

OPERATION AND SERVICE MANUAL

240L Broadband Power Amplifier



OPERATION & SERVICE MANUAL

240L

Broadband Power Generator



HIGH RF VOLTAGES MAY BE PRESENT AT THE OUTPUT OF THIS UNIT. All operating personnel should use extreme caution in handling these voltages and be thoroughly familiar with this manual.



DO NOT USE ANY CFC (CHLOROFLUOROCARBON) SOLVENT IN THE MAINTENANCE OF THIS PRODUCT. In recognition of our responsibility to protect the environment, this product has been manufactured without the use of CFC's. The no-clean flux now used in all soldering operations may leave a small inert residue which will not affect the performance of the product. The use of CFC's for cleaning or maintenance may result in partial liquification of the no-clean flux residue, which will damage the unit and void the warranty.

Notice

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Warranty

ENI warrants to the original purchaser for a period of one year from the date of delivery, each instrument to be free from defects in materials and workmanship. For a period of one year, ENI will, at its option, adjust, repair, or replace defective parts, without charge to the original purchaser, so that the instrument performs according to its specifications.

When warranty service is required, the instrument must be returned, transportation prepaid, to the factory or to one of ENI's designated service centers. If, in our opinion, the instrument has been damaged by accident, unreasonable use, buyer-supplied software or interfacing, improper site preparation or maintenance, or abnormal conditions of operation, repairs will be billed at standard rates. In this case, an estimate will be submitted before the work is started.

THIS LIMITED WARRANTY IS EXCLUSIVE AND ENI MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, AND ALL OTHER EXPRESS ORAL OR WRITTEN WARRANTIES AND ALL WARRANTIES IMPLIED BY LAW, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTY OF QUALITY ARE EXCLUDED AND DISCLAIMED. IN NO EVENT SHALL ENI BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM BREACH OF ANY WARRANTY, WHETHER EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR FROM ANY CAUSE WHATSOEVER, INCLUDING NEGLIGENCE. Buyer's sole and exclusive remedy under this warranty shall be repair or replacement as set forth above, or if ENI is unable to repair or replace the defective part within a reasonable time, a refund of the price of the part or goods which give rise to the warranty claim.

Service and Technical Assistance

For **Technical Support** for your particular application, contact the nearest ENI Sales and Service Center. The following information will help us provide you with prompt and efficient service:

- All of the information contained on the unit's name plate.
- Detailed description (i.e. physical damage and/or performance anomalies, quantitative and/or qualitative deviation from specifications), including miscellaneous symptoms, dates and times.
- The environment and circumstances under which the issue developed.
- Names and telephone numbers of important contacts.
- Supporting test data and/or records that can be provided.
- Any previous, related conversations and/or correspondence with ENI.

For **Service or Repair** contact the closest Customer Service Department with the following information:

- Model and serial number
- Detailed description of malfunction
- Purchase order number
- Your company's "Bill To" and "Ship To" address

You will receive a RMA (Return Materials Authorization) number, the warranty status of the unit to be returned and estimated repair charge, if any. The RMA number is your authorization number. Please type this number on your purchase order and shipping label. After ENI receives the unit, a firm quote and estimated date of completion will be given.

Sales and Service Locations

| | | | |
|-----------------------|--|---------------------|-------------------------|
| ENI East Coast | A Division of Astec America, Inc., 100 Highpower Road, Rochester, NY 14623 | | |
| | Tel: (716) 427-8300 | Fax: (716) 427-7839 | Service: (716) 292-7478 |
| ENI West Coast | 2065 Martin Ave., Suite 101, Santa Clara, CA 95050 | | |
| | Tel: (408) 727-0993 | Fax: (408) 727-1352 | |
| ENI Europe | Mundells Court, Welwyn Garden City, Hertfordshire AL 1EN England | | |
| | Tel: (0707) 371558 | Fax: (0707) 339286 | |
| ENI Germany | Holderäckerstrasse 14, D-7016 Gerlingen, Germany | | |
| | Tel: 07156-21095 | Fax: 07156-49372 | |
| ENI Japan | 541 Aoyogi, Kunitachi, Tokyo 186, Japan | | |
| | Tel: 0425 229011 | Fax: 04025 222636 | |
| | Fujita Bldg 4F, 2-27 Nishitenmna 3-chome, Kita-Ku, Osaka 530, Japan | | |
| | Tel: 06-367-0823 | Fax: 06-367-0827 | |

Table of Contents

| | | |
|------------------|------------------------------|----------|
| Chapter 1 | Introduction | 3 |
| 1.1 | Introduction | 3 |
| 1.2 | Specifications | 3 |
| Chapter 2 | Operation | 5 |
| 2.1 | Introduction | 5 |
| 2.2 | Rack Installation | 5 |
| 2.2.1 | Mains Voltage Setting | 5 |
| 2.2.2 | Mains Fuse Rating | 6 |
| 2.2.3 | Mains Lead Connection | 6 |
| 2.3 | Operation | 6 |
| Chapter 3 | Technical Description | 7 |
| 3.1 | General Description | 7 |
| Chapter 4 | Maintenance | 9 |
| 4.1 | Introduction | 9 |
| 4.2 | Access and Layout | 9 |
| 4.3 | Performance Checks | 10 |
| 4.3.1 | Initial Check | 10 |
| 4.4 | Re-Alignment Procedure | 11 |
| 4.4.1 | Measurement of Gain | 11 |
| 4.4.2 | Measurement of Harmonics | 12 |
| 4.5 | Packaging for Reshipment | 13 |

Chapter 5 Figures 15

Figure 1 Specifications 17
Figure 2 Gain Measurement 19
Figure 3 Harmonic Measurement 21

Figure 4 **Outline Drawings** 23
 Power Amplifier Board (240L-4301) A-1
 Driver / Combiner Board (240L-4302) A-2
 P.S. Transistor Board (240L-4303) A-3
 P.S. Regulator Board (240L-4304) A-4
 RF Voltmeter Board (240L-4305) A-5

 Parts List 240L-1301

 Glossary of Abbreviations

Chapter 1

Introduction

1.1 Introduction

The Model 240L is a broadband solid state power amplifier covering the frequency range of 20 kHz to MHz.

More than 40W of RF power can be produced at the output, with low harmonic and intermodulation distortion. Up to 200W of saturated power can be produced with increased distortion products. A highly linear Class A design, the Model 240L will amplify inputs of AM, FM, SSB, pulse and other complex modulations. The 50 dB gain of the unit is unconditionally stable and will not oscillate for any possible combination of source and load impedance. It is protected against failure due to output load mismatch and/or overdrive.

Output RF voltage level, as well as power output into 50 Ω , is monitored by a front panel meter. An integral power supply permits operation from 115/230 single phase AC power.

1.2 Specifications

Physical and electrical specifications are listed in Figure 1.

Chapter 2

Operation

2.1 Introduction

The ENI 240L RF amplifier is used to increase the r.f. output level of signal sources in the 20 kHz to 10 MHz range. No tuning or any other form of adjustment is required other than the selection of the correct power supply input voltage.

The 240L produces rated power output connector, regardless of load impedance. Any power reflected due to output load mismatch is absorbed in the amplifier. Therefore, although the output impedance is 50 Ω (typical VSWR:1.5:1), the amplifier will work into any load impedance.

2.2 Rack Installation

For standard nineteen inch relay rack installations, rack mounting brackets are supplied with the unit. Remove the two #8-32 screws on each side of the cover nearest the front panel. Attach the rack mounting brackets firmly using the hardware removed above. The rubber feet may be unscrewed and removed if the minimum vertical usage of the relay rack is necessary.

2.2.1 Mains Voltage Setting

The supply voltage selection switch is located at the rear of the instrument and is normally set for 115 VAC operation.

Before connecting the unit to the mains supply, check that the supply voltage selection switch is correctly set. Extensive damage will result if the Amplifier is connected to the wrong supply voltage. Under no circumstances should this switch be operated while the supply is connected.

2.2.2 Mains Fuse Rating

The mains fuse F1 is located on the rear panel. The replacement part number details are:

| | | | |
|-------|-------|-----------|---------------------|
| 115 V | 8 amp | Slow Blow | ENI Part No. 313008 |
| 230 V | 4 amp | Slow Blow | ENI Part No. 313004 |

2.2.3 Mains Lead Connection

For 230 VAC operation, a suitable mains supply plug must be fitted to the mains lead attached to the instrument. The three conductors are color coded as follows:

| | | |
|-------|---|---------|
| BLACK | - | Live |
| WHITE | - | Neutral |
| GREEN | - | Earth |

2.3 Operation

Determine and adjust the voltage setting and fuse rating as described in the previous sections 2.2.1 and 2.2.2 then proceed as follows:

- (i) Ensure input voltage is not excessive

The 1 V rms indicated maximum input voltage is 5 times the level of the input signal required to achieve maximum output. Input voltages in excess of 2V peak may permanently damage the instrument.

- (ii) Connect the input signal via a 50 Ω coaxial lead and BNC plug to the input connector.
 - (iii) Connect the output via a 50 Ω coaxial lead and BNC plug to the load.
-

Chapter 3

Technical Description

3.1 General Description

The ENI 240L is designed to amplify signals by 50 dB in the frequency band 20 kHz to 10 MHz. The signal from the front panel BNC connector is fed via a length of 50 Ω coaxial cable into the input of the driver/combiner module (240L-4302). The signal at the collector of Q1 is amplified further by transistor Q2. The output signal at the collector of Q2 is then split into two equal phase and amplitude signals by transformer T2. The two output signals from T2 are fed to the bases of Q3 and Q4. The output signals of transistors Q3 and Q4 are combined in transformer T3, impedance matched in transformers T4 and T6 and split into two equal phase and amplitude signals by transformer T7. These output signals are fed to connectors J3 and J4 which are fed via coaxial cables to the inputs of the two power amplifier modules (240L-4301).

The signal applied at J5 is impedance matched and split into two equal phase and amplitude signals by transformers T1 and T2. The signals at the outputs of T2 are split and phase reversed by transformers T3 and T4. The outputs of transformers T3 and T4 are fed to the bases of Q1, Q2 and Q3, Q4 respectively. The power outputs of Q1 and Q2 are combined in the phase reversing transformer T5 and the power outputs of Q3 and Q4 are combined in phase reversing transformer T6. The output signals from T5 and T6 are combined and impedance matched to 50 Ω at the output connector J7 by transformers T7 and T8.

The output signals from the two power amplifier modules (240L-4301) are fed via coaxial cables to J9 and J10 of the driver/combiner module (240L-4302). These two signals are combined by hybrid transformer T8. Capacitor C18 and transformer T9 match the combined RF output signal to 50 Ω at connector J11. The output signal is fed via a 50 Ω coaxial cable to the RF voltmeter module J12 (3100L-4206).

The signal at J12 is connected via a length of microstrip transmission line to the output BNC connector J13. Off of this microstrip line resistors R1, R2, R3 and R4 make up a high impedance voltage divider. A fast switching hot carrier diode CR1 rectifies the RF voltage from the divider. A wire gimmick (capacitor C2) compensates for the high frequency roll-off of the diode CR1. Resistors R4, R5, R6 and capacitor C1 filter the rectified RF and convert it to DC which is fed to the front panel meter (M1).

The amplifier power requirements are 115 V or 230 VAC. at 450W. The power supply unit provides a 36 VDC, 7.0A source and a 21VDC 40 mA source. The 36VDC source is regulated by series pass transistors Q1, Q2, Q3 and Q4 and integrated circuit regulator IC1. R3 adjusts the supply to 36V. The front panel light and the RF voltmeter are connected to the 21VDC source and the lamp will indicate when the power supply is operating correctly.

Chapter 4

Maintenance

4.1 Introduction

The ENI 240L RF amplifier requires no periodic maintenance. The instrument is unconditionally stable and is failsafe under all load conditions. Damage can only be externally caused by the incorrect selection of the supply voltage or by an input signal in excess of the specified 1V rms maximum.

This chapter therefore, deals only with certain fundamental procedures for fault location and with the subsequent re-alignment procedures.

Performance limits quoted are for guidance only and should not be taken for guaranteed performance specifications unless they are also quoted in Figure 1.

4.2 Access and Layout

The ENI 240L RF amplifier is housed in an aluminum chassis. The cover can be removed by releasing the eight #8-32 screws on the side of the unit and the eight #4-40 flat head Phillips head screws on the top of the unit and lifting by the handle.

The rear panel supports the mains fuse holder, the mains input voltage selector switch (S2) and the cooling fan.

4.3 Performance Checks

To determine the amplifier's performance carry out the following procedure.

4.3.1 Initial Check

The following check can be made after repair and adjustments or whenever the condition of the unit is in question.

- (i) Connect power supply. Switch on power and observe that the supply lamp (DS1) illuminates.
- (ii) Connect a sweep generator (HP 8601 or similar) capable of sweeping the frequency range 20 kHz to 10 MHz to the input connector.
- (iii) Adjust the output level of the sweep generator so that a 50 Ω video detector connected at the output of the unit will not be damaged by excessive power output.
- (iv) Observe the gain versus frequency ripple on an oscilloscope calibrated in decibels. The gain variation must be not more than ± 1.5 dB over the frequency range.
- (v) Connect a calorimetric power meter (HP434 or equivalent) through a 10 dB 100W attenuator to the output connector. Adjust the input CW signal to any frequency between 20 kHz and 10 MHz for 40W output.
- (vi) Observe the harmonic distortion of the output of a spectrum analyzer. The harmonic components contributed by the amplifier should be at least 25 dB down from the fundamental.

If the requirements of this check are not met, verify that:

- (a) The mains supply switch and fuse are correctly selected and that DSI is illuminated.
- (b) The power supply voltage is set at 36V by R3.

If the above checks are found to be correct, then normal fault location procedures, with reference to the circuit diagram Reference 1 should be followed to determine the correct operation of the driver/combiner and power amplifier modules.

4.4 Re-Alignment Procedure

Before any adjustment is made to the unit, first:

- (i) Ensure that the mains switch and fuse are correctly selected and that DSI is illuminated.
- (ii) Measure the power supply voltages and adjust per section 4.3.1 (b).

4.4.1 Measurement of Gain

Equipment required:

- | | | |
|-----|------------------------|---------------------------|
| (a) | Oscilloscope | - Telequipment Model S54A |
| (b) | Sweep/Signal Generator | - HP8601A |
| (c) | 50 Ω Detector | - Wavetek D151 |
| (d) | Attenuator, 10dB, 20W | - Narda 766-10 |

Connect the equipment as shown in Figure 2, then proceed as follow:

- (a) Set the oscilloscope to DC, time/CM to Ext.X, and vertical gain to 10MV/CM.
- (b) Set the sweep/generator to the S/S mode with the start frequency at 20 kHz and the sweep width to 10 MHz.
- (c) Disconnect the ENI 240L from the set-up and connect the sweep/generator RF output directly to the 10dB attenuator.
- (d) Adjust the output level of the sweep/generator for full vertical deflection on the oscilloscope face.
- (e) Calibrate the scope face to show 3 dB in 1 dB steps by attenuating the sweep/generator in 1 dB steps and marking the traces with a grease pencil.
- (f) Return sweep/generator output level to full deflection. Rotate the step attenuator on the sweep/generator (CCW) so that the output is reduced by 50 dB.
- (g) Reconnect the 240L into the test set-up of Figure 2.

- (h) Place the 240L power switch to the "on" position.
 - (i) Observe the gain versus frequency sweep on the oscilloscope.
 - 1. The average gain should be 50 dB (within 1 dB).
 - 2. The gain variation should be within the 3 dB markings as shown on the oscilloscope.
-

4.4.2 Measurement of Harmonics

Equipment required:

- (a) Sweep/signal generator HP8601A
- (b) Attenuator, 30 dB Bird 8321
- (c) Calorimetric Power Meter HP434A
- (d) Spectrum Analyzer HP140T Display Unit
 HP8554L Spectrum Analyzer
 RF Section
 HP8552A Spectrum Analyzer
 IF Section
- (e) Attenuator, 10dB Bird 8341

Connect the Equipment as shown in Figure 3 then proceed as follows:

- (a) Adjust the sweep/signal generator at a CW center frequency of 4 MHz for an indicated output of 40W on the power meter.
 - (b) Using the spectrum analyzer, check that the level of the carrier harmonics less than -25 dB with respect to the carrier.
-

4.5 Packaging for Reshipment

In the event of the equipment being returned for servicing it should be packed in the original shipping carton and packing material. If this is not available, wrap the instrument in heavy paper or plastic and place in a rigid outer box of wood, fiberboard or very strong corrugated cardboard. Use ample soft packing to prevent movement. Provide additional support for projecting parts to relieve these of unnecessary shock. Close the carton securely and seal with durable tape. Mark the shipping container FRAGILE to ensure careful handling.

Chapter 5

Figures

| | | |
|----------|-------------------------------------|---------|
| Figure 1 | Specifications | page 17 |
| Figure 2 | Gain Measurement | 19 |
| Figure 3 | Harmonic Measurement | 21 |
| Figure 4 | Outline Drawings: | 23 |
| | Power Amplifier Board (240L-4301) | A-1 |
| | Driver / Combiner Board (240L-4302) | A-2 |
| | P.S. Transistor Board (240L-4303) | A-3 |
| | P.S. Regulator Board (240L-4304) | A-4 |
| | RF Voltmeter Board (240L-4305) | A-5 |

Glossary of Abbreviations

240L Specifications

| | |
|-----------------------------------|--|
| Frequency Coverage: | 20kHz to 10MHz |
| Gain: | 50dB, ± 1.5 variation |
| Class A Linear Output: | 40 Watts |
| Harmonic Distortion: | Typically more than 28dB below fundamental at 40 Watts output. |
| Saturated RF Power Output: | Greater than 50 Watts 20kHz to 10MHz Greater than 100 Watts 30kHz to 4MHz Greater than 150 Watts 40kHz to 2MHz |
| Input/Output Impedance: | 50 Ω , VSWR 1.5 maximum |
| Noise Figure: | 8dB maximum |
| Stability: | Unconditionally stable |
| Protection: | Unit will withstand more than 16dB overdrive for all output load conditions. |
| Output Meter: | Average reading voltmeter calibrated in volts (0-100V) also calibrated in watts into 50 Ω (0-200W), $\pm 5\%$ accuracy. |
| Power Requirements: | 115-230VAC $\pm 8\%$ at 450 Watts |
| Size: | 7 x 10 x 16.5 inches 17.8 x 25.4 x 41.9 cm. |
| Weight: | 35 pounds 15.9 kg |
| Connectors: | BNC |

Figure 2

Gain Measurement

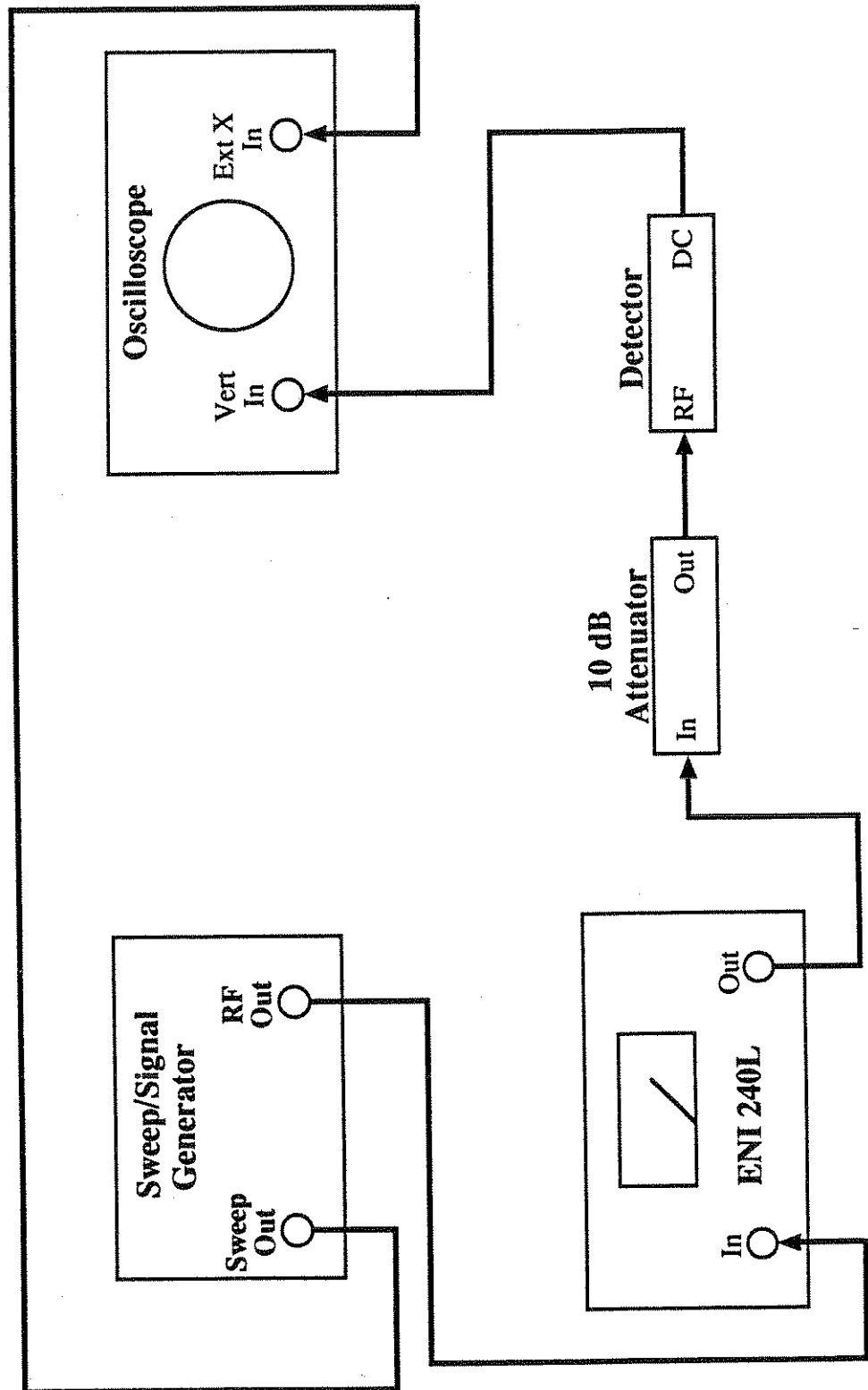
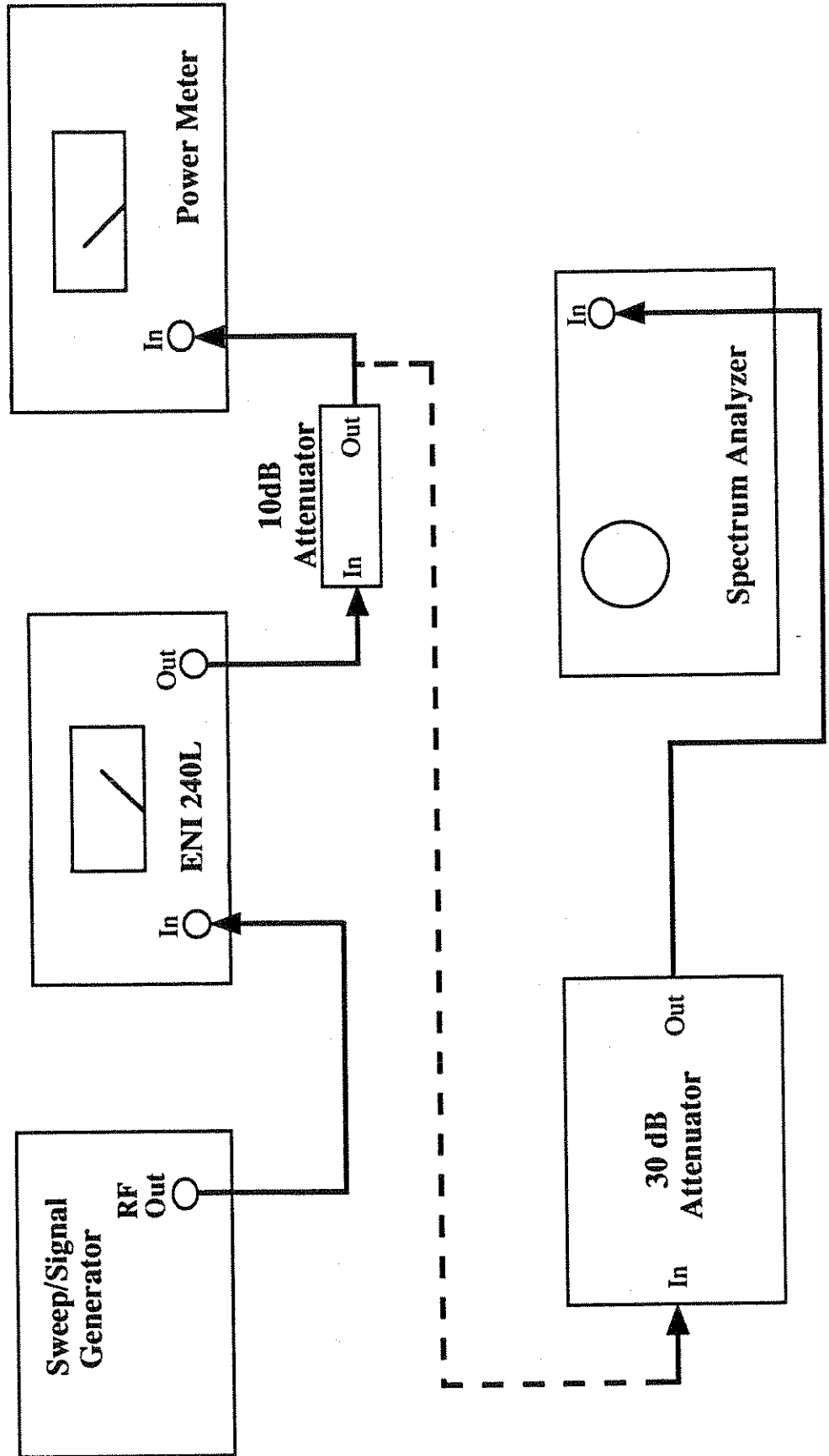


Figure 3

Harmonic Measurement



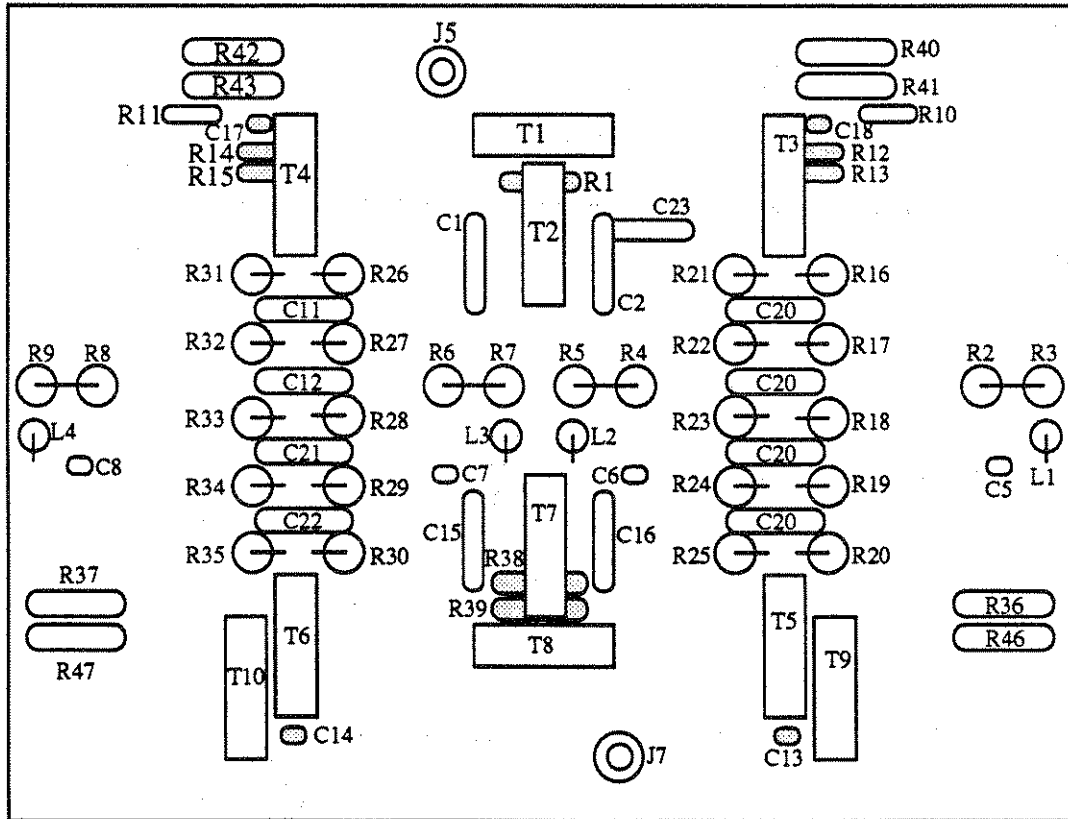
Outline Drawings

| | | | |
|----|-------------------------|-------------|-----|
| A. | Power Amplifier Board | (240L-4301) | A-1 |
| B. | Driver / Combiner Board | (240L-4302) | A-2 |
| C. | P.S. Transistor Board | (240L-4303) | A-3 |
| D. | P.S. Regulator Board | (240L-4304) | A-4 |
| E. | RF Voltmeter Board | (240L-4305) | A-5 |

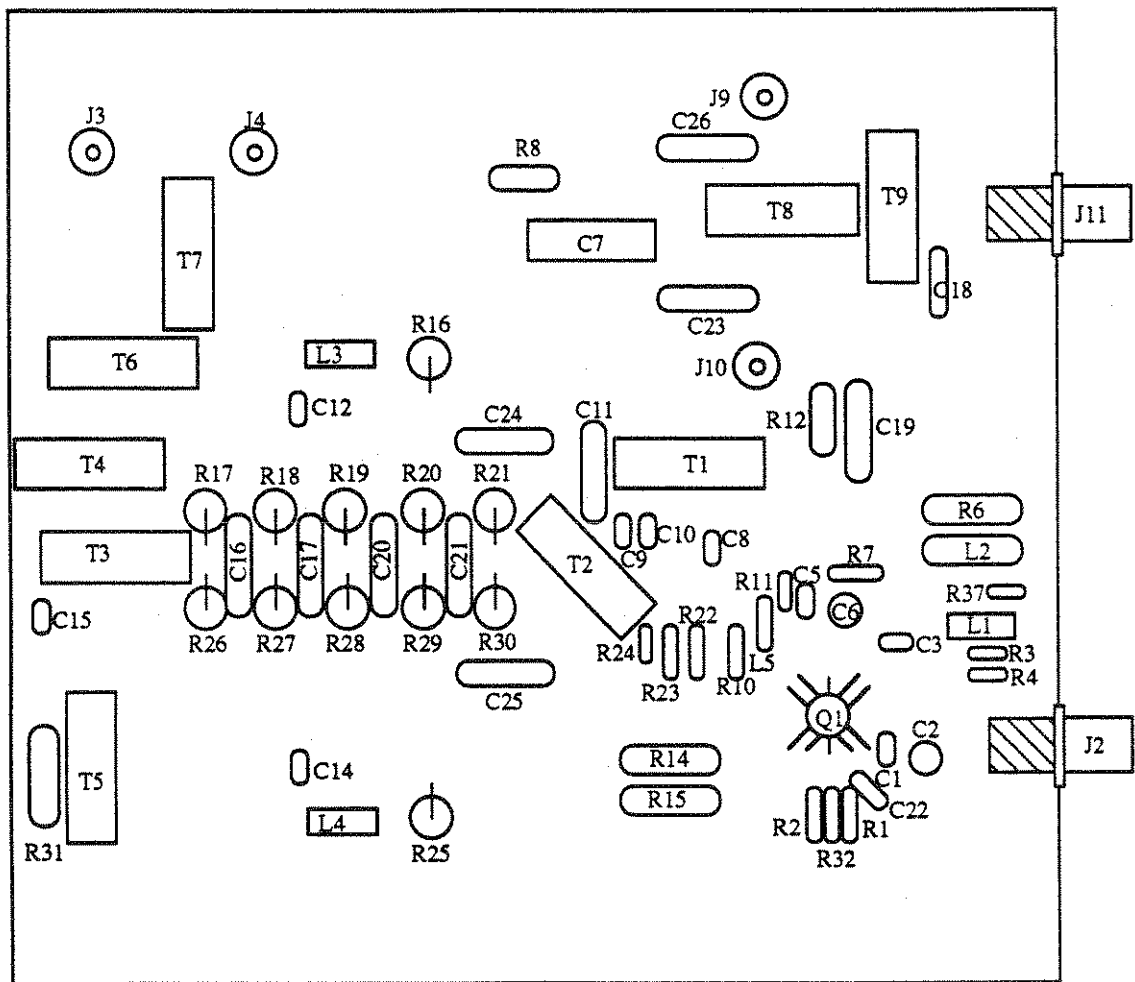
Parts List

240L-1301

240L Power Amplifier Board (240L-4301)

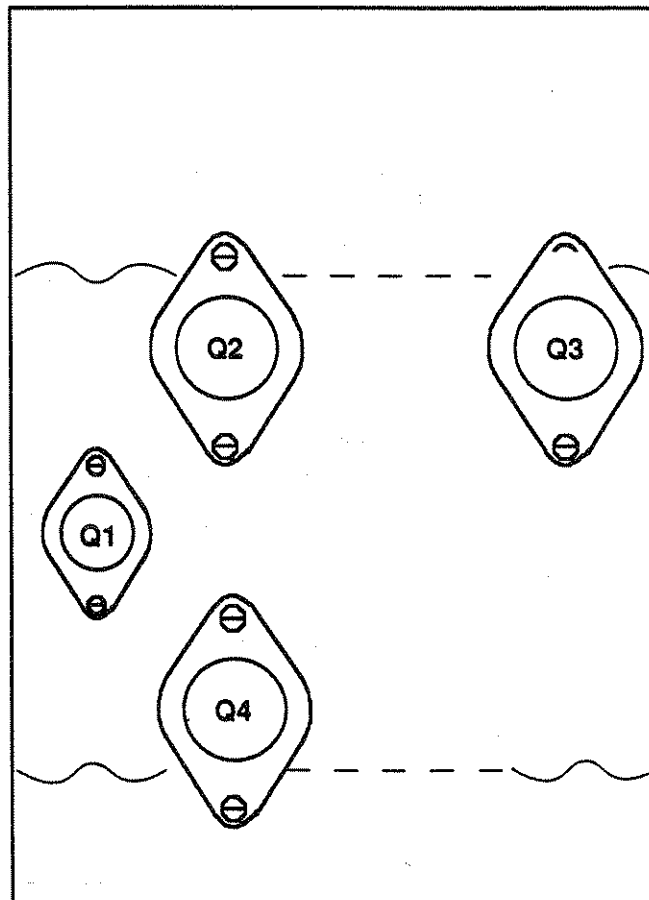
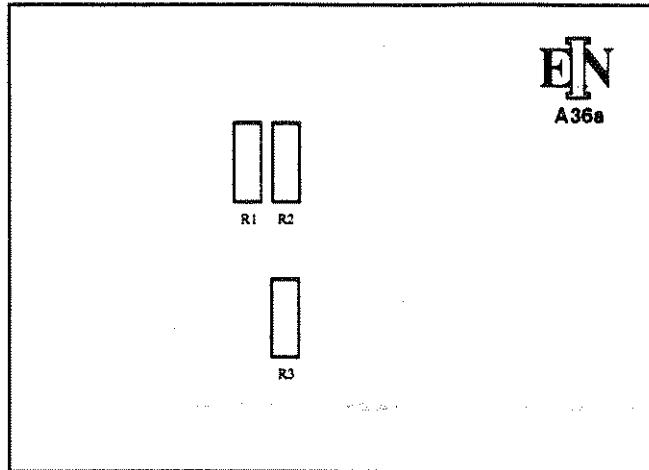


240L Driver/Combiner Board (240L-4302)



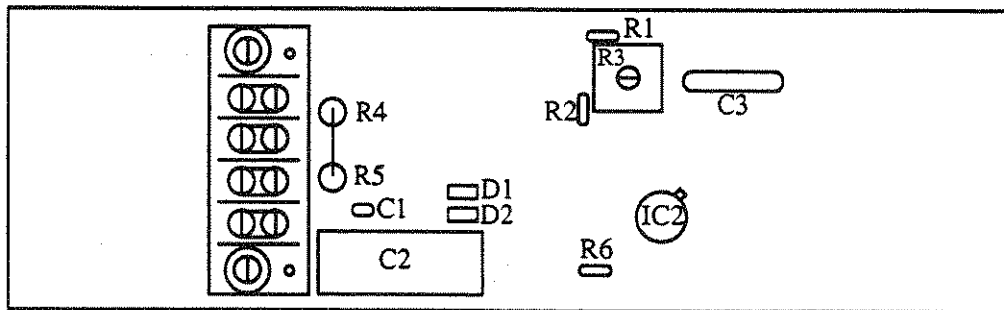
240L Power Supply Transistor Board Assembly (240L-4303)

Front of Board

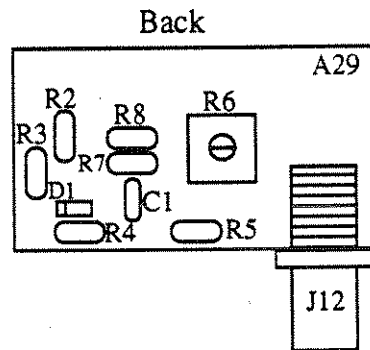
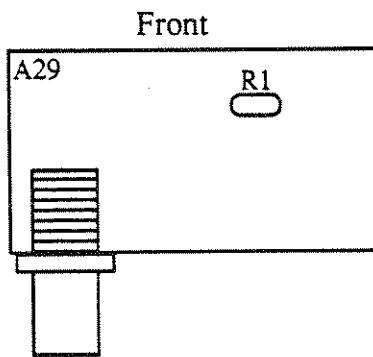


Back of Assembly

240L Power Supply Regulator Board
(240L-4304)



240L RF Voltmeter Board
(240L-4305)



INDEX

240L SCHEMATIC DIAGRAMS

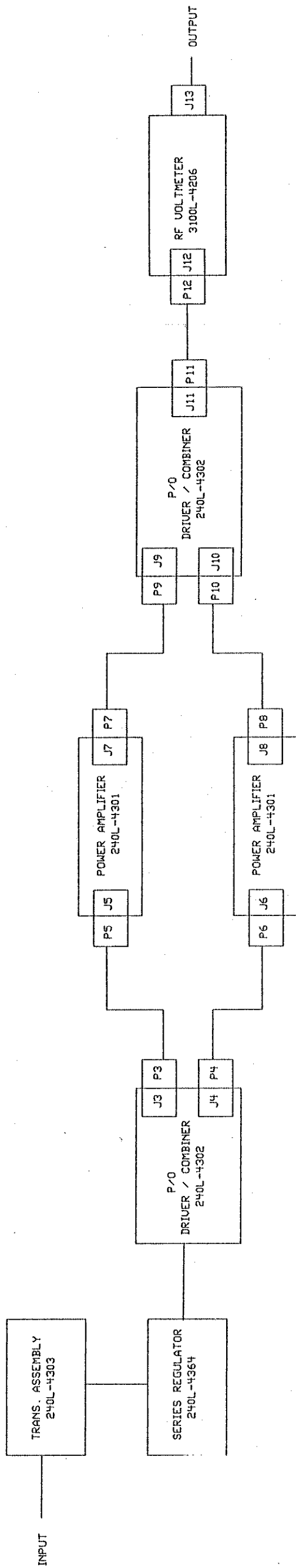
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| 240L POWER WIRING | 240L-SCH-03 | 240L.PWR |
| 240L DRIVER / COMBINER | 240L-SCH-04 | 240L.P1 |
| 240L POWER AMPLIFIER | 240L-SCH-05 | 240L.P2 |

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| A | ECO #3206 | | 9/90 | INDEX |
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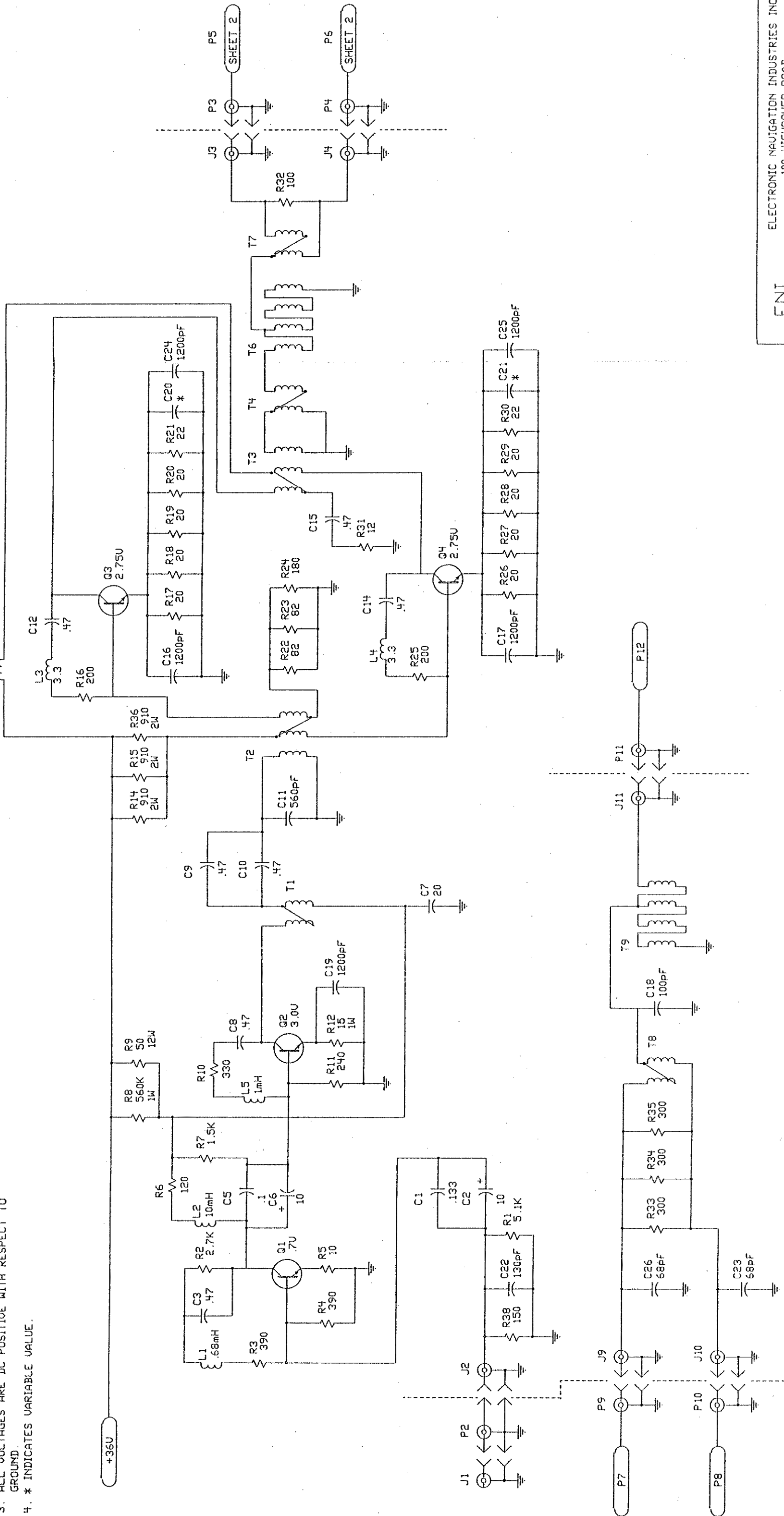
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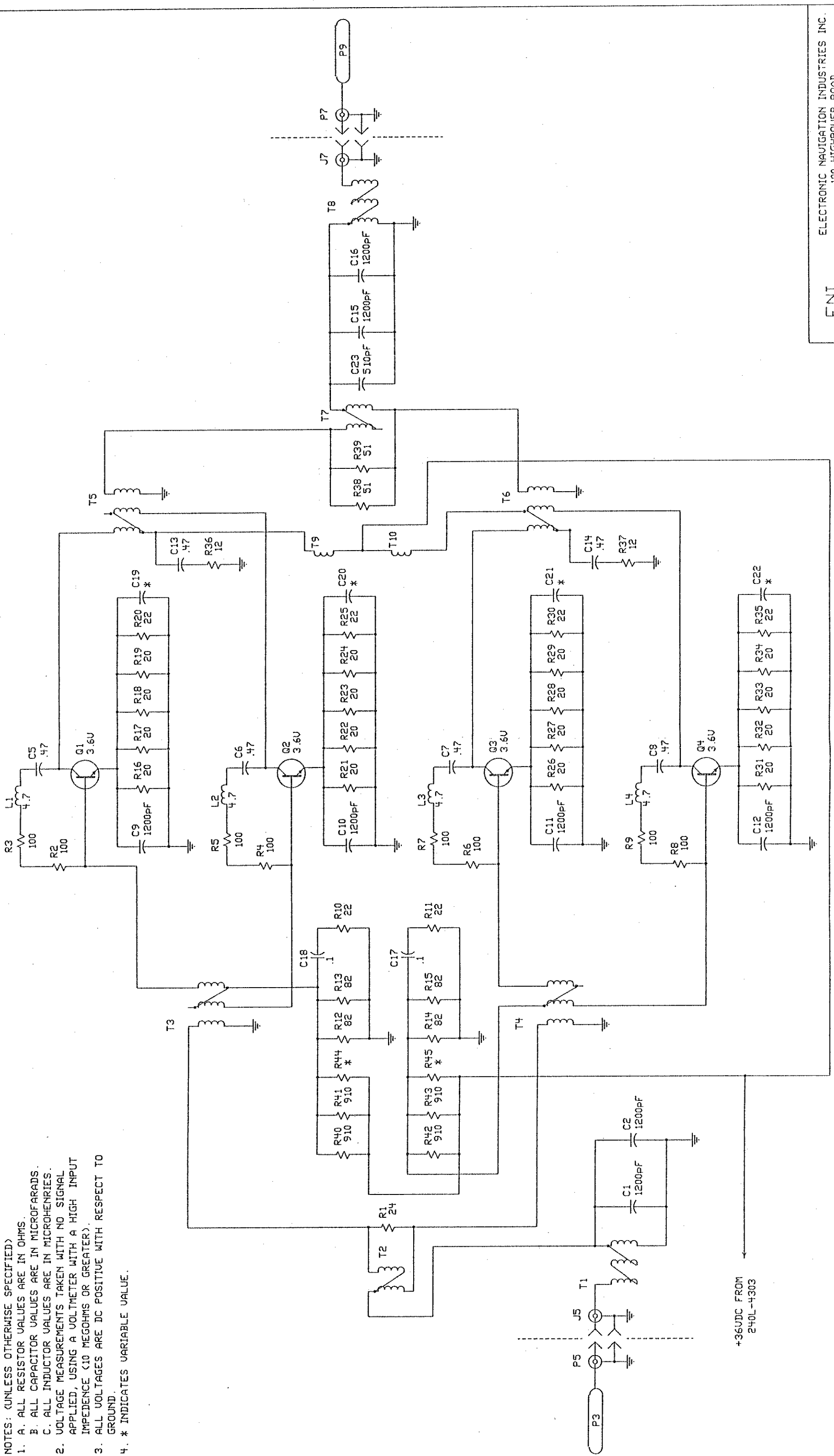
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DRIVER / COMBINER
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 240L
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 SHEET 1 OF 1

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| | 12/90 | CHK. | |
| | | ENG. | |
| | | APP. | |

| REV | NO. | DESCRIPTION |
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| B | 240L-4301 | |

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| PAGE | PART NUMBER | DESCRIPTION | QTY |
|------|-------------|-------------------------------|-------|
| 1 | 240L-1301 | 240L POWER AMPLIFIER | 0.000 |
| | 240L-009 | RACK MOUNTING BRACKET | 2.000 |
| 2 | 240L-2301 | POWER DISTRIBUTION ASSEMBLY | 1.000 |
| 7 | 240L-3301 | BASEPLATE ASSEMBLY | 1.000 |
| | 240L-004 | BASEPLATE | 1.000 |
| | 240L-011-1 | FRONT CORNER BRACKET | 1.000 |
| | 240L-011-2 | FRONT CORNER BRACKET | 1.000 |
| | 240L-012-1 | REAR CORNER BRACKET | 1.000 |
| | 240L-012-2 | REAR CORNER BRACKET | 1.000 |
| | A300-016 | CAPACITOR CLAMP | 1.000 |
| 13 | 240L-4303 | PS TRANSISTOR BOARD | 1.000 |
| | 240L-015 | POWER SUPPLY HEATSINK | 1.000 |
| 14 | 240L-4304 | PS REGULATOR BOARD | 1.000 |
| 8 | 240L-3303 | BACK PANEL ASSEMBLY | 1.000 |
| | 240L-003 | BACK PANEL | 1.000 |
| 9 | 240L-3304 | FRONT PANEL ASSEMBLY | 1.000 |
| | 240L-001 | FRONT PANEL | 1.000 |
| 15 | 240L-4305 | RF VOLTMETER BOARD | 1.000 |
| 3 | 240L-3306 | PA HEATSINK ASSEMBLY | 1.000 |
| | 240L-006-2 | LEFT PA HEATSINK | 1.000 |
| | 240L-008 | PC BOARD BRACKET | 1.000 |
| | 240L-014 | HEATSINK FIN | 1.000 |
| 10 | 240L-4301 | POWER AMPLIFIER BOARD | 1.000 |
| 4 | 240L-3307 | DRIVER/COMB HEATSINK ASSEMBLY | 1.000 |
| | 240L-007 | DRIVER HEATSINK | 1.000 |
| 11 | 240L-4302 | DRIVER COMBINER BOARD | 1.000 |
| 5 | 240L-3308 | RIGHT P A HEATSINK ASSY | 1.000 |
| | 240L-006-1 | RIGHT PA HEATSINK | 1.000 |
| | 240L-008 | PC BOARD BRACKET | 1.000 |
| | 240L-014 | HEATSINK FIN | 1.000 |
| 12 | 240L-4301 | POWER AMPLIFIER BOARD | 1.000 |
| 6 | 240L-3310 | COVER ASSEMBLY | 1.000 |
| | 240L-010 | COVER | 1.000 |

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PART NUMBER      DESCRIPTION      QTY      REFERENCE DESIGNATORS
-----
240L-TM          MANUAL 240L          1.000
10017           CABLE ASSY CA2-2    9.5"     1.000
10026           CABLE ASSY CA4-2    18.0"    4.000
240L-005-H50    HARNESS GROUP        1.000
240L-009        RACK MOUNTING BRACKET 2.000
240L-2301       POWER DISTRIBUTION ASSEMBLY 1.000
240L-3306       PA HEATSINK ASSEMBLY 1.000
240L-3307       DRIVER/COMB HEATSINK ASSEMBLY 1.000
240L-3308       RIGHT P A HEATSINK ASSY 1.000
240L-3310       COVER ASSEMBLY        1.000
5030            BOX 19.14 X 13.04 X 10.10 1.000
5115            SMALL CORNER PADS     8.000
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| PART NUMBER | DESCRIPTION | QTY | REFERENCE DESIGNATORS |
|-------------|----------------------|-------|-----------------------|
| 240L-3301 | BASEPLATE ASSEMBLY | 1.000 | |
| 240L-3303 | BACK PANEL ASSEMBLY | 1.000 | |
| 240L-3304 | FRONT PANEL ASSEMBLY | 1.000 | |

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PART NUMBER      DESCRIPTION      QTY      REFERENCE DESIGNATORS
-----
240L-006-2      LEFT PA HEATSINK      1.000
240L-008      PC BOARD BRACKET      1.000
240L-014      HEATSINK FIN          1.000
240L-4301      POWER AMPLIFIER BOARD  1.000
10633      SWITCH 2450-088-105  1.000  TS1
10676      TRANSISTOR 2N5039     4.000
2372      STANDOFF HEX BRASS 4-40 X .50  4.000
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| PART NUMBER | DESCRIPTION | QTY | REFERENCE DESIGNATORS |
|-------------|--------------------------------|-------|-----------------------|
| 240L-007 | DRIVER HEATSINK | 1.000 | |
| 240L-4302 | DRIVER COMBINER BOARD | 1.000 | |
| 10676 | TRANSISTOR 2N5039 | 2.000 | |
| 681070 | TRANSISTOR, 2N3733 | 1.000 | |
| 2371 | STANDOFF RND BRASS 4-40 X .375 | 4.000 | |

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| PART NUMBER | DESCRIPTION | QTY | REFERENCE DESIGNATORS |
|-------------|-------------------------------|-------|-----------------------|
| 240L-006-1 | RIGHT PA HEATSINK | 1.000 | |
| 240L-008 | PC BOARD BRACKET | 1.000 | |
| 240L-014 | HEATSINK FIN | 1.000 | |
| 240L-4301 | POWER AMPLIFIER BOARD | 1.000 | |
| 10676 | TRANSISTOR 2N5039 | 4.000 | |
| 2372 | STANDOFF HEX BRASS 4-40 X .50 | 4.000 | |

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PART NUMBER      DESCRIPTION      QTY      REFERENCE DESIGNATORS
-----
240L-010         COVER          1.000
10306           HANDLE /WITH HAND POL. COVERS  1.000
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=====
PART NUMBER      DESCRIPTION      QTY      REFERENCE DESIGNATORS
-----
240L-004         BASEPLATE             1.000
240L-011-1       FRONT CORNER BRACKET 1.000
240L-011-2       FRONT CORNER BRACKET 1.000
240L-012-1       REAR CORNER BRACKET  1.000
240L-012-2       REAR CORNER BRACKET  1.000
A300-016         CAPACITOR CLAMP      1.000
240L-4303        PS TRANSISTOR BOARD  1.000
240L-4304        PS REGULATOR BOARD  1.000
10114            CAP 8200 MF 75V ALEL 1.000
10660            TRANSFORMER 240L     1.000
121007           BRIDGE 35A 400V     1.000
10276            FEET PLASTIC 760-3572 4.000
10646            TERM BLK 6 TERM 6-172 1.000
10651            MARK STRIP 6 TERMS   1.000
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PART NUMBER          DESCRIPTION          QTY    REFERENCE DESIGNATORS
-----
240L-003             BACK PANEL                1.000
10261                FAN TUBEAXIAL 4.68"SQ 113CFM  1.000  B1
10290                FUSE 3AB CER SLOBLO 8A 250V  1.000  F1
10298                FUSE HOLDER 1 342001L        1.000
10341                LINECORD A 18/3            1.000
10627                SWITCH 115/230             1.000
10265                FAN FILTER 06450-M         1.000
10347                CLAMP LINECORD             1.000
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PART NUMBER      DESCRIPTION      QTY      REFERENCE DESIGNATORS
-----
240L-3304-C1     INPUT CABLE ASS'Y      0.000
240L-001         FRONT PANEL            1.000
240L-4305        RF VOLTMETER BOARD     1.000
10176            CONN RCPT BNC PNL 50 OHM 1.000
11114            CONN ADAPT BNC BULKHEAD 50 OHM 1.000
10333            LAMP INCNDSNT 28V 327 1.000
10334            LAMP RED               1.000
10384            METER 4.5" 45/40 MIL 840-586D 1.000 M1
10620            SWITCH ST42A           1.000
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PART NUMBER      DESCRIPTION      QTY      REFERENCE DESIGNATORS
-----
030-04-26-1F-50  TOROID          2.000    T2,7
035-03-26-1C-50  TOROID          4.000    T3,4,5,6
035-03-26-1F-50  TOROID          2.000    T1,8
040-01-26-1F-50  TOROID          2.000    T9,10
10065             CAP .1 MF 50V CER RAD      2.000    C17,18
10066             CAP .47MF, 50V            6.000    C5-8,13,14
10092             CAP 510 PF 300V 5% MICA RAD 1.000    C23
10094             CAP 1200 PF 300V 5% MICA RAD 12.000   C1,2,9,12,15,16,19-22
10143             CHOKE, PHEN, 4.7UH, 10%, Q33, 7.9MH 4.000    L1,2,3,4
221117           CONN. *SMB* REAR MOUNT SOLDER 2.000
10423             POWER AMP PCB A-3          1.000
120005           RES C-FILM  22 OHM 1/2W 5% C7 2.000    R10,11
120009           RES C-FILM  82 OHM 1/2W 5% C7 4.000    R12-15
1000004          RES MTL FILM  24 OHM 1W 5%          1.000    R1
2000005          RES MTL FILM  20 OHM 2W 5%          20.000   R16-35
2000006          RES MTL FILM  24 OHM 2W 5%          4.000    R36,37,46,47
2000010          RES MTL FILM  51 OHM 2W 5%          2.000    R38,39
2000013          RES MTL FILM 100 OHM 2W 5%          8.000    R2-9
2000022          RES MTL FILM  910 OHM 2W 5%         4.000    R40-43
10705           SOCKET TRANS  2 PINS 2TS-3          4.000

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| PART NUMBER | DESCRIPTION | QTY | REFERENCE DESIGNATORS |
|-----------------|-------------------------------------|--------|-----------------------|
| 030-04-26-1F-50 | TOROID | 2.000 | T6,9 |
| 031-04-26-1F-50 | TOROID | 3.000 | T1,7,8 |
| 035-03-26-1C-50 | TOROID | 2.000 | T2,3 |
| 040-01-26-1F-50 | TOROID | 1.000 | T5 |
| 048-02-28-1F-50 | TOROID | 1.000 | T4 |
| 10065 | CAP .1 MF 50V CER RAD | 2.000 | C1,5 |
| 10066 | CAP .47MF, 50V | 7.000 | C3,8-10,12,14,15 |
| 10081 | CAP 68 PF 300V 5% MICA RAD | 2.000 | C23,26 |
| 10083 | CAP 100 PF 330V 5% MICA RAD | 1.000 | C18 |
| 10085 | CAP 130 PF 300V 5% MICA RAD | 1.000 | C22 |
| 10093 | CAP 560 PF 300V 5% MICA RAD | 1.000 | C11 |
| 10094 | CAP 1200 PF 300V 5% MICA RAD | 7.000 | C16,17,19,20,21,24,25 |
| 10104 | CAP 10 MF 10V TANT AXIAL | 1.000 | C2 |
| 10106 | CAP 10 MF 35V TANT AXIAL | 1.000 | C6 |
| 10107 | CAP 22MF,50V ELEC. AXIAL | 1.000 | C7 |
| 10138 | CHOKE, PHEN, .68UH, 10%, Q50 | 1.000 | L1 |
| 10140 | CHOKE, PHEN, 1UH, 10%, Q50, 25MHZ | 1.000 | L5 |
| 10142 | CHOKE, PHEN, 3.3UH, 10%, Q33, 7.9MH | 2.000 | L3,4 |
| 11419 | CHOKE 10 MH | 1.000 | L2 |
| 10176 | CONN RCPT BNC PNL 50 OHM | 2.000 | |
| 221117 | CONN. *SMB* REAR MOUNT SOLDER | 4.000 | |
| 10424 | DRIVER COMBINER PCB A-4 | 1.000 | |
| 120009 | RES C-FILM 82 OHM 1/2W 5% C7 | 2.000 | R22,23 |
| 120016 | RES C-FILM 330 OHM 1/2W 5% C7 | 1.000 | R10 |
| 120027 | RES C-FILM 1.5K OHM 1/2W 5% C7 | 1.000 | R7 |
| 140003 | RES C-FILM 10 OHM 1/4W 5% C7 | 1.000 | R5 |
| 140020 | RES C-FILM 150 OHM 1/4W 5% C7 | 1.000 | R38 |
| 140021 | RES C-FILM 180 OHM 1/4W 5% C7 | 1.000 | R24 |
| 140023 | RES C-FILM 240 OHM 1/4W 5% C7 | 1.000 | R11 |
| 140028 | RES C-FILM 390 OHM 1/4W 5% C7 | 2.000 | R3,4 |
| 140039 | RES C-FILM 1.8K OHM 1/4W 5% C7 | 1.000 | R37 |
| 140049 | RES C-FILM 5.1K OHM 1/4W 5% C7 | 1.000 | R1 |
| 1000017 | RES MTL FILM 560 OHM 1W 5% | 1.000 | R8 |
| 1000039 | RES MTL FILM 15 OHM 1W 5% | 1.000 | |
| 2000002 | RES MTL FILM 12 OHM 2W 5% | 1.000 | R31 |
| 2000005 | RES MTL FILM 20 OHM 2W 5% | 10.000 | R17-21,26-30 |
| 2000013 | RES MTL FILM 100 OHM 2W 5% | 1.000 | R32 |
| 2000014 | RES MTL FILM 120 OHM 2W 5% | 1.000 | R6 |
| 2000016 | RES MTL FILM 200 OHM 2W 5% | 2.000 | R16,25 |
| 2000018 | RES MTL FILM 300 OHM 2W 5% | 3.000 | R33,34,35 |
| 2000022 | RES MTL FILM 910 OHM 2W 5% | 2.000 | R14,15 |
| 10599 | RES 50 OHM 12W | 1.000 | R9 |
| 10694 | TRANSISTOR ENI-5744 | 1.000 | Q1 |
| 10705 | SOCKET TRANS 2 PINS 2TS-3 | 2.000 | |
| 10313 | HEATSINK 207-CB | 1.000 | |

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PART NUMBER      DESCRIPTION      QTY      REFERENCE DESIGNATORS
-----
030-04-26-1F-50  TOROID          2.000    T2,7
035-03-26-1C-50  TOROID          4.000    T3,4,5,6
035-03-26-1F-50  TOROID          2.000    T1,8
040-01-26-1F-50  TOROID          2.000    T9,10
10065             CAP .1 MF 50V CER RAD      2.000    C17,18
10066             CAP .47MF, 50V            6.000    C5-8,13,14
10092             CAP 510 PF 300V 5% MICA RAD 1.000    C23
10094             CAP 1200 PF 300V 5% MICA RAD 12.000   C1,2,9,12,15,16,19-22
10143             CHOKE, PHEN, 4.7UH, 10%, Q33, 7.9MH 4.000    L1,2,3,4
221117           CONN. 'SMB' REAR MOUNT SOLDER 2.000
10423             POWER AMP PCB A-3         1.000
120005           RES C-FILM 22 OHM 1/2W 5% C7 2.000    R10,11
120009           RES C-FILM 82 OHM 1/2W 5% C7 4.000    R12-15
1000004          RES MTL FILM 24 OHM 1W 5%    1.000    R1
2000005          RES MTL FILM 20 OHM 2W 5%    20.000   R16-35
2000006          RES MTL FILM 24 OHM 2W 5%    4.000    R36,37,46,47
2000010          RES MTL FILM 51 OHM 2W 5%    2.000    R38,39
2000013          RES MTL FILM 100 OHM 2W 5%   8.000    R2-9
2000022          RES MTL FILM 910 OHM 2W 5%   4.000    R40-43
10705           SOCKET TRANS 2 PINS 2TS-3    4.000

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PART NUMBER      DESCRIPTION      QTY      REFERENCE DESIGNATORS
-----
240L-015        POWER SUPPLY HEATSINK      1.000
10445          POWER SUPPLY PCB A-36      1.000
10580          RES MTL FILM   .1 OHM 2W 10%      3.000  R1,2,3
10678          TRANSISTOR 2N4233A      1.000  Q1
10684          XSTR RFPWR NPN 200W 140V ENI-1      3.000  Q2,3,4
10310          HEATSINK 170-HC      3.000
10311          HEATSINK 172-HC      1.000
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| PART NUMBER | DESCRIPTION | QTY | REFERENCE DESIGNATORS |
|-------------|---------------------------------|-------|-----------------------|
| 10063 | CAP .033 MF RPE121Z5U333M50V | 1.000 | C1 |
| 10093 | CAP 560 PF 300V 5% MICA RAD | 1.000 | C3 |
| 10108 | CAP 47 MF TLB1J470MAA | 1.000 | C2 |
| 10238 | 6.2 ZENER DIODE 1N753A | 2.000 | CR1,2 |
| 10327 | IC POS ADJ OUTPUT VLTG REG 1CKT | 1.000 | IC1 |
| 10408 | RES POT 200 OHM 72PLR200 | 1.000 | R3 |
| 10443 | PS REGULATOR PCB A-30 | 1.000 | |
| 140043 | RES C-FILM 2.7K OHM 1/4W 5% C7 | 1.000 | R2 |
| 140051 | RES C-FILM 6.2K OHM 1/4W 5% C7 | 1.000 | R1 |
| 140062 | RES C-FILM 30K OHM 1/4W 5% C7 | 1.000 | |
| 1000019 | RES MTL FILM 750 OHM 1W 5% | 2.000 | R4,5 |
| 10644 | TERM BLK 4 TERM 4-172 | 1.000 | |

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| PART NUMBER | DESCRIPTION | QTY | REFERENCE DESIGNATORS |
|-------------|--------------------------------|-------|-----------------------|
| 10065 | CAP .1 MF 50V CER RAD | 1.000 | C1 |
| 10176 | CONN RCPT BNC PNL 50 OHM | 1.000 | |
| 10249 | G.P.SCHOTTKY BARRIER DIODE | 1.000 | D1 |
| 10410 | RES POT 500 OHM | 1.000 | R6 |
| 10442 | RF VOLTMETER PCB A-29 | 1.000 | |
| 120037 | RES C-FILM 4.7K OHM 1/2W 5% C7 | 3.000 | R1,2,3 |
| 140007 | RES C-FILM 22 OHM 1/4W 5% C7 | 1.000 | R8 |
| 140028 | RES C-FILM 390 OHM 1/4W 5% C7 | 1.000 | R4 |
| 140035 | RES C-FILM 1K OHM 1/4W 5% C7 | 1.000 | R5 |
| 140044 | RES C-FILM 3K OHM 1/4W 5% C7 | 1.000 | R7 |

Glossary of Abbreviations

| | |
|------------|--------------------|
| A | Amperes |
| AMP | Amperes |
| ASSY | Assembly |
| BR | Bridge |
| CAP | Capacitor |
| CER | Ceramic |
| DESIG | Designation |
| ELECT | Electrolytic |
| FWD | Forward |
| IC | Integrated Circuit |
| K | Kilohms |
| k Ω | Kilohms |
| mV | Millivolts |
| pF | Picofarad |
| PIV | Peak Inverse Power |
| PWR | Power |
| POT | Potentiometer |
| REF | Reference |
| REQ | Required |
| RFL | Reflected |
| RES | Resistor |
| S.B. | Slow Blow |
| μ F | Microfarad |
| μ F | Microfarad |
| μ H | Microhenry |
| μ H | Microhenry |
| V | Volts |
| VDCW | DC Working Voltage |
| W | Watts |
| WW | Wire Wound |