INSTRUCTION MANUAL

MODEL 1121
PROGRAMMABLE
AUDIO ANALYZER

BOONTON

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IMPORTANT NOTICE

April 11, 2007

INSTRUCTION MANUAL-ADDENDUM: MODEL 1121

Instruction manual addenda are issued to adapt the manual to changes and improvements made after this printing. Please review the following text and retain with your manual for future reference. These changes will be applied in the next printing of the manual.

Thank you for selecting BOONTON ELECTRONICS for your Test and Measurement needs.

Page 1-2 TABLE 1-1. PERFORMANCE SPECIFICATIONS.
SOURCE SPECIFICATIONS
Frequency
Accuracy:
CHANGE “10 ppm” to “20 ppm”.

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IMPORTANT NOTICE

September 5, 2007

INSTRUCTION MANUAL-ADDENDUM: MODEL 1121

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Thank you for selecting BOONTON ELECTRONICS for your Test and Measurement needs.

Page 1-2 **TABLE 1-1. PERFORMANCE SPECIFICATIONS.**

SYSTEM SPECIFICATIONS

Signal-to-Noise

Input Voltage Range:

CHANGE "50 mV" to "250 mV".

Page 1-3 **TABLE 1-1. PERFORMANCE SPECIFICATIONS CONTINUED.**

ANALYZER SPECIFICATIONS

Distortion Measurement

Distortion Measurement Range: REPLACE WITH THE FOLLOWING;

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

Page 1-3 **TABLE 1-1. PERFORMANCE SPECIFICATIONS CONTINUED.**

ANALYZER SPECIFICATIONS

SINAD Measurement

SINAD Measurement Range: REPLACE WITH THE FOLLOWING;

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

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

Page 5-15 **TABLE 5-13. RESIDUAL DISTORTION TEST RECORD.**
CHANGE "200 mV" SOURCE LEVEL TO "250 mV" 7 PLACES.

Page 5-16 **TABLE 5-14. RESIDUAL SIGNAL-TO-NOISE TEST RECORD.**
CHANGE "356 mV" SOURCE LEVEL TO "500 mV" 6 PLACES.

IMPORTANT NOTICE

February 28, 2008

OPERATION AND MAINTENANCE MANUAL-ADDENDUM: MODEL 1121

Operation and Instruction manual addenda are issued to adapt the manual to changes and improvements made after this printing. Please review the following text and retain with your manual for future reference. These changes will be applied in the next printing of the manual.

Thank you for selecting BOONTON ELECTRONICS for your Test and Measurement needs.

Page 6-46 **Parts List** "**11102800A PWA '1121' POWER SUPPLY (A11)** "

1) REMOVE LINE CONTAINING C18,21 BEC PART NUMBER 224270000
2) ADD REFERENCE DESIGNATORS R13, R14 TO LINE CONTAINING R10,12. CHANGE QTY FROM 2 TO 4.

Page 7-23 "**Figure 7-23. Power Supply A11 Parts Location Diagram.**"

REPLACE WITH DRAWING 111028C

Page 7-29 "**Figure 7-24. Power Supply A11.1, Schematic.**"

REPLACE WITH DRAWING 83163511A REV. D

DRAWING 83163511A REV. D INCLUDES THE FOLLOWING CHANGES;

1) REMOVE C21.
2) ADD 301 OHM RESISTOR (R13) FROM U9 PIN1 TO CATHODE OF CR15.

Page 7-31 "**Figure 7-25. Power Supply A11.2, Schematic.**"

REPLACE WITH DRAWING 83163512A REV. D

DRAWING 83163511A REV. D INCLUDES THE FOLLOWING CHANGES;

1) REMOVE C18.
2) ADD 301 OHM RESISTOR (R14) FROM U3 PIN1 TO CATHODE OF CR9.

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 a.c. 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 and 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.

CAUTION

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 a CAUTION sign until the indicated conditions are fully understood and met.

WARNING

The WARNING sign denotes a hazard. It call 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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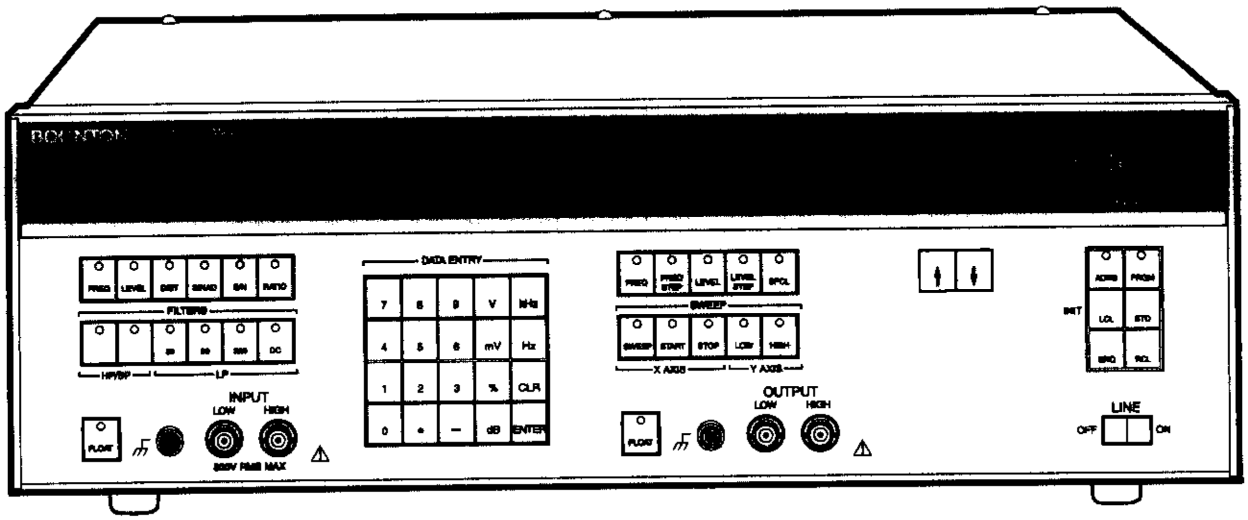


MODEL 1121 AUDIO ANALYZER

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 1121 Audio Analyzer.

1-3. DESCRIPTION.

1-4. The Model 1121 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 1121. 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 1121 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 1121 is specified as less than 0.01% with typical performance an order of magnitude better than specified.

c. **Versatile Source Output.** The Model 1121 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 1121 has a fully differential/balanced input for testing bridged amplifiers and power supplies.

e. **Separate Displays of All Functions.** The Model 1121 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 1121 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 1121 is designed to interface easily with controllers currently in use. A versatile free-form number entry system is used so that the 1121 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 1121 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 1121 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:** ±1 dB
- **Input Voltage Range:** 50 mV to 300 V
- **Residual Noise (the greater of):**
  - 85 dB or 10 µV; 80 kHz BW
  - 85 dB or 20 µV; 220 kHz BW
  - 85 dB or 40 µV; 500 kHz BW

Distortion
- **Residual Distortion and Noise (the greater of):**
  - -80 dB or 10 µV; 10 Hz to 20 kHz, 80 kHz BW
  - -74 dB or 20 µV; 10 Hz to 50 kHz, 220 kHz BW
  - -70 dB or 40 µV; 10 Hz to 50 kHz, 500 kHz BW
  - -65 dB or 40 µV; 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

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):**
  - ± 0.5% of setting + 0.05% of range; 10 Hz to 50 kHz
  - ± 1.0% of setting + 0.05% of range; 50 kHz to 100 kHz
  - ± 1.5% of setting + 0.1% of range; 100 kHz to 140 kHz

- **Flatness, ref 1 kHz (0.30 mV to 8 V into 50 ohms):**
  - ± 0.5%; 10 Hz to 50 kHz
  - ± 1.0%; 10 Hz to 100 kHz
  - ± 1.5%; 10 Hz to 140 kHz

Output
- **Impedance:**
  - 50 ohms ± 2%
  - 150 ohms ± 1%
  - 600 ohms ± 1%
- **Distortion and Noise (the greater of):**
  - 0.01% (-80 dB) or 10 µV; 10 Hz to 20 kHz, 80 kHz bandwidth
  - 0.02% (-74 dB) or 20 µV; 10 Hz to 50 kHz, 220 kHz bandwidth
  - 0.032% (-70 dB) or 35 µV; 10 Hz to 50 kHz, 500 kHz bandwidth
  - 0.056% (-65 dB) or 35 µV; 50 to 100 kHz, 500 kHz bandwidth
  - 0.1% (-60 dB) or 35 µV; 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

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
  - 1.0 Hz; 20.000 to 199.999 kHz

TABLE 1-1. PERFORMANCE SPECIFICATIONS CONTINUED.

Timebase
Type: 10 MHz TCXO
Accuracy: ±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:
± 1%; 50 Hz to 50 kHz, 1 mV to 300 V
± 2%, 20 Hz to 100 kHz, 1 mV to 300 V
± 3%; 10 Hz to 100 kHz, 1 mV to 300 V
± 4%; 10 Hz to 100 kHz, 0.3 mV to 300 V
Flatness: (1 mV to 300 V)
± 0.5%; 50 Hz to 50 kHz
± 1.0%; 20 Hz to 100 kHz
± 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: ± 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 ± 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:
± 1 dB; 20 Hz to 20 kHz
± 2 dB; 10 Hz to 100 kHz
Input Voltage Range: 50 mV to 300 V
Distortion Measurement Range:
0.01% (-80 dB) or 10 μV;
10 Hz to 20 kHz, 80 kHz bandwidth
0.02% (-74 dB) or 20 μV;
10 Hz to 50 kHz, 220 kHz bandwidth
0.032% (-70 dB) or 40 μV;
10 Hz to 50 kHz, 500 kHz bandwidth
0.056% (-65 dB) or 40 μV;
50 to 100 kHz, 500 kHz bandwidth

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:
± 1 dB; 20 Hz to 20 kHz
± 2 dB; 10 Hz to 100 kHz
Input Voltage Range: 50 mV to 300 V
SINAD Measurement Range:
80dB or 10 μV;
10 Hz to 20 kHz, 80 kHz bandwidth
74 dB or 20 μV;
10 Hz to 50 kHz, 220 kHz bandwidth
70 dB or 40 μV;
10 Hz to 50 kHz, 500 kHz bandwidth
65 dB or 40 μV;
50 to 100 kHz, 500 kHz bandwidth

Standard Audio Filters
30 kHz Low-pass Filter
Accuracy: 30 kHz ± 2 kHz
Rolloff: Third-order Butterworth, 60 dB/decade

80 kHz Low-pass Filter
Accuracy: 80 kHz ± 4 kHz
Rolloff: Third-order Butterworth, 60 dB/decade

220 kHz Low-Pass Filter
Accuracy: 220 kHz ± 20 kHz
Rolloff: Third-order Butterworth, 60 dB/decade

TABLE 1-1. PERFORMANCE SPECIFICATIONS CONTINUED.

Optional Audio Filters

400 Hz High-pass Filter
Accuracy: 400 Hz ± 40 Hz
Rolloff: Seventh-order Butterworth, 140 dB/decade

Audio Band-pass Filter
Accuracy:
22.4 Hz ± 5%, 60 dB/decade rolloff
22.4 kHz ± 5%, 60 dB/octave rolloff

A, B, C Weighting Filter
Accuracy:
± 0.2 dB; 1.0 kHz
± 1.0 dB; 40 Hz to 5.0 kHz
± 1.5 dB; 25 to 40 Hz, 5.0 to 10.0 kHz
± 2.0 dB; 20 to 25 Hz, 10.0 to 20.0 kHz

CCITT or C-MESSAGE Band-pass Filter
Accuracy:
± 0.2 dB; 800 Hz CCITT,
± 0.2 dB; 1000 Hz C-MESSAGE
± 1.0 dB; 300 to 3000 Hz
± 2.0 dB; 50 to 300 Hz, 3.0 to 3.5 kHz
± 3.0 dB; 3.5 to 5 kHz

CCIR or CCIR/ARM Band-pass Filter
Accuracy:
± 0.2 dB; 6.3 to 7.1 kHz
± 0.4 dB; 7.1 to 10 kHz
± 0.5 dB; 200 to 6300 Hz
± 1.0 dB; 31.5 to 200 Hz, 10 to 20 kHz
+ 2.0 dB - ∞; 20 to 31.5 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: ± 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 rdng/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, ± 10%, 50 to 400 Hz, 80 VA

Operating Temperature: 0 to 55 degrees centigrade
Operating Humidity: <95 ± 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
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

TABLE 1-1. PERFORMANCE SPECIFICATIONS CONTINUED.

Ventilation Requirements:
1-1/2 inch clearance after installation, top, side, and rear

Temperature:
Non-Operating: -40 to 75 degrees C

Altitude:
Operating: 10,000 Ft

Humidity:
95% (non-condensing)

Battery Type:
Refer to page 6-12

CE MARK: Declares Conformity to European Community (EC) Council Directives: 89/336/EEC//93/68/EEC, 73/23/EEC//93/68EEC & Standards: EN55011, EN50082-1, EN61010-1

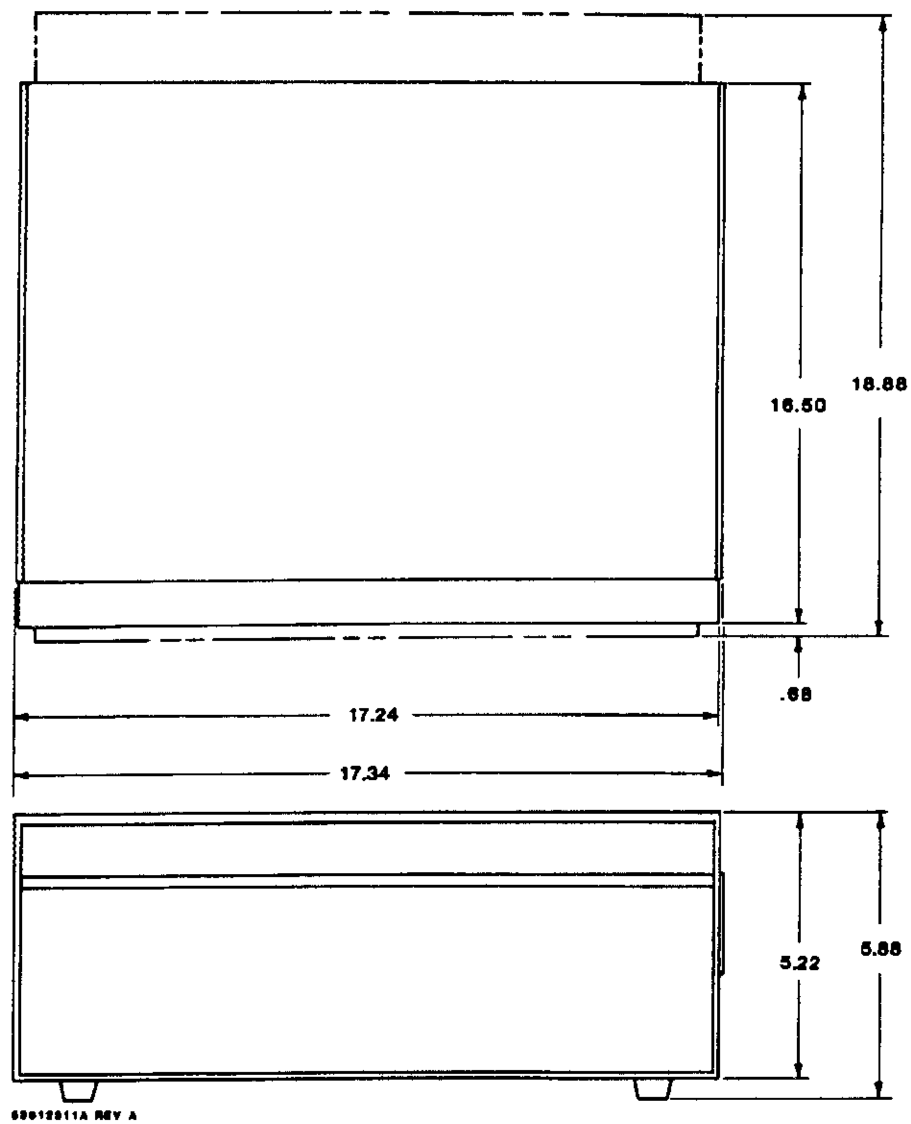


Figure 1-1. Outline Dimensions.

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 1121 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 ± 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 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.

Line Voltage Select Chart

VAC ±10%	100 120	220 240	50 to 400 HZ
Fuse	3/4 A T	3/8 A T	80 VA

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 1121 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

TABLE 2-1. INITIAL CONDITIONS.

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

of the Model 1121 to the initialized values and conditions listed in Table 2-1.

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 1121 is resumed.

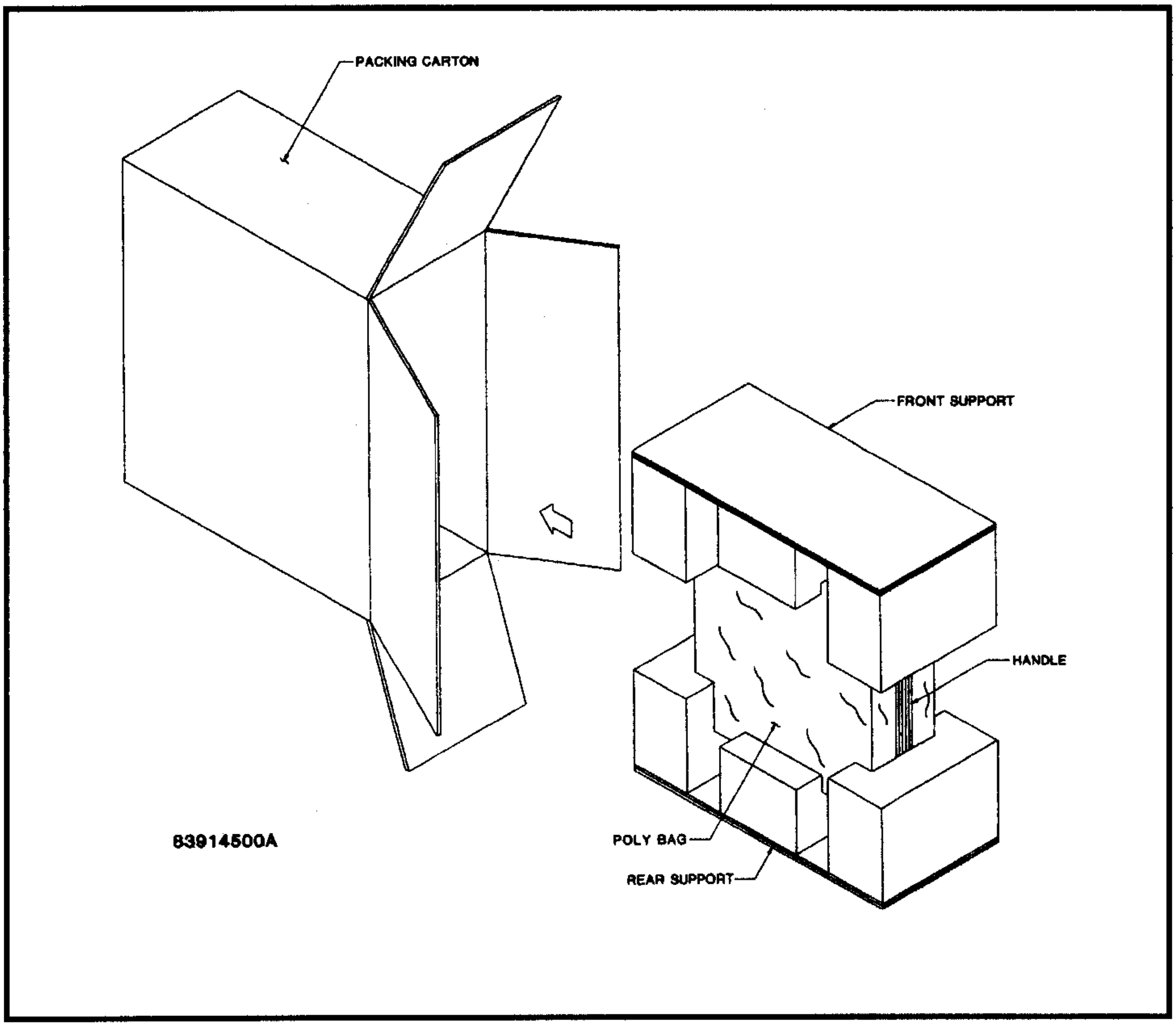


Figure 2-1. Packing and Unpacking Diagram.

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. This section contains the operating instructions for the Model 1121 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 1121 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 1121. 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 1121 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 1121 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

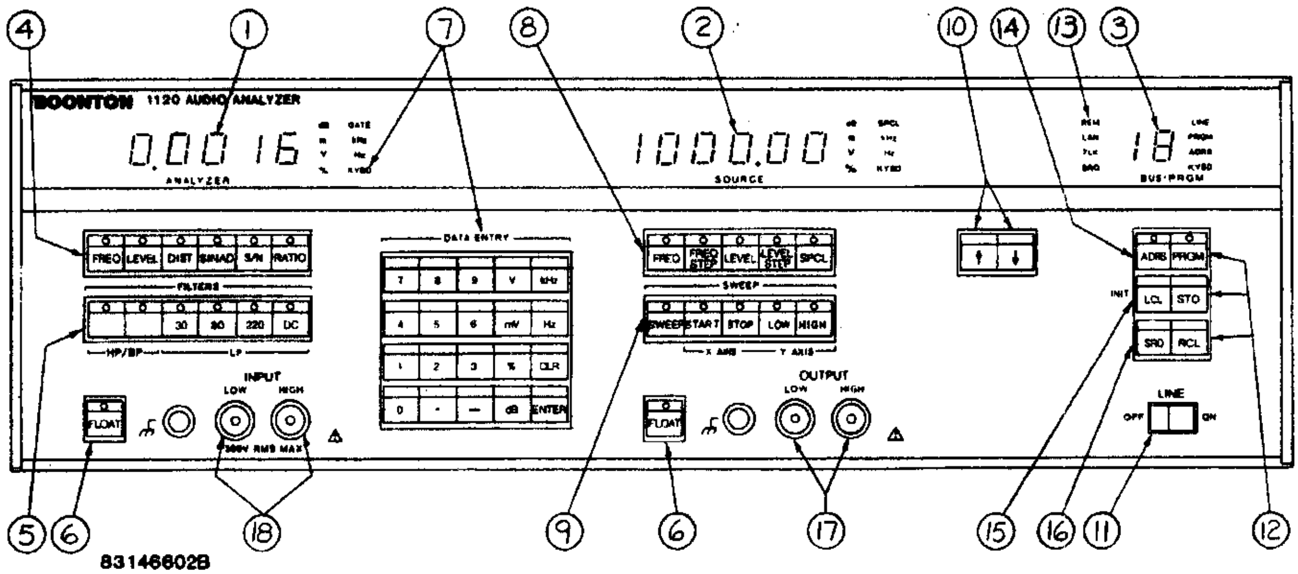


Figure 3-1. Model 1121, Front View

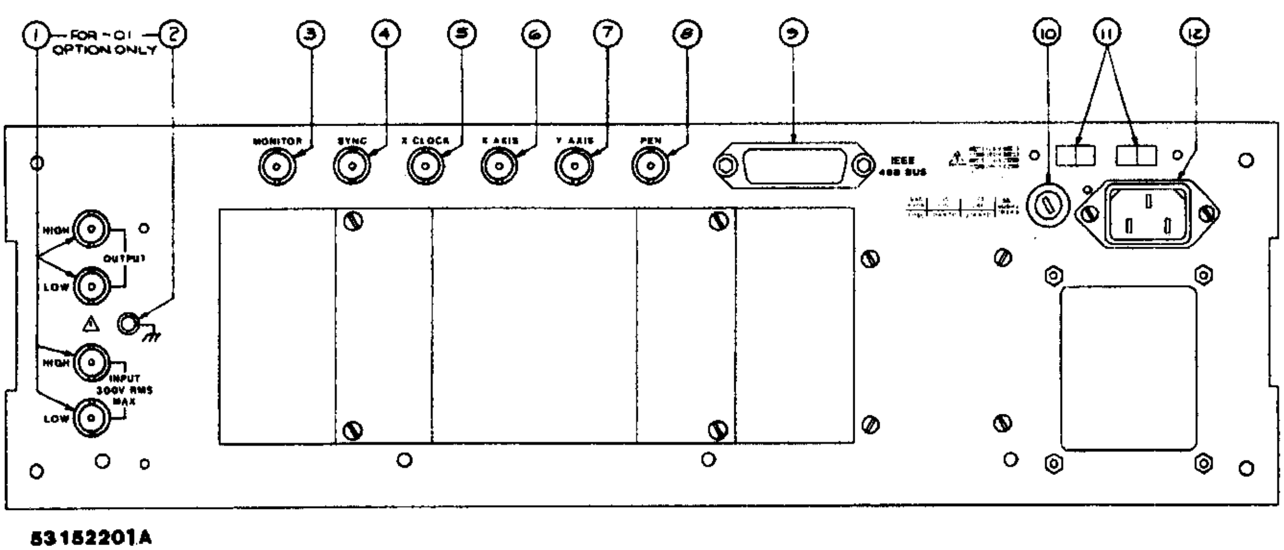


Figure 3-2. Model 1121, Rear View

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
SWEEP keys	3-1, 9	Selects the following sweep parameters.
SWEEP key		Enables the start of the sweep sequence and indicates sweep in progress.
START key		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.
STOP key		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.
HIGH key		Allows display and entry of the upper Y axis scale value in units compatible with the active analyzer measurement mode.
LOW key		Allows display and entry of the lower Y axis scale value in units compatible with the active analyzer measurement mode.
Step keys	3-1, 10	Step keys increment or decrement the active source or sweep function in frequency or level step sizes and single steps the program location function.
LINE switch	3-1, 11	Switches the instrument AC power on or off.
PROGRAM keys	3-1, 12	Selects the following program functions
PRGM key		Allows display and entry of the store/recall program location.
STO key		Stores the instrument setup at the current program location.
RCL key		Recalls the instrument setup at the current proram location.
Bus status	3-1, 13	Displays the current IEEE-488 bus status; REM (remote enabled), LSN (listener addressed), TLK (talker active), and SRQ (service request).
ADRS key	3-1, 14	Allows display and entry of IEEE-488 bus address.
LCL/INIT key	3-1, 15	Causes the instrument to "go-to-local" when remote enabled otherwise executes the initialize sequence.
SRQ key	3-1, 16	Sets the IEEE-488 bus SRQ line true.
OUTPUT connectors	3-1, 17	LOW and HIGH. Used to connect the source to external devices. The LOW terminal is connected to chassis ground in the non-floating mode.
INPUT connectors	3-1, 18	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.
Optional connectors	3-2, 1	Used to replace the front panel input and output connectors.

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

Control, Indicator, or Connector	Figure and Index 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 selector switches	**3-2, 11**	Selects the desired line operating voltage.
AC connector	**3-2, 12**	AC power connector.

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.

3-13. Analyzer Measurement Description. The Model 1121 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 1121 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 1121 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 1121 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 1121 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 notch filter can be displayed in Hz or kHz units. To select the distortion measurement function simply de-

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

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

TABLE 3-3. VALID FUNCTION ARGUMENT RANGE.

Function	Argument Range	Entry Action	Error No.
ANALYZER GROUP:			
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
SOURCE GROUP:			
FREQ	10 Hz TO 150 kHz	Set source frequency	01
FREQ STEP	0 Hz to 150 kHz	Set frequency increment	02
LEVEL[1]	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[1]	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[1]	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
BUS/PRGM GROUP:			
ADRS	0 to 30	Set IEEE-488 bus address	10
PRGM	0 to 99	Set store/recall location	11

NOTE[1] 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.

press 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 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.

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 1121 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 13 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 tuning may become indeterminate and causes the ☐ message 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 1121 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 1121 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	300.0 to 150.1 V	300.0 to 150.1 V
150.0 to 75.1 V	150.0 to 75.1 V	150.0 to 75.1 V
75.00 to 30.1 V	75.00 to 30.1 V	75.00 to 30.1 V
30.00 to 15.01 V	30.00 to 15.01 V	30.00 to 15.01 V
15.00 to 7.51 V	15.00 to 7.51 V	15.00 to 7.51 V
7.500 to 3.01 V	7.500 to 3.01 V	7.500 to 3.01 V
3.000 to 1.501 V	3.000 V and below	3.000 to 1.501 V
1500 to 751 mV		1500 to 751 mV
750.0 to 301 mV		750.0 to 301 mV
300.0 to 150.1 mV		300.0 to 150.1 mV
150.0 to 75.1 mV		150.0 to 100.1 mV
75.00 to 30.1 mV		100.0 to 50.1 mV
30.00 to 15.01 mV		50.0 mV and below
15.00 to 7.51 mV		
7.500 to 3.01 mV		
3.000 to 1.501 mV		
1.500 to 0.751 mV		
0.7500 to 0.301 mV		
0.3000 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 lot 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 1121 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 1121 contains a variable frequency, low distortion

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

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 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 1121 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 1121 source oscillator achieves high frequency accuracy and resolution through the use of a frequency lock technique. The design of the Model 1121 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 1121 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 1121 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 1121 is the scaled result of the sweep frequency or level relative to the START and STOP values. The Model 1121 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 1121 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 1121 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 Y AXIS 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 1121 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 1121 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 51 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 1121 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 1121, 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 front-panel 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 1121 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 1121. 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.

TABLE 3-6. OUTPUT LEVEL RANGES.

Level Ranges:	Resolution:
16.000 to 3.005 V	5. 0mV
3.000 to 0.301 V	1.0 mV
300.0 to 30.1 mV	0.1 mV
30.00 to 0.00 mV	0.01 mV

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 tine 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.

Option Switch A4S1 Functions:

		Listen:	Talk:
0	Restores settings of internal option switch		
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		

Mode Alteration Functions:

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

Automatic Calibration and Test Functions:
(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

Signal-to-Noise Delay Functions:

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

Frequency Sweep Resolution Functions:

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

Sweep Rate Functions:

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

AC Detector Selection Functions:

70 RMS detector enabled
71 Average detector enabled
72 Quasi-peak detector enabled.

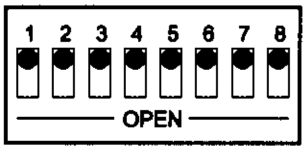
Source Output Impedance Selection Functions:

75 50 ohm output impedance
76 150 ohm output impedance
77 600 ohm output impedance

dBV/dBm Display Mode Selection Functions:

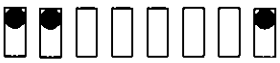
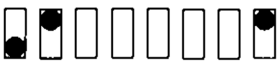
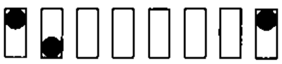
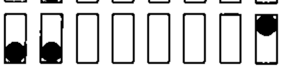
80 dBV display reference: 1.000 V
81 dBm display reference: 1 mW, 50 ohms
82 dBm display reference: 1 mW, 75 ohms
83 dBm display reference: 1 mW, 150 ohms
84 dBm display reference: 1 mW, 300 ohms
85 dBm display reference: 1 mW, 600 ohms
86 dBm display reference: 1 mW, 900 ohms

TABLE 3-8. OPTION SWITCH A4S1.

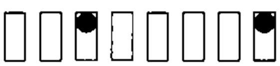
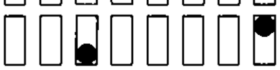


Factory settings.

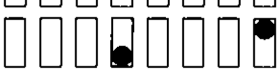
Eos Character Selection:

	Listen: LF or CR LF	Talk: CR LF
	Listen: CR	Talk: CR LF
	Listen: CR	Talk: CR
	Listen: CR	Talk: LF

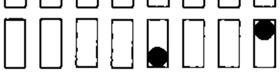
Pen Status Control:

	Pen-up is active low
	Pen-up is active high

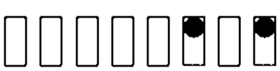
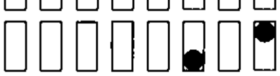
SPCL Function Disable:

	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:

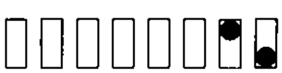
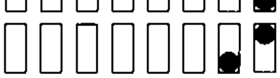
	Lamp Test
	Filter Option Entry Mode

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 1121. 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 1121 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 1121. 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 1121 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.

Analyzer Function Group:

AF Analyzer frequency
AL Analyzer level
DN Distortion
SI SINAD
SN Signal-to-noise
RA Enable ratio mode
RO Disable ratio mode

Source Function Group:

SF Source frequency
FZ Frequency step size
SL Source level
LZ Level step size
SP Special function

Sweep Function Group:

SW Sweep mode
SG Signal generator mode
XL Start function
XR Stop function
YL Low function
YH High function

Program Function Group:

PG Program location
RE Recall program
ST Store program

Units Group:

HZ Hertz
KH Kilo Hertz
VO Volt
MV Millivolt
PC Percent
DB Decibel

Float Group:

SA Single-ended analyzer input
FA Floating analyzer input
SS Single-ended source output
FS Floating source output

Output Impedance Group:

Z0 50 ohm source output
Z1 150 ohm source output
Z2 600 ohm source output

Filter Group:

F0 Disable both optional filters
F1 Enable optional filter No. 1 (left)
F2 Enable optional filter No. 2 (right)
L0 Disable all low-pass filters
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)

Detector Group:

RM Enable rms detector
AV Enable average detector
QP Enable quasi-peak detector

Talk Mode/Address Group:

TS Talk status
TV Talk value
TF Talk function
TL Talk learn string
TB Talk burst string
TP Talk program revision
AD IEEE-488 bus address

Trigger Group:

IM Immediate mode
WT Wait-for-trigger mode
TR Trigger

Display Mode Group:

BL Blank display
UD Update display

Error and SRQ Group:

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	FREQ (source)
2	FREQ STEP
3	LEVEL (source)
4	LEVEL STEP
5	SPCL
6	START
7	STOP
8	LOW
9	HIGH
10	ADRS
11	PRGM
12	FREQ (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:

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

b. The go-to-local (GTL) bus command is sent.

c. Remote enable (REN) is set false.

NOTE

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 1121 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
Universal Command Group:	
Device Clear (DCL)	Clear errors
Local Lockout (LLO)	Disable LCL/INIT key
Serial Poll Enable (SPE)	Sets talk mode for poll response
Serial Poll Disable (SPD)	Restores talk mode before poll
Addressed Command Group:	
Selective Device Clear (SDC)	Same as device clear (DCL)
Go to Local (GTL)	Sets LOCAL mode
Group Execute Trigger (GET)	Triggers a measurement
All Others:	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:

a. Fixed or floating formats are accepted.

b. The optional + or - sign may precede the mantissa and/or the exponent.

c. The optional radix point may appear at any position within the mantissa. A radix point in the exponent is ignored.

d. The optional "E" for exponent may be upper or lower case.

e. 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:

a. 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.

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. The Model 1121 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 resident

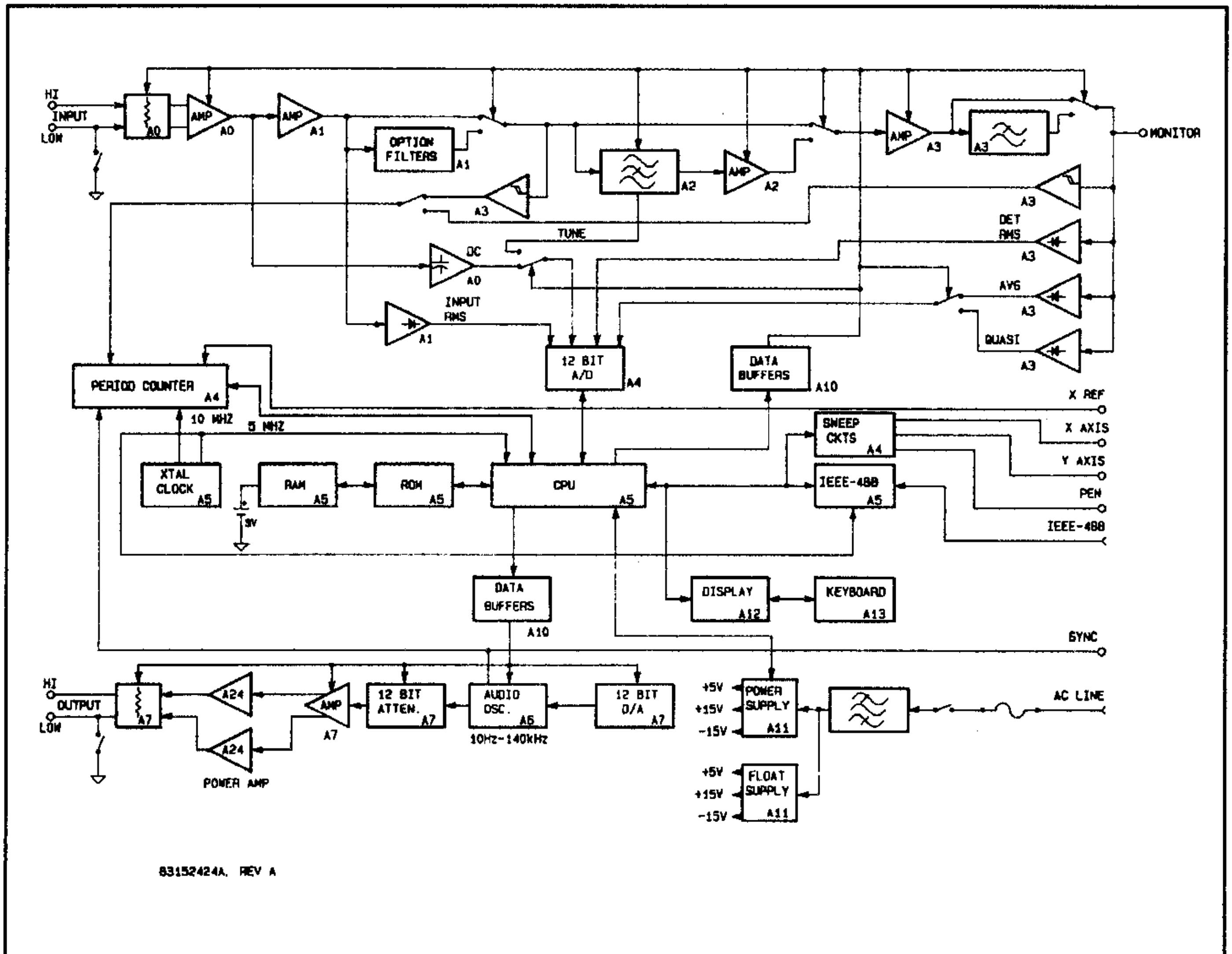


Figure 4-1. Functional Block Diagram

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.

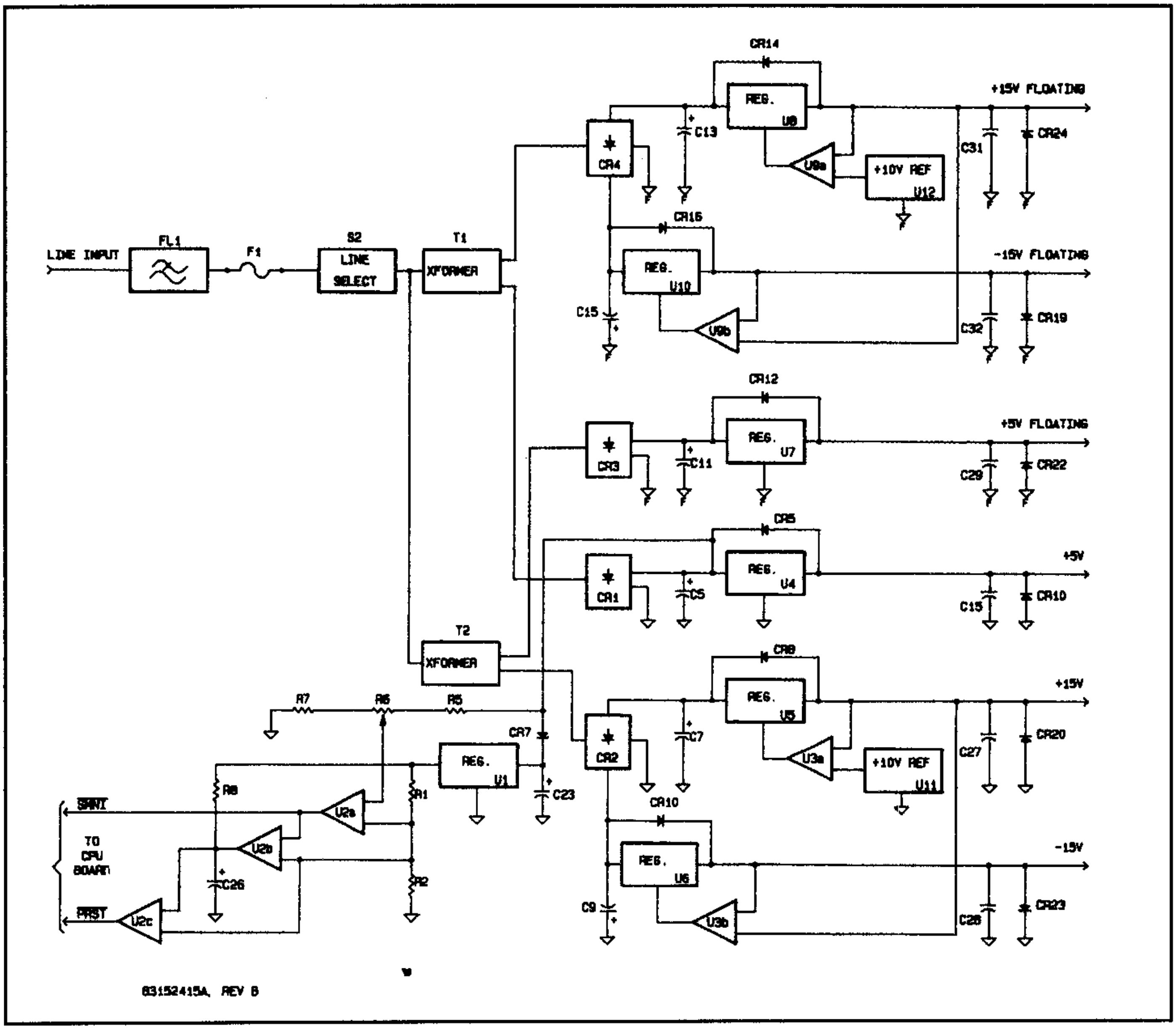


Figure 4-2. Power Supply Circuits Block Diagram.

4-14. DETAILED CIRCUIT DESCRIPTION.

4-15. A11 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 1121 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.

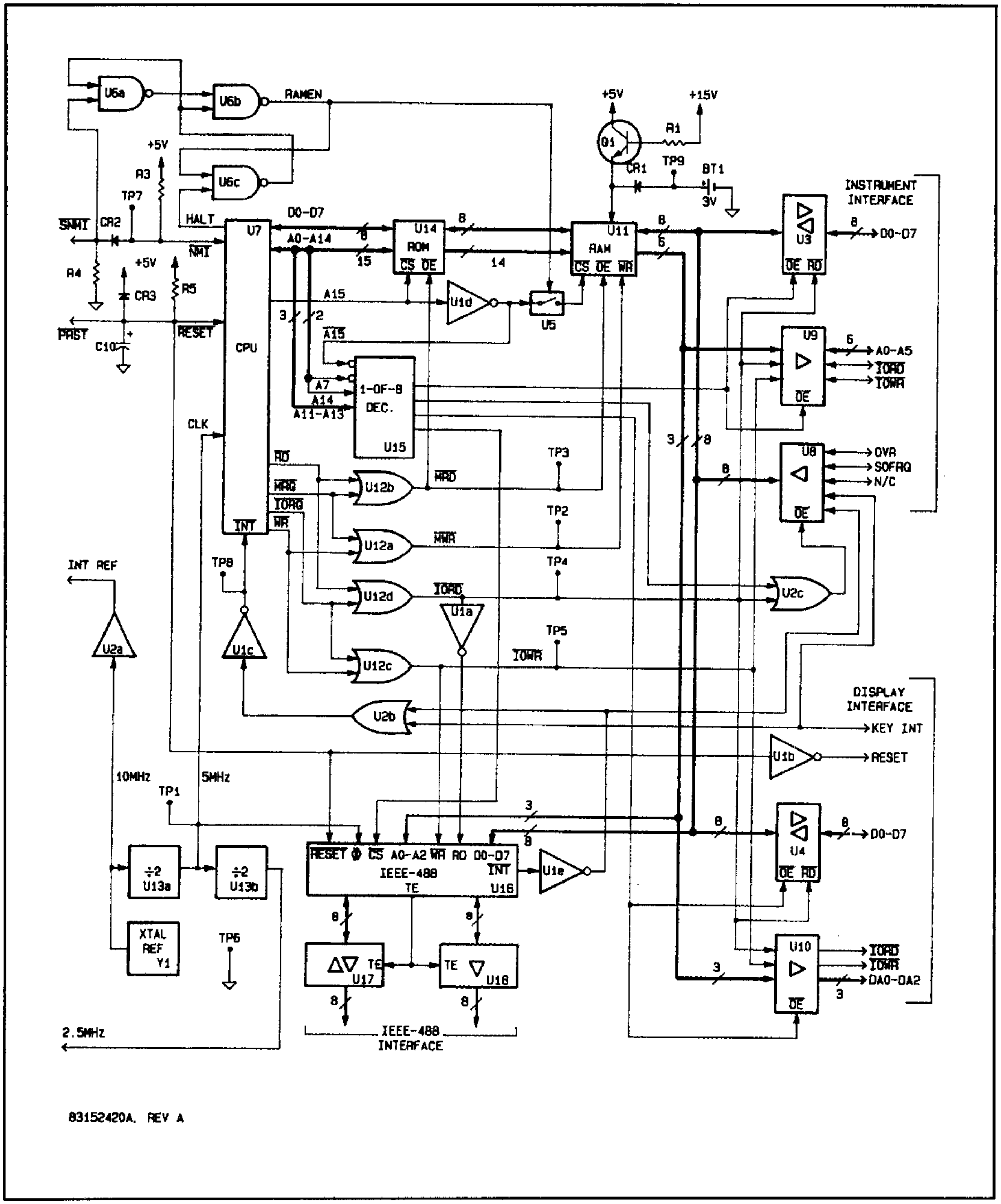


Figure 4-3. CPU Circuits Block Diagram.

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 1121. 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

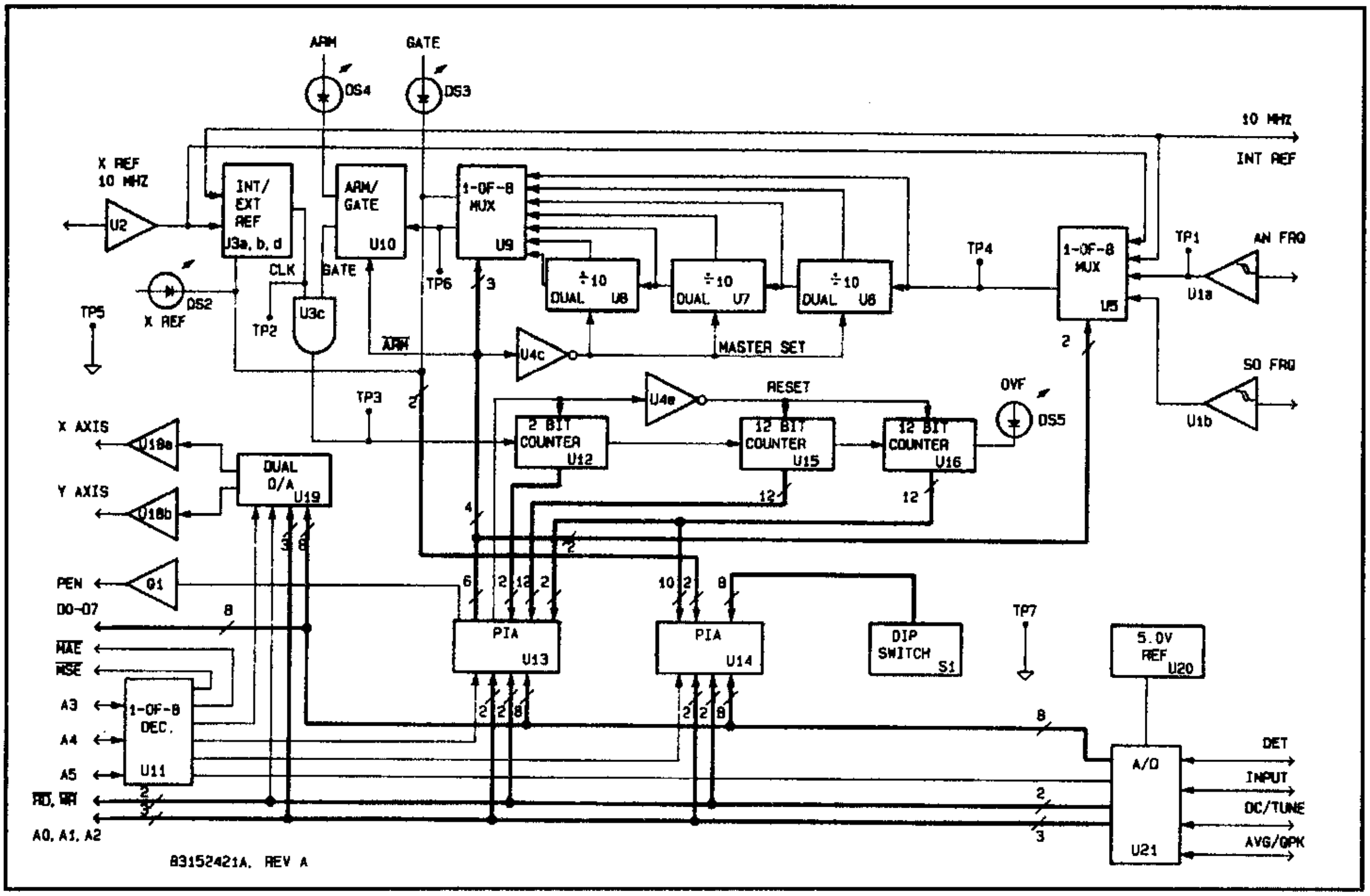


Figure 4-4. Frequency Counter Circuits Block Diagram

I/O read and write signals for qualifying data transfers between memory or I/O peripherals and the CPU (TP2-TP5).

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 memory 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 1121 circuits. Key closures are detected and sent to the microprocessor which interprets and modifies the display LEDs appropriately. The software configurable display/keyboard microcontroller, U4, 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 U4 and buffered through U1 and current limiting resistors R1a through h. The LED anodes are individually connected to a one-of-sixteen decoder consisting of U5 and U6 and buffers U2 and U3. All segment decoding is done by the microprocessor so that no additional decoders are required.

4-32. All of the alphanumeric annunciators are static and latched by octal latches U8, U9 and U10. Resistors R4, R5 and R6 limit the current through the LEDs. Decoding for these latches is accomplished by U7.

4-33. The key LEDs are all static and latched by octal latches U12, U14 and U16. In addition some LEDs on the keyboard are decoded further by one-of-eight decoders U18 and U19. Resistors R7 thorugh R10 limit the current through the keyboard LEDs.

4-34. Keyswitch decoding is accomplished by scanning the keyboard and detecting key closures. Microcontroller U4 controls the scanning of the keyboard thorugh decoder U17 which generates the column strobes C0 through C7. Any key closure will convey the column strobe to one of eight row lines, R0 through R7, which are monitored by U4. Multiple key closures and key debouncing are handled by U4. 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 1121. 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

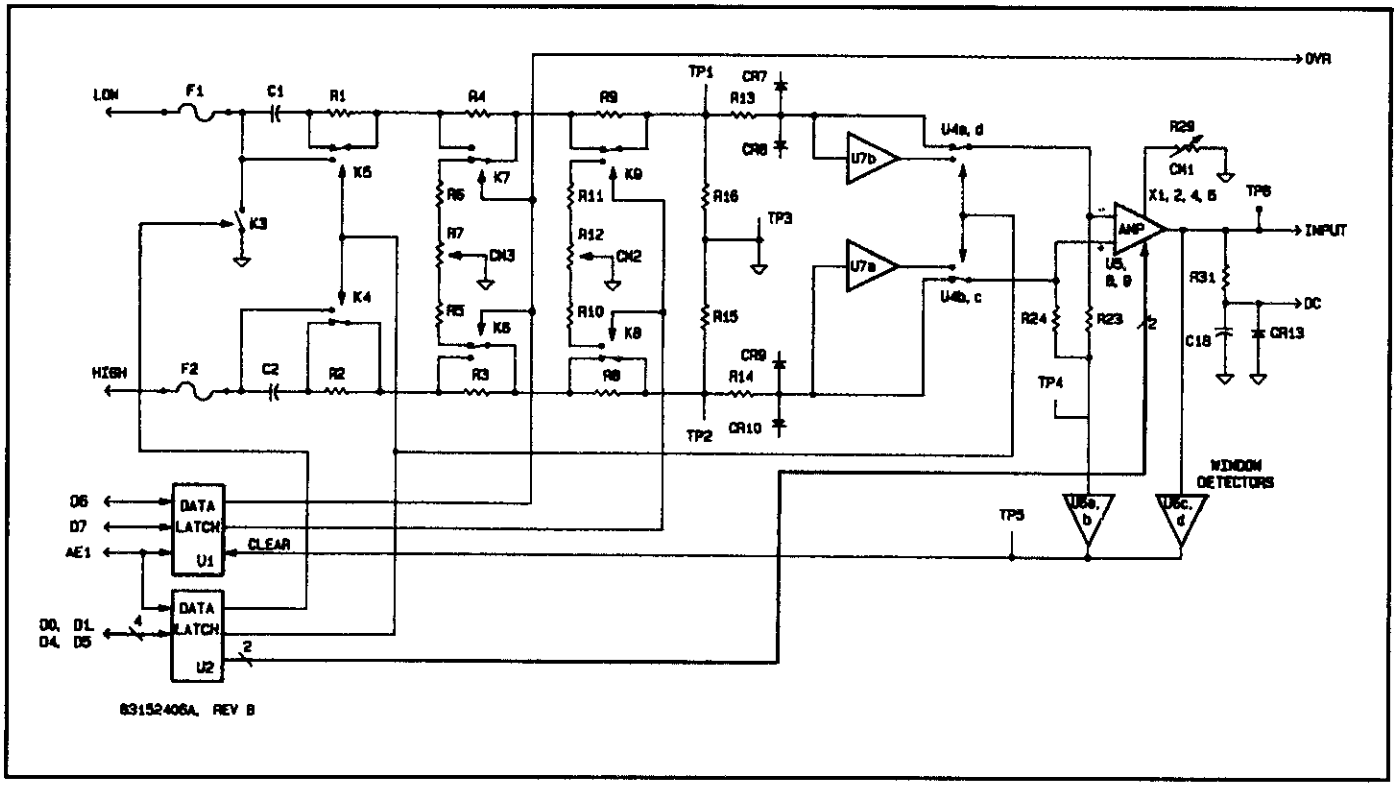


Figure 4-5. Input Circuits Block Diagram.

output of U10a pin 5 goes to gate U3c which allows the reference to pass to the counter accumulator during the gate interval (TP3).

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 1121. 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,

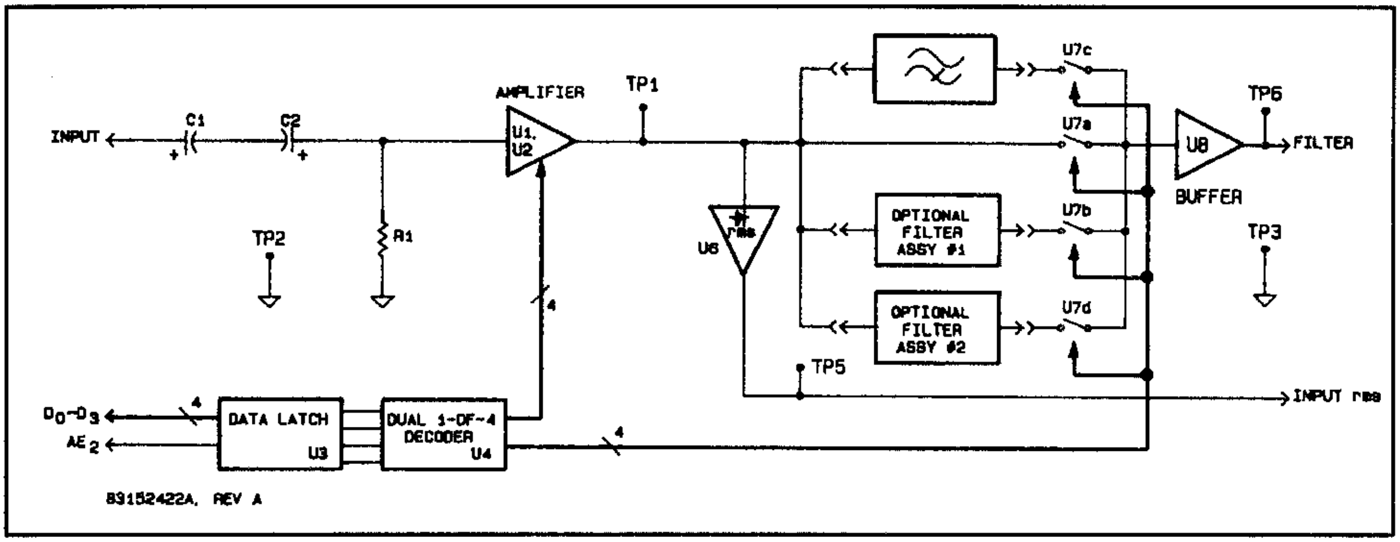


Figure 4-6. Filter Circuits Block Diagram.

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.

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 thorugh 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 ± 10 volts. The common mode signal is formed by summing the outputs of U5 and U8 with resistors R23 and R24 (TP4). The ± 10 volt window is formed by CR11, CR12, and R26. Any common mode or differential peak amplitude exceeding ± 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 thorugh 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 int he 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 09 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 thorugh 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 thorugh 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

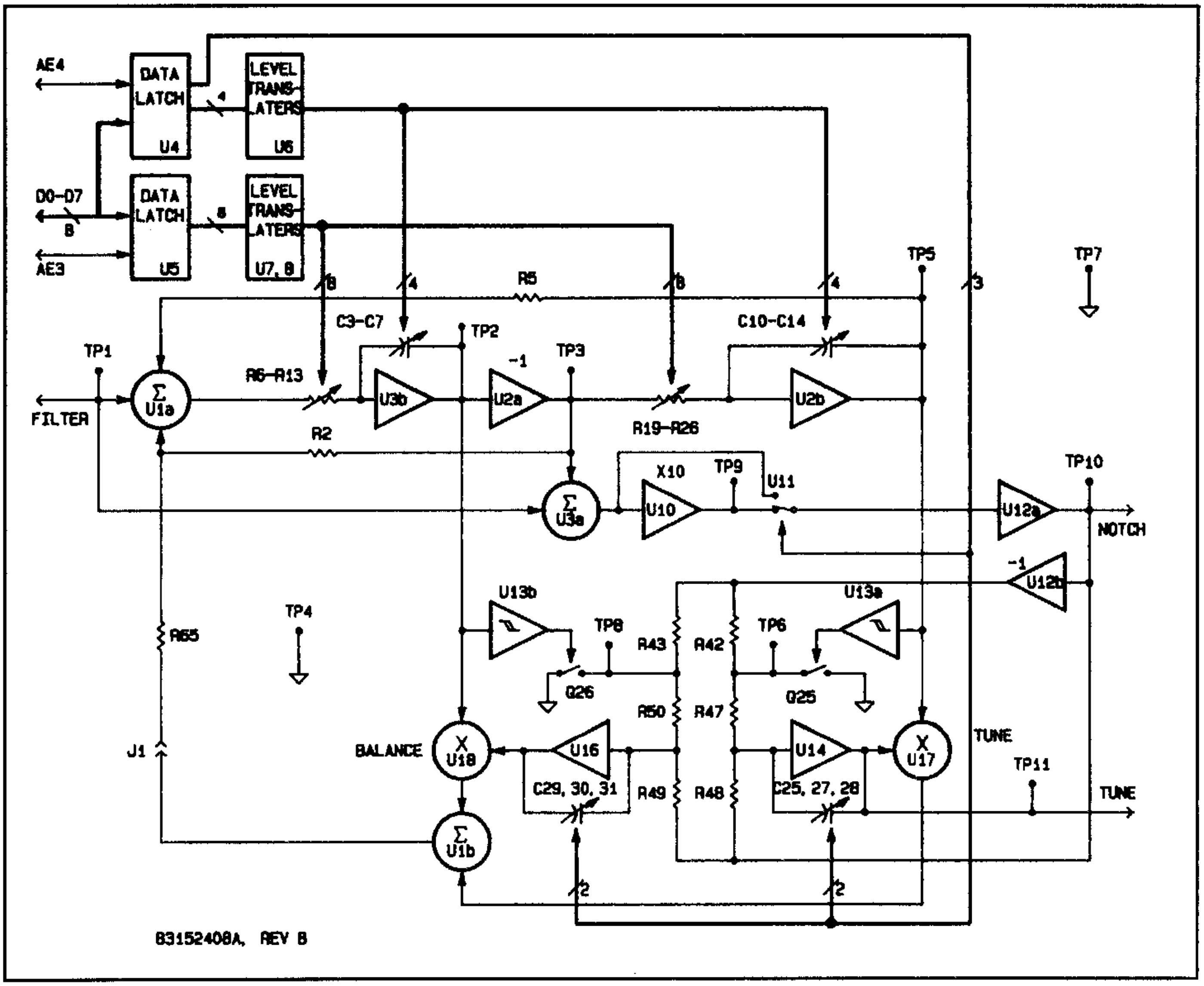


Figure 4-7. Notch Filter Circuits Block Diagram.

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 thorugh 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.

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 1121. 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 bipo-

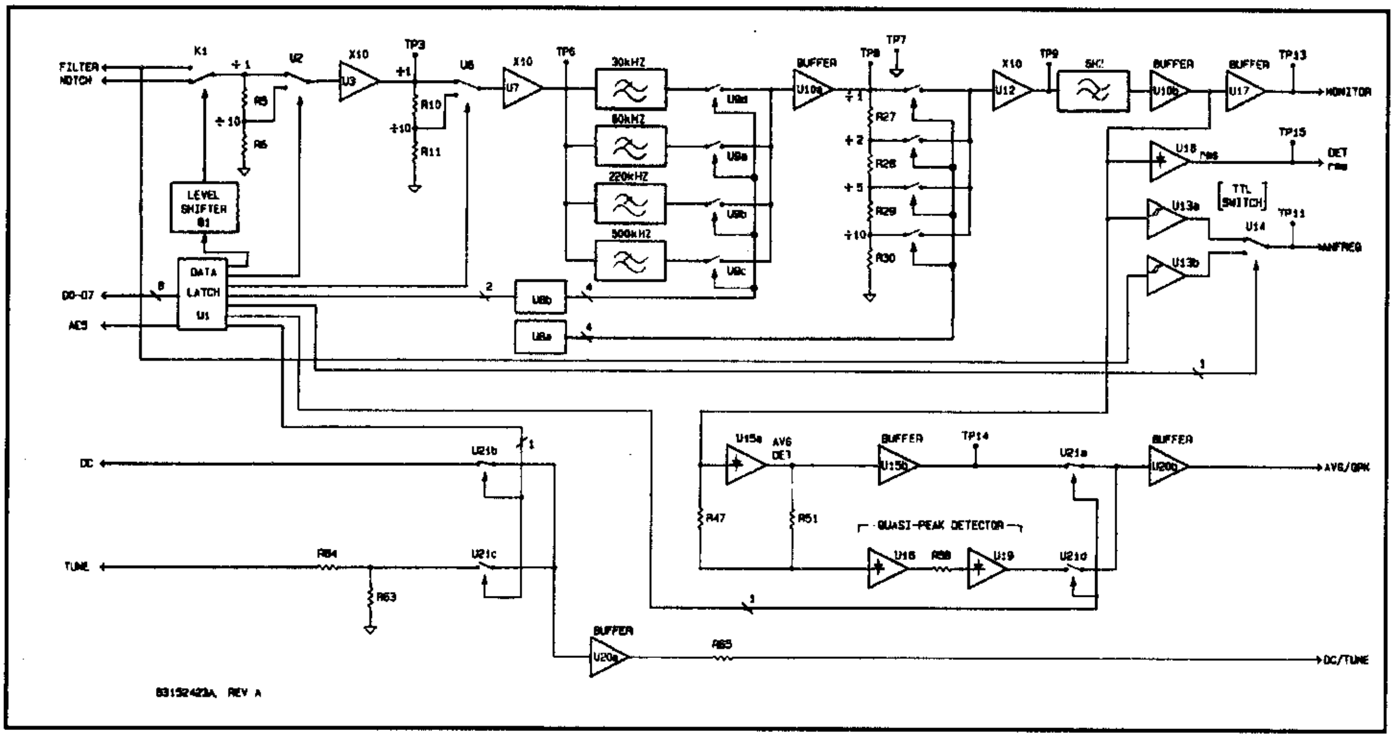


Figure 4-8. Detector Circuits Block Diagram.

lar voltage reference formed by CR6, CR7, and R19. All output swings of amplifier U3 will be limited to less than ± 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.

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 thorugh 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 1121. 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 sinewave input waveform. Inverting amplifier U13b presents a positive 0 to 3 volt level to the A/D converter (TP7).

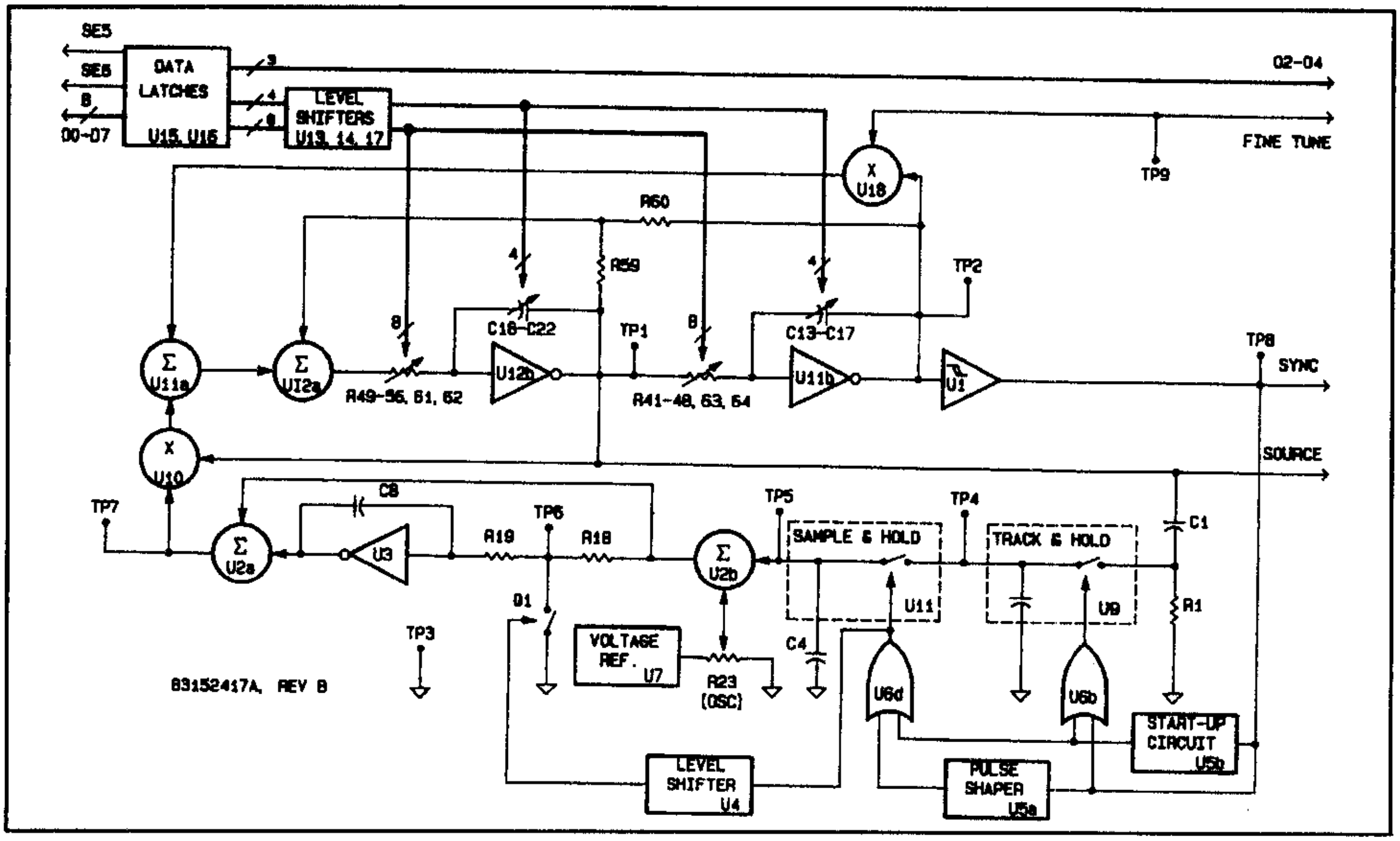


Figure 4-9. Source Circuits Block Diagram.

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 tot he 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 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 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 µs 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 µs 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 inventing 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).

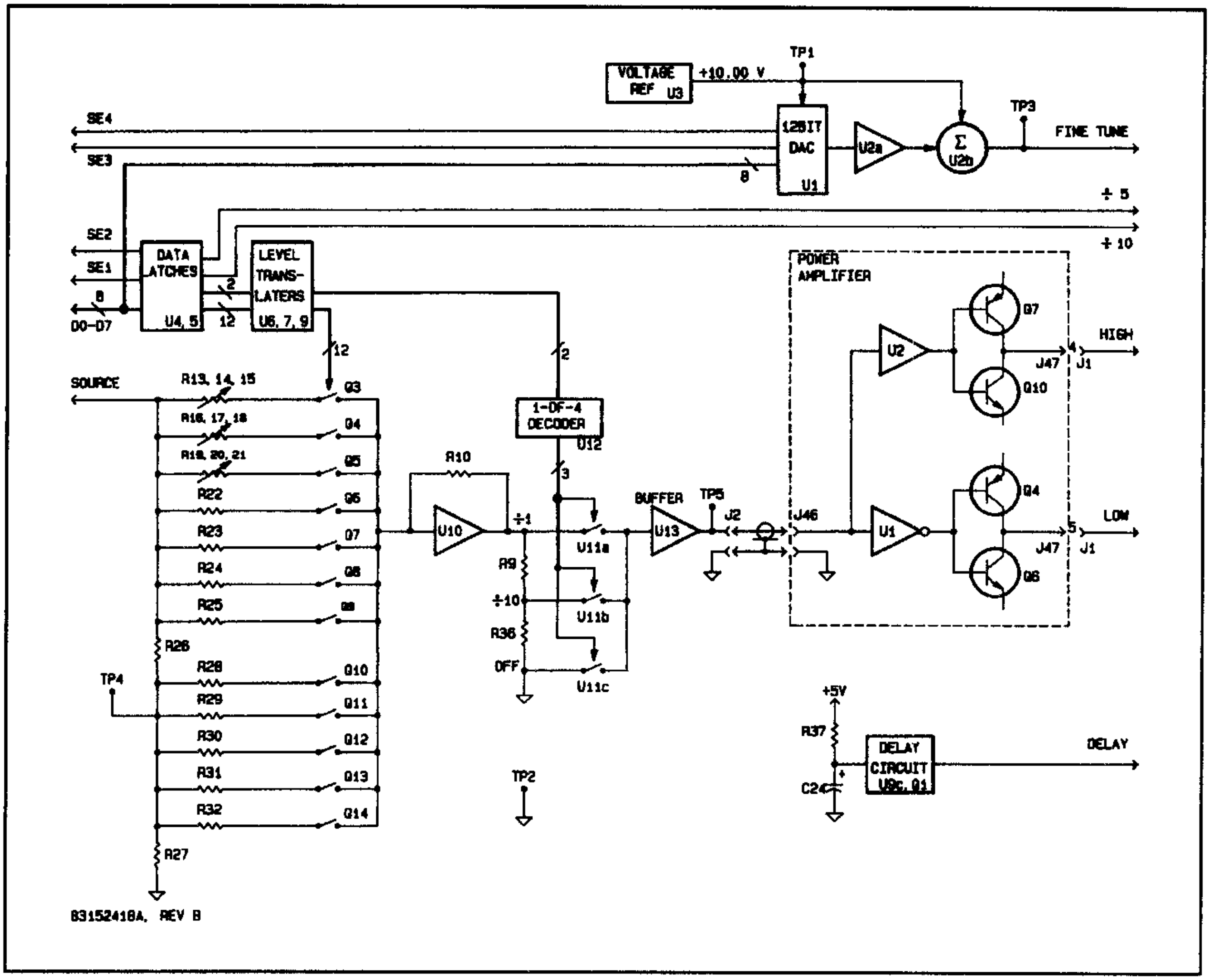


Figure 4-10. Output Circuits Block Diagram.

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.

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 1121 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.

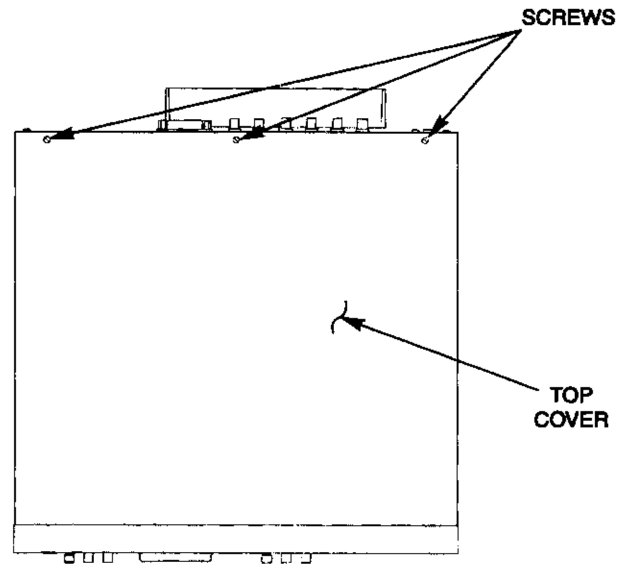


Figure 5-1. Removing Covers

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	**Frequency Range:** 10 Hz to 200 kHz **Level Range:** 1mV to 300 V **Flatness:** ± 0.3%; 10 - 30 Hz ± 0.25%; 30 Hz - 200 kHz **AC Accuracy:** ± 0.1%; 50 Hz - 50 kHz **DC Accuracy:** ± 0.05%	X		X	Fluke Model 5100B-03
Test Oscillator	**Frequency Range:** 5 Hz to 500 kHz **Level Range:** 0 to 3 V rms **Flatness:** ± 0.3 dB	X			Tektronix Model SG502
Frequency Counter	**Range:** 10 Hz to 200 kHz **Accuracy:** 0.1 ppm	X			HP Model 5345A
Digital Multimeter	**AC Accuracy:** ± 1.0% **Resolution:** 1 µV; 0 to 200 mV 10 µV; 200 to 2000 mV 100 µV; 2.0 to 20.0 V		X		Fluke Model 8840A-09
Wave Analyzer	**Frequency Range:** 20 Hz to 50 kHz **Bandwidth:** 10 Hz **Display Range:** 70 dB		X		HP Model 3581A
Frequency Standard	**Frequency:** 10 MHz **Level:** TTL compataible **Accuracy:** 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; ± 0.3dB; 50 ohm	X			HP 355D
50 ohm resistor	50 ohms, ±0.1%, 2 watt, T2	X			KDI PME 75
150 ohm resistor	150 ohms, ±0.1%, 1 watt, T2	X			Dale CMF 70
600 ohm resistor	600 ohms, ±0.1%, 1 watt, T2	X			Dale CMF 70

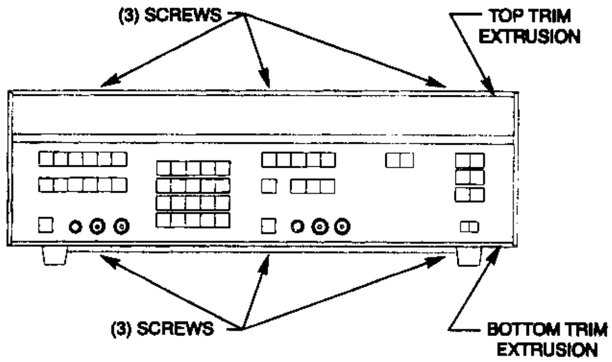


Figure 5-2. Removing Top and Bottom Trip Extrusions

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.

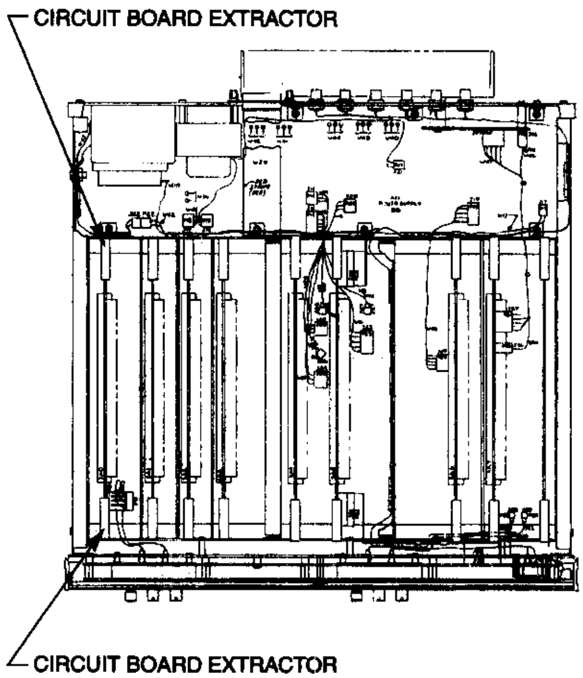


Figure 5-3. Removing Circuit Boards

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, nonconductive 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 1121 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 1121 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.

$$Z_{OUT} = \left(\frac{100.6\%}{DISP\%} - 1\right)596.4$$

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.

$$Z_{OUT} = \left(\frac{100.15\%}{DISP\%} - 1\right)149.8$$

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.

$$Z_{OUT} = \left(\frac{100.05\%}{DISP\%} - 1\right) 49.98$$

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 1121 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 1121 HI and LOW outputs to the Analyzer HI and LOW inputs using the balanced cable and adapters.

f. Enter the Model 1121 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 1121 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 1121 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 1121 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 1121 HI output to the input of the HP 355D step attenuator and connect the output of the attenuator to the Model 1121 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 1121 output level to 3.000 volts at 1 kHz.

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

d. Set the Model 1121 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 1121 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 the 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 instrument 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 Tble 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 3 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 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 dB ± 0.05 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 dB ± 0.05dB.

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 dB ± 0.05 dB.

g. Check the frequency against the specified limits and record the result, pass or fail, in Tble 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 5-17 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:

a. Set the Source to a frequency of 1000 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.

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:

a. Set the Source to a frequency of 1000 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.

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.

CALIBRATOR LEVEL	CALIBRATOR FREQUENCY	MINIMUM	ACTUAL	MAXIMUM
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 LEVEL	CALIBRATOR FREQUENCY	SPCL 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_{OUT}
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.

SOURCE FREQUENCY	REFERENCE	MINIMUM	ACTUAL	MAXIMUM
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.

SOURCE FREQUENCY	MINIMUM	PASS/FAIL		MAXIMUM
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.

SOURCE FREQUENCY	MINIMUM	PASS/FAIL		MAXIMUM
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.

FILTER	MINIMUM	PASS/FAIL		MAXIMUM
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.

SOURCE LEVEL	FREQUENCY	BW	PASS/FAIL		MAXIMUM
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
200.0 mV	10 Hz	80 kHz	PASS	FAIL	-80.00 dB
200.0 mV	20 Hz	80 kHz	PASS	FAIL	-80.00 dB
200.0 mV	100 Hz	80 kHz	PASS	FAIL	-80.00 dB
200.0 mV	1000 Hz	80 kHz	PASS	FAIL	-80.00 dB
200.0 mV	10000 Hz	80 kHz	PASS	FAIL	-80.00 dB
200.0 mV	20000 Hz	80 kHz	PASS	FAIL	-80.00 dB
200.0 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.

SOURCE LEVEL	FREQUENCY	BW	PASS/FAIL		MINIMUM
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
356 mV	10 Hz	80 kHz	PASS	FAIL	85.00 dB
356 mV	20 Hz	80 kHz	PASS	FAIL	85.00 dB
356 mV	100 Hz	80 kHz	PASS	FAIL	85.00 dB
356 mV	1000 Hz	80 kHz	PASS	FAIL	85.00 dB
356 mV	10000 Hz	80 kHz	PASS	FAIL	85.00 dB
356 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.

SOURCE LEVEL	SOURCE FREQUENCY	PASS/FAIL		MAXIMUM
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.

SOURCE FREQUENCY	MINIMUM	PASS/FAIL		MAXIMUM
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.

SOURCE FREQUENCY	MINIMUM	PASS/FAIL		MAXIMUM
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	$-\infty$	PASS	FAIL	-46.3

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

SOURCE FREQUENCY	MINIMUM	PASS/FAIL		MAXIMUM
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.

SOURCE FREQUENCY	MINIMUM	PASS/FAIL		MAXIMUM
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.

SOURCE FREQUENCY	MINIMUM	PASS/FAIL		MAXIMUM
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.

SOURCE FREQUENCY	MINIMUM	PASS/FAIL		MAXIMUM
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 1121 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. Remove the timebase adjustment access screw in the top of A5Y1 to expose the trimmer adjustment.

d. Connect the House Standard frequency reference to the rear panel X CLK input.

e. Apply power to the instrument.

f. Enter special function 35 to enable the frequency counter check mode.

g. Observe the SOURCE display and adjust A5Y1 until the display indicates 10000.00 kHz ± 1 count.

h. Disconnect power from the instrument.

i. Replace the timebase adjustment access screw and cable.

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% ± 0.1%

g. Enter special function 26, note the display and adjust A0C32 for an indication of 100.00% ± 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% ± 0.1%.

g. Enter special function 26, note the display and adjust A0C33 for an indication of 100.00% ± 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 1121 to initialize the instrument. Connect the Model 1121 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 mV ± 0.3 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 mV ± 0.5 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 mV ± 0.5 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 1121.

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 1121 HI and LOW outputs to the Multimeter input using the balanced cable and adapters.

e. Set the Model 1121 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 ± 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 ± 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 ± 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 1121 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 1121 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 1121 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 ± 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 ± 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.

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 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, 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, AOU1
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

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 1121 as it was received.

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

a. Wrap the Model 1121 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 ≥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 1121 in the shipping container. Maintain storage temperature range of -4 to 140°F (-40 to 71°C) at 75±5 relative humidity.

SECTION 6
PARTS LIST

6-1. INTRODUCTION.

6-2. The replaceable parts for the Model 1121 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. MANUFACTURER'S COMMERCIAL AND GOVERNMENT ENTITY CODE NUMBERS.

01121	Allen Bradley	31918	ITT Schadow, Inc.
01295	Texas Instruments	32293	Intersil, Inc.
02114	Ferroxcube Corp.	32575	AMP
02735	RCA Solid State Division	33297	NEC
03888	Pyrofilm (KDI)	33883	RMc
04222	AVX Ceramics Company	34335	Advanced Micro Devices
04713	Motorola Semiconductor	34371	Harris Semiconductor
04901	Boonton Electronics Corporation	34899	Fair-rite
06383	Panduit Corporation	49956	Raytheon Corporation
06665	Precision Monolithics	51406	Murata Corporation of America
06776	Robinson Nugent, Inc.	51640	Analog Devices, Inc.
07263	Fairchild Semiconductor	54420	Dage - MTI
11961	Semicon	54426	Buss Fuses
13812	Dialco Division of Amperex	54473	Panasonic
14655	Cornell-Dubilier	56289	Sprague Electric Company
14752	Electro Cube, Inc.	56708	Zilog, Inc.
15636	Elec-Trol	57582	Kahgan Electronics Corporation
17856	Siliconix, Inc.	61637	Kemet - Union Carbide
18324	Signetics Corporation	64537	Pyrofilm (KDI)
19505	Applied Eng'r. Products	71450	CTS Corporation
19701	Mepco Electra	73138	Beckman Instruments, Helipot Division
20307	Arco - Micronoics	74970	E.F. Johnson
24226	Gowanda Electronics	75915	Littlefuse
27014	National Semiconductor	81073	Grayhill
27264	Molex, Inc.	82389	Switchcraft
27735	F-Dyne electornics	91293	Johanson
27802	Vectron Labs	91637	Dale Electronics
28480	Hewlett-Packard Corporation	95348	Gordos Corporation
31313	Components Corporation	98291	Sealectro Corporation
31781	EDAC	S4217	United Chemicon, Inc.

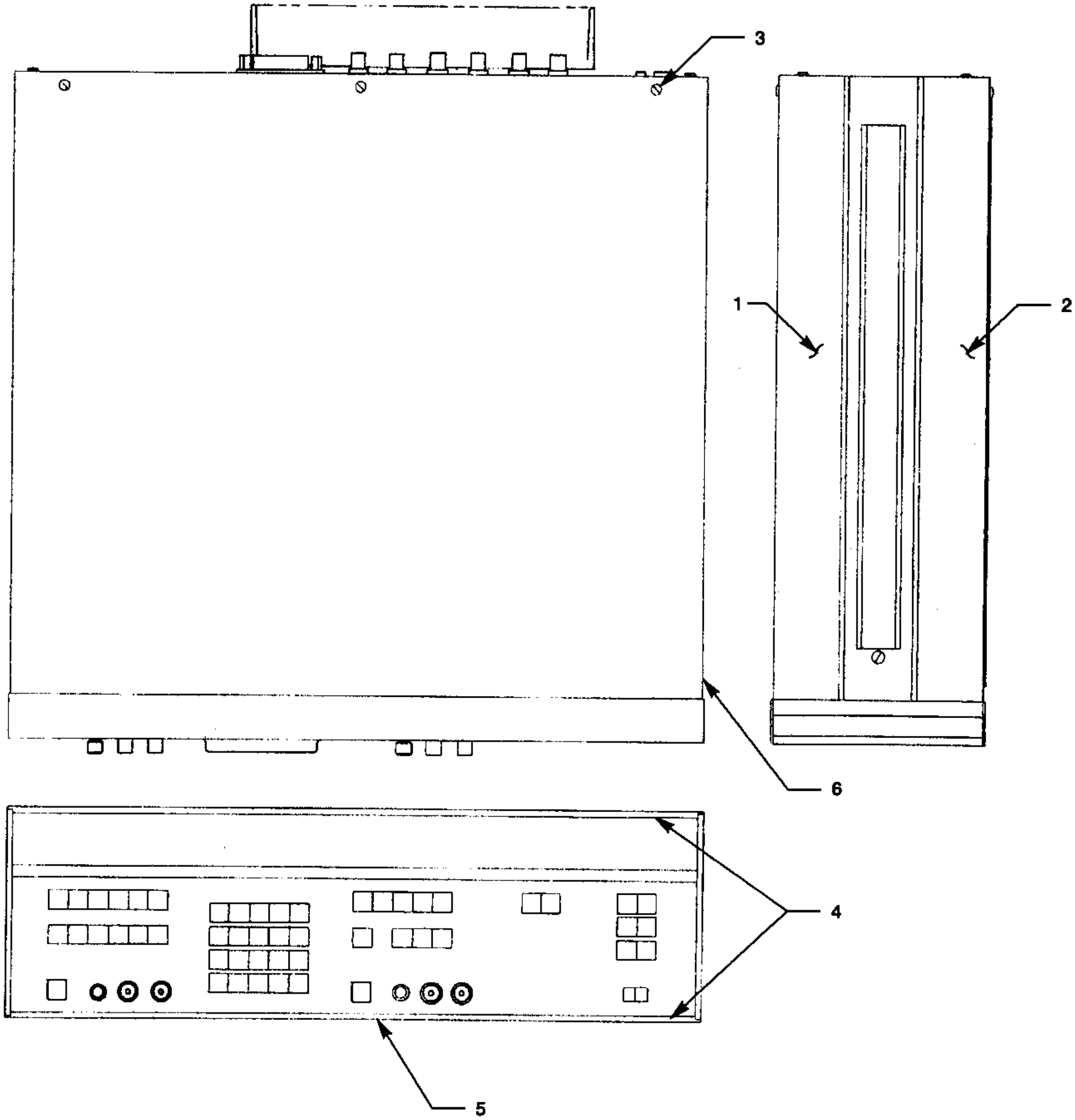


Figure 6-1. Model 1121 Programmable Audio Analyzer

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

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
1	TOP COVER	04901	60004902A	1	60004902A
2	BOTTOM COVER	04901	04311802A	1	04311802A
3	SCREW, BINDING HEAD, SS, BLK OXIDE, 6-32 x 1/4	04901	79326901A	6	79326901A
4	TRIM, FRONT PANEL (TOP AND BOTTOM)	04901	60463301A	2	60463301A
5	SCREW, BHSL SEMS, 4-40x1/4 (W/LOCKWASHER)	04901	911002000	3	911002000
6	1121 FRAME ASSY	04901	11212501A	1	11212501A

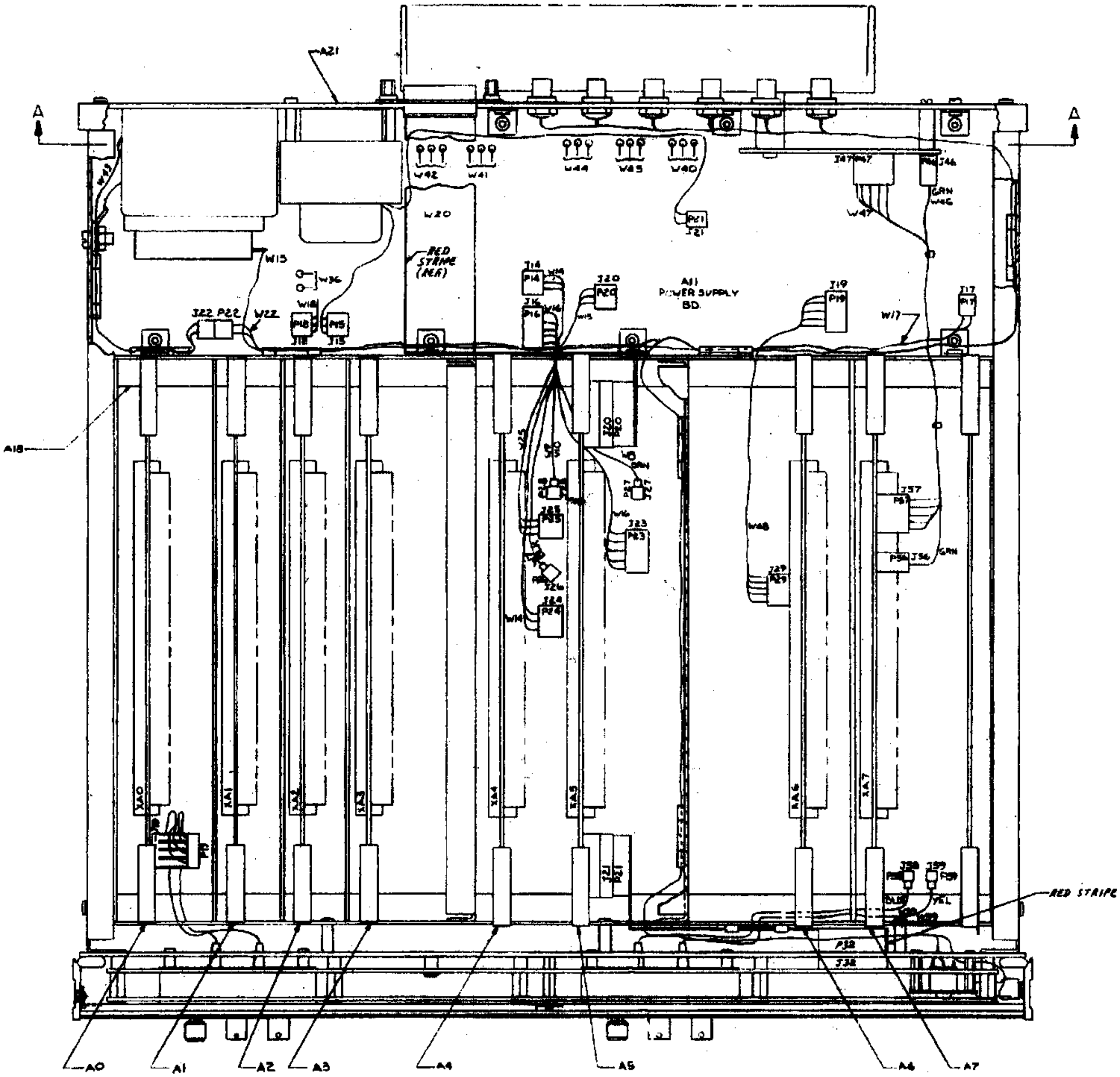


Figure 6-2. '1121' Frame Assy (Sheet 1 of 2)

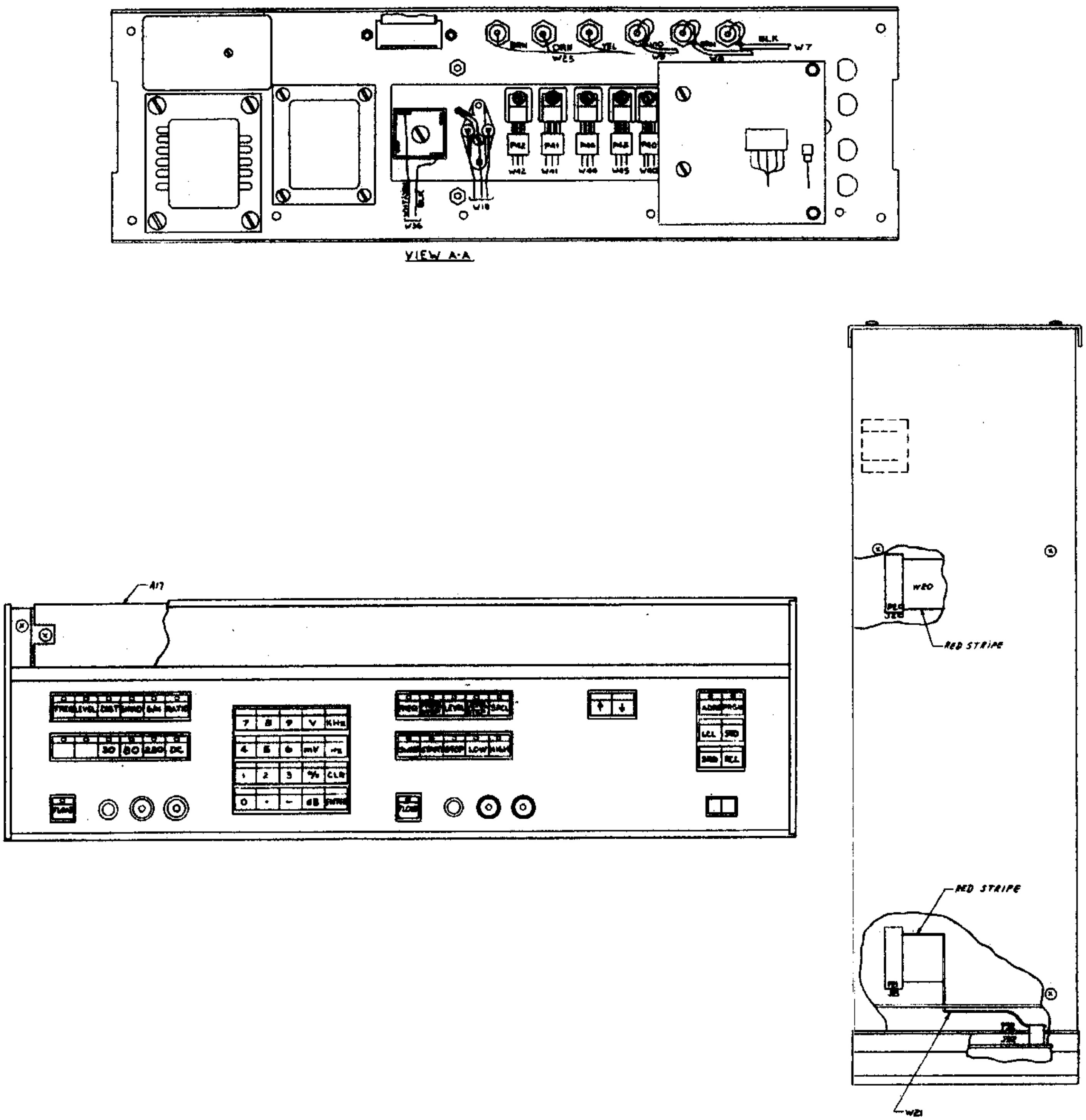


Figure 6-2. '1121' Frame Assy (Sheet 2 of 2)

TABLE 6-2 REPLACEABLE PARTS LIST.

11212501A '1121' FRAME ASSY (A22)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
A0	PWA '1121' INPUT	04901	11202802A	1	11202802A
A1	PWA '1121' MAIN FILTER	04901	11210500A	1	11210500A
A2	PWA '1121' NOTCH	04901	11208001A	1	11208001A
A3	PWA '1121' DETECTOR	04901	11210000A	1	11210000A
A4	PWA '1121' FREQ COUNTER	04901	11201905A	1	11201905A
A5	PWA '1121' CPU	04901	11202703A	1	11202703A
A6	PWA '1121' SOURCE	04901	11207700A	1	11207700A
A7	PWA '1121' OUTPUT	04901	11103201A	1	11103201A
A11	PWA '1121' POWER SUPPLY	04901	11102800A	1	11102800A
A17	'1121' FRONT PANEL ASSY	04901	11200406A	1	11200406A
A18	'1121' CARD CAGE ASSY	04901	11201205A	1	11201205A
A21	'1121' REAR PANEL ASSY	04901	11104103B	1	11104103B
A22	'1121' FRAME ASSY	04901	11212521A	1	11212521A
W14	CABLE ASSY WIRE 22GA 3C 7.00L	04901	57124200A	1	57124200A
W16	CABLE ASSY WIRE 22GA 5C 6.50L	04901	57121901A	1	57121901A
W21	CABLE ASSY FLAT 26 CKT 15.00L	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
W48	CABLE ASSY WIRE 22GA 5C 8.00L	04901	57124100A	1	57124100A

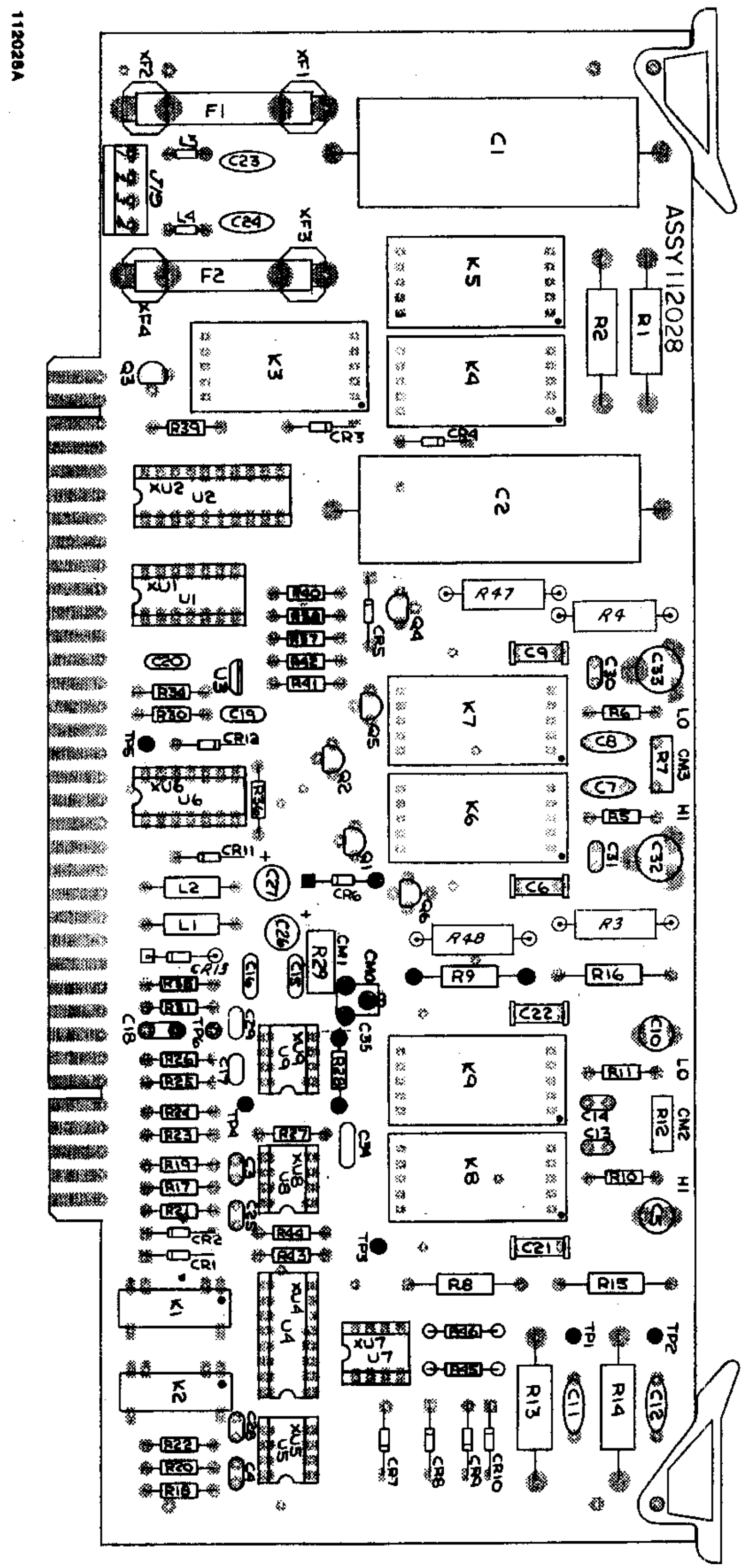


Figure 6-3. PWA '1121' Input (A0)

11202802A REV A PWA '1121' INPUT (A0) (Figure 6-3)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C1-2	CAP MATCHED PAIR	04901	23418000A	2	23418000A
C3-4	CAP MICA 20 pF 5% 300V	14655	CD5CC200J	2	205017000
C5,10	CAP VAR CER 5-25pF 250V VIO	91293	9374	2	281021000
C6,9,21-22	CAP CER 8.2pF + -0.5pF 500V	32897	301-000-R2G0-829D	4	224322000
C7-8	CAP MICA 680pF 1% 300V	14655	CD15FC581F03	2	200015000
C11-12	CAP MICA 20000pF 5% 500V	00853	CMR07F203J0DM	2	20302000A
C13-14	CAP MICA 12pF 5% 300V	57582	KD5120J301	2	205005000
C15-16	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C17	CAP MICA 10pF 5% 300V	14655	CD5CC100J	1	205002000
C18	CAP CER 1.0uF 20% 50V	04222	SR305E105MAA	1	224264000
C19-20	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C23-24	CAP CER 33pF 5% 1000V	56289	10TCC-Q33	2	224139000
C25	CAP MICA 56pF 5% 300V	14655	CD5EC560J	1	205031000
C26-27	CAP EL 100uF 20% 25V	S4217	SM-25-VB-101M	2	283334000
C28	CAP MICA 27pF 5% 300V	14655	CD5EC270J	1	205008000
C29,31	CAP MICA 33pF 5% 300V	20307	DM5-EC330J	2	205010000
C30	CAP MICA 130pF 5% 100V	14655	CD5FA131J	1	205011000
C32-33	CAP VAR CER 6-70pF	91293	9315	2	281010000
C34	CAP MICA 18pF 5% 300V	14655	CD5CC180J	1	205046000
C35	CAP VAR-CER 5-30pF RIGHT ANGLE	91293	9383	1	28102800A
CR1-6	DIODE SIG 1N914	01295	1N914	6	530058000
CR7-10	DIODE SIG FDH-300	27014	FDH300	4	530052000
CR11-12	DIODE ZENER 1N5230B 4.7V 5%	04713	1N5230B	2	530103000
F1-2	FUSE 0.25 AMP 250V AGC	54426	AGC-1/4	2	54550600A
J19	HEADER 4 PIN STRAIGHT	06383	HPSS156-4-C	1	477344000
K1-2	RELAY FORM "A"	15636	RA3080-1051	2	471033000
K3-9	RELAY REED 15V PSEUDO FORM "C"	18542	1632-3-1	7	47104800A
L1-2	INDUCTOR 5.6uH 10%	24226	15/561	2	400308000
L3-4	FERRITE BEADS	34899	2643000101	2	483247000
Q1-6	TRANS NPN 2N3904	04713	2N3904	6	528071000
R1-2, 13-14	RES COMP 10K 5% 1W	01121	GB1035	4	302125000
R3-4	RES MF 54.20K 0.1% 1W	91637	CMF-70-5422-B-T9	2	32675900A
R5-6	RES MF 1.000K 0.1% 1/8W	64537	PME55-T9-1K	2	324241000
R7	RES VAR 20 OHM 20% 0.5W	73138	72XWR20	1	311397000
R8-9	RES MF 90.00K 0.1% 1/2W	64537	PME65-T9-90K	2	32676100A
R10-11	RES MF 11.00K 0.1% 1/8W	64537	PME55-T9-11K	2	32592300A
R12	RES VAR 200 OHM 10% 0.5W	73138	72XWR200	1	311339000
R15-16	RES MF 100.0K 0.1% 1/2W	64537	PME65-T9-100K	2	32676300A
R17-18	RES MF 2.000K 0.1% 1/8W	64537	PME55-T9-2K	2	324275000
R19-21	RES MF 4.000K 0.1% 1/8W	64537	PME55-T9-4K	3	324313000
R22	RES MF 8.000K 0.1% 1/8W	64537	PME55-T9-8K	1	32592400A
R23-24	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	2	341400000
R25-27	RES MF 5.000K 0.1% 1/8W	64537	PME55-T9-5K	3	324326000
R28	RES MF 4.950K 0.1% 1/8W	64537	PME55-T9-4.95K	1	32592500A

R29	RES VAR 100 OHM 10% 0.5W	73138	72XWR100	1	311306000
R30-31	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	2	341400000
R34-35	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	2	341367000
R36	RES MF 20.0K 1% 1/4W	19701	5043ED20K00F	1	341429000
R37-42	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	6	341329000
R43-46	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	4	341300000
R47-48	RES MF 44.80K 1% 1W	91637	CMF-70-4482-8-T9	2	32675800A
U1	IC 74LS74 FLIP FLOP	01295	SN74LS74N	1	534157000
U2	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	1	534263000
U3	IC UA7805UC VOLT REG	07263	uA7805UC	1	53511700A
U4	IC 13333 ANALOG SWITCH LF	27014	LF13333N	1	535095000
U5, 8-9	IC 5534AFE OP AMP	18324	NE5534AFE	3	53514401A
U6	IC 339 QUAD COMPARATOR	27014	LM339N	1	535018000
U7	IC OPA2107AP DUAL OP AMP	13919	OPA2107AP	1	53520200A
XF1-4	FUSE CLIP	54426	1A-1119-10	4	482110000
XU1,6	SOCKET IC 14 PIN	06776	ICN-143-S3-G	2	473019000
XU2	SOCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000
XU4	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU5, 7-9	SOCKET IC 8 PIN	06776	ICN-083-S3-G	4	473041000

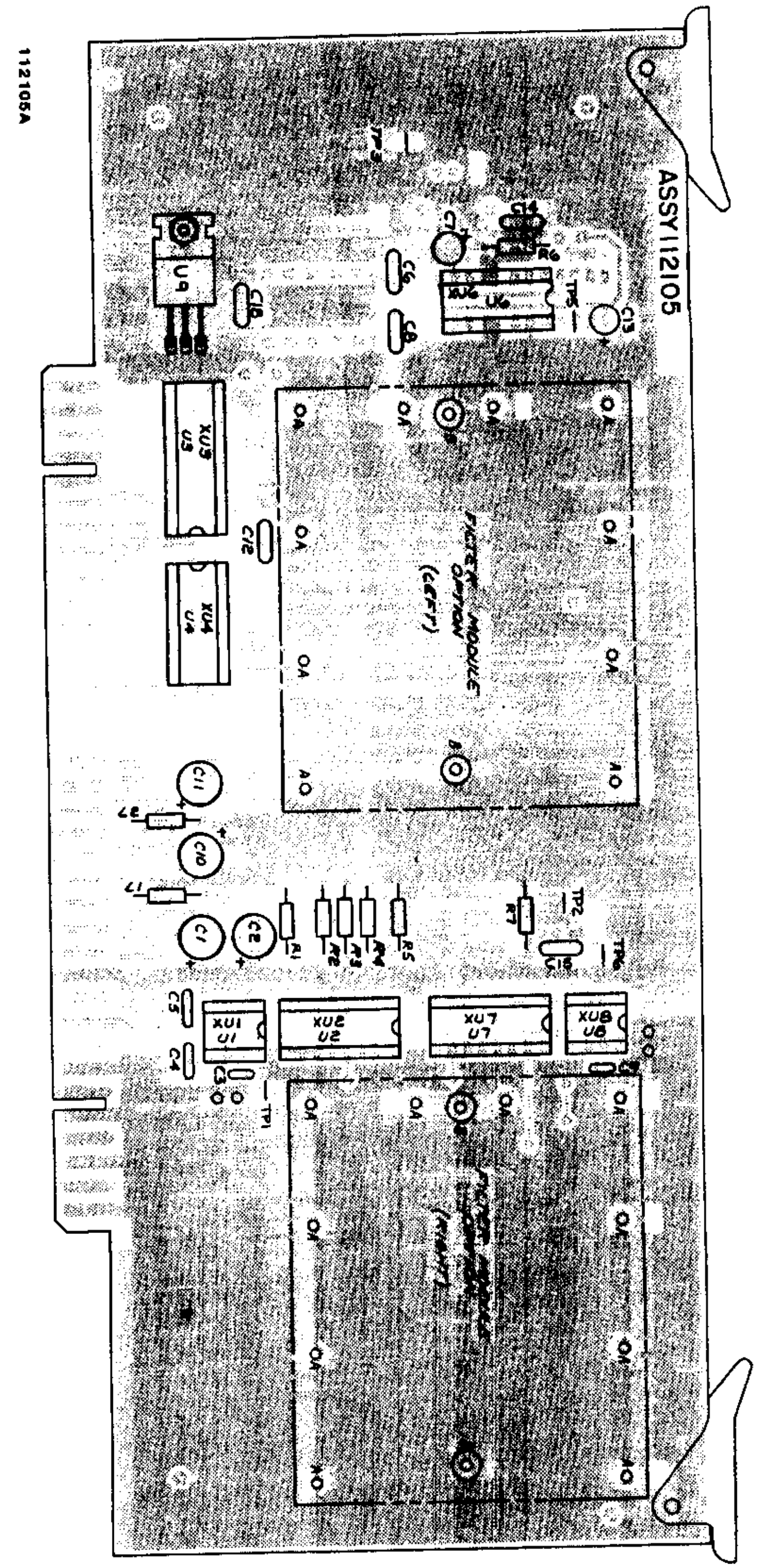


Figure 6-4. PWA '1121' Main Filter (A1)

11210500A REV A PWA '1121' MAIN FILTER (A1) (Figure 6-4)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C1-2,10-11	CAP EL 100uF 20% 25V	S4217	SM-25-VB-101M	4	283334000
C3	CAP MICA 10pF 5% 300V	14655	CD5CC100J	1	205002000
C4-6,8,14	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	5	224268000
C7	CAP TANT 2.2uF 20% 35V	61637	T368B225M035ASC2513	1	283317000
C9	CAP MICA 20pF 5% 300V	14655	CD5CC200J	1	205017000
C12,15	CAP CER 1.0uF 20% 50V	04222	SR305E105MAA	2	224264000
C13	CAP TANT 56uF 10% 6V	56289	196D566X9006KA1	1	283228000
C18	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
L1-2	INDUCTOR 5.6uH 10%	24226	10/561	2	400408000
P1A-10A	SOCKET SPRING COMP LEAD .072	32575	1-332070-7	10	479333000
P1B-10B	SOCKET SPRING COMP LEAD .072	32575	1-332070-7	10	479333000
R1	RES MF 4.02K 1% 1/4W	19701	5043ED4K020F	1	341358000
R2	RES MF 3.000K 0.1% 1/8W	64537	PME55-T9-3K	1	324300000
R3	RES MF 1.000K 0.1% 1/8W	64537	PME55-T9-1K	1	324241000
R4-5	RES MF 500 OHM 0.1% 1/8W	64537	PME55-T9-500 OHM	2	324205000
R6	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R7	RES MF 20.0K 1% 1/4W	19701	5043ED20K00F	1	341429000
U1,8	IC 5534AFE OP AMP	18324	NE5534AFE	2	53514401A
U2,7	IC 13201N ANALOG SWITCH	27014	LF13201N	2	535106000
U3	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	1	534263000
U4	IC 74LS139 DECODE/MULTPXR	01295	SN74LS139N	1	534188000
U6	IC AD637JQ WIDEBAND RMS/DC CON	51640	AD637JQ	1	53520300A
U9	IC UA7805UC VOLT REG	07263	uA7805UC	1	53511700A
XU1,8	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000
XU2,4,7	SOCKET IC 16 PIN	06776	ICN-163-S3-G	3	473042000
XU3	SOCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000
XU6	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000

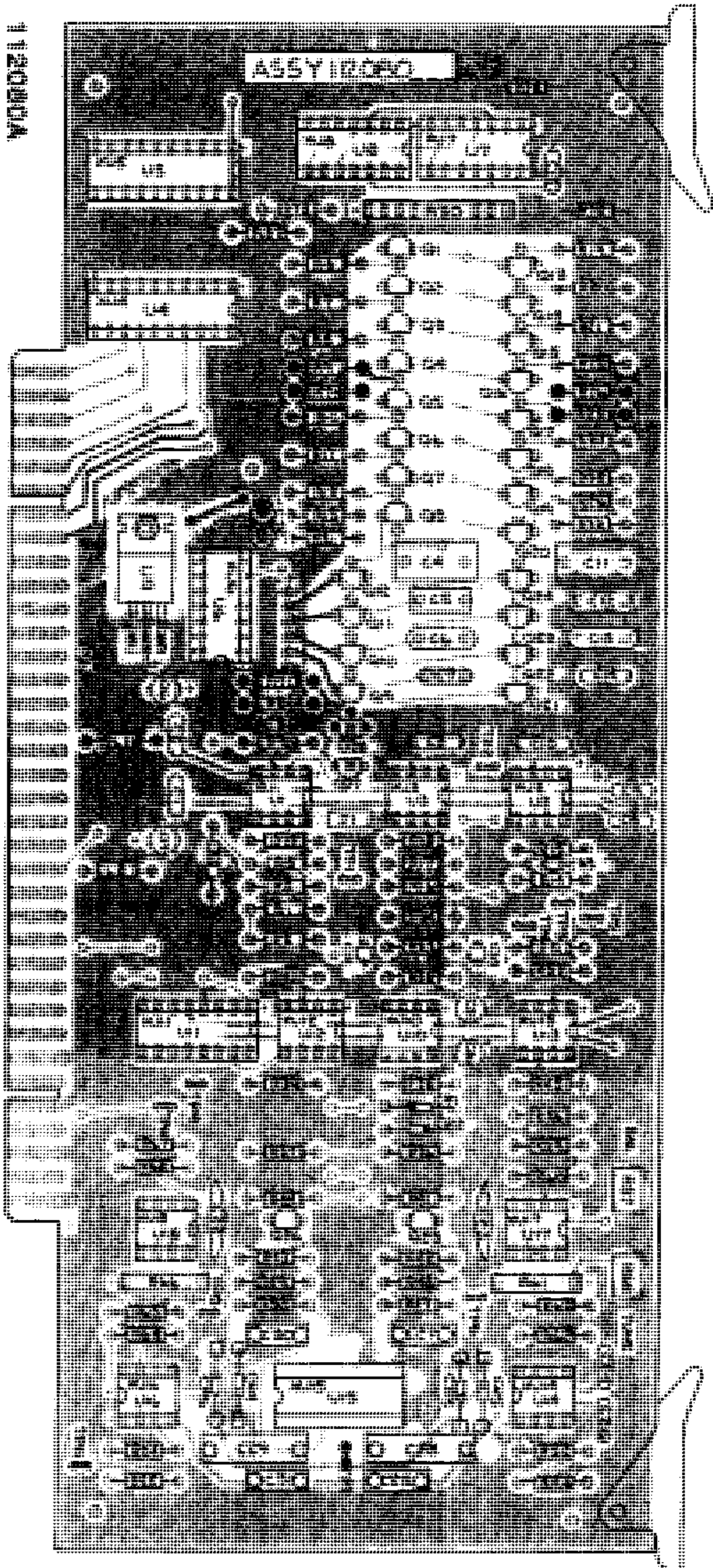


Figure 6-5. PWA '1121' Notch (A2)

11208001A REV B PWA '1121' NOTCH (A2) (Figure 6-5)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C1-2, 8-9	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	4	224268000
C3,10	CAP MICA 430pF 1% 500V	14655	CD15FD431F03	2	200037000
C4,11	CAP MPC 0.47uF 1% 50V	27735	MPC-53-0.47-50-1	2	23417500A
C5,12	CAP MPC 0.047uF 1% 50V	27735	MPC-53-.047-50-1	2	23417400A
C6,13	CAP MICA 8200pF 1% 100V	14655	CD19FA822F	2	200532000
C7,14	CAP MICA 680pF 1% 300V	14655	CD15FC581F03	2	200015000
C15,24,26	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C16-17	CAP EL 100uF 20% 25V	S4217	SM-25-VB-101M	2	283334000
C18-19	CAP TANT 56uF 10% 6V	56289	196D566X9006KA1	2	283228000
C20-21	CAP EL 10uF 20% 25V	S4217	SM-25-VB-10-M	2	283336000
C22-23	CAP CER 0.02uF 20% 500V	51406	GP5-203MF	2	224118000
C25,31	CAP MPC 0.033uF 2% 50V	27735	MPC-53-0.033-50-2	2	23417600A
C27,30	CAP MPC 0.1uF 2% 50V	14752	652A-1-A-104G	2	234139000
C28-29	CAP MPC 0.33uF 10% 100V	19701	719B1GD33RPK101SB	2	234162000
C32	CAP CER 1.0uF 20% 50V	04222	SR305E105MAA	1	224264000
C33	CAP MICA 8.0pF 10% 300V	57582	KD5080D301	1	205001000
C34	CAP MICA 5.0pF + -0.5pF 300V	14655	CD5CC050D	1	205000000
CR1-6	DIODE SIG 1N914	01295	1N914	6	530058000
J1	CONN M 03 CKT ST .1CT	06383	MFSS100-3-C-A	1	477364000
L1-2	INDUCTOR 5.6uH 10%	24226	10/561	2	400408000
P1	SHUNT 2 CIRCUIT	27264	15-38-1024	1	483253000
Q1-24	TRANS FET J108	17856	J-108	24	52815600A
Q25-26	TRANS FET PN4391	27014	PN4391	2	52815900A
Q27-28	TRANS FET J108	17856	J-108	2	52815600A
R1-2,71	RES MF 20.0K 1% 1/4W	19701	5043ED20K00F	3	341429000
R3,5,36	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	3	341400000
R4	RES MF 8.25K 1% 1/4W	19701	5043ED8K250F	1	341388000
R6,10,19	RES MF 40.00K 0.1% 1/8W	64537	PME55-T9-40K	3	32591900A
R7,11,20	RES MF 20.00K 0.1% 1/8W	03888	PME55-T9-20K	3	32591800A
R8,12,21	RES MF 10.00K 0.1% 1/8W	91637	CMF55-1002-B-T9	3	32593100A
R9,13,16-18	RES MF 5.000K 0.1% 1/8W	64537	PME55-T9-5K	2	324326000
R22,26	RES MF 5.000K 0.1% 1/8W	64537	PME55-T9-5K	2	324326000
R23	RES MF 40.00K 0.1% 1/8W	64537	PME55-T9-40K	1	32591900A
R24	RES MF 20.00K 0.1% 1/8W	03888	PME55-T9-20K	1	32591800A
R25	RES MF 10.00K 0.1% 1/8W	91637	CMF55-1002-B-T9	1	32593100A
R27	RES MF 3.32K 1% 1/4W	19701	5043ED3K320F	1	341350000
R28	RES MF 1.82K 1% 1/4W	19701	5043ED1K820F	1	341325000
R29	RES NETWORK 3.3K 2% 0.9W 6pin	71450	750-61-R3.3K	1	34504500A
R30	RES NETWORK 3.3K 2% 1.5W 10pin	71450	750-101-R3.3K	1	345030000
R31-32	RES MF 100K 1% 1/4W	19701	5043ED100K0F	2	341500000
R33	RES MF 1.000K 0.1% 1/8W	64537	PME55-T9-1K	1	324241000
R34	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	1	341329000
R35	RES MF 9.000K 0.1% 1/4W	64537	PME55-T9-9K	1	324354000
R14,15,37-40	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	4	341367000
R41,44	RES MF 24.9K 1% 1/4W	19701	5043ED24K90F	2	341438000
R42-43	RES MF 3.01K 1% 1/4W	19701	5043ED3K010F	2	341346000
R45-46	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	2	341400000

R47,50	RES MF 30.1K 1% 1/4W	19701	5043ED30K10F	2	341446000
R48-49	RES MF 66.5K 1% 1/4W	19701	5043ED66K50F	2	341479000
R51,53	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	2	341400000
R52,54	RES MF 10.0 OHM 1% 1/4W	19701	5043ED10R00F	2	341100000
R55-56	RES MF 100K 1% 1/4W	19701	5043ED100K0F	2	341500000
R57-58	RES VAR 20K 10% 0.5W	73138	82PAR20K	2	311374000
R59-60	RES MF 49.9K 1% 1/4W	19701	5043ED49K90F	2	341567000
R61,66	RES NETWORK 100K 2% 1.5W	71450	1750-61-R100K	2	345032000
R62-63	RES MF 80.6K 1% 1/4W	19701	5043ED80K60F	2	341487000
R64-65	RES MF 100K 1% 1/4W	19701	5043ED100K0F	2	341500000
R67-68,72	RES MF 49.9K 1% 1/4W	19701	5043ED49K90F	3	341467000
R69-70	RES MF 33.2K 1% 1/4W	19701	5043ED33K20F	2	341450000
R73,75	RES MF 102 OHM 1% 1/4W	19701	5043ED102R0F	2	341201000
R74,76	RES MF 1.50K 1% 1/4W	19701	5043ED1K500F	2	341317000
U1-3,12	IC 5532AFE DUAL OP AMP 8 DIP	01295	NE5532AFE	4	53512101A
U4-5	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	2	534263000
U6-8	IC 339 QUAD COMPARATOR	27014	LM339N	3	535018000
U9	IC UA7805UC VOLT REG	07263	uA7805UC	1	53511700A
U10	IC HA7-2625-5 OP AMP	34371	HA7-2525-5	1	53511901A
U11	IC 13333 ANALOG SWITCH LF	27014	LF13333N	1	530595000
U13	IC 393 OP AMP	27014	LM393N	1	535107000
U14,16	IC OP-07EP OP AMP	06665	OP-07EP	2	535110000
U15	IC 13201N ANALOG SWITCH	27014	LF13201N	1	535106000
U17-18	IC 4200AD ANALOG MULTIPLIER	49956	RC4200AD	2	53508301A
XU1-3,10	SOCKET IC 8 PIN	06776	ICN-083-S3-G	4	473041000
XU4-5	SOCKET IC 20 PIN	06776	ICN-203-S3-G	2	473065000
XU6-8	SOCKET IC 14 PIN	06776	ICN-143-S3-G	3	473019000
XU11,15	SOCKET IC 16 PIN	06776	ICN-163-S3-G	2	473042000
XU12-14	SOCKET IC 8 PIN	06776	ICN-083-S3-G	3	473041000
XU16-18	SOCKET IC 8 PIN	06776	ICN-083-S3-G	3	473041000

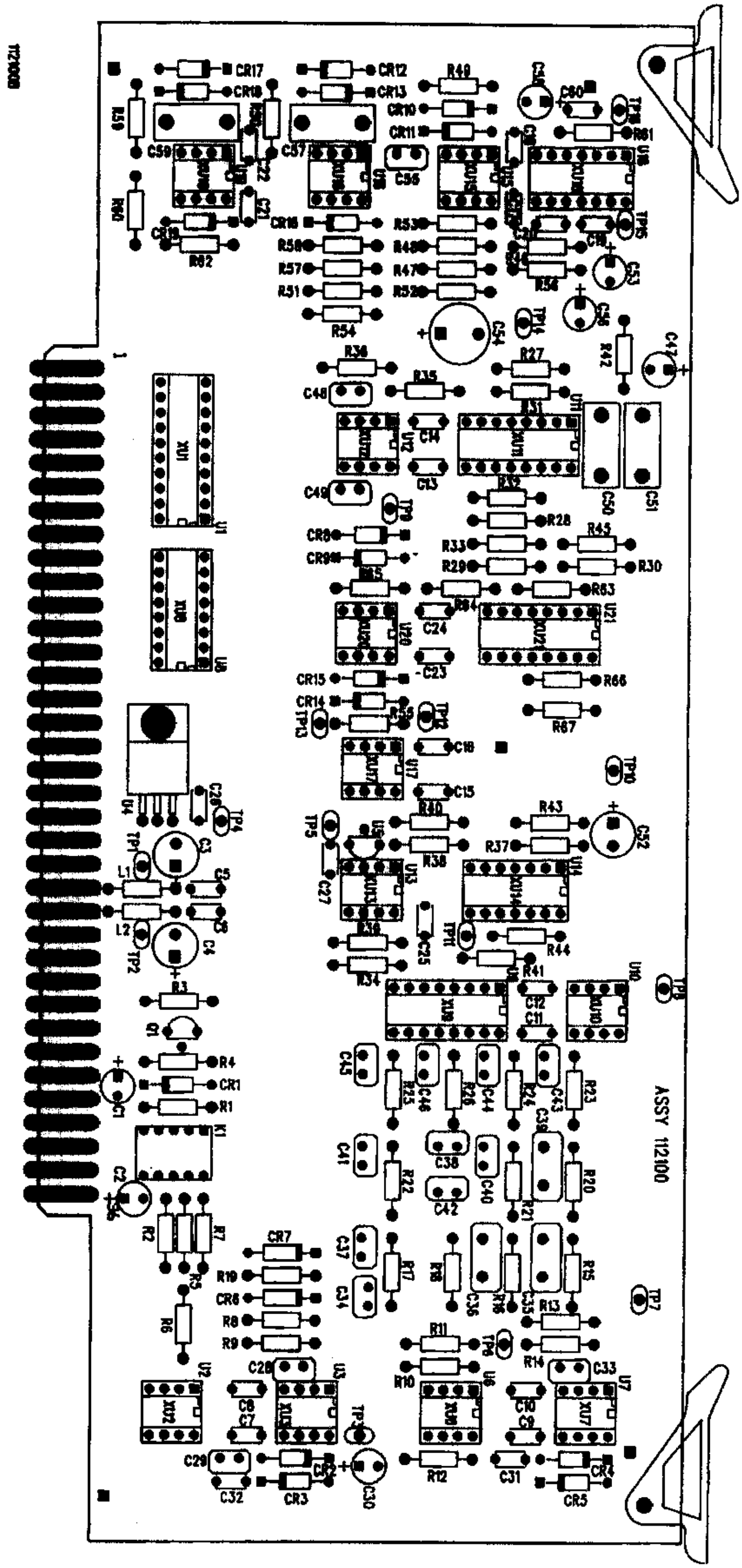


Figure 6-6. PWA '1121' Detector (A3)

11210000A REV B PWA '1121' DETECTOR (A3) (Figure 6-6)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C1,30,47	CAP TANT 56uF 10% 6V	56289	196D566X9006KA1	3	283228000
C2	CAP TANT 10uF 20% 20V	61637	T368B106M020AS	1	283205000
C3-4,52	CAP EL 100uF 20% 25V	S4217	SM-25-VB-101M	3	283334000
C5-25	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	20	224268000
C26-27	CAP CER 1.0uF 20% 50V	04222	SR305E105MAA	2	224264000
C28,33,48	CAP MICA 3.0pF + -0.5pF 300V	14655	CD5CC030D	3	205013000
C29,34,49	CAP MICA 51pF 5% 300V	57582	KD5510J301	3	205020000
C31-32,60	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	3	224268000
C35	CAP MICA 1000pF 1% 100V	51406	DM15-102F	1	200113000
C36,39	CAP MICA 500pF 1% 500V	14655	CD15FD501F	2	200123000
C37,44-46	CAP MICA 56pF 1% 300V	57582	KD5560F301	4	205053000
C38	CAP MICA 24pF 5% 300V	14655	CD5FC240J	1	20506002A
C40	CAP MICA 250pF 1% 50V	14655	CD5FY251F	1	205034000
C41	CAP MICA 240pF 1% 50V	14655	CD5FY241F	1	205042000
C42	CAP MICA 120pF 1% 50V	20307	DM5-FY121F	1	205050000
C43	CAP MICA 130pF 5% 100V	14655	CD5FA131J	1	205011000
C50-51	CAP MPC 0.22uF 2% 50V	14752	652A-1-A224G	2	234167000
C53	CAP TANT 56uF 10% 6V	56289	196D566X9006KA1	1	283228000
C54	CAP TANT 100uF 20% 10V	56289	196D107X0010PE4	1	283291000
C55	CAP MICA 7.0pF 0.5pF 300V	20307	DM5-CC070J	1	205030000
C56	CAP TANT 4.7uF 10% 10V	56289	196D475X9010HA1	1	283226000
C57,59	CAP MPC 1.0uF 10% 50V	14752	652A-1-A-105K	2	234152000
C58	CAP TANT 2.2uF 20% 35V	61637	T368B225M035ASC2513	1	283317000
CR1,14-15	DIODE SIG 1N914	01295	1N914	3	530058000
CR2-5,8-9	DIODE HSCH1001 (1N6263)	28480	HSCH-1001	6	530174000
CR6-7	DIODE ZENER 1N5230B 4.7V 5%	04713	1N5230B	2	530103000
CR10-11	DIODE SIG 5082-2835	28480	5082-2835	2	530167000
CR12-13	DIODE SIG FDH-300	27014	FDH300	2	530052000
CR16-19	DIODE SIG FDH-300	27014	FDH300	4	530052000
K1	RELAY DUAL FORM "C" 12V	AROMT	TQZE-12V	1	47106100A
L1-2	INDUCTOR 5.6uH 10%	24226	10/561	2	400408000
Q1	TRANS NPN 2N3904	04713	2N3904	1	528071000
R1-2,34,37	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	4	341367000
R3,57,64	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	3	341329000
R4	RES MF 243 OHM 1% 1/4W	19701	5043ED243R0F	1	341327000
R5,10	RES MF 1.800K 0.1% 1/8W	64537	PME55-T9-1.8K	2	324272000
R6,11	RES MF 200 OHM 0.1% 1/8W	64537	PMT355-T9-200 OHM	2	324162000
R7,12	RES MF 182 OHM 1% 1/4W	19701	5043ED182R0F	2	341225000
R8,13	RES MF 1.000K 0.1% 1/8W	64537	PME55-T9-1.8K	2	324272000
R9,14,36	RES MF 9.000K 0.1% 1/4W	64537	PME55-T9-9K	3	324354000
R15,26	RES MF 3.32K 1% 1/4W	19701	5043ED3K320F	2	341350000
R16-17	RES MF 2.43K 1% 1/4W	19701	5043ED2K430F	2	341337000
R18	RES MF 2.000K 0.1% 1/8W	64537	PME55-T9-2K	1	324275000
R19,21,49	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	3	341400000
R20	RES MF 13.3K 1% 1/4W	19701	5043ED13K30F	1	341412000

R22	RES MF 6.19K 1% 1/4W	19701	5043ED6K190F	1	341376000
R23	RES MF 21.5K 1% 1/4W	19701	5043ED21K50F	1	341432000
R24	RES MF 15.0K 1% 1/4W	19701	5043ED15K00F	1	341417000
R25	RES MF 2.61K 1% 1/4W	19701	5043ED2K610F	1	341340000
R27,65	RES MF 5.000K 0.1% 1/8W	64537	PME55-T9-5K	2	324326000
R28	RES MF 3.000K 0.1% 1/8W	64537	PME55-T9-3K	1	324300000
R29-30,35	RES MF 1.000K 0.1% 1/8W	64537	PME55-T9-1K	3	324241000
R31	RES MF 2.49K 1% 1/4W	19701	5043ED2K490F	1	341338000
R32	RES MD 909 OHM 1% 1/4W	19701	5043ED909R0F	1	341292000
R33	RES MF 1.62K 1% 1/4W	19701	5043ED1K620F	1	341320000
R38-39	RES MF 49.9K 1% 1/4W	19701	5043ED49K90F	2	341467000
R40-41	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	2	341300000
R42	RES MF 105K 1% 1/4W	19701	5043ED105K0F	1	341502000
R43-44,63	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	3	341300000
R45	RES MF 374K 1% 1/4W	19701	5043ED374K0F	1	341555000
R46	RES MF 17.8K 1% 1/4W	19701	5043ED17K80F	1	341424000
R47,51	RES MF 2.74K 1% 1/4W	19701	5043ED2K740F	2	341342000
R48,66-67	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	3	341367000
R50	RES MF 1.13K 1% 1/4W	19701	5043ED1K130F	1	341305000
R52-53,61	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	3	341400000
R54	RES MF 402K 1% 1/RW	19701	5043ED402K0F	1	341558000
R55	RES MF 604 OHM 1% 1/4W	19701	5043ED604R0F	1	341275000
R56	RES MF 11.0K 1% 1/4W	19701	5043ED11K00F	1	341404000
R58	RES MF 150K 1% 1/4W	19701	5043ED150K0F	1	341517000
R59	RES MF 75.0K 1% 1/4W	19701	5043ED75K00F	1	341484000
R60	RES MF 619K 1% 1/4W	19701	5043ED619K0F	1	341576000
R62	RES MF 200K 1% 1/4W	19701	5043ED200K0F	1	341529000
U1	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	1	534263000
U2,6	IC 419 ANALOG SWITCH	17856	DG-419-DJ	2	53452400A
U3,7,12	IC HA7-2625-5 OP AMP	34371	HA7-2625-5	3	53511901A
U4	IC UA7805UC VOLT REG	07263	uA7805UC	1	53511700A
U5	IC79L05 VOLT REG	04713	MC79L05ACP	1	535090000
U8	IC 74LS139 DECODE/MULTPXR	01295	SN74LS139N	1	534188000
U9,11	IC 13201N ANALOG SWITCH	27014	LF13201N	2	535106000
U10,15	IC OPA2107AP DUAL OP AMP	13919	OPA2107AP	2	53520200A
U13	IC 393 OP AMP	27014	LM393N	1	535107000
U14	IC 74LS00 2 INP POS NAND	01295	SN74LSOON	1	534167000
U16,19-20	IC TL072BCP DUAL OP AMP	01295	TLO72BCP	3	535102000
U17	IC 5534AFE OP AMP	18324	NE5534AFE	1	53514401A
U18	IC AD637 JQ WIDEBAND RMS/DC CON	51640	AD637JQ	1	53520300A
U21	IC 13333 ANALOG SWITCH LF	27014	LF13333N	1	535095000
XU1	SOCKET UC 29 OUB	06776	ICN-203-S3-G	1	473065000
XU2-3,6-7	SOCKET IC 8 PIN	06776	ICN-083-S3-G	4	473041000
XU8-9,11	SOCKET IC 16 PIN	06776	ICN-163-S3-G	3	473042000
XU10,12-13	SOCKET IC 8 PIN	06776	ICN-083-S3-G	3	473041000
XU14,18	SOCKET IC 14 PIN	06776	ICN-143-S3-G	2	473019000
XU15-17	SOCKET IC 8 PIN	06776	ICN-083-S3-G	3	473041000
XU19-20	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000
XU21	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000

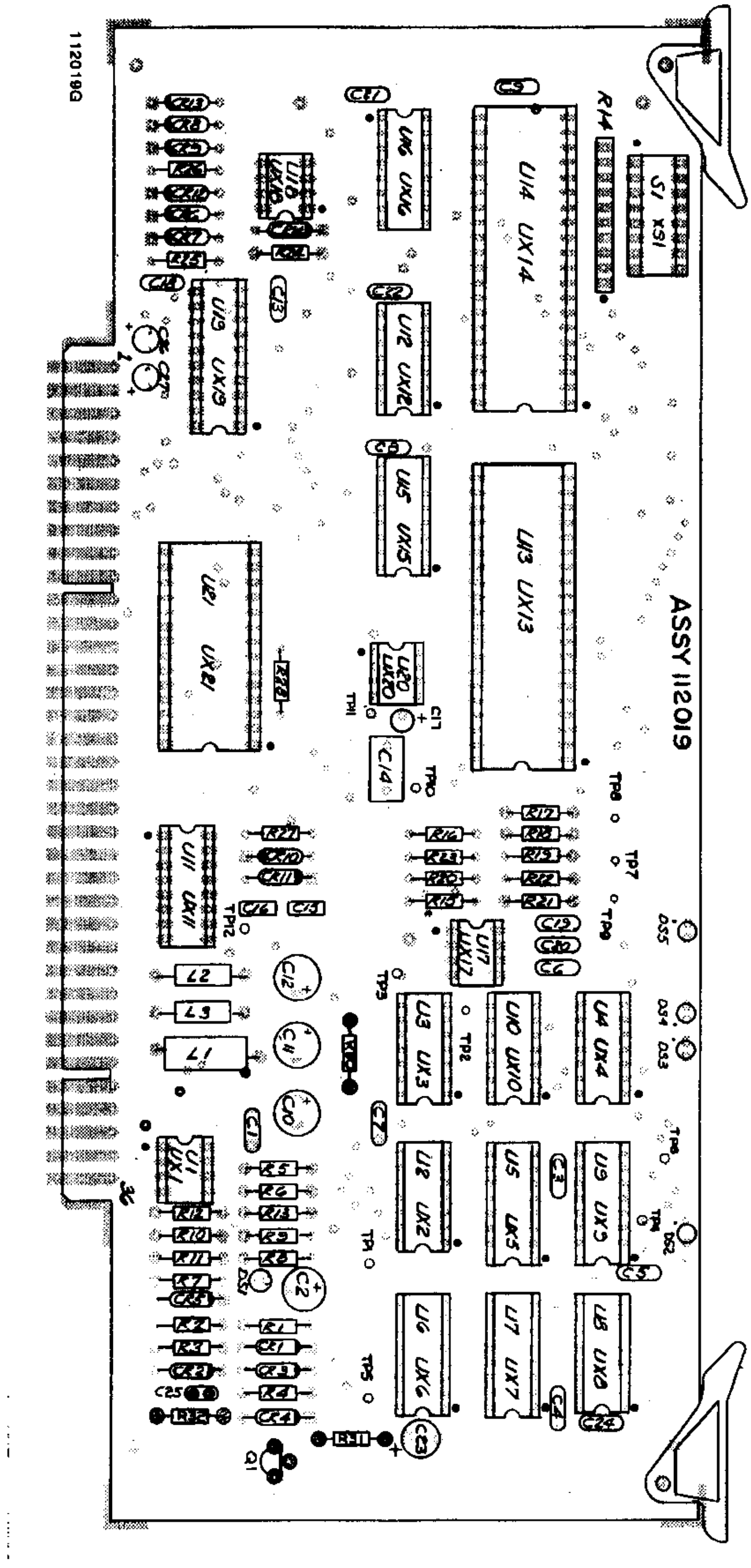


Figure 6-7. PWA '1121' Freq Counter

11201905A REV C PWA '1121' FREQ COUNTER (A4) (Figure 6-7)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C1,3-9,13	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	9	224268000
C2,10-12	CAP EL 100uF 20% 25V	S4217	SM-25-VB-101M	4	283334000
C14	CAP MICA 2200pF 5% 500V	57582	KD19222J501	1	200525000
C15	CAP CER 3900pF 10% 100V	61637	C052K392K1X5CA	1	224319000
C16	CAP CER 560pF 10% 200V	61637	C052K561K2X5CA	1	224290000
C17	CAP TANT 4.7uF 10% 10V	56289	196D475X9010HA1	1	283226000
C18,21-22	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	3	224268000
C23	CAP EL 100uF 20% 25V	S4217	SM-25-VB-101M	1	283334000
C24	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
C25	CAP MICA 250pF 5% 50V	57582	KD251J101	1	205037000
C27-27	CAP TANT 2.2uF 20% 35V	61637	T368B225M035ASC2513	2	283317000
CR1-9	DIODE SIG 1N914	01295	1N914	9	530058000
CR10-11	DIODE SIG FDH-300	27014	FDH300	2	530052000
CR12-13	DIODE SIG 1N914	01295	1N914	2	530058000
CR14	DIODE ZENER 1N5231B 5.1V 5%	04713	1N5231B	1	530169000
DS1	LED RED DIFF 5082-4684	28480	HLMP-1301	1	536024000
DS2-5	LED RED DIFF HLMP-6620	28480	HLMP-6620	4	536026000
L1	INDUCTOR VK200/19-4B	02114	VK200/19-4B	1	400410000
L2-3	INDUCTOR 5.6uH 10%	24226	15/561	2	400308000
Q1	TRANS PNP 2N3906	04713	2N3906	1	528076000
R1	RES MF 215 OHM 1% 1/4W	19701	5043ED215R0F	1	341232000
R2	RES MF 332 OHM 1% 1/4W	19701	5043ED332R0F	1	341245000
R3	RES MF 499 OHM 1% 1/4W	19701	5043ED499R0F	1	341267000
R4,6-7	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	3	341400000
R5,13,31	RES MF 3.01K 1% 1/4W	19701	5043ED3K010F	3	341346000
R8-10	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	3	341300000
R11-12	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	2	341400000
R14	RES NETWORK 3K/6.2K 2% 2.7W	73138	L105-5-R3K/6.2K	1	345031000
R24,30	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	2	341329000
R25-26	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	2	341300000
R27	RES MF 56.2K 1% 1/4W	19701	5043ED56K20F	1	341472000
R28	RES MF 5.000K 0.1% 1/8W	64537	PME55-T9	1	324326000
R32	RES MF 100 OHM 1% 1/4W	19701	5043ED100R0F	1	341200000
S1	SWITCH ROCKER (8 SW)	81073	76SB08S	1	465283000
U1	IC 393 OP AMP	27014	LM393N	1	535107000
U2	IC 74LS04 HEX INVERTER	01295	SN74LS04N	1	534155000
U3-4	IC 74LS00 2 INP POS NAND	01295	SN74LSOON	2	534167000
U5,9	IC 74F151PC 8 INPUT MULTIPLEX	07263	74F151PC	2	534374000
U6-8	IC 74LS490 DUAL DEC COUNTER	18324	N74LS490N	3	534238000
U10,12	IC 74F74PC DUAL D FLIP FLOP	07263	74F74PC	2	534367000
U11	IC74LS138 DECDR/MPX	01295	SN74LS138N	1	534246000
U13-14	IC 71055 INTERFACE	52464	MSM82C55A-5RS	2	53441100A
U15-16	IC4040B COUNTER/DIVIDER	02735	CD4040BE	1	534275000
U18	IC 5532AFE DUAL OP AMP 8 DIP	01295	NE5532AFE	1	53512101A
U19	IC AD7549JN DUAL 12 BIT DAC	24355	AD7549JN	1	53152700A

U20	IC REF-02-CZ 5 VOLT REFERENCE	06665	REF-02-CZ	1	53152900A
U21	IC AD7582KN 12 BIT A/D	24355	AD7582KN	1	53152800A
XS1	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU1,18,20	SOCKET IC 8 PIN	06776	ICN-083-S3-G	3	473041000
XU2-4,10	SOCKET IC 14 PIN	06776	ICN-143-S3-G	4	473019000
XU5-9,11	SOCKET IC 16 PIN	06776	ICN-163-S3-G	6	473042000
XU12	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000
XU13-14	SOCKET IC 40 PIN	06776	ICN-406-S4-TG	2	473052000
XU15-16	SOCKET IC 16 PIN	06776	ICN-163-S3-G	2	473042000
XU19	SOCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000
XU21	SOCKET IC 28 PIN	06776	ICN-286-S4-G	1	473044000

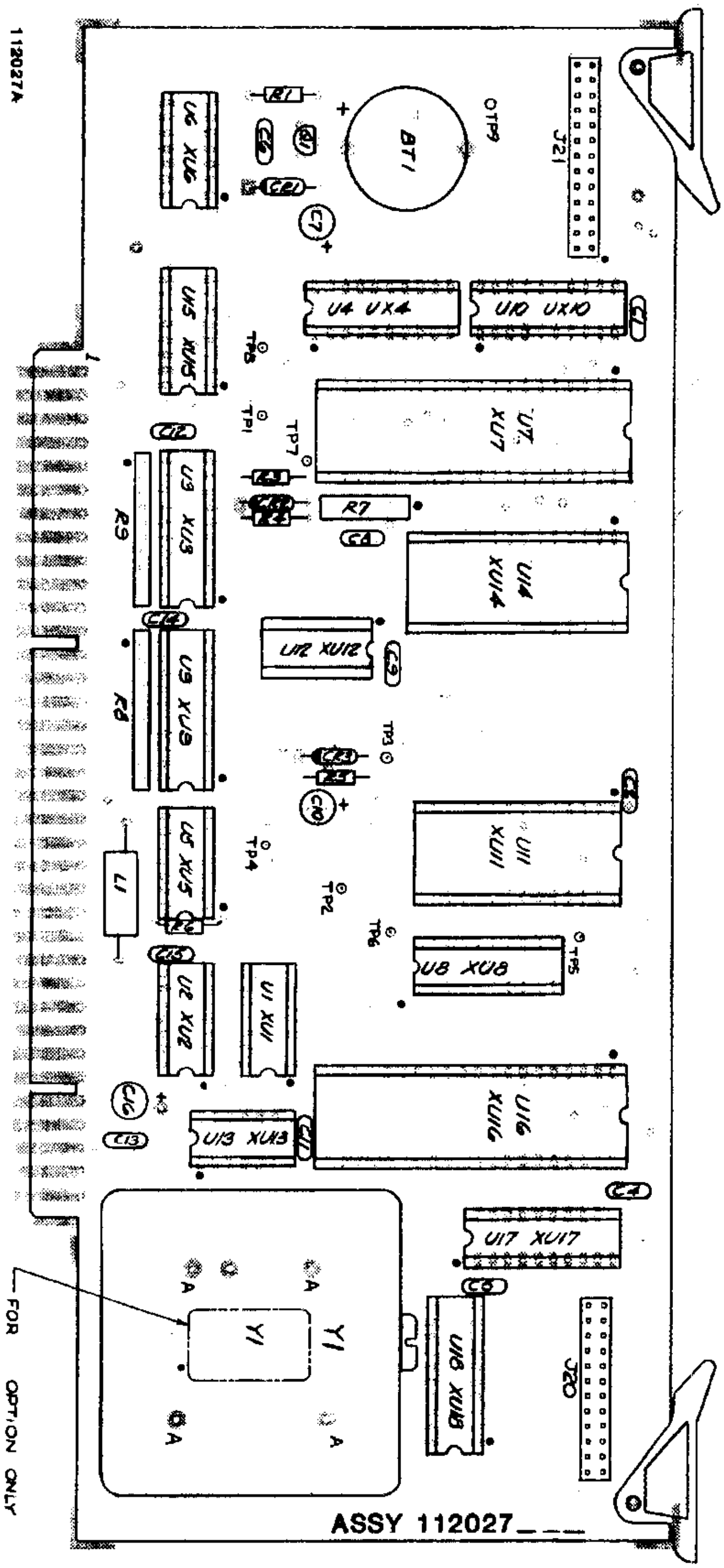


Figure 6-8. PWA '1121' CPU (A5)

11202705A REV B PWA '1121' CPU (A5) (Figure 6-8)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
BT1,2	BATTERY, ALKALINE 1.5V	54473	LR44	2	55600900A
C1-2,4-6	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	5	224268000
C7,10	CAP TANT 15uF 10% 20V	56289	199D156X9020DA1	2	283227000
C8-9,11-15	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	7	224268000
C16	CAP EL 100uF 20% 25V	S4217	SM-25-VB-101M	1	283334000
CR1-3	DIODE SIG 1N914	01295	1N914	3	530058000
J20	CONN M 24 CKT HDR DBL ROW .1CT	06776	NSH-24DB-S2-TG	1	47742224A
J21	CONN M 26 CKT HDR DBL ROW .1CT	06776	NSH-26DB-S2-TG	1	47742226A
L1	INDUCTOR VK200/19-4B	02114	VK200/19-4B	1	400410000
Q1	TRANS NPN 2N3904	04713	2N3904	1	528701000
R1,4,6	RES MF 100K 1% 1/4W	19701	5043ED100K0F	3	341500000
R3	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R5	RES MF 22.1K 1% 1/4W	19701	5043ED22K10F	1	341433000
R7	RES NETWORK 3K/6.2K 2% 1.5W	73138	L06-5C302/622	1	345033000
R8-9	RES NETWORK 3K/6.2K 2% 2.7W	73138	L105-5R3K/6.2K	2	345031000
U1	IC 74LS04 HEX INVERTER	01295	SN74LS04N	1	534155000
U2,12	IC 74LS32 QUAD 2 INPUT OR	01295	SN74LS32N	2	531468000
U3-4	IC 8304BN 8 BIT TRI ST TRANS	27014	DP8304BN	2	534251000
U5	IC 4066A CMOS BILAT SW	02735	CD4066AE	1	534078000
U6	IC 4023B COS/MOS NAND	02735	CD4023AE	1	534143000
U7	IC Z80 MICROPRCS 6 MHz CMOS	56708	Z84C00-06PE	1	53440906A
U8,10	IC 74LS541 OCTAL BUFFER	01295	SN74LS541N	2	534381000
U9	IC PEEL CPU 1120-S3	04901	53470500A	1	53470500A
U11	IC TC 55257 PL-10	TOSHI	TC55257APL-10	1	53449400A
U13	IC 74F74PC DUAL D FLIP FLOP	07263	74F74PC	1	534367000
U14	IC EPROM PROG CPU 1120-S	04901	53469500A	1	53469500A
U15	IC 74LS138 DECDR/MPX	01295	SN74LS138N	1	534246000
U16	IC 9914ANL IEEE BUX PROCESSOR	01295	TMS9914ANL	1	534288000
U17	IC 75160 IEEE BUS TRANSCEIVER	01295	SN75160BN	1	534286000
U18	IC 75161 IEEE BUS TRANSCEIVER	01295	SN75161BN	1	534287000
XBT1,2	BATTERY HOLDER	94139	#127	2	48330700A
XU1-2,5-6	SOCKET IC 14 PIN	06776	ICN-143-S3-G	4	473019000
XU3-4,8-10	SOCKET IC 20 PIN	06776	ICN-203-S3-G	5	473065000
XU7,16	SOCKET IC 40 PIN	06776	ICN-406-S4-TG	2	473052000
XU11,14	SOCKET IC 28 PIN	06776	ICN-286-S4-G	2	473044000
XU12-13	SOCKET IC 14 PIN	06776	ICN-143-S3-G	2	473019000
XU15	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU17-18	SOCKET IC 20 PIN	06776	ICN-203-S3-G	2	473065000
Y1	CRYSTAL OSC 10 MHz	27802	CO-251-B16	1	547904000

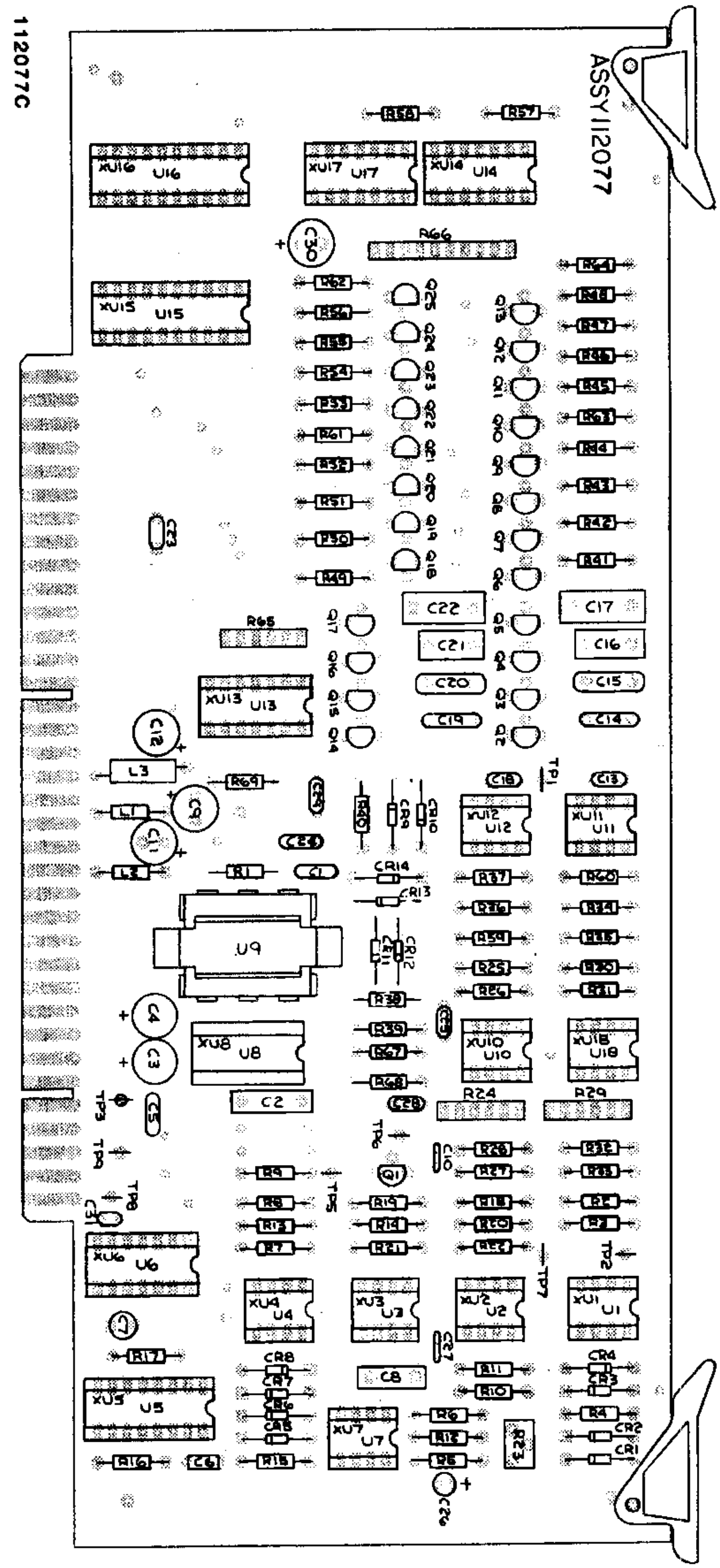


Figure 6-9. PWA '1121' Source (A6)

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

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART 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

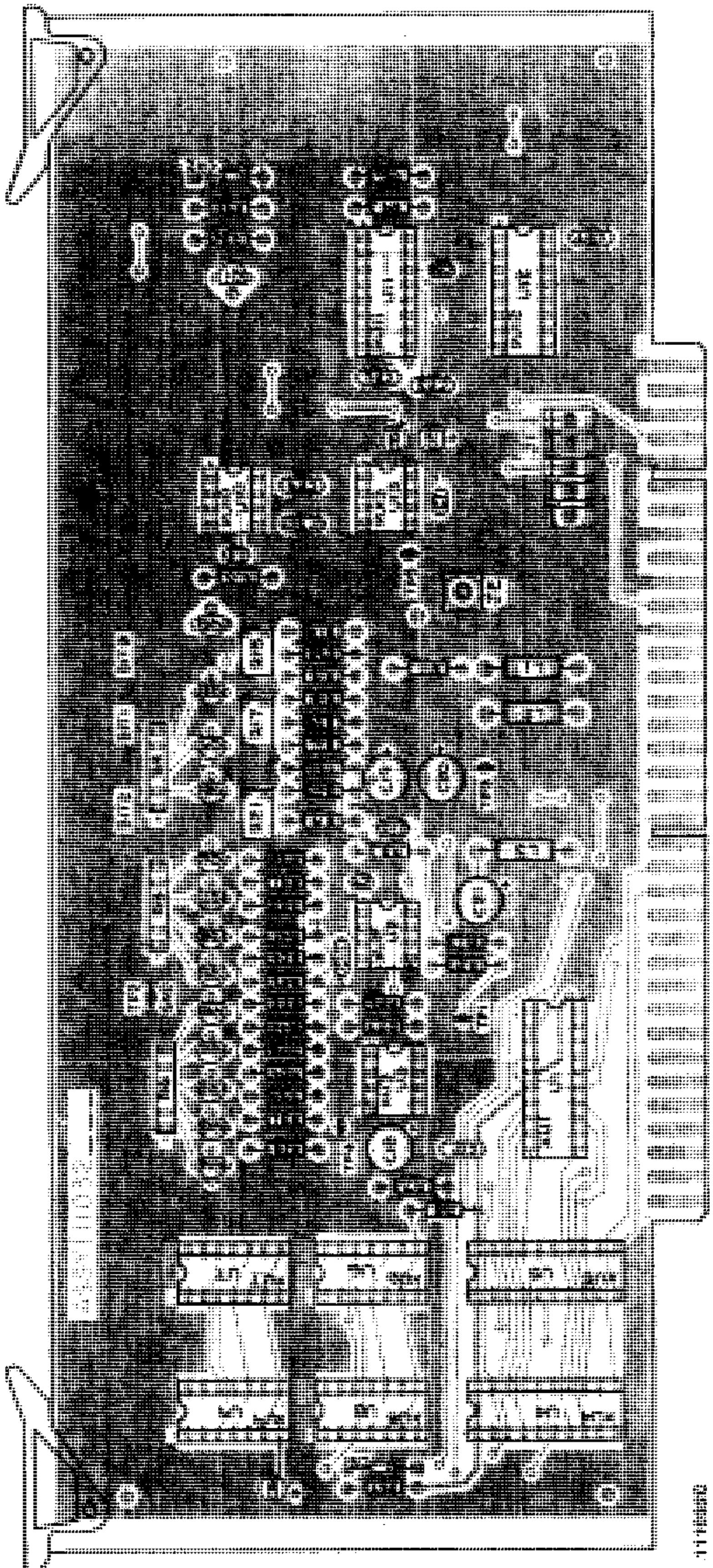


Figure 6-10. PWA '1121' Output (A7)

11103201A REV A PWA '1121' OUTPUT (A7) (Figure 6-10)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C1	CAP MICA 5.0pF + -0.5pF 300V	14655	CD5CC050D	1	205000000
C3	CAP MICA 18pF 5% 300V	14655	CD5CC180J	1	205046000
C7	CAP MICA 22pF 5% 300V	14655	CD5CC220J	1	205036000
C10-12	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	3	224268000
C18-21	CAP EL 100uF 20% 25V	S4217	SM-25-VB-101M	4	283334000
C22-23	CAP EL 10uF 20% 25V	S4217	SM-25-VB-10-M	2	283336000
C24	CAP TANT 10uF 20% 25V	56289	196D106X0025KA1	1	283293000
C25-27	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	3	224268000
C28	CAP MICA 300pF 5% 50V	14655	CD5FY301J	1	205026000
C29-30	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
CR1-2	DIODE SIG 1N914	01295	1N914	2	530058000
J1	HEADER 5 PIN STRAIGHT	06383	MPSS156-5-D	1	477345000
J2	CONNECTOR "SMB"	19505	209	1	477317000
L1-3	INDUCTOR 5.6uH 10%	24226	15/561	3	400308000
Q1	TRANS NPN 2N3904	04713	2N3904	1	528071000
Q2-14	TRANS FET PN4391	27014	PN4391	13	52815900A
R1,38-44	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	8	341400000
R2	RES MF 15.0K 1% 1/4W	19701	5043ED15K00F	1	341417000
R3,33-34	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	3	341367000
R4-6	RES NETWORK 100K 2% 1.5W	71450	750-61-R100K	3	345032000
R7	RES MF 1.82K 1% 1/4W	19701	5043ED1K820F	1	341325000
R8	RES MF 3.01K 1% 1/4W	19701	5043ED3K010F	1	341346000
R9	RES MF 900 OHM 0.1% 1/8W	64537	PME55-T9-900 OHM	1	324235000
R10	RES MF 9.000K 0.1% 1/4W	64537	PME55-T9-9K	1	324354000
R11	RES MF 10.0 OHM 1% 1/4W	19701	5043ED10R00F	1	341100000
R13	RES MF 5.49K 1% 1/4W	19701	5043ED5K490F	1	341371000
R14	RES MF 33.2K 1% 1/4W	19701	5043ED33K20F	1	341450000
R15,17,21	RES VAR 50K 10% 0.5W	73138	82PAR50K	3	311375000
R16	RES MF 11.0K 1% 1/4W	19701	5043ED11K00F	1	341404000
R18	RES MF 95.3K 1% 1/4W	19701	5043ED95K30F	1	341494000
R19	RES MF 24.3K 1% 1/4W	19701	5043ED24K30F	1	341437000
R20	RES MF 90.9K 1% 1/4W	19701	5043ED90K90F	1	341492000
R22,28	RES MF 40.00K 0.1% 1/8W	64537	PME55-T9-40K	2	32591900A
R23,29	RES MF 80.00K 0.1% 1/8W	64537	PME55-T9-80K	2	32592000A
R24,30	RES MF 160.0K 0.1% 1/8W	64537	PME55-T9-160K	2	32592100A
R25,31	RES MF 320.0K 0.1% 1/8W`	64537	PME55-T9-320K	2	32592200A
R26	RES MF 1.50K 1% 1/4W	19701	5043ED1K500F	1	341317000
R27	RES MF 100 OHM 1% 1/RW	19701	5043ED100R0F	1	341200000
R32	RES MF 649K 1% 1/RW	19701	5043ED649K0F	1	34157800A
R36	RES MF 100 OHM 0.1% 1/8W	64537	PME55-T9-100 OHM	1	324118000
R37	RES MF 499K 1% 1/4W	19701	5043ED499K0F	1	341567000
U1	IC AD7548 12 BIT DAC CMOS	51640	AD7548JN	1	53512000A
U2	IC TL072ACP OPER AMPLIFIER	01295	TL072ACP	1	53507400A
U3	IC REF-01CP VOLTAGE REFERENCE	06665	REF-01CP	1	535116000
U4-5	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	2	534263000
U6-9	IC 339 QUAD COMPARATOR	27014	LM339N	4	535018000
U10,13	IC 5534AFE OP AMP	18324	NE5534AFE	2	53514401A

U11	IC 13201N ANALOG SWITCH	27014	LF13201N	1	535106000
U12	IC 74LS139 DECODE/MULTPXR	01295	SN74LS139N	1	534188000
XU1,4-5	SOCKET IC 20 PIN	06776	ICN-203-SE-G	3	473065000
XU2-3,10	SOCKET IC 8 PIN	06776	ICN-083-S3-G	3	473041000
XU6-9	SOCKET IC 14 PIN	06776	ICN-143-S3-G	4	473019000
XU11-12	SOCKET IC 16 PIN	06776	ICN-163-S3-G	2	473042000
XU13	SOCKET IC 8 PIN	06776	ICN-083-S3-G	1	473041000

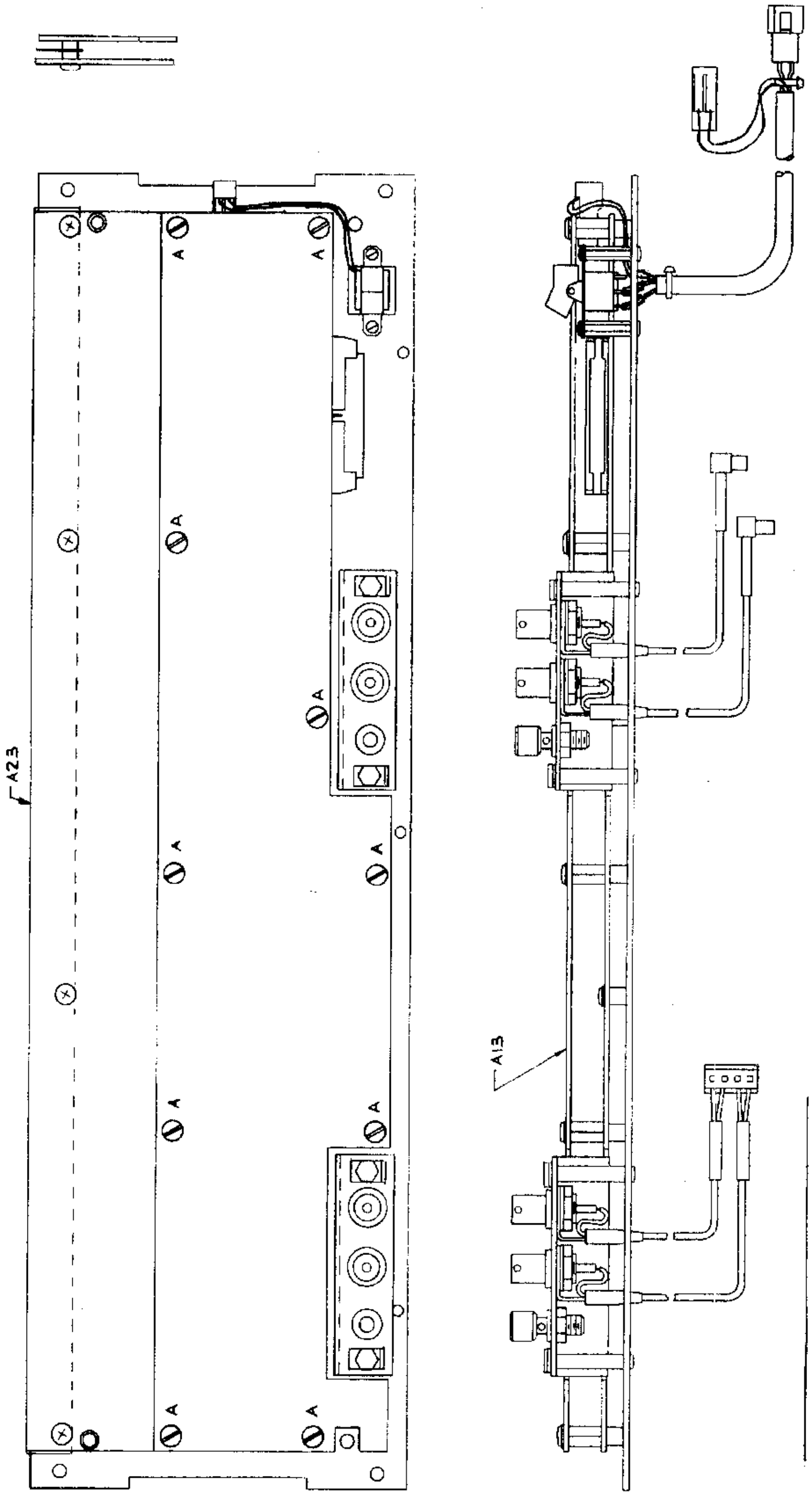


Figure 6-11. Front Panel Assy (A17)

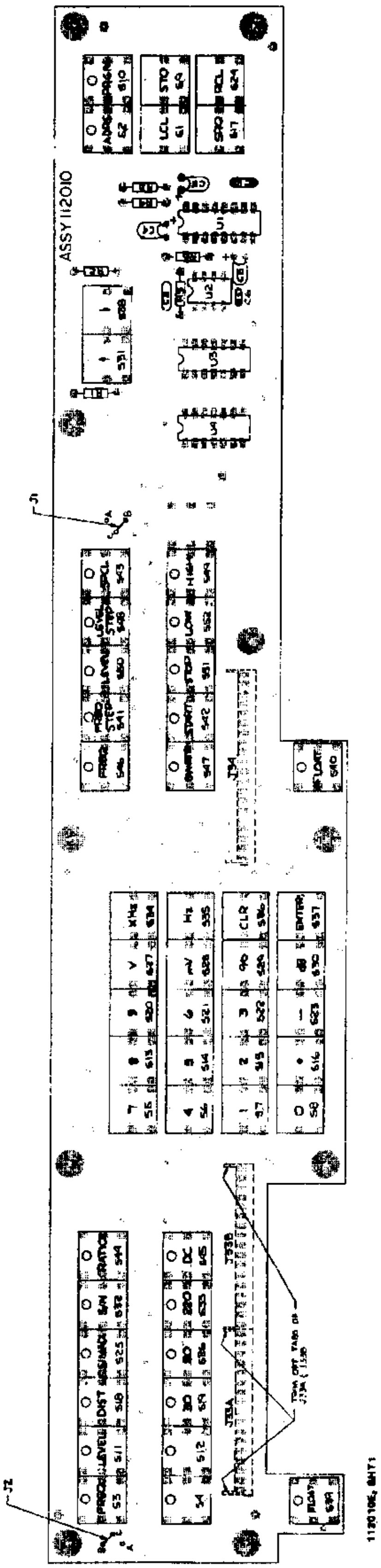


Figure 6-12. PWA '1121' Keyboard (A13)

11200406A REV C FRONT PANEL ASSY (A17) (Figure 6-11)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
A13	PWA '1121' KEYBOARD	04901	11201000A	1	11201000A
A23	'1121' SUB PANEL ASSY	04901	11200506A	1	11200506A

11201000A REF F PWA '1121 KEYBOARD (A13) (Figure 6-12)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C1-2	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C3-4	CAP TANT 15uF 10% 20V	56289	199D156X9020DA1	2	283227000
C5	CAP TANT 4.7uF 10% 10V	56289	196D475X9010HA1	1	283226000
C6	CAP CER 0.01uF 10% 100V	04222	SR201C103KAA	1	224269000
J33A-33B	CONNECTOR 17 PIN (F)	27264	22-02-2175	2	47945617A
J34	CONNECTOR 20 PIN	27264	22-02-2205	1	479399000
R1-2	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	2	341329000
R3-4	RES MF 100K 1% 1/4W	19701	5043ED100K0F	2	341500000
R5-6	RES MF 49.9K 1% 1/4W	19701	5043ED49K90F	2	341467000
S1, 5-9	SWITCH PUSH BUTTON W/O LED	31918	200330	6	465294000
S2-4,10-12	SWITCH PUSH BUTTON W/LED	31918	200480	6	465293000
S13-17	SWITCH PUSH BUTTON W/O LED	31918	200330	5	465294000
S18-19	SWITCH PUSH BUTTON W/LED	31918	200480	2	465293000
S20-24	SWITCH PUSH BUTTON W/O LED	31918	200330	5	465294000
S25-26	SWITCH PUSH BUTTON W/LED	31918	200480	2	465293000
S27-31	SWITCH PUSH BUTTON W/O LED	31918	200330	5	465294000
S32-33	SWITCH PUSH BUTTON W/LED	31918	200480	2	465293000
S34-38	SWITCH PUSH BUTTON W/O LED	31918	200330	5	465294000
S39-52	SWITCH PUSH BUTTON W/LED	31918	200480	14	465293000
U1	IC 74123 MONO MULTI	01295	SN74123N	1	534071000
U2	IC 7555 TIMER CMOS 8 DIP	32293	ICM75551PA	1	53512600A
U3	IC 74LS02 2 INPT POS NOR	01295	SN74LSO2N	1	534154000
U4	IC 4066A CMOS BILAT SW	02735	CD4066AE	1	534078000

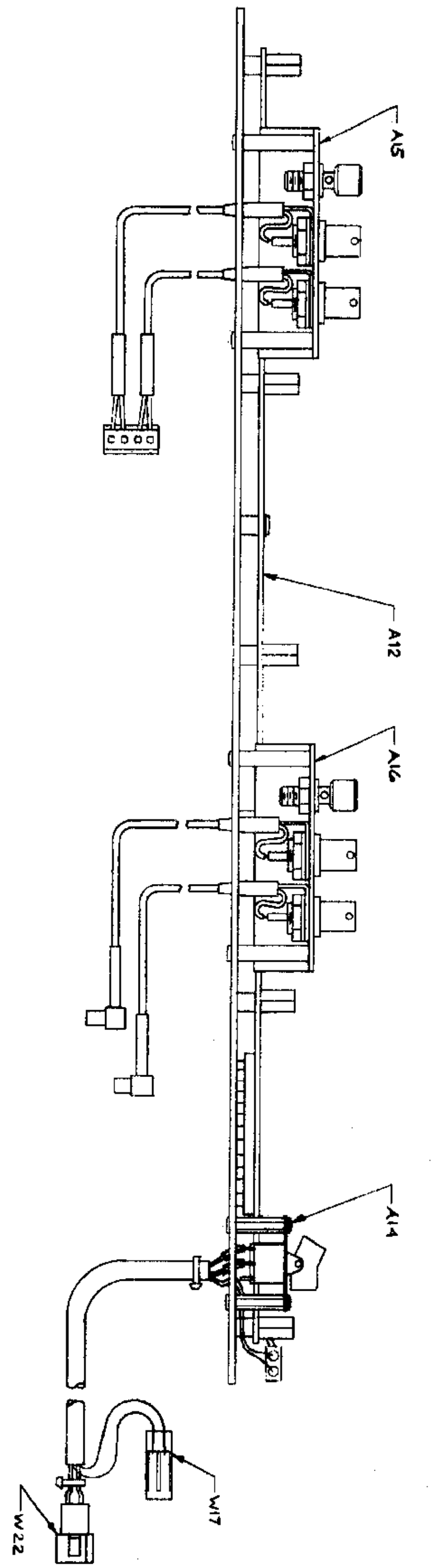


Figure 6-13. Sub Panel Assy (A23)

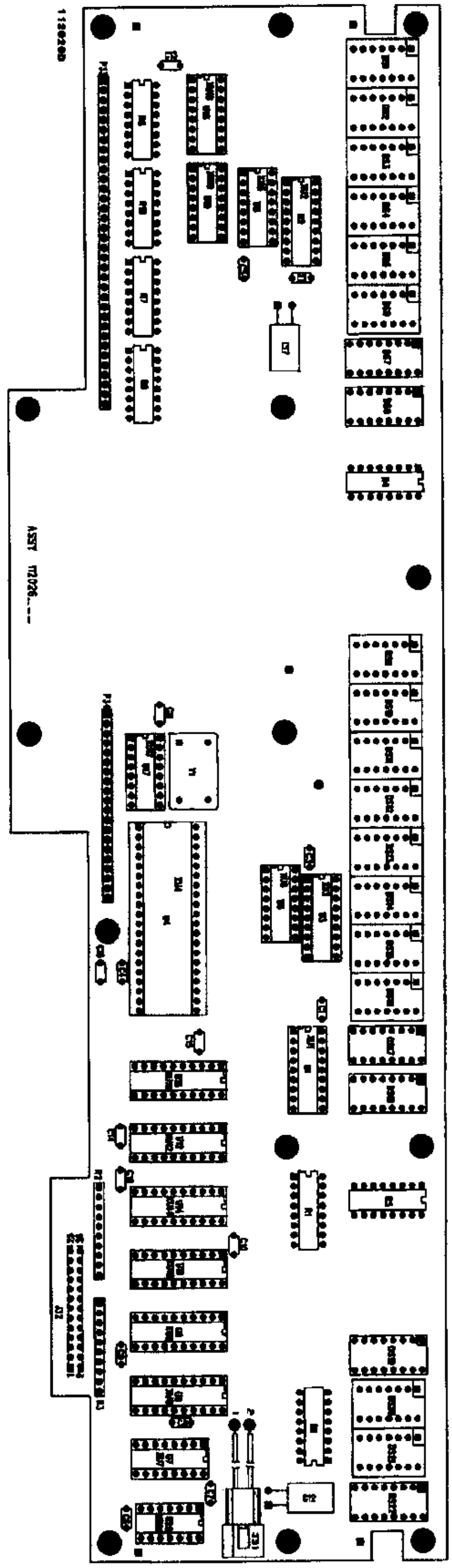


Figure 6-14. PWA '1121' Display (A12)

11200506A REV B SUB PANEL ASSY (A23) (Figure 6-13)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
A12	PWA '1121' DISPLAY	04901	11202600A	1	11202600A
A14	'1121' POWER SWITCH ASSY	04901	11200603A	1	11200603A
A15	'1121' BRKT CONN ASSY INPUT	04901	11200701A	1	11200701A
A16	'1121' BRKT CONN ASSY OUT	04901	11208200A	1	11208200A

11202600A REV E PWA '1121' DISPLAY (A12) (Figure 6-14)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C1-11	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	11	224268000
C12,17	CAP EL 100uF 20% 25V	S4217	SM-25-VB-101M	2	283334000
C13-16,18	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	5	224268000
DS1-6,9-16	DISPLAY NUMERIC 5082-7651	28480	5082-7651-S02	14	536811000
DS7-8	LED LIGHT BAR MOD HLMP-2620	28480	HLMP-2620	2	536027000
DS17-19,22	LED LIGHT BAR MOD HLMP-2620	28480	HLMP-2620	4	536027000
DS20,21	DISPLAY NUMERIC 5082-7651	28480	5082-7651-S02	14	635811000
J31	CABLE ASSY	04901	57129602A	1	57129602A
J32	CONN M 26 CKT HDR DBL ROW .1CT	06776	NSH-26DB-S2-TG	1	47742226A
P33A-33B	CONN M 17 CKT .1CT ST	27264	22-03-2171	2	47741117A
P34	CONNECTOR 20 PIN STRAIGHT	27264	22-03-2201	1	477397000
R1	RES NETWORK 22 OHM + -2 OHM 2W	01121	316B151	3	345026000
R2-3	RES NETWORK 3K/6.2K 2% 2.7W	73138	L105-5-R3K/6.2K	2	345031000
R4-6	RES NETWORK 150 OHM 2% 1.5W	01121	316B151	3	345026000
R7-10	RES NETWORK 330 OHM 2% 1.5W	73138	898-3-R330	4	345027000
U1	IC ULN2803A TRANSITOR ARRAY	56289	ULN2803A	1	534274000
U2-3	IC UDN2585A TRANSISTOR ARRAY	56289	UDN2585A	2	534392000
U4	IC 8279-2 KEYBD/DISP INTERFACE	33297	uPD8279C-2	1	534211000
U5-7,17-19	IC 74LS138 DECDR/MPX	01295	SN74LS138N	6	534246000
U8-10,12	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	4	534263000
U14,16	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	2	534263000
U20	IC 74LS00 2 INP POS NAND	01295	SN74LSOON	1	534167000
XU1-3	SOCKET IC 18 PIN	06776	ICT-183-S3-TG	3	473045000
XU4	SOCKET IC 40 PIN LOW PROFILE	06776	ICN-406-S-TG	1	473068000
XU5-7	SOCKET IC 16 PIN	06776	ICN-163-S3-G	3	473042000
XU8-10,12	SOCKET IC 20 PIN	06776	ICN-203-S3-G	4	473065000
XU14,16	SOCKET IC 20 PIN	06776	ICN-203-S3-G	2	473065000
XU17-19	SOCKET IC 16 PIN	06776	ICN-163-S3-G	3	473042000
XU20	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000
XDS1-6	SOCKET IC 14 PIN	06776	ICN-143-WB-G	6	473066000
XDS7-8	SOCKET IC 16 PIN	06776	ICN-163-WB-TG 30	2	47304701A
XDS9-16	SOCKET IC 14 PIN	06776	ICN-143-WB-G	8	473066000
XDS17-19	SOCKET IC 16 PIN	06776	ICN-163-WB-TG 30	3	47304701A
XDS20-21	SOCKET IC 14 PIN	06776	ICN-143-WB-G	2	473066000
XDS22	SOCKET IC 16 PIN	06776	ICN-163-WB-TG	1	473047000
Y1	CRYSTAL OSC 1.000 MHz	04901	54790505A	1	54790505A

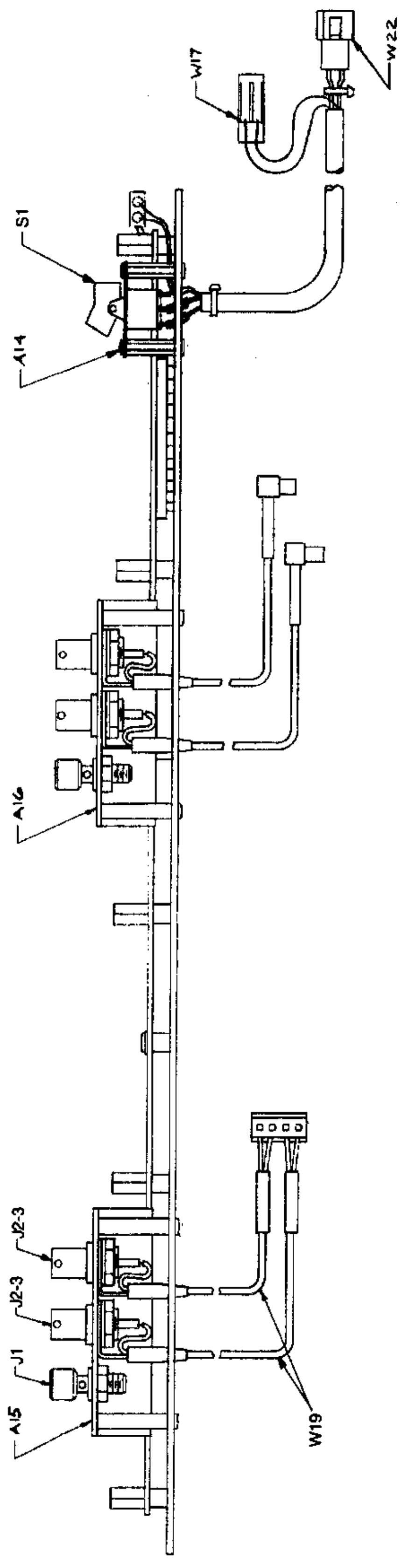


Figure 6-15. Power Switch (A14), BRKT Assy Input (A15) and Output (A16)

11200603A REV A '1121' POWER SWITCH ASSY (A14) (Figure 6-15)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
S1	SWITCH ROCKER DPDT	09353	7201-J1-Z-Q-E-9	1	46532200A
W17/W22	CABLE ASSY WIRE 22/24 GA 2/4C	04901	57130600A	6	57130600A

11200701A '1121' REV A BRKT CONN ASSY INPUT (A15) (Figure 6-15)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
J1	CONNECTOR BINDING POST GROUND	74970	111-2223-001	1	47945400A
J2-3	CONN COAX BNC	54420	UG-625B/U	2	479123000
W19	CABLE COAXIAL ASSY INPUT	04901	57223901A	1	57223901A

11208200A REV A '1121' BRKT CONN ASSY OUTPUT (A16) (Figure 6-15)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
J4	CONNECTOR BINDING POST GROUND	74970	111-2223-001	1	47945400A
W58	CABLE ASSY COAX (BL) BNC/SMB	04901	57226302A	1	57226302A
W59	CABLE ASSY COAX (Y) BNC/SMB	04901	57226301A	1	57226301A

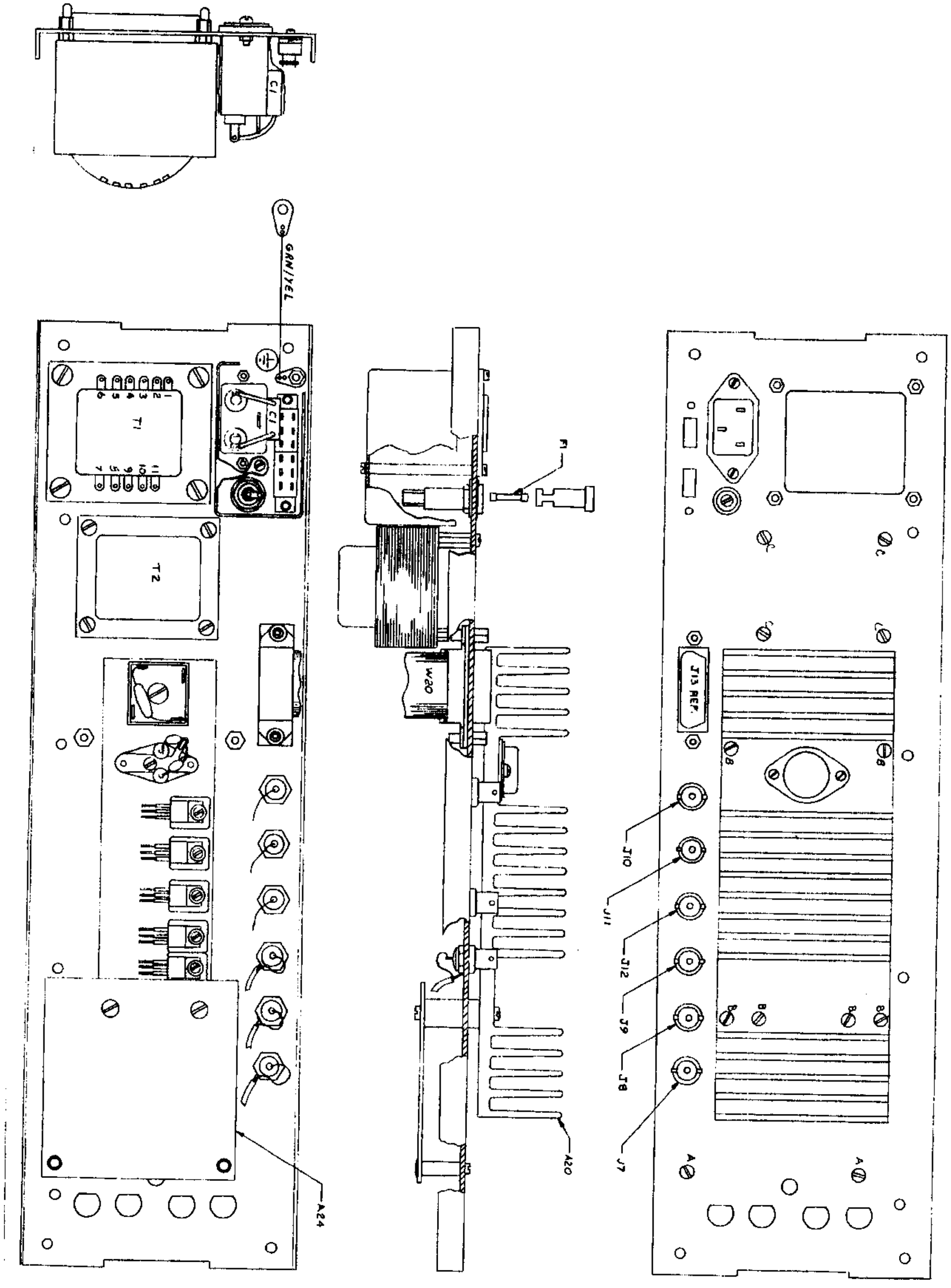


Figure 6-16. Rear Panel Assy (A21) (Sheet 1 of 2)

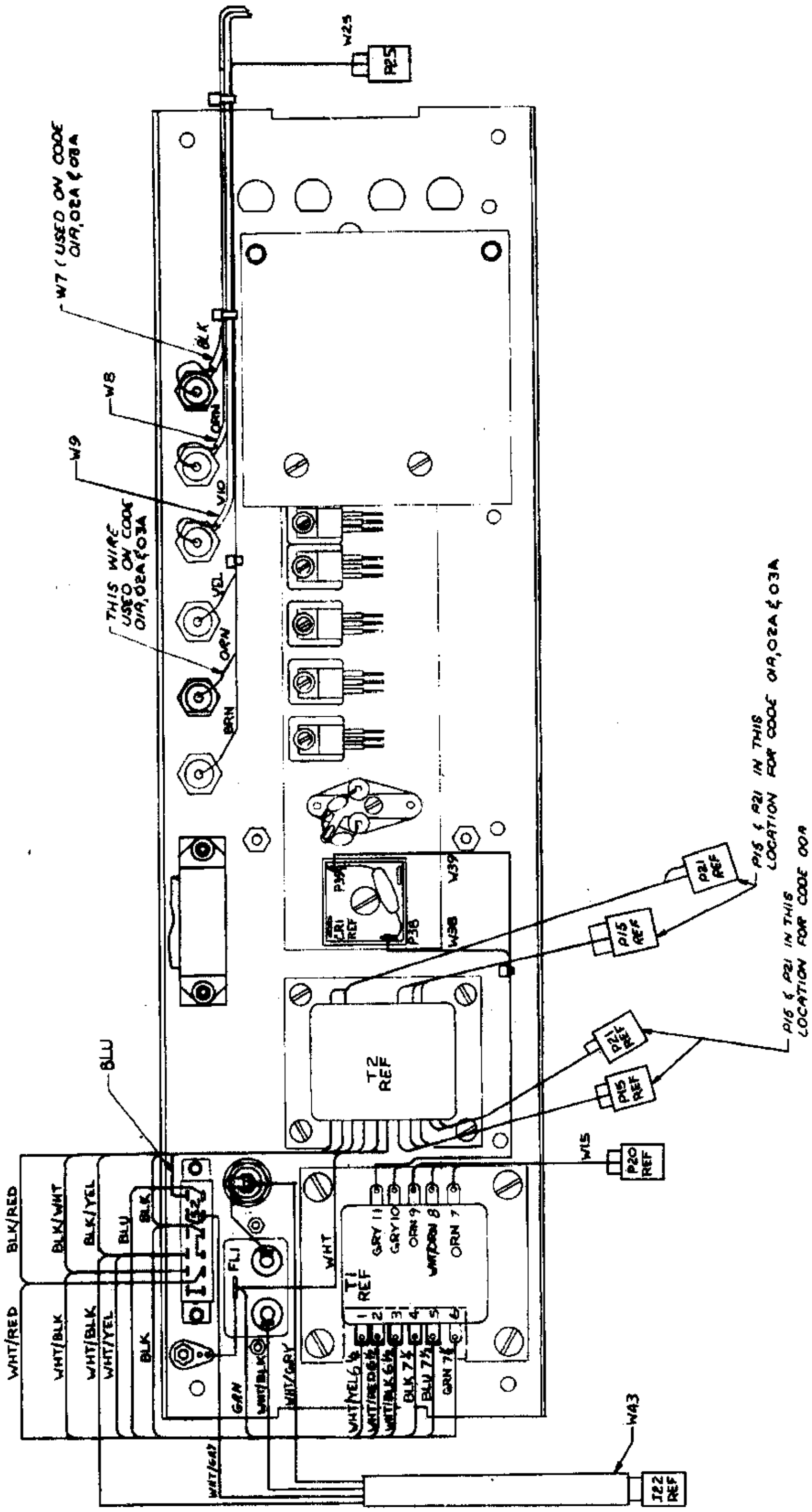


Figure 6-16. Rear Panel Assy (A21) (Sheet 2 of 2)

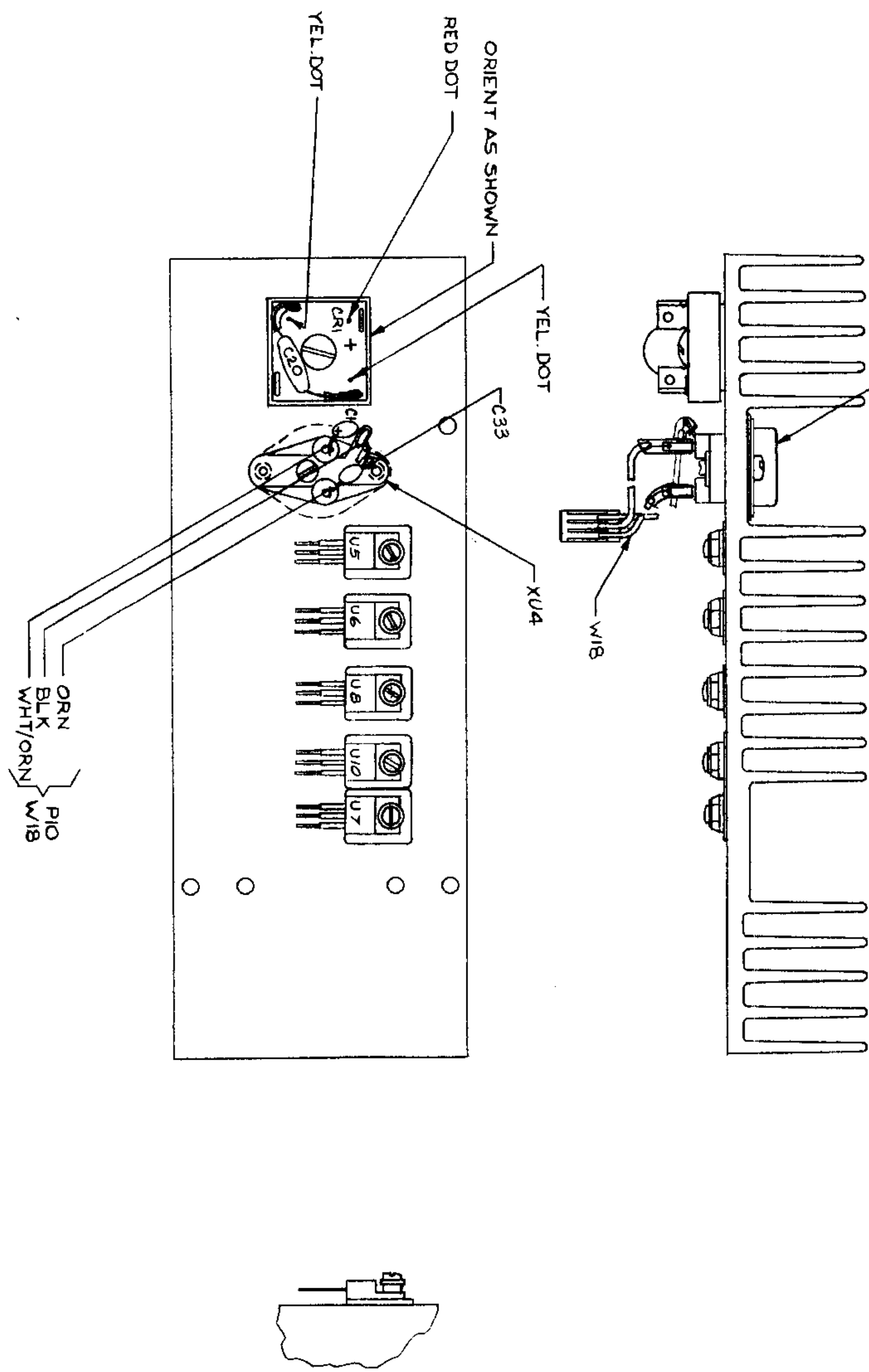


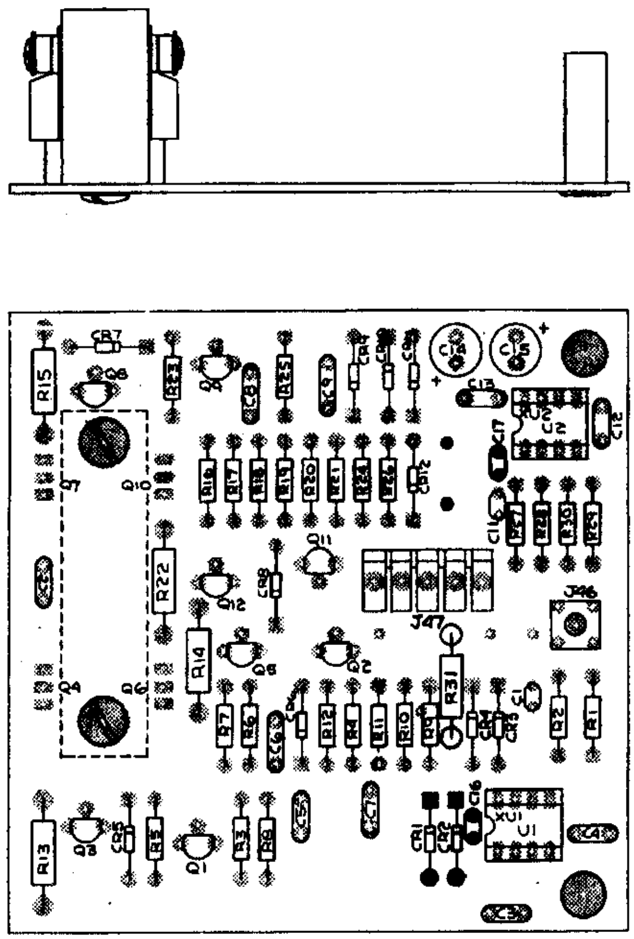
Figure 6-17. Heat Sink Assy (A20)

11104103B REV E '1121' REAR PANEL ASSY (A21) (Figure 6-16)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
A19	REAR PANEL UNIT	04901	60339900A	1	60339900A
A20	'1121' HEAT SINK ASSY	04901	11100401A	1	11100401A
A24	PWA '1121' PWR AMPLIFIER	04901	11103401A	1	11103401A
C1	CAP POLY .1uF 250VAC	54473	ECQ-U2AZ104MV	1	23420100A
FL	FUSE 0.75 AMP 250V MDL SLO BLO	54426	MDL-3/4	1	545533000
FL1	FILTER LINE	56289	3JX5421A	1	439004000
J7-12	CONN COAX BNC	54420	UG-625B/U	6	479123000
T1	TRANSFORMER POWER	04901	44609600B	1	44609600B
T2	TRANSFORMER ASSY	04901	11104700A	1	11104700A
W7	CABLE COAX ASSEMBLY (BLACK)	04901	57223615A	1	57223615A
W8	CABLE ASSY COAX RG316/U 22.00L	04901	57223613A	1	57223613A
W9	CABLE ASSY COAX RG316/U 23.00L	04901	57223614A	1	57223614A
W15	CABLE ASSY WIRE 22GA 3C 10.50L	04901	57121705A	1	57121705A
W20	CABLE ASSY FLAT 24 CKT 17.125L	04901	92019800A	1	92019800B
W25	CABLE ASSEMBLY	04901	57124302A	1	57124302A
W38-39	CABLE ASSY WIRE 20GA 1C 10.50L	04901	57121801A	2	57121801A
W43	CABLE ASSY WIRE 24GA 4C 7.75L	04901	57120100B	1	57120101B

1110401A REV A '1121' HEAT SINK ASSY (A20) (Figure 6-17)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C1	CAP TANT 1.0uF 10% 35V	56289	199D105X9035AA2	1	283216000
C20	CAP CER 0.01uF 20% 500V	33883	BGP Z5U W/FDCL	1	224271000
C33	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
CR1	DIODE BRIDGE 15A 50V	11961	SDA-980-1	1	532030000
U4	IC 323K REGULATAOR	27014	LM323K	1	535024000
U5,7-8	IC UA7805UC VOLT REG	07263	uA7805UC	3	53511700A
U6,10	IC 7905 VOLT REG	27014	LM7905CT	2	53515100A
W18	CABLE ASSY WIRE 22GA 3 C 8.00L	04901	57121704A	1	57121704A
XU4	SOCKET TRANSISTOR PWR TO-E	06776	MP-3452G	1	47308000A



111034B

Figure 6-18. Power Amplifier (A24)

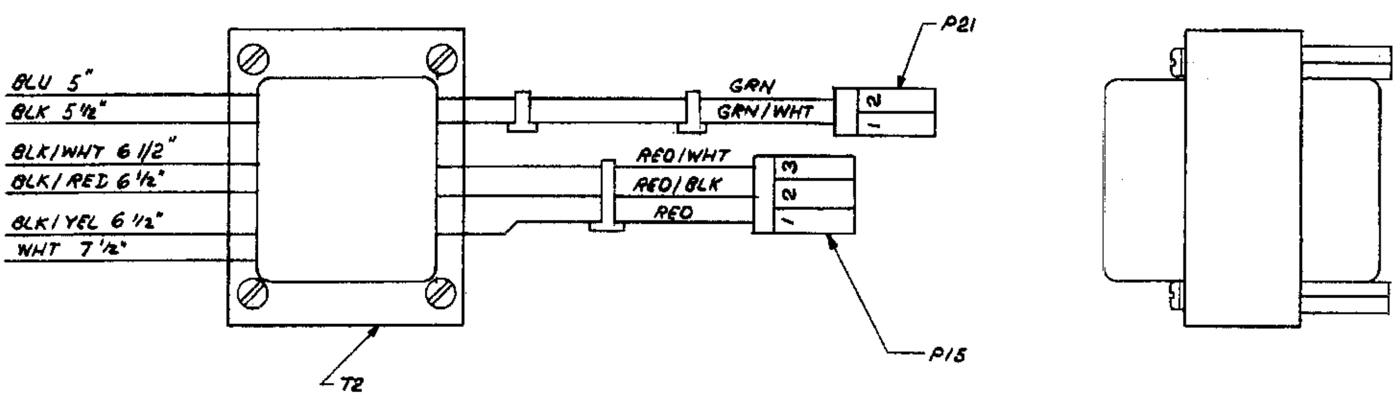


Figure 6-19. Transformer Assy (T1)

11103401A REV A '1121' PWR AMPLIFIER (A24) (Figure 6-18)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C1,11	CAP MICA 10pF 5% 300V	14655	CD5CC100J	2	205002000
C2-5,12-13	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	6	224268000
C6-9	CAP CER 2200pF 10% 250V	16546	CF-222	4	224309000
C14-15	CAP EL 100uF 20% 25V	S4217	SM-25-VB-101M	2	283334000
CR1-12	DIODE SIG 1N914	01295	1N914	12	530058000
J46	CONNECTOR "SMB"	19505	209	1	477317000
J47	HEADER 5 PIN STRAIGHT	06383	MPSS156-5-D	1	477345000
Q1,5,9,12	TRANS NPN 2N3904	04713	2N3904	4	528071000
Q2-3,8,11	TRANS PNP 2N3906	04713	2N3906	4	528076000
Q4,7	TRANS PNP D45H11	04713	D45H11	2	52816200A
Q6,10	TRANS NPN D44H11	04713	D44H11	2	52816100A
R1,28,30	RES MF 5.000K 0.1% 1/8W	64537	PME55-T9-5K	3	324326000
R2,27,29	RES MF 7.500K 0.1% 1/4W	91637	CMF-55-7501-B-T9	3	32593200A
R3-4,25-26	RES MF 2.49K 1% 1/4W	19701	5043ED2K490F	4	341338000
R5,12	RES MF 200 OHM 1% 1/4W	19701	5043ED200R0F	2	341229000
R6,11,16	RES MF 301 OHM 1% 1/4W	19701	5043ED301R0F	3	341246000
R7,10,17	RES MF 39.2 OHM 1% 1/4W	19701	5043ED39R20F	3	341157000
R8-9,18-19	RES MF 150 OHM 1% 1/4W	19701	5043ED150R0F	4	341217000
R13-15,22	RES MF 3.92 OHM 1% 1/2W	91637	CMF503R92 T2	4	34205700A
R20	RES MF 39.2 OHM 1% 1/4W	19701	5043ED39R20F	1	341157000
R21	RES MF 301 OHM 1% 1/4W	19701	5043ED301R0F	1	341246000
R23-24	RES MF 200 OHM 1% 1/4W	19701	5043ED200R0F	2	341229000
R31	RES MF 3.92 OHM 1% 1/2W	91637	CMF603R92 T2	1	34205700A
U1-2	IC 5534AFE OP AMP	18324	NE5534AFE	2	53514401A
XU1-2	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000

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

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
P15	CONNECTOR 3 CIRCUIT	06383	CE156-22-3-C	1	479406000
P21	CONNECTOR 2 PIN	06383	CE156F22-2-C or D	1	479405000
T2	TRANSFORMER POWER	04901	44609800A	1	44609800A

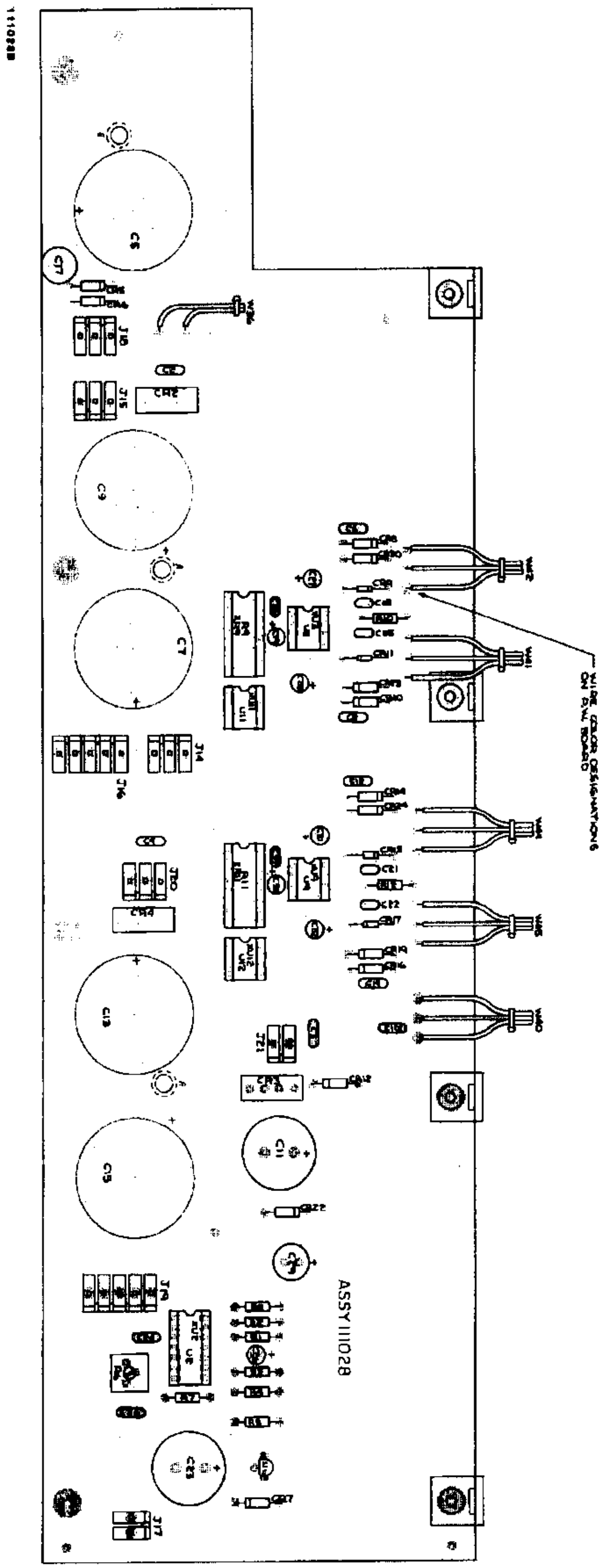


Figure 6-20. PWA '1121' Power Supply (A11)

11102800A REV D PWA '1121' POWER SUPPLY (A11) (Figure 6-20)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C2-4	CAP CER 0.01uF 100V	33883	BT Z5U	3	224119000
C5,7,9,13	CAP EL 6800uF 20% 50V	54473	ECE-S1HG682U	4	283384004
C6,8,10,12	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	4	224268000
C11	CAP EL 4700uF -10% +50% 16V	S4217	SM-16-VB-4700M	1	283352000
C14,24-25	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	3	224268000
C15	CAP EL 6800uF 20% 50V	54473	ECE-S1HG682U	1	283384004
C17,29	CAP EL 100uF 20% 25V	S4217	SM-25-VB-101M	2	283334000
C18,21	CAP CER 0.001uF 10% 100V	04222	SR151C102KAA	2	224270000
C19,26-28	CAP TANT 10uF 20% 25V	56289	196D106X0025KA1	4	283293000
C22,35-37	CAP MICA 270pF 5% 50V	57582	KD5271J101	4	205045000
C23	CAP EL 2200uF 20% 35V	57582	KSM-2200-35	1	283351000
C30-32	CAP TANT 10uF 20% 25V	56289	196D106X0025KA1	3	283293000
CR2-4	DIODE BRIDGE FWLD-50	11961	FWLA-50	3	532028000
CR5-8,10	DIODE SIG 1N4001	04713	1N4001	5	530151000
CR9,11,15	DIODE ZENER 1N5242B 12V 5%	04713	1N5242B	3	530146000
CR12,14,16	DIODE SIG 1N4001	04713	1N4001	3	530151000
CR17	DIODE ZENER 1N5242B 12V 5%	04713	1N5242B	1	530146000
CR19-20	DIODE SIG 1N4001	04713	1N4001	2	530151000
CR22-24	DIODE SIG 1N4001	04713	1N4001	3	530151000
J14-15,18	HEADER 3 PIN STRIAGHT .156 SPA	06383	HPSS156-3-C	3	477343000
J16,19	HEADER 5 PIN STRAIGHT	06383	MPSS156-5-D	2	477345000
J17,21	HEADER 2 PIN STRAIGHT	06383	HPSS156-2-C	2	477342000
J20	HEADER 3 PIN STRAIGHT .156 SPA	06383	HPSS156-3-C	1	477343000
R1-2,7	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	3	341300000
R3,8	RES MF 100K 1% 1/4W	19701	5043ED100K0F	2	341500000
R4	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R5	RES MF 3.01K 1% 1/4W	19701	5043ED3K010F	1	341346000
R6	RES VAR 1K 10% 0.5W	73138	72PR1K	1	311316000
R9,11	RES NETWORK 10K .1% 1.5W 16pin	73138	698-3R10KD	2	345010000
R10,12	RES MF 301 OHM 1% 1/4W	19701	5043ED301R0F	2	341246000
U1	IC 78L05 VOLT REG	07263	uA78L05AWC	1	535044000
U2	IC 339 QUAD COMPARATOR	27014	LM339N	1	535018000
U3,9	IC TL072CP DUAL OP AMP	01295	TL072CP	2	535092000
U11-12	IC REF-01CP VOLTAGE REFERENCE	06665	REF-01CP	2	535116000
W36	CABLE ASSY WIRE 22GA 2C 6.50L	04901	571206000	1	571206000
W40	CABLE ASSY WIRE 24GA 3C 3.25L	04901	57120303A	1	57120303A
W41	CABLE ASSY WIRE 24GA 3C 4.50L	04901	571204000	1	571204000
W42	CABLE ASSY WIRE 24GA 3C 5.25L	04901	57120304A	1	57120304A
W44	CABLE ASSY WIRE 24GA 3C 3.50L	04901	57120305A	1	57120305A
W45	CABLE ASSY WIRE 24GA 3C 3.50L	04901	57120306A	1	57120306A
XR9,11	SOCKET IC 16 PIN	06776	ICN-163-S3-G	2	473042000
XU2	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000
XU3,9	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000
XU11-12	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000

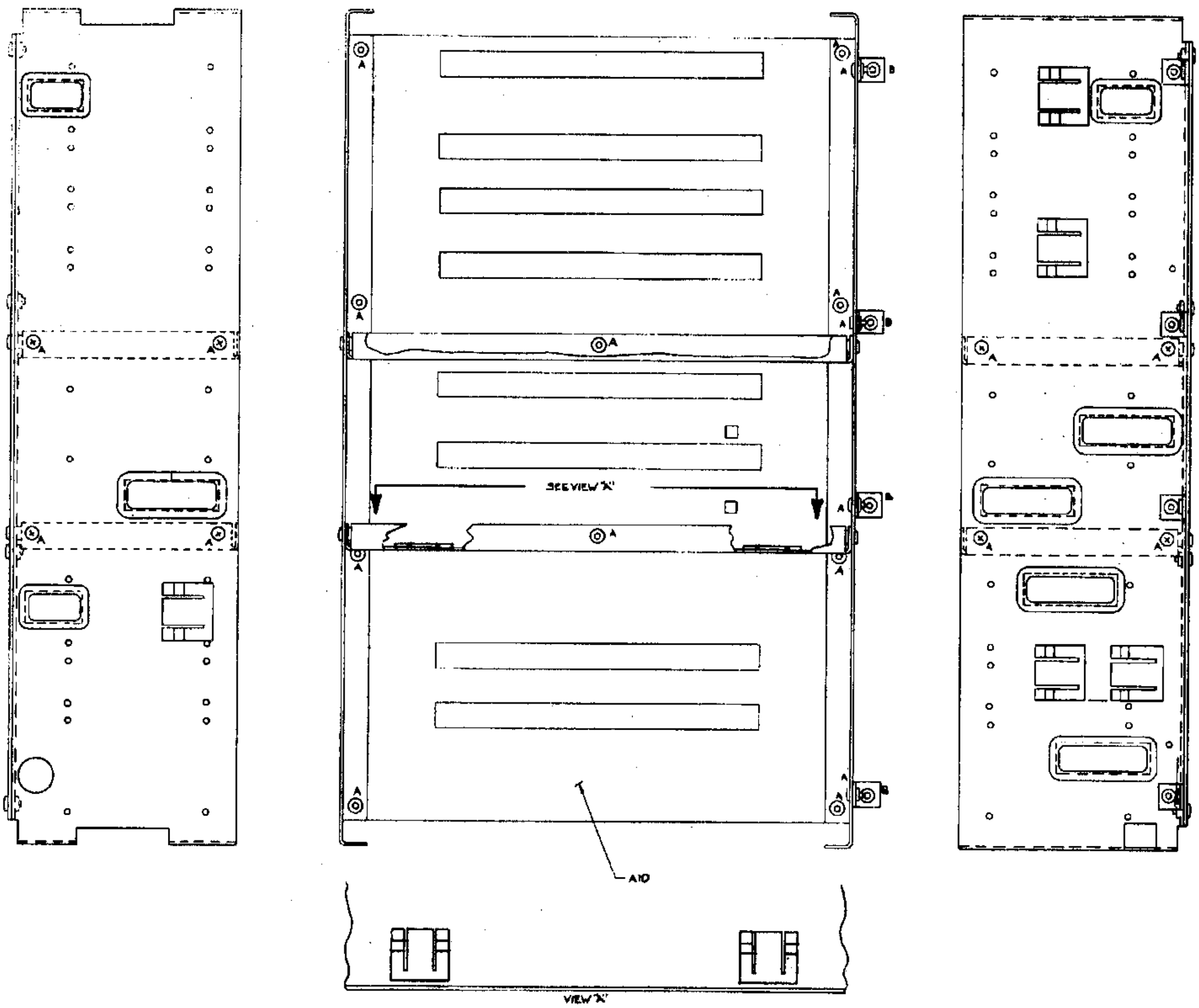


Figure 6-21. '1121' Card Cage Assy (A18)

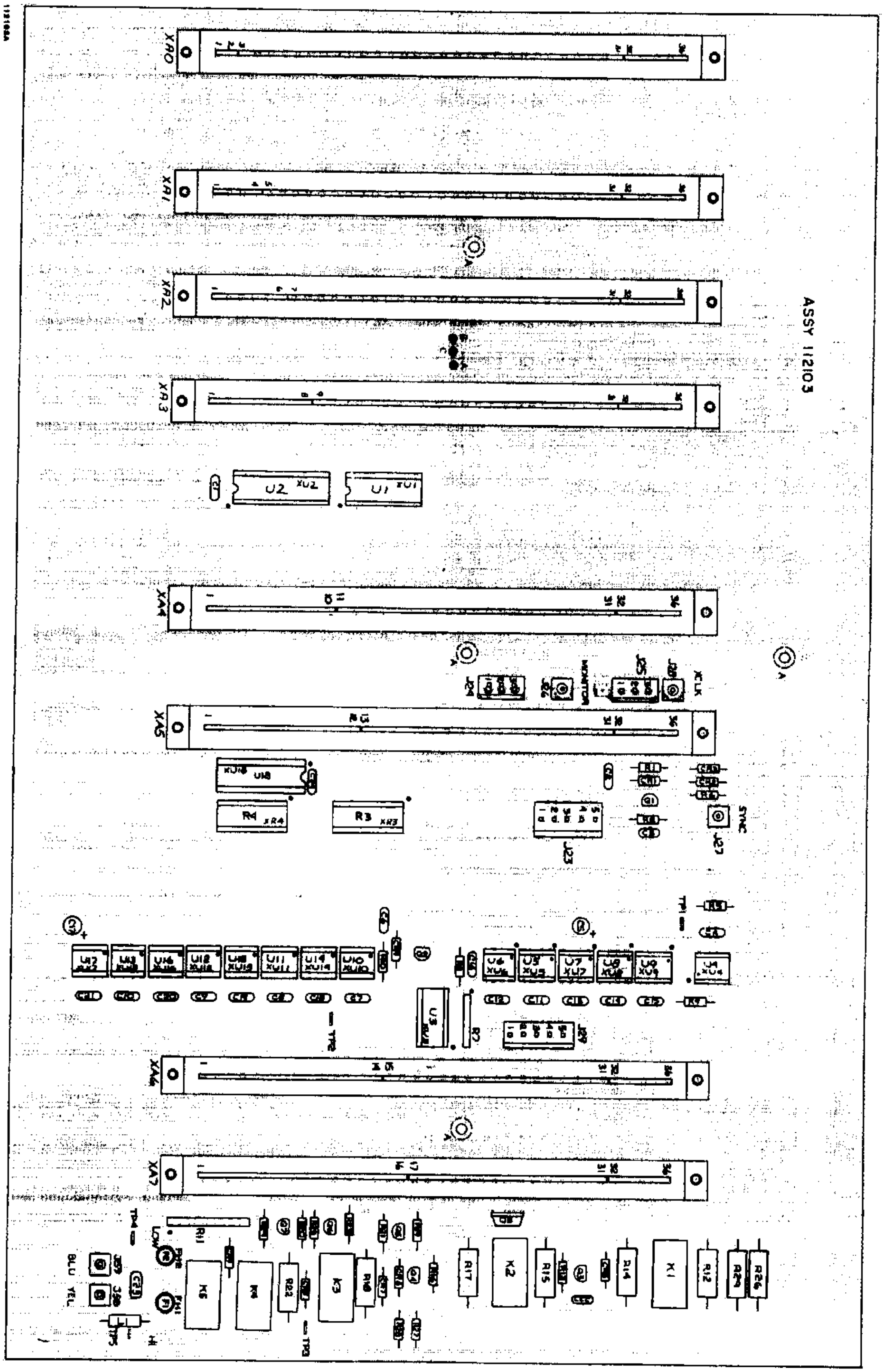


Figure 6-22. PWA '1121' Mother (A10)

11201205A REV A '1121' CARD CAGE ASSY (A18) (Figure 6-21)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
A10	PWA '1121' MOTHER	04901	11210300A	1	11210300A

11210300A REV B PWA '1121' MOTHER (A10) (Figure 6-22)
MODEL: 1121

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART NUMBER
C1-2,6,22	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	4	224268000
C3	CAP CER 0.01uF 10% 100V	04222	SR201C103KAA	1	224269000
C4,7-16	CAP CER 0.01uF 100V	33883	BT Z5U	11	224119000
C5,17	CAP TANT 100uF 10% 20V	56289	196D107X0020TE4	2	283313000
C18-21	CAP CER 0.01uF 100V	33883	BT Z5U	4	224119000
C23	CAP CAR 0.22uF 10% 200V	61637	C340C224M2R5CA	1	22439200A
C24	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
CR1,4	DIODE HSCH1001 (1N6263)	28480	HSCH-1001	2	530174000
CR2-3,5-9	DIODE SIG 1N914	01295	1N914	7	530058000
F1	FUSE 0.3 AMP 125V MICRO	75915	273.300	1	54554212A
F2	FUSE 1.5 AMP 125V MICRO	75915	27301.5	1	54554220A
FH1-2	FUSEHOLDER PWB VERT MOUNT	75915	281005	2	48211801A
J23,29	HEADER 5 PIN STRAIGHT	06383	MPSS156-5-D	2	477345000
J24-25	HEADER 3 PIN STRAIGHT .156 SPA	06383	HPSS156-3-C	2	477343000
J26-28	CONNECTOR "SMB"	19505	209	3	477317000
J58-59	CONNECTOR "SMB"	19505	209	2	477317000
K1-2	RELAY FORM C 12V DPDT	TAKAM	RZ-12W-C	2	47105700A
K3-5	RELAY FORM A 12V HEAVY DUTY	TAKAM	JY-12H-K	3	47105800A
L1	INDUCTOR 5.6uH 10%	24226	15/561	1	400308000
Q1-7	TRANS NPN 2N3904	04713	2N3904	7	528071000
Q8	TRANS NPN D44H11	04713	D44H11	1	52816100A
R1,10	RES MF 511 OHM 1% 1/4W	19701	5043ED511R0F	2	341268000
R2	RES MF 2.21K 1% 1/4W	19701	5043ED2K210F	1	341333000
R3-4	RES NETWORK 330 OHM 2% 1.5W	73138	898-E-R330	2	345027000
R5	RES MF 475 OHM 1% 1/4W	19701	5043ED475R0F	1	341265000
R6,21	RES MF 100 OHM 1% 1/4W	19701	5043ED100R0F	2	341200000
R7	RES NETWORK 470 OHM 2% 1.5W 6P	71450	750-61-R470	1	345029000
R8	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	1	341300000
R9	RES MF 332 OHM 1% 1/4W	19701	5043ED332R0F	1	341250000
R11	RES NETWORK 470 OHM 2% 2.3W	71450	750-101-R470	1	34504414A
R12	RES MF 200 OHM 0.1% 1/2W	64537	PME65-T9-200 OHM	1	32677600A
R13,16	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	2	341329000
R14	RES MF 52.5 OHM 0.1% 1W	64537	PME70-T9-62.5 OHM	1	32677500A
R15,22	RES MF 450.0 OHM 0.1t 1/2W	64537	PME65-T9-450 OHM	2	32677300A
R17	RES MF 55.5 OHM 0.1% 1W	64537	PME70-T9-55.5 OHM	1	32677100A
R18,26,29	RES MF 100.0 OHM 0.1% 1W	64537	PME65-T9-100 OHM	3	32677200A

R19-20,23	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	3	341329000
R24-25	RES MF 100 OHM 1% 1/4W	19701	5043ED100R0F	2	341200000
R27	RES MF 2.74K 1% 1/4W	19701	5043ED2K740F	1	341342000
R28	RES MF 3.09K 1% 1/4W	19701	5043ED3K090F	1	341347000
U1,3	IC 74LS138 DECDR/MPX	01295	SN74LS138N	2	534246000
U2,18	IC 74LS541 OCTAL BUFFER	01295	SN74LS541N	2	54381000
U4-17	OPTO-COUPLER HCPL-2601	28480	HCLP-2601	14	536037000
XA0-7	CONNECTOR 36 PIN	31781	306-036-521-102	8	479338000
XR3-4	SOCKET IC 16 PIN	06776	ICN-163-S3-G	2	473042000
XU1,3	SOCKET IC 16 PIN	06775	ICN-163-S3-G	2	473042000
XU2,18	SOCKET IC 20 PIN	06776	ICN-203-S3-G	2	473065000
XU4-17	SOCKET IC 8 PIN	06776	ICN-083-S3-G	14	473041000

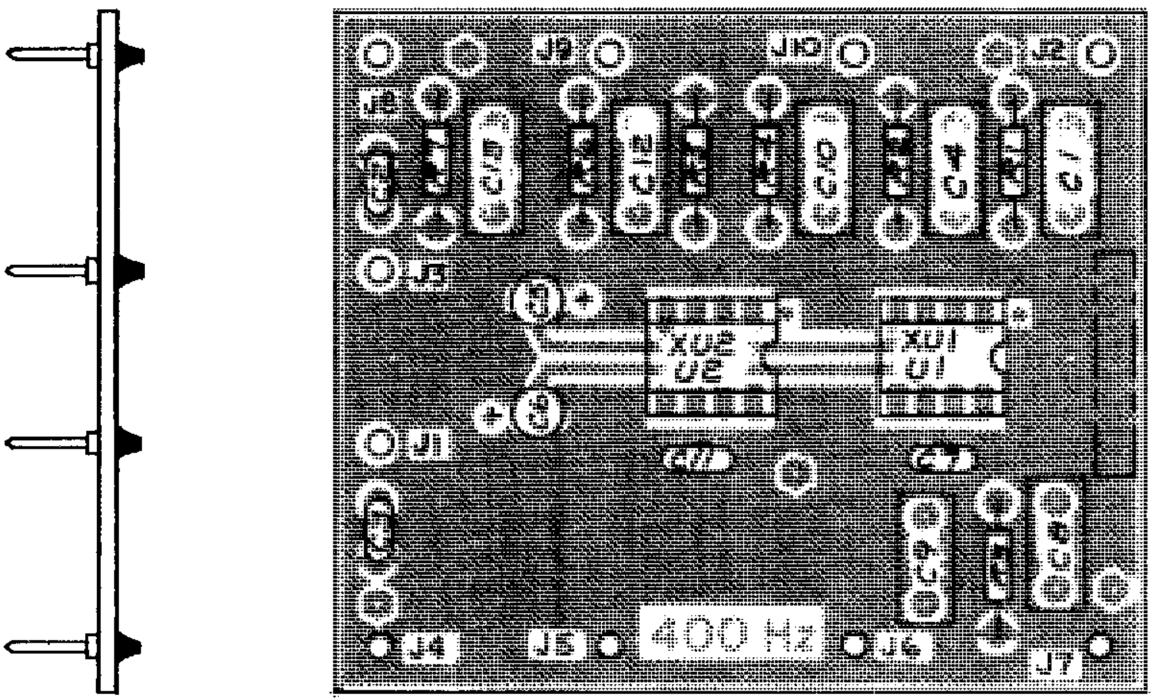


Figure 6-23. PWA 400 Hz High Pass Filter

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

REF. DESIG.	DESCRIPTION	CAGE CODE	MFG PART NUMBER	QTY	BEC PART 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

SECTION VII
SCHEMATIC DIAGRAMS

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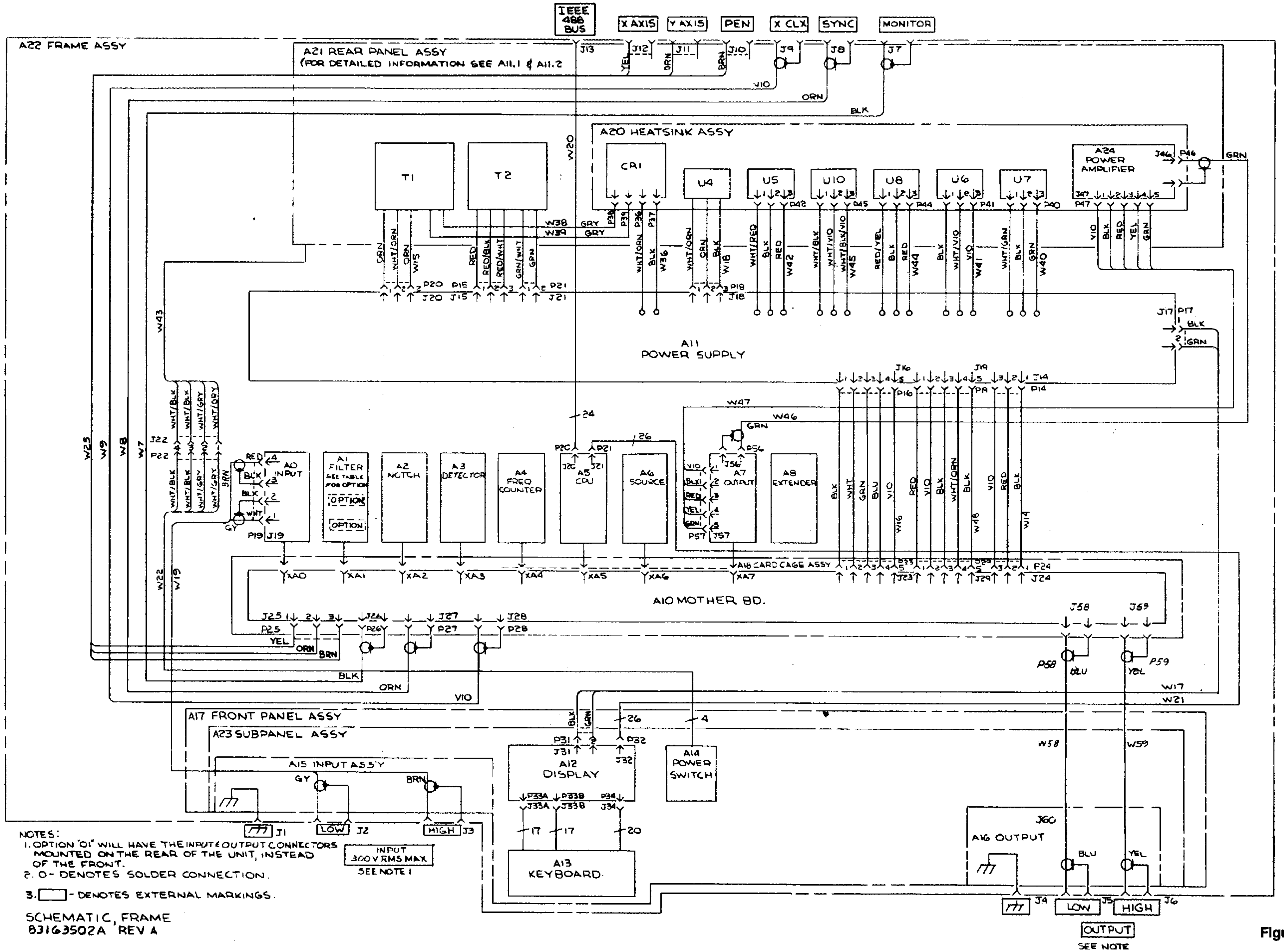
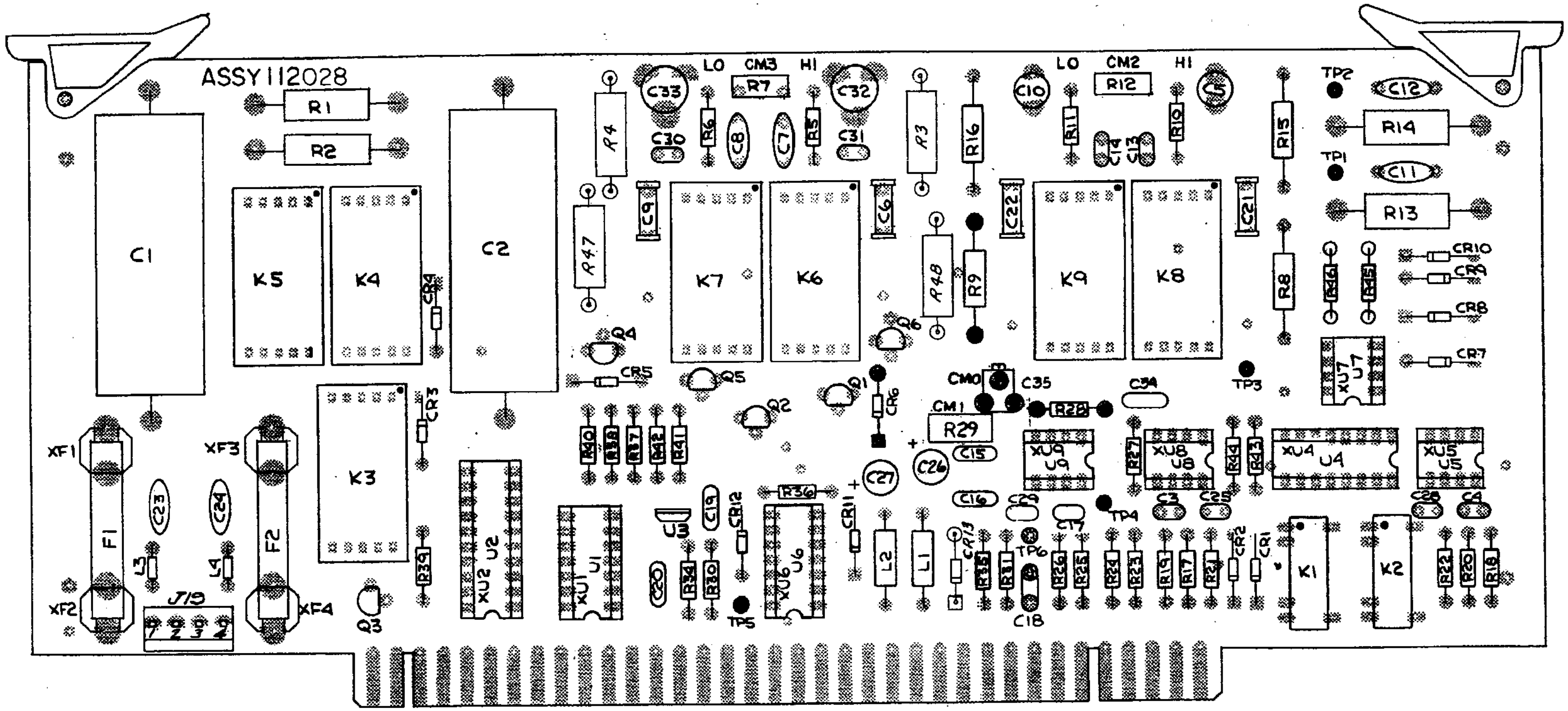


FILTER OPTIONS	
OPTION	ASS'Y
400	A1A30
CCITT	A1A31
CCIR	A1A32
CCIR/ARM	A1A33
A WTG	A1A34
B WTG	A1A35
C WTG	A1A36
AUDIO	A1A37
C MSG	A1A38

NOTES:
1. OPTION 'O1' WILL HAVE THE INPUT & OUTPUT CONNECTORS MOUNTED ON THE REAR OF THE UNIT, INSTEAD OF THE FRONT.
2. O - DENOTES SOLDER CONNECTION.
3. [ ] - DENOTES EXTERNAL MARKINGS.

SCHEMATIC, FRAME
83163502A REV A

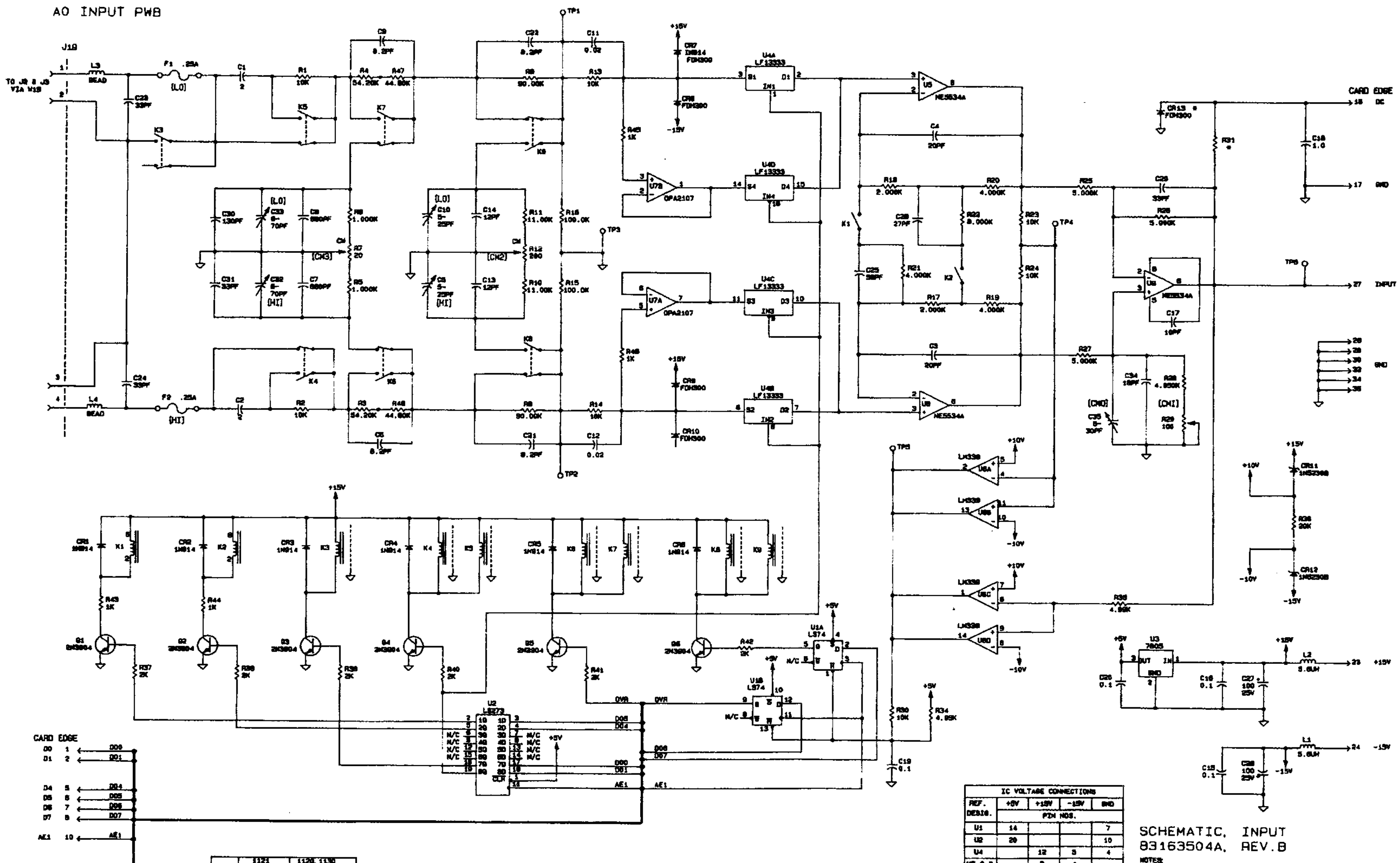
Figure 7-1. Main Frame Schematic



112028A

PART NUMBER	MODEL
11202801A	1120, 1130, 1120-S/1 1120-S/10
11202802A	1121, 1120-S/3

Figure 7-2. Input Board A0 Parts Location Diagram



	1121 1120-S/3	1120, 1130 1120-S/1 1120-S/10
R31	10.00K	5.00K
CR13	NOT USED	USED

IC VOLTAGE CONNECTIONS				
REF. DESIG.	+5V	+15V	-15V	GND
	PIN NOS.			
U1	14			7
U2	20			10
U4		12	5	4
U5, 8, 9		7	4	
U6		3	12	
U7		8	4	

SCHEMATIC, INPUT
83163504A, REV.B

NOTES:

1. CAPACITANCE VALUES IN UF UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
3. LAST NUMBERS USED: C35 CR13 L4 Q6 R48 TP6 U9
4. "*" SEE TABLE.

Figure 7-3. Input Board A0 Schematic

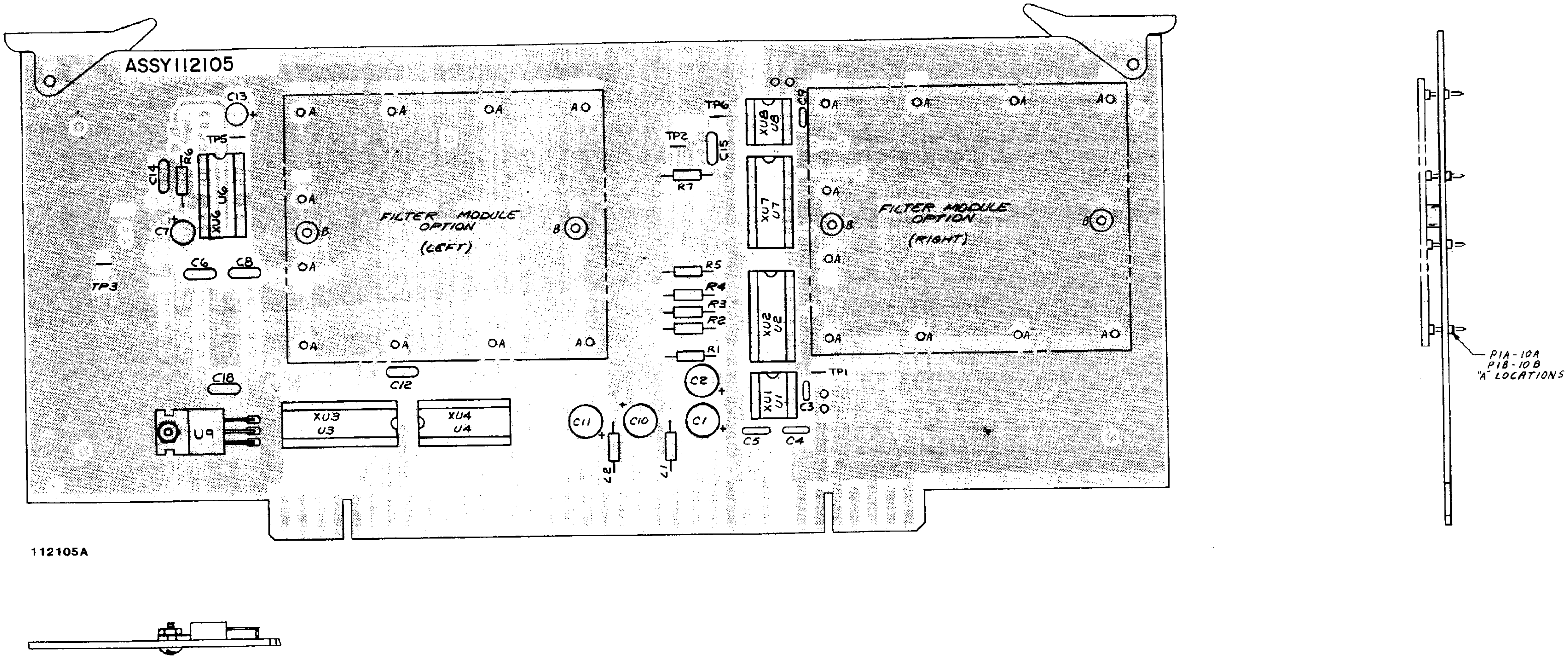
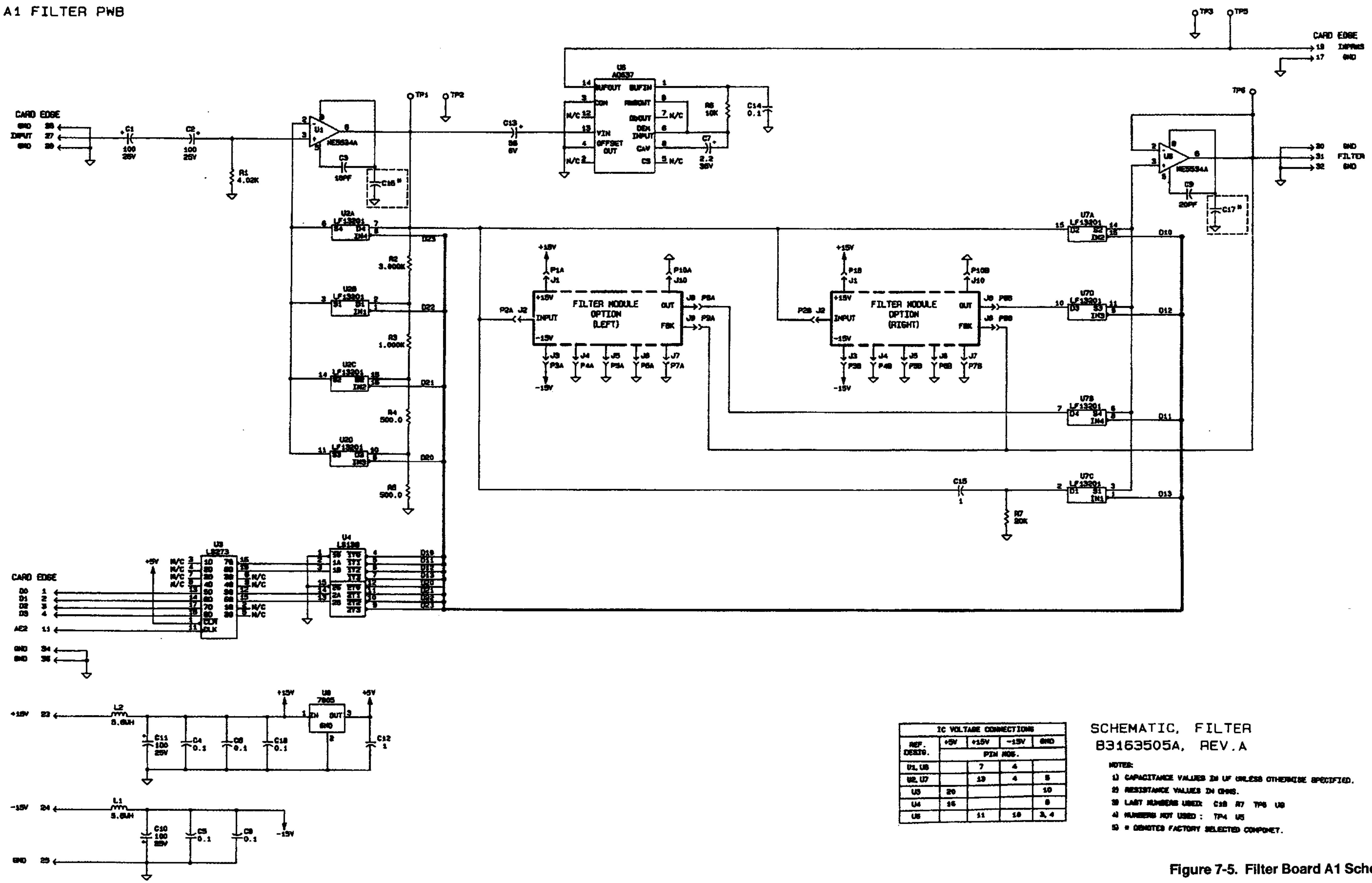


Figure 7-4. Filter Board A1 Parts Location Diagram

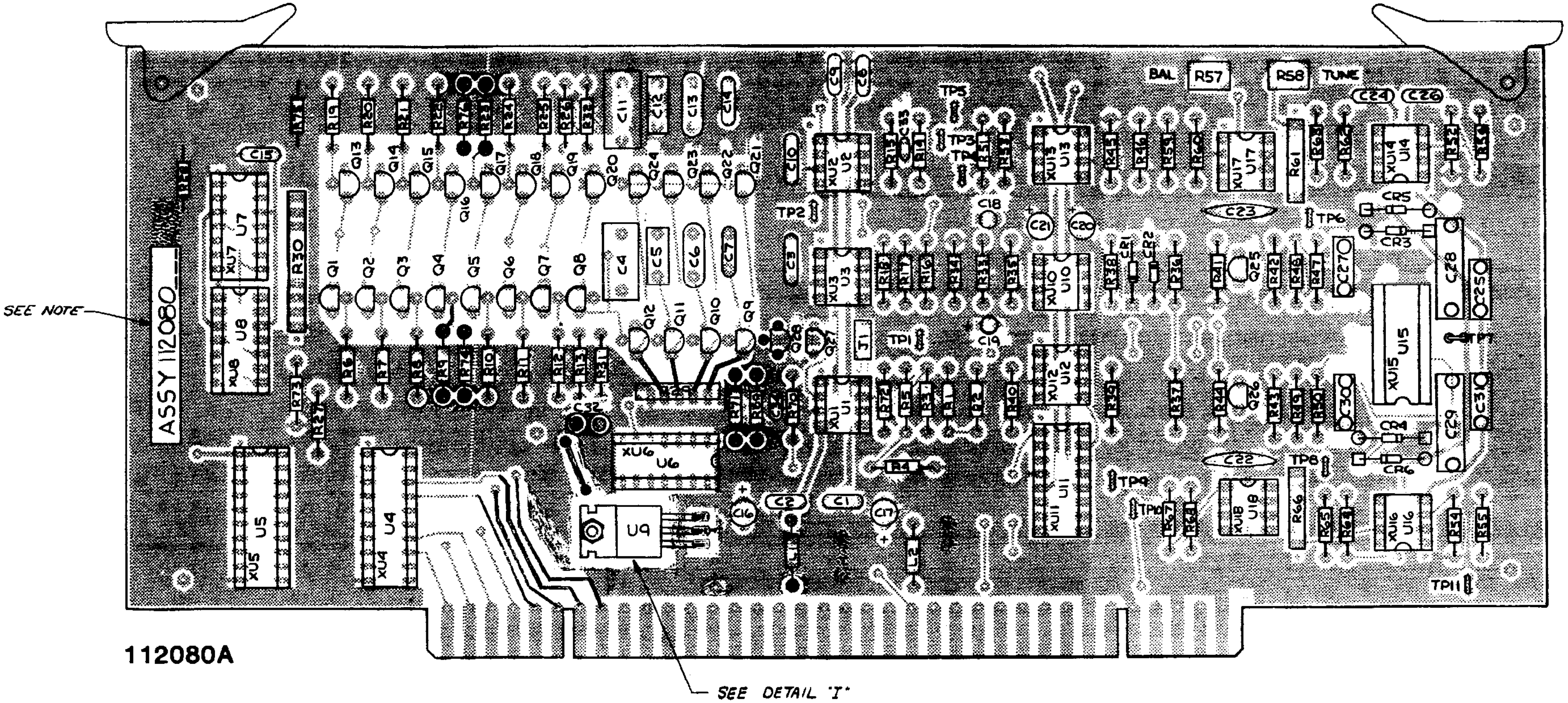


IC VOLTAGE CONNECTIONS				
REF. DESIG.	+5V	+15V	-15V	GND
	PIN NOS.			
U1, U8		7	4	
U2, U7		13	4	5
U3	20			10
U4	16			8
U6		11	10	3, 4

NOTES:

1) CAPACITANCE VALUES IN UF UNLESS OTHERWISE SPECIFIED.
2) RESISTANCE VALUES IN OHMS.
3) LAST NUMBERS USED: C18 R7 TP6 U8
4) NUMBERS NOT USED : TP4 U5
5) * DENOTES FACTORY SELECTED COMPONET.

Figure 7-5. Filter Board A1 Schematic



NOTE:
MARK FINAL ASSY PART NUMBER WITH 1/8" HIGH BLACK CHARACTERS, REFER TO MANUFACTURING ORDER FOR COMPLETE PART NUMBER.

DETAIL 'I'

PART NUMBER	MODEL
11208000A	1120-S/10
11208001A	1120-S/3

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

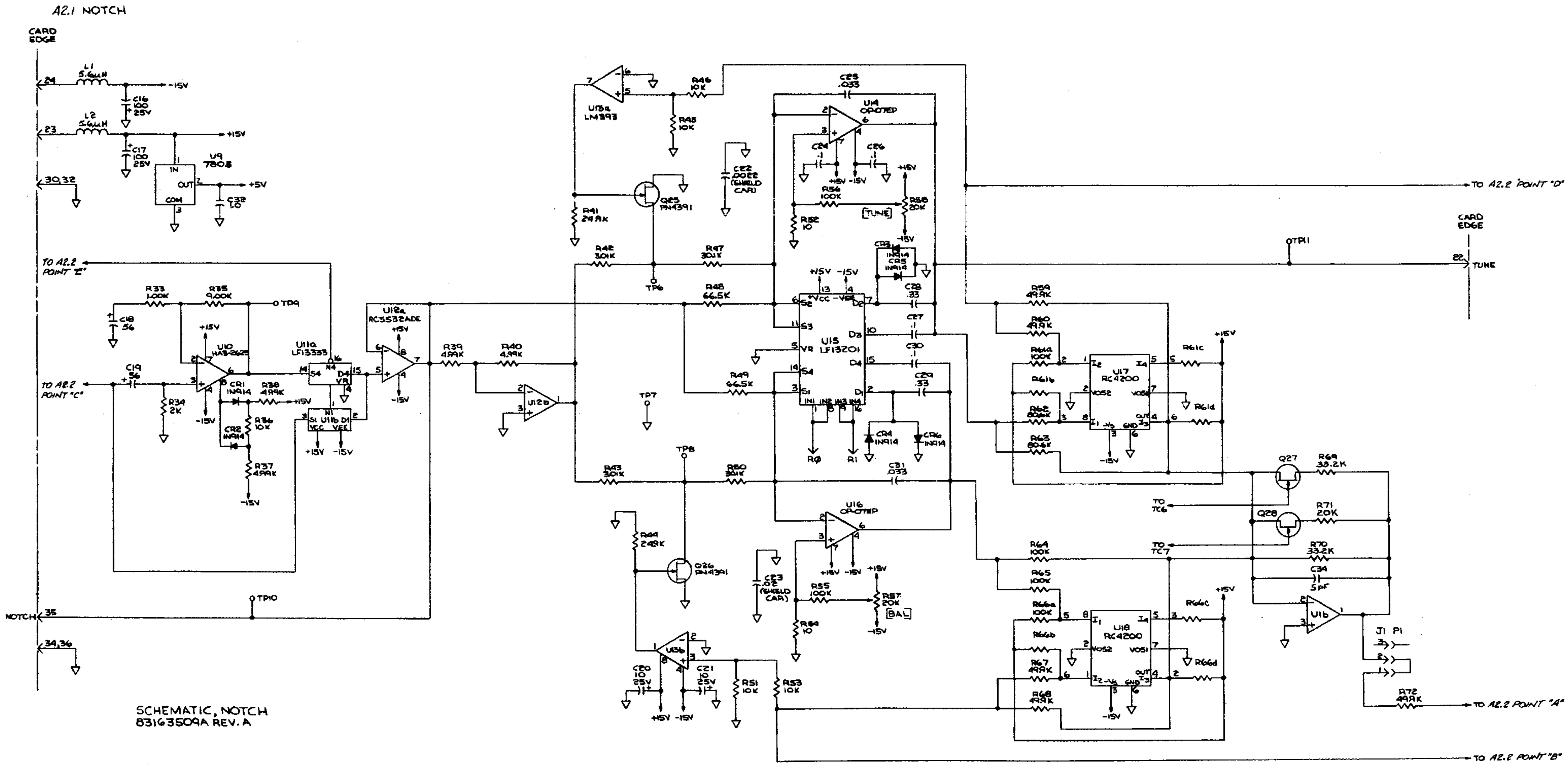
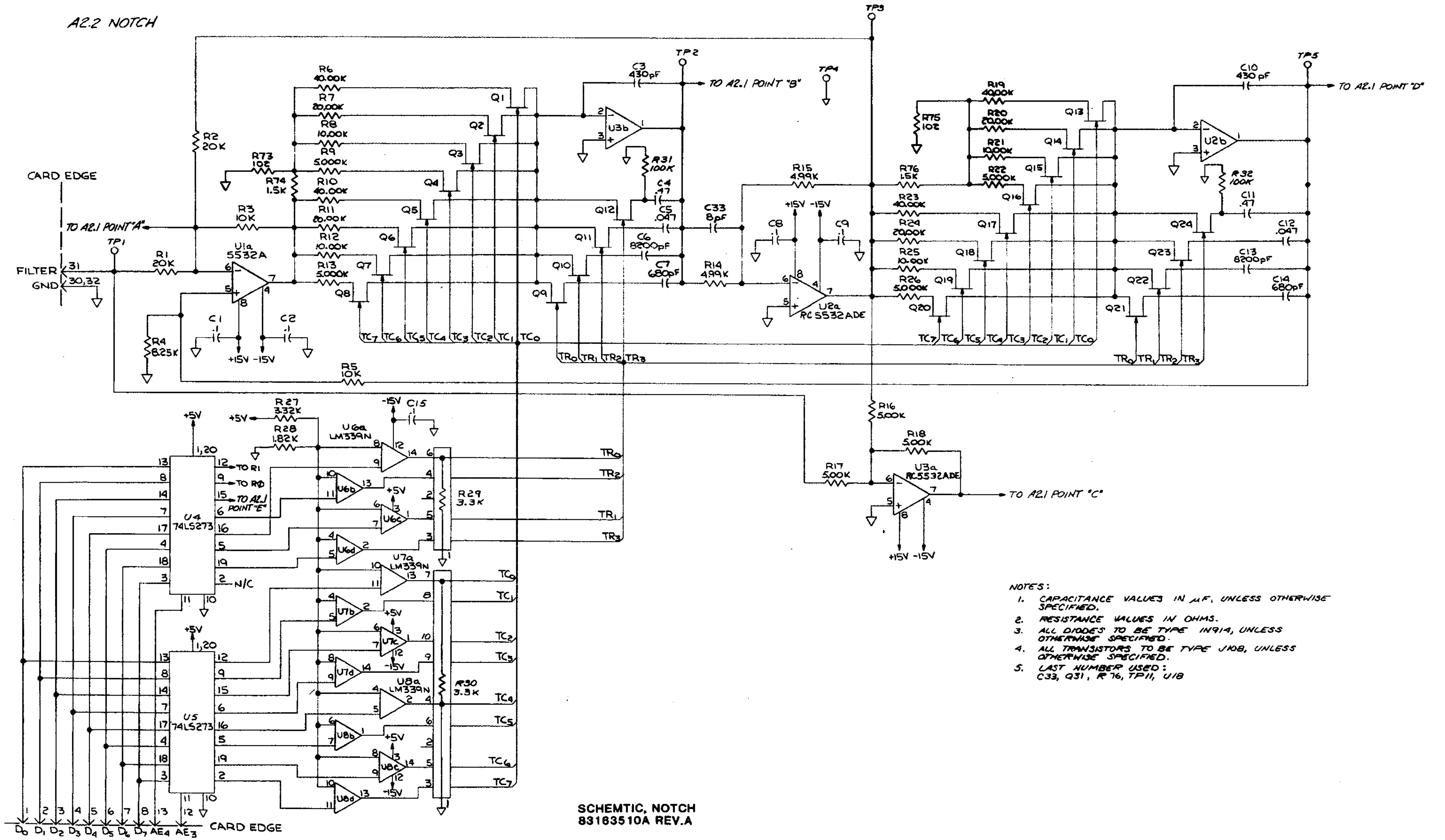


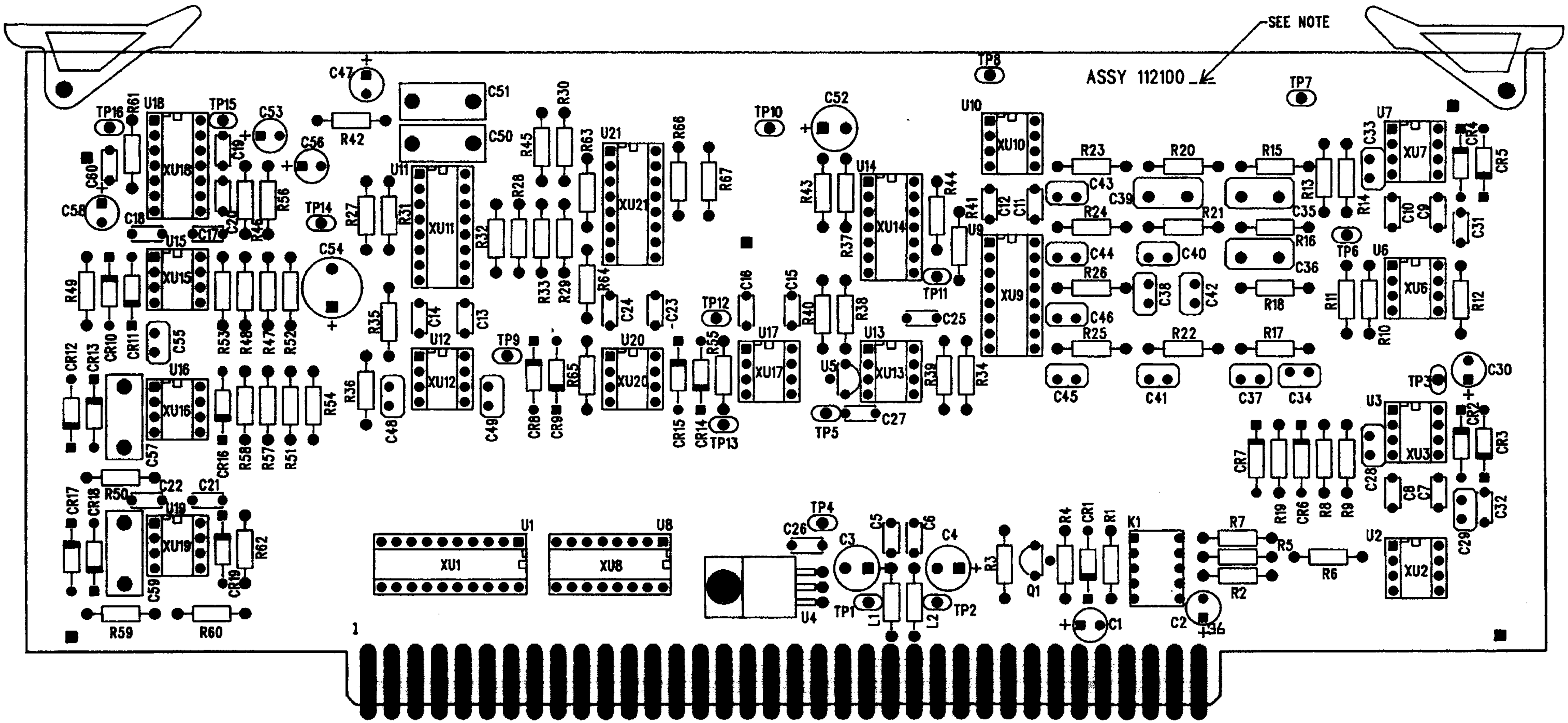
Figure 7-7. Notch Board A2.1Schematic



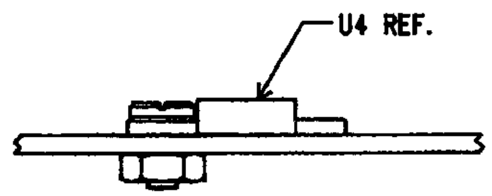
NOTES:

1. CAPACITANCE VALUES IN µF, UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS.
3. ALL DIODES TO BE TYPE IN914, UNLESS OTHERWISE SPECIFIED.
4. ALL TRANSISTORS TO BE TYPE J108, UNLESS OTHERWISE SPECIFIED.
5. LAST NUMBER USED: C33, Q31, R76, TP11, U18

Figure 7-8. Notch Board A2.2 Schematic



112100B

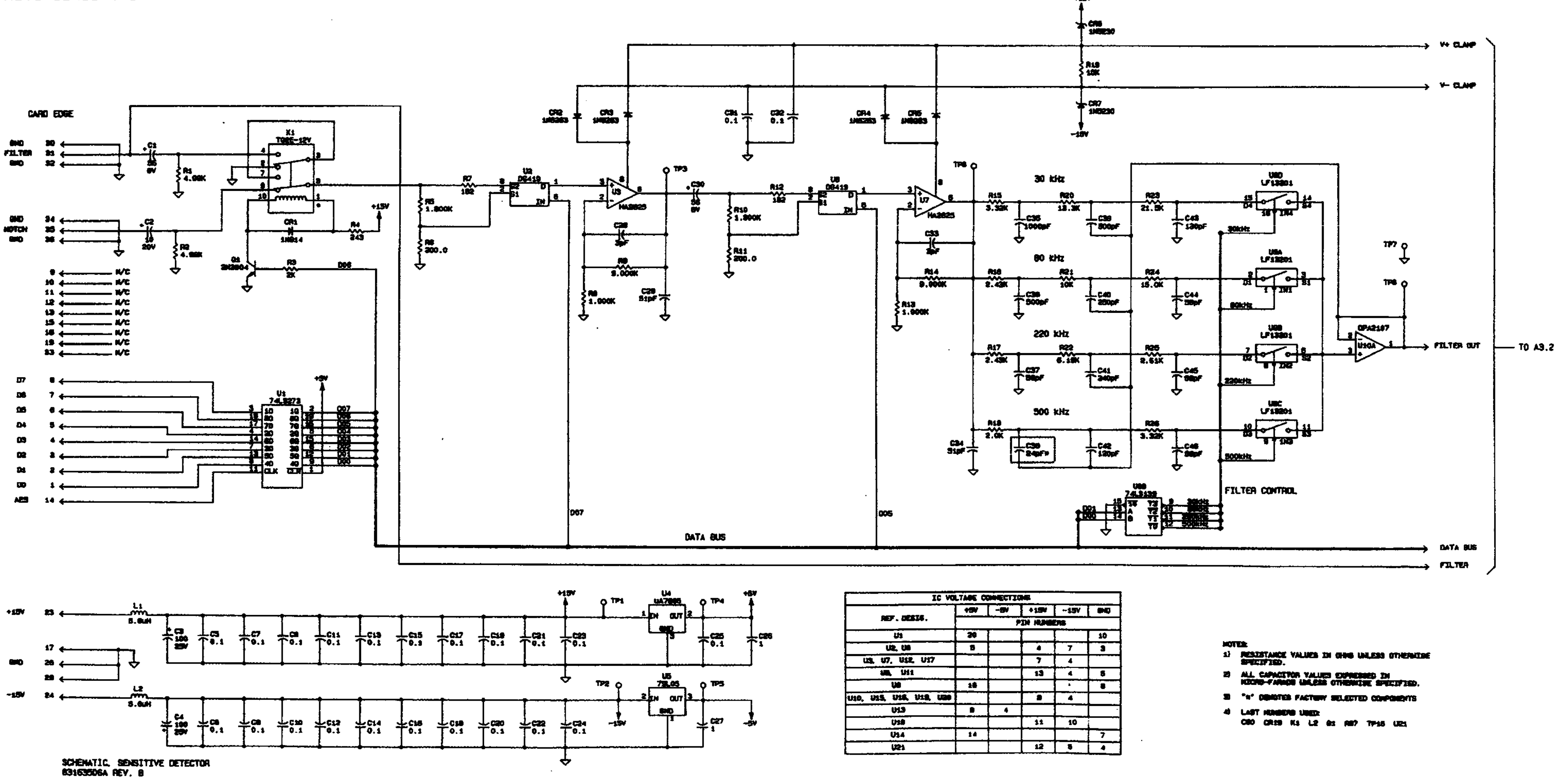


NOTE:

MARK FINAL ASS'Y PART NUMBER WITH 1/8 HIGH BLACK CHARACTERS.
REFER TO MANUFACTURING ORDER FOR COMPLETE PART NUMBER.

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

A3.1 SENSITIVE DETECTOR PWB



IC VOLTAGE CONNECTIONS					
REF. DESIG.	+5V	-5V	+15V	-15V	GND
	PIN NUMBERS				
U1	20				10
U2, U6	5		4	7	3
U3, U7, U12, U17			7	4	
U8, U11			13	4	5
U9	16			.	8
U10, U15, U16, U19, U20			8	4	
U13	8	4			
U18			11	10	
U14	14				7
U21			12	5	4

NOTES:

1) RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
2) ALL CAPACITOR VALUES EXPRESSED IN MICRO-FARADS UNLESS OTHERWISE SPECIFIED.
3) "*" DENOTES FACTORY SELECTED COMPONENTS
4) LAST NUMBERS USED:
C50 CR19 K1 L2 Q1 R27 TP16 U21

Figure 7-10. Detector Board A3.1 Schematic

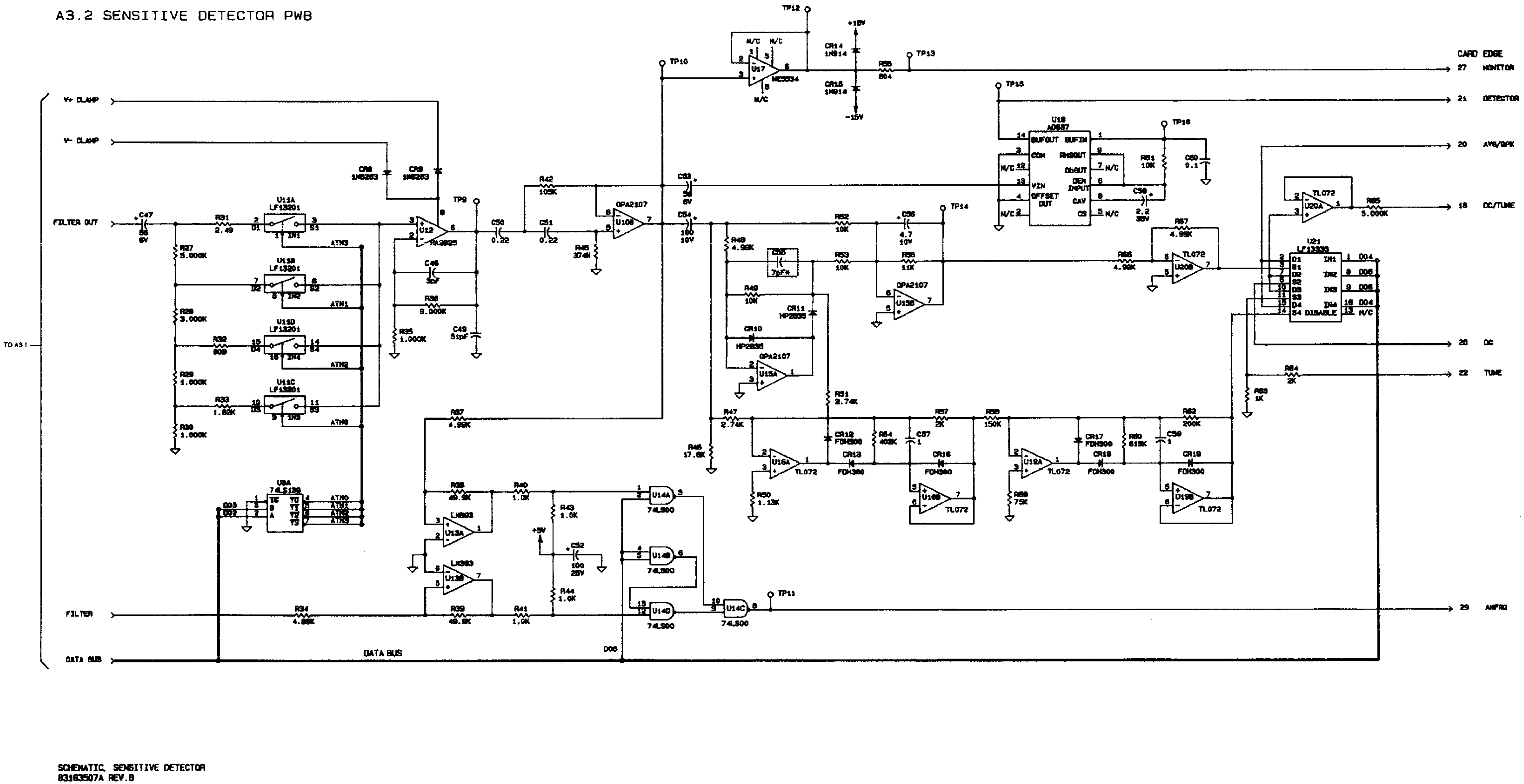
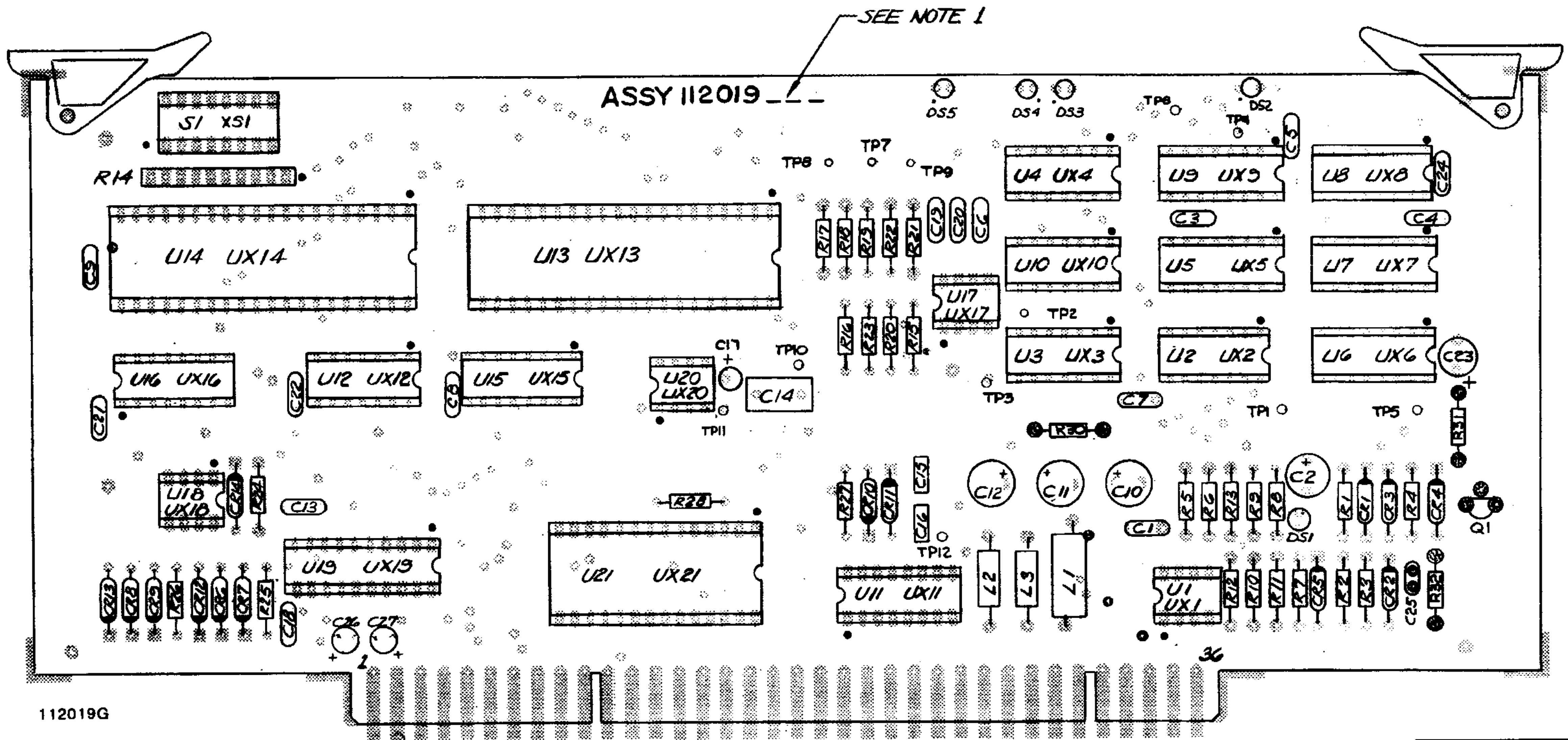


Figure 7-11. Detector Board A3.2 Schematic.



NOTES:

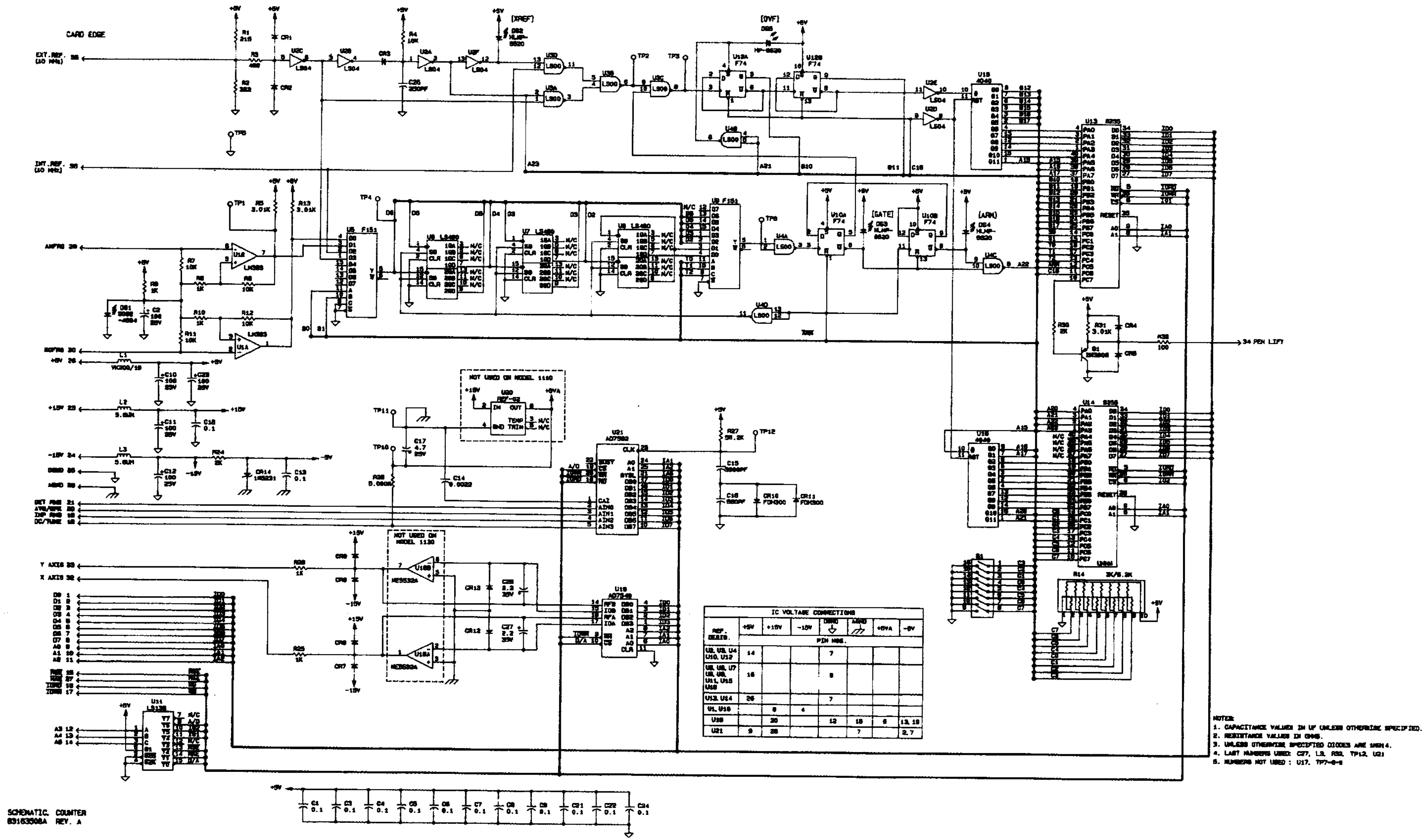
1- MARK FINAL ASSY PART NUMBER WITH 1/8 INCH HIGH BLACK CHARACTERS. REFER TO MANUFACTURING ORDER FOR COMPLETE PART NUMBER.

BEC CODE	REMARKS	ITEMS NOT USED
00A	MODEL 1120	
01A	MODEL 1110	U17, U21, U20
02A	MODEL 1130	U18, U19
03B	MODEL 1110, 1120, 1130 UNTESTED	U17, U18, U19, U20, U21
04A	MODEL 1120-S/1 (HARRIS)	
05A	1120-S/3	R15, R16, R17, R18, R19, R20, R22, R23, C20, TP8, TP9, U17, XU17, C19, R21

(*) FOR COMPLETE PART NUMBER ADD BEC CODE TO DRAWING NUMBER

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

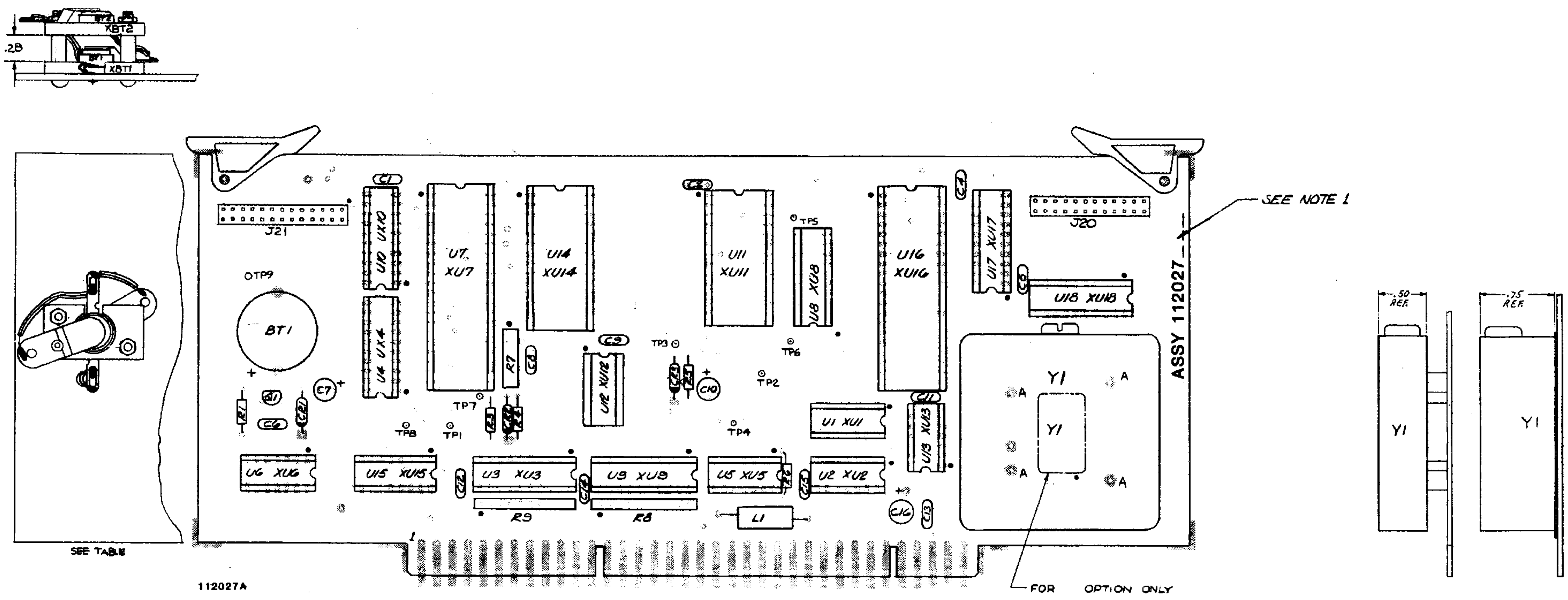
A4 SCHEMATIC, COUNTER



REF. DESIG.	+5V	+15V	-15V	DGND	AGND	+5VA	-5V
	PIN NOS.						
U2, U3, U4 U10, U12	14			7			
U5, U6, U7 U8, U9, U11, U15 U16	16			8			
U13, U14	26			7			
U1, U18		8	4				
U19		20		12	18	6	13, 19
U21	9	28			7		2, 7

NOTES:
1. CAPACITANCE VALUES IN UF UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS.
3. UNLESS OTHERWISE SPECIFIED DIODES ARE 1N914.
4. LAST NUMBERS USED: C27, L3, R32, TP12, U21
5. NUMBERS NOT USED : U17, TP7-8-9

Figure 7-13. Counter Board A4 Schematic.



NOTES:
1- MARK FINAL ASSY PART NUMBER WITH 1/8 INCH HIGH BLACK CHARACTERS. REFER TO MANUFACTURING ORDER FOR COMPLETE PART NUMBER.

PART NUMBER	MODEL	REMARKS	
11202700A	1120	U14 VARIABLE	USE BT1 ONLY
11202701A	1110		
11202702A	1130		
11202703A	1121, 11806/3		
11202704A	1120-6/1		

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

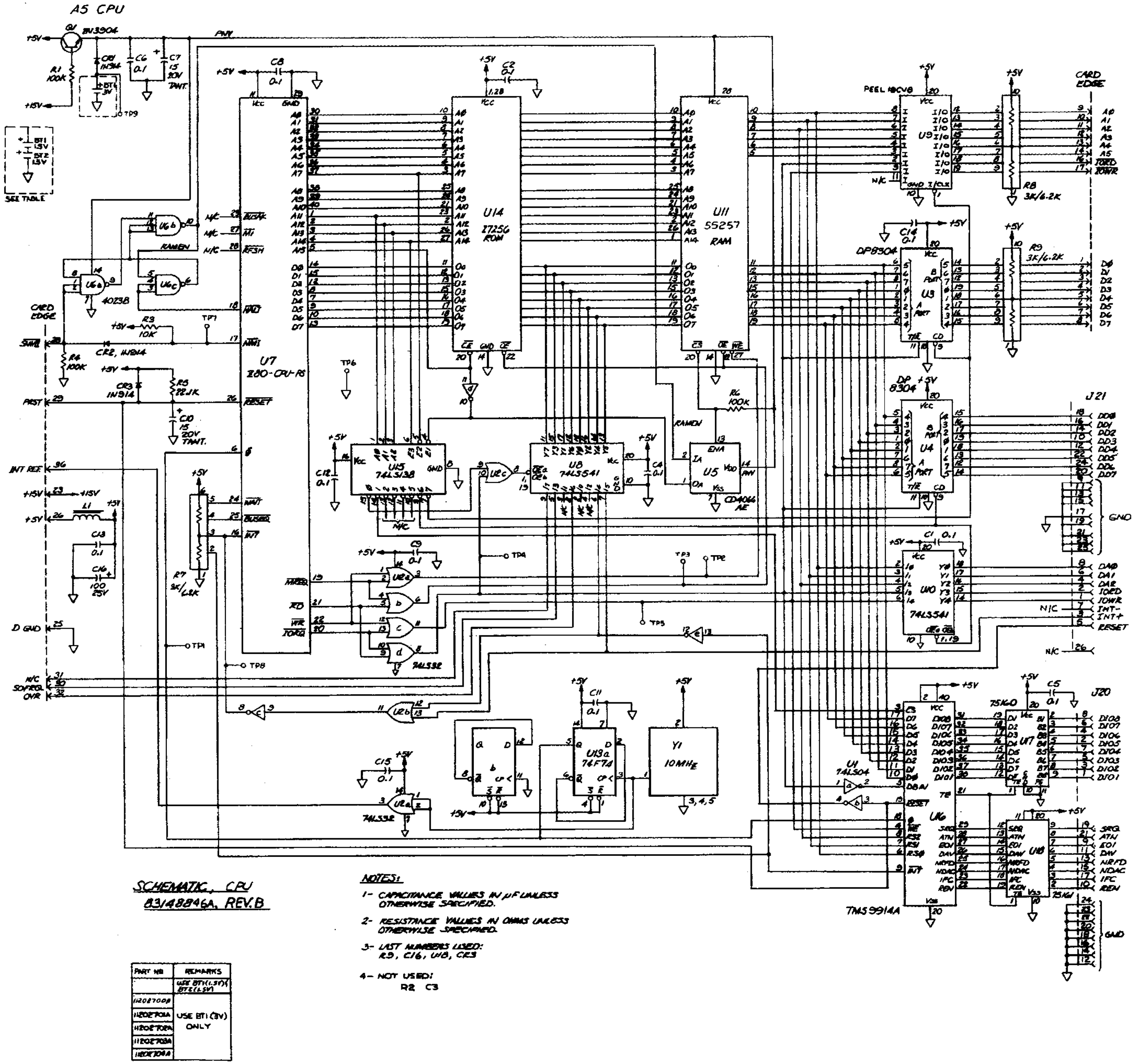
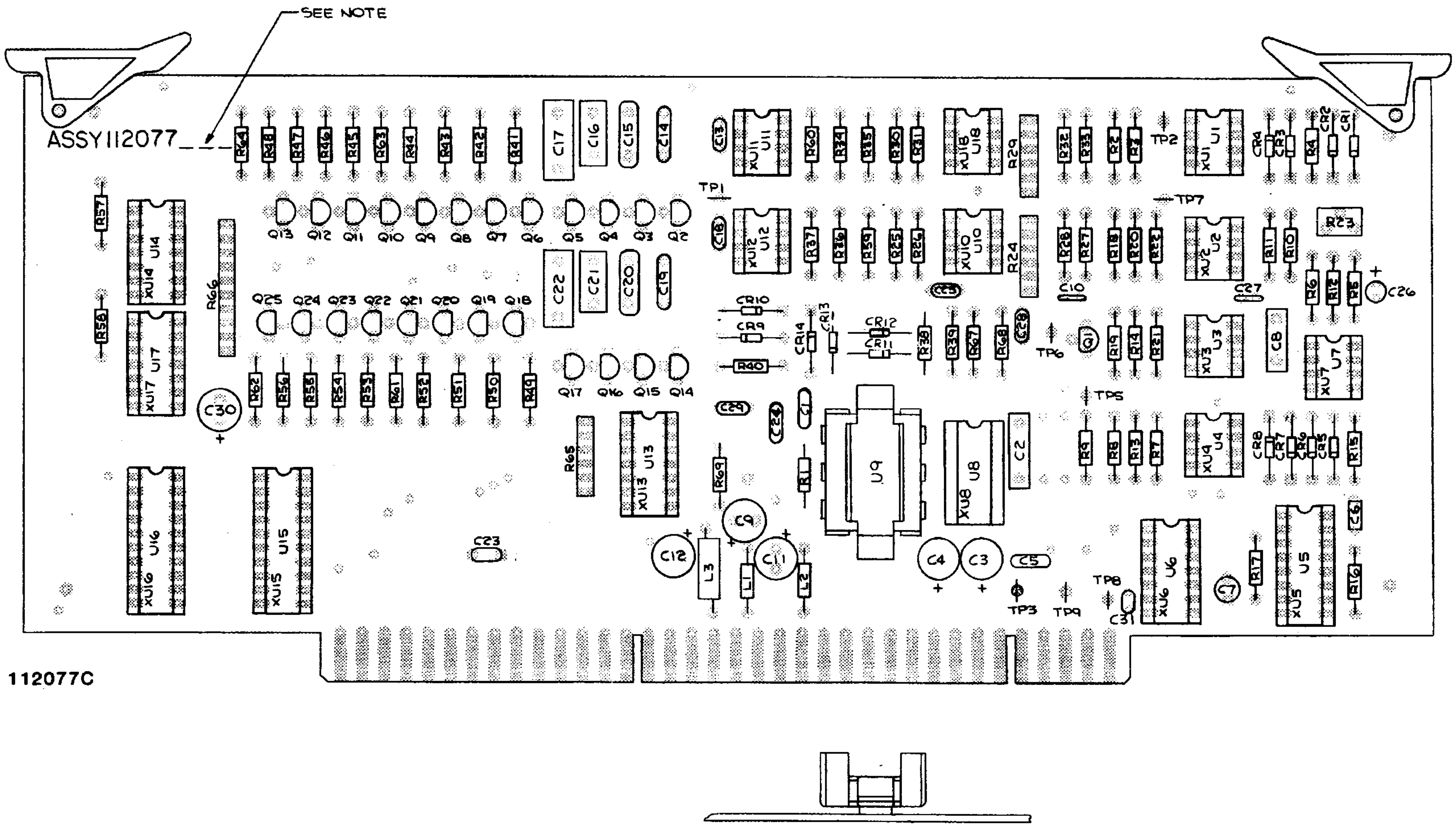


Figure 7-15. C.P.U. Board A5 Schematic.



NOTE:
MARK FINAL ASSY PART NUMBER WITH 1/8 HIGH BLACK CHARACTERS. REFER TO MANUFACTURING ORDER FOR COMPLETE PART NUMBER.

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

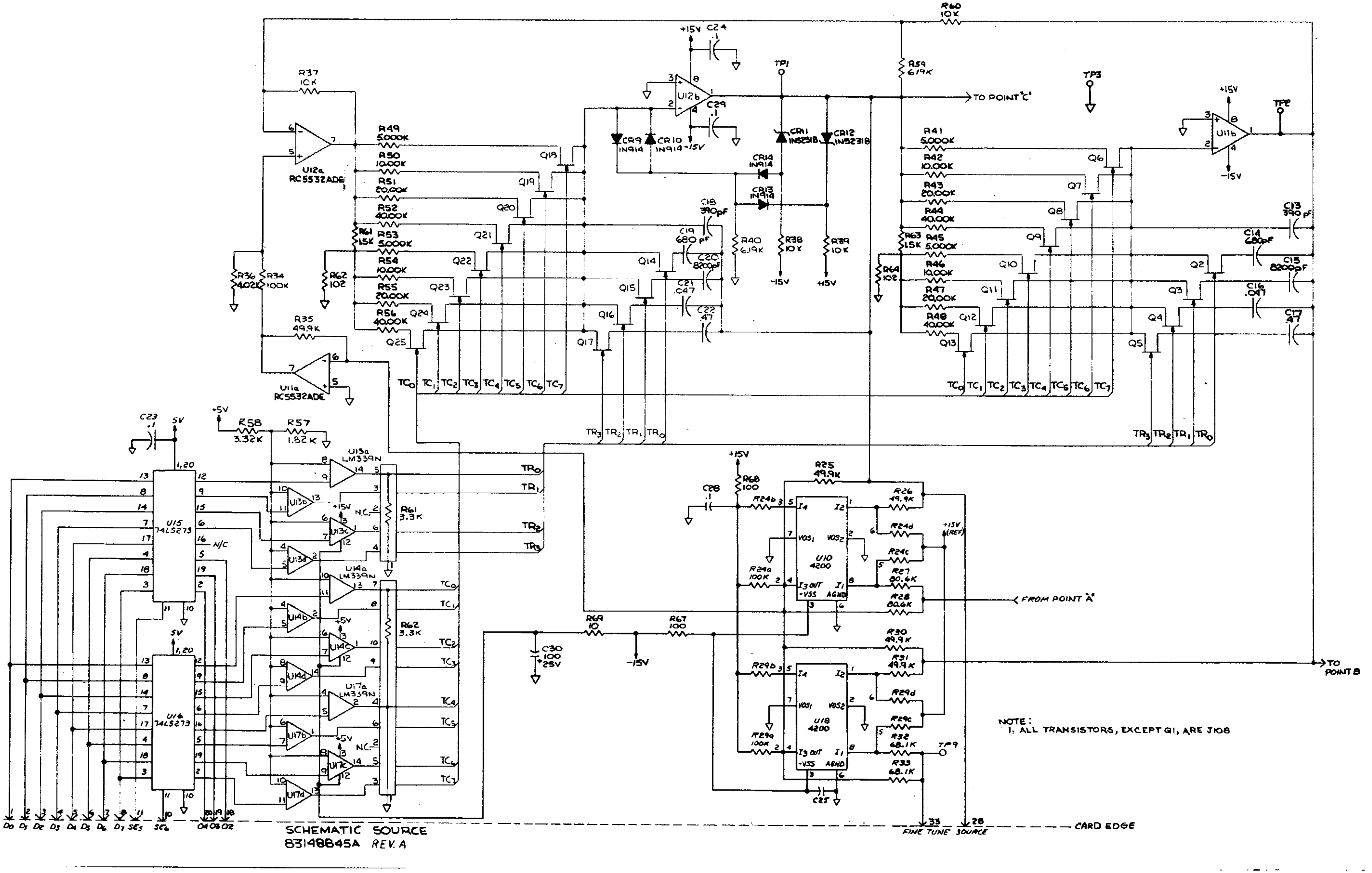


Figure 7-17. Source Board A6.1 Schematic.

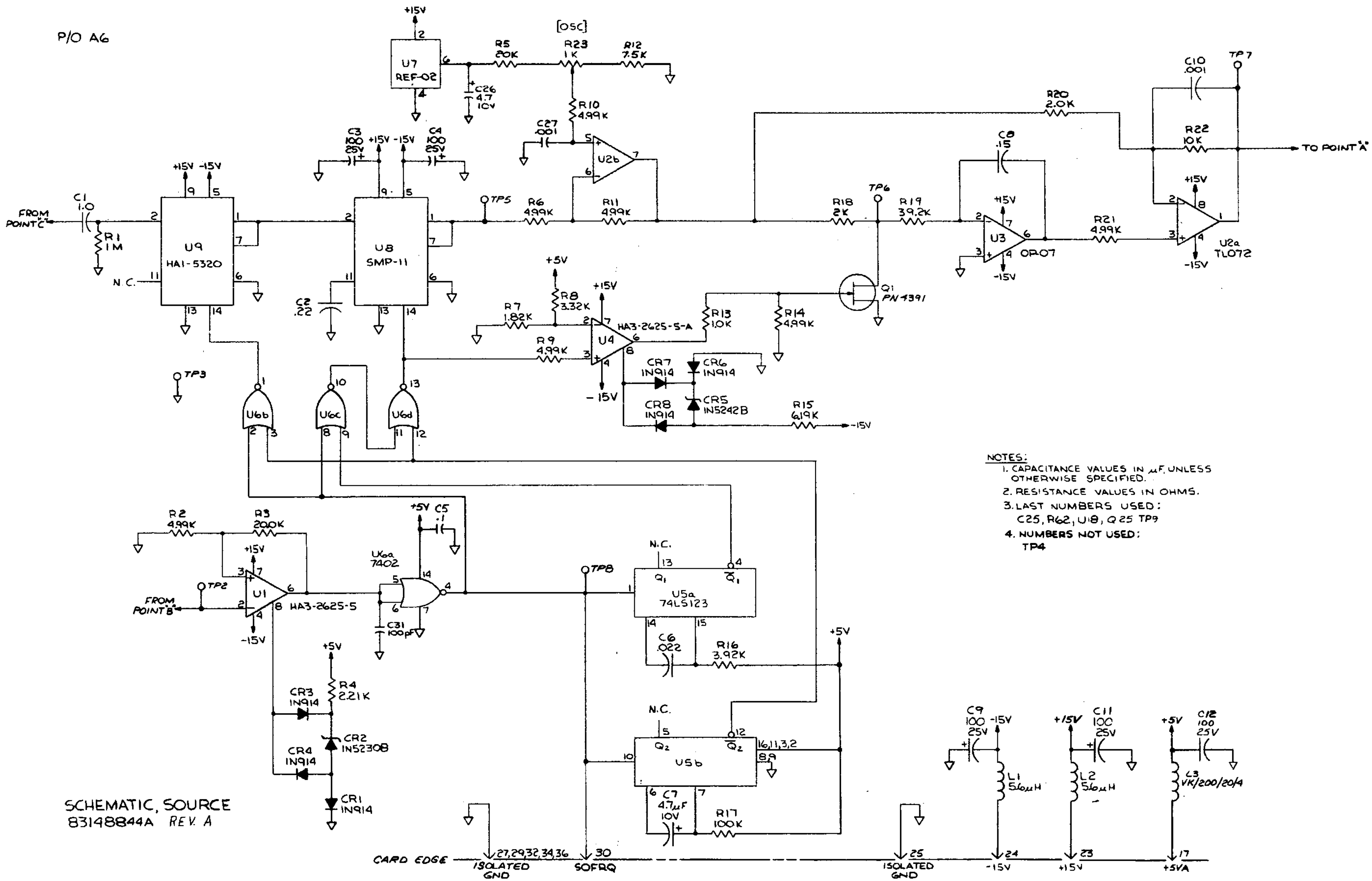
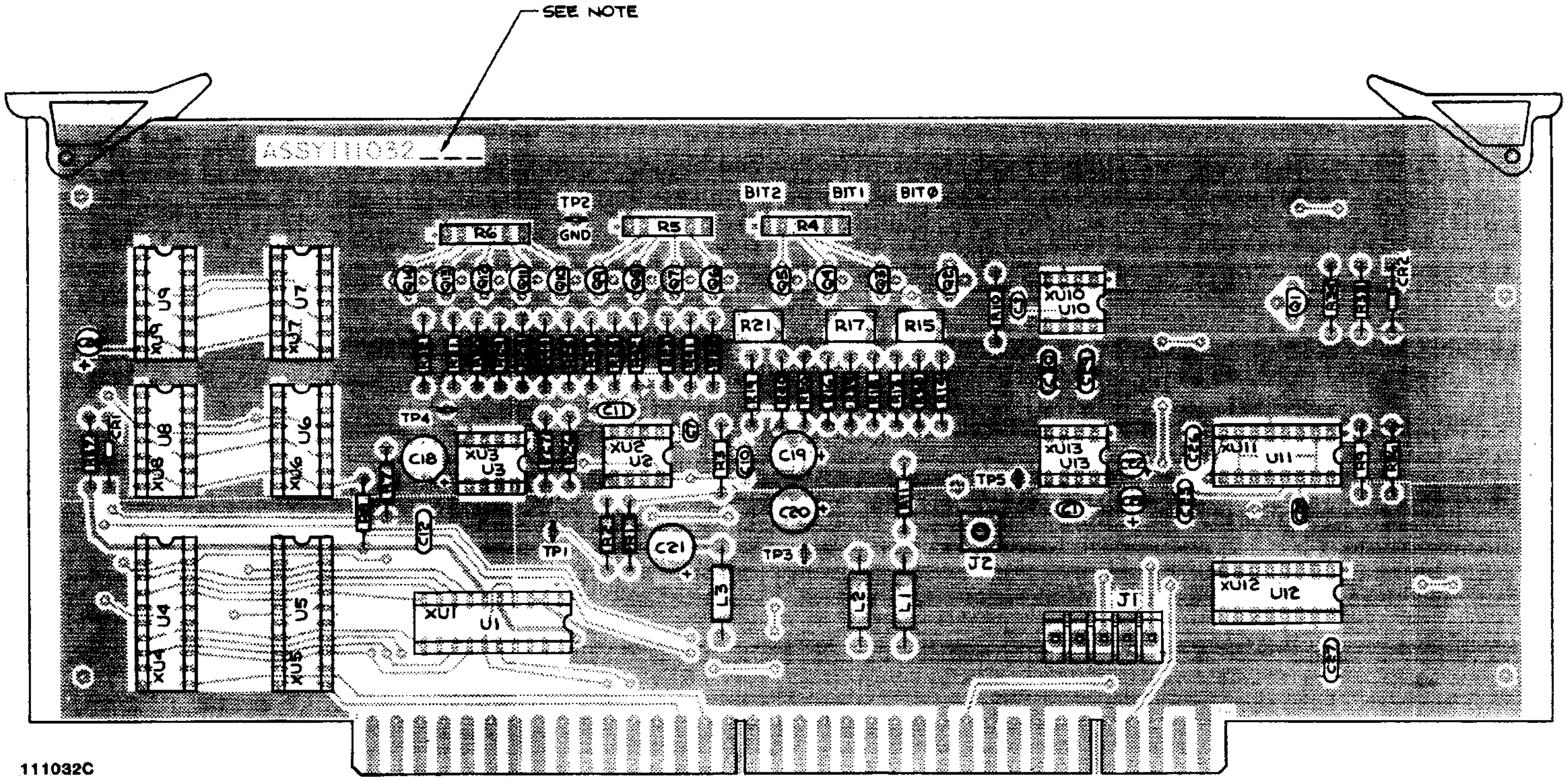


Figure 7-18. Source Board A6.2 Schematic.



111032C

PART NUMBER	MODEL	REMARKS
111032OOA	1110 1120-S/I	U10 & U13 VARIABLE
111032O1A	1120-S/I (HARRIS)	

NOTE:
MARK FINAL ASSY PART NUMBER WITH 1/8" HIGH BLACK CHARACTERS, REFER TO MANUFACTURING ORDER FOR COMPLETE PART NUMBER.

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

A7 OUTPUT

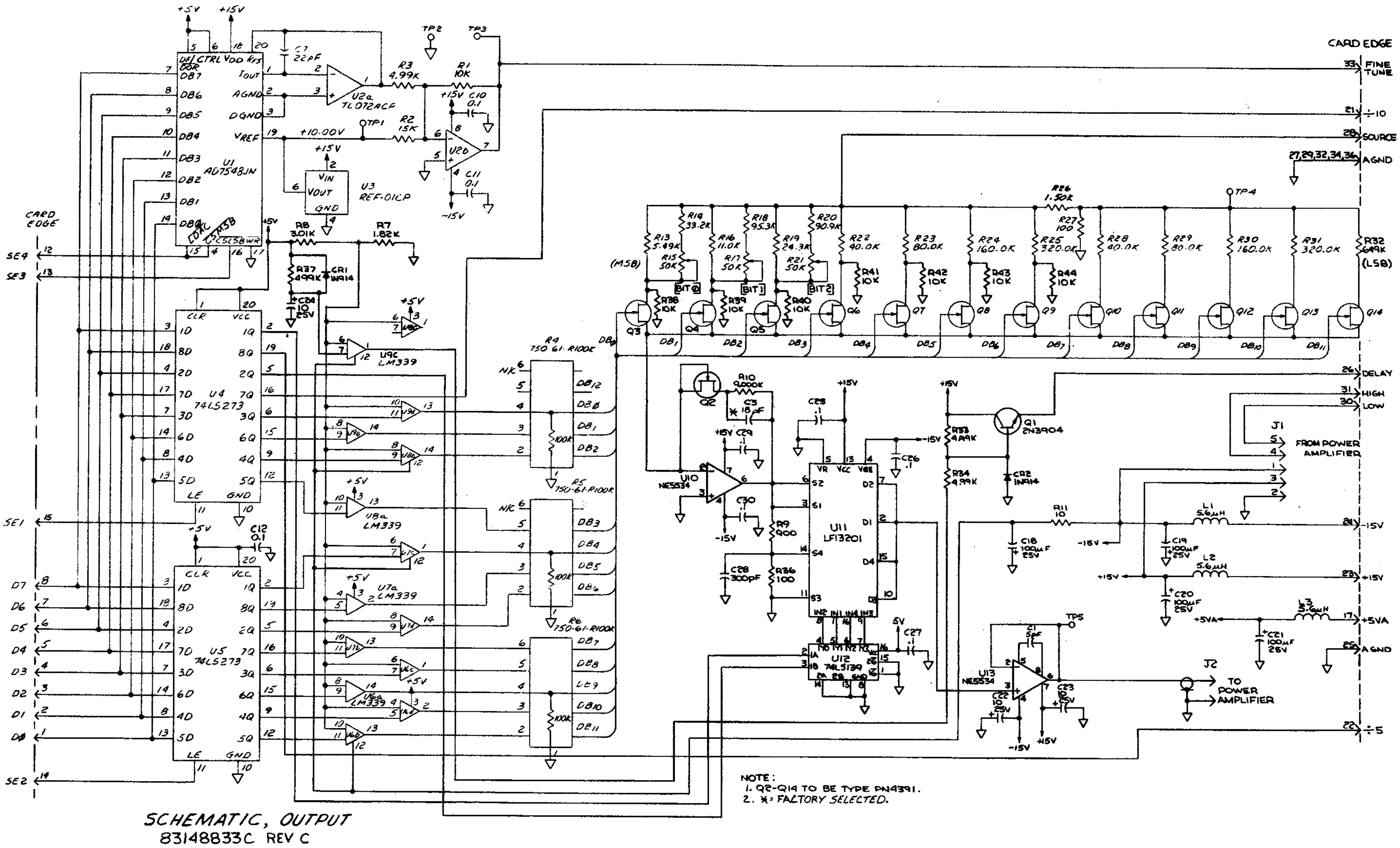
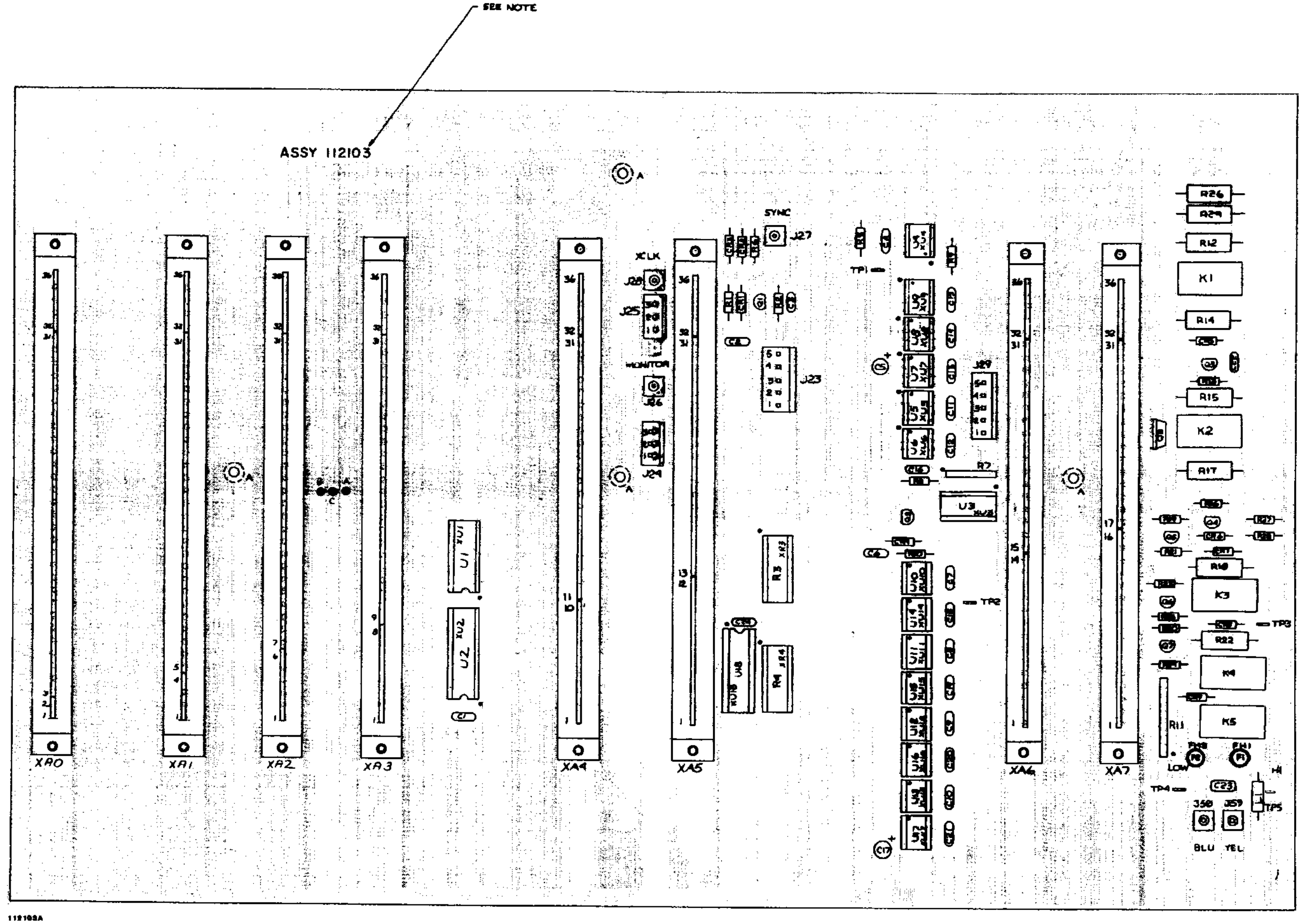
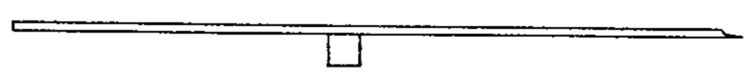


Figure 7-20. Output Board A7 Schematic.



112103A



NOTE:
MARK FINAL ASSY PART NUMBER WITH 1/8" HIGH BLACK CHARACTERS. REFER TO MANUFACTURING ORDER FOR COMPLETE PART NUMBER.

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

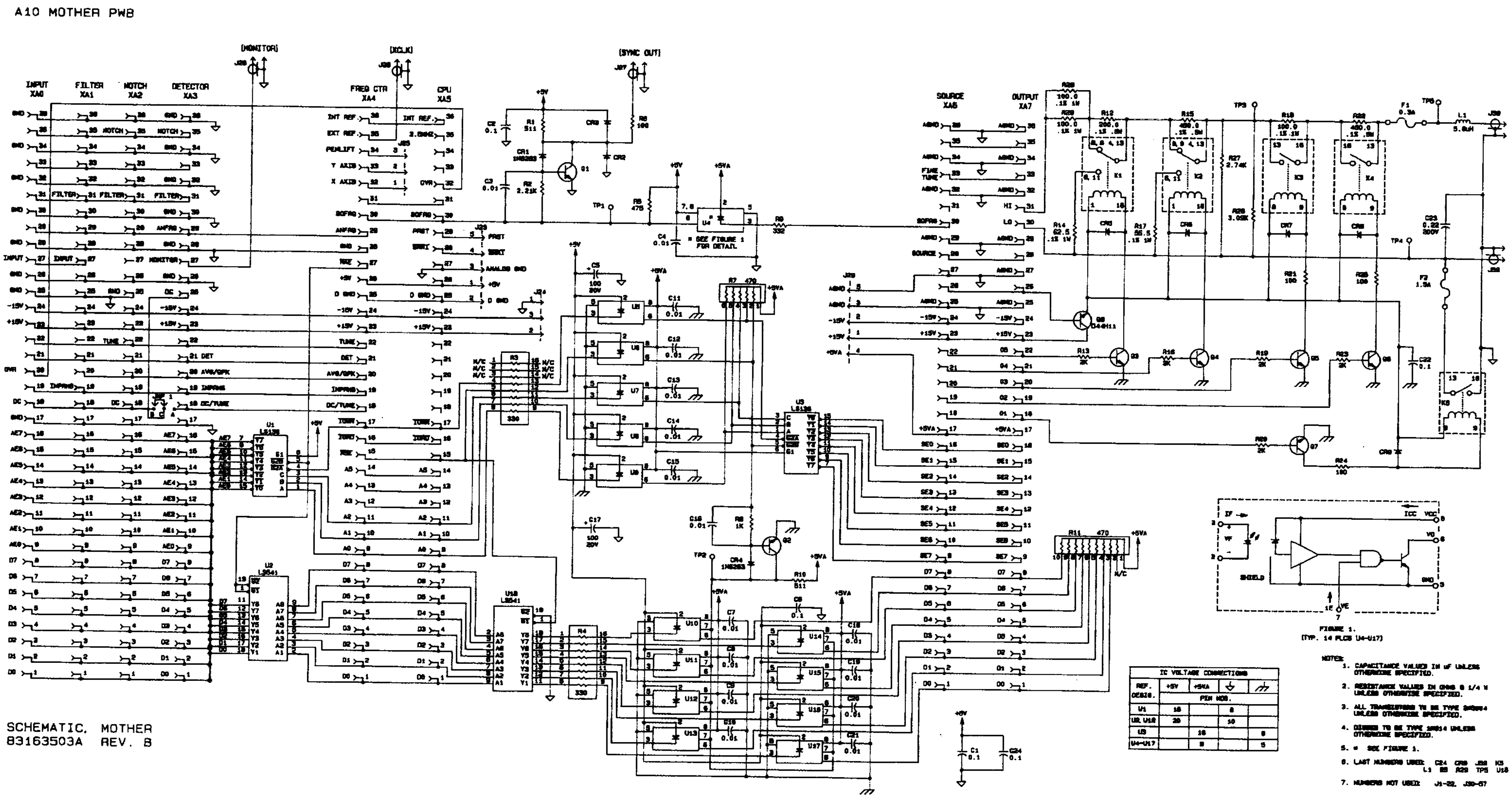
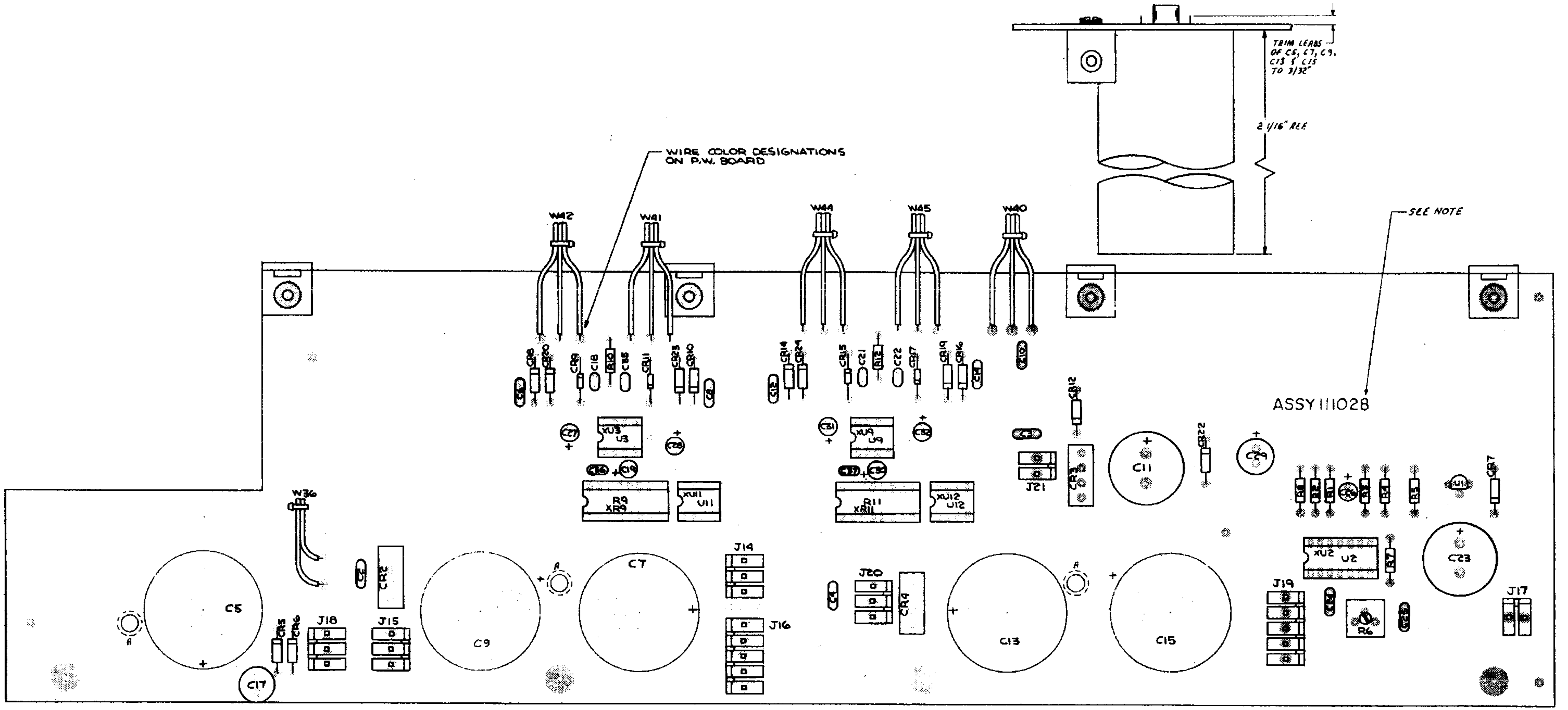


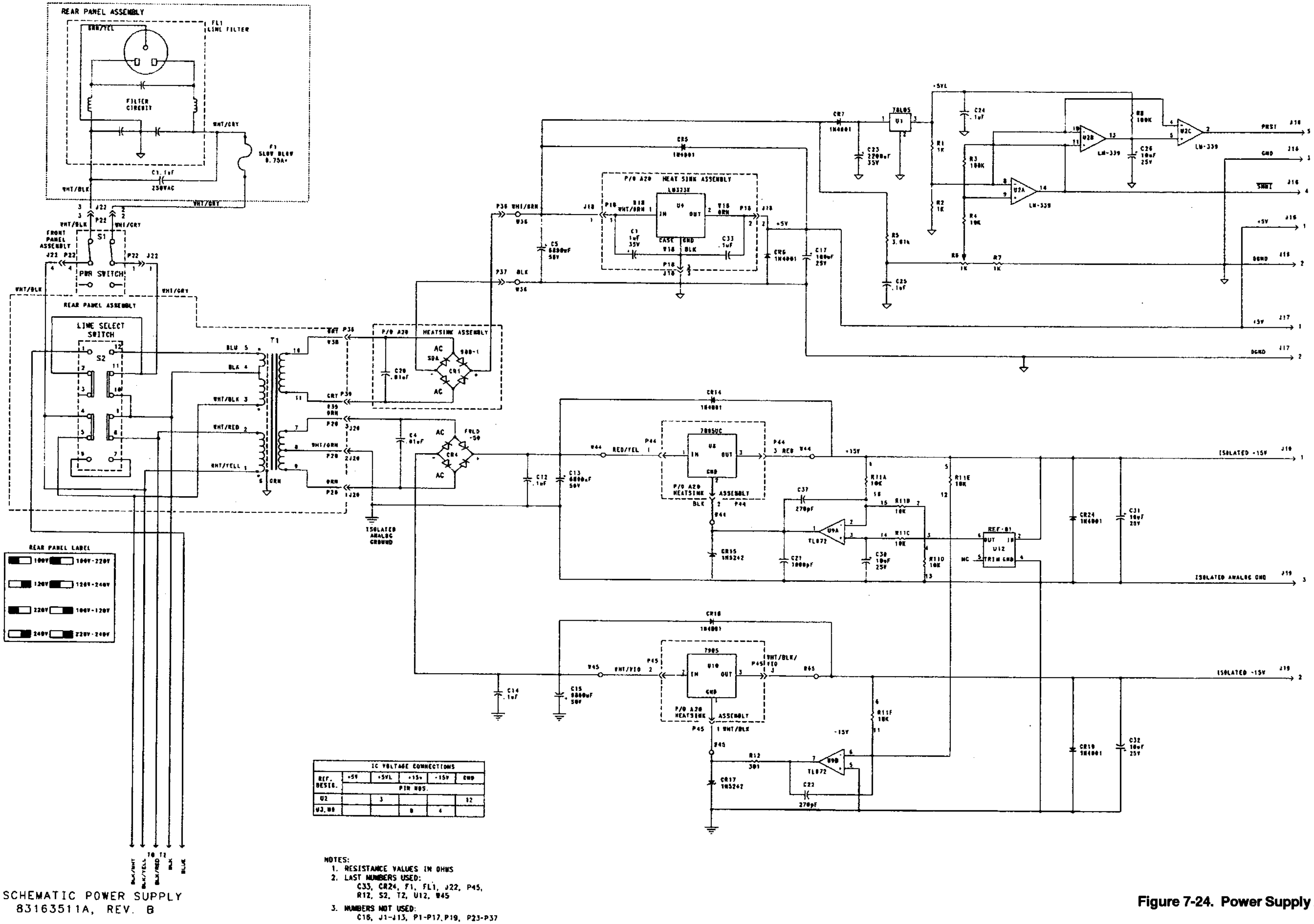
Figure 7-22. Mother Board A10 Schematic.



T110288

NOTE:
MARK FINAL ASSY PART NUMBER WITH 1/8 HIGH BLACK CHARACTERS. REFER TO MANUFACTURING ORDER FOR COMPLETE PART NUMBER.

Figure 7-23. Power Supply A11 Parts Location Diagram.



IC VOLTAGE CONNECTIONS					
REF. DESIG.	+5V	+5VL	+15V	-15V	GND
	PIN NOS.				
U2		3			12
U3,U9			8	4	

NOTES:
1. RESISTANCE VALUES IN OHMS
2. LAST NUMBERS USED:
   C33, CR24, F1, FL1, J22, P45,
   R12, S2, T2, U12, W45
3. NUMBERS NOT USED:
   C16, J1-J13, P1-P17, P19, P23-P37

Figure 7-24. Power Supply A11.1 Schematic.

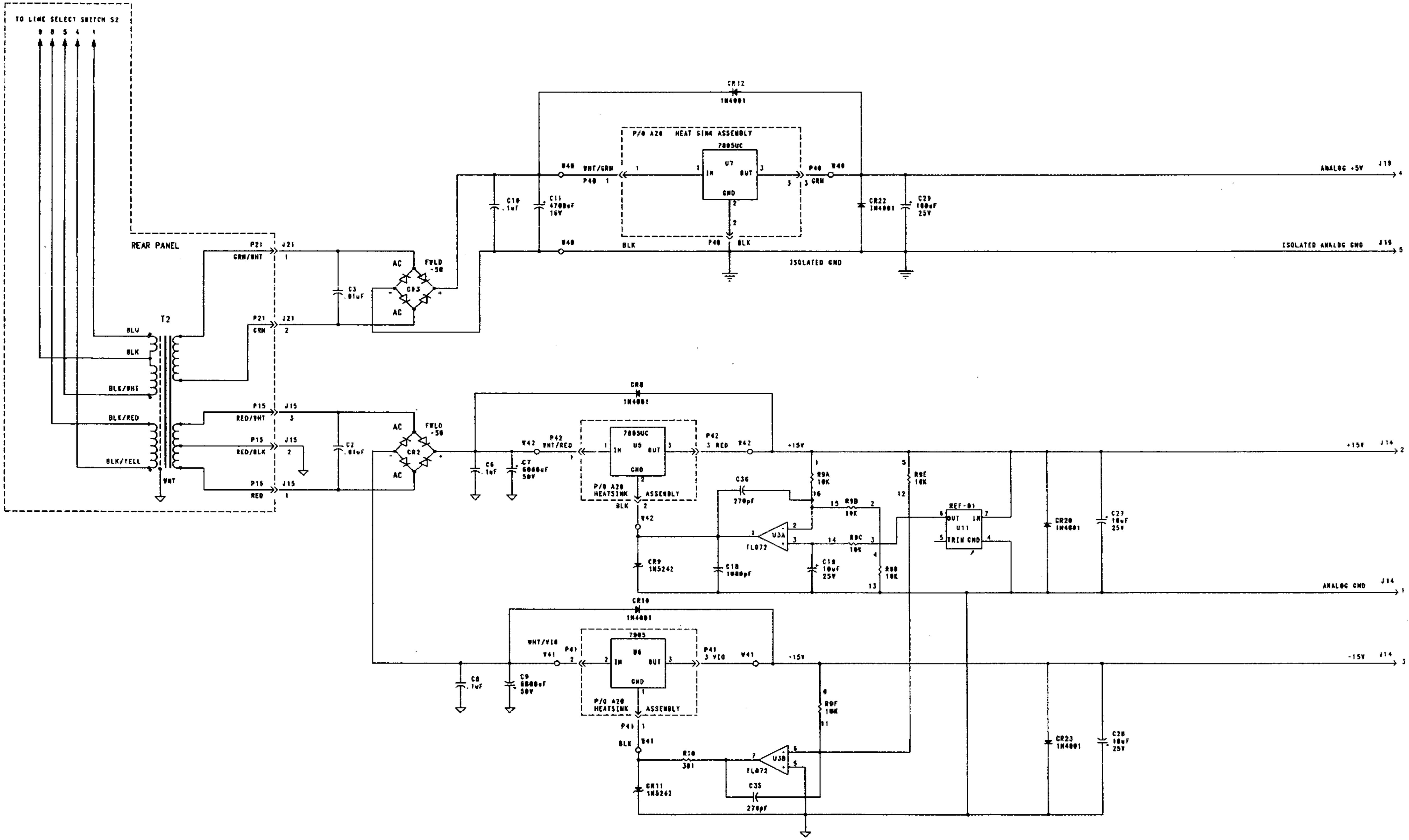
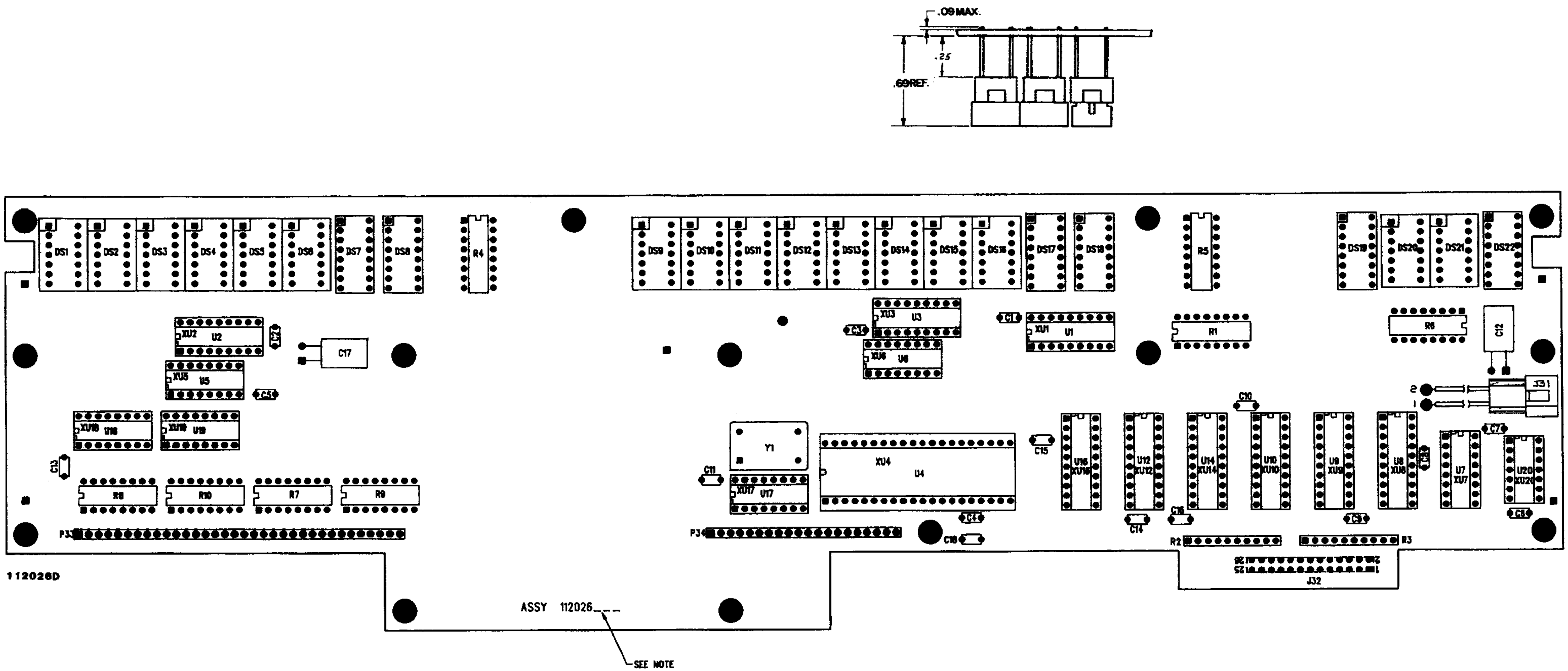


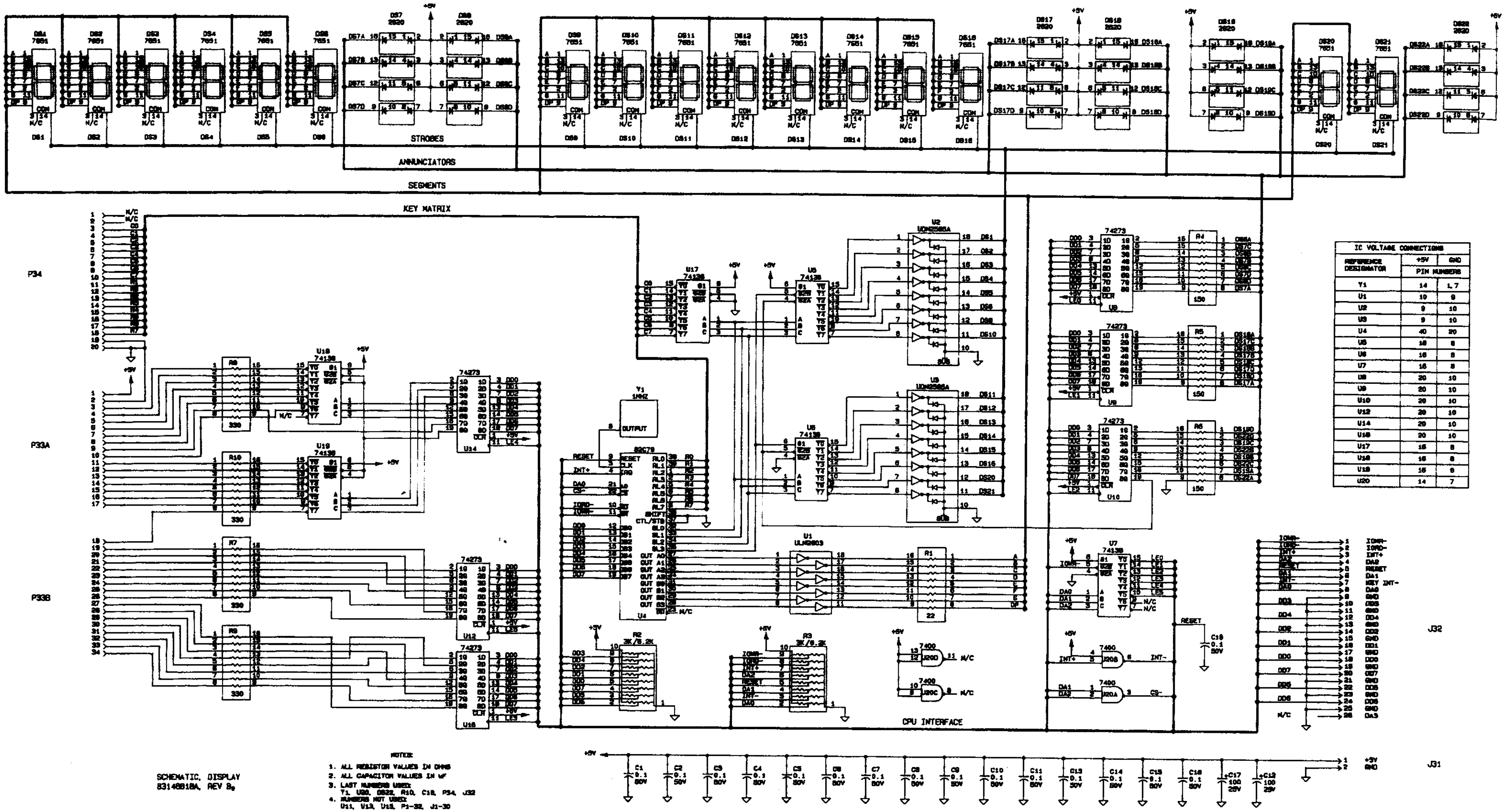
Figure 7-25. Power Supply A11.2 Schematic.



NOTE: MARK FINAL ASSY PART NUMBER WITH 1/8" HIGH BLACK CHARACTERS.
REFER TO MANUFACTURING ORDER FOR COMPLETE PART NUMBER.

SEC CODE	WIRE COLOR		MODEL
	POSITION 1	POSITION 2	
00A	BLK	GRN	1110, 1120, 1130
01A	WHT/ORN	BLK	8220

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

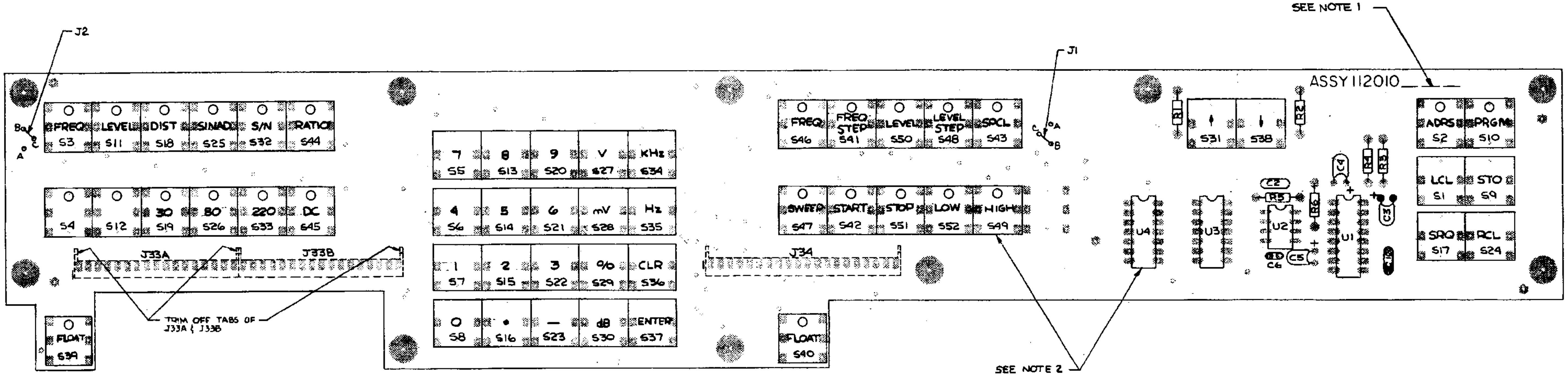


IC VOLTAGE CONNECTIONS		
REFERENCE DESIGNATOR	+5V	GND
	PIN NUMBERS	
Y1	14	1, 7
U1	10	9
U2	9	10
U3	9	10
U4	40	20
U5	16	8
U6	16	8
U7	16	8
U8	20	10
U9	20	10
U10	20	10
U12	20	10
U14	20	10
U16	20	10
U17	16	8
U18	16	8
U19	16	8
U20	14	7

SCHEMATIC, DISPLAY
83148818A, REV B

NOTES:
1. ALL RESISTOR VALUES IN OHMS
2. ALL CAPACITOR VALUES IN uF
3. LAST NUMBERS USED:
   Y1, U20, DS22, R10, C18, P34, J32
4. NUMBERS NOT USED:
   U11, U13, U15, P1-32, J1-30

Figure 7-27. Display Board A12 Schematic Sheet 1.



112010E₂ SHT1

BUTTONS (MODELS 1120 & 1120-51)							
ITEM NO.	LEGEND	ITEM NO.	LEGEND	ITEM NO.	LEGEND	ITEM NO.	LEGEND
2	ADRS	15	80	28	4	41	SRQ
3	PRGM	16	220	29	5	42	STO
4	FREQ	17		30	6	43	ENTER
5	LEVEL	18	FREQ/STEP	31	7	44	dB
6	DIST	19	LEVEL/STEP	32	8	45	CLR
7	SINAD	20	START	33	9	46	%
8	S/N	21	STOP	34	0	47	Hz
9	RATIO	22	LOW	35	—	48	mV
10		23	HIGH	36	•	49	kHz
11	DC	24	SPCL	37	↑	50	V
12	FLOAT	25	1	38	↓		
13	SWEEP	26	2	39	LCL		
14	30	27	3	40	RCL		

NOTE:
1. MARK "FINAL" ASSY PART NUMBER WITH 1/8" HIGH BLACK CHARACTERS. REFER TO MANUFACTURING ORDER FOR COMPLETE PART NUMBER.
2. TO AVOID A POSSIBLE INTERFERENCE BETWEEN KEYBOARD AND DISPLAY BOARD, THE LEADS OF COMPONENTS S49 AND U4 MUST BE TRIMMED TO 1/32 LONG MAX.

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

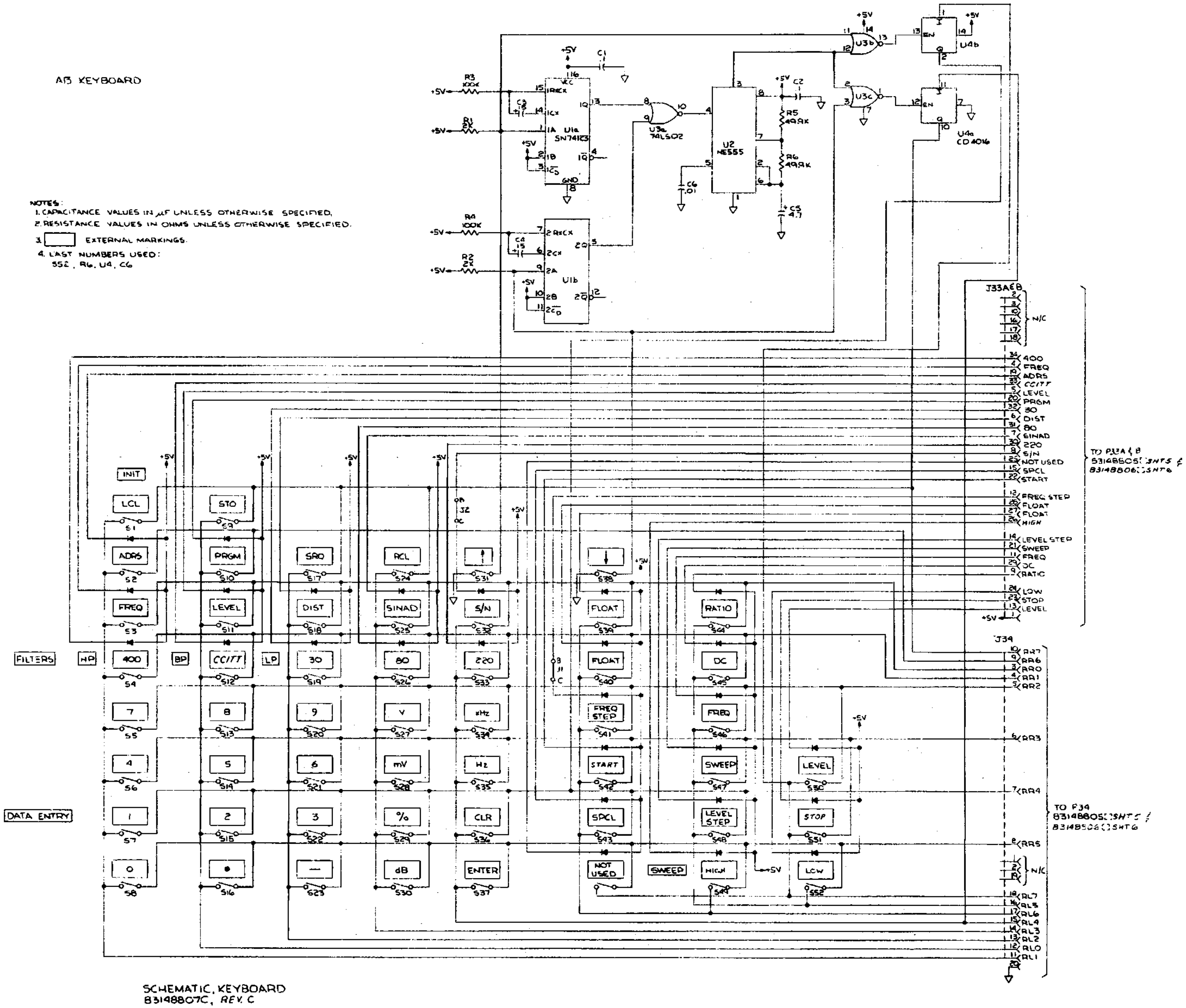


Figure 7-29. Key Board A13 Schematic.

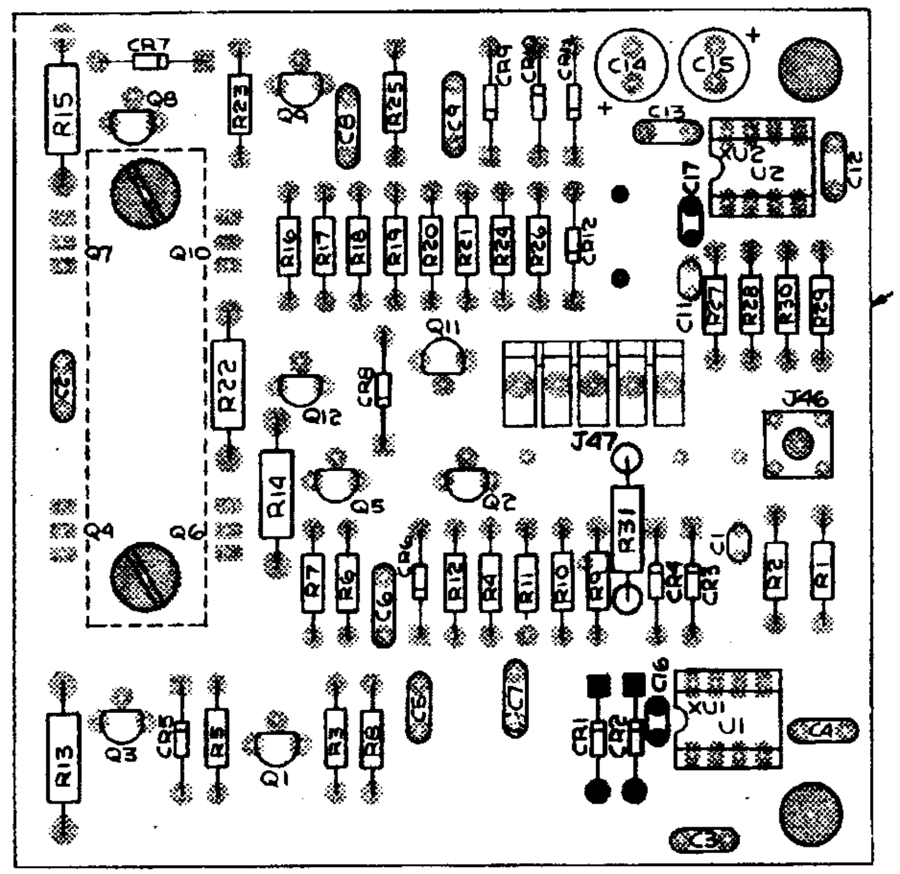
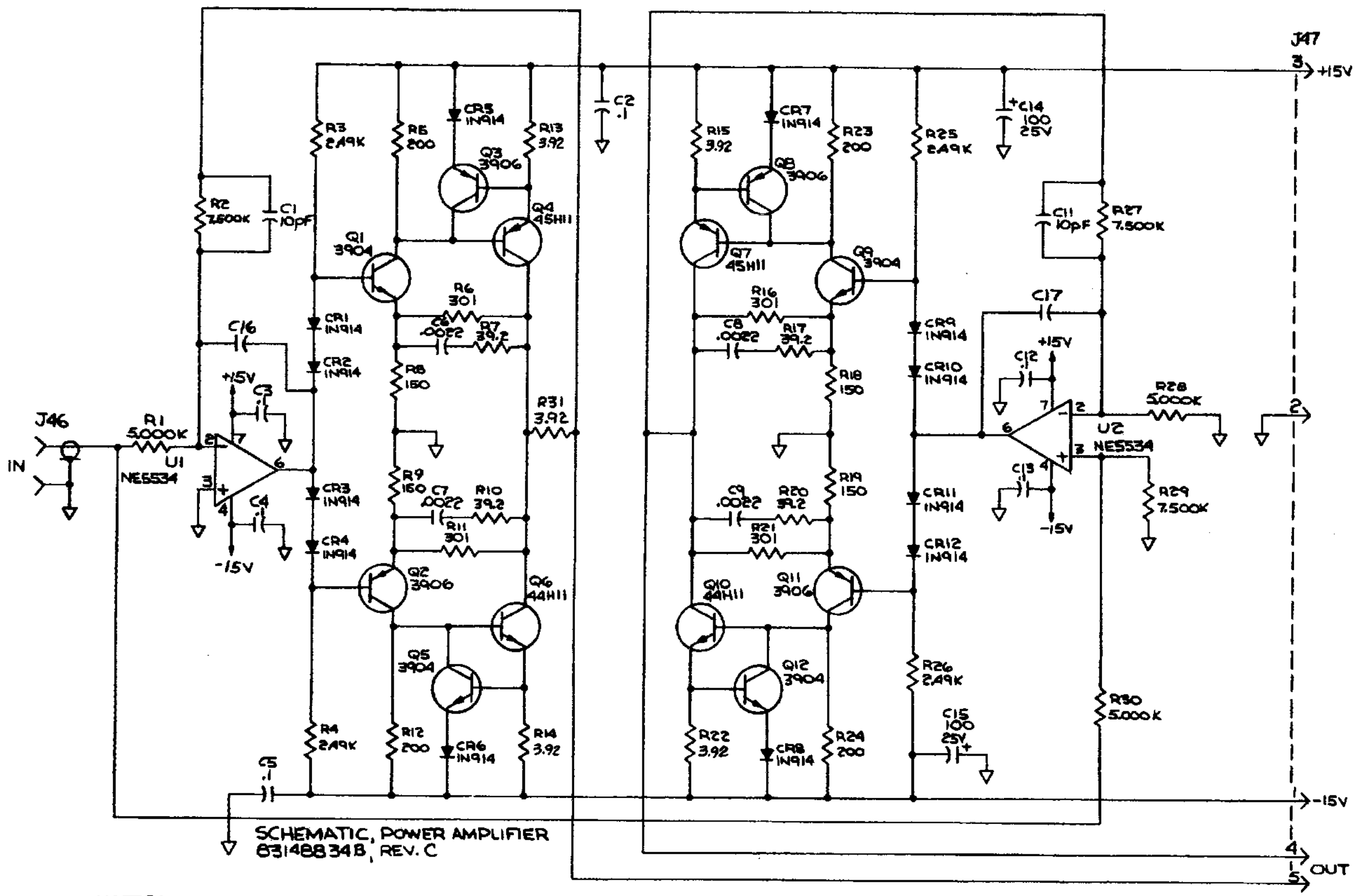


Figure 7-30. Amplifier Board A24 Parts Location Diagram.



NOTES:
1. CAPACITANCE VALUES IN µF UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
3. LAST NUMBERS USED:
C17 R31 Q12 CR12
4. C16 & C17 ARE SELECTED AT TEST.

Figure 7-31. Amplifier Board A24 Schematic.

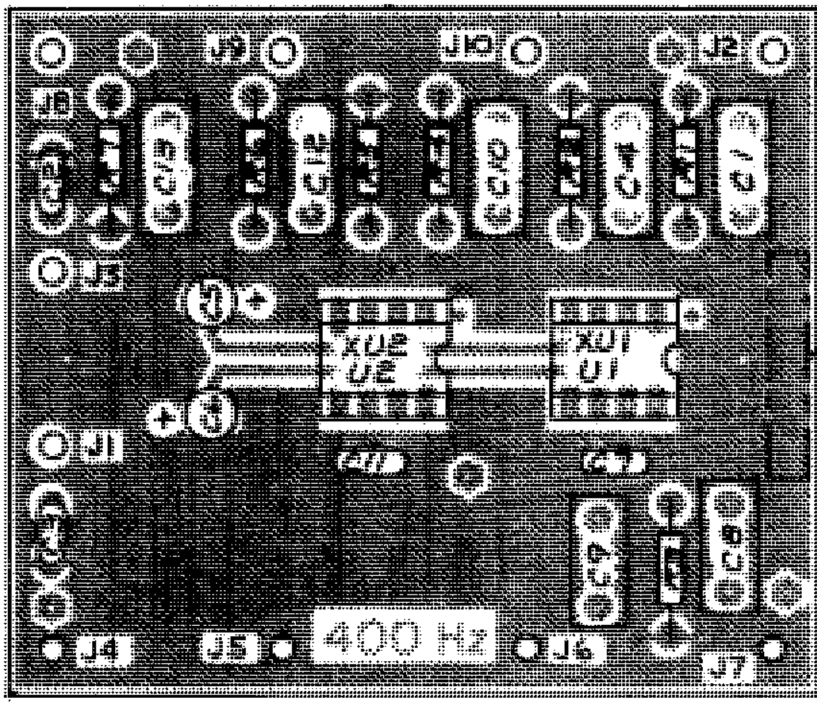


Figure 7-32. 400 Hz Board A1A30 Parts Location Diagram.

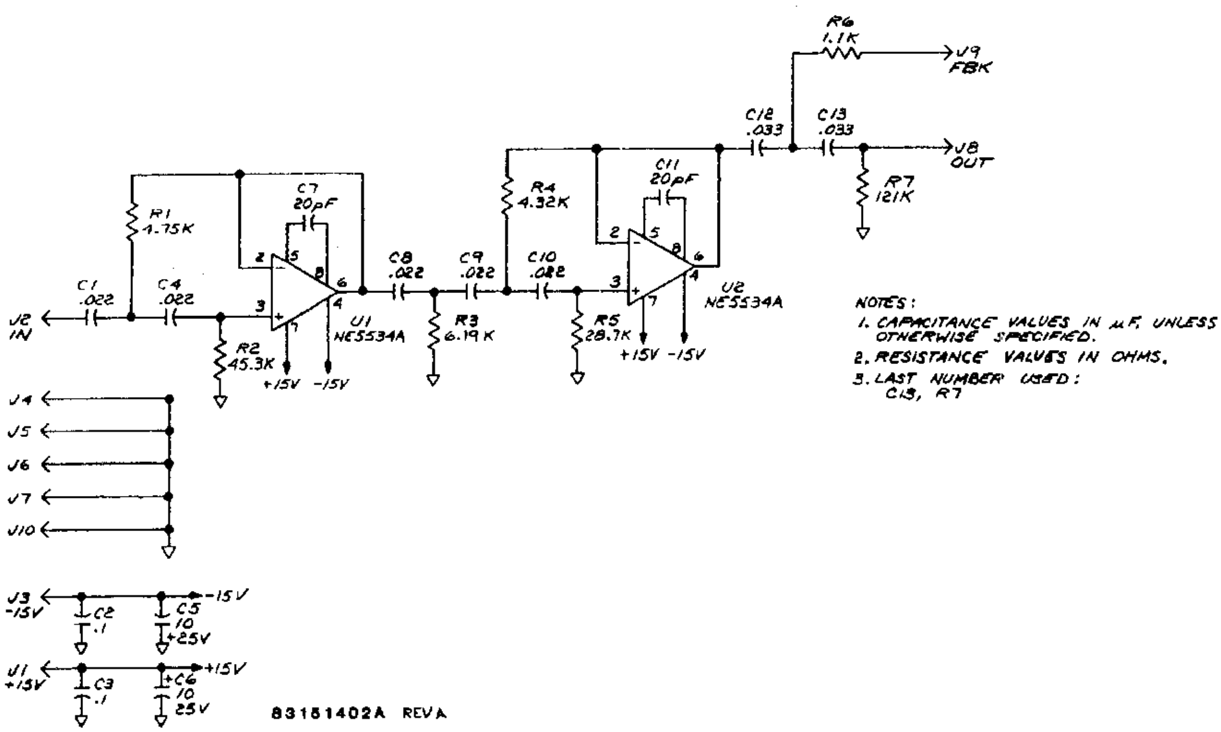
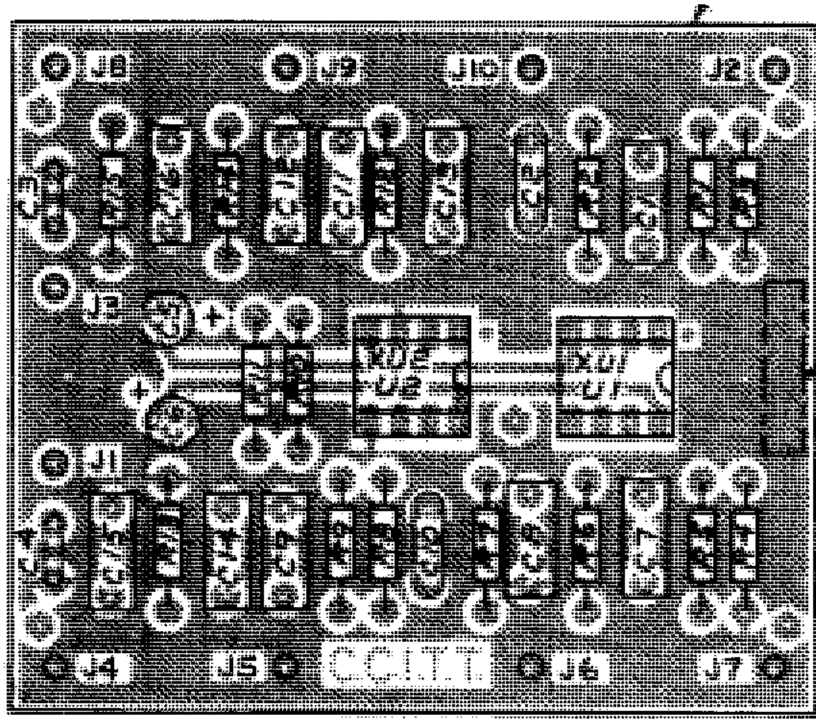
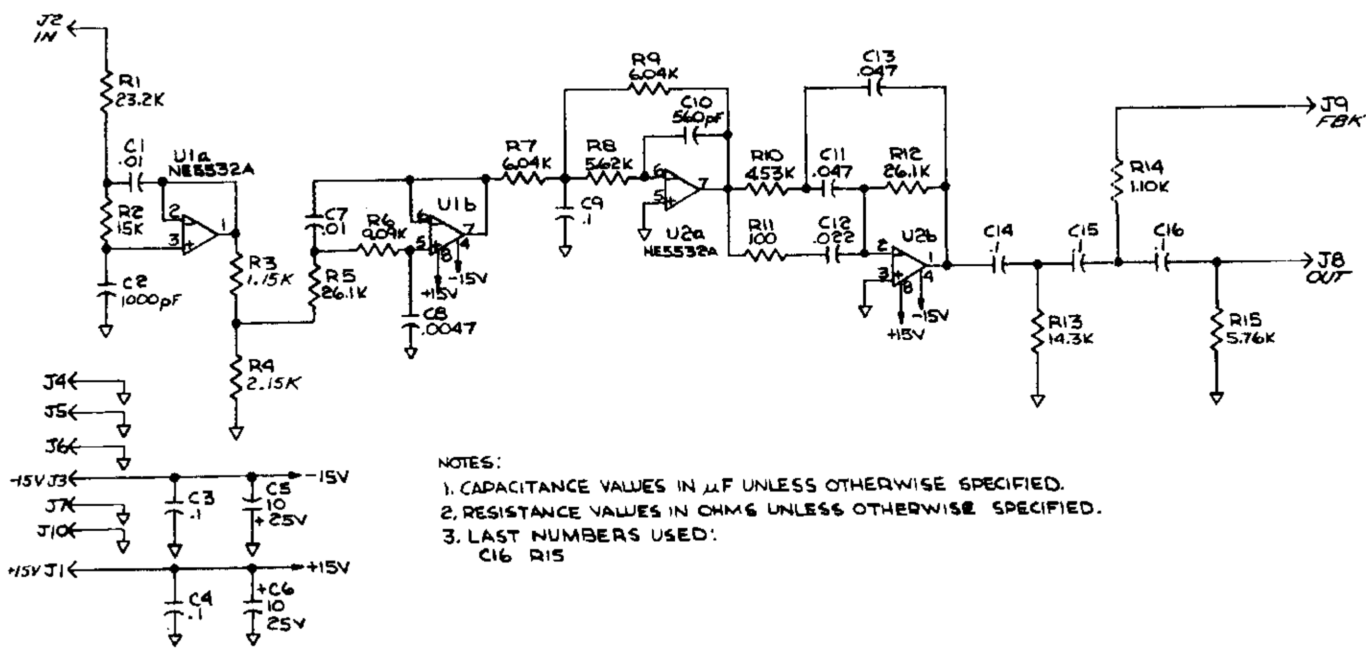


Figure 7-33. 400 Hz Board A1A30 Schematic.



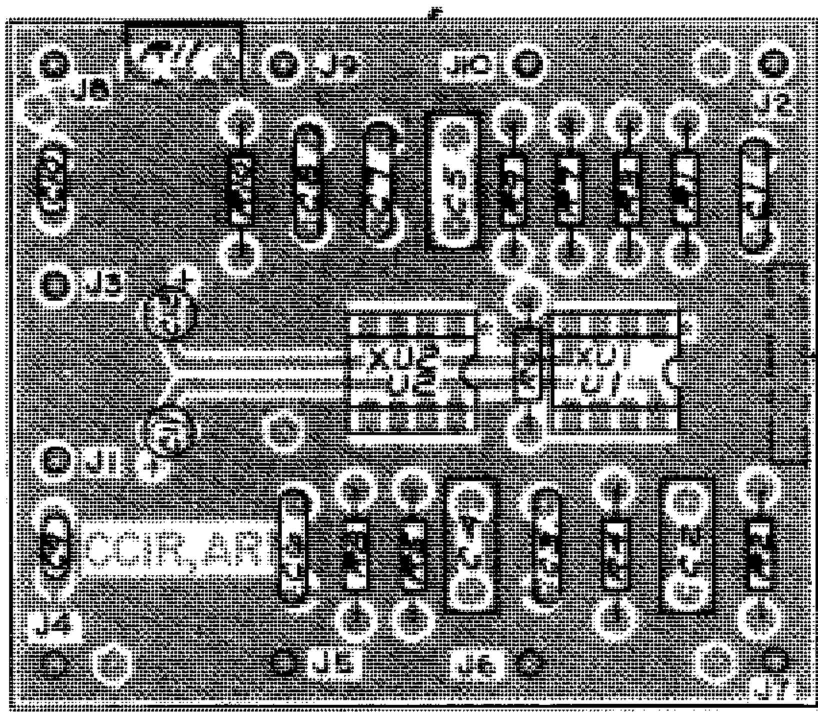
112040A

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



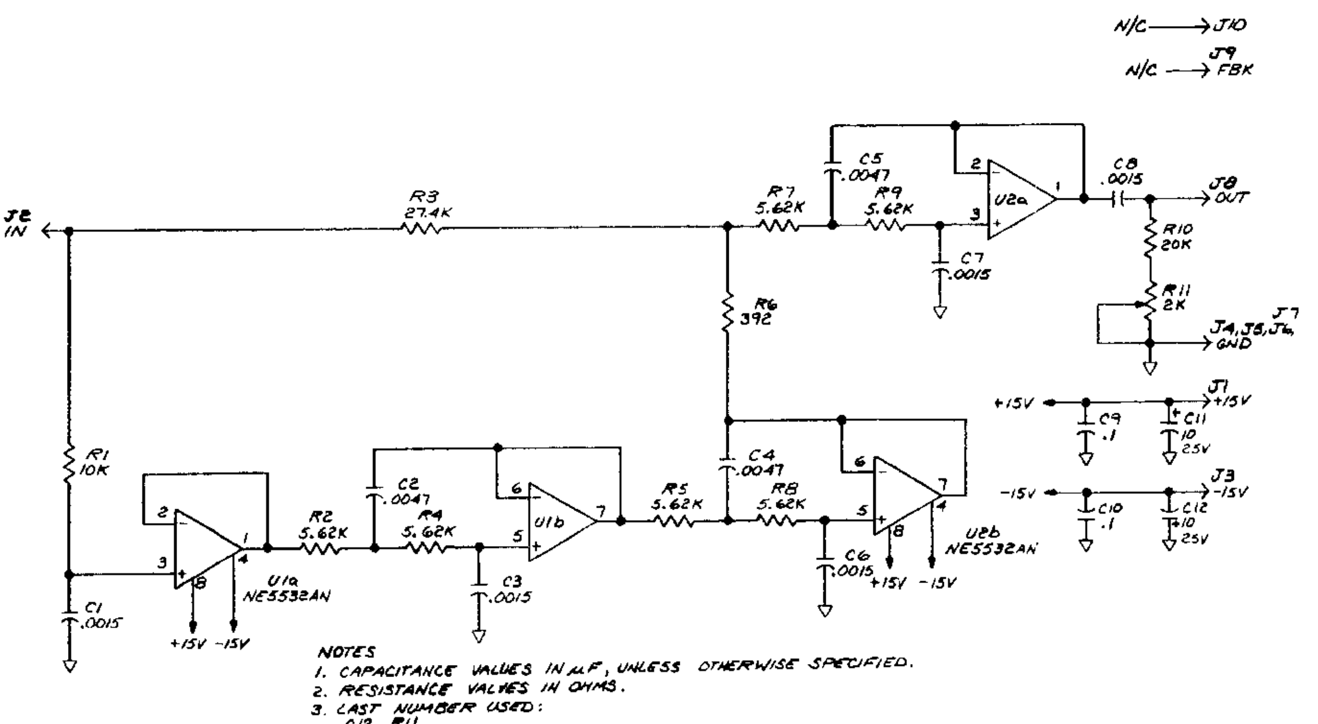
83151403A REV A

Figure 7-35. CCITT Board A1A31 Schematic.



112037A

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



83151404A REV A

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

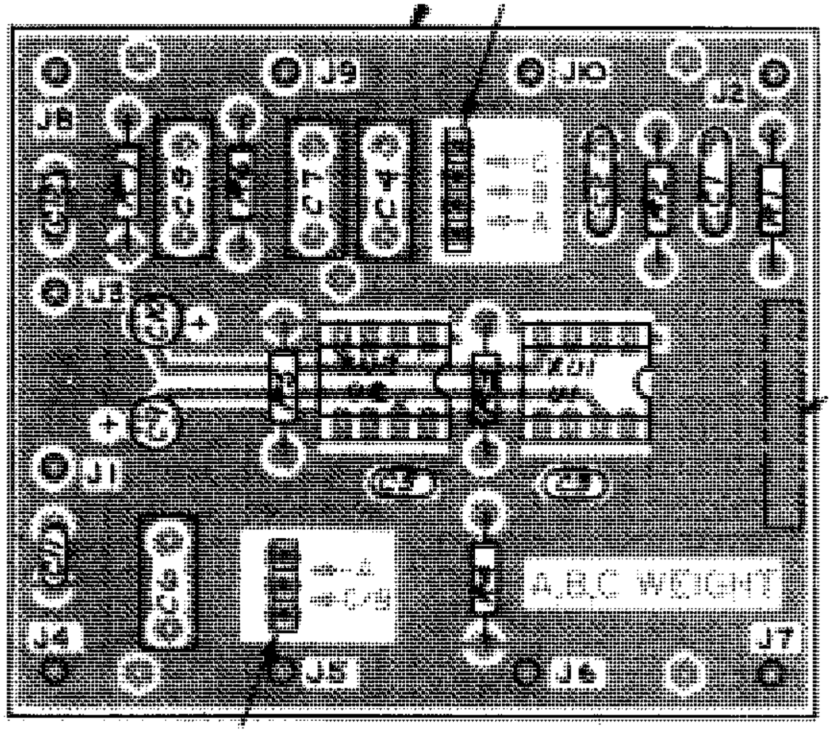


Figure 7-38. A,B,C WTNG Board A1A34,35,36 Parts Location Diagram.

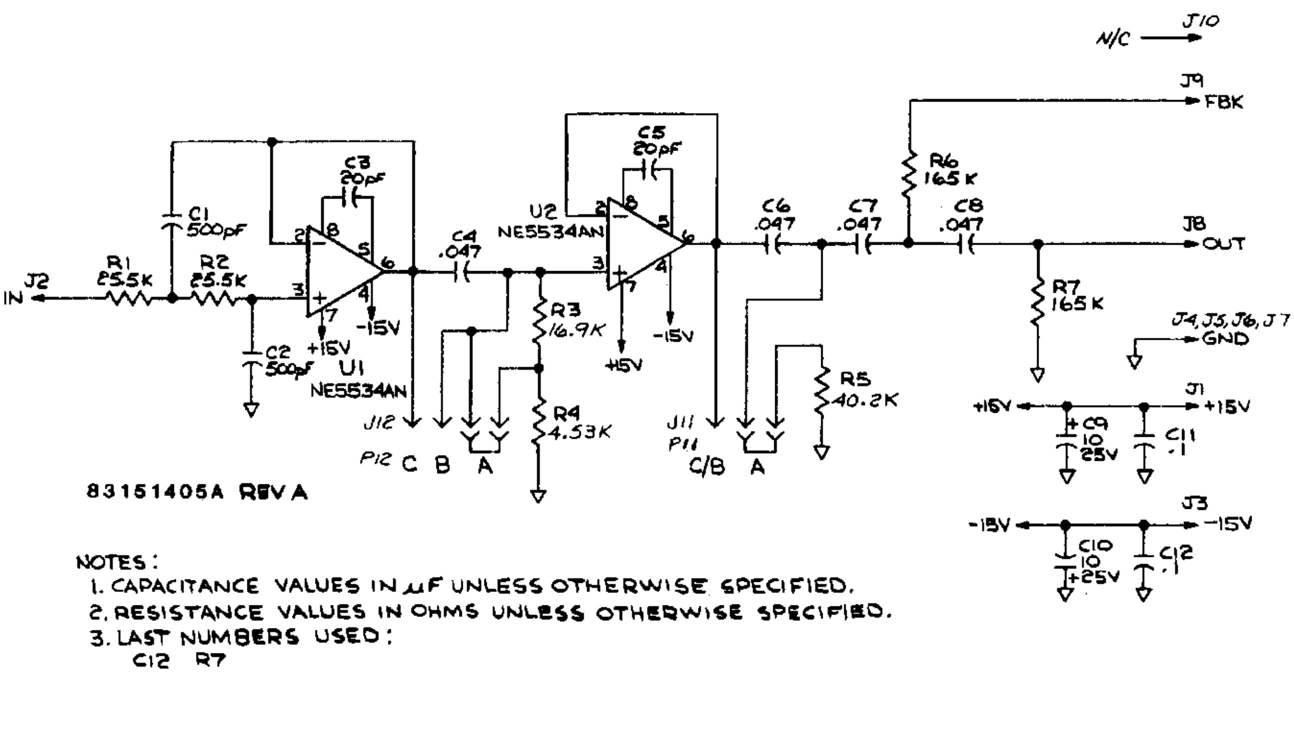


Figure 7-39. A,B,C WTNG Board A1A34,35,36 Schematic.

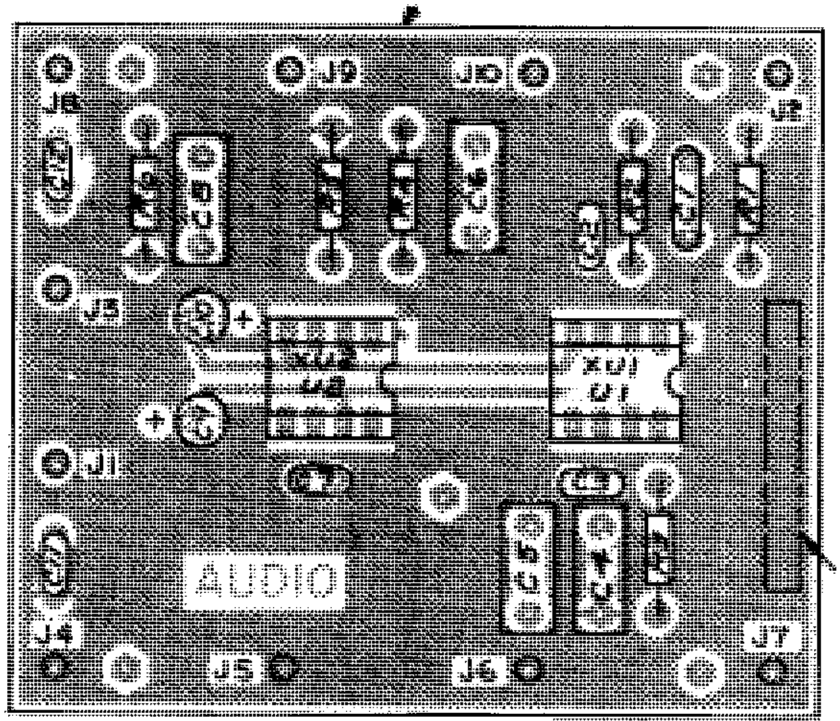


Figure 7-40. AUDIO Board A1A37 Parts Location Diagram.

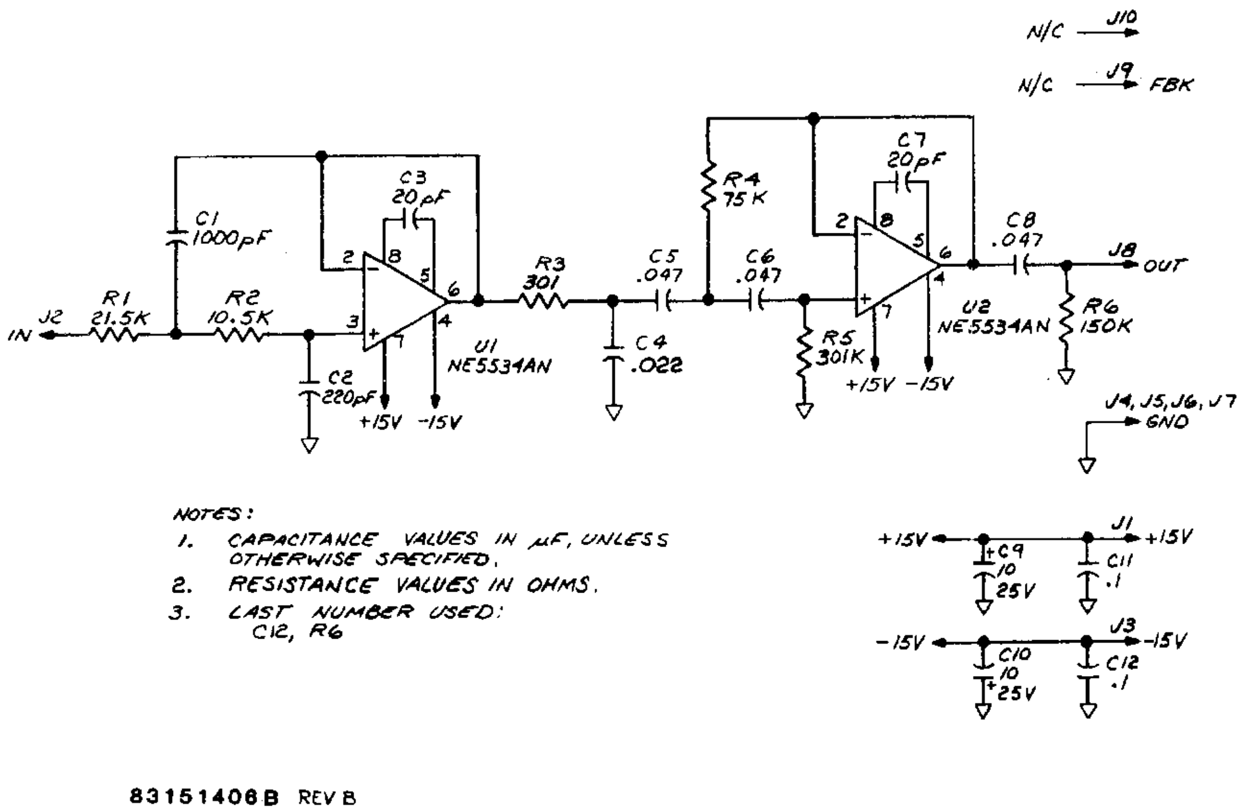


Figure 7-41. AUDIO Board A1A37 Schematic.

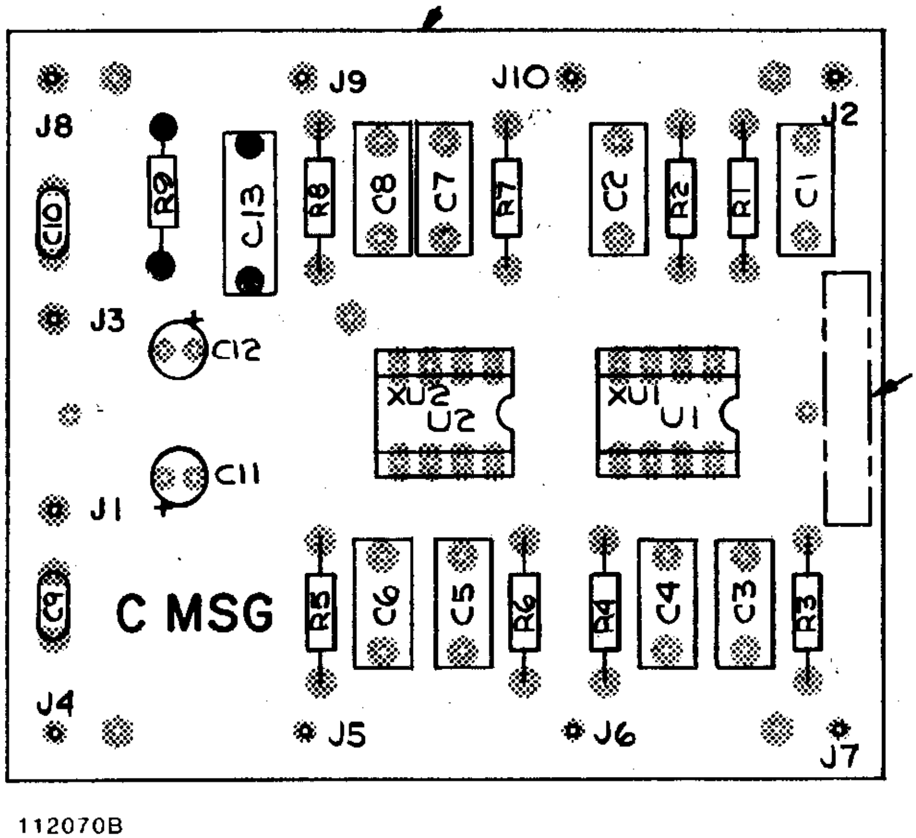


Figure 7-42. C-MESSAGE Board A1A38 Parts Location Diagram.

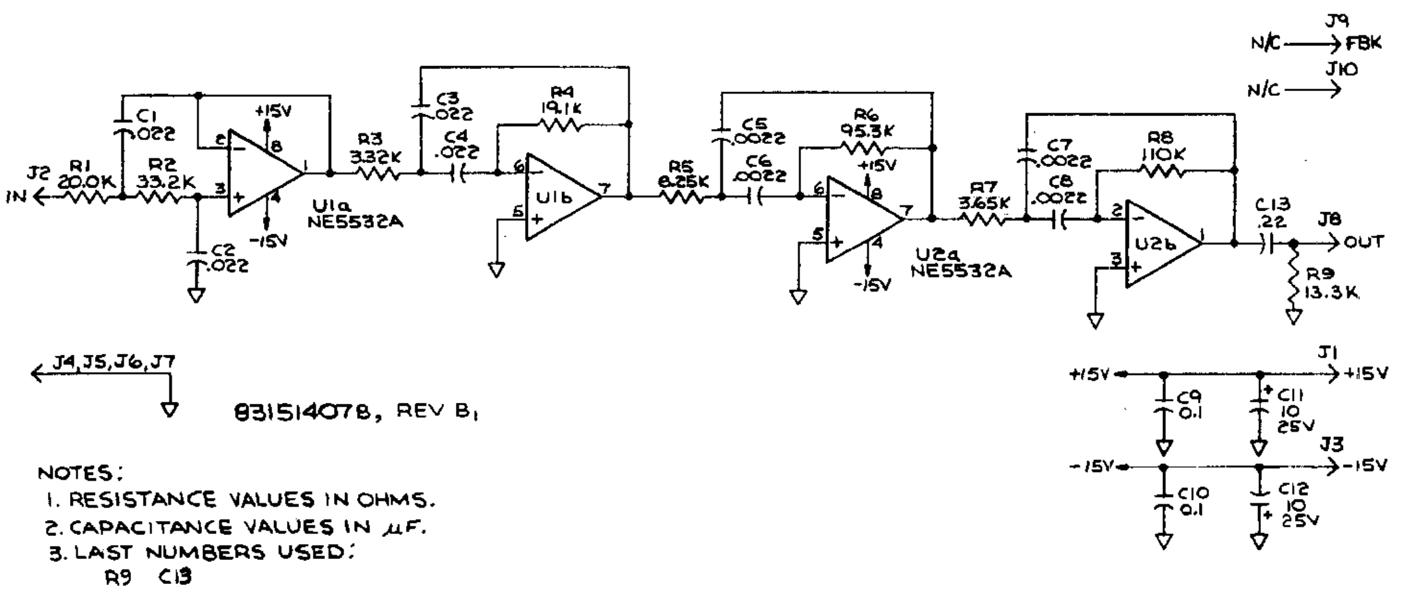


Figure 7-43. C-MESSAGE Board A1A38 Schematic.

IMPORTANT NOTICE

DECEMBER 1, 1995

INSTRUCTION MANUAL-ADDENDUM: MODEL 1121

Instruction manual addenda are issued to adapt the manual to changes and improvements made after this printing. Please review the following text and retain with your manual for future reference. These changes will be applied in the next printing of the manual.

Thank you for selecting BOONTON ELECTRONICS for your Test and Measurement needs.

Page 1-4 Table 1-1 General Information

Add the following:

Ventilation Requirements:
1 1/2 inch clearance after installation, top,side, and rear

Temperature:
Non-Operating: -40 to 75 degrees C

Altitude:
Operating: 10,000 FT
Non-Operating: 15,000 FT

Humidity:
95% (non-condensing)

Battery Type:
Refer to page 6-12

CE MARK: Declares Conformity to European Community (EC) Council Directives : 89/336/EEC//93/68/EEC, 73/23/EEC//93/68/EEC & Standards : EN55011, EN50082-1, EN61010-1

Page 2-1 Line Voltage Select Chart

Change 3/4 ATD & 3/8 ATD to 3/4A T & 3/8 A T

Page 7-29, Fig. 7-29, Power Supply Schematic

Add capacitor C1 across the Line Filter output terminals

Page 6-21,Parts List, Rear Panel Assembly

Add C1 Capacitor, Polyester .1uF 250VAC Panasonic ECQ-U2A104MV
23420100A

IMPORTANT NOTICE

MARCH 31,1997

INSTRUCTION MANUAL-ADDENDUM: MODEL 1121

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Page 7-29/7-31, PWR SUPPLY SCHEMATIC
CHANGE C5,7,9,13&15 TO 6800uF, 50V

Page 6-21, PWR SUPPLY REPLACEMENT PARTS
CHANGE C5,7,9,13,15 TO CAP EL. 6800uF 20% 50V, BEC P/N 28338400A

REF CN 1246

98403402B

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