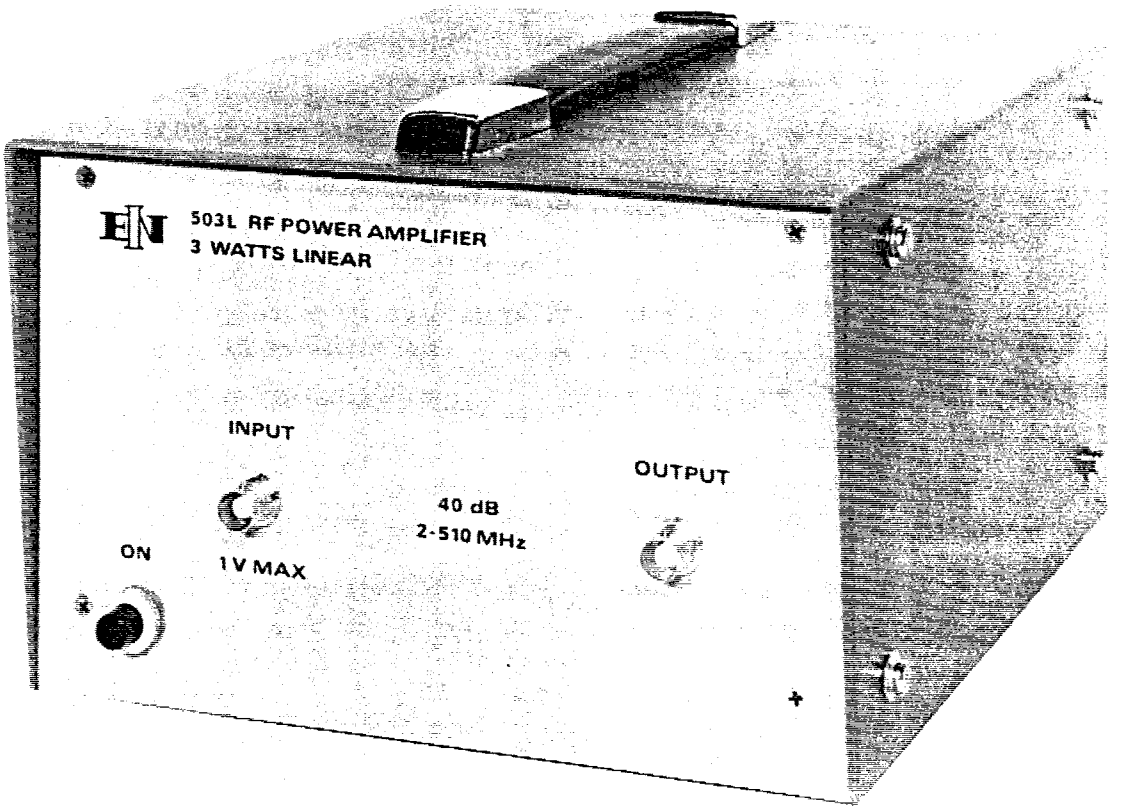
ELECTRONIC NAVIGATION INDUSTRIES, INC.

INSTRUCTION MANUAL

MODEL 503L

BROADBAND POWER AMPLIFIER



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WARRANTY

Electronic Navigation Industries, Inc. warrants each instrument to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing and replacing any defective parts for a period of one (1) year after delivery to the original purchaser.

When warranty service is required, the instrument must be returned transportation charges prepaid 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 work is started.

There are no other warranties expressed or implied, including any warranty of merchantibility or fitness. Seller shall not be responsible for any incidental or consequential damages arising from any breach of warranty.

CHAPTER 1. GENERAL INFORMATION

1.1 INTRODUCTION

The Model 503L is a general purpose broadband amplifier capable of more than 3 watts of linear power output when driven by any laboratory signal or sweep generator from 2 to 510 MHz.

An ultra linear Class A design, the 503L will "boost" the output of any signal source by a flat 40 dB (± 1.5 dB) and provide its full forward output power into any load impedance (from an open to a short circuit). Its output is a faithful reproduction of the input waveform for AM, FM, SSB, CATV, pulse and other complex modulations. Although specified only over the 2 to 510 MHz frequency range, full power output is typically available from 1.6 to 540 MHz.

The use of microwave transistors on thin film substrates, microstrip circuitry, and plug-in modules make the 503L both reliable and easy to service. An integral power supply and cooling system permit operation over a wide range of temperature and AC line conditions.

1.2 DATA SUMMARY

Frequency Coverage:	2 to 510 MHz
Gain:	40 dB nominal
Gain Variation:	± 1.5 dB
Maximum Linear Power Output:	More than 3 watts
Harmonic Distortion:	All harmonics greater than 25 dB below the fundamental at 2.5 watts output. Lower Distortion at reduced power.
Input/Output Impedance:	50 ohms
Input VSWR:	1.5 Maximum
Output VSWR:	2.5 Maximum
Stability:	Unconditionally stable
Typical 3rd Order Intermodulation Intercept Point:	+ 44 dBM

Noise Figure:	10 dB
Power Requirements:	115/230V a.c. ± 10% 50-60 Hz, at 90 watts
Size and Weight:	5¼ x 8 x 10 inches - 11 pounds 13.3 x 23 x 25.4 cm - 5kg.
Operating Temperature:	0^{o} to 45^{o} C
Protection:	Unit will withstand a +20 dB overdrive (1 volt RMS) for all output load conditions, including short and open circuits.
Output Connectors:	BNC standard, SMA and type N optional
Rack Mounting:	Adaptors provided

CHAPTER 2. OPERATION

2.1 INTRODUCTION

The ENI 503L RF amplifier is used to increase the r.f. output level of signal sources in the 2 to 510 MHz range. No tuning or any other form of adjustment is required other than the selection of the correct power supply input voltage.

The 503L produces rated power output at its 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 ohms (typical VSWR: 2:1), 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. Verify left and right brackets by positioning them next to the cover screw holes and noting that the bottom of each bracket is flush with the base of the chassis. 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 V a.c. operation.

CAUTION

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:

2 amp	Slow Blow	ENI Part No. 313002

The 2 amp rating is correct for both 115 and 230 volts a.c.

2.2.3 Mains Lead Connection

For 230 V a.c. 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 2 volts peak may permanently damage the instrument.

(ii) Connect the input signal via a 50 ohm coaxial lead and BNC plug to the input connector.

(iii) Connect the output via a 50 ohm coaxial lead and BNC plug to the load.

CHAPTER 3. TECHNICAL DESCRIPTION

3.1 GENERAL DESCRIPTION

The ENI 503L is designed to amplify signals by 40 dB in the frequency band of 2 to 510 MHz. The signal from the front panel BNC connector is fed via a length of 50 ohm coaxial cable to the input of the preamplifier module (503L-3365). The signal from the input of the preamplifier is fed via a length of microstrip transmission line to a π network attenuator R1, R2, and R3 (see figure 5.1).

The output from the attenuator is fed to the input of low noise amplifier stage Q1. The output of Q1 is amplified and amplitude leveled by stage Q2. Capacitor C7 is varied to level the gain vs. frequency response of the overall unit. The low distortion output of Q3 is fed via 50 ohm coaxial cable to a π attenuator network R1, R2, and R3 at the input of power amplifier module (503L-3366).

RF signal at the output of the attenuator is coupled through C2 to the base of Q1. The output signal at the collector of Q1 is then split into two equal phase and amplitude signals by transformer T2. Transformer T1 matches the output impedance of Q1 to the input impedance of T2. The two output signals from T2 are fed through resistors R12, R13, R14 to Q2 and R44, R45, R46 to Q5 respectively. The output signal from Q2 is impedance matched and split into two equal phase and amplitide signals by transformers T3 and T4 where they are fed to the bases of Q3 and Q4 through π attenuators. In a like manner, the output of Q5 is impedance matched and split into two equal phase and amplitude signals by transformer T6 and T7 where they are fed to the bases of Q6 and Q7 through π attenuators.

The outputs of the four power amplifier stages Q3, Q4, Q6 and Q7 are combined by hybrid transformers T5, T8 and T9. Capacitors C68, C69 and transformer T10 match the combined RF output signal to 50 ohms at connector J5. The output of the power amplifier module is fed via 50 ohm coaxial cable to the output BNC connector J6.

The amplifier power requirements are 115 V or 230 V a.c. at 90 watts. The power supply unit provides a 15 V d.c. 300 mA source and a 22 V d.c. 3 amp source. The 15 V d.c. source is regulated by series pass transistor Q1 and integrated circuit regulator IC1. R2 adjusts the supply to 15 volts. The 22 V d.c. source is regulated by series pass transistor Q2 and integrated circuit regulator IC2. R9 adjusts this supply to 22 volts. The 22 V d.c. supply is over-current protected in case excessive demand is placed on it. R5 adjusts the short circuit load to 3 amperes. The front panel light located in the front panel push button switch assembly is connected to the 22 V d.c. supply and will indicate when the power supply is operating correctly.

CHAPTER 4. MAINTENANCE

4.1 INTRODUCTION

The ENI 503L 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 1 volt 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 the Data Summary Section 1.2.

4.2 ACCESS AND LAYOUT

The ENI 503L 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 lifting by the handle.

The lamp indicator in the on-off switch may be replaced by unscrewing the knurled bezel on the switch and removing the lamp assembly.

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

The preamplifier module is mounted to the baseplate with two # 4-40 screws. The power amplifier module is mounted to the base plate by three # 6-32 screws. Before removal of either of these modules it is necessary to first remove the coaxial cables connected to it and the appropriate lead from the terminal block located on the power supply regulator board.

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 (Wavetek 2001 or similar) capable of sweeping the frequency range 2 to 510 MHz to the input connector.

(iii) Adjust the output level of the sweep generator so that a 50 ohm video detecto 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 short length of 50 ohm cable to the output connector. Adjust the input CW signal to any frequency between 2 and 510 MHz for 2.5 watts output.

(vi) Observe the harmonic distortion of the output on 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 DS1 is illuminated.

(b) The preamplifier supply voltage is set at 15 volts by R2.

(c) The power amplifier supply voltage is set at 22 volts by R9.

If the above checks are found to be correct, then normal fault location procedures, with reference to the circuit diagram Figure 5.1 should be followed to determine the correct operation of the preamplifier 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 DS1 is illuminated.

(ii) Measure the power supply voltages and adjust per section 4.3.1 (b) and 4.3.1 (c).

4.4.1 Measurement of Gain

Equipment required:

(a) Oscilloscope - Telequipment Model S54A
(b) Sweep/Signal Generator - Wavetek 2001
(c) 50 ohm Detector - Wavetek D151
(d) Attenuator, 10 dB, 20 watts - Narda 766-10

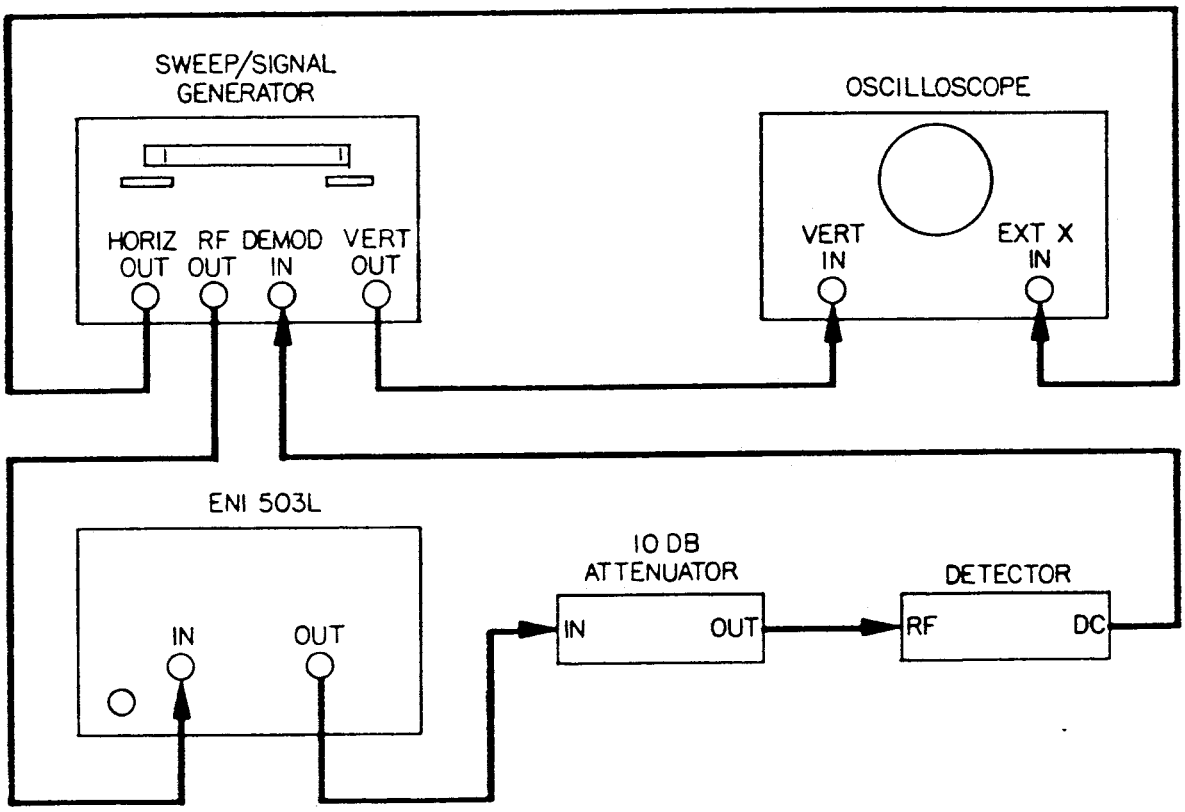

Fig. 4.1 Gain Measurement

Connect the equipment as shown in Figure 4.1, then proceed as follows:

(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 2 MHz and the sweep width to 510 MHz.

(c) Disconnect the ENI 503L from the set-up and connect the sweep/generator RF output directly to the 10 dB 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 40 dB.

(g) Reconnect the 503L into the test set-up of Figure 4.1.

(h) Push the 503L power switch to the "on" position.

(i) Observe the gain versus frequency sweep on the oscilloscope.

1. The average gain should be 40 dB (within 1 dB).

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

(j) If the gain versus frequency sweep is out of specification, adjust A86C7 (located beneath the snap plug on the pre-amplifier module) using an insulated slotted screwdriver until the sweep observed on the oscilloscope is within the 3 dB markings.

4.4.2 Measurement of Harmonics

Equipment required:

(a) Sweep/signal generator - Wavetek 2001
(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

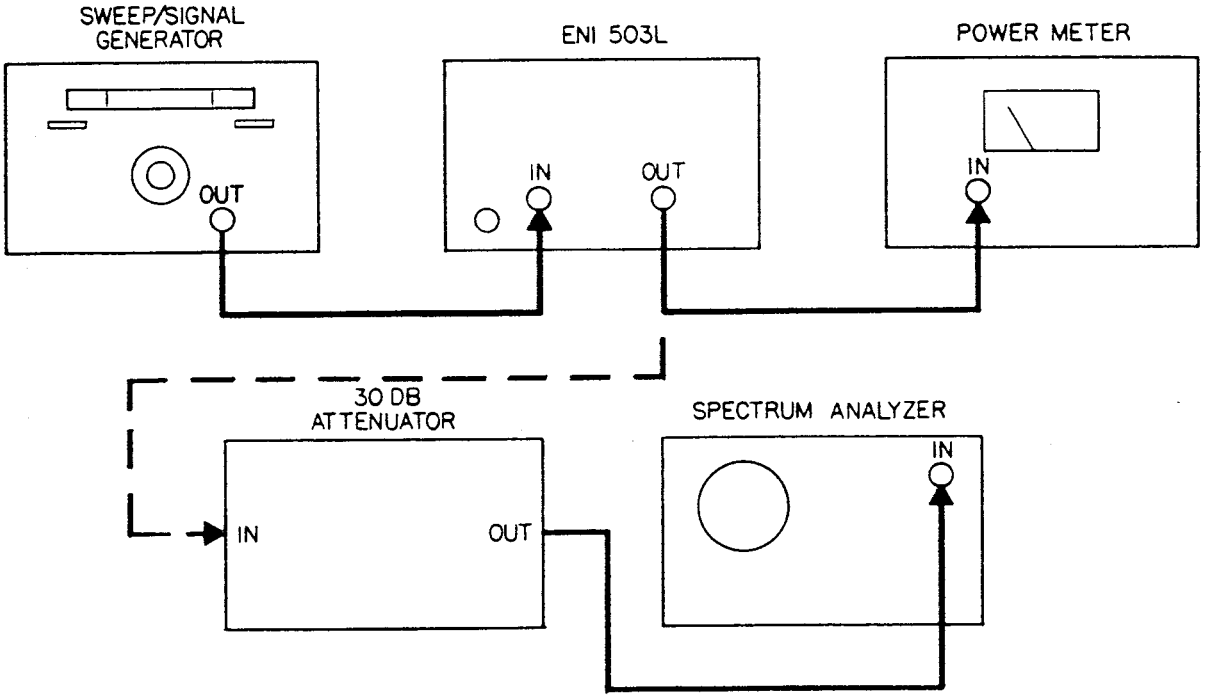

Fig. 4.2 Harmonic Measurement

Connect the equipment as shown in Figure 4.2 then proceed as follows:

(a) Adjust the sweep/signal generator at a CW center frequency of 150 MHz for an indicated output of 2.5 watts on the power meter.

(b) Using the spectrum analyzer, check that the level of the carrier harmonics are less than -25 dB with respect to the carrier.

(c) If the above specification is not met, the 22 volt d.c. supply may be varied up to $\pm$ .5 V to reduce the harmonic level.

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. SCHEMATIC AND PARTS LIST

5.1 SCHEMATIC DIAGRAM

A complete schematic diagram appears in figure 5.1.

5.2 PARTS LISTS

Table 5.1 provides a listing of all electrical parts and those mechanical parts which may be required for replacement. Electrical parts are listed by module number and by reference designations as indicated on the schematic diagram. Parts list includes a description, part number and manufacturers federal supply code number. Table 5.2 provides a reference glossary of abbreviations used in the parts list.

5.3 LIST OF MANUFACTURERS

Table 5.3 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.

5.4 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.

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	KILO OHMS
KO	KILO OHMS
mV	MILLIVOLTS
pF	PICOFARAD
PIV	PEAK INVERSE VOLTAGE
PWR	POWER
POT	POTENTIOMETER
REF	REFERENCE
REQ	REQUIRED
RFL	REFLECTED
RES	RESISTOR
S.B.	SLOW BLOW
uF	MICROFARAD
µF	MICROFARAD
uH	MICROHENRY
µH	MICROHENRY
V	VOLTS
VDCW	DC WORKING VOLTAGE
W	WATTS
WW	WIRE WOUND

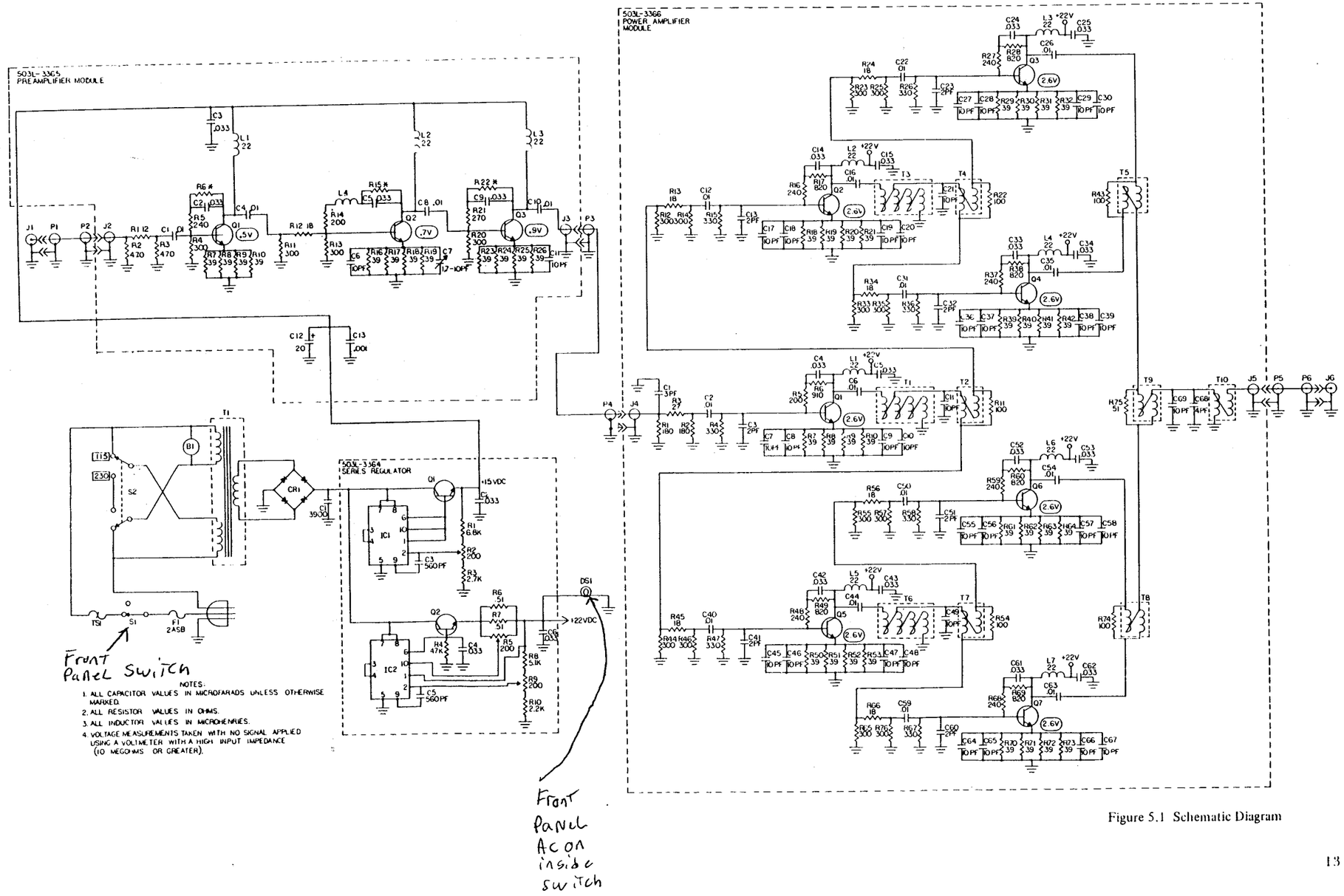

Figure 5.1 Schematic Diagram

TABLE 5-1. REPLACEMENT PARTS LIST.

REF. DESIG.	DESCRIPTION	MFR. CODE	PART NO.
	CHASSIS MOUNTED PARTS (NO PREFIX):		
B1	Motor, Fan	28875	WS2107F-7
C1	Cap, Elect, 3900UF 50 VDCW	56289	36D392G050AC2A
CR1	6A FW Bridge	83003	VH148
DS1	Lamp 28VDC-40MA	72619	101-8430-0931-201
F1	Fuse Type 3AG 2ASB	75915	313002
XF1	Fuse Holder	75915	342001
J1,J6	Jack, Type BNC	13511	UG-625B/U
S1	Switch, Illuminated	87034	616-6-1
S2	Switch, Slide DPDT	22753	622-HK-115/230
T1	Transformer, Power	12715	AM-5177A
	SERIES REGULATOR (NO PREFIX):		
Q1	Transistor	79089	40312
Q2	Transistor	04713	2N3715
R6-7	Resistor, WW, .51 ohms 5%, 2W	75042	BWH.5
A45	Power Supply Regulator Board	10226	503L-4363
A45R1	Resistor, Film, 6.8K, 5%, 1/2W	16299	HC5-6.8K
A45R2	Pot, 200 ohm, 5%	32997	3389T-1-201
A45R3	Resistor, Film, 2.7K, 5%, 1/2W	16299	HC5-2.7K
A45R4	Resistor, Comp, 47K, 5%, 1/4W	01121	RC07GF473J
A45R5	Pot, 200 ohm, 5%	32997	3389T-1-201
A45R8	Resistor, Film, 5.1K, 5%, 1/2W	16299	HC5-5.1K
A45R9	Pot, 200 ohm, 5%	32997	3389T-1-201
A45R10	Resistor, Film, 2.2K, 5%, 1/2W	16299	HC5-2.2K
A45C2	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A45C3	Cap, Mica, 560PF, 5%	09023	CM06FD561J03
A45C4	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A45C5	Cap, Mica, 560PF, 5%	09023	CM06FD561J03
A45C6	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A45IC1,2	IC Regulator	49956	RC723CT
	RF PREAMPLIFIER MODULE (NO PREFIX):		
C12	Cap, Elect, 20UF, 50 VDCW	56289	TE1305
C13	Cap, Feed Through, 1000PF	72982	357-0001-540-102M
A86	RF Preamplifier Board	10226	503L-4362

REF. DESIG.	DESCRIPTION	MFR. CODE	PART NO.
	RF PREAMPLIFIER MODULE (Cont.)		
A86R1	Resistor, Comp, 12 ohm, 5%, 1/8W	01121	RC05GF120J
A86R2,R3	Resistor, Comp, 470 ohm, 5%, 1/8W	01121	RC05GF471J
A86R4	Resistor, Comp, 300 ohm, 5%, 1/4W	01121	RC07GF301J
A86R5	Resistor, Comp, 240 ohm, 5%, 1/4W	01121	RC07GF241J
A86R6	Resistor, Comp, Variable	01121	
A86R7-R10	Resistor, Comp, 39 ohm, 5%, 1/4W	01121	RC07GF390J
A86R11	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC07GF301J
A86R12	Resistor, Comp, 18 ohm, 5%, 1/8W	01121	RC05GF180J
A86R13	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A86R14	Resistor, Comp, 200 ohm, 5%, 1/4W	01121	RC07GF201J
A86R15	Resistor, Comp, Variable	01121	
A86R16-R19	Resistor, Comp, 39 ohm, 5%,1/4W	01121	RC07GF390J
A86R20	Resistor, Comp, 300 ohm, 5%, 1/4W	01121	RC07GF301J
A86R21	Resistor, Comp, 270 ohm, 5%, 1/4W	01121	RC07GF271J
A86R22	Resistor, Comp, Variable	01121	
A86R23-R26	Resistor, Comp, 39 ohm, 5%, 1/4W	01121	RC07GF390J
A86C1	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A86C2,C3	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A86C4	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A86C5	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A86C6	Cap, Mica, 10PF, 5%	09023	DM5CC100A
A86C7	Cap, 1.7-10PF	91293	9301
A86C8	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A86C9	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A86C10	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A86C11	Cap, Mica, 10PF, 5%	09023	DM5CC100A
A86L1-L3	Choke, RF, 22UH, 10%	99800	MS18130-24
A86L4	Choke, RF	10226	
A86Q1-Q3	Transistor, RF	10226	LT2001
	RF POWER AMPLIFIER ASSY. (NO PREFIX):	10226	503L-3366
Q1-7	Transistor, Sil, NPN	10226	2240
TS1	Thermostat	14604	2450-88-105
A47	Power Amplifier Board	10226	503L-4361
A47R1,2	Resistor, Comp, 180 ohm, 5%, 1/8W	01121	RC05GF181J
A47R3	Resistor, Comp, 27 ohm, 5%, 1/4W	01121	RC07GF270J
A47R4	Resistor, Comp, 330 ohm, 5%, 1/4W	01121	RC07GF331J
A47R5	Resistor, Comp, 200 ohm, 5%, 1/2W	01121	RC20GF201J
A47R6	Resistor, Comp, 910 ohm, 5%, 1/2W	01121	RC20GF911J
A47R7-10	Resistor, Comp, 39 ohm, 5%, 1/4W	01121	RC07GF390J

REF. DESIG.	DESCRIPTION	MFR. CODE	PART NO.
	RF POWER AMPLIFIER ASSY. (Cont.)		
A47R11	Resistor, Comp, 100 ohm, 5%, 1/4W	01121	RC07GF101J
A47R12	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A47R13	Resistor, Comp, 18 ohm, 5%, 1/8W	01121	RC05GF180J
A47R14	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A47R15	Resistor, Comp, 330 ohm, 5%, 1/4W	01121	RC07GF331J
A47R16	Resistor, Comp, 240 ohm, 5%, 1/2W	01121	RC20GF241J
A47R17	Resistor, Comp, 820 ohm, 5%, 1/2W	01121	RC20GF821J
A47R18-21	Resistor, Comp, 39 ohm, 5%, 1/4W	01121	RC07GF390J
A47R22	Resistor, Comp, 100 ohm, 5%, 1/4W	01121	RC07GF101J
A47R23	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A47R24	Resistor, Comp, 18 ohm, 5%, 1/8W	01121	RC05GF180J
A47R25	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A47R26	Resistor, Comp, 330 ohm, 5%, 1/4W	01121	RC07GF331J
A47R27	Resistor, Comp, 240 ohm, 5%, 1/2W	01121	RC20GF241J
A47R28	Resistor, Comp, 820 ohm, 5%, 1/2W	01121	RC20GF821J
A47R29-32	Resistor, Comp, 39 ohm, 5%, 1/4W	01121	RC07GF390J
A47R33	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A47R34	Resistor, Comp, 18 ohm, 5%, 1/8W	01121	RC05GF180J
A47R35	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A47R36	Resistor, Comp, 330 ohm, 5%, 1/4W	01121	RC07GF331J
A47R37	Resistor, Comp, 240 ohm, 5%, 1/2W	01121	RC20GF241J
A47R38	Resistor, Comp, 820 ohm, 5%, 1/2W	01121	RC20GF821J
A47R39-42	Resistor, Comp, 39 ohm, 5%, 1/4W	01121	RC07GF390J
A47R43	Resistor, Comp, 100 ohm, 5%, 1/4W	01121	RC07GF101J
A47R44	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A47R45	Resistor, Comp, 18 ohm, 5%, 1/8W	01121	RC05GF180J
A47R46	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A47R47	Resistor, Comp, 330 ohm, 5%, 1/4W	01121	RC07GF331J
A47R48	Resistor, Comp, 240 ohm, 5%, 1/2W	01121	RC20GF241J
A47R49	Resistor, Comp, 820 ohm, 5%, 1/2W	01121	RC20GF821J
A47R50-53	Resistor, Comp, 39 ohm, 5%, 1/4W	01121	RC07GF390J
A47R54	Resistor, Comp, 100 ohm, 5%, 1/4W	01121	RC07GF101J
A47R55	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A47R56	Resistor, Comp, 18 ohm, 5%, 1/8W	01121	RC05GF180J
A47R57	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A47R58	Resistor, Comp, 330 ohm, 5%, 1/4W	01121	RC07GF331J
A47R59	Resistor, Comp, 240 ohm, 5%, 1/2W	01121	RC20GF241J
A47R60	Resistor, Comp, 820 ohm, 5%, 1/2W	01121	RC20GF821J
A47R61-64	Resistor, Comp, 39 ohm, 5%, 1/4W	01121	RC07GF390J
A47R65	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC06GF301J
A47R66	Resistor, Comp, 18 ohm, 5%, 1/8W	01121	RC05GF180J

REF. DESIG.	DESCRIPTION	MFR. CODE	PART NO.
	RF POWER AMPLIFIER ASSY. (Cont.)		
A47R67	Resistor, Comp, 330 ohm, 5%, 1/4W	01121	RC07GF331J
A47R68	Resistor, Comp, 240 ohm, 5%, 1/2W	01121	RC20GF241J
A47R69	Resistor, Comp, 820 ohm, 5%, 1/2W	01121	RC20GF821J
A47R70-73	Resistor, Comp, 39 ohm, 5%, 1/4W	01121	RC07GF390J
A47R74	Resistor, Comp, 100 ohm, 5%, 1/4W	01121	RC07GF101J
A47R75	Resistor, Comp, 51 ohm, 5%, 1/4W	01121	RC07GF510J
A47R76	Resistor, Comp, 300 ohm, 5%, 1/8W	01121	RC05GF301J
A47C1	Cap, Mica, 3PF, 5%	09023	DM5CC030A
A47C2	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C3	Cap, Mica, 2PF, 5%	09023	DM5CC020A
A47C4-5	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A47C6	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C7-11	Cap, Mica, 10PF, 5%	09023	DM5CC100A
A47C12	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C13	Cap, Mica. 2PF, 5%	09023	DM5CC020A
A47C14-15	Cap, Cer, .033, 50 VDCW	72982	8121-050-651-333Z
A47C16	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C17-21	Cap, Mica, 10PF, 5%	09023	DM5CC100A
A47C22	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C23	Cap, Mica, 2PF, 5%	09023	DM5CC020A
A47C24-25	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A47C26	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C27-30	Cap, Mica, 10PF, 5%	09023	DM5CC100A
A47C31	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C32	Cap, Mica, 2PF, 5%	09023	DM5CC020A
A47C33-34	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A47C35	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C36-39	Cap, Mica, 10PF, 5%	09023	DM5CC100A
A47C40	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C41	Cap, Mica, 2PF, 5%	09023	DM5CC020A
A47C42-43	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A47C44	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C45-49	Cap, Mica, 10PF, 5%	09023	DM5CC100A
A47C50	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C51	Cap, Mica, 2PF, 5%	09023	DM5CC020A
A47C52-53	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A47C54	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C55-58	Cap, Mica, 10PF, 5%	09023	DM5CC100A

REF. DESIG.	DESCRIPTION	MFR. CODE	PART NO.
	RF POWER AMPLIFIER ASSY. (Cont.)		
A47C59	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C60	Cap, Mica, 2PF, 5%	09023	DM5CC020A
A47C61-62	Cap, Cer, .033UF, 50 VDCW	72982	8121-050-651-333Z
A47C63	Cap, Cer, .012UF, Chip	32159	SC21BX123V
A47C64-67	Cap, Mica, 10PF, 5%	09023	DM5CC100A
A47C68	Cap, Mica, 4PF, 5%	09023	DM5CC040A
A47C69	Cap, Mica, 10PF, 5%	09023	DM5CC100A
A47L1-L7	Choke, RF, 22UH, 10%	99800	MS18130-24
A47T1	Transformer	10226	
A47T2	Transformer	10226	
A47T3	Transformer	10226	
A47T4	Transformer	10226	
A47T5	Transformer	10226	
A47T6	Transformer	10226	
A47T7	Transformer	10226	
A47T8	Transformer	10226	
A47T9	Transformer	10226	
A47T10	Transformer	10226	

TABLE 5.2. GLOSSARY OF ABBREVIATIONS

AMP	AMPERES	PF	PICOFARAD
AMPL	AMPLIFIER	POT	POTENTIOMETER
BKT	BRACKET	REF	REFERENCE
CAP	CAPACITOR	RES	RESISTOR
CER	CERAMIC	SIL	SILICON
COMP	COMPOSITION CARBON	UF	MICROFARADS
DPDT	DOUBLE-POLE, DOUBLE THROW	UH	MICROHENRY
ELECT	ELECTROLYTIC	V	VOLTS
IN	INCHES	VAR	VARIABLE
K	KILOHMS	VDCW	DC WORKING VOLTS
MTG	MOUNTING	W	WATTS
MW	MILLIWATTS	WW	WIRE WOUND

TABLE 5.3. LIST OF MANUFACTURERS

FEDERAL SUPPLY CODE NUMBER	MANUFACTURER	ADDRESS
01121	Allen-Bradley Co.	Milwaukee, WI.
04713	Motorola, Inc. Semiconductor Prod. Div.	Phoenix, AZ.
09023	Cornell-Dubilier Electronics	Sanford, N.C.
10226	ELECTRONIC NAVIGATION INDUSTRIES, INC.	Rochester, N.Y.
12715	American Magnetics Corp.	Carterville, IL.
13511	Amphenol Corp, Inc.	Los Gatos, CA
14604	Elmwood Sensors, Inc.	Cranton, R.I.
16299	Corning Glass	Raleigh, N.C.
22753	U I D Electronics Corp.	Hollywood, FL.
32997	Bourns, Inc.	Riverside, CA.
49956	Raytheon Co.	Lexington, MA.
56289	Sprague Electric Co.	N. Adams, MA.
72982	Erie Technological Products, Inc.	Erie, PA.
75042	I R C Div. of TRW, Inc.	Philadelphia, PA.
75915	Littlefuse, Inc.	Des Plaines, IL.
79089	RCA	Harrison, N.Y.
99800	Delevan Electronics Corp.	E. Aurora, N.Y.
72619	Dialight Corp.	Brooklyn, N.Y.
28875	IMC Magnetics	Rochester, N.H.
32159	West-Cap Arizona	Tucson, AZ.
71590	Centralab Electronics	Milwaukee, WI.
83003	Varo, Inc.	Garland, TX.
87034	Marco Oak Industries	Anaheim, CA.
91293	Johanson Manufacturing Co.	Boonton, N.J.

FACTORY SERVICE

When Factory Service is required, the following steps should be taken:

(1) Notify ENI, giving full details of the difficulty. Include the instrument's serial number.

(2) Upon receipt of shipping instructions, forward the instrument, transportation prepaid, to the factory or to the authorized repair station indicated on the instructions.

If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the warranty.

08/17/92 INDEX FOR 503L-1361 503L POWER AMPLIFIER

PAGE	PART NUMBER	DESCRIPTION	QTY
1	503L-1361	503L POWER AMPLIFIER	0.000
	503L-012-1	RACK MOUNTING BRACKET	1.000
	503L-012-2	RACK MOUNTING BRACKET	1.000
2	503L-2361	POWER DISTRIBUTION ASSEMBLY	1.000
6	503L-3361	BASEPLATE ASSEMBLY	1.000
	310L-005-1	CORNER BRACKET	2.000
	310L-005-2	CORNER BRACKET	2.000
	503L-003	BASEPLATE	1.000
7	503L-3362	FRONT PANEL ASSEMBLY	1.000
	503L-001	FRONT PANEL	1.000
8	503L-3364	SERIES REGULATOR ASSEMBLY	1.000
	503L-006	REGULATOR HEATSINK	1.000
12	503L-4363	REGULATOR BOARD	1.000
9	503L-3367	REAR PANEL ASSEMBLY	1.000
	503L-011	REAR PANEL	1.000
3	503L-3363	COVER ASSEMBLY	1.000
	503L-005	COVER	1.000
4	503L-3365	RF PREAMPLIFIER ASSEMBLY	1.000
	503L-007	PRE-AMP ENCL	1.000
	503L-008	TOP COVER ENCLOSURE	1.000
	503L-009	BOTTOM COVER ENCLOSURE	1.000
	503L-010	PRE-AMPLIFIER HEATSINK	1.000
10	503L-4362	PREAMPLIFIER BOARD	1.000
5	503L-3366	POWER AMPLIFIER ASSEMBLY	1.000
	503L-004	PA HEATSINK	1.000
11	510L-4441	POWER AMPLIFIER BOARD	1.000
6	10303	GROMMET	1.000

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
10025	CABLE ASSY CA4-1 6.0"	1.000	
10026	CABLE ASSY CA4-2 18.0"	1.000	
10035	CABLE ASSY CA6-17 18.0"	1.000	
503L-012-1	RACK MOUNTING BRACKET	1.000	
503L-012-2	RACK MOUNTING BRACKET	1.000	
503L-2361	POWER DISTRIBUTION ASSEMBLY	1.000	
503L-3363	COVER ASSEMBLY	1.000	
503L-3365	RF PREAMPLIFIER ASSEMBLY	1.000	
503L-3366	POWER AMPLIFIER ASSEMBLY	1.000	
10222	CORE A TOROID GREEN	1.000	
10224	CORE C TOROID GREEN	2.000	
10303	GROMMET	1.000	

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
503L-3361	BASEPLATE ASSEMBLY	1.000	
503L-3362	FRONT PANEL ASSEMBLY	1.000	
503L-3364	SERIES REGULATOR ASSEMBLY	1.000	
503L-3367	REAR PANEL ASSEMBLY	1.000	
10303	GROMMET	1.000	

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
503L-005	COVER	1.000	
10305	6"HANDLE(W/POLISHED COVERS)	1.000	

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
503L-007	PRE-AMP ENCL	1.000	
503L-008	TOP COVER ENCLOSURE	1.000	
503L-009	BOTTOM COVER ENCLOSURE	1.000	
503L-010	PRE-AMPLIFIER HEATSINK	1.000	
503L-4362	PREAMPLIFIER BOARD	1.000	
10051	CAP .001 UF 357-000-X5UD-102M	1.000	
10107	CAP 22 MF TLB1H220MAA	1.000	
221117	CONN. 'SMB' REAR MOUNT SOLDER	2.000	
10679	TRANSISTOR LT2001	3.000	

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
503L-004	PA HEATSINK	1.000	
510L-4441	POWER AMPLIFIER BOARD	1.000	
10633	SWITCH 2450-088-105 ELMSENSORS	1.000	
10680	TRANSISTOR ENI-2240	7.000	

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
310L-005-1	CORNER BRACKET	2.000	
310L-005-2	CORNER BRACKET	2.000	
503L-003	BASEPLATE	1.000	
10111	CAP 3900 MF 50V ALEL	1.000	
671006	TRANSFORMER 503L/603L	1.000	
10005	BRIDGE 100V 6.0 AMPS	1.000	
10125	CLAMP,CAPACITOR,1.375"-1.875"	1.000	
10275	FEET PLASTIC 760-3571	4.000	
10646	TERM BLK 6 TERM 6-172	1.000	
10648	TERM BLK 8 TERM 8-140	1.000	
10651	MARK STRIP 6 TERMS	1.000	
10652	MARK STRIP 8 TERMS SERIES 140	1.000	

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
503L-001	FRONT PANEL	1.000	
10173	CONN RCPT BNC PNL 50 OHM	2.000	
221115	CONN. "SMB" RIGHT ANGLE PCB MT	2.000	
10333	LAMP INCNDSNT 28V 327	1.000	
641049	SWITCH - LIGHTED PUSHBTN (SP)	1.000	

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
503L-006	REGULATOR HEATSINK	1.000	
503L-4363	REGULATOR BOARD	1.000	
10296	FUSE CLIP 3AG RIVIT PCB	2.000	
10583	RES MTL FILM .51 OHM 2W 5%	2.000	
10672	TRANSISTOR 2N3055	1.000	
10678	TRANSISTOR 2N4233A	1.000	
10310	HEATSINK 170-HC	1.000	
10311	HEATSINK 172-HC	1.000	
8775	STABDOFF RND BRASS 4-40 X .625	4.000	
10644	TERM BLK 4 TERM 4-142	1.000	

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
503L-011	REAR PANEL	1.000	
10261	FAN TUBEAXIAL 4.68"SQ 113CFM	1.000	
10282	FUSE 3AG GLS SLOBLO 2A 250V	1.000	
10298	FUSE HOLDER 1 342001L	1.000	
10341	LINECORD A 18/3	1.000	
10265	FAN FILTER 06450-M	1.000	
10347	CLAMP LINECORD	1.000	

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
10054	CAP CER TRIM 2-10PF 250VDC@85C	1.000	
10063	CAP .033 MF RPE121Z5U333M50V	4.000	
10103	CAP 10PF DM5CC100A	2.000	
10118	CAP .22 MF 50V CER CHIP	4.000	
10145	CHOKE,IRON,22UH,Q75,2.5MHZ	3.000	
10472	PRE AMP PCB A-86	1.000	
140011	RES C-FILM 39 OHM 1/4W 5% C7	12.000	
140022	RES C-FILM 200 OHM 1/4W 5% C7	1.000	
140023	RES C-FILM 240 OHM 1/4W 5% C7	1.000	
140024	RES C-FILM 270 OHM 1/4W 5%	1.000	
140025	RES C-FILM 300 OHM 1/4W 5% C7	2.000	
180001	RES 12 OHM 1/8W 5% C7	1.000	
180002	RES 18 OHM 1/8W 5% C7	1.000	
180010	RES 300 OHM 1/8W 5% C7	2.000	
180011	RES 470 OHM 1/8W 5% C7	2.000	

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
10063	CAP .033 MF RPE121Z5U333M50V	14.000	
10099	CAP 2 PF DM5CC020D	7.000	
10101	CAP MICA 4PF 300V .5%	1.000	
10103	CAP 10PF DM5CC100A	32.000	
10118	CAP .22 MF 50V CER CHIP	14.000	
10145	CHOKE,IRON,22UH,Q75,2.5MHZ	7.000	
221116	CONN. "SMB" VERTICAL PCB MOUNT	2.000	
10456	POWER AMP BOARD A-57B	1.000	
120013	RES C-FILM 200 OHM 1/2W 5% C7	3.000	
120014	RES C-FILM 240 OHM 1/2W 5% C7	4.000	
120027	RES C-FILM 1.5K OHM 1/2W 5% C7	7.000	
140011	RES C-FILM 39 OHM 1/4W 5% C7	28.000	
140013	RES C-FILM 51 OHM 1/4W 5% C7	1.000	
140018	RES C-FILM 100 OHM 1/4W 5% C7	5.000	
140026	RES C-FILM 330 OHM 1/4W 5% C7	7.000	
180002	RES 18 OHM 1/8W 5% C7	6.000	
180003	RES 27 OHM 1/8W 5% C7	1.000	
180007	RES 180 OHM 1/8W 5% C7	2.000	
180010	RES 300 OHM 1/8W 5% C7	12.000	
10226	CORE E BALUM YELLOW	4.000	
10230	CORE I BALUM YELLOW	3.000	

PART NUMBER	DESCRIPTION	QTY	REFERENCE DESIGNATORS
10063	CAP .033 MF RPE121Z5U333M50V	3.000	
10093	CAP 560 PF 300V 5% MICA RAD	2.000	
10327	IC POS ADJ OTPUT VLTG REG 1CKT	2.000	
10408	RES POT 200 OHM 72PLR200	3.000	
10450	REGULATOR PCB A-45	1.000	
140064	RES C-FILM 47K OHM 1/4W 5% C7	1.000	
10568	RES M-FILM 2.2K OHM 1/2W 2%	1.000	
10569	RES M-FILM 2.7K OHM 1/2W 2%	1.000	
10570	RES M-FILM 5.1K OHM 1/2W 2%	1.000	
10571	RES M-FILM 6.8K OHM 1/2W 2%	1.000	