OPERATION & SERVICE MANUAL

1140LA

Broadband Power Amplifier

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 CFCs. The no-clean flux now used in all soldering operations may leave a small inert residue that will not affect the performance of the product. The use of CFCs for cleaning or maintenance may result in partial liquification of the no-clean flux residue, which will damage the unit and void the warranty.

This product is manufactured at ENI's Rochester NY plant, an ISO 9001 Quality System Certified Facility.

Notice

Revision Level: D1
Manual Order Number: 1140LA-TM

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 that give rise to the warranty claim.

Service And Technical Assistance

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

- Model and serial number
- Purchase order number
- Detailed description of malfunction
- 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.

For Technical Assistance 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 nameplate.
- Names and telephone numbers of important contacts.
- 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
- Supporting test data and/or records that can be provided.
- Any previous, related conversations and/or correspondence with ENI.

Sales & Service Locations

ROCHESTER, NY	A Division of Astec America, Inc. 100 Highpower Road Rochester, NY 14623	Tel: (716) 292-7440 Fax: (716) 427-7839 Svc: (716) 292-7478
	Toll Free USA Sales Hotline: **Toll Free USA Service Hotline:**	**1-800-267-5362** **1-800-724-ENI1 (3641)**
FREMONT, CA	48834 Kato Road, Suite 110A Fremont, CA 94538	Tel: (510) 353-4ENI (4364) Fax: (510) 353-4360
AUSTIN, TX	4150 Freidrich Lane Suite J Austin, TX 78744	Tel: (512) 462-2191 Fax: (512) 462-9411
UNITED KINGDOM	Mundells Court, Welwyn Garden City Hertfordshire AL7 1EN England	Tel: (01707) 371 558 Fax: (01707) 339 286
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JAPAN	541 Aoyogi Kunitachi Tokyo 186 Japan	Tel: (0425) 229 011 Fax: (0425) 222 636
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Product and Applications information also available on the Internet at:

http://www.enipower.com

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PRODUCT MANUAL REVISION CONTROL FORM

Title:	1140LA Operation & Service Manual	Part #:	1140LA-TM Rev #: D1	Final Assy #:	1140LA-1331 Eff. Date: 09/22/98

CONTENTS	DESCRIPTION	REV LEVEL
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General Information

Introduction

The ENI Model 1140LA is an all solid-state amplifier that has a flat frequency response from 9 kHz to 250 MHz with a gain of 55 dB. Its 50Ω input is compatible with any laboratory signal generator, function generator or integrated circuit oscillator. Input and output impedances are 50Ω and the unit may be driven to full power output by most RF synthesizers, signal generators and swept signal sources. Output power from zero to more than 1500 W is continuously adjustable by varying the amplitude of the low-level input. Any load impedance (from an open to a short circuit) may be connected to the output of the 1140LA without fear of damage or oscillation. The unit provides maximum power transfer to a 50Ω load impedance; however, any load impedance between 40 to 60Ω can be driven with no reduction in power output. Gain is 55 dB nominal with variation of less than ±1.0 dB over the entire frequency range. It provides at least 600 W of saturated power from 4 kHz to 400 kHz.

A built-in, true-average power meter measures both the power leaving the 1140LA (forward power) and the power absorbed by the load (load power). Extraordinary meter accuracy is provided by a unique computer circuit in the output. By adjusting the tuning (or frequency of the load) and observing the increase in load power, optimum match can be readily achieved.

Complete with built-in power supply and cooling system, the 1140LA will operate from any 115 VAC line with a 35 A capacity.

The 1140LA will deliver its rated power output into any load impedance regardless of match (up to 400 W of reflected power). Output RF voltage is displayed on the front panel meter. The 1140LA is packaged for bench mounting and is shipped with rack-mounting adaptors. The 1140LA will raise the power level of signal sources and generators without requiring tuning or bandswitching.

This manual is divided into four chapters and two appendices. Please refer to the following descriptions to help you locate the information you need.

Chapter 1	Deals with precautionary details. Please read this section if you are unfamiliar with the 1140LA or ENI's warranty procedures.
Chapter 2	Tells you how to install and power up the unit for the first time and describes operational details of the 1140LA.
Chapter 3	Provides a technical description of 1140LA circuits.
Chapter 4	Describes specific circuits, maintenance and troubleshooting. Use this section if there is a problem with your 1140LA.
Appendix A	Provides technical specifications of the 1140LA.
Appendix B	Contains schematics and parts lists for the 1140LA.

Chapter 1

Safety

1.1 Labels

Labels are provided to alert operating and service personnel to conditions that may cause personal injury or damage to the equipment from misuse or abuse. Please read the labels and understand their meaning.

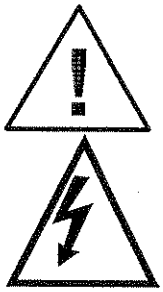
1.1.1 Important Operating or Maintenance Cautions

The caution label is used in this manual to advise the reader of important operating or maintenance procedures that must be carefully followed to maintain equipment reliability.

1.1.2 Shock Hazard Warnings

The warning label is used in this manual to warn the reader of a procedure or practice that could result in personal injury if not followed carefully.

1.1.3 Service

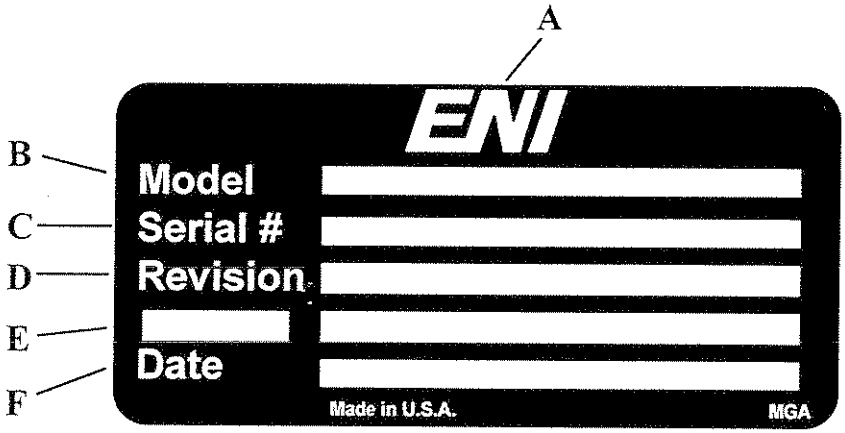


ENI is responsible for safety, reliability, and performance of the equipment only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by authorized personnel.
- The electrical installation is made in accordance with the installation instructions provided and the room in which the equipment is installed complies with the environmental requirements.
- The equipment is used in accordance with the instructions for use.

1.1.4 Nameplate

The 1140LA can be identified by a nameplate at the rear of the unit that contains the following information.



A. **Manufacturer:**
ENI
Rochester, NY USA

B. **Model:**
The assembly number that uniquely identifies product configuration.

C. **Serial #:**
A number that is sequentially assigned as the product is manufactured.

D. **Revision:**
The revision letter identifying product configuration. Revision A is the initial revision level.

E. The customer name and identification number.

F. **Date:**
Proper identification of the date of manufacture.

Chapter 2

Installation and Operation

2.1 Initial Inspection

2.1.1 Mechanical Inspection

If damage to the shipping carton is evident, request the carrier's agent be present when the unit is unpacked. Check for equipment damage and inspect the cabinet and panels for dents and scratches.

2.1.2 Claim for Damage

Please notify ENI directly or your authorized ENI representative if the 1140LA is mechanically damaged or fails to meet specifications upon receipt. Retain our shipping carton and packing material for the carrier's inspection, as well as for subsequent use to return the unit should this become necessary.

2.1.3 Packaging for Reshipment

Whenever possible, the original shipping carton and packing material should be used for reshipment. If the original packing material is not available, wrap the instrument in heavy paper or plastic. Use a strong shipping container. If a cardboard carton is used, it should be at least 200-lb. test material.

Use shock-absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement inside the container wall on each side. Protect the front panel by means of cardboard spacers inserted between the front panel and the shipping carton. Make sure that the instrument cannot move in the container during shipping. Seal the carton with a good grade of shipping tape and mark the container:

FRAGILE! ELECTRONIC INSTRUMENT

2.2 Installation Requirements

2.2.1 Rack Installation

In order to install the Model 1140LA in a standard, 19-inch relay rack mounting brackets must be attached to the cover as follows:

1. Remove all screws (3 #8-32), located on both sides of the cover and the 8 (#4-40) Phillips-head screws located on the top of the cover. Carefully lift the cover up.
2. Verify the left and right rack-mounting brackets by holding them next to the screw holes. Mounting bracket overhang should be at the bottom of the unit.
3. Attach mounting brackets to the sides of the unit by inserting the screws (removed in Step 1) through the brackets.
4. Tighten all screws carefully to ensure that the unit is held firmly in place.
5. The six rubber feet on the baseplate may be unscrewed and removed if minimum vertical usage of the relay rack is necessary.

2.2.2 Mains Lead Connection

The 1140LA requires a 115 V, 50-60 Hz, single-phase power source with a minimum fused capacity of 35 A. A standard three-pin grounded plug, MEMA-L5-30P, is provided for attachment to a receptacle, NEMA-L5-30R. Or, this plug may be removed and hard wired to the power mains as follows:

BLACK	Live
WHITE	Neutral
GREEN	Earth

2.3 Operation

2.3.1 Initial Turn-on Procedure

To operate the 1140LA, simply:

1. Turn Circuit Breaker (left side of the front panel) **ON**.
2. Connect the output of an appropriate signal source (signal generator, function generator or oscillator) to the INPUT connector on the 1140LA. Initially, the input level should be kept below 1 Vpp.
3. Connect a 50Ω coaxial cable between the OUTPUT connector of the 1140LA and the load.
4. Place the POWER switch, located below the output meter, in the FORWARD position. The output power meter will indicate the power being delivered to the load. In the LOAD position, the output power meter indicates the power being absorbed by the load. The difference between these two readings is the reflected power that is absorbed in the amplifier. If the reflected power exceeds 400 W, the 1140LA will automatically cut out and the OVERLOAD LED will light.
5. To reset the 1140LA the input signal should be reduced and the OVERLOAD button (part of the Overload LED) should be depressed.

Note: Under certain load mismatches or cooling system failures, the 1140LA will cut out due to overheating. When this occurs, the OVERLOAD LED will light. This condition cannot be reset from the front panel but will automatically reset upon cooling of the amplifier heatsinks. Reset should occur within two minutes. If the output is allowed to exceed 1600 W, the circuit breaker may reset to the OFF (red flag) position and shut down the unit.

6. Increase the input signal voltage until the required power output is delivered to the load.

Do not, under any circumstances, increase the input level beyond 4 Vpp or permit the signal source frequency to extend below 6 kHz. Severe damage may result from these actions.

2.3.2 Performance Check

The electrical performance of the 1140LA should be verified as soon as possible after receipt. The following procedure will verify that the 1140LA will deliver more than 1500 W of power from 9 kHz to 11 kHz and more than 1100 W from 180 kHz to 250 kHz:

1. Connect an appropriate signal generator to the input of the 1140LA.
2. Connect the 1140LA output to a 30 dB, 2000 W attenuator (Bird #8329 or equivalent). If a calorimetric wattmeter (HP-434A or equivalent) is available, connect the output of the attenuator to its input.
3. Set:

Signal Source	CW
Output Level	1.5 Vpp (approximately)
Frequency	250 kHz

4. Increase the input signal until 1100 W is indicated on the 1140LA output power meter.
5. Slowly decrease the frequency while observing the power meter. Note that at every frequency down to 9 kHz the power output is in excess of the specifications. The power indicated on the 1140LA meter should be within ±3% of that indicated on the calorimeter.

2.4 Tuning the Load

To operate the 1140LA at its maximum efficiency, the load impedance should be as close to 50Ω resistive as possible. Tuning the load to 50Ω is a simple matter using the 1140LA power meter. The following procedure is useful in tuning a piezoelectric or magnetostrictive transducer.

1. Place the transducer into an actual mechanical operating environment.
2. Set the 1140LA input level so that forward power is 350 W or less.
3. Observe the load power while tuning the operating frequency for resonance. At resonance the load power will be maximum.
4. Using a variable reactive tuning network or element (capacitance for magnetostrictive and inductive for piezoelectric), tune for maximum load power. At maximum load power all of the reactance has been tuned out and the load is purely resistive.
5. If there is still a substantial difference between the forward and load power, a tapped transformer (step-up or step-down, depending on the load resistance) should be connected between the 1140LA and the transducer. Change the transformer taps in the direction of increasing load power. When the load power equals forward power, the impedance is 50Ω resistive.

Note: Further information on transducer matching, availability of transformers and bias supplies may be obtained by contacting ENI's Engineering Department.

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Chapter 3

Technical Description

3.1 General Description

The 1140LA is designed to amplify signals by 55 dB in the frequency range of 9 kHz to 250 kHz.

The signal from the front panel connector is fed via a length of 50Ω coaxial cable to K5, Pin 4, located on the front panel assembly (1140LA-3331). Relay K5, Pins 4 and 7 are normally closed when K5 is energized, thus allowing the input signal to pass through to the power supply and driver module (1140LA-4333).

The input signal is coupled to T1 (which provides isolation for the 135 VDC power supply), and C1 to the base of Low Noise Transistor Q4. The amplified signal at the collector of Q4 is matched, split, and phase reversed by Transformer T2.

Two equal amplitude, phase-reversed signals are fed to the bases of Q5 and Q6. The power outputs of Q5 and Q6 are combined and matched in phase-reversing Transformer T3. The output at T3 is matched phase, reversed, and split into four equal-amplitude signals by T4, T5 and T6. These signals are then fed to the inputs of the four power amplifier modules.

At each of the four power amplifier modules (RSV-8-4781), hybrid transformers T1, T2, and T3 split the signal into four equal phase-and-amplitude signals. These signals are fed to the bases of eight final power amplifier transistors (Q1-Q8). These transistors are so arranged as to form four parallel sets of two. The outputs at the collectors of each pair are fed through their associated fuses to combining hybrids T4, T5, and T6. Fuses F1-F4 protect the DC power supply should a transistor failure occur.

The outputs from the four power amplifier modules are fed to the output combiner module (RS-16-4801) where transformers T1, T2 and T3 combine and match the signals to form a single 50Ω output.

The meter control circuit (part of 1140LA-4333) connected to the output of the 1140LA measures both the forward and the load power. A front panel switch (S3) selects either the forward or actual load power on the meter display. This is accomplished passively by a three-transformer matrix (T7-T9) that uses a broadband ferrite loaded transmission line coupling mechanism. The output of this matrix is divided into two channels for final computation in an integrated circuit multiplier. The output of the multiplier drives the meter display.

The 1140LA is designed to withstand 400 W of reflected power. Should the reflected power exceed 400 W, a +1 VDC potential is developed across R33. This +1 VDC is sent to the overload relay module (1400-4504). This energizes the overload relay, which, in turn, energizes K2 and K4. With K2 energized, the 135 VDC is removed from the power supply, driver module, and the power amplifier modules. With K4 energized, DS1 illuminates and K5 is de-energized, thereby breaking the input signal path and placing the unit into an overload condition.

Reducing the input drive level and depressing the overload reset button (S1) will make the unit operational once again. In an overheat condition, the normally open thermal switch (TS1) will close, which, in turn, energizes K2 and K4. Depressing the overload button (S1) will have no effect in the overheat mode. After approximately two minutes, the unit will automatically reset itself.

The amplifier power requirements are 115 VAC at 35 A. Regulated DC is supplied by the series pass transistors Q9-Q18 (RS-16-4803) driven by Q8 in a Darlington arrangement. Voltage control and feedback are provided by Q1, Q7 (1140LA-4333) and their associated components. The power supply voltage is adjusted to +13 VDC by R20. The regulated +135 VDC output of the power supply is also fed to Q2 and Q3, which, in turn, provide the lower working voltage for the driver amplifier.

Chapter 4

Maintenance and Calibration

4.1 Periodic Maintenance

The 1140LA power amplifier requires no periodic maintenance. The instrument is unconditionally stable and is fail-safe under all load conditions. Damage can only be externally caused by an input signal in excess of the specified 4 Vpp maximum or operation below 6 kHz. Therefore, this chapter deals only with certain fundamental procedures for fault location and with subsequent re-alignment procedures.

Note: Performance limits quoted are for guidance only and should not be taken for guaranteed performance specifications unless quoted as such in the formal specification.

4.2 Assembly Description

4.2.1 **Power Amplifier** RS-8-4781

The four power amplifier modules are located on the left and right sides of the amplifier "U" chassis. The power amplifiers are connected to the external circuitry by multi-pin connectors located at the top of each module.

To remove the modules, first disconnect the multi-pin connectors and remove the eight hold-down screws on each module.

4.2.2 **Power Supply/Driver** 1140LA-4333

The power supply/driver module is located across the center of the "U" assembly. Its function is to provide pre-amplification to the power amplifiers and provides a re-regulated source of DC voltage for the power supply regulator.

4.2.3 **Power Supply Regulator** RS-16-4803

The power supply regulator module is located across the center of the "U" assembly next to the power supply and driver module. Its function is to supply regulated DC voltage to the power amplifier modules.

4.2.4 **Meter Control** 1140LA-4333

The meter control circuitry is located on the power supply and driver module, which is located across the center of the "U" assembly. Its function is to monitor the output power of the unit and to provide control signals to the overload relay located on the front panel assembly.

4.2.5 **Output Combiner** RS-16-4801

The output combiner module is located across the center of the "U" assembly below the power supply, driver module, and power supply regulator. Its function is to take the outputs of each of the four power amplifiers, combine them, and provide a single 50Ω output to the meter control module.

4.3 Transistor Replacement

To avoid serious shock hazard, ensure that the amplifier is disconnected from the AC power source before removing a panel.

4.3.1 Component Removal

4.3.1.1 Cover Removal

Remove the top cover by removing the six (6) #8-32 screws from each side of the inverted "U" internal assembly.

Each power amplifier module contains one fuse; all four should be visible at this point. If any of the fuses have blown, then the associated power transistors should be replaced to achieve full specified power output. The two transistors are in a vertical line approximately 0.5 inches to the left of the blown fuse.

4.3.1.2 Removal of Inverted "U" Assembly

Use the following procedure to replace faulty transistors:

Detach and remove the inverted "U" assembly from the baseplate as follows:

1. Remove the four (4) #6-32 flathead Phillips screws, located in the four corners of the front panel. Pull the front panel forward until the inverted "U" assembly is clear.
2. Remove the cover on the top of the inverted "U" assembly by removing the six (6) #4-40 screws and lift the cover off.
3. Remove the phono plug on the left side of the meter control assembly, which is located in the center of the inverted "U" assembly.
4. Remove the "BNC" plug on the front edge of the output combiner assembly, which is located in the center of the inverted "U" assembly.
5. Unplug the two 15-pin strip connectors located on the left front of the inverted "U" assembly.
6. Remove the eight (8) #8-32 screws holding the inverted "U" assembly to the baseplate and carefully lift the inverted "U" assembly straight up.

4.3.1.3 Power Amplifier Heatsink Removal

Remove the three (3) #4-40 screws that hold the power supply and driver heatsink assembly to the PA heatsink assembly.

4.3.1.4 Power Amplifier Module Removal

1. Remove the power amplifier module by removing the four (4) #4-40 screws located approximately 0.5 inches to the left of each fuse. Remove the four (4) #4-40 screws, located at each corner of the module.
2. Pull apart the 9-pin strip connector located at the top of the module.
3. Pull the power amplifier module straight out from the inverted "U" assembly.

4.3.1.5 Replacement of RF Power Transistor

1. Remove the four (4) 34-40 screws and associated hardware from the defective transistors.
2. Remove the defective transistors and replace them with two new transistors.

Ensure that the mica washer is placed between each transistor and the PA heatsink assembly. Also ensure placement of the nylon shoulder washer over each screw on the outside of the heatsink before replacing any metal hardware.

3. Tighten the #4-40 screws until the transistors are tightly secured.
4. Replace the power amplifier module (RS-8-4781) by carefully aligning the eight transistor sockets with pins on each of the transistors. Press the module down until it sets on the eight #4-40 spacers on the PA heatsink assembly.
5. Replace the four #4-40 screws, attaching the PA heatsink to the PS and driver heatsink, forming the inverted "U" assembly.
6. Replace the inverted "U" assembly on the baseplate. Re-secure all connectors previously removed.
7. Return the cover to position over the inverted "U" assembly and re-install the six #4-40 screws.
8. Replace the front panel and re-secure with the four #6-32 flathead Phillips screws. Replace the cover.

4.4 Troubleshooting

Refer to this simplified table should you believe that the 1140LA is not functioning properly. This table is an itemized listing of the most frequent type difficulties anyone might encounter while operating the 1140LA.

Troubleshooting Guide

Symptoms	Probable Cause	Recommendations
Fan does not run with circuit breaker in the on position.	Main line fuse or circuit breaker is insufficient to handle the current draw.	Make sure the line fuse or circuit breaker is capable of 35 A capacity minimum at 115 V.
Overload light comes on during amplifier operation.	Output load is improperly tuned.	Follow load-tuning procedure, section 2.5.
Circuit breaker resets to the OFF position during amplifier operation.	Output load is mis-tuning.	Follow load-tuning procedure, section 2.5.
	Excessive power output level.	Reduce output level.
Push-to-reset button does not turn overload light off.	Amplifier has overheated and thermostatic control has taken over.	Allow unit to cool down and overload light will turn off automatically. Check to see that the fan is turning and intake is free of obstructions or dirt build-up. Check input air temperature to verify that it is not excessive; check the output load tuning; reduce the output level.
Power output is below normal for a given level setting.	Load mis-tuning.	Check for mis-tuning.
	Faulty transistors.	Check for blown fuses on circuit model RS-8-4781. If fuses are blown, faulty transistors are indicated and must be replaced per section 4.3.1.5 (or returned to factory).

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Appendix A

1140LA Specifications

The following appendix lists complete physical and operation specifications for the 1140LA.

1140LA Specifications

Revision Level: B

Frequency Coverage	9 kHz to 250 kHz
Gain	55 dB (nominal)
Gain Variation	±1 dB from 9 kHz to 250 kHz (measured at 1000 W).
Drive Source Requirement	Any signal generator, function generator or oscillator capable of up to 2.0 Vpp output into 50Ω.
Maximum Power Output	09 kHz to 11 kHz: 1.2 kW 11 kHz to 75 kHz: 1.6 kW 75 kHz to 180 kHz: 1.5 kW 180 kHz to 250 kHz: 1.1 kW
Input Impedance	50Ω
Matched Output Load Impedance	50Ω; the unit will supply full power to any load impedance between 40Ω and 60Ω resistive.
Thermal Protection	Thermostatic protection provides automatic cutout should the power transistors overheat due to load mismatch or cooling system failure. Automatic reset upon cooling.
Power Required	115 VAC, 50-60 Hz, 35 A maximum.
Cooling System	Forced Air
Power Meter	True-average reading accurate to better than ±4% of full scale (0-2000 W). Front panel switch permits measurement of the forward power (power leaving the amplifier) and load power (actual power absorbed by the load).
Mismatch Protection	The unit will tolerate up to 400 W of power reflected from any load impedance subject to operation of the thermal protection. Instantaneous cutout is provided should the mismatch exceed allowable limits.
Front Panel Controls	AC On/Off, Forward/Load Meter Select, Overload Reset
Front Panel Indicators	Power Meter Scale, Overload Indicator
Front Panel Connectors	Type "BNC" RF Input (4 Vp-p max.) connector and RF Output connector.
Rear Panel Connector	AC rear panel linecord
Operating Temperature	0° to 45° Ambient
Size	8 3/4" x 17" x 20 1/4" 22 cm x 43.2 cm x 51.4 cm
Weight	50 lbs.; 22.7 kg
Rack Mounting	19-inch rack adapters are provided.

Appendix B

Service Appendix

This appendix provides drawings and schematics of the major circuit boards plus a parts list for 1140LA.

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