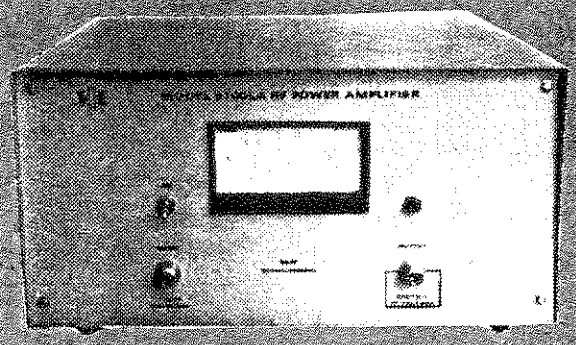
OPERATING AND SERVICE INSTRUCTIONS
MODEL 3100LA



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When warranty service is required, the instrument must be returned transportation charges pre-paid to the factory or our authorized service facility. If, in our opinion, the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.

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CHAPTER 1

GENERAL INFORMATION

1.1 INTRODUCTION

The ENI Model 3100LA is an all solid state amplifier which has a flat frequency response from 250kHz to 150MKz. it provides up to 100W of linear power with low harmonic and intermodulation distortion. Gain is 55dB nominal, with variation of less than ± 1.5dB over the entire frequency range. Input and output impedance are 50ohms and the unit may be driven to full power output by most RF synthesizers, signal generators and swept signal sources.

The ENI Model 3100LA will deliver its rated power output into any load impedance, regardless of match. Built-in protection circuitry will absorb the power reflected from a mismatched load without causing failure or oscillation.

Output RF voltage is displayed on the front panel meter. The Model 3100LA is packaged for bench mounting and is shipped with rack mounting adapters. Its integral power supply and cooling operate from a 100/ 107.5/ 1150/ 120 or 200/ 125/ 230/ 240VAC 50/60Hz main supply.

The Model 3100LA will raise the power level of signal sources and generators without requiring tuning or bandswitching. The Class A linear circuitry will amplify signals of AM, FM, SSB, TV and complex modulations limited only by their peak input and bandwidth, with minimum distortion.

1.2 SPECIFICATIONS

Physical and electrical specifications are listed in Table 1-1.

1.3 INSTRUMENT IDENTIFICATION

Each amplifier is identified by a serial number tag on the back panel of the unit. Both the model number and the serial number should be given in any correspondence with the company.

TABLE 1-1. SPECIFICATION

FREQUENCY COVERAGE:	250kHz to 150MHz
GAIN	55 dB Nominal
GAIN VARIATION	± 1.5 dB
MAXIMUM LINEAR OUTPUT:	More than 100W from 250kHz to 150MHz. More than 50W from 150MHz to 180MHz and from 100kHz to 150kHz.
HARMONIC DISTORTION:	All harmonics more than 24 dB below main signal at 75W output.
TYPICAL 3RD ORDER INTERMODULATION INTERCEPT POINT:	+59dBm
INPUT/OUTPUT IMPEDANCE:	50 ohms
INPUT VSWR:	Less than 1.5
OUTPUT VSWR:	Less than 2.5
NOISE FIGURE:	10dB Maximum
STABILITY:	Unconditionally stable; unit will not oscillate for any condition of load and source impedance.
PROTECTION:	Unit will withstand more than 16 dB of overdrive (input signal of 1V RMS) for all output load conditions.
OUTPUT METERING:	Average reading voltmeter calibrated in RMS volts for a sine wave with an accuracy of ±4% of full scale 0-100 volts; also calibrated in Watts into 50 ohms (0-200W)
POWER REQUIREMENTS:	100/ 107.5/ 115/ 120 or 200/ 215/ 230/ 240 VAC; ±8%, 50-60Hz, 1100W
OPERATING TEMPERATURE:	0° to +40°C
SIZE:	8 3/4 x 17 x 17 in. 22.2 x 43.2 x 43.2 cm
WIEGHT:	60 lbs; 27.3 kg.
CONNECTORS:	Type N
RACK MOUNTING:	Adaptors Provided

CHAPTER 2

PREPARATION

2.1 INITIAL INSPECTION

2.1.1 Mechanical Check

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

2.1.2 Claim for Damage

If the Model 3100LA is mechanically damaged or fails to meet specification upon receipt, notify ENI or our representative immediately. Retain the shipping carton and packing material for the carriers inspection as well as for subsequent use in returning the unit if necessary.

2.1.3 Performance Check

The electrical performance of the Model 3100LA should be verified as soon as possible after receipt. The following is a performance check that is suitable for incoming inspection.

a. Set the amplifier front panel power switch to the ON position and check that the pilot light illuminates and the fan motor is operating normally.

b. Perform RF Output Power Test, Section 5.1.4.

2.2 PREPARATION FOR USE

2.2.1 Power Requirements

The Model 3100LA requires a 50-60Hz, single phase, power source capable of supplying 1100W. The unit must be adjusted to accommodate the available AC line voltage. This is accomplished by connecting the jumpers to the correct terminals of the terminal strip TB1, in accordance with Table 2-1.

Terminal strip TB1 is mounted on the baseplate at the rear of the unit and is accessible by removing the four (4) #6-32 screws from the rear panel and sliding it straight out.

Disconnect the line cord from the power main when adjusting the operating voltage. Failure to connect jumpers to their proper terminals may result in severe damage to the instrument.

2.2.2 Power Cable Ground Protection

To protect operating personnel, the ENI Model 3100LA is equipped with a three conductor cable consisting of a black hot line, a white common line, and a green chassis ground. Then using a two prong adapter, the green tap on the adapter must be connected to earth ground.

Table 2-1.

LINE VOLTAGE SELECTION CHART

Nominal Line Voltage	Jumpers		AC Hot Black	AC Neutral White
	White	Black		
100VAC	1-2	3-4	1	4
107.5VAC	1-2	5-6	1	6
115VAC	1-2	7-8	1	8
120VAC	1-2	9-10	1	10
200VAC	2-3	Remove Jumper	1	4
215VAC	2-5		1	6
230VAC	2-7		1	8
240VAC	2-9		1	10

CHAPTER 3
OPERATION

3.1 FUNCTIONAL DESCRIPTION

The ENI Model 3100LA is a linear Class A amplifier capable of increasing the output of any signal generator, frequency synthesizer, sweep generator or laboratory signal source from 250 kHz to 150 MHz.

The Model 3100LA is completely protected against damage due to load mismatch provided that the input RF level does not exceed 1 volt RMS or 1.4 volts peak. If the attached signal source is capable of generating substantially more than this input voltage, please use caution in adjusting it. The Model 3100LA will saturate well before the maximum input voltage and there will be no increase in output power at that point.

The 3100LA is unconditionally stable. Any impedance can be connected to the input and output of the amplifier, without causing oscillation.

The 3100LA will deliver its rated power to any load impedance regardless of match. Load mismatch will cause RF power to reflect back to the amplifier. The unit is designed to withstand 100 percent reflected power (a pure reactance open or short circuit load will cause 100 percent reflected power) continuously without damage.

An output meter is provided to indicate the average output voltage (calibrated in RMS) as well as the power output when the unit is connected to a 50 ohm load. Since the meter responds only to average output, the modulation characteristics of the input signal must be taken into account when interpreting the meter readings. For example, the amplifier may be in saturation during the ON portion of a pulse yet the meter reading will be low due to the low duty cycle of the pulse input.

3.2 CONTROLS, INDICATORS AND CONNECTORS

Front and rear panel devices are described in Table 3-1.

3.3 OPERATING PROCEDURE

Refer to the following procedure as a guide to operating the Model 3100LA.

a. The input and output are connected via the front panel type N connectors to the signal source and load respectively.

b. The input signal should be increased gradually while observing the output voltage on the output RF voltmeter.

c. When the Model 3100LA is connected to a 50 ohm load, the CW power output of the unit may be read directly from the meter scale.

d. When the amplifier is connected to an arbitrary or unknown load impedance, the following procedure will insure a low distortion power output.

   1. Disconnect the output load cable from the output type N connector of the Model 3100LA.

   2. If the CW output voltage is less than 100 volts RMS, the unit is operating at low distortion regardless of the load impedance.

   3. Reconnect the output of the amplifier to the load.

e. If the output of the amplifier is monitored by a high frequency oscilloscope or spectrum analyzer, the input signal may be increased until the point of maximum undistorted power output is observed.

3.4 PRECAUTIONS

a. The input and output of the Model 3100LA should not be connected together. This will cause oscillation and may damage the input preamplifier.

b. The Model 3100LA should not remain connected to an antenna when the unit is not in use. If thunderstorms are likely, it would be prudent to earth ground the unit's case.

c. When the input signal voltage of the signal source is unknown, insert an attenuator between it and the Model 3100LA input.

TABLE 3-1. FRONT AND REAR PANEL DEVICES

DEVICE	FUNCTION
Power Switch	Throwing toggle to "ON" position connects fan and power supply to main power source.
Meter	Indicates output voltage and also power for a 50 ohm load. The meter circuit responds to the average RF voltage and is calibrated in RMS volts for a sine wave. The voltage pick-off is mounted directly behind the front panel at the output connector.
Input Connector	Type N for connection of the driving generator. Input impedance is 50 ohms. No more than 0.25 volts is required to obtain saturated output. Up to 1.4 volts peak can be supplied without causing damage; however, no additional power output can be expected.
Output Connector	Type N for connection of amplifier output to load.
Fuse	Holder required 3 AG size, slow blow type fuse: 15A
Line Cord	Three prong type plug with safety ground pin connected to cabinet.

CHAPTER 4
PRINCIPLES OF OPERATION

4.1 GENERAL

The Model 3100LA achieves its high level of power output by combining the power outputs of a number of individual transistor amplifiers. The hybrid combining technique permits each amplifier to operate independently of all the others and to supply its power output contribution without regard to the other amplifier stages. This isolation is afforded by ferrite loaded transformer hybrids connected at the input and output of each transistor pair.

Each amplifier module is designed to have an input and output impedance of 50 ohms. Therefore, the individual modules can be disconnected and tested independently.

Highly linear Class A transistors are used throughout the amplifier. Their linearity is augmented by negative feedback networks connected to each stage. The high power output transistors have nichrome resistors deposited at their emitter terminals to increase linearity and reliability.

The amplifier is powered by a low noise DC regulator of dissipative design. Over-temperature protection is built into the power supply and cooling fan.

4.2 BLOCK DIAGRAM DESCRIPTION

A block diagram of the entire Model 3100LA is shown in figure 4-1. The electrical schematics are shown in Figures 7-1 and 7-2. Input signal from the front panel type N connector is fed to the driver amplifier module (3100LA-14401). The driver has four equal amplitude and phase outputs. Each driver channel has a typical gain of 28 dB and a minimum power output of 1.8 watts. The driver outputs are fed via coaxial cables to the four power amplifier modules (3200L-4732).

Each power amplifier has a gain of 18 dB and is capable of producing more than 35 watts of power at its output. These outputs are summed and isolated from each other in the output combiner (3100LA-14002). RF output is fed into the output type N connector and to the RF voltmeter module (3100LA-14403). The RF voltmeter module provides a DC signal to the front panel meter, proportional to the output level. The power distribution (3100LA-12401) provides cooling and DC power to the entire unit. The five regulated power supplies are each capable of supplying 26.4 volts at a current of 5 amperes.

4.2.1 Driver Amplifier Module 3100LA-14401

Input RF signal is fed through connector J2 to the base of low noise transistor Q1 through the attenuator resistors R1, R2 and R3. Additional amplification is provided by tandem stages Q2, Q3, Q4, and Q5. The power output of Q5 is then split through the 4-way hybrid splitter consisting of T2, T3 and T4. The output power at each of the connectors J3 through J6 are matched in amplitude and phase.

4.2.2 Power Amplifier Module 3200L-4732

The input signal is fed through connector J7 attenuated by resistors R1, R2, and R3 and matched by transformer T1 and capacitor C1 to the base of the driver transistor Q1. The output of Q1 is split into four equal phase and amplitude signals by transformers T2, T3, and T4. Transformers T5 through T8 match the output of the driver stage to the bases of the output power transistors Q2 through Q5. The equal amplitude and phase outputs of these transistors are coupled through a four-way hybrid combiner consisting of transformers T13, T14 and T15 and matched by transformers T16 and capacitor C27 to the output connector J11.

4.2.3 Output Combiner Module 3100LA-14402

RF Power is injected into the combiner at connectors J15 through J18 and is summed by hybrid transformers T2 and T4. Transformer T1 and capacitor C1 match the output impedance of the combiner to 50 ohms. Resistors R1, R2 and R3 will dissipate power only if the power amplifiers are unmatched or a failure has occurred. The total summed output of all four RF signals is available at connector J19, the final output of the combiner.

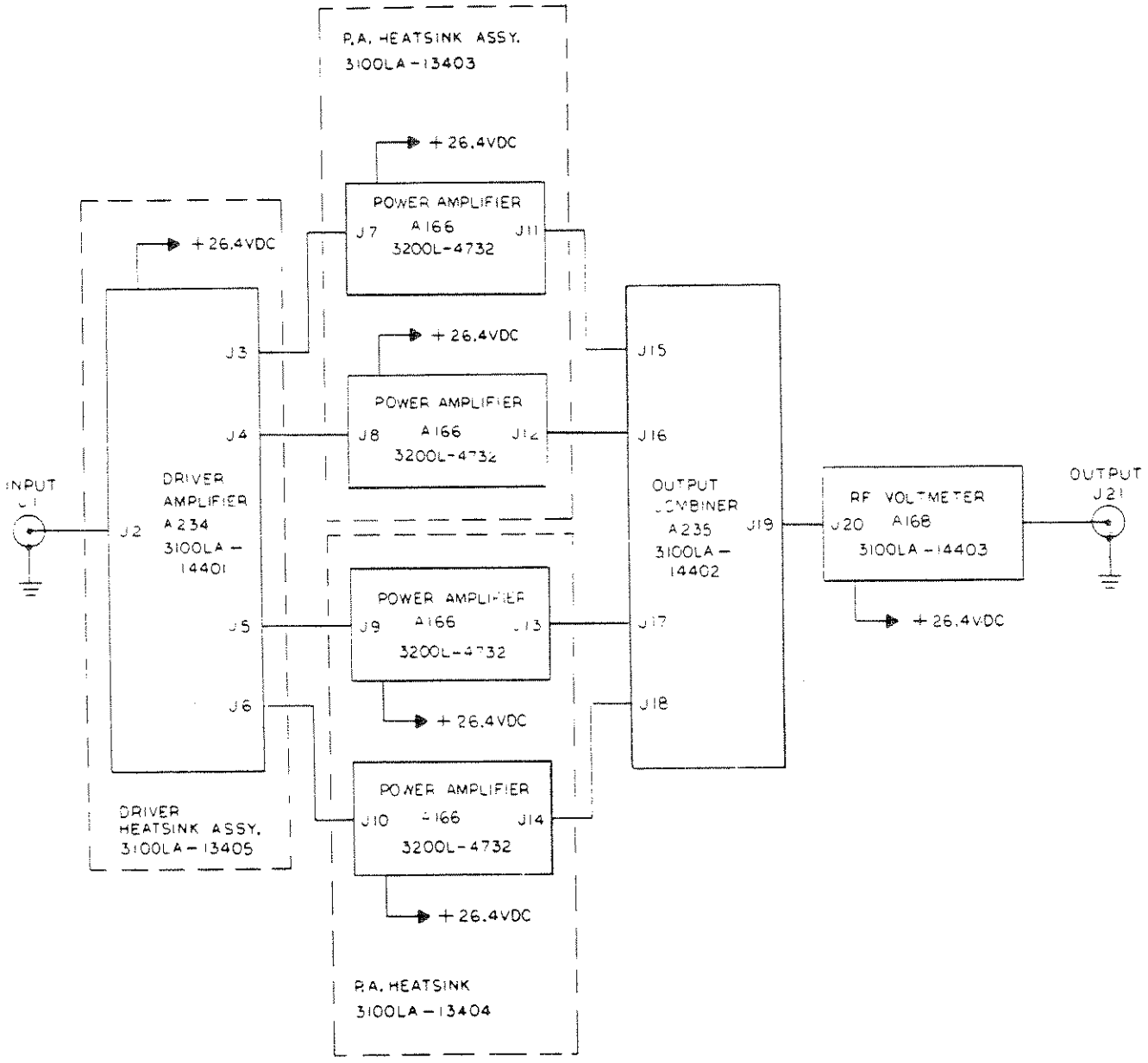


Figure 4-1. Block Diagram

4.2.4 RF Voltmeter Module 3100LA-14403

Resistors R1, R2 and R3 make up a high impedance voltage divider which is connected to the RF output voltage at the 3100LA output connector J21. A fast switching hot carrier diode D1 rectifies the RF voltage from the divider. A gimmick (etched on the PC board) compensates for the high frequency roll off of the diode D1. Resistors R4 and R5 and capacitor C3 filter the rectified RF and convert it to DC which is fed to the front panel meter.

4.2.5 Power Distribution 3100LA-12401

The AC power is distributed from terminal block TB1 to the power transformer T1. The white and black jumpers on TB1 allow selection of line voltages for the primary of transformer T1 (See power connections section 2.2.1). The secondary of T1 supplies voltage to three full wave bridge rectifiers CR1, CR2, and CR3 on the baseplate assembly (3100LA-13401). The output of each rectifier is connected to capacitor C1, C2, and C3 respectively. The outputs of CR1, CR2 and CR3 are fed to the collectors of Q1, Q2 and Q3 located on the power supply assemblies (3100LA-13406). These power supply assemblies form a total of five series pass regulators of the dissipative type and are connected to five integrated circuit voltage regulators, IC1 through IC5, located on the power supply regulator board (A236) 3100LA-14404. The voltage output of each supply is adjusted by potentiometer A235 R21 through A236 R25. Each of the five power supplies has its own short circuit protection adjusted by potentiometer A236 R16 through A236 R20 and are factory set.

CHAPTER 5
PERFORMANCE TEST PROCEDURES

5.1 PERFORMANCE TESTS

5.1.1 General

There are three tests required to check the operation and performance of the Model 3100LA. These tests are as follows: the gain and gain variation test, the RF output power test and the RF output distortion test.

5.1.2 Test Equipment Required

The following test equipment is required for accomplishing the Model 3100LA performance tests. Equivalent substitutes for recommended models may be used.

a. Oscilloscope - Tektronix Model T921

b. Sweep/Signal Generator - Wavetek 2001

c. RF Generator/Sweeper - HP-8601A

d. 50 ohm Detector - HP8471A
- or Wavetek D151

e. Attenuator, 30 dB, 500 Watts - Bird 8325

f. Attenuator, 30 dB, 200 Watts - Bird 8322

g. Attenuator, 10 dB, 20 Watts - Narda 766-10

h. Power Meter - HP 435B, 8482B power sensor with matching 30dB attenuator

i. Spectrum Analyzer - HP 140T Display Unit
- HP 8554L Spectrum
- Analyzer-RF Section
- HP8552A Spectrum
- Analyzer-1F Section

5.1.3 Gain and Gain Variation Test

The purpose of this test is to verify the gain and gain flatness versus frequency of the Model 3100LA.

5.1.3.1 CALIBRATION OF SET-UP

a. Set up the test equipment as shown in figure 5-1.

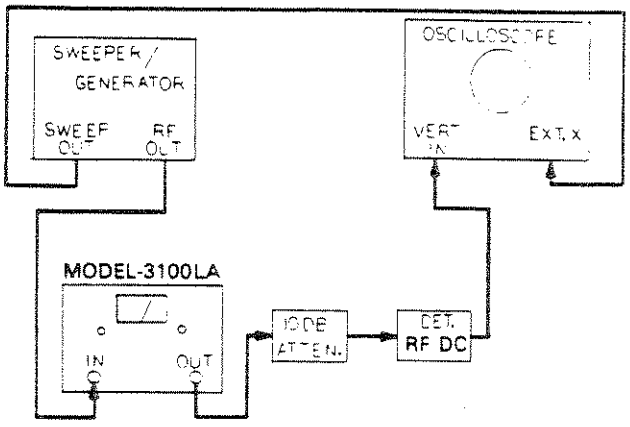


Figure 5-1. Gain and Gain Variation Test Set-Up

b. Set the oscilloscope to DC, time/CM to Ext. X, and vertical gain to 10 mV/CM.

c. Set Sweep/Generator to the S/S mode with start frequency at 1 MHz and the stop frequency at 150 MHz.

d. Disconnect the Model 3100LA from the set-up and connect the Sweeper/Generator RF output directly to the 10 dB attenuator.

e. Adjust the output level of the Sweeper/Generator for full vertical deflection of the oscilloscope face.

f. Calibrate the scope face to show 3 dB in 1 dB steps and mark the traces with a grease pencil.

g. 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. Reduce the output an additional 5 dB with the vernier control.

h. Reconnect Model 3100LA into the test set-up of Figure 5-1.

i. Repeat steps (a) through (h) using the HP8601A Sweep/Generator with start frequency at 250 kHz and stop frequency at 1 MHz.

5.1.3.2 MEASUREMENT PROCEDURE

a. Turn on Model 3100LA power switch.

b. Observe the gain versus frequency sweep on the oscilloscope.

c. The average gain should be 55 dB (within 2 dB).

d. The gain variation should be within the 3 dB markings as shown on the oscilloscope face.

5.1.4 RF Power Output Test

The purpose of the RF power output test is to verify that the Model 3100LA will deliver its rated power output over the frequency range of 0.25 MHz to 150 MHz.

5.1.4.1 MEASUREMENT PROCEDURE

a. Set-up the test equipment as shown in Figure 5-2.

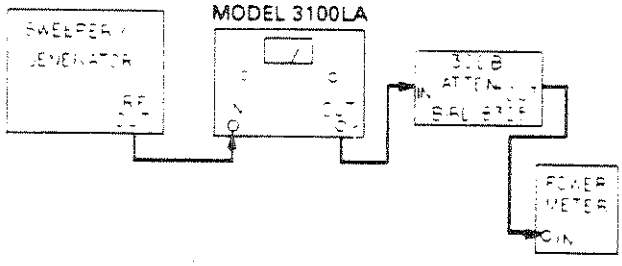


Figure 5-2. RF Output Power Test Set-Up

b. Set the power meter to the .3 watt range. With the 30 dB series attenuator, this corresponds to a full scale deflection of 300 watts.

c. Set the Sweep/Generator Wavetek Model 2001 to the CW mode, level to +10 dBm and frequency to 150 MHz.

d. Slowly decrease frequency while observing the power meter. Note that at every frequency down to 1.0 MHz the power output is greater than 100 watts.

e. Using the HP model 8601A Sweep/Generator in the CW mode, level at +10 dBm, frequency set at 1 MHz, slowly decrease frequency while observing the power meter. Note that at every frequency down to 250 kHz the power output is greater than 100 watts.

5.1.5 RF Output Distortion Test

The purpose of this test is to verify that the harmonic distortion of the Model 3100LA and hence its linearity is within specified limits.

5.1.5.1 MEASUREMENT PROCEDURE

a. Set-up the test equipment as shown in Figure 5-3.

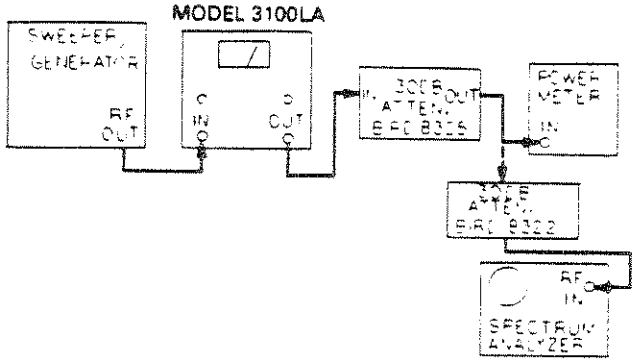


Figure 5-3. RF Output Distortion Test Set-Up

b. Set the power meter to .10 watt range. With the 30 dB series attenuator, this corresponds to a full scale deflection of 100 watts.

c. Set the Generator/Sweeper to CW and frequency to 150 MHz.

d. Adjust the Generator/Sweeper output level so that the output power indicated on the calorimetric power meter is 75 watts.

e. Disconnect the cable from the power meter and connect to the Spectrum Analyzer through a 30 dB attenuator.

f. Observe that all harmonics are at least 24 dB below the fundamental.

g. Repeat steps a. through f. with the generator set at 10 MHz, 30 MHz, 80 MHz, 110 MHz, and 130 MHz, in succession.

h. Repeat steps a. through f. with HP model 8601A Sweep/Generator set at 250 kHz.

CHAPTER 6
TROUBLE SHOOTING AND REPAIR

6.1 TROUBLESHOOTING

The first step in isolating a malfunction is to review the conditions under which the symptoms were observed and check that it was not caused by the external cabling or associated test equipment. Before proceeding to the detailed test procedure, a complete visual inspection of the 3100LA should be accomplished. Check for burnt or discolored components and broken wires and note any details which might localize the malfunction.

Commonly found symptoms together with their probable cause and troubleshooting recommendations are listed in the Troubleshooting Guide, Table 6-1.

TABLE 6-1. TROUBLESHOOTING GUIDE

SYMPTOM	PROBABLE CAUSE	RECOMMENDATIONS
Power Lamp does not light	Burned out bulb	Check for 26.4 volts across bulb.
	Defective power supply	Perform test in section 6.3.2.
	Thermal switch open	If TS1 contacts do not close after unit has cooled, replace thermal switch.
	Defective power switch	Replace switch (S1).
	Blown fuse	Replace fuse with 15 amp slo-blown 3AG.
Power Lamp dim	Power supply out of adjustment	Perform power supply adjustment section 6.3.2.
	TB3 wired incorrectly	Check section 2.2.1.
Blown fuse	Defective power supply	Perform test in section 6.3.2.
	Wrong fuse	Verify that 15 amp slo-blown 3AG Fuse is installed.
	Defective line cord or AC wiring	Visually inspect for signs of insulation breakdown.
No RF output or gain	Broken input or output type N connector	Visually inspect connectors for broken pins.
	Defective input or output internal cables	Visually inspect cables at input and output connectors.

TABLE 6-1. TROUBLESHOOTING GUIDE (continued)

SYMPTOM	PROBABLE CAUSE	RECOMMENDATIONS
Low RF Output or Gain	Defective input cables	Visually inspect cables.
	Faulty Power Supply Adjustment	Perform power supply adjustment section 6.3.2.
	Defective RF Amplifier Module	Perform procedure for locating faulty RF module, section 6.2.
Excessive Distortion	Defective Power Amplifier Module	Perform procedure for locating faulty RF module, section 6.2.
Amplifier Overheating	Defective Fan	Check that fan is operating properly.
	Ambient air is above specifications.	Measure the ambient temperature.
	Defective Power Supply	Perform test in section 6.3.2.
Incorrect Front Panel Meter Indication	Improper Calibration or defective RF voltmeter board (A168)	Perform RF voltmeter adjustment section 6.2.3.
	Defective Meter	Replace Meter
Meter reads up scale with input and output cables removed	Sticking meter movement	Replace Meter
	Unit oscillating because of loose or defective internal coax cable connections.	Tighten all RF connectors
Excessive ripple on gain versus frequency sweep of amplifier	Ripple on power supply	Perform DC power supply test, section 6.3.2.

6.2 LOCATING FAULTY RF MODULE

6.2.1 General

The input and output impedance of each of the RF modules in the Model 3100LA is 50 ohms. Therefore, they can be disconnected from each other at any point and tested independently. The following sections provide a method of locating a faulty RF module.

6.2.2 Isolating Amplifier Problem

a. Set up the test equipment as shown in Figure 5-2 for RF power output test.

b. Set the RF generator to CW, the frequency to 10 MHz and output level to 0 dBm. If the Model 3100LA output power level is less than 100 watts, as indicated on the power meter, a faulty RF module may exist.

c. With an output of 100 watts or less, disconnect the coaxial cable from J11 of the power amplifier module (3200L-4732) and observe the output power of the 3100LA as indicated on the power meter. The power will drop 44% (±4%) for a properly functioning power amplifier. Reconnect the coax cable to J11 and remove the coax cable from J12. Observe the power drop. Repeat the identical procedure for J13, and J14.

If the power output drops an equal amount (within 4%) as each cable is removed the fault is in either the four way output combiner (3100LA-14402) or the driver amplifier section (3100LA-14401). Perform tests in section 6.2.2.1 and 6.2.2.3.

If the output power does not drop or drops less than normal, as each of the cables is removed, the fault is in the power amplifier associated with that cable. Perform tests in section 6.2.2.2.

6.2.2.1 FOUR WAY COMBINER TEST 3100LA-14402

Set the low level sweep/signal generator to cover 1 to 150 MHz. Connect the output of the sweep generator to the output connector J19.

Connect the RF detector to jack J15 on the output combiner and three 50 ohm dummy loads to connectors J16 through J18. Measure the total loss through the combiner. If the measured response is 6.3 ±0.3 dB, then the J15 channel is operating properly.

To check the remaining channels connect the RF detector to each connector J16 through J18 successively, while terminating all the remaining connectors with the three 50 ohm loads. Each channel should have the same loss response of 6.3 ±0.3 dB as indicated for connector J15.

6.2.2.2 RF POWER AMPLIFIER MODULE TEST 3200L-4732

Two tests are required to test an RF power amplifier module. They are a bias voltage check and a low power sweep test. In order to perform these tests the following test equipment is required. Equivalent substitutes may be used for the recommended models.

1. DVM - Fluke 8000A
   - or Fluke 8100A
2. Sweeper/Generator Model 2001
3. Oscilloscope - Tektronix T921
4. 50 ohm Detector - Wavetek D151
5. Attenuator, 10 dB, 20 Watts - Narda 766-10
6. Power Supply, Lambda LK-361-FM
7. Cooling Fan - Rotron Type 113

6.2.2.2.1 Bias Voltage Check

a. Adjust the power supply to +26.4 volts.

b. Connect the power supply minus (−) lead to the heatsink. Connect the positive (+) lead of the power supply to the red wire of the power amplifier to be tested.

c. Position the cooling fan so that the cooling air is directed at the heatsink quadrant to which the power amplifier module under test is mounted.

d. Verify that the emitter voltage of transistor Q1 is +3.0 VDC ±.15 VDC and the emitter voltages of Q2-Q5 are +2.80 VDC ±.15 VDC. (See Figure 7-1).

e. If all voltages are within tolerance proceed to the low power sweep test.

6.2.2.2.2 Low Power Sweep Test

a. Set-Up the test equipment as shown in Figure 6-1.

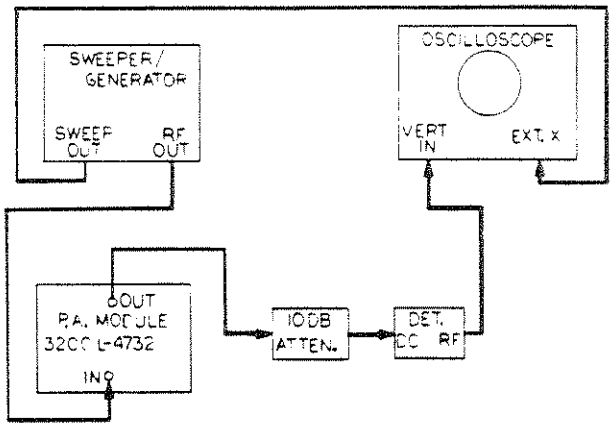


Figure 6-1. Low Power Sweep Test Set-Up

b. Set oscilloscope to DC, Time/CM to Ext. X and vertical gain to 10mV/CM.

c. Set the Sweeper/Generator to the S/S mode with the start frequency at 1 MHz and stop frequency at 150 MHz.

d. Disconnect the power amplifier module under test from the test set-up and connect the sweeper/generator RF output directly to the 10 dB attenuator.

e. Adjust the output level of the sweeper/generator for full vertical deflection on the oscilloscope face.

f. Calibrate the scope face to show 2 dB in 1 dB steps and mark the traces with a grease pencil. pencil.

g. Return sweeper/generator output level to full deflection. Rotate the step attenuator on the sweeper/generator (CCW) so that the output is reduced by 10 dB; reduce the output an additional 9 dB with the vernier control.

h. Reconnect the power amplifier module under test per figure 6-1.

6.2.2.2.3 Measurement Procedure

a. Turn on power supply connected to power amplifier module under test.

b. Observe the gain versus frequency sweep on the oscilloscope.

c. The average gain should be 19 dB.

d. The gain variation should be within the 2 dB markings as shown on the oscilloscope face.

e. If the average gain or gain variation do not comply with steps C and D the module is faulty.

6.2.2.3 DRIVER AMPLIFIER MODULE 3100LA-14401

If the test in section 6.2.2.2 shows that the power amplifier modules (3200L-4732) are not faulty and the four-way combiner test in section 6.2.2.1 shows that the four-way output combiner is not faulty, then the driver is suspect. A check of the power supply per section 6.3.2 should be performed to conclude positively that the driver amplifier module is faulty.

6.2.3 RF Voltmeter 3100LA-14403

The Model 3100LA output meter should be accurate to within ±8 watts of the actual output power. If the meter is out of calibration, the following alignment procedure should be used:

6.2.3.1 ALIGNMENT PROCEDURE

a. Set-up the test equipment as shown in Figure 5-2.

b. Set the generator/sweeper to CW, and the frequency to 1 MHz. Adjust the output level so that 100 watts is indicated on the power meter.

c. Adjust potentiometer R5, located on the RF voltmeter module so that the front panel meter indicates 100 watts.

d. Set the generator/sweeper to 150 MHz and adjust the output level so that 100 watts is indictated on the power meter. Move resistor R2 on the RF voltmeter module from side to side (closer or further away from the gimmick trace etched on the top of the module) until the front panel meter indicates 100 watts.

6.3 DC POWER SUPPLY

6.3.1 General

The following test and adjustment procedure should be performed after the replacement of the power supply assembly consisting of regulator board (3100LA-14404) and power supply (3100LA-13406) or if the power supply voltage is out of adjustment.

The power supply regulator board (A-236) is divided into five separate voltage regulators. The individual controls, test points, voltages and destinations are shown in table 6-2.

6.3.2 Test Procedure

a. To test the power supply the following equipment is required. Equivalent substitutes may be used for the recommended models.

1. Digital Voltmeter - Fluke 8000A
   - or Fluke 8100A
2. Oscilloscope - Tektronix T921

b. Disconnect all external cables from the Model 3100LA.

c. Connect the minus (–) DVM lead to the chassis and the positive (+) lead to terminal block TBI PIN 1 on the power supply regulator. The DVM should indicate 26.4 volts DC. Adjust A236R21 until voltage is within this range.

d. Connect the oscilloscope to the terminal block. The ripple on the supply should be less than 25 millivolts.

e. Repeat procedure for TB1 and TB2 all pins and adjust supplies per Table 6-2.

TABLE 6-2. REGULATOR CONNECTIONS

CONTROL	VOLTAGE TEST POINTS	VOLTAGE	DESTINATION
A236R21	TB1 pin 1		PA1
A236R22	TB1 pin 2		PA2
A236R23	TB1 pin 4; TB2 pins 1, 2		Driver, RF Voltmeter, DS1
A236R24	TB2 pin 3		PA3
A236R25	TB2 pin 4	26.4	PA4

6.4 DISASSEMBLY PROCEDURES

6.4.1 General

The following disassembly procedures describe the recommended method of removing assemblies and printed circuit modules for the purpose of test, repair and/or replacement. Careful handling should be used to avoid damaging the boards.

6.4.2 Tools Required

The Model 3100LA is assembled with standard hardware. Screw sizes range from #2-56 to #8-32 and are of the Phillips or slotted types. Standard tools are required for their removal.

6.4.3 Removal of Cover

Remove all screws, (12 #8-32 and 4 #6-32), located on both sides of the cover and the 8 #4-40 Philips head screws located on top of the cover. Carefully lift the cover up.

To replace the cover, simply reverse the procedure. When replacing the cover, care should be taken that the cover does not come into contact with the internal cabling.

6.4.4 Driver Amplifier Heatsink Assembly 3100LA-13405

a. Remove the six #4-40 screws holding the module to the power amplifier heatsink assemblies.

b. Remove the input cable from J2 on the driver amplifier.

c. Remove the four output cables from J3 to J6.

d. Remove the +26.4 VDC input wire (red) from A236TB1, pin 4 (D).

6.4.5 Power Supply Regulator Board (A236) 3100LA-14404

a. Remove cover support brackets by removing five #4-40 screws per bracket.

b. Remove all red wires from A236 terminal blocks TB1 and TB2. Note position of wires for reassembly.

c. Unplug all molex connectors from the underside of the board.

6.4.6 Four Way Output Combiner (A236) 3100LA-14402

a. Remove the four input cables from J15-J18 and the output cable from J19.

b. Remove the four #4-40 screws holding the module to the power amplifier heatsink assemblies.

6.4.7 Power Amplifier Heatsink Assemblies 3100LA-13403 or 13404

a. To remove either of the heatsink assemblies (3100LA-13403 or 13404) it is necessary to remove the driver amplifier heatsink assembly (3100LA-13405) the power regulator board (3100LA-14404) and the four way output combiner (3100LA-14402) per sections 6.4.4, 6.4.5 and 6.4.6.

b. Remove two #4-40 screws holding thermo-

c. Remove the five #6-32 screws from the base-

6.4.8 Power Supply Assembly 3100LA-13406

a. Remove driver amplifier heatsink assembly (3100LA-13405) and power supply regulator board (3100LA-14404) per sections 6.4.4 and 6.4.5.

b. Drop rear panel by releasing its 4 #6-32 screws.

c. Remove two #6-32 screws holding the assembly to the baseplate.

6.4.9 Power Amplifier Module (A166) 3200L-4732

a. Remove the heatsink assembly (3100LA-13403 or 13404) (see section 6.4.7).

b. Remove the four #4-40 screws and nuts which hold the module to the heatsink.

c. Remove five #8-32 reduced nuts which hold the transistors to the heatsink.

d. Carefully lift the board from the heatsink.

e. During assembly, care must be taken to insure proper alignment of the transistors and that all wires are properly dressed.

CHAPTER 7
SCHEMATICS AND PARTS LIST

7.1 SCHEMATIC DIAGRAMS

Complete schematic diagrams appear in figures 7-1 and 7-2.

7.2 PARTS LIST

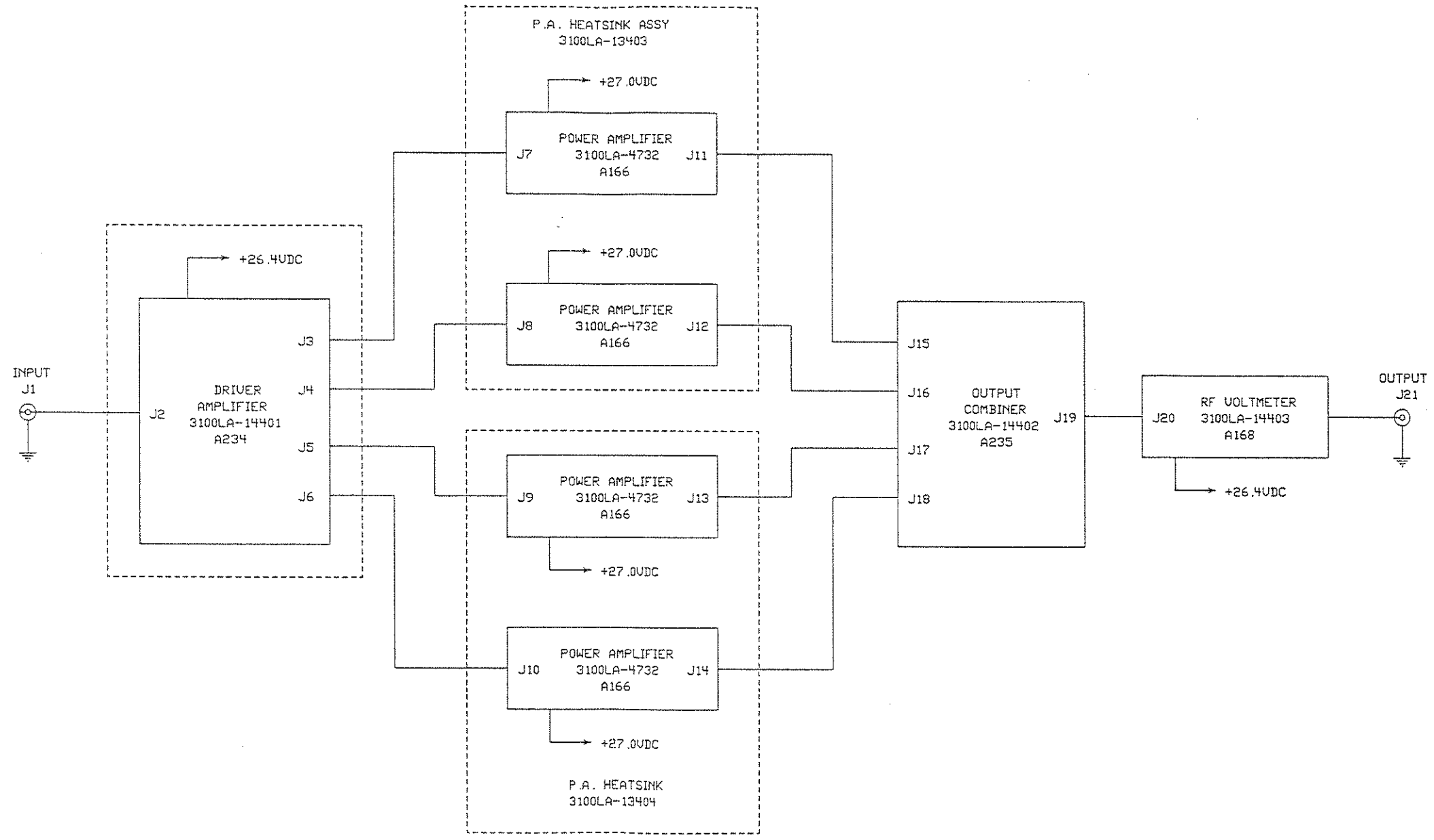
Table 7-1 provides a listing of all electrical parts which may be required for replacement. Electrical parts are listed by module number and by reference designations as indicated on the schematic diagrams. Parts list includes a description, part number and manufacturers federal supply code number. Table 7-2 provides a reference glossary of abbreviations used in the parts list.

7.3 LIST OF MANUFACTURERS

Table 7-3 provides a correlation of the manufacturers federal supply code numbers used in the parts list with the names and addresses of the manufacturers. If ENI's manufacturer code number (10226) appears, that part must be obtained directly from Electronic Navigation Industries, Inc.

7.4 ORDERING REPLACEMENT PARTS

To obtain replacement parts, address order or inquiry to Electronic Navigation Industries, Inc. or its authorized service facility. Identify parts by number as listed in the parts list (Table 7-1).



REV	DESCRIPTION	APPROVED	DATE	REV	DESCRIPTION	APPROVED	DATE
				B	REDRAWN ON CAD ECO #3493		1/91

ENI — ELECTRONIC NAVIGATION INDUSTRIES INC,
100 HIGHPOWER ROAD
ROCHESTER, NEW YORK 14623

DRAWN RLD 1/91
CHK. 1/91
ENG 1/91
APP 1/31/91

BLOCK DIAGRAM
3100LA

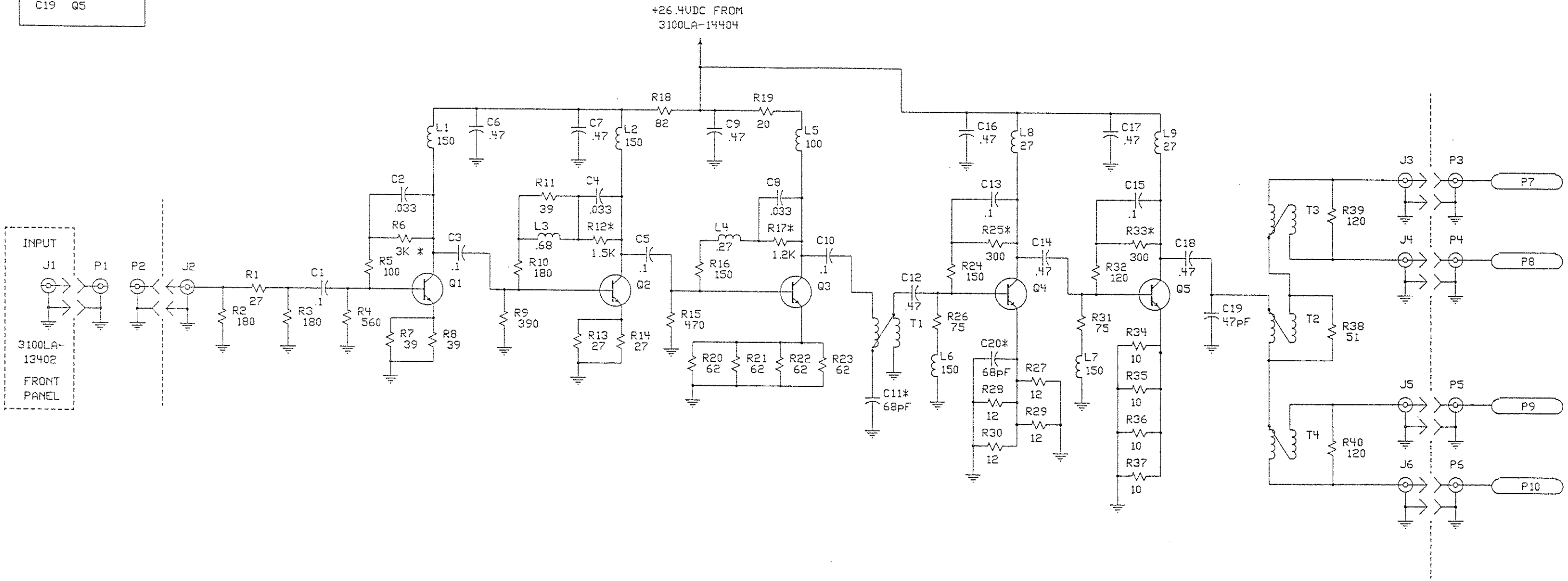
DWG. NO. 3100LA-SCH-01 REV B

SHEET 1 OF 1

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. A. ALL RESISTOR VALUES ARE IN OHMS.
   B. ALL CAPACITOR VALUES ARE IN MICROFARADS.
   C. ALL INDUCTOR VALUES ARE IN MICROHENRIES.
2. VOLTAGE MEASUREMENTS TAKEN WITH NO SIGNAL APPLIED, USING A VOLTMETER WITH A HIGH INPUT IMPEDENCE (10 MEGOHMS OR GREATER).
3. ALL VOLTAGES ARE DC POSITIVE WITH RESPECT TO GROUND.
4. * INDICATES VARIABLE VALUE.

LAST REFERENCE DESIGNATOR USED
R40 L9 T4
C19 Q5



NOTE: DOCUMENTATION GENERATED USING THE HIWIRE SOFTWARE
THE DISKS AND FILES WILL BE ARCHIVED IN THE VAULT. DISK NAME:

REFERENCE DRAWING	REFERENCE DESIGNATOR
3100LA-SCH-03	P7, P8, P9, P10

REV	DESCRIPTION	APPROVED	DATE
A	ECO #1101		7/86
B	ECO #3493, REDRAWN ON CAD		1/91

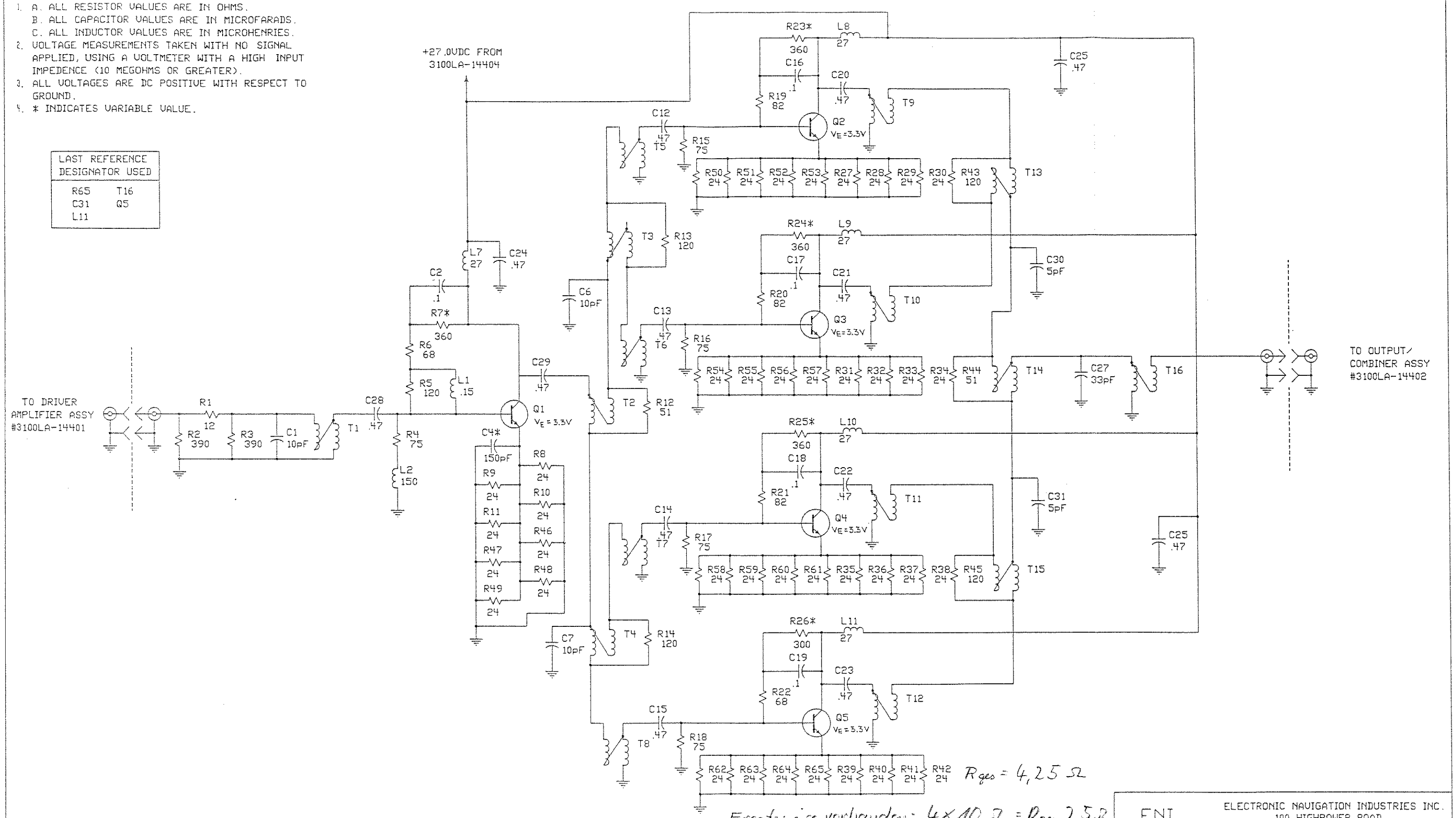
ENI
ELECTRONIC NAVIGATION INDUSTRIES INC.
100 HIGHPOWER ROAD
ROCHESTER, NEW YORK 14623

DRAWN RLD 1/91	DRIVER AMPLIFIER SCHEMATIC DIAGRAM 3100LA-14401
CHK. TOS 1/91	
ENG. 1/91	
APP 1/31/91	DWG. NO. 3100LA-SCH-02 REV B
	SHEET 1 OF 1

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. A. ALL RESISTOR VALUES ARE IN OHMS.
   B. ALL CAPACITOR VALUES ARE IN MICROFARADS.
   C. ALL INDUCTOR VALUES ARE IN MICROHENRIES.
2. VOLTAGE MEASUREMENTS TAKEN WITH NO SIGNAL APPLIED, USING A VOLTMETER WITH A HIGH INPUT IMPEDENCE (10 MEGOHMS OR GREATER).
3. ALL VOLTAGES ARE DC POSITIVE WITH RESPECT TO GROUND.
4. * INDICATES VARIABLE VALUE.

LAST REFERENCE DESIGNATOR USED	
R65	T16
C31	Q5
L11	



NOTE: DOCUMENTATION GENERATED USING THE HIWIRE SOFTWARE
THE DISKS AND FILES WILL BE ARCHIVED IN THE VAULT. DISK NAME:
REFERENCE DRAWING REFERENCE DESIGNATOR

REV	DESCRIPTION	APPROVED	DATE	REV	DESCRIPTION	APPROVED	DATE
				A	RELEASE RLD		1/91

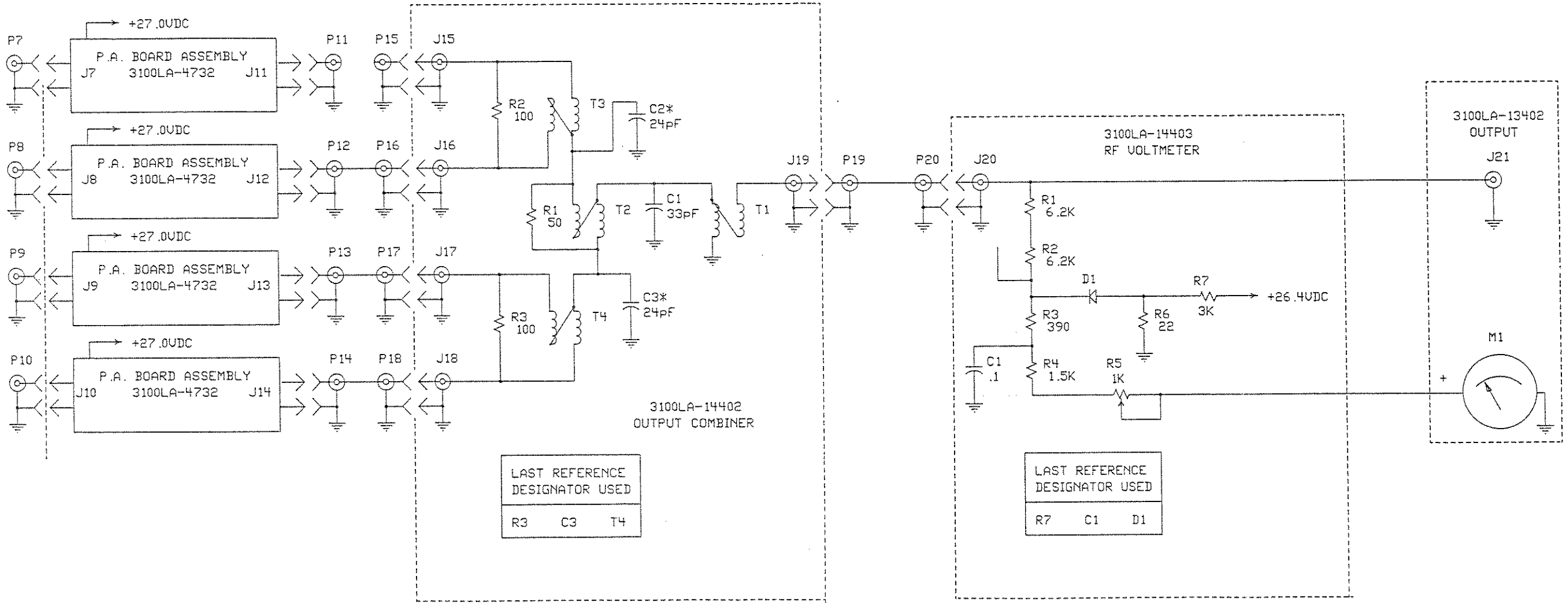
ENI

ELECTRONIC NAVIGATION INDUSTRIES INC.
100 HIGHPOWER ROAD
ROCHESTER, NEW YORK 14623

DRAWN RLD 1/91	POWER AMPLIFIER SCHEMATIC DIAGRAM 3100L-4732
CHK. 1/91	
ENG. 1/91	DWG. NO. 3100LA-SCH-03 REV A
APP. 1/30/91	SHEET 1 OF 1

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. A. ALL RESISTOR VALUES ARE IN OHMS.
   B. ALL CAPACITOR VALUES ARE IN MICROFARADS.
   C. ALL INDUCTOR VALUES ARE IN MICROHENRIES.
2. VOLTAGE MEASUREMENTS TAKEN WITH NO SIGNAL APPLIED, USING A VOLTMETER WITH A HIGH INPUT IMPEDENCE (10 MEGOHMS OR GREATER).
3. ALL VOLTAGES ARE DC POSITIVE WITH RESPECT TO GROUND.
4. * INDICATES VARIABLE VALUE.



LAST REFERENCE DESIGNATOR USED		
R3	C3	T4

LAST REFERENCE DESIGNATOR USED		
R7	C1	D1

NOTE: DOCUMENTATION GENERATED USING THE HIWIRE SOFTWARE
THE DISKS AND FILES WILL BE ARCHIVED IN THE VAULT. DISK NAME:
REFERENCE DRAWING REFERENCE DESIGNATOR

REV	DESCRIPTION	APPROVED	DATE	REV	DESCRIPTION	APPROVED	DATE
				A	RELEASE RLD		1/91

ENI

ELECTRONIC NAVIGATION INDUSTRIES INC.
100 HIGHPOWER ROAD
ROCHESTER, NEW YORK 14623

DRAWN RLD 1/91
CHK.
ENG. 1/91
APP.

OUTPUT COMBINER/RF VOLTMETER/
OUTPUT SCHEMATIC DIAGRAM
3100LA-14402/14403/ 13402

DWG. NO. 3100LA-SCH-04 REV A

SHEET 1 OF 1

TABLE 7-1 REPLACEMENT PARTS LIST (Cont'd)

REF. DESIGN	DESCRIPTION	MFR. CODE	PART NO.
	DRIVER AMPLIFIER CONT'D		
A234R20-23	Res. 62 ohm 1/4W 5%	10226	Carbon Film
A234R11	VARIABLE VALUE	10226	Carbon Film
A234R5	Res. 100 ohm 1/4W 5%	10226	Carbon film
A234R16	Res. 150 ohm 1/4W 5%	10226	Carbon film
A234R10	Res. 180 ohm 1/4W 5%	10226	Carbon film
A234R9	Res. 390 ohm 1/4W 5%	10226	Carbon film
A234R15	Res. 470 ohm 1/4W 5%	10226	Carbon film
A234R4	Res. 560 ohm 1/4W 5%	10226	Carbon film
A234R17	VARIABLE VALUE	10226	Carbon film
A234R12	VARIABLE VALUE	10226	Carbon film
A234R6	VARIABLE VALUE	10226	Carbon Film
A234R26,31	Res. 75 ohm 1/2W 5%	10226	Carbon Film
A234R39,40	Res. 120 ohm 1/2W 5%	10226	Carbon Film
A234R34-37	Res. 10 ohm 1W 5%	10226	Metal Oxide
A234R27-30	Res. 12 ohm 1W 5%	10226	Metal Oxide
A234R38	Res. 51 ohm 1W 5%	10226	Metal Oxide
A234R19	Res. 20 ohm 2W 5%	10226	Metal Oxide
A234R32	Res. 120 ohm 2W 5%	10226	Metal Oxide
A234R24	Res. 150 ohm 2W 5%	10226	Metal Oxide
A234R25,33	VARIABLE VALUE	10226	Metal Oxide
A234R18	Res. 82 ohm 3W 5%	10226	Metal Oxide
A234C2,4,8	Capacitor .033uF 50V	36346	C320C333M5U -ICA-C9250
A234C1,3,5 10,13,15	Capacitor .1uF 50V	36346	C330C104M5U -ICA-C9250
A234C6,7,9 12,14,16,17 18	Capacitor .47uF 50V	36346	C330C474M5u -ICA-C9250
A234C19	Capacitor 47 pF	09023	CM05ED470J03
A234C11	Capacitor, Chip 120pF	29990	100B-121-KP-300
A234L4	Choke .27uHy	99800	1026-00
A234L3	Choke .68uHy	99800	1537-08
A234L8,9	Choke 27uHy	99800	2890-30
A234L5	Choke 100uHy	99800	2890-42
A234L1,2,6 7	Choke 150uHy	99800	3500-12
A234Q1,2	Transistor	10226	LT2001
A234Q3	Transistor	10226	ENI-6B
A234Q4,5	Transistor	10226	ENI-16
A234T1-4	Transformer	10226	
	POWER AMPLIFIER	10226	3200L-4732
A166R5,13 14	Res. 120 ohm 1/4W 5%	10226	Carbon Film
A166R1	Res. 12 ohm 1/2W 5%	10226	Carbon Film
A166R12	Res. 51 ohm 1/2W 5%	10226	Carbon Film

TABLE 7-1 REPLACEMENT PARTS LIST (Cont'd)

REF. DESIGN	DESCRIPTION	MFR. CODE	PART NO.
	POWER AMPLIFIER COMT'D		
A166R4, 15-18A166R2,3 55	Res. 75 ohm 1/2W 5% 10226	10226	Carbon Film Res. 390 ohm 1/2W Carbon Film
A166R27-42	Res. 10 ohm 1W 5%	10226	Metal Oxide
A166R8-11	Res. 12 ohm 1W 5%	10226	Metal Oxide
A166R44	Res. 51 ohm 2W 5%	10226	Metal Oxide
A166R19-22	Res. 68 ohm 2W 5%	10226	Metal Oxide

TABLE 7-1 REPLACEMENT PARTS LIST

REF. DESIGN	DESCRIPTION	MFR. CODE	PART NO.
	BASE PLATE ASSEMBLY	10226	3100LA-13401
T1	Transformer, Power	12715	AM6205A
C1	Capacitor 3900uf,50V	56289	36D392G050BC2A
C2,3	Capacitor 1200uf,40V	56289	36D123G040BC2A
CR1-3	Bridge Rectifier	04713	MDA-3501
	FRONT PANEL ASSEMBLY	10226	3100LA-13402
M1	Meter	32171	840-586
S1	Switch	27191	7361K5
DS1	Lamp Assembly	72619	101-8430-0931-201
	Bulb	71744	327
J1,21	Connector	10172	UG-606IU
	REAR PANEL ASSEMBLY	10226	A150-3212
B1	Fan #10	28875	120V282115V
F1	Fuse	3AG-15A	75915
F1	Fuse 3AG-15ASB	75915	313015
	POWER SUPPLY ASSEMBLY	10226	3100LA-13406
Q1	Transistor	79089	40312
Q2,3	Transistor	10226	EN1-1
R1,R2	Resistor,18ohm 5W 10%	75042	PW-5
	POWER SUPPLY REGULATOR	10226	3100LA-14404
A236RI-5	RES 47K ohm 1/4W 5%	10226	Carbon Film
A236R6-10	Res 2.7K ohm,1/2W 2%	16299	HC-5
A236R11-15	Res. 7.5K ohm, 1/2W,2%	16299	HC-5
A236R16-20	Potentiometer 200ohm	32997	3386T-1-201
A236R21-25	Potentiometer 500ohm	32997	3386T-1-501
A236C1-10	Capacitor .033uf 50V	36346	C320C333M5U-ICA-C9250
A236C11-20	Capacitor .1uf 50V	36346	C330C104M5U-ICA-C9250
A236C21-25	Capacitor 560 pF	09023	CM06FD561J03
A236C26-30	Capacitor 50uf 50V	56289	500D506G050DD7
A236C31-35	Capacitor 6800pF CHIP CAP	95275	
A236C1C1-5	Integrated Circuit	49956	RC723CT
	DRIVER AMPLIFIER	10226	3100lA-14401
A234R1	Res. 27ohm 1/8W 5%	10226	Carbon Film
A234R2,3	Res. 180ohm 1/8W 5%	10226	Carbon Film
A234R13,14	Res. 27ohm 1/4W 5%	10226	Carbon Film
A234R7,8	Res. 39ohm 1/4W 5%	10226	Carbon Film

TABLE 7-1. REPLACEMENT PARTS LIST (continued)

REF. DESIGN.	DESCRIPTION	MFR. CODE	PART NO.
A166R43, 45	Res. 120 ohm 2w 5%	10226	Metal Oxide
A166R23-26	Res. 36o ohm 2w 5%	10226	Metal Oxide
A166C2, 16-19	Capacitor .μF 50V	36346	C330C104M5U-ICA-C9250
A166C12-15, 20-26, 28, 29	Capacitor .47μF 50V	36346	C330c474M5U-ICA-C9250
A166C1, 6-11	Capacitor 10pF	09023	CM05ED100J03
A166C5	Capacitor 27pF	09023	CM05ED270J03
A166C27	Capacitor 33pF	09023	CM05ED330J03
A166C4	Capacitor 150pF	09023	CM05ED151J03
A166L1	Choke .15μHy	99800	1025-00
A166L7-11	Choke 27μHy	99800	2890-30
A166L2-6	Choke 150μHy	99800	3500-12
A166Q1-5	Transistor	10226	ENI-16
A166T1-16	Transformer	10226	
	OUTPUT COMBINER	10226	3100LA-14402
A235R1	Res. 50 ohm 50w	10226	MR250-875
A235R2, 3	Res. 100 ohm 50w	10226	MR250-875
A235C1	Capacitory 33pF	09023	CM05ED330Jo3
A35C2, 3	Capacitor 24pF	09023	CM05ED240Jo3
A235T1-4	Transformer	10226	
	R.F. VOLTMETER	10226	3100LA-14403
A168R6	Res. 22 ohm ¼w 5%	10226	Carbon Film
A168R3	Res. 390 ohm ¼w 5%	10226	Carbon Film
A168R4	Res. 1.5K ohm ¼w 5%	10226	Carbon Film
A168R7	Res. 3K ohm ¼w 5%	10226	Carbon Film
A168R1, 2	Res. 6.2K ohm 2w 5%	10226	Metal Oxide
A168R5	Potentiometer 1K ohm	32997	3386T-1-102
A168D1	Diode	24840	5082-2811
A168C1	Capacitor .1μF 50V	36346	C330C104M5U-ICA-C9250

TABLE 7-2. GLOSSARY OF ABBREVIATIONS

A	AMPERES	PIV	PEAK INVERSE VOLTAGE
AMP	AMPERES	POT	POTENTIOMETER
ASSY	ASSEMBLY	REF	REFERENCE
BR	BRIDGE	REQ	REQUIRED
CAP	CAPACITOR	RES	RESISTOR
CER	CERAMIC	S.B.	SLOW BLOW
COMP	COMPOSITION CARBON	μF	MICROFARAD
		V	VOLTS
DESIG	DESIGNATION	VDCW	DC WORKING VOLTS
ELECT	ELECTROLYTIC	W	WATTS
I.C.	INTEGRATED CIRCUIT	WW	WIRE WOUND
K	KILOHMS		
μH	MICROHENRY		
mV	MILLIVOLTS		
pF	PICOFARAD		

TABLE 7-3. LIST OF MANUFACTURERS

FEDERAL SUPPLY CODE NUMBER	MANUFACTURER	ADDRESS
04713	Motorola, Inc.	Phoenix, AZ
09023	Cornell-Dubilier Electronics	Sanford, NC
10226	Electronic Navigation Industries	Rochester, NY
12715	American Magnetics Corp.	Carterville, IL
13511	Amphenol Corp.	Los Gatos, CA
16299	Corning Glass	Raleigh, NC
24840	Hewlett Packard Co.	Palo Alto, CA
27191	Cutler Hammer	Milwaukee, WI
28875	IMC Magnetics	Rochester, NH
29990	American Technical Ceramics	Huntington Station, NY
32171	Modutec, Inc.	Norwalk, CT
32997	Bourns, Inc.	Riverside, CA
36346	Union Carbide (Kemet)	New York, NY
49956	Raytheon Co.	Lexington, MA
56289	Sprague Electric Co.	N. Adams, MA
71744	Chicago Miniature Lamp Works	Chicago, IL
72619	Dialight Corp.	Brooklyn, NY
75042	I.R.C. Division of TRW, Inc.	Philadelphia, PA
75915	Littlefuse, Inc.	Des Plaines, IL
79089	R.C.A.	Harrison, NY
95275	Vitramon	Bridgeport, CT
99800	Delevan Electronics Corp.	E. Aurora, NY