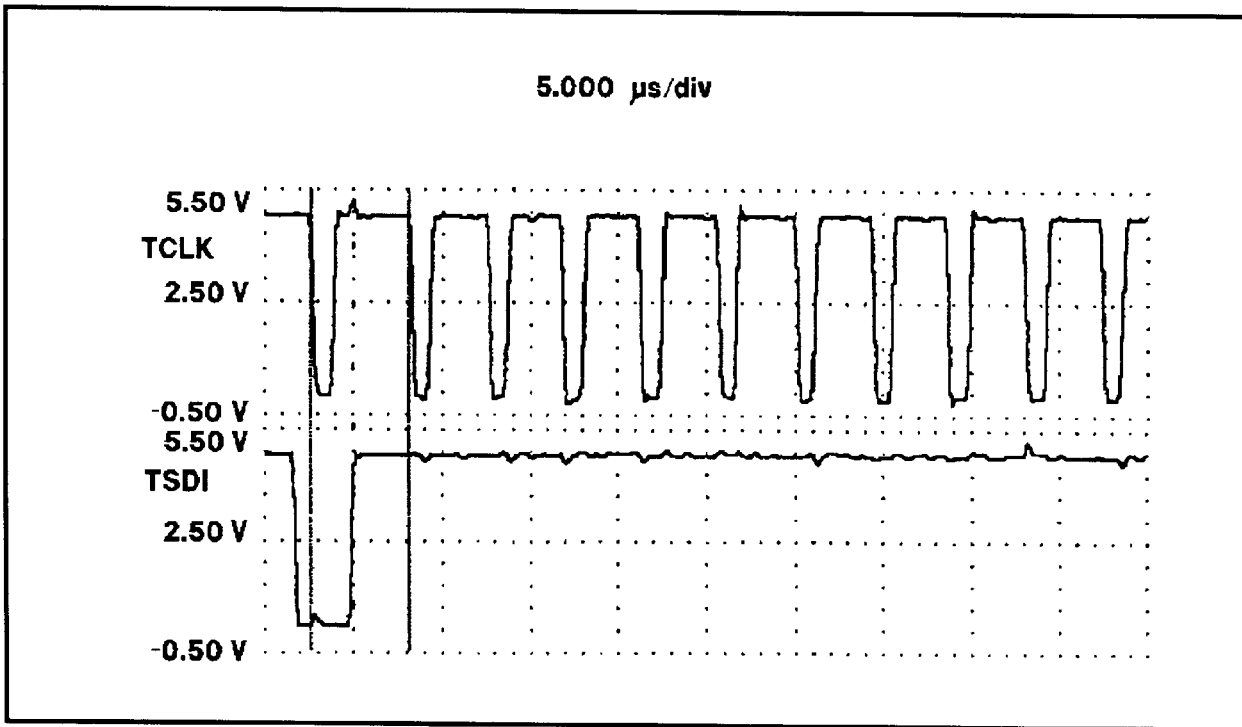


Figure 3-23. TSDI, TCLK - Test Scanner Control Outputs (typical).

Observe on the Digital PCB CSDI (common serial data in) at U7-pin 16 (74HC540) and CCLK (common serial clock) at U7-pin 15. Compare them to Figure 3-24 in View Mode. If these signals are wrong, then troubleshoot CSDI at U2-pin 5 (80C31), and U7-pins 4 and 16 (74HC540). Troubleshoot CCLK at U2-pin 6, and U7-pins 5 and 15. If these signals appear OK, but the relays are still non-operational, refer to scanner troubleshooting section in this manual for further information.

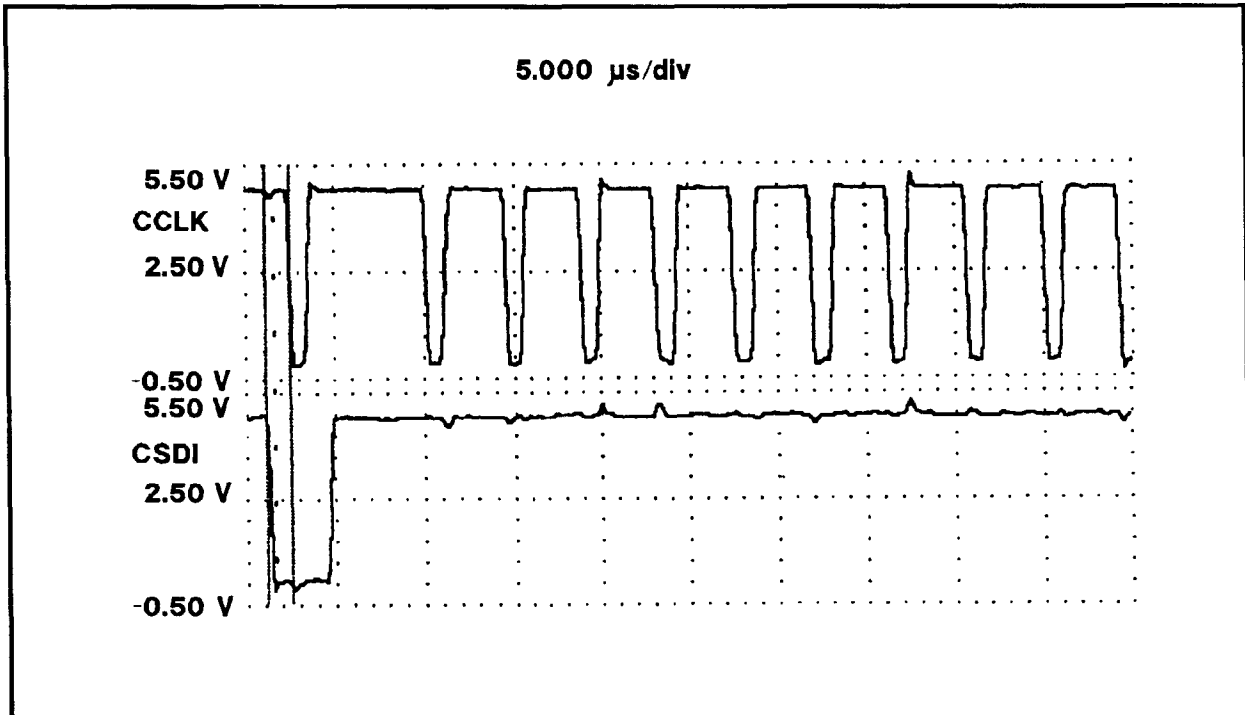


Figure 3-24. CSDI, CCLK - Common Scanner Outputs (typical).

GPIB COMMUNICATION

Connect the 5100DS to a known good computer with the 5100DS software and a GPIB board installed. Turn the 5100DS power on. Start the 5100DS software, then start the Calibration program by pressing C. Watch for GPIB error messages on the PC monitor. Make a note of any displayed messages.

If the "GPIB FAILURE - Time Out error" message appears, then perform troubleshooting on the Digital PCB.

If the "GPIB FAILURE - Write function detected no Listeners..." message appears, then the fault can be either be due to a faulty GPIB cable, connection, or defective Digital PCB.

Be sure the GPIB cable is good by testing all wires for continuity and then rerun the Calibration program. Investigate the Digital PCB if the fault is still present.

The GPIB section consists of GPIB controller U17 (7210C), receiver and transmitter U18 (75160) and U22 (75162), buffer U20 (74HC540), and switch S2.

Be sure U17 receives a good clock signal by comparing U17-pin 3 with Figure 3-25. If not similar to figure, then check the clock divider U16-pin 10, and clock input inverter U12-pin 6 for proper operation.

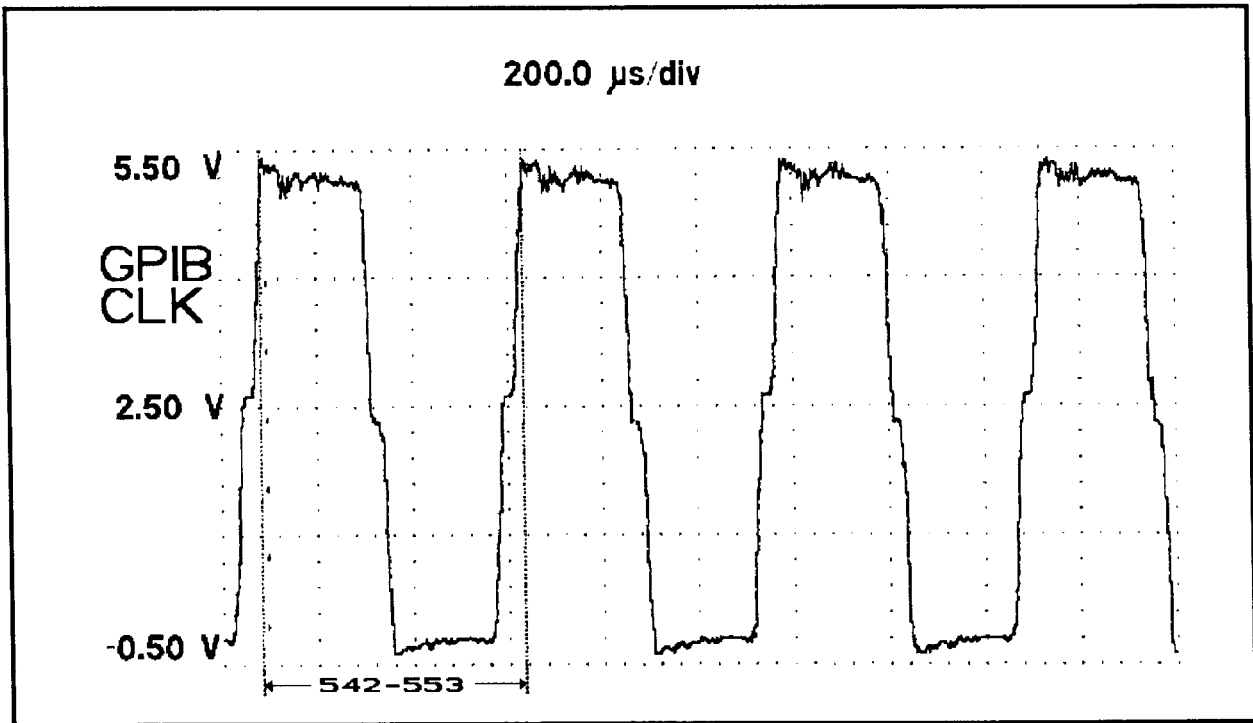


Figure 3-25. GPIB Clock.

The GPIB device address for the 5100DS is set by switch S2. The default setting for the 5100DS is 1. The microcomputer reads the setting only during the power on or reset cycle. To set another device address, turn the 5100DS power off. Move the switch to the new address and turn the power on.

Replace U17, U18, and U19 if the rest of the circuitry on the Digital PCB is OK and the GPIB is still faulty. Run the 5100DS software to retest.

3-13. Scanner Troubleshooting

NOTE: Scanner troubleshooting may be divided into two areas of attention. If the 5100 Maintenance Utility program's Relay Check utility reports a multitude of TEST relay failures, then refer to steps 5 to 13 below. If a multitude of COMMON relay failures are displayed, then refer to steps 14 to 22. If the Relay Check utility identifies a few faulty relay(s) on one or more Scanners, then go to step 23 below and begin troubleshooting at that point.

1. The Scanner PCB receives +5 VDC from the Backplane PCB. Check the voltage between U2-pin 1 (5832) and ground. Make sure it is between +4.75 and +5.25 VDC.
2. Control signals from the Digital PCB are routed to each of the Scanner PCBs. If any control signal is faulty, the Scanner PCB will not operate correctly. The following steps will troubleshoot these control lines.
3. To verify the operation of the Scanner PCBs, start the Maintenance program at \5100 by typing "M51" and then press ↵. Press "R" to run the Relay Check utility program. After running this test, the program will display OK, SHORT, or OPEN for each relay on the four Scanner PCBs. If an entire PCB is faulty as indicated by this display, then most likely the controller on that Scanner is faulty.

NOTE: To facilitate access to various test points while troubleshooting these PCBs, use of a extender board is suggested. Contact Huntron Technical Support for information on how to order this troubleshooting aid.

4. If a faulty TEST scanner is found, then start at the next step. If a faulty COMMON scanner is found, then skip to step 14. If only a small number of relay faults are indicated from the Relay Check utility, then start at step 23.

TEST SCANNERS - CONTROLLER TROUBLESHOOTING

5. There are two Scanner PCBs in the TEST relay bank. Each Scanner PCB is identical, however its position in the Backplane PCB defines its function as a TEST 1 or TEST 2 PCB and which set of 32 relays onboard are switched as 1 to 32 (TEST 1) or 33 to 64 (TEST 2).
6. The TEST Scanner PCBs receive several control signals /STR (strobe), /OE (output enable), and /CLK (serial clock) from the Digital PCB via the Backplane PCB. In addition to these common control signals from the Digital PCB, the TEST 1 Scanner PCB receives Serial Data In (/SDI) from the Digital PCB and sends its Serial Data Output (/SDO) to the TEST 2 Scanner PCB Serial Data Input (/SDI).

7. Run the Maintenance Utility program and select R, Relay Check utility at the menu. Using an oscilloscope, observe the TEST 1 Scanner PCB CLK on U2-pin 40 (5832) while running this test and compare it with Figure 3-26. If different, then troubleshoot the input buffer U1-pin 5 (input), and pin 6 (output). If /CLK is not present, then refer to the Digital PCB troubleshooting section pertaining to the scanner interface. If the /CLK waveform appears to be loaded down, then it may be necessary to isolate the fault by removing the remainder of the Scanner PCBs from the Backplane PCB.
8. Similarly, observe the TEST 2 Scanner PCB CLK on U2-pin 40 (5832) and compare it with Figure 3-26. Follow troubleshooting notes as in step 7 above if needed.

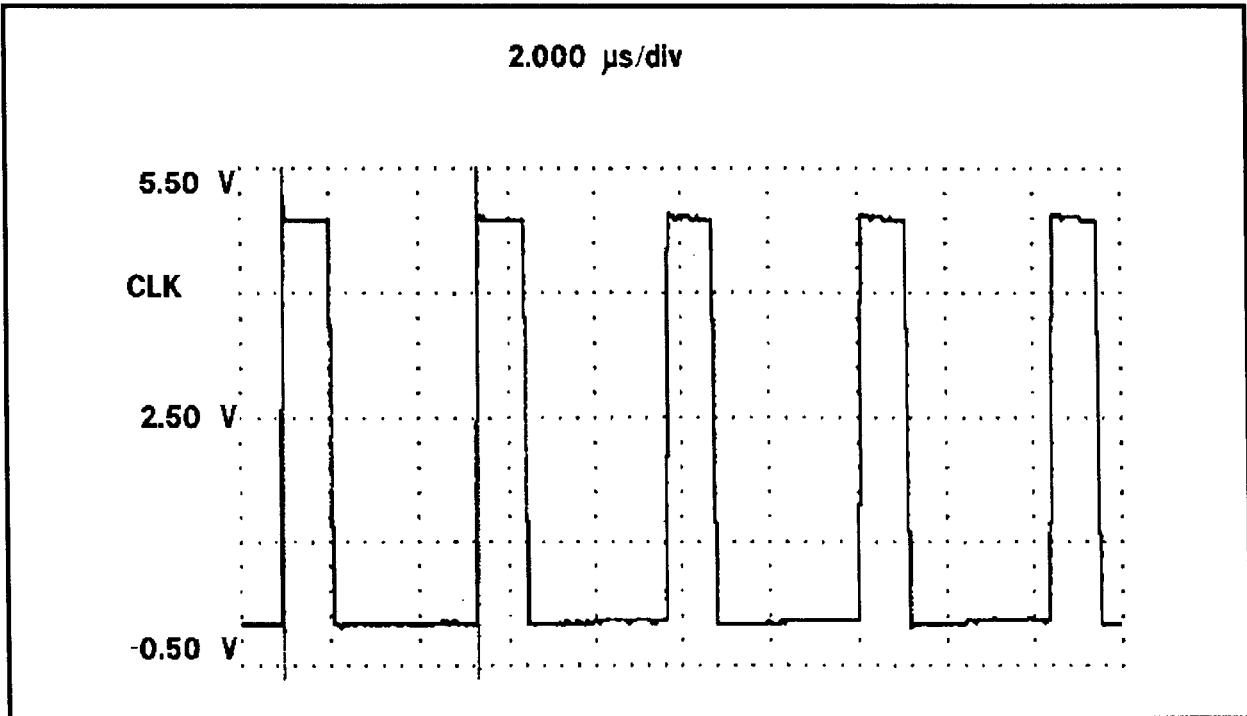


Figure 3-26. TEST or COMMON Scanner PCB CLK Waveform.

9. Observe the TEST 1 Scanner PCB SDI on U2-pin 2 (5832) and compare with Figure 3-27 while running the Relay Check utility again. To repeat this test, press R at the menu. If the waveform is different, then troubleshoot input buffer U1-pin 1 (input), and pin 2 (output). If /SDI is absent, then refer to the Digital PCB troubleshooting section pertaining to the scanner interface. If /SDI waveform appears to be loaded down, then it may be necessary to isolate the fault by removing the other Scanner PCBs from the backplane until the fault is found.

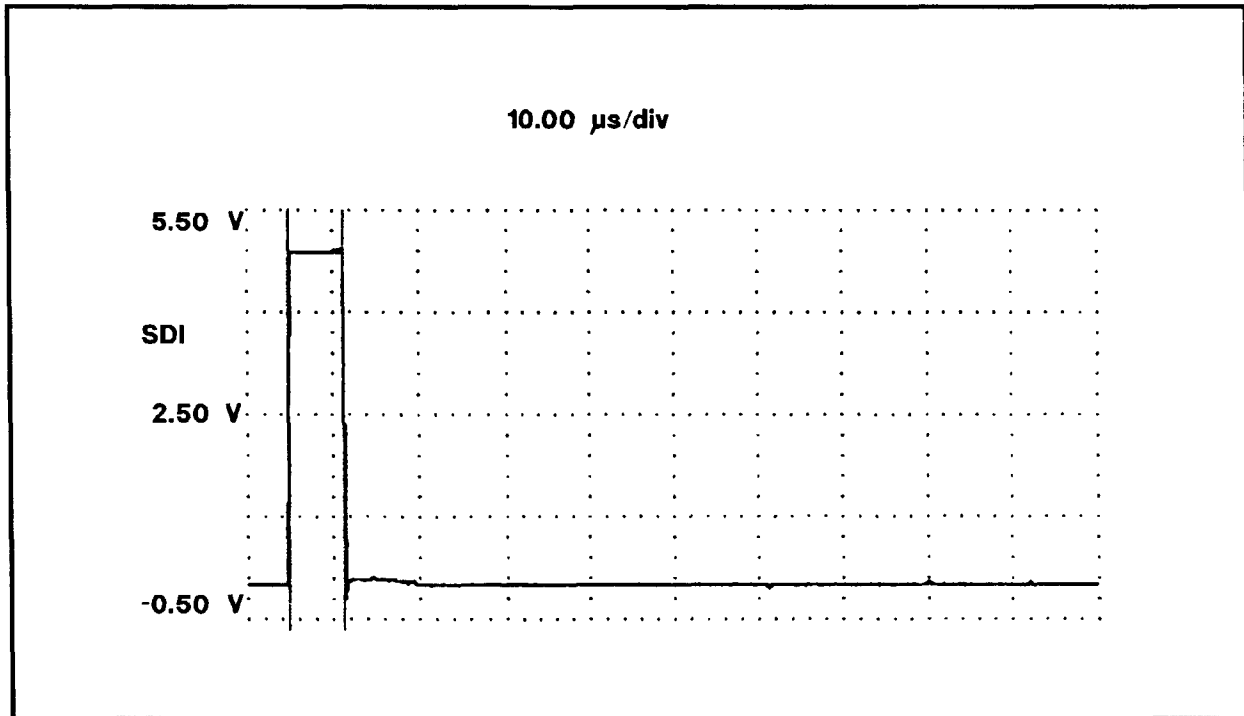


Figure 3-27. TEST 1 or COMMON 1 Scanner PCB SDI Waveform.

10. Observe the TEST 1 Scanner PCB SDO at U1-pin 10 (74HC04) while running the Relay Check utility. Compare with Figure 3-28 and if different, then troubleshoot U1 and U2 on TEST 1 scanner.

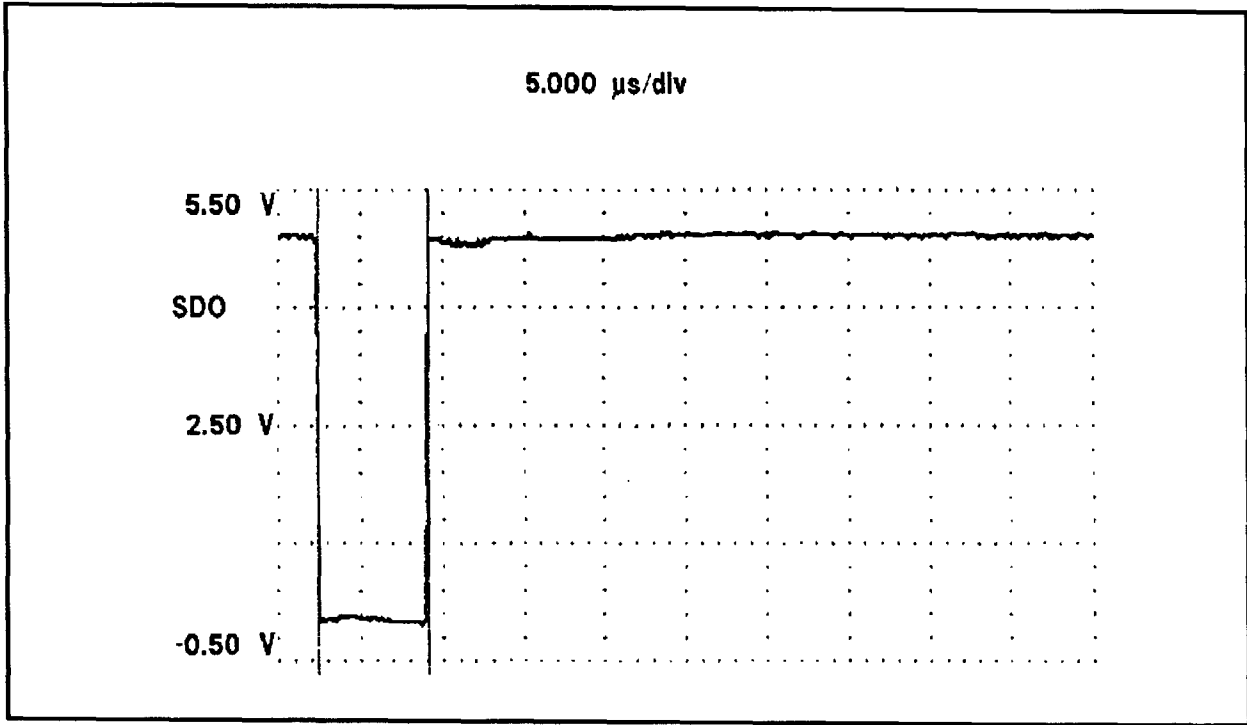


Figure 3-28. TEST 1 or COMMON 1 Scanner PCB SDO Waveform.

11. Repeat the Relay Check utility while observing /SDI on the TEST 2 Scanner PCB at U1-pin 1 (74HC04) and compare to Figure 3-29. This signal originates from TEST 1 Scanner PCB (/SDO signal). If /SDI is different, then troubleshoot the Backplane PCB for a likely cause of this fault.

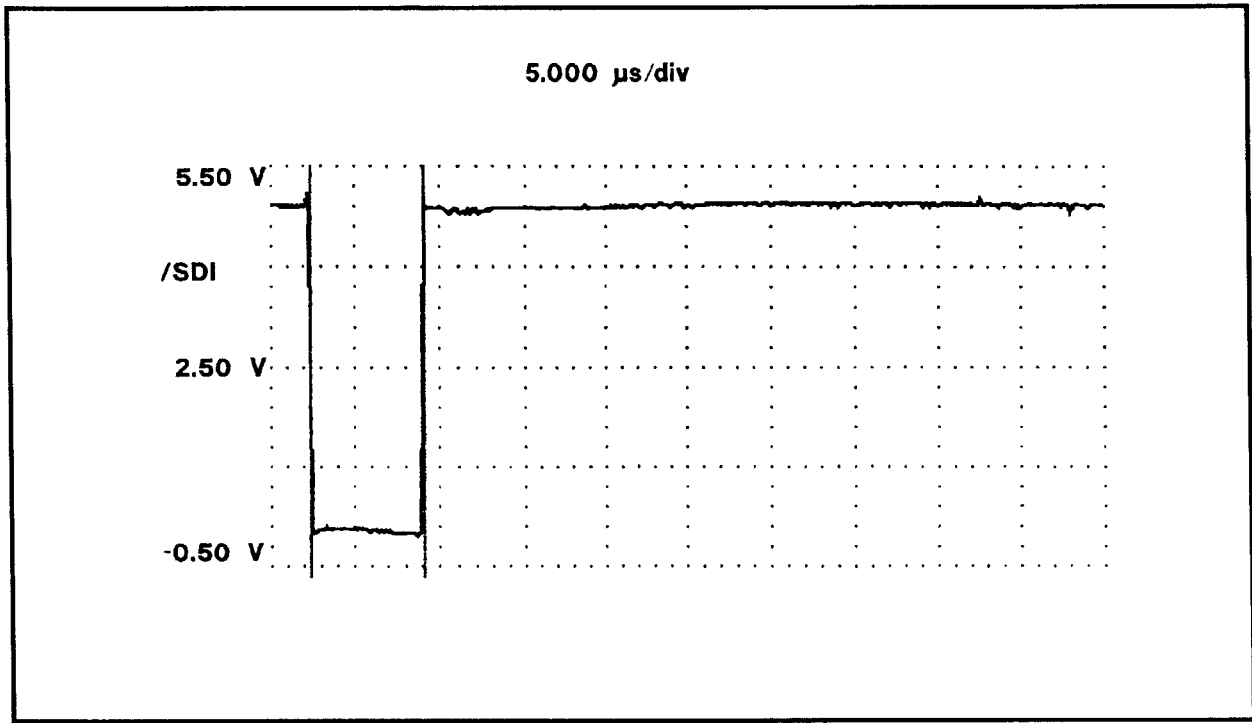


Figure 3-29. TEST 2 or COMMON 2 Scanner PCB /SDI Waveform.

12. While running the Relay Check utility, observe the TEST 2 Scanner PCB SDI (Serial Data In) at U2-pin 2 and compare it to Figure 3-30. If different, then troubleshoot U1 for possible fault.

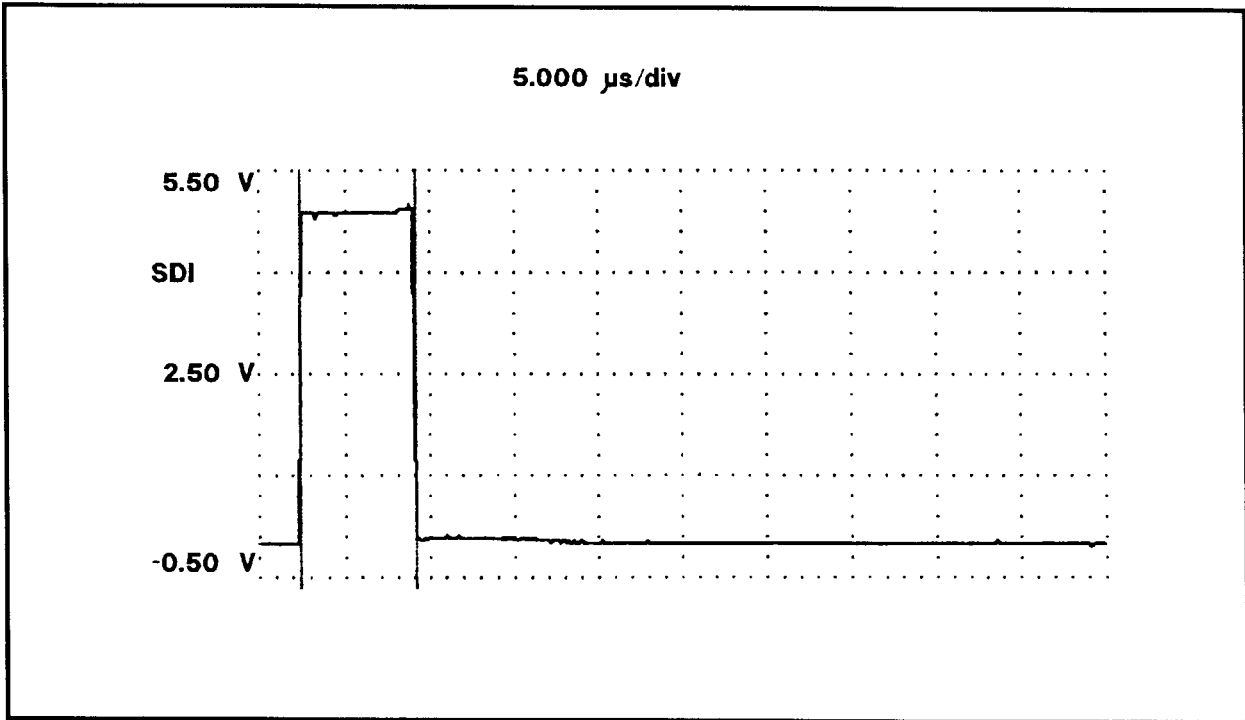


Figure 3-30. TEST 2 or COMMON 2 Scanner PCB SDI Waveform.

13. Next observe TEST 2 Scanner PCB /SDO at U1-pin 10 while repeating the Relay Check utility and compare with Figure 3-31. If different, then troubleshoot U1-pin 10 (/SDO output), 1.A5.U1-pin 11 (/SDO input), and 1.A5.U2-pin 39 (Serial Data Out). If the /SDO signal appears to be shorted, then it may be necessary to troubleshoot off this PCB to either the Backplane PCB or the Digital PCB. Refer to the appropriate sections of this manual if needed.

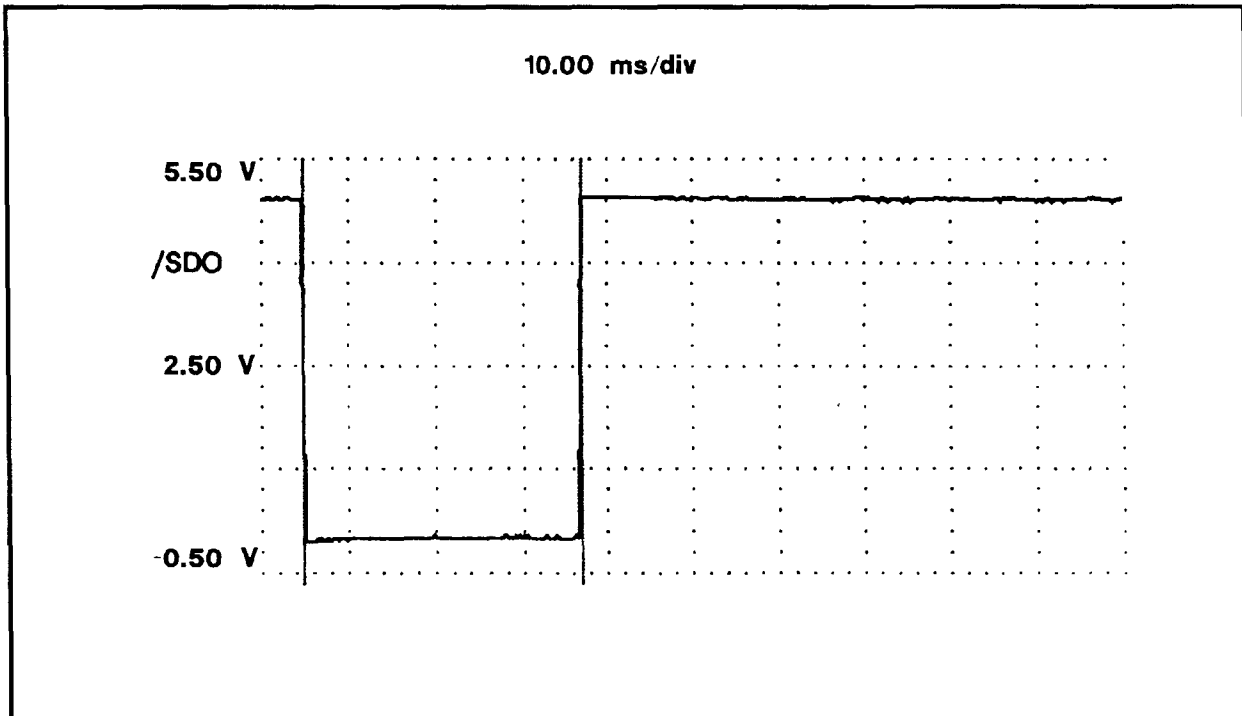


Figure 3-31. TEST 2 or COMMON 2 Scanner PCB /SDO Waveform.

COMMON SCANNERS - CONTROLLER TROUBLESHOOTING

14. There are two Scanner PCBs in the COMMON relay bank in the 5100DS. Each Scanner PCB is identical, however its position in the Backplane PCB defines its function as a COMMON 1 or COMMON 2 PCB and which set of 32 relays onboard are switched as 1 to 32 (COMMON 1) or 33 to 64 (COMMON 2).
15. The COMMON Scanner PCBs receive control signals /STR (strobe), /OE (output enable), and /CLK (serial clock) from the Digital PCB via the Backplane PCB. In addition to these common control signals from the Digital PCB, COMMON 1 Scanner PCB receives Serial Data In (/SDI) from the Digital PCB and sends its Serial Data Output (/SDO) to COMMON 2 Scanner PCB Serial Data Input (/SDI).
16. Run the Maintenance Utility program and select R, Relay Check utility. Using an oscilloscope, observe the COMMON 1 Scanner PCB CLK on U2-pin 40 (5832) while the relays are being tested and compare with Figure 3-26. If different, then troubleshoot input buffer U1-pin 5 (input) and pin 6 (output). If /CLK is absent, then refer to the Digital PCB troubleshooting section pertaining to the scanner interface. If /CLK waveform appears to be loaded down, then it may be necessary to isolate the fault by removing the remainder of the Scanner PCBs from the Backplane.
17. Similarly, observe the COMMON 2 Scanner PCB CLK at U2-pin 40 (5832) and compare with Figure 3-26. Follow troubleshooting as in step 16 above if needed.

25. Locate the faulty relay as reported by the test routine on the Scanner PCB. Referring to the Scanner PCB schematic, find the appropriate output pin of U2 (5832) that connects to the faulty relay and observe with an oscilloscope while rerunning the relay test to investigate its operation. Troubleshoot the relay contact, coil, and its output driver in U2.
26. After repair, rerun the Relay Check utility to verify correct operation. If the test routine reports the same fault, then the problem may be due to defective relay contacts or a fault on the Backplane PCB or Input PCB.
27. Swap the suspect faulty Scanner PCB with one of the others making note of the suspect PCB. Rerun the relay test.
28. If the test reports the failure still on the suspect PCB, then the relay contacts on the suspect PCB are likely to be the cause of the failure. Troubleshoot and replace as needed.
29. If the relay test reports the failure on a different Scanner PCB then the Backplane PCB and Input PCB are likely to contain the fault condition (e.g. open or shorted circuit). Troubleshoot and repair as needed.
30. Rerun the Relay Check utility after troubleshooting and repair has been performed to verify correct operation has been restored.

3-14. Analog Troubleshooting

The following procedure can be used to locate problems on the Analog PCB Assembly. You should do this procedure if any of the conditions listed below occur:

- A calibration check indicates that unit is out of calibration.
- Unit is not able to pass all of the performance tests.
- During the hardware calibration procedure, it was not possible to obtain all the required measurements.
- You were directed to this procedure by another section.
- You suspect a problem on the Analog PCB.

This procedure should be followed step by step until the fault is discovered.

NOTE: While the major test points are available at the top edge of the Analog PCB assembly, to facilitate access to all test points referred to during this procedure the use of an extender board is suggested. Contact Huntron Technical Support for further details.

CAUTION

Do not remove or install any PCB assembly unless the power is turned off.

Before starting this procedure, try to do the main calibration procedure (Section 3-9) and then the performance tests (Section 3-6) if these have not been done already.

To control the Analog PCB assembly, use the ANALOG DIAGNOSTIC UTILITY of the maintenance program, M51.EXE. To start the maintenance program, from \5100, type "M51" and then press ↵. When the main menu appears, press "A" to get analog diagnostics. Your screen should appear as shown in Figure 3-33. (For further information about the Analog Diagnostic Utility, refer to Table 3-6.)

| HUNTRON TRACKER 5100DS ANALOG DIAGNOSTIC UTILITY | | | | | | | |
|---|------------|------------|--------------------|------|------------------|------|---|
| Key | Function | Status | Horizontal Byte | Data | Vertical Byte | Data | |
| Up/Down | - Range | = MEDIUM 2 | 12 | | 112 | | |
| F1 | - Waveform | = SINE | 25 | * | 125 | | * |
| F2 | - Mode | = NORMAL | 38 | | 138 | | |
| F3 | - Signal | = ON | 50 | | 150 | | |
| F4 | - Tracker | = ON | 62 | | 162 | | |
| F5 | - Testline | = OPEN | 75 | * | 175 | | * |
| F6 | - Offset | = OFF | 88 | | 188 | | |
| F7 | - Data | = HOLD | 100 | | 200 | | |
| | | | Offset | 0 | | | 0 |
| Esc | - Exit | | | | | | |

Figure 3-33. Analog Diagnostic Utility.

Table 3-6.
Analog Diagnostic Utility keys

| Key | Function | Description |
|-------------|----------|---|
| ↑↓ (Arrows) | Range | Selects the impedance range applied to the component under test such as LOW, MED 1, MED 2 or HIGH. Control lines RC0 and RC1 are used to select ranges. |
| F1 | Waveform | Selects the type of signal that is generated by the Tracker: either a TRIANGLE or a SINE wave. Control line STS is used to select the desired waveform. |
| F2 | Mode | This function selects the input to the A/D converter (ADC). NORMAL switches the ADC input to the Tracker signal outputs. DIAG(nostic) switches the ADC input to Testpoint 1 and the 1.2V voltage reference output. Control line NTM is used to select the ADC input. |
| F3 | Signal | This function toggles the Tracker signal ON or OFF to the power amp input. The CRT displays a dot when signal is OFF. Control line SAS is used to activate/deactivate the outputs. |
| F4 | Tracker | This function controls the Tracker output signal at the range generator circuit. When OFF, the range relays are disabled and the CRT displays a dot. When ON, the proper range relay is enabled (normal) and the CRT displays a horizontal trace. Control line TD is used to implement this function. |
| F5 | Testline | This function performs an OPEN or a SHORT of the Tracker output signal at the front panel jacks. The SHORT is accomplished by closing a pair of test and common relays (relay/pin #33) together. The CRT displays a vertical trace to indicate this state. |
| F6 | Offset | Enables/Disables the correction of the Tracker signal's DC error voltage by the software. The offset can be viewed at the bottom of the data display. |
| F7 | Data | Selects between a single or continuous reading of the digitized Tracker signal at the output of the ADC. HOLD locks the horizontal and vertical bytes at one sample and does not change the display. READ allows the bytes to be updated and the display changed continuously. |

If you are unable to run the analog diagnostics due to a GPIB error, check that your GPIB cable is properly connected and then try again. If you still get a GPIB error, refer to Digital Troubleshooting to locate the fault before proceeding any further.

The Analog Diagnostic Utility is used to control ranges, waveforms, and terminal conditions (open or short) as well as several other control lines which are useful for troubleshooting.

This procedure uses an oscilloscope that meets the minimum requirements of Table 3-1. Use probes with 10MΩ input impedance and select DC coupling on the scope. Probes should be grounded to the GND test point on the Analog PCB Assembly.

ANALOG TROUBLESHOOTING PROCEDURE:

Unless otherwise noted, all part number reference designations, test points, and pin numbers (e.g. U27-pin 6) are on the Analog PCB Assembly. To locate any part in the parts lists add the prefix "1.A1."

1. Connect a probe to TP1 (refer to Figure 3-9 for test point locations). Select the TRIANGLE waveform by pressing F1. TP1 should be a 200Hz (5msec) triangle wave with ±1.2 Volt peaks. If not, check the top lead of C2 which should have the same waveform. If the waveform at C2 is not correct, then the Triangle Wave Oscillator is not working. If the waveform at C2 is different from TP1 then the Waveform Select circuit is not working. Check following parts for faults:

Triangle Wave Oscillator - Q1, Q2, Q3, U1, U2, U3, U4, U5, U6, U7, and U18

Various waveforms within the Triangle Wave Oscillator are shown in Figure 3-34 as a troubleshooting aid.

Waveform Select circuit - U3 and U10

U3-pin 10 should be at +5V for TRIANGLE and zero for SINE. If not, check STS line.

Make sure both TP1 and the top lead of C2 are the same 200Hz triangle wave with ±1.2 Volt peaks and all the waveforms in Figure 3-34 are correct before continuing.

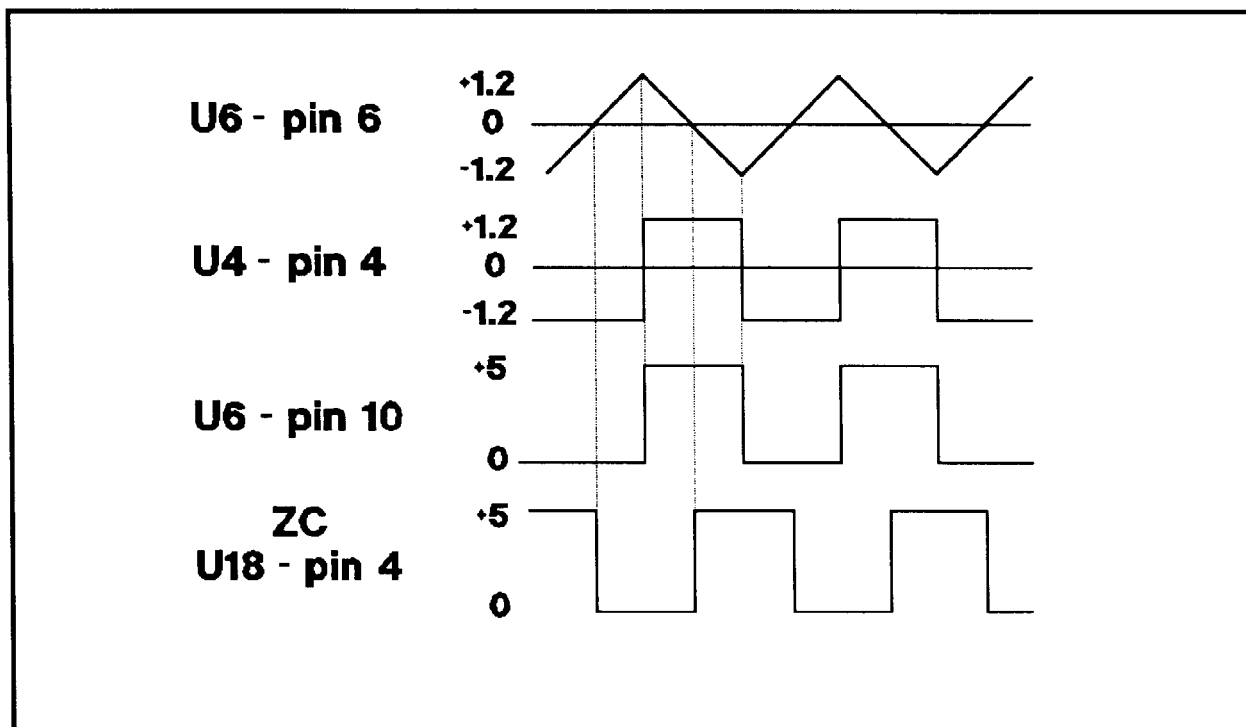


Figure 3-34. Triangle Oscillator Waveforms

- Press F1 again to select the SINE waveform. Now TP1 should be a 200Hz sine wave with ± 1.2 Volt peaks. If TP1 is a sine wave but too big or too small, see if R29 [SINE LEVEL] can be used to make the amplitude of the sine wave match the amplitude of the triangle wave (press F2 repeatedly to compare amplitudes). If TP1 is not a sine wave then check at U9-pin 7 for the sine wave described above. If U9-pin 7 is OK then there is a Waveform Select problem (see step 1). If U9-pin 7 is not OK then check all the components in the Triangle to Sine Converter:

Triangle to Sine Converter - U8, U9, and U25

Make sure TP1 is working properly in sine mode before continuing.

- At this point, if steps 1 and 2 are OK, it is possible to check the Analog to Digital Converter (ADC) section for proper operation. Press F1 to change back to a triangle wave, press F2 to change Mode from NORMAL to DIAG, and then press F7 to change Data from HOLD to READ. Data readings should appear on the right side of the screen and be continuously updated. Press F6 to account for the system offset. Your monitor should show a display similar to Figure 3-35.

| HUNTRON TRACKER 5100DS ANALOG DIAGNOSTIC UTILITY | | | | | | |
|---|------------|------------|------------|--------|----------|-------|
| Key | Function | Status | Horizontal | | Vertical | |
| | | | Byte | Data | Byte | Data |
| Up/Down | - Range | = MEDIUM 2 | 12 | 80 | 112 | 120 |
| F1 | - Waveform | = SINE | 25 | 120 * | 125 | 120 * |
| F2 | - Mode | = DIAG | 38 | 81 | 138 | 120 |
| F3 | - Signal | = ON | 50 | -3 | 150 | 120 |
| F4 | - Tracker | = ON | 62 | -86 | 162 | 120 |
| F5 | - Testline | = OPEN | 75 | -124 * | 175 | 120 * |
| F6 | - Offset | = ON | 88 | -86 | 188 | 120 |
| F7 | - Data | = READ | 100 | -4 | 200 | 120 |
| | | | Offset | 2 | | 2 |
| Esc | - Exit | | | | | |

Figure 3-35. Analog Diagnostic Utility - DIAG mode.

In DIAG mode, the Horizontal data monitors TP1 and the Vertical data monitors the +1.2V reference voltage. All 200 bytes are continuously read from the hardware and selected points are displayed. Since the +1.2V line is a DC Voltage, all Vertical bytes should be the same value (within one count). That value should be between 119 and 126 if U1 and the ADC section are working properly. The Horizontal bytes show different points on the TP1 triangle wave as shown in Figure 3-36.

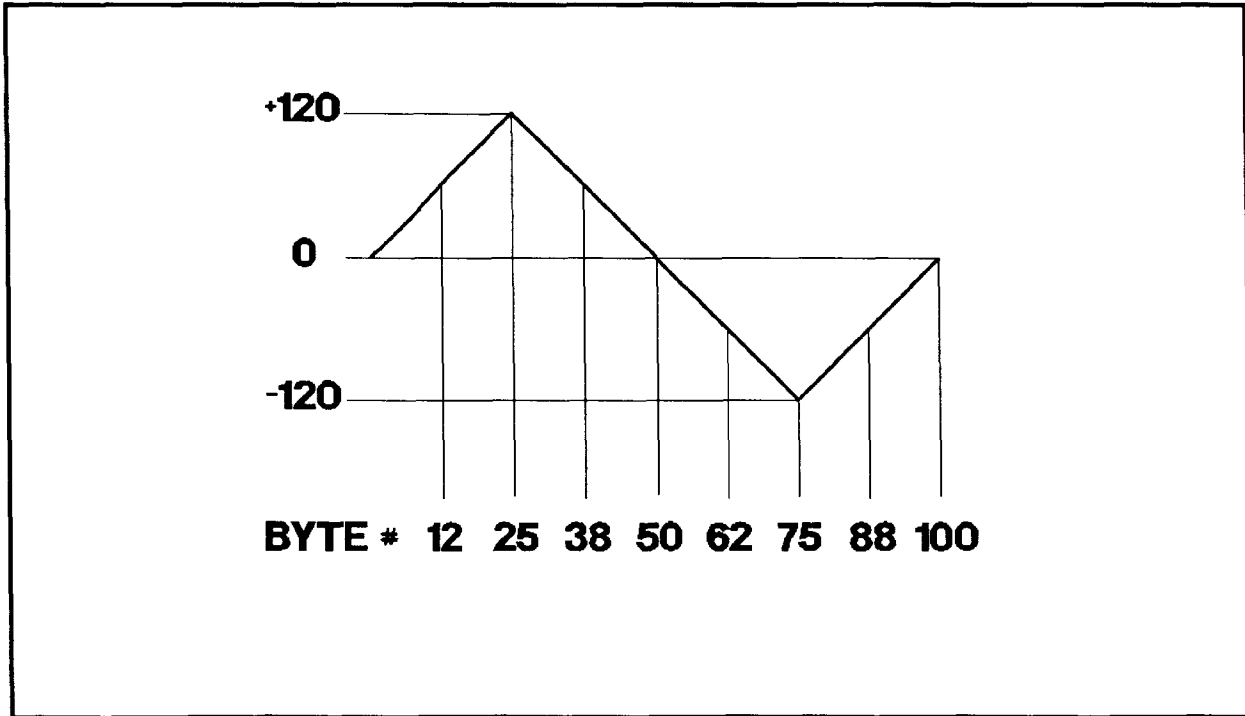


Figure 3-36. TP1 Triangle Waveform.

If all of the above is working correctly then the ADC section is OK. If not, check the components in the ADC section:

ADC Section - U26, U27, U28, U29, U30, U31, U32

Make sure the ADC section is working properly before continuing.

- Connect a probe to R46 at the end closest to T1. This allows the Power Amp Output (PAO) to be checked. The waveform at this point should be a 200Hz triangle wave (if sine wave, press F1) with approximately ± 4 Volt peaks. Proper operation is as follows: The range level controls adjust the peak amplitude slightly above and below ± 4 Volts for each individual range. Select each range below and verify that the control for that range can actually adjust the amplitude at PAO:

| RANGE | CONTROL | RC0 | RC1 |
|-------|---------|-----|-----|
| HIGH | R32 | +5V | +5V |
| MED2 | R35 | +5V | 0 |
| MED1 | R38 | 0 | +5V |
| LOW | R41 | 0 | 0 |

If any control does not function as described, check all the components in the Range Level Controls section (R31 through R42 and U11) to locate the fault. Proper voltage levels on control lines RC0 and RC1 are shown as an aid. If all controls affect PAO as they should but the amplitude is significantly greater or less than ± 4 Volts, check the Power Amp Section (U12 and U13 plus related passive components). If PAO is zero in all ranges check the TSC circuit. Press F4 to change Signal from ON to OFF which should toggle the TSC line on U3-pin 11. When Signal is ON, TSC should be +5V and U3-pin 14 should have a triangle wave with approximately ± 1.1 Volt peaks in all ranges.

If all of the above is OK, select the LOW range and use F5 to toggle between OPEN and SHORT. The amplitude should not change at PAO under these conditions. If PAO becomes distorted and/or clipped while in LOW-SHORT, check U13.

Make sure all of the above tests and conditions are working properly before continuing.

- At this point, refer back to performance tests to see if any of the open circuit voltage tests failed (tests #5 through #12). If there was a failure check the following components in the Tracker Range Generator.

| FAILED RANGE | COMPONENTS |
|--------------|------------|
| HIGH | K4, R50 |
| MED2 | K3, R51 |
| MED1 | K2, R52 |
| LOW | K1, R53 |

If any of the range relays (K1 through K4) are not working check the Range Relay Drive Circuits (U23 and U24). If the relays are OK then the range resistor could be open or there could be an open winding on the Signal Transformer (T1). If the above conditions are OK, again refer to the performance test results to see if any of the short circuit current tests failed (tests #13 through #20). If there was a failure again check the appropriate range resistor for proper value. If all resistors are within $\pm 0.1\%$ of their marked values, then T1 is most likely at fault.

Make sure all of the above conditions are working properly before continuing.

6. Connect a probe to TP3 so that the Horizontal section can be checked. With the Testline set to OPEN, the waveform at TP3 should be a 200Hz triangle wave (if sine, press F1) with approximately ± 1 Volt peaks in all ranges. Press F5 to change Testline to SHORT and TP3 should go to zero in all ranges. If TP3 does not work as described above, connect a scope probe to U19-pin 6 and examine the waveforms there. With a SHORT the signal should be zero in all ranges and with an OPEN there should be a 200Hz triangle wave with the following approximate amplitudes:

| | |
|-------|-----------------|
| RANGE | U19-pin 6 |
| HIGH | ± 2.4 Volts |
| MED2 | ± 0.8 Volts |
| MED1 | ± 0.6 Volts |
| LOW | ± 0.4 Volts |

If U19-pin 6 does not meet these conditions then that circuit is defective. If U19-pin 6 is OK then connect a probe to U21-pin 13. This point should meet the conditions for TP3 above. If it does not meet them, then check U20 and U21 for the fault. If U21-pin 13 is OK, then U22 is most likely defective. When checking U22 make sure that pins 1, 3, 5 and 7 (TP3) all have the same waveform with an OPEN.

Make sure all of the above conditions are met before proceeding.

7. Now connect a probe to TP2 so that the Vertical section can be checked. When the Testline is OPEN, this test point should have a zero level just like TP3 for a short. When the Testline is a SHORT, TP2 should be just like TP3 for an open (refer to step 6 above). If TP2 does not work as described above, connect a probe to U14-pin 6 and select a SHORT. The amplitude of the waveforms in each range should be the same as the chart in step 6 except for the LOW range which should be approximately ± 0.3 Volts. If U14-pin 6 is not correct then check U14 and all its related components which include R54-R60 and the other pole of relays K1 to K4 that was not checked in step 5. If U14-pin 6 is OK, then connect a probe to U16-pin 13. This point should meet the conditions for TP2 above. If U16-pin 13 is not correct, then check U15 and U16 for the fault. If U16-pin 13 is OK, then U17 is probably defective. When checking U17 make sure that pins 1, 3, 5, and 7 (TP2) all have the same waveform with a SHORT.

Make sure all of the above conditions are met before proceeding.

8. At this point the signal path has been fully tested from the oscillator to TP2 and TP3. Earlier in step 3, the ADC section was checked and any fault should have been corrected. Press F2 to select NORMAL mode. The data readings (with TRIANGLE selected) for an OPEN are shown in Figure 3-37 and the data readings for a SHORT are shown in Figure 3-38. When F1 is pressed to select the SINE waveform, an OPEN should look like Figure 3-39 and a SHORT should be like Figure 3-40. While all of these figures are for the MEDIUM2 range, the other three ranges should show approximately the same data readings. Also the figures show data for a calibrated unit so at this point it would be wise to try the hardware calibration again and then check your unit's performance against Figures 3-37 through 3-40. If any problem is found, U30 is the most likely failure. If the unit performs like these figures then the Analog PCB assembly is performing correctly.

| HUNTRON TRACKER 5100DS ANALOG DIAGNOSTIC UTILITY | | | | | | | |
|---|------------|------------|------------|-------|----------|------|--|
| Key | Function | Status | Horizontal | | Vertical | | |
| | | | Byte | Data | Byte | Data | |
| Up/Down | - Range | = MEDIUM 2 | 12 | 48 | 112 | 0 | |
| F1 | - Waveform | = TRIANGLE | 25 | 100 * | 125 | 0 * | |
| F2 | - Mode | = NORMAL | 38 | 48 | 138 | 0 | |
| F3 | - Signal | = ON | 50 | 0 | 150 | 0 | |
| F4 | - Tracker | = ON | 62 | -48 | 162 | 0 | |
| F5 | - Testline | = OPEN | 75 | -99 * | 175 | 0 * | |
| F6 | - Offset | = ON | 88 | -48 | 188 | 0 | |
| F7 | - Data | = READ | 100 | 0 | 200 | 0 | |
| | | | Offset | 2 | | 2 | |
| Esc | - Exit | | | | | | |

Figure 3-37. Analog Diagnostic Utility - Normal Mode, Triangle, Open.

| HUNTRON TRACKER 5100DS ANALOG DIAGNOSTIC UTILITY | | | | | | | |
|---|------------|------------|------------|------|----------|-------|--|
| Key | Function | Status | Horizontal | | Vertical | | |
| | | | Byte | Data | Byte | Data | |
| Up/Down | - Range | = MEDIUM 2 | 12 | 0 | 112 | 47 | |
| F1 | - Waveform | = TRIANGLE | 25 | 0 * | 125 | 98 * | |
| F2 | - Mode | = NORMAL | 38 | 0 | 138 | 48 | |
| F3 | - Signal | = ON | 50 | 0 | 150 | 0 | |
| F4 | - Tracker | = ON | 62 | 0 | 162 | -47 | |
| F5 | - Testline | = SHORT | 75 | 0 * | 175 | -99 * | |
| F6 | - Offset | = ON | 88 | 0 | 188 | -49 | |
| F7 | - Data | = READ | 100 | 0 | 200 | -1 | |
| | | | Offset | 2 | | 2 | |
| Esc | - Exit | | | | | | |

Figure 3-38. Analog Diagnostic Utility - Normal mode, Triangle, Short.

| HUNTRON TRACKER 5100DS ANALOG DIAGNOSTIC UTILITY | | | | | | |
|---|------------|------------|------------|--------|----------|------|
| Key | Function | Status | Horizontal | | Vertical | |
| | | | Byte | Data | Byte | Data |
| Up/Down | - Range | = MEDIUM 2 | 12 | 69 | 112 | 0 |
| F1 | - Waveform | = SINE | 25 | 100 * | 125 | 0 * |
| F2 | - Mode | = NORMAL | 38 | 68 | 138 | 0 |
| F3 | - Signal | = ON | 50 | 0 | 150 | 0 |
| F4 | - Tracker | = ON | 62 | -68 | 162 | 0 |
| F5 | - Testline | = OPEN | 75 | -100 * | 175 | 0 * |
| F6 | - Offset | = ON | 88 | -68 | 188 | 0 |
| F7 | - Data | = READ | 100 | 0 | 200 | 0 |
| | | | Offset | 2 | | 2 |
| Esc | - Exit | | | | | |

Figure 3-39. Analog Diagnostic Utility - Normal Mode, Sine, Open.

| HUNTRON TRACKER 5100DS ANALOG DIAGNOSTIC UTILITY | | | | | | |
|---|------------|------------|------------|------|----------|--------|
| Key | Function | Status | Horizontal | | Vertical | |
| | | | Byte | Data | Byte | Data |
| Up/Down | - Range | = MEDIUM 2 | 12 | 0 | 112 | 68 |
| F1 | - Waveform | = SINE | 25 | 0 * | 125 | 100 * |
| F2 | - Mode | = NORMAL | 38 | 0 | 138 | 68 |
| F3 | - Signal | = ON | 50 | 0 | 150 | 1 |
| F4 | - Tracker | = ON | 62 | 0 | 162 | -68 |
| F5 | - Testline | = SHORT | 75 | 0 * | 175 | -100 * |
| F6 | - Offset | = ON | 88 | 0 | 188 | -69 |
| F7 | - Data | = READ | 100 | 0 | 200 | 0 |
| | | | Offset | 2 | | 2 |
| Esc | - Exit | | | | | |

Figure 3-40. Analog Diagnostic Utility - Normal Mode, Sine, Short.

3-15. CRT Display Troubleshooting

When a problem occurs with the signatures on the CRT display, the user should follow this procedure sequentially until the fault is discovered. Start the Maintenance program, press "A" to select the Analog Diagnostic Utility, and use F5 to control whether the CRT signature is an open or a short.

1. Set up an oscilloscope with these settings: channel X (horizontal) set to 0.2V/division at probe tip, channel Y (vertical) also set to 0.2V/division at probe tip. Then put the scope in X-Y mode and use the position controls to place the resulting "dot" in the center of the CRT where the horizontal axis and vertical axis cross each other.
2. Hook the channel X probe to 1.A1.P1-pin 17C (the 96 pin DIN connector on the Analog PCB Assembly) and hook the channel Y probe to 1.A1.P1-pin 18C. This will produce proper signatures on the scope CRT if the horizontal and vertical outputs on 1.A1 are working properly. Check for the following performance:

An open circuit should display a horizontal line six divisions long in all ranges.

A short circuit should display a vertical line six divisions long in all ranges.

3. If the scope CRT duplicates the problem observed on the 5100DS CRT, or in any way does not meet the performance specified in Step 2, then the fault is on 1.A1 and the user should refer to the Analog Troubleshooting procedure.
4. If the performance of step 2 is satisfied, then 1.A1 is working properly and the problem must be in the CRT section of 1.A2 (Backplane PCB). Move the CRT Assembly out of the way at this point to gain access to the components underneath it (see Section 3-4). However, do not disconnect the CRT Assembly electrically.
5. Referring to the Backplane PCB Schematic in Section 5, connect the X and Y probes to 1.A2.U8-pin 1 and 1.A2.U8-pin 7 respectively. This should result in similar performance as Step 2 except the lines will be less than six divisions long and the vertical line will be shorter than the horizontal line. If this is not true, then 1.A2.U8 is probably faulty.
6. If the outputs from 1.A2.U8 are good, move the X and Y probes to 1.A2.U9-pin 14 and 1.A2.U9-pin 15 respectively. The signatures obtained at this point should look exactly like those of step 5 if 1.A2.U9 is working properly. Make sure 1.A2.U9-pins 10 and 11 are at a logic one (+5VDC) for this test. If not, check the /CD control line from the Digital PCB (1.A3).
7. The next section is the deflection drivers which are Q4 through Q9 and their related components.

WARNING

This circuit operates on +180VDC. To avoid electric shock, do not touch any parts of this circuit.

First, check the +180V supply for a voltage between +160VDC and +190VDC with respect to GND on the Analog PCB (conditions: open TEST jack, AC line voltage close to 120 VAC for 115V models). If +180V is out of tolerance, check the following components:

1.A2: C6, D3, D4, D5, D6, and R12
1.T1

8. Next, check the current sources for the differential amplifiers. The bias voltage on the bases of Q8 and Q9 should be approximately -2.5VDC with respect to GND. Also the emitter voltages of Q8 and Q9 should both be approximately -3.2VDC. If these conditions are not met, check the following components:

1.A2: D11, R31, R32, R33, R38, Q8, Q9

9. The position controls are checked next. Measure the DC voltage on the base of 1.A2.Q5. The HORIZONTAL position control on the front panel should be able to change this voltage from +0.6 Volts to -0.6 Volts (0.6 is approximate). The VERTICAL position control should be able to control the base of 1.A2.Q6 over the same range. If either position control does not work as described, use a clip lead to short the base of 1.A2.Q5 and/or 1.A2.Q6 to ground and see if the problem on the CRT is improved or gone. If it is, then the problem may be on the CRT Control PCB (1.A7.A2) and the user should check the components on that assembly. If the problem remains, check 1.A2: Q4, Q5, Q6, Q7 and their emitter and collector resistors for any fault.
10. If the deflection drivers are correct, the user must check the operation of the high voltage CRT circuits.

WARNING

Hazardous voltages are present in this section of the circuit. To avoid electric shock, do not touch any parts of this circuit.

First, check the -1200V supply for a voltage between -1190VDC and -1210VDC. Refer to Section 3-8 on CRT calibration for proper measurement and adjustment of this supply. If the voltage cannot be adjusted into tolerance, troubleshoot 1.A2.U1 and related components.

11. If the -1200V supply is working properly, check the Astigmatism/Focus/Intensity circuits:

1.A2: C17, R13, R14, R15, R16, R17, R18

Also check the 6.3VAC filament voltage. The voltage should be between 5.3VAC and 7.3VAC. If it is not, 1.T1 is probably defective.

NOTE: The 6.3 VAC winding of the transformer is biased at -1200VDC (maximum) with respect to COMMON. To measure it safely, disconnect 1.T1.P3 (part of T1 Assembly) from 1.A2.J18 and measure the AC voltage on 1.T1.P3.

12. If all of the above checks out correct, turn the power off, disconnect the CRT Assembly from 1.A2, and check the continuity of the CRT Harness. The problem is either a defective CRT or CRT Harness.
13. If the TRACE ROTATION adjustment on the front panel does not work properly, check the following components:
1.A2: Q2, Q3, U12 1.A8.L1

3-16. LINE FUSES AND VOLTAGE SELECTION

The power line fuse is in a removeable tray in the power entry module on the back panel of the 5100DS. The power entry module has the main power switch on top, the recessed male power cord connector in the middle and the fuse tray on the bottom. The fuse tray also functions as the line voltage select switch on 115V/230V units. The following describes how to use the fuse tray correctly.

To check or replace the power line fuse or to change the operating line voltage selector, do the following:

1. Turn off power.
2. Disconnect line cord from line outlet.
3. Remove line cord from power entry module receptacle.
4. Using a small flat blade tool, gently pry outwards at indentation on top of fuse tray, directly below the center pin of line receptacle.
5. Grasp tray and remove.

To verify fuse, remove fuse and check; when replacing a fuse, make sure the correct type and rating is used as specified.

NOTE: A spare fuse of the same type and rating is provided in the unused position of the tray.

To change the operating line voltage from the factory setting do the following:

1. Remove fuse from tray and replace with correct type as specified for the selected line voltage.
2. Grasp tray so that the selected line voltage matches the pointer at the lower right corner of the power entry module (refer to Figure 3-41a and Figure 3-41b).
3. Insert fuse tray into power entry module and push firmly to seat.

NOTE: 100V models are not line voltage selectable. Use the 110V-120V position and make sure the correct fuse is used as specified.

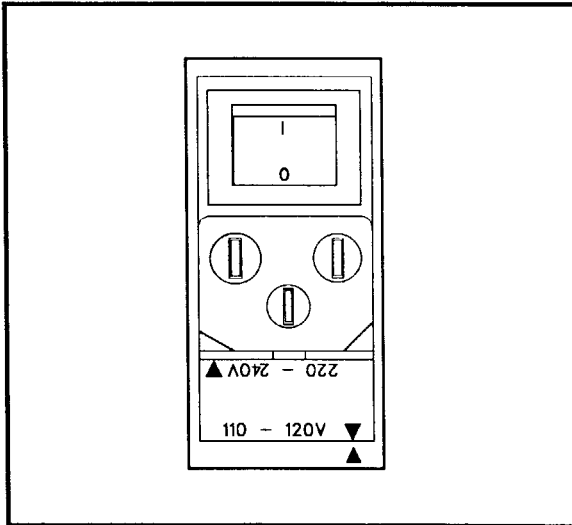


Figure 3-41a. 110-120V position.

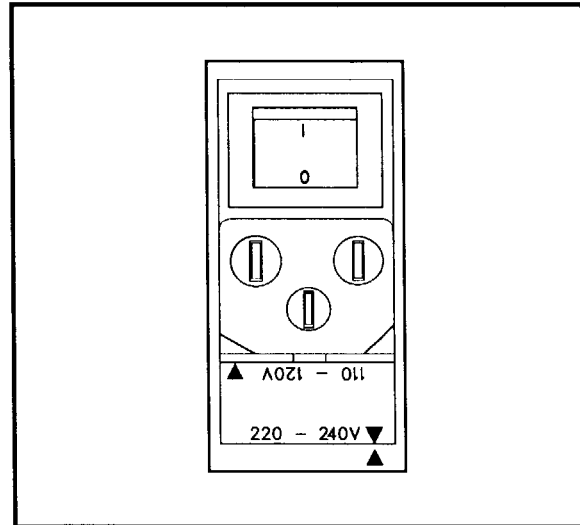


Figure 3-41b. 220-240V position.

3-17. EXTERNAL CLEANING AND LUBRICATION

WARNING

To avoid electric shock or instrument damage, never get water inside the case. To avoid instrument damage, never apply solvents to the instrument.

Should the 5100DS case require cleaning, wipe the instrument with a cloth that is lightly dampened with water or mild detergent solution. The 5100DS requires no lubrication.

3-18. STORAGE INSTRUCTIONS

For optimum protection, store unit indoors in a dry place.

NOTES:

SECTION 4

LIST OF REPLACEABLE PARTS

4-1. INTRODUCTION

This section contains the parts list for the 5100DS. The components of each assembly are listed alphanumerically by reference designation. Both electrical and mechanical components are listed by reference designation, and can be referenced to illustrations and schematics. Parts lists include the following information:

1. Reference Designation (REF DES)
2. Description of each part (Description)
3. Huntron Part Number (Huntron P/N)
4. Commercial And Government Entity (CAGE)
5. Manufacturer's Part Number

Numbers in parenthesis following the description refer to the total quantity of the part in that assembly. The part description generally includes either generic part numbers or component specifications.

4-2. HOW TO OBTAIN PARTS

Components may be ordered directly from a manufacturer by using the part description, or from Huntron Instruments, Inc. or its authorized distributors by using the HUNTRON PART NUMBER. In the event the part ordered has been replaced by a new part, the replacement will be accompanied by an explanatory note and installation instructions if necessary. To ensure prompt and efficient handling of your order, please include the following information:

1. Quantity
2. Huntron Part Number
3. Part Description
4. Reference Designation
5. Printed Circuit Board Part Number and Revision Letter
6. Instrument Model and Serial Number

CAUTION

Devices indicated by an asterisk (*) in the list of replaceable parts are subject to damage by static discharge.

FINAL ASSEMBLY PARTS LIST (refer to Figure 4-1)

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|--|----------------|-------|------------------------------|
| 1 | Final Assembly | | | |
| 1.A1 | * Analog PCB Assembly | 06-3056 | 57705 | 06-3056 |
| 1.A2 | * Backplane PCB Assembly | 06-3055 | 57705 | 06-3055 |
| 1.A3 | * Digital PCB Assembly | 06-3057 | 57705 | 06-3057 |
| 1.A4 | Input PCB Assembly | 06-3053 | 57705 | 06-3053 |
| 1.A5 | * Scanner PCB Assembly (4) | 06-3051 | 57705 | 06-3051 |
| 1.A6 | Not Used | | | |
| 1.A7 | Front Control Assembly | 06-2054 | 57705 | 06-2054 |
| 1.A8 | CRT Assembly | 06-2064 | 57705 | 06-2064 |
| 1.A9 | Ground Wire Assembly | 06-4013 | 57705 | 06-4013 |
| 1.A10 | Interconnect Cable Assembly | 06-4016 | 57705 | 06-4016 |
| 1.F1 | Fuse, 1/2 Amp, 250V (115V) | 02-0011 | 75915 | 312.500 |
| | Fuse, 1/4 Amp, 250V (230V) | 02-0010 | 75915 | 312.250 |
| 1.MP1 | Cover | 01-3038 | 57705 | 01-3038 |
| 1.MP2 | Chassis | 01-3037 | 57705 | 01-3037 |
| 1.MP3 | Rear PCB Support Metal Bracket | 01-3033 | 57705 | 01-1033 |
| 1.MP4 | Single PCB Support Metal Bracket | 01-3032 | 57705 | 01-3032 |
| 1.MP5 | Quad PCB Support Metal Bracket | 01-3030 | 57705 | 01-3030 |
| 1.MP6 | PCB Channel Guide (10-16) | 01-1215 | 32559 | DC-450 |
| 1.MP7 | Power Entry Module | 06-6057 | N/A | FN393-6-05-11 |
| 1.MP8 | Not Used | | | |
| 1.MP9 | Base, CRT Yoke | 01-1166 | 57705 | 01-1166 |
| 1.MP10 | Cap, CRT Yoke | 01-1165 | 57705 | 01-1165 |
| 1.MP11 | Stop, CRT | 01-1167 | 57705 | 01-1167 |
| 1.MP12 | Screw, Philips P.H., 3/8" 4-40 (13-14) | 07-3051 | 73734 | 19024 |
| 1.MP13 | Screw, Philips F.H., 3/8" 4-40 (2) | 07-3073 | 73734 | 18224 |
| 1.MP14 | Not Used | | | |
| 1.MP15 | Screw, Philips P.H., 3/8" 6-32 (21) | 07-3061 | 73734 | 19044 |
| 1.MP16 | Screw, Philips P.H., 1/2" 6-32 (4) | 07-3075 | 73734 | 19046 |
| 1.MP17 | Screw, Philips P.H., 2" 6-32 (2) | 07-3065 | 73734 | 19055 |
| 1.MP18 | Screw, Philips P.H., 1/2" 8-32 (4) | 07-3028 | 73734 | 19066 |
| 1.MP19 | Washer, Internal Star #4 (14) | 07-3020 | 73734 | 1302 |
| 1.MP20 | Washer, Internal Star #6 (18) | 07-3060 | 73734 | 1304 |
| 1.MP21 | Washer, External Star #6 (2) | 07-3074 | 73734 | 1322 |
| 1.MP22 | Nut, Hex , 6-32 (8) | 07-3054 | 73734 | 8006 |
| 1.MP23 | Feet, Rubber (4) | 07-2072 | 83330 | 2135 |
| 1.MP24 | Spacer, Round, 6-32 (2) | 07-3071 | 06540 | 8170-A-0632-17 |
| 1.MP25 | Clamping Bar | 01-3035 | 57705 | 01-3035 |
| 1.MP26 | Foam Strip (If Used) | 01-1216 | 57705 | 01-1216 |
| 1.T1 | Power Transformer (115V/230V) | 06-6045 | 57705 | 06-6045 |
| | Power Transformer (100V) | 06-6046 | 57705 | 06-6046 |

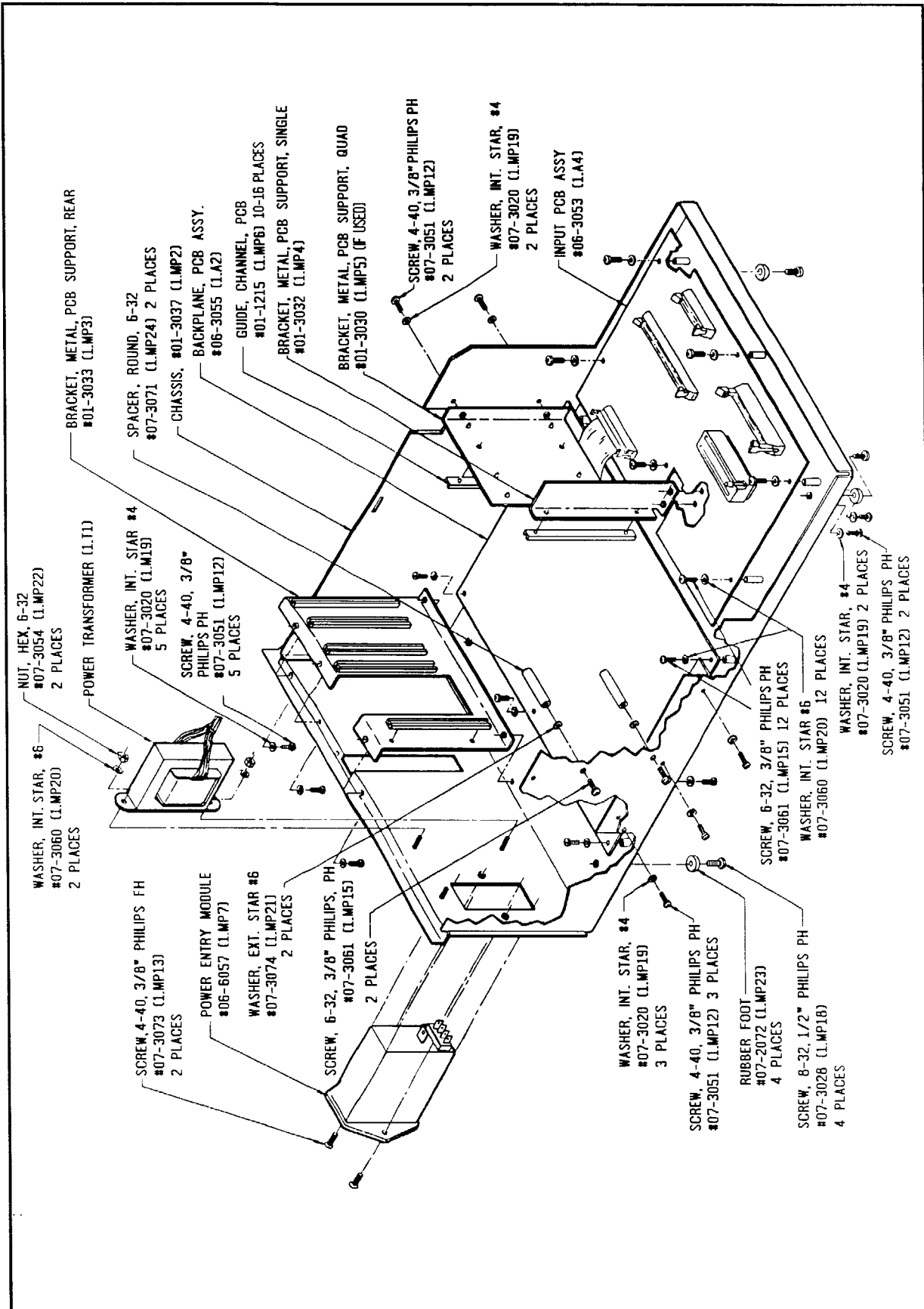


Figure 4-1a. Final Assembly

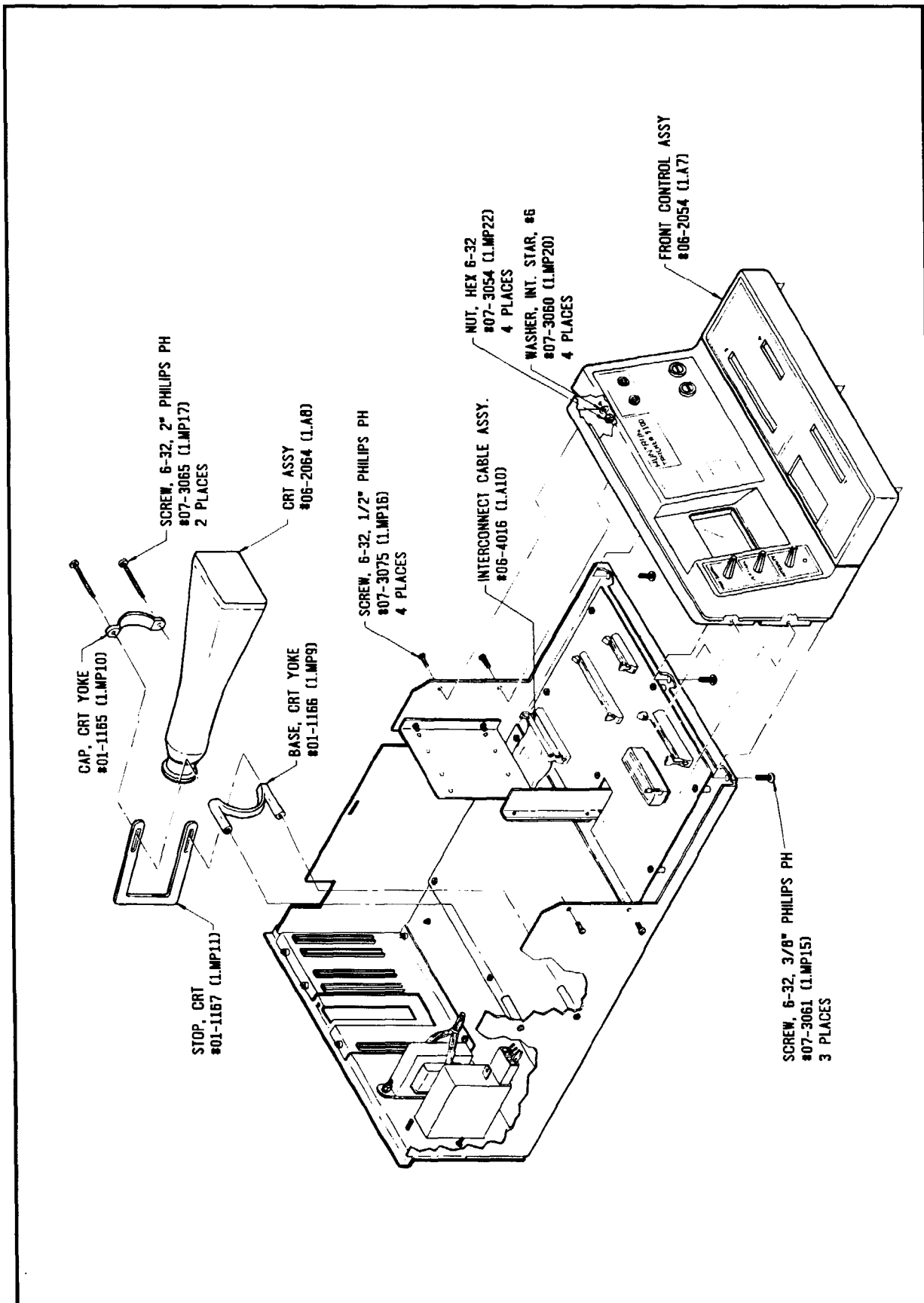


Figure 4-1b. Final Assembly.

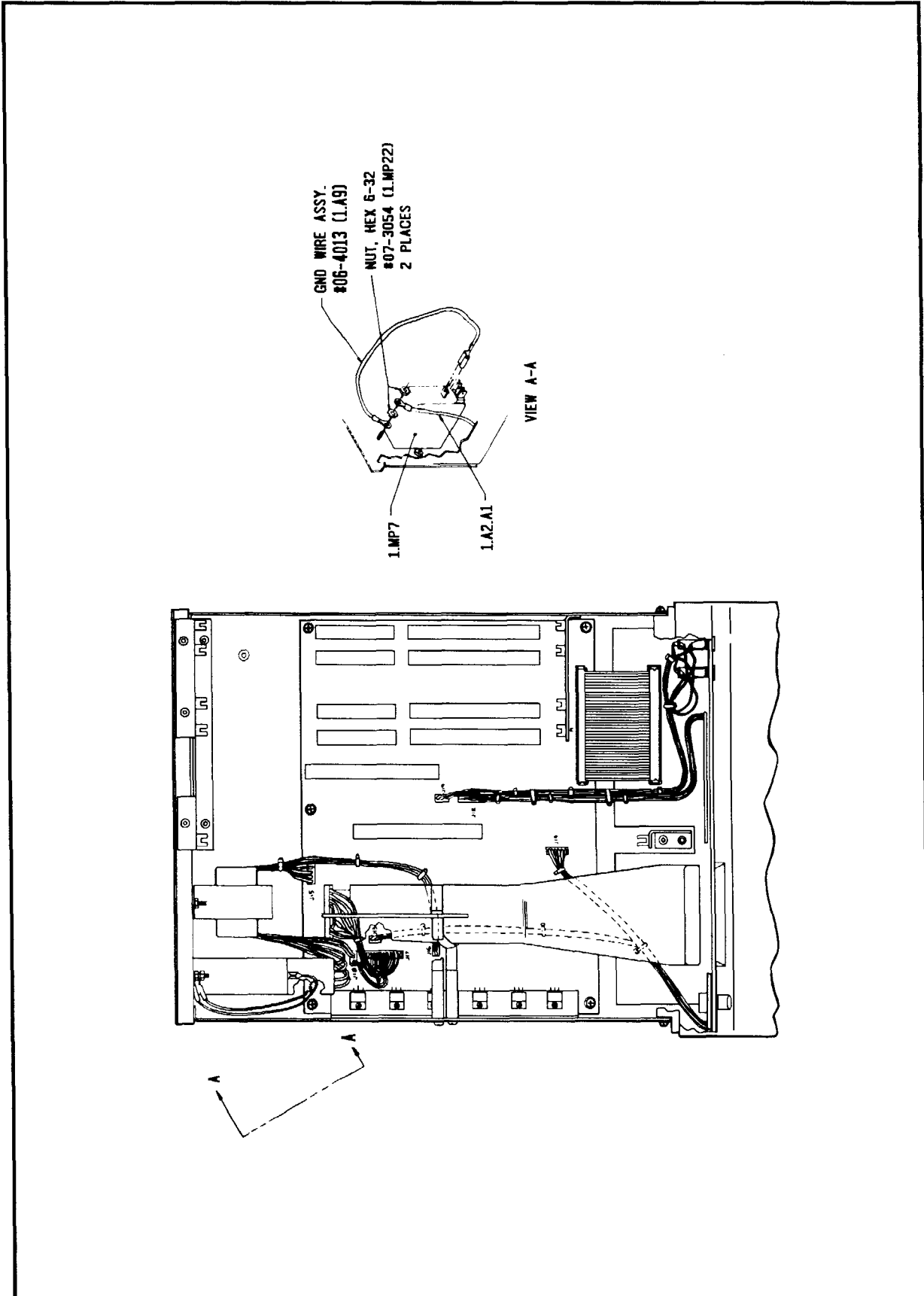


Figure 4-1c. Final Assembly.

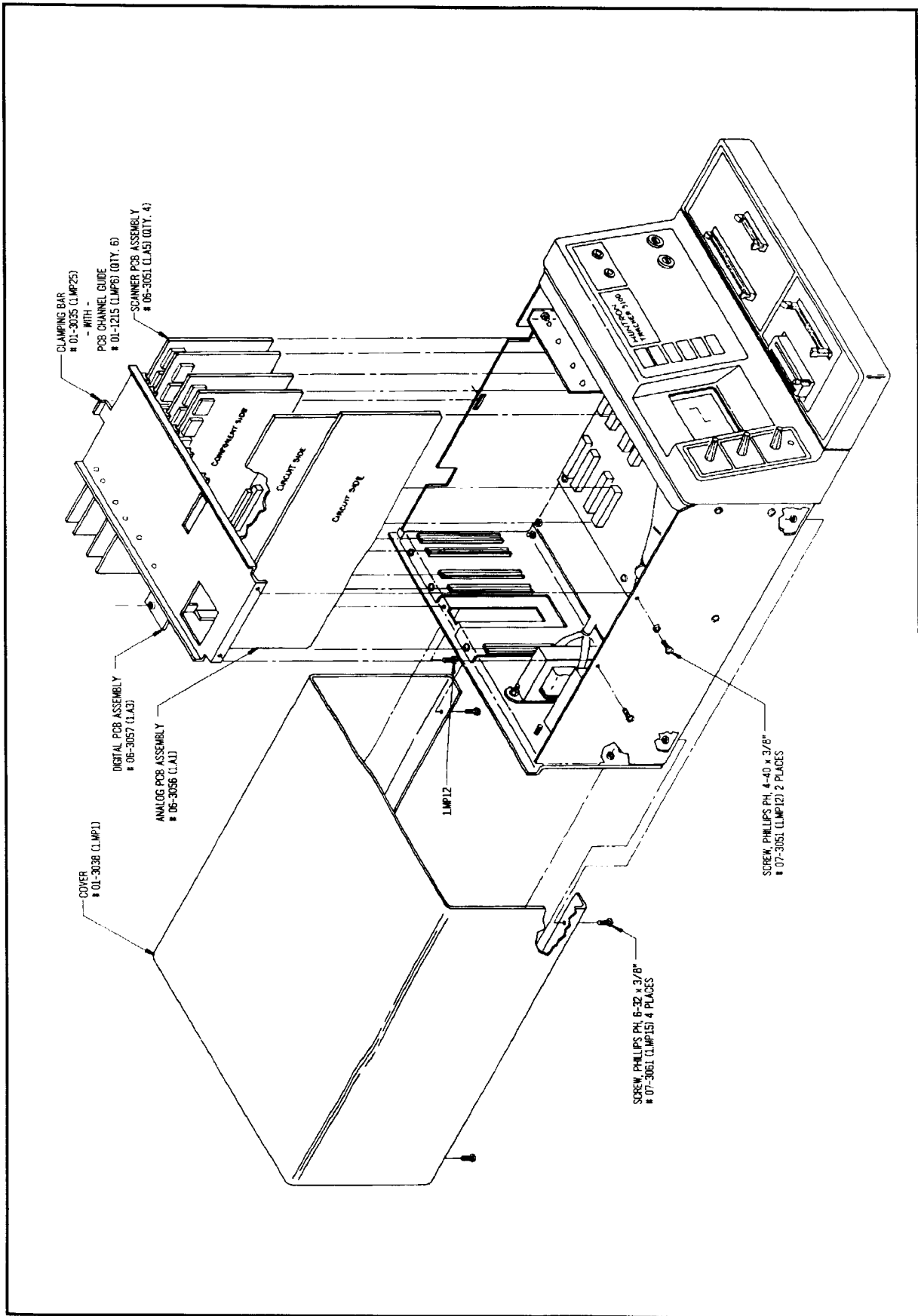


Figure 4-1d. Final Assembly.

ANALOG PCB ASSEMBLY PARTS LIST

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|--------------------------|----------------|-------|------------------------------|
| 1.A1 | * Analog PCB Assembly | 06-3056 | 57705 | 06-3056 |
| 1.A1.C1 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A1.C2 | Cap, Carb .015uF, 1% | 03-3085 | 12406 | C5L153F |
| 1.A1.C3 | Not Used | | | |
| 1.A1.C4 | Not Used | | | |
| 1.A1.C5 | Cap, Mono .1uF, 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A1.C6 | Cap, Mono .1uF, 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A1.C7 | Cap, Mono .1uF, 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A1.C8 | Cap, Mono .1uF, 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A1.C9 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A1.C10 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A1.C11 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A1.C12 | Cap, Mono .1uF, 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A1.C13 | Cap, Mono .1uF, 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A1.C14 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A1.C15 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A1.C16 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A1.C17 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A1.C18 | Cap, Tant 1uF, 35V | 03-3081 | 31433 | T350A105K035AS |
| 1.A1.C19 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A1.C20 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A1.C21 | Cap, Mono .1uF, 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A1.C22 | Not Used | | | |
| 1.A1.C23 | Not Used | | | |
| 1.A1.C24 | Not Used | | | |
| 1.A1.C25 | Cap, Mono 270pF, 5%, 50V | 03-3058 | 54583 | FK11COG1H271J |
| 1.A1.C26 | Not Used | | | |
| 1.A1.C27 | Not Used | | | |
| 1.A1.C28 | Not Used | | | |
| 1.A1.C29 | Not Used | | | |
| 1.A1.C30 | Not Used | | | |
| 1.A1.C31 | Cap, Film 1000pF, 5% | 03-3059 | 68919 | FKS2 .001/100/5 |
| 1.A1.C32 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A1.C33 | Cap, Tant 47uF, 16V | 03-3064 | 31433 | T350J476M016AS |
| 1.A1.D1 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A1.D2 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A1.D3 | Diode, Signal | 04-4007 | 07263 | 1N914 |
| 1.A1.D4 | Diode, Signal | 04-4007 | 07263 | 1N914 |
| 1.A1.K1 | Relay, 2 Form A, DIP | 07-4032 | 95348 | 832A-1 |
| 1.A1.K2 | Relay, 2 Form A, DIP | 07-4032 | 95348 | 832A-1 |
| 1.A1.K3 | Relay, 2 Form A, DIP | 07-4032 | 95348 | 832A-1 |
| 1.A1.K4 | Relay, 2 Form A, DIP | 07-4032 | 95348 | 832A-1 |

LIST OF REPLACEABLE PARTS

ANALOG PCB ASSEMBLY PARTS LIST (con't)

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|------------------------------------|----------------|-------|------------------------------|
| 1.A1.MP1 | PCB, Analog | 07-7741 | 57705 | 07-7741 |
| 1.A1.MP2 | Standoff, 1/8", 4-40 (2) | 07-3077 | 55566 | 3045B |
| 1.A1.MP3 | Screw, Philips P.H., 1/2" 2-56 (2) | 07-3069 | 73734 | 19006 |
| 1.A1.MP4 | Nut, Hex, 2-56 (2) | 07-3064 | 83330 | 1363 |
| 1.A1.MP5 | Tape, Foam, 1 5/8" x 1/2" x 1/16" | 01-1219 | 57705 | 01-1219 |
| 1.A1.MP6 | Screw, Philips P.H., 3/8" 4-40 (2) | 07-3051 | 73734 | 19024 |
| 1.A1.MP7 | Washer, Internal Star #4 (2) | 07-3020 | 73734 | 1302 |
| 1.A1.MP8 | Test Pin, 1 Pin (4) | 07-2090 | 22526 | 22-58-1501 |
| 1.A1.P1 | Connector, Male, 96 Pin DIN | 07-1188 | 81312 | 96P-6033-0731-0 |
| 1.A1.Q1 | Transistor, PNP | 05-5039 | 27014 | 2N3906 |
| 1.A1.Q2 | Transistor, PNP | 05-5039 | 27014 | 2N3906 |
| 1.A1.Q3 | Transistor, PNP | 05-5039 | 27014 | 2N3906 |
| 1.A1.R1 | Res MF, 7.50K, .1%, 1/8W, 25ppm | 02-2263 | 91637 | RN55E7501B |
| 1.A1.R2 | Res MF, 20.0K, .1%, 1/8W, 25ppm | 02-2242 | 91637 | RN55E2002B |
| 1.A1.R3 | Res MF, 20.0K, .1%, 1/8W, 25ppm | 02-2242 | 91637 | RN55E2002B |
| 1.A1.R4 | Res MF, 10.0K, .1%, 1/8W, 25ppm | 02-2251 | 91637 | RN55E1002B |
| 1.A1.R5 | Res CF, 1M, 5%, 1/4W | 02-2130 | 09021 | CF 1/4 1M J |
| 1.A1.R6 | Res VAR, 5K, 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| 1.A1.R7 | Res MF, 80.6K, .1%, 1/8W, 25ppm | 02-2310 | 91637 | RN55E8062B |
| 1.A1.R8 | Res MF, 82.5K, .1%, 1/8W, 25ppm | 02-2311 | 91637 | RN55E8252B |
| 1.A1.R9 | Res CF, 1K, 5%, 1/4W | 02-2125 | 09021 | CF 1/4 1K J |
| 1.A1.R10 | Not Used | | | |
| 1.A1.R11 | Not Used | | | |
| 1.A1.R12 | Not Used | | | |
| 1.A1.R13 | Not Used | | | |
| 1.A1.R14 | Res MF, 16.9K, .1%, 1/8W, 25ppm | 02-2275 | 91637 | RN55E1692B |
| 1.A1.R15 | Res MF, 3.09K, .1%, 1/8W, 25ppm | 02-2276 | 91637 | RN55E3091B |
| 1.A1.R16 | Res MF, 39.2, .1%, 1/8W, 25ppm | 02-2247 | 91637 | RN55E39R2B |
| 1.A1.R17 | Res MF, 39.2, .1%, 1/8W, 25ppm | 02-2247 | 91637 | RN55E39R2B |
| 1.A1.R18 | Res MF, 2.00K, .1%, 1/8W, 25ppm | 02-2248 | 91637 | RN55E2001B |
| 1.A1.R19 | Res MF, 475, .1%, 1/8W, 25ppm | 02-2249 | 91637 | RN55E4750B |
| 1.A1.R20 | Res MF, 39.2, .1%, 1/8W, 25ppm | 02-2247 | 91637 | RN55E39R2B |
| 1.A1.R21 | Res MF, 49.9K, .1%, 1/8W, 25ppm | 02-2314 | 91637 | RN55E4992B |
| 1.A1.R22 | Res VAR, 10K, 25%, RA | 02-1042 | 32997 | 3306W-1-103 |
| 1.A1.R23 | Res MF, 18.2K, .1%, 1/8W, 25ppm | 02-2253 | 91637 | RN55E1822B |
| 1.A1.R24 | Res MF, 22.1K, .1%, 1/8W, 25ppm | 02-2303 | 91637 | RN55E2212B |
| 1.A1.R25 | Res MF, 4.75K, .1%, 1/8W, 25ppm | 02-2304 | 91637 | RN55E4751B |
| 1.A1.R26 | Res MF, 2.00K, .1%, 1/8W, 25ppm | 02-2248 | 91637 | RN55E2001B |
| 1.A1.R27 | Res MF, 3.09K, .1%, 1/8W, 25ppm | 02-2276 | 91637 | RN55E3091B |
| 1.A1.R28 | Res MF, 9.09K, .1%, 1/8W, 25ppm | 02-2308 | 91637 | RN55E9091B |
| 1.A1.R29 | Res VAR, 1K, 25%, RA | 02-1043 | 32997 | 3306W-1-102 |
| 1.A1.R30 | Res CF, 1M 5%, 1/4W | 02-2130 | 09021 | CF 1/4 1M J |
| 1.A1.R31 | Res MF, 1.21K, .1%, 1/8W, 25ppm | 02-2256 | 91637 | RN55E1211B |
| 1.A1.R32 | Res VAR, 5K, 25%, RA | 02-1041 | 32997 | 3306W-1-502 |

ANALOG PCB ASSEMBLY PARTS LIST (con't)

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|---------------------------------|----------------|-------|------------------------------|
| 1.A1.R33 | Res MF, 66.5K, .1%, 1/8W, 25ppm | 02-2309 | 91637 | RN55E6652B |
| 1.A1.R34 | Res MF, 1.21K, .1%, 1/8W, 25ppm | 02-2256 | 91637 | RN55E1211B |
| 1.A1.R35 | Res VAR, 5K, 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| 1.A1.R36 | Res MF, 66.5K, .1%, 1/8W, 25ppm | 02-2309 | 91637 | RN55E6652B |
| 1.A1.R37 | Res MF, 1.21K, .1%, 1/8W, 25ppm | 02-2256 | 91637 | RN55E1211B |
| 1.A1.R38 | Res VAR, 5K, 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| 1.A1.R39 | Res MF, 66.5K, .1%, 1/8W, 25ppm | 02-2309 | 91637 | RN55E6652B |
| 1.A1.R40 | Res MF, 1.21K, .1%, 1/8W, 25ppm | 02-2256 | 91637 | RN55E1211B |
| 1.A1.R41 | Res VAR, 5K, 25%, RA | 02-1041 | 32997 | 3306W-1-502 |
| 1.A1.R42 | Res MF, 66.5K, .1%, 1/8W, 25ppm | 02-2309 | 91637 | RN55E6652B |
| 1.A1.R43 | Res CF, 510K, 5%, 1/4W | 02-2142 | 09021 | CF 1/4 510K J |
| 1.A1.R44 | Res CF, 1M, 5%, 1/4W | 02-2130 | 09021 | CF 1/4 1M J |
| 1.A1.R45 | Res WW, .47, 5%, 1/2W | 02-2230 | 09021 | WW 1/2 .47 J |
| 1.A1.R46 | Res WW, .47, 5%, 1/2W | 02-2230 | 09021 | WW 1/2 .47 J |
| 1.A1.R47 | Res MF, 10.0K, .1%, 1/8W, 25ppm | 02-2251 | 91637 | RN55E1002B |
| 1.A1.R48 | Res MF, 24.9K, .1%, 1/8W, 25ppm | 02-2252 | 91637 | RN55E2492B |
| 1.A1.R49 | Res CF, 2.7, 5%, 1/4W | 02-2165 | 09021 | CF 1/4 2.7 J |
| 1.A1.R50 | Res MF, 86.6K, .1%, 1/8W, 25ppm | 02-2254 | 91637 | RN55E8662B |
| 1.A1.R51 | Res MF, 28.0K, .1%, 1/8W, 25ppm | 02-2255 | 91637 | RN55E2802B |
| 1.A1.R52 | Res MF, 1.21K, .1%, 1/8W, 25ppm | 02-2256 | 91637 | RN55E1211B |
| 1.A1.R53 | Res MF, 36.5, .1%, 1W, 25ppm | 02-2257 | 91637 | RN65E36R5B |
| 1.A1.R54 | Res MF, 36.5, .1%, 1/8W, 25ppm | 02-2284 | 91637 | RN55E36R5B |
| 1.A1.R55 | Res MF, 1.21K, .1%, 1/8W, 25ppm | 02-2256 | 91637 | RN55E1211B |
| 1.A1.R56 | Res MF, 28.0K, .1%, 1/8W, 25ppm | 02-2255 | 91637 | RN55E2802B |
| 1.A1.R57 | Res MF, 86.6K, .1%, 1/8W, 25ppm | 02-2254 | 91637 | RN55E8662B |
| 1.A1.R58 | Res MF, 499K, .1%, 1/8W, 25ppm | 02-2258 | 91637 | RN55E4993B |
| 1.A1.R59 | Res MF, 20.0K, .1%, 1/8W, 25ppm | 02-2242 | 91637 | RN55E2002B |
| 1.A1.R60 | Res MF, 20.0K, .1%, 1/8W, 25ppm | 02-2242 | 91637 | RN55E2002B |
| 1.A1.R61 | Not Used | | | |
| 1.A1.R62 | Res MF, 6.04K, .1%, 1/8W, 25ppm | 02-2264 | 91637 | RN55E6041B |
| 1.A1.R63 | Res MF, 2.49K, .1%, 1/8W, 25ppm | 02-2261 | 91637 | RN55E2491B |
| 1.A1.R64 | Res MF, 20.0, .1%, 1/8W, 25ppm | 02-2312 | 91637 | RN55E20R0B |
| 1.A1.R65 | Res MF, 7.50K, .1%, 1/8W, 25ppm | 02-2263 | 91637 | RN55E7501B |
| 1.A1.R66 | Res MF, 10.2K, .1%, 1/8W, 25ppm | 02-2293 | 91637 | RN55E1022B |
| 1.A1.R67 | Res MF, 20.0K, .1%, 1/8W, 25ppm | 02-2242 | 91637 | RN55E2002B |
| 1.A1.R68 | Res MF, 20.0K, .1%, 1/8W, 25ppm | 02-2242 | 91637 | RN55E2002B |
| 1.A1.R69 | Res MF, 499K, .1%, 1/8W, 25ppm | 02-2258 | 91637 | RN55E4993B |
| 1.A1.R70 | Res MF, 20.0K, .1%, 1/8W, 25ppm | 02-2242 | 91637 | RN55E2002B |
| 1.A1.R71 | Not Used | | | |
| 1.A1.R72 | Res MF, 6.04K, .1%, 1/8W, 25ppm | 02-2264 | 91637 | RN55E6041B |
| 1.A1.R73 | Res MF, 2.49K, .1%, 1/8W, 25ppm | 02-2261 | 91637 | RN55E2491B |
| 1.A1.R74 | Res MF, 10.0, .1%, 1/8W, 25ppm | 02-2262 | 91637 | RN55E10R0B |
| 1.A1.R75 | Res MF, 7.50K, .1%, 1/8W, 25ppm | 02-2263 | 91637 | RN55E7501B |
| 1.A1.R76 | Res MF, 10.0K, .1%, 1/8W, 25ppm | 02-2251 | 91637 | RN55E1002B |
| 1.A1.R77 | Res MF, 15.0K, .1%, 1/8W, 25ppm | 02-2265 | 91637 | RN55E1502B |
| 1.A1.R78 | Res MF, 13.3K, .1%, 1/8W, 25ppm | 02-2307 | 91637 | RN55E1332B |
| 1.A1.R79 | Res CF, 1K, 5%, 1/4W | 02-2125 | 09021 | CF 1/4 1K J |

LIST OF REPLACEABLE PARTS

ANALOG PCB ASSEMBLY PARTS LIST (con't)

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|------------------------------------|----------------|-------|------------------------------|
| 1.A1.RN1 | Resistor Network, 10K X 3 | 02-3002 | 32997 | 4306R-102-103 |
| 1.A1.RN2 | Resistor Network, 10K X 3 | 02-3002 | 32997 | 4306R-102-103 |
| 1.A1.RN3 | Resistor Network, 10K X 3 | 02-3002 | 32997 | 4306R-102-103 |
| 1.A1.RN4 | Resistor Network, 100K X 9 | 02-3003 | 32997 | 4310R-101-104 |
| 1.A1.RN5 | Resistor Network, 100K X 9 | 02-3003 | 32997 | 4310R-101-104 |
| 1.A1.T1 | Transformer, Signal | 06-6034 | 57705 | 06-6034 |
| 1.A1.U1 | IC, Voltage Ref., 1.2V | 05-5014 | 32293 | ICL8069DCZR |
| 1.A1.U2 | IC, Precision Op Amp | 05-5067 | 06665 | OP07EP |
| 1.A1.U3 | * IC, 3P2T Analog Switch | 05-5054 | 27014 | 74HC4053 |
| 1.A1.U4 | IC, Precision Op Amp | 05-5067 | 06665 | OP07EP |
| 1.A1.U5 | IC, Precision Op Amp | 05-5067 | 06665 | OP07EP |
| 1.A1.U6 | * IC, Dual J-K Flip Flop | 05-5049 | 27014 | 74HC109 |
| 1.A1.U7 | IC, Quad Comparator | 05-5076 | 27014 | LM339AN |
| 1.A1.U8 | IC, Precision Op Amp | 05-5067 | 06665 | OP07EP |
| 1.A1.U9 | IC, Dual Op Amp | 05-5047 | 27014 | LF412ACN |
| 1.A1.U10 | IC, Precision Op Amp | 05-5067 | 06665 | OP07EP |
| 1.A1.U11 | * IC, 2P4T Analog Switch | 05-5051 | 27014 | 74HC4052 |
| 1.A1.U12 | IC, Power Op Amp | 05-5019 | 07263 | uA759 |
| 1.A1.U13 | IC, Power Op Amp | 05-5019 | 07263 | uA759 |
| 1.A1.U14 | IC, Precision Op Amp | 05-5067 | 06665 | OP07EP |
| 1.A1.U15 | IC, Precision Op Amp | 05-5067 | 06665 | OP07EP |
| 1.A1.U16 | * IC, 2P4T Analog Switch | 05-5051 | 27014 | 74HC4052 |
| 1.A1.U17 | IC, Dual Op Amp | 05-5047 | 27014 | LF412ACN |
| 1.A1.U18 | * IC, Hex Schmitt Trigger Inverter | 05-5062 | 27014 | 74HC14 |
| 1.A1.U19 | IC, Precision Op Amp | 05-5067 | 06665 | OP07EP |
| 1.A1.U20 | IC, Precision Op Amp | 05-5067 | 06665 | OP07EP |
| 1.A1.U21 | * IC, 2P4T Analog Switch | 05-5051 | 27014 | 74HC4052 |
| 1.A1.U22 | IC, Dual Op Amp | 05-5047 | 27014 | LF412ACN |
| 1.A1.U23 | * IC, Dual 2/4 Decoder | 05-5048 | 27014 | 74HC239 |
| 1.A1.U24 | IC, Transistor Array | 05-5072 | 52769 | ULN2803A |
| 1.A1.U25 | IC, Matched NPN Pair | 05-5050 | 27014 | LM394CN |
| 1.A1.U26 | * IC, Hex Schmitt Trigger Inverter | 05-5062 | 27014 | 74HC14 |
| 1.A1.U27 | * IC, Octal Inverter | 05-5068 | 27014 | 74HC540 |
| 1.A1.U28 | * IC, Octal Inverter | 05-5068 | 27014 | 74HC540 |
| 1.A1.U29 | * IC, Octal D Flip-Flop | 05-5070 | 27014 | 74HC564 |
| 1.A1.U30 | * IC, 2P4T Analog Switch | 05-5051 | 27014 | 74HC4052 |
| 1.A1.U31 | IC, Op Amp | 05-5021 | 27014 | LF411ACN |
| 1.A1.U32 | IC, A/D Converter, 8 bit | 05-5053 | 24335 | AD670JN |
| 1.A1.XU32 | Socket, IC, 20 Pin | 07-1221 | 31855 | BU200Z |

BACKPLANE PCB ASSEMBLY PARTS LIST

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|--------------------------------|----------------|-------|------------------------------|
| 1.A2 | * Backplane PCB Assembly | 06-3055 | 57705 | 06-3055 |
| 1.A2.A1 | Backplane Ground Wire Assembly | 06-4021 | 57705 | 06-4021 |
| 1.A2.C1 | Cap, Electrolytic 1uF 450V | 03-3040 | 00199 | CE04W2W010B |
| 1.A2.C2 | Cap, Electrolytic 1uF 450V | 03-3040 | 00199 | CE04W2W010B |
| 1.A2.C3 | Cap, Electrolytic 1uF 450V | 03-3040 | 00199 | CE04W2W010B |
| 1.A2.C4 | Cap, Electrolytic 1uF 450V | 03-3040 | 00199 | CE04W2W010B |
| 1.A2.C5 | Cap, Ceramic 0.01uF 2KV | 03-3042 | 80201 | HS103M |
| 1.A2.C6 | Cap, Electrolytic 22uF 250V | 03-3055 | 00199 | CEUSM2E220 |
| 1.A2.C7 | Cap, Tant 10uF 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A2.C8 | Cap, Tant 10uF 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A2.C9 | Cap, Tant 10uF 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A2.C10 | Cap, Electrolytic 2200uF 35V | 03-3086 | 00199 | CEUSM1V222 |
| 1.A2.C11 | Cap, Tant 10uF 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A2.C12 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A2.C13 | Cap, Electrolytic 2200uF 35V | 03-3086 | 00199 | CEUSM1V222 |
| 1.A2.C14 | Cap, Tant 10uF 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A2.C15 | Cap, Mono 0.1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A2.C16 | Cap, Tant 10uF 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A2.C17 | Cap, Electrolytic 1uF 450V | 03-3040 | 00199 | CE04W2W010B |
| 1.A2.C18 | Not Used | | | |
| 1.A2.C19 | Not Used | | | |
| 1.A2.C20 | Cap, Tant 10uF 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A2.C21 | Cap, Tant 10uF 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A2.C22 | Cap, Mono 0.1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A2.C23 | Cap, Mono 0.1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A2.C24 | Cap, Mono 0.1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A2.C25 | Cap, Mono 0.1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A2.D1 | Diode, 3KV | 04-4016 | 11961 | HV30 |
| 1.A2.D2 | Diode, 3KV | 04-4016 | 11961 | HV30 |
| 1.A2.D3 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A2.D4 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A2.D5 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A2.D6 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A2.D7 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A2.D8 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A2.D9 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A2.D10 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A2.D11 | Diode, Signal | 04-4007 | 07263 | 1N914 |
| 1.A2.D12 | Diode, Signal | 04-4007 | 07263 | 1N914 |
| 1.A2.D13 | Diode, Signal | 04-4007 | 07263 | 1N914 |
| 1.A2.D14 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A2.D15 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A2.D16 | Diode, 600V | 04-4012 | 71744 | 1N4005 |
| 1.A2.D17 | Diode, 600V | 04-4012 | 71744 | 1N4005 |

LIST OF REPLACEABLE PARTS

BACKPLANE PCB ASSEMBLY PARTS LIST (con't)

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|------------------------------------|----------------|-------|------------------------------|
| 1.A2.J1 | Connector, Female, 96 Pin DIN | 07-1206 | 81312 | 96S-6033-0731-2 |
| 1.A2.J2 | Connector, Female, 48 Pin DIN | 07-1207 | 81312 | 48S-6033-0731-2 |
| 1.A2.J3 | Connector, Female, 96 Pin DIN | 07-1206 | 81312 | 96S-6033-0731-2 |
| 1.A2.J4 | Connector, Female, 48 Pin DIN | 07-1207 | 81312 | 48S-6033-0731-2 |
| 1.A2.J5 | Connector, Female, 96 Pin DIN | 07-1206 | 81312 | 96S-6033-0731-2 |
| 1.A2.J6 | Connector, Female, 48 Pin DIN | 07-1207 | 81312 | 48S-6033-0731-2 |
| 1.A2.J7 | Connector, Female, 96 Pin DIN | 07-1206 | 81312 | 96S-6033-0731-2 |
| 1.A2.J8 | Connector, Female, 48 Pin DIN | 07-1207 | 81312 | 48S-6033-0731-2 |
| 1.A2.J9 | Connector, Female, 96 Pin DIN | 07-1206 | 81312 | 96S-6033-0731-2 |
| 1.A2.J10 | Connector, Female, 96 Pin DIN | 07-1206 | 81312 | 96S-6033-0731-2 |
| 1.A2.J11 | Connector, Male, 64 Pin IDC | 07-1143 | 27264 | 10-86-2643 |
| 1.A2.J12 | Header, 8 Pin | 07-1211 | 27264 | 22-23-2081 |
| 1.A2.J13 | Header, 3 Pin | 07-1208 | 27264 | 22-23-2031 |
| 1.A2.J14 | Header, 6 Pin | 07-1210 | 27264 | 22-23-2061 |
| 1.A2.J15 | Header, 6 Pin | 07-1210 | 27264 | 22-23-2061 |
| 1.A2.J16 | Header, 3 Pin | 07-1208 | 27264 | 22-23-2031 |
| 1.A2.J17 | Header, 12 Pin | 07-1212 | 27264 | 22-23-2121 |
| 1.A2.J18 | Header, 4 Pin | 07-1209 | 27264 | 22-23-2041 |
| 1.A2.J19 | Header, 4 Pin | 07-1209 | 27264 | 22-23-2041 |
| 1.A2.MP1 | PCB, Backplane | 07-7755 | 57705 | 07-7755 |
| 1.A2.MP2 | Thermal Insulator (3) | 07-2075 | 8W262 | R601157911674 |
| 1.A2.MP3 | Nylon Shoulder Bushing (3) | 07-3053 | 91833 | 3102 |
| 1.A2.MP4 | Not Used | | | |
| 1.A2.MP5 | Screw, Philips P.H., 3/8" 4-40 (3) | 07-3051 | 73734 | 19024 |
| 1.A2.MP6 | Heat Sink | 01-3036 | 57705 | 01-3036 |
| 1.A2.MP7 | Screw, Philips P.H., 1/2" 4-40 (3) | 07-3085 | 73734 | 19026 |
| 1.A2.MP8 | Not Used | | | |
| 1.A2.MP9 | Not Used | | | |
| 1.A2.MP10 | Insulator, Capacitor (5) | 07-2077 | 15819 | 343-10 |
| 1.A2.Q1 | Transistor, NPN 500V | 05-5016 | 01295 | TIP50 |
| 1.A2.Q2 | Transistor, NPN | 05-5013 | 27014 | PN2222 |
| 1.A2.Q3 | Transistor, PNP | 05-5039 | 27014 | 2N3906 |
| 1.A2.Q4 | Transistor, NPN 300V | 05-5003 | 04713 | MPSA42 |
| 1.A2.Q5 | Transistor, NPN 300V | 05-5003 | 04713 | MPSA42 |
| 1.A2.Q6 | Transistor, NPN 300V | 05-5003 | 04713 | MPSA42 |
| 1.A2.Q7 | Transistor, NPN 300V | 05-5003 | 04713 | MPSA42 |
| 1.A2.Q8 | Transistor, NPN 300V | 05-5003 | 04713 | MPSA42 |
| 1.A2.Q9 | Transistor, NPN 300V | 05-5003 | 04713 | MPSA42 |
| 1.A2.Q10 | Not Used | | | |
| 1.A2.Q11 | Transistor, NPN | 05-5013 | 27014 | PN2222 |
| 1.A2.R1 | Res CF, 10M, 5%, 1/2W | 02-2102 | 09021 | CF 1/2 10M J |
| 1.A2.R2 | Res CF, 10M, 5%, 1/2W | 02-2102 | 09021 | CF 1/2 10M J |
| 1.A2.R3 | Res CF, 10M, 5%, 1/2W | 02-2102 | 09021 | CF 1/2 10M J |
| 1.A2.R4 | Res CF, 10M, 5%, 1/2W | 02-2102 | 09021 | CF 1/2 10M J |

BACKPLANE PCB ASSEMBLY PARTS LIST (con't)

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|-----------------------------------|----------------|-------|------------------------------|
| 1.A2.R5 | Res CF, 2M, 5%, 1/4W | 02-2129 | 09021 | CF 1/4 2M J |
| 1.A2.R6 | Res CF, 1K, 5%, 1/4W | 02-2125 | 09021 | CF 1/4 1K J |
| 1.A2.R7 | Res CF, 2.2M, 5%, 1/4W | 02-2131 | 09021 | CF 1/4 2.2M J |
| 1.A2.R8 | Res CF, 2.2K, 5%, 1/4W | 02-2079 | 09021 | CF 1/4 2.2K J |
| 1.A2.R9 | Res MO, High Voltage 5M, 5%, 1/2W | 02-2088 | 63060 | MOX-300-005004F |
| 1.A2.R10 | Res VAR, 10K | 02-1044 | 51406 | RVS0707V100-3-103 |
| 1.A2.R11 | Res CF, 12K, 5%, 1/4W | 02-2238 | 09021 | CF 1/4 12K J |
| 1.A2.R12 | Res CF, 180K, 5%, 1/4W | 02-2124 | 09021 | CF 1/4 180K J |
| 1.A2.R13 | Res VAR, 1M | 02-1035 | 51406 | RVS0707V100-3-105 |
| 1.A2.R14 | Res MO, High Voltage 5M, 5%, 1/2W | 02-2088 | 63060 | MOX-300-005004F |
| 1.A2.R15 | Res VAR, 1M | 02-1035 | 51406 | RVS0707V100-3-105 |
| 1.A2.R16 | Res CF, 220K, 5%, 1/4W | 02-2204 | 09021 | CF 1/4 220K J |
| 1.A2.R17 | Res CF, 68K, 5%, 1/4W | 02-2103 | 09021 | CF 1/4 68K J |
| 1.A2.R18 | Res CF, 4.7M, 5%, 1/4W | 02-2127 | 09021 | CF 1/4 4.7M J |
| 1.A2.R19 | Res CF, 82K, 5%, 1/4W | 02-2224 | 09021 | CF 1/4 82K J |
| 1.A2.R20 | Res CF, 39K, 5%, 1/4W | 02-2239 | 09021 | CF 1/4 39K J |
| 1.A2.R21 | Res VAR, 10K | 02-1044 | 51406 | RVS0707V100-3-103 |
| 1.A2.R22 | Res MF, 10.0K, 1%, 1/8W, 100ppm | 02-2189 | 91673 | RN55D1002F |
| 1.A2.R23 | Res MF, 15.0K, 1%, 1/8W, 100ppm | 02-2200 | 91673 | RN55D1502F |
| 1.A2.R24 | Res VAR, 10K | 02-1044 | 51406 | RVS0707V100-3-103 |
| 1.A2.R25 | Res MF, 4.75K, 1%, 1/8W, 100ppm | 02-2283 | 91673 | RN55D4751F |
| 1.A2.R26 | Res CF, 100K, 5%, 1/4W | 02-2139 | 09021 | CF 1/4 100K J |
| 1.A2.R27 | Res CF, 180K, 5%, 1/4W | 02-2124 | 09021 | CF 1/4 180K J |
| 1.A2.R28 | Res CF, 180K, 5%, 1/4W | 02-2124 | 09021 | CF 1/4 180K J |
| 1.A2.R29 | Res CF, 1K, 5%, 1/4W | 02-2125 | 09021 | CF 1/4 1K J |
| 1.A2.R30 | Res CF, 1K, 5%, 1/4W | 02-2125 | 09021 | CF 1/4 1K J |
| 1.A2.R31 | Res CF, 15K, 5%, 1/4W | 02-2151 | 09021 | CF 1/4 15K J |
| 1.A2.R32 | Res CF, 1.6K, 5%, 1/4W | 02-2135 | 09021 | CF 1/4 1.6K J |
| 1.A2.R33 | Res CF, 3.6K, 5%, 1/4W | 02-2202 | 09021 | CF 1/4 3.6K J |
| 1.A2.R34 | Res CF, 180K, 5%, 1/4W | 02-2124 | 09021 | CF 1/4 180K J |
| 1.A2.R35 | Res CF, 180K, 5%, 1/4W | 02-2124 | 09021 | CF 1/4 180K J |
| 1.A2.R36 | Res CF, 1K, 5%, 1/4W | 02-2125 | 09021 | CF 1/4 1K J |
| 1.A2.R37 | Res CF, 1K, 5%, 1/4W | 02-2125 | 09021 | CF 1/4 1K J |
| 1.A2.R38 | Res CF, 1.6K, 5%, 1/4W | 02-2135 | 09021 | CF 1/4 1.6K J |
| 1.A2.R39 | Res CF, 100K, 5%, 1/4W | 02-2139 | 09021 | CF 1/4 100K J |
| 1.A2.R40 | Not Used | | | |
| 1.A2.R41 | Res CF, 1K, 5%, 1/4W | 02-2125 | 09021 | CF 1/4 1K J |
| 1.A2.R42 | Not Used | | | |
| 1.A2.R43 | Not Used | | | |
| 1.A2.R44 | Res MF, 121, 1%, 1/8W, 100ppm | 02-2294 | 91637 | RN55D1210F |
| 1.A2.R45 | Res MF, 825, 1%, 1/8W, 100ppm | 02-2295 | 91637 | RN55D8250F |
| 1.A2.R46 | Res MF, 825, 1%, 1/8W, 100ppm | 02-2295 | 91637 | RN55D8250F |
| 1.A2.R47 | Res MF, 121, 1%, 1/8W, 100ppm | 02-2294 | 91637 | RN55D1210F |
| 1.A2.U1 | IC, Op Amp | 05-5009 | 27014 | LM741CN |
| 1.A2.U2 | IC, Regulator +5V | 05-5017 | 27014 | 7805 |
| 1.A2.U3 | IC, Regulator +5V | 05-5017 | 27014 | 7805 |

LIST OF REPLACEABLE PARTS

BACKPLANE PCB ASSEMBLY PARTS LIST (con't)

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|----------------------------|----------------|-------|------------------------------|
| 1.A2.U4 | IC, Regulator +5V | 05-5017 | 27014 | 7805 |
| 1.A2.U5 | IC, Regulator +Variable | 05-5074 | 27014 | LM317T |
| 1.A2.U6 | IC, Regulator -Variable | 05-5073 | 27014 | LM337T |
| 1.A2.U7 | IC, Regulator -5V | 05-5037 | 27014 | 7905 |
| 1.A2.U8 | IC, Dual Op Amp | 05-5043 | 27014 | LF412CN |
| 1.A2.U9 | * IC, Triple Analog Switch | 05-5054 | 27014 | 74HC4053 |
| 1.A2.U10 | Not Used | | | |
| 1.A2.U11 | * IC, Hex Inverter | 05-5046 | 27014 | 74HC04 |
| 1.A2.U12 | IC, HV Op Amp | 05-5075 | 04713 | MC1436CP1 |
| 1.A2.Z1 | Varistor, 130V | 02-0009 | 89730 | V180ZA5 |

DIGITAL PCB ASSEMBLY PARTS LIST

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|---------------------------------|----------------|-------|------------------------------|
| 1.A3 | * Digital PCB Assembly | 06-3057 | 57705 | 06-3057 |
| 1.A3.C1 | Cap, Mono 47pF 50V | 03-3083 | 54583 | FK11COG1H470J |
| 1.A3.C2 | Cap, Mono 47pF 50V | 03-3083 | 54583 | FK11COG1H470J |
| 1.A3.C3 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C4 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C5 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C6 | Cap, Tant 10uF 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A3.C7 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C8 | Cap, Mono .01uF 50V | 03-3051 | 54583 | FK20Y5V1H103M |
| 1.A3.C9 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C10 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C11 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C12 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C13 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C14 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C15 | Not Used | | | |
| 1.A3.C16 | Not Used | | | |
| 1.A3.C17 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C18 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C19 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C20 | Not Used | | | |
| 1.A3.C21 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C22 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C23 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C24 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C25 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C26 | Not Used | | | |
| 1.A3.C27 | Not Used | | | |
| 1.A3.C28 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C29 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A3.C30 | Not Used | | | |
| 1.A3.C31 | Not Used | | | |
| 1.A3.C32 | Not Used | | | |
| 1.A3.C33 | Cap, Tant 10uF 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A3.C34 | Not Used | | | |
| 1.A3.C35 | Cap, Electrolytic, 1000uF, 25V | 03-3084 | 00199 | CEUST1E102 |
| 1.A3.DS1 | LED, Right Angle, Red | 04-4023 | 72619 | 550-0406 |
| 1.A3.H1 | Socket Jumper, 2 Pin | 07-1192 | 22526 | 65474-00212 |
| 1.A3.H2 | Socket Jumper, 2 Pin | 07-1192 | 22526 | 65474-00212 |
| 1.A3.J1 | Connector, GPIB | 07-1219 | 00779 | 553119-1 |
| 1.A3.J2 | Header, Single Row 8 .1" Spaced | 07-1204 | 22526 | 22-58-1508 |
| 1.A3.J3 | Header, Dual Row 16 .1" Spaced | 07-1205 | 95354 | 9100-1-216-02 |

LIST OF REPLACEABLE PARTS

DIGITAL PCB ASSEMBLY PARTS LIST (con't)

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|-------------|---|----------------|-------|------------------------------|
| 1.A3.JP1 | Header, 2 Terminal | 07-1191 | 22526 | 68000-402 |
| 1.A3.JP2 | Header, 3 Terminal | 07-1126 | 22526 | 68000-403 |
| 1.A3.MP1 | PCB, Digital | 07-7740 | 57705 | 07-7740 |
| 1.A3.MP2 | Bracket, RS232 | 01-3042 | 57705 | 01-3042 |
| 1.A3.MP3 | Heat Sink | 07-2087 | 30161 | 5780-B |
| 1.A3.MP4 | Nut, Hex, 2-56 (2) | 07-3064 | 83330 | 1363 |
| 1.A3.MP5 | Screw, Philips P.H., 1/2" 2-56 (2) | 07-3069 | 73734 | 19006 |
| 1.A3.MP6 | Not Used | | | |
| 1.A3.MP7 | Nut, Hex, 4-40 (2) | 07-3052 | 73734 | 8003 |
| 1.A3.MP8 | Screw, Philips P.H., 3/8" 4-40 (5) | 07-3051 | 73734 | 19024 |
| 1.A3.MP9 | Washer, Flat Steel #4 (2) | 07-3019 | 73734 | 1403 |
| 1.A3.MP10 | Washer, Split Lock #4 (2) | 07-3087 | 73734 | 1355 |
| 1.A3.MP11 | Jackscrew, 4-40 x 3.5 x .6 Metric (2) | 07-3086 | 00779 | 552634-9 |
| 1.A3.MP12 | Standoff, 1/8" 4-40 (5) | 07-3077 | 55566 | 3045B |
| 1.A3.MP13 | Tape, Foam, Double Sided, 3/8" X 3/8" X 1/8" | 01-1218 | 57705 | 01-1218 |
| 1.A3.P1 | Connector, Male, 96 Pin DIN | 07-1188 | 81312 | 96P-6033-0731-0 |
| 1.A3.R1-R19 | Not Used | | | |
| 1.A3.R20 | Res CF, 10K, 5%, 1/4W | 02-2137 | 09021 | CF 1/4 10K J |
| 1.A3.R21 | Res CF, 10K, 5%, 1/4W | 02-2137 | 09021 | CF 1/4 10K J |
| 1.A3.R22 | Res CF, 150, 5%, 1/4W | 02-2138 | 09021 | CF 1/4 150 J |
| 1.A3.R23 | Not Used | | | |
| 1.A3.R24 | Res CF, 10K, 5%, 1/4W | 02-2137 | 09021 | CF 1/4 10K J |
| 1.A3.R25 | Res WW, 25, 5%, 10W | 02-2313 | 91637 | RS-10 25 5% |
| 1.A3.RN1 | Resistor Network, 100K x 9 | 02-3003 | 32997 | 4310R-101-104 |
| 1.A3.RN2 | Resistor Network, 100K x 9 | 02-3003 | 32997 | 4310R-101-104 |
| 1.A3.RN3 | Resistor Network, 100K x 9 | 02-3003 | 32997 | 4310R-101-104 |
| 1.A3.RN4 | Resistor Network, 100K x 9 | 02-3003 | 32997 | 4310R-101-104 |
| 1.A3.S1 | Switch, Momentary SPST | 07-4024 | N/A | TR2-01-65 |
| 1.A3.S2 | Switch, DIP, P.B. | 07-4028 | 81073 | 76PSB08 |
| 1.A3.U1 | * IC, RAM 2K x 8, 200ns | 05-6005 | 66958 | MK6116N-20 |
| 1.A3.U2 | * IC, Microcontroller | 05-5059 | 24649 | 80C31BH |
| 1.A3.U3 | * IC, Latch, Octal Tri-State | 05-5057 | 27014 | 74HC573 |
| 1.A3.U4 | * IC, EPROM, Programmed | 06-5037 | 57705 | 06-5037 |
| 1.A3.U5 | * IC, Dual Monostable | 05-5052 | 27014 | 74HC4538 |
| 1.A3.U6 | * IC, Octal Bus Transceiver | 05-5092 | 27014 | 74HC640 |
| 1.A3.U7 | * IC, Octal Inverter | 05-5068 | 04713 | 74HC540 |
| 1.A3.U8 | * IC, Octal Inverter | 05-5068 | 04713 | 74HC540 |
| 1.A3.U9 | * IC, 1 of 8 Decoder | 05-5093 | 27014 | 74HC138 |
| 1.A3.U10 | Not Used | | | |
| 1.A3.U11 | Not Used | | | |

DIGITAL PCB ASSEMBLY PARTS LIST (con't)

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|--------------------------------------|----------------|-------|------------------------------|
| 1.A3.U12 | * IC, Hex Schmitt Trigger Inverter | 05-5062 | 27014 | 74HC14 |
| 1.A3.U13 | * IC, Quad NAND Gate | 05-5063 | 27014 | 74HC00 |
| 1.A3.U14 | * IC, Hex Schmitt Trigger Inverter | 05-5062 | 27014 | 74HC14 |
| 1.A3.U15 | * IC, Quad NOR Gate | 05-5055 | 27014 | 74HC02 |
| 1.A3.U16 | * IC, Dual J-K Flip Flop | 05-5049 | 04713 | 74HC109 |
| 1.A3.U17 | * IC, GPIB TLC | 05-5095 | 33297 | D7210C |
| 1.A3.U18 | * IC, GPIB Octal Transceiver Data | 05-5096 | 01295 | SN75160A |
| 1.A3.U19 | * IC, Regulator +5V | 05-5017 | 27014 | 7805 |
| 1.A3.U20 | * IC, Octal Inverter | 05-5068 | 04713 | 74HC540 |
| 1.A3.U21 | * IC, Octal D-Flip-Flop, T.S. Output | 05-5070 | 27014 | 74HC564 |
| 1.A3.U22 | IC, GPIB Octal Transceiver Control | 05-5097 | 01295 | SN75162A |
| 1.A3.X1 | Crystal, 11.00 MHz | 05-7000 | N/A | ECS-110 |
| 1.A3.XU1 | Socket, IC, 24 Pin | 07-1223 | 31855 | BU240Z |
| 1.A3.XU2 | Socket, IC, 40 Pin | 07-1225 | 31855 | BU400Z |
| 1.A3.XU4 | Socket, IC, 28 Pin | 07-1224 | 31855 | BU280Z |
| 1.A3.XU17 | Socket, IC, 40 Pin | 07-1225 | 31855 | BU400Z |
| 1.A3.XU18 | Socket, IC, 20 Pin | 07-1221 | 31855 | BU200Z |
| 1.A3.XU22 | Socket, IC, 22 Pin | 07-1222 | 31855 | BU220Z |

LIST OF REPLACEABLE PARTS

INPUT PCB ASSEMBLY PARTS LIST

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|------------------------------|----------------|-------|------------------------------|
| 1.A4 | Input PCB Assembly | 06-3053 | 57705 | 06-3053 |
| 1.A4.J1 | Socket, Universal 40 Pin ZIF | 07-1190 | 19613 | 240-6182-00-1905 |
| 1.A4.J2 | Connector, Male, 40 Pin IDC | 07-1144 | 27264 | 10-86-2403 |
| 1.A4.J3 | Connector, Male, 64 Pin IDC | 07-1143 | 27264 | 10-86-2643 |
| 1.A4.J4 | Connector, Male, 20 Pin IDC | 07-1145 | 27264 | 10-86-2203 |
| 1.A4.J5 | Connector, Male, 64 Pin IDC | 07-1143 | 27264 | 10-86-2643 |
| 1.A4.MP1 | PCB, Input | 07-7751 | 57705 | 07-7751 |
| 1.A4.XJ1 | Socket, Wirewrap, 40 Pin | 07-1169 | 52072 | CA-40S-T3WW-LC |

SCANNER PCB ASSEMBLY PARTS LIST

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|------------------------------------|----------------|-------|------------------------------|
| 1.A5 | * Scanner PCB Assembly | 06-3051 | 57705 | 06-3051 |
| 1.A5.C1 | Cap, Mono .1uF, 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A5.C2 | Cap, Mono .1uF, 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A5.C3 | Cap, Tant 10uF, 25V | 03-3011 | 31433 | T350E106M025AS |
| 1.A5.MP1 | PCB, Scanner | 07-7750 | 57705 | 07-7750 |
| 1.A5.MP2 | Nut, Hex, 2-56 (4) | 07-3064 | 83330 | 1363 |
| 1.A5.MP3 | Screw, Philips P.H., 1/2" 2-56 (4) | 07-3069 | 73734 | 19006 |
| 1.A5.K1 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K2 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K3 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K4 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K5 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K6 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K7 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K8 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K9 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K10 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K11 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K12 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K13 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K14 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K15 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K16 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K17 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K18 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K19 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |

SCANNER PCB ASSEMBLY PARTS LIST (con't)

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|------------------------------------|----------------|-------|------------------------------|
| 1.A5.K20 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K21 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K22 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K23 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K24 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K25 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K26 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K27 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K28 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K29 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K30 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K31 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.K32 | Relay, 1 Form A, SIP | 07-4033 | 71482 | DSS-4 1A05B |
| 1.A5.P1 | Connector, Male, 96 Pin DIN | 07-1188 | 81312 | 96P-6033-0731-0 |
| 1.A5.P2 | Connector, Male, 48 Pin DIN | 07-1189 | 81312 | 48P-6033-0731-0 |
| 1.A5.U1 | * IC, Hex Inverter | 05-5046 | 27014 | 74HC04 |
| 1.A5.U2 | * IC, Shift Register/Driver 32 Bit | 05-5045 | 52769 | UCN5832A |
| 1.A5.XU2 | Socket, IC, 40 Pin | 07-1194 | 31855 | ED40-DT |

FRONT CONTROL ASSEMBLY PARTS LIST (refer to Figure 4-2)

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|------------|------------------------------------|----------------|-------|------------------------------|
| 1.A7 | Front Control Assembly | 06-2054 | 57705 | 06-2054 |
| 1.A7.A1 | Display PCB Assembly | 06-3047 | 57705 | 06-3047 |
| 1.A7.A2 | CRT Control PCB Assembly | 06-3049 | 57705 | 06-3049 |
| 1.A7.A3 | Terminal Harness Assembly | 06-4014 | 57705 | 06-4014 |
| 1.A7.F1 | Fuse, 1/4 Amp, 250V, type AGC | 02-0010 | 75915 | 312.250 |
| 1.A7.F2 | Fuse, 1 Amp, 250V, type AGC | 02-0013 | 75915 | 312.001 |
| 1.A7.J1 | Banana Jack, Red | 07-1147 | 83330 | 1509-102 |
| 1.A7.J2 | Banana Jack, Black | 07-1148 | 83330 | 1509-103 |
| 1.A7.MP1 | Face Plate | 01-1217 | 57705 | 01-1217 |
| 1.A7.MP2 | Fuse Holder (2) | 07-2088 | 61935 | FEU 031.1699 |
| 1.A7.MP3 | Overlay, Control | 01-2263 | 57705 | 01-2263 |
| 1.A7.MP4 | Overlay, Display | 01-2262 | 57705 | 01-2262 |
| 1.A7.MP5 | Overlay, Connector | 01-2265 | 57705 | 01-2265 |
| 1.A7.MP6 | Gasket, Vertical (2) | 01-1066 | 57705 | 01-1066 |
| 1.A7.MP7 | Gasket, Horizontal (2) | 01-1067 | 57705 | 01-1067 |
| 1.A7.MP8 | Graticule, Homalite | 01-2003 | 57705 | 01-2003 |
| 1.A7.MP9 | Knob, Black (3) | 07-2070 | 59270 | S110.125-Black |
| 1.A7.MP10 | Cap, Knob, Black (3) | 07-2071 | 59270 | C110-Black |
| 1.A7.MP11 | Screw, Philips P.H., 3/8" 4-40 (2) | 07-3051 | 73734 | 19024 |
| 1.A7.MP12 | Screw, Philips P.H., 1/2" 6-32 (3) | 07-3075 | 73734 | 19046 |
| 1.A7.MP13 | Washer, Internal Star #4 (4) | 07-3020 | 73734 | 1302 |
| 1.A7.MP14 | Washer, Internal Star #6 (3) | 07-3060 | 73734 | 1304 |
| 1.A7.MP15 | Spacer, Hex, 6-32 (3) | 07-3076 | 55566 | 2109-6 |
| 1.A7.MP16 | Screw, Philips P.H., 1/2" 4-40 (2) | 07-3085 | 73734 | 19026 |

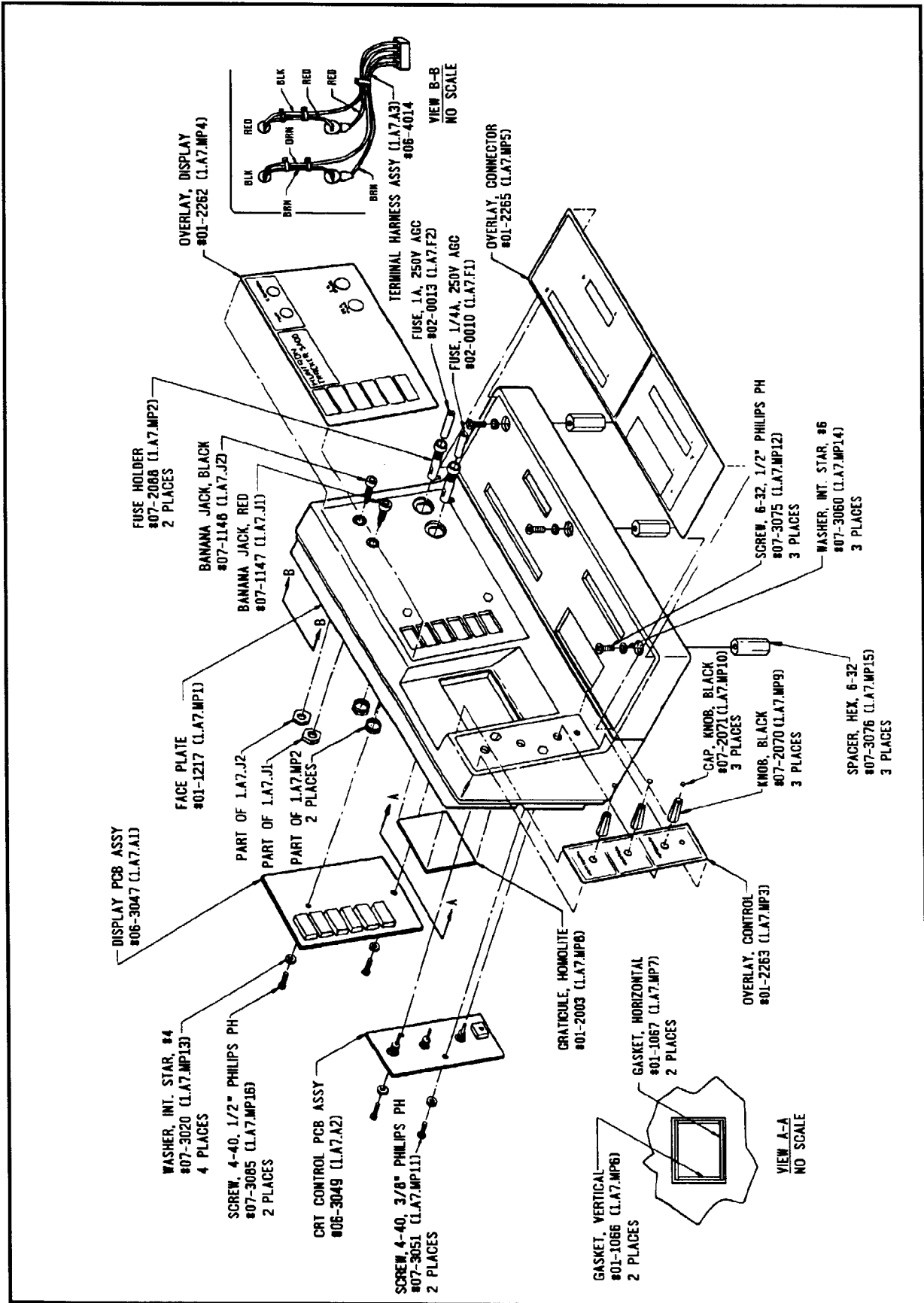


Figure 4-2. Front Control Assembly.

LIST OF REPLACEABLE PARTS

DISPLAY PCB ASSEMBLY PARTS LIST

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|--------------|-------------------------------|----------------|-------|------------------------------|
| 1.A7.A1 | Display PCB Assembly | 06-3047 | 57705 | 06-3047 |
| 1.A7.A1.A1 | Harness, Display PCB | 06-4018 | 57705 | 06-4018 |
| 1.A7.A1.DS1 | LED, Light Bar, Yellow | 04-4018 | 28480 | HLMP-2785 |
| 1.A7.A1.DS2 | LED, Light Bar, Green | 04-4019 | 28480 | HLMP-2885 |
| 1.A7.A1.DS3 | LED, Light Bar, Green | 04-4019 | 28480 | HLMP-2885 |
| 1.A7.A1.DS4 | LED, Light Bar, Green | 04-4019 | 28480 | HLMP-2885 |
| 1.A7.A1.DS5 | LED, Light Bar, Green | 04-4019 | 28480 | HLMP-2885 |
| 1.A7.A1.DS6 | LED, Light Bar, Red | 04-4020 | 28480 | HLMP-2685 |
| 1.A7.A1.MP1 | PCB, Display | 07-7753 | 57705 | 07-7753 |
| 1.A7.A1.R1 | Res CF, 33, 5%, 1/4W | 02-2289 | 09021 | CF 1/4 33 J |
| 1.A7.A1.RN1 | Resistor Network, 180 Ohm x 8 | 02-3001 | 73138 | 898-3-R180 |
| 1.A7.A1.RN2 | Resistor Network, 180 Ohm x 8 | 02-3001 | 73138 | 898-3-R180 |
| 1.A7.A1.RN3 | Resistor Network, 180 Ohm x 8 | 02-3001 | 73138 | 898-3-R180 |
| 1.A7.A1.XDS1 | Socket, IC, 16 Pin | 07-1130 | 31855 | ED16-DT |
| 1.A7.A1.XDS2 | Socket, IC, 16 Pin | 07-1130 | 31855 | ED16-DT |
| 1.A7.A1.XDS3 | Socket, IC, 16 Pin | 07-1130 | 31855 | ED16-DT |
| 1.A7.A1.XDS4 | Socket, IC, 16 Pin | 07-1130 | 31855 | ED16-DT |
| 1.A7.A1.XDS5 | Socket, IC, 16 Pin | 07-1130 | 31855 | ED16-DT |
| 1.A7.A1.XDS6 | Socket, IC, 16 Pin | 07-1130 | 31855 | ED16-DT |

CRT CONTROL PCB ASSEMBLY PARTS LIST

| REF DES | DESCRIPTION | HUNTRON P/N | CAGE | MANUFACTURERS PART NUMBER |
|-------------|--------------------------|----------------|-------|------------------------------|
| 1.A7.A2 | CRT Control PCB Assembly | 06-3049 | 57705 | 06-3049 |
| 1.A7.A2.A1 | Harness, Position | 06-4019 | 57705 | 06-4019 |
| 1.A7.A2.A2 | Harness, Intensity | 06-4020 | 57705 | 06-4020 |
| 1.A7.A2.C1 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A7.A2.C2 | Cap, Mono .1uF 50V | 03-3028 | 54583 | FK20Y5V1H104M |
| 1.A7.A2.D1 | Diode, Signal | 04-4007 | 07263 | 1N914 |
| 1.A7.A2.D2 | Diode, Signal | 04-4007 | 07263 | 1N914 |
| 1.A7.A2.MP1 | PCB, CRT Control | 07-7752 | 57705 | 07-7752 |
| 1.A7.A2.R1 | Res CF, 1.8K, 5%, 1/4W | 02-2128 | 09021 | CF 1/4 1.8K J |
| 1.A7.A2.R2 | Res VAR, 10K, 25% | 02-1038 | 32997 | 3386Y-1-103 |
| 1.A7.A2.R3 | Res CF, 1.8K, 5%, 1/4W | 02-2128 | 09021 | CF 1/4 1.8K J |
| 1.A7.A2.R4 | Pot, Control, 1K | 02-1028 | 12697 | 388N 1K |
| 1.A7.A2.R5 | Pot, Control, 1K | 02-1028 | 12697 | 388N 1K |
| 1.A7.A2.R6 | Pot, Control, 500K | 02-1023 | 32997 | 92C1A-D24-823 |

NOTES:

SECTION 5

SCHEMATIC DIAGRAMS

5-1. SCHEMATICS

The following list shows the component location diagrams and schematic diagrams for the 5100DS.

| Figure | Description | Page |
|--------|---|------|
| 5-1. | Analog PCB Component Locations. | 5-2 |
| 5-2. | Analog PCB Schematics. | 5-3 |
| 5-3. | Backplane PCB Component Locations. | 5-8 |
| 5-4. | Backplane PCB Schematics. | 5-9 |
| 5-5. | Digital PCB Component Locations. | 5-14 |
| 5-6. | Digital PCB Schematics. | 5-15 |
| 5-7. | Input PCB Component Locations. | 5-20 |
| 5-8. | Input PCB Schematic. | 5-21 |
| 5-9. | Scanner PCB Component Locations. | 5-22 |
| 5-10. | Scanner PCB Schematic. | 5-23 |
| 5-11. | Display PCB Component Locations. | 5-24 |
| 5-12. | Display PCB Schematic. | 5-25 |
| 5-13. | CRT Control PCB Component Locations. | 5-26 |
| 5-14. | CRT Control PCB Schematic. | 5-27 |
| 5-15. | Terminal/Fuse Assembly Schematic. | 5-28 |
| 5-16. | Primary Circuits Schematics. | 5-29 |

NOTE

Several figures in this section have multiple illustrations. For example Figure 5-2 is made up of five schematics and is numbered 5-2a through 5-2e. Use this numbering method for all figures with multiple illustrations.

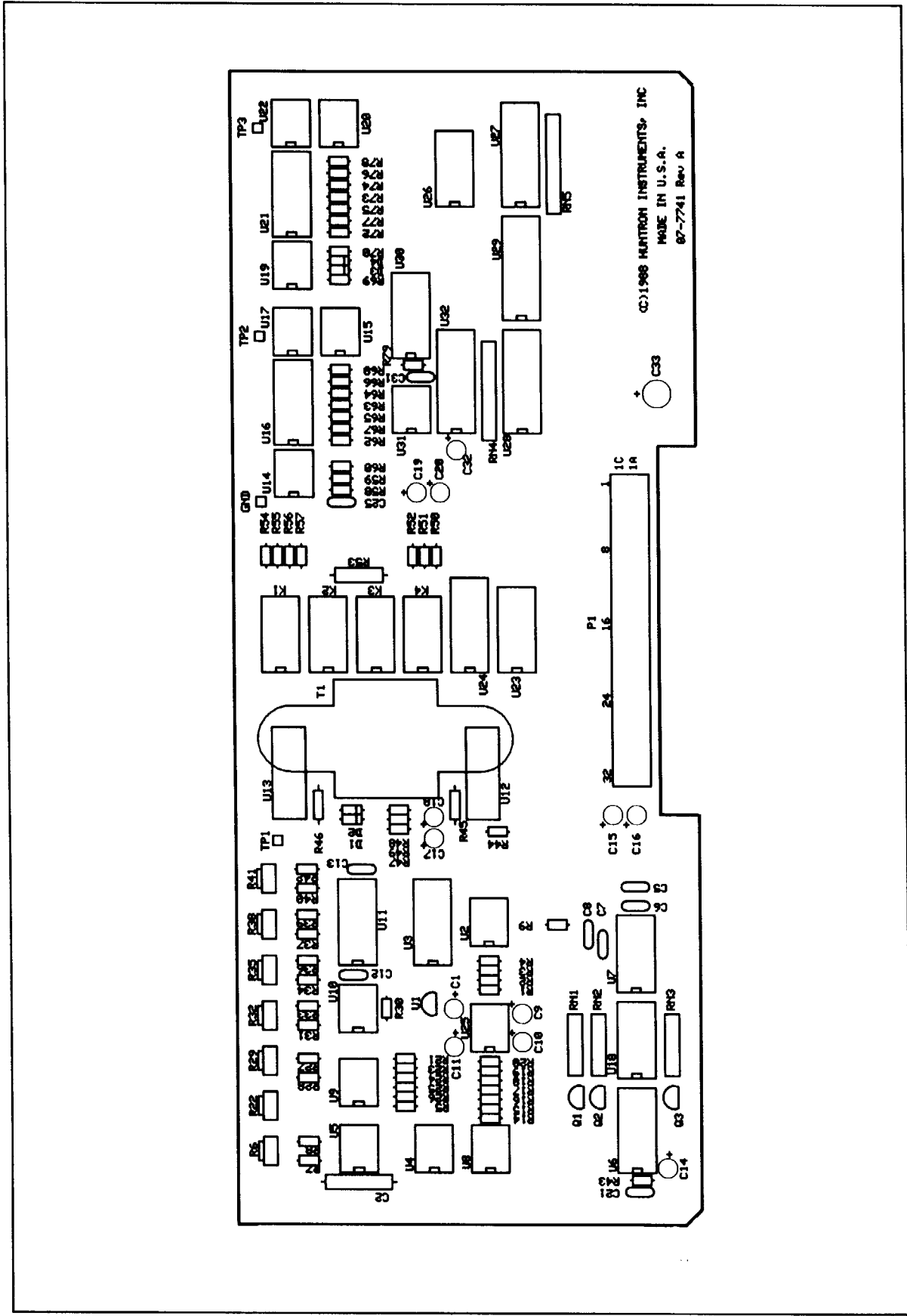
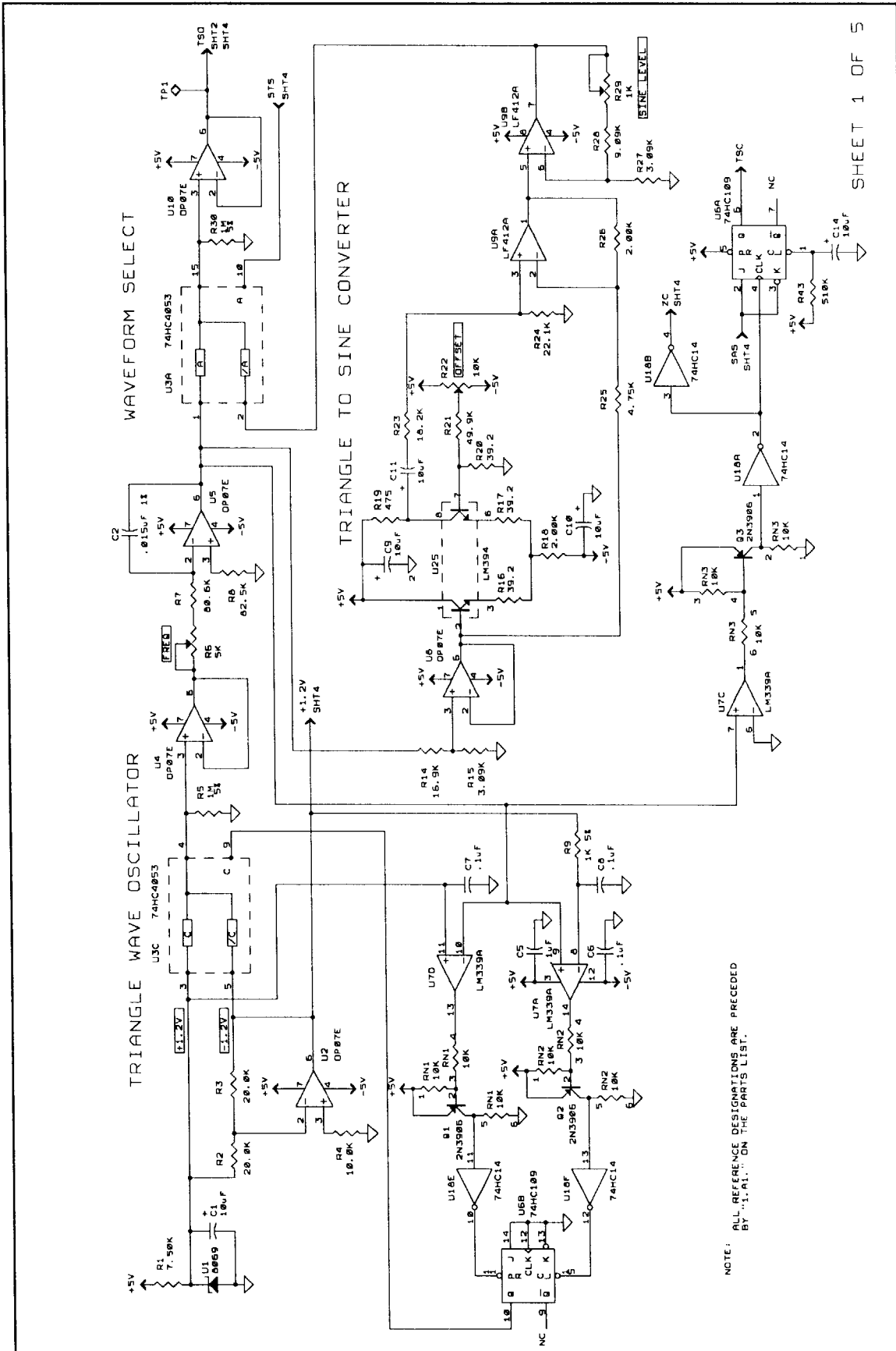
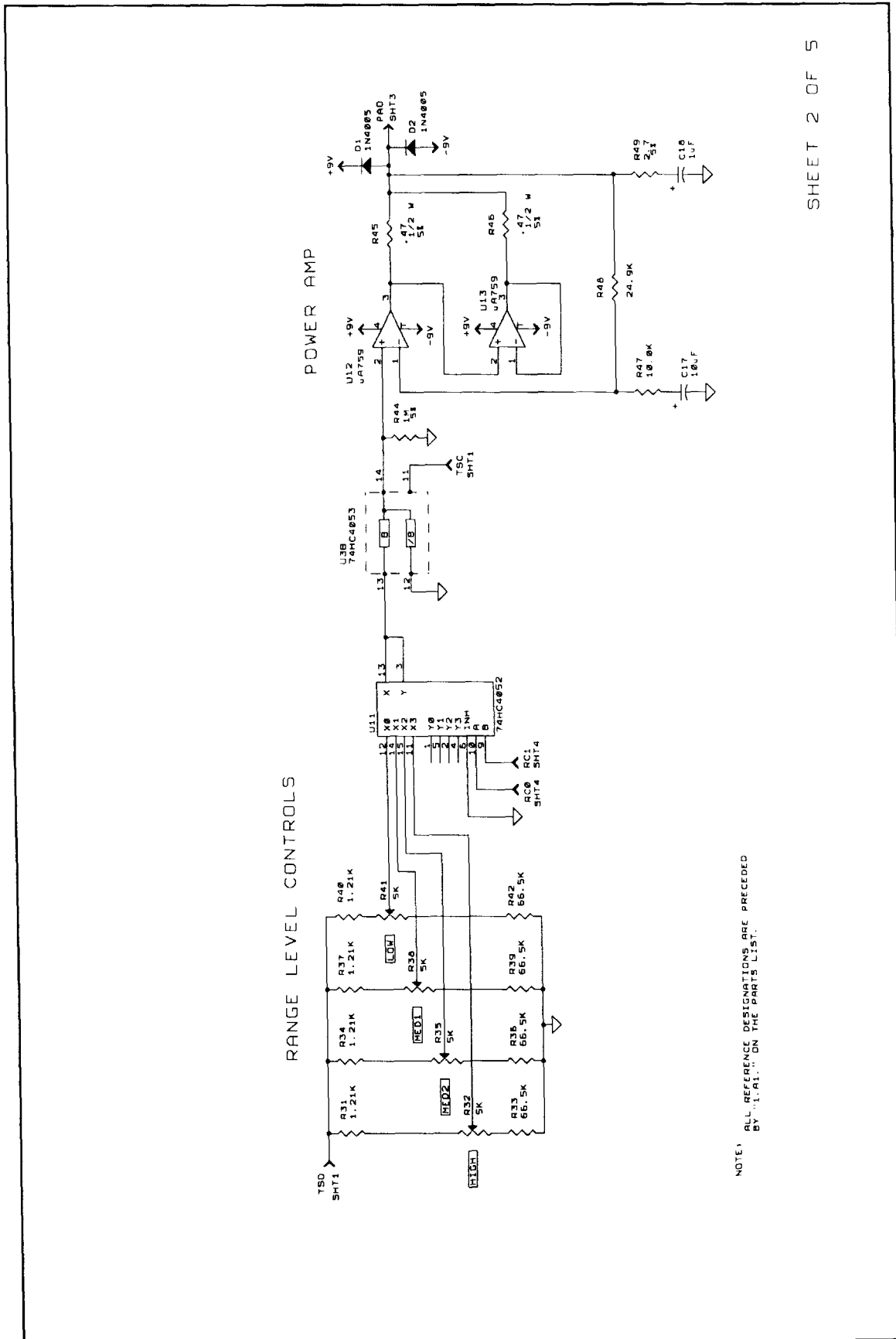


Figure 5-1. Analog PCB Component Locations.



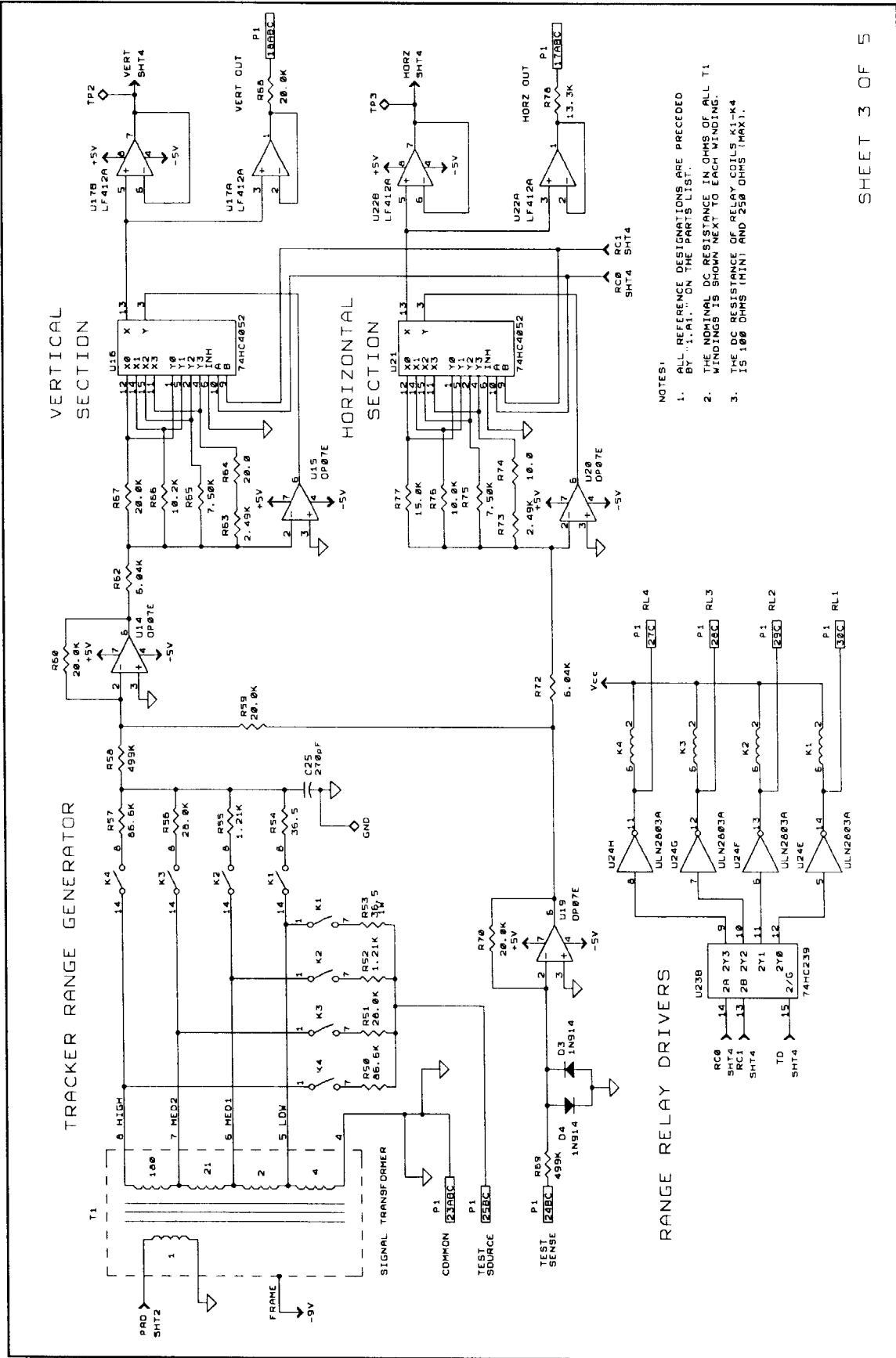
SHEET 1 OF 5

Figure 5-2a. Analog PCB Schematic - Triangle/Sine Oscillator.



NOTE: ALL REFERENCE DESIGNATIONS ARE PRECEDED BY "1.01." ON THE PARTS LIST.

Figure 5-2b. Analog PCB Schematic - Range Level Control/Power Amp.



SHEET 3 OF 5

Figure 5-2c. Analog PCB Schematic - Range Generator/Horizontal/Vertical.

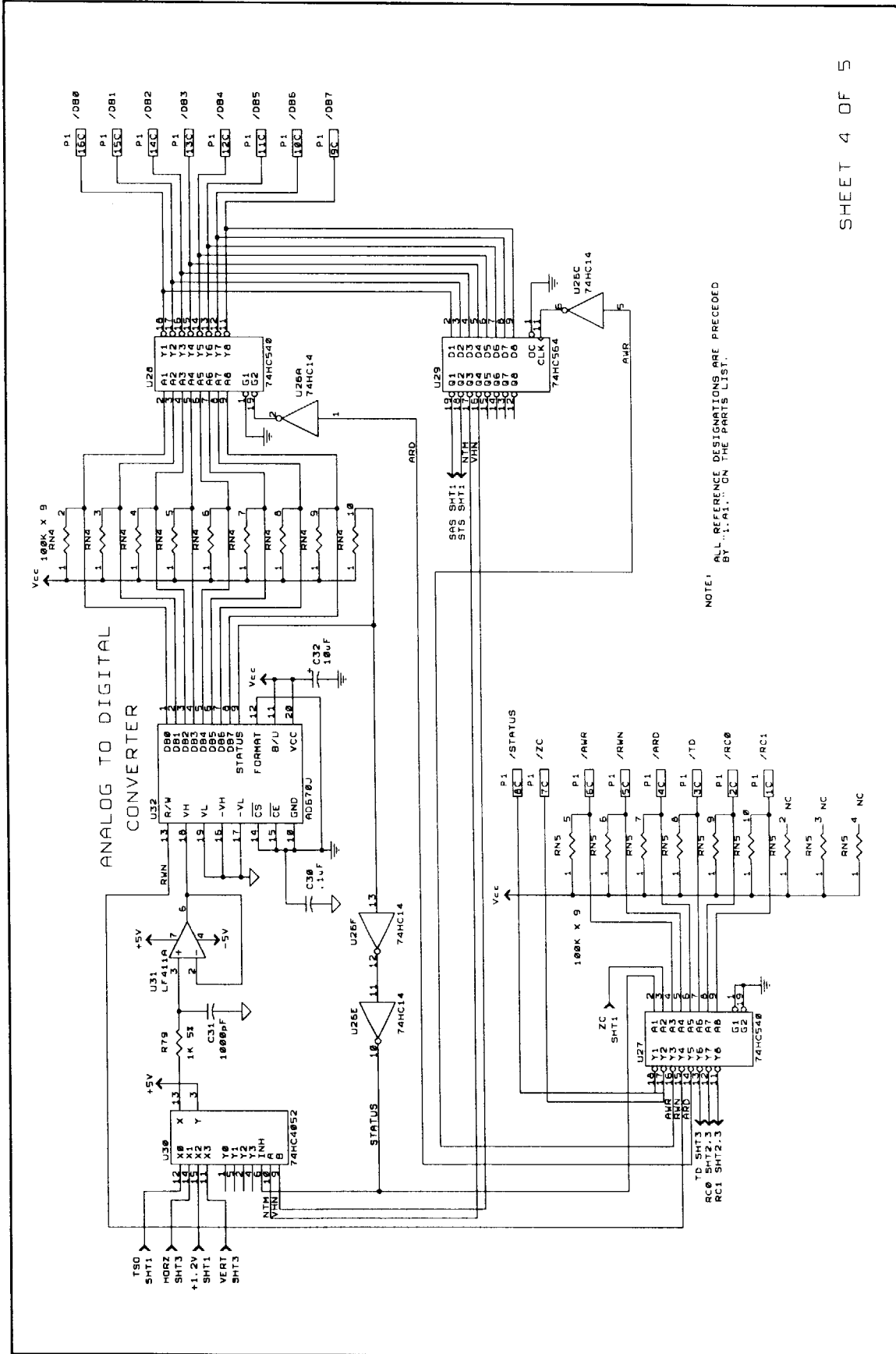
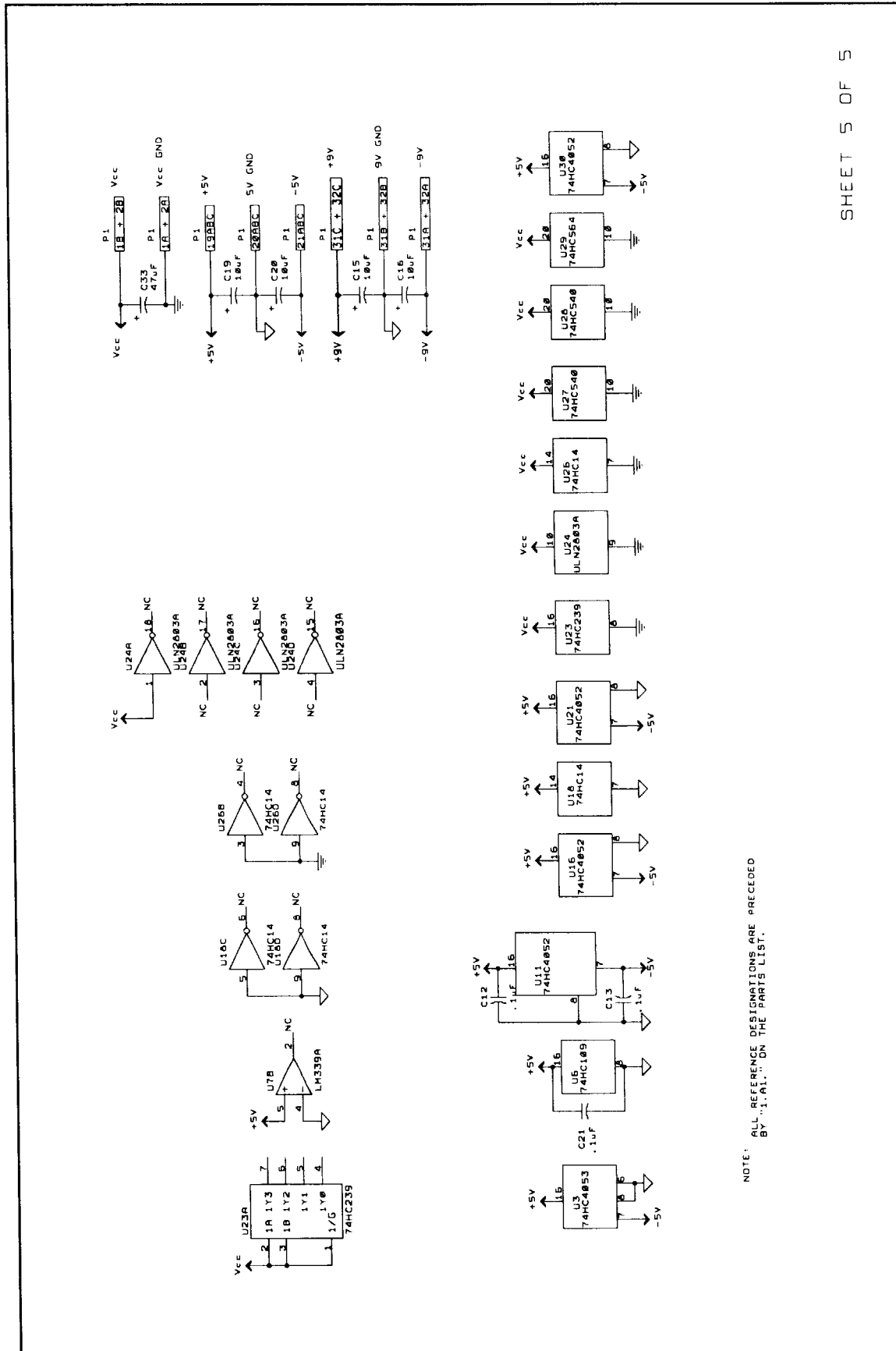


Figure 5-2d. Analog PCB Schematic - Analog To Digital Converter.



SHEET 5 OF 5

Figure 5-2e. Analog PCB Schematic - Power Supply.

NOTE: ALL REFERENCE DESIGNATIONS ARE PRECEDED BY "1.01." ON THE PARTS LIST.

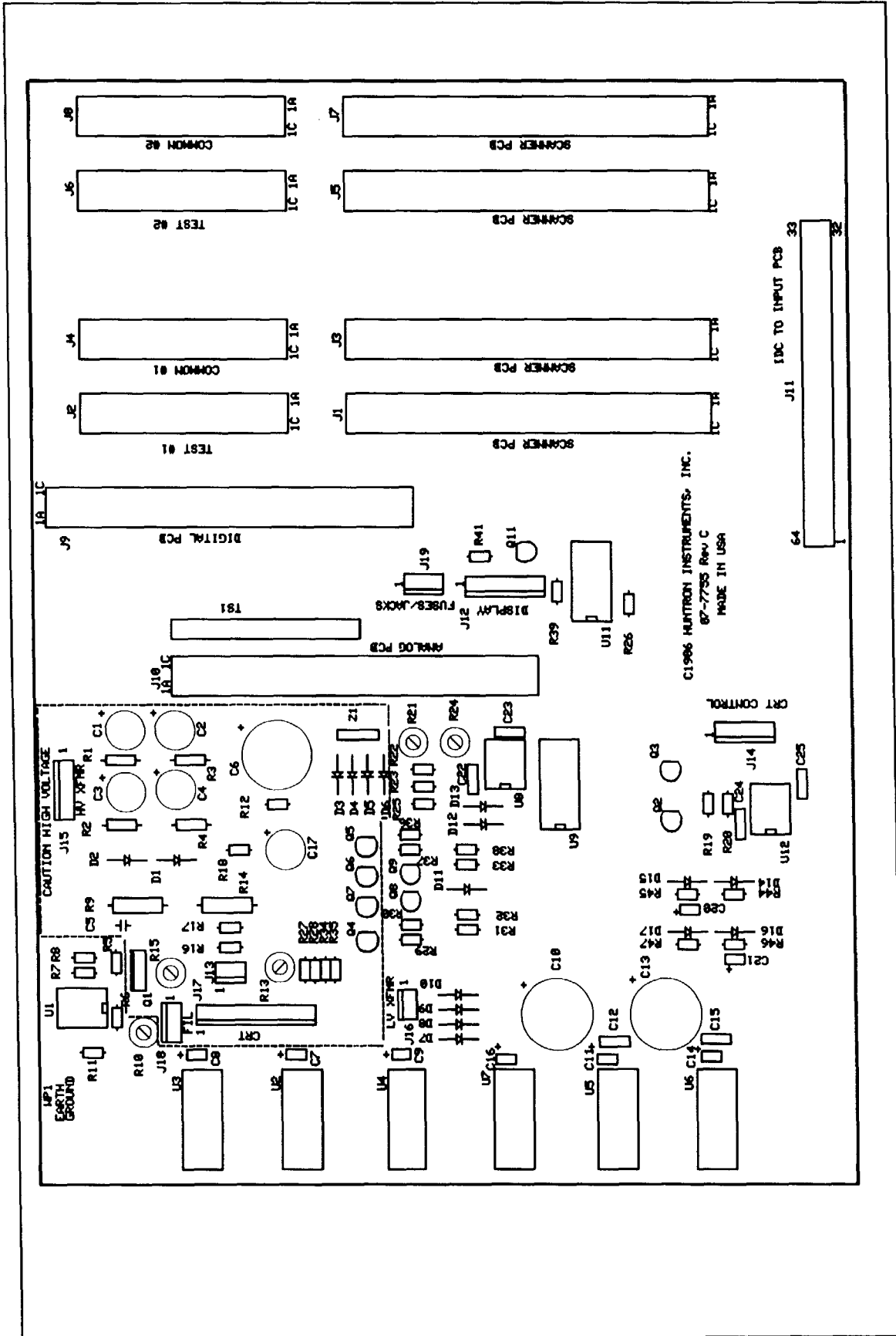
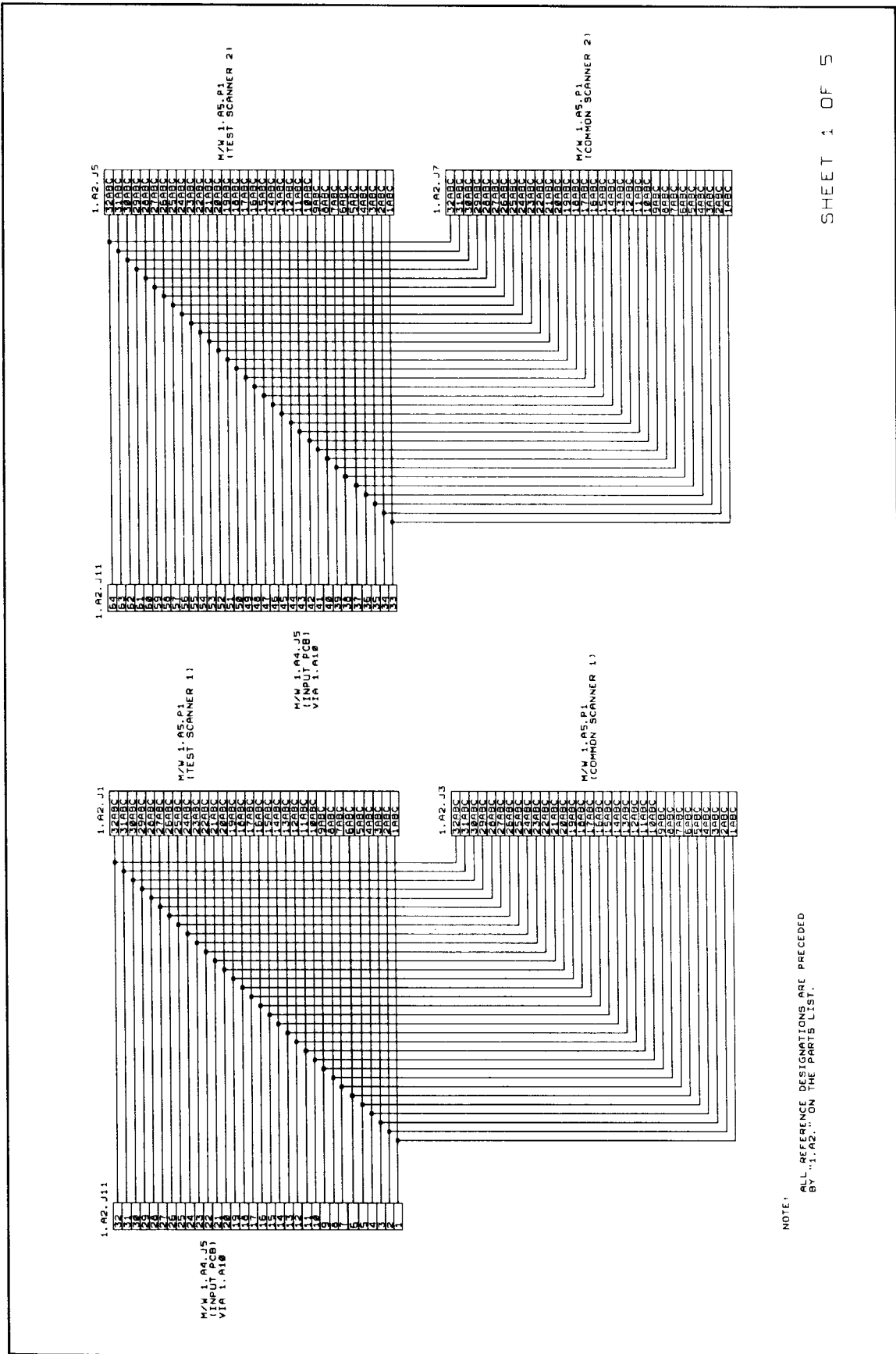


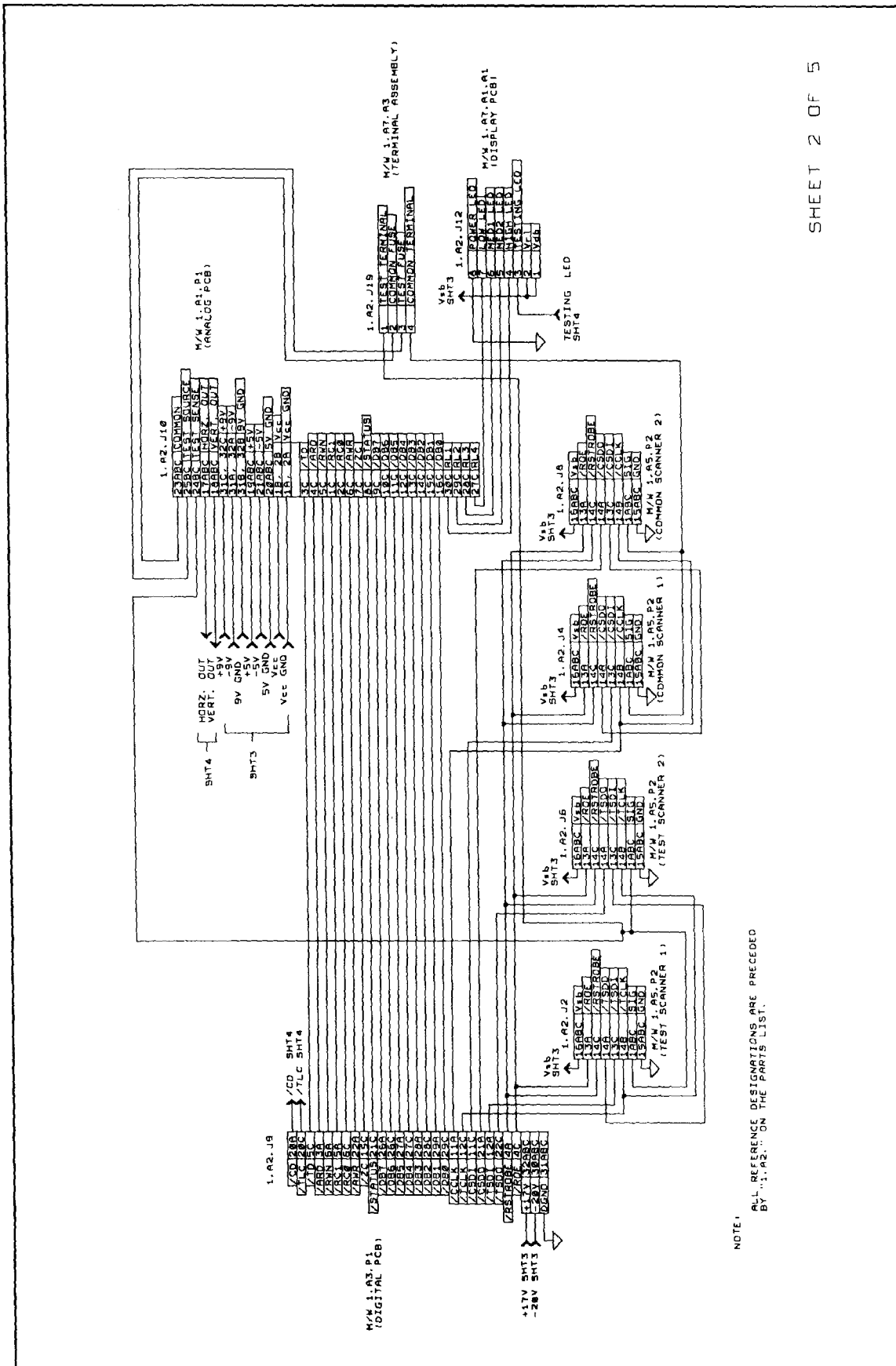
Figure 5-3. Backplane PCB Component Locations.



NOTE:
ALL REFERENCE DESIGNATIONS ARE PRECEDED
BY "1.A2." ON THE PARTS LIST.

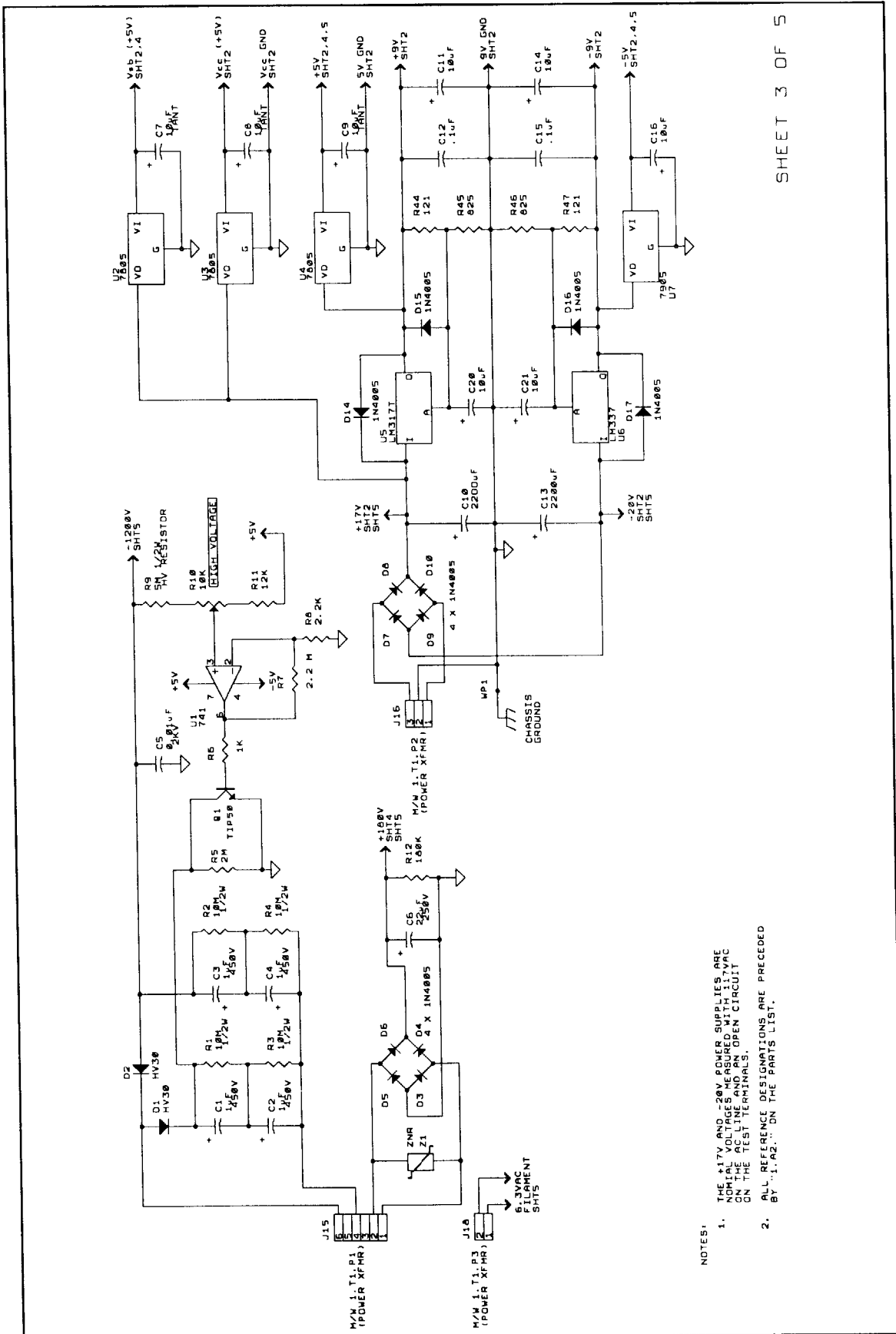
SHEET 1 OF 5

Figure 5-4a. Backplane PCB Schematic - PCB Interconnections (Part 1).



SHEET 2 OF 5

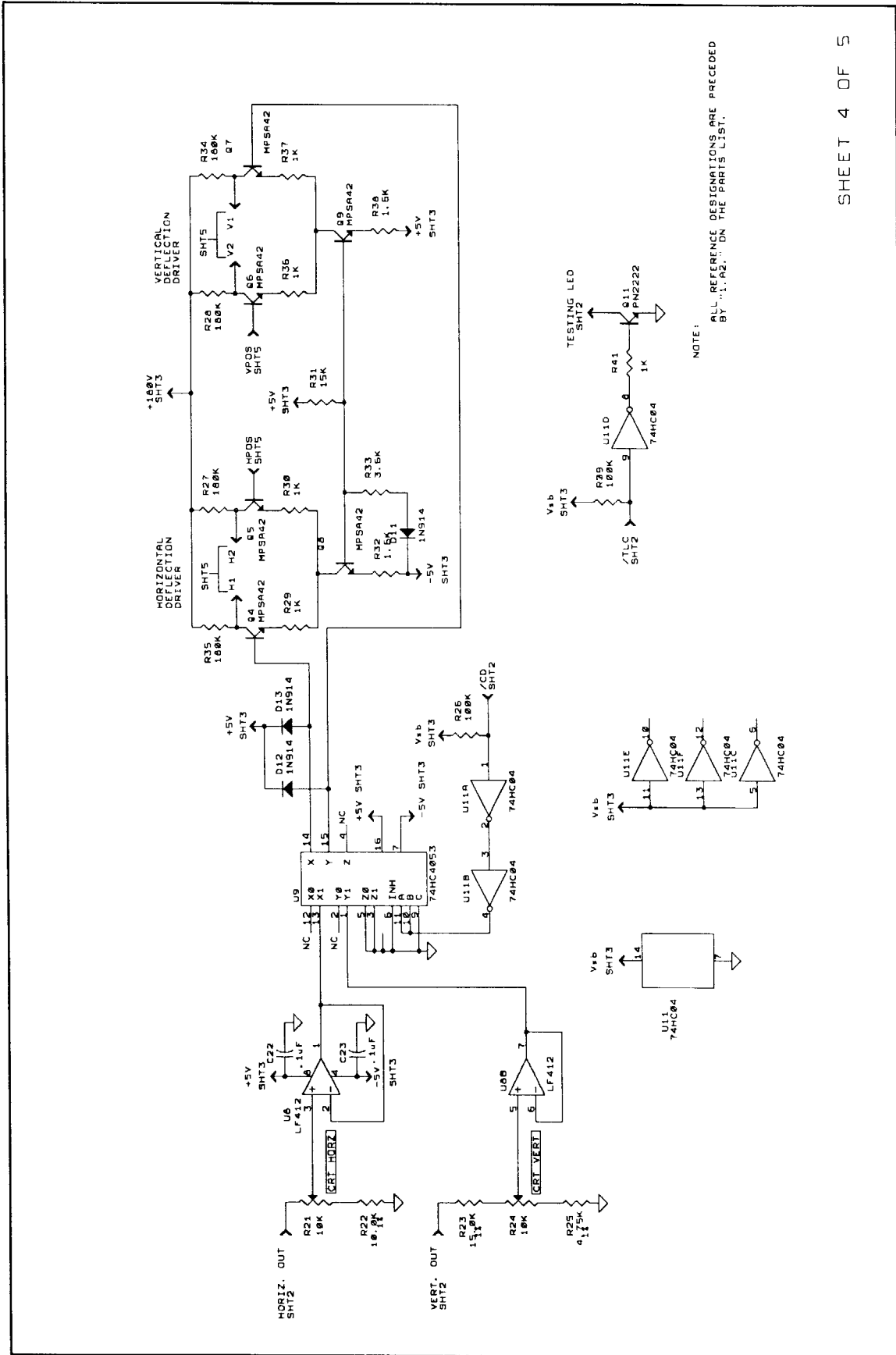
Figure 5-4b. Backplane PCB Schematic - PCB Interconnections (Part 2).



SHEET 3 OF 5

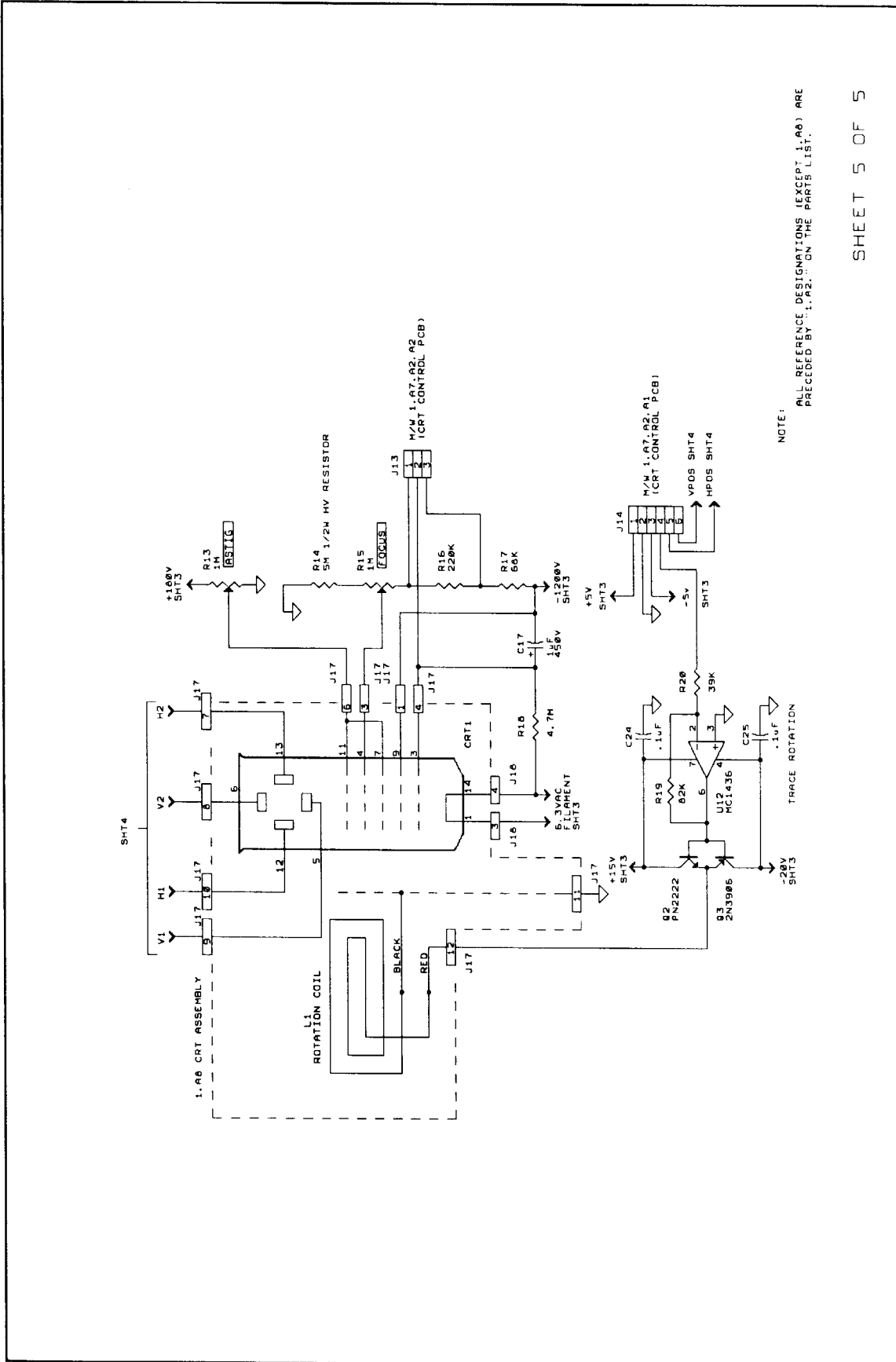
Figure 5-4c. Backplane PCB Schematic - Power Supplies.

- NOTES:
1. THE +17V AND -28V POWER SUPPLIES ARE NOMINAL VOLTAGES MEASURED WITH 1.17VAC ON THE AC LINE AND AN OPEN CIRCUIT ON THE TEST TERMINALS.
 2. ALL REFERENCE DESIGNATIONS ARE PRECEDED BY ".1.A2." ON THE PARTS LIST.



NOTE:
ALL REFERENCE DESIGNATIONS ARE PRECEDED BY "1.63" ON THE PARTS LIST.

Figure 5-4d. Backplane PCB Schematic - CRT Deflection Drivers.



NOTE:
ALL REFERENCE DESIGNATIONS (EXCEPT 1.06) ARE
PRECEDED BY 1.06. ON THE PARTS LIST.

SHEET 5 OF 5

Figure 5-4e. Backplane PCB Schematic - CRT High Voltage/Trace Rotation.

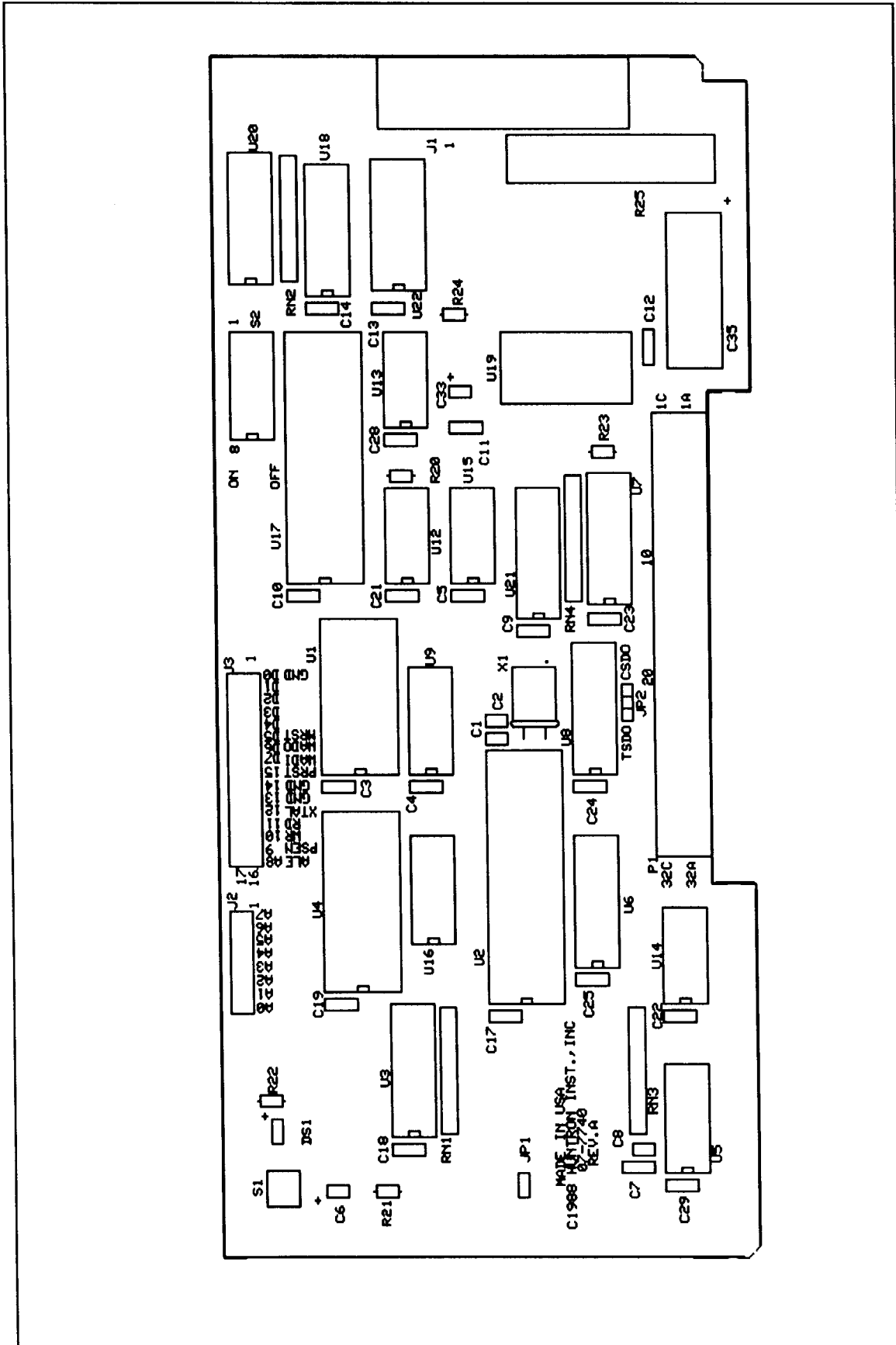
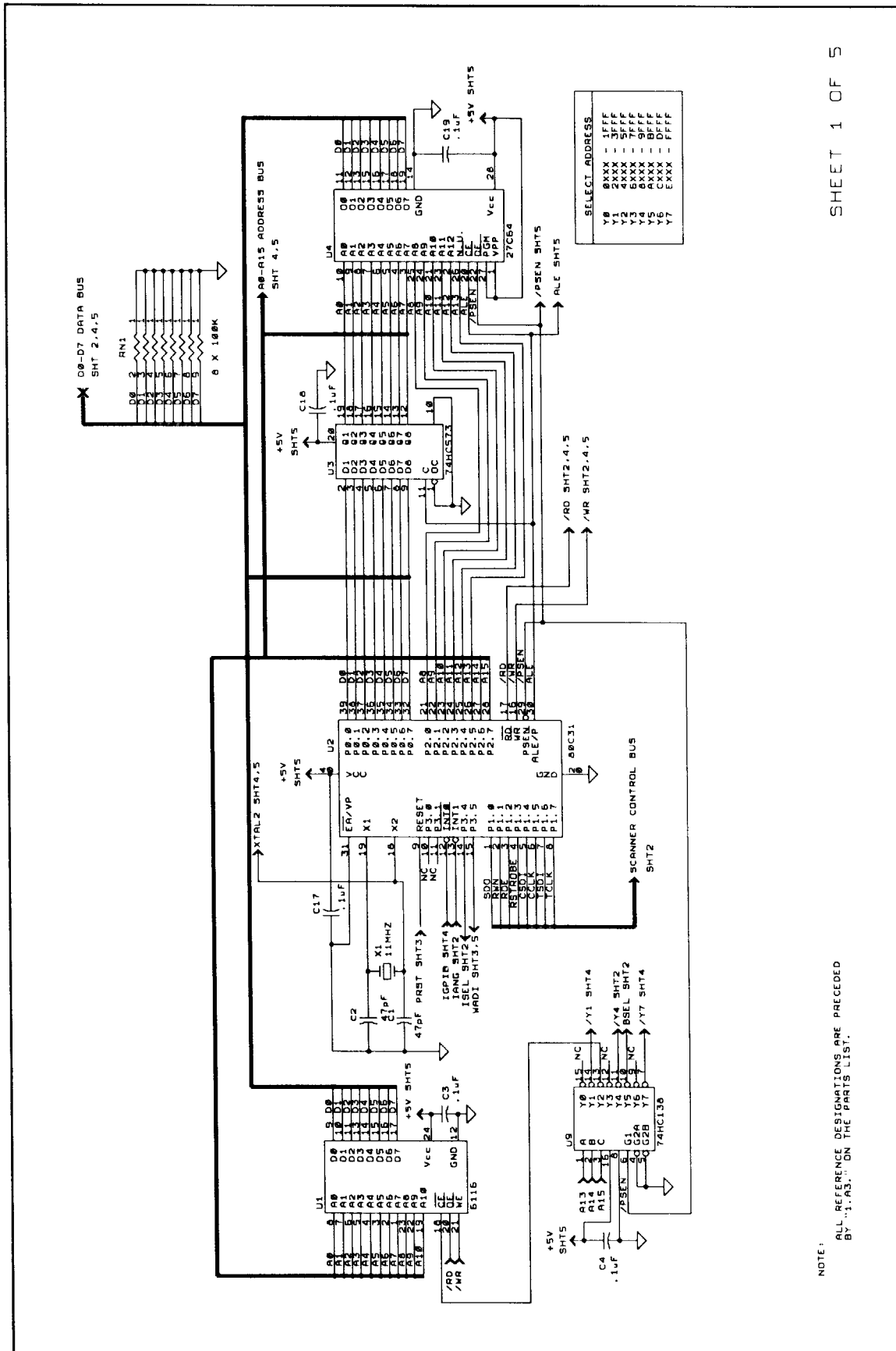


Figure 5-5. Digital PCB Component Locations.



SHEET 1 OF 5

Figure 5-6a. Digital PCB Schematic - Microcomputer/Memory.

NOTE:
ALL REFERENCE DESIGNATIONS ARE PRECEDED BY "1.A3." ON THE PARTS LIST.

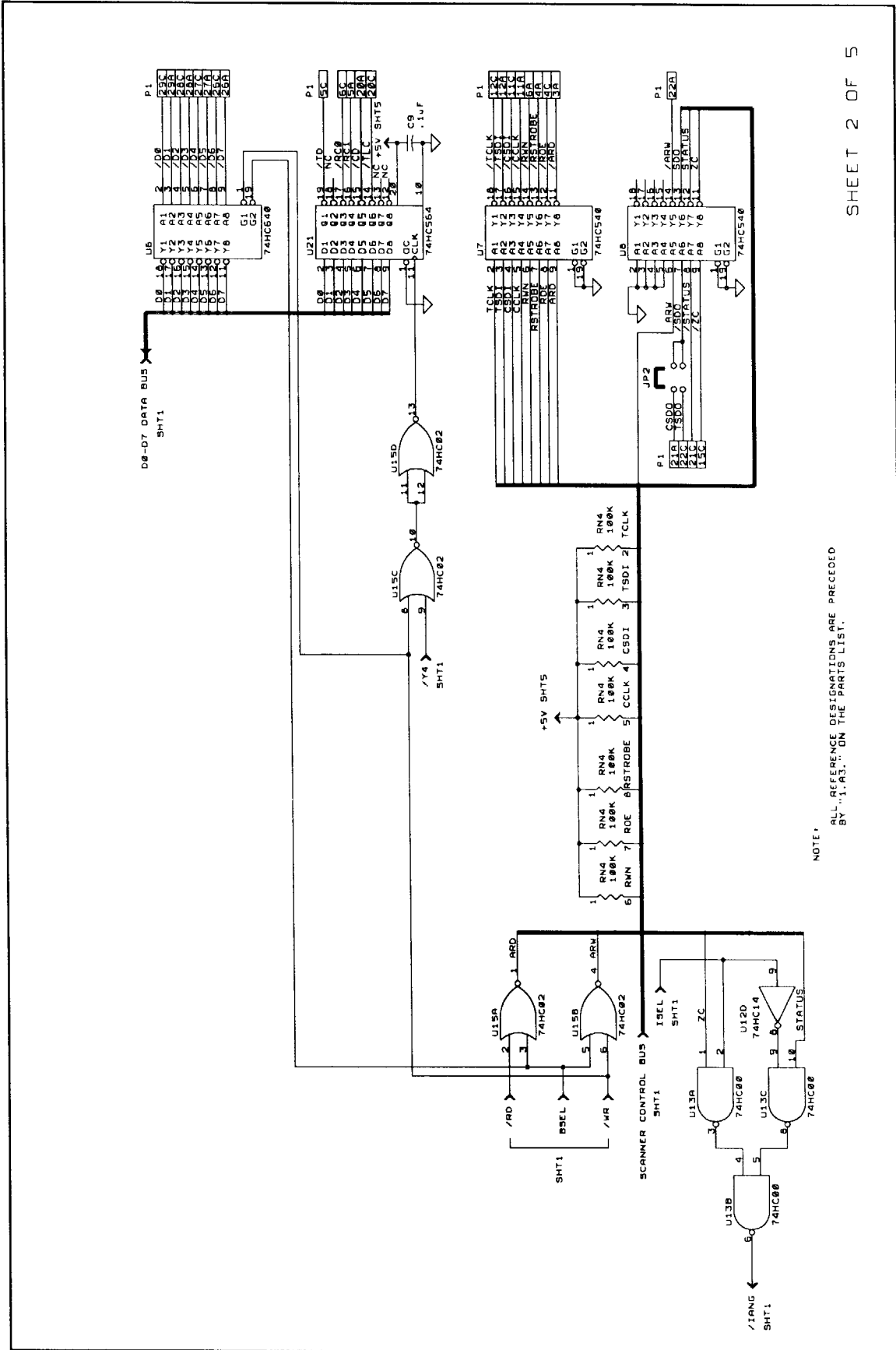
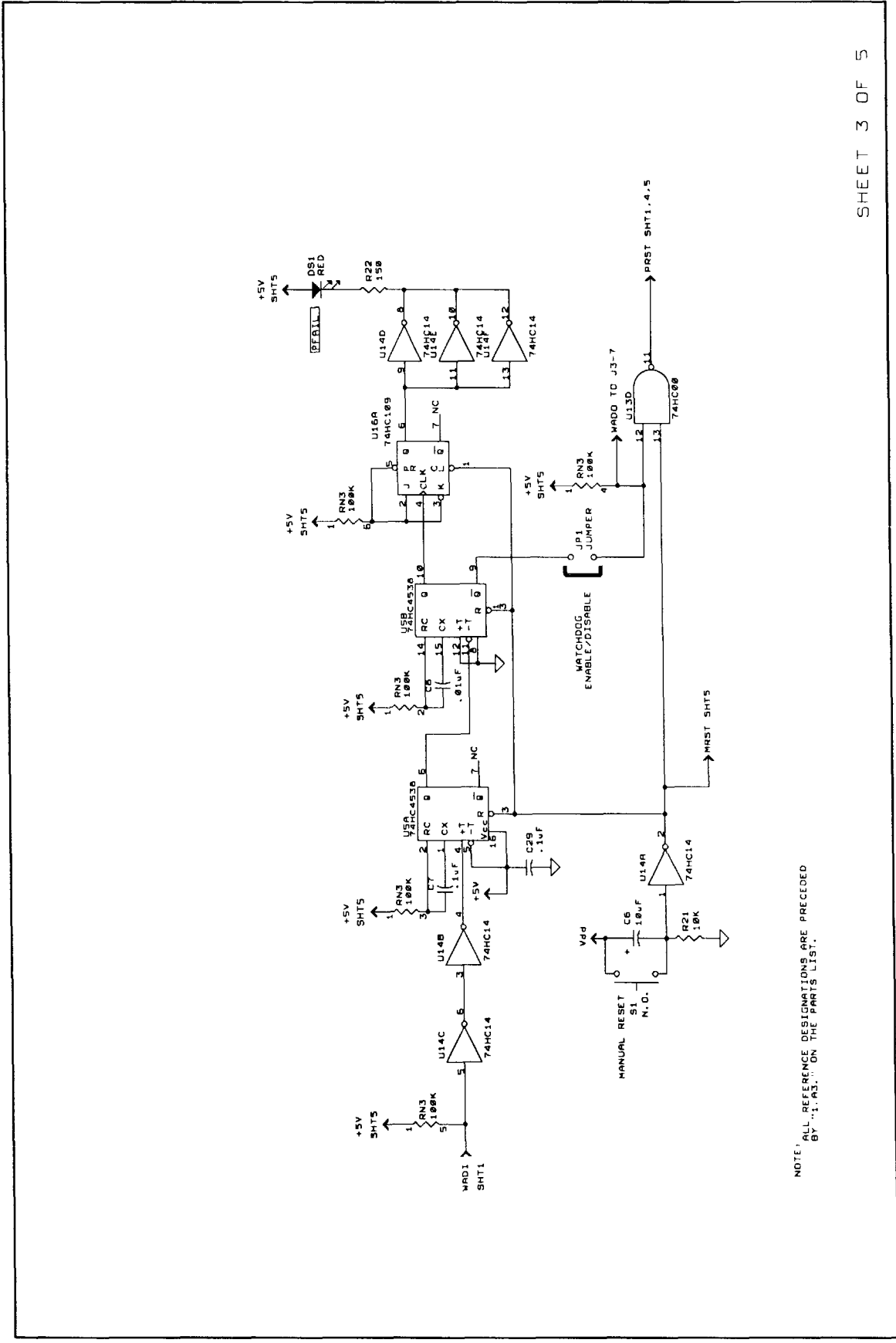


Figure 5-6b. Digital PCB Schematic - Analog/Scanner Interface.



NOTE: ALL REFERENCE DESIGNATIONS ARE PRECEDED BY "A31" ON THE PARTS LIST.

Figure 5-6c. Digital PCB Schematic - Watch Dog.

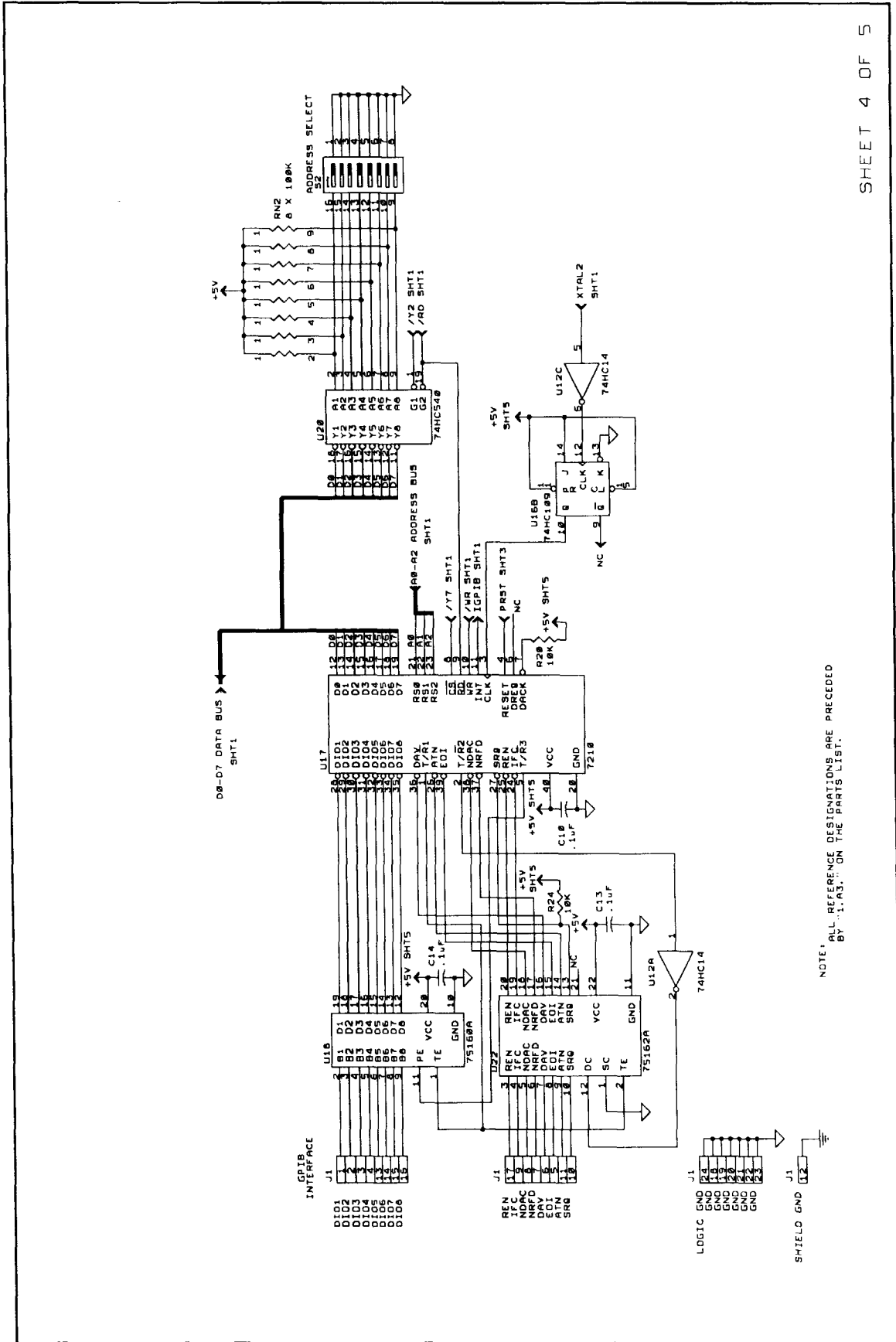
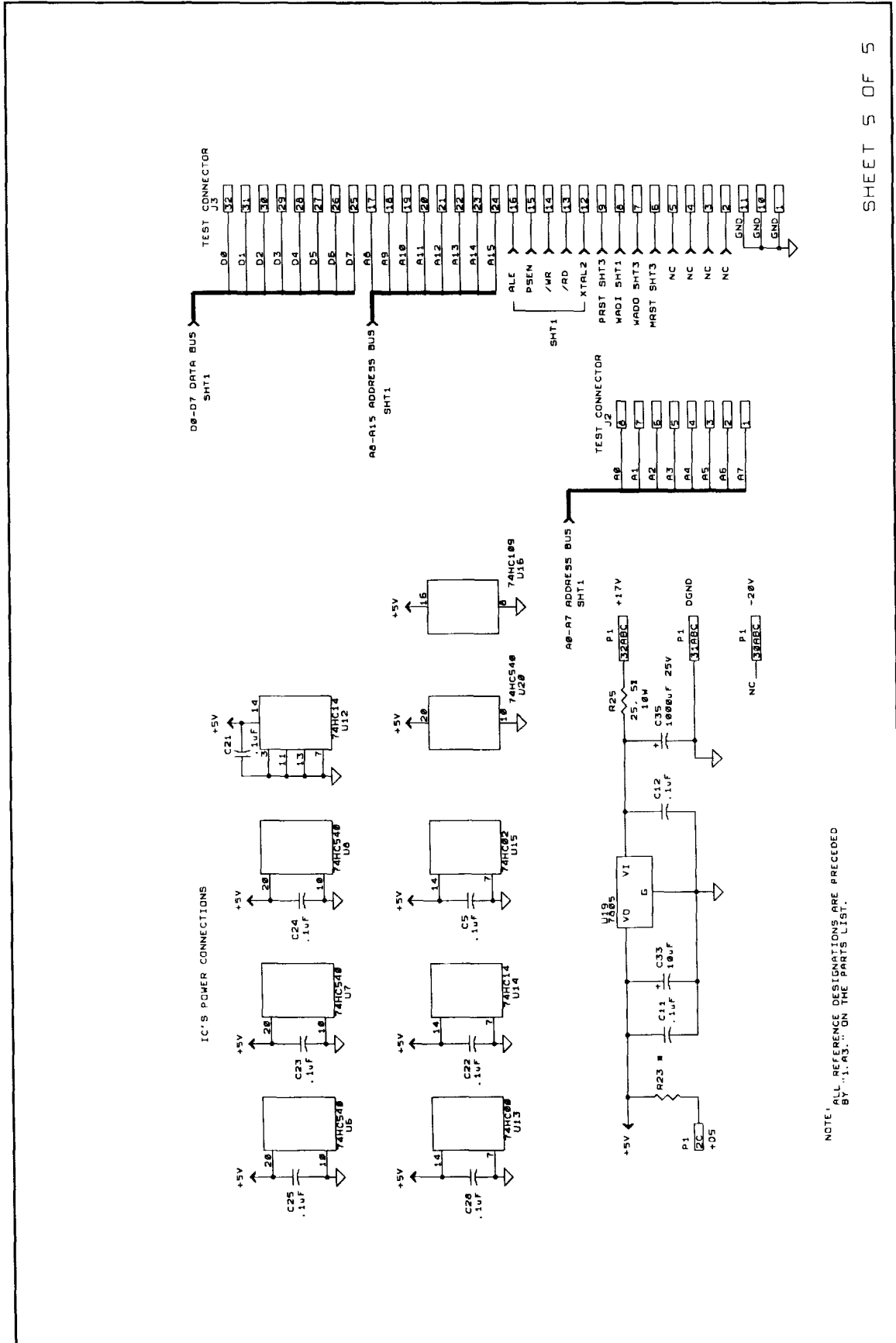


Figure 5-6d. Digital PCB Schematic - GPIB Interface.

NOTE: ALL REFERENCE DESIGNATIONS ARE PRECEDED BY 1-637- ON THE PARTS LIST.



SHEET 5 OF 5

Figure 5-6e. Digital PCB Schematic - Power Supply.

NOTE: ALL REFERENCE DESIGNATIONS ARE PRECEDED BY 1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

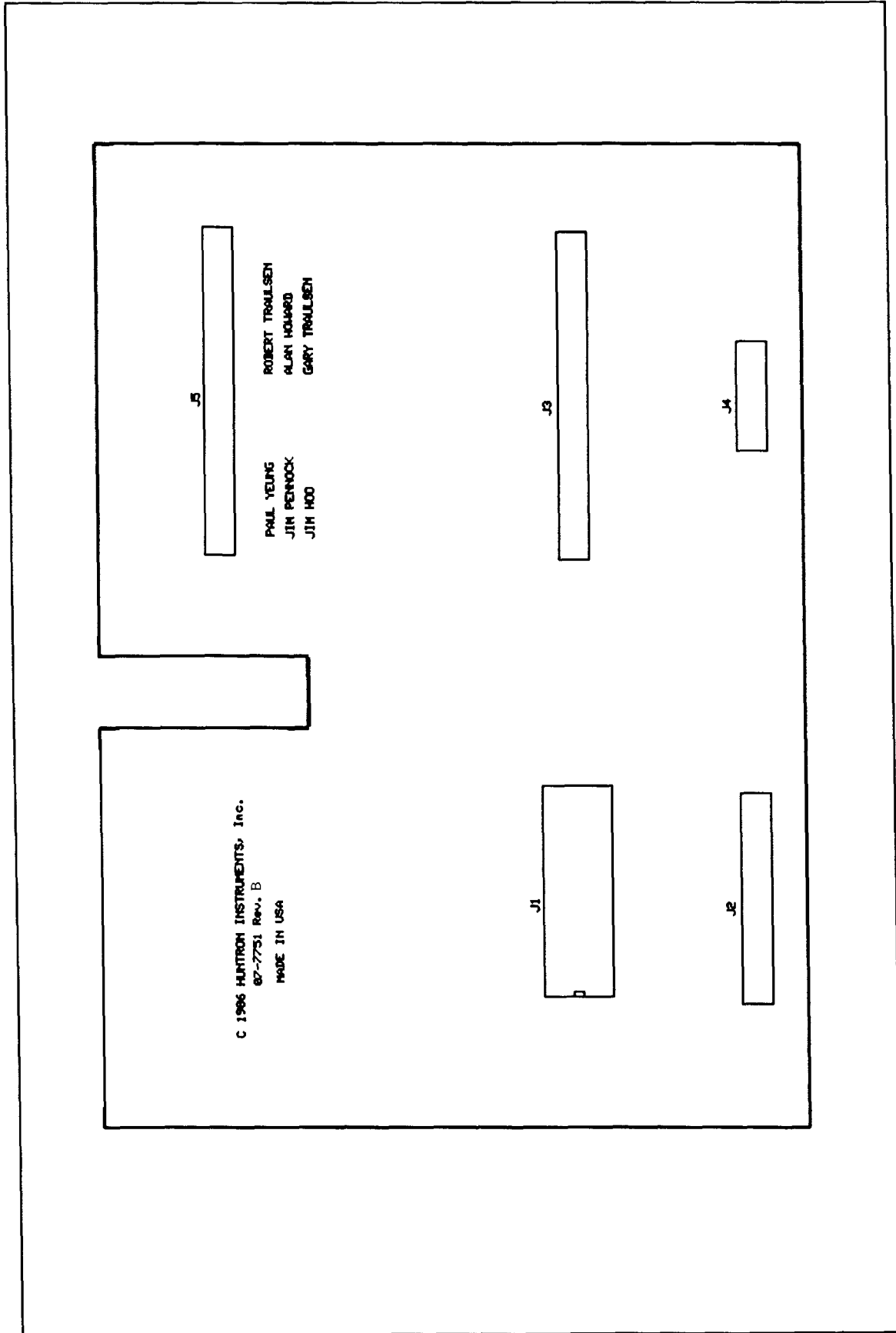


Figure 5-7. Input PCB Component Locations.

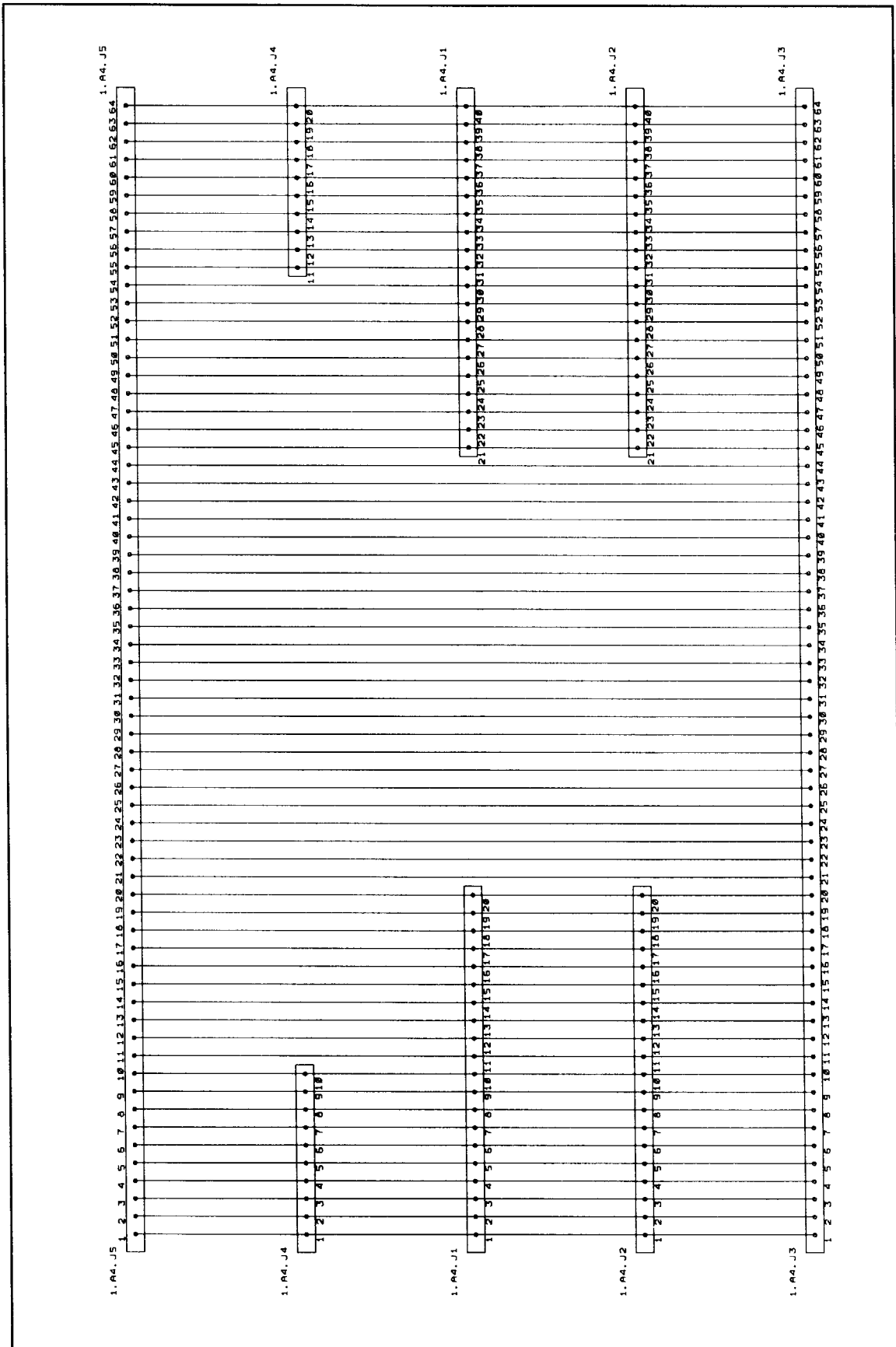


Figure 5-8. Input PCB Schematic.

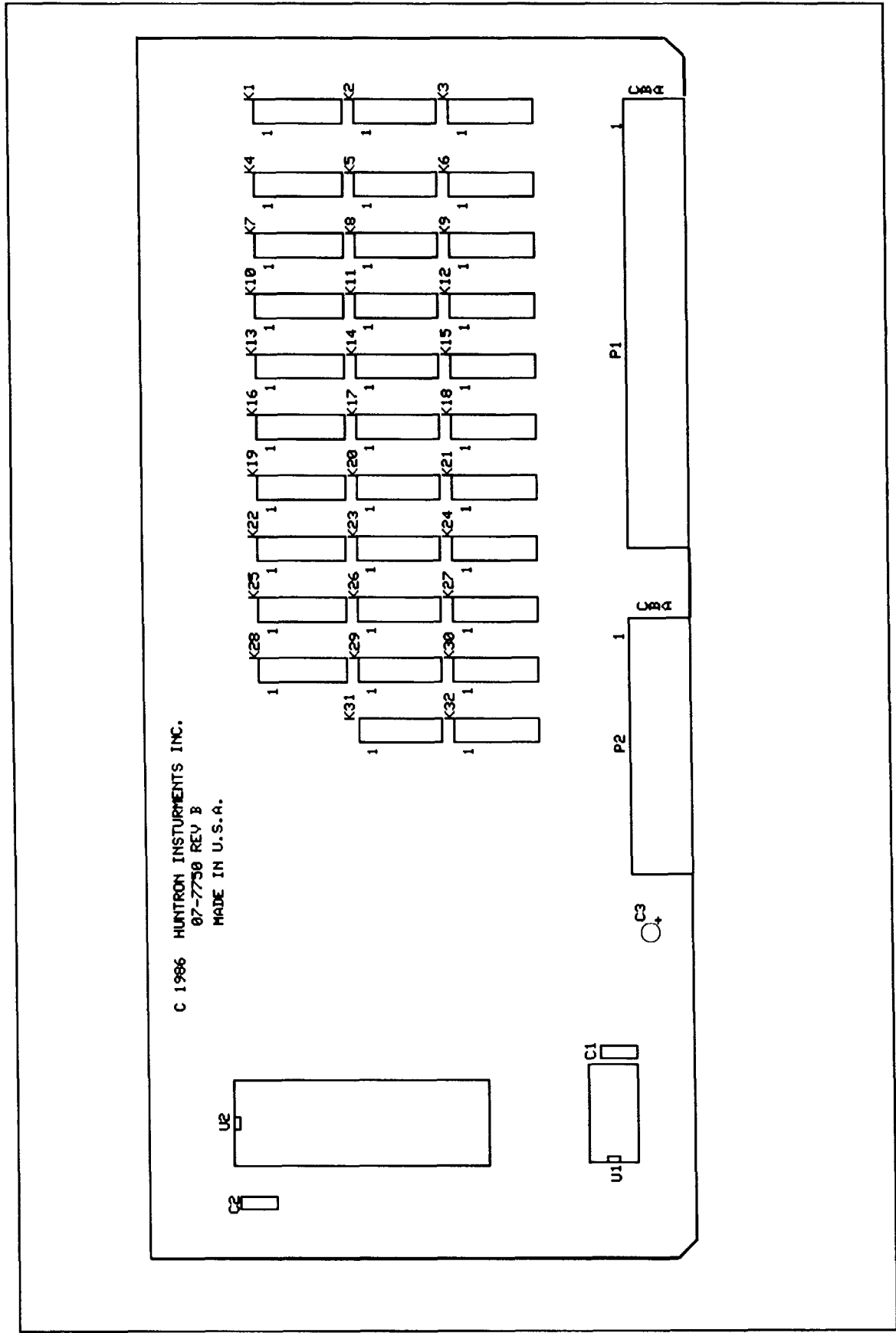
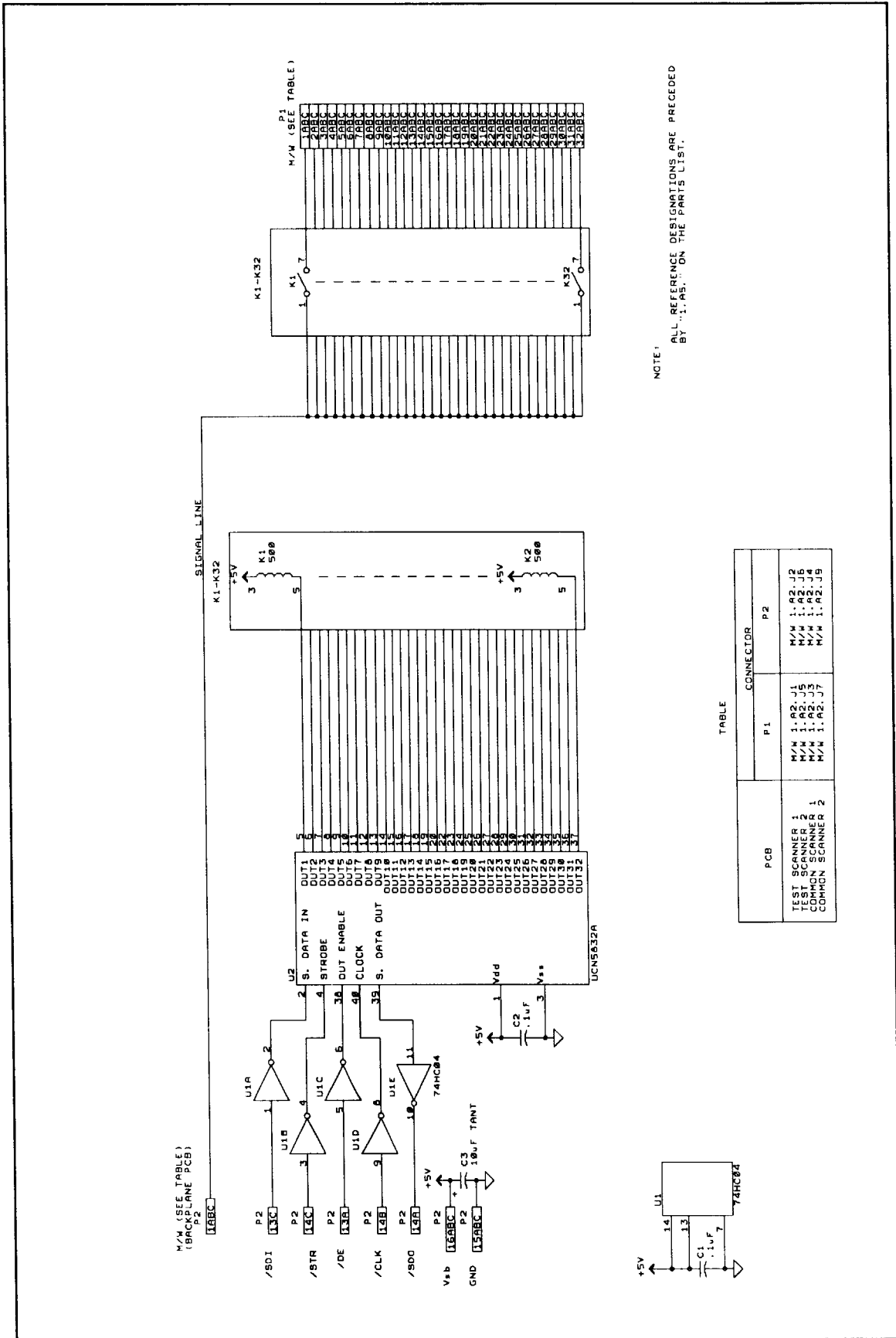


Figure 5-9. Scanner PCB Component Locations.



NOTE:
ALL REFERENCE DESIGNATIONS ARE PRECEDED BY "U.P.S." ON THE PARTS LIST.

TABLE

| PCB | CONNECTOR | |
|------------------|-------------|-------------|
| | F1 | P2 |
| TEST SCANNER 1 | M/M 1.A2.J1 | M/M 1.A2.J6 |
| TEST SCANNER 2 | M/M 1.A2.J5 | M/M 1.A2.J6 |
| COMMON SCANNER 1 | M/M 1.A2.J3 | M/M 1.A2.J4 |
| COMMON SCANNER 2 | M/M 1.A2.J7 | M/M 1.A2.J5 |

Figure 5-10. Scanner PCB Schematic.

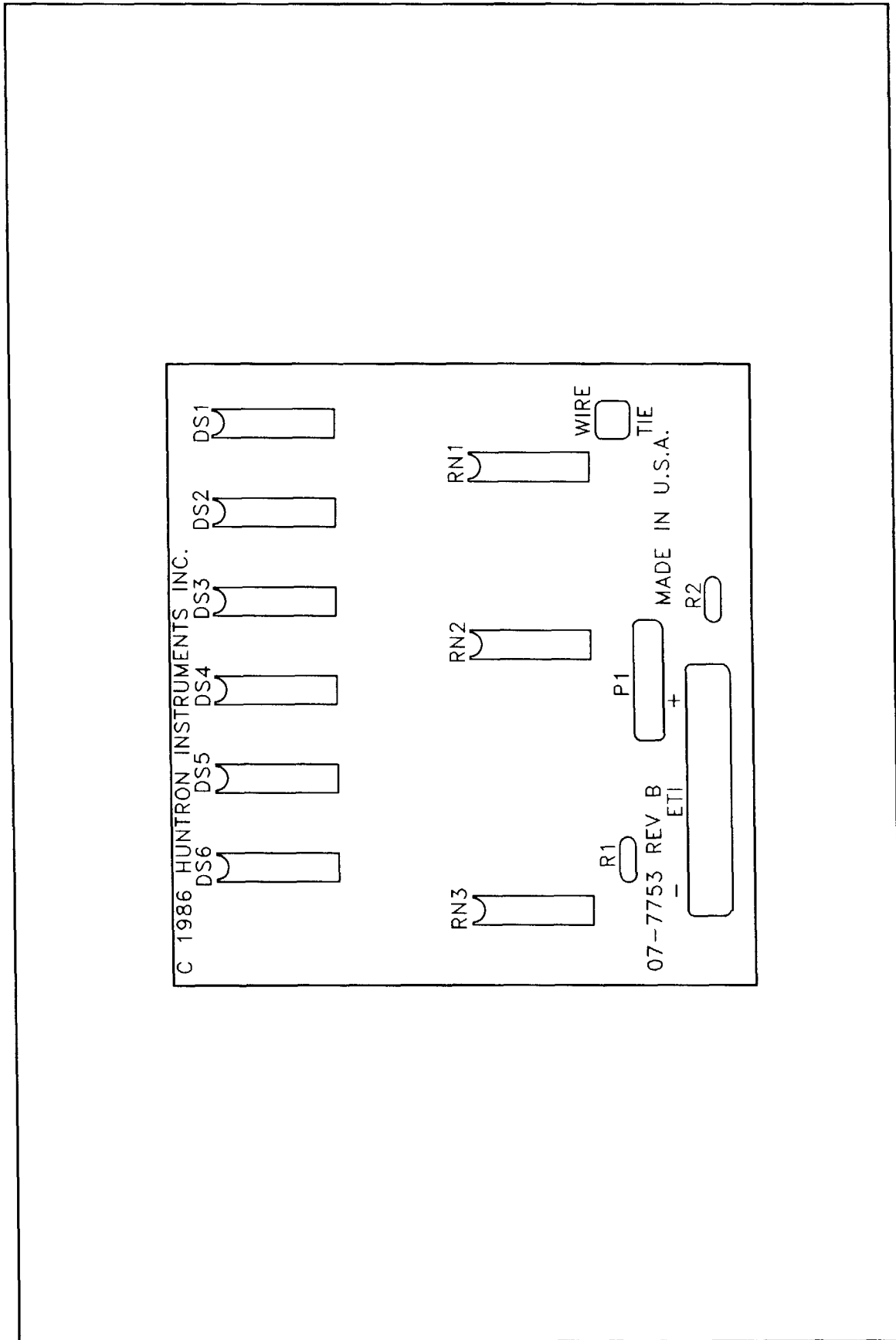


Figure 5-11. Display PCB Component Locations.

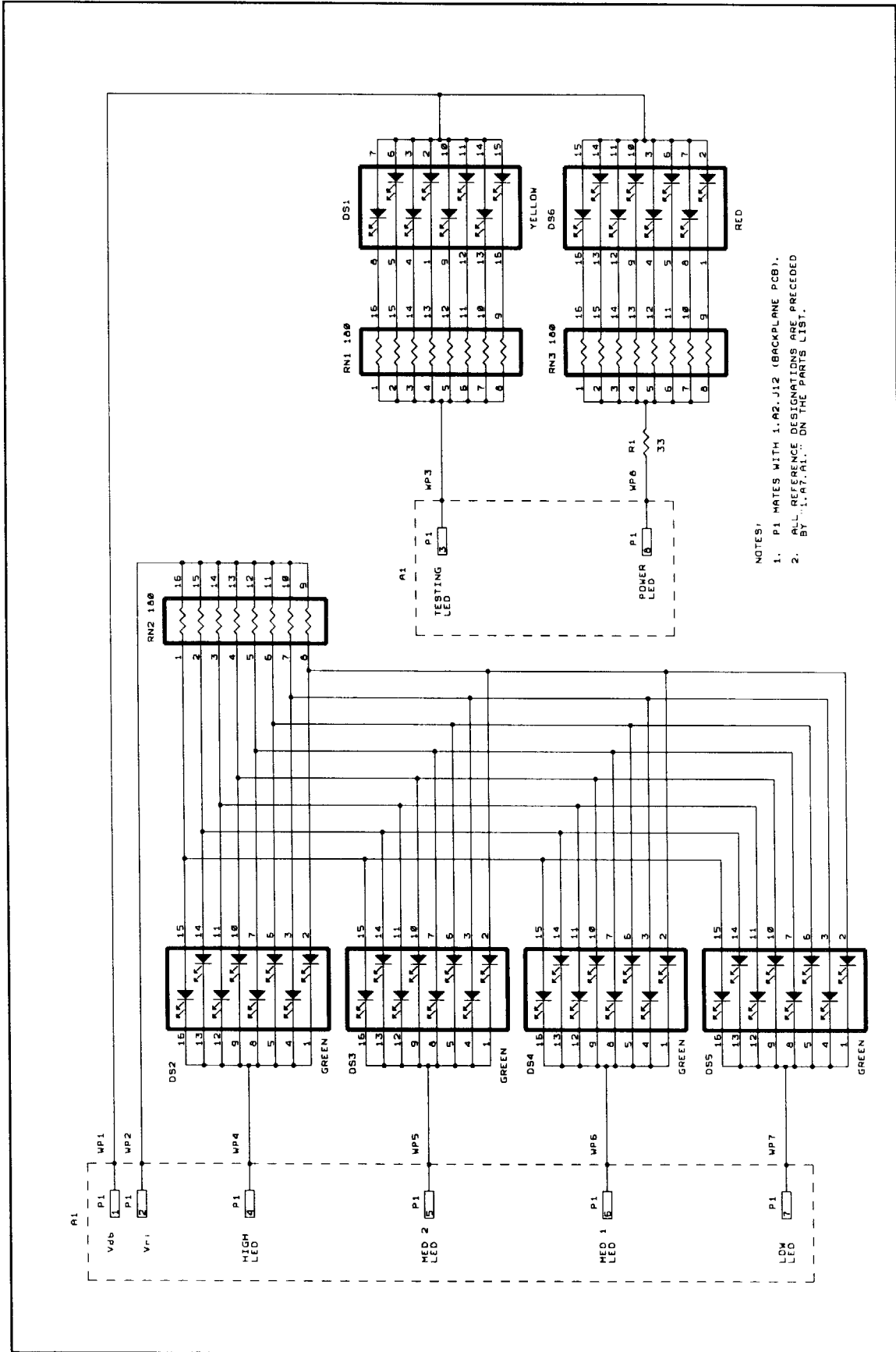


Figure 5-12. Display PCB Schematic.

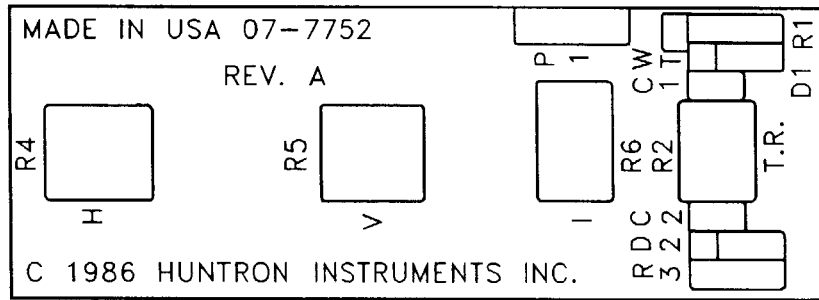
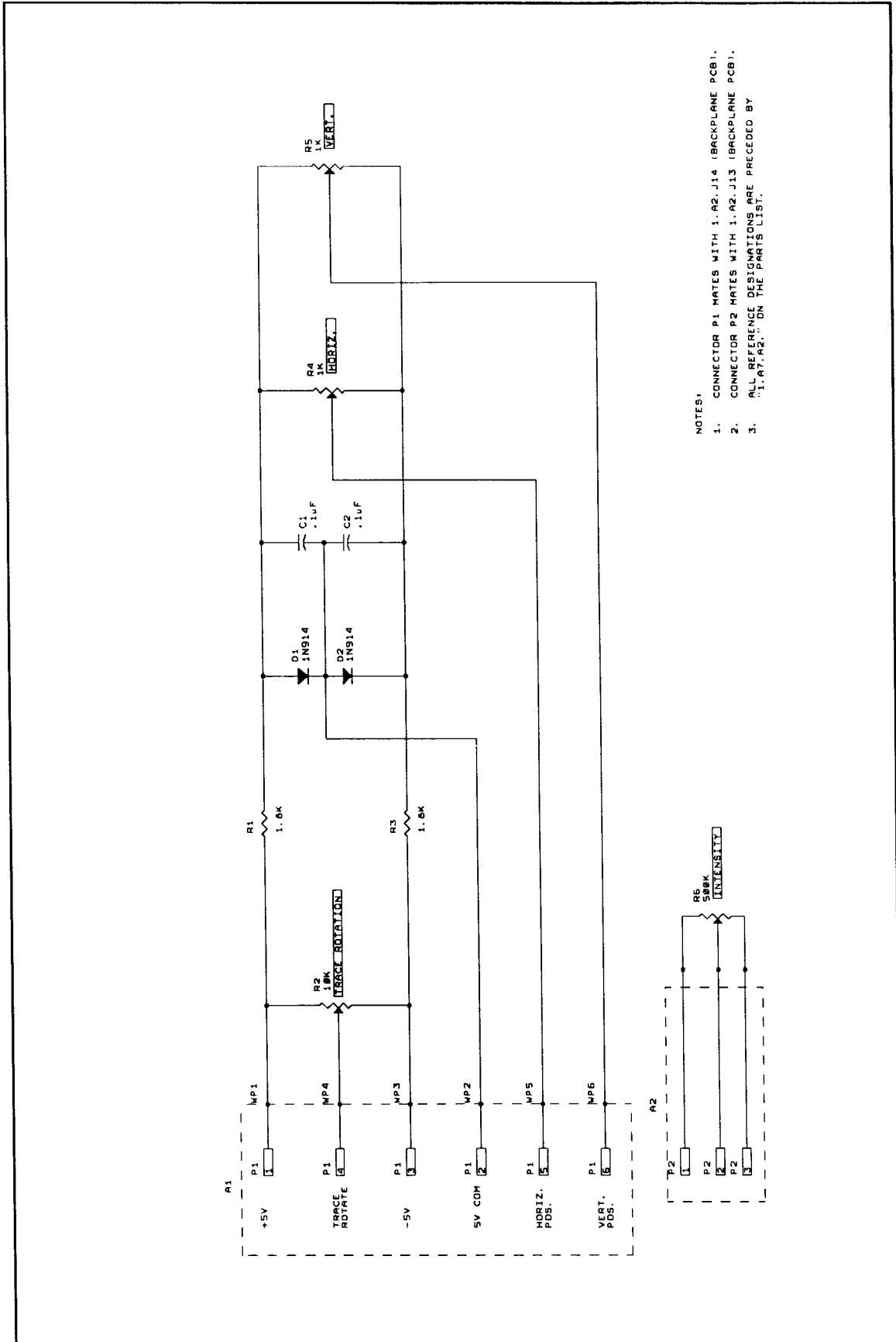


Figure 5-13. CRT Control PCB Component Locations.



- NOTES:
1. CONNECTOR P1 MATES WITH 1.A2.J14 (BACKPLANE PCB).
 2. CONNECTOR P2 MATES WITH 1.A2.J13 (BACKPLANE PCB).
 3. ALL REFERENCE DESIGNATIONS ARE PRECEDED BY "1.A2." ON THE PARTS LIST.

Figure 5-14. CRT Control PCB Schematic.

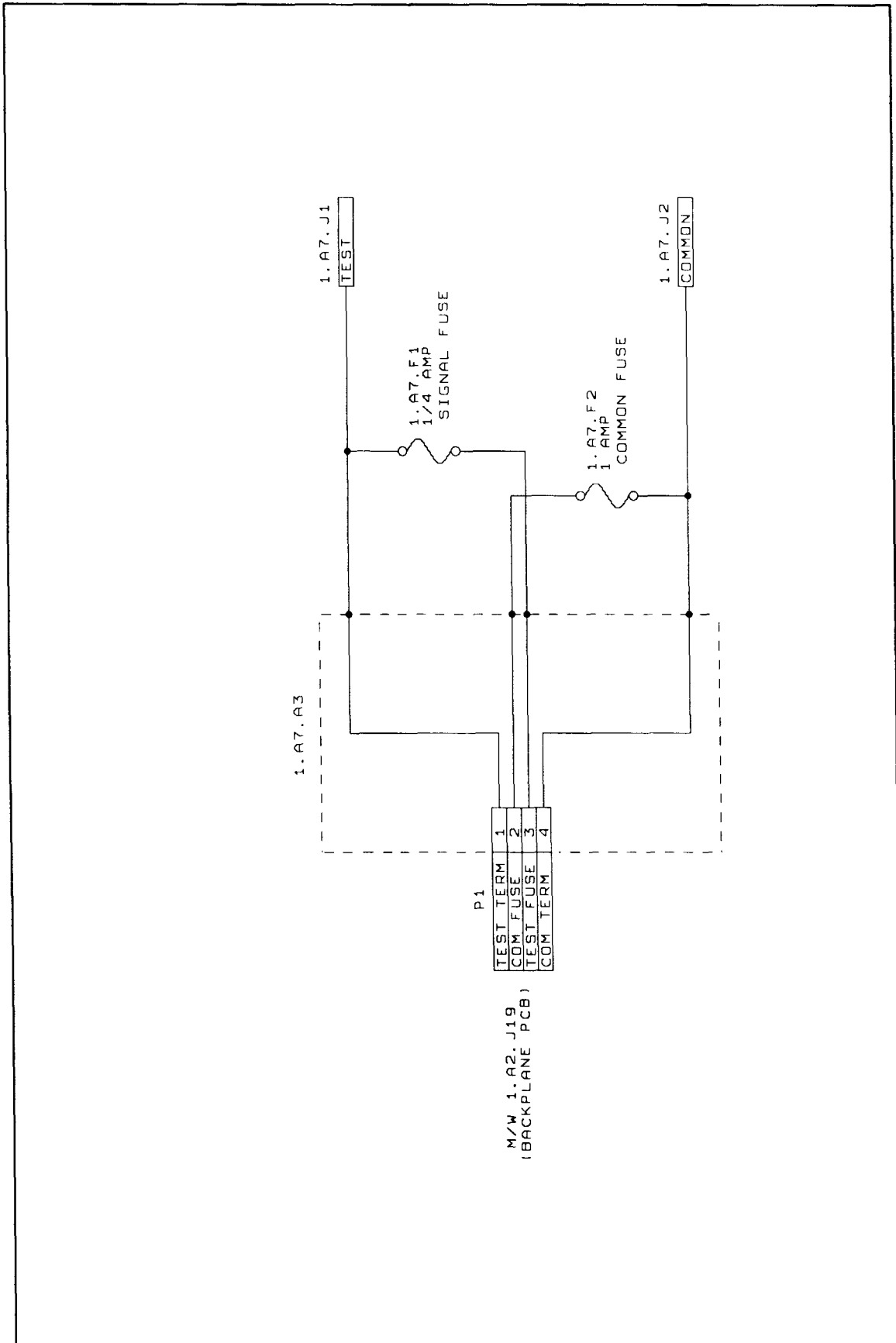


Figure 5-15. Terminal/Fuse Assembly Schematic.

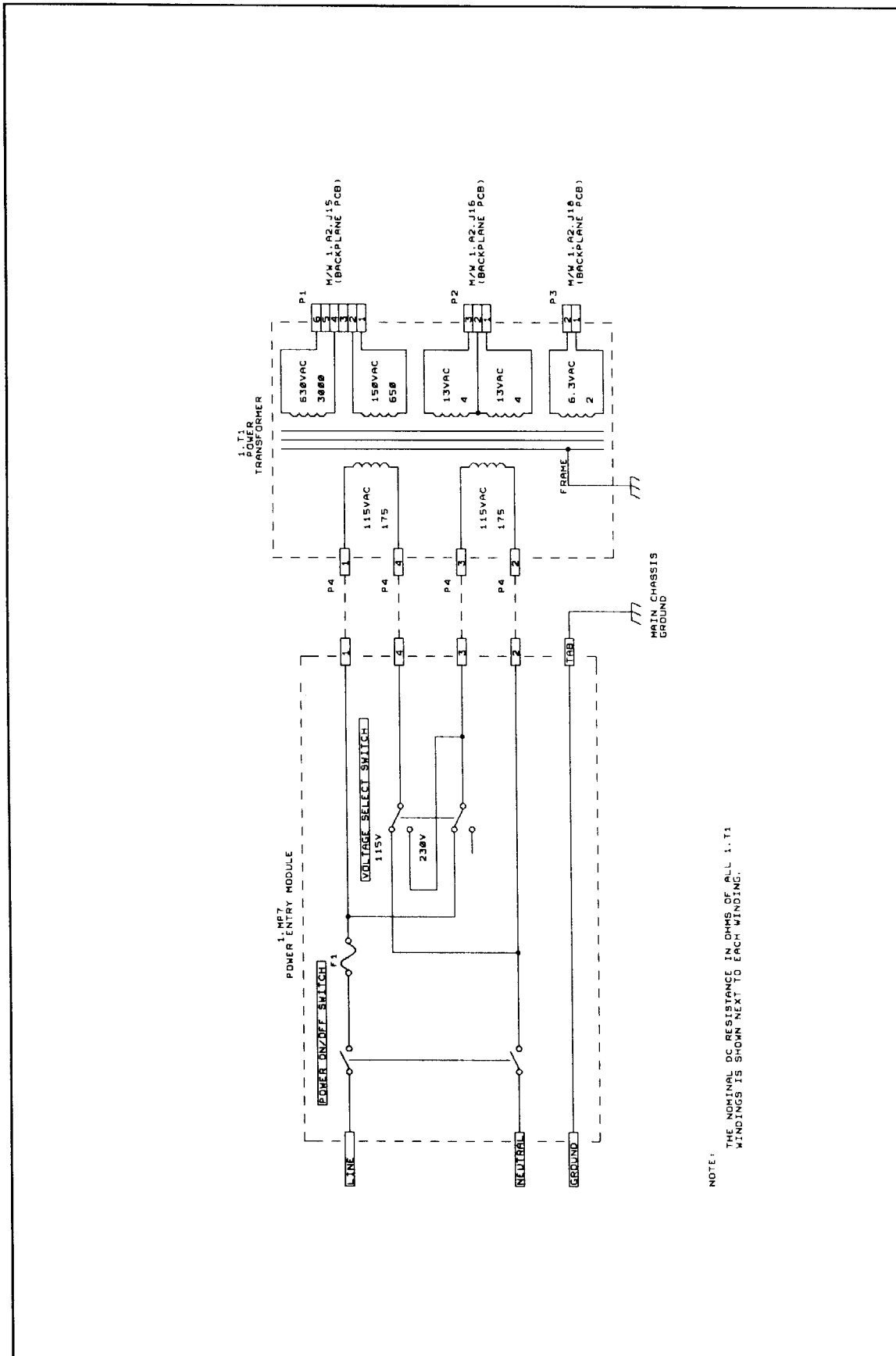
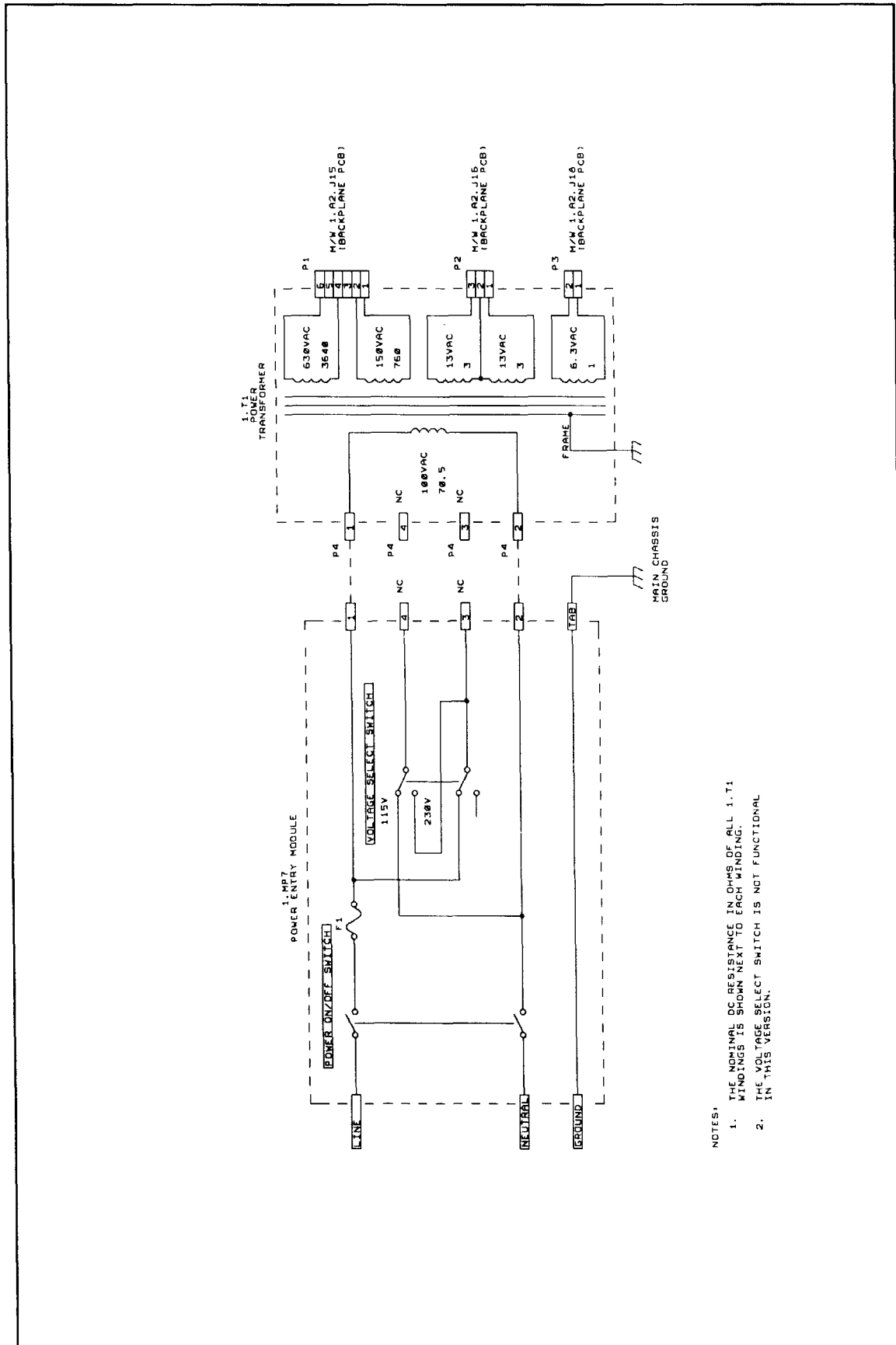


Figure 5-16a. Primary Circuits Schematic - 115V/230V Model.



- NOTES:
1. THE NOMINAL DC RESISTANCE IN OHMS OF ALL 1.1:1 WINDINGS IS SHOWN NEXT TO EACH WINDING.
 2. THE VOLTAGE SELECT SWITCH IS NOT FUNCTIONAL IN THIS VERSION.

Figure 5-16b. Primary Circuits Schematic - 100V Model.