

INSTRUCTION MANUAL  
**MODEL 1121A**  
**PROGRAMMABLE**  
**AUDIO ANALYZER**

REV DATE 02/23  
MANUAL P/N 98407600A



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## SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation and maintenance of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Boonton Electronics assumes no liability for the customer's failure to comply with these requirements.

### THE INSTRUMENT MUST BE GROUNDED

To minimize shock hazard the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three conductor, three prong power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to a two-contact adapter with the (green) grounding wire firmly connected to an electrical ground at the power outlet.

### DO NOT OPERATE THE INSTRUMENT IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes.

### KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions dangerous voltages may exist even though the power cable was removed; therefore, always disconnect power and discharge circuits before touching them.

### DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

### DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Do not install substitute parts or perform any unauthorized modification of the instrument. Return the instrument to Boonton Electronics for repair to ensure that the safety features are maintained.

### SAFETY SYMBOLS

This safety requirement symbol (located on the rear panel) has been adopted by the International Electrotechnical Commission, Document 66 (Central Office) 3, paragraph 5.3, which directs that the instrument be so labeled if, for the correct use of the instrument, it is necessary to refer to the instruction manual. In this case it is recommended that reference be made to the instruction manual when connecting the instrument to the proper power source. Verify that the correct fuse is installed for the power available, and that the switch on the rear panel is set to the applicable operating voltage.



The CAUTION sign denotes a hazard. It calls attention to an operation procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the equipment. Do not proceed beyond the CAUTION sign until the indicated conditions are fully understood and met.



The WARNING sign denoted a hazard. It calls attention to an operation procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.



Indicates dangerous voltages.

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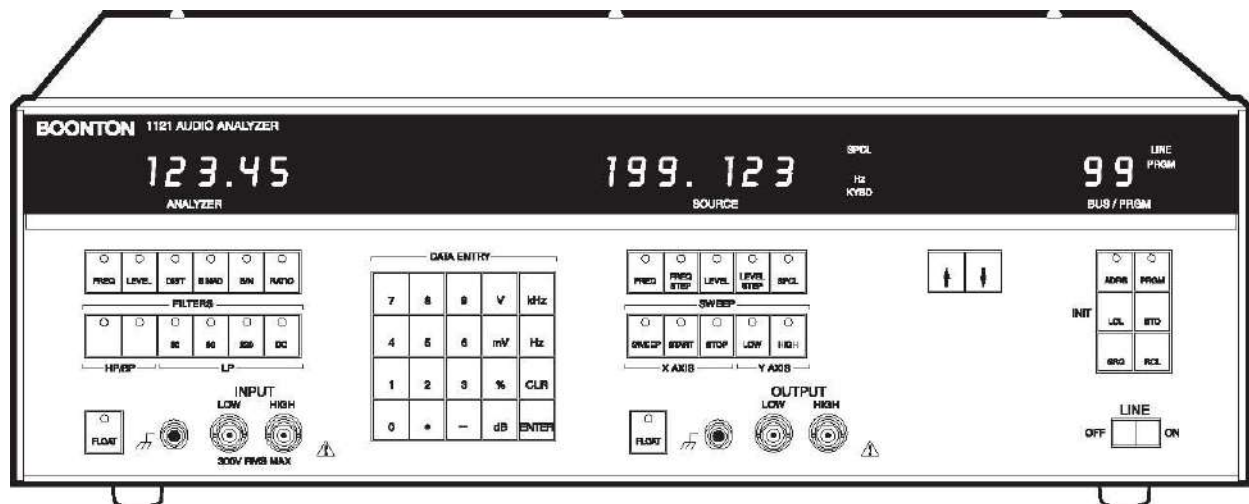
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MODEL 1121A AUDIO ANALYZER

## SECTION I GENERAL INFORMATION

### 1-1. INTRODUCTION.

**1-2.** This instruction manual provides installation, operating and maintenance instructions, theory of operation, schematics and parts lists for the Model 1121A Audio Analyzer.

### 1-3. DESCRIPTION.

**1-4.** The Model 1121A is a versatile, precision, solid-state instrument with features and performance characteristics especially suited to laboratory and industrial applications. Human engineering considerations have been emphasized in both the mechanical and electrical design of the Model 1121A. The result is an audio analyzer that is easy and convenient to use. Among the outstanding features are:

a. **Versatile Audio Analyzer.** Advanced generation and measurement techniques enable the Model 1121A to provide fast, accurate measurements. Measurement modes include frequency, AC or DC level, distortion, SINAD, signal-to-noise and full ratiometric capability. The precision audio source provides accurate, low distortion signals over wide frequency and level ranges. Demanding applications are satisfied by the high output power capability and selectable output impedance.

b. **Ultra-low Distortion.** The mark of quality for any audio analyzer is low residual distortion and noise. The total harmonic distortion of the Model 1121A is specified as less than 0.01% with typical performance an order of magnitude better than specified.

c. **Versatile Source Output.** The Model 1121A features wide control over its output configurations. Source impedance can be set to 50, 150, or 600 ohms in either a floating or single-ended configuration. All source impedances are available at the same set of output connectors, eliminating the need to multiplex separate 50 ohm and high impedance outputs.

d. **Balanced Input.** The Model 1121A has a fully differential/balanced input for testing bridged amplifiers and power supplies.

e. **Separate Displays of All Functions.** The Model 1121A has 3 separate display windows to simultaneously present analyzer measurements, source settings and program number or bus address information. Continuous display of IEEE-488 bus status is also presented.

f. **Full Range of Filter Selections.** The Model 1121A provides a wide range of filter selections and weighting characteristics for industry-standard audio measurements.

g. **Sweep Operation.** Frequency or level can be swept in user-selected linear or logarithmic steps over any portion of the range. The selected analyzer measurement provides the Y axis information. Rear panel X axis, Y axis and PEN outputs are provided for plotter application.

h. **Instrument Setup Memory.** Up to 99 front panel setups containing all data required to configure the instrument to a previous operating mode can be stored in non-volatile memory for future recall. The last valid instrument setup before power interruption is also saved automatically and restored when power is resumed.

i. **IEEE-488 Interface Bus.** All instrument functions are programmable except line on/off. Annunciators to the left of the BUS/PRGM display window show the status of bus activity. The 1121A is designed to interface easily with controllers currently in use. A versatile free-form number entry system is used so that the 1121A will accept any conceivable valid number string. Triggering may be performed in immediate or wait modes. There are six talk modes which can be addressed in either the remote or local state. The 1121A also provides a choice of several end-of-string terminators. Service-request (SRQ) can be asserted on errors or using the front panel SRQ key and the LCL/INIT key will force return to local control when using the bus as long as a lockout message has not been sent.

### 1-5. ACCESSORIES.

**1-6.** The available accessories are listed in Table 1-1. The AC power cord, spare input, output and line fuses are supplied with the instrument.

### 1-7. OPTIONS.

**1-8.** The available options are listed in Table 1-1.

### 1-9. SPECIFICATIONS.

**1-10.** Performance specifications for the Model 1121A Audio Analyzer are listed in Table 1-1.

TABLE 1-1 PERFORMANCE SPECIFICATIONS.

## SYSTEM SPECIFICATIONS

### Signal-to-Noise

#### Fundamental Frequency Range:

10 Hz to 100 kHz usable to 140 kHz

#### Display Range: 0.00 to 140.00 dB

#### Accuracy: $\pm 1$ dB

#### Input Voltage Range: 250 mV to 300 V

#### Residual Noise (the greater of):

85 dB or 10  $\mu$ V; 80 kHz BW

85 dB or 20  $\mu$ V; 220 kHz BW

85 dB or 40  $\mu$ V; 500 kHz BW

### Distortion

#### Residual Distortion and Noise (the greater of):

-80 dB or 10  $\mu$ V; 10 Hz to 20 kHz, 80 kHz BW

-74 dB or 20  $\mu$ V; 10 Hz to 50 kHz, 220 kHz BW

-70 dB or 40  $\mu$ V; 10 Hz to 50 kHz, 500 kHz BW

-65 dB or 40  $\mu$ V; 50 to 100 kHz, 500 kHz BW

## SOURCE SPECIFICATIONS

### Frequency

#### Range: 10 Hz to 140 kHz

#### Resolution:

0.001 Hz; 10.000 to 199.999 Hz

0.01 Hz; 200.00 to 1999.99 Hz

0.1 Hz; 2.0000 to 19.9999 kHz

1.0 Hz; 20.000 to 140.000 kHz

#### Accuracy: 10 ppm + timebase accuracy + 1 count

#### Flatness, ref 1 kHz (0.30 mV to 8 V into 50 ohms):

$\pm 0.5\%$ ; 10 Hz to 50 kHz

$\pm 1.0\%$ ; 10 Hz to 100 kHz

$\pm 1.5\%$ ; 10 Hz to 140 kHz

### Output

#### Impedance:

50 ohms  $\pm 2\%$

150 ohms  $\pm 1\%$

600 ohms  $\pm 1\%$

#### Distortion and Noise (the greater of):

0.01% (-80 dB) or 10  $\mu$ V;

10 Hz to 20 kHz, 80 kHz bandwidth

0.02% (-74 dB) or 20  $\mu$ V;

10 Hz to 50 kHz, 220 kHz bandwidth

0.032% (-70 dB) or 35  $\mu$ V;

10 Hz to 50 kHz, 500 kHz bandwidth

0.056% (-65 dB) or 35  $\mu$ V;

50 to 100 kHz, 500 kHz bandwidth

0.1% (-60 dB) or 35  $\mu$ V;

100 to 140 kHz, 500 kHz bandwidth

#### Output Power (50 ohm source):

31.07 dBm (8.00 V) into 50 ohm load

29.82 dBm (12.00 V) into 150 ohm load

25.60 dBm (14.76 V) into 600 ohm load

1.0 Hz; 20.000 to 199.999 kHz

### Level

#### Range: 0.01 mV to 16.000 V rms, open circuit

#### Full Scale Ranges:

16.000 V, 3.000 V, 300.0 mV, 30.00 mV

#### Resolution:

0.01 mV; 0.00 to 30.00 mV

0.1 mV; 30.0 to 300.0 mV

1 mV; 300 to 3000 mV

5 mV; 3.000 to 16.000 V

#### Accuracy (settings from 0.60 mV to 16.000 V):

$\pm 0.5\%$  of setting + 0.05% of range;

10 Hz to 50 kHz

$\pm 1.0\%$  of setting + 0.05% of range;

50 kHz to 100 kHz

$\pm 1.5\%$  of setting + 0.1% of range;

100 kHz to 140 kHz

## ANALYZER SPECIFICATIONS

### Frequency Measurement

#### Range: 5 Hz to 200 kHz

#### Sensitivity:

5 mV in the Frequency mode

50 mV in the Distortion and SINAD modes

#### Accuracy: Timebase accuracy + 1 count

#### Resolution: (for input levels below 100 mV the resolution is reduced by a factor of 10)

0.001 Hz; 5.000 to 199.999 Hz

0.01 Hz; 200.00 to 1999.99 Hz

0.1 Hz; 2.0000 to 19.9999 kHz

TABLE 1-1 PERFORMANCE SPECIFICATIONS

**Timebase****Type:** 10 MHz TCXO **Accuracy:**  $\pm 1$  ppm/yr**AC Level Measurement****Range: (full scale)** 300.0 V, 30.00 V, 3.000 V, 300.0 mV, 30.00 mV, 3.000 mV, 0.3000 mV**Overrange:** 33% except on 300 V range**Accuracy:**

- $\pm 1\%$ ; 50 Hz to 50 kHz, 1 mV to 300 V
- $\pm 2\%$ , 20 Hz to 100 kHz, 1 mV to 300 V
- $\pm 3\%$  10 Hz to 100 kHz, 1 mV to 300 V
- $\pm 4\%$ ; 10 Hz to 100 kHz, 0.3 mV to 300 V

**Flatness: (1 mV to 300 V)**

- $\pm 0.5\%$ ; 50 Hz to 50 kHz  $\pm$
- 1.0%; 20 Hz to 100 kHz  $\pm$
- 2.0%; 10 Hz to 100 kHz

**DC Level Measurement****Range (full scale)** 300.0V, 30.00 V, 3.000 V**Overrange:** 33% except on 300 V range**Accuracy:**  $\pm 1\%$  or 6 mV whichever is greater**Common Mode Rejection Ratio****CMRR:**

- > 70 dB; 20 Hz to 1 kHz
- > 45 dB; 1 kHz to 20 kHz

**Limits:**

- 4.25 V pk; 3.000 V range
- 42.5 V pk; 30.00 V range
- 425 V pk; 300.0 V range

**Analyzer Input****Type:** Balanced (full differential)**Impedance:**100 k ohms  $\pm 1\%$ , < 300 pF, each side to ground**Protection:** Excessive common mode levels are hardware limited on all input ranges and fuse protection is employed against peak levels exceeding 425 volts**Distortion Measurement****Fundamental Frequency Range:**

10 Hz to 100 kHz usable to 140 kHz

**Resolution:**

- 0.00001%; <0.11000%
- 0.0001%; <1.1000%
- 0.001%; <11.000%
- 0.01%; <100.00%

**Display Range:**

0.00001 to 100.00% (-140.00 to 0.00 dB)

**Accuracy:**

- $\pm 1$  dB; 20 Hz to 20 kHz
- $\pm 2$  dB; 10 Hz to 100 kHz

**Input Voltage Range:** 50 mV to 300 V**Distortion Measurement Range:**

- 10 Hz to 20 kHz, 80 kHz bandwidth
- 0.056% (-65 dB); 100 mV to 200 mV Input Voltage Range
- 0.032% (-70 dB); 200 mV to 350 mV Input Voltage Range
- 0.010% (-80 dB); 350 mV to 300 V Input Voltage Range

- 10 Hz to 50 kHz, 220 kHz bandwidth
- 0.056% (-65 dB); 100 mV to 200 mV Input Voltage Range
- 0.020% (-74 dB); 200 mV to 300 V Input Voltage Range

- 10 Hz to 50 kHz, 500 kHz bandwidth
- 0.056% (-65 dB); 100 mV to 200 mV Input Voltage Range
- 0.032% (-70 dB); 200 mV to 300 V Input Voltage Range

- 50 kHz to 100 kHz, 500 kHz bandwidth
- 0.056% (-65 dB); 100 mV to 300 V Input Voltage Range

- 10 Hz to 100 kHz, all bandwidths
- 0.10% (-60 dB) (typical); 50 mV to 100 mV Input Voltage Range

**SINAD Measurement****Fundamental Frequency Range:**

- 10 Hz to 100 kHz usable to 140 kHz
- (tuned to source frequency setting)

**Display Range:** 0.00 to 140.00 dB**Accuracy:**

- $\pm 1$  dB; 20 Hz to 20 kHz
- $\pm 2$  dB; 10 Hz to 100 kHz

**Input Voltage Range:** 50 mV to 300 V**SINAD Measurement Range:**

- 10 Hz to 20 kHz, 80 kHz bandwidth
- 65 dB; 100 mV to 200 mV Input Voltage Range
- 70 dB; 200 mV to 350 mV Input Voltage Range
- 80 dB; 350 mV to 300 V Input Voltage Range

- 10 Hz to 50 kHz, 220 kHz bandwidth
- 65 dB; 100 mV to 200 mV Input Voltage Range
- 74 dB; 200 mV to 300 V Input Voltage Range

- 10 Hz to 50 kHz, 500 kHz bandwidth
- 65 dB; 100 mV to 200 mV Input Voltage Range
- 70 dB; 200 mV to 300 V Input Voltage Range

- 50 kHz to 100 kHz, 500 kHz bandwidth
- 65 dB; 100 mV to 300 V Input Voltage Range

**TABLE 1-1 PERFORMANCE SPECIFICATIONS**

10 Hz to 100 kHz, all bandwidths  
60 dB (typical); 50 mV to 100 mV Input Voltage Range

**Standard Audio Filters****30 kHz Low-pass Filter**

**Accuracy:** 30 kHz  $\pm$  2 kHz

**Rolloff:** Third-order Butterworth, 60 dB/decade

**80 kHz Low-pass Filter**

**Accuracy:** 80 kHz  $\pm$  4 kHz

**Rolloff:** Third-order Butterworth, 60 dB/decade

**220 kHz Low-Pass Filter**

**Accuracy:** 220 kHz  $\pm$  20 kHz

**Rolloff:** Third-order Butterworth, 60 dB/decade

**TABLE 1-1 PERFORMANCE SPECIFICATIONS****Optional Audio Filters****400 Hz High-pass Filter Accuracy:**

**Accuracy:** 400 Hz  $\pm$  40 Hz

**Rolloff:** Seventh-order Butterworth, 140 dB/decade

**Audio Band-pass Filter****Accuracy:**

22.4 Hz  $\pm$  5%, 60 dB/decade rolloff

22.4 kHz  $\pm$  5%, 60 dB/octave rolloff

**A, B, C Weighting Filter****Accuracy:**

$\pm$  0.2 dB; 1.0 kHz

$\pm$  1.0 dB; 40 Hz to 5.0 kHz

$\pm$  1.5 dB; 25 to 40 Hz, 5.0 to 10.0 kHz

$\pm$  2.0 dB; 20 to 25 Hz, 10.0 to 20.0 kHz

**SUPPLEMENTAL INFORMATION****AC Measurement**

**Bandwidth:** 5 Hz to 500 kHz

**RMS Detector:**

True rms responding for signals with a crest factor of  $<3$

**Average Detector:**

Average responding rms calibrated

**Quasi-peak Detector:**

Meets CCIR recommendation 458-3

Accuracy:  $\pm$  6%; 20 Hz to 20 kHz

**Analyzer Measurement Speed**

| Function   | First Reading | Rate:        |
|------------|---------------|--------------|
| Frequency  | $< 1$ sec     | 4 rdngs/sec  |
| Level      | $< 1$ sec     | 10 rdngs/sec |
| Distortion | $< 1$ sec     | 8 rdngs/sec  |
| SINAD      | $< 1$ sec     | 8 rdngs/sec  |
| S/N        | $< 2$ sec     | 1 rdngs/sec  |

**Frequency Measurement****Technique:**

Reciprocal measurement with 10 MHz timebase

**Physical and Environmental Specifications****General:**

Manufactured to the intent of MIL-T-28800E, Type III, Class 5, Style E

**Power Requirements:**

100, 120, 220, 240 volts AC,  $\pm$  10%, 50 to 400 Hz, 80 VA

**CCITT or C-MESSAGE Band-pass Filter**

$\pm$  0.2 dB; 800 Hz CCITT,

$\pm$  0.2 dB; 1000 Hz C-MESSAGE

$\pm$  1.0 dB; 300 to 3000 Hz

$\pm$  2.0 dB; 50 to 300 Hz, 3.0 to 3.5 kHz

$\pm$  3.0 dB; 3.5 to 5 kHz

**CCIR or CCIR/ARM Band-pass Filter****Accuracy:**

$\pm$  0.2 dB; 6.3 to 7.1 kHz

$\pm$  0.4 dB; 7.1 to 10 kHz

$\pm$  0.5 dB; 200 to 6300 Hz

$\pm$  1.0 dB; 31.5 to 200 Hz, 10 to 20 kHz

+ 2.0 dB -  $\infty$ ; 20 to 31.5 kHz

**Operating Temperature:** 0 to 55 degrees centigrade

**Operating Humidity:**  $<95 \pm 5\%$  non-condensing

**Warm-up Time:** 30 minutes

**Dimensions:**

17.34 inches (44.04 cm) wide, 5.88 inches

(14.9 cm) high, 18 inches (45.8 cm) deep

**Weight:** 25 lbs (11.3 kg)

**Accessories Included:**

Spare input, output and line fuses and AC power cord

**Accessories Available:**

950044 Rack mounting hardware

950043 Chassis slide kit

954018 Single binding post to BNC (M)

954019 BNC (F) to phono plug

954020 Phono jack to BNC (M)

954021 Two conductor shielded balanced line, 36"

954022 XLR Audio connector to three banana plugs

TABLE 1-1 PERFORMANCE SPECIFICATIONS

Options:

- 01 Rear panel input and output
- 11 400 Hz high-pass filter
- 12 CCITT band-pass filter
- 13 CCIR band-pass filter
- 15 A weighting filter
- 16 B weighting filter
- 17 C weighting filter
- 18 Audio band-pass filter
- 19 C-Message band-pass filter

Remote Interface:

IEEE-488-1978. Implements AH1, SH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0, and E1

Ventilation Requirements:

1-1/2 inch clearance after installation, top, side, rear

Temperature:

Non-Operating: -40 to 75 degrees C

AltitudeOperating: 10,000 Ft EEC,

Humidity: and 95% (non-condensing)

Battery Type: Refer to page 6-12

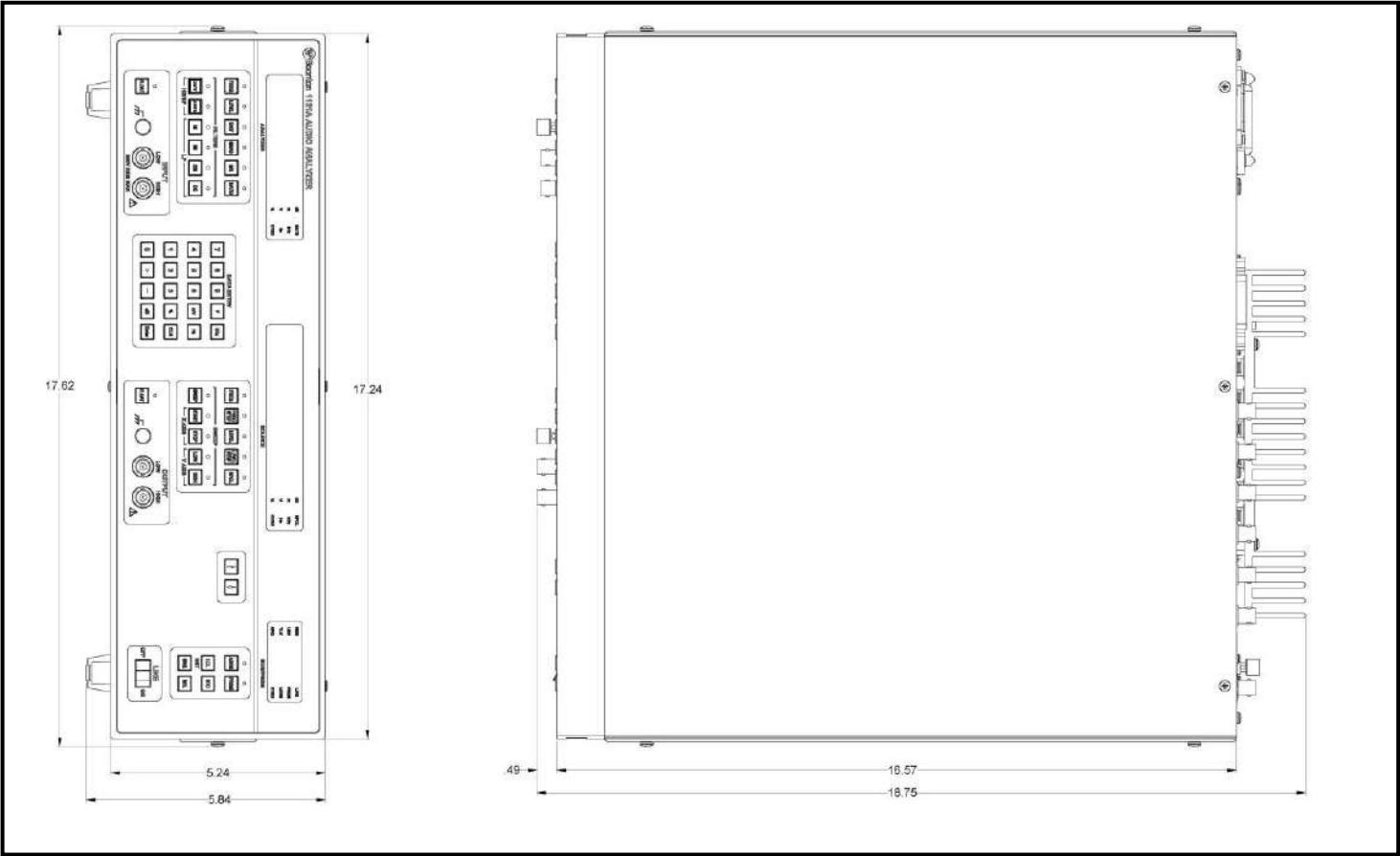


Figure 1-1. Outline Dimensions.

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## SECTION II INSTALLATION

### 2-1. INTRODUCTION.

**2-2.** This section contains the unpacking, mounting, power requirements, cable connections, and preliminary check-out instructions for the Model 1121A Audio Analyzer.

### 2-3. UNPACKING.

**2-4.** The instrument is shipped complete and is ready to use upon receipt. Unpack the instrument from its shipping container and inspect for damage that may have occurred during shipment. Refer to Figure 2-1.

### NOTE

*Save the packing material and container for possible use in reshipment of the instrument.*

### 2-5. MOUNTING.

**2-6.** For bench mounting choose a clean, sturdy, uncluttered mounting surface. For rack mounting, an accessory kit is available which provides mounting ears. The rack mounting kit contains the required hardware and instructions.

### 2-7. POWER REQUIREMENTS.

**2-8.** The instrument has a tapped power transformer and two line voltage selection switches which permit operation from 100, 120, 220, or 240 volt  $\pm 10\%$ , 50 to 400 Hz, single phase AC power sources.

### CAUTION

*Always make certain that the line voltage selection switches are set to the correct positions corresponding to the voltage of the AC power source, and that a fuse of the correct rating is installed before connecting the*

|                   |            |            |                 |
|-------------------|------------|------------|-----------------|
| VAC<br>$\pm 10\%$ | 100<br>120 | 220<br>240 | 50 to<br>400 Hz |
| Fuse              | 3/4 A T    | 3/8 A T    | 80 VA           |

*instrument to any AC power source.*

**2-9.** Set the rear panel line voltage selector switches to the appropriate positions as indicated in the Line Voltage

Select Chart and check that the line fuse is correct for the selected power source.

### 2-10. CABLE CONNECTIONS.

#### 2-11. Front panel connector:

**INPUT.** Analyzer Input HIGH and LOW BNC type connectors and chassis ground allow connection of external audio signals for analysis. The input impedance is 100 k ohms either side to ground. The LOW terminal is connected to chassis ground in the non-floating mode.

**OUTPUT.** Source output HIGH and LOW BNC type connectors and chassis ground allow connection to external devices and components. The output impedance is selected using special functions 75, 76, and 77. The LOW terminal is connected to chassis grounding the non-floating mode.

#### 2-12. Rear panel connectors:

**MONITOR.** The MONITOR BNC type output connector provides a scaled output of the input signal in the level, frequency and signal-to-noise measurement modes and a scaled output of the input signal with the fundamental removed in the distortion and SINAD measurement modes. The output impedance is 600 ohms.

**X CLK.** The X CLK BNC type input connector provides a means of connecting to an external 10 MHz counter reference. The external reference is automatically selected when a TTL level signal is present.

**SYNC.** The SYNC BNC type output connector provides a TTL compatible signal relative to the source frequency setting.

**X AXIS.** The X AXIS BNC type output connector provides a 0 to 5 volt d.c. level relative to the sweep frequency or level in the sweep mode. The output impedance is 1000 ohms.

**Y AXIS.** The Y AXIS BNC type output connector provides a 0 to 5 volt d.c. level relative to the analyzer measurement and entered HIGH and LOW plot limits. The output impedance is 1000 ohms.

**PEN.** The PEN BNC type output connector provides a TTL compatible signal to control the pen of an external recorder.

**2-13. PRELIMINARY CHECK.**

**2-14.** The preliminary check verifies that the Model 1121A is operational and should be performed before the instrument is placed into use. To perform the preliminary check, set the front panel LINE switch to ON. Wait several seconds then depress the LCL/INIT key. The SOURCE display will contain the instrument firmware number and the other displays will contain dashes for a period of about two seconds. The SOURCE display will then contain 1000.00 Hz with the KYBD legend illuminated. The ANALYZER display will contain the  message for one level measurement cycle. The initialize sequence resets all functions and operating modes of the Model 1121A to the initialized values and conditions listed in Table 2-1.

**TABLE 2-1. INITIAL CONDITIONS.**

| Analyzer Group:                                                                                                                          | Source Group:                                                                                                                                                                                                                                     | Sweep Group:                                                                                                     | Bus/Prgm Group:                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| LEVEL function enabled<br>Linear display units<br>RATIO mode disabled<br>Filters disabled<br>FLOAT mode disabled<br>RMS detector enabled | KYBD legend illuminated<br>FREQ function enabled<br>FREQ set to 1000.00 Hz<br>FREQ STEP set to 0.000 Hz<br>LEVEL set to 0.0 mV<br>LEVEL STEP set to 0.0 mV<br>SPCL functions 0, 10, 40, 55, 63, 70, 77, and 80 are selected<br>FOAT mode disabled | SWEEP disabled<br>START set to 20.000 Hz<br>STOP set to 20.000 kHz<br>LOW set to 0.000 mV<br>HIGH set to 300.0 V | ADRS is unchanged<br>PRGM is set to 99<br>SRQ is cleared<br>Bus status is unchanged |

**2-15.** Program location 99 is a recall-only location which contains the initialize values. The operating conditions at the time the instrument power is interrupted are maintained in non-volatile memory and restored when power to the Model 1121A is resumed.

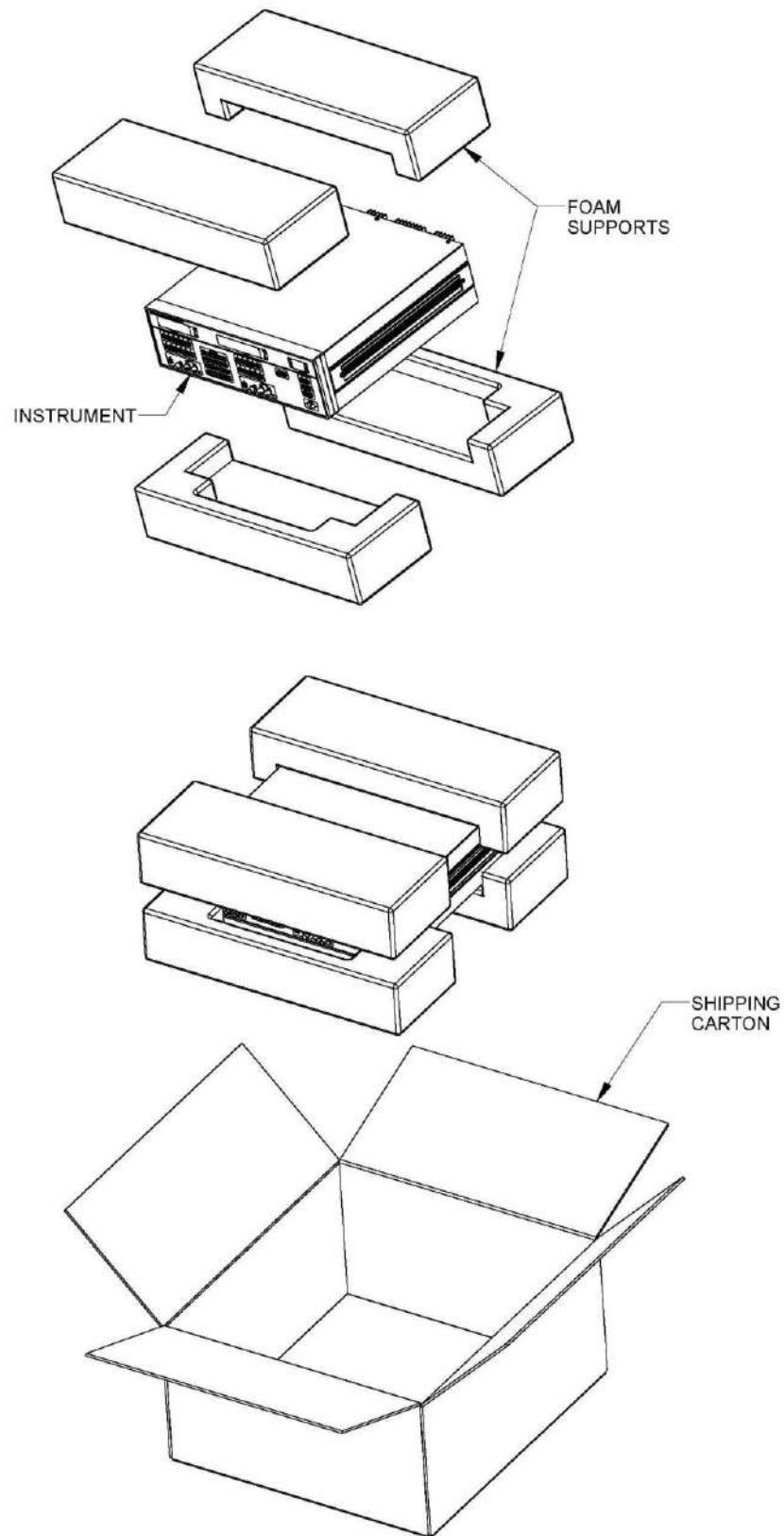


Figure 2-1. Packing and Unpacking Diagram.

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## SECTION III OPERATION

### 3-1. INTRODUCTION.

**3-2.** This section contains the operating instructions for the Model 1121A Audio Analyzer.

### 3-3. OPERATING CONTROLS, INDICATORS AND CONNECTIONS.

**3-4.** The controls, indicators and connectors used during the operation of the instrument are listed in Table 3-1 and shown in Figures 3-1 and 3-2.

### 3-5. OPERATING INSTRUCTIONS.

**3-6.** The operating instructions for the Model 1121A are divided into sections of Initial Conditions, Local Operation and Remote Operation.

### 3-7. INITIAL CONDITIONS.

**3-8.** Initialize the instrument as follows:

- a. Connect the power cord to the instrument and to the desired power source. Refer to paragraph 2-7 for proper power application.
- b. Set the front panel power switch to ON.
- c. Depress the LCL/INIT key.
- d. The SOURCE display will contain the instrument firmware identification number and the other displays will contain dashes for a period of about two seconds. The SOURCE display will then contain 1000.00 Hz with the KYBD legend illuminated and the ANALYZER display will change to contain the  message for one level measurement cycle.

### 3-9. LOCAL OPERATION.

**3-10. Function Selection.** The DATA ENTRY keypad is common to all functions of the Model 1121A. The KYBD legend determines the active display window to which the DATA ENTRY keypad is dedicated at any given time. To select a function simply depress the function key desired. The results will be the LED of the function key will be illuminated, the current value of the selected function will be displayed in the window above the key, and the KYBD legend will be illuminated in the display window. The DATA ENTRY keypad is dedicated to the selected function and any unit selection or number entry will appear in the active display window. When selecting

measurement functions the  message may appear to indicate that a measurement cannot be displayed instantly for any of five possible reasons:

1. The first measurement cycle is in progress and cannot be displayed.
2. The measurements' minimum signal requirements are not met, for example, frequency measurements cannot be made if the input level is too low.
3. The input level is overrange.
4. The input signal is changing faster than the analyzer can respond.
5. The notch filter is in the process of being tuned to the fundament frequency in the distortion or SINAD modes.

**3-11. Data Entry Operation.** Once a function has been selected, new values may be entered with the DATA ENTRY keypad. To enter data simply depress the desired digit keys followed by the appropriate unit key or ENTER key. During digit selection a (') mark will appear in the display to the left of the first digit selected to indicate the number in the display is in the process of being entered. No action is taken until the unit or ENTER key is depressed. The unit keys can also be used aside from number entry to select display modes. For example, to change the level measurement displayed in mV to logarithmic units in dBV, simply select the analyzer LEVEL key and depress the dB key in the DATA ENTRY keypad. The display program will calculate and display the logarithmic value. The ENTER key serves a dual function as a dimensionless unit key for SPCL, ADRS, and PRGM number entry and also as a default unit terminator of V, %, and Hz for functions where more than one unit can be selected.

**3-12.** Many of the Model 1121A functions have multiple display and entry modes. Listed in Table 3-2, Function Display And Data Entry Units, are the display legends which can be active for each function along with the unit keys in the DATA ENTRY keypad which select the available display modes. Argument entry ranges for all the Model 1121A functions are described in Table 3-3, Valid Function Argument Range. Number entry out of range of the selected functions will result in an error displayed in the SOURCE display window. Errors can be cleared by depressing any key. If at any time prior to entry a wrong digit is entered, depress the CLR key to clear and restore the previous display.

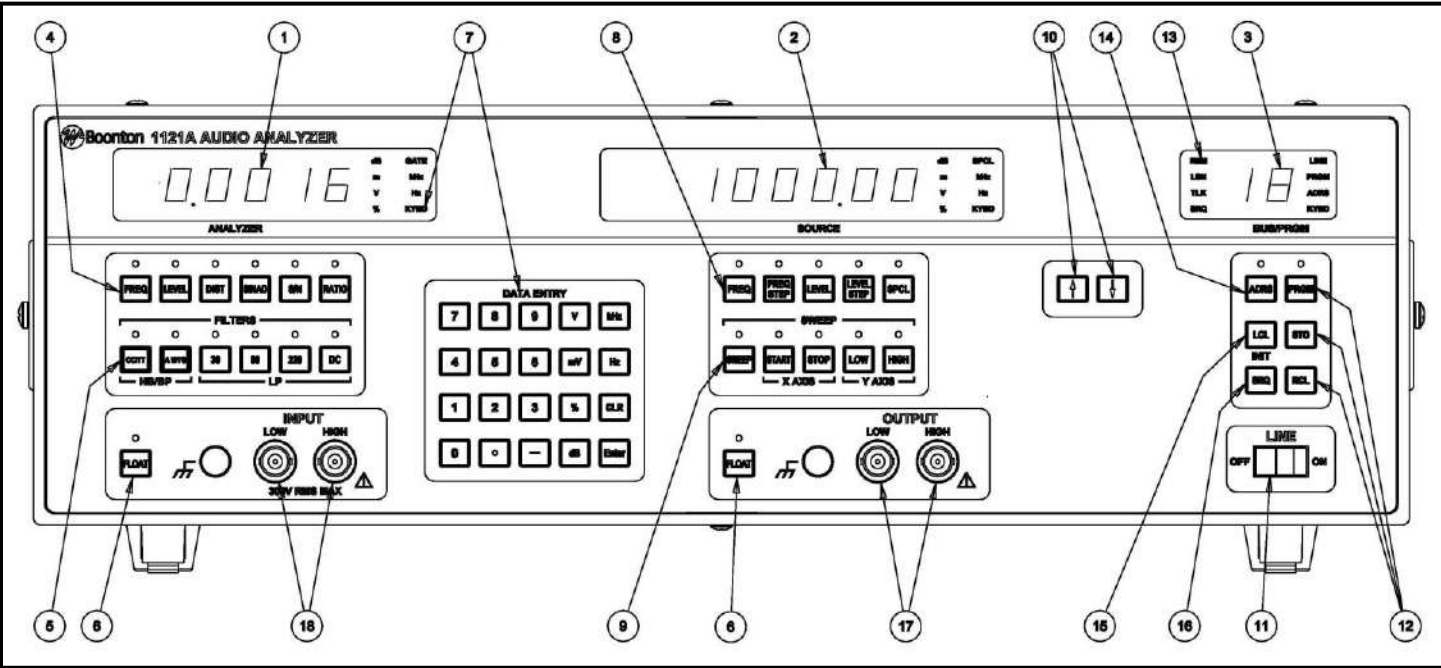


Figure 3-1. Model 1121A, Front View

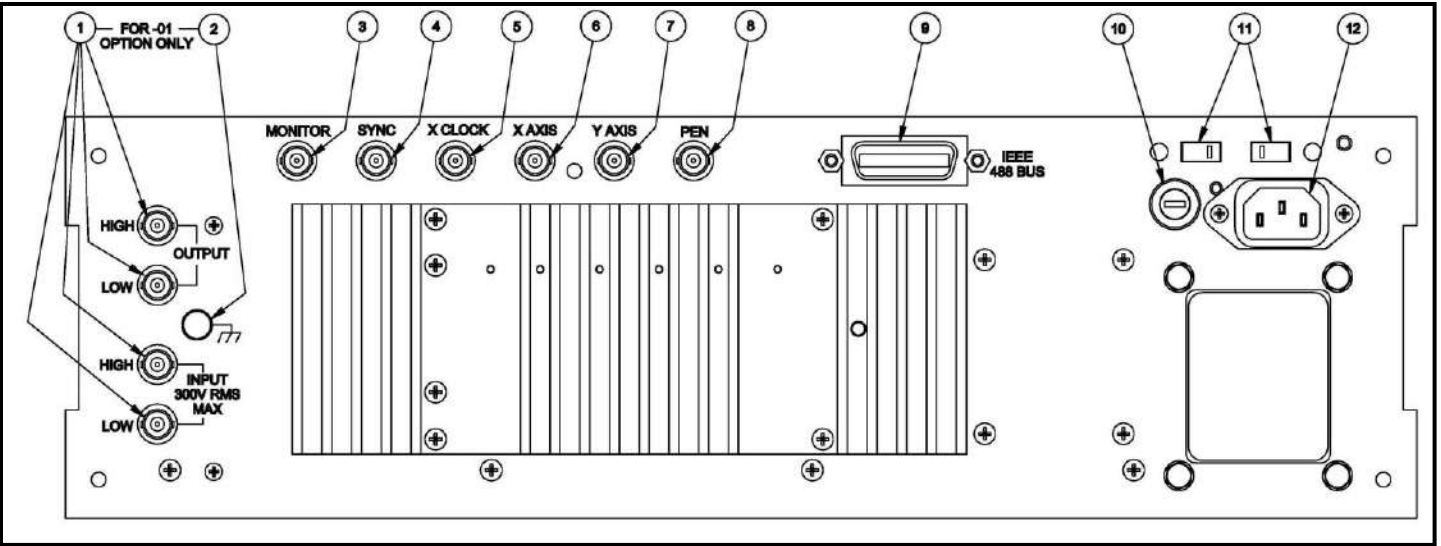


Figure 3-2. Model 1121A, Rear View

TABLE 3-1. CONTROLS, INDICATORS AND CONNECTORS.

| Control, Indicator, or Connector | Figure and Index No. | Function                                                                                                                                                                                               |
|----------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ANALYZER display                 | 3-1,1                | Displays frequency, AC and DC level, distortion, SINAD, S/N and ratio measurements. (6 digit LED display)                                                                                              |
| SOURCE display                   | 3-1,2                | Displays source frequency and level, frequency and level step sizes, special function, start, stop, low and high sweep values. Alternately displays error codes and messages. (8 digit LED display)    |
| BUS/PRGM display                 | 3-1,3                | Displays current program number or IEEE-488 bus address. (2 digit LED display)                                                                                                                         |
| ANALYZER keys                    | 3-1,4                | Selects the following active analyzer functions.                                                                                                                                                       |
| FREQ key                         |                      | Displayed in Hz or kHz with GATE indication.                                                                                                                                                           |
| LEVEL key                        |                      | Displayed in V, mV, dBV or dBm.                                                                                                                                                                        |
| DIST key                         |                      | Displayed in %, dB, dBV, dBm, V, or mV. Notch tune frequency displayed in Hz or kHz. Notch capable of automatic or manual tuning.                                                                      |
| SINAD key                        |                      | Displayed in dB. Notch filter is tuned to the source frequency setting.                                                                                                                                |
| S/N key                          |                      | Displayed in dB. Measured by monitoring the AC level while turning the source level on and off.                                                                                                        |
| RATIO key                        |                      | Displays amplitude ratios in % or dB and frequency ratios in Hz or kHz.                                                                                                                                |
| FILTER keys                      | 3-1, 5               | Selects optional filters, 30 kHz, 80 kHz, 220 kHz low-pass or DC level filters.                                                                                                                        |
| FLOAT keys                       | 3-1, 6               | Selects floating or single-ended input and output connection.                                                                                                                                          |
| DATA ENTRY keypad                | 3-1, 7               | Used with the function keys to enter data into the active display designated by the KYBD annunciator.                                                                                                  |
| SOURCE keys                      | 3-1, 8               | Selects the following active functions.                                                                                                                                                                |
| FREQ key                         |                      | Allows display and entry of the source frequency in Hz or kHz units.                                                                                                                                   |
| FREQ STEP key                    |                      | Allows display and entry of the frequency increment value in Hz or kHz units for use with the step keys and the linear frequency sweep mode.                                                           |
| LEVEL key                        |                      | Allows display and entry of the source level in mV, V, dBV or dBm units.                                                                                                                               |
| LEVEL STEP key                   |                      | Allows display and entry of the level increment value in mV, V, or dB units for use with the step keys and the linear and log level sweep mode.                                                        |
| SPCL key                         |                      | Allows alteration to the normal analyzer modes of operation such as: range hold, notch tune hold, slow responding detector, and special modes for testing, troubleshooting, and automatic calibration. |

TABLE 3-1. CONTROLS, INDICATORS AND CONNECTORS CONTINUED.

| Control, Indicator, or Connector | Figure and Index No. | Function                                                                                                                                              |
|----------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SWEEP keys</b>                | <b>3-1, 9</b>        | Selects the following sweep parameters.                                                                                                               |
| <b>SWEEP key</b>                 |                      | Enables the start of the sweep sequence and indicates sweep in progress.                                                                              |
| <b>START key</b>                 |                      | Allows display and entry in Hz or kHz units of the starting sweep frequency or in mV, V, dBV or dBm units of the starting sweep level.                |
| <b>STOP key</b>                  |                      | Allows display and entry in Hz or kHz units of the ending sweep frequency or in mV, V, dBV or dBm units of the ending sweep level.                    |
| <b>HIGH key</b>                  |                      | Allows display and entry of the upper Y axis scale value in units compatible with the active analyzer measurement mode.                               |
| <b>LOW key</b>                   |                      | Allows display and entry of the lower Y axis scale value in units compatible with the active analyzer measurement mode.                               |
| <b>Step keys</b>                 | <b>3-1, 10</b>       | Step keys increment or decrement the active source or sweep function in frequency or level step sizes and single steps the program location function. |
| <b>LINE switch</b>               | <b>3-1, 11</b>       | Switches the instrument AC power on or off.                                                                                                           |
| <b>PROGRAM keys</b>              | <b>3-1, 12</b>       | Selects the following program functions                                                                                                               |
| <b>PRGM key</b>                  |                      | Allows display and entry of the store/recall program location.                                                                                        |
| <b>STO key</b>                   |                      | Stores the instrument setup at the current program location.                                                                                          |
| <b>RCL key</b>                   |                      | Recalls the instrument setup at the current program location.                                                                                         |
| <b>Bus status</b>                | <b>3-1, 13</b>       | Displays the current IEEE-488 bus status; REM (remote enabled), LSN (listener addressed), TLK (talker active), and SRQ (service request).             |
| <b>ADRS key</b>                  | <b>3-1, 14</b>       | Allows display and entry of IEEE-488 bus address.                                                                                                     |
| <b>LCL/INIT key</b>              | <b>3-1, 15</b>       | Causes the instrument to "go-to-local" when remote enabled otherwise executes the initialize sequence.                                                |
| <b>SRQ key</b>                   | <b>3-1, 16</b>       | Sets the IEEE-488 bus SRQ line true.                                                                                                                  |
| <b>OUTPUT connectors</b>         | <b>3-1, 17</b>       | LOW and HIGH. Used to connect the source to external devices. The LOW terminal is connected to chassis ground in the non-floating mode.               |
| <b>INPUT connectors</b>          | <b>3-1, 18</b>       | LOW and HIGH. Used to apply an external audio signal for analysis. The LOW terminal is connected to chassis ground in the non-floating mode.          |
| <b>Optional connectors</b>       | <b>3-2, 1</b>        | Used to replace the front panel input and output connectors.                                                                                          |

TABLE 3-1. CONTROLS, INDICATORS AND CONNECTORS CONTINUED.

| Control,<br>Indicator,<br>or Connector | Figure<br>and Index<br>No. | Function                                                                                                                                                                                         |
|----------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ground connector                       | 3-2, 2                     | Chassis ground connector.                                                                                                                                                                        |
| MONITOR connector                      | 3-2, 3                     | Provides a scaled output of the input signal in the frequency, level and S/N modes. Provides a scaled output of the input signal with the fundamental removed in the distortion and SINAD modes. |
| SYNC connector                         | 3-2, 4                     | Provides a TTL compatible output relative to the source frequency.                                                                                                                               |
| X CLK connector                        | 3-2, 5                     | Provides a TTL compatible input for an external 10 MHz timebase reference. Automatic switching to external reference when present.                                                               |
| X AXIS connector                       | 3-2, 6                     | Provides a 0 to 5 v DC output for plotter application.                                                                                                                                           |
| Y AXIS connector                       | 3-2, 7                     | Provides a 0 to 5 v DC output for plotter application.                                                                                                                                           |
| PEN connector                          | 3-2, 8                     | Provides a TTL compatible output for plotter pen control.                                                                                                                                        |
| IEEE-488 connector                     | 3-2, 9                     | Provides a means for connecting the standard IEEE-488 bus interface cable.                                                                                                                       |
| Fuse holder                            | 3-2, 10                    | AC line fuse holder.                                                                                                                                                                             |
| Line voltage<br>selector switches      | 3-2, 11                    | Selects the desired line operating voltage.                                                                                                                                                      |
| AC connector                           | 3-2, 12                    | AC power connector.                                                                                                                                                                              |

**3-13. Analyzer Measurement Description.** The Model 1121A contains an independent distortion analyzer which can measure frequency, AC and DC level, distortion, SINAD and signal-to-noise. In addition, ratio measurements can be made with all analyzer measurement modes. A wide range of special functions enhance the basic measurement modes without sacrificing the simplified operation of the analyzer. Standard and optional audio filters are provided to aid in harmonic distortion analysis and weighted noise measurements. Finally, the ability to store and recall specific measurement combinations aid in configuring measurement applications for manual and remote use.

**3-14. Analyzer Input Description.** The input configuration of the Model 1121A can be selected for single-ended or balanced/differential operation. The input mode can be enabled using the front panel FLOAT key or over the IEEE-488 bus interface.

**3-15. Frequency Measurement Function.** The Model 1121A measures wide ranges of audio frequency with high accuracy and resolution. Microprocessor control of the reciprocal counter results in automatic selection of frequency ranges for maximum resolution. Measurements are referenced to an internal 10 MHz timebase accurate to 0.0001% and external reference capability is also provided.

**3-16. Frequency Measurement Display Units.** Frequency measurements can be displayed in Hz or kHz for values above 199.999 Hz with automatic selection of Hz units below this limit. To select the Frequency measurement functions simply depress the FREQ key which illuminates both the key's LED and the KYBD legend in the ANALYZER display. Display units can then be selected by depressing the Hz or kHz keys.

**3-17. Special Frequency Measurement Modes.** Special function 11 is provided to preset and hold specific level ranges for frequency measurement. Refer to paragraph 3-65. The frequency measurement mode can function to input levels 14 db below the selected level range. For example by setting the 3.000 volt level range, measurements can be made with signal levels as low as 600 mV.

**3-18. Level Measurement Function.** The Model 1121A measures both AC and DC voltage with high dynamic range and selectable AC bandwidth. Resolution at full scale is 3000 counts with an additional 33% overrange capability. The AC rms detector is true rms responding for signals with crest factors less than 3. Average and quasi-peak responding detectors (rms calibrated) can also be selected. Refer to paragraph 3-74. A period sampling measurement technique is employed which results in adaptive measurement rates optimized to the period of the dominant AC component of the input signal.

This technique yields fast settled measurements in the AC level mode while effectively filtering large AC components in the DC level mode. Measurement bandwidth is selectable using the standard and optional filters to reject out-of-band noise or provide industry-standard weighting characteristics.

**3-19. Level Measurement Display Units.** AC and DC level measurements can be displayed in linear or logarithmic units. Linear measurements are displayed in mV or V with V automatically selected for levels above 750 mV and mV automatically selected for levels below 0.300 V. Logarithmic measurements are displayed in various forms. The default mode uses dBV units (dB relative to 1.000 V rms). Power in dBm units (dB relative to 1 mW) can be selected for various impedances as described in paragraph 3-74. To select the Level measurement function simply depress the LEVEL key which illuminates both the key's LED and the KYBD legend in the ANALYZER display. The various display modes can then be selected by depressing the appropriate units associated with the desired display mode. For example, to select AC level in logarithmic units depress the dB key and to return the display to linear units depress the mV or V keys.

**3-20. Special Level Measurement Modes.** Special function 11 is provided to preset and hold specific level ranges to achieve faster first measurement rates and to eliminate possible range-to-range nonlinearity. Refer to paragraph 3-65. Special function 17 extends the measurements sampling period to provide a more consistent reading in the presence of noise. AC and DC calibration is performed through the use of special function codes 20 through 24. The rms, average or quasi-peak AC detector type can be selected using special function 70, 71 or 72, respectively. Special functions 80 through 86 select logarithmic display modes in dBV or dBm units.

**3-21. Distortion Measurement Function.** The Model 1121A measures total harmonic distortion and noise over a wide range of frequency. The notch filter is automatically tuned to reject the fundamental frequency and pass only the harmonic and noise content. The AC measurement techniques are similar to those used in the level measurement function yielding fast settled measurements. Measurement bandwidth is selectable to reject noise while accurately preserving harmonic components. Measurement results can be displayed in several forms. The combination of harmonics and noise can be displayed as an absolute level in mV, V, dBV or dBm units or as a ratio in % or dB units to the total input signal consisting of fundamental, harmonics and noise.

**3-22. Distortion Measurement Display Units.** Distortion measurements can be displayed in linear or logarithmic units. Linear ratiometric measurements are

displayed in % while logarithmic measurements are displayed in dB where 0.00 dB is referenced to 100.0%. Distortion measurements can also be displayed as an absolute level in units of mV, V, dBV or dBm. The distortion level display mode is useful to measure noise level in the presence of a holding tone. The holding tone is removed by the notch filter and the noise level alone is measured and displayed. In addition the frequency of the displayed in Hz or kHz units. To select the distortion measurement function simply depress the DIST

key which illuminates both the key's LED and the KYBD legend in the ANALYZER display. The various display modes can then be selected by depressing the the appropriate units associated with the desired display mode. For example, to select distortion level in logarithmic units (dBV or dBm) depress the DIST key followed in sequence by the mV or V keys and the dB key. The mV or V keys select the distortion measurement to be displayed as an absolute level and the dB key converts the results to logarithmic unit.

**TABLE 3-2. FUNCTION DISPLAY AND DATA ENTRY UNITS.**

| Function               | Display Legends             | Unit Keys           | Default Units (ENTER Key) |
|------------------------|-----------------------------|---------------------|---------------------------|
| <b>ANALYZER GROUP:</b> |                             |                     |                           |
| FREQ                   | Hz kHz                      | mV V Hz kHz         | V                         |
| LEVEL                  | mV V dBV dBm                | mV V dB             | V                         |
| DIST                   | mV V Hz kHz<br>% dB dBV dBm | mV V Hz kHz<br>% dB | %                         |
| SINAD                  | dB                          | mV V dB             | dB                        |
| S/N                    | dB                          | dB                  | no entry                  |
| RATIO                  | % dB                        | % dB                | no entry                  |
| <b>SOURCE GROUP:</b>   |                             |                     |                           |
| FREQ                   | Hz kHz                      | Hz kHz              | Hz                        |
| FREQ STEP              | Hz kHz                      | Hz kHz              | Hz                        |
| LEVEL                  | mV V dBV dBm                | mV V dB             | V                         |
| LEVEL STEP             | mV V dB                     | mV V dB             | V                         |
| SPCL                   | SPCL                        | ENTER               | dimensionless             |
| START                  | mV V Hz kHz<br>dBV dBm      | mV V Hz kHz<br>dB   | Hz                        |
| STOP                   | mV V Hz kHz<br>dBV dBm      | mV V Hz kHz<br>dB   | Hz                        |
| LOW                    | mV V Hz kHz<br>% dB dBV dBm | mV V Hz kHz<br>% dB | V                         |
| HIGH                   | mV V Hz kHz<br>% dB dBV dBm | mV V Hz kHz<br>% dB | V                         |
| <b>BUS/PRGM GROUP:</b> |                             |                     |                           |
| ADRS                   | ADRS                        | ENTER               | dimensionless             |
| PRGM                   | PRGM                        | ENTER               | dimensionless             |

TABLE 3-3. VALID FUNCTION ARGUMENT RANGE.

| Function               | Argument Range    | Entry Action                        | Error No. |
|------------------------|-------------------|-------------------------------------|-----------|
| <b>ANALYZER GROUP:</b> |                   |                                     |           |
| FREQ                   | 0 mV to 300 V     | Set input level range               | 12        |
| LEVEL                  | 0 mV to 300 V     | Set input level range               | 13        |
| DIST                   | 0 mV to 300 V     | Set input level range               | 14        |
|                        | 0 to 100%         | Set distortion range (lin)          | 14        |
|                        | -140 to 0.0 dB    | Set distortion range (log)          | 14        |
|                        | 5 Hz to 140 kHz   | Set notch tune frequency            | 14        |
| SINAD                  | 0 mV to 300 V     | Set input level range               | 15        |
|                        | 0 to 140 dB       | Set SINAD range (log)               | 15        |
| S/N                    | no entry allowed  |                                     | 20        |
| RATIO                  | no entry allowed  |                                     | 17        |
| <b>SOURCE GROUP:</b>   |                   |                                     |           |
| FREQ                   | 10 Hz TO 150 kHz  | Set source frequency                | 01        |
| FREQ STEP              | 0 Hz to 150 kHz   | Set frequency increment             | 02        |
| LEVEL <sup>1</sup>     | 0 mV to 16 V      | Set open circuit output level (lin) | 03        |
|                        | -140 to 24.08 dBV | Set open circuit output level (log) | 03        |
| LEVEL STEP             | 0 mV to 16 V      | Set level increment (lin)           | 04        |
|                        | 0 to 140 dB       | Set level increment (log)           | 04        |
| SPCL                   | See TABLE 3-7     | See TABLE 3-7                       | 05        |
| START <sup>1</sup>     | 10 Hz to 150 kHz  | Set sweep start frequency           | 06        |
|                        | 0 mV to 16 V      | Set sweep start level (lin)         | 06        |
|                        | -140 to 24.08 dBV | Set sweep start level (log)         | 06        |
| STOP <sup>1</sup>      | 10 Hz to 150 kHz  | Set sweep stop frequency            | 07        |
|                        | 0 mV to 16 V      | Set sweep stop level (lin)          | 07        |
|                        | -140 to 24.08 dBV | Set sweep stop level (log)          | 07        |
| LOW                    | -300 to 300 V     | Set low plot limit (lin)            | 08        |
|                        | -30000 to 30000%  | Set low plot limit (lin)            | 08        |
|                        | -140 to 49.54 dB  | Set low plot limit (log)            | 08        |
|                        | -49.54 to 140 dB  | Set low plot limit (S/N, SINAD)     | 08        |
|                        | -300 to 300 kHz   | Set low plot limit (lin)            | 08        |
| HIGH                   | -300 to 300 V     | Set high plot limit (lin)           | 09        |
|                        | -30000 to 30000%  | Set high plot limit (lin)           | 09        |
|                        | -140 to 49.54 dB  | Set high plot limit (log)           | 09        |
|                        | -49.54 to 140 dB  | Set high plot limit (S/N, SINAD)    | 09        |
|                        | -300 to 300 kHz   | Set high plot limit (lin)           | 09        |
| <b>BUS/PRGM GROUP:</b> |                   |                                     |           |
| ADRS                   | 0 to 30           | Set IEEE-488 bus address            | 10        |
| PRGM                   | 0 to 99           | Set store/recall location           | 11        |

NOTE<sup>1</sup> Amplitude values can be entered and displayed in dBm units. The allowable argument range for dBm values varies based on the source and load impedance settings and is limited by the open-circuit voltage range.

**3-23. Special Distortion Measurement Modes.** Special functions 12 and 13 are provided to preset and hold specific input level and distortion ranges. Refer to paragraph 3-65. Special function 17 extends the measurements sampling period to provide a more consistent reading in the presence of noise. Using special function 14, notch filter tuning can be held at specific frequencies to aid in tuning the notch filter in the event that a stable frequency measurement cannot be achieved or to enable notch filter tuning to frequencies other than the fundamental. As with all amplitude measurement functions, the rms, average, or quasi-peak detector type can be selected using special function 70, 71 or 72, respectively. Special functions 80 through 86 select logarithmic distortion level display units in dBV or dBm.

**3-24. SINAD Measurement Function.** The Model 1121A measures SINAD (signal-to-noise and distortion) in the same manner as the distortion measurement except that the notch filter is tuned and held at the source frequency to permit measurements in the presence of large amounts of noise. If an external oscillator is used, it must be tuned to within 3% of the source frequency setting. The AC measurement techniques are similar to those used in the level measurement function yielding fast settled measurements. Measurement bandwidth is selectable to reject noise while accurately preserving harmonic components. The combination of harmonics and noise is displayed as a percentage of the total input signal consisting of fundamental, harmonics and noise.

**3-25. SINAD Measurement Display Units.** SINAD measurements are only displayed in dB units. To select the SINAD measurement function simply depress the SINAD key which illuminates both the key's LED and the KYBD legend in the ANALYZER display.

**3-26. Special SINAD Measurement Modes.** Special functions 12 and 12 are provided to preset and hold specific input level and SINAD ranges. Refer to paragraph 3-65. Special function 17 extends the measurements sampling period to provide more consistent readings in the presence of noise. When measuring large amounts of noise (0 to 10 dB SINAD), the notch filter turning may become indeterminate and causes the  to be displayed. Special function 15 is designed to disable the  message in this circumstance. As with all amplitude measurement functions, the rms, average, or quasi-peak detector type can be selected using special function 70, 71 or 72, respectively.

**3-27. S/N Measurement Function.** The Model 1121A measures S/N (signal-to-noise) by alternately turning the source output on and off and displaying the ratio of the two measurements. The measurement techniques are similar to those used by the level measurement mode. Measurement bandwidth is selectable using the filters to reject out of band noise or provide industry standard weighting characteristics.

**3-28. S/N Measurement Display Units.** S/N measurements are only displayed in dB units. To select the S/N measurement function simply depress the S/N key which illuminates both the key's LED and the KYBD legend in the ANALYZER display.

**3-29. Special S/N Measurement Modes.** Special function 17 extends the measurement sampling period to provide more consistent readings in the presence of noise. Special functions 40 through 49 are used to program the amount of delay between the signal measurement and noise measurement to allow time for the device under test to respond to the change in amplitude. As with all amplitude measurement functions, the rms, average, or quasi-peak detector type can be selected using special functions 70, 71, and 72.

**3-30. Using the Ratio Mode.** The Model 1121A enables all measurement modes to be displayed as a relative value to a previous measurement value. In a ratiometric measurement, such as flatness response, amplitude measurements at various frequencies are displayed relative to a reference level at a frequency of 1 kHz. Another sample of a ratiometric measurement is the measurement of the percent of AC ripple on a DC level.

**3-31 Ratio Measurement Display Units.** Ratiometric level measurements are displayed in % or dB units whereas relative frequency measurements are displayed in Hz or kHz. To select the ratio mode simply depress an analyzer measurement key such as LEVEL followed by the RATIO key. The LEDs of both keys will be illuminated along with the KYBD legend in the ANALYZER display. When the next measurement cycle is complete, the measurement value will become the ratio reference and the display will indicate 100.00%, 0.00 dB or 0.000 Hz depending on the previous log/linear display mode.

TABLE 3-4. INPUT LEVEL RANGES.

| AC Level Ranges:                                                                                                                                                                                                                                                                                                                                                                           | DC Level Ranges:                                                                                                                      | Distortion and SINAD Input Level Ranges                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 300.0 to 150.1 V<br>150.0 to 75.1 V<br>75.00 to 30.1 V<br>30.00 to 15.01 V<br>15.00 to 7.51 V<br>7.500 to 3.01 V<br>3.000 to 1.501 V<br>1500 to 751 mV<br>750.0 to 301 mV<br>300.0 to 150.1 mV<br>150.0 to 75.1 mV<br>75.00 to 30.1 mV<br>30.00 to 15.01 mV<br>15.00 to 7.51 mV<br>7.500 to 3.01 mV<br>3.000 to 1.501 mV<br>1.500 to 0.751 mV<br>0.7500 to 0.301 mV<br>0.3000 mV and below | 300.0 to 150.1 V<br>150.0 to 75.1 V<br>75.00 to 30.1 V<br>30.00 to 15.01 V<br>15.00 to 7.51 V<br>7.500 to 3.01 V<br>3.000 V and below | 300.0 to 150.1 V<br>150.0 to 75.1 V<br>75.00 to 30.1 V<br>30.00 to 15.01 V<br>15.00 to 7.51 V<br>7.500 to 3.01 V<br>3.000 to 1.501 V<br>1500 to 751 mV<br>750.0 to 301 mV<br>300.0 to 150.1 mV<br>150.0 to 100.1 mV<br>100.0 to 50.1 mV<br>50.0 mV and below |

Selection of display units can be made by depressing either the %, dB, kHz or Hz keys. On subsequent measurement cycles the results will be displayed relative to the original ratio reference. The RATIO key is an alternate action key, therefore, depressing the RATIO key again will deselect the ratio mode, extinguish the key's LED and return the display to the normal measurement mode. If another measurement function is selected while the ratio mode is active, the LED on the RATIO key will be extinguished but the ratio reference is preserved for the original measurement function and can be reactivated by depressing the original measurement function key. The ratio mode is limited to only one reference value and the old ratio reference is lost if the ratio mode is activated in an alternate measurement function.

**3-32 Using Analyzer Filters.** The audio filter keys are alternate action keys which means they are "toggled" on and off with each key stroke. The optional filters are mutually exclusive; therefore, depressing one of the keys will cancel the other. The same is true of the low-pass filters, only one low-pass filter can be used at a time. The DC filter, however, is mutually exclusive with all filters and will also be canceled by selecting any measurement functions other than Level.

**3-33.** The minimum bandwidth consistent with the measurement bandwidth should be used to minimize noise errors. For example, when measuring the distortion of a 1 kHz fundamental tone, the 30 kHz low-pass filter is recommended. The DC low-pass filter is provided to attenuate all AC components and measure DC level directly. The DC low-pass filter can only be activated in

the analyzer level mode. Band-pass filters are combinations of high- and low-pass filters and are used in some measurements to simulate the sensitivity of the human ear to the audible frequency spectrum. High-pass filter selection is used to eliminate power line harmonics when present. The 400 Hz high-pass filter typically provides more than 80 dB of attenuation at 60 Hz.

**3-34.** The CCIR filter is a special case since its application depends on whether the average or quasi-peak detector is selected. The CCIR recommendation 468-3 specifies the filter should be used with the quasi-peak detector. Another application referred to as the CCIR/ ARM calls for using the average responding meter (ARM) and applying a gain correction value of -6.6 dB. The Model 1121A will accommodate both applications. The average or quasi-peak detector can be selected using special function 71 or 72 respectively. The level readings will also be adjusted by -6.6 dB automatically when the average detector is selected.

**3-35. Audio Oscillator General Description.** The Model 1121A contains a variable frequency, low distortion audio oscillator and a precision programmable amplifier/attenuator. The oscillator frequency tuning uses a frequency lock technique under microprocessor control to yield high accuracy and resolution. The output level can be varied in very fine increments over a wide range of levels. Levels can be set in either linear or logarithmic units to accommodate existing test procedures and applications. The oscillator incorporates a user configurable sweep

**TABLE 3-5. DISTORTION AND SINAD RANGES.**

| Linear:             | Logarithmic:        |
|---------------------|---------------------|
| 100.0 to 50.01%     | 0.00 to -6.01 dB    |
| 50.00 to 20.01%     | -6.02 to -13.97 dB  |
| 20.00 to 10.01%     | -13.98 to -19.99 dB |
| 10.00 to 5.001%     | -20.00 to -26.01 dB |
| 5.000 to 2.001%     | -26.02 to -33.97 dB |
| 2.000 to 1.001%     | -33.98 to -39.99 dB |
| 1.000 to 0.5001%    | -40.00 to -46.01 dB |
| 0.5000 to 0.2001%   | -46.02 to -53.97 dB |
| 0.2000 to 0.1001%   | -53.98 to -59.99 dB |
| 0.1000 to 0.05001%  | -60.00 to -66.01 dB |
| 0.05000 to 0.02001% | -66.02 to -73.97 dB |
| 0.02000 to 0.01001% | -73.98 to -79.99 dB |
| 0.01000% and below  | -80.00 dB and below |

mode which can be programmed to sweep frequency or level in logarithmic or linear increments.

**3-36. Oscillator Output Description.** The output configuration of the Model 1121A can be selected for single-ended or balanced/floating operation using the FLOAT key. Special functions 75, 76, and 77 select the respective 50 ohm, 150 ohm, and 600 ohm source output impedance.

**3-37. Source Frequency Display and Selection.** To select the Frequency function simply depress the FREQ key. The key's LED and the KYBD legend will be illuminated and the SOURCE display window will contain the current frequency setting. Once the function is selected a new frequency may be entered using the DATA ENTRY keypad. Display units can be selected by depressing either the Hz or kHz keys.

**3-38. Source Frequency Lock Mode Description.** The Model 1121A source oscillator achieves high frequency accuracy and resolution through the use of a frequency lock technique. The design of the Model 1121A enables internal measurement of the oscillator frequency. During initialization after power is applied or when the LCL/INIT key is depressed, the oscillator is sequenced through its five frequency bands and specific frequencies settings are verified for accuracy. Tuning errors are stored by the control program in internal memory as calibration factors. If the oscillator fails to function on any of the frequency bands, an error (30-34) will be displayed as an indication of a hardware fault requiring service.

**3-39.** When a frequency setting is entered the oscillator is coarse tuned to the setting by the control program. Thereafter, the internal frequency of the oscillator is measured and fine adjustments are made by the control

program to tune the oscillator to within tolerance. Special function 16 disables the frequency lock mode to enable faster frequency updates and sweep rates where the full frequency accuracy of the oscillator is not required.

**3-40. Source level Display and Selection.** To select the Level function simply depress the LEVEL key. The key's LED and the KYBD legend will be illuminated and the LEVEL display window will contain the current level setting. Once the function is selected a new level may be entered using the DATA ENTRY keypad. The level function allows display and selection of the open-circuit output level. When a level is selected, the programmable amplifier/attenuator is configured by the microprocessor circuits to one of the ranges listed in Table 3-6. Special function 18 disables the automatic range selection and holds the range that is active at the time the special function was enabled. When the range-hold mode is active, new levels may be entered from 0 V up to the maximum value for the selected range. This mode provides the ability to set levels over a wide dynamic range without the possible delay and transients associated with range to range transitions. The LEVEL function can be incremented or decremented by the value in the LEVEL STEP function.

**3-41. Amplitude Display Units.** Amplitude values for the LEVEL, START and STOP functions may be displayed in linear units of mV or V or as a logarithmic value in units of dBV or dBm. Display units can be selected by depressing either the mV, V, or dB keys. Special functions 80 through 86 select the logarithmic display mode converts the linear voltage display (open-circuit) to a logarithmic value relative to 1.000 V rms. When a dBm mode is selected, the actual power into the load is calculated and displayed based on the open-circuit level and source and load impedance selections.

**3-42. Step Size and Step Key Operation.** The keys marked with up and down arrows are used to increment and decrement source and program function values in the active window designated by the KYBD legend. If an arrow key is constantly depressed, the stepping will repeat. Functions which can be stepped are PRGM, FREQ, START, STOP, and LEVEL. Stepping any other function has no effect.

**3-43. Increment/Decrement Program Number.** The Program number can be stepped in single increments. A special Auto-recall function is provided which automatically executes the recall operation after the program location function has been incremented or decremented with the step keys. This function allows rapid recall of sequential program setups by using a single key or bus mnemonic. The auto-recall function can be enabled or disabled using the internal option switch A4S1-5 or special functions 7 and 8.

**3-44. Increment/Decrement Frequency Values.** Frequency values in the FREQ, START, and STOP functions can be stepped by the value in the FREQ STEP function. Available frequency step sizes are listed in Table 3-3. If the step size is smaller than the resolution of the selected function, the function will be stepped by the resolution value. The frequency step size also functions as the step size for the linear frequency sweep mode.

**3-45. Increment/Decrement Level Values.** Amplitude values in the LEVEL, START, and STOP functions can be stepped by the value in the LEVEL STEP function. Level step sizes can be linear or logarithmic values. Available level step sizes are listed in Table 3-3. If the step size is smaller than the resolution of the selected function, the function will be stepped by the resolution value. Table 3-6 lists the output level ranges and resolution. The level step size also functions as the step size for the linear and logarithmic level sweep modes.

**3-46. Sweep Mode General Description.** The Model 1121A provides a user programmable sweep capability which simplifies time consuming measurements such as flatness, distortion vs. power output and compression/expansion linearity. In the sweep mode the source of the Model 1121A is used as the stimulus and can be configured to sweep frequency or level in linear or logarithmic steps. The source provides the X axis and pen control signals for an external plotter/recorder. The analyzer measurement provides the Y axis information. The Y axis scale can be set using the HIGH and LOW plot limit functions.

**3-47. SWEEP Key Description.** The SWEEP key is an alternate action key which initiates and terminates the sweep. The key's LED indicates a sweep is in progress and will be illuminated for the period of one sweep.

**3-48. START Key Description.** The START key allows

entry of either the frequency or level START value. The START value defines the origin of the X axis which corresponds to 0 volts at the X AXIS output connector. When the START key is depressed the SOURCE display will contain the START value and 0 volts is presented at the X AXIS output connector as an aid in setting the offset adjustment on most X-Y plotters.

**3-49. STOP Key Description.** The STOP key allows entry of either the frequency or level STOP value. The STOP value defines the end of the X axis which corresponds to 5 volts at the X AXIS output connector. When the STOP key is depressed the SOURCE display will contain the STOP value and 5 volts is presented at the X AXIS output connector as an aid in setting the sensitivity adjustment on most X-Y plotters.

**3-50. X AXIS Output Description.** The X AXIS output of the Model 1121A is the scaled result of the sweep frequency or level relative to the START and STOP values. The Model 1121A can be swept in level or frequency with 4096 points of resolution on the X axis. Selection of a level or frequency sweep is determined by the type of START and STOP values entered: START and STOP level entries designate a level sweep and START and STOP frequency entries designate a frequency sweep.

**3-51. Y AXIS Output Description.** The Y AXIS output of the Model 1121A is the scaled result of the analyzer measurement value relative to the HIGH and LOW values. There are 4096 points of resolution between 0 and 5 volts on the Y axis. Any measurement mode can be used for sweeping. Various measurement modes and applications require greater measurement settling before a data point is generated. The Model 1121A allows for user configurable settling times using special functions 61 through 69. The settling time is based on the number of consecutive measurement cycles achieved before a data point is plotted. Special function 60 disables the analyzer measurement and the YAXIS output and allows the source to be used as a rapid incremental sweep generator with X AXIS and PEN control.

**3-52.** The HIGH and LOW plot limits are always displayed in the same units as the analyzer measurement mode. The Y AXIS output will be scaled linearly or logarithmically depending on the display units. For example, if the distortion measurement is displayed in % units the result will be plotted linearly between the LOW and HIGH plot limits and if displayed in dB units the result will be a logarithmic plot. Analyzer measurements displayed in mV or V units will be plotted linearly and those displayed in dBV or dBm will be plotted logarithmically.

**3-53. PEN Output Description.** The Model 1121A generates a TTL compatible pen control output for use with a plotter/recorder. The active state of the PEN output is selected using option switch A4S1-3 or special functions 5 and 6.

**3-54. Using The Sweep Mode.** When the SWEEP key is depressed the START value is transferred to the LEVEL or FREQ function, and the function is activated. When the sweep is in progress the X AXIS output will produce an incrementing voltage between 0 and 5 volts. The START and STOP values must be compatible in level or frequency units or an error will be displayed when the SWEEP key is depressed. When the sweep sequence is initiated the X axis information is presented at the rear panel X AXIS output and after an approximate 1 sec delay the PEN output is set true. When the sweep is terminated the PEN output is immediately set false. The PEN output can be set independent of any sweep operation using the PU and PD bus mnemonics.

**3-55.** The sweep mode will be terminated if any number entry is attempted, any function is selected other than the functions displayed at the start of the sweep sequence, or either the SWEEP key or the LCL/INIT key is depressed. Selecting filters, floating modes and display units will not terminate the sweep mode. If a sweep has been terminated, it can be resumed by selecting the appropriate LEVEL or FREQ function and depressing the SWEEP key. The sweep will be activated and will resume from the displayed value until the STOP value is reached.

**3-56. Generating Frequency Sweeps.** The Model 1121A can generate user configurable frequency sweep sequences up to the entire frequency range of the oscillator in logarithmic or linear increments. The range of the sweep is defined by the START and STOP values which can be in ascending or descending order. Logarithmic frequency increments are selected using special function 1 through 59 and vary from 16 to 4096 steps. Linear frequency increments are selected using special function 50 and the FREQ STEP function defines the increment value. Linear sweep step sizes which exceed the X axis resolution limit of 4096 steps are allowed, however, the X AXIS output voltage will dwell at the same level for more than one frequency increment.

**3-57. Generating Level Sweeps.** The Model 1121A can generate user configurable level sweep sequences up to the entire level range of the oscillator in logarithmic or linear increments. The range of the sweep is defined by the START and STOP values which can be in ascending or descending order. Logarithmic and linear level increments are selected using the LEVEL STEP function. Special functions 50 through 59 have no effect on level sweep. A logarithmic level sweep is defined by a LEVEL STEP value expressed in dB units and a linear level sweep is defined by a LEVEL STEP value expressed in mV or V units. Level sweep step sizes which exceed the X axis resolution limit of 4096 steps are allowed, however, the X AXIS output voltage will dwell at the same level for more than one level increment.

**3-58. Program Store And Recall Description.** The

entire status of the Model 1121A, including all functions, entered values and display modes, can be saved in a program location of non-volatile memory for recall at a later time. Up to 99 such programs (0-98) can be stored and recalled.

**3-59. Store Operation.** To save the complete frontpanel setup in the program memory, first set all the desired instrument operating parameters to be stored. Next depress the PRGM key and enter the desired program location with the DATA ENTRY keypad and the ENTER key. Finally, depress the STO key to save the complete instrument status in program memory. Below is a list of all the parameters which are retained in program memory.

1. All entered values of all functions.
2. All source impedance and floating settings.
3. All display modes and selected display units.
4. All special function settings.

**3-60. Recall Operation.** To recall the front-panel setup in the program memory, depress the PRGM key and enter the desired program location with the DATA ENTRY keypad and the ENTER key. After the memory location has been selected, depress the RCL key. Program location 99 is a recall-only location that restores the initialize parameters in the same manner as the LCL/INIT key. Any panel setting may be changed after recalling a program location.

**3-61. Program Memory Initialization.** In normal use the internal memory is never erased, new programs are simply written over the old ones. It is necessary, however, to erase the program memory after a new firmware revision has been installed or after the CPU circuit board has been serviced. Entering special function 25 will erase the entire program memory. Attempting to recall an erased program will result in Error 11 being displayed. Special function 25 can be disabled using the internal option switch A4S1-4.

**3-62. Special Function Description.** The Model 1121A provides special modes of operation for specific application situations. Special function modes shown in Table 3-5 can be selected using the SPCL key and the DATA ENTRY keypad.

**3-63. Option Switch Functions.** Codes 1 through 8 supersede current settings of the internal option switch, A4S1. The option switch settings are restored on power-up, by executing special function 0, or by depressing the LCL/INIT key.

**3-64. Mode Alteration Functions.** Codes 11 through 19 alter the normal operation of the Model 1121A. When selected, the SPCL legend in the SOURCE display window will remain illuminated as an indication of the special operating mode regardless of the function displayed.

**3-65.** The range-hold functions, 11 through 13, affect the analyzer measurements by defeating the autorange capability. The input level or post-notch distortion range can be held at its present value by entering the appropriate special function code. Other ranges can be set and held by selecting the desired analyzer measurement mode and entering the level or distortion range directly into the ANALYZER display window using the DATA ENTRY keypad. Available level and distortion ranges for all analyzer measurement modes are listed in Tables 3-4 and 3-5. It is not necessary to enter the exact full scale value to set a range, rather the value need only fall within the desired range. When a range is selected the appropriate special code will automatically be activated and the SPCL legend will be illuminated. Range-hold mode is cleared by selecting an alternate analyzer function, using special function 10 or initializing the instrument.

**3-66.** The notch-hold and ignore-tune-status functions, 14 and 15, affect the analyzer distortion and SINAD measurement modes by defeating the auto-tune capability in the distortion mode and disabling the tune-status information in the SINAD mode. Tune-status information is unreliable in the presence of very high amounts of noise (0 to 10 dB SINAD) resulting in the [ ] message being displayed. The ability to select the frequency of the notch filter enables the distortion mode circuits to function as a programmable notch filter to attenuate selected tones other than the fundamental. These special modes can be activated by entering the special code or by selecting the analyzer distortion mode and entering the notch frequency directly into the ANALYZER display window using the DATA ENTRY keypad. Direct entry of the notch frequency will automatically select Special 14 and the SPCL legend will be illuminated. Notch-hold and ignore-tune-status modes are cleared by using special function 10 or initializing the instrument.

| Level Ranges:     | Resolution: |
|-------------------|-------------|
| 16.000 to 3.005 V | 5.0 mV      |
| 3.000 to 0.301 V  | 1.0 mV      |
| 300.0 to 30.1 mV  | <0.1 mV     |
| 30.00 to 0.00 m   | 0.01 mV     |

**TABLE 3-6. OUTPUT LEVEL RANGES.**

**3-67.** The unlock frequency function, 16, is provided to speed repetitive frequency setting and measurements. In normal operation a variable period of 20 to 200 mS is required to measure the actual oscillator frequency, calculate the frequency deviation and apply fine tune correction. Inhibiting the frequency lock mode results in faster operation at the cost of frequency accuracy. The unlock mode is cleared by entering special function 10 or initializing the instrument.

**3-68.** The slow detector function, 17, is provided to extend the level measurement sampling time to provide more consistent readings in the presence of noise. The level measurement employs a period sampling technique which adjusts the measurement period to include the period of the dominant AC signal. This process is extended to include low frequency components which cause inconsistent readings. The slow detector mode is cleared by using special function 10 or initializing the instrument.

**3-69.** The output range-hold function, 18, is provided to hold selected output level ranges. The active range at the time the special function is activated will be held. Available level ranges and resolution are listed in Table 3-6. Range-hold mode is cleared by entering special function 10 or initializing the instrument.

TABLE 3-7. SPECIAL FUNCTIONS.

|                                                     |                                                                                           |              |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------|--------------|
| <b>Option Switch A4S1 Functions:</b>                |                                                                                           |              |
| 0                                                   | Restores settings of internal option switch                                               |              |
|                                                     | <u>Listen:</u>                                                                            | <u>Talk:</u> |
| 1                                                   | EOS Character: LF or CR LF                                                                | CR LF        |
| 2                                                   | EOS Character: CR                                                                         | CR LF        |
| 3                                                   | EOS Character: CR                                                                         | CR           |
| 4                                                   | EOS Character: CR                                                                         | CR           |
| 5                                                   | Pen-up is active high                                                                     |              |
| 6                                                   | Pen-up is active low                                                                      |              |
| 7                                                   | Disable program auto-recall                                                               |              |
| 8                                                   | Enable program auto-recall                                                                |              |
| <b>Mode Alteration Functions:</b>                   |                                                                                           |              |
| 10                                                  | Clear functions 11 through 19.                                                            |              |
| 11                                                  | Range Hold: input voltage range and post notch detector range                             |              |
| 12                                                  | Range Hold: input voltage range.                                                          |              |
| 13                                                  | Range Hold: post notch detector range.                                                    |              |
| 14                                                  | Notch Hold: hold notch frequency tuning at preset frequency in distortion mode            |              |
| 15                                                  | Ignore Tune Status: display SINAD measurements without regard to tune-status information. |              |
| 16                                                  | Unlock frequency                                                                          |              |
| 17                                                  | Slow Detector: noise rejecting filter response.                                           |              |
| 18                                                  | Hold output level range                                                                   |              |
| <b>Automatic Calibration and Test Functions:</b>    |                                                                                           |              |
| (Can be disabled using Option Switch A4S1-4)        |                                                                                           |              |
| 20                                                  | Auto Cal AC Level                                                                         |              |
| 21                                                  | Auto Cal Optional Filter No. 1                                                            |              |
| 22                                                  | Auto Cal Optional Filter No. 2                                                            |              |
| 23                                                  | Auto Cal DC Offset                                                                        |              |
| 24                                                  | Auto Cal DC Level                                                                         |              |
| 25                                                  | Erase all program memory locations                                                        |              |
| 26                                                  | 300 Volt range - special calibration mode                                                 |              |
| 27                                                  | 30 Volt range - special calibration mode                                                  |              |
| 28                                                  | 3 Volt range - special calibration mode                                                   |              |
| 30                                                  | Dac test mode                                                                             |              |
| 31                                                  | Counter plug-in board test mode                                                           |              |
| 32                                                  | Input and Filter plug-in board test mode                                                  |              |
| 33                                                  | Notch and Detector plug-in board test mode                                                |              |
| 35                                                  | Frequency check mode                                                                      |              |
| <b>Signal-to-Noise Delay Functions:</b>             |                                                                                           |              |
| 40                                                  | Automatic Selection                                                                       |              |
| 41                                                  | 0.2 sec delay                                                                             |              |
| 42                                                  | 0.4 sec delay                                                                             |              |
| 43                                                  | 0.6 sec delay                                                                             |              |
| 44                                                  | 0.8 sec delay                                                                             |              |
| 45                                                  | 1.0 sec delay                                                                             |              |
| 46                                                  | 1.2 sec delay                                                                             |              |
| 47                                                  | 1.4 sec delay                                                                             |              |
| 48                                                  | 1.6 sec delay                                                                             |              |
| 49                                                  | 1.8 sec delay                                                                             |              |
| <b>Frequency Sweep Resolution Functions:</b>        |                                                                                           |              |
| 50                                                  | Linear frequency sweep (FREQ STEP value determines resolution)                            |              |
| 51                                                  | 16 step logarithmic sweep                                                                 |              |
| 52                                                  | 32 step logarithmic sweep                                                                 |              |
| 53                                                  | 64 step logarithmic sweep                                                                 |              |
| 54                                                  | 128 step logarithmic sweep                                                                |              |
| 55                                                  | 256 step logarithmic sweep                                                                |              |
| 56                                                  | 512 step logarithmic sweep                                                                |              |
| 57                                                  | 1024 step logarithmic sweep                                                               |              |
| 58                                                  | 2048 step logarithmic sweep                                                               |              |
| 59                                                  | 4096 step logarithmic sweep                                                               |              |
| <b>Sweep Rate Functions:</b>                        |                                                                                           |              |
| 60                                                  | Rapid Sweep (disable analyzer)                                                            |              |
| 61                                                  | 1 measurement/step                                                                        |              |
| 62                                                  | 2 measurement/step                                                                        |              |
| 63                                                  | 3 measurement/step                                                                        |              |
| 64                                                  | 4 measurement/step                                                                        |              |
| 65                                                  | 5 measurement/step                                                                        |              |
| 66                                                  | 6 measurement/step                                                                        |              |
| 67                                                  | 7 measurement/step                                                                        |              |
| 68                                                  | 8 measurement/step                                                                        |              |
| 69                                                  | 9 measurement/step                                                                        |              |
| <b>AC Detector Selection Functions:</b>             |                                                                                           |              |
| 70                                                  | RMS detector enabled                                                                      |              |
| 71                                                  | Average detector enabled                                                                  |              |
| 72                                                  | Quasi-peak detector enabled.                                                              |              |
| <b>Source Output Impedance Selection Functions:</b> |                                                                                           |              |
| 75                                                  | 50 ohm output impedance                                                                   |              |
| 76                                                  | 150 ohm output impedance                                                                  |              |
| 77                                                  | 600 ohm output impedance                                                                  |              |
| <b>dBV/dBm Display Mode Selection Functions:</b>    |                                                                                           |              |
| 80                                                  | dBV display reference: 1.000 V                                                            |              |
| 81                                                  | dBm display reference: 1 mW, 50 ohms                                                      |              |
| 82                                                  | dBm display reference: 1 mW, 75 ohms                                                      |              |
| 83                                                  | dBm display reference: 1 mW, 150 ohms                                                     |              |
| 84                                                  | dBm display reference: 1 mW, 300 ohms                                                     |              |
| 85                                                  | dBm display reference: 1 mW, 600 ohms                                                     |              |
| 86                                                  | dBm display reference: 1 mW, 900 ohms                                                     |              |

TABLE 3-8. OPTION SWITCH A4S1.

Factory settings.

#### Eos Character Selection:

Listen: LF or CR LF

Talk: CR LF

Listen: CR

Talk: CR LF

Listen: CR

Talk: CR

Listen: CR

Talk: LF

#### Pen Status Control:

Pen-up is active low

Pen-up is active high

#### SPCL Function Disable:

Enable SPCL Functions 20-39

Disable SPCL Functions 20-39

#### Auto Recall Enable:

Disable Program Auto-recall

Enable Program Auto-recall

#### SRQ Enable:

Disable SRQ

Enable SRQ

#### Test Mode Enable:

Lamp Test

Filter Option Entry Mode

TABLE 3-9. ERROR CODES.

| Error Code | Description                                                                                       |
|------------|---------------------------------------------------------------------------------------------------|
| 01         | Illegal source frequency entry                                                                    |
| 02         | Illegal frequency step size entry                                                                 |
| 03         | Illegal source level entry                                                                        |
| 04         | Illegal level step size entry                                                                     |
| 05         | Illegal special function entry                                                                    |
| 06         | Illegal start frequency or level entry                                                            |
| 07         | Illegal stop frequency or level entry                                                             |
| 08         | Illegal low plot limit entry                                                                      |
| 09         | Illegal high plot limit entry                                                                     |
| 10         | Illegal bus address entry                                                                         |
| 11         | Store/recall error: attempting to recall an erased location or store in read-only location No. 99 |
| 12         | Frequency error: attempting to set an illegal voltage range or any frequency entry                |
| 13         | Level error: attempting to set an illegal input voltage range                                     |
| 14         | Distortion error: attempting to set an illegal input range, notch frequency, or distortion range  |
| 15         | SINAD error: attempting to set an illegal input range or SINAD range                              |
| 17         | Ratio error: attempting to enter an analyzer setting while in the ratio mode                      |
| 18         | Ratio error: ratio display overrange                                                              |
| 19         | Ratio error: unable to enter ratio mode while displaying notch tune frequency                     |
| 20         | Illegal units for active function                                                                 |
| 21         | Buffer overflow: too many key entries for display or IEEE-488 buffer overflow                     |
| 22         | IEEE-488 bus error: non existent mnemonic                                                         |
| 23         | IEEE-488 bus error: illegal Learn string format                                                   |
| 24         | IEEE-488 bus error: illegal Burst string format                                                   |
| 25         | Sweep error: start and stop units are not compatible                                              |
| 26         | Sweep error: start and stop values are equal                                                      |
| 30-34      | Hardware error: unable to Frequency lock                                                          |
| 40         | Auto cal error: unable to calibrate post-notch rms detector                                       |
| 41         | Auto cal error: unable to calibrate average detector                                              |
| 42         | Auto cal error: unable to calibrate input rms detector                                            |
| 43         | Auto cal error: unable to calibrate DC detector at full scale                                     |
| 44         | Auto cal error: unable to calibrate quasi-peak detector                                           |
| 45         | Auto cal error: unable to calibrate option filter No. 1                                           |
| 46         | Auto cal error: unable to calibrate DC detector offset                                            |
| 47         | Auto cal error: unable to calibrate option filter No. 2                                           |
| 50-92      | Diagnostic error codes. See Table 5-23 for description                                            |

**3-70. Calibration and Test Functions.** Codes 20 through 39 are used in calibration, testing and troubleshooting of the Model 1121A. These functions can be disabled using Option switch A4S1-4 to prevent accidental use resulting possible loss of current calibration and memory data.

**3-71. S/N Delay Functions.** Codes 40 through 49 provide user configurable delay between the signal measurement and noise measurement. The delay allows time for a device under test to respond to the change in output level during the signal-to-noise measurement cycle.

**3-72. Frequency Sweep Resolution Functions.** Codes 50 through 59 allow selection of linear or logarithmic frequency sweep modes and logarithmic sweep resolution. The default mode after initialization is code 55.

**3-73. Sweep Rate Functions.** Codes 60 through 69 allow selection of the delay for each sweep step. The delay is based on the number of consecutive analyzer measurements before a data point is plotted. The default mode after initialization is code 63.

**3-74. AC Detector Selection Functions.** Codes 70 and 71 are used as an alternate mode for selection of the AC detector type. The default mode after initialization is the rms detector, code 70.

**3-75. Source Impedance Selection Functions.** Codes 75 through 77 are used for selection of the source output impedance. The default mode after initialization is 600 ohms, code 77.

**3-76. dBV/dBm Display Mode Functions.** Codes 80 through 86 are used to select the reference used to calculate the logarithmic display value. All logarithmic levels will be displayed in the form selected. The default mode after initialization is code 80, dBV.

**3-77. Option Switch, A4S1, Operation.** Several of the Model 1121A operating features are internally programmable by setting bit switch A4S1. Gaining access to the switch requires that the cover be removed. The option switch consists of eight separate switches which change the operating conditions of the Model 1121A. Some of the option switch functions can be altered using the special functions 1 through 8. Table 3-8 list the individual switches and their function.

**3-78.** Positions 1 and 2 of A4S1 are used for end-of-string (EOS) control for the IEEE-488 bus. End-or-Identify (EOI) is always recognized and asserted in addition to the EOS characters selected. Position 3 determines the pen-up active state of the PEN output on the rear panel. Position 4 is available to restrict the use of special functions 20 through 39. These special functions are associated with calibration and repair of the

instrument. Position 5 determines the operation of the IEEE-488 SRQ function. When enabled the SRQ line will be set true if the SRQ key is depressed or if the instrument is in the remote condition and an error is generated. Position 6 determines the auto-recall function. Normally the REC key must be depressed in order to recall any program location. When enabled the auto-recall function automatically performs the REC function when using the step keys to increment or decrement the PRGM function. However, entering a program location directly using the DATA ENTRY keypad requires that the REC key be depressed to execute the recall function. Positions 7 and 8 are used for test modes. When the lamp test is selected the display LEDs, display legends, and key LEDs with the exception of the LEVEL and SOURCE function keys will be constantly illuminated. The remaining function keys will be illuminated in sequence.

**3-79. Error Codes.** Error codes and descriptions for the Model 1121A are listed in Table 3-9. The error codes will appear in the SOURCE display window and will be returned by the talk-status (TS) IEEE-488 bus function if executed. The SRQ status byte will consist of the error code expressed in excess sixty-four. The status code 64 decimal means the SRQ was activated by the front panel SRQ key rather than an error.

### 3-80. REMOTE OPERATION.

**3-81.** Any front-panel operation of the instrument with the exception of the LINE ON/OFF switch can be remotely controlled under direction of an IEEE-488 interface controller.

**3-82. Setting the Bus Address.** To set the IEEE-488 bus address (MLTA), depress the ADRS key, enter the address number by means of the DATA ENTRY keypad and use the ENTER key to complete the entry. The address may be any decimal number from 0 to 30, inclusive. A secondary address is not implemented.

**3-83. Entering the Remote Mode.** The instrument is put in the remote mode by addressing it as a listener with remote enable (REN) true. In the remote state the keyboard is disabled, except for the LCL/INIT key and the POWER ON/OFF switch, and the REM status annunciator is illuminated.

TABLE 3-10. IEEE-488 BUS MNEMONICS.

|                                 |                             |                                 |                                          |
|---------------------------------|-----------------------------|---------------------------------|------------------------------------------|
| <b>Analyzer Function Group:</b> |                             | <b>Output Impedance Group:</b>  |                                          |
| AF                              | Analyzer frequency          | Z0                              | 50 ohm source output                     |
| AL                              | Analyzer level              | Z1                              | 150 ohm source output                    |
| DN                              | Distortion                  | Z2                              | 600 ohm source output                    |
| SI                              | SINAD                       |                                 |                                          |
| SN                              | Signal-to-noise             |                                 |                                          |
| RA                              | Enable ratio mode           |                                 |                                          |
| RO                              | Disable ratio mode          |                                 |                                          |
| <b>Source Function Group:</b>   |                             | <b>Filter Group:</b>            |                                          |
| SF                              | Source frequency            | F0                              | Disable both optional filters            |
| FZ                              | Frequency step size         | F1                              | Enable optional filter No. 1 (left)      |
| SL                              | Source level                | F2                              | Enable optional filter No. 2 (right)     |
| LZ                              | Level step size             | L0                              | Disable all low-pass filters             |
| SP                              | Special function            | L1                              | Enable 30 kHz low-pass filter            |
|                                 |                             | L2                              | Enable 80 kHz low-pass filter            |
|                                 |                             | L3                              | Enable 220 kHz low-pass filter           |
|                                 |                             | L4                              | Enable DC low-pass filter (AC rejection) |
| <b>Sweep Function Group:</b>    |                             | <b>Detector Group:</b>          |                                          |
| SW                              | Sweep mode                  | RM                              | Enable rms detector                      |
| SG                              | Signal generator mode       | AV                              | Enable average detector                  |
| XL                              | Start function              | QP                              | Enable quasi-peak detector               |
| XR                              | Stop function               |                                 |                                          |
| YL                              | Low function                |                                 |                                          |
| YH                              | High function               |                                 |                                          |
| <b>Program Function Group:</b>  |                             | <b>Talk Mode/Address Group:</b> |                                          |
| PG                              | Program location            | TS                              | Talk status                              |
| RE                              | Recall program              | TV                              | Talk value                               |
| ST                              | Store program               | TF                              | Talk function                            |
|                                 |                             | TL                              | Talk learn string                        |
|                                 |                             | TB                              | Talk burst string                        |
|                                 |                             | TP                              | Talk program revision                    |
|                                 |                             | AD                              | IEEE-488 bus address                     |
| <b>Units Group:</b>             |                             | <b>Trigger Group:</b>           |                                          |
| HZ                              | Hertz                       | IM                              | Immediate mode                           |
| KH                              | Kilo Hertz                  | WT                              | Wait-for-trigger mode                    |
| VO                              | Volt                        | TR                              | Trigger                                  |
| MV                              | Millivolt                   |                                 |                                          |
| PC                              | Percent                     |                                 |                                          |
| DB                              | Decibel                     |                                 |                                          |
| <b>Float Group:</b>             |                             | <b>Display Mode Group:</b>      |                                          |
| SA                              | Single-ended analyzer input | BL                              | Blank display                            |
| FA                              | Floating analyzer input     | UD                              | Update display                           |
| SS                              | Single-ended source output  |                                 |                                          |
| FS                              | Floating source output      |                                 |                                          |
|                                 |                             | <b>Error and SRQ Group:</b>     |                                          |
|                                 |                             | CL                              | Clear error                              |
|                                 |                             | CH                              | Self check                               |
|                                 |                             | EI                              | Enable SRQ interrupt                     |
|                                 |                             | DI                              | Disable SRQ interrupt                    |
|                                 |                             | SQ                              | Set SRQ true                             |

TABLE 3-11. TALK FUNCTION (TF) DECODING.

Talk Function String Format:

99,999,999,999,AAAAAAAAAAAA

**Active Function Assignments:**

|    |                  |
|----|------------------|
| 1  | FRBQ (source)    |
| 2  | FRBQ STEP        |
| 3  | LEVEL (source)   |
| 4  | LEVEL STEP       |
| 5  | SPCL             |
| 6  | START            |
| 7  | STOP             |
| 8  | LOW              |
| 9  | HIGH             |
| 10 | ADRS             |
| 11 | PRGM             |
| 12 | FRBQ (analyzer)  |
| 13 | LEVEL (analyzer) |
| 14 | DIST             |
| 15 | SINAD            |
| 16 | S/N              |

**Filter and Floating Bit Assignments:**

|        |                         |
|--------|-------------------------|
| [8]MSB | Float Analyzer Input    |
| [7]    | Optional Filter No. 1   |
| [6]    | Float Source Output     |
| [5]    | Optional Filter No. 2   |
| [4]    | DC low-pass filter      |
| [3]    | 30 kHz low-pass filter  |
| [2]    | 220 kHz low-pass filter |
| [1]LSB | 80 kHz low-pass filter  |

**Special Mode Bit Assignments:**

|        |                         |
|--------|-------------------------|
| [8]MSB | Notch-tune Hold         |
| [7]    | Input Range Hold        |
| [6]    | Ignore Tune status      |
| [5]    | Unlock Source Frequency |
| [4]    | Reserved                |
| [3]    | Post Notch Range Hold   |
| [2]    | Slow Detector           |
| [1]LSB | Output Range Hold       |

**Option Switch Bit Assignments:**

|        |        |                                 |
|--------|--------|---------------------------------|
| [8]MSB | A4S1-8 | Reserved                        |
| [7]    | A4S1-7 | Reserved                        |
| [6]    | A4S1-6 | Enable SRQ                      |
| [5]    | A4S1-5 | Enable Program Auto-recall      |
| [4]    | A4S1-1 | End-of-String Character Select  |
| [3]    | A4S1-2 | End-of-String Character Select  |
| [2]    | A4S1-3 | Pen-up is Active High           |
| [1]LSB | A4S1-4 | Disable Special Functions 20-39 |

**Alternate Operating Modes:**

|    |                                              |
|----|----------------------------------------------|
| Z0 | 50 ohm output impedance                      |
| Z1 | 150 ohm output impedance                     |
| Z2 | 600 ohm output impedance                     |
| [] | Boxes currently displayed in ANALYZER window |
| SW | Sweep mode                                   |
| RA | Ratio mode                                   |
| XC | External counter reference                   |
| RM | rms detector enabled                         |
| AV | Average detector enabled                     |
| QP | Quasi-peak detector enabled                  |

**3-84. Returning to Local Mode.** The instrument may be returned to the local mode as follows:

- b. The go-to-local (GTL) bus command is sent.
- c. Remote enable (REN) is set false.

### NOTE

- a. The LCL/INIT key is depressed, provided local lockout (LLO) is not active.

*The instrument must be placed in the remote mode for it to store and respond to data messages.*

**3-85. Triggered Operation.** In the remote mode the instrument can be operated in the immediate mode (mnemonic IM), or in the wait-for-trigger mode (WT). The immediate mode is the default condition and results in the immediate response to mnemonic commands and settings. The wait-for-trigger mode causes the execution of commands and settings to be deferred until a trigger is received. This aids in synchronizing the instrument's state changes to other system components. The wait-for-trigger mode is set when the WT mnemonic is encountered in the input string. From that point on execution is delayed. No change will occur until one of the following events is encountered:

- a. "Group-execute-trigger" (GET) is received.
- b. The mnemonic TR (trigger) is interpreted.
- c. Any mnemonic following IM (immediate) is interpreted.

### NOTE

*Event (c), above, or go-to-local terminates the wait-for-trigger mode and restores the immediate mode. The wait-for-trigger mode is not active in location operation.*

**3-86. Talk Operation.** The instrument may be addressed as a talker without regard for remote/local mode. When the talker state is set by the bus controller, the instrument sends a character string which is determined by the current talk mode. One of six different talk modes is selected by sending the appropriate mnemonic with the Model 1121A addressed as a listener. The selected mode will remain in effect until changed.

**3-87. Talk Status (TS) Mode.** In the TS mode the error code status of the instrument is returned as a number. Normal status returns a 0 code otherwise the error number is returned. The TS mode will automatically clear the error after the status is reported. The TS mode is the default talk mode after initialization of the instrument.

**3-88. Talk Value (TV) Mode.** In the TV mode the argument of the active function designated by the KYBD annunciator is returned as a number. All values returned are in basic units such as: Hz, V, dB, etc.

**3-89. Talk Program (TP) Mode.** In the TP mode a 10 digit number is returned that uniquely identifies the firmware and installed optional filters. A radix separates the firmware date code and the optional filter identification number. The 4 digit code to the right of the radix will correspond to the codes listed in Table 5-2.

**3-90. Talk Function (TF) Mode.** In the TF mode a variable length string of ASCII characters will be returned which identifies the state of all active functions. The bit assignments are arranged to allow for string or byte oriented decoding. The various characters are listed in Table 3-11.

**3-91. Talk Learn (TL) Mode.** In the TL mode a compressed parameter string of 169 ASCII characters, the last of which is an ASCII (\$), is returned. This string can be sent back to the instrument at any time to restore the exact state of all functions and settings which defined it, but it must be sent as a complete string without alteration. When the (\$) character is encountered in the input buffer, the learn mode is automatically activated. While this form provides a compact and fast method to save and restore all settings, it bypasses much of the error control and must be used with caution.

**3-92. Talk Burst (TB) Mode.** In the TB mode a compressed parameter string of 21 ASCII characters, the last of which is an ASCII (&), is returned. Like the Learn string, this string can be sent back to the instrument at any time to restore the exact state of the source level and frequency settings which defined it, but it must be sent as a complete string without alteration. While this form provides a compact and fast method to save and restore frequency and amplitude setting to create sweep or tone burst sequences, it bypasses update of the display and much of the error control and must be used with caution. To prevent the display from giving false indications the display may be blanked using the (BL) command.

**TABLE 3-12. BUS COMMAND RESPONSES.**

| Commands                                                                                                                              | Instrument Response                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>Universal Command Group:</b><br>Device Clear (DCL)<br>Local Lockout (LLO)<br>Serial Poll Enable (SPE)<br>Serial Poll Disable (SPD) | Clear errors<br>Disable LCL/INIT key<br>Sets talk mode for poll response<br>Restores talk mode before poll |
| <b>Addressed Command Group:</b><br>Selective Device Clear (SDC)<br>Go to Local (GTL)<br>Group Execute Trigger (GET)                   | Same as device clear (DCL)<br>Sets LOCAL mode<br>Triggers a measurement                                    |
| <b>All Others:</b>                                                                                                                    | Ignored                                                                                                    |

**3-93. End-Of-String (EOS) Control.** The instrument provides several end-of-string options to accommodate a wide variety of controllers. The instrument always terminates on EOI (end-or-identify) true and always sends EOI true with the last character of every string. In addition, CR, LF, or CRLF may be used. The use of CR and LF is selected by option switch A4S1-1 and 2 and special functions 1 through 4. Detection of EOI is not affected by A4S1 switch settings.

**3-94. Using “Service Request” (SRQ).** The instrument may be configured to set SRQ true when it is in the remote mode and an error occurs. This is enabled by setting the option switch A4S1-6 to the open position. The bus controller must be programmed to respond to SRQ true. In the usual case, the controller then executes a serial poll to determine which device caused SRQ to be true. If the instrument is the requesting device, it will respond to the serial poll with a single byte which expresses the error code number in excess sixty-four. The serial poll will clear the SRQ line automatically. In small systems only one instrument may be capable of using SRQ. In this situation there is no need to execute a serial poll since the identity of the requesting device is known. The error code may be obtained directly from the talk status (TS) mode. The SRQ line can then be cleared by sending the clear (CL) command.

**3-95. Bus Command Responses.** IEEE-488 bus commands are sent by the controller to all devices on the bus (Universal Command Group) or to addressed devices only (Addressed Command Group). The response of the instrument is listed in Table 3-12.

**3-96. Program Function Mnemonics.** Each front panel key is assigned a program mnemonic. Programming the mnemonic, followed by unit values, if appropriate, is analogous to manual front-panel operation. In addition, other program mnemonics are used for functions that are applicable only in remote operation. Table 3-10 lists all the program function mnemonics.

**3-97. Number Formatting.** Number formatting rules are as follows:

- Fixed or floating formats are accepted.
- The optional + or - sign may precede the mantissa and/or the exponent.
- The optional radix point may appear at any position within the mantissa. A radix point in the exponent is ignored.
- The optional “E” for exponent may be upper or lower case.
- ASCII characters having hexadecimal values of 0 to 23 and 26 to 2B are ignored.

**3-98. Data String Format.** Data string formats are as follows:

- The programming sequence is in natural order, that is, a function mnemonic is sent first followed by the argument, if appropriate.

b. ASCII characters having hexadecimal values of 0 to 23 and 26 to 2B are ignored. The ASCII (\$) and (&), hexadecimal 24 and 25, are reserved. Lower case letters are automatically changed to upper case.

c. A primary function mnemonic sent without a following argument will make the specified function active.

d. The data string may not exceed 150 characters and may be terminated with LF, CR, and/or EOI.

e. Interpretation of the data string does not begin until termination occurs.

f. If units are unspecified for any argument, default units are automatically appended. The functions SPCL and PRGM always use default units.

g. If a unit mnemonic is sent without a corresponding argument, the display will reflect the change provided that the units are appropriate for the active function and the display can accommodate the rescaled number.

**3-99. Data String Errors.** Errors are detected during interpretation. The occurrence of an error will display the error code if the display is enabled, and will set SRQ true, if enabled. The error and SRQ can be cleared by a serial poll, a status request (TS), or a clear error instruction (CL). All errors cause previous valid parameters to be restored. No new input can be processed until an existing error is cleared.

**3-100. Data String Examples.** The following are examples of typical programming strings in HP BASIC:

OUTPUT 715; "SP16SF1234.56HZ"

OUTPUT 715; "Z1FSSL2VO"

OUTPUT 715; "PG1RE"

OUTPUT 715; "RADB"

**3-101. Store and Recall Operation.** Store and Recall operation may be used to advantage with a bus controller. The instrument provides either temporary or long-term storage for control strings. This can be used to minimize bus traffic by storing several control setups at initialization and recalling them when needed with a simple string statements, such as:

OUTPUT 715; "PG23RE"

Since few controllers have power fail protection, the data in the instrument's non-volatile memory is the more secure.

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## SECTION IV THEORY OF OPERATION

### 4-1. INTRODUCTION.

**4-2.** The Model 1121A is a versatile, solid-state, microprocessor controlled, audio analyzer that covers the frequency range of 10 Hz to 140 kHz. The instrument contains an independent audio source and analyzer for stimulus response testing with simultaneous display of source settings and analyzer measurements. Function parameters can be keyed in through a front panel keyboard or with remote programming using the IEEE-488 interface. Selected modes and values are displayed on an alphanumeric display and LED indicators. Input commands are processed by the internal microprocessor and control signals are developed to configure the internal

circuits in accordance with the commands. The use of the microprocessor also enables the storage of up to 99 complete sets of instrument setup data. Commonly used setups can be entered into non-volatile memory either through the keyboard or through the IEEE-488 interface; thereafter, the instrument can be set to any desired set of conditions in memory by keying in the code number assigned to the desired setup in storage.

### 4-3. FUNCTIONAL BLOCK DIAGRAM.

**4-4.** Control of the instrument operation is exercised by a microprocessor that executes a fixed program

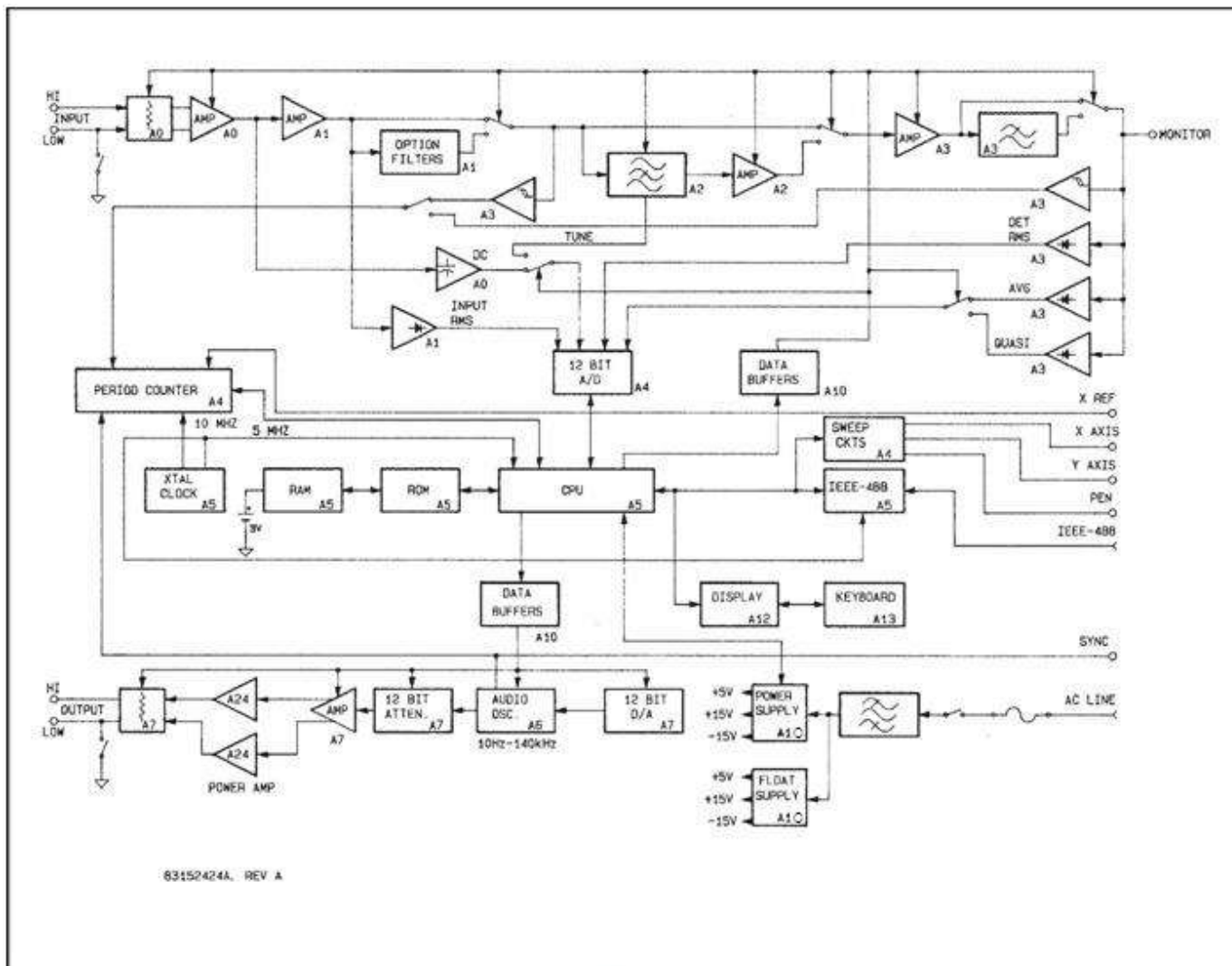


Figure 4-1. Functional Block Diagram

resident in read-only-memory (ROM). Timing of the microprocessor operations is controlled by a 5 MHz clock. A random-access-memory (RAM) provides storage capability for microprocessor data. To ensure retention of data in storage, the non-volatile RAM is powered from an internal 3 volt lithium battery. The main power supply develops the operating power required by the instrument.

**4-5.** The microprocessor communicates with the internal circuits through a data bus and an address bus. Command information is entered into the microprocessor through the front panel keyboard or an IEEE-488 interface. DIP switches are provided for option and test purposes. Input data selection is displayed by means of a digital readout and LED indicators. The microprocessor stores and processes input data, and generates data and address information to cause execution of command functions.

**4-6.** The audio input signal is first applied to a pair of differential attenuators followed by an instrumentation amplifier. The combination of amplification and attenuation works to normalize a 300 mV to 300 V input level range to a range between 1.2 and 3 volts. The DC component of the input signal is detected after the amplifier, filtered, and measured with one channel of the analog-to-digital converter (A/D) for the DC level measurement mode.

**4-7.** The AC component of the input signal is AC coupled and amplified further by factors of either X1, X2.5, X5, or X10. The rms level of the AC waveform is converted to DC and measured with another channel of the A/D converter. The level measurement at this stage is used to autorange the input attenuators and amplifiers and is also used in the calculation of the distortion and SINAD measurements. After the rms detector, connectors are provided for up to two optional filters which can be selected individually and inserted into the signal path.

**4-8.** A programmable notch filter tuned to the fundamental frequency is inserted into the signal path in the distortion and SINAD measurement modes. The notch filter is tuned by the microprocessor circuits based on a manually selected or measured fundamental frequency. An amplifier with gain factors of X1 or X10 follows the notch filter. The notch filter and associated amplifier are bypassed in the frequency, AC and DC level, and signal-to-noise (S/N) measurement modes.

**4-9.** A programmable gain amplifier follows the notch filter circuits and provides amplification over a range of X1 to X10000 in X1, X2, or X5 increments. The amplifier is used in conjunction with the input amplifier in the AC level and S/N measurement modes to provide extended range from 300mV down to 0.3 mV full scale. In the distortion and SINAD measurement modes the amplifier is used in conjunction with the notch amplifier

to boost harmonic and noise content in the pass band of the notch filter by up to 80 dB. Low-pass filter selections are provided before the last stage of the amplifier to attenuate out-of-band noise and preserve significant harmonic components. Following the low-pass filters are three level detectors. The rms, average, and quasi-peak level of the AC waveform is converted to DC and measured with another channel of the A/D converter. The level measurement at this stage is used to autorange the post-notch detector amplifiers and is also used in the AC level, distortion, SINAD and S/N measurement modes. The signal presented to the AC detectors is buffered and presented at the rear panel MONITOR output for external analysis.

**4-10.** The audio output signal is generated by a low distortion oscillator design which tunes from 10 Hz to 140 kHz. Microprocessor controlled coarse and fine tuning precisely sets and maintains the source frequency. A peak detecting sampler is used in the automatic level control circuits (ALC) to maintain a constant amplitude at all frequency settings.

**4-11.** The output of the oscillator is applied to a programmable attenuator which adjusts output level in 1 mV increments over a 0.001 to 3.000 volt range. The attenuator output is amplified and attenuated further to provide a total level range of 0.01 mV to 16.000 volts open circuit. A class A power amplifier is used to convert the single-ended source to a differential output with a 50 ohm impedance. The oscillator, output attenuator and power amplifier are isolated from the chassis by an optically coupled digital interface and a floating power supply to enable the source to operate in a floating configuration. Output impedance selections of 150 and 600 ohms are achieved by inserting 100 and 450 ohm resistors in series with the 50 ohm output.

**4-12.** The period counter circuits are shared by the source and analyzer. The actual source frequency is measured to enable fine tuning of the oscillator as part of a frequency lock loop. The analyzer frequency is measured for the frequency measurement mode and for automatic tuning of the notch filter.

**4-13.** The power supply circuits convert the incoming line voltage into regulated DC operating voltages to power the instrument circuitry.

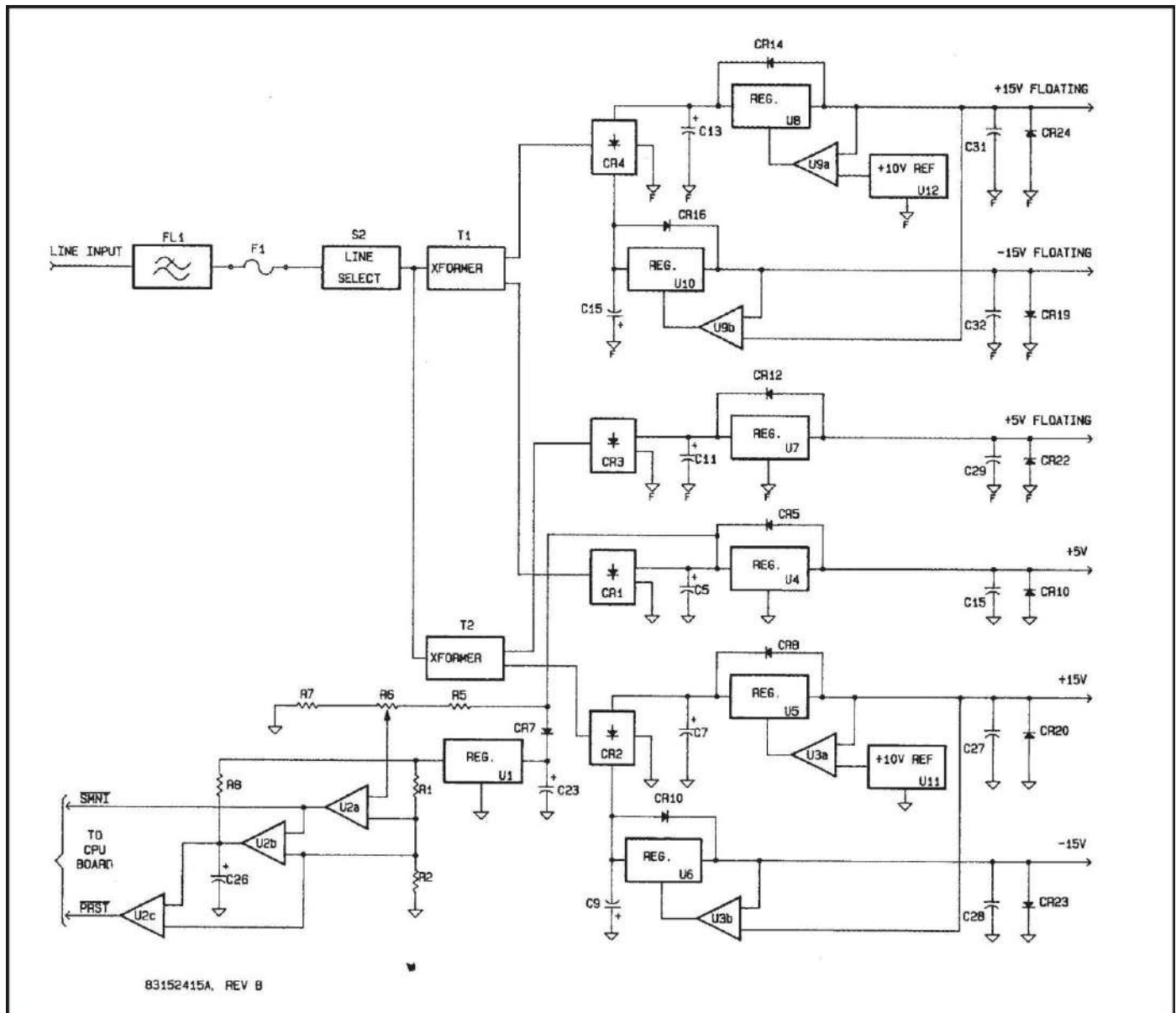


Figure 4-2. Power Supply Circuits Block Diagram.

#### 4-14. DETAILED CIRCUIT DESCRIPTION.

**4-15. A10 Power Supply Circuits.** The power supply provides the main power for the logic and analog circuits. Refer to Figure 4-2.

**4-16.** Line power is connected to transformers T1 and T2 via line filter FL1, fuse F1, and line voltage selector switch S2. FL1 keeps internally generated RF signals from appearing on the power connecting cable thus preventing unwanted electromagnetic radiation. Line switch S2 alters the connections to the primaries of T1 and T2 allowing the Model 1121A to operate from line voltages of 100 to 240 volts. The dual power supplies provide fixed and floating sources of +5, +15 and -15 volts. The fixed and floating supplies are essentially identical; therefore,

only one will be described in detail.

**4-17.** One of the two secondary windings on T1 is connected through full-wave bridge CR1 to regulator U4. This regulator generates a +5 volt regulated voltage for logic circuits. Capacitor C5 provides the essential energy storage which reduces the ripple voltage at the input of U4. C15 provides local bypassing of the regulator circuits and diodes CR5 and CR10 protect the integrated regulator from reverse power.

Figure 4-3. CPU Circuits Block Diagram.

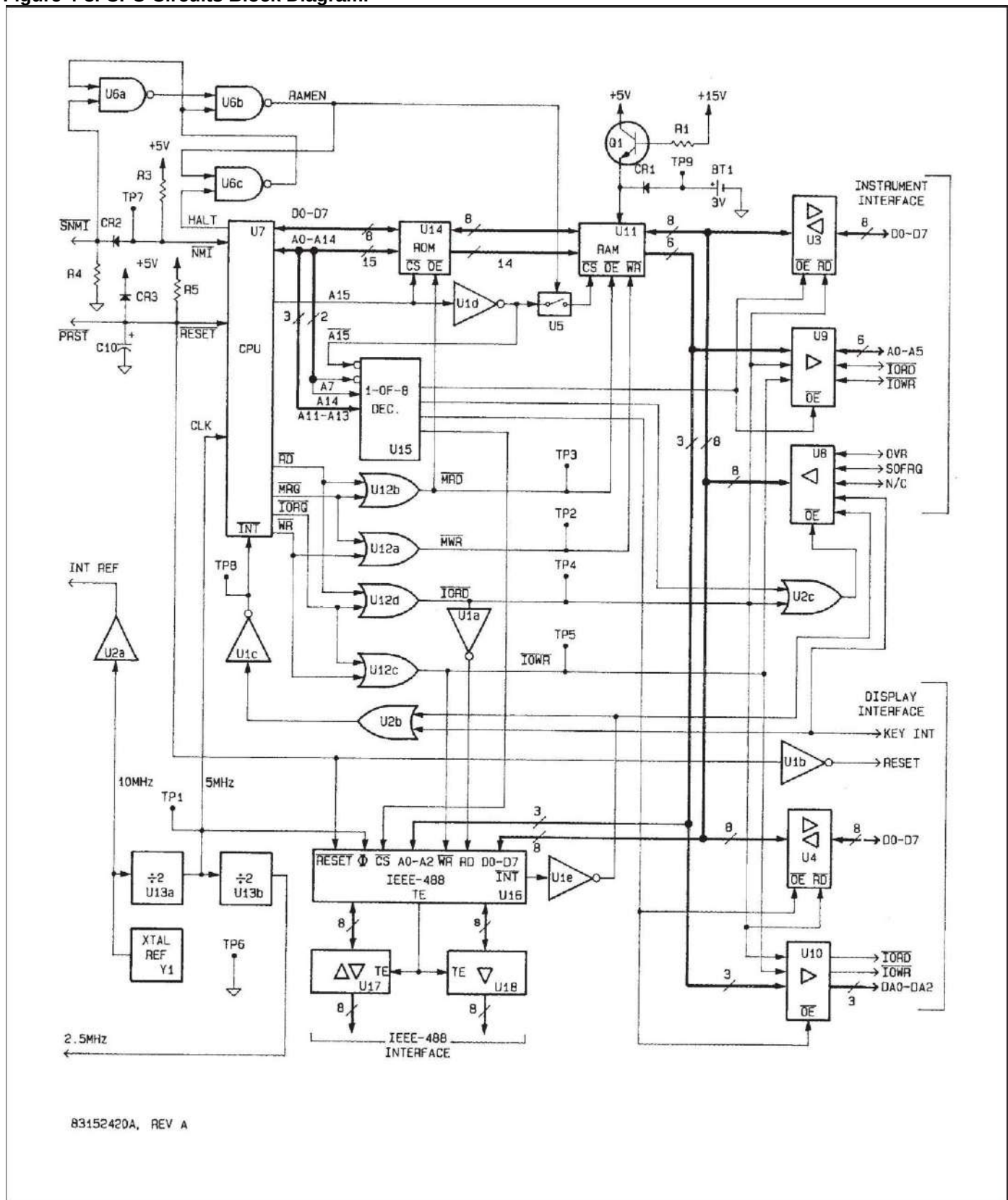


Figure 4-3. CPU Circuits Block Diagram.

**4-18.** The other secondary winding of T1 is connected through full-wave bridge CR4 to regulators U8 and U10. These regulators are enclosed in feedback loops to improve regulation and increase the operating voltages from 5 to 15 volts. Capacitors C13 and C15 reduce input ripple voltage and CR14, CR16, CR19, and CR24 provides reverse voltage protection. Reference U12 provides the voltage reference for the power supply. Precision resistors R10a, b, and e configure U9a for a gain of +1.5. This converts the +10.00 volts output of U12 to +15.00 volts. R10f and d configure U9b for a gain of -1 which inverts the +15.00 volt supply to -15.00 volts. Zener diodes CR17 and CR18 are required to ensure proper start-up of the supply, and are normally reverse biased when the supplies are operating properly. C31 and C32 provide local bypassing to maintain loop stability as the supply loading changes.

**4-19.** An additional 5 volt regulator, U1, supplies power to the power-fail circuits. The operating voltage for U1 is the +5 volt supply input voltage which is about 9 volts at nominal line. Capacitor C23 ensures that the output of U1 will be maintained as long as possible when line voltage is removed. The power-fail circuit operates to properly isolate the random access memory from logic circuitry when the line voltage drops or the instrument is switched off. Comparator U2a monitors the unregulated voltage which supplies the 5 volt logic supplies. Resistors R1 and R2 divide the power-fail circuit supply by two as a reference for U2a. If the power line voltage drops to about -11% of nominal, U2a switches, pulling line SNMI low. This activates the power-fail sequence which interrupts the microprocessor and isolates the random access memory. U2b buffers the SNMI signal and drives a delay network, R8 and C26. When the open-collector output of U2b goes low, C26 is discharged quickly. This output is buffered by U2c to drive the PRST line which resets the CPU circuitry. When the output of U2b switches off, the PRST signal is delayed by the time required to charge C26 to one half of the power-fail supply voltage. This prevents multiple CPU resets as the supply voltage decays toward zero.

**4-20. A10 Motherboard Circuits.** The motherboard circuitry provides the main interconnect for the operating circuits of the Model 1121A. The motherboard circuits include the connectors for the plug-in boards, the power supply connectors and instrument data and address buffers for the source and analyzer analog sections. The motherboard circuits also contain the source output attenuators and impedance selection circuits.

**4-21.** Address decoding on the counter plug-in board generates the Master Analyzer Enable (MAE) signal which enables address decoder U1 and tri-state buffer U2. MAE is only active during instrument data write cycles to the analyzer circuits and inhibits RF generated noise caused by the many data transfers between the CPU and

counter plug-in boards. The instrument data lines to the source and output plug-in boards are buffered in the same manner with decoder U3, buffer U18 and the Master Source Enable (MSE) signal from the counter plug-in board. Additionally, the source interface is optically coupled using U5 through U17 to allow the source oscillator circuits to operate while isolated from the chassis. Optical coupler U4 conveys the sync square wave from the source board back to the counter circuit board for measurement (TP1). The rear panel SYNC output signal is buffered by Q1 and associated circuitry.

**4-22.** The parallel combination of R26 and R29 from the 50 ohm output impedance of the power amplifier. A 14 dB attenuator (/5) is formed by R12, R14 and K1. Relay K1 engages the attenuator for output level settings of 3.000 volts and below. A 20 dB attenuator (/10) is formed by R15, R17 and K2 (TP3). Relay K2 engages the attenuator for output level settings of 300.0 mV and below. The 150 ohm output impedance is configured by adding R18, 100 ohms, in series with the 50 ohm output using K3. The 600 ohm output impedance is configured by adding R22, 450 ohms, in series with the 150 ohm output using K4. Float relay K5 connects the LOW output terminal (TP4) to chassis ground through fuse F2 in the non-floating mode while fuse F1 protects the source circuits HI output (TP5) from reverse power. During power-up Q8 disables the +15 volt supply to relays K1 through K5 for approximately 1 second to provide time for the C.P.U. to initialize the source circuits.

**4-23. A5 CPU Circuits.** The CPU circuits are the central control circuits of the instrument. They receive input commands and data from the front panel keyboard or an IEEE-488 interface and configure the internal circuits of the instrument in accordance with the input commands and data. Storage facilities for up to 99 complete front panel setups are also provided. Refer to Figure 4-3.

**4-24.** The Z-80 CPU, U7, executes a control program resident in read-only memory, (ROM) U14. Program variables and front panel setups are stored in random-access memory, (RAM) U11. Local communications on the CPU board are via the high-speed data bus D0 through D7 and address bus A0 through A15. Memory address space partitioning is divided equally between RAM and ROM and is accomplished through inverter U1d. All other instrument peripherals are partitioned in the I/O address space which is accomplished with decoder U15. U12a, b, c, and d generate memory read and write signals and I/O read and write signals for qualifying data transfers between memory or I/O peripherals and the CPU (TP2TP5).

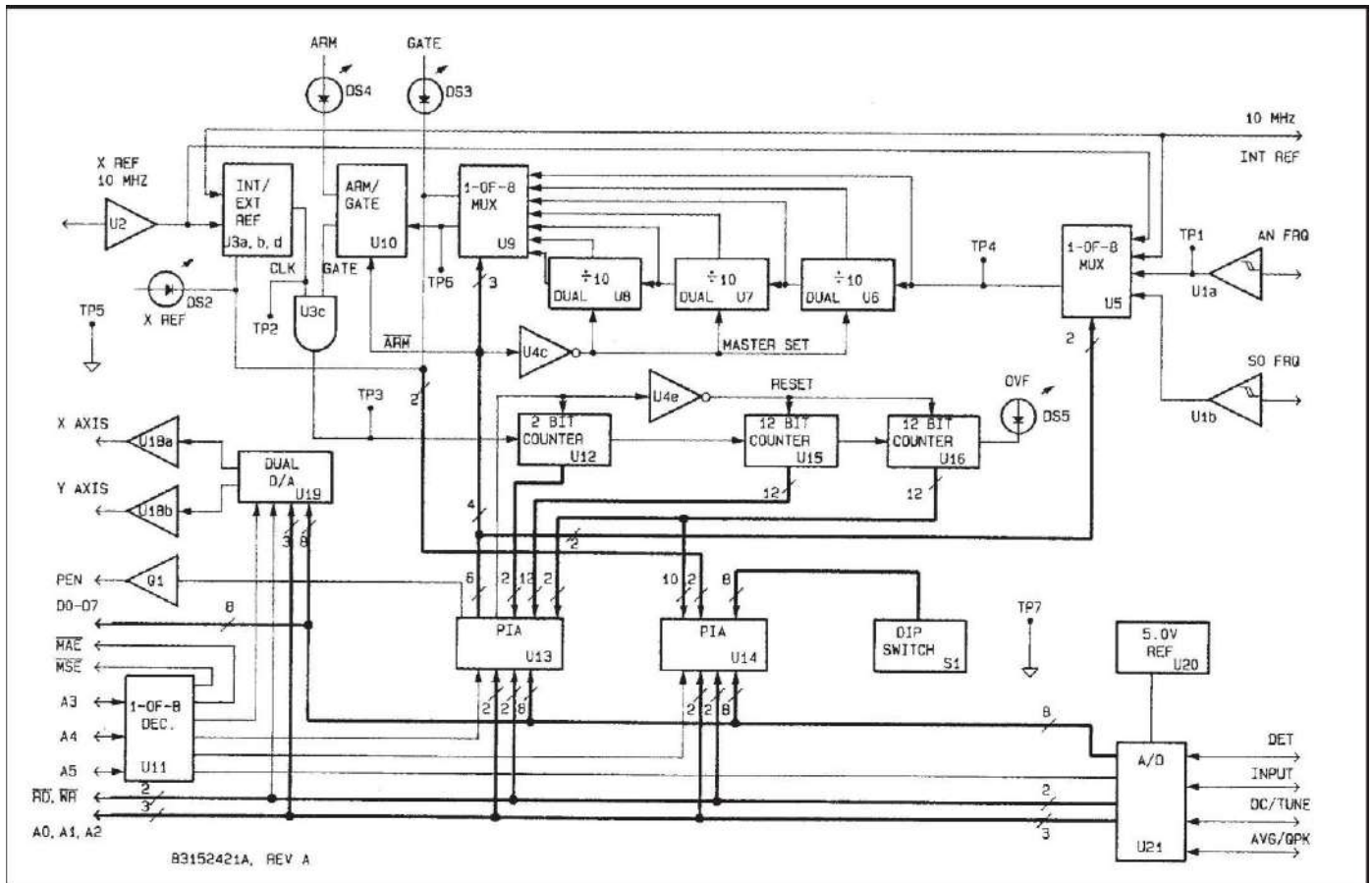


Figure 4-4. Frequency Counter Circuits Block Diagram

**4-25.** The RAM is powered from a non-volatile power supply consisting of Q1, CR1 and BT1 (TP9). If a power fault occurs, circuits in the power supply activate the SNMI line which in turn activates the NMI processor interrupt line (TP7). This causes the processor to stop the control program and execute a HALT instruction which sets the HALT pin low. This inhibits further write cycles to the RAM by setting a latch formed by U6c and d which disconnects the chip select (CS) line to the RAM using analog switch U5. Signal PRST is also set low shortly after SNMI is activated, causing the CPU to be reset to the program start. When proper operating voltage is restored, the SNMI line returns high releasing NMI and restoring the RAM CS connection. During the power down interval the RAM is powered by BT1 (TP9).

**4-26.** Microprocessor timing is controlled by a 5 MHz clock (TP1) which is derived from a 10 MHz TCXO, Y1, and flip-flop divider U13a. The 5 MHz clock signal is also used by the IEEE-488 microcontroller, U16. The 10 MHz TCXO output is also buffered through U2a and is used for the internal timebase reference for the frequency counter circuits.

**4-27.** All IEEE-488 interface operations are conducted by U16 in conjunction with the microprocessor interrupt routines. These routines move data into and out of mem

ory buffers as required in response to bus commands. U17 and U18 are buffer circuits which connect U16 to the IEEE-488 bus via J20. These buffers meet the electrical requirements of the IEEE-488.

**4-28.** Interrupt oriented control enables the CPU and control program to respond quickly to peripheral activity. When bus activity occurs, U16 sets the INT line (TP8) via U1e, U2b and U1c. When a display/keyboard interrupt occurs the KEY INT line sets the microprocessor interrupt line through U2b and U1c. The microprocessor determines the source of the interrupt by reading the interrupt status buffer, U8, and services the requesting peripheral device.

**4-29.** The instrument bus interface adapter consists of U3, U9, R8, and R9. These tri-state buffers are normally in the high-impedance mode during all memory transfers and I/O data transfers occurring between the CPU and the display/keyboard circuits or the IEEE-488 interface.

**4-30.** The display/keyboard bus interface adapter consists of U4 and U10. These tri-state buffers are only active during display/keyboard circuit transactions.

**4-31. A12 Display And A13 Keyboard Circuits.** The display and keyboard circuits provide the operator interface to the Model 1121A circuits. Key closures are detected and sent to the microprocessor which interprets and modifies the display LEDs appropriately. The software configurable display/keyboard CPLD, U1 is programmed to operate 16 display digits. All of the seven segment displays are connected to a common cathode driver bus which is generated by U1 and buffered through U7 and current limiting resistors R118 through R125. The LED anodes are individually connected to buffers U3 and U4. All segment decoding is done by the CPLD so that no additional decoders are required.

**4-32.** All of the alphanumeric annunciators are static and latched by the CPLD U1. Resistors R126 through R148 limit the current through the LEDs.

**4-33.** The key LEDs are all static and latched by the CPLD U1.

**4-34.** Keyswitch decoding is accomplished by scanning the keyboard and detecting key closures. CPLD U1 controls the scanning of the keyboard through decoder U17 which generates the column strobes RL0 through RL7. Any key closure will convey the column strobe to one of eight row lines, RR0 through RR7, which are monitored by U1. Multiple key closures and key debouncing are handled by U1. When a keyswitch closure occurs a microprocessor interrupt is generated and processed as described in the CPU board section.

**4-35. A4 Frequency Counter Circuits.** The counter circuits provide the frequency measurement functions of the Model 1121A. Additionally, the analog-to-digital converter (A/D), the sweep output circuits, and the option switch are located on the counter plug-in board. Refer to Figure 4-4.

**4-36.** The 10 MHz internal frequency reference from the CPU board is connected to gate U3d. The other input of U3d is a signal derived from the external reference input. If an external reference signal is present, pin 6 of U2a will be a TTL compatible signal at the external reference frequency rate. The signal is inverted by U2b and detected by CR3, C25 and R4. When a signal is present the input of inverter U2c will be a TTL low level which is the control to automatically switch to the external reference using U2d, U3a, U3b, and U3d. The output of U3b (TP2) is the reference frequency for the counter circuits derived from either the internal or external source. DS2 will be illuminated when the external reference is active.

**4-37.** The analyzer frequency line ANFRQ is generated on the detector plug-in board and is applied to hysteresis amplifier U1a and associated components. U1a acts as a buffer between the analog and digital sections of the instrument and is insensitive to the noise which is present

between the analog and digital grounds. The output of U1a (TP1) is applied to the input multiplexer, U5, of the counter. U5 selects one of four inputs; source frequency, analyzer frequency, external reference, and internal reference, based on the state of control lines S0 and S1. The output of U5 (TP4) is applied to a chain of dual decade dividers, U6, U7 and U8. These dividers are used for period selections and divide the selected input by factors of 1 to 1000000 in decade increments. All the divider output are presented to a second multiplexer, U9, which selects one of the six period divisions based on control lines T0, T1 and T2.

**4-38.** Dual flip-flop, U10, controls the arm and gate intervals. The output of U9 (TP6) is inverted by U4b and applied to the clock input of U10a. The arm interval synchronizes the counter circuits to begin the gate interval on the next rising edge of the measurement signal. The ARM line is set low to clear flip-flop U10a and, after being inverted by U4c, is applied to the master set (MS) lines of U6, U7 and U8. The MS sets all the divider output high which prepares the dividers to all start at count 0 with the next falling edge of the measurement signal. The rising edge of the ARM line clocks U10b, sets the U10b pin 9 high and illuminates DS4. When the falling edge of the measurement signal occurs, U10a is clocked and the gate interval begins when U10a pin 5 goes high. Simultaneously U10a pin 6 goes low which illuminates DS3 and clears the arm latch U10b. When U10b is cleared, DS4 is extinguished and U10b pin 9 is set low. The gate interval continues until U10a pin 5 is clocked low by the next rising edge of U10a pin 3. Gate U4a detects the end of the arm and gate intervals and indicates to the CPU that the count is complete. The counter will hold the count until the next arm interval is initiated. The output of U10a pin 5 goes to gate U3c which allows the reference to pass to the counter accumulator during the gate interval (TP3).

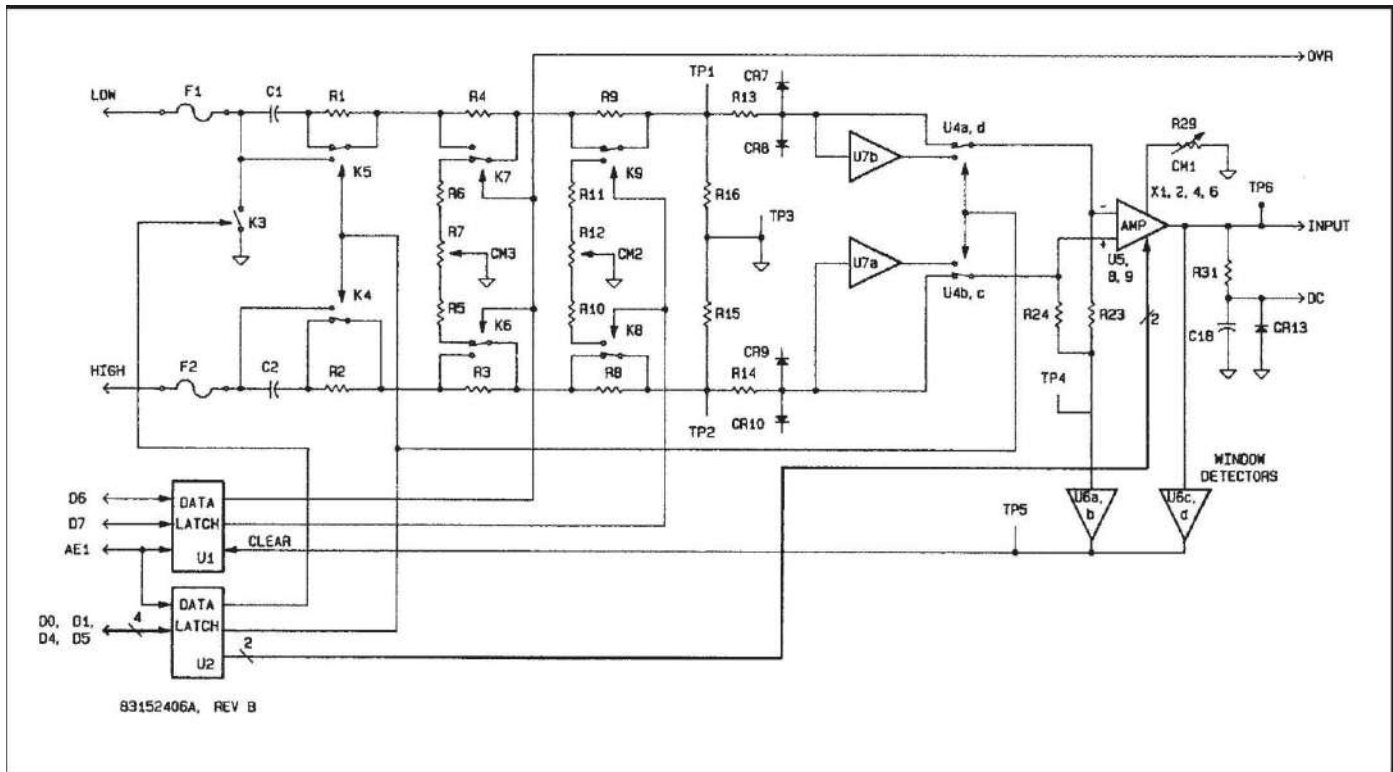


Figure 4-5. Input Circuits Block Diagram.

**4-39.** The gated reference is applied to a 26 bit accumulator consisting of U12, U15 and U16. The accumulators cleared by a TTL low level from U13 pin 11. By detecting the most significant bit of the accumulator, U4d will prevent the accumulator from overflowing and illuminate DS5. The accumulator is read by the CPU through I/O devices U13-14.

**4-40.** The option dip switch is connected to one port of I/O device U14 along with lines indicating external reference control and gate status.

**4-41.** Analog-to-digital converter (A/D), U21, converts one of four DC levels to a 12 bit binary representation where full scale is an input level of +5 volts. Reference U20 provides the 5 volt reference for the A/D converter. Auto zero capacitor C14 charges to the offset level before each A/D conversion. R28 provides a +2.5 volt offset to channel 3 of the A/D converter to allow for the bipolar input range of the DC measurement mode. A clock generating circuit consisting of R27, C15, CR10, CR11, and C16 sequences the auto-zero and conversion cycles of the A/D converter.

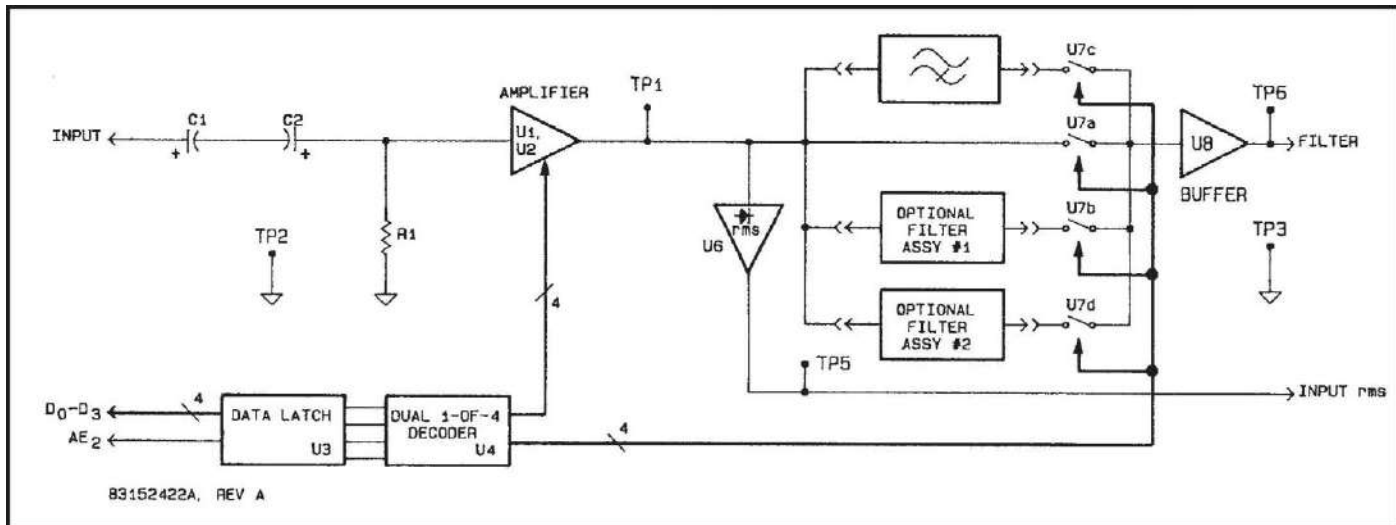
**4-42.** The sweep output circuits generate the X AXIS, Y AXIS, and PEN outputs. Transistor Q1 generates the PEN output under command by the CPU through I/O device U13 pin 10. Reverse power protection is provided by R12, CR4 and CR5. The X AXIS and Y AXIS outputs are generated by dual 12 bit digital-to-analog converter

(D/A), U19, and associated voltage amplifiers U18a and b. The -5 volt reference voltage for the D/A converter is zener regulated from the -15 volt supply by R24 and CR14 and filtered by C13. Reverse power protection is provided by R25, R26, and CR6 through CR9.

**4-43.** Address decoder U11 decodes the chip select lines for I/O devices U13 and U14, D/A converter U19, and A/D converter U21. MAE and MSE, the master analyzer and source enable commands used on the motherboard, are also generated by U11.

**4-44. A0 Input Circuits.** The input circuits provide the attenuation and initial gain along with over voltage protection and AC/DC mode switching for the Model 1121A. Refer to Figure 4-5.

**4-45.** The audio input signal is applied to the input plug-in board through low-pass filters L3, L4, C23, and C24 to reduce RF interference. Fuses, F1 and F2, prevent damage due to excessive input level. Float mode relay, K3, connects the LOW terminal to chassis ground in the non-floating mode. K3 is energized through transistor Q3 by data latched in U2 from the CPU circuits. AC coupling capacitors C1 and C2 are bypassed in the DC level mode by relays K4 and K5. Resistors R1 and R2 discharge C1 and C2 in the AC mode. Relays K4 and K5 are energized through transistor Q4 by data latched in U2 from the CPU circuits.



**Figure 4-6. Filter Circuits Block Diagram.**

**4-46.** A 40 dB attenuator is formed by resistors R3 through R7, R15, and R16. This attenuator is engaged by relays K6 and K7 for level ranges above 30 volts. High frequency compensation is provided by C6 through C9 and C30 through C33. Common mode adjustment R7 adjusts the attenuation balance between the high and low inputs when the attenuator is engaged. Relays K6 and K7 are energized through transistor Q5 by data latched in U1 from the CPU circuits.

**4-47.** A 20 dB attenuator is formed by resistors R8 through R11, R15, and R16. This attenuator is engaged by relays K8 and K9 for level ranges between 3 and 30 volts. High frequency compensation is provided by C5, C10, C13, C14, C21, and C22. Common mode adjustment R12 adjusts the attenuation balance between the high and low inputs when the attenuator is engaged. Relays K8 and K9 are energized through transistor Q6 by data latched in U1 from the CPU circuits. Over voltage protection is provided by clamping diodes CR7 through CR10 and R13 and R14 (TP1, TP2).

**4-48.** In the DC level mode, buffers U7a and U7b are switched in the signal path by analog switch U4. U7a and b are low DC offset devices which are necessary for DC level measurement accuracy. Analog switch U4 is wired in a DPDT form and is controlled by data latch, U2, which also energizes K4 and K5. Instrumentation amplifier consisting of U5, U8, U9, and associated components provide programmable gains of X1, X2, X4, and X6. Gain setting resistors R17 through R22 are configured by K1 and K2 for gain selections. Relays K1 and K2 are energized through Q1 and Q2 and resistors R43 and R44 by data latched in U2. High frequency compensation is provided by C3, C4, C25, C28 and C29. Amplifier U9 and resistors R25 through R29 from the differential to single-ended converter stage of the instrumentation amplifier. R29 enables the adjustment of the common mode rejection of the stage.

**4-49.** The common mode (TP4) and differential (TP6) signals are separately monitored by window detectors U6a through d for peak voltages exceeding  $\pm 10$  volts. The common mode signal is formed by summing the outputs of U5 and U8 with resistors R23 and R24 (TP4). The  $\pm 10$  volt window is formed by CR11, CR12, and R26. Any common mode or differential peak amplitude exceeding  $\pm 10$  volts will cause the open-collector output (TP5) of the detecting device to sink to -15 volts which is applied through R30 and R34 to the latch clear inputs of U1. Clearing latch U1 will engage the 40 dB attenuator and remove the overrange condition. The state of the 40 dB attenuator is monitored by the CPU circuits through the overrange status line, OVR, connected to U1 pin 9.

**4-50.** In the DC level measurement mode the DC level at the output of the instrumentation amplifier is filtered by R31 and C18 and measured by one channel of the A/D converter on the counter plug-in board.

**4-51. A1 Filter Circuits.** The output of the Input circuits is further amplified by the filter plug-in board and the rms value of the AC signal is detected. Up to two optional filter modules can be installed on the filter board and inserted into the signal path. Refer to Figure 4-6.

**4-52.** The signal from the input plug-in board is AC coupled to programmable gain amplifier U1 through C1, C2, and R1. Gain selections of X1, X2.5, X5, and X10 are determined by R2, R3, R4 and R5 and are selected by analog switch U2a, b, c and d. Gain selection data from the CPU board is latched in U3. Dual one-of-four decoder U4 decodes the data and enables one of the three gain selections.

**4-53.** The output of the amplifier U1 (TP1) is applied to a monolithic rms-to-DC converter, U6, which converts the AC signal to a DC level representing the rms value of the

waveform. Capacitor C7 is required by U6 for filter averaging. The output of U6 (TP5) is measured by one channel of the A/D converter on the counter plug-in board. The signal level is measured at this stage in the analyzer circuits for distortion and SINAD measurement calculation and for autoranging the input attenuators and amplifiers.

**4-54.** Analog switches U7a, b, and d and buffer U8 are used to bypass or select one of two optional filter modules when installed (TP6). Filter selection data from the CPU circuits is latched in U3 and decoded by U4.

**4-55. A2 Notch Filter Circuits.** The notch filter is an automatically tuned and balanced state-variable notch filter. The filter is inserted into the signal path to remove the fundamental frequency component and pass harmonics and noise for the distortion and SINAD measurement modes. Refer to Figure 4-7.

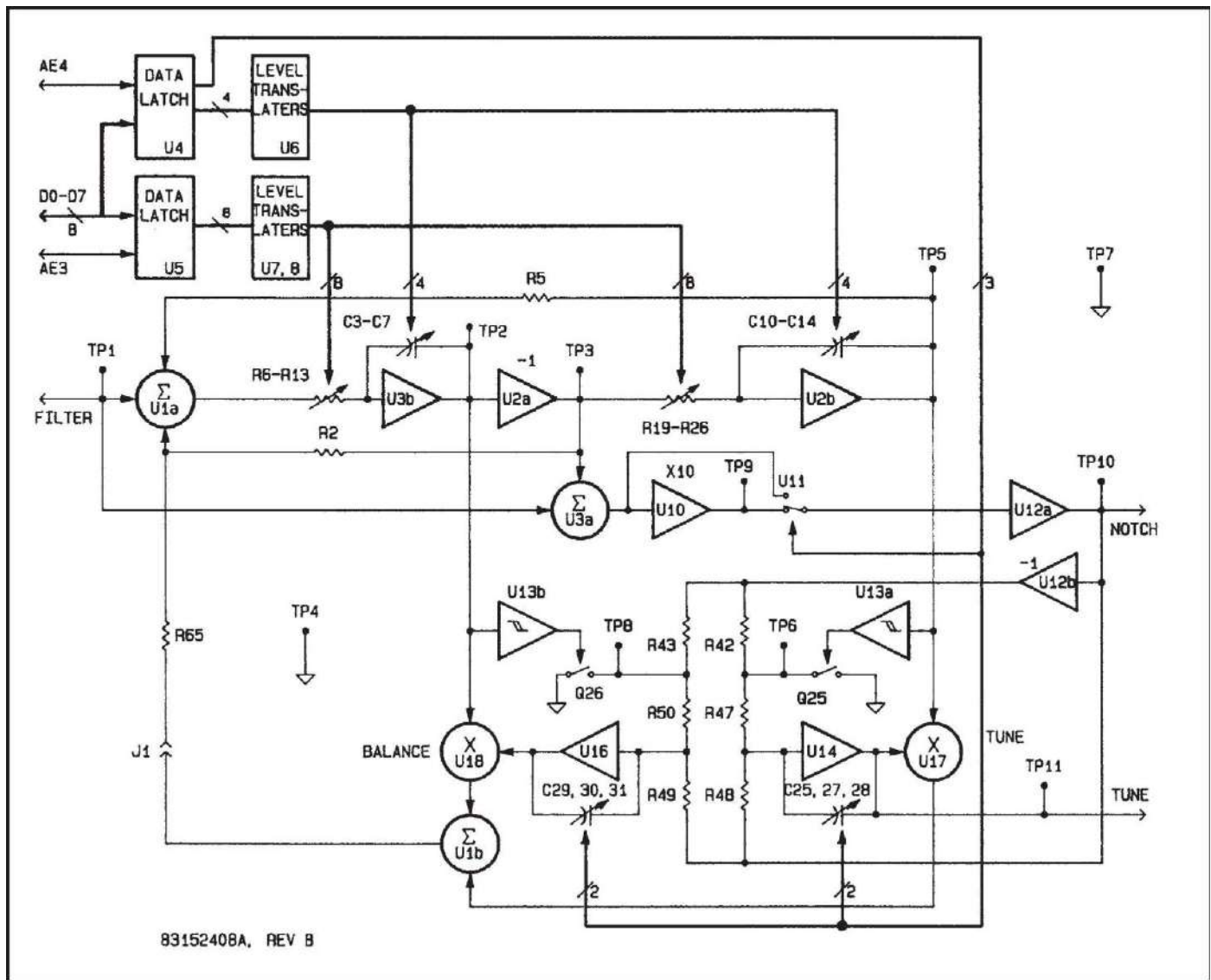
**4-56.** The notch filter consists of a state-variable band-pass filter and a balance amplifier, U3a. In operation the band-pass filter is tuned to the fundamental frequency measured by the counter circuits. The output of the band-pass filter (TP3) is then subtracted from the input signal (TP1), leaving only the harmonic and noise components of the input signal (TP9). Fine adjustment of the notch center frequency and the amplitude of the band-pass output is accomplished by two control loops which operate to reduce the in-phase and quadrature components of the fundamental signal at the output of the balance amplifier.

**4-57.** The individual integrators in the filter are identical, so only one will be described in detail. The output from summing amplifier U1a is applied to a series of eight resistors. The values of these resistors, R6 through R13, are chosen in a binary series to operate as a discrete 8 bit D/A converter. These resistors are selected for frequency tuning within a selected frequency band by FET switches Q1 through Q8. Capacitors C3 through C7 are selected by FET switches Q9 through Q12 for integrator tuning over five frequency bands. Integrating amplifier U3b completes the integrator (TP2). Coarse tuning of the filter is provided by the selection of resistor and capacitor combinations by the control program. Data from the control program is latched in data latches U4 and U5. The 12 comparators contained in U6, U7, and U8 and associated pull-up resistors R29 and R30 act as level translators to convey the latched TTL data to gate drive levels necessary to operate the FET switches.

**4-58.** The band-pass filter output is generated at the output of inverting amplifier U2a (TP3). Balance amplifier U3a subtracts the band-pass output from the filter input signal forming a notch filter response. The output of the balance amplifier is further amplified with a gain of 10 by

U10 and associated circuits. Analog switch U11a and b in conjunction with buffer U12a select the gain depending on range information from the control program. The output of U12a (TP10) is further processed by the detector circuits and used in the distortion and SINAD measurement modes.

**4-59.** The balance and tuning of the filter is controlled by synchronously detecting and reducing the in-phase and quadrature components of the fundamental at the output of U12a. Comparators U13a and b detect the in-phase (TP2) and quadrature (TP5) signals in the band-pass filter and generate gate switching levels for chopper FETs Q25 and Q26. Amplifier U12b inverts the output of U12a and provides an out-of-phase signal to be used in generating full-wave rectified signals for the tune and balance integrators. The rectifier operates as follows: During the time that switches Q25 and Q26 are shorted to ground a current flow in resistors R48 and R49 to the integrators. When Q25 and Q26 are open, twice as much current at the opposite phase flows through resistors R42, R47 (TP6), R43, and R50 (TP8). Since the currents are out of phase the net current flow is the same and in the same direction providing a full-wave rectified current to the integrators. Integrating amplifiers U14 and U16 generate error voltages in proportion to any in-phase or quadrature error currents. The integrator time constants are selected by analog switch U15 and capacitors C27 through C30 to allow optimum tracking dynamics across the tuning range of the filter. The tune and balance error voltages are applied to four-quadrant multipliers U17 and U18. The current outputs through pin 4 of each multiplier is summed together and amplified by U1b. The output of U1b is the product of the tune and balance error voltages and the in-phase and quadrature signals which are summed back into the filter through U1a to cancel tuning and balance errors. The control loops can be disabled to aid in troubleshooting the notch filter circuits by removing jumper J1.



**Figure 4-7. Notch Filter Circuits Block Diagram.**

**4-60.** A tune status output signal is generated by tune integrator U14 (TP11). The tune voltage is applied to one channel of the A/D converter on the counter plug-in board where the control program can monitor the tune status to determine if the notch filter is properly tuned. Tune and balance adjustments R57 and R58 are adjusted to null out any error voltages in the control loops which would limit the effective depth of the notch filter.

**4-61. A3 Detector Circuits.** The detector circuits provide the post notch gain, low-pass filters, frequency counter schmitt triggers, and the rms, average and quasi-peak detectors for the Model 1121A. Refer to Figure 4-8.

**4-62.** Relay K1 is selected by the control program to insert the notch filter into the signal path in the distortion and SINAD measurement modes. In all other modes the filter is bypassed. Analog switch U2 with resistors R5, R6 and R7 form a programmable attenuator with 0 dB or 20 dB of

attenuation. This attenuator is followed by amplifier U3 having a gain of 20 dB determined by R8 and R9. The attenuator and amplifier combination form a programmable 0 dB or 20 dB gain stage. The amplifier is actively clamped by diodes CR2 and CR3 to the bipolar voltage reference formed by CR6, CR7, and R19. All output swings of amplifier U3 will be limited to less than  $\pm 10$  volts peak preventing the stage from saturating and enabling fast recover after transients. The output of U3 (TP3) is AC coupled to an identical programmable amplifier stage consisting of analog switch U6, R10 through R14, and U7.

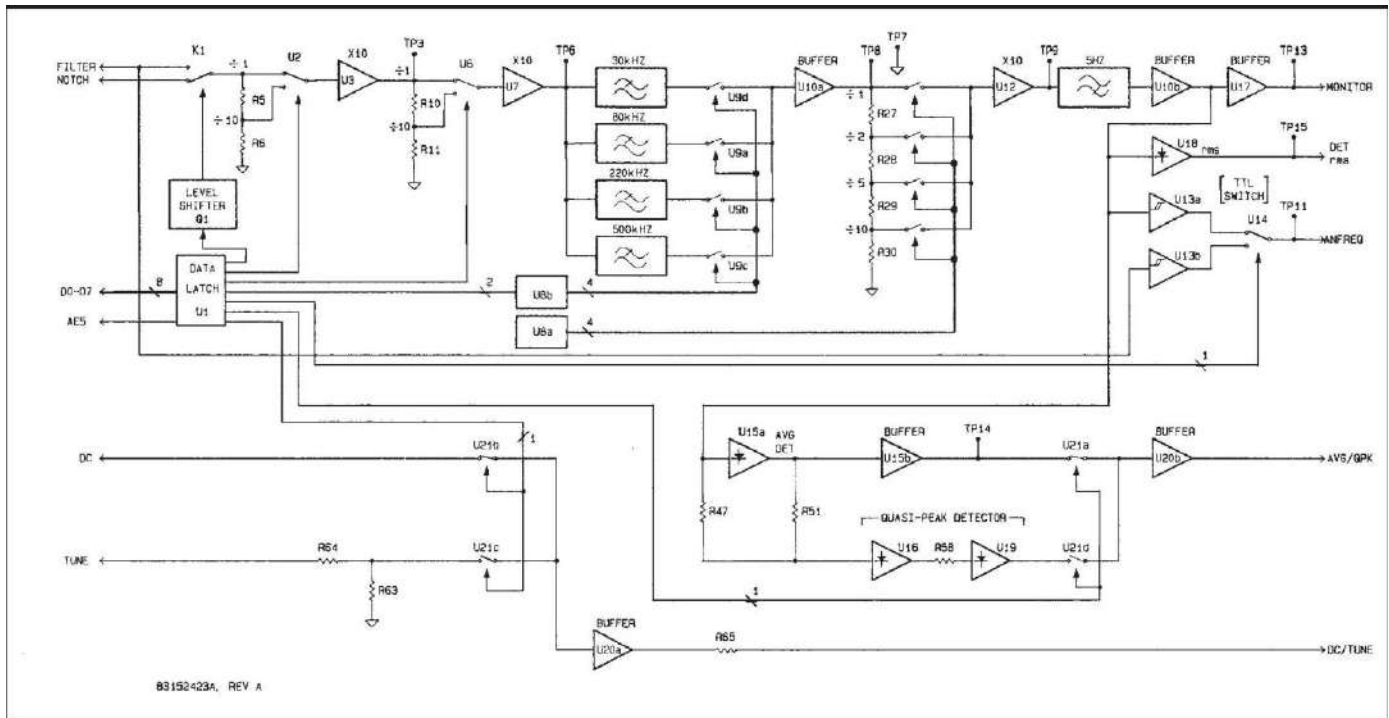


Figure 4-8. Detector Circuits Block Diagram.

**4-63.** Following U7 (TP6) are the low-pass filter selections. Analog switches U9a through d select the various filter values for the 30 kHz, 80 kHz, 220 kHz or 500 kHz low-pass filters. Unity gain buffer U10a completes the selected filter (TP8). The output of U10a (TP8) is AC coupled to a final programmable attenuator consisting of analog switch U11a through d and R27 through R33. Amplifier U12 is an identical clamped gain stage as U3 and U7 with a gain of 20 dB. The combination of the attenuator and amplifier form a programmable gain stage with gain selections of X1, X2, X5, and X10.

**4-64.** Amplifier U10b and associated components form a 5 Hz high-pass filter which determines the low frequency bandwidth of the Model 1121A. Buffer amplifier U17 and CR14, CR15 and R55 present the detector output signal to the rear panel MONITOR output connector for external analysis (TP13).

**4-65.** The complete detector amplifier and attenuator chain is programmable for a gain change of 0 to 60 dB in 1X, 2X, or 5X increments. In the distortion and SINAD modes the 20 dB amplifier on the notch filter plug-in board increases the chain to a total combined gain of 80 dB. The programmable gain is required to maintain a constant level of between 1.2 and 3 volts at the rms, average and quasi-peak detectors to preserve the resolution and accuracy of the analyzer over a wide dynamic range. The rms detector consists of U18 and associated components. The output of the rms detector (TP15) is a DC level equal in amplitude to the rms value of the input

signal.

**4-66.** The quasi-peak detector consists of U16 and U19 and associated components. U16 forms an integrator with an attack time of less than 2 ms and decay time of 400 ms. U19 forms an integrator with an attack time of 200 ms and decay time of 600 ms. The average detector consists of U15a and b and associated components. U15a forms a full wave rectifier circuit and C56 filters the output to a DC level representing the average value of the input signal (TP14). Analog switch U21 selects either the average or quasi-peak detector for measurement by one channel of the A/D converter on the counter plug-in board. Resistors R37 and R37 balance the gain of the average and rms detectors to be equal for a sine-wave input waveform. Inverting amplifier U13b presents a positive 0 to 3 volt level to the A/D converter (TP7).

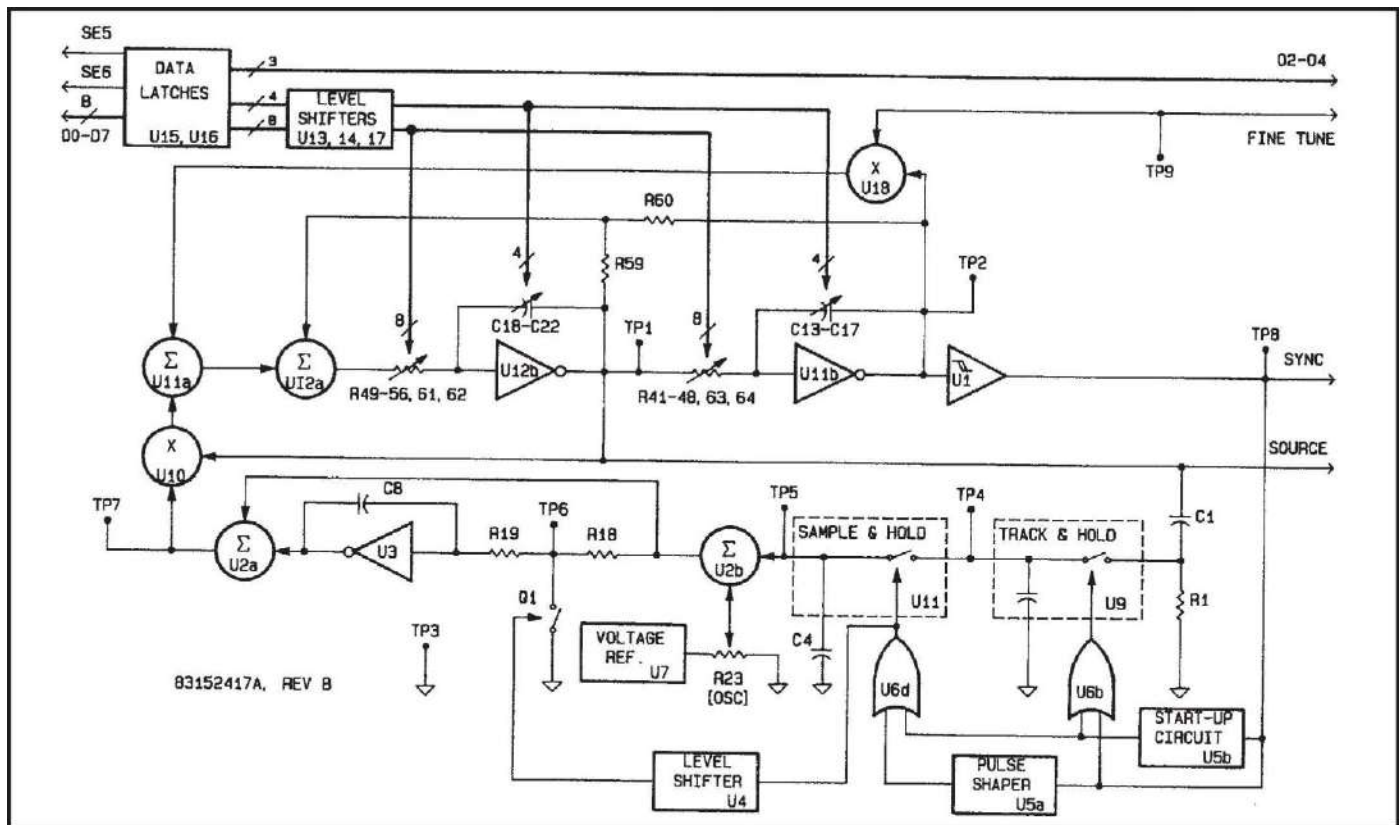


Figure 4-9. Source Circuits Block Diagram.

**4-67.** Detector selection is controlled by the data latched in U1 by the control program. Dual one-of-four decoder U8 decodes the latched data to analog switches U9 and U11.

**4-68. A6 Source Circuits.** The source oscillator is a digitally tuned, automatically leveled state-variable oscillator. The source circuits generate a sinusoidal audio waveform at a constant amplitude over a frequency range of 10 Hz to 140 kHz. Refer to Figure 4-9.

**4-69.** The source oscillator consists of a state-variable oscillator and a automatic level control (ALC) loop. In operation the oscillator is coarse tuned to the selected frequency and then the actual frequency is measured by the counter circuits and fine adjustments are made by the control program to achieve an accurate frequency.

**4-70.** Coarse frequency tuning is achieved by adjusting the time constant of the two integrators. The individual integrators are identical, so only one will be described in detail. The output from summing amplifier U12a is applied to a series of eight resistors. The values of these resistors, R49 through R56, are chosen in a binary sequence. Resistors are selected for frequency tuning within a selected frequency band by FET switches Q18 through Q25. Capacitors C18 through C22 are selected by FET switches Q14 through Q17 for integrator tuning over five

frequency bands. Integrating amplifier U12b completes the integrator (TP1). Coarse tuning of the oscillator is provided by the selection of resistor and capacitor combinations by the control program. Data from the control program is latched in data latches U15 and U16. The 12 comparators contained in U13, U14, and U17 and associated pull-up resistors R61, R62, and R63 act as level translators to convey the latched TTL data to gate drive levels necessary to operate the FET switches.

**4-71.** The oscillator output is generated at the output of integrating amplifier U12b (TP1). A limiter circuit formed by CR9 through CR14 and R38 through R40 prevent overload transients in the output which may occur during frequency transitions.

**4-72.** The leveling and fine tuning of the oscillator is controlled by adjusting the in-phase and quadrature components of the source signal at the output of U12b. The ALC circuits sample the positive peak of the sine wave and compare the peak level to a voltage reference. The difference is sampled by an error integrator and applied to gain control circuits which work to reduce leveling errors by adjusting the feedback of the in-phase component.

**4-73.** A quadrature detector is formed by U1 and associated components. The output of U1 is a TTL compatible square wave used in the ALC loop to detect the peak of the source output waveform. The output of U1 is buffered by gate U6a and is used to generate the rear panel SYNC output (TP8). The SOFRQ output is also applied to the counter circuits to enable internal measurement of the actual source frequency.

**4-74.** The source output signal is AC coupled by C1 and R1 and applied to a track-and-hold circuit, U9. The quadrature detector generates the track and hold control signal which tracks the rise of the sinusoid and holds the peak value for 180 degrees. The output of U9 (TP4) is sampled by U10 immediately following the start of the hold period. The hold period of U9 effectively extends the peak of the sinusoid to eliminate sampling aperture errors. The 30  $\mu$ s sampler aperture is determined by one-shot U5a and timing network C6 and R16. The output of U10 (TP5) is a DC level equal to the positive peak amplitude of the source output signal. Voltage reference U7 generates +5 volts which is applied to a voltage divider network formed by R5, R23, and R12. Oscillator calibration adjustment R23 allows fine adjustment of the source output level. The output of U10 is subtracted from the calibration reference by amplifier U2b and associated components forming an error voltage. Error integrator U3 is enabled by shunt chopper Q1 (TP6) during the 30  $\mu$ s sampling period. A level translator circuit consisting of U4 and associated components convert the TTL sampling signal to gate drive levels to control FET Q1. The output of the error integrator, U3, is amplified by U2a and applied to four-quadrant multiplier U10 to complete the ALC control loop. One-shot U5b and timing network R17 and C7 forms a start-up circuit which triggers after a 200 ms absence of the quadrature signal. When U5b triggers, U9 and U10 are set in track and sample modes to guarantee oscillation when the power is first applied and when there is no quadrature signal.

**4-75.** The fine tune and ALC error voltages are applied to four-quadrant multipliers U10 and U18. The current outputs through pin 4 of each multiplier is summed together and amplified by U11a. The output of U11a is the product of the ALC error and fine tune voltages and the in-phase (TP1) and quadrature (TP2) signals which are summed back into the oscillator through U12a. The ALC control loop can be disabled to aid in troubleshooting the oscillator circuits by removing U10. In this design the ALC control loop operates to reduce oscillation, therefore, removing U10 causes the oscillator level to increase to the limit set by the limiter circuits controlling U12b. The oscillator and ALC circuits can then be investigated individually.

**4-76. A7 Output Circuits.** The output circuits consist of the differential power output amplifier (located on the rear

panel heat sink), the variable gain and attenuation to cover a level range of 0.01 mV to 16 volts, and the programmable DC voltage used to fine tune the frequency of the source circuits. Refer to Figure 4-10.

**4-77.** The source oscillator output is applied to resistors R13 through R32. The values of these resistors are chosen in a binary series to operate as a discrete 12 bit D/A converter. These resistors are selected for level increments within the 16 volts, 3 volt, 300 mV or 30 mV level ranges by FET switches Q3 through Q14. The three most significant bits are trimmed for maximum accuracy by resistor R15, R17, and R21. Data from the control program is latched in data latches U4 and U5. The 14 comparators contained in U6 through U9 and associated pull-up resistors R4, R5, and R6 act as level translators to convey the latched TTL data to gate drive levels necessary to operate the FET switches. Amplifier U10 is a summing amplifier which combines the currents from the selected bits in the discrete 12 bit D/A converter. Analog switch U11 and resistors R9 and R36 form a programmable attenuator with selections of 0 dB, -20 dB and OFF. The -20 dB range is enabled for signal levels of 30.00 mV and below. In the signal-to-noise measurement mode, U11 is configured to squelch the source output during the noise measurement interval.

**4-78.** The output amplifier is formed by rear panel assembly A24. The single-ended signal is applied to amplifiers U1 and U2 to form a differential HI and LOW output. The LOW amplifier formed by U1, Q4, Q6 and associated circuitry is configured as an inverting amplifier while U2, Q7, Q10 and associated circuitry is non inverting and drives the HI output. The power transistors Q4, Q6, Q7, and Q10 are current boosters to supply current into impedances as low as 50 ohms.

**4-79.** The fine tune voltage is generated by 12 bit D/A converter U1. A 10 volt reference for the D/A converter (TP1) is provided by U3. Amplifier U2a provides a 0 to -10 volt output from the D/A converter while U2b and resistors R1, R2, and R3 generate a -6.7 to +13.4 volt output range to tune the source oscillator (TP3).

Figure 4-10. Output Circuits Block Diagram.

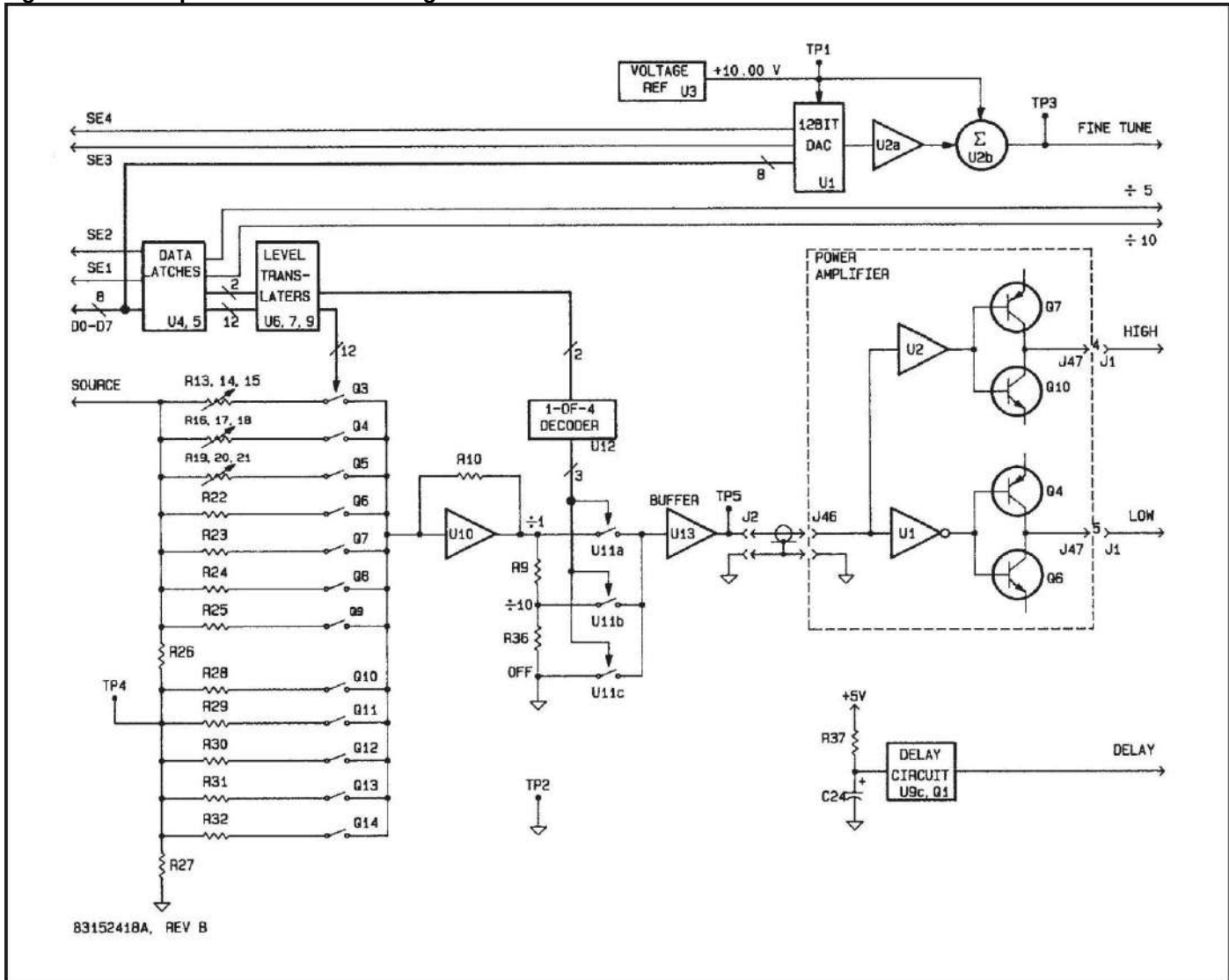


Figure 4-10. Output Circuits Block Diagram.

**4-80.** A power-on delay circuit is formed by R37, C24, and U9c. The one second delay provides time for the CPU to initialize the source circuits. When power is applied, C24 charges through R37 to +5 volts. Comparator U9c detects at the +1.8 volt level and turns Q1 on. The emitter of Q1 drives Q8 on the motherboard supplying +15 volts to relays K1 through K5.

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## SECTION V MAINTENANCE

### 5-1. INTRODUCTION.

**5-2.** This section contains the safety requirements, required test equipment, and procedures for cleaning, removal and replacement, inspection, performance test, and adjustment for the Model 1121A Audio Analyzer.

### 5-3. SAFETY REQUIREMENTS.

**5-4.** Although this instrument has been designed in accordance with international safety standards, general safety precautions must be observed during all phases of operation, service and repair of the instrument. Failure to comply with the precautions listed in the Safety Summary at the front of this manual or with specific warnings given throughout this manual could result in serious injury or death. Service and adjustments should be performed only by qualified service personnel.

### 5-5. REQUIRED TEST EQUIPMENT.

**5-6.** Test equipment required for the performance tests, adjustments and troubleshooting is listed in Table 5-1. Any equipment that satisfies the critical specifications in the table may be substituted for the recommended models. However, the performance tests are based on the assumption that the recommended test equipment is used.

### 5-7. CLEANING PROCEDURE.

**5-8.** Painted surfaces can be cleaned with a commercial, spray-type window cleaner or with a mild soap and water solution.

#### CAUTION

*Avoid the use of chemical cleaning agents which might damage the plastics used in the instrument.  
Recommended cleaning agents are isopropyl alcohol, a solution of 1 part kelite and 20 parts water, or a solution of 1% mild detergent and 99% water.*

### 5-9. REMOVAL AND REPLACEMENT.

**5-10. Instrument Covers.** Remove the instrument covers as follows:

- a. Disconnect the power cord and all signal cables from the instrument.
- b. Remove the three screws located at the rear of the cover (Figure 5-1) and slowly lift the cover up and to the rear.

c. Turn the unit over and remove the bottom cover in the same manner as the top cover was removed.

d. To replace the covers, reverse the removal procedure.

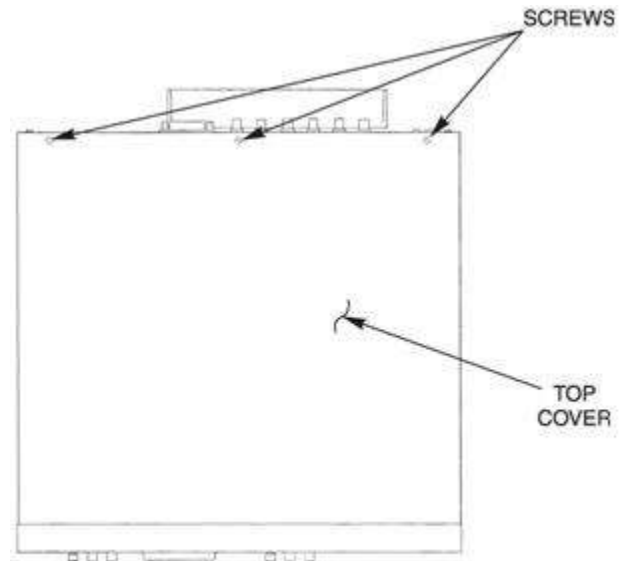


Figure 5-1 Removing Covers

**5-11. Display/Keyboard Access.** To gain access to the display and keyboard proceed as follows:

- a. Remove the instrument covers as described in paragraph 5-10.
- b. Remove the three screws that hold the top trim extrusion and remove the trim strip (Figure 5-2).

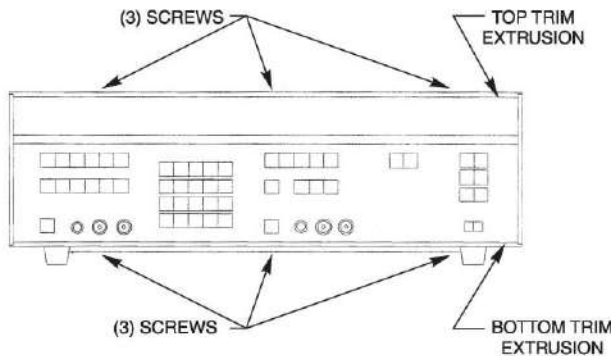
#### CAUTION

*When removing the display window be careful not to scratch the inner surface of the window.*

- c. Remove the plastic display window.

TABLE 5-1. RECOMMENDED TEST EQUIPMENT.

| INSTRUMENT          | CRITICAL SPECIFICATIONS                                                                                                                                                                                                                                      | USAGE                  |            |                  | MODEL                 |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------|------------------|-----------------------|
|                     |                                                                                                                                                                                                                                                              | PERFORMANCE EVALAUTION | ADJUSTMENT | TROUBLE-SHOOTING |                       |
| AC/DC Calibrator    | <b>Frequency Range:</b><br>10 Hz to 200 kHz<br><b>Level Range:</b> 1mV to 300 V<br><b>Flatness:</b><br>$\pm 0.3\%$ ; 10 - 30 Hz<br>$\pm 0.25\%$ ; 30 Hz - 200 kHz<br><b>AC Accuracy:</b><br>$\pm 0.1\%$ ; 50 Hz - 50 kHz<br><b>DC Accuracy:</b> $\pm 0.05\%$ | X                      |            | X                | Fluke Model 5100B-03  |
| Test Oscillator     | <b>Frequency Range:</b><br>5 Hz to 500 kHz<br><b>Level Range:</b> 0 to 3 V-rms<br><b>Flatness:</b> $\pm 0.3$ dB                                                                                                                                              | X                      |            |                  | Tektronix Model SG502 |
| Frequency Counter   | <b>Range:</b> 10 Hz to 200 kHz<br><b>Accuracy:</b> 0.1 ppm                                                                                                                                                                                                   | X                      |            |                  | HP Model 5345A        |
| Digital Multimeter  | <b>AC Accuracy:</b> $\pm 1.0\%$<br><b>Resolution:</b><br>1 $\mu$ V; 0 to 200 mV<br>10 $\mu$ V; 200 to 2000 mV<br>100 $\mu$ V; 2.0 to 20.0 V                                                                                                                  |                        | X          |                  | Fluke Model 8840A-09  |
| Wave Analyzer       | <b>Frequency Range:</b><br>20 Hz to 50 kHz<br><b>Bandwidth:</b> 10 Hz<br><b>Display Range:</b> 70 dB                                                                                                                                                         |                        | X          |                  | HP Model 3581A        |
| Frequency Standard  | <b>Frequency:</b> 10 MHz<br><b>Level:</b> TTL compataible<br><b>Accuracy:</b> 0.1 ppm                                                                                                                                                                        |                        | X          |                  | House Standard        |
| Variac/Line Monitor | 20% variation about 100, 120 or 240 volts                                                                                                                                                                                                                    |                        | X          |                  | Powerstat 3PN116B     |
| Balanced Cable      | Two conductor shielded balanced line                                                                                                                                                                                                                         | X                      | X          | X                | BEC 954021            |
| Adapters (4 req.)   | Single binding post to BNC (M)                                                                                                                                                                                                                               | X                      | X          | X                | BEC 954018            |
| Step Attenuator     | 0 dB, 40 dB; $\pm 0.3$ dB; 50 ohm                                                                                                                                                                                                                            | X                      |            |                  | HP 355D               |
| 50 ohm resistor     | 50 ohms, $\pm 0.1\%$ , 2 watt, T2                                                                                                                                                                                                                            | X                      |            |                  | KDI PME 75            |
| 150 ohm resistor    | 150 ohms, $\pm 0.1\%$ , 1 watt, T2                                                                                                                                                                                                                           | X                      |            |                  | Dale CMF 70           |
| 600 ohm resistor    | 600 ohms, $\pm 0.1\%$ , 1 watt, T2                                                                                                                                                                                                                           | X                      |            |                  | Dale CMF 70           |



**Figure 5-2. Removing Top and Bottom Trip Extrusions**

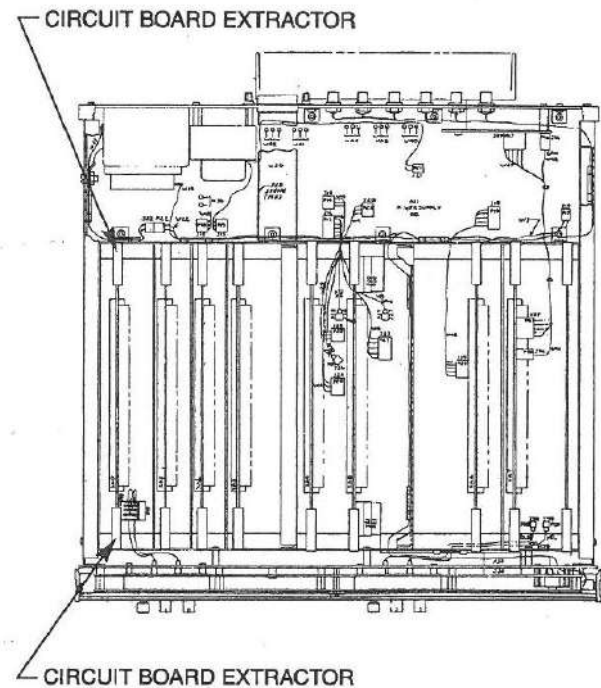
- d. Turn the instrument over and remove the three screws that hold the bottom trim extrusion and remove the trim strip.
- e. Tilt the bottom of the front panel away from the instrument until all switches are clear. Pull the front panel up to clear the center trim extrusion for access.
- f. To replace the display/keyboard, reverse the removal procedure.

**5-12. Plug-in Circuit boards.** Remove the plug-in circuit board as follows:

- a. Remove the instrument covers as described in paragraph 5-10.
- b. Grasp the circuit board extractors, pull up, and slide the circuit board up and out of the instrument.
- c. To replace circuit boards, reverse the removal procedure.

**5-13. Optional Filters.** Install the optional filters as follows:

- a. Remove the instrument top cover as described in paragraph 5-10.
- b. Remove the Filter board (brown extractors). Refer to paragraph 5-12. Place the board on a flat working surface with the components up and the extractors at the top.



**Figure 5-3. Removing Circuit Boards**

**TABLE 5-2. OPTIONAL FILTERS.**

| FILTER TYPE | SPECIAL OPTION CODE |                | CALIBRATION SETTINGS |         |
|-------------|---------------------|----------------|----------------------|---------|
|             | LEFT POSITION       | RIGHT POSITION | FREQUENCY            | LEVEL   |
| NO FILTER   | 10                  | 20             | N/A                  | N/A     |
| 400 Hz      | 11                  | 21             | 1000 Hz              | 3.000 V |
| CCITT       | 12                  | 22             | 800 Hz               | 3.000 V |
| CCIR        | 13                  | 23             | 6300 Hz              | 3.000 V |
| A WTNG      | 15                  | 25             | 1000 Hz              | 3.000 V |
| B WTNG      | 16                  | 26             | 1000 Hz              | 3.000 V |
| C WTNG      | 17                  | 27             | 1000 Hz              | 3.000 V |
| AUDIO       | 18                  | 28             | 1000 Hz              | 3.000 V |
| C-MESSAGE   | 19                  | 29             | 1000 Hz              | 3.000 V |

## NOTE

*There are two positions available for optional filters. These positions are located on the right and left-center part of the circuit board. The right position corresponds to optional filter No. 2 which is activated by the right-most optional filter key on the front panel and the left-center position corresponds to optional filter No. 1 which is activated by the left-most optional filter key. Either position will accommodate any of the available optional filters.*

c. Install the optional filter in the desired position and replace the circuit board.

### WARNING

*There are voltages at various points in the instrument which can, if contacted, cause personal injury. Observe all safety precautions. Service and adjustments should be performed by trained service personnel only.*

d. Set the option switch A4S1-7 to the open position and connect power to the instrument.

e. Set the LINE ON/OFF switch to ON and depress the LCL/INIT key.

f. After the initialization sequence is complete, depress the SPCL key and enter the special option number listed in Table 5-2 that defines the filter type and position for each filter installed.

g. Set the option switch A4S1-7 to the closed position and set the LINE ON/OFF switch to OFF.

h. Disconnect all power to the instrument and replace the instrument top cover. After the optional filters are installed, they should be calibrated as described in paragraph 5-20.

**5-14. Firmware Integrated Circuit.** Remove the EPROM as follows:

a. Remove the instrument top cover as described in paragraph 5-10.

b. Remove the CPU board (green extractors). Refer to paragraph 5-12. Place the board on a flat, non-conductive working surface with the components up.

### CAUTION

*When removing and replace an integrated circuit (IC) note the mark or notch used for pin number identification.*

c. Locate EPROM A5U14. Remove the IC with a straight pull away from the board.

d. EPROM is a replaceable part and does not require reprogramming. Install the replacement IC and replace the circuit board.

### WARNING

*There are voltages at various points in the instrument which can, if contacted, cause personal injury. Observe all safety precautions. Service and adjustments should be performed by trained service personnel only.*

e. Connect power to the instrument and set the LINE ON/OFF switch to ON.

f. Depress the LCL/INIT key to initialize the instrument. The new firmware number will appear in the SOURCE display for a few seconds before the instrument resumes normal operation.

g. Enter special function 25 to initialize the program memory.

h. Set the LINE ON/OFF switch to OFF, disconnect all power to the instrument and replace the instrument top cover.

## 5-15. Electronic Component Repair or Replacement.

Most components are readily accessible for inspection and replacement when the instrument covers are removed. Solid-state circuit components, mounted on plug-in circuit boards, are used throughout the instrument. Refer to NAVAIR 01-1A-505 and/or T.O. 00-25-234/TM 43-0158 for repair or replacement procedures of electronic components. EPROM is replaceable and does not require reprogramming.

## NOTE

### References:

NAVAIR 01-1A-505 (Installation Practices, Aircraft electric and Electronic Wiring)

T.O. 00-25-234/TM 43-0158 (General Shop Practice Requirements for the Repair, Maintenance, and Test of Electrical Equipment)

## 5-16. INSPECTION.

**5-17.** If an equipment malfunction occurs, perform a visual inspection of the instrument. Inspect for signs of damage caused by excessive shock, vibration, or overheating, such as broken wires, loose hardware and parts, loose electrical connections, or accumulations of dirt and other foreign matter. Correct any problems discovered, then perform the performance tests to verify that the instrument is operational. If a malfunction persists or the instrument fails any of the performance tests, refer to the

adjustment procedure. After the instrument has been adjusted, perform the performance tests again to verify instrument operation. The following inspection procedure shall be used to locate obvious malfunctions within the Audio Analyzer.

- a. Inspect all external surfaces of Model 1121A for physical damage, breakage, loose or dirty contacts, and missing components.

### WARNING

*Hazardous voltages are present when covers are removed. Where maintenance can be performed without having power applied, power should be removed.*

- b. Remove covers and shields as required to gain access to components.
- c. Inspect CBA surfaces for discoloration, cracks, breaks, and warping.
- d. Inspect CBA conductors for breaks, cracks, cuts, erosion, or looseness.
- e. Inspect all assemblies for burnt or loose components.
- f. Inspect all chassis-mounted components for looseness, breakage, and loose contacts or conducts.
- g. Inspect equipment for disconnected, broken, cut, loose, or frayed cables or wires.

## 5-18. PERFORMANCE TESTS.

**5-19.** The performance tests should be performed about every 12 months or after the instrument has been repaired. The performance tests may also be performed when the instrument is first received to verify instrument performance.

**5-20. Initial Calibration.** Calibrate the instrument as follows:

- a. Set the LINE ON/OFF switch to ON and depress the LCL/INIT key to initialize the instrument.
- b. Enable the Analyzer input floating mode.
- c. Connect the 50 Hz - 50 kHz Calibrator output to the Analyzer HI and LOW input terminals using the balanced cable and adapters.
- d. Set the Calibrator to a frequency of 1 kHz and a level of 3.000 volts and enable the Calibrator output.
- e. After the Analyzer measurement settles, enter special function 20 to calibrate full scale AC level. The

SOURCE display will indicate the - CAL - message momentarily and any errors will be reported. The calibration will take approximately 2 seconds after which the SOURCE display will indicate special function 10.

- f. If any of the optional filters are installed, set the Calibrator to the reference frequency and level listed in Table 5-2 designated for the filter to be calibrated and enable the Calibrator output.

g. Enter the special function that corresponds to the filter position to be calibrated. Special function 21 will calibrate the optional filter No. 1 installed in the left-most position while special function 22 calibrates optional filter No. 2 installed in the right-most position. The SOURCE display will indicate the - CAL - message momentarily and any errors will be reported. The calibration will take approximately 1 second after which the SOURCE display will indicate special function 10.

- h. Set the Calibrator to a level of 0.000 volts DC and depress the Analyzer DC key to enable the DC level measurement mode.

- i. After the Analyzer measurement settles, enter special function 23 to calibrate DC level offset. The

SOURCE display will indicate the - CAL - message momentarily and any errors will be reported. The calibration will take approximately 2 seconds after which the SOURCE display will indicate special function 10.

- j. Set the Calibrator to a level of 3.000 volts DC.

k. After the Analyzer measurement settles, enter special function 24 to calibrate full scale DC level. The SOURCE display will indicate the - CAL - message momentarily and any errors will be reported. The calibration will take approximately 1 second after which the SOURCE display will indicate special function 10.

**5-21. Analyzer DC Level Accuracy.** Depress the LCL/INIT key to initialize the instrument. After the initialization sequence is complete, enable the input floating mode, enable the DC low-pass filter and enter special function 17 to enable the slow detector mode. Connect the DC Calibrator output using the balanced cable and adapters to the Analyzer HI and LOW input terminals. Enter the Calibrator settings listed in Table 5-3 and record the Analyzer DC level readings.

**5-22. Analyzer AC Level Accuracy.** Depress the LCL/INIT key to initialize the instrument, enable the input floating mode and enter special function 17 to enable the slow detector mode. Connect the 50 Hz - 50 kHz Calibrator output using the balanced cable and adapters to the Analyzer HI and LOW input terminals. Enter the Calibrator settings listed in Table 5-4 and record the Analyzer AC level readings.

**5-23. Analyzer Level Flatness.** The level flatness test is made in the level ratio mode where the ratio reference is set at a frequency of 1 kHz and at a specific test level. The frequency is then varied and the resultant relative amplitude measurements are recorded.

**5-24.** Depress the LCL/INIT key to initialize the instrument and enter special function 17 to enable the slow detector mode. Connect the Wideband Calibrator output using the balanced cable and adapters to the Analyzer HI and LOW inputs and connect the 50 ohm load across the binding post adapters. Perform the following procedure for each test level listed in Table 5-5.

- a. Enter the Calibrator level at a frequency of 1 kHz.
- b. Enable the level ratio mod to set the flatness reference.
- c. Enter the Calibrator test frequencies and Analyzer special functions indicated in Table 5-5 and record the Analyzer ratio measurements.

**5-25. Source Impedance Accuracy.** Depress the LCL/INIT key to initialize the instrument. Connect the HI and LOW outputs using the balanced cable and adapters to the Analyzer HI and LOW inputs. Perform the following procedure.

- a. Set the Model 1121A output level to 3.000 volts.
- b. Depress the RATIO key to enable the ratio mode.
- c. Connect the 600 ohm load across the binding post adapter at the input of the Analyzer.
- d. Note the display and calculate the output impedance using the following formula and record  $Z_{OUT}$  in Table 5-6.

$$Z_{OUT} = (100.6\% / DISP\% - 1) 596.4$$

- e. Disable the ratio mode and remove the 600 ohm load.
- f. Enter special function 76 (150 ohm output).
- g. Depress the RATIO key to enable the ratio mode.
- h. Connect the 150 ohm load across the binding post adapters at the input of the Analyzer.
- i. Note the display and calculate the output impedance using the following formula and record  $Z_{OUT}$  in Table 5-6.

$$Z_{OUT} = (100.15\% / DISP\% - 1) 149.8$$

- j. Disable the ratio mode and remove the 150 ohm load.
- k. Enter special function 75 (50 ohm output).
- l. Depress the RATIO key to enable the ratio mode.
- m. Connect the 50 ohm load across the binding post adapters at the input of the Analyzer.

$$Z_{OUT} = (100.05\% / DISP\% - 1) 49.98$$

- n. Note the display and calculate the output impedance using the following formula and record  $Z_{OUT}$  in Table 5-6.
- o. Disable the ratio mode and remove the 50 ohm load.

**5-26. Source Level Accuracy.** In this test the Analyzer level reference is set using the precision calibrator. The accuracy of the Model 1121A is then measured at the same test levels and compared to the measurements using the calibrator thereby eliminating the Analyzer measurement errors.

**5-27.** Depress the LCL/INIT key to initialize the instrument. Enter special function 75 (50 ohm output) and enable the input floating mode. Perform the following procedure for each test level listed in Table 5-7.

- a. Connect the 50 Hz - 50 kHz Calibrator output to the Analyzer HI and LOW inputs using the balanced cable and adapters.
- b. Depress the Analyzer LEVEL key and enter the Model 5100B level in the ANALYZER display window to set and hold the input level range.
- c. On the AC Calibrator enter the Model 5100B level at a frequency of 1 kHz.
- d. After the ANALYZER display settles enable the ratio mode to set the calibrator level reference.
- e. Connect the Model 1121A HI and LOW outputs to the Analyzer HI and LOW inputs using the balanced cable and adapters.

- f. Enter the Model 1121A test level at a frequency of 1 kHz and record the measurement in the ACTUAL column in Table 5-7.

**5-28. Source Level Flatness.** The level flatness test is made using the Analyzer ratio mode where a level reference is set at a frequency of 1 kHz and at a specific

test level. The frequency is then varied and the resultant relative amplitude errors are measured. In this test the Analyzer flatness is first verified using the precision AC calibrator and recorded. The Model 1121A flatness is then measured at the same test levels and compared to the measurements using the calibrator thereby eliminating the Analyzer measurement errors.

**5-29.** Depress the LCL/INIT key to initialize the instrument and enter special function 17 to enable the slow detector mode. Connect the Wideband Calibrator output using the balanced cable and adapters to the Analyzer HI and LOW inputs and connect the 50 ohm load across the binding post adapters at the Analyzer input. Perform the following procedure for each test level listed in Table 5-8.

a. On the Calibrator enable the wideband source output and enter the Model 5100B test level at a frequency of 1 kHz.

b. On the Audio Analyzer enter the calibrator level in the ANALYZER display window to set and hold the input level range.

c. Enable the Analyzer level ratio mode to set the flatness reference.

d. On the Calibrator enter the test frequencies between 10 Hz and 100 kHz indicated in Table 5-8 and record the Analyzer ratio measurements in the REFERENCE column.

**5-30.** Depress the LCL/INIT key to initialize the instrument. Connect the HI and LOW outputs using the balanced cable and adapters to the Analyzer HI and LOW inputs. Enter special function 75 (50 ohm output). Enable the input floating mode and connect the 50 ohm load across the binding post adapters at the Analyzer input. Perform the following procedure for each test level listed in Table 5-8.

a. On the Model 1121A enter the test level at a frequency of 1 kHz. Before entering the 6.0 mV down-scale test level, the 300 mV range must be held by entering the special function 18 while the 300 mV level is set.

b. On the Audio Analyzer enter the Model 5100B test level in the ANALYZER display window to set and hold the input level range.

c. Enable the Analyzer level ratio mode to set the flatness reference.

d. On the Model 1121A enter the test frequencies indicated in Table 5-8.

e. Note the display and calculate the actual flatness by subtracting the value in the REFERENCE column in Table 5-8 from the displayed measurement and record the result in the ACTUAL column. At the 140 kHz test

frequency subtract the 100 kHz value in the REFERENCE column from the displayed measurement and record the result.

**5-31. Analyzer Low Level AC Accuracy.** Depress the LCL/INIT key to initialize the instrument. Enter special function 75 (50 ohm output). Connect the Model 1121A HI output to the input of the HP 355D step attenuator and connect the output of the attenuator to the Model 1121A HI input. Perform the following procedure for each test frequency listed in Table 5-9.

a. Set the attenuator to 40 dB.

b. Set the Model 1121A output level to 3.000 volts at 1 kHz.

c. Depress the RATIO key to enable the ratio mode.

d. Set the Model 1121A output level to 30.00 mV and the attenuator to 0 dB.

e. Record the analyzer ratio measurement in the REFERENCE column in Table 5-9.

f. Depress the RATIO key to disable the ratio mode and set the attenuator to 40 dB.

g. Multiply the analyzer measurement by the reference value from step e above, divide the product by 100.00% and record the result in the ACTUAL column in Table 5-9.

**5-32. Frequency Accuracy.** Depress the LCL/INIT key to initialize the instrument. Connect the Source HI and LOW outputs using the balanced cable and adapters to the Analyzer HI and LOW inputs and enter a source level of 2 volts. Connect the SYNC output on the rear panel of the Model 1121A to the Frequency Counter CHANNEL A input and set the Frequency Counter controls as follows:

|                        |           |
|------------------------|-----------|
| FUNCTION.....          | FREQ A    |
| GATE TIME .....        | 10 sec    |
| DISPLAY POSITION ..... | AUTO      |
| LEVEL .....            | PRESET    |
| SLOPE .....            | +         |
| ATTEN.....             | 1 MEG, X1 |
| AC/DC .....            | AC        |
| CHECK/COM/SEP .....    | SEP       |

**5-33. Source Frequency Accuracy.** For each test frequency listed in table 5-10 set the Source to the test frequency, verify the Source frequency accuracy by comparing the setting and external counter measurements and record the results, pass or fail.

**5-34. Analyzer Frequency Accuracy.** For each test frequency listed in table 5-11 set the Source to the test

frequency, verify the Analyzer frequency measurement accuracy by comparing the external counter and Analyzer frequency measurement and record the results, pass or fail.

**5-35. Low-Pass Filter Accuracy.** The filter accuracy test is made by setting an amplitude ratio reference at a frequency of 1 kHz and adjusting the frequency at the same reference level for a display of -3.01 dB or 70.7%. The frequency is then measured and checked against the specified limits.

**5-36.** Depress the LCL/INIT key to initialize the instrument. Connect the output of the Test Oscillator to the input of the Audio Analyzer and terminate the Analyzer input with 600 ohms. Set the Test Oscillator to a frequency of 1 kHz +/- 10 Hz and a level of 2 volts +/- 50 mV. Enable the Analyzer level ratio mode and depress the dB key. Perform the following procedure for each low-pass filter listed in Table 5-12.

- a. Enable the specified low-pass filter.
- b. Adjust the Test Oscillator frequency toward

the corner frequency of the selected filter for a display indication of -3.01 dB +/- 0.05 dB.

- c. Check the frequency against the specified limits and record the result, pass or fail, in Table 5-12.

**5-37. Residual Distortion and Noise.** In this test the Source is connected to the Analyzer and the combination of distortion and noise is measured at various frequencies and levels. In this manner the Source and Analyzer are measured simultaneously. If either the Source or Analyzer is out of specification, a known to be good source or analyzer may be substituted to determine which part of the instrument is at fault.

**5-38.** Depress the LCL/INIT key to initialize the instrument and enter special function 75 (50 ohm output). Connect the Source HI and LOW outputs using the balanced cable and adapters to the Analyzer HI and LOW inputs and connect the 50 ohm load across the binding post adapters at the Analyzer input. Enable the input floating mode and depress the DIST and DB keys. Set the Source to the levels and frequencies listed in Table 5-13, enable low-pass filter specified in the BW column and record the results, pass or fail.

**5-39. Residual Signal-to-Noise Ratio.** In this test the Source is connected to the Analyzer and the residual signal-to-noise is measured at various frequencies and levels. Due to the synchronous nature of the measurement only the Source and Analyzer of the same instru-

ment may be used together.

**5-40.** Depress the LCL/INIT key to initialize the instrument and enter special function 75 (50 ohm output). Connect the source HI and LOW outputs using the balanced cable and adapters to the Analyzer HI and LOW inputs and connect the 50 ohm load across the binding post adapters at the Analyzer input. Enable the input floating mode and depress the S/N key. Set the Source to the levels and frequencies listed in Table 5-14, enable the low-pass filter specified in the BW column and record the results, pass or fail.

**5-41. Common Mode Rejection Ratio.** Depress the LCL/INIT key to initialize the instrument and enter special function 75 (50 ohm output). Enable the input floating mode and depress the Analyzer LEVEL key and dB key. Perform the following procedure.

- a. Connect the Source HI output to the Analyzer HI input using the BNC cable.
- b. Set the Source level to 2.500 volts at a frequency of 1 kHz.
- c. Enable the Analyzer ratio mode to set the common mode signal reference.
- d. Enter special function 12 to hold the 1.5 volt input range.
- e. Connect the Source HI output to both Analyzer HI and LOW inputs using BNC cables and a Tee adapter.
- f. Set the Source to the test frequencies and levels listed in Table 5-15 and record the results, pass or fail.

**5-42. Optional Filter Accuracy.** The filter accuracy tests are made by setting an amplitude ratio reference at a reference frequency and measuring the relative amplitude at other specified test frequencies. The results are then compared to the specification limits.

**5-43. Optional Filter Test Connections.** The test connection setup is identical for all the optional filter performance tests. Depress the LCL/INIT key to initialize the instrument and enable the Analyzer input floating mode. Connect the Source HI and LOW outputs to the Analyzer HI and LOW inputs using the balanced cable and adapters. Enter special function 75 (50 ohm source impedance) and terminate the Analyzer input with 50 ohms.

TABLE 5-3. ANALYZER DC LEVEL ACCURACY TEST RECORD.

| CALIBRATOR<br>LEVEL | MINIMUM | ACTUAL | MAXIMUM |
|---------------------|---------|--------|---------|
| 0.000 V             | -0.006  | _____  | 0.006   |
| 3.000 V             | 2.970   | _____  | 3.030   |
| 30.00 V             | 29.70   | _____  | 30.30   |
| 300.0 V             | 297.0   | _____  | 303.0   |
| -300.0 V            | -297.0  | _____  | -303.0  |
| -30.00 V            | -29.70  | _____  | -30.30  |
| -3.000 V            | -2.970  | _____  | -3.030  |

**5-44. 400 Hz High-Pass Filter Accuracy.** Perform the test as follows:

- a. Set the Source to a frequency of 1 kHz and a level of 2 volts.
- b. Enable the Analyzer level ratio mode and depress the dB key.
- c. Enter special function 12 to hold the 1.5 volt input range.
- d. Enable the 400 Hz high-pass filter and adjust the Source frequency for an ANALYZER display indication of  $-3.01 \text{ dB} \pm 0.05 \text{ dB}$ .
- e. Check the frequency against the specified limits and record the result, pass or fail, in Table 5-12.

**5-45. AUDIO Band-Pass Filter Accuracy.** Refer to paragraph 5-43 for the test connections and perform the test as follows:

- a. Set the Source to a frequency of 1 kHz and a level of 2 volts.
- b. Enable the Analyzer level ratio mode and depress the dB key.
- c. Enter special function 12 to hold the 1.5 volt input range.
- d. Enable the AUDIO band-pass filter and set the Source frequency to 22.4 Hz and fine adjust the frequency for an ANALYZER display indication of  $-3.01 \text{ dB} \pm 0.05 \text{ dB}$ .
- e. Check the frequency against the specified limits and record the result, pass or fail, in Table 5-12.
- f. Set the Source frequency to 22.4 kHz and fine adjust the frequency for an ANALYZER display indication of  $-3.01 \text{ dB} \pm 0.05 \text{ dB}$ .
- g. Check the frequency against the specified limits and record the result, pass or fail, in Table 5-12.

**5-46. CCITT Filter Accuracy.** Refer to paragraph 5-43 for the test connections and perform the test as follows:

- a. Set the Source to a frequency of 800 Hz and a level of 2 volts.
- b. Enable the Analyzer level ratio mode and depress the dB key.
- c. Enter special function 12 to hold the 1.5 volt input range and special function 71 to select the average

detector.

- d. Enable the CCIR band-pass filter and set the Source to the frequencies listed in Table 5-16 and record the results, pass or fail.

**5-47. CCIR Filter Accuracy.** Refer to paragraph 5-43 for the test connections and perform the test as follows:

- a. Set the Source to a frequency of 2000 Hz and a level of 2 volts.
- b. Enable the Analyzer level ratio mode and depress the dB key.
- c. Enter special function 12 to hold the 1.5 volt input range and special function 71 to select the average detector.
- d. Enable the CCIR band-pass filter and set the Source to the frequencies listed in Table 5-17 and record the results, pass or fail.

**5-48. A, B, and C Weighting Filter Accuracy.** Refer to paragraph 5-43 for the test conditions and perform the test as follows:

Set the Source to a frequency of 1000 Hz and a level of 2 volts.  
Enable the Analyzer level ratio mode and depress the dB key.  
Enter special function 12 to hold the 1.5 volt input range.

- d. Enable the A, B, or C Weighting filter and set the Source to the frequencies listed in Table 5-18, 5-19 or 5-20 for the respective A, B, or C weighting filter and record the results, pass or fail.

**5-49. C-MESSAGE Filter Accuracy.** Refer to paragraph 5-43 for the test connections and perform the test as follows:

Set the Source to a frequency of 1000 Hz and a level of 2 volts.  
Enable the Analyzer level ratio mode and depress the dB key.

- d. Enable the C-MESSAGE weighting filter and set the Source to the frequencies listed in Table 5-21 and record the result, pass or fail.

**TABLE 5-4. ANALYZER AC LEVEL ACCURACY TEST RECORD.**

| <b>CALIBRATOR<br/>LEVEL</b> | <b>CALIBRATOR<br/>FREQUENCY</b> | <b>MINIMUM</b> | <b>ACTUAL</b> | <b>MAXIMUM</b> |
|-----------------------------|---------------------------------|----------------|---------------|----------------|
| 3.000 mV                    | 50 Hz                           | 2.970          | _____         | 3.030          |
| 30.00 mV                    | 50 Hz                           | 29.70          | _____         | 30.30          |
| 300.0 mV                    | 50 Hz                           | 297.0          | _____         | 303.0          |
| 3.000 V                     | 50 Hz                           | 2.970          | _____         | 3.030          |
| 30.00 V                     | 50 Hz                           | 29.70          | _____         | 30.30          |
| 300.0 V                     | 50 Hz                           | 297.0          | _____         | 303.0          |
| 3.000 mV                    | 1000 Hz                         | 2.970          | _____         | 3.030          |
| 30.00 mV                    | 1000 Hz                         | 29.70          | _____         | 30.30          |
| 300.0 mV                    | 1000 Hz                         | 297.0          | _____         | 303.0          |
| 3.000 V                     | 1000 Hz                         | 2.970          | _____         | 3.030          |
| 30.00 V                     | 1000 Hz                         | 29.70          | _____         | 30.30          |
| 300.0 V                     | 1000 Hz                         | 297.0          | _____         | 303.0          |
| 3.000 mV                    | 50000 Hz                        | 2.970          | _____         | 3.030          |
| 30.00 mV                    | 50000 Hz                        | 29.70          | _____         | 30.30          |
| 300.0 mV                    | 50000 Hz                        | 297.0          | _____         | 303.0          |
| 3.000 V                     | 50000 Hz                        | 2.970          | _____         | 3.030          |

TABLE 5-5. ANALYZER AC LEVEL FLATNESS TEST RECORD.

| CALIBRATOR<br>LEVEL | CALIBRATOR<br>FREQUENCY | SPCL<br>CODE | MINIMUM | ACTUAL | MAXIMUM |
|---------------------|-------------------------|--------------|---------|--------|---------|
| 1.000 mV            | 10 Hz                   |              | 98.00   | _____  | 102.00  |
| 1.000 mV            | 20 Hz                   |              | 99.00   | _____  | 101.00  |
| 1.000 mV            | 50 Hz                   |              | 99.50   | _____  | 100.50  |
| 1.000 mV            | 50000 Hz                |              | 99.50   | _____  | 100.50  |
| 1.000 mV            | 100000 Hz               |              | 99.00   | _____  | 101.00  |
| 3.000 mV            | 10 Hz                   |              | 98.00   | _____  | 102.00  |
| 3.000 mV            | 20 Hz                   |              | 99.00   | _____  | 101.00  |
| 3.000 mV            | 50 Hz                   |              | 99.50   | _____  | 100.50  |
| 3.000 mV            | 50000 Hz                |              | 99.50   | _____  | 100.50  |
| 3.000 mV            | 100000 Hz               |              | 99.00   | _____  | 101.00  |
| 50.00 mV            | 10 Hz                   |              | 98.00   | _____  | 102.00  |
| 50.00 mV            | 20 Hz                   |              | 99.00   | _____  | 101.00  |
| 50.00 mV            | 50 Hz                   |              | 99.50   | _____  | 100.50  |
| 50.00 mV            | 50000 Hz                |              | 99.50   | _____  | 100.50  |
| 50.00 mV            | 100000 Hz               |              | 99.00   | _____  | 101.00  |
| 150.0 mV            | 10 Hz                   |              | 98.00   | _____  | 102.00  |
| 150.0 mV            | 20 Hz                   |              | 99.00   | _____  | 101.00  |
| 150.0 mV            | 50 Hz                   |              | 99.50   | _____  | 100.50  |
| 150.0 mV            | 50000 Hz                |              | 99.50   | _____  | 100.50  |
| 150.0 mV            | 100000 Hz               |              | 99.00   | _____  | 101.00  |
| 3.000 V             | 10 Hz                   | 28           | 98.00   | _____  | 102.00  |
| 3.000 V             | 20 Hz                   | 28           | 99.00   | _____  | 101.00  |
| 3.000 V             | 50 Hz                   | 28           | 99.50   | _____  | 100.50  |
| 3.000 V             | 50000 Hz                | 28           | 99.50   | _____  | 100.50  |
| 3.000 V             | 100000 Hz               | 28           | 99.00   | _____  | 101.00  |
| 3.000 V             | 50000 Hz                | 27           | 99.50   | _____  | 100.50  |
| 3.000 V             | 100000 Hz               | 27           | 99.00   | _____  | 101.00  |
| 3.000 V             | 50000 Hz                | 26           | 99.50   | _____  | 100.50  |
| 3.000 V             | 100000 Hz               | 26           | 99.00   | _____  |         |

**TABLE 5-6. SOURCE IMPEDANCE ACCURACY TEST RECORD.**

| IMPEDANCE | TOLERANCE  | Z <sub>OUT</sub> |
|-----------|------------|------------------|
| 50 ohms   | ± 1.0 ohm  | _____            |
| 150 ohms  | ± 1.5 ohms | _____            |
| 600 ohms  | ± 6.0 ohms | _____            |

**TABLE 5-7. SOURCE LEVEL ACCURACY TEST RECORD.**

| SOURCE LEVEL | CALIBRATOR LEVEL | MINIMUM | ACTUAL | MAXIMUM |
|--------------|------------------|---------|--------|---------|
| 0.600 mV     | 1.200 mV         | 46.95   | _____  | 52.95   |
| 3.000 mV     | 3.000 mV         | 98.95   | _____  | 100.95  |
| 30.00 mV     | 30.00 mV         | 99.45   | _____  | 100.45  |
| 300.0 mV     | 300.0 mV         | 99.45   | _____  | 100.45  |
| 3.000 V      | 3.000 V          | 99.45   | _____  | 100.45  |
| 16.000 V     | 16.000 V         | 99.45   | _____  | 100.45  |

**TABLE 5-8. SOURCE LEVEL FLATNESS TEST RECORD.**

| CALIBRATOR LEVEL | SOURCE LEVEL | TEST FREQUENCY | REFERENCE | MINIMUM | ACTUAL | MAXIMUM |
|------------------|--------------|----------------|-----------|---------|--------|---------|
| 1.5 V            | 3.0 V        | 10 Hz          | _____     | -0.50   | _____  | + 0.50  |
| 1.5 V            | 3.0 V        | 50 kHz         | _____     | -0.50   | _____  | + 0.50  |
| 1.5 V            | 3.0 V        | 100 kHz        | _____     | -1.00   | _____  | + 1.00  |
|                  | 3.0 V        | 140 kHz        | _____     | -1.50   | _____  | + 1.50  |
| 15 mV            | 30 mV        | 50 kHz         | _____     | -0.50   | _____  | + 0.50  |
| 15 mV            | 30 mV        | 100 kHz        | _____     | -1.00   | _____  | + 1.00  |
|                  | 30 mV        | 140 kHz        | _____     | -1.50   | _____  | + 1.50  |
| 150 mV           | 300 mV       | 50 kHz         | _____     | -0.50   | _____  | + 0.50  |
| 150 mV           | 300 mV       | 100 kHz        | _____     | -1.00   | _____  | + 1.00  |
|                  | 300 mV       | 140 kHz        | _____     | -1.50   | _____  | + 1.50  |
| 3.0 mV           | 6.0 mV       | 50 kHz         | _____     | -0.50   | _____  | + 0.50  |
| 3.0 mV           | 6.0 mV       | 100 kHz        | _____     | -1.00   | _____  | + 1.00  |
|                  | 6.0 mV       | 140 kHz        | _____     | -1.50   | _____  | + 1.50  |

**TABLE 5-9. ANALYZER LOW LEVEL ACCURACY TEST RECORD.**

| <b>SOURCE<br/>FREQUENCY</b> | <b>REFERENCE</b> | <b>MINIMUM</b> | <b>ACTUAL</b> | <b>MAXIMUM</b> |
|-----------------------------|------------------|----------------|---------------|----------------|
| 10 Hz                       | _____            | 0.2880 mV      | _____         | 0.3120 mV      |
| 20 Hz                       | _____            | 0.2880 mV      | _____         | 0.3120 mV      |
| 50 Hz                       | _____            | 0.2880 mV      | _____         | 0.3120 mV      |
| 1000 Hz                     | _____            | 0.2880 mV      | _____         | 0.3120 mV      |
| 50000 Hz                    | _____            | 0.2880 mV      | _____         | 0.3120 mV      |
| 100000 Hz                   | _____            | 0.2880 mV      | _____         | 0.3120 mV      |

**TABLE 5-10. SOURCE FREQUENCY ACCURACY TEST RECORD.**

| <b>SOURCE<br/>FREQUENCY</b> | <b>MINIMUM</b> | <b>PASS/FAIL</b> |      | <b>MAXIMUM</b> |
|-----------------------------|----------------|------------------|------|----------------|
| 190.000 Hz                  | 189.997 Hz     | PASS             | FAIL | 1900.03 Hz     |
| 1900.00 Hz                  | 1899.97 Hz     | PASS             | FAIL | 1900.03 Hz     |
| 19000.0 Hz                  | 18999.7 Hz     | PASS             | FAIL | 19000.3 Hz     |
| 140000 Hz                   | 139997 Hz      | PASS             | FAIL | 140003 Hz      |

**TABLE 5-11. ANALYZER FREQUENCY ACCURACY TEST RECORD.**

| <b>SOURCE<br/>FREQUENCY</b> | <b>MINIMUM</b> | <b>PASS/FAIL</b> |      | <b>MAXIMUM</b> |
|-----------------------------|----------------|------------------|------|----------------|
| 190.000 Hz                  | -0.001 Hz      | PASS             | FAIL | + 0.001 Hz     |
| 1900.00 Hz                  | -0.01 Hz       | PASS             | FAIL | + 0.01 Hz      |
| 19000.0 Hz                  | -0.1 Hz        | PASS             | FAIL | + 0.1 Hz       |
| 140000 Hz                   | -1 Hz          | PASS             | FAIL | + 1 Hz         |

**TABLE 5-12. FILTER ACCURACY TEST RECORD.**

| <b>FILTER</b>    | <b>MINIMUM</b> | <b>PASS/FAIL</b> |      | <b>MAXIMUM</b> |
|------------------|----------------|------------------|------|----------------|
| 30 kHz Low-pass  | 28 kHz         | PASS             | FAIL | 32 kHz         |
| 80 kHz Low-pass  | 76 kHz         | PASS             | FAIL | 84 kHz         |
| 220 kHz Low-pass | 200 kHz        | PASS             | FAIL | 240 kHz        |
| 400 Hz High-pass | 360 Hz         | PASS             | FAIL | 440 Hz         |
| AUDIO Band-pass  | 21.28 kHz      | PASS             | FAIL | 23.52 kHz      |
|                  | 21.28 kHz      | PASS             | FAIL | 23.52 kHz      |

**TABLE 5-13. RESIDUAL DISTORTION TEST RECORD.**

| <b>SOURCE LEVEL</b> | <b>FREQUENCY</b> | <b>BW</b> | <b>PASS/FAIL</b> |      | <b>MAXIMUM</b> |
|---------------------|------------------|-----------|------------------|------|----------------|
| 16.000 V            | 10 Hz            | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 16.000 V            | 20 Hz            | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 16.000 V            | 100 Hz           | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 16.000 V            | 1000 Hz          | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 16.000 V            | 10000 Hz         | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 16.000 V            | 20000 Hz         | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 16.000 V            | 50000 Hz         | 220 kHz   | PASS             | FAIL | -74.00 dB      |
| 16.000 V            | 100000 Hz        | 500 kHz   | PASS             | FAIL | -65.00 dB      |
| 16.000 V            | 140000 Hz        | 500 kHz   | PASS             | FAIL | -60.00 dB      |
| 250.0 mV            | 10 Hz            | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 250.0 mV            | 20 Hz            | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 250.0 mV            | 100 Hz           | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 250.0 mV            | 1000 Hz          | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 250.0 mV            | 10000 Hz         | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 250.0 mV            | 20000 Hz         | 80 kHz    | PASS             | FAIL | -80.00 dB      |
| 250.0 mV            | 50000 Hz         | 220 kHz   | PASS             | FAIL | -74.00 dB      |
| 142.3 mV            | 100000 Hz        | 500 kHz   | PASS             | FAIL | -65.00 dB      |
| 80.0 mV             | 140000 Hz        | 500 kHz   | PASS             | FAIL | -60.00 dB      |

**TABLE 5-14. RESIDUAL SIGNAL-TO-NOISE TEST RECORD.**

| <b>SOURCE<br/>LEVEL</b> | <b>FREQUENCY</b> | <b>BW</b> | <b>PASS/FAIL</b> |      | <b>MINIMUM</b> |
|-------------------------|------------------|-----------|------------------|------|----------------|
| 16.000 V                | 10 Hz            | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 16.000 V                | 20 Hz            | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 16.000 V                | 100 Hz           | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 16.000 V                | 1000 Hz          | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 16.000 V                | 10000 Hz         | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 16.000 V                | 20000 Hz         | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 16.000 V                | 50000 Hz         | 220 kHz   | PASS             | FAIL | 85.00 dB       |
| 16.000 V                | 100000 Hz        | 500 kHz   | PASS             | FAIL | 85.00 dB       |
| 16.000 V                | 140000 Hz        | 500 kHz   | PASS             | FAIL | 85.00 dB       |
| 500 mV                  | 10 Hz            | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 500 mV                  | 20 Hz            | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 500 mV                  | 100 Hz           | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 500 mV                  | 1000 Hz          | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 500 mV                  | 10000 Hz         | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 500 mV                  | 20000 Hz         | 80 kHz    | PASS             | FAIL | 85.00 dB       |
| 711 mV                  | 50000 Hz         | 220 kHz   | PASS             | FAIL | 85.00 dB       |
| 1.423 mV                | 100000 Hz        | 500 kHz   | PASS             | FAIL | 85.00 dB       |
| 1.423 mV                | 140000 Hz        | 500 kHz   | PASS             | FAIL | 85.00 dB       |

**TABLE 5-15. COMMON MODE REJECTION RATIO TEST RECORD.**

| <b>SOURCE<br/>LEVEL</b> | <b>SOURCE<br/>FREQUENCY</b> | <b>PASS/FAIL</b> |      | <b>MAXIMUM</b> |
|-------------------------|-----------------------------|------------------|------|----------------|
| 2.500 V                 | 20 Hz                       | PASS             | FAIL | -70.00 dB      |
| 2.500 V                 | 60 Hz                       | PASS             | FAIL | -70.00 dB      |
| 2.500 V                 | 1000 Hz                     | PASS             | FAIL | -70.00 dB      |
| 2.500 V                 | 2000 Hz                     | PASS             | FAIL | -40.00 dB      |

**TABLE 5-16. CCITT FILTER ACCURACY TEST RECORD.**

| <b>SOURCE<br/>FREQUENCY</b> | <b>MINIMUM</b> | <b>PASS/FAIL</b> |      | <b>MAXIMUM</b> |
|-----------------------------|----------------|------------------|------|----------------|
| 50.00 Hz                    | -65.0          | PASS             | FAIL | -61.0          |
| 100.00 Hz                   | -43.0          | PASS             | FAIL | -39.0          |
| 200.00 Hz                   | -23.0          | PASS             | FAIL | -19.0          |
| 300.00 Hz                   | -11.6          | PASS             | FAIL | -9.6           |
| 400.00 Hz                   | -7.3           | PASS             | FAIL | -5.3           |
| 800.00 Hz                   | -0.2           | PASS             | FAIL | 0.2            |
| 1000.0 Hz                   | 0.0            | PASS             | FAIL | 2.0            |
| 1200.0 Hz                   | -1.0           | PASS             | FAIL | 1.0            |
| 1600.0 Hz                   | -2.7           | PASS             | FAIL | -0.7           |
| 2000.0 Hz                   | -4.0           | PASS             | FAIL | -2.0           |
| 3000.0 Hz                   | -6.6           | PASS             | FAIL | -4.6           |
| 3500.0 Hz                   | -10.5          | PASS             | FAIL | -6.5           |
| 4000.0 Hz                   | -18.0          | PASS             | FAIL | -12.0          |
| 5000.0 Hz                   | -39.0          | PASS             | FAIL | -33.0          |

**TABLE 5-17. CCIR FILTER ACCURACY TEST RECORD.**

| <b>SOURCE<br/>FREQUENCY</b> | <b>MINIMUM</b> | <b>PASS/FAIL</b> |      | <b>MAXIMUM</b> |
|-----------------------------|----------------|------------------|------|----------------|
| 31.50 Hz                    | -35.6          | PASS             | FAIL | -33.6          |
| 63.00 Hz                    | -30.5          | PASS             | FAIL | -28.5          |
| 100.00 Hz                   | -26.4          | PASS             | FAIL | -24.4          |
| 200.00 Hz                   | -19.9          | PASS             | FAIL | -18.9          |
| 400.00 Hz                   | -13.9          | PASS             | FAIL | -12.9          |
| 800.00 Hz                   | -8.0           | PASS             | FAIL | -7.0           |
| 1000.0 Hz                   | -6.1           | PASS             | FAIL | -5.1           |
| 2000.0 Hz                   | -0.5           | PASS             | FAIL | 0.5            |
| 3150.0 Hz                   | 2.9            | PASS             | FAIL | 3.9            |
| 4000.0 Hz                   | 4.4            | PASS             | FAIL | 5.4            |
| 5000.0 Hz                   | 5.6            | PASS             | FAIL | 6.6            |
| 6300.0 Hz                   | 6.4            | PASS             | FAIL | 6.8            |
| 7100.0 Hz                   | 6.2            | PASS             | FAIL | 6.6            |
| 8000.0 Hz                   | 5.4            | PASS             | FAIL | 6.2            |
| 9000.0 Hz                   | 4.1            | PASS             | FAIL | 4.9            |
| 10.000 kHz                  | 2.1            | PASS             | FAIL | 2.9            |
| 12.500 kHz                  | -6.6           | PASS             | FAIL | -4.6           |
| 14.000 kHz                  | -11.9          | PASS             | FAIL | -9.9           |
| 16.000 kHz                  | -18.3          | PASS             | FAIL | -16.3          |
| 20.000 kHz                  | -28.8          | PASS             | FAIL | -26.8          |
| 31.500 kHz                  | -∞             | PASS             | FAIL | -46.3          |

**TABLE 5-18. A WEIGHTING FILTER ACCURACY TEST RECORD.**

| <b>SOURCE<br/>FREQUENCY</b> | <b>MINIMUM</b> | <b>PASS/FAIL</b> |      | <b>MAXIMUM</b> |
|-----------------------------|----------------|------------------|------|----------------|
| 19.95 Hz                    | -52.5          | PASS             | FAIL | -48.5          |
| 31.62 Hz                    | -40.9          | PASS             | FAIL | -37.9          |
| 50.12 Hz                    | -31.2          | PASS             | FAIL | -29.2          |
| 100.0 Hz                    | -20.1          | PASS             | FAIL | -18.1          |
| 199.5 Hz                    | -11.9          | PASS             | FAIL | -9.9           |
| 316.2 Hz                    | -7.6           | PASS             | FAIL | -5.6           |
| 501.2 Hz                    | -4.2           | PASS             | FAIL | -2.2           |
| 1000.0 Hz                   | -0.2           | PASS             | FAIL | 0.2            |
| 1995 Hz                     | 0.2            | PASS             | FAIL | 2.2            |
| 3162 Hz                     | 0.2            | PASS             | FAIL | 2.2            |
| 5012 Hz                     | -1.0           | PASS             | FAIL | 2.0            |
| 10000 Hz                    | -4.0           | PASS             | FAIL | -1.0           |
| 19950 Hz                    | -11.3          | PASS             | FAIL | -7.3           |

**TABLE 5-19. B WEIGHTING FILTER ACCURACY TEST RECORD.**

| <b>SOURCE<br/>FREQUENCY</b> | <b>MINIMUM</b> | <b>PASS/FAIL</b> |      | <b>MAXIMUM</b> |
|-----------------------------|----------------|------------------|------|----------------|
| 19.95 Hz                    | -26.2          | PASS             | FAIL | -22.2          |
| 31.62 Hz                    | -18.6          | PASS             | FAIL | -15.6          |
| 50.12 Hz                    | -12.6          | PASS             | FAIL | -10.6          |
| 100.0 Hz                    | -6.6           | PASS             | FAIL | -4.6           |
| 199.5 Hz                    | -3.0           | PASS             | FAIL | -1.0           |
| 316.2 Hz                    | -1.8           | PASS             | FAIL | 0.2            |
| 501.2 Hz                    | -1.3           | PASS             | FAIL | 0.7            |
| 1000.0 Hz                   | -0.2           | PASS             | FAIL | 0.2            |
| 1995 Hz                     | -1.1           | PASS             | FAIL | 0.9            |
| 3162 Hz                     | -1.4           | PASS             | FAIL | 0.6            |
| 5012 Hz                     | -2.7           | PASS             | FAIL | 0.3            |
| 10000 Hz                    | -5.8           | PASS             | FAIL | -2.8           |
| 19950 Hz                    | -13.1          | PASS             | FAIL | -9.1           |

**TABLE 5-20. C WEIGHTING FILTER ACCURACY TEST RECORD.**

| <b>SOURCE<br/>FREQUENCY</b> | <b>MINIMUM</b> | <b>PASS/FAIL</b> |      | <b>MAXIMUM</b> |
|-----------------------------|----------------|------------------|------|----------------|
| 19.95 Hz                    | -8.2           | PASS             | FAIL | -4.2           |
| 31.62 Hz                    | -4.5           | PASS             | FAIL | -1.5           |
| 50.12 Hz                    | -2.3           | PASS             | FAIL | -0.3           |
| 100.0 Hz                    | -1.3           | PASS             | FAIL | 0.7            |
| 199.5 Hz                    | -1.0           | PASS             | FAIL | 1.0            |
| 316.2 Hz                    | -1.0           | PASS             | FAIL | 1.0            |
| 501.2 Hz                    | -1.0           | PASS             | FAIL | 1.0            |
| 1000.0 Hz                   | -0.2           | PASS             | FAIL | 0.2            |
| 1995 Hz                     | -1.2           | PASS             | FAIL | 0.8            |
| 3162 Hz                     | -1.5           | PASS             | FAIL | 0.5            |
| 5012 Hz                     | -2.8           | PASS             | FAIL | 0.2            |
| 10000 Hz                    | -5.9           | PASS             | FAIL | -2.9           |
| 19950 Hz                    | -13.2          | PASS             | FAIL | -9.2           |

**TABLE 5-21. C-MESSAGE FILTER ACCURACY TEST RECORD.**

| <b>SOURCE<br/>FREQUENCY</b> | <b>MINIMUM</b> | <b>PASS/FAIL</b> |      | <b>MAXIMUM</b> |
|-----------------------------|----------------|------------------|------|----------------|
| 60.00 Hz                    | -57.7          | PASS             | FAIL | -53.7          |
| 100.00 Hz                   | -44.5          | PASS             | FAIL | -40.5          |
| 200.00 Hz                   | -27.0          | PASS             | FAIL | -23.0          |
| 300.00 Hz                   | -17.5          | PASS             | FAIL | -15.5          |
| 400.00 Hz                   | -12.4          | PASS             | FAIL | -10.4          |
| 800.00 Hz                   | -2.5           | PASS             | FAIL | -0.5           |
| 1000.0 Hz                   | -0.2           | PASS             | FAIL | 0.2            |
| 1200.0 Hz                   | -1.2           | PASS             | FAIL | 0.8            |
| 1500.0 Hz                   | -2.0           | PASS             | FAIL | 0.0            |
| 2500.0 Hz                   | -2.4           | PASS             | FAIL | -0.4           |
| 3000.0 Hz                   | -3.5           | PASS             | FAIL | -1.5           |
| 3500.0 Hz                   | -9.6           | PASS             | FAIL | -5.6           |
| 4000.0 Hz                   | -17.5          | PASS             | FAIL | -11.5          |
| 5000.0 Hz                   | -31.5          | PASS             | FAIL | -25.5          |

**5-50. ADJUSTMENTS.**

**5-51.** The Model 1121A adjustments are listed in Table 5-22. Test equipment required for the adjustments is listed in Table 5-1.

**5-52. A11 Power Supply Adjustment.**

**5-53.** The power supply has only one adjustment which is the power supply Power Fail Adjustment. The Power Fail Adjustment sets the low line trip level that interrupts the processor operation until the proper AC voltage is applied.

**5-54. A11R6 Power Fail Adjustment.** Perform the adjustment as follows:

- a. Disconnect all power to the Audio Analyzer and remove the top cover.
- b. Set the rear panel line voltage switch to the appropriate voltage.

- c. Verify that the line fuse is the proper value as listed on the LINE VOLTAGE SELECT chart located on the rear panel.

- d. Connect the variac to an appropriate power source and adjust for a line indication of nominal -10% (90, 108, 200 or 216 volts).

**WARNING**

*There are voltages at various points in the instrument which can, if contacted, cause personal injury. Observe all safety precautions.*

- e. Connect the Audio Analyzer power cord to the variac and set the LINE ON/OFF switch to ON.

- f. Observe the display and adjust A11R6 clockwise until the display just blanks, then slowly counterclockwise until the display returns.

**TABLE 5-22. LIST OF ADJUSTMENTS.**

| ADJUSTMENT |                                | LOCATION           |
|------------|--------------------------------|--------------------|
| A11R6      | Power Fail                     | Power Supply Board |
| A5Y1       | Timebase Frequency             | CPU Board          |
| A3R57      | Notch Balance                  | Notch Board        |
| A3R58      | Notch Tune                     | Notch Board        |
| A0R29,C25  | 3 V Range CMRR                 | Input Board        |
| A0R12      | 30 V Range CMRR                | Input Board        |
| A0R7       | 300 V Range CMRR               | Input Board        |
| A0C5       | HI Input 30 V Range Flatness   | Input Board        |
| A0C32      | HI Input 300 V Range Flatness  | Input Board        |
| A0C10      | LOW Input 30 V Range Flatness  | Input Board        |
| A0C33      | LOW Input 300 V Range Flatness | Input Board        |
| A6R23      | Output Level                   | Source Board       |
| A7R21      | Attenuator Bit 2               | Output Board       |
| A7R17      | Attenuator Bit 1               | Output Board       |
| A7R15      | Attenuator Bit 0               | Output Board       |
| A1A32R11   | CCIR Cal                       | CCIR Filter Board  |

**5-55. A5 CPU Adjustment.**

**5-56.** The only adjustment on the CPU Board is the Timebase Frequency Adjustment which is adjusted to provide the specific frequency accuracy for the system time standard.

**5-57. A5Y1 Timebase Frequency Adjustment.** Perform the procedure as follows:

- a. Disconnect power from the instrument.
- b. Remove the IEEE-488 interface cable on the CPU Board.
- c. Connect the House Standard frequency reference to the rear panel X CLK input.
- d. Apply power to the instrument.
- e. Enter special function 35 to enable the frequency counter check mode.
- f. Observe the SOURCE display and adjust A5Y1 until the display indicates  $10000.00 \text{ kHz} \pm 1 \text{ count}$ .
- h. Disconnect power from the instrument.

**5-58. A3 Notch Board Adjustments.** The Notch Board adjustments consist of A3R57 Notch Balance and A3R58 Notch Tune. These adjustments compensate for offsets in the notch filter which could reduce the effective depth of the notch.

**5-59. A3R57 Balance and A3R58 Tune Adjustments.** Perform the adjustments as follows:

- a. Depress the LCL/INIT key to initialize the instrument.
- b. Connect the Source HI and LOW outputs to the Analyzer HI and LOW inputs using the balanced cable and adapters.
- c. Connect the Wave Analyzer input to the MONITOR output on the rear panel of the Audio Analyzer.
- d. Set the Wave Analyzer control as follows:
 

|                            |        |
|----------------------------|--------|
| SCALE.....                 | 90 dB  |
| FREQUENCY.....             | 1 kHz  |
| AMPLITUDE REF LEVEL.....   | NORMAL |
| INPUT SENSITIVITY.....     | 10 dB  |
| RESOLUTION BANDWIDTH ..... | 10 Hz  |
| AFC .....                  | OFF    |
| SWEEP MODE.....            | OFF    |
- e. Set the Source level to 3.000 volts and depress the Analyzer DIST key.

f. Observe the Wave Analyzer and alternately adjust A3R46 and A3R49 for a minimum indication. The null measurement should be in excess of 40 dB.

**5-60. A0 Input Board Adjustments.**

**5-61.** The Input Board adjustments consist of four common mode rejection adjustments: A0R29 and A0C35 3 V Range CMRR, A0R12 30 V Range CMRR and A0R7300 V Range CMRR, and four flatness adjustments: A0C5 HI Input 30 V Range Flatness, A0C32 HI Input 300 V Range Flatness, A0C10 LOW Input 30 V Flatness, and A0C33 LOW Input 300 V Flatness.

**5-62. A0R29, A0R12, A0R7 and A0C35 CMRR Adjustments.**

Perform the adjustments as follows:

- a. Depress the LCL/INIT key to initialize the instrument.
- b. Enable the Analyzer input float mode and connect the Source HI output to the Analyzer HI and LOW inputs using BNC cables and a TEE adapter.
- c. Connect the Wave Analyzer input to the MONITOR output on the rear panel of the Audio Analyzer.
- d. Set the Wave Analyzer controls as follows:
 

|                            |        |
|----------------------------|--------|
| SCALE.....                 | 90 dB  |
| FREQUENCY.....             | 1 kHz  |
| AMPLITUDE REF LEVEL.....   | NORMAL |
| INPUT SENSITIVITY.....     | 0 dB   |
| RESOLUTION BANDWIDTH ..... | 10 Hz  |
| AFC .....                  | OFF    |
| SWEEP MODE.....            | OFF    |

e. Set the Source level to 3.000 volts and enter special function 28.

f. Observe the Wave Analyzer and alternately adjust A0R29 and A0C35 for a minimum indication. The null measurement should be in excess of 75 dB.

g. Enter special function 27.

h. Observe the Wave Analyzer and adjust A0R12 for a minimum indication. The null measurements should be in excess of 75 dB. If a 75 dB null cannot be achieved, alternately adjust A0C5 or A0C10 flatness adjustments and A0R12 for a null in excess of 75 dB.

i. Enter special function 26.

j. Observe the Wave Analyzer and adjust A0R7 for a minimum indication. The null measurement should be in excess of 75 dB. If a 75 dB null cannot be achieved, alternately adjust A0C32 or A0C33 flatness adjustments and A0R7 for a null in excess of 75 dB.

#### 5-63. A0C5 and A0C32 Flatness Adjustments.

Perform the adjustments as follows:

- a. Depress the LCL/INIT key to initialize the instrument.
- b. Enable the input floating mode and connect the Source HI and LOW outputs to the Analyzer HI and LOW inputs, respectively, using the balanced cable and adapters.
- c. Set the Source frequency to 100 kHz and level to 3.000 volts.
- d. Enter special functions 17 and 28.
- e. Depress the RATIO key to enable the Analyzer level ratio mode.
- f. Enter special function 27, note the display and adjust A0C32 for an indication of  $100.00\% \pm 0.1\%$
- g. Enter special function 26, note the display and adjust A0C32 for an indication of  $100.00\% \pm 0.1\%$

#### 5-64. A0C10 and A0C33 Flatness Adjustments.

Perform the adjustments as follows:

- a. Depress the LCL/INIT key to initialize the instrument.
- b. Enable the input floating mode and connect the Source HI and LOW outputs to the Analyzer input LOW and HI, respectively, using the balanced cable and adapters.
- c. Set the Source frequency to 100 kHz and level to 3.000 volts.
- d. Enter special functions 17 and 28.
- e. Depress the RATIO key to enable the Analyzer level ratio mode.
- f. Enter special function 27, note the display and adjust A0C10 for an indication of  $100.00\% \pm 0.1\%$ .
- g. Enter special function 26, note the display and adjust A0C33 for an indication of  $100.00\% \pm 0.1\%$

#### 5-65. A7 Output Board Adjustments.

The Output Board adjustments consist of three attenuator adjustments which trim the most significant bits of the programmable attenuator for optimum level accuracy.

#### 5-66. A7R21, A7R17, and A7R15 Adjustments.

Perform the adjustments as follows:

- a. Depress the LCL/INIT key on the Model 1121A to initialize the instrument. Connect the Model 1121A HI and LOW outputs to the Multimeter HI and LOW inputs using the balanced cable and adapters and enter special function 75 (50 ohm output).
- b. Set the Multimeter to measure AC level.
- c. Set the level (open circuit) to 511 mV.
- d. Observe the multimeter display.
- e. Set the level to 512 mV and adjust A7R21 for an increase of  $1 \text{ mV} \pm 0.3 \text{ mV}$  above the measurement in step d above.
- f. Set the level to 1023 mV.
- g. Observe the Multimeter display.
- h. Set the level to 1024 mV and adjust A7R17 for an increase of  $1 \text{ mV} \pm 0.5 \text{ mV}$  above the measurement in step g. above.
- i. Set the level to 2047 mV.
- j. Observe the Multimeter display.
- k. Set the level to 2048 mV and adjust A7R15 for an increase of  $1 \text{ mV} \pm 0.5 \text{ mV}$  above the measurement in step j above.

#### 5-67. A6 Source Board Adjustments.

The only adjustment on the Source Board is the Output Level adjustment which sets the full scale output level of the Model 1121A.

#### 5-68. A6R23 Output Level Adjustment.

Perform the adjustments as follows:

- a. Connect the 50 Hz - 50 kHz Calibrator output to the Multimeter input using the balanced cable and adapters and set the Multimeter to measure AC level.
- b. Set the Calibrator to 1.000 kHz and 3.000 volts and enable the Calibrator output.

c. After the Multimeter measurement settles, depress the OFFSET key to enable the level ratio mode.

d. Disconnect the Calibrator and connect the Model 1121A HI and LOW outputs to the Multimeter input using the balanced cable and adapters.

e. Set the Model 1121A level to 3.000 volts at a frequency of 1 kHz and enter special function 75 (50 ohm output).

f. Note the Multimeter display and adjust A6R23 for a Multimeter level ratio display of  $0.00 \pm 1.0$  mV.

#### **5-69. A37 CCIR, CCIR/ARM Filter Board Adjustment.**

**5-70.** The CCIR, CCIR/ARM optional filter board adjustment consist of A37R1`1 Cal. The adjustment sets the high-pass weighting response and is identical for both the CCIR and the CCIR/ARM filter applications.

**5-71. A37R11 CCIR Cal Adjustment.** Perform the adjustment as follows:

a. Depress the LCL/INIT key to initialize the instrument.

b. Connect the Source HI and LOW outputs to the Analyzer HI and LOW inputs using the balanced cable and adapters.

c. Enable the CCIR filter.

d. Set the Source frequency to 6.300 kHz at a level of 3.000 volts.

e. Enable the Analyzer level ratio mode and depress the dB key.

f. Set the Source frequency to 1.000 kHz.

g. Adjust A37R11 for a ANALYZER display of  $-12.20$  dB  $\pm 0.05$  dB.

h. Set the Source frequency to 6.300 kHz and note the Analyzer ratio measurement. If the display indication is not  $0.00 \pm 0.05$  dB then disable the ratio mode and repeat steps e through h.

#### **5-72. TROUBLESHOOTING.**

**5-73.** Instrument malfunction will generally be evident from front panel indications, or IEEE-488 bus responses. The problems will fall into two general categories: catastrophic failures or selective failure of one subsystem.

**5-74.** Catastrophic failures would generally cause the Model 1121A to be completely inoperative. For instance, if the microprocessor was not operating properly, the

display would contain meaningless symbols and the keyboard would not be responsive. Such failures are usually located in the power supply circuits, interconnecting cables, and the CPU plug-in board.

**5-75.** Selective failures and performance out of specification are usually limited to one section of the instrument and will be evident from manipulation of the front panel controls. For example, incorrect or erratic distortion measurements will indicate a fault in the notch filter circuits on the Notch Filter plug-in board. Further isolation of the problem requires an understanding of the simplified block diagrams detailed in the theory of operation section of this manual and experience in troubleshooting analog and digital circuits.

#### **5-76. TROUBLE LOCALIZATION.**

**5-77.** The circuits of the Model 1121A are divided into three sections: analyzer circuits, source circuits and interface circuits. The interface circuits consist of the power supply and digital circuits including the frequency counter, CPU, display, and keyboard.

**5-78. Special Diagnostic Function Codes.** Special function codes 30 through 33 are provided to localize selective failures in the source, analyzer and frequency counter circuits. When entered, these codes continuously execute the designated test sequence until the LCL/INIT key is depressed. During the initialization sequence, analyzer level range and counter tests, error codes are reported if a fault is encountered. Table 5-23 lists the ranges, error codes and probable causes to aid in localizing a fault.

**5-79. DAC Test Code.** Contained in the Model 1121A are three digital-to-analog converters (DAC) which can be configured to generate a low frequency ramp waveform using special function 30. A coarse stepped ramp waveform is usually an indication of missing data bits in the DAC circuits. The display will indicate the "dac tst" message when the test is active.

**5-80.** The first 12 bit DAC, A7U1, is used to fine tune the oscillator frequency and is located on the Output plug-in board. The ramp can be found at A7U2 pin 7 (TP3) and will have a peak to peak amplitude of 20 volts from -5 to +14 volts.

**5-81.** The remaining 12 bit DACs are used to generate the rear panel X AXIS and Y AXIS outputs. The ramps from these DACs can be found at the rear panel recorder output connectors and will have a peak amplitude extending from 0 to + 5 volts. The PEN output is toggled between 0 and + 5 volts at the ramp frequency to provide an external sync signal.

**5-82. Counter Plug-in Board Test.** The period counter can be tested using special function 31. In this test sequence the counter is configured to measure the timebase reference. The reference is divided in decade increments from 1 to 10,000 in the period ranging circuits. Each of the five frequency ranges is sequentially checked for accuracy while the ANALYZER display indicates the range being tested. The SOURCE display will indicate an error code if a fault is evident on the tested range.

**5-83. Input and Filter Plug-in Board Test.** The Input and filter plug-in boards can be tested using special function 32. In this test sequence an external signal source set to 1 kHz and 3.000 volts is required. The HI and LOW inputs can be checked separately by enabling the float mode and connecting the signal source to either input. Each of the 13 level ranges is sequentially checked to an accuracy limit of  $\pm 0.5\%$  while the ANALYZER display indicates the range being tested. The SOURCE display will indicate an error code if a fault is evident on the tested range.

**5-84. Notch And Detector Plug-in Board Test.** The Notch and Detector plug-in boards can be tested using special function 33. In this test sequence an external signal source set to 1 kHz and 3.000 volts is applied to the Analyzer input. Each of the 13 post notch detector ranges is sequentially checked to an accuracy limit of  $\pm 1.0\%$  while the ANALYZER display indicates the range being tested. The SOURCE display will indicate an error code if a fault is evident on the tested range.

## 5-85. PREPARATION FOR SHIPMENT.

**5-86. Use of Shipping Case or Containers.** If the original shipping case or container was saved, pack the Model 1121A as it was received.

**5-87. Packaging.** When using packing materials other than the original, use the following guidelines:

- a. Wrap the Model 1121A in polyethylene sheeting.
- b. Select a double wall cardboard container. Inside dimensions must be at least 6 inches greater than the equipment. The carton must meet test strength requirements of  $\geq 275$  lbs. (124.7 kg).
- c. Protect all sides with shock-absorbing material to prevent equipment movement within the container.
- d. Seal carton with approved sealing tape.
- e. Mark carton "FRAGILE" on all sides, top, and bottom of shipping container.

## 5-88. STORAGE.

Pack the Model 1121A in the shipping container. Maintain storage temperature range of  $-4$  to  $140^{\circ}\text{F}$  ( $-40$  to  $71^{\circ}\text{C}$ ) at  $75\pm 5$  relative humidity.

**TABLE 5-23. DIAGNOSTIC ERROR CODE DESCRIPTION.**

| FAULT     | DESCRIPTION                  | PROBABLE CAUSE                                          |
|-----------|------------------------------|---------------------------------------------------------|
| Error 30  | 10 - 125 Hz freq. lock       | A6Q5, A6Q17, A6U13                                      |
| Error 31  | 125 - 1250 Hz freq. lock     | A6Q4, A6Q16, A6U13                                      |
| Error 32  | 1.25 - 7.5 kHz freq. lock    | A6Q3, A6Q15, A6U13                                      |
| Error 33  | 7.5 - 55 kHz freq. lock      | A6Q2, A6Q14, A6U13                                      |
| Error 34  | 55 - 140 kHz freq. lock      | A6Q2-Q5, A6Q14-Q17, A6U13                               |
| ALL 30-34 | 10 Hz to 140 kHz freq. lock  | A6Q18-25, A6Q6-13, A6U1<br>A6U7, A6U8, A6U13-17, A6U1-3 |
| Error 40  | Detector board rms conv.     | A3U18, A4U20-21                                         |
| Error 41  | Detector board average conv. | A3U15, A3U20-21, A4U20-21                               |
| Error 42  | Filter board rms conv.       | A1U6, A4U20-21                                          |
| Error 43  | DC full scale                | A0U7, A0U4, A0U2, A3U20-21,<br>A4U20-21                 |

TABLE 5-23 DIAGNOSTIC ERROR CODE DESCRIPTION.

| FAULT     | DESCRIPTION                     | PROBABLE CAUSE                                   |
|-----------|---------------------------------|--------------------------------------------------|
| Error 44  | Detector board quasi-peak conv. | A3U16, A3U19-21                                  |
| Error 45  | Optional filter No. 2           | A1U4, A1U7-8                                     |
| Error 46  | DC offset                       | A0U7, A0U4, A0U2, A0K4, A0K5, A3U20-21, A4U20-21 |
| Error 47  | Optional filter No. 1           | A1U4, A1U7, A1U8                                 |
| Error 50  | 199.999 Hz range                | A4U5, A4U9, A4U13                                |
| Error 51  | 1.99999 kHz range               | A4U6, A4U9, A4U13                                |
| Error 52  | 19.9999 kHz range               | A4U6, A4U9, A4U13                                |
| Error 53  | 199.999 kHz range               | A4U7, A4U9, A4U13                                |
| Error 54  | 1999.99 kHz range               | A4U7, A4U9, A4U13                                |
| All 50-54 | Counter accumulator             | A4U5, A4U9, A4U10, A4U3, A4U12-16, A5Y1          |
| Error 60  | 300 V range                     | A0K6, A0K7, A0U1                                 |
| Error 61  | 150 V range                     | A0K6, A0K7, A0U1, A0K2, A0U2, A0U6               |
| Error 62  | 75 V range                      | A0K6, A0K7, A0U1, A0K1, A0U2, A0U6               |
| Error 63  | 30 V range                      | A0K8, A0K9, A0U1                                 |
| Error 64  | 15 V range                      | A0K8, A0K9, A0U1, A0K2, A0U2, A0U6               |
| Error 65  | 7.5 V range                     | A0K8, A0K9, A0U1, A0K1, A0U2, A0U6               |
| Error 66  | 3.0 V range                     | A0K1, A0K2, A0U1, A0U2, A0U6                     |
| Error 67  | 1.5 V range                     | A1U1-U4                                          |
| Error 68  | 0.75 V range                    | A1U1-U4                                          |
| Error 69  | 0.3 V range                     | A1U1-U4                                          |
| Error 70  | 0.15 V range                    | A1U1-U4                                          |
| Error 71  | 0.1 V range                     | A1U1-U4                                          |
| Error 72  | 0.05 V range                    | A1U1-U4                                          |
| Error 80  | 100% range                      | A3U1, A3U8, A3U11-12                             |
| Error 81  | 50% range                       | A3U1, A3U8, A3U11-12                             |
| Error 82  | 20% range                       | A3U1, A3U8, A3U11-12                             |
| Error 83  | 10% range                       | A3U1, A3U8, A3U11-12                             |
| Error 84  | 5% range                        | A3U1-2, A3U8, A3U11                              |
| Error 85  | 2% range                        | A3U1-2, A3U8, A3U11                              |
| Error 86  | 1% range                        | A3U1-2, A3U8, A3U11                              |
| Error 87  | 0.5% range                      | A3U1-3, A3U8, A3U11                              |
| Error 88  | 0.2% range                      | A3U1-3, A3U8, A3U11                              |
| Error 89  | 0.1% range                      | A3U1-3, A3U8, A3U11                              |
| Error 90  | 0.05% range                     | A2U4, A2U10-U12                                  |
| Error 91  | 0.02% range                     | A2U4, A2U10-U12                                  |
| Error 92  | 0.01% range                     | A2U4, A2U10-U12                                  |
| All 80-92 | 100 - 0.01% ranges              | A3K1, A3U1, A3U4, A3U9-10                        |

## SECTION VI

### PARTS LIST

#### 6-1. INTRODUCTION.

**6-2.** The replaceable parts for the Model 1121A are listed in Table 6-2. The replaceable parts list contains the

reference symbol, description, manufacturer, and both the BEC and manufacturer part numbers. Table 6-1 lists the manufacturer's Commercial and Government Entity (CAGE) code numbers.

**TABLE 6-1. MANUFACTURERS CAGE CODE NUMBERS.**

|       |                                           |       |                               |
|-------|-------------------------------------------|-------|-------------------------------|
| 00779 | TE Connectivity                           | 50434 | Avago Technologies            |
| 01295 | Texas Instruments                         | 50558 | Electronic Concepts Inc       |
| 02113 | Coilcraft                                 | 51406 | Murata Corporation of America |
| 04222 | AVX Ceramics Company                      | 51640 | Analog Devices, Inc.          |
| 04713 | Freescale                                 | 52769 | Sprague-Goodman Electronics   |
| 04901 | Boonton Electronics Corporation           | 53507 | Robleyco                      |
| 05245 | Corcom, Inc                               | 54453 | Sullins Electronics Corp      |
| 06383 | Panduit Corporation                       | 54473 | Panasonic                     |
| 07263 | Fairchild Semiconductor                   | 55153 | Dielectric Labs, Inc.         |
| 08JA0 | Microsemi Corp.                           | 55322 | Samtec Inc.                   |
| 0EHX1 | NIC Ccomponents Corp.                     | 56DR1 | ST Microelectronics Inc       |
| 0GP22 | Wurth Electronics                         | 59124 | KOA Speer Electronics Inc     |
| 0JY53 | Capax Technologies Inc                    | 59365 | Aeroflex / Metelics, Inc.     |
| 0MJ08 | Linear Integrated Systems Inc             | 5L401 | Solid State Inc               |
| 12060 | Diodes Incorporated                       | 61429 | Fox Electronics               |
| 13454 | Crystek Crystals Corporation              | 61935 | Schurter, Inc.                |
| 13919 | Burr-Brown Corp                           | 64155 | Linear Technology             |
| 14655 | Cornell-Dublier                           | 64667 | National Instruments          |
| 15542 | Mini Circuits Labs.                       | 65238 | Novacap, Inc.                 |
| 17856 | Siliconix, Inc.                           | 65786 | Cypress Semiconductor         |
| 1D3Q0 | CTS Corporation                           | 65VR8 | Macronix America, Inc.        |
| 1ES66 | Maxim Integrated Products, Inc.           | 66675 | Lattice Semiconductor Corp    |
| 1FN41 | Atmel Corporation                         | 68994 | Xilinx, Inc.                  |
| 1MQ07 | ON Semiconductor                          | 70097 | Catalyst Semiconductor Inc    |
| 1W7D7 | Massachusetts Bay Technologies            | 71607 | Busmann Mfg                   |
| 24226 | Gowanda Electronics                       | 74868 | Amphenol Corporation          |
| 27014 | National Semiconductor                    | 7Y525 | Silonex Inc                   |
| 27264 | Molex, Inc.                               | 91637 | Vishay Dale Electronics, Inc. |
| 28480 | Hewlett-Packard Company                   | 91833 | Keystone Electronics Corp.    |
| 30817 | Laird Technologies, Inc.                  | 95077 | SV Microwave                  |
| 31433 | Kemet Electronics Corporation             | 98291 | ITT Cannon RF Products        |
| 32293 | Intersil, Inc.                            | 99800 | API Delevan                   |
| 32997 | Bourns                                    | C4620 | Fastron GMBH                  |
| 34371 | Intersil Corporation                      | H0H68 | NXP Semiconductors            |
| 3FJ41 | Rectron Electronic Enterprises, Inc       | S4217 | Nippon Chem-Con Corporation   |
| 3N087 | Mill-Max Mfg Corp                         | S5518 | Rohm LTD                      |
| 4JUL4 | Spansion LLC                              |       |                               |
| 4S177 | International Manufacturing Services, Inc |       |                               |

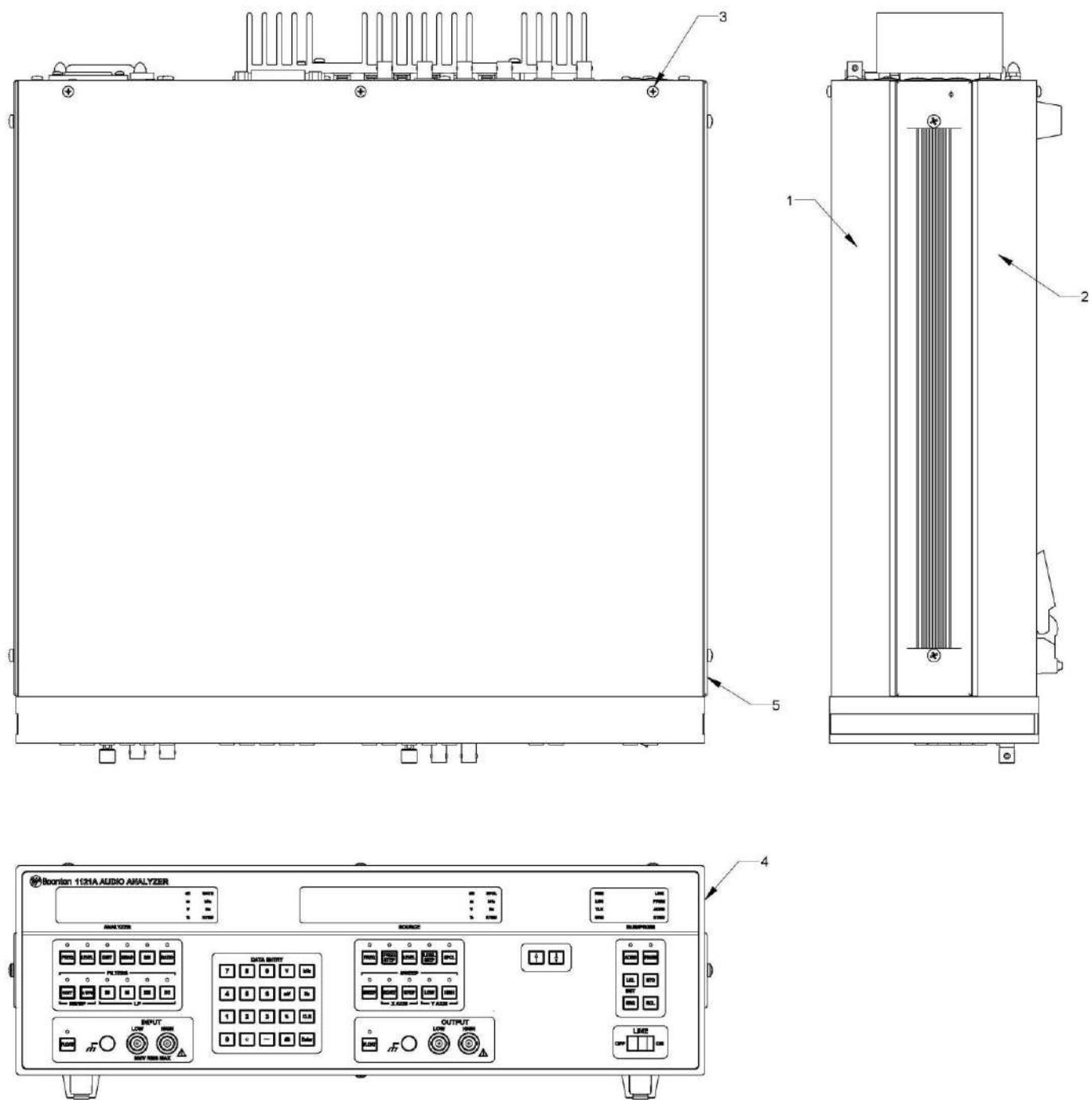


Figure 6-1. Model 1121A Programmable Audio Analyzer

**PROGRAMMABLE AUDIO ANALYZER (Figure 6-1)**  
**MODEL: 1121A**

| REF.<br>DESIG. | DESCRIPTION                                       | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|----------------|---------------------------------------------------|--------------|--------------------|-----|--------------------|
| 1              | TOP COVER                                         | 04901        | 60004902A          | 1   | 60004902A          |
| 2              | BOTTOM COVER                                      | 04901        | 04311802A          | 1   | 04311802A          |
| 3              | SCREW, BINDING HEAD, SS,<br>BLK OXIDE, 6-32 x 1/4 | 04901        | 79326901A          | 6   | 79326901A          |
| 4              | 1121A FRAME ASSY                                  | 04901        | 11220200A          | 1   | 11220200A          |

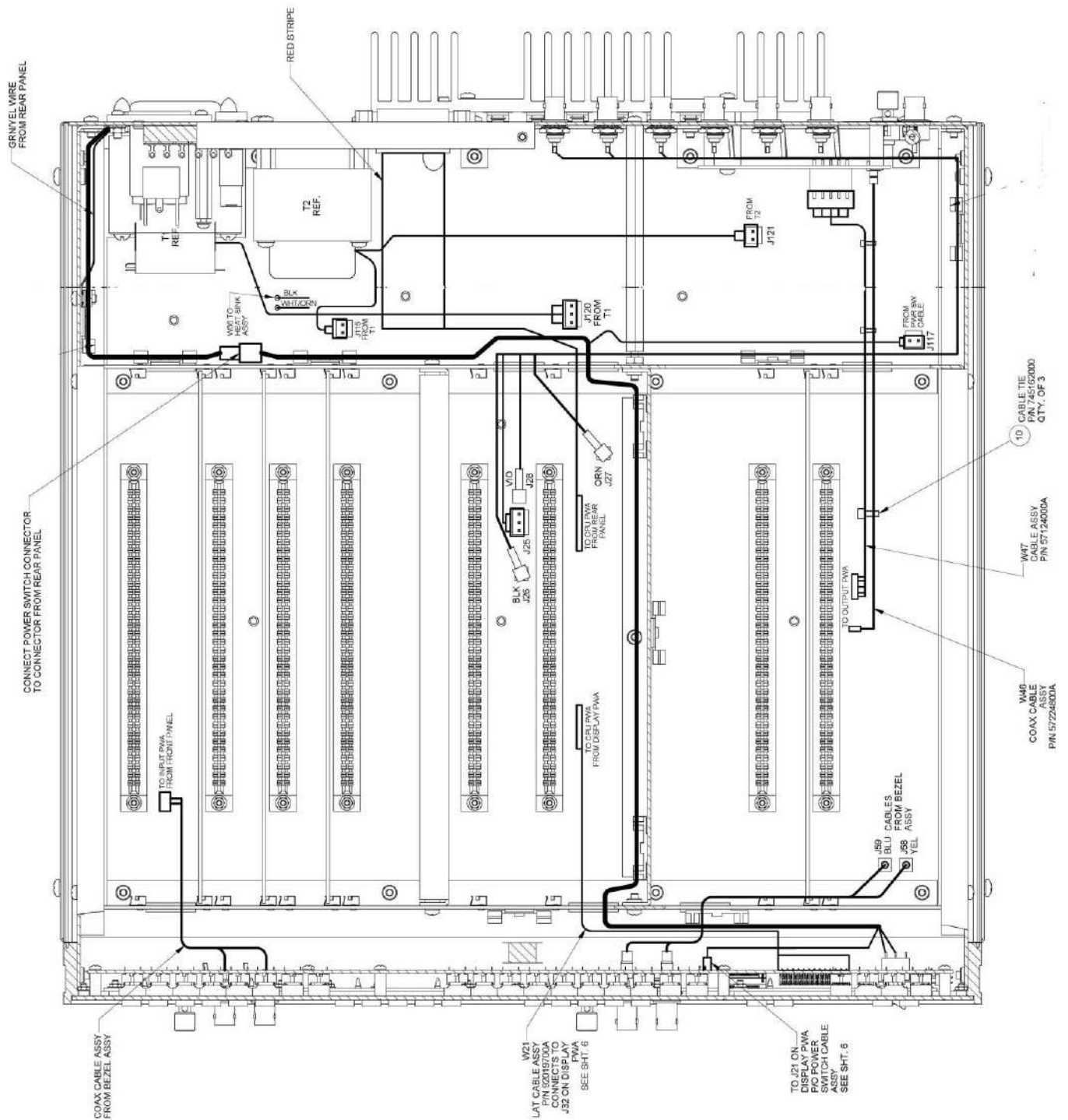


Figure 6-2. '1121A' Frame Assy (Sheet 1 of 2)

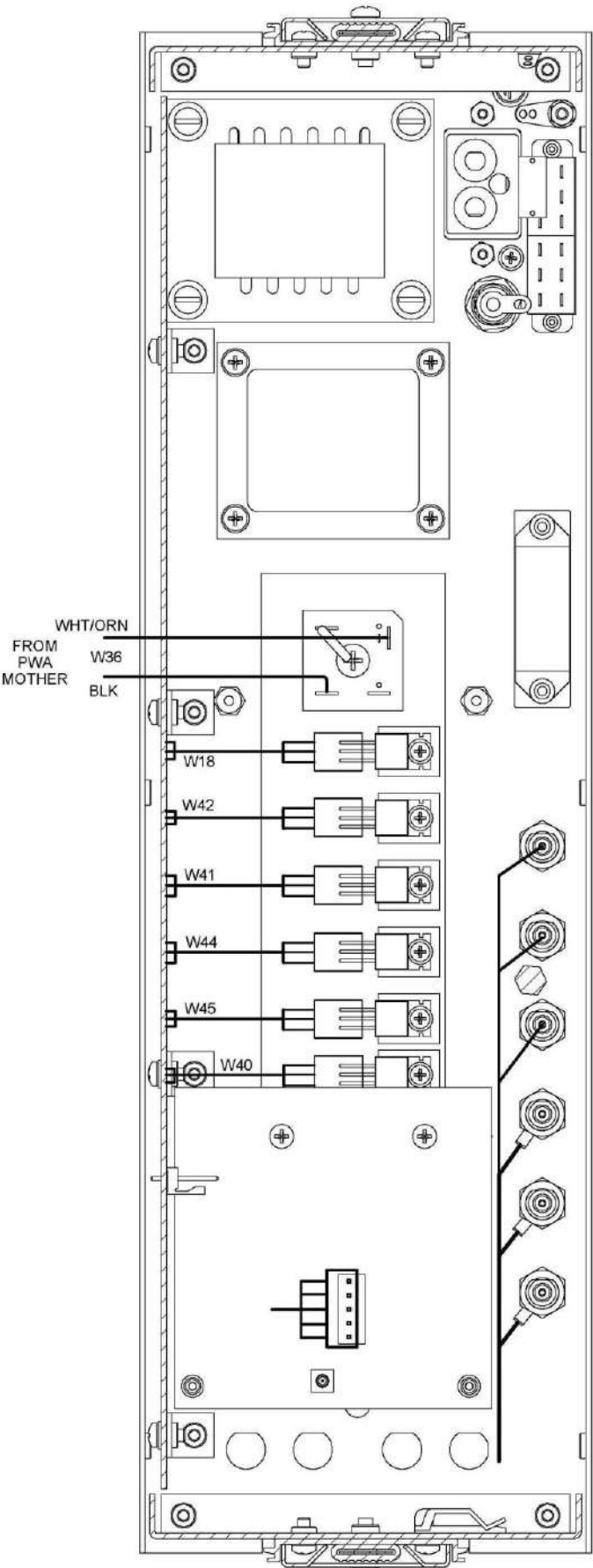


Figure 6-2. '1121A' Frame Assy (Sheet 2 of 2)

TABLE 6-2 REPLACEABLE PARTS LIST.

| <b>11220100A REV A READY INVENTORY 1121A (FIGURE 6-2)</b> |                             |                      |                            |            |                            |
|-----------------------------------------------------------|-----------------------------|----------------------|----------------------------|------------|----------------------------|
| <b>MODEL: 1121A</b>                                       |                             |                      |                            |            |                            |
| <b>REF.<br/>DESIG.</b>                                    | <b>DESCRIPTION</b>          | <b>CAGE<br/>CODE</b> | <b>MFG PART<br/>NUMBER</b> | <b>QTY</b> | <b>BEC PART<br/>NUMBER</b> |
| A0                                                        | PWA INPUT 1121A             | 04901                | 11202803B                  | 1          | 11202803B                  |
| A1                                                        | PWA MAIN FILTER 1121A       | 04901                | 11210501B                  | 1          | 11210501B                  |
| A2                                                        | PWA NOTCH 1121A             | 04901                | 11208002B                  | 1          | 11208002B                  |
| A3                                                        | PWA DETECTOR 1121A          | 04901                | 11210001B                  | 1          | 11210001B                  |
| A4                                                        | PWA FREQUENCY COUNTER 1121A | 04901                | 11201906B                  | 1          | 11201906B                  |
| A5                                                        | PWA CPU 1121A               | 04901                | 11202706B                  | 1          | 11202706B                  |
| A6                                                        | PWA SOURCE 1121A            | 04901                | 11207701B                  | 1          | 11207701B                  |
| A7                                                        | PWA OUTPUT 1121A            | 04901                | 11103202B                  | 1          | 11103202B                  |
| A22                                                       | FRAME ASSY 1121A            | 04901                | 11220200A                  | 1          | 11220200A                  |

| <b>11220200A REV A FRAME ASSY 1121A (A22) (Figure 6-2)</b> |                                |                      |                            |            |                            |
|------------------------------------------------------------|--------------------------------|----------------------|----------------------------|------------|----------------------------|
| <b>MODEL: 1121A</b>                                        |                                |                      |                            |            |                            |
| <b>REF.<br/>DESIG.</b>                                     | <b>DESCRIPTION</b>             | <b>CAGE<br/>CODE</b> | <b>MFG PART<br/>NUMBER</b> | <b>QTY</b> | <b>BEC PART<br/>NUMBER</b> |
| A17                                                        | BEZEL ASSEMBLY 1121A           | 04901                | 11220300A                  | 1          | 11220300A                  |
| A21                                                        | REAR PANEL ASSY 1121A          | 04901                | 11220700A                  | 1          | 11220700A                  |
| W21                                                        | CABLE ASSY FLAT 26 CKT 15"LONG | 04901                | 92019700A                  | 1          | 92019700A                  |
| W46                                                        | CABLE ASSY COAX (GRN) 9.875L   | 04901                | 57224800A                  | 1          | 57224800A                  |
| W47                                                        | CABLE ASSY WIRE 22GA 5C 9.00L  | 04901                | 57124000A                  | 1          | 57124000A                  |
| <b>11220200A REV A CARD CAGE DETAIL (Figure 6-21)</b>      |                                |                      |                            |            |                            |
| A10                                                        | PWA MOTHER/POWER SUPPLY 1121A  | 04901                | 11220600A                  | 1          | 11220600A                  |
| REF 2                                                      | BRACKET CARD CAGE FRONT 1121A  | 04901                | 60487000A                  | 1          | 60487000A                  |
| REF 3                                                      | BRACKET CARD CAGE REAR 1121A   | 04901                | 60487100A                  | 1          | 60487100A                  |
| REF 4                                                      | BRACKET CARD CAGE CENTER UNIT  | 04901                | 60473200A                  | 2          | 60473200A                  |

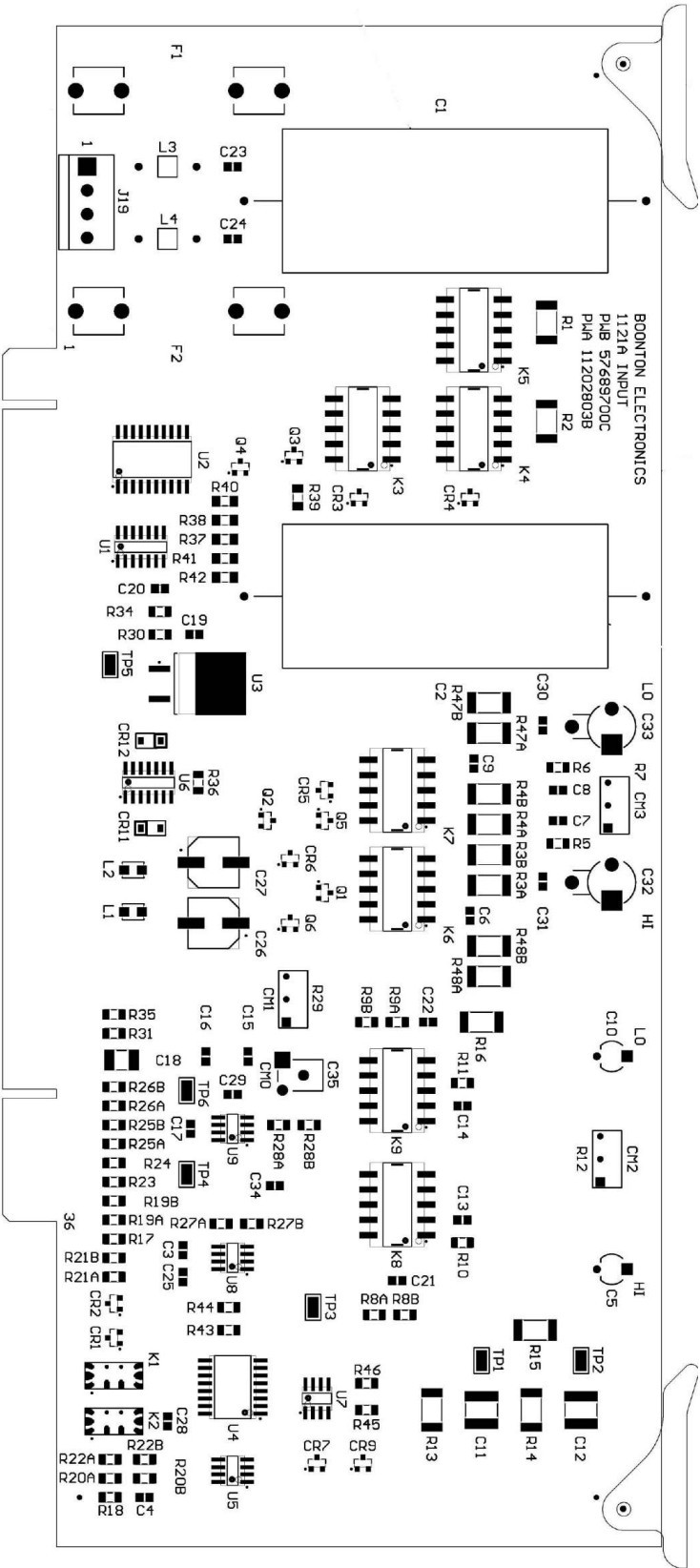


Figure 6-3. PWA '1121A' Input (A0)

**11202803A PWA INPUT 1121A (A0) (Figure 6-3)**  
**MODEL: 1121A**

| REF.<br>DESIG.   | DESCRIPTION                               | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|------------------|-------------------------------------------|--------------|--------------------|-----|--------------------|
| C1-2             | CAP MATCHED PAIR                          | 04901        | 23418000A          | 1   | 23418000A          |
| C3-4             | CAP CER CHIP 20pF 5% 500V COG 0805        | 31433        | C0805C200J5GACTU   | 2   | 20901900A          |
| C5               | CAP VAR CER 5-25pF 250V VIO               | 91293        | 9374               | 1   | 281021000          |
| C6               | CAP CER CHIP 8.2pF +/-0.5pF 500V 0805     | 31433        | CBR08C829BCGAC     | 1   | 20902000A          |
| C7-8             | CAP CER CHIP 470pF 5% 50V 0805            | 31433        | C0805C471J5GACTU   | 2   | 20902100A          |
| C9               | CAP CER CHIP 8.2pF +/-0.5pF 500V 0805     | 31433        | CBR08C829BCGAC     | 1   | 20902000A          |
| C10              | CAP VAR CER 5-25pF 250V VIO               | 91293        | 9374               | 1   | 281021000          |
| C11-12           | CAP CER CHIP 20000pF 5% 500V 2020         | 65238        | 2020N204J501NM     | 2   | 21600000A          |
| C13-14           | CAP CER CHIP 12pF 5% 500V 0805            | 31433        | C0805C120J5GACTU   | 2   | 20902200A          |
| C15-16           | CAP CER CHIP 0.1uF 10% 50V 0805           | 31433        | C0805C104K5RAC     | 2   | 20900500A          |
| C17              | CAP CER CHIP 10pF 5% 500V 0805            | 31433        | C0805C100JCGACTU   | 1   | 20902300A          |
| C18              | CAP CER CHIP 1uF 20% 50V                  | 31433        | C1812C105M5UACTU   | 1   | 22452400A          |
| C19-20           | CAP CER CHIP 0.1uF 10% 50V0805            | 31433        | C0805C104K5RAC     | 2   | 20900500A          |
| C21-22           | CAP CER CHIP 8.2pF +/-0.5pF 500V 0805     | 31433        | CBR08C829BCGAC     | 2   | 20902000A          |
| C23-24           | CAP CER CHIP 33pF 5% 1000V 0805           | 31433        | C0805C330JDGACTU   | 2   | 20902400A          |
| C25              | CAP CER CHIP 56pF 5% 500V 0805            | 31433        | C0805C560J5GACTU   | 1   | 20902500A          |
| C26-27           | CAP ELEC 100uF 20% 25V SM SIZE F          | 54473        | EEE-1EA101P        | 2   | 28339300A          |
| C28              | CAP CER CHIP 27pF 5% 500V 0805            | 31433        | C0805C270J5GACTU   | 1   | 20902600A          |
| C29              | CAP CER CHIP 33pF 5% 500V 0805            | 31433        | C0805C330JCGACTU   | 1   | 20902700A          |
| C32-C33          | CAP VAR CER 6-70pF                        | 91293        | 9315               | 2   | 281010000          |
| C34              | CAP CER CHIP 18pF 5% 500V 0805            | 31433        | C0805C180J5GACTU   | 1   | 20902900A          |
| C35              | CAP VAR-CER 5-30pF RGHT ANGLE             | 91293        | 9383               | 1   | 28102800A          |
| CR1-6            | DIODE MMBD914 SOT-23                      | 1MQ07        | MMBD914LT1G        | 6   | 53100000A          |
| CR7, CR9         | DIODE SIGNAL MMBD1503A SOT-23             | 07263        | MMBD1503A          | 2   | 53102400A          |
| CR11-12          | DIODE ZENER 4.7V 5% 0.5W MMSZ5230B SOT-12 | 07263        | MMSZ5230B          | 2   | 53102700A          |
| F1-2             | FUSE 1/4A (0.25A) 250V                    | 71400        | AGC 1/4            | 2   | 54550600A          |
| J19              | CONN M 4 PIN POLARIZED HEADER .156 SP     | 06383        | MPSS156-4-D-A      | 1   | 477344000          |
| K1-2             | RELAY SPST REED FORM "A" SM               | C0491        | CRR05-1A           | 2   | 47200400A          |
| K3-9             | RELAY FORM C 12V SM                       | 61529        | TQ2SA-12V          | 7   | 47107200A          |
| L1-2             | INDUCTOR 5.6UH 341MA 1210                 | 99800        | 1210-562K          | 2   | 40049300A          |
| L3-4             | FERRITE BEADS                             | 34899        | 2643000101         | 2   | 483247000          |
| Q1-6             | TRANSISTOR NPN 3904 SOT-23                | 1MQ07        | MMBT3904TT1G       | 6   | 52817800A          |
| R1-2             | RES CHIP 10K 5% 1/2W 2512                 | 4S177        | RC3-2512-1002J     | 2   | 32240001A          |
| R3A, R4A         | RES CHIP 82.50K 0.1% 1/2W 2512            | 4S177        | TPI-2512-8252B     | 2   | 32248802A          |
| R3B, R4B         | RES CHIP 158K 0.1% 1/2W 2512              | 4S177        | TPI-2512-1583B     | 2   | 32251902A          |
| R5-R6            | RES CHIP 1.00K 0.1% 1/4W 1206             | 4S177        | TPI-1206-1001B     | 2   | 31930010A          |
| R7               | RES VAR 20 OHM 20% 0.5W                   | 73138        | 72XWR20            | 1   | 311397000          |
| R8A, R9A         | RES CHIP 57.6K 0.1% 1/4W 1206             | 4S177        | TPI-1206-5762B     | 2   | 31947310A          |
| R8B, R9B         | RES CHIP 32.4K 0.1% 1/4W 1206             | 4S177        | TPI-1206-3242B     | 2   | 31944910A          |
| R10-R11          | RES CHIP 11.0K 0.1% 1/4W 1206             | 4S177        | TPI-1206-1102B     | 2   | 31940410A          |
| R12              | RES VAR 200 OHM 10% 0.5W                  | 32997        | 3386B-1-201        | 1   | 311339000          |
| R13-14           | RES CHIP 10K 5% 1/2W 2512                 | 4S177        | RC3-2512-1002J     | 2   | 32240001A          |
| R15-16           | RES CHIP 100.0K 0.1% 1/2W 2512            | 4S177        | TPI-2512-1003B     | 2   | 32250002A          |
| R17-18           | RES CHIP 2.00K 0.1% 1/4W 1206             | 4S177        | TPI-1206-2001B     | 2   | 31932910A          |
| R19A-B           | RES CHIP 2.00K 0.1% 1/4W 1206             | 4S177        | TPI-1206-2001B     | 2   | 31932910A          |
| R20A-B           | RES CHIP 2.00K 0.1% 1/4W 1206             | 4S177        | TPI-1206-2001B     | 2   | 31932910A          |
| R21A-B           | RES CHIP 2.00K 0.1% 1/4W 1206             | 4S177        | TPI-1206-2001B     | 2   | 31932910A          |
| R22A             | RES CHIP 4.99K 0.1% 1/4W(1206             | 4S177        | TPI-1206-4991B     | 1   | 31936710A          |
| R22B             | RES CHIP 3.01K 0.1% 1/4W 1206             | 4S177        | TPI-1206-3011B     | 1   | 31934610A          |
| R23-24           | RES CHIP 10K 1% 100PPM 1206               | 4S177        | RCI-1206-1002F     | 2   | 33740000A          |
| R25A, R26A, R27A | RES CHIP 2.74K 0.1% 1/4W 1206             | 4S177        | RCI-0805-2741F     | 4   | 31934210A          |
| R25B, R26B, R27B | RES CHIP 2.26K 0.1% 1/4W 1206             | 4S177        | TPI-1206-2261B     | 3   | 31933410A          |
| R28A             | RES CHIP 2.74K 0.1% 1/4W 1206             | 4S177        | RCI-0805-2741F     | 1   | 31934210A          |
| R28B             | RES CHIP 2.21K 0.1% 1/4W 1206             | 4S177        | RCI-1206-2211F     | 1   | 31933310A          |
| R29              | RES VAR 100 OHM 10% 0.5W                  | 32997        | 3386B-1-101        | 1   | 311306000          |

|            |                                           |       |                |   |           |
|------------|-------------------------------------------|-------|----------------|---|-----------|
| R30-31     | RES CHIP 10K 1% 100PPM 1206               | 4S177 | RCI-1206-1002F | 2 | 33740000A |
| R34-35     | RES CHIP 4.99K 1% 100PPM 1206             | 4S177 | RCI-1206-4991F | 2 | 33736700A |
| R36        | RES CHIP 20K 1% 100PPM 1206               | 4S177 | RCI-1206-2002F | 1 | 33742900A |
| R37-42     | RES CHIP 2.0K 1% 1/4W 1206                | 4S177 | RCI-1206-2001F | 6 | 33732900A |
| R43-46     | RES CHIP 1K 1% 100PPM 1/4W 1206           | 4S177 | RCI-1206-1001F | 4 | 33730000A |
| R47A, R48A | RES CHIP 46.4K 0.1% 1/2W 2512             | 4S177 | TPI-2512-4642B | 2 | 32246402A |
| R47B, R48B | RES CHIP 1.30M 0.1% 1/2W 2512             | 4S177 | TPI-2512-1304B | 2 | 32261102A |
| U1         | IC SN74LS74 DUAL D-TYPE FLIP-FLOP SOIC-14 | 01295 | SN74LS74AD     | 1 | 53706200A |
| U2         | IC SN74LS273 OCTAL D FLIP-FLOP SOIC-20    | 01295 | SN74LS273DW    | 1 | 53705400A |
| U3         | IC MC7805 POS VOLTAGE REG 1A D2PAK-3      | 1MQ07 | MC7805ABD2TG   | 1 | 53806800A |
| U4         | IC SW06 QUAD SPST-JFET ANALOG SWITCH      | 51640 | SW06GSZ        | 1 | 53807600A |
| U5         | IC NE5534 LOW-NOISE OP AMP SOIC-8         | 01295 | NE5534D        | 1 | 53806400A |
| U6         | IC LM339 QUAD COMPARATOR 14-SOP           | 07263 | LM339M         | 1 | 53805200A |
| U7         | IC OPA2107 PRECISION DUAL OP AMP SO-8     | 01295 | OPA2107AU      | 1 | 53807700A |
| U8-9       | IC NE5534 LOW-NOISE OP AMP SOIC-8         | 01295 | NE5534D        | 2 | 53806400A |
| XF1-4      | FUSE CLIP                                 | 75915 | 102079         | 4 | 482110000 |

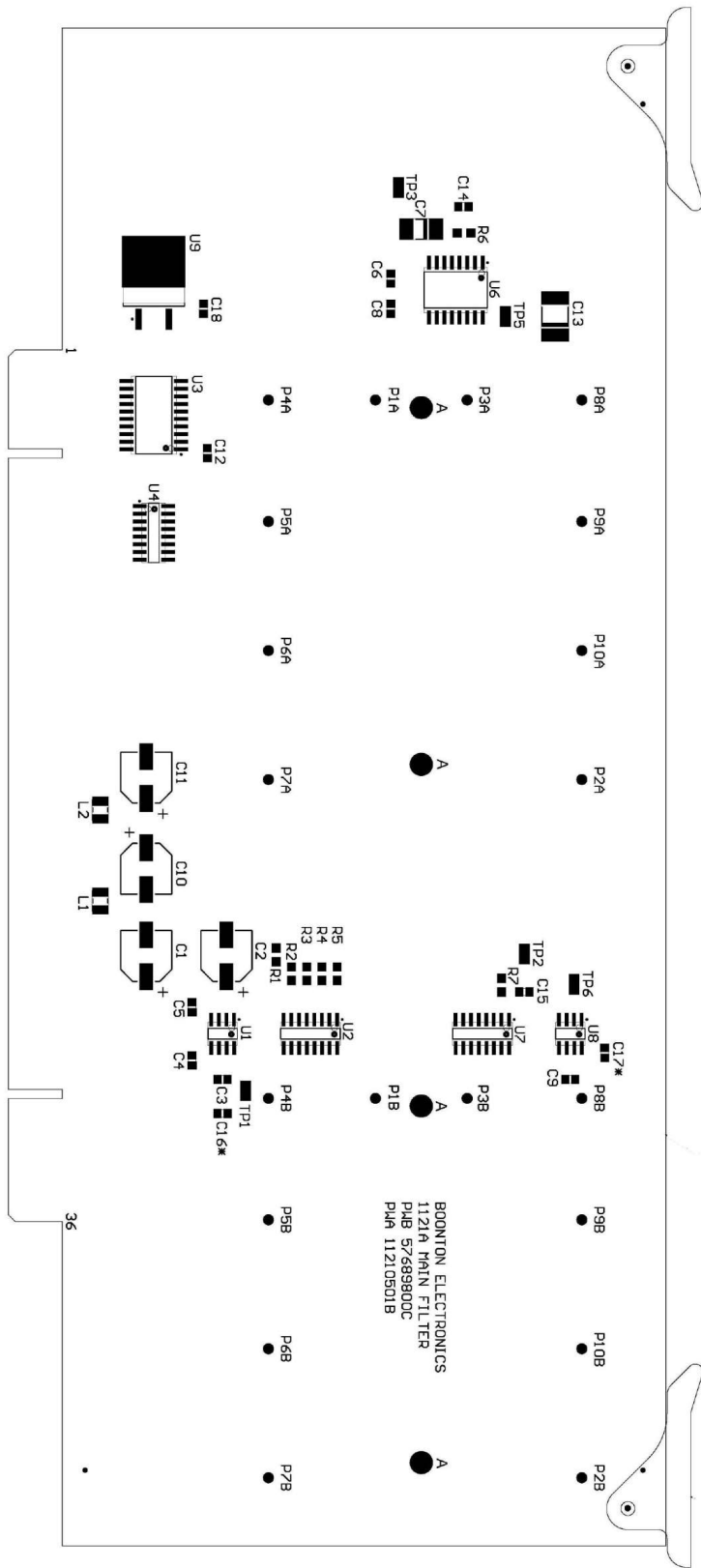
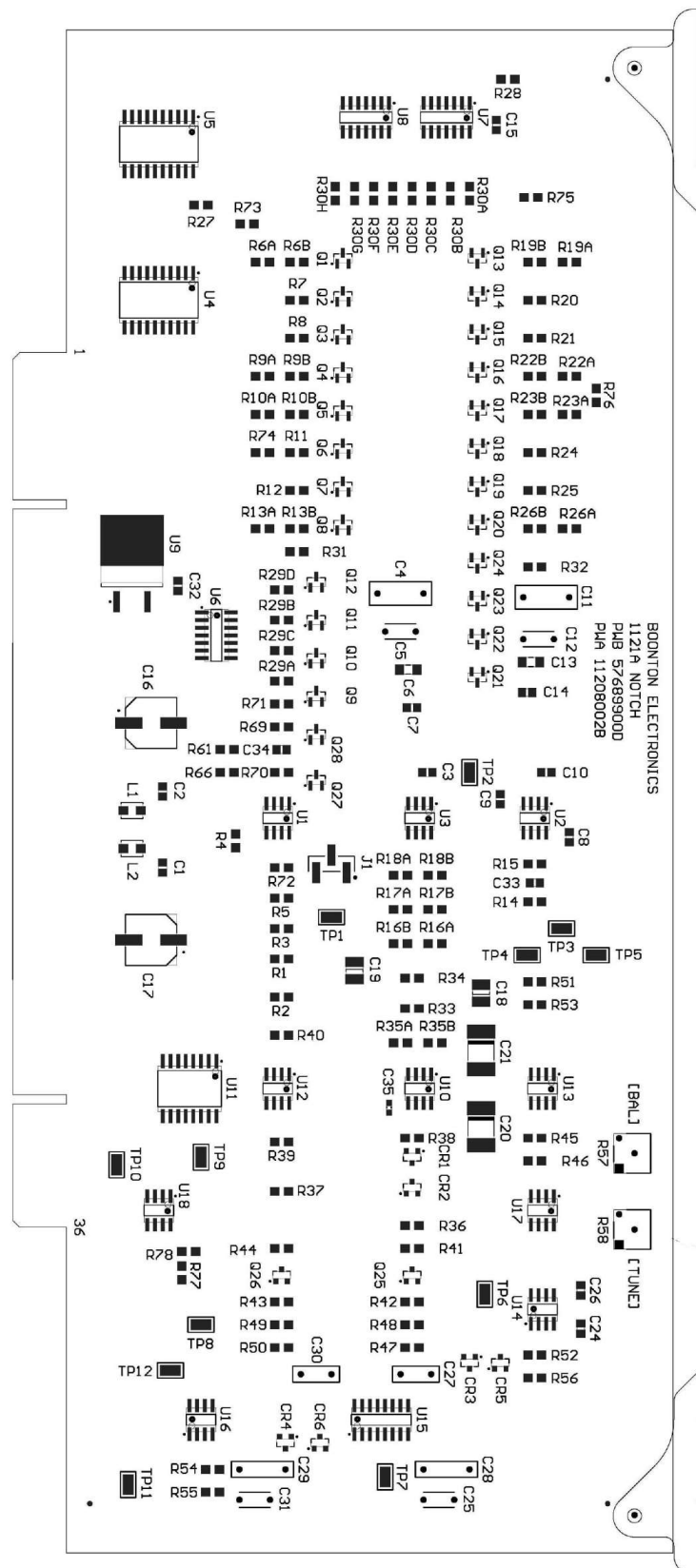


Figure 6-4. PWA '1121A' Main Filter (A1)

**11210501A PWA MAIN FILTER 1121A (A1) (Figure 6-4)**  
**MODEL: 1121A**

| REF.<br>DESIG. | DESCRIPTION                            | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|----------------|----------------------------------------|--------------|--------------------|-----|--------------------|
| C1-2           | CAP ELEC 100uF 20% 25V SM SIZE F       | 54773        | EEE-1EA101P        | 2   | 28339300A          |
| C3             | CAP CER CHIP 10pF 5% 50V 0805          | 31433        | C0805C100J5GACTU   | 1   | 22455900A          |
| C4-6           | CAP CER CHIP 0.1uF 10% 50V 0805        | 31433        | C0805C104K5RAC     | 3   | 20900500A          |
| C7             | CAP TANT CHIP 2.2uF 20% 35V            | 31433        | T491C225M035AT     | 1   | 28340800A          |
| C8             | CAP CER CHIP 0.1uF 10% 50V 0805        | 31433        | C0805C104K5RAC     | 1   | 20900500A          |
| C9             | CAP CER CHIP 20pF 5% 50V 0805          | 31433        | C0805C200J5GACTU   | 1   | 20901200A          |
| C10-11         | CAP ELEC 100uF 20% 25V SM SIZE F       | 54773        | EEE-1EA101P        | 2   | 28339300A          |
| C12            | CAP CER CHIP 1uF 10% 25V 0805          | 31433        | C0805C105K3RACTU   | 1   | 20900600A          |
| C13            | CAP TANT CHIP 68uF 20% 25V EIA 7343-43 | 04222        | TPSE686M025R0125   | 1   | 24001100A          |
| C14            | CAP CER CHIP 0.1uF 10% 50V 0805        | 31433        | C0805C104K5RAC     | 1   | 20900500A          |
| C15            | CAP CER CHIP 1uF 10% 25V 0805          | 31433        | C0805C105K3RACTU   | 1   | 20900600A          |
| C18            | CAP CER CHIP 0.1uF 10% 50V 0805        | 31433        | C0805C104K5RAC     | 1   | 20900500A          |
| L1-2           | INDUCTOR CHIP 5.6uH 5% 341mA 1210      | 99800        | 1210R-562J         | 2   | 42002700A          |
| R1             | RES CHIP 4.02K 1% 1/8W 0805            | 4S177        | RCI-0805-4021F     | 1   | 31835800A          |
| R2             | RES CHIP 3.010K 0.1% 1/8W 0805         | 4S177        | TPI-0805-3011B     | 1   | 31834602A          |
| R3             | RES CHIP 1.000K 0.1% 1/8W 0805         | 4S177        | TPI-0805-1001B     | 1   | 31830002A          |
| R4-5           | RES CHIP 499 OHMS 0.1% 1/8W 0805       | 4S177        | TPI-0805-4990B     | 2   | 31826702A          |
| R6             | RES CHIP 10.0K 1% 1/8W 0805            | 4S177        | RCI-0805-1002F     | 1   | 31840000A          |
| R7             | RES CHIP 20.0K 1% 1/8W 0805            | 4S177        | RCI-0805-2002F     | 1   | 31842900A          |
| U1             | IC NE5534 LOW-NOISE OP AMP SOIC-8      | 01295        | NE5534D            | 1   | 53806400A          |
| U2             | IC DG201A SPST ANALOG SWITCH SOIC-16   | 1ES66        | DG201ACSE          | 1   | 53806600A          |
| U3             | IC SN74LS273 OCTAL D FLIP-FLOP SOIC-20 | 01295        | SN74LS273DW        | 1   | 53705400A          |
| U4             | IC SN74LS139 DECODER/DEMULTI-PLEXER    | 01295        | SN74LS139AD        | 1   | 53806500A          |
| U6             | IC AD637 WIDEBAND RMS TO DC CONVERTER  | 51640        | AD637JRZ           | 1   | 53806700A          |
| U7             | IC DG201A SPST ANALOG SWITCH SOIC-16   | 1ES66        | DG201ACSE          | 1   | 53806600A          |
| U8             | IC NE5534 LOW-NOISE OP AMP SOIC-8      | 01295        | NE5534D            | 1   | 53806400A          |
| U9             | IC MC7805 POS VOLT REG 1A D2PAK-3      | 1MQ07        | MC7805ABD2TG       | 1   | 53806800A          |



**11208002A PWA NOTCH 1121A (A2) (Figure 6-5)**  
**MODEL: 1121A**

| REF.<br>DESIG.   | DESCRIPTION                           | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|------------------|---------------------------------------|--------------|--------------------|-----|--------------------|
| C1-2             | CAP CER CHIP 0.1uF 10% 50V 0805       | 31433        | C0805C104K5RAC     | 2   | 20900500A          |
| C3               | CAP CER CHIP 430pF 1% 50V 0805        | 31433        | C0805C431F5GACTU   | 1   | 20904100A          |
| C4               | CAP MPC 0.47uF 1% 50V LEADED          | 50558        | ECR474BF           | 1   | 23800600A          |
| C5               | CAP MPC 0.047uF 1% 50V LEADED         | 50558        | ECR473BF           | 1   | 23800500A          |
| C6               | CAP CER CHIP 8200pF 1% 50V COG 1206   | 65238        | 1206N822F500NM     | 1   | 21000200A          |
| C7               | CAP CER CHIP 680pF 1% 50V 0805        | 31433        | C0805C681F5ACTU    | 1   | 20904000A          |
| C8-9             | CAP CER CHIP 0.1uF 10% 50V 0805       | 31433        | C0805C104K5RAC     | 2   | 20900500A          |
| C10              | CAP CER CHIP 430pF 1% 50V 0805        | 31433        | C0805C431F5GACTU   | 1   | 20904100A          |
| C11              | CAP MPC 0.47uF 1% 50V LEADED          | 50558        | ECR474BF           | 1   | 23800600A          |
| C12              | CAP MPC 0.047uF 1% 50V LEADED         | 50558        | ECR473BF           | 1   | 23800500A          |
| C13              | CAP CER CHIP 8200pF 1% 50V COG 1206   | 65238        | 1206N822F500NM     | 1   | 21000200A          |
| C14              | CAP CER CHIP 680pF 1% 50V 0805        | 31433        | C0805C681F5ACTU    | 1   | 20904000A          |
| C15              | CAP CER CHIP 0.1uF 10% 50V 0805       | 31433        | C0805C104K5RAC     | 1   | 20900500A          |
| C16-17           | CAP ELEC 100uF 20% 25V SM SIZE F      | 54473        | EEE-1EA101P        | 2   | 28339300A          |
| C18-19           | CAP TANT CHIP 68uF 10% 6.3V 1210      | 04222        | TPSB686K006R0500   | 2   | 24001700A          |
| C20-21           | CAP TANT 10UF 25V SM                  | 31433        | T491D106M025AS     | 2   | 28338900A          |
| C24              | CAP CER CHIP 0.1uF 10% 50V 0805       | 31433        | C0805C104K5RAC     | 1   | 20900500A          |
| C25              | CAP MPC 0.033uF 2% 50V LEADED         | 50558        | ECR333BG           | 1   | 23800700A          |
| C26              | CAP CER CHIP 0.1uF 10% 50V 0805       | 31433        | C0805C104K5RAC     | 1   | 20900500A          |
| C27              | CAP MPC 0.1uF 2% 50V LEADED           | 50558        | ECR104BG           | 1   | 23800300A          |
| C28-29           | CAP MPC 0.33uF 10% 50V LEADED         | 50558        | ECR334BK           | 2   | 23800400A          |
| C30              | CAP MPC 0.1uF 2% 50V LEADED           | 50558        | ECR104BG           | 1   | 23800300A          |
| C31              | CAP MPC 0.033uF 2% 50V LEADED         | 50558        | ECR333BG           | 1   | 23800700A          |
| C32              | CAP CER CHIP 1uF 10% 25V 0805         | 31433        | C0805C105K3RACTU   | 1   | 20900600A          |
| C33              | CAP CER CHIP 8.0pF +/-0.5pF 50V 0805  | 04222        | 08055A8R0DAT2A     | 1   | 20904200A          |
| C34              | CAP CER CHIP 5.0pF +/-0.5pF 500V 0805 | 31433        | C0805C509C5GACTU   | 1   | 20901500A          |
| C25              | CAP CER CHIP 20pF 5% 50V 0603         | 31433        | C0603C200J5GAC     | 1   | 20802900A          |
| CR1-6            | DIODE MMBD914 SOT-23                  | 1MQ07        | MMBD914LT1G        | 6   | 53100000A          |
| J1               | CONN M 3 PIN SINGLE ROW HEADER .10 SP | 55322        | TSM-103-02-L-SV    | 1   | 49200603A          |
| L1-2             | INDUCTOR 5.6UH 341MA 1210             | 99800        | 1210-562K          | 2   | 40049300A          |
| P1               | SHUNT 2 CIRCUIT (RoHS)                | 27264        | 15-38-1024         | 1   | 483253000          |
| Q1-24            | TRANS N-CHANNEL SWITCH MMBFJ108 SOT-3 | 07263        | MMBFJ108           | 24  | 52902500A          |
| Q25-26           | TRANSISTOR JFET N-CH SOT-23           | 1MQ07        | MMBF4391LT1G       | 2   | 52818100A          |
| Q27-28           | TRANS N-CHANNEL SWITCH MMBFJ108 SOT-3 | 07263        | MMBFJ108           | 2   | 52902500A          |
| R1-2             | RES CHIP 20.0K 1% 1/8W 0805           | 4S177        | RCI-0805-2002F     | 2   | 31842900A          |
| R3               | RES CHIP 10.0K 1% 1/8W 080            | 4S177        | RCI-0805-1002F     | 1   | 31840000A          |
| R4               | RES CHIP 8.25K 1% 1/8W 0805           | 4S177        | RCI-0805-8251F     | 1   | 31838800A          |
| R5               | RES CHIP 10.0K 1% 1/8W 080            | 4S177        | RCI-0805-1002F     | 1   | 31840000A          |
| R6A-B, R7        | RES CHIP 20.0K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2002B     | 3   | 31842902A          |
| R8               | RES CHIP 10.0K 0.1% 1/8W 0805         | 4S177        | TPI-0805-1002B     | 1   | 31840002A          |
| R9A              | RES CHIP 2.74K 0.1% 1/8W(0805         | 4S177        | TPI-0805-2741B     | 1   | 31834202A          |
| R9B              | RES CHIP 2.26K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2261B     | 1   | 31833402A          |
| R10A-B, R11      | RES CHIP 20.0K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2002B     | 3   | 31842902A          |
| R12              | RES CHIP 10.0K 0.1% 1/8W 0805         | 4S177        | TPI-0805-1002B     | 1   | 31840002A          |
| R13A             | RES CHIP 2.74K 0.1% 1/8W(0805         | 4S177        | TPI-0805-2741B     | 1   | 31834202A          |
| R13B             | RES CHIP 2.26K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2261B     | 1   | 31833402A          |
| R14-15           | RES CHIP 4.99K 1% 1/8W 0805           | 4S177        | RCI-0805-4991F     | 2   | 31836700A          |
| R16A, R17A, R18A | RES CHIP 2.74K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2741B     | 3   | 31834202A          |
| R16B, R17B, R18B | RES CHIP 2.26K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2261B     | 3   | 31833402A          |
| R19A-B, R20      | RES CHIP 20.0K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2002B     | 3   | 31842902A          |
| R21, R25         | RES CHIP 10.0K 0.1% 1/8W 0805         | 4S177        | TPI-0805-1002B     | 2   | 31840002A          |
| R22A, R26A       | RES CHIP 2.74K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2741B     | 2   | 31834202A          |
| R22B, R26B       | RES CHIP 2.26K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2261B     | 2   | 31833402A          |
| R23A-B, R24      | RES CHIP 20.0K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2002B     | 3   | 31842902A          |
| R27              | RES CHIP 3.32K 1% 1/8W 0805           | 4S177        | RCI-0805-3321F     | 1   | 31835000A          |
| R28              | RES CHIP 1.82K 1% 1/8W 0805           | 4S177        | RCI-0805-1821F     | 1   | 31832500A          |
| R29A-D, R30A-H   | RES CHIP 3.32K 1% 1/8W 0805           | 4S177        | RCI-0805-3321F     | 12  | 31835000A          |

|          |                                            |       |                |   |           |
|----------|--------------------------------------------|-------|----------------|---|-----------|
| R31-32   | RES CHIP 100K 1% 1/8W 0805                 | 4S177 | RCI-0805-1003F | 2 | 31850000A |
| R33      | RES CHIP 1.000K 0.1% 1/8W 0805             | 4S177 | TPI-0805-1001B | 1 | 31830002A |
| R34      | RES CHIP 2.00K 1% 1/8W 0805                | 4S177 | RCI-0805-2001F | 1 | 31832900A |
| R35A     | RES CHIP 7.87K 0.1% 1/8W 0805              | 4S177 | TPI-0805-7871B | 1 | 31838602A |
| R35B     | RES CHIP 1.13K 0.1% 1/8W 0805              | 4S177 | TPI-0805-1131B | 1 | 31830502A |
| R36      | RES CHIP 10.0K 1% 1/8W 080                 | 4S177 | RCI-0805-1002F | 1 | 31840000A |
| R37-40   | RES CHIP 4.99K 1% 1/8W 0805                | 4S177 | RCI-0805-4991F | 4 | 31836700A |
| R41, R44 | RES CHIP 24.9K 1% 1/8W 0805                | 4S177 | RCI-0805-2492F | 2 | 31843800A |
| R42-43   | RES CHIP 3.01K 1% 1/8W 0805                | 4S177 | RCI-0805-3011F | 2 | 31834600A |
| R45-R46  | RES CHIP 10.0K 1% 1/8W 080                 | 4S177 | RCI-0805-1002F | 2 | 31840000A |
| R47, R60 | RES CHIP 30.1K 1% 1/8W 0805                | 4S177 | RCI-0805-3012F | 2 | 31844600A |
| R48-49   | RES CHIP 66.5K 1% 1/8W 0805                | 4S177 | RCI-0805-6652F | 2 | 31847900A |
| R51, R53 | RES CHIP 10.0K 1% 1/8W 080                 | 4S177 | RCI-0805-1002F | 2 | 31840000A |
| R52, R54 | RES CHIP 10.0 OHMS 1% 1/8W 0805            | 4S177 | RCI-0805-10R0F | 2 | 31810000A |
| R55-56   | RES CHIP 100K 1% 1/8W 0805                 | 4S177 | RCI-0805-1003F | 2 | 31850000A |
| R57-58   | RES VAR 20K 10% 0.5W                       | 32997 | 3329W-1-203    | 2 | 311374000 |
| R59-60   | RES CHIP 49.9K 1% 1/8W 0805                | 4S177 | RCI-0805-4992F | 2 | 31846700A |
| R61      | RES CHIP 60.4K 1% 1/8W 0805                | 4S177 | RCI-0805-6042F | 1 | 31847500A |
| R66      | RES CHIP 75K 1% 1/8W 0805                  | 4S177 | RCI-0805-7502F | 1 | 31848400A |
| R67-68   | RES CHIP 49.9K 1% 1/8W 0805                | 4S177 | RCI-0805-4992F | 2 | 31846700A |
| R69-70   | RES CHIP 33.2K 1% 1/8W 0805                | 4S177 | RCI-0805-3322F | 2 | 31845000A |
| R71      | RES CHIP 20.0K 1% 1/8W 0805                | 4S177 | RCI-0805-2002F | 1 | 31842900A |
| R72      | RES CHIP 49.9K 1% 1/8W 0805                | 4S177 | RCI-0805-4992F | 1 | 31846700A |
| R73, R75 | RES CHIP 102 OHMS 1% 1/8W 0805             | 4S177 | RCI-0805-1020F | 2 | 31820100A |
| R74, R76 | RES CHIP 1.50K 1% 1/8W 0805                | 4S177 | RCI-0805-1501F | 2 | 31831700A |
| U1-3     | IC NE5532A DUAL LOW-NOISE OP AMP 8-SOP     | 01295 | NE5532AD       | 3 | 53807500A |
| U4-5     | IC SN74LS273 OCTAL D FLIP-FLOP SOIC-20     | 01295 | SN74LS273DW    | 2 | 53705400A |
| U6-8     | IC LM339 QUAD COMPARATOR 14-SOP            | 07263 | LM339M         | 3 | 53805200A |
| U9       | IC MC7805 POS VOLT REG 1A D2PAK-3          | 1MQ07 | MC7805ABD2TG   | 1 | 53806800A |
| U10      | IC LT1222 LOW NOISE HI SPEED OP AMP SOIC-8 | 64155 | LT1222CS8#PBF  | 1 | 53807900A |
| U11      | IC SW06 QUAD SPST-JFET ANALOG SWITCH       | 51640 | SW06GSZ        | 1 | 53807600A |
| U12      | IC TL072A LOW NOISE OP AMP SOIC-8          | 01295 | TL072ACD       | 1 | 53805000A |
| U13      | IC LM393M DUAL DIFF COMPARATOR 8-SOIC      | 01295 | LM393D         | 1 | 53806900A |
| U14, U16 | IC OP07C PRECISION OP AMP 8-SOIC           | 01295 | OP07CD         | 2 | 53808300A |
| U15      | IC DG201A SPST ANALOG SWITCH SOIC-16       | 1ES66 | DG201ACSE      | 1 | 53806600A |
| U17-18   | IC AD633 ANALOG MULTIPLIER 8-SOIC_N        | 51640 | AD633JRZ       | 2 | 53808200A |

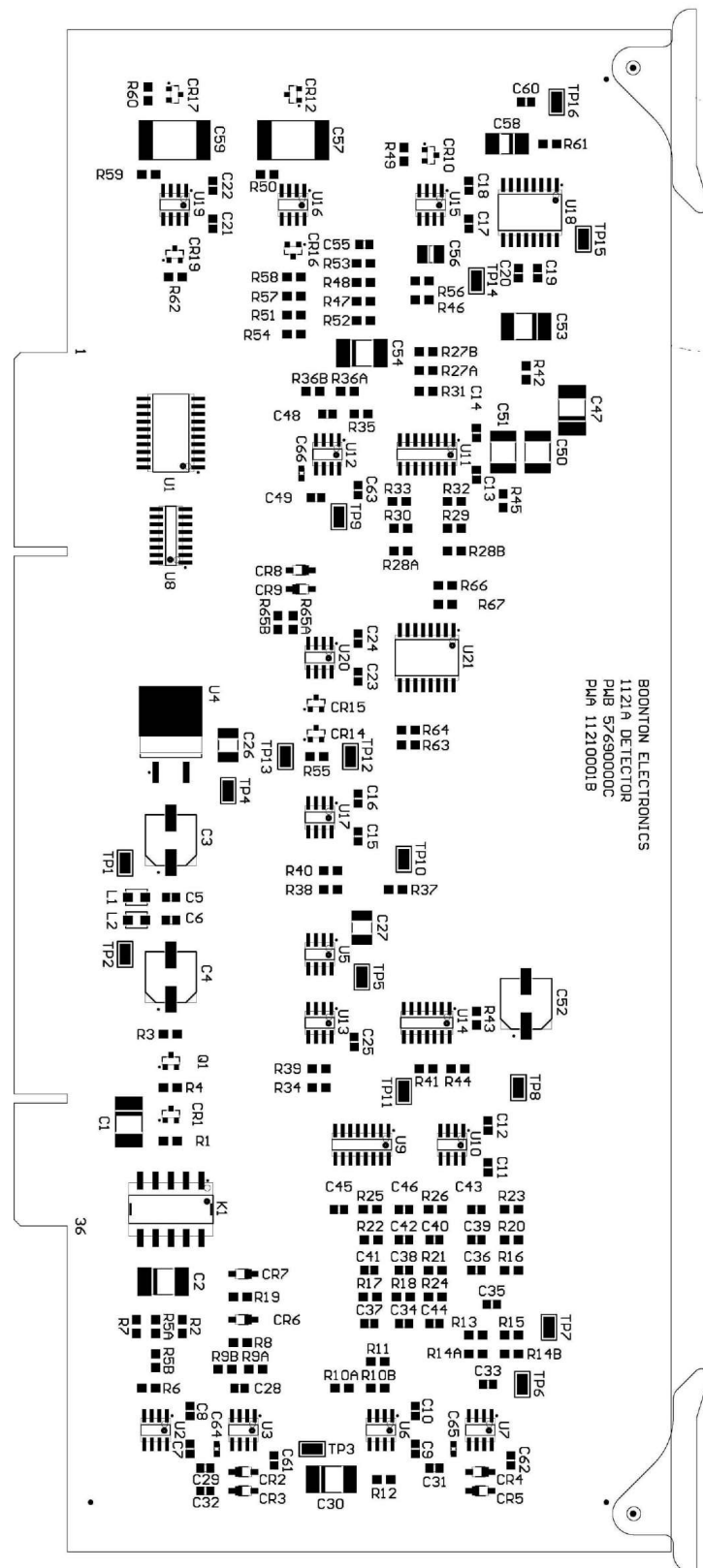


Figure 6-6. PWA '1121A' Detector (A3)

**11210001A PWA DETECTOR 1121A (A3) (Figure 6-6)**  
**MODEL: 1121A**

| REF.<br>DESIG. | DESCRIPTION                               | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|----------------|-------------------------------------------|--------------|--------------------|-----|--------------------|
| C1             | CAP TANT CHIP 68uF 20% 25V EIA 7343-43    | 31433        | B45025E6869M137    | 1   | 24001100A          |
| C2             | CAP TANT CHIP 10uF 20% 35V 7343-73        | 04222        | TPSE106M035R0200   | 1   | 28341800A          |
| C3-4           | CAP ELEC 100uF 20% 25V SM SIZE F          | 54473        | EEE-1EA101P        | 2   | 28339300A          |
| C5-25          | CAP CER CHIP 0.1uF 10% 50V 0805           | 31433        | C0805C104K5RAC     | 21  | 20900500A          |
| C26-27         | CAP CER CHIP 1uF 20% 50V                  | 31433        | C1812C105M5UACTU   | 2   | 22452400A          |
| C28            | CAP CER CHIP 3.0pF +/-0.5pF 500V 0805     | 31433        | C0805C309C5GACTU   | 1   | 20903000A          |
| C29            | CAP CER CHIP 51pF 5% 500V 0805            | 31433        | C0805C510J5GACTU   | 1   | 20903100A          |
| C30            | CAP TANT CHIP 68uF 20% 25V EIA 7343-43    | 31433        | B45025E6869M137    | 1   | 24001100A          |
| C31-32         | CAP CER CHIP 0.1uF 10% 50V 0805           | 31433        | C0805C104K5RAC     | 2   | 20900500A          |
| C33            | CAP CER CHIP 3.0pF +/-0.5pF 500V 0805     | 31433        | C0805C309C5GACTU   | 1   | 20903000A          |
| C34            | CAP CER CHIP 51pF 5% 50V 0805             | 31433        | C0805C510J5GACTU   | 1   | 20903100A          |
| C35            | CAP CER CHIP 1000pF 1% 100V 0805          | 31433        | C0805C102F5GACTU   | 1   | 20903200A          |
| C36            | CAP CER CHIP 500pF 1% 500V 0805           | 65283        | 0805N501F500NM     | 1   | 20903300A          |
| C37            | CAP CER CHIP 56pF 1% 500V 0805            | 31433        | C0805C560F5GACTU   | 1   | 20903400A          |
| C38            | CAP CER CHIP 24pF 5% 500V 0805            | 44648        | CL21C240JBANNNC    | 1   | 20901600A          |
| C39            | CAP CER CHIP 500pF 1% 500V 0805           | 65283        | 0805N501F500NM     | 1   | 20903300A          |
| C40            | CAP CER CHIP 250pF 1% 100V 0805           | 51406        | GRM2165C1H241FA01D | 1   | 20903500A          |
| C41            | CAP CER CHIP 240pF 1% 100V 0805           | 04222        | 08051A241FAT2A     | 1   | 20903600A          |
| C42            | CAP CER CHIP 120pF 1% 100V 0805           | 31433        | C0805C121FGACTU    | 1   | 20903700A          |
| C43            | CAP CER CHIP 130pF 5% 500V 0805           | 31433        | C0805C131J5GACTU   | 1   | 20902800A          |
| C44            | CAP CER CHIP 51pF 5% 500V 0805            | 31433        | C0805C510J5GACTU   | 1   | 20903100A          |
| C45-46         | CAP CER CHIP 56pF 1% 500V 0805            | 31433        | C0805C560F5GACTU   | 2   | 20903400A          |
| C47            | CAP TANT CHIP 68uF 20% 25V EIA 7343-43    | 31433        | B45025E6869M137    | 1   | 24001100A          |
| C48            | CAP CER CHIP 3.0pF +/-0.5pF 500V 0805     | 31433        | C0805C309C5GACTU   | 1   | 20903000A          |
| C49            | CAP CER CHIP 51pF 5% 500V 0805            | 31433        | C0805C510J5GACTU   | 1   | 20903100A          |
| C50-51         | CAP PLASTIC FILM CHIP 0.22uF 2% 50V       | 54473        | ECHU1H224GX9       | 2   | 23800100A          |
| C52            | CAP ELEC 100uF 20% 25V SM SIZE F          | 54473        | EEE-1EA101P        | 1   | 28339300A          |
| C53            | CAP TANT CHIP 68uF 20% 25V EIA 7343-43    | 31433        | B45025E6869M137    | 1   | 24001100A          |
| C54            | CAP TANT CHIP 100uF 10% 20V SM 7343       | 31433        | T491D107K020AT     | 1   | 24001500A          |
| C56            | CAP TANT CHIP 4.7uF 10% 20V EIA 3528-21   | 31433        | T491B475K020AT     | 1   | 24000100A          |
| C57            | CAP PLASTIC FILM CHIP 1.0uF 10% 100V      | 54473        | ECWU1105KCV        | 1   | 23800200A          |
| C58            | CAP TANT CHIP 2.2uF 20% 35V               | 31433        | T491C225M035AT     | 1   | 28340800A          |
| C59            | CAP PLASTIC FILM CHIP 1.0uF 10% 100V      | 54473        | ECWU1105KCV        | 1   | 23800200A          |
| C60            | CAP CER CHIP 0.1uF 10% 50V 0805           | 31433        | C0805C104K5RAC     | 1   | 20900500A          |
| CR1            | DIODE MMBD914 SOT-23                      | 1MQ07        | MMBD914LT1G        | 1   | 53100000A          |
| CR2-5          | DIODE SCHOTTKY BARRIER IN6263W SOD-123    | 12060        | 1N6263W-7-F        | 4   | 53101900A          |
| CR6-7          | DIODE ZENER 4.7V 5% 0.5W MMSZ5230B SOT-12 | 07263        | MMSZ5230B          | 2   | 53102700A          |
| CR8-9          | DIODE SCHOTTKY BARRIER IN6263W SOD-123    | 12060        | 1N6263W-7-F        | 2   | 53101900A          |
| CR10           | DIODE SCHOTTKY BARRIER HSMS-2822 SOT-23   | 50434        | HSMS-2822-BLKG     | 1   | 53101500A          |
| CR12           | DIODE SIGNAL MMBD1503A SOT-23             | 07263        | MMBD1503A          | 1   | 53102400A          |
| CR14-15        | DIODE MMBD914 SOT-23                      | 1MQ07        | MMBD914LT1G        | 2   | 53100000A          |
| CR16-17, CR19  | DIODE SIGNAL MMBD1503A SOT-23             | 07263        | MMBD1503A          | 3   | 53102400A          |
| K1             | RELAY FORM C 12V SM                       | 61529        | TQ2SA-12V          | 1   | 47107200A          |
| L1-2           | INDUCTOR 5.6uH 341MA 1210                 | 99800        | RCI-0805-4993F     | 2   | 40049300A          |
| Q1             | TRANSISTOR NPN 3904 SOT-23                | 1MQ07        | MMBT3904TT1G       | 1   | 52817800A          |
| R1-2           | RES CHIP 4.99K 1% 1/8W 0805               | 4S177        | RCI-0805-4991F     | 2   | 31836700A          |
| R3             | RES CHIP 2.00K 1% 1/8W 0805               | 4S177        | RCI-0805-2001F     | 1   | 31832900A          |
| R4             | RES CHIP 243 OHMS 1% 1/8W(0805            | 4S177        | RCI-0805-2430F     | 1   | 31823700A          |
| R5A            | RES CHIP 1.05K 0.1% 1/8W 0805             | 4S177        | TPI-0805-1051B     | 1   | 31830202A          |
| R5B            | RES CHIP 750 OHMS 0.1% 1/8W 0805          | 4S177        | TPI-0805-7500B     | 1   | 31828402A          |
| R6             | RES CHIP 200 OHMS 0.1% 1/8W 0805          | 4S177        | TPI-0805-2000B     | 1   | 31822902A          |
| R7             | RES CHIP 182 OHMS 1% 1/8W 0805            | 4S177        | RCI-0805-1820F     | 1   | 31822500A          |
| R8             | RES CHIP 1.000K 0.1% 1/8W 0805            | 4S177        | TPI-0805-1001B     | 1   | 31830002A          |
| R9A            | RES CHIP 7.87K 0.1% 1/8W 0805             | 4S177        | TPI-0805-7871B     | 1   | 31838602A          |
| R9B            | RES CHIP 1.13K 0.1% 1/8W 0805             | 4S177        | TPI-0805-1131B     | 1   | 31830502A          |
| R10A           | RES CHIP 1.05K 0.1% 1/8W 0805             | 4S177        | TPI-0805-1051B     | 1   | 31830202A          |
| R10B           | RES CHIP 750 OHMS 0.1% 1/8W 0805          | 4S177        | TPI-0805-7500B     | 1   | 31828402A          |

|          |                                            |       |                |   |           |
|----------|--------------------------------------------|-------|----------------|---|-----------|
| R11      | RES CHIP 200 OHMS 0.1% 1/8W 0805           | 4S177 | TPI-0805-2000B | 1 | 31822902A |
| R12      | RES CHIP 182 OHMS 1% 1/8W 0805             | 4S177 | RCI-0805-1820F | 1 | 31822500A |
| R13      | RES CHIP 1.000K 0.1% 1/8W 0805             | 4S177 | TPI-0805-1001B | 1 | 31830002A |
| R14A     | RES CHIP 7.87K 0.1% 1/8W 0805              | 4S177 | TPI-0805-7871B | 1 | 31838602A |
| R14B     | RES CHIP 1.13K 0.1% 1/8W 0805              | 4S177 | TPI-0805-1131B | 1 | 31830502A |
| R15      | RES CHIP 3.32K 1% 1/8W 0805                | 4S177 | RCI-0805-3321F | 1 | 31835000A |
| R16-17   | RES CHIP 2.43K 1% 1/8W 0805                | 4S177 | RCI-0805-2431F | 2 | 31833700A |
| R18      | RES CHIP 2.00K 0.1% 1/8W 0805              | 4S177 | TPI-0805-2001B | 1 | 31832902A |
| R19, R21 | RES CHIP 10.0K 1% 1/8W 0805                | 4S177 | RCI-0805-1002F | 2 | 31840000A |
| R20      | RES CHIP 13.3K 1% 1/8W 0805                | 4S177 | RCI-0805-1332F | 1 | 31841200A |
| R22      | RES CHIP 6.19K 1% 1/8W 0805                | 4S177 | RCI-0805-6191F | 1 | 31837600A |
| R23      | RES CHIP 21.5K 1% 1/8W 0805                | 4S177 | RCI-0805-2152F | 1 | 31843200A |
| R24      | RES CHIP 15.0K 1% 1/8W 0805                | 4S177 | RCI-0805-1502F | 1 | 31841700A |
| R25      | RES CHIP 2.61K 1% 1/8W 0805                | 4S177 | RCI-0805-2611F | 1 | 31834000A |
| R26      | RES CHIP 3.32K 1% 1/8W 0805                | 4S177 | RCI-0805-3321F | 1 | 31835000A |
| R27A     | RES CHIP 2.74K 0.1% 1/8W 0805              | 4S177 | TPI-0805-2741B | 1 | 31834202A |
| R27B     | RES CHIP 2.26K 0.1% 1/8W 0805              | 4S177 | TPI-0805-2261B | 1 | 31833402A |
| R28A-B   | RES CHIP 1.50K 0.1% 1/8W 0805              | 4S177 | TPI-0805-1501B | 2 | 31831702A |
| R29-30   | RES CHIP 1.000K 0.1% 1/8W 0805             | 4S177 | TPI-0805-1001B | 2 | 31830002A |
| R31      | RES CHIP 2.49K 1% 1/8W 0805                | 4S177 | RCI-0805-2491F | 1 | 31833800A |
| R32      | RES CHIP 909 OHMS 1% 1/8W 0805             | 4S177 | RCI-0805-9090F | 1 | 31829200A |
| R33      | RES CHIP 1.62K 1% 1/8W 0805                | 4S177 | RCI-0805-1621F | 1 | 31832000A |
| R34      | RES CHIP 4.99K 1% 1/8W 0805                | 4S177 | RCI-0805-4991F | 1 | 31836700A |
| R35      | RES CHIP 1.000K 0.1% 1/8W 0805             | 4S177 | TPI-0805-1001B | 1 | 31830002A |
| R36A     | RES CHIP 7.87K 0.1% 1/8W 0805              | 4S177 | TPI-0805-7871B | 1 | 31838602A |
| R36B     | RES CHIP 1.13K 0.1% 1/8W 0805              | 4S177 | TPI-0805-1131B | 1 | 31830502A |
| R37      | RES CHIP 4.99K 1% 1/8W 0805                | 4S177 | RCI-0805-4991F | 1 | 31836700A |
| R38-39   | RES CHIP 49.9K 1% 1/8W 0805                | 4S177 | RCI-0805-4992F | 2 | 31846700A |
| R40-41   | RES CHIP 1.00K 1% 1/8W 0805                | 4S177 | RCI-0805-1001F | 2 | 31830000A |
| R42      | RES CHIP 105K 1% 1/8W 0805                 | 4S177 | RCI-0805-1053F | 1 | 31850200A |
| R43-44   | RES CHIP 1.00K 1% 1/8W 0805                | 4S177 | RCI-0805-1001F | 2 | 31830000A |
| R45      | RES CHIP 374K 1% 1/8W 0805                 | 4S177 | RCI-0805-3743F | 1 | 31855500A |
| R46      | RES CHIP 17.8K 1% 1/8W 0805                | 4S177 | RCI-0805-1782F | 1 | 31842400A |
| R47      | RES CHIP 2.74K 1% 1/8W 0805                | 4S177 | RCI-0805-2741F | 1 | 31834200A |
| R48      | RES CHIP 4.99K 1% 1/8W 0805                | 4S177 | RCI-0805-4991F | 1 | 31836700A |
| R49      | RES CHIP 10.0K 1% 1/8W 0805                | 4S177 | RCI-0805-1002F | 1 | 31840000A |
| R50      | RES CHIP 1.13K 1% 1/8W 0805                | 4S177 | RCI-0805-1131F | 1 | 31830500A |
| R51      | RES CHIP 2.74K 1% 1/8W 0805                | 4S177 | RCI-0805-2741F | 1 | 31834200A |
| R52-53   | RES CHIP 10.0K 1% 1/8W 0805                | 4S177 | RCI-0805-1002F | 2 | 31840000A |
| R54      | RES CHIP 402K 1% 1/8W 0805                 | 4S177 | RCI-0805-4023F | 1 | 31855800A |
| R55      | RES CHIP 604 OHMS 1% 1/8W 0805             | 4S177 | RCI-0805-6040F | 1 | 31827500A |
| R56      | RES CHIP 11.0K 1% 1/8W 0805                | 4S177 | RCI-0805-1102F | 1 | 31840400A |
| R57      | RES CHIP 2.00K 1% 1/8W 0805                | 4S177 | RCI-0805-2001F | 1 | 31832900A |
| R58      | RES CHIP 150K 1% 1/8W 0805                 | 4S177 | RCI-0805-1503F | 1 | 31851700A |
| R59      | RES CHIP 75K 1% 1/8W 0805                  | 4S177 | RCI-0805-7502F | 1 | 31848400A |
| R60      | RES CHIP 499K 1% 1/8W 0805                 | 4S177 | RCI-0805-4993F | 1 | 31856700A |
| R61      | RES CHIP 10.0K 1% 1/8W 0805                | 4S177 | RCI-0805-1002F | 1 | 31840000A |
| R62      | RES CHIP 200K 1% 1/8W 0805                 | 4S177 | RCI-0805-2003F | 1 | 31852900A |
| R63      | RES CHIP 1.00K 1% 1/8W 0805                | 4S177 | RCI-0805-1001F | 1 | 31830000A |
| R64      | RES CHIP 2.00K 1% 1/8W 0805                | 4S177 | RCI-0805-2001F | 1 | 31832900A |
| R65A     | RES CHIP 2.74K 0.1% 1/8W 0805              | 4S177 | TPI-0805-2741B | 1 | 31834202A |
| R65B     | RES CHIP 2.26K 0.1% 1/8W 0805              | 4S177 | TPI-0805-2261B | 1 | 31833402A |
| R66-67   | RES CHIP 4.99K 1% 1/8W 0805                | 4S177 | RCI-0805-4991F | 2 | 31836700A |
| U1       | IC SN74LS273 OCTAL D FLIP-FLOP SOIC-20     | 01295 | SN74LS273DW    | 1 | 53705400A |
| U2       | IC 419 (SO-8)                              | 17856 | DG419DY-E3     | 1 | 53459500A |
| U3       | IC LT1222 LOW NOISE HI SPEED OP AMP SOIC-8 | 64155 | T1222CS8#PBF   | 1 | 53807900A |
| U4       | IC MC7805 POS VOLT REG 1A D2PAK-3          | 1MQ07 | MC7805ABD2TG   | 1 | 53806800A |
| U5       | IC MC79L00A 100mA NEG VOLT REG             | 1MQ07 | MC79L05ACDG    | 1 | 53807800A |
| U6       | IC 419 (SO-8)                              | 17856 | DG419DY-E3     | 1 | 53459500A |
| U7       | IC LT1222 LOW NOISE HI SPEED OP AMP SOIC-8 | 64155 | T1222CS8#PBF   | 1 | 53807900A |
| U8       | IC SN74LS139 DECODER/DEMULTI-PLEXER        | 01295 | SN74LS139AD    | 1 | 53806500A |
| U9       | IC DG201A SPST ANALOG SWITCH SOIC-16       | 01295 | DG201ACSE      | 1 | 53806600A |

|        |                                            |       |               |   |           |
|--------|--------------------------------------------|-------|---------------|---|-----------|
| U10    | IC OPA2107 PRECISION DUAL OP AMP SO-8      | 01295 | OPA2107AU     | 1 | 53807700A |
| U11    | IC DG201A SPST ANALOG SWITCH SOIC-16       | 01295 | DG201ACSE     | 1 | 53806600A |
| U12    | IC LT1222 LOW NOISE HI SPEED OP AMP SOIC-8 | 64155 | LT1222CS8#PBF | 1 | 53807900A |
| U13    | IC LM393M DUAL DIFF COMPARATOR 8-SOIC      | 07263 | LM393M        | 1 | 53806900A |
| U14    | IC SN74LS00 2 INPUT POSITIVE NAND GATE     | 01295 | SN74LS00D     | 1 | 53705500A |
| U15    | IC OPA2107 PRECISION DUAL OP AMP SO-8      | 01295 | OPA2107AU     | 1 | 53807700A |
| U16    | IC TL072A LOW NOISE OP AMP SOIC-8          | 01295 | TL072ACD      | 1 | 53805000A |
| U17    | IC NE5534 LOW-NOISE OP AMP SOIC-8          | 01295 | NE5534D       | 1 | 53806400A |
| U18    | IC AD637 WIDEBAND RMS TO DC CONVERTER      | 51640 | AD637JRZ      | 1 | 53806700A |
| U19-20 | IC TL072A LOW NOISE OP AMP SOIC-8          | 01295 | TL072ACD      | 2 | 53805000A |
| U21    | IC SW06 QUAD SPST-JFET ANALOG SWITCH       | 51640 | SW06GSZ       | 1 | 53807600A |

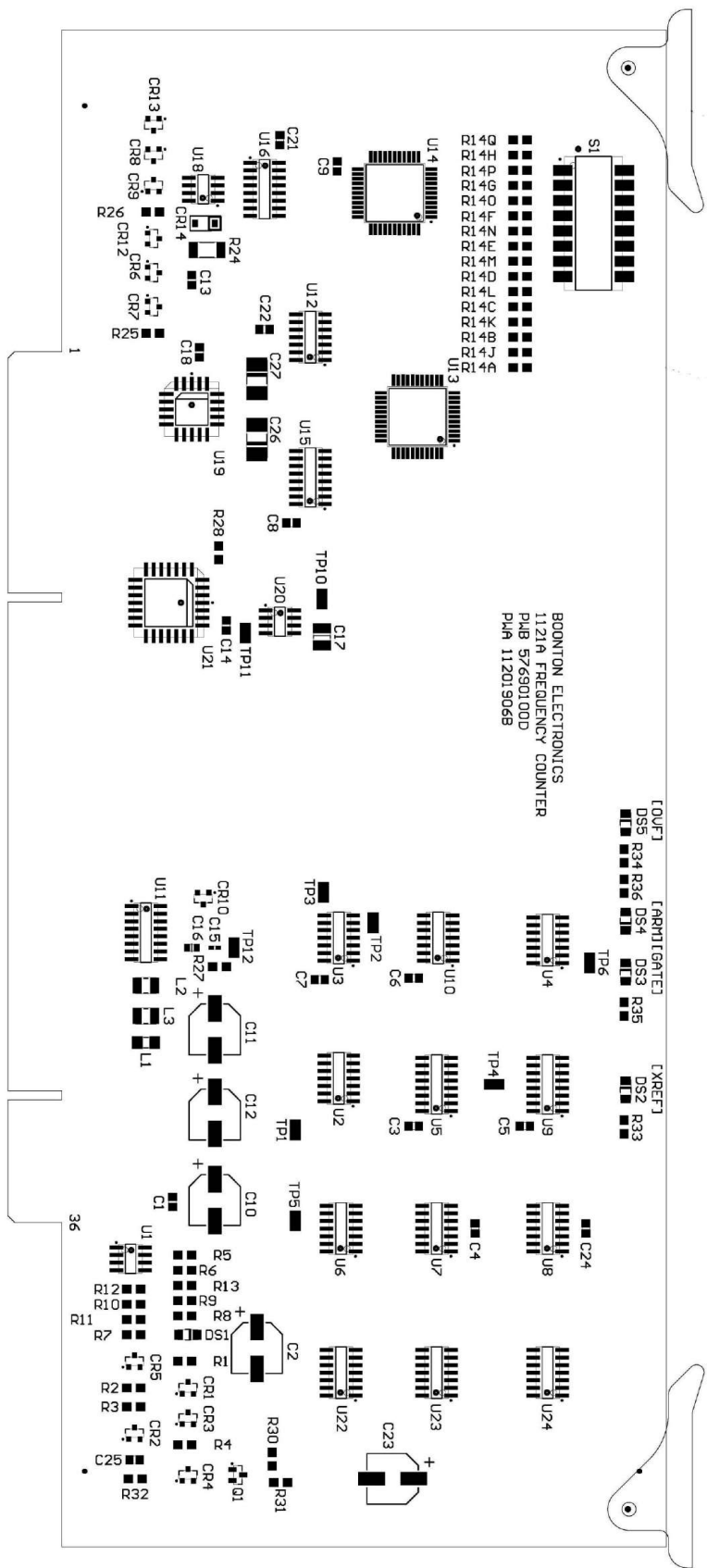
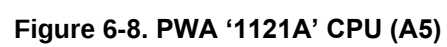


Figure 6-7. PWA '1121A' Freq Counter

**11201906A PWA FREQUENCY COUNTER 1121A (A4) (Figure 6-7)**  
**MODEL: 1121A**

| REF.<br>DESIG. | DESCRIPTION                               | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|----------------|-------------------------------------------|--------------|--------------------|-----|--------------------|
| C1             | CAP CER CHIP 0.1uF 10% 50V 0805           | 31433        | C0805C104K5RAC     | 1   | 20900500A          |
| C2             | CAP ELEC 100uF 20% 25V SM SIZE F          | 54473        | ECEV1EA101P        | 1   | 28339300A          |
| C3-9           | CAP CER CHIP 0.1uF 10% 50V 0805           | 31433        | C0805C104K5RAC     | 7   | 20900500A          |
| C10-12         | CAP ELEC 100uF 20% 25V SM SIZE F          | 54473        | ECEV1EA101P        | 3   | 28339300A          |
| C13            | CAP CER CHIP 0.1uF 10% 50V 0805           | 31433        | C0805C104K5RAC     | 1   | 20900500A          |
| C14            | CAP CER CHIP 2200pF 5% 25V 080            | 31433        | C0603C103K5RAC     | 1   | 22456000A          |
| C15            | CAP CER CHIP 3900pF 10% 50V 0402          | 31433        | CO0402C392KTRACTU  | 1   | 20603100A          |
| C16            | CAP CER CHIP 560pF 5% 50V                 | 31433        | C0603C561J5GACTU   | 1   | 22451700A          |
| C17            | CAP TANT CHIP 4.7uF 10% 20V3528-21        | 31433        | T491B475K020AT     | 1   | 24000100A          |
| C18, C21-22    | CAP CER CHIP 0.1uF 10% 50V 0805           | 31433        | C0805C104K5RAC     | 3   | 20900500A          |
| C23            | CAP ELEC 100uF 20% 25V SM SIZE F          | 54473        | ECEV1EA101P        | 1   | 28339300A          |
| C24            | CAP CER CHIP 0.1uF 10% 50V 0805           | 31433        | C0805C104K5RAC     | 1   | 20900500A          |
| C25            | CAP CER CHIP 250pF 2% 50V 0805            | 04222        | 08055A251GAT2A     | 1   | 20901300A          |
| C26-27         | CAP TANT CHIP 2.2uF 20% 35V               | 31433        | T491C225M035AT     | 2   | 28340800A          |
| CR1-9          | DIODE MMBD914 SOT-23                      | 1MQ07        | MMBD914LT1G        | 9   | 53100000A          |
| CR10-11        | DIODE SIGNAL MMBD1503A SOT-23             | 07263        | MMBD1503A          | 2   | 53102400A          |
| CR12-13        | DIODE MMBD914 SOT-23                      | 1MQ07        | MMBD914LT1G        | 2   | 53100000A          |
| CR14           | DIODE ZENER 5.1V MMSZ5231B SOD-123        | 07263        | MMSZ5231B          | 1   | 53102500A          |
| DS1-5          | LED CHIP RED SM                           | 28480        | HSMS-C150          | 5   | 53901000A          |
| L1             | INDUCTOR CHIP MID CURRENT 500 OHMS 1206   | 30817        | MI1206L501R-10     | 1   | 42003200A          |
| L2-3           | INDUCTOR CHIP 5.6uH 5% 341mA 1210         | 99880        | 1210R-562J         | 2   | 42002700A          |
| Q1             | TRANSISTOR 3906 (SOT-23)                  | 1MQ07        | MMBT3904TT1G       | 1   | 52817900A          |
| R1             | RES CHIP 215 OHMS 1% 1/8W 0805            | 4S177        | RCI-0805-2150F     | 1   | 31823200A          |
| R2             | RES CHIP 332 OHMS 1% 1/8W 0805            | 4S177        | RCI-0805-3320-F    | 1   | 31825000A          |
| R3             | RES CHIP 499 OHMS 1% 1/8W 0805            | 4S177        | RCI-0805-4990F     | 1   | 31826700A          |
| R4             | RES CHIP 10.0K 1% 1/8W 0805               | 4S177        | RCI-0805-1002F     | 1   | 31840000A          |
| R5             | RES CHIP 3.01K 1% 1/8W(0805               | 4S177        | RCI-0805-3011F     | 1   | 31834600A          |
| R6-7           | RES CHIP 10.0K 1% 1/8W 0805               | 4S177        | RCI-0805-1002F     | 2   | 31840000A          |
| R8-10          | RES CHIP 1.00K 1% 1/8W 0805               | 4S177        | RCI-0805-1001F     | 3   | 31830000A          |
| R11-12         | RES CHIP 10.0K 1% 1/8W 0805               | 4S177        | RCI-0805-1002F     | 2   | 31840000A          |
| R13, R14A-H    | RES CHIP 3.01K 1% 1/8W(0805               | 4S177        | RCI-0805-3011F     | 9   | 31834600A          |
| R14J-R         | RES CHIP 6.19K 1% 1/8W 0805               | 4S177        | RCI-0805-6191F     | 9   | 31837600A          |
| R24            | RES CHIP 475 OHMS 5% 1/2W 2010            | 4S177        | RCI-2010-4700J     | 1   | 32026500A          |
| R25-26         | RES CHIP 1.00K 1% 1/8W 0805               | 4S177        | RCI-0805-1001F     | 2   | 31830000A          |
| R27            | RES CHIP 56.2K 1% 1/8W 0805               | 4S177        | RCI-0805-5622F     | 1   | 31847200A          |
| R28            | RES CHIP 4.99K 0.1% 1/8W 0805             | 4S177        | PI-0805-4991B      | 1   | 31836710A          |
| R30            | RES CHIP 2.00K 1% 1/8W 0805               | 4S177        | RCI-0805-2001F     | 1   | 31832900A          |
| R31            | RES CHIP 3.01K 1% 1/8W 0805               | 4S177        | RCI-0805-3011F     | 1   | 31834600A          |
| R32            | RES CHIP 100 OHMS 1% 1/8W 0805            | 4S177        | RCI-0805-1000F     | 1   | 31820000A          |
| R33-36         | RES CHIP 1.00K 1% 1/8W 0805               | 4S177        | RCI-0805-1001F     | 4   | 31830000A          |
| S1             | SWITCH DIP 8 POS SURF MT                  | 80207        | SDA08H0SB          | 1   | 46532400A          |
| U1             | IC LM393M DUAL DIFF COMPARATOR 8-SOIC     | 07263        | LM393DG            | 1   | 53806900A          |
| U2             | IC SN74LS04 HEX INVERTER SOIC-D-14        | 01295        | SN74LS04D          | 1   | 53807000A          |
| U3-4           | IC SN74LS00 2 INPUT POS NAND GATE SOIC-14 | 01295        | SN74LS00D          | 2   | 53705500A          |
| U5             | IC SN74F151B 8 INPUT MULTI-PLEXER SOIC-16 | 01295        | SN74F151BD         | 1   | 53807100A          |
| U6-8           | IC SN74LS90 DECADE COUNTER SOIC-14        | 01295        | SN74LS90D          | 3   | 53705600A          |
| U9             | IC SN74F151B 8 INPUT MULTI-PLEXER SOIC-16 | 01295        | SN74F151BD         | 1   | 53807100A          |
| U10            | IC SN74F74 DUAL D-TYPE FLIP-FLOP SOIC-14  | 01295        | SN74F74D           | 1   | 53705700A          |
| U11            | IC SN74LS138 DECODER/MULTI-PLEXER SOIC-16 | 01295        | SN74LS138D         | 1   | 53807200A          |
| U12            | IC SN74F74 DUAL D-TYPE FLIP-FLOP SOIC-14  | 01295        | SN74F74D           | 1   | 53705700A          |
| U13-14         | IC 82C55A CMOS PROG INTER (44 Ld MQFP)    | 33293        | CQ82C55AZ          | 2   | 53705900A          |
| U15-16         | IC CD4040B BINARY COUNTER/DIVIDER SOIC-16 | 01295        | CD4040BM           | 2   | 53705800A          |
| U18            | IC NE5532A DUAL LOW-NOISE OP AMP 8-SOP    | 01295        | NE5532AD           | 1   | 53807500A          |
| U19            | IC AD7549 DUAL 12-BIT DAC PLCC-20         | 51640        | AD7549JP           | 1   | 53706000A          |
| U20            | IC REF02 5V VOLTAGE REFERENCE 8 SOIC_N    | 51640        | REF02CSZ           | 1   | 53807300A          |
| U21            | IC AD7582 12-BIT CMOS A/D CONVERTER PLCC  | 51640        | AD7582KPZ          | 1   | 53807400A          |
| U22-24         | IC SN74LS90 DECADE COUNTER SOIC-14        | 01295        | SN74LS90D          | 3   | 53705600A          |



**11202706A PWA CPU 1121A (A5) (Figure 6-8)**  
**MODEL: 1121A**

| REF.<br>DESIG. | DESCRIPTION                                  | CAGE<br>CODE | MFG PART<br>NUMBER   | QTY | BEC PART<br>NUMBER |
|----------------|----------------------------------------------|--------------|----------------------|-----|--------------------|
| B1             | BATTERY LITHIUM POLY C COIN CELL 3V          | 61058        | BR2325               | 1   | 55601900A          |
| C1-2, C4-6     | CAP CER CHIP 0.1uF 10% 50V 0805              | 31433        | C0805C104K5RAC       | 5   | 20900500A          |
| C7             | CAP TANT CHIP 15uF 20% 25V SM 7341-31        | 31433        | T491D156M025AT       | 1   | 24001600A          |
| C8-9           | CAP CER CHIP 0.1uF 10% 50V 0805              | 31433        | C0805C104K5RAC       | 2   | 20900500A          |
| C10            | CAP TANT CHIP 15uF 20% 25V SM 7341-31        | 31433        | T491D156M025AT       | 1   | 24001600A          |
| C11-15         | CAP CER CHIP 0.1uF 10% 50V 0805              | 31433        | C0805C104K5RAC       | 5   | 20900500A          |
| C16            | CAP ELEC 100uF 20% 25V SM SIZE F             | 54473        | EEE-1EA101P          | 1   | 28339300A          |
| CR1-3          | DIODE MMBD914 SOT-23                         | 1MQ07        | MMBD914LT1G          | 3   | 53100000A          |
| J20            | CONN M 24 CKT DBL ROW HDR .1SP 16 24T        | 55332        | TSW-112-07-S-D       | 1   | 47742224A          |
| J21            | CONN M 26 CKT HDR 2x13 100SP                 | 55332        | TSW-113-07-S-D       | 1   | 47742226A          |
| L1             | INDUCTOR CHIP MID CURRENT 500 OHMS 1206      | 30817        | MI1206L501R-10       | 1   | 42003200A          |
| P1             | CONN M 10 PIN DOUBLE ROW HEADER .10 SP       | 55332        | TSM-105-02-L-DV      | 1   | 47750010A          |
| Q1             | TRANSISTOR NPN 3904 SOT-23                   | 1MQ07        | MMBT3904TT1G         | 1   | 52817800A          |
| R1             | RES CHIP 100K 1% 1/8W 0805                   | 4S177        | RCI-0805-1003F       | 1   | 31850000A          |
| R3             | RES CHIP 10.0K 1% 1/8W 0805                  | 4S177        | RCI-0805-1002F       | 1   | 31840000A          |
| R4             | RES CHIP 100K 1% 1/8W 0805                   | 4S177        | RCI-0805-1003F       | 1   | 31850000A          |
| R5             | RES CHIP 22.1K 1% 1/8W 0805                  | 4S177        | RCI-0805-2212F       | 1   | 31843300A          |
| R6             | RES CHIP 100K 1% 1/8W 0805                   | 4S177        | RCI-0805-1003F       | 1   | 31850000A          |
| R7A-D          | RES CHIP 3.32K 1% 1/8W 0805                  | 4S177        | RCI-0805-3321F       | 4   | 31835000A          |
| R7E-H          | RES CHIP 6.34K 1% 1/8W 0805                  | 4S177        | RCI-0805-6341F       | 4   | 31837700A          |
| R8A-H          | RES CHIP 3.32K 1% 1/8W 0805                  | 4S177        | RCI-0805-3321F       | 8   | 31835000A          |
| R8I-P          | RES CHIP 6.34K 1% 1/8W 0805                  | 4S177        | RCI-0805-6341F       | 8   | 31837700A          |
| R9A-H          | RES CHIP 3.32K 1% 1/8W 0805                  | 4S177        | RCI-0805-3321F       | 8   | 31835000A          |
| R9I-P          | RES CHIP 6.34K 1% 1/8W 0805                  | 4S177        | RCI-0805-6341F       | 8   | 31837700A          |
| U1             | IC SN74LS04 HEX INVERTER SOIC-D-14           | 01295        | SN74LS04D            | 1   | 53807000A          |
| U2             | IC SN74LS32D QUAD 2-INPUT FLOP SOIC-14       | 01295        | SN74LS32D            | 1   | 53706300A          |
| U3-4           | IC SN74LS245 OCTAL BUS TRANS SSOP-20         | 01295        | SN74LS245DBR         | 2   | 53707100A          |
| U5             | IC CD4066BM CMOS QUAD SWITCH SOIC-14         | 01295        | CD4066BM             | 1   | 53704300A          |
| U6             | IC CD4023BM CMOS NAND GATE SOIC-14           | 01295        | CD4023BN             | 1   | 53706400A          |
| U7             | IC Z84C00 Z80 MICRO 6 MHz CMOS (44 PIN LQFP) | 56708        | Z84C0006AEG          | 1   | 53706500A          |
| U8             | IC SN74LS541 OCTAL BUFFER SOIC-20            | 01295        | SN74LS541DW          | 1   | 53703900A          |
| U9             | IC AFT1502AS EEPROM CPLD (TQFP-44 PIN )      | 1FN41        | ATF1502AS-10 AU44    | 1   | 53707000A          |
| U10            | IC SN74LS541 OCTAL BUFFER SOIC-20            | 01295        | SN74LS541DW          | 1   | 53703900A          |
| U11            | IC CY62256N CMOS STATIC RAM 256K (32K X 8)   | 65786        | CY62256NLL-70NXC     | 1   | 53706600A          |
| U12            | IC SN74LS32D QUAD 2-INPUT FLOP SOIC-14       | 01295        | SN74LS32D            | 1   | 53706300A          |
| U13            | IC SN74F74 DUAL D-TYPE FLIP-FLOP SOIC-14     | 01295        | SN74F74D             | 1   | 53705700A          |
| U14            | IC FLASH 4M 512KX8 70NS 32PLCC               | 65VR8        | MX29F040CQC-70G      | 1   | 53480300A          |
| U15            | IC SN74LS138 DECODER/MPX SOIC-16             | 01295        | SN74LS138D           | 1   | 53704000A          |
| U16            | IC NAT9914 IEEE 488.2 CONTROLLER 44 PIN      | 64667        | NAT9914BPQ           | 1   | 53706700A          |
| U17            | IC SN75160B IEEE BUS TRANSCEIVER SOIC-20     | 01295        | SN75160BDW           | 1   | 53706800A          |
| U18            | IC SN75161B IEEE BUS TRANSCEIVER SOIC-20     | 01295        | SN75161BDW           | 1   | 53706900A          |
| XB1            | BATTERY HOLDER COIN CELL 23mm SM             | 91833        | 1071                 | 1   | 55660000A          |
| XU14           | PLCC32 SOCKET SM                             | 3N087        | 540-44-032-17-400000 | 1   | 47309800A          |
| Y1             | CRYSTAL OSCILLATOR 10 MHz                    | 13454        | CXOH20-BP-10.000     | 1   | 54801600A          |

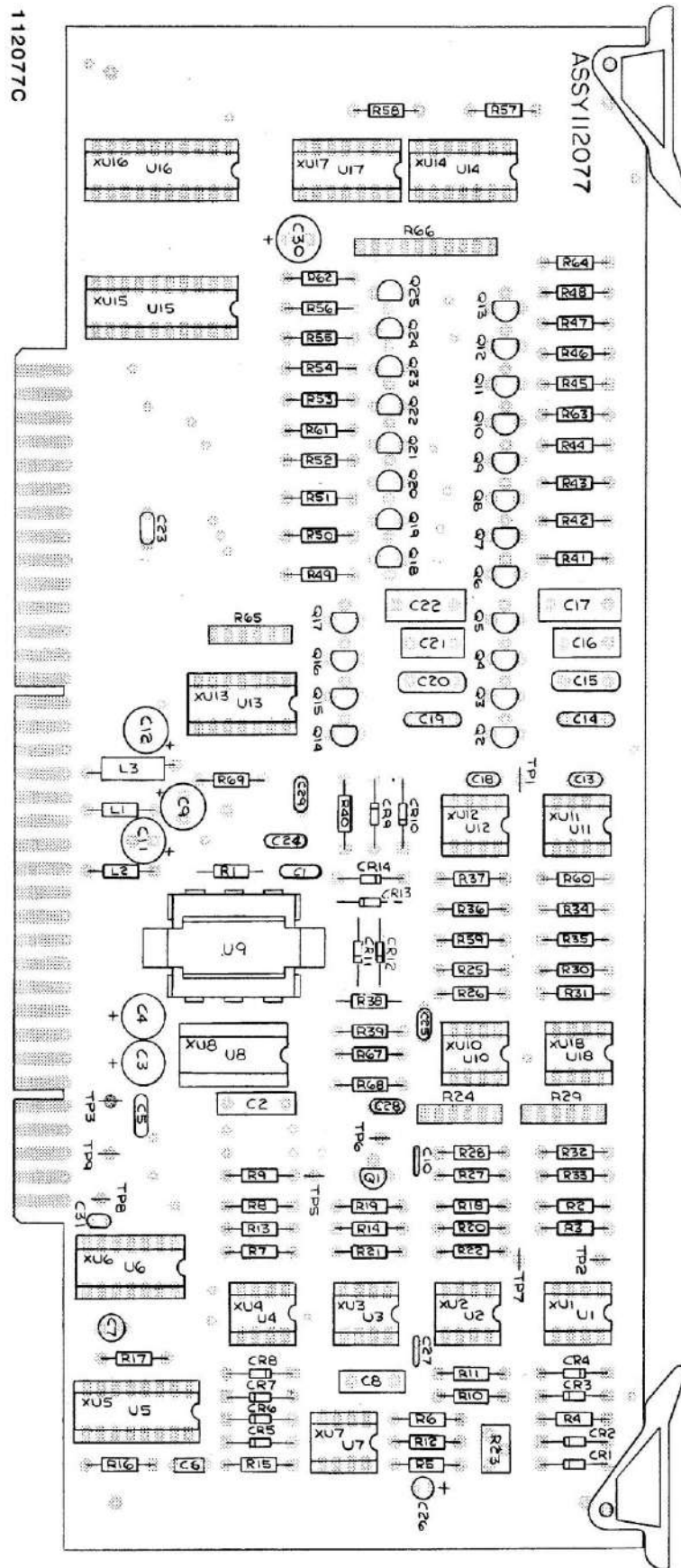


Figure 6-9. PWA '1121A' Source (A6)

**11202703A REV C PWA '1121' SOURCE (A6) (Figure 6-9)**  
**MODEL: 1121**

| REF.<br>DESIG. | DESCRIPTION                 | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|----------------|-----------------------------|--------------|--------------------|-----|--------------------|
| C1             | CAP CER 1.0uF 20% 50V       | 04222        | SR305E105MAA       | 1   | 224264000          |
| C2             | CAP MPC 0.22uF 2% 50V       | 14752        | 652A-1-A224G       | 1   | 234167000          |
| C3-4,9         | CAP EL 100uF 20% 25V        | S4217        | SM-25-VB-101M      | 3   | 283334000          |
| C5,23-25       | CAP CER 0.1uF 20% 50V       | 04222        | SR215E104MAA       | 4   | 224268000          |
| C6             | CAP CER 0.022uF 10% 50V     | 61637        | C052K223K5X5CA     | 1   | 224302000          |
| C7,26          | CAP TANT 4.7uF 10% 10V      | 56289        | 196D475X9010HA1    | 2   | 283226000          |
| C8             | CAP MPC 0.15uF 2% 50V       | 14752        | 652A-1-A-154G      | 1   | 234145000          |
| C10,27         | CAP CAR 0.001uF 10% 100V    | 04222        | SR151C102KAA       | 2   | 224270000          |
| C11-12,30      | CAP EL 100uF 20% 25V        | S4217        | SM-25-VB-101M      | 3   | 283334000          |
| C13,18         | CAP MICA 390pF 5% 500V      | 57582        | KD15391J501        | 2   | 200108000          |
| C14,19         | CAP MICA 680pF 1% 300V      | 14655        | CD15FC681F03       | 2   | 200015000          |
| C15,20         | CAP MICA 8200pF 1% 100V     | 14655        | CD19FA822F         | 2   | 200532000          |
| C16,21         | CAP MPC 0.047uF 2% 50V      | 14752        | 652A-1-A473G       | 2   | 234144000          |
| C17,22         | CAP MPC 0.47uF 1% 50V       | 27735        | MPC-53-0.47-50-1   | 2   | 23417500A          |
| C28-29         | CAP CER 0.1uF 20% 50V       | 04222        | SR215E104MAA       | 2   | 224268000          |
| C31            | CAP MICA 100pF 5% 300V      | 20307        | DM5-FC101J         | 1   | 205006000          |
| CR1,3-4        | DIODE SIG 1N914             | 01295        | 1N914              | 3   | 530058000          |
| CR2            | DIODE ZENER 1N5230B 4.7V 5% | 04713        | 1N5230B            | 1   | 530103000          |
| CR5            | DIODE ZENER 1N5242B 12V 5%  | 04713        | 1N5242B            | 1   | 530146000          |
| CR6-10         | DIODE SIG 1N914             | 01295        | 1N914              | 5   | 530058000          |
| CR11-12        | DIODE ZENER 1N5231B 5.1V 5% | 04713        | 1N5231B            | 2   | 530169000          |
| CR13-14        | DIODE SIG 1N914             | 01295        | 1N914              | 2   | 530058000          |
| L1-2           | INDUCTOR 5.6uH 10%          | 24226        | 10/561             | 2   | 400408000          |
| L3             | INDUCTOR VK200/20-4B        | 02114        | VK-200-20/4B       | 1   | 400409000          |
| Q1             | TRANS FET PN 4391           | 27014        | PN4391             | 1   | 52815900A          |
| Q2-25          | TRANS FET J108              | 17856        | J-108              | 24  | 52815600A          |
| R1             | RES MF 1.00M 1% 1/4W        | 19701        | 5043ED1M000F       | 1   | 341600000          |
| R2,6,9-11      | RES MF 4.99K 1% 1/4W        | 19701        | 5043ED4K990F       | 5   | 341367000          |
| R3,5           | RES MF 20.0K 1% 1/4W        | 19701        | 5043ED20K00F       | 2   | 341429000          |
| R4             | RES MF 2.21K 1% 1/4W        | 19701        | 5043ED2K210F       | 1   | 341333000          |
| R7,57          | RES MF 1.82K 1% 1/4W        | 19701        | 5043ED1K820F       | 2   | 341325000          |
| R8,58          | RES MF 3.32K 1% 1/4W        | 19701        | 5043ED3K320F       | 2   | 341350000          |
| R12            | RES MF 7.50K 1% 1/4W        | 19701        | 5043ED7K500F       | 1   | 341384000          |
| R13            | RES MF 1.00K 1% 1/4W        | 19701        | 5043ED1K000F       | 1   | 341300000          |
| R14,21         | RES MF 4.99K 1% 1/4W        | 19701        | 5043ED4K990F       | 2   | 341367000          |
| R15,40         | RES MF 6.19K 1% 1/4W        | 19701        | 5043ED6K190F       | 2   | 341376000          |
| R16            | RES MF 3.92K 1% 1/4W        | 19701        | 5043ED3K920F       | 1   | 341357000          |
| R17,34         | RES MF 100K 1% 1/4W         | 19701        | 5043ED100K0F       | 2   | 341500000          |
| R18,20         | RES MF 2.00K 1% 1/4W        | 19701        | 5043ED2K000F       | 2   | 341329000          |
| R19            | RES MF 39.2K 1% 1/4W        | 19701        | 5043ED39K20F       | 1   | 341457000          |
| R22,37-39      | RES MF 10.0K 1% 1/4W        | 19701        | 5043ED10K00F       | 4   | 341400000          |
| R23            | RES VAR 1K 10% 0.5W         | 73138        | 82PAR1K            | 1   | 311370000          |
| R24,29         | RES NETWORK 100K 2% 1.5W    | 71450        | 750-61-R100K       | 2   | 345032000          |
| R25-26         | RES MF 49.9K 1% 1/4W        | 19701        | 5043ED49K90F       | 2   | 341467000          |
| R27-28         | RES MF 80.6K 1% 1/4W        | 19701        | 5043ED80K60F       | 2   | 341487000          |

|            |                                 |       |                 |   |           |
|------------|---------------------------------|-------|-----------------|---|-----------|
| R30-31,35  | RES MF 49.9K 1% 1/4W            | 19701 | 5043ED49K90F    | 3 | 341467000 |
| R32-33     | RES MF 68.1K 1% 1/4W            | 19701 | 5043ED68K10F    | 2 | 341480000 |
| R36        | RES MF 4.02K 1% 1/4W            | 19701 | 5043ED4K020F    | 1 | 341358000 |
| R41,45,49  | RES MF 5.000K 0.1% 1/8W         | 64537 | PME55-T9-5K     | 3 | 324326000 |
| R42,46,50  | RES MF 10.00K 0.1% 1/8W         | 91637 | CMF55-1002-B-T9 | 3 | 32593100A |
| R43,47,51  | RES MF 20.00K 0.1% 1/8W         | 03888 | PME55-T9-20K    | 3 | 32591800A |
| R44,48,52  | RES MF 40.00K 0.1% 1/8W         | 64537 | PME55-T9-40K    | 3 | 32591900A |
| R53        | RES MF 5.000K 0.1% 1/8W         | 64537 | PME55-T9-5K     | 1 | 324326000 |
| R54        | RES MF 10.00K 0.1% 1/8W         | 91637 | CMF55-1002-B-5O | 1 | 32593100A |
| R55        | RES MF 20.00K 0.1% 1/8W         | 03888 | PME55-T9-20K    | 1 | 32591800A |
| R56        | RES MF 40.00K 0.1% 1/8W         | 64537 | PME55-T9-40K    | 1 | 32591900A |
| R59        | RES MF 619K 1% 1/4W             | 19701 | 5043ED619K0F    | 1 | 341576000 |
| R60        | RES MF 10.0K 1% 1/4W            | 19701 | 5043ED10K00F    | 1 | 341400000 |
| R61,63     | RES MF 1.50K 1% 1/4W            | 19701 | 5043ED1K500F    | 2 | 341317000 |
| R62,64     | RES MF 102 OHM 1% 1/4W          | 19701 | 5043ED102R0F    | 2 | 341201000 |
| R65        | RES NETWORK 3.3K 2% 0.9W 6pin   | 71450 | 750-61-R3.3K    | 1 | 34504500A |
| R66        | RES NETWORK 3.3K 2% 1.5W 10 pin | 71450 | 750-101-R3.3K   | 1 | 345030000 |
| R67-68     | RES MF 100 OHM 1% 1/4W          | 19701 | 5043ED100R0F    | 2 | 341200000 |
| R69        | RES MF 10.0 OHM 1% 1/4W         | 19701 | 5043ED10R00F    | 1 | 341100000 |
| U1-4       | IC HA7-2625-5 OP AMP            | 34371 | HA7-2625-5      | 2 | 53511901A |
| U2         | IC TL072CP DUAL OP AMP          | 01295 | TL072CP         | 1 | 535092000 |
| U3         | IC OP-07EP OP AMP               | 06665 | OP-07EP         | 1 | 535110000 |
| U5         | IC 74123 MONO MULTI             | 01295 | SN74123N        | 1 | 534071000 |
| U6         | IC 7402 QUAD 2 INPUT NOR        | 01295 | SN7402N         | 1 | 534027000 |
| U7         | IC REF-02-CZ 5 VOLT REFERENCE   | 06665 | REF-02-CZ       | 1 | 53512900A |
| U8         | IC SMP-11GY SAMPLE & HOLD AMPL  | 06665 | SMP11GY         | 1 | 53444601A |
| U9         | IC HA1-5320-5 SAMPLE & HOLD     | 34371 | HA1-5320-5      | 1 | 53153000A |
| U10,18     | IC 4200AD ANALOG MULTIPLIER     | 49956 | RC4200AD        | 2 | 53508301A |
| U11-12     | IC 5532AFE DUAL OP AMP 8 DIP    | 18324 | NE5532AFE       | 2 | 53512101A |
| U13-14,17  | IC 339 QUAD COMPARATOR          | 27014 | LM339N          | 3 | 535018000 |
| U15-16     | IC 74LS273 OCTAL D FLIPFLOP     | 01295 | SN74LS273N      | 2 | 534263000 |
| XU1-4,7    | SOCKET IC 8 PIN                 | 06776 | ICN-083-S3-G    | 5 | 473041000 |
| XU5        | SOCKET IC 16 PIN                | 06776 | ICN-163-S3-G    | 1 | 473042000 |
| XU6,8      | SOCKET IC 14 PIN                | 06776 | ICN-143-S3-G    | 2 | 473019000 |
| XU10-12,18 | SOCKET IC 8 PIN                 | 06776 | ICN-083-S3-G    | 4 | 473041000 |
| XU13-14,17 | SOCKET IC 14 PIN                | 06776 | ICN-143-S3-G    | 3 | 473019000 |
| XU15-16    | SOCKET IC 20 PIN                | 06776 | ICN-203-S3-G    | 2 | 473065000 |

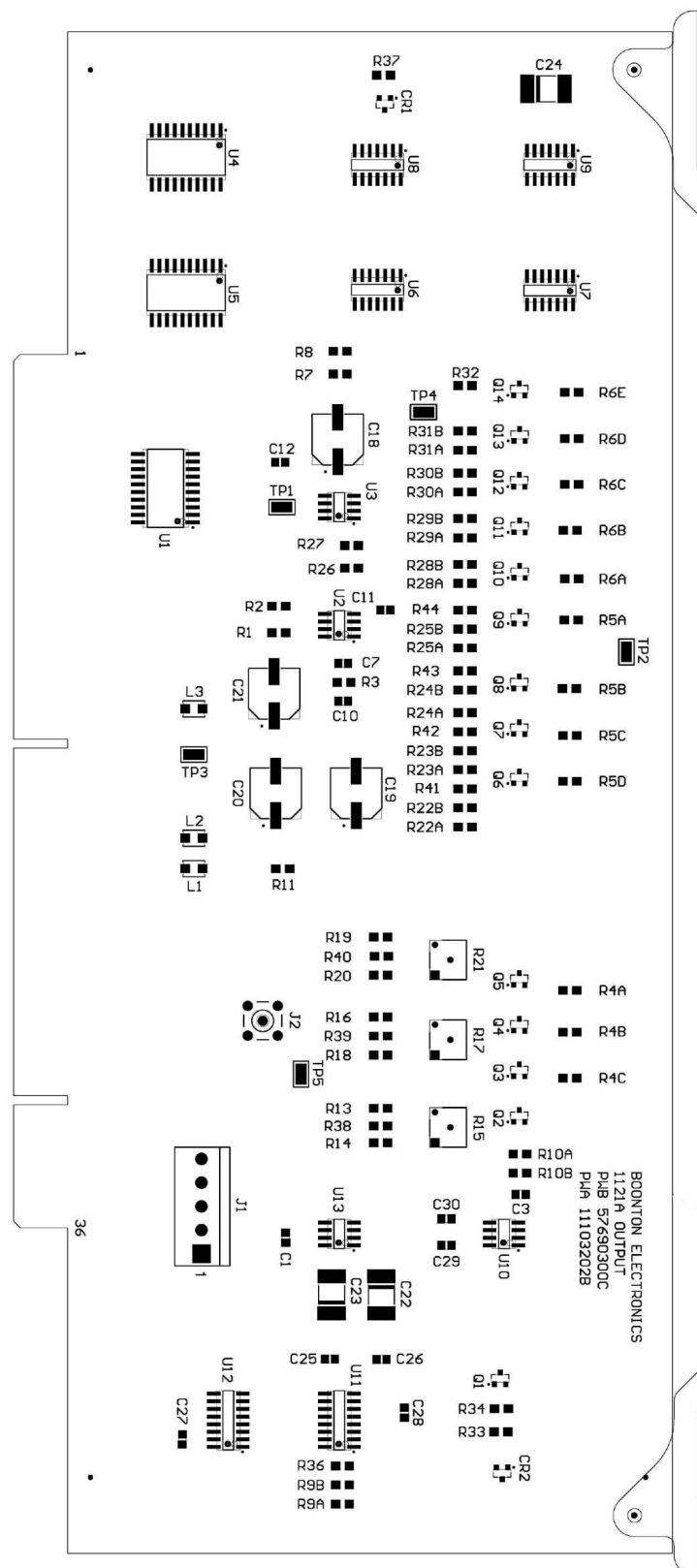


Figure 6-10. PWA '1121A' Output (A7)

**11103202A PWA OUTPUT 1121A (A7) (Figure 6-10)**  
**MODEL: 1121A**

| REF.<br>DESIG. | DESCRIPTION                           | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|----------------|---------------------------------------|--------------|--------------------|-----|--------------------|
| C1             | CAP CER CHIP 5.0pF +/-0.5pF 500V 0805 | 31433        | C0805C509C5GACTU   | 1   | 20901500A          |
| C3             | CAP CER CHIP 24pF 5% 500V 0805        | 44648        | CL21C240JBANNNC    | 1   | 20901600A          |
| C7             | CAP CER CHIP 22pF 5% 500V             | 31433        | C0805C220J5GACTU   | 1   | 20901800A          |
| C10-12         | CAP CER CHIP 0.1uF 10% 50V 0805       | 31433        | C0805C104K5RAC     | 3   | 20900500A          |
| C18-C21        | CAP ELEC 100uF 20% 25V SM SIZE F      | 54473        | EEE-1EA101P        | 4   | 28339300A          |
| C22-23         | CAP TANT 10uF 25V SM                  | 31433        | T491D106M025AS     | 2   | 28338900A          |
| C24            | CAP TANT CHIP 10uF 20% 35V 7343-73    | 04222        | TPSE106M035R0200   | 1   | 28341800A          |
| C25-27         | CAP CER CHIP 0.1uF 10% 50V 0805       | 31433        | C0805C104K5RAC     | 3   | 20900500A          |
| C28            | CAP CER CHIP 300pF 5% 500V 0805       | 31433        | C0805C3015GACTU    | 1   | 20901700A          |
| C29-30         | CAP CER CHIP 0.1uF 10% 50V 0805       | 31433        | C0805C104K5RAC     | 2   | 20900500A          |
| CR1-2          | DIODE MMBD914 SOT-23                  | 1MQ07        | MMBD914LT1G        | 2   | 53100000A          |
| J1             | CONN M 5 PIN POLARIZED HEADER .156 SP | 00779        | 641208-5           | 1   | 477345000          |
| J2             | CONNECTOR "SMB" M 50 OHM STRAIGHT     | 95077        | 2385-0001          | 1   | 477317000          |
| L1-3           | INDUCTOR 5.6uH 341MA 1210             | 99800        | 1210-562K          | 3   | 40049300A          |
| Q1             | TRANSISTOR NPN 3904 SOT-23            | 1MQ07        | MMBT3904TT1G       | 1   | 52817800A          |
| Q2-14          | TRANSISTOR JFET N-CH SOT-23           | 1MQ07        | MMBF4391LT1G       | 13  | 52818100A          |
| R1             | RES CHIP 10.0K 1% 1/8W 0805           | 4S177        | RCI-0805-1002F     | 1   | 31840000A          |
| R2             | RES CHIP 15.0K 1% 1/8W 0805           | 4S177        | RCI-0805-1502F     | 1   | 31841700A          |
| R3             | RES CHIP 4.99K 1% 1/8W 0805           | 4S177        | RCI-0805-4991F     | 1   | 31836700A          |
| R4A-C          | RES CHIP 100K 1% 1/8W 0805            | 4S177        | RCI-0805-1003F     | 3   | 31850000A          |
| R5A-D          | RES CHIP 100K 1% 1/8W 0805            | 4S177        | RCI-0805-1003F     | 4   | 31850000A          |
| R6A-E          | RES CHIP 100K 1% 1/8W 0805            | 4S177        | RCI-0805-1003F     | 5   | 31850000A          |
| R7             | RES CHIP 1.82K 1% 1/8W 0805           | 4S177        | RCI-0805-1821F     | 1   | 31832500A          |
| R8             | RES CHIP 3.01K 1% 1/8W 0805           | 4S177        | RCI-0805-3011F     | 1   | 31834600A          |
| R9A            | RES CHIP 787 OHMS 0.1% 1/8W 0805      | 4S177        | TPI-0805-7870B     | 1   | 31828602A          |
| R9B            | RES CHIP 113 OHMS 0.1% 1/8W 0805      | 4S177        | TPI-0805-1130B     | 1   | 31820502A          |
| R10A           | RES CHIP 7.87K 0.1% 1/8W 0805         | 4S177        | TPI-0805-7871B     | 1   | 31838602A          |
| R10B           | RES CHIP 1.13K 0.1% 1/8W 0805         | 4S177        | TPI-0805-1131B     | 1   | 31830502A          |
| R11            | RES CHIP 10.0 OHMS 1% 1/8W 0805       | 4S177        | RCI-0805-10R0F     | 1   | 31810000A          |
| R13            | RES CHIP 5.49K 1% 1/8W 0805           | 4S177        | RCI-0805-5491F     | 1   | 31837100A          |
| R14            | RES CHIP 33.2K 1% 1/8W 0805           | 4S177        | RCI-0805-3322F     | 1   | 31845000A          |
| R15            | RES VAR 50K 10% 0.5W                  | 73138        | 3329W-1-503        | 1   | 311375000          |
| R16            | RES CHIP 11.0K 1% 1/8W 0805)          | 4S177        | RCI-0805-1102F     | 1   | 31840400A          |
| R17            | RES VAR 50K 10% 0.5W                  | 73138        | 3329W-1-503        | 1   | 311375000          |
| R18            | RES CHIP 95.3K 1% 1/8W 0805           | 4S177        | RCI-0805-9532F     | 1   | 31849400A          |
| R19            | RES CHIP 24.3K 1% 1/8W 0805           | 4S177        | RCI-0805-2432F     | 1   | 31843700A          |
| R20            | RES CHIP 90.9K 1% 1/8W 0805           | 4S177        | RCI-0805-9092F     | 1   | 31849200A          |
| R21            | RES VAR 50K 10% 0.5W                  | 73138        | 3329W-1-503        | 1   | 311375000          |
| R22A-B         | RES CHIP 20.0K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2002B     | 2   | 31842902A          |
| R23A           | RES CHIP 49.9K 0.1% 1/8W 0805         | 4S177        | TPI-0805-4992B     | 1   | 31846702A          |
| R23B           | RES CHIP 30.1K 0.1% 1/8W 0805         | 4S177        | TPI-0805-3012B     | 1   | 31844602A          |
| R24A           | RES CHIP 150K 0.1% 1/8W 0805          | 4S177        | TPI-0805-1503B     | 1   | 31851702A          |
| R24B           | RES CHIP 10.0K 0.1% 1/8W 0805         | 4S177        | TPI-0805-1002B     | 1   | 31840002A          |
| R25A           | RES CHIP 205K 0.1% 1/8W 0805          | 4S177        | TPI-0805-2053B     | 1   | 31853002A          |
| R25B           | RES CHIP 115K 0.1% 1/8W 0805          | 4S177        | TPI-0805-1153B     | 1   | 31850602A          |
| R26            | RES CHIP 1.50K 1% 1/8W 0805           | 4S177        | RCI-0805-1501F     | 1   | 31831700A          |
| R27            | RES CHIP 100 OHMS 1% 1/8W 0805        | 4S177        | RCI-0805-10000F    | 1   | 31820000A          |
| R28A-B         | RES CHIP 20.0K 0.1% 1/8W 0805         | 4S177        | TPI-0805-2002B     | 2   | 31842902A          |
| R29A           | RES CHIP 49.9K 0.1% 1/8W 0805         | 4S177        | TPI-0805-4992B     | 1   | 31846702A          |
| R29B           | RES CHIP 30.1K 0.1% 1/8W 0805         | 4S177        | TPI-0805-3012B     | 1   | 31844602A          |
| R30A           | RES CHIP 150K 0.1% 1/8W 0805          | 4S177        | TPI-0805-1503B     | 1   | 31851702A          |
| R30B           | RES CHIP 10.0K 0.1% 1/8W 0805         | 4S177        | TPI-0805-1002B     | 1   | 31840002A          |
| R31A           | RES CHIP 205K 0.1% 1/8W 0805          | 4S177        | TPI-0805-2053B     | 1   | 31853002A          |
| R31B           | RES CHIP 115K 0.1% 1/8W 0805          | 4S177        | TPI-0805-1153B     | 1   | 31850602A          |
| R32            | RES CHIP 649K 1% 1/8W 0805            | 4S177        | RCI-0805-6493F     | 1   | 31857800A          |
| R33-34         | RES CHIP 4.99K 1% 1/8W 0805           | 4S177        | RCI-0805-4991F     | 2   | 31836700A          |
| R36            | RES CHIP 100 OHMS 0.1% 1/8W 0805)     | 4S177        | TPI-0805-1000B     | 1   | 31820002A          |

|         |                                         |       |                |   |           |
|---------|-----------------------------------------|-------|----------------|---|-----------|
| R37     | RES CHIP 499K 1% 1/8W 0805              | 4S177 | RCI-0805-4993F | 1 | 31856700A |
| R38-R44 | RES CHIP 10.0K 1% 1/8W 0805             | 4S177 | RCI-0805-1002F | 7 | 31840000A |
| U1      | IC AD7548 12-BIT CMOS DAC SOIC-20       | 51640 | AD7548JRZ      | 1 | 53706100A |
| U2      | IC TL072A LOW NOISE OP AMP SOIC-8       | 01295 | TL072ACD       | 1 | 53805000A |
| U3      | IC REF01 VOLTAGE REFERENCE 10V SOIC-8   | 51640 | REF01CSZ       | 1 | 53804900A |
| U4-5    | IC SN74LS273 OCTAL D FLIP-FLOP SOIC-20  | 01295 | SN74LS273DW    | 2 | 53705400A |
| U6-9    | IC LM339 QUAD COMPARATOR 14-SOP         | 07263 | LM339M         | 4 | 53805200A |
| U10     | IC NE5534 LOW-NOISE OP AMP SOIC-8       | 01295 | NE5534D        | 1 | 53806400A |
| U11     | IC DG201A SPST ANALOG SWITCH SOIC-16    | 1ES66 | DG201ACSE      | 1 | 53806600A |
| U12     | IC SN74LS139 DECODER/DEMULTIPLEXER SOIC | 01295 | SN74LS139AD    | 1 | 53806500A |
| U13     | IC NE5534 LOW-NOISE OP AMP SOIC-8       | 01295 | NE5534D        | 1 | 53806400A |

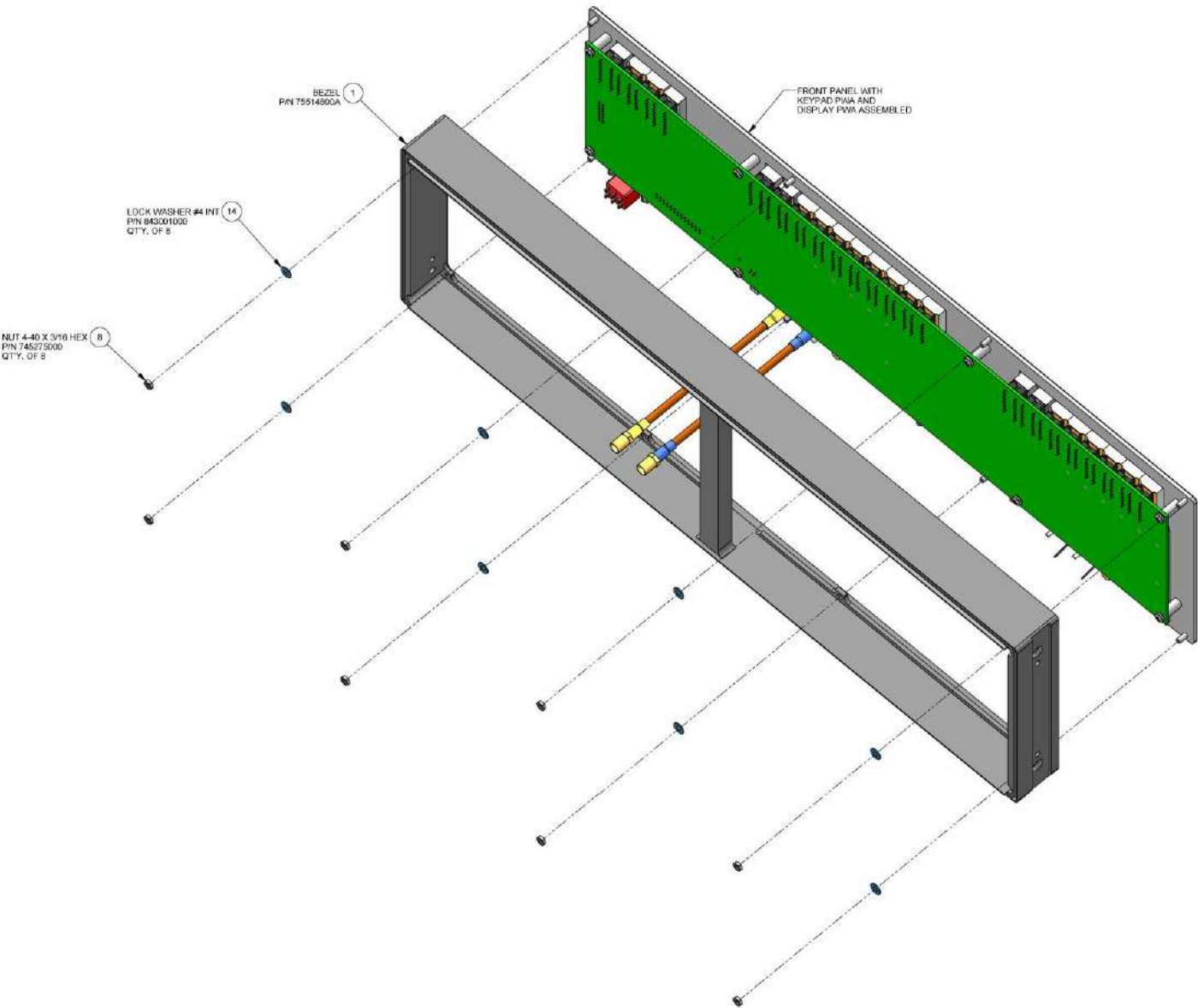
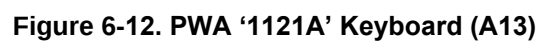


Figure 6-11. Front Bezel Assy (A17)



**11220300A REV A BEZEL ASSY 1121A (A17) (Figure 6-11)**  
**MODEL: 1121A**

| REF.<br>PART<br>DESIG.<br>NUMBER | DESCRIPTION                   | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC       |
|----------------------------------|-------------------------------|--------------|--------------------|-----|-----------|
| REF 1                            | BEZEL 1121A                   | 04901        | 75514800A          | 1   | 75514800A |
| REF 2                            | FRONT PANEL 1121A             | 04901        | 60360000A          | 1   | 60360000A |
| A13                              | PWA KEYPAD 1121A              | 04901        | 11220500A          | 1   | 11220500A |
| REF 3                            | KEYPAD SILICONE RUBBER        | 04901        | 75755101A          | 1   | 75755101A |
| REF 4                            | KEYPAD SILICONE RUBBER        | 04901        | 75755102A          | 1   | 75755102A |
| REF 5                            | KEYPAD SILICONE RUBBER        | 04901        | 75755103A          | 1   | 75755103A |
| REF 6                            | KEYPAD SILICONE RUBBER        | 04901        | 75755104A          | 1   | 75755104A |
| A12                              | PWA DISPLAY 1121A             | 04901        | 11220400A          | 1   | 11220400A |
| J2 , J3                          | CONN F COAX BNC               | 02660        | UG625B/U           | 2   | 479123000 |
| J1, J4                           | CONNECTOR BINDING POST GROUND | 74970        | 111-2223-001       | 2   | 47945400A |
| REF 19                           | CABLE ASSY COAX 10" L (INPUT) | 04901        | 57223901A          | 1   | 57223901A |
| W58                              | CABLE ASSY COAX (BL) BNC/SMB  | 04901        | 57226302A          | 1   | 57226302A |
| W59                              | CABLE ASSY COAX (Y) BNC/SMB   | 04901        | 57226301A          | 1   | 57226301A |
| REF 15                           | CABLE ASSY POWER SWITCH       | 04901        | 57400900A          | 1   | 57400900A |

**11220500A REV A PWA KEYPAD 1121A (A13) (Figure 6-12)**  
**MODEL: 1121A**

| REF.<br>PART<br>DESIG.<br>NUMBER | DESCRIPTION                              | CAGE<br>CODE | MFG PART<br>NUMBER        | QTY | BEC       |
|----------------------------------|------------------------------------------|--------------|---------------------------|-----|-----------|
| J33                              | CONN F 30 POS 60 PIN 0.5mm SP SHROUDED   | 55322        | ERF5-030-05.0-L-DV-K-TR 1 |     | 49301400A |
| DS2-4                            | LED RED T-3/4 SUBMINIATURE HI EFFICIENCY | 50434        | HLMP-6300                 | 3   | 53900800A |
| DS10-12                          | LED RED T-3/4 SUBMINIATURE HI EFFICIENCY | 50434        | HLMP-6300                 | 3   | 53900800A |
| DS18-19                          | LED RED T-3/4 SUBMINIATURE HI EFFICIENCY | 50434        | HLMP-6300                 | 2   | 53900800A |
| DS25-26                          | LED RED T-3/4 SUBMINIATURE HI EFFICIENCY | 50434        | HLMP-6300                 | 2   | 53900800A |
| DS32-33                          | LED RED T-3/4 SUBMINIATURE HI EFFICIENCY | 50434        | HLMP-6300                 | 2   | 53900800A |
| DS39-40                          | LED RED T-3/4 SUBMINIATURE HI EFFICIENCY | 50434        | HLMP-6300                 | 2   | 53900800A |
| DS41-52                          | LED RED T-3/4 SUBMINIATURE HI EFFICIENCY | 50434        | HLMP-6300                 | 12  | 53900800A |

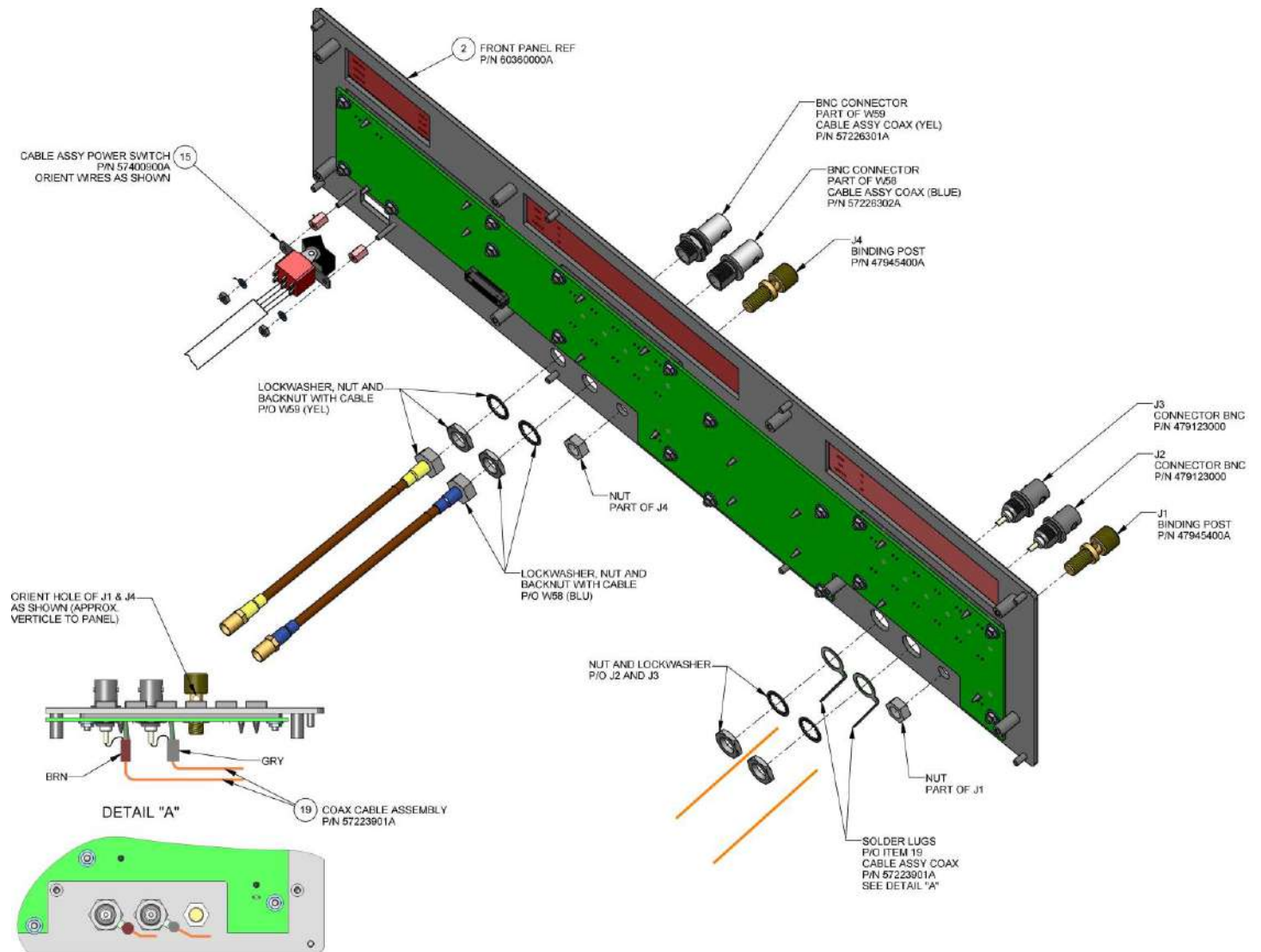


Figure 6-13. Bezel Sub Assy

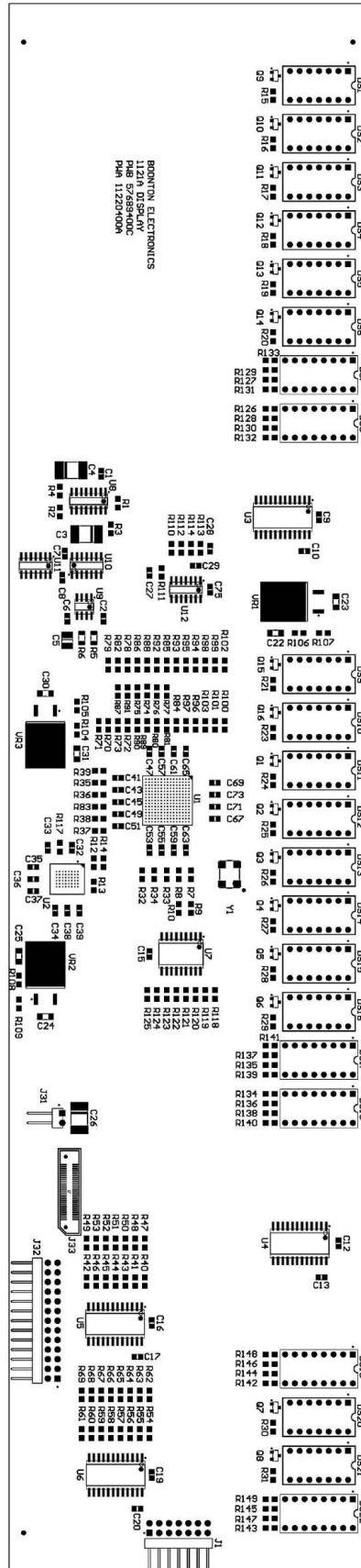


Figure 6-14. PWA '1121A' Display (A12)

**11220400A REV A PWA DISPLAY 1121A (A12) (Figure 6-14)**  
**MODEL: 1121A**

| REF.<br>DESIG. | DESCRIPTION                             | CAGE<br>CODE | MFG PART<br>NUMBER      | QTY | BEC PART<br>NUMBER |
|----------------|-----------------------------------------|--------------|-------------------------|-----|--------------------|
| C1-2           | CAP CER CHIP 0.1uF 10% 50V 0805         | 31433        | C0805C104K5RAC          | 2   | 20900500A          |
| C3, C4         | CAP TANT CHIP 15uF 20% 25V SM 7341-31   | 31433        | T491D156M025AT          | 2   | 24001600A          |
| C5             | CAP TANT CHIP 4.7uF 10% 20V EIA 3528-21 | 31433        | T491B475K020AT          | 1   | 24000100A          |
| C6 C29         | CAP CER CHIP 0.01uF 10% 50V 0805        | 31433        | C0805C103K5RAC          | 2   | 20900400A          |
| C7-10          | CAP CER CHIP 0.1uF 10% 50V 0805         | 31433        | C0805C104K5RAC          | 4   | 20900500A          |
| C12-13         | CAP CER CHIP 0.1uF 10% 50V 0805         | 31433        | C0805C104K5RAC          | 2   | 20900500A          |
| C15-17         | CAP CER CHIP 0.1uF 10% 50V 0805         | 31433        | C0805C104K5RAC          | 3   | 20900500A          |
| C19-20         | CAP CER CHIP 0.1uF 10% 50V 0805         | 31433        | C0805C104K5RAC          | 2   | 20900500A          |
| C22-25         | CAP CER CHIP 10uF 20% 16V 1206          | 31433        | C1206C106M4PACTU        | 4   | 21000100A          |
| C26            | CAP TANT CHIP 100uF 10% 20V(SM 7343     | 31433        | T491D107K020AT          | 1   | 24001500A          |
| C27            | CAP CER CHIP 0.1uF 10% 50V 0805         | 31433        | C0805C104K5RAC          | 1   | 20900500A          |
| C28            | CAP CER CHIP 1uF 10% 25V 0805           | 31433        | C0805C105K3RACTU        | 1   | 20900600A          |
| C30-31         | CAP CER CHIP 10uF 20% 16V 1206          | 31433        | C1206C106M4PACTU        | 2   | 21000100A          |
| C32-39         | CAP CER CHIP 0.1uF 10% 50V 0805         | 31433        | C0805C104K5RAC          | 8   | 20900500A          |
| C41-75         | CAP CER CHIP 0.1uF 10% 50V 0805         | 31433        | C0805C104K5RAC          | 35  | 20900500A          |
| DS1-6          | DISPLAY NUMERIC 5082-7651               | 28480        | 5082-7651-DE000         | 6   | 536811000          |
| DS7-8          | LED LIGHT BAR MOD HLMP-2620             | 28480        | HLMP-2620-EF000         | 2   | 536027000          |
| DS9-16         | DISPLAY NUMERIC 5082-7651               | 28480        | 5082-7651-DE000         | 8   | 536811000          |
| DS17-19        | LED LIGHT BAR MOD HLMP-2620             | 28480        | HLMP-2620-EF000         | 3   | 536027000          |
| DS20-21        | DISPLAY NUMERIC 5082-7651               | 28480        | 5082-7651-DE000         | 2   | 536811000          |
| DS22           | LED LIGHT BAR MOD HLMP-2620             | 28480        | HLMP-2620-EF000         | 1   | 536027000          |
| J1             | CONN M 14 PIN DBL ROW HEADER RT .10SP   | 55322        | TSW-107-08-F-D-RA       | 1   | 49201514A          |
| J3             | CONN M 30 POS 60 PIN 0.5mm SP HEADER    | 55322        | ERM5-030-02.0-L-DV-K-TR | 1   | 49201400A          |
| J31            | CONN M 2 CKT RT ANG POLIZ .1CT          | 06383        | MPAS100-2-A             | 1   | 47740902A          |
| J32            | CONN M 26 PIN DBL ROW HEADER RT .10SP   | 55322        | TSW-113-08-F-D-RA       | 1   | 49201526A          |
| Q1-16          | TRANS DARLINGTON PNP MMBTA63LT1G        | 1MQ07        | MMBTA63LT1G             | 16  | 52902300A          |
| R1-2           | RES CHIP 2.00K 1% 1/8W 0805             | 4S177        | RCI-0805-2001F          | 2   | 31832900A          |
| R3-4           | RES CHIP 100K 1% 1/8W 0805              | 4S177        | RCI-0805-1003F          | 2   | 31850000A          |
| R5-6           | RES CHIP 49.9K 1% 1/8W 0805             | 4S177        | RCI-0805-4992F          | 2   | 31846700A          |
| R7-8           | RES CHIP 47.5K 1% 1/8W 0805             | 4S177        | RCI-0805-4752F          | 2   | 31846500A          |
| R12-14         | RES CHIP 2.43K 1% 1/8W 0805             | 4S177        | RCI-0805-2431F          | 3   | 31833700A          |
| R15-21, R23-31 | RES CHIP 4.75K 1% 1/8W 0805             | 4S177        | RCI-0805-4751F          | 16  | 31836500A          |
| R32-39         | RES CHIP 33.2 OHMS 1% 1/8W 0805         | 4S177        | RCI-0805-33R2F          | 8   | 31815000A          |
| R40-46         | RES CHIP 3.32K 1% 1/8W 0805             | 4S177        | RCI-0805-3321F          | 7   | 31835000A          |
| R47-53         | RES CHIP 6.34K 1% 1/8W 0805             | 4S177        | RCI-0805-6341F          | 7   | 31837700A          |
| R54-61         | RES CHIP 3.32K 1% 1/8W 0805             | 4S177        | RCI-0805-3321F          | 8   | 31835000A          |
| R62-69         | RES CHIP 6.34K 1% 1/8W 0805             | 4S177        | RCI-0805-6341F          | 8   | 31837700A          |
| R70-77         | RES CHIP 4.75K 1% 1/8W 0805             | 4S177        | RCI-0805-4751F          | 8   | 31836500A          |
| R78-103        | RES CHIP 150 OHMS 1% 1/8W 0805          | 4S177        | RCI-0805-1500F          | 26  | 31821700A          |
| R104           | RES CHIP 121 OHMS 1% 1/8W 0805          | 4S177        | RCI-0805-1210F          | 1   | 31820800A          |
| R105           | RES CHIP 0.0 OHMS 1% 1/8W 0805          | 91639        | CRCW08050000Z0EA        | 1   | 31871000A          |
| R106           | RES CHIP 121 OHMS 1% 1/8W 0805          | 4S177        | RCI-0805-1210F          | 1   | 31820800A          |
| R107           | RES CHIP 200 OHMS 1% 1/8W 0805          | 4S177        | RCI-0805-2000F          | 1   | 31822900A          |
| R108           | RES CHIP 121 OHMS 1% 1/8W 0805          | 4S177        | RCI-0805-1210F          | 1   | 31820800A          |
| R109           | RES CHIP 53.6 OHMS 1% 1/8W 0805         | 4S177        | RCI-0805-53R6F          | 1   | 31817000A          |
| R110           | RES CHIP 2.61K 1% 1/8W 0805             | 4S177        | RCI-0805-2611F          | 1   | 31834000A          |
| R111           | RES CHIP 1.00K 1% 1/8W 0805             | 4S177        | RCI-0805-1001F          | 1   | 31830000A          |
| R112           | RES CHIP 3.32K 1% 1/8W 0805             | 4S177        | RCI-0805-3321F          | 1   | 31835000A          |
| R113           | RES CHIP 200K 1% 1/8W 0805              | 4S177        | RCI-0805-2003F          | 1   | 31852900A          |
| R114           | RES CHIP 4.75K 1% 1/8W 0805             | 4S177        | RCI-0805-4751F          | 1   | 31836500A          |
| R117           | RES CHIP 2.43K 1% 1/8W 0805             | 4S177        | RCI-0805-2431F          | 1   | 31833700A          |
| R118-125       | RES CHIP 22.1 OHMS 1% 1/8W 0805         | 4S177        | RCI-0805-22R1F          | 8   | 31813300A          |
| R126-149       | RES CHIP 150 OHMS 1% 1/8W 0805          | 4S177        | RCI-0805-1500F          | 24  | 31821700A          |
| U1             | IC XILINX SPARTAN FPGA XC6SLX9-2CSG225C | 68994        | XC6SLX9-2CSG225C        | 1   | 53704400A          |
| U2             | IC XILINX FLASH PROM 8Mb XCF08P 48 PIN  | 68994        | XCF08P                  | 1   | 53704500A          |
| U3-6           | IC SN74LVC4245A OCTAL BUS TRANSCEIVER   | 01295        | SN74LVC4245ADW          | 4   | 53704600A          |
| U7             | IC ULN2803A DARLINGTON TRANS ARRAY      | 01295        | ULN2803ADW              | 1   | 53704700A          |
| U8             | IC SN74LS123 MONOSTABLE MULTI-VIBRATOR  | 01295        | SN74LS123DR             | 1   | 53704100A          |
| U9             | IC 7555 CMOS RC TIMER SOIC-8            | 34371        | ICM7555IBAZ             | 1   | 53805300A          |

|           |                                           |       |                    |   |           |
|-----------|-------------------------------------------|-------|--------------------|---|-----------|
| U10       | IC SN74LS02 QUAD 2 INPUT POS NOR GATE     | 01295 | SN74LS02D          | 1 | 53704200A |
| U11       | IC CD4066BM CMOS QUAD BILATERAL SWITCH    | 01295 | CD4066BM           | 1 | 53704300A |
| U12       | IC LM339 QUAD COMPARATOR 14-SOP           | 07263 | LM339M             | 1 | 53805200A |
| VR1-3     | IC LD1086 POS VOLT REGULATOR 3 PIN D2PAK  | K1422 | LS1086D2T          | 3 | 53805500A |
| XDS1-6    | SOCKET IC 14 PIN                          | 00779 | 2-640357-4         | 6 | 473019000 |
| XDS7-8    | SOCKET IC 16 PIN                          | 00779 | 2-640358-4         | 2 | 473042000 |
| XDS9-16   | SOCKET IC 14 PIN                          | 00779 | 2-640357-4         | 8 | 473019000 |
| XDS17-19  | SOCKET IC 16 PIN                          | 00779 | 2-640358-4         | 3 | 473042000 |
| XDS20-S21 | SOCKET IC 14 PIN                          | 00779 | 2-640357-4         | 2 | 473019000 |
| XDS22     | SOCKET IC 16 PIN                          | 00779 | 2-640358-4         | 1 | 473042000 |
| Y1        | CRYSTAL CLOCK OSC 9.83MHz 3.3V SM 7.5x5mm | 61429 | FXO-HC730-9.830000 | 1 | 54800100A |

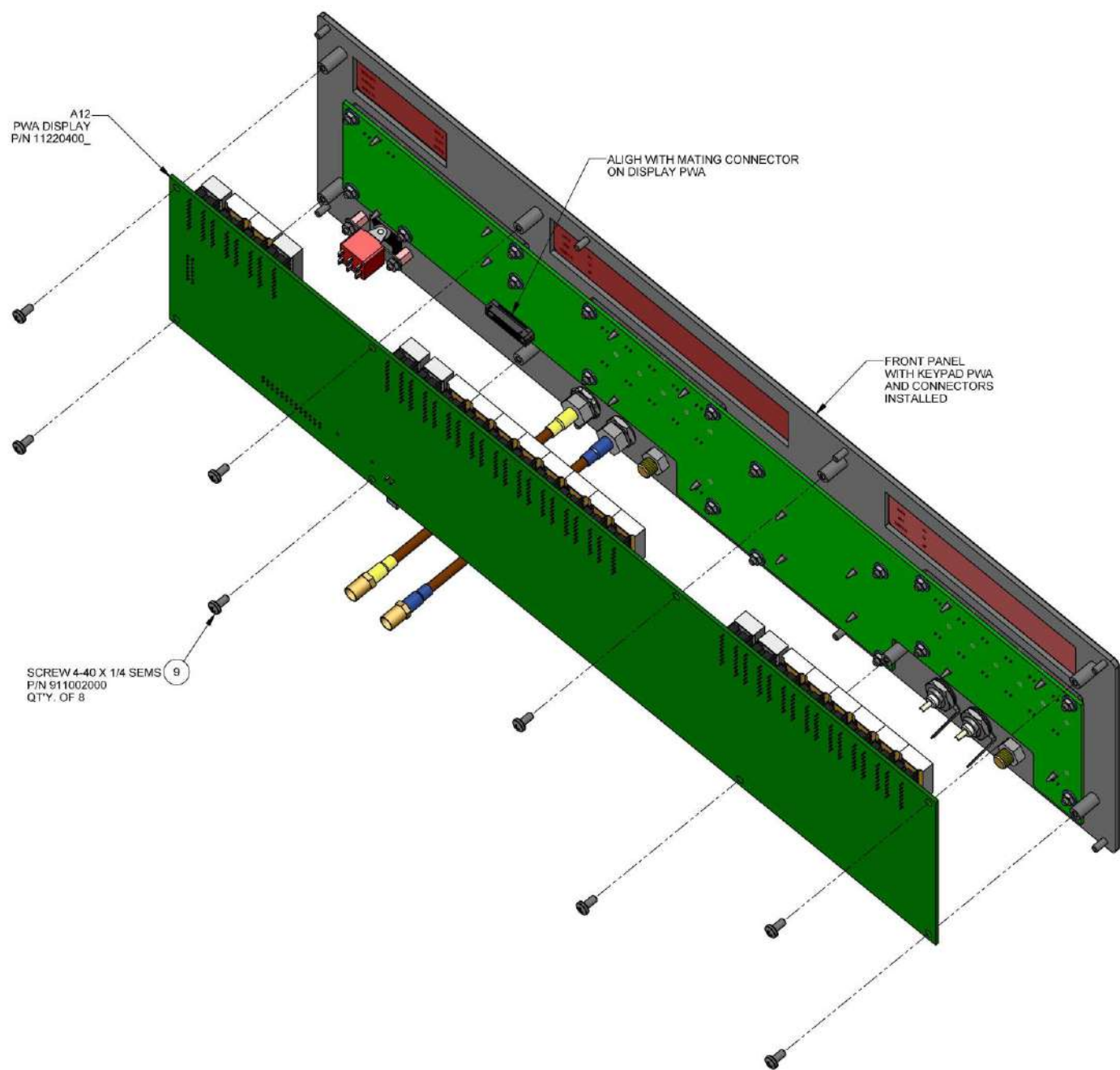
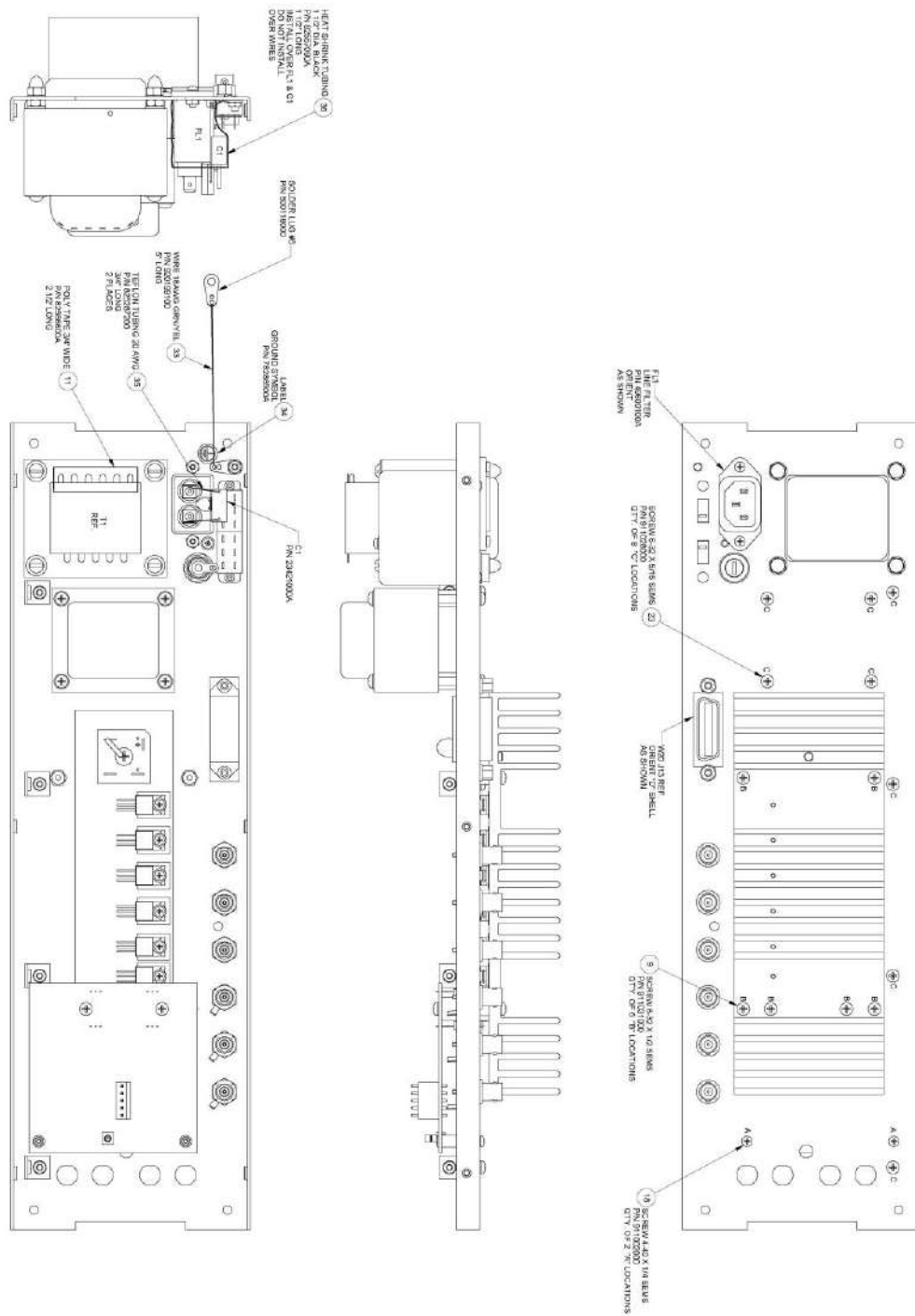


Figure 6-15 Front Panel Assy



**Figure 6-16. Rear Panel Assy (A21) (Sheet 1 of 2)**



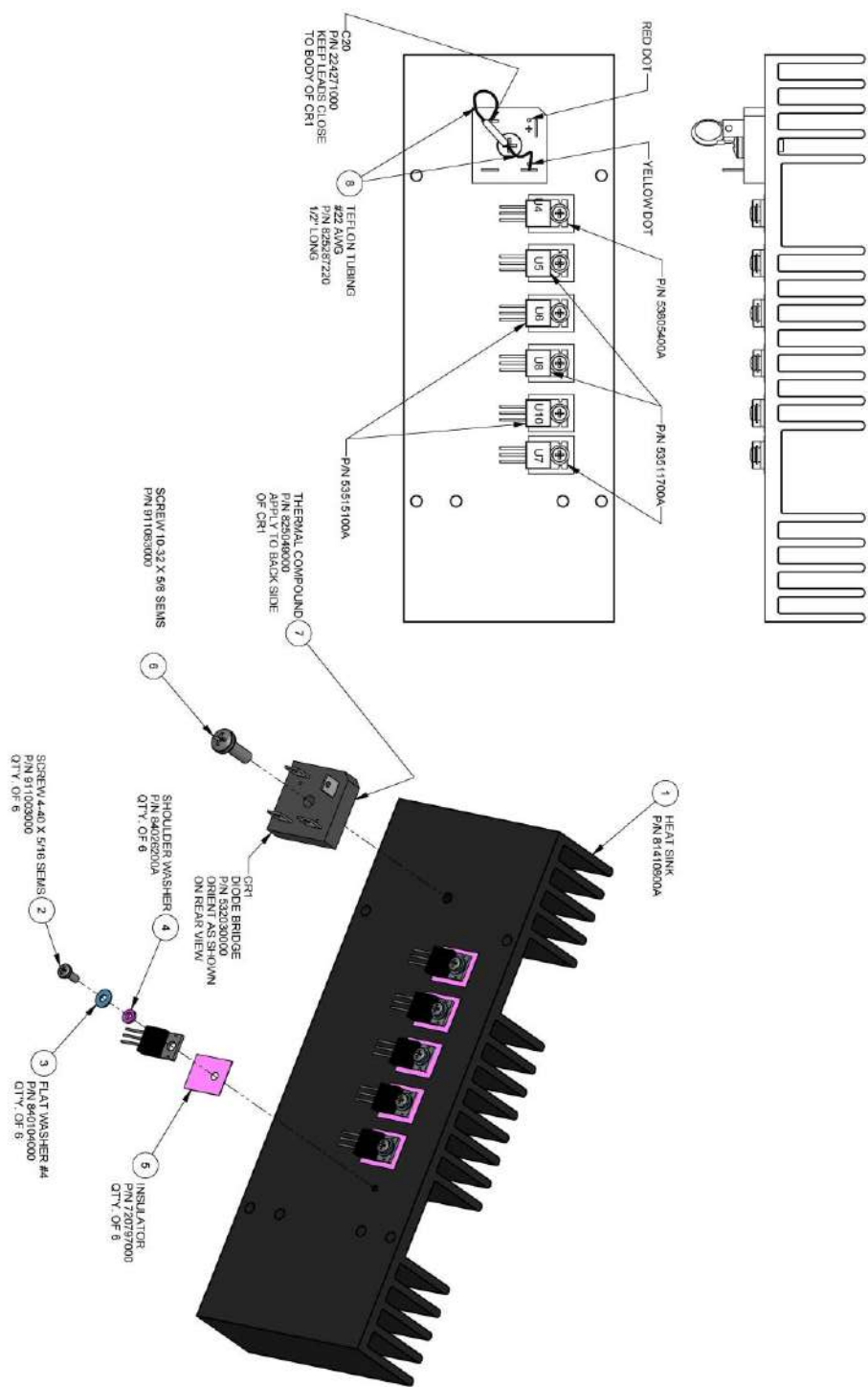


Figure 6-17. Heat Sink Assy (A20)

**11220700A REV A REAR PANEL ASSY 1121A (A21) (Figure 6-16)**  
**MODEL: 1121A**

| REF.<br>DESIG. | DESCRIPTION                           | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|----------------|---------------------------------------|--------------|--------------------|-----|--------------------|
| A20            | HEAT SINK ASSEMBY 1121A               | 04901        | 11220800A          | 1   | 11220800A          |
| A24            | PWA POWER AMPLIFIER 1121A             | 04901        | 11103402B          | 1   | 11103402B          |
| C1             | CAP PE 0.1uF 20% 250VAC               | 04901        | 23420100A          | 1   | 23420100A          |
| F1             | FUSE 1A 250V SLO-BLO 1/4 DIA X 1 1/4L | 71400        | MDL-1-R            | 1   | 54600000A          |
| FL1            | CONN M POWER ENTRY SHIELDED           | 04901        | 49600100A          | 1   | 49600100A          |
| J7 - J12       | CONN F COAX BNC                       | 02660        | 479123000          | 6   | 479123000          |
| T1             | TRANSFORMER POWER                     | 04901        | 44609600B          | 1   | 44609600B          |
| T2             | TRANSFORMER ASSY                      | 04901        | 11104700A          | 1   | 11104700A          |
| W7             | CABLE COAX ASSEMBLY (BLACK) 22L       | 04901        | 57223615A          | 1   | 57223615A          |
| W8             | CABLE ASSY COAX RG316/U 22.00L (ORN)  | 04901        | 57223613A          | 1   | 57223613A          |
| W9             | CABLE ASSY COAX RG316/U 23.00L (VIO)  | 04901        | 57223614A          | 1   | 57223614A          |
| W15            | CABLE ASSY WIRE 22GA 3C 10.50L        | 04901        | 57121705A          | 1   | 57121705A          |
| W20            | CABLE ASSY FLAT 24 CKT GPIB           | 04901        | 92019800B          | 1   | 92019800B          |
| W25            | CABLE ASSEMBLY                        | 04901        | 57124302A          | 1   | 57124302A          |
| W38, W39       | CABLE ASSY WIRE 20GA 1C 10.50L        | 04901        | 57121801A          | 2   | 57121801A          |
| W43            | CABLE ASSY WIRE 24GA 4C 10.75L        | 04901        | 57120101B          | 1   | 57120101B          |
| REF 1          | REAR PANEL 1121A                      | 04901        | 60360100A          | 1   | 60360100A          |
| REF 6          | FUSE CARRIER GRAY 1/4 x 1-1/4         | 61935        | FEK0031.1666       | 1   | 482114000          |
| REF 5          | FUSE HOLDER                           | 61935        | FEU0031.1673       | 1   | 482117000          |
| REF 16         | COVER AC POWER                        | 04901        | 81238700B          | 1   | 81238700B          |

**11220800A REV A HEAT SINK ASSY 1121A (A20) (Figure 6-17)**  
**MODEL: 1121A**

| REF.<br>DESIG. | DESCRIPTION                          | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|----------------|--------------------------------------|--------------|--------------------|-----|--------------------|
| C20            | CAP CER 0.01uF 20% 500V              | 51406        | DD16F10Z5F103K500V | 1   | 224271000          |
| CR1            | DIODE BRIDGE 15A 50V                 | 5L401        | KBPC1504           | 1   | 532030000          |
| U4             | IC LM323 POSITIVE VOLTAGE REGULATOR  | 01295        | LM1085IT-5.0/NOPB  | 1   | 53805400A          |
| U5 U7 U8       | IC UA7805UC VOLT REG                 | 1MQ07        | MC7805ACTG         | 3   | 53511700A          |
| U6 U10         | IC 7905 VOLT REG                     | 1MQ07        | MC7905CTG          | 2   | 53515100A          |
| REF 1          | HEAT SINK FABRICATED 1121A           | 04901        | 81410800A          | 1   | 81410800A          |
| REF 5          | INSULATOR SILICON PAD                | 55285        | 7403-09FR-51       | 6   | 720797000          |
| REF 4          | WASHER SHOULDER .215 OD .116 ID .139 | 13103        | 7721-7PPS          | 6   | 84026200A          |

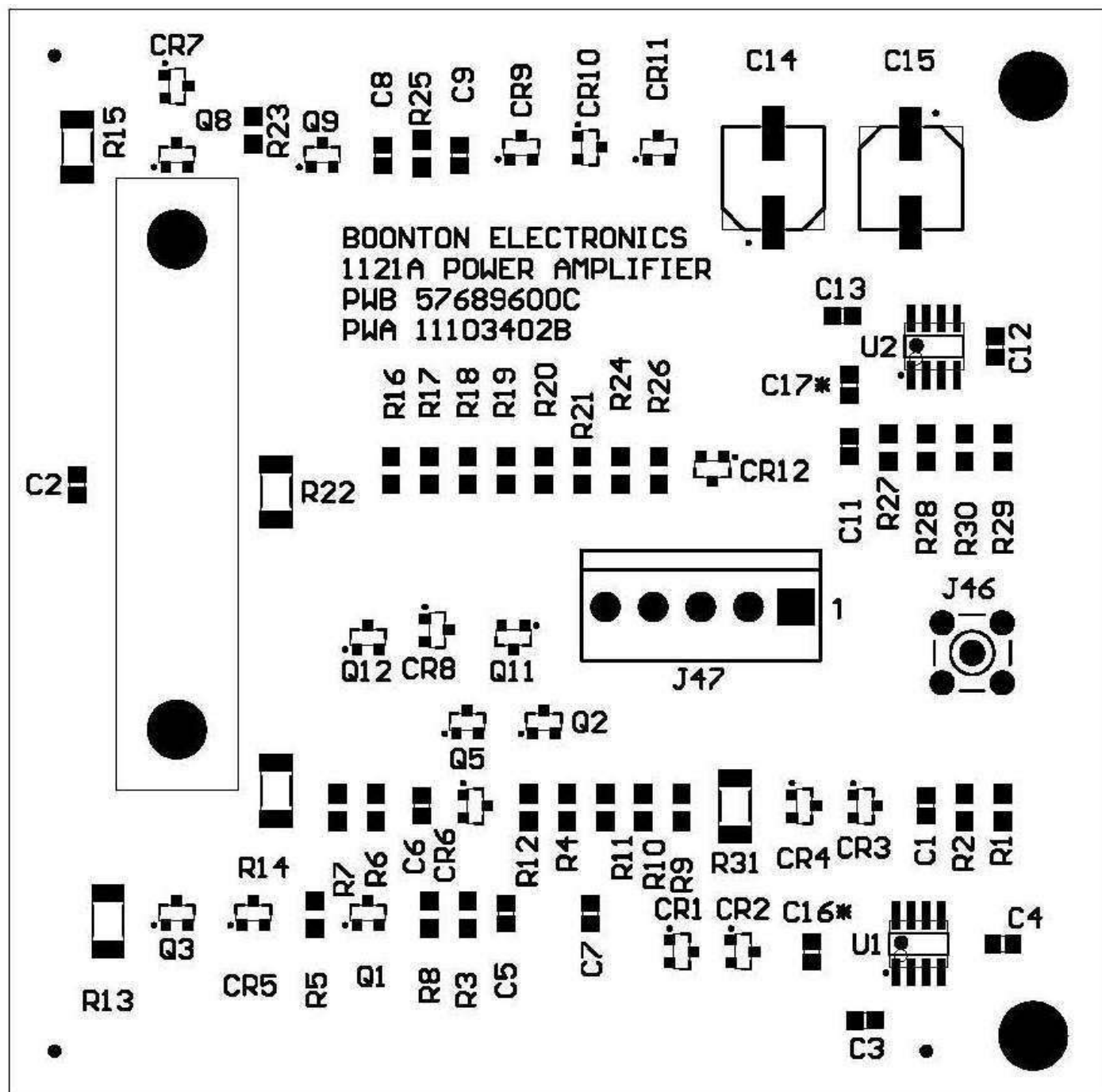


Figure 6-18. Power Amplifier (A24)

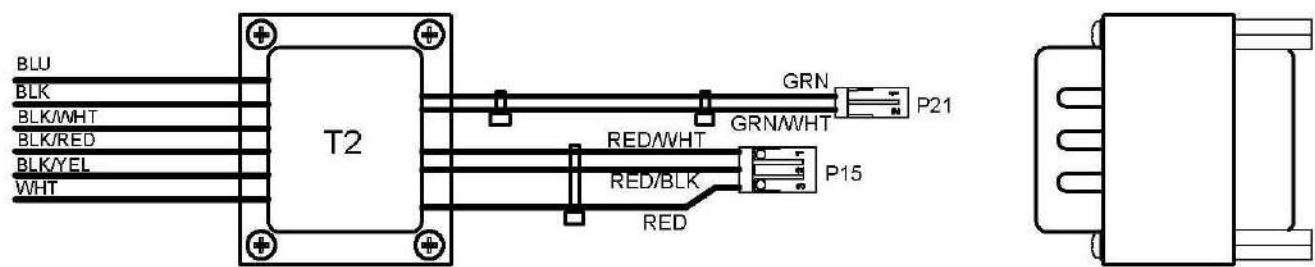


Figure 6-19. Transformer Assy (T1)

**11103402B REV A PWA POWER AMPLIFIER 1121A (A24) (Figure 6-18)**  
**MODEL: 1121A**

| REF.<br>DESIG. | DESCRIPTION                           | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|----------------|---------------------------------------|--------------|--------------------|-----|--------------------|
| C1             | CAP CER CHIP 10pF 5% 200V 0805        | 31433        | C0805C100J5GACTU   | 1   | 20901400A          |
| C2-C5          | CAP CER CHIP 0.1uF 10% 50V 0805       | 31433        | C0805C104K5RAC     | 4   | 20900500A          |
| C6-9           | CAP CER CHIP 2200pF 10% 250V 2012     | 31433        | C0805X222K5RACTU   | 4   | 21500000A          |
| C11            | CAP CER CHIP 10pF 5% 200V 0805        | 31433        | C0805C100J5GACTU   | 1   | 20901400A          |
| C12-13         | CAP CER CHIP 0.1uF 10% 50V 0805       | 31433        | C0805C104K5RAC     | 2   | 20900500A          |
| C14-15         | CAP ELEC 100uF 20% 25V SM SIZE F      | 54473        | ECEV1EA101P        | 2   | 28339300A          |
| CR1-12         | DIODE MMBD914 SOT-23                  | 1MQ07        | MMBD914LT1G        | 12  | 53100000A          |
| J46            | "CONNECTOR ""SMB"" M 50 OHM STRAIGHT" | 95077        | 2385-0001          | 1   | 477317000          |
| J47            | CONN M 5 PIN POLARIZED HEADER .156 SP | 00779        | 641208-5           | 1   | 477345000          |
| Q1             | TRANSISTOR NPN 3904 SOT-23            | 1MQ07        | MMBT3904TT1G       | 1   | 52817800A          |
| Q2-3           | TRANSISTOR 3906 SOT-23                | 1MQ07        | MMBT3906TT1G       | 2   | 52817900A          |
| Q4             | TRANS PNP D45H11                      | 1MQ07        | D45H11             | 1   | 52816200A          |
| Q5             | TRANSISTOR NPN 3904 SOT-23            | 1MQ07        | MMBT3904TT1G       | 1   | 52817800A          |
| Q6             | TRANS NPN D44H11                      | 1MQ07        | D44H11G            | 1   | 52816100A          |
| Q7             | TRANS PNP D45H11                      | 1MQ07        | D45H11             | 1   | 52816200A          |
| Q8             | TRANSISTOR 3906 SOT-23                | 1MQ07        | MMBT3906TT1G       | 1   | 52817900A          |
| Q9             | TRANSISTOR NPN 3904 SOT-23            | 1MQ07        | MMBT3904TT1G       | 1   | 52817800A          |
| Q10            | TRANS NPN D44H11                      | 1MQ07        | D44H11G            | 1   | 52816100A          |
| Q11            | TRANSISTOR 3906 SOT-23                | 1MQ07        | MMBT3906TT1G       | 1   | 52817900A          |
| Q12            | TRANSISTOR NPN 3904 SOT-23            | 1MQ07        | MMBT3904TT1G       | 1   | 52817800A          |
| R1             | RES CHIP 4.99K 0.1% 1/8W 0805         | 4S177        | TPI-0805-4991B     | 1   | 31836710A          |
| R2             | RES CHIP 7.500K 0.1% 1/8W 0805        | 4S177        | TPI-0805-7502B     | 1   | 31838402A          |
| R3-4           | RES CHIP 2.49K 1% 1/8W 0805           | 4S177        | RCI-0805-2491F     | 2   | 31833800A          |
| R5             | RES CHIP 200 OHMS 1% 1/8W 0805        | 4S177        | RCI-0805-2000F     | 1   | 31822900A          |
| R6             | RES CHIP 301 OHMS 1% 1/8W 0805        | 4S177        | RCI-0805-3010F     | 1   | 31824600A          |
| R7             | RES CHIP 39.2 OHMS 1% 1/8W 0805       | 4S177        | RCI-0805-39R2F     | 1   | 31815700A          |
| R8-9           | RES CHIP 150 OHMS 1% 1/8W 0805        | 4S177        | RCI-0805-1500F     | 2   | 31821700A          |
| R10            | RES CHIP 39.2 OHMS 1% 1/8W 0805       | 4S177        | RCI-0805-39R2F     | 1   | 31815700A          |
| R11            | RES CHIP 301 OHMS 1% 1/8W 0805        | 4S177        | RCI-0805-3010F     | 1   | 31824600A          |
| R12            | RES CHIP 200 OHMS 1% 1/8W 0805        | 4S177        | RCI-0805-2000F     | 1   | 31822900A          |
| R13-15         | RES CHIP 3.92 OHMS 1% 1/2W(2010       | 4S177        | RCI-2010-3R92F     | 3   | 32070301A          |
| R16            | RES CHIP 301 OHMS 1% 1/8W 0805        | 4S177        | RCI-0805-3010F     | 1   | 31824600A          |
| R17            | RES CHIP 39.2 OHMS 1% 1/8W 0805       | 4S177        | RCI-0805-39R2F     | 1   | 31815700A          |
| R18-19         | RES CHIP 150 OHMS 1% 1/8W 0805        | 4S177        | RCI-0805-1500F     | 2   | 31821700A          |
| R20            | RES CHIP 39.2 OHMS 1% 1/8W 0805       | 4S177        | RCI-0805-39R2F     | 1   | 31815700A          |
| R21            | RES CHIP 301 OHMS 1% 1/8W 0805        | 4S177        | RCI-0805-3010F     | 1   | 31824600A          |
| R22            | RES CHIP 3.92 OHMS 1% 1/2W(2010       | 4S177        | RCI-2010-3R92F     | 1   | 32070301A          |
| R23-24         | RES CHIP 200 OHMS 1% 1/8W 0805        | 4S177        | RCI-0805-2000F     | 2   | 31822900A          |
| R25-26         | RES CHIP 2.49K 1% 1/8W 0805           | 4S177        | RCI-0805-2491F     | 2   | 31833800A          |
| R27            | RES CHIP 7.500K 0.1% 1/8W 0805        | 4S177        | TPI-0805-7502B     | 1   | 31838402A          |
| R28            | RES CHIP 4.99K 0.1% 1/8W 0805         | 4S177        | TPI-0805-4991B     | 1   | 31836710A          |
| R29            | RES CHIP 7.500K 0.1% 1/8W 0805        | 4S177        | TPI-0805-7502B     | 1   | 31838402A          |
| R30            | RES CHIP 4.99K 0.1% 1/8W 0805         | 4S177        | TPI-0805-4991B     | 1   | 31836710A          |
| R31            | RES CHIP 3.92 OHMS 1% 1/2W 2010       | 4S177        | RCI-2010-3R92F     | 1   | 32070301A          |
| U1-2           | IC NE5534 LOW-NOISE OP AMP SOIC-8     | 01295        | NE5534D            | 2   | 53806400A          |

**11104700A REV B TRANSFORMER ASSY (T1) (Figure 6-19)**  
**MODEL: 1121A**

| REF.<br>DESIG. | DESCRIPTION         | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|----------------|---------------------|--------------|--------------------|-----|--------------------|
| P15            | CONNECTOR 3 CIRCUIT | 06383        | CE156-22-3-C       | 1   | 479406000          |
| P21            | CONNECTOR 2 PIN     | 06383        | CD156F22-2-D       | 1   | 479405000          |
| T2             | TRANSOFMRER POWER   | 04901        | 44609800A          | 1   | 44609800A          |

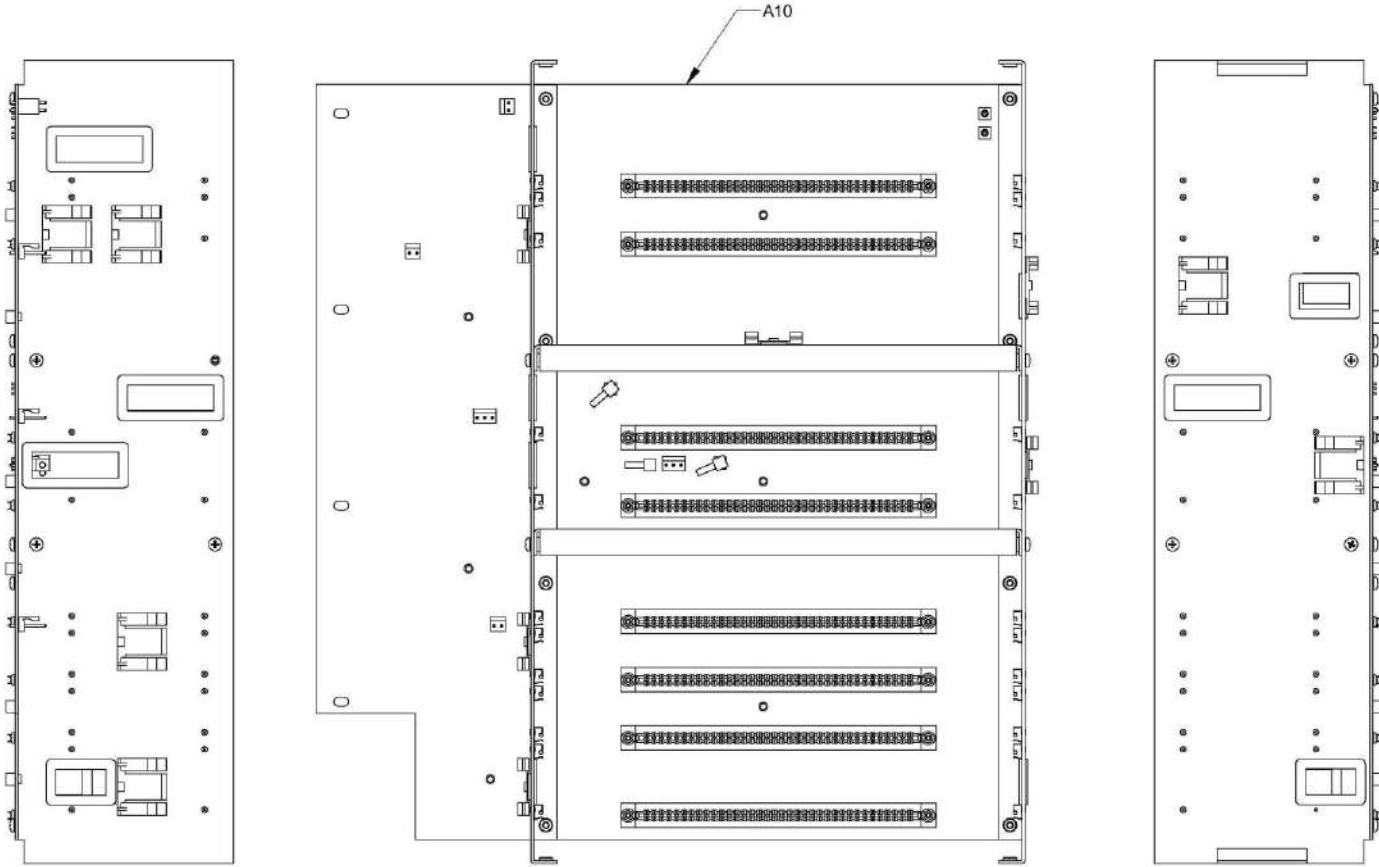


Figure 6-20. '1121A' Card Cage Assy (A18)

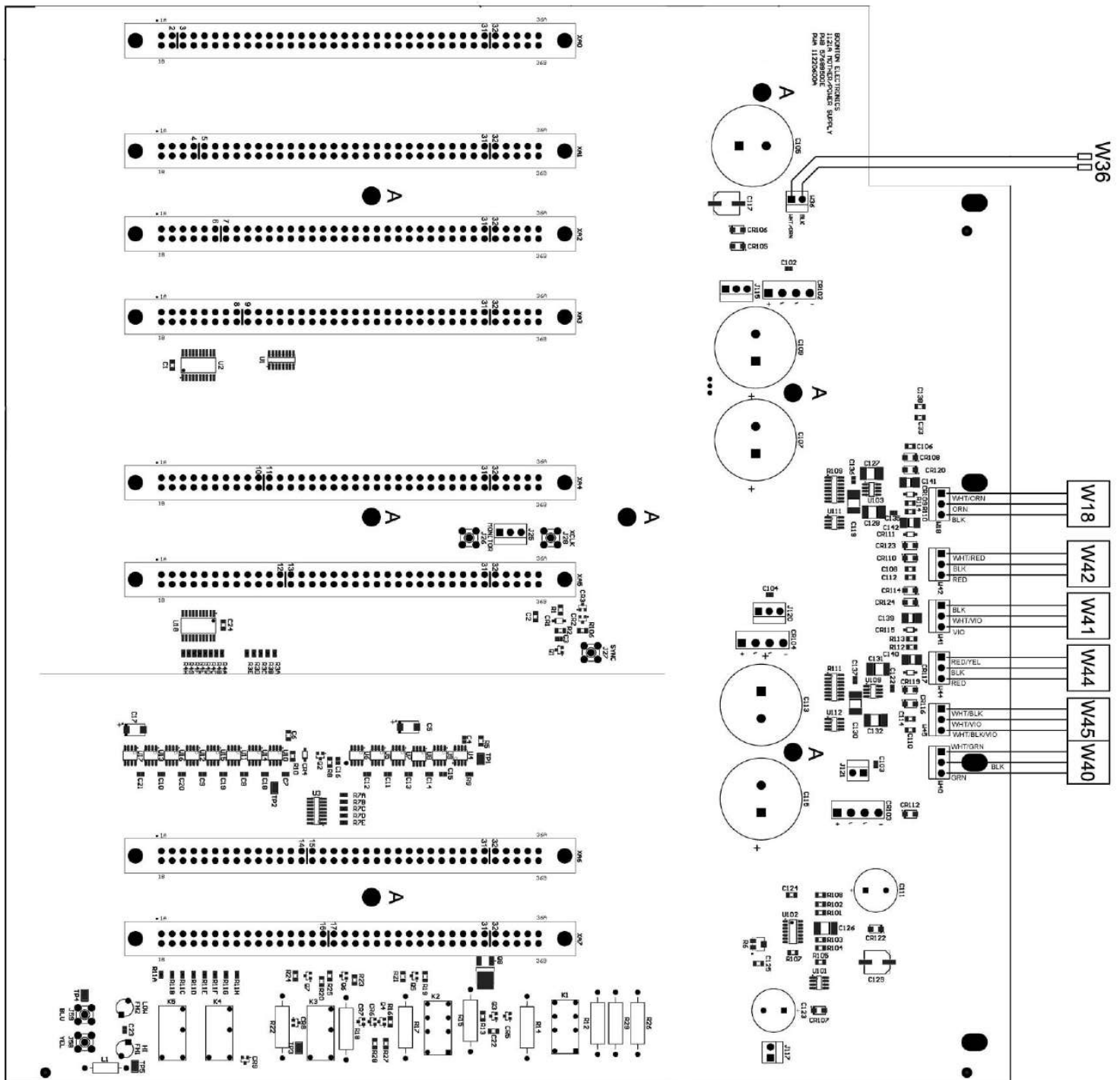


Figure 6-21. PWA '1121A' Mother (A10)

**11220600A REV A PWA MOTHER/POWER SUPPLY 1121A (A10) (Figure 6-22)**  
**MODEL: 1121A**

| REF.<br>DESIG.   | DESCRIPTION                             | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|------------------|-----------------------------------------|--------------|--------------------|-----|--------------------|
| C1-2             | CAP CER CHIP 0.1uF 20% 50V 1206         | 31433        | C1206C104M5UACTU   | 2   | 22452100A          |
| C3-4             | CAP CER CHIP 0.01uF 10% 50V 0805        | 31433        | C0805C103K5RACTU   | 2   | 22452300A          |
| C5               | CAP TANT CHIP 100uF 10% 20V SM 7343     | 31433        | T491D107K020AT     | 1   | 24001500A          |
| C6               | CAP CER CHIP 0.1uF 20% 50V 1206         | 31433        | C1206C104M5UACTU   | 1   | 22452100A          |
| C7-16            | CAP CER CHIP 0.01uF 10% 50V 0805        | 31433        | C0805C103K5RACTU   | 10  | 22452300A          |
| C17              | CAP TANT CHIP 100uF 10% 20V SM 7343     | 31433        | T491D107K020AT     | 1   | 24001500A          |
| C18-21           | CAP CER CHIP 0.01uF 10% 50V 0805        | 31433        | C0805C103K5RACTU   | 4   | 22452300A          |
| C22              | CAP CER CHIP 0.1uF 20% 50V 1206         | 31433        | C1206C104M5UACTU   | 1   | 22452100A          |
| C23              | CAP CER CHIP 0.22uF 10% 100V 0805       | 31433        | C0805C224K1RACTU   | 1   | 20900800A          |
| C24              | CAP CER CHIP 0.1uF 20% 50V 1206         | 31433        | C1206C104M5UACTU   | 1   | 22452100A          |
| C102-104         | CAP CER CHIP 0.01uF 10% 50V 0805        | 31433        | C0805C103K5RACTU   | 3   | 22452300A          |
| C105             | CAP EL 6800uF 20% 50V                   | 54473        | ECE-S1HG682U       | 1   | 28338400A          |
| C106             | CAP CER CHIP 0.1uF 20% 50V 1206         | 31433        | C1206C104M5UACTU   | 1   | 22452100A          |
| C107             | CAP EL 6800uF 20% 50V                   | 54473        | ECE-S1HG682U       | 1   | 28338400A          |
| C108             | CAP CER CHIP 0.1uF 20% 50V 1206         | 31433        | C1206C104M5UACTU   | 1   | 22452100A          |
| C109             | CAP EL 6800uF 20% 50V                   | 54473        | ECE-S1HG682U       | 1   | 28338400A          |
| C110             | CAP CER CHIP 0.1uF 20% 50V 1206         | 31433        | C1206C104M5UACTU   | 1   | 22452100A          |
| C111             | CAP EL 4700uF 20% 16V                   | 55680        | UVX1C472MHA        | 1   | 283352000          |
| C112             | CAP CER CHIP 0.1uF 20% 50V 1206         | 31433        | C1206C104M5UACTU   | 1   | 22452100A          |
| C113             | CAP EL 6800uF 20% 50V                   | 54473        | ECE-S1HG682U       | 1   | 28338400A          |
| C114             | CAP CER CHIP 0.1uF 20% 50V 1206         | 31433        | C1206C104M5UACTU   | 1   | 22452100A          |
| C115             | CAP EL 6800uF 20% 50V                   | 54473        | ECE-S1HG682U       | 1   | 28338400A          |
| C117             | CAP ELEC 100uF 20% 25V SM SIZE F        | 54473        | ECEV1EA101P        | 1   | 28339300A          |
| C119             | CAP TANT CHIP 10uF 20% 35V 7343-73      | 04222        | TPSE106M035R0200   | 1   | 28341800A          |
| C122             | CAP CER CHIP 0.1uF 10% 50V 0805         | 31433        | C0805C104K5RAC     | 1   | 20900500A          |
| C123             | CAP EL 2200uF 20% 35V                   | 90201        | TKR222M1VK32V      | 1   | 283351000          |
| C124-125         | CAP CER CHIP 0.1uF 20% 50V 1206         | 31433        | C1206C104M5UACTU   | 2   | 22452100A          |
| C126-128         | CAP TANT CHIP 10uF 20% 35V 7343-73      | 04222        | TPSE106M035R0200   | 3   | 28341800A          |
| C129             | CAP ELEC 100uF 20% 25V SM SIZE F        | 54473        | ECEV1EA101P        | 1   | 28339300A          |
| C130-132         | CAP TANT CHIP 10uF 20% 35V 7343-73      | 04222        | TPSE106M035R0200   | 3   | 28341800A          |
| C135-137         | CAP CER CHIP 0.1uF 10% 50V 0805         | 31433        | C0805C104K5RAC     | 3   | 20900500A          |
| CR1              | DIODE SCHOTTKY BARRIER IN6263W SOD-123  | 12060        | 1N6263W-7-F        | 1   | 53101900A          |
| CR2-3            | DIODE MMBD914 SOT-23                    | 1MQ07        | MMBD914LT1G        | 2   | 53100000A          |
| CR4              | DIODE SCHOTTKY BARRIER IN6263W SOD-123  | 12060        | 1N6263W-7-F        | 1   | 53101900A          |
| CR5-9            | DIODE MMBD914 SOT-23                    | 1MQ07        | MMBD914LT1G        | 5   | 53100000A          |
| CR102-104        | DIODE BRIDGE RS-401S FWLD-50            | 11961        | FWLD-50            | 3   | 532028000          |
| CR105-108        | DIODE ES1A 1A 50PIV SMA/DO-214AC        | 07263        | ES1A               | 4   | 53102000A          |
| CR109            | DIODE ZENER 12V 5% MMSZ5242B SOD-123    | 1MQ07        | MMSZ5242BT1G       | 1   | 53102100A          |
| CR110            | DIODE ES1A 1A 50PIV SMA/DO-214AC        | 07263        | ES1A               | 1   | 53102000A          |
| CR111            | DIODE ZENER 12V 5% MMSZ5242B SOD-123    | 1MQ07        | MMSZ5242BT1G       | 1   | 53102100A          |
| CR112, CR114     | DIODE ES1A 1A 50PIV SMA/DO-214AC        | 07263        | ES1A               | 2   | 53102000A          |
| CR115            | DIODE ZENER 12V 5% MMSZ5242B SOD-123    | 1MQ07        | MMSZ5242BT1G       | 1   | 53102100A          |
| CR116            | DIODE ES1A 1A 50PIV SMA/DO-214AC        | 07263        | ES1A               | 1   | 53102000A          |
| CR117            | DIODE ZENER 12V 5% MMSZ5242B SOD-123    | 1MQ07        | MMSZ5242BT1G       | 1   | 53102100A          |
| CR119-120        | DIODE ES1A 1A 50PIV SMA/DO-214AC        | 07263        | ES1A               | 2   | 53102000A          |
| CR122-124        | DIODE ES1A 1A 50PIV SMA/DO-214AC        | 07263        | ES1A               | 3   | 53102000A          |
| FH1-2            | FUSE HOLDER PWB VERT MOUNT MICRO FUSE   | 75915        | 281005             | 2   | 48211801A          |
| J25              | CONN M 3 PIN POLARIZED HEADER .156 SP   | 00779        | 3-641208-3         | 1   | 477343000          |
| J26-28, J58-59   | CONNECTOR""SMB" M 50 OHM STRAIGHT       | 95077        | 2385-0001          | 5   | 477317000          |
| J115, J118, J120 | CONN M 3 PIN POLARIZED HEADER .156 SP   | 00779        | 3-641208-3         | 3   | 477343000          |
| J117, J121       | CONN M 2 PIN POLARIZED HEADER .156 SP   | 00779        | 3-641208-2         | 2   | 477342000          |
| K1-2             | RELAY DPDT 2 FORM C 12V DC              | 8Z697        | DS2E-M-DC12V       | 2   | 47105700A          |
| K3 -5            | RELAY FORM A 12V HEAVY DUTY             | 61725        | JY-12H-K           | 3   | 47105800A          |
| L1               | INDUCTOR 5.6uH 10%                      | 24226        | 15M561K            | 1   | 400308000          |
| Q1-Q7            | TRANSISTOR NPN 3904 SOT-23              | 1MQ07        | MMBT3904TT1G       | 7   | 52817800A          |
| Q8               | TRANS SILICONE PWR MJD44H11 8A 80V DPAK | 1MQ07        | MJD44H11G          | 1   | 52902200A          |
| R1               | RES CHIP 511 OHM 1% 1/4W 1206           | 4S177        | RCI-1206-5110F     | 1   | 33726800A          |

|                  |                                         |       |                   |    |           |
|------------------|-----------------------------------------|-------|-------------------|----|-----------|
| R2               | RES CHIP 2.21K 1% 1/4W 1206             | 4S177 | RCI-0805-2211F    | 1  | 31933300A |
| R3A-E, R4A-H     | RES CHIP 332 OHMS 1% 1/8W 0805          | 4S177 | RCI-0805-3320-F   | 13 | 31825000A |
| R5               | RES CHIP 475 OHM 1% 1/4W 1206           | 4S177 | RCI-1206-4750F    | 1  | 33726500A |
| R6               | RES VAR CHIP 1K 10% 0.5W CERMET SM      | 32997 | 3314J-1-102       | 1  | 32300300A |
| R8,R101-102,R107 | RES CHIP 1K 1% 100PPM 1/4W 1206         | 4S177 | RCI-1206-1001F    | 4  | 33730000A |
| R9               | RES CHIP 332 OHM 1% 1/4W 1206           | 4S177 | RCI-1206-3320F    | 1  | 33725000A |
| R10              | RES CHIP 511 OHM 1% 1/4W 1206           | 4S177 | RCI-1206-5110F    | 1  | 33726800A |
| R12              | RES MF 200 OHM 0.1% 1/2W                | 91637 | CMF-65-200R0-B-T9 | 1  | 32677600A |
| R13              | RES CHIP 2.0K 1% 1/4W 1206              | 4S177 | RCI-1206-2001F    | 1  | 33732900A |
| R15              | RES MF 450.0 OHM 0.1% 1/2W              | 91637 | CMF-65-450R0-B-T9 | 1  | 32677300A |
| R16              | RES CHIP 2.0K 1% 1/4W 1206              | 4S177 | RCI-1206-2001F    | 1  | 33732900A |
| R17              | RES MF 55.5 OHM 0.1% 1W                 | 91637 | CMF-70-55R50-B-T9 | 1  | 32677100A |
| R18              | RES MF 100.0 OHM 0.1% 1W                | 91637 | CMF-65-100R0-B-T9 | 1  | 32677200A |
| R19-R20          | RES CHIP 2.0K 1% 1/4W 1206              | 4S177 | RCI-1206-2001F    | 2  | 33732900A |
| R21              | RES CHIP 100 OHM 1% 1/4W 1206           | 4S177 | RCI-1206-1000F    | 1  | 33720000A |
| R22              | RES MF 450.0 OHM 0.1% 1/2W              | 91637 | CMF-65-450R0-B-T9 | 1  | 32677300A |
| R23              | RES CHIP 2.0K 1% 1/4W 1206              | 4S177 | RCI-1206-2001F    | 1  | 33732900A |
| R24-25           | RES CHIP 100 OHM 1% 1/4W 1206           | 4S177 | RCI-1206-1000F    | 2  | 33720000A |
| R26              | RES MF 100.0 OHM 0.1% 1W                | 91637 | CMF-65-100R0-B-T9 | 1  | 32677200A |
| R27              | RES CHIP 2.74K 1% 1/4W 1206             | 4S177 | RCI-1206-2741F    | 1  | 31934200A |
| R28              | RES CHIP 3.09K 1% 1/4W 1206             | 4S177 | RCI-1206-3091F    | 1  | 31934700A |
| R29              | RES MF 100.0 OHM 0.1% 1W                | 91637 | CMF-65-100R0-B-T9 | 1  | 32677200A |
| R103             | RES CHIP 100K 1% 1/4W 1206              | 4S177 | RCI-1206-1003     | 1  | 31950000A |
| R104             | RES CHIP 10.0K 1% 1/4W 1206             | 4S177 | RCI-1206-1002     | 1  | 31940000A |
| R105             | RES CHIP 3.01K 1% 1/4W 1206             | 4S177 | RCI-1206-3011     | 1  | 31934600A |
| R106             | RES CHIP 100 OHM 1% 1/4W 1206           | 4S177 | RCI-1206-1000F    | 1  | 33720000A |
| R108             | RES CHIP 100K 1% 1/4W 1206              | 4S177 | RCI-1206-1003     | 1  | 31950000A |
| R109             | RES NETWORK 10K 0.1% 1.5W SOIC-16       | 54789 | NOMCT16031002A    | 1  | 34600500A |
| R110             | RES CHIP 301 OHM 1% 100PPM 1206         | 4S177 | RCI-1206-3010F    | 1  | 33724600A |
| R111             | RES NETWORK 10K 0.1% 1.5W SOIC-16       | 54789 | NOMCT16031002A    | 1  | 34600500A |
| R112-114         | RES CHIP 301 OHM 1% 100PPM 1206         | 4S177 | RCI-1206-3010F    | 3  | 33724600A |
| U1               | IC SN74LS138 DECODER/MPX SOIC-16        | 01295 | SN74LS138D        | 1  | 53704000A |
| U2               | IC SN74LS541 OCTAL BUFFER SOIC-20       | 01295 | SN74LS541DW       | 1  | 53703900A |
| U3               | IC SN74LS138 DECODER/MPX SOIC-16        | 01295 | SN74LS138D        | 1  | 53704000A |
| U4-17            | IC HCPL-0601 OPTOCOUPLER SINGLE CHANNEL | 28480 | HCPL-0601         | 14 | 53900700A |
| U18              | IC SN74LS541 OCTAL BUFFER SOIC-20       | 01295 | SN74LS541DW       | 1  | 53703900A |
| U101             | IC MC78L05 100mA VOLTAGE REGULATOR      | 1MQ07 | MC78L05ABDG       | 1  | 53805100A |
| U102             | IC LM339 QUAD COMPARATOR 14-SOP         | 07263 | LM339M            | 1  | 53805200A |
| U103, U109       | IC TL072A LOW NOISE OP AMP SOIC-8       | 01295 | TL072ACD          | 2  | 53805000A |
| U111-112         | IC REF01 VOLTAGE REFERENCE 10V SOIC-8   | 51640 | REF01CSZ          | 2  | 53804900A |
| W18              | CABLE ASSY WIRE 24GA 3C 2.75L           | 04901 | 57120309A         | 1  | 57120309A |
| W36              | CABLE ASSY WIRE 22GA 2C 6.50L           | 04901 | 571206000         | 1  | 571206000 |
| W41              | CABLE ASSY WIRE 24GA 3C 2.75L           | 04901 | 57120310A         | 1  | 57120310A |
| W40              | CABLE ASSY WIRE 24GA 3C 2.75L           | 04901 | 57120311A         | 1  | 57120311A |
| W42              | CABLE ASSY WIRE 24GA 3C 2.75L           | 04901 | 57120312A         | 1  | 57120312A |
| W44              | CABLE ASSY WIRE 24GA 3C 2.75L           | 04901 | 57120313A         | 1  | 57120313A |
| W45              | CABLE ASSY WIRE 24GA 3C 2.75L           | 01901 | 57120314A         | 1  | 57120314A |
| XA0-7            | CONN F 36 PIN DUAL ROW CARD EDGE        | 54453 | EBM36DRTH         | 8  | 49301336A |

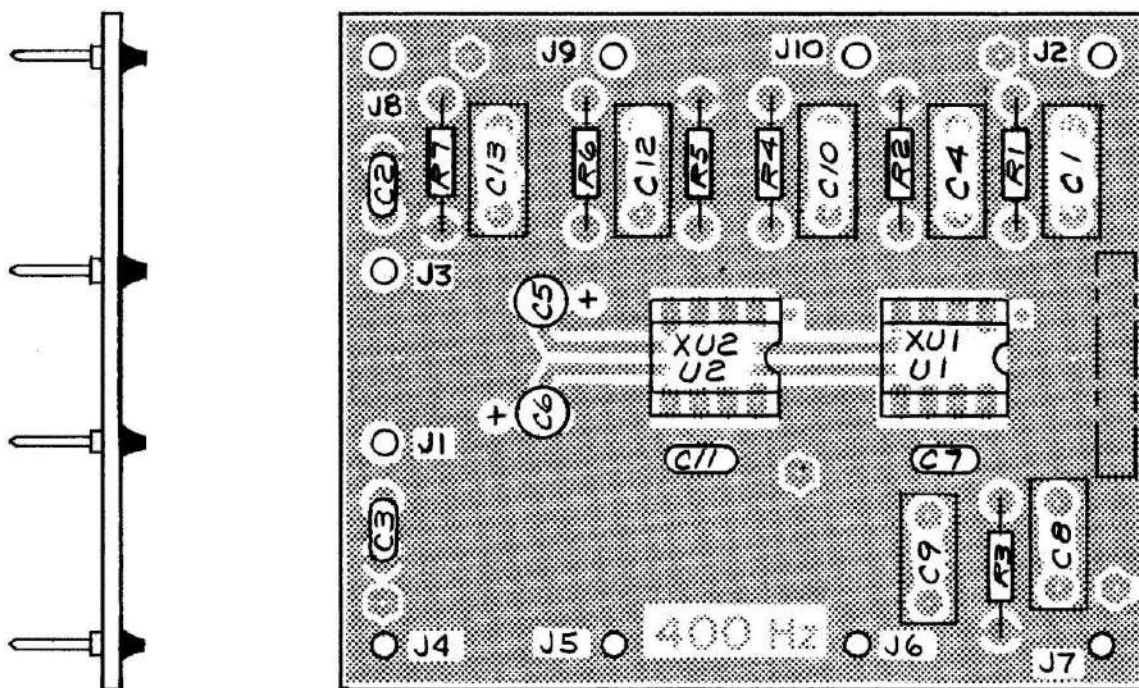


Figure 6-22. PWA 400 Hz High Pass Filter

**11203800A REV B PWA 400Hz HIGH PASS FILTER (Figure 6-23)**  
**MODEL: 1121**

| REF.<br>DESIG. | DESCRIPTION                    | CAGE<br>CODE | MFG PART<br>NUMBER | QTY | BEC PART<br>NUMBER |
|----------------|--------------------------------|--------------|--------------------|-----|--------------------|
| C7,11          | CAP MICA 20pF 5% 300V          | 14655        | CD5CC200J          | 2   | 205017000          |
| C2,3           | CAP CER 0.1uF 20% 50V          | 04222        | SR215E104MAA       | 2   | 224268000          |
| C1,4,8-10      | CAP MPC 0.022uF 2% 50V         | 14752        | 652A-1-A2236       | 5   | 234166000          |
| C12-13         | CAP MPC 0.033uF 2% 50V         | 27735        | MPC-53-.033-50-2   | 2   | 23417600A          |
| C5-6           | CAP EL 10uF 20% 25V            | 54217        | SM-25-VB-10-M      | 2   | 283336000          |
| R6             | RES MF 1.10K 1% 1/4W           | 19701        | 5043ED1K100F       | 1   | 341304000          |
| R4             | RES MF 4.32K 1% 1/4W           | 19701        | 5043ED4K320F       | 1   | 341361000          |
| R1             | RES MF 4.75K 1% 1/4W           | 19701        | 5043ED4K750F       | 1   | 341365000          |
| R3             | RES MF 6.19K 1% 1/4W           | 19701        | 5043ED6K190F       | 1   | 341376000          |
| R5             | RES MF 28.7K 1% 1/4W           | 19701        | 5043ED28K70F       | 1   | 341444000          |
| R2             | RES MF 45.3K 1% 1/4W           | 19701        | 5043ED45K30F       | 1   | 341463000          |
| R7             | RES MF 121K 1% 1/4W            | 19701        | 5043ED121K0F       | 1   | 341508000          |
| XU1-2          | SOCKET IC 8 PIN                | 06776        | ICN-083-S3-G       | 2   | 473041000          |
| J1-10          | TERMINAL .040 OD .270 LG .062M | 18310        | 09-7148-2-035      | 10  | 510038000          |
| U1-2           | IC 5534AN OP AMP               | 18324        | NE5534AN           | 2   | 535061000          |

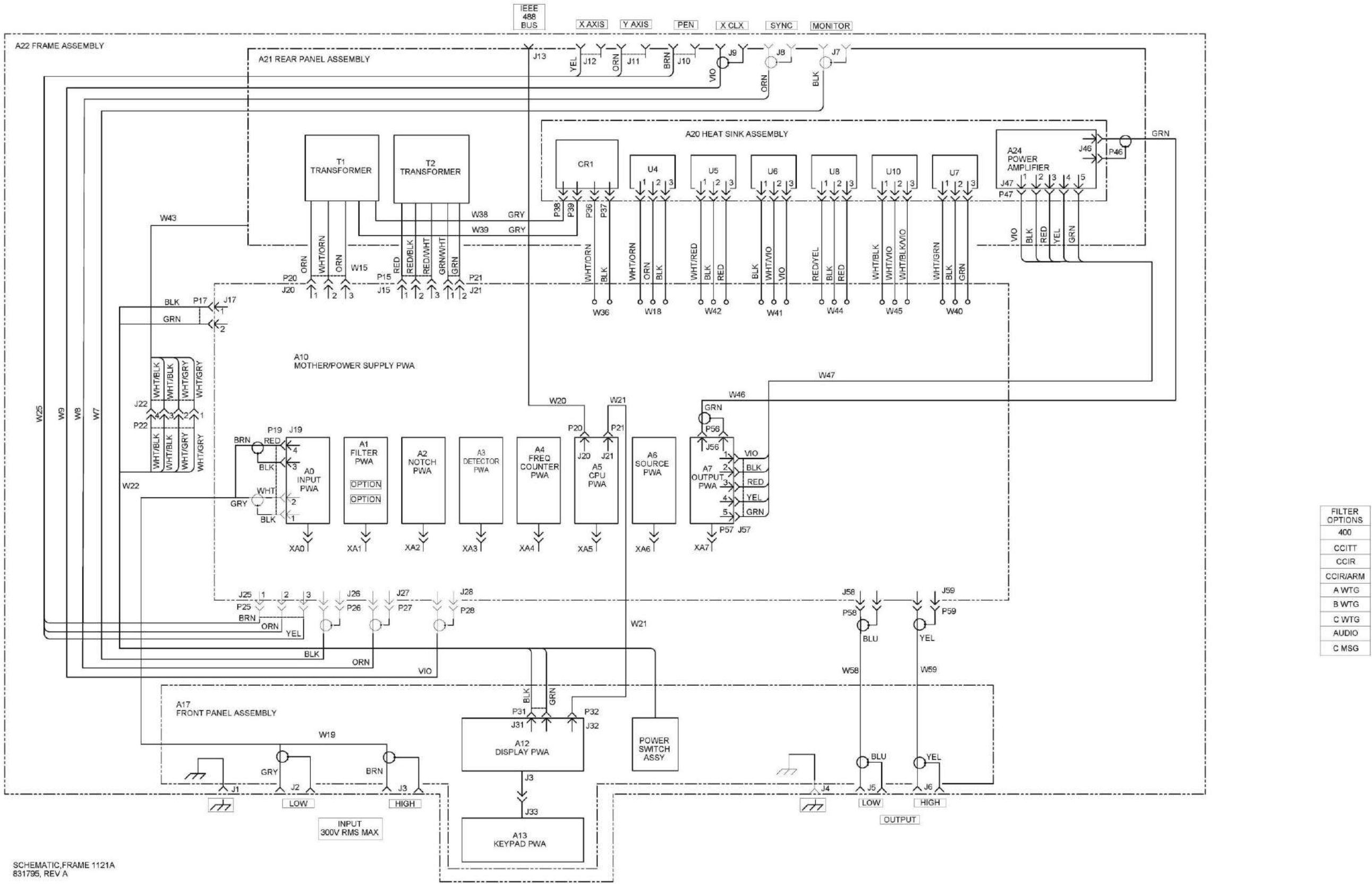
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## SECTION VII SCHEMATIC DIAGRAMS

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SCHEMATIC, FRAME 1121A  
831795, REV A

Figure 7-1. Main Frame Schematic

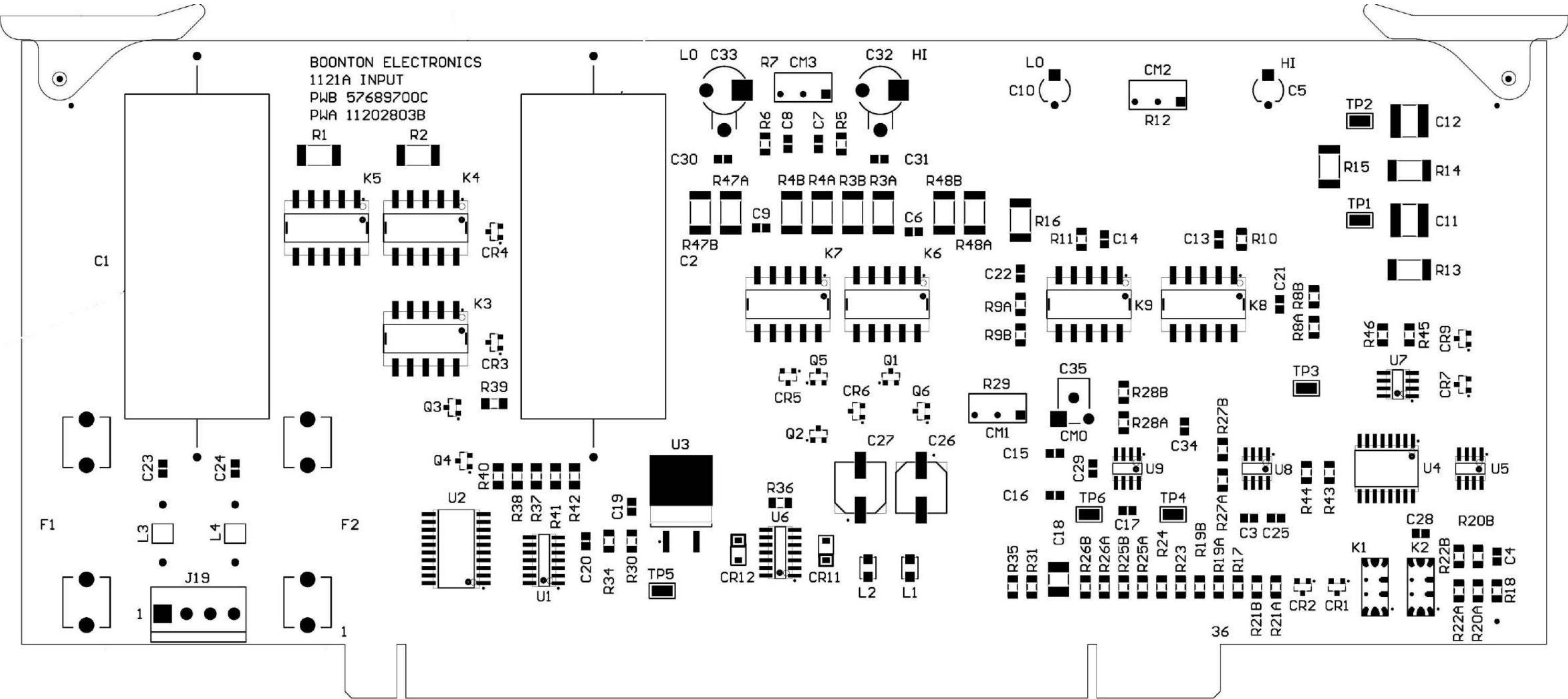
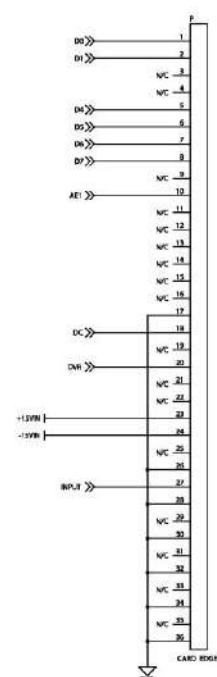


Figure 7-2. Input Board A0 Parts Location Diagram



7-5

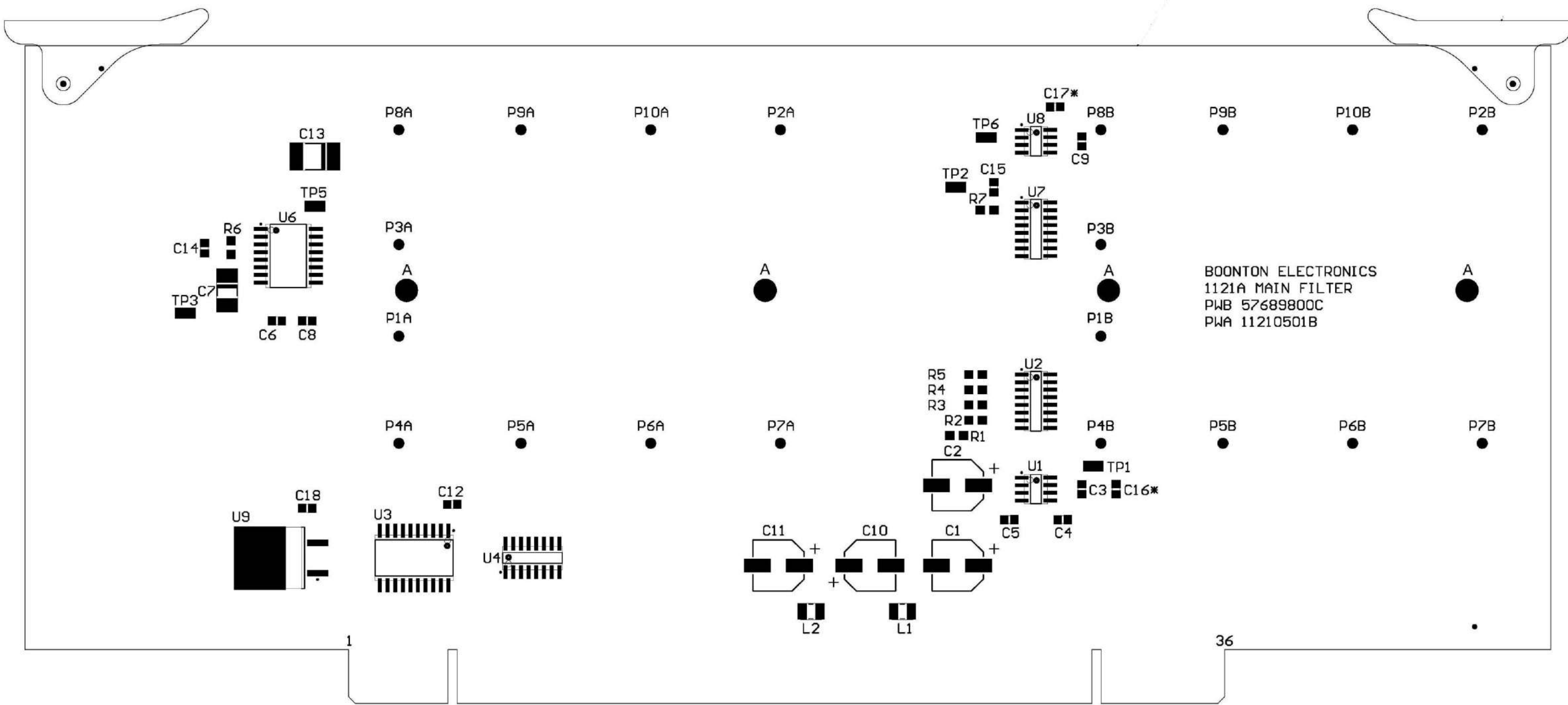


Figure 7-4. Filter Board A1 Parts Location Diagram



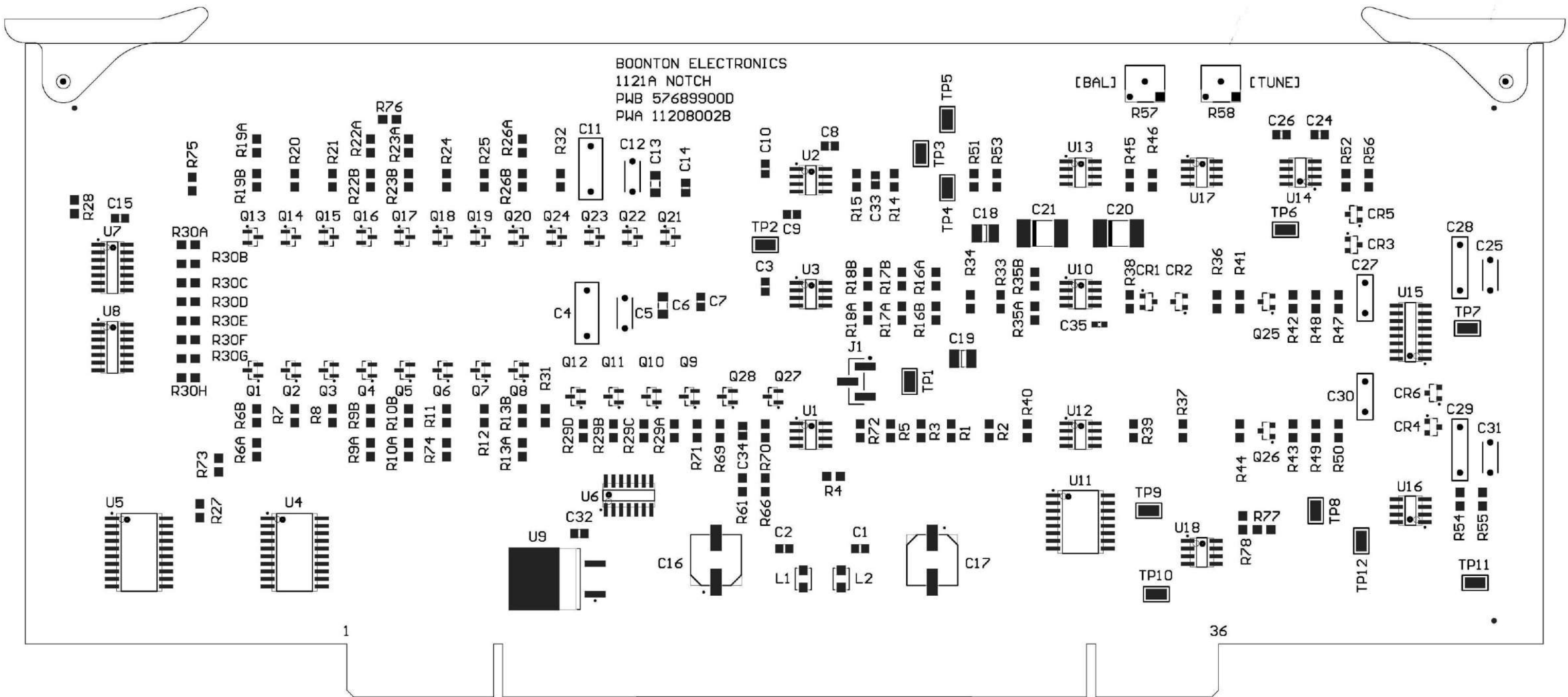


Figure 7-6. Notch Board A2 Parts Location Diagram.

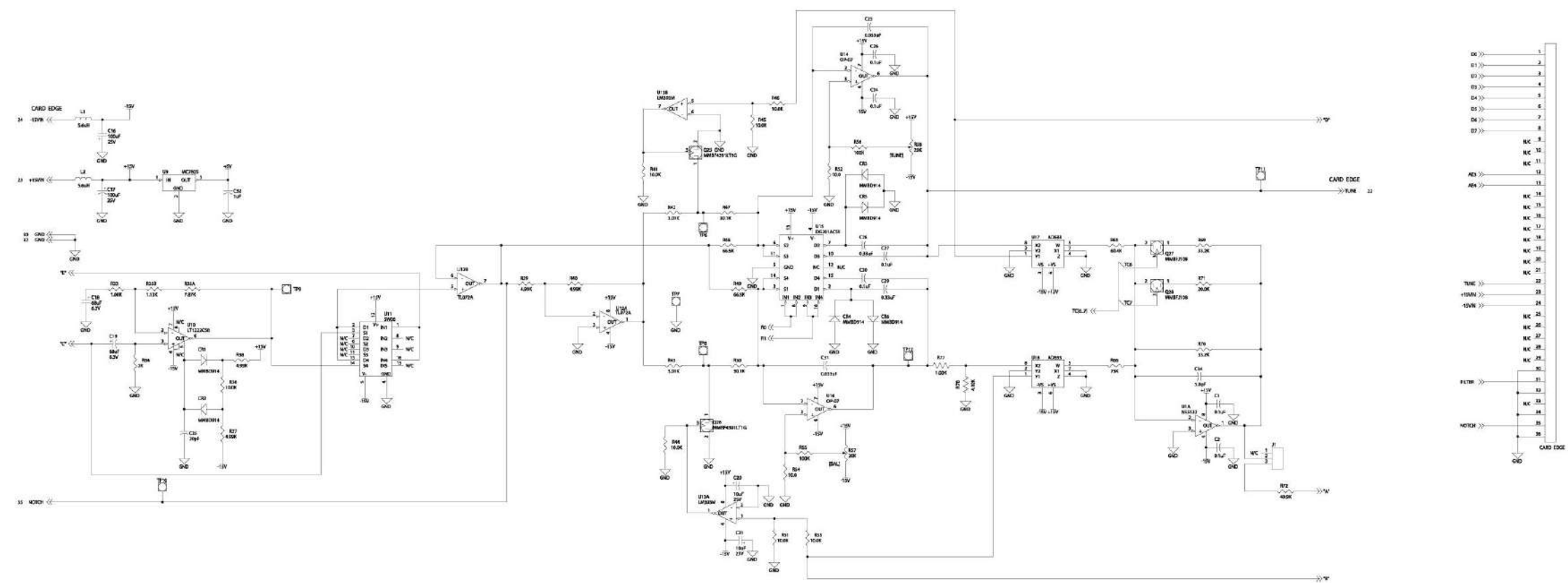
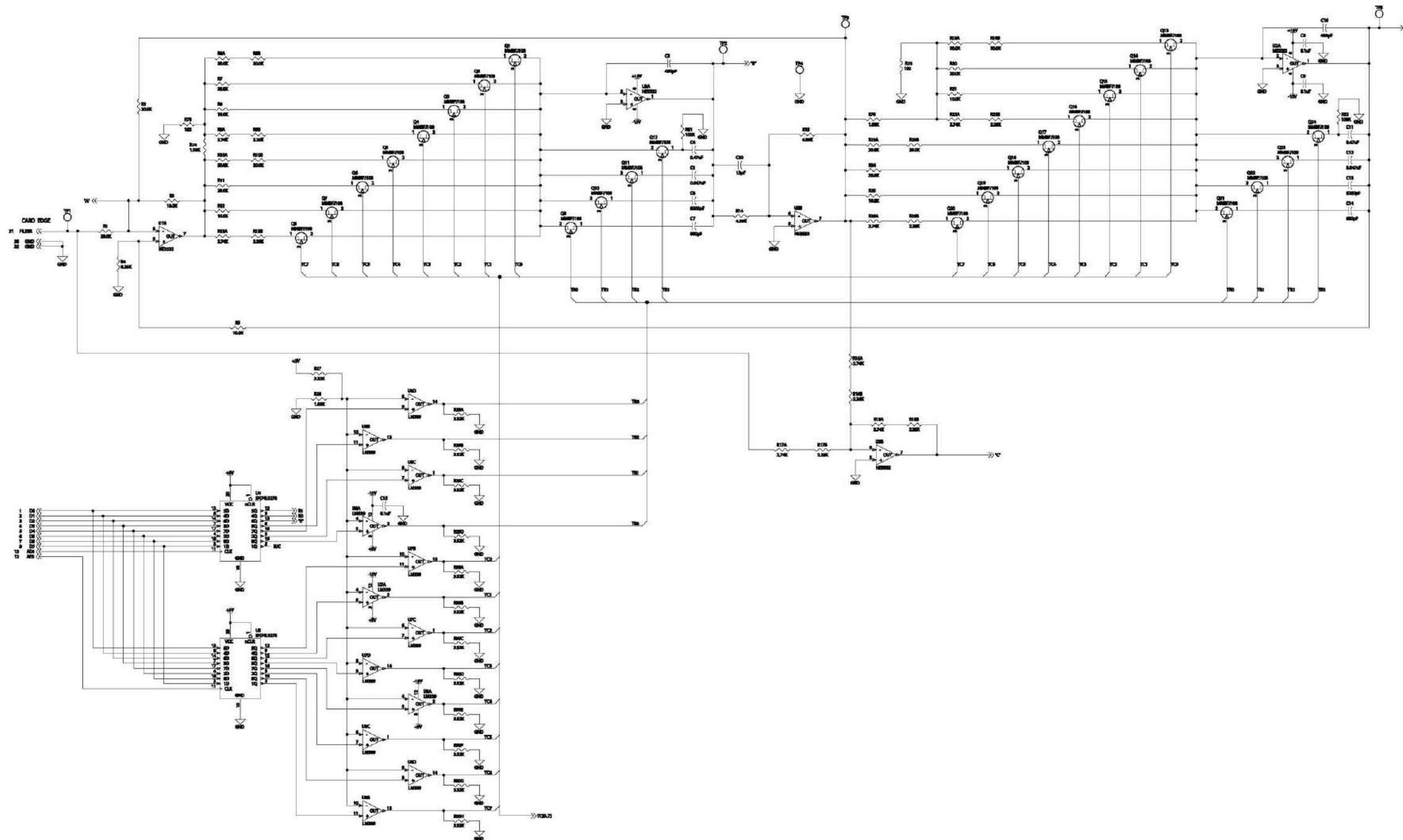


Figure 7-7. Notch Board A2.1Schematic

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**Figure 7-8. Notch Board A2.2 Schematic**

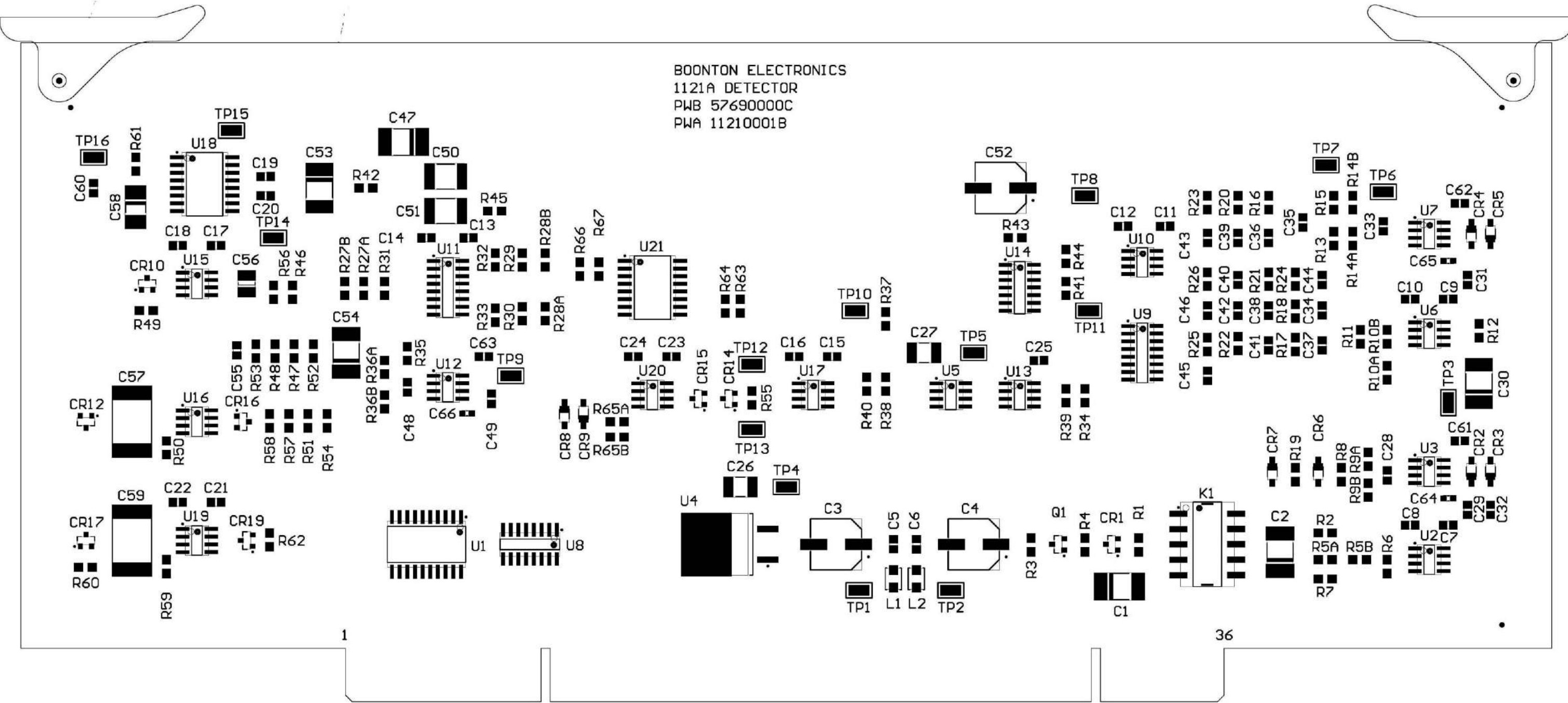


Figure 7-9. Detector Board A3 Parts Location Diagram.

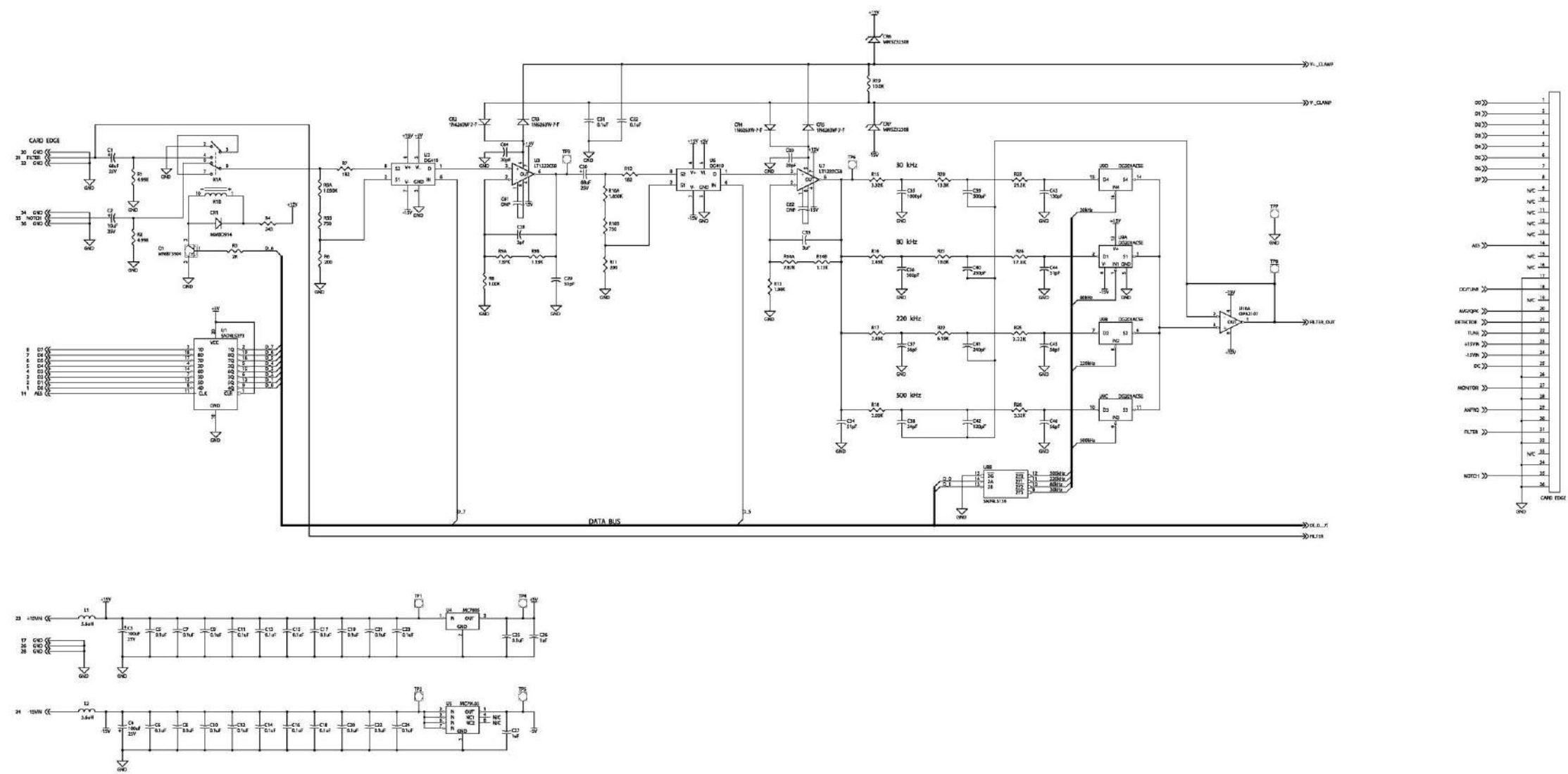
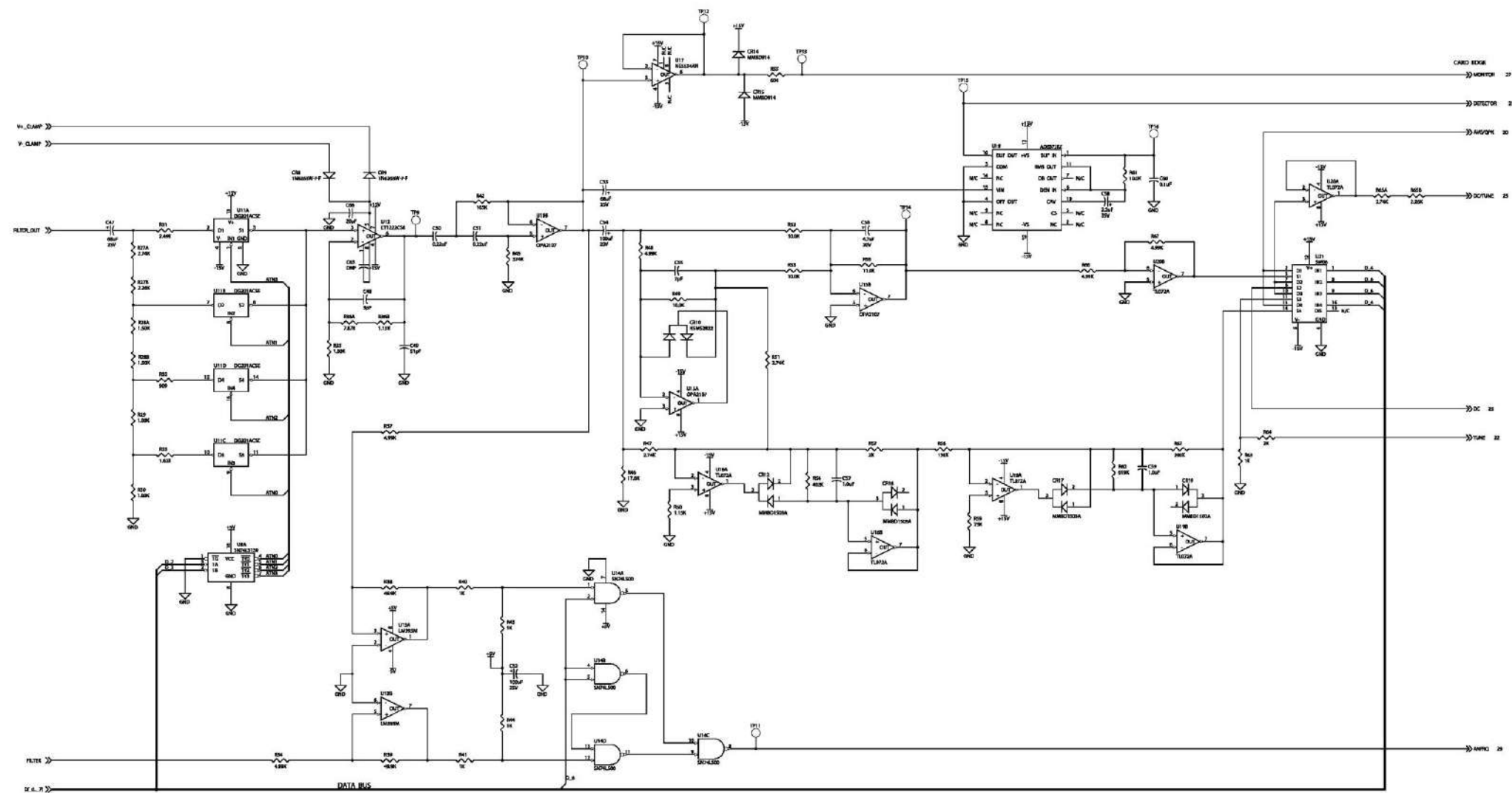


Figure 7-10. Detector Board A3.1 Schematic

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**Figure 7-11. Detector Board A3.2 Schematic.**

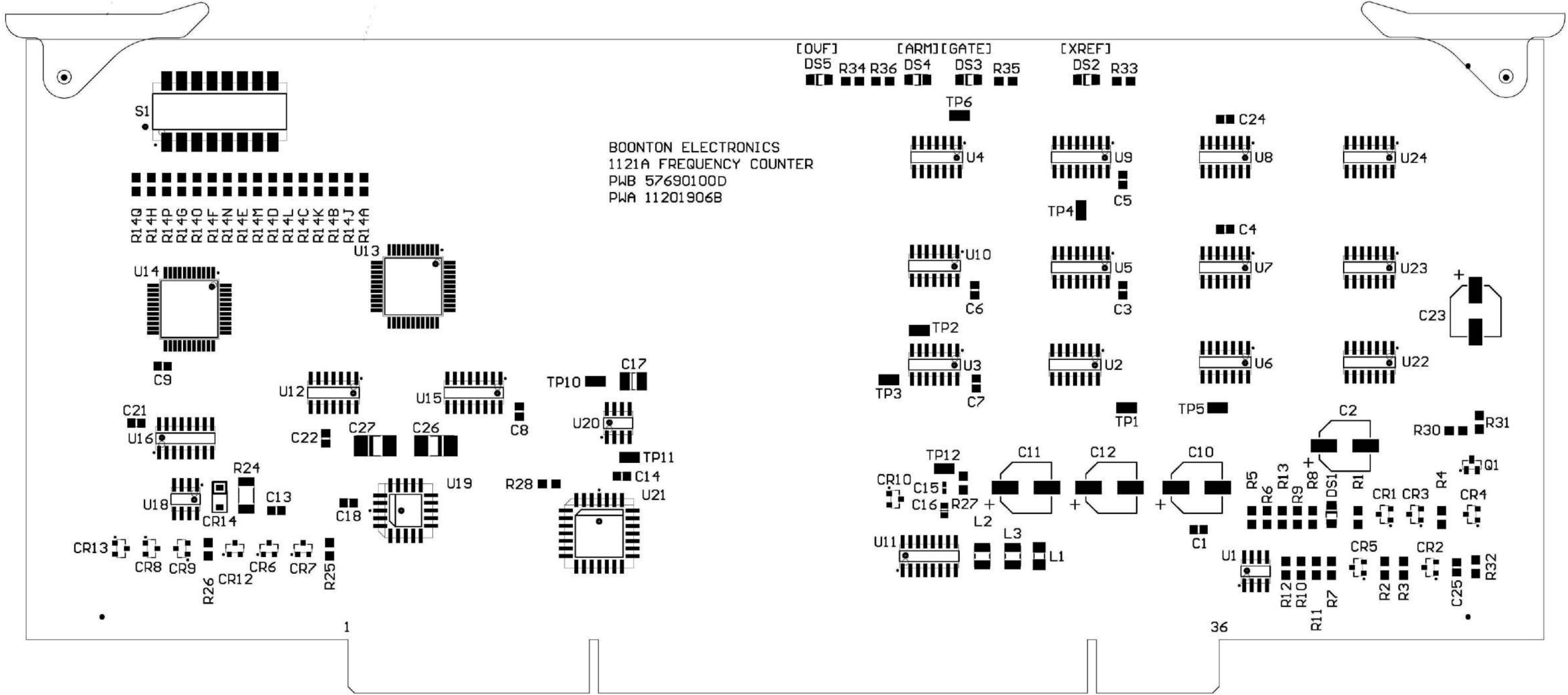


Figure 7-12. Counter Board A4 Parts Location Diagram.

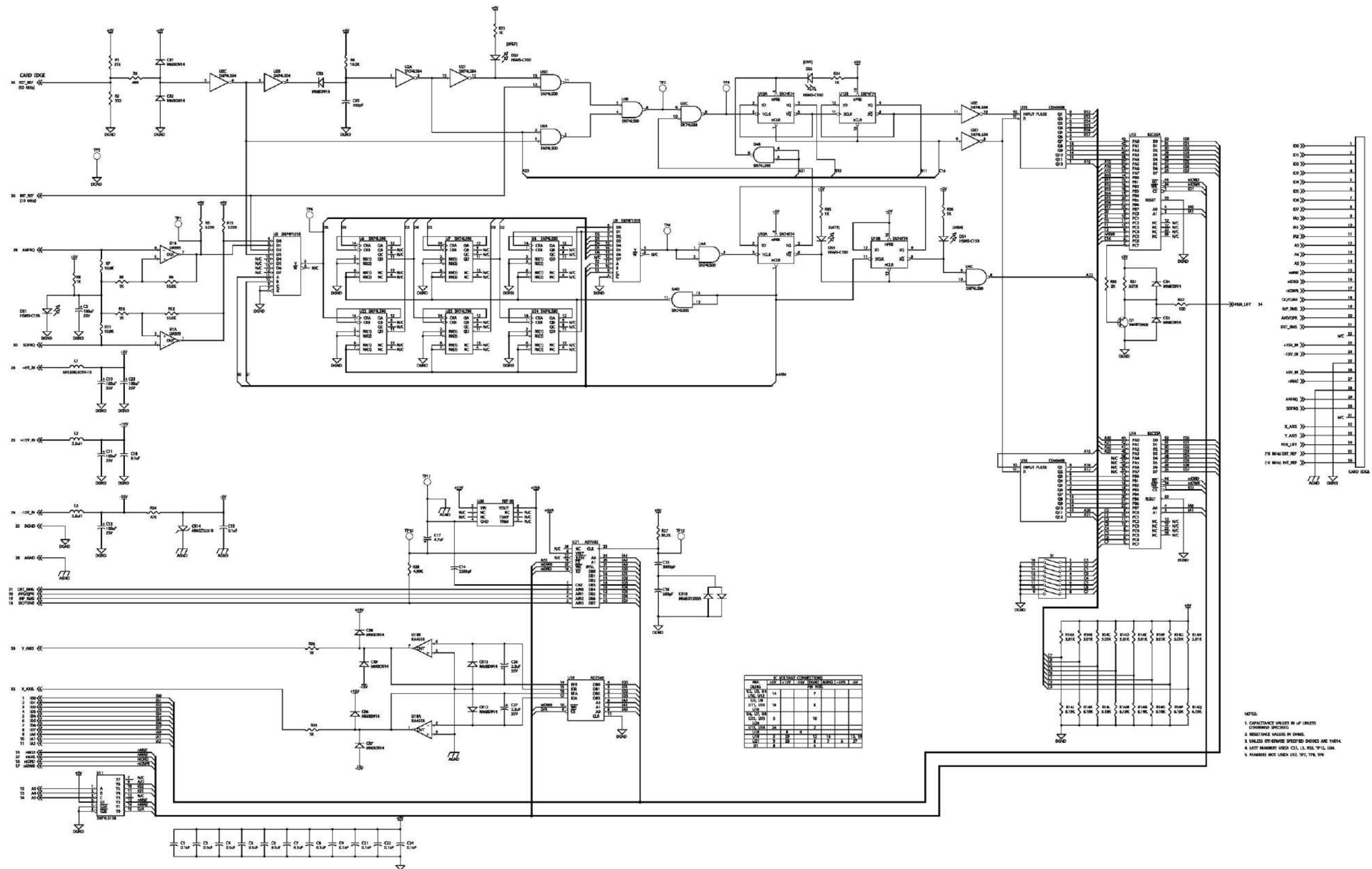


Figure 7-13. Counter Board A4 Schematic.

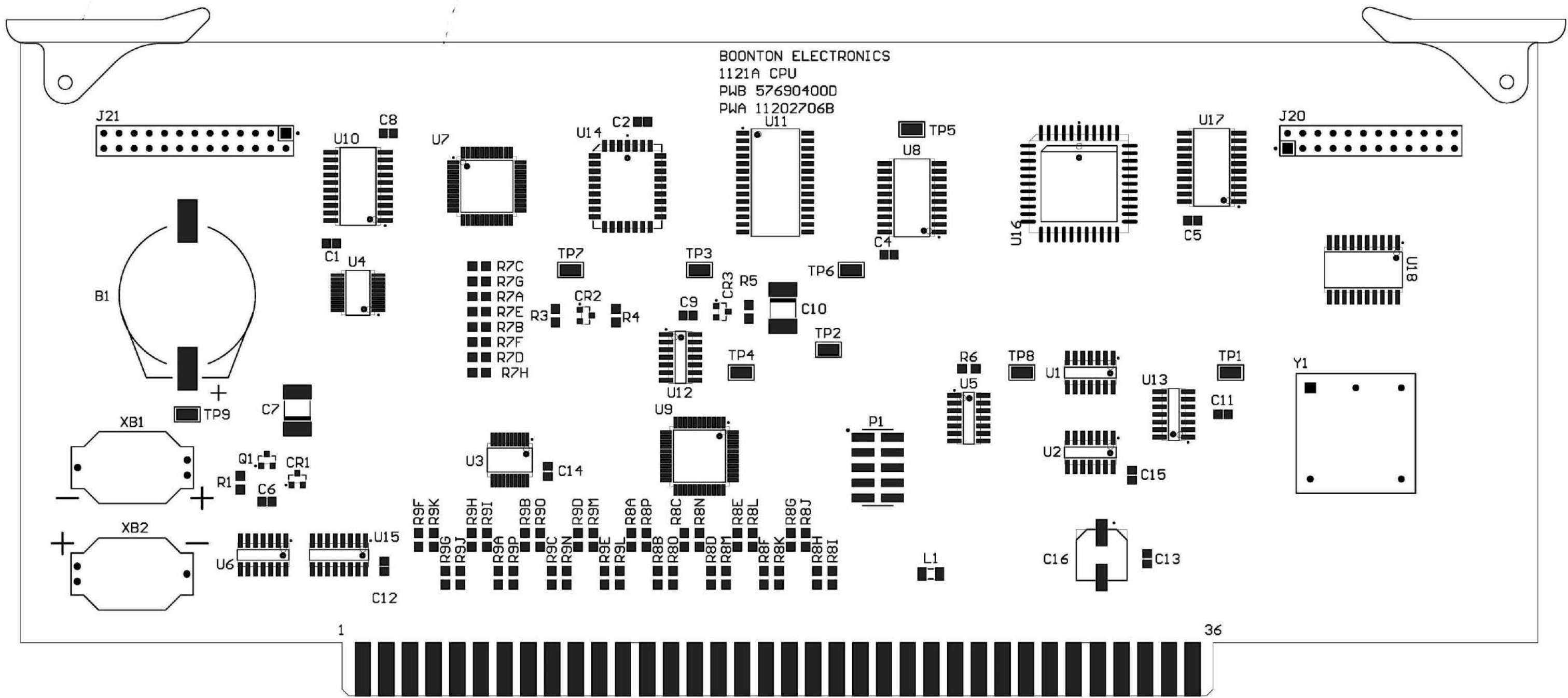


Figure 7-14. C.P.U. Board A5 Parts Location Diagram.

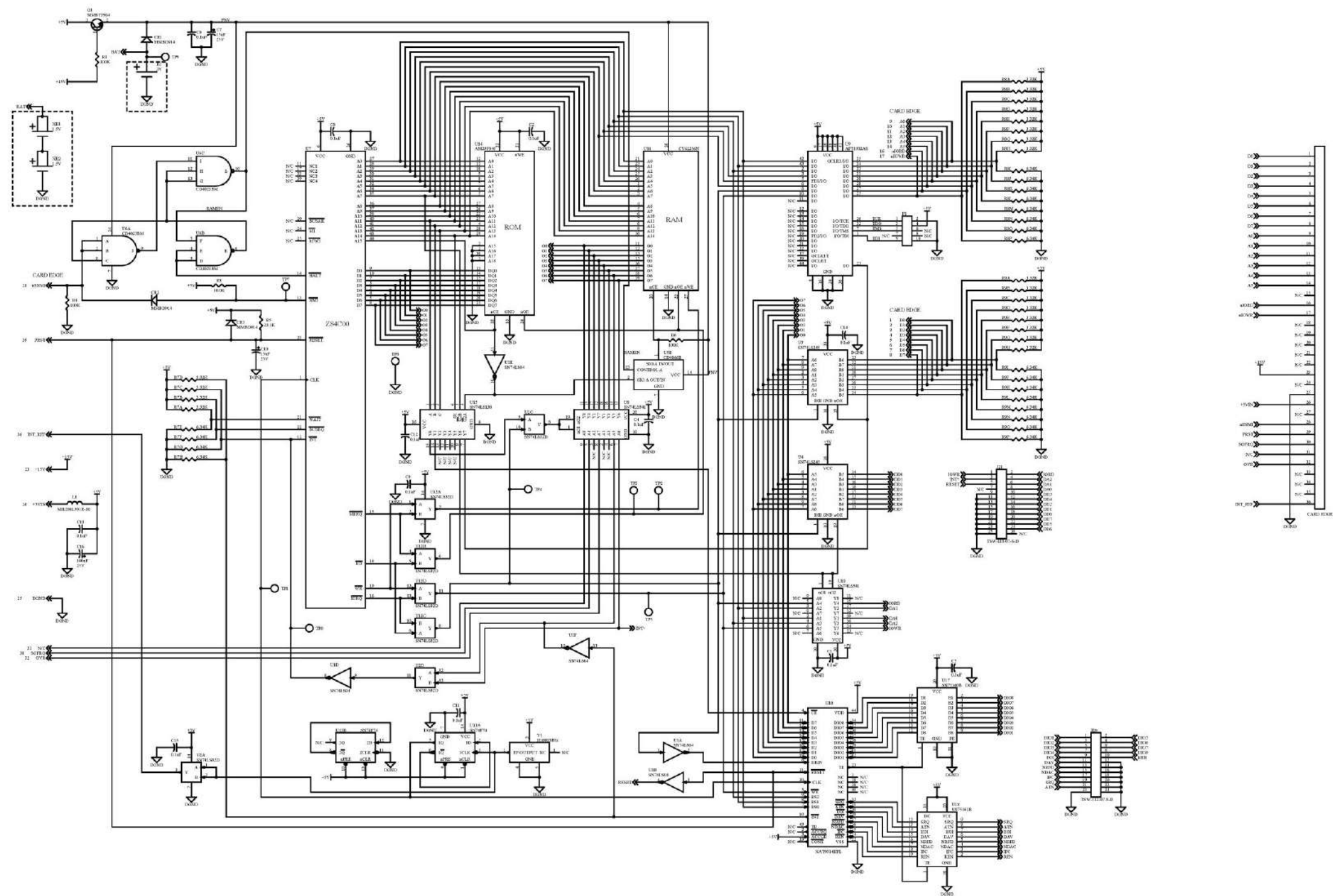


Figure 7-15. C.P.U. Board A5 Schematic.

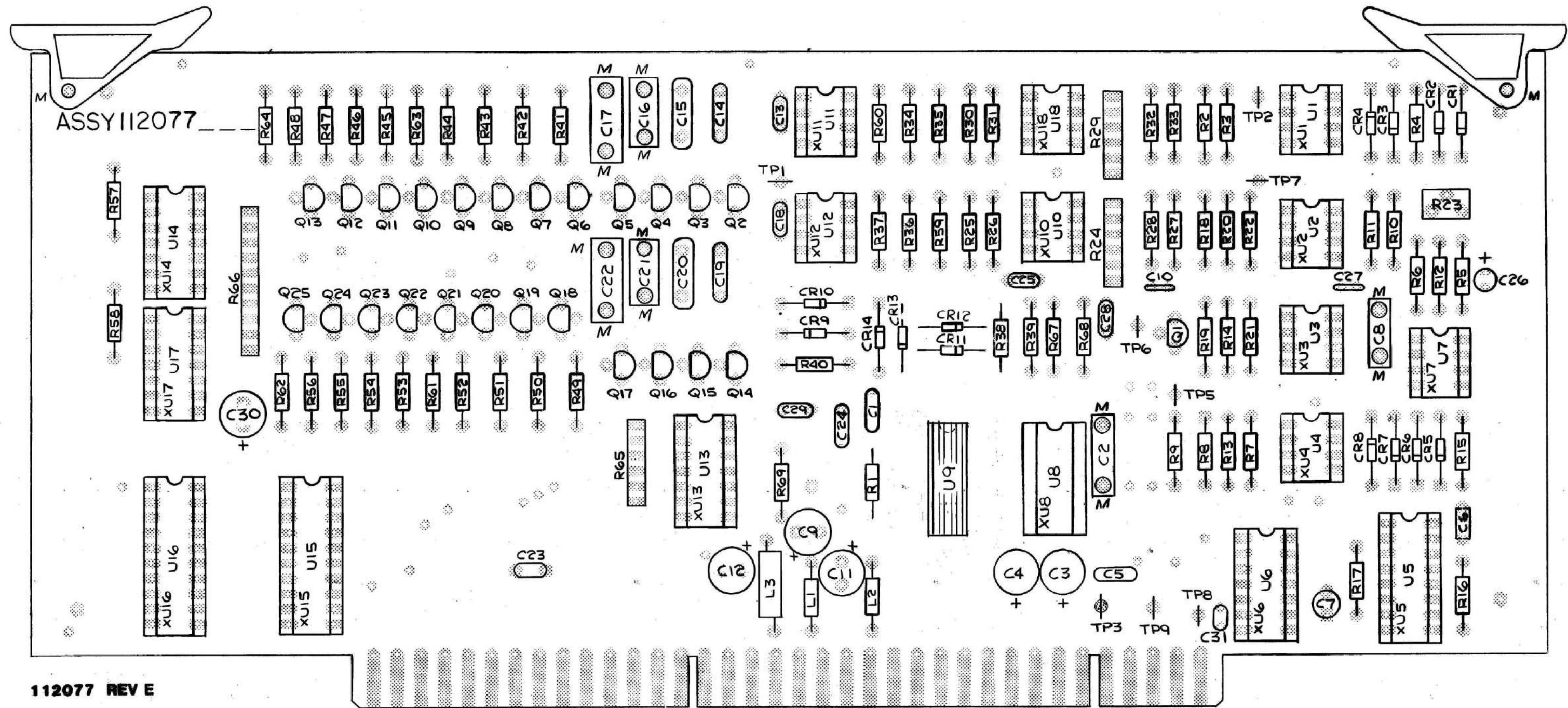


Figure 7-16. Source Board A6 Parts Location Diagram.  
7-20

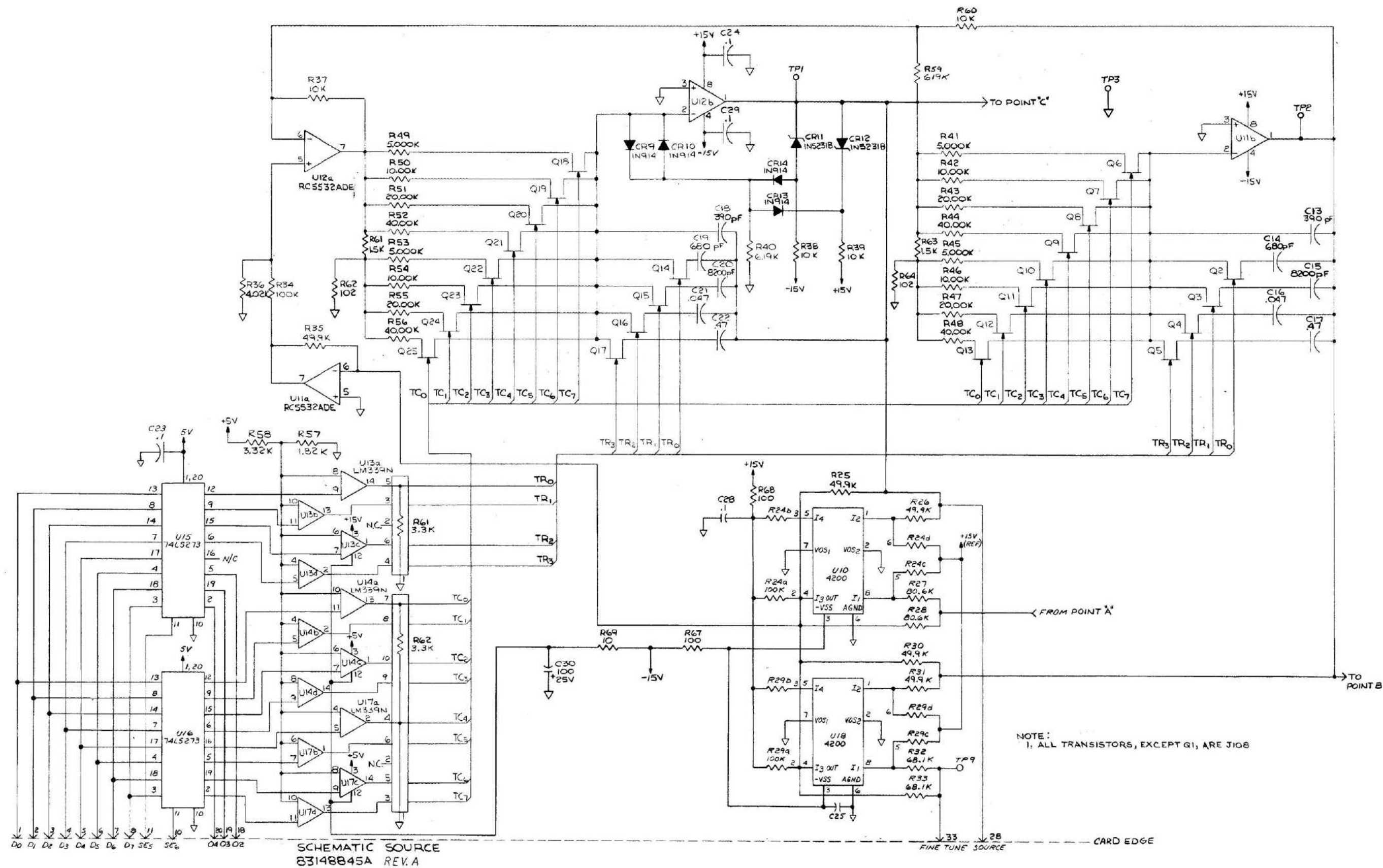


Figure 7-17. Source Board A6.1 Schematic.

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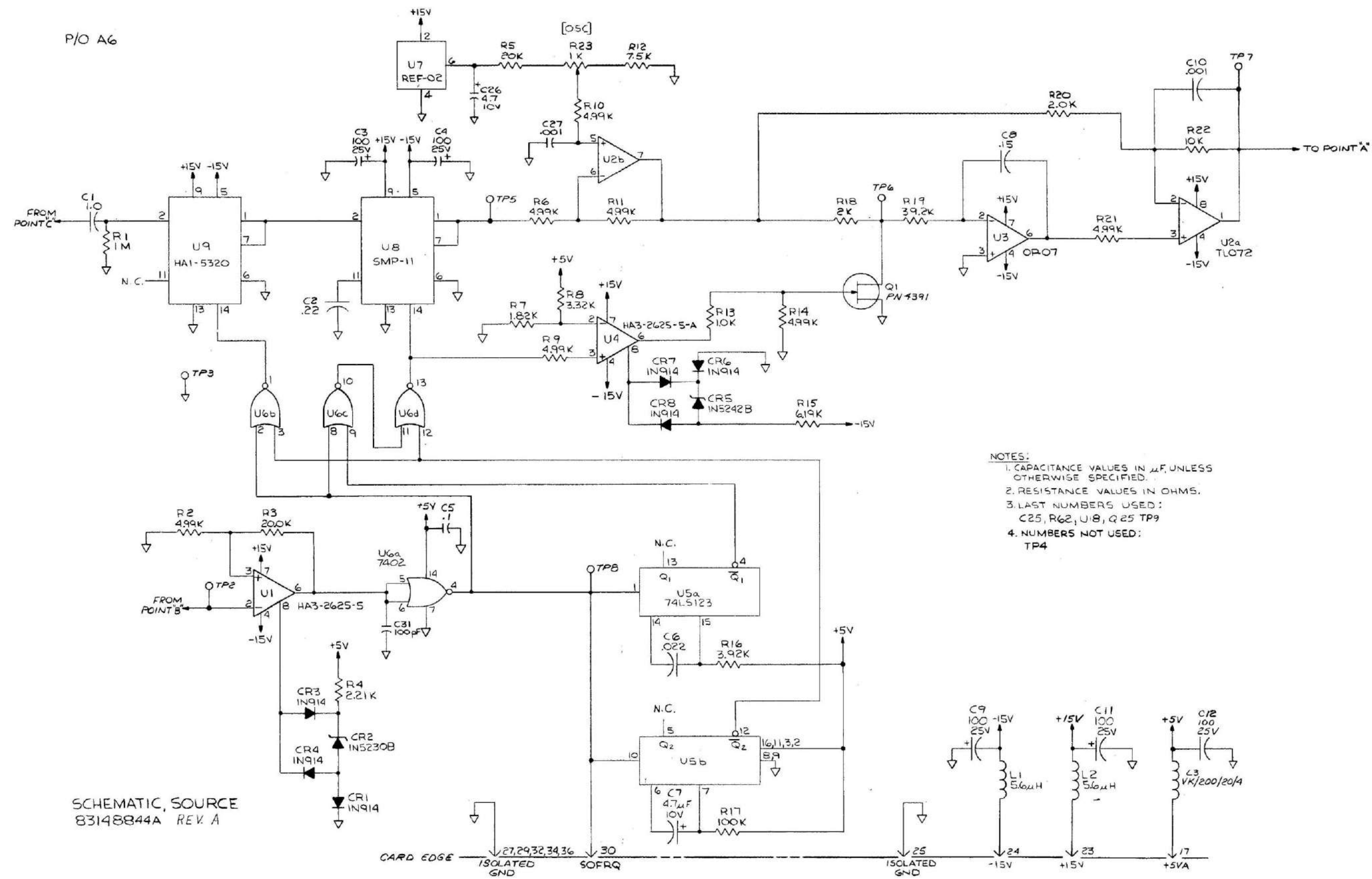


Figure 7-18. Source Board A6.2 Schematic.

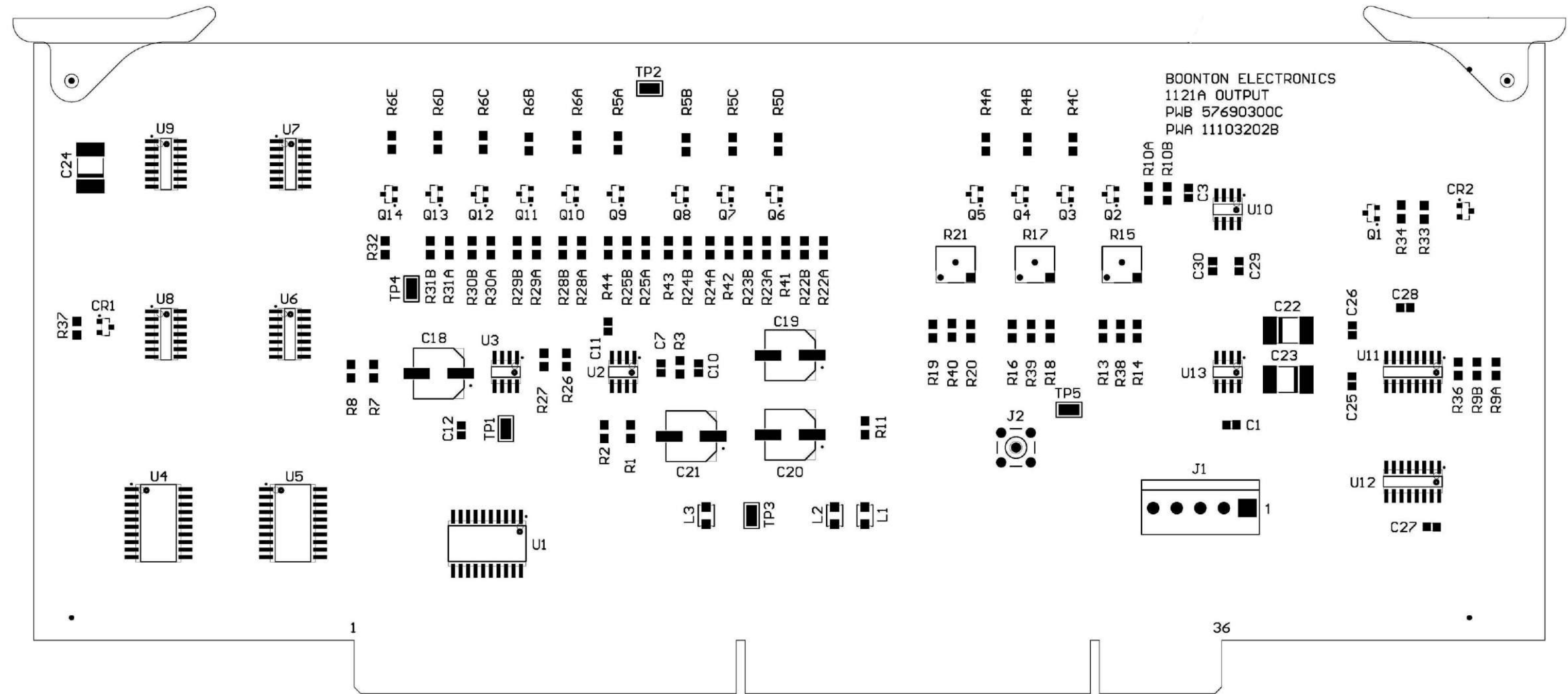


Figure 7-19. Output Board A7 Parts Location Diagram.

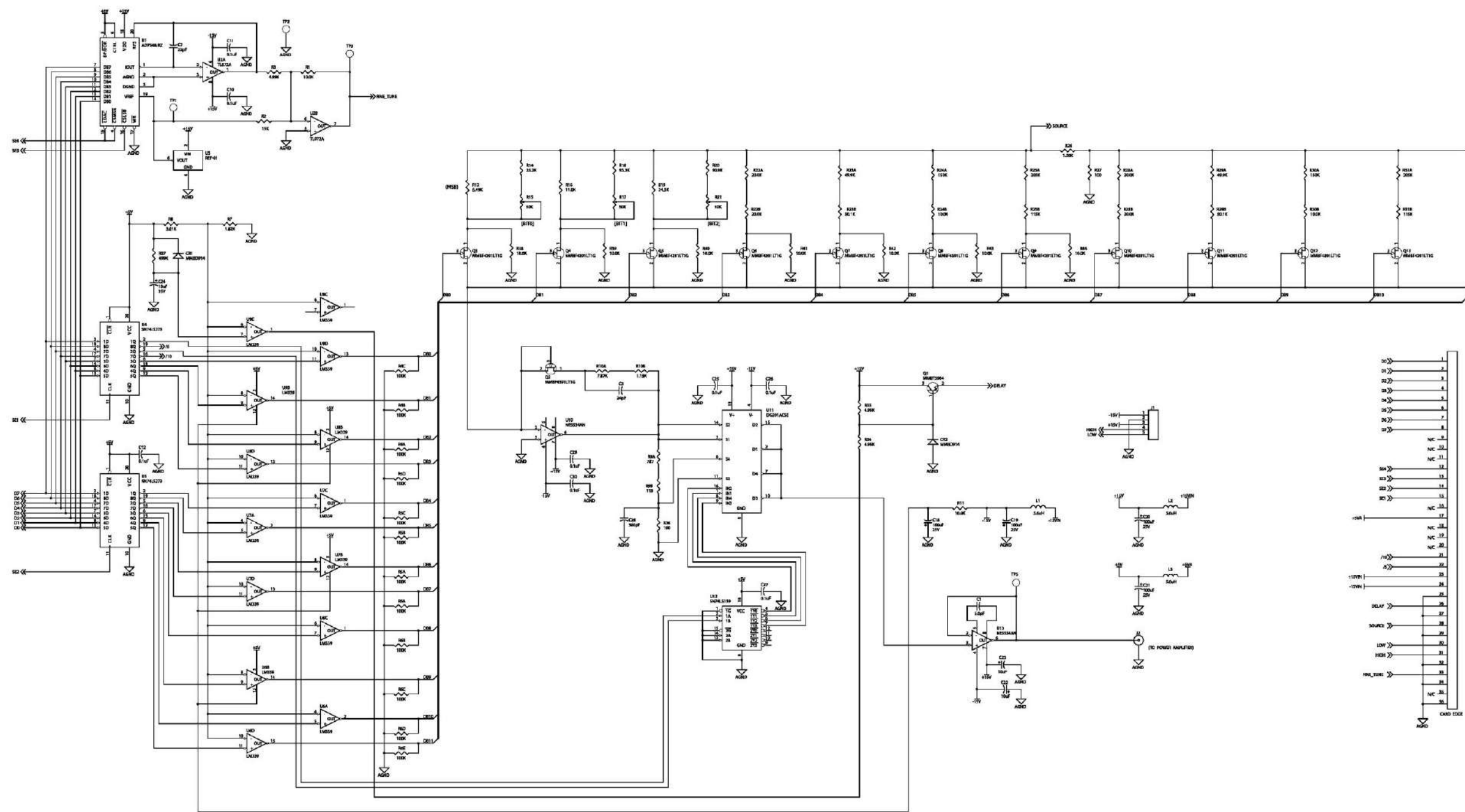


Figure 7-20. Output Board A7 Schematic.

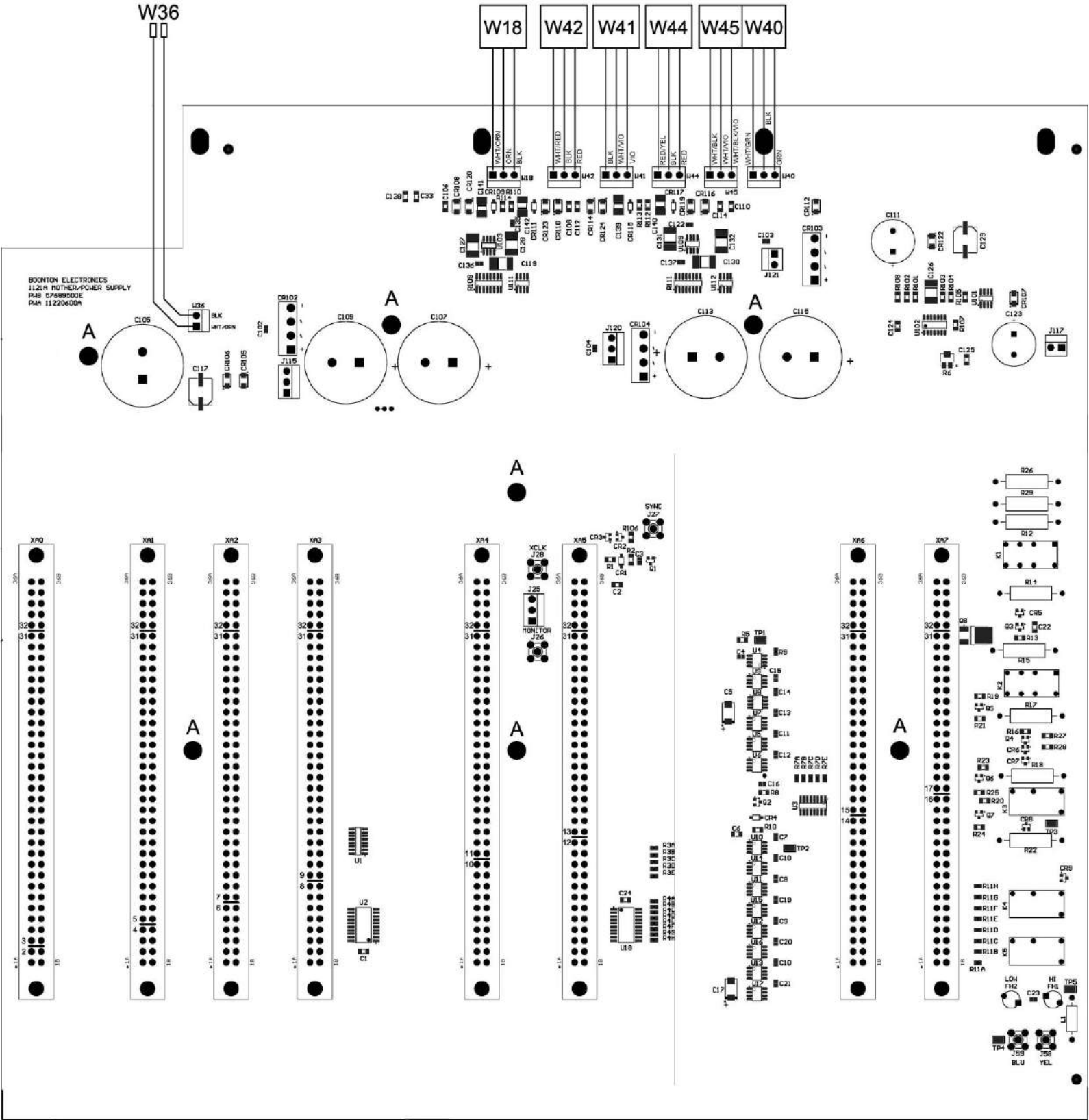


Figure 7-21. Mother Board A10 Parts Location Diagram.



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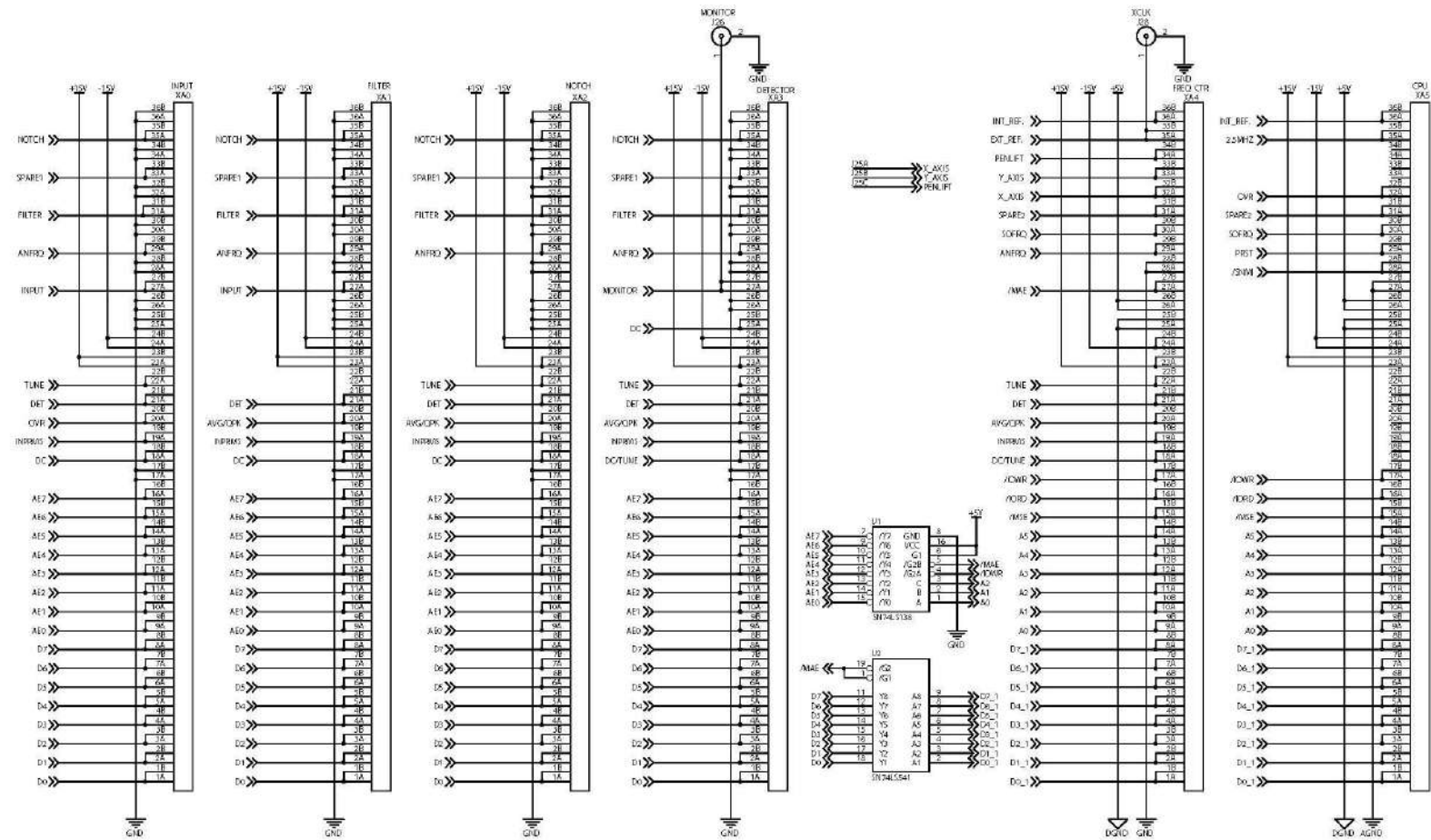


Figure 7-23. Mother/Power Supply Board A10.2 Schematic.

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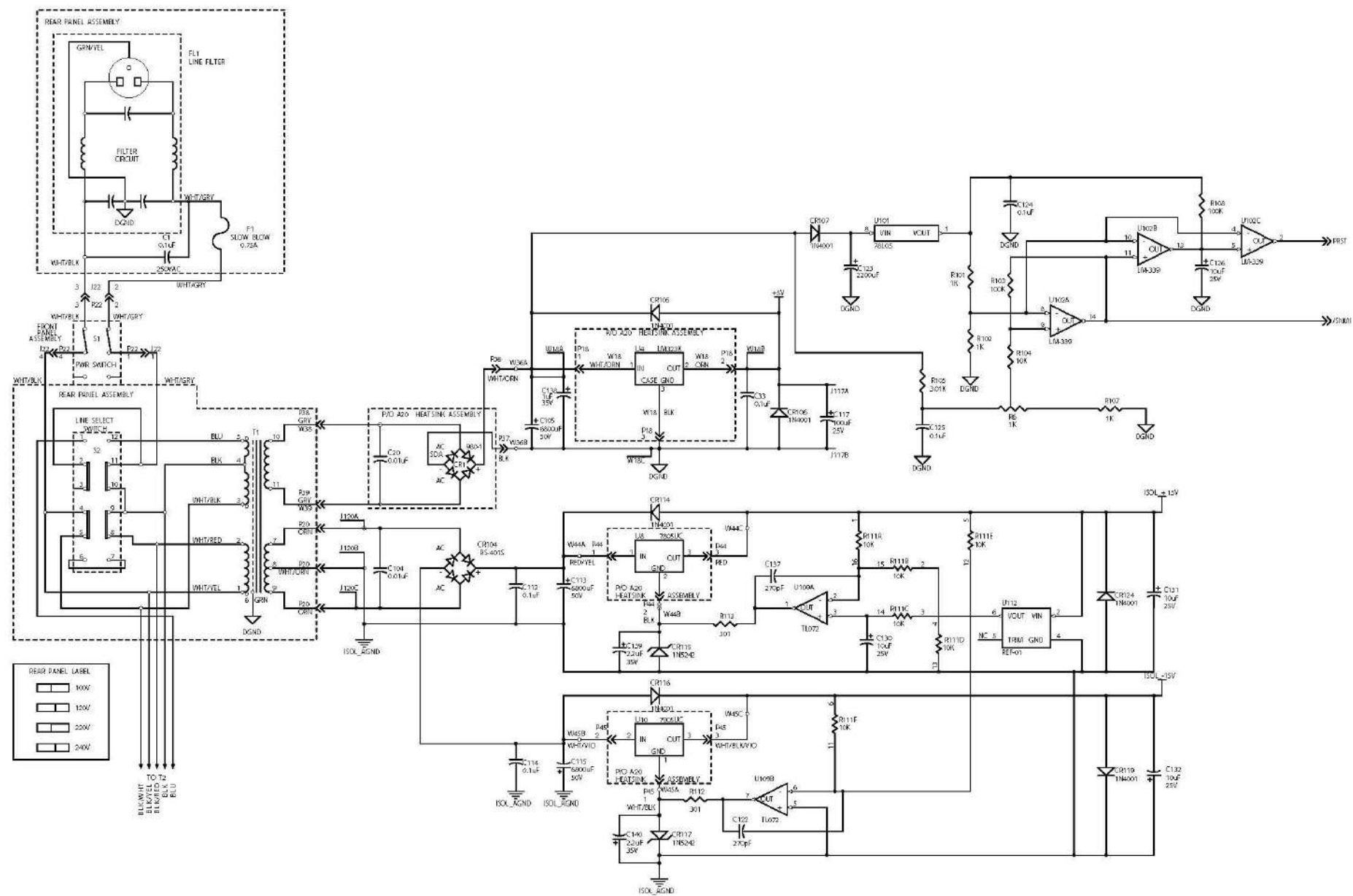
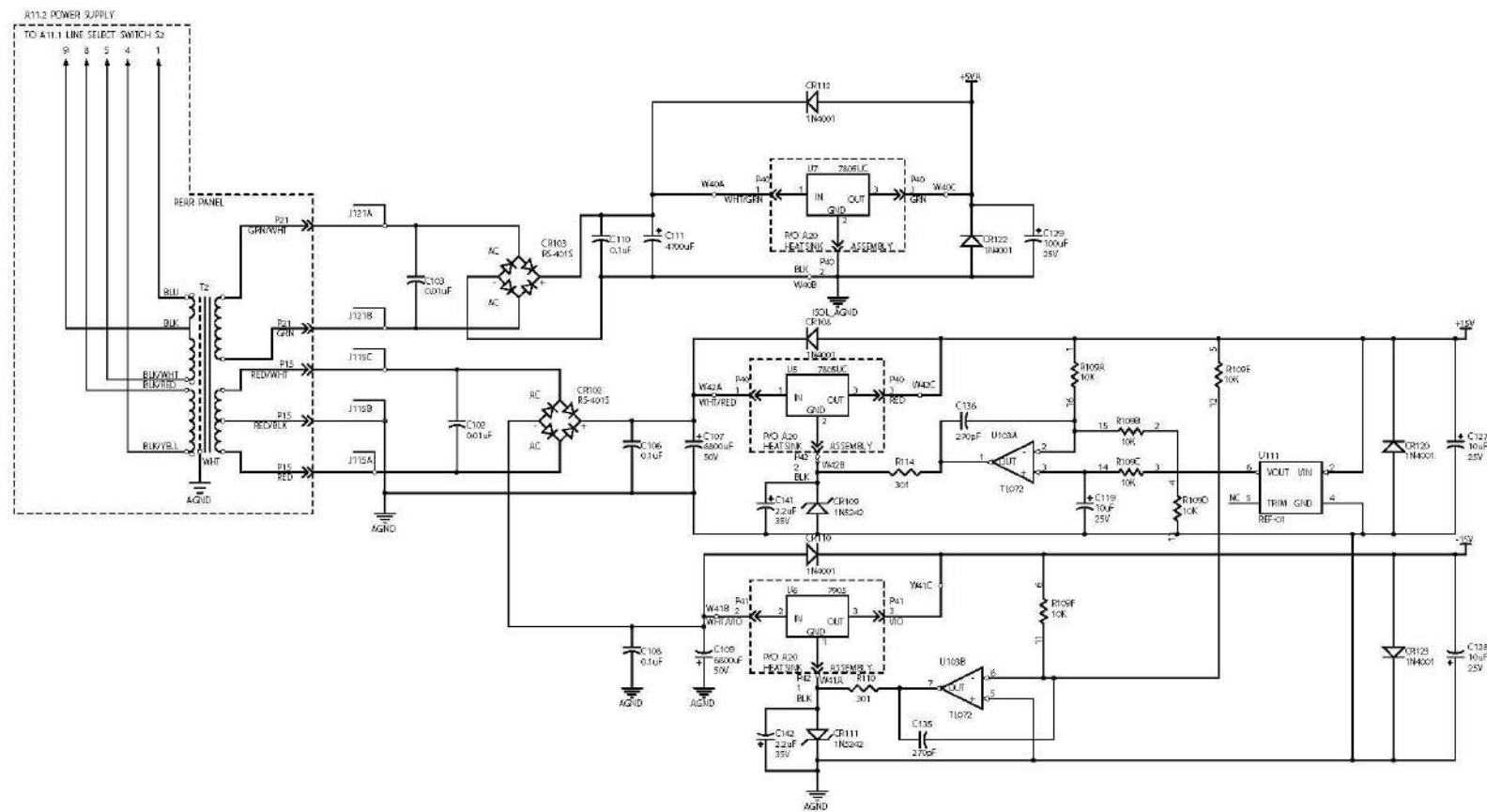


Figure 7-24. Mother/Power Supply Board A10.3 Schematic.

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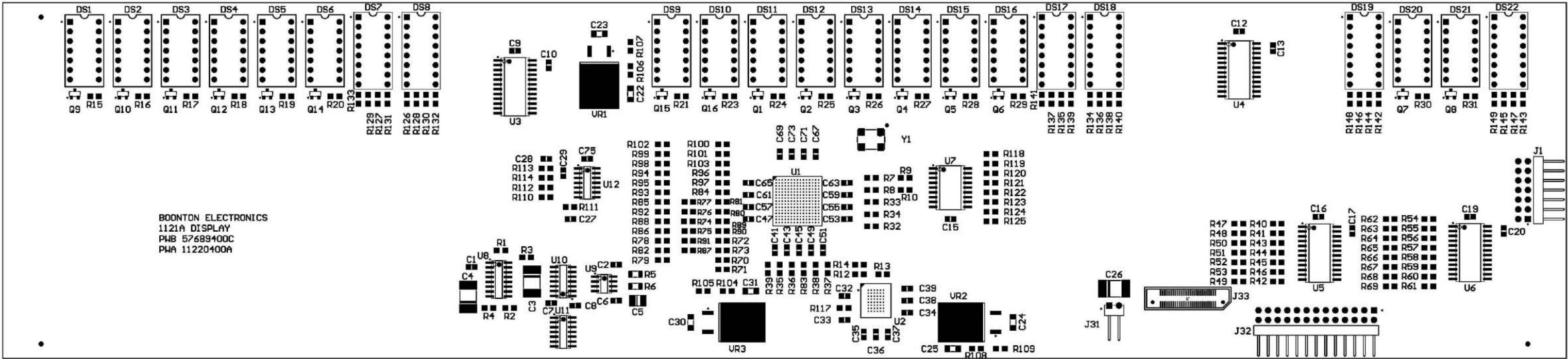


Figure 7-26. Display Board A12 Parts Location Diagram.

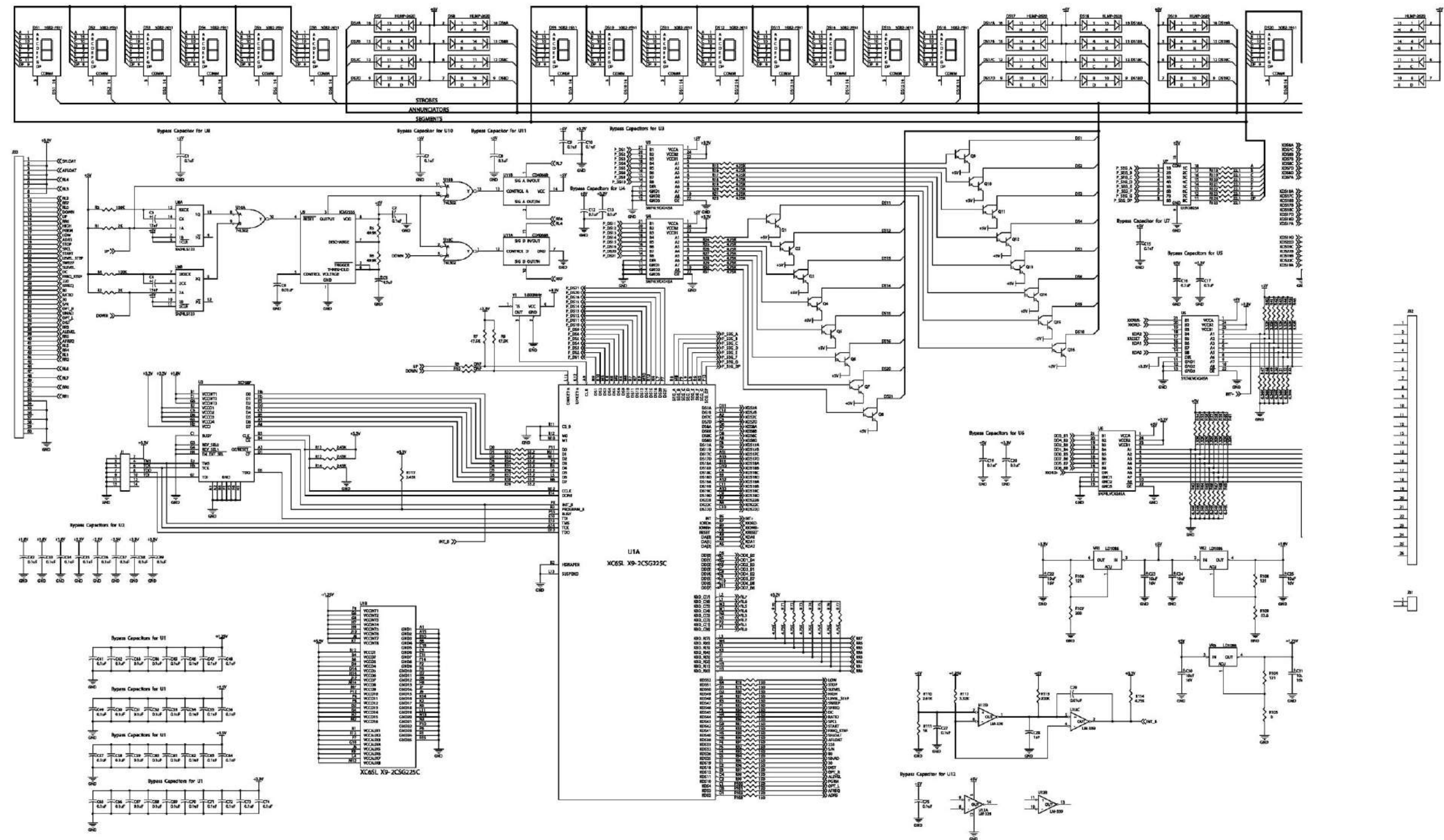
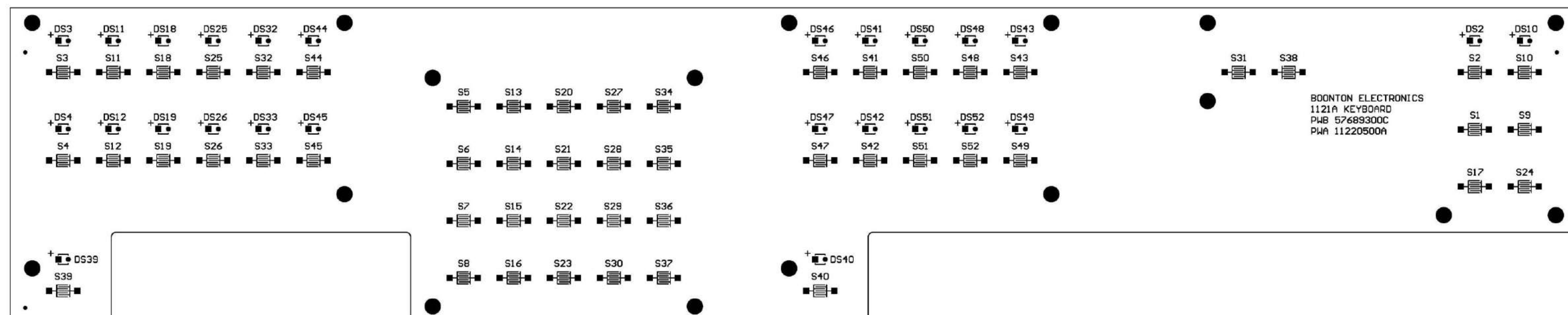


Figure 7-27. Display Board A12 Schematic.



**Figure 7-28. Key Board A13 Parts Location Diagram.**

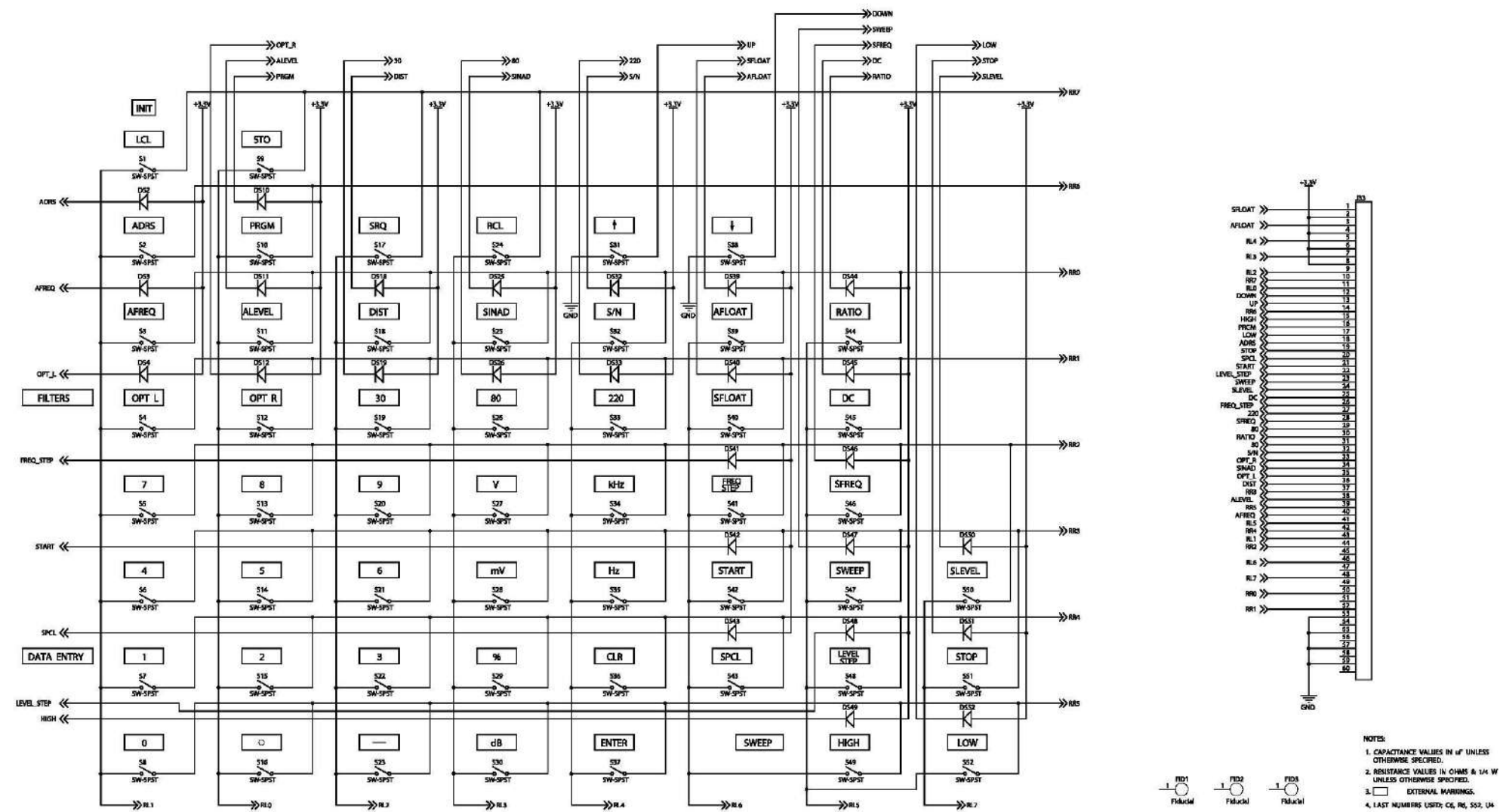


Figure 7-29. Key Board A13 Schematic

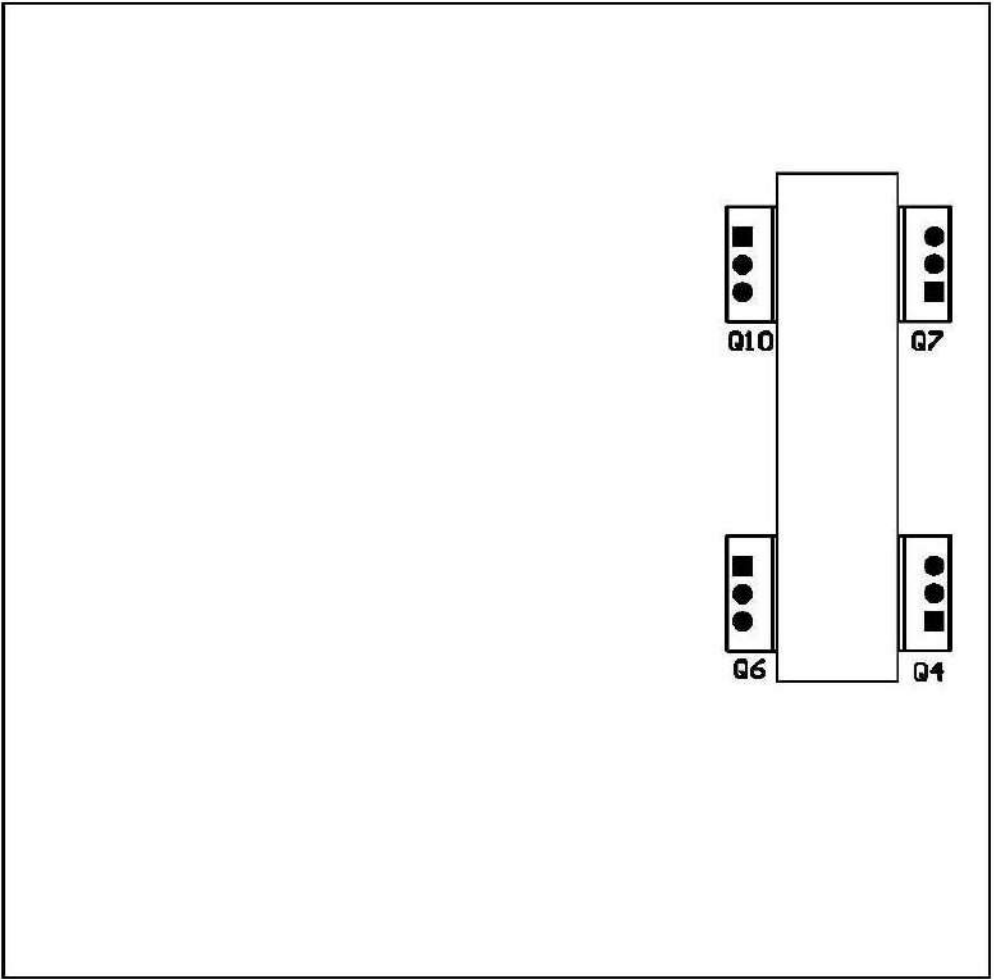
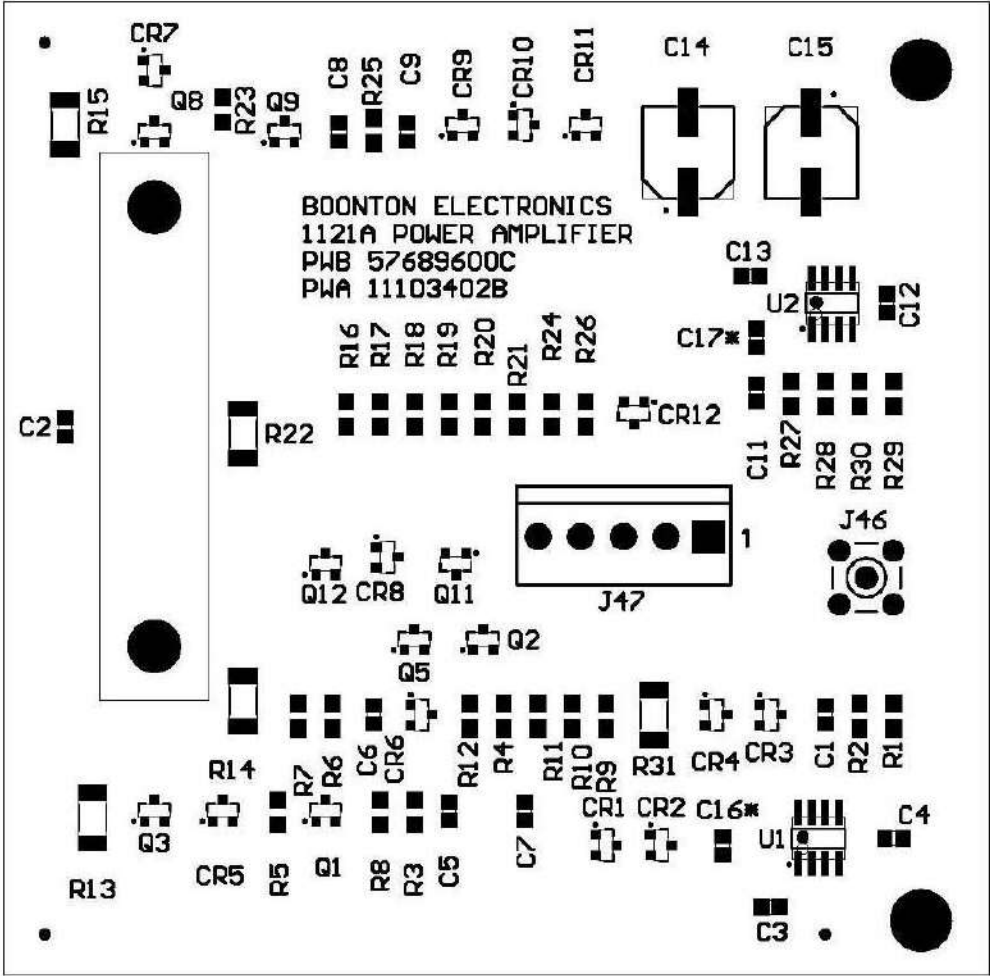


Figure 7-30. Power Amplifier A24 Parts Location Diagram.

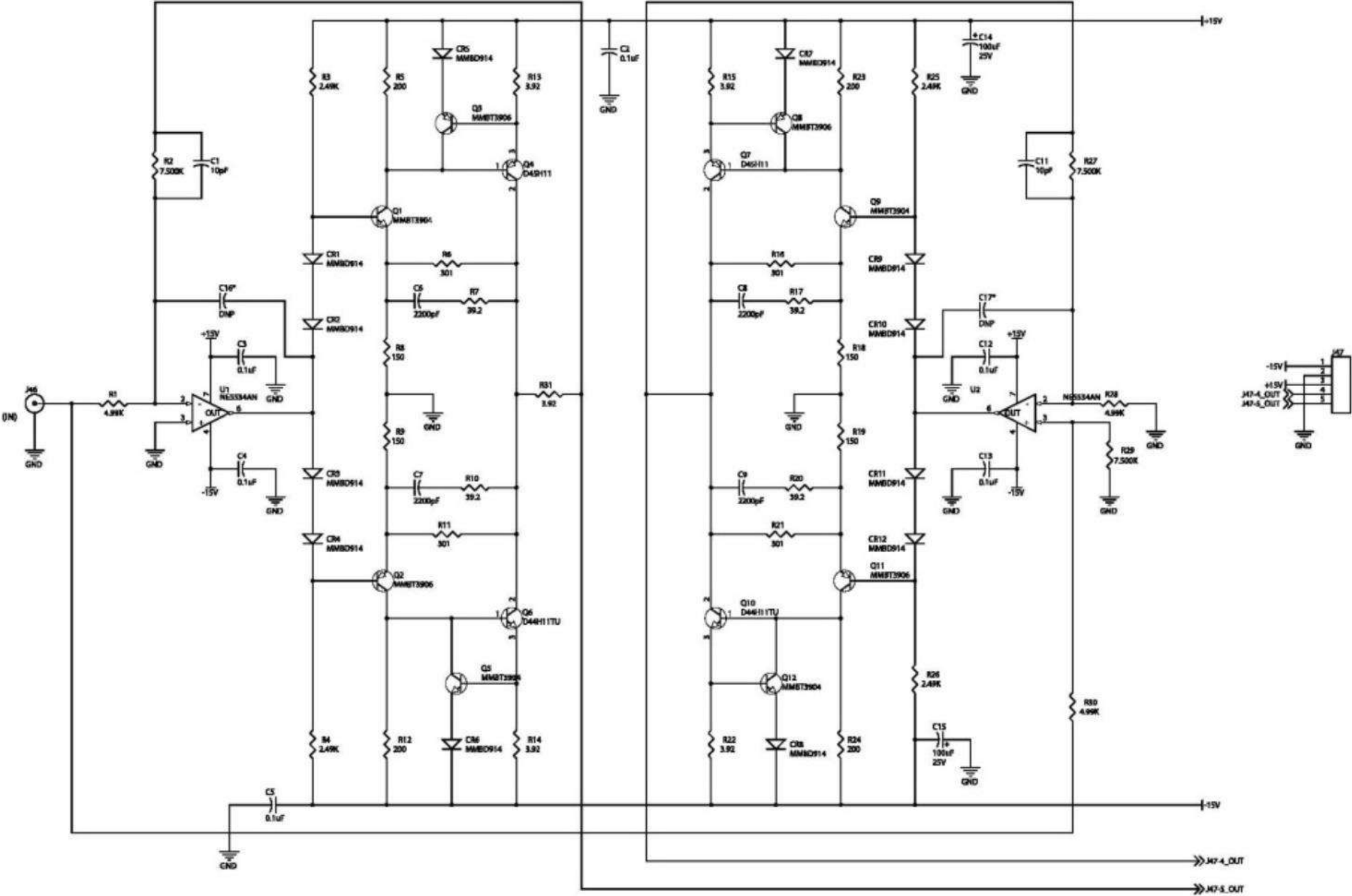


Figure 7-31. Power Amplifier A24 Schematic.

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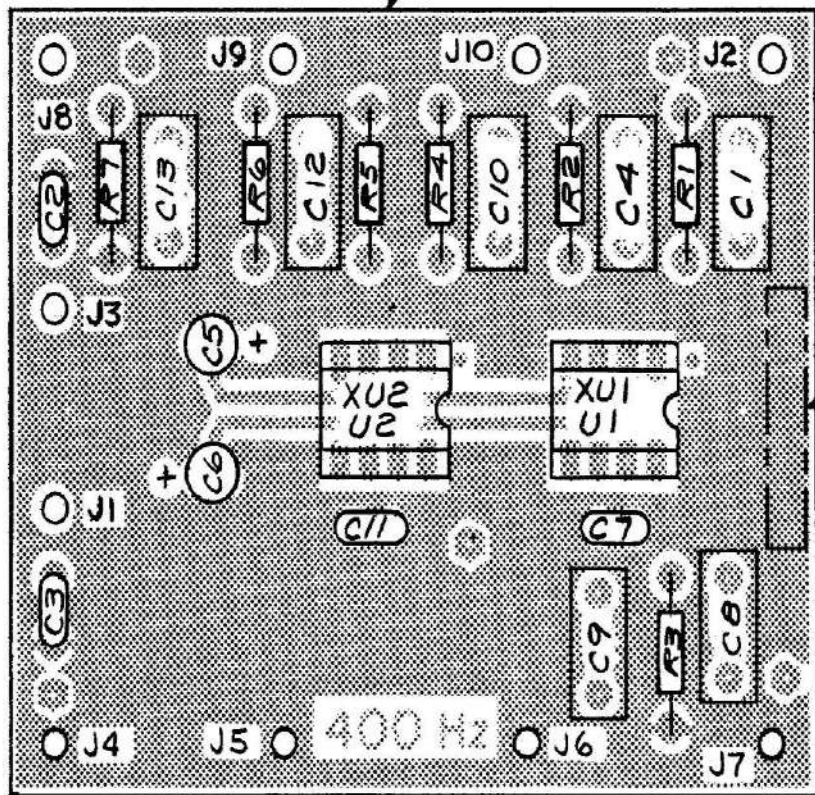


Figure 7-32. 400 Hz Board A1A30 Parts Location Diagram.

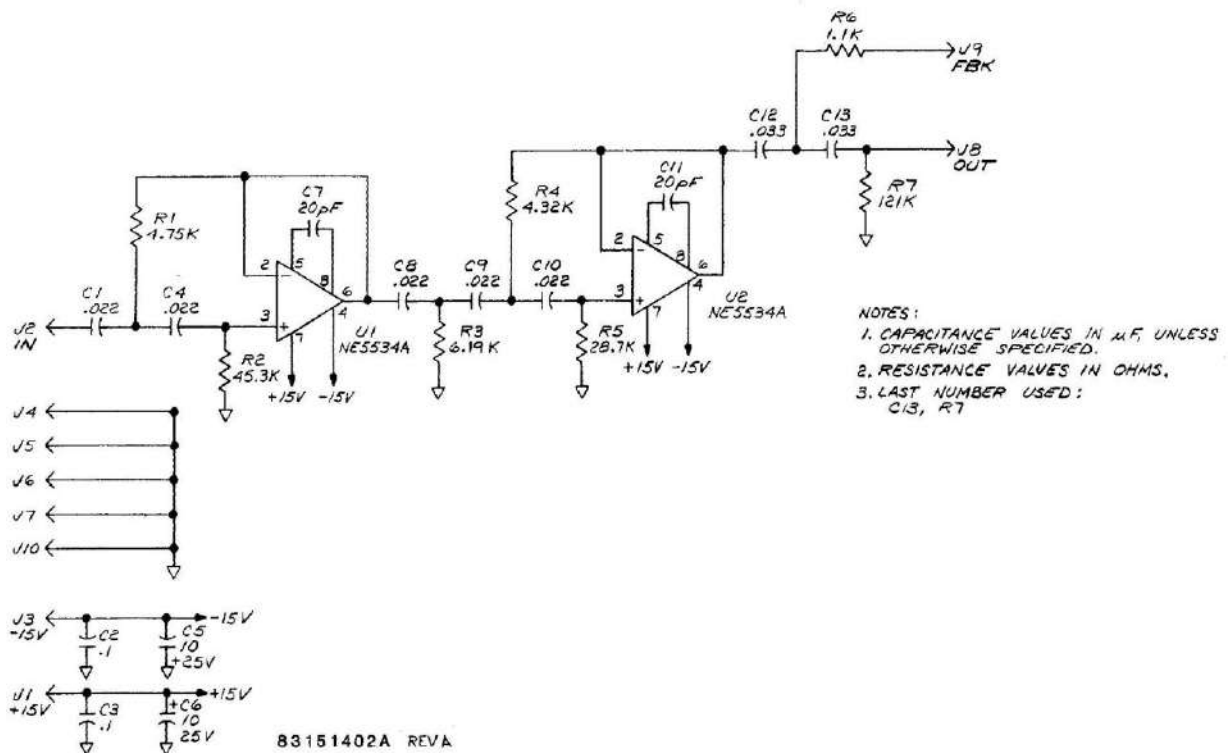
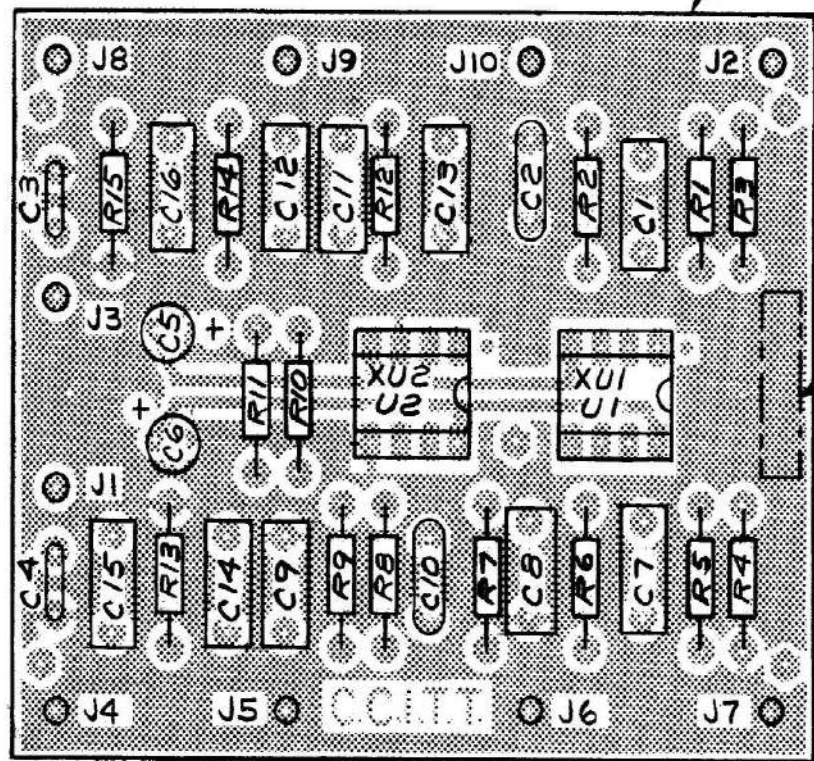
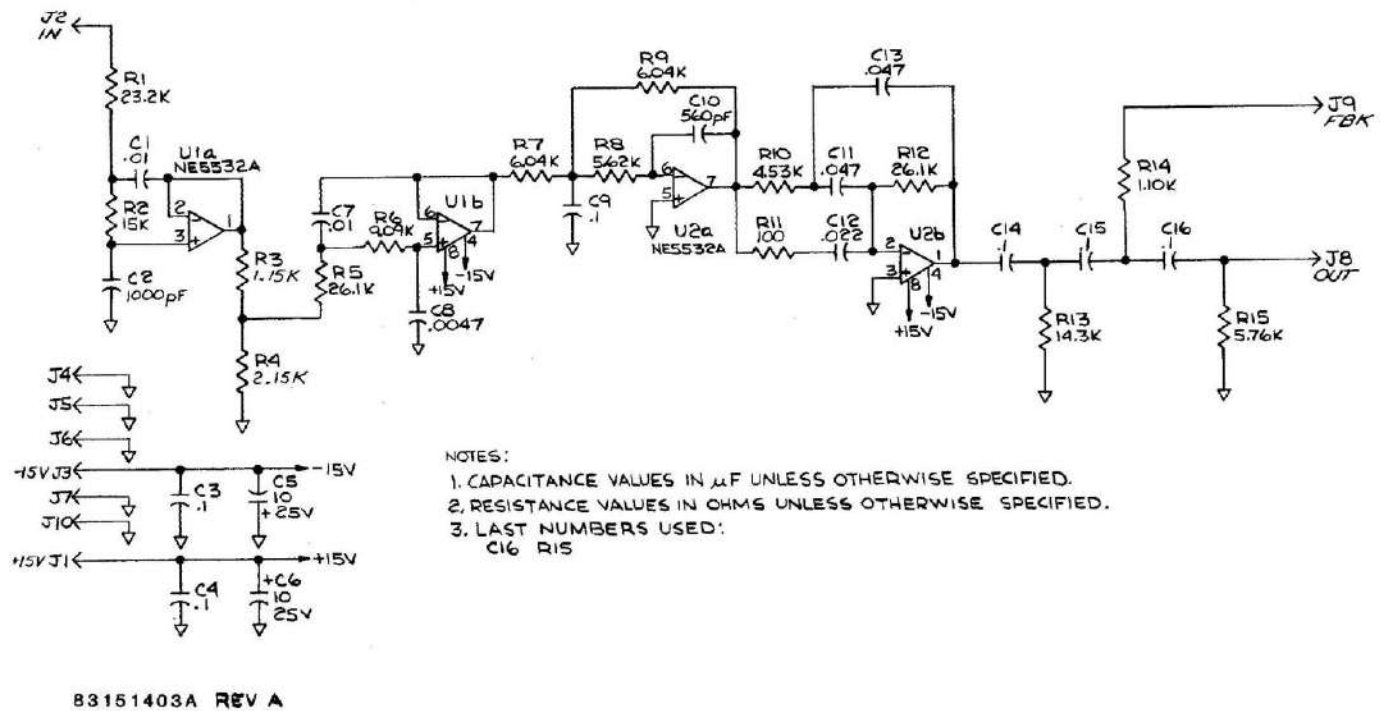


Figure 7-33. 400 Hz Board A1A30 Schematic.



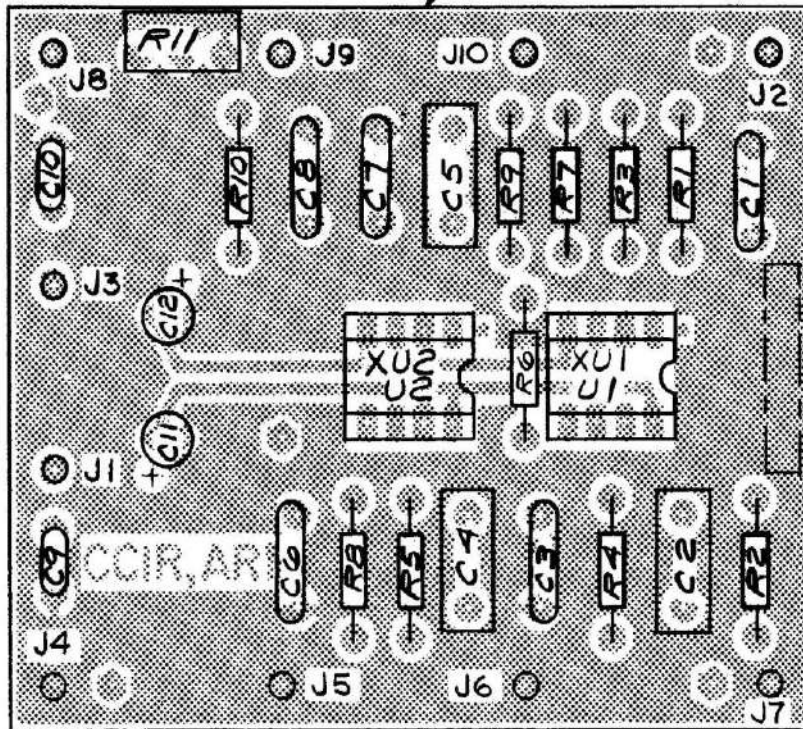
112040A

Figure 7-34. CCITT Board A1A31 Parts Location Diagram.



83151403A REV A

Figure 7-35. CCITT Board A1A31 Schematic.



112037A

Figure 7-36. CCIR Board A1A32,A33 Parts Location Diagram.

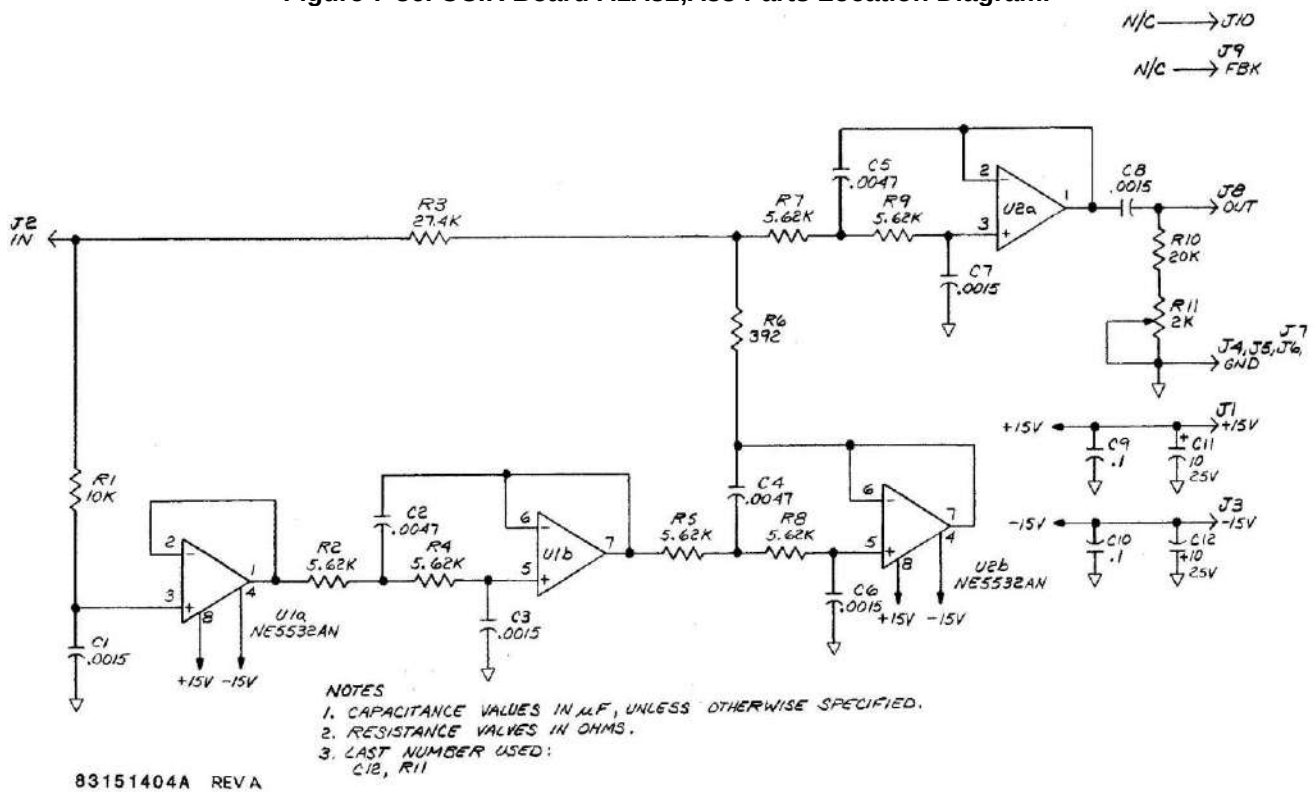


Figure 7-37. CCIR Board A1A32,A33 Schematic.

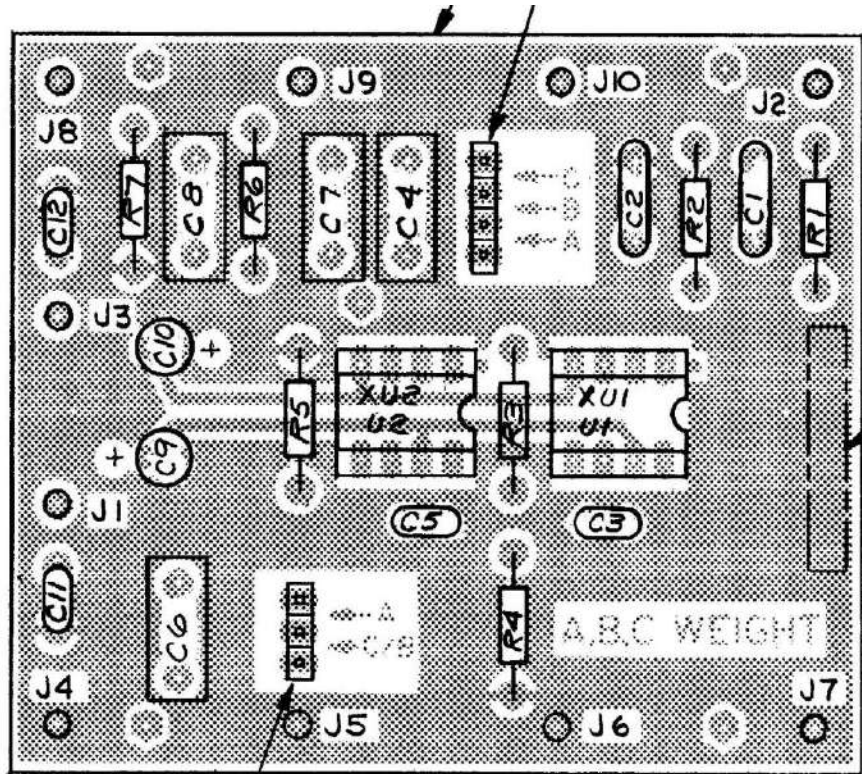


Figure 7-38. A,B,C WTNG Board A1A34,35,36 Parts Location Diagram.

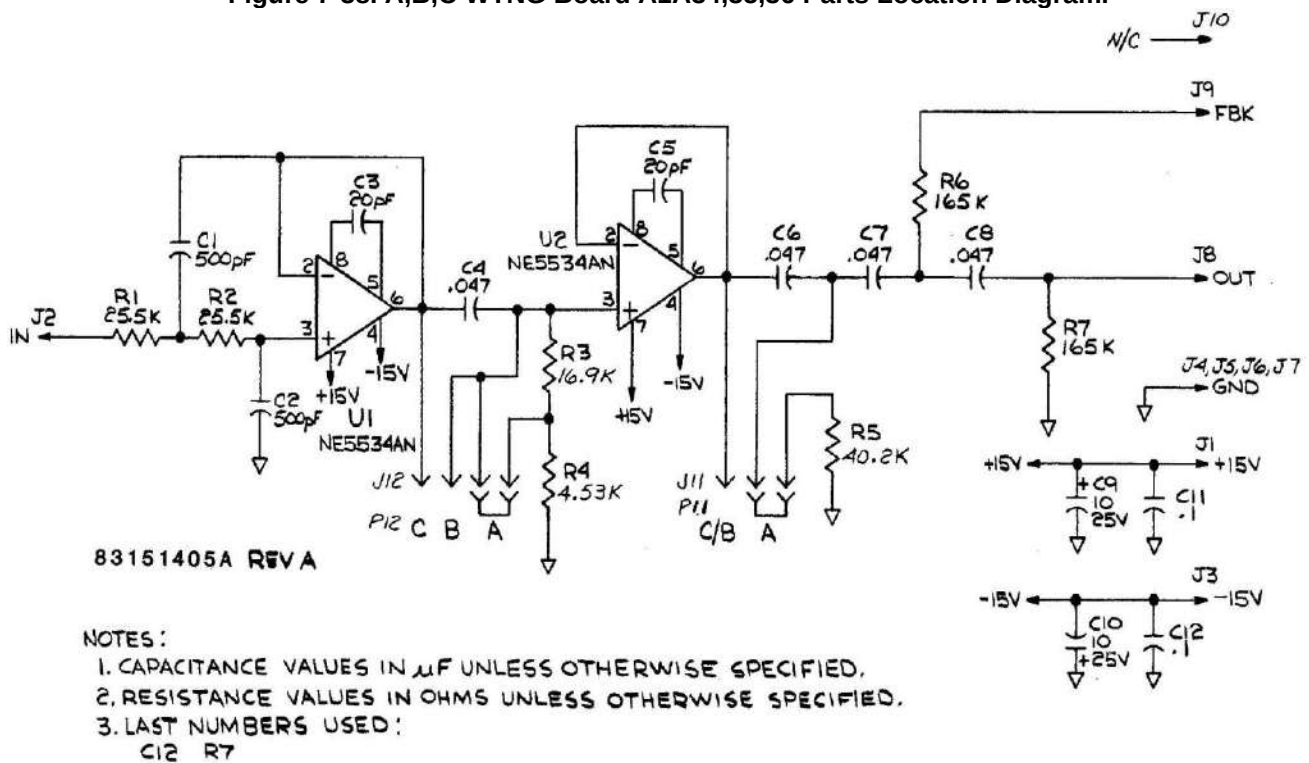
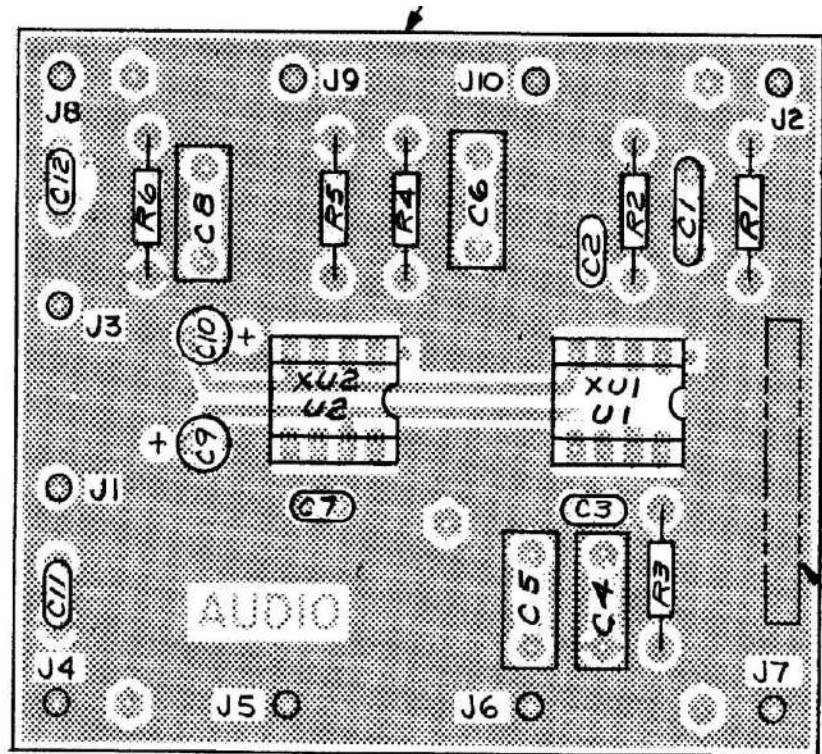
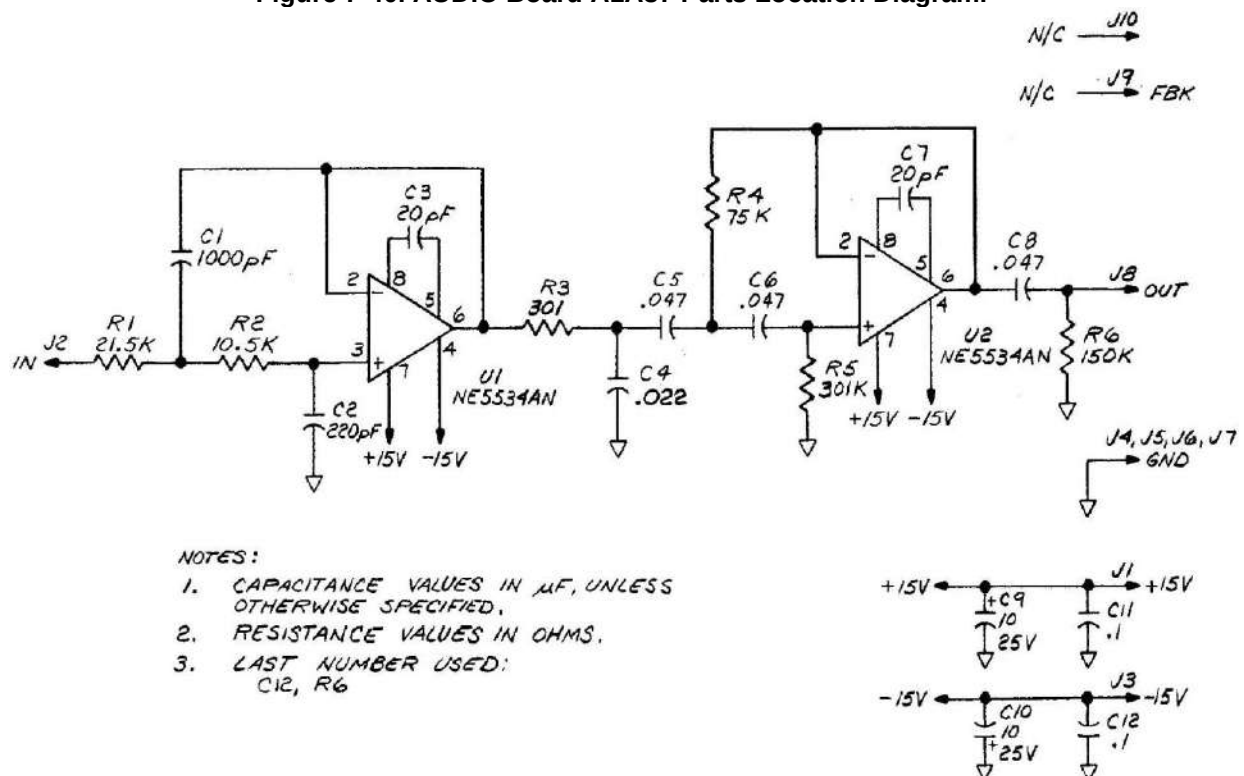


Figure 7-39. A,B,C WTNG Board A1A34,35,36 Schematic.

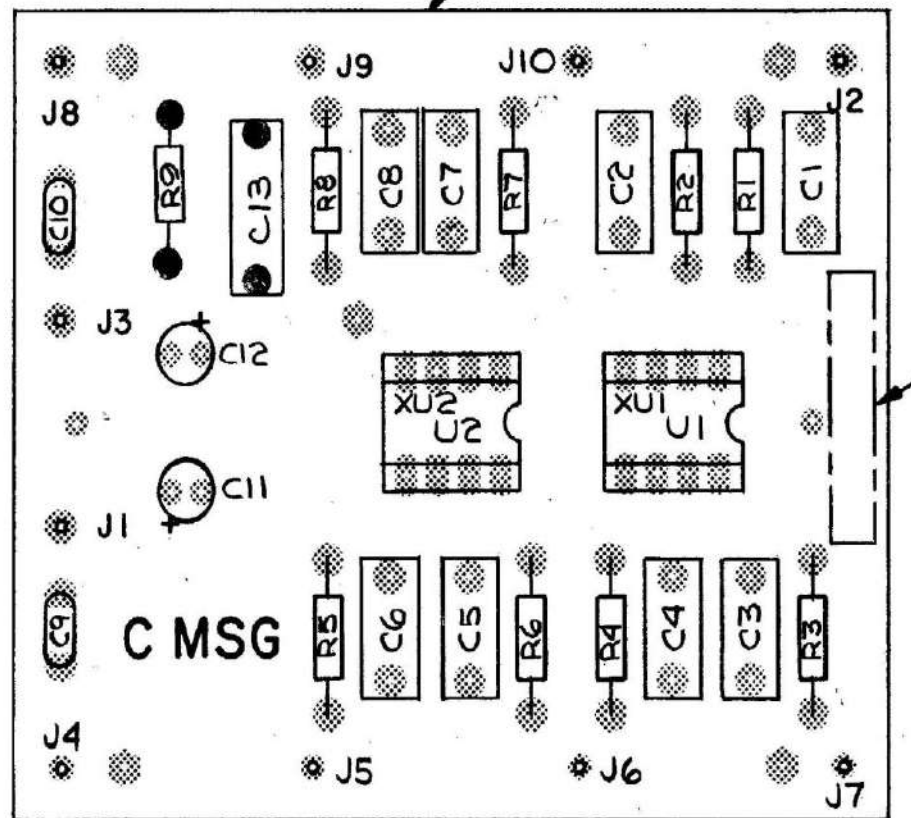


**Figure 7-40. AUDIO Board A1A37 Parts Location Diagram.**



83151406 B REV B

**Figure 7-41. AUDIO Board A1A37 Schematic.**



112070B

Figure 7-42. C-MESSAGE Board A1A38 Parts Location Diagram.

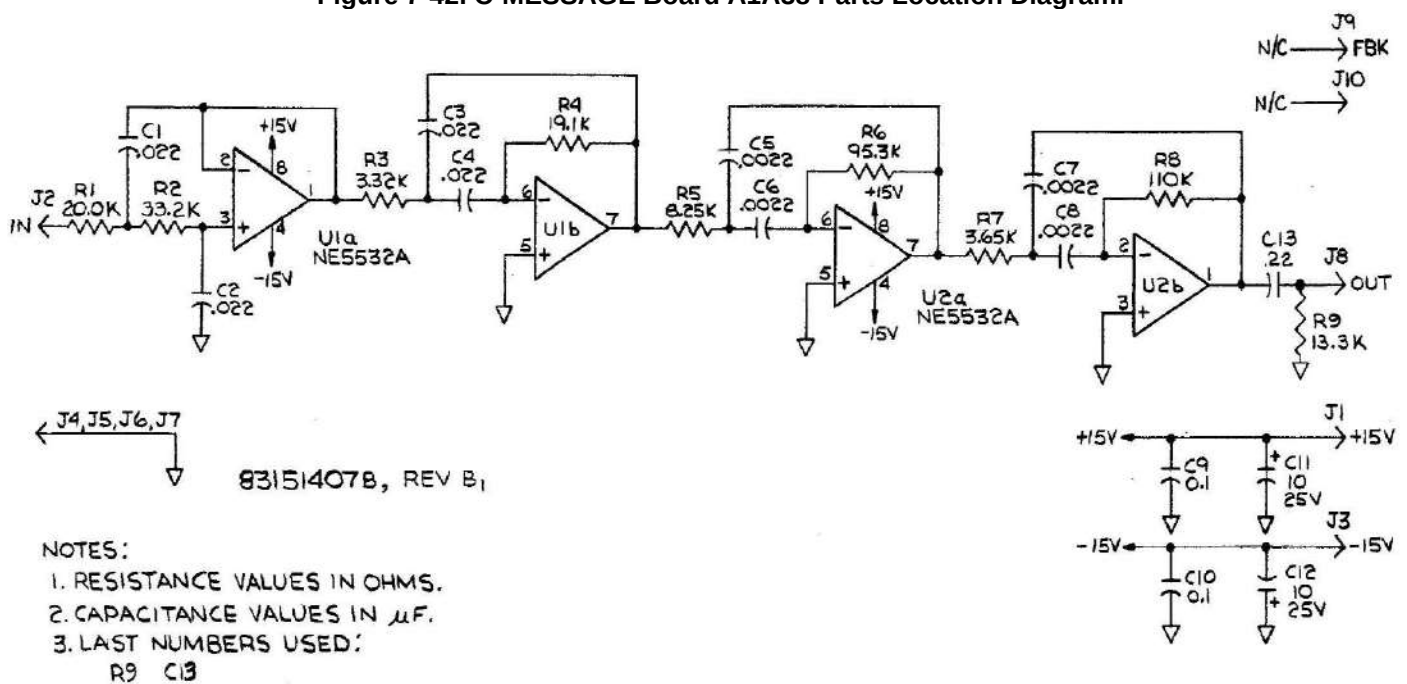


Figure 7-43. C-MESSAGE Board A1A38 Schematic.

## WARRANTY

Boonton Electronics warrants its products to the original Purchaser to be free from defects in material and workmanship for a period of one year from date of shipment for instrument, and for one year from date of shipment for probes, power sensors and accessories. Boonton further warrants that its instruments will perform within all current specifications under normal use and service for one year from date of shipment. These warranties do not cover active devices that have given normal service, sealed assemblies which have been opened or any item which has been repaired or altered without Boonton's authorization.

Boonton's warranties are limited to either the repair or replacement, at Boonton's option, of any product found to be defective under the terms of these warranties.

There will be no charge for parts and labor during the warranty period. The Purchaser shall prepay shipping charges to Boonton or its designated service facility and shall return the product in its original or an equivalent shipping container. Boonton or its designated service facility shall pay shipping charges to return the product to the Purchaser. The Purchaser shall pay all shipping charges, duties and taxes if a product is returned to Boonton from outside of the United States.

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Boonton shall not be liable to any incidental or consequential damages, as defined in Section 2-715 of the Uniform Commercial Code, in connection with the products covered by the foregoing warranties.



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