PJ 250

FM Power Amplifier
87.5 - 108 MHz Range

TECHNICAL MANUAL

INDEX

PRELIMINARY INSTRUCTIONS AND WARRANTY INFORMATION

1. Please observe all safety precautions when handling this unit. This equipment contains dangerous currents and voltages.

2. This manual is written as a general guide for those having previous knowledge and experience with this kind of equipment. It is not intended to contain a complete statement of all safety precautions which should be observed by personnel in using this or other electronic equipment.

3. BEXT Inc. does not assume responsibility for injury or damage resulting from improper procedures or practices of untrained/unqualified personnel in the handling of this unit.

4. Please observe all local codes and fire protection standards in the operation of this unit.

5. CAUTION: Always disconnect power before opening covers or removing any part of this unit. Use appropriate grounding procedures to short out capacitors and high voltage points before servicing.

6. Any damage to the goods must be reported to the carrier in writing on the shipment receipt. Any discrepancy/damage discovered subsequent to delivery shall be reported to BEXT Inc. within five days of receipt.

7. BEXT Inc. extends to the original end-user purchaser all original manufacturer's warranties which are transferable and all claims are to be made directly to BEXT Inc. per indicated procedures.

8. All manufacturer's warranties will be supported by BEXT Inc. to ensure precise and speedy service where possible.

9. BEXT Inc. shall not be liable for damages of any nature arising out of or in connection with the product or its use thereof.

10. BEXT's warranty shall not include:

    10.1 Reshipment of the unit to BEXT for repair purposes.
    10.2 Any unauthorized repairs/modifications.
    10.3 Incidental/consequential damages as a result of any defect.
    10.4 Nominal non-incidental defects.
    10.5 Reshipment costs or insurance of the unit or replacement units/parts.

11. Warranty shall commence on the invoice date and for the period of the manufacturer's warranty.

12. To claim your rights under this warranty:

    12.1 Contact the dealer or distributor from whom this product was purchased. Describe the problem and ask if they have an easy solution. Dealers and distributors are supplied with information on problems which may occur and usually can repair the unit more quickly than going directly to the factory. It is also often true that errors in installation or use will be discovered by your dealer.

    12.2 If your dealer cannot help, contact BEXT Inc. at (619) 239-8462 and explain the problem. If it is determined that the unit needs to be returned to the factory, BEXT will provide a return authorization number with instructions.

    12.3 When you receive the return authorization, you can return the unit. Pack the unit carefully for shipment. Preferably, use the original packing materials and assume that the shipping carton will be dropped several times during the transportation process. We recommend the use of UPS or similar freight services and would discourage the use of the postal system. The customer assumes the risk of loss, (i.e. BEXT Inc., is not responsible for damage or loss) until the package is received by BEXT, so we advise taking out insurance for the full replacement value of the unit. Ship the unit PREPAID to the address specified by BEXT's service manager on the return authorization. DO NOT RETURN UNITS WITHOUT A RETURN AUTHORIZATION, AS THEY WILL NOT BE ACCEPTED.

    12.4 Be sure to enclose a written descriptive statement of the problem experienced and a copy of your original invoice establishing the starting date of the warranty.

13. BEXT Inc. reserves the right to modify the design and specifications of the equipment in this manual without notice.

14. Replacement and warranty parts may be ordered from the address below. Be sure to include equipment model and serial number and part description and part number.

BEXT Inc.

1045 Tenth Avenue
San Diego, CA 92101 USA
(619) 239-8462 • FAX (619) 239-8474

24-Hour Pager: (619) 529-4711

e-mail: support@bext.com
http://www.bext.com

INSTALLATION

INSTALLATION

A. Read the BEXT warning, shipping and warranty information at the front of the manual.
B. Handle the unit as carefully as possible.
C. Unpack the amplifier and, before any other operation, check that the amplifier isn't damaged and that all controls on the front and rear panel are in good condition.
D. Save the original packing materials.

MECHANICAL / ELECTRICAL

A. Operate the unit with adequate ventilation in a relatively cool environment.
B. Check that the A.C. supply is adequate for the expected power consumption and that the line voltage matches the taps in the unit with minimal line voltage variation. If the line voltage fluctuates frequently and extensively, a voltage regulator is recommended. A surge/transient suppression system is also highly recommended.
C. Never operate the unit without a dummy load or properly matched antenna load.
D. If you are going to operate solid state equipment as a final amplifier in a very crowded transmitting site, it is suggested that a fundamental frequency/cavity bandpass filter be inserted in the line between the equipment and the antenna. The BEXT staff can assist you.

OPERATION

A. Open the cover and check the voltage setting on the transformer. The transformer offers several taps for different voltages. If it is found necessary to move the taps, move only the A.C. primary taps. Do not move the fan wires which are connected to the same terminal block.
B. Turn the "power adjust" of the exciter to zero and turn the power switches to the "off" position of both the amplifier and the exciter. Set the exciter to the desired frequency of operation.
C. Connect the RF output of the exciter to the input of the amplifier. The input of the amplifier uses a type "N" connector. Use good quality cable to prevent RF leakage. Connect the RF output of the amplifier to a suitable dummy load or antenna.
D. Connect the exciter A.C. cord to the plug provided on the rear of the amplifier. This will provide protection by shutting down the exciter when an alarm condition is detected by the amplifier. Connect the amplifier A.C. cord to the A.C. supply.
E. Turn the amplifier power on. The power indicator should come on and the fans should begin running. **CAUTION:** Do not apply RF drive unless the fans are running properly. If the unit does not come on the user should check the following:
    1. Check the A.C. line fuses.
    2. Check the A.C. line connections.
    3. Check the internal transformer taps and the fan/blower itself.
F. Turn on the exciter. The power indicator light should come on and a lock indication should come on. The exciter blower should also be running. Check all power supply voltages on the amplifier and exciter to ensure they are correct before proceeding. The amplifier voltage should be approximately 28 volts. Exciter voltages will be marked on the front panel of the exciter and will vary with the type of exciter.
G. Set the power meter switch to the forward power position on both the exciter and the amplifier. Slowly advance the power on the exciter until RF power output is observed on both meters. Check now for VSWR. If the standing wave reading appears normal (less than 1.5:1) then proceed to raise the power. The voltage on the amplifier should remain steady at approximately

28 volts. The exciter PA voltage will change with drive level. Efficiency of the amplifier will be approximately 60%.

H. Maximum VSWR should never exceed 2:1. Should the amplifier see a VSWR higher than this it will trip the alarm board and shut down both the amplifier and the exciter.

I. Alarm conditions which will shut down the amplifier are: VSWR of greater than 2:1; excessive power output(higher than the rating); high temperature. Should the amplifier sense any of the above conditions it will shut down and automatically attempt to restart after 90 seconds and will attempt 4 times to restart. The unit will then shut down for 15 minutes; and again go through the 4 restart attempts. After four of these cycles the unit will go into a permanent shutdown. The power must be recycled to reset the alarm circuits. The operator should always look at the front panel to determine which alarm shut the unit down. This will aid in locating conditions which are causing the problem should one exist.

J. Telemetry is provided on the rear panel to monitor the voltage, current, power, and reflected power of the amplifier. Terminals are also provided to enable putting the amplifier in standby via a momentary contact closure. A momentary contact closure will also reactivate the amplifier. A second input is provided which will place the amplifier and exciter in standby. Two "BNC" connectors labeled "REMOTE" are provided on the rear of the amplifier and another on the rear of the exciter. Connect the exciter remote BNC to the either of the amplifier remote BNC connectors. By placing a ground on the center pin of the second BNC connector the RF drive will be shut down to the amplifier. This can be accomplished by placing a ground on the exciter remote connection only.

K. High VSWR conditions may be caused by icing of the antenna during winter storms. Leaking transmission lines may have moisture or damage may occur to the antenna itself. Do not attempt to reset the alarm levels to circumvent an external problem. This will cause damage to the expensive RF output transistors and void the warranty. The user should also provide effective lightening protection such as sorted quarter wave stubs on the transmission line. Power line protection is also recommended as lightening hits many time come in on the power or telephone lines. The telemetry lines should also be protected if connected to the telephone lines or lines exiting the building. A good grounding system will help ensure many years of reliable operation from your solid state equipment.

TABLE A
TECHNICAL SPECIFICATIONS

A.C. Supply	100-130 V or 198-250 V 50-60 Hz
Cooling	Forced Ventilation
Frequency Range	from 87.5 to 108 MHz or from 66 to 75 MHz
Power Output	Max 300 W, typ. 250 W (Note: Limit power to 250W to maintain a good level of reliability.
RF Drive Power	approximately 25 W for P out=250 W
RF Input Impedance	50 ohm
RF Output Impedance	50 ohm
I/O Connector	Standard "N" Connector
Harmonic and Spurious Signal Suppression	meets or exceeds FCC and CCIR regulations
Power Consumption	800 w

TABLE B
DIMENSIONAL AND ENVIRONMENTAL SPECIFICATIONS

Cabinet Dimension	122mm(4.8")H x 420mm(16.54")W 350mm(13.78")D
Panel Size	483mm(19")W x 132mm(5.2")H
Operating Temperature	-10°C to 45°C
Humidity	90% Max, Non Condensing
Weight	19 Kg

The protection acts for excessive SWR, over-temperature and overdrive. It indicates the problem with warning lights and disables the pilot exciter.

FRONT AND REAR PANEL CONTROLS

A. FRONT PANEL

1. Fuse 6.3 amps 220 Vac or 15 amps 120Vac
2. On/Off A.C. power switch
3. A.C. Blown Fuse Indicator
4. A.C. Power Indicator
5. Multimeter
6. Multimeter Switch
7. D.C. Fuse 20 amps
8. D.C. Blown Fuse Indicator
9. Temperature Alarm Indicator Lamp
10. Excessive Drive Alarm
11. VSWR Alarm Indicator
12. Remote Disable Indicator

B. REAR PANEL

1. RF output connector Type "N"
2. RF input connector Type "N"
3. Accessory AC plug for exciter (max 3 amps)
4. Remote protection connector Type "BNC", ground to activate
5. Remote protection connector Type "BNC". ground to activate
6. Telemetry Connections
7. Air Duct
8. A.C. Line Input

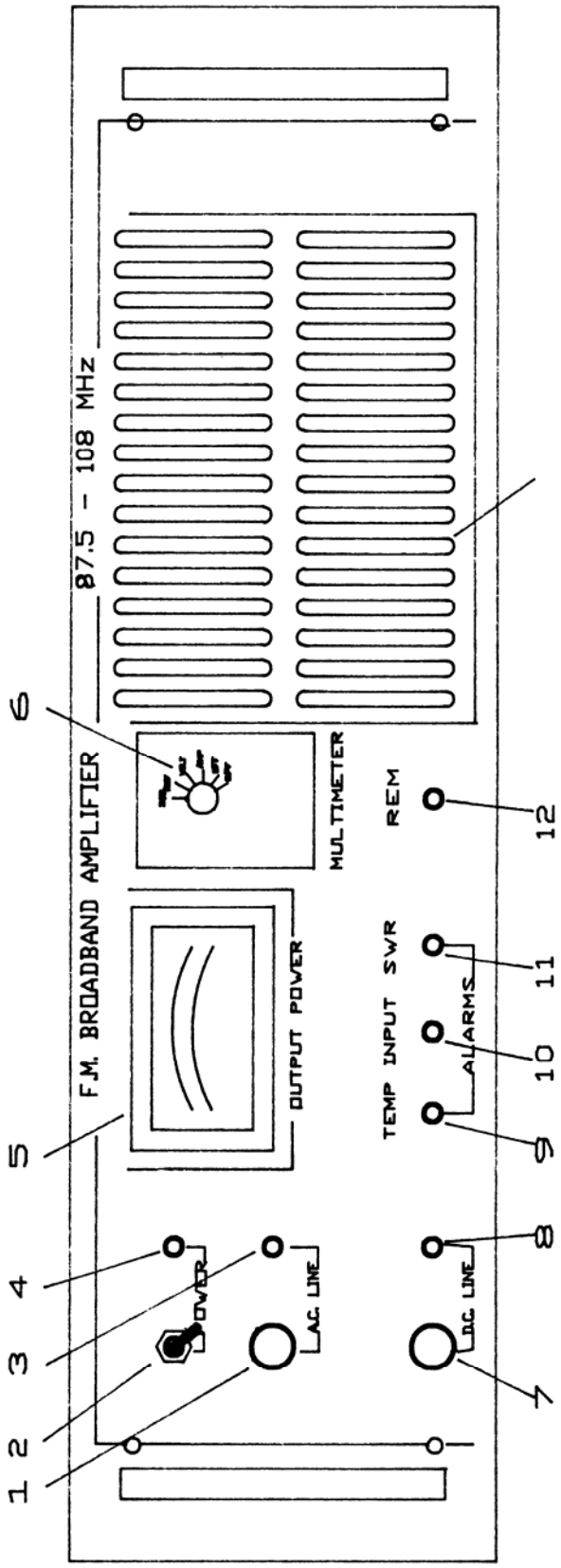


FIGURE 1 FRONT PANEL

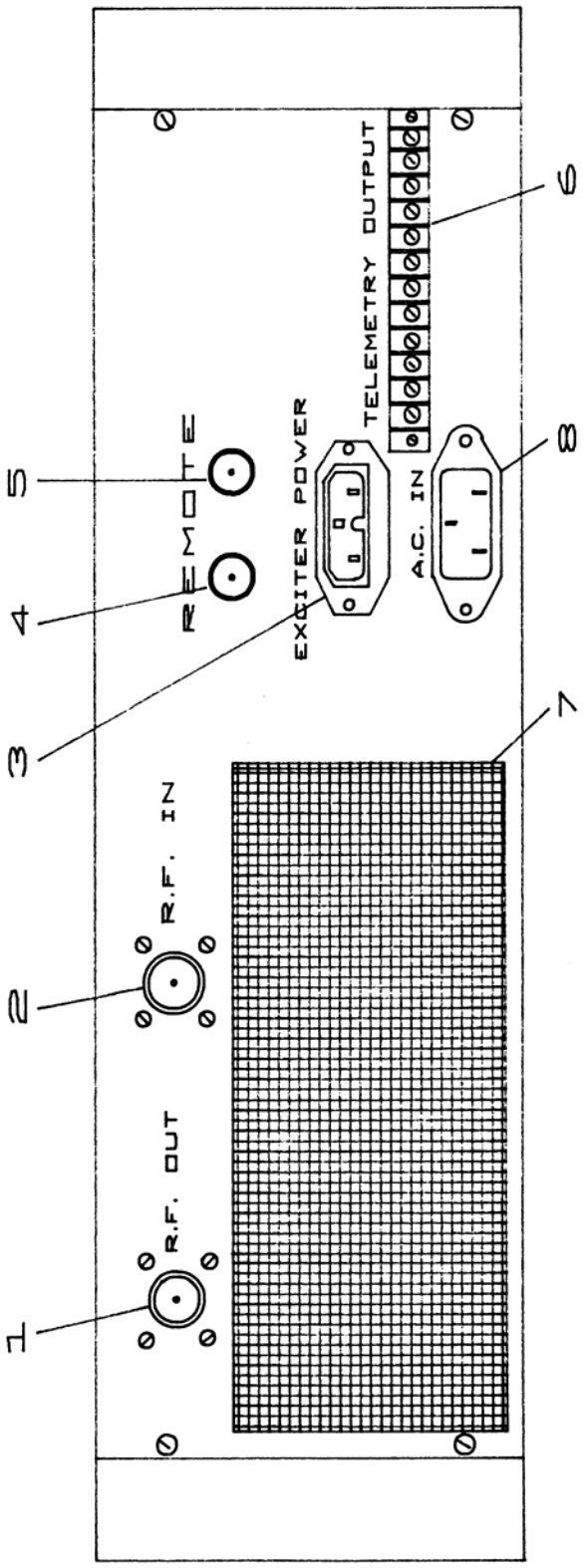


FIGURE 2 REAR PANEL

PJ250 GENERAL DESCRIPTION

EXTERNAL DESCRIPTION

The PJ250 is housed in a 3U 19" rack, on the front panel the alarm indicators are placed in a central position, the mains switch and the meter for the forward and reflected power. On the rear panel the RF INPUT and RF OUTPUT connectors are located, together with the interlock connectors, one of BNC type and one VDE female, the main voltage input.

ELECTRICAL DESCRIPTION

The PJ250 is a power amplifier working on the 87.5-108 MHz band with an output power in excess of 250W and a drive level of about 25W. This amplifier uses a RF module composed of four amplification stages (MRF 317), with power supplies fixed with the RF module on cooling ribs to obtain a high dissipation. A built in low pass filter suppresses the harmonic contents below the FCC and CCIR requirements. A protection system protects the amplifier against thermal problems, excessive input drive power and excessive SWR inside the amplifier or along the feeder. This system provides an automatic reset to initial conditions when the problem ceases.

METERS AND INDICATORS

The forward and reflected power of the amplifier are read by the analog multimeter (11.Fig.1) and selected by the selector (12.Fig.l) on the front panel. Various led indicators indicate the alarm conditions caused by thermal problems (3.Fig.l), excessive input drive power (4.Fig.l) and excessive SWR (5.Fig.l). A green indicator confirms the amplifier is operational (10.Fig.1).

PROTECTION CIRCUITS

The protection circuits put the amplifier in stand-by in the case of a fault condition. After 90 seconds the protection reactivates the amplifier if the fault has disappeared. If not, this process is repeated 4 times, at the end of which the amplifier stays disabled for 15 min; after 15 min, if the trouble persists, the protection performs another four cycles and then disables the amplifier indefinitely. If during these cycles the anomaly disappears and the amplifier works regularly for more than 15 min, the counting system is reset and the original conditions established.
NOTE: the intervals described are nominal.

ELECTRICAL DESCRIPTION

INTRODUCTION

This section describes the overall working theory of the PJ250. For ease of description the amplifier is subdivided into subassemblies that will be discussed in detail below. The block diagram is illustrated in Fig.5.

POWER SUPPLY

The power supply comprises of a P.C. board fitted to the cooling fins and is accessible from the lower part of the amplifier, unscrewing the fixing bolts of the cooling fins as shown in Fig.4. A mains transformer has a selectable input for voltages between 110 and 240 V and two outputs:

"A": 31 V, "B": 18 V.

The output "A" drives the RF modules. Output "B" supplies the ALARMS CARD; inside this circuit a rectifying and stabilization circuit provides the +15 V needed by the electronics.

ALARMS CARD

This module is composed of a board shielded by a metal box mounted on the left side near the rear panel, as shown in Fig.3. on this board, the electronics detect any system anomaly such as excessive SWR, internal or antenna, over-temperature or overdrive, This module will also, whenever possible, reset the system to its original conditions, after a fault has occurred.

RF POWER AMPLIFIER

The module is placed in the upper right side of the amplifier. This module is totally shielded and placed on a heat sink (see Fig.3). This circuit delivers 300W with 25-30W of drive and is supplied by a dedicated power supply. The quiescent parameters of each module are:

Vdc=28V Ia=15A Pout=250 W

The active devices employed are BJT NPN MOTOROLA (MRF317).

LOW PASS FILTER

This filter is fitted in a metallic box mounted on the heat sink on the right position as shown in Fig.3. Thanks to this low pass filter the harmonic suppression is greater than 75 dBm.

DIRECTIONAL COUPLER

This circuit is placed on the upper right side of the amplifier and fitted on the rear panel as shown in Fig.3. This module makes the measurement of the forward and reflected power.

RECOMMENDED TEST EQUIPMENT

INSTRUMENT TYPE	SUGGESTED MODEL	CRITICAL SPECIFICATIONS
Non Inductive Dummy Load	Bird	50 ohm P > 250 W
Spectrum Analyzer	Advantest MOD. R4131D	10KHz-3.5GHz
FM Monitoring	R/S	
Demodulator	MOD. F.A.M.	
Digital Multimeter	MOD. Metrix	
Calibrated in-line Wattmeter with Sample	Bird MOD. 43	50 ohm
Exciter	BEXT MOD TEX 30	Frequency 87.5-108MHz Pout from 2W to 30W
Dummy Load		25 ohm P 500W

MAINTENANCE

INTRODUCTION

The following section provides general maintenance information and electrical adjustment procedures for the PJ250 Amplifier. Maintenance is divided into categories dependent upon the complexity of the procedure and the test equipment required to complete the maintenance.

WARNING! WARNING! WARNING!

When the amplifier is operated with the top cover removed, hazardous voltages are accessible on the A.C. line voltage selector and heavy currents are accessible on the exposed terminals of the power supply filter capacitor and power transistors mounted on the RF amplifier heat sink assembly. Use the insulated tuning tool provided for any adjustment and do not touch any component within the amplifier when power is applied. Ensure all primary power is disconnected from the amplifier before attempting equipment maintenance.

FIRST LEVEL MAINTENANCE

ORDINARY MAINTENANCE

The only regular maintenance needed by the PJ250, is the periodic replacement of the blowers, and the cleaning of dust filters and any dust accumulated inside the amplifier. The time between overhauling of the blowers depends upon several environmental factors, temperature, humidity, dust pollution etc., Blowers should be checked every 6 months and replaced if noisy. They should be replaced any way after 18 months of service.

SECOND LEVEL MAINTENANCE

CARDS REPLACEMENT

This section contains useful information for card replacement.
WARNING! TO RE-INSTALL CARDS SIMPLY FOLLOW THE REVERSE PROCEDURE.

POWER SUPPLY REPLACEMENT

1) open the top and bottom covers.
2) Remove the four screws (three external and one internal) of the Power Supply section placed under the RF section.
3) From the bottom of the amplifier, open the power supply section taking care not to break the wires connected to the card.
4) Disconnect the four fasteners placed on the power supply, and unsolder the other wire.
5) Extract the power supply section.

ALARMS CARD REPLACEMENT

1) Open the top cover.
2) Remove the screws fixing the card on the left side of the amplifier.
3) Take note of the position of wires placed on the rear of the metal box.
4) Unsolder the wires placed on the rear of the metal box.
5) Extract the Alarms card.

DIRECTIONAL COUPLER REPLACEMENT

1) Open the top cover.
2) Remove the fixing screws of the "N" type output connector (1.Fig.2).
3) Unsolder the output cable (RG 303 type) of the low-pass filter placed on the RF section.
4) Take note of the position of the four wires going out of the directional coupler and unsolder them.
5) Extract the Directional Coupler.

TRANSFORMER REPLACEMENT

1) Open the top and bottom covers.
2) Remove the central fixing bolt of the transformer.

3) Take note of the position of the transformer's wires connected to the terminal block placed on the metal support of the transformer (U.S. version), while for the standard version the wires of the fuse and of the switch should be unsoldered.
4) Disconnect these wires from the terminal block (only for the U.S. version).
5) Unsolder the two wires connecting the transformer with the Alarms card.
6) Disconnect the fastener of the transformer placed on the diode bridge fixed on the central chassis of the amplifier.
7) Extract the transformer.

FAN REPLACEMENT

1) Open the top and bottom covers.
2) Remove the four screws of the front panel.
3) Slide the front panel slowly.
4) Remove the fixing screws of the fan to the two rails.
5) Break the straps of the fan's wires.
6) Disconnect the fasteners connected to the top of the fan (some units may not be fitted with fasteners; in this case desolder the wires).
7) Extract the fan.

INTERNAL ADJUSTMENTS

POWER SUPPLY ADJUSTMENT

No adjustments are needed after this board has been changed.

DIRECTIONAL COUPLER BALANCING (PWR MEASURE)

1) Place the DIR/REF selector (12.Fig.1) to the REF position.
2) Connect (1.Fig.2) a non inductive dummy load 50 ohm / 250W to RF output with a through wattmeter (e.g. BIRD mod.43) in series as shown in SETUP 1.
3) Set the exciter power to obtain 250W on the through external wattmeter.
4) Now, adjust variable capacitor C2 placed on the directional coupler to obtain the minimum value on the meter, very near to zero.

FORWARD AND REFLECTED POWER ADJUSTMENT

1) Perform SETUP 1, and increase the amplifier's output power to 250W (on the external wattmeter).
2) Place the DIR/REF selector (12.Fig.1) to the DIR position.
3) Adjust trimmer R9 placed on the directional coupler so that the same reading is obtained on the PJ250 meter.
4) Switch off the amplifier.
5) Connect a dummy load 25 ohm 500W (2 dummy loads 50 ohm 250W in parallel) with a through wattmeter (e.g.. BIRD mod.43) in series, set for the reading of reflected power (SETUP 2).
6) Adjust the drive power to minimum and switch on the amplifier again.
7) Adjust the output power of the exciter to obtain a reading of 25W of reflected power on the external wattmeter.
8) Adjust trimmer R6 placed on the directional coupler to obtain the same reading on the PJ250 meter.

ALARMS CARD ADJUSTMENT

There are three trimmers on the Alarms card that are necessary to adjust the alarm thresholds: over-temperature - (R4); VSWR - (R7); and overdrive - (R21).

CALIBRATION OF OVER-TEMPERATURE ALARM THRESHOLD

1) Short-circuit the thermal switch placed on the RF section's heat sink.
2) Adjust the trimmer, R4, placed on the Alarms card until the over-temperature protection is activated, and the TEMP led lights up (3.Fig.1).
3) Remove the short-circuit on the thermal switch and verify that the TEMP led goes out.
4) Repeat this procedure again to verify the correct trimmer R4 adjustment.

CALIBRATION OF VSWR

1) Connect a dummy load, 25 ohm 500W (two dummy loads 50 ohm 250W in parallel) with a by-pass wattmeter in series (e.g., BIRD mod.43) set for reflected power reading (SETUP 2).
2) Adjust the output power of the exciter to obtain a reading of 25W of reflected power on the external wattmeter and the PJ250 meter.
3) Adjust the trimmer, R7, placed on the Alarms card until the R.O.S. protection is activated, and the SWR led lights up (5.Fig.l).
4) Decrease the output power of the exciter and wait for the SWR led to go out (automatic protection cycle).
5) Increase the output power of the exciter again over the R.0.S. threshold of 25W, and verify once again, that the SWR led lights up (5.Fig.1).

CALIBRATION OF OVER-DRIVE ALARM THRESHOLD

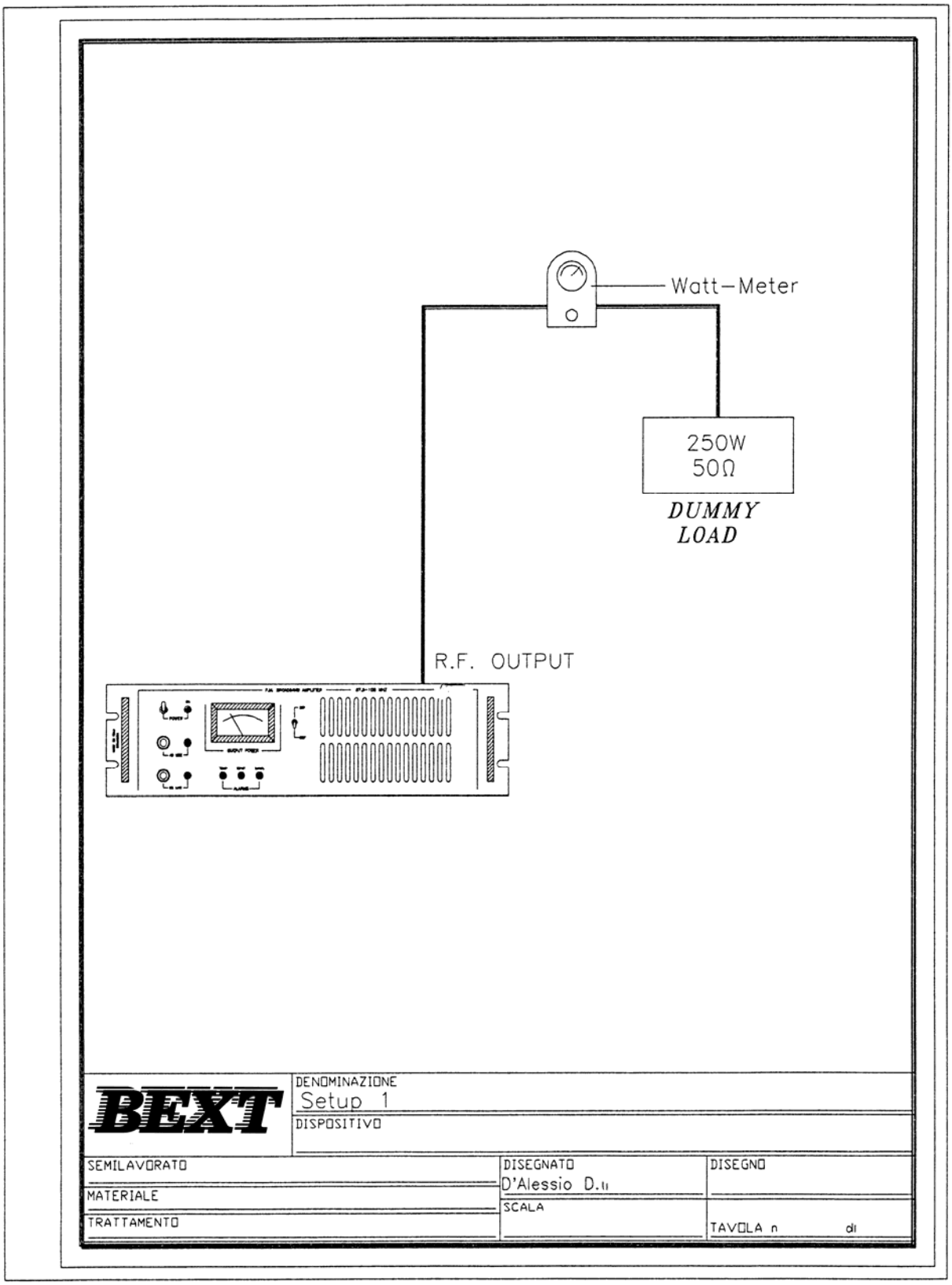
1) Adjust the driver power to minimum and switch on the amplifier.
2) Place the DIR/REF selector (12.Fig,l) to the REF position.
3) Connect (1.Fig.2) a non inductive dummy load 50 ohm 250W to the RF output with a through wattmeter (e.g., BIRD mod.43) in series as shown in the SETUP 1.
4) Set the exciter power to obtain 250W on the through external wattmeter and on the PJ250 meter.
5) Increase the output power of the exciter again until a reading of 270W on the PJ250 meter is obtained.
6) Adjust the trimmer, R21, placed on the Alarms card until the over-drive protection is activated, and the INPUT led lights up (4.Fig.1) with immediate shutdown of the amplifier.
7) Decrease the drive power of the exciter and wait for the INPUT led to go out.
8) Increase the drive power of the exciter again over the overdrive threshold of 270W, and verify, that the INPUT led lights up (4.Fig.1).

RF SECTION ADJUSTMENT

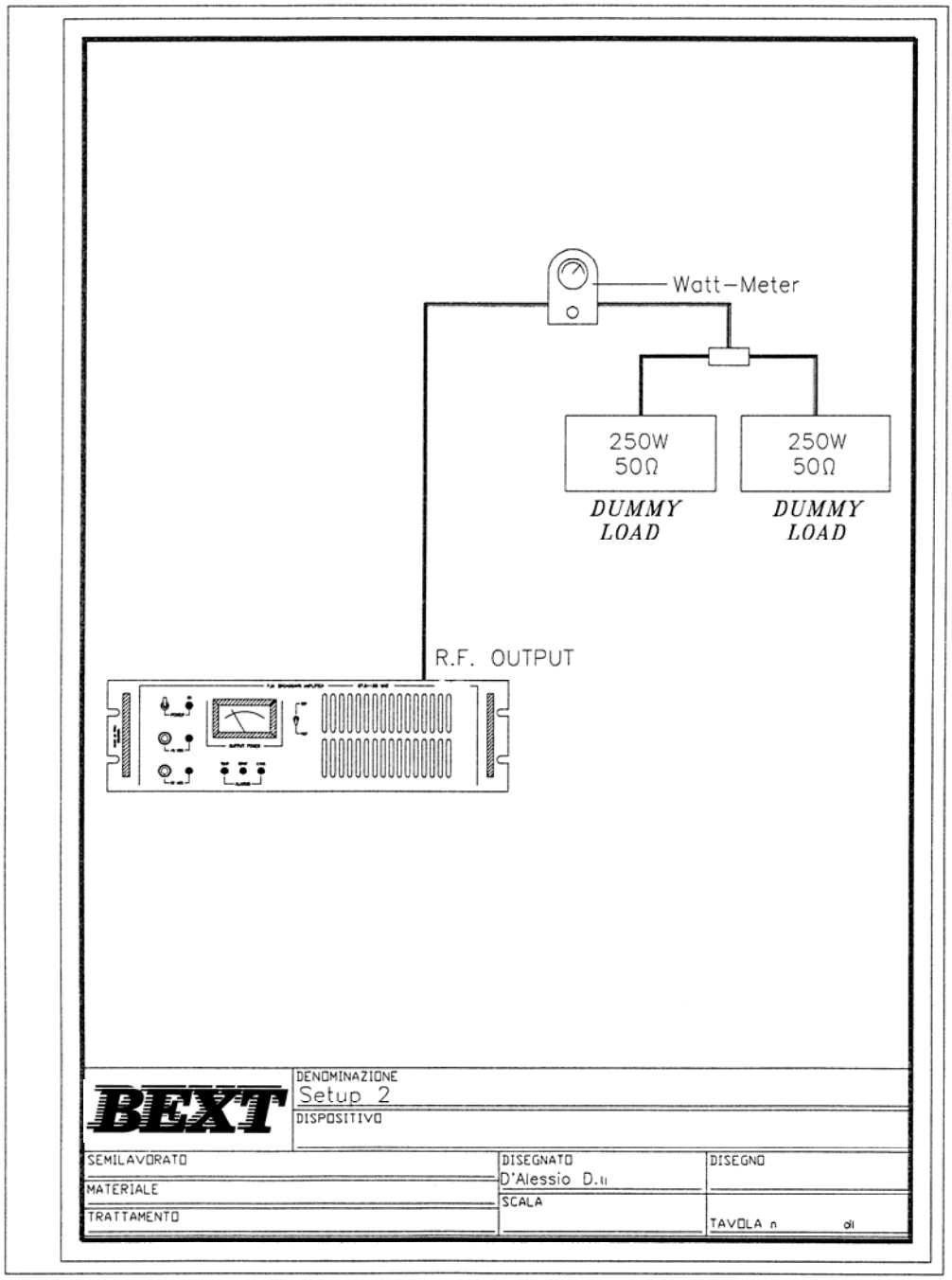
No adjustment is required inside the RF section because it's a factory adjusted module; if calibration is necessary, please send the module to your local distributor.

LOW-PASS FILTER ADJUSTMENT

No adjustment is required inside the Low-Pass Filter module because it's a factory adjusted module; if calibration is necessary, please send the module to your local distributor.


Watt–Meter
250W
50Ω
DUMMY
LOAD
R.F. OUTPUT
BEXT
DENOMINAZIONE
Setup 1
DISPOSITIVO
SEMILAVORATO
MATERIALE
TRATTAMENTO
DISEGNATO
D'Alessio D.ti
SCALA
DISEGNO
TAVOLA n
di

SETUP 1


Watt–Meter
250W
50Ω
DUMMY
LOAD
250W
50Ω
DUMMY
LOAD
R.F. OUTPUT
BEXT
DENOMINAZIONE
Setup 2
DISPOSITIVO
SEMILAVORATO
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SETUP 2

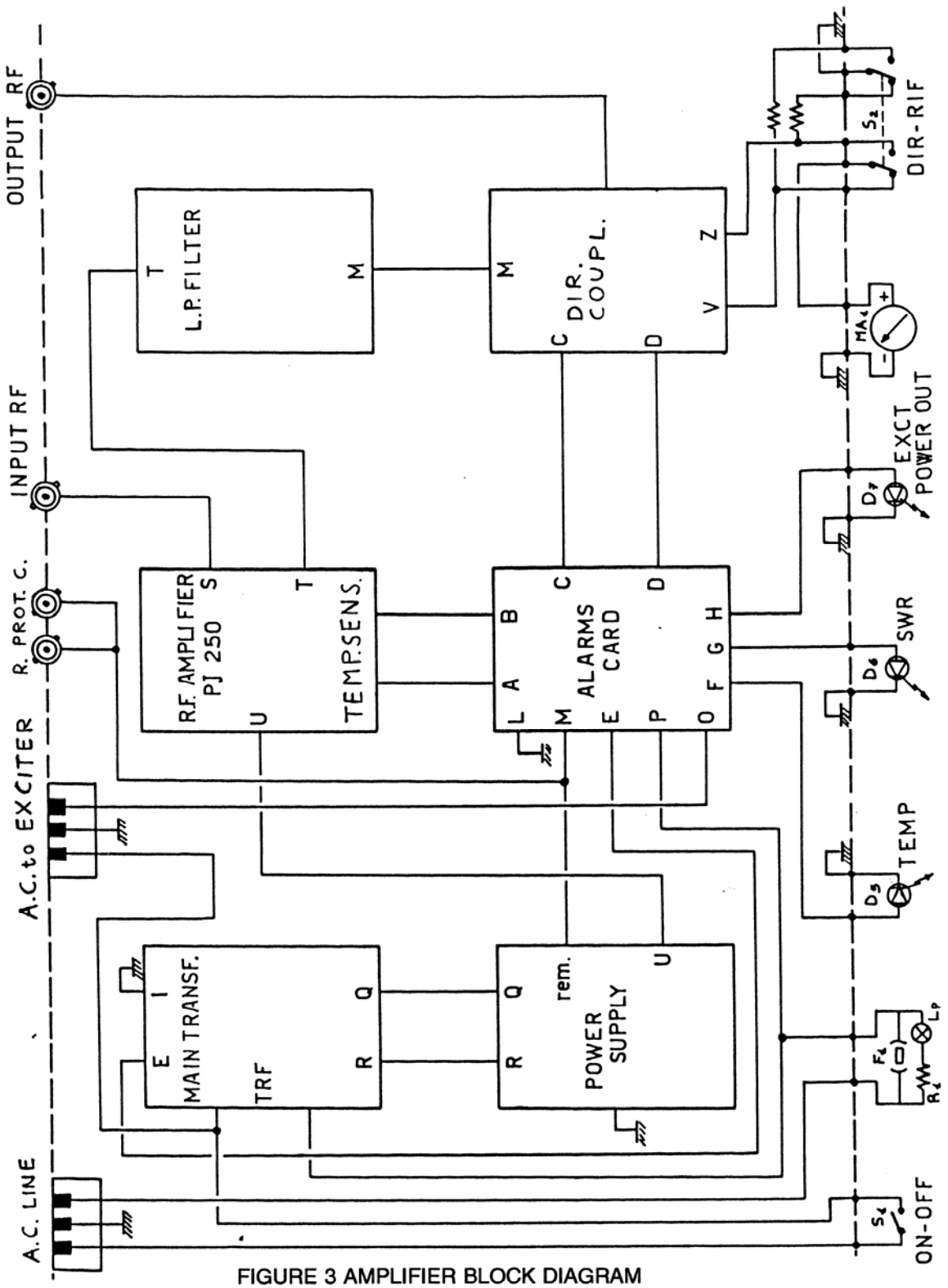

FIGURE 3 AMPLIFIER BLOCK DIAGRAM

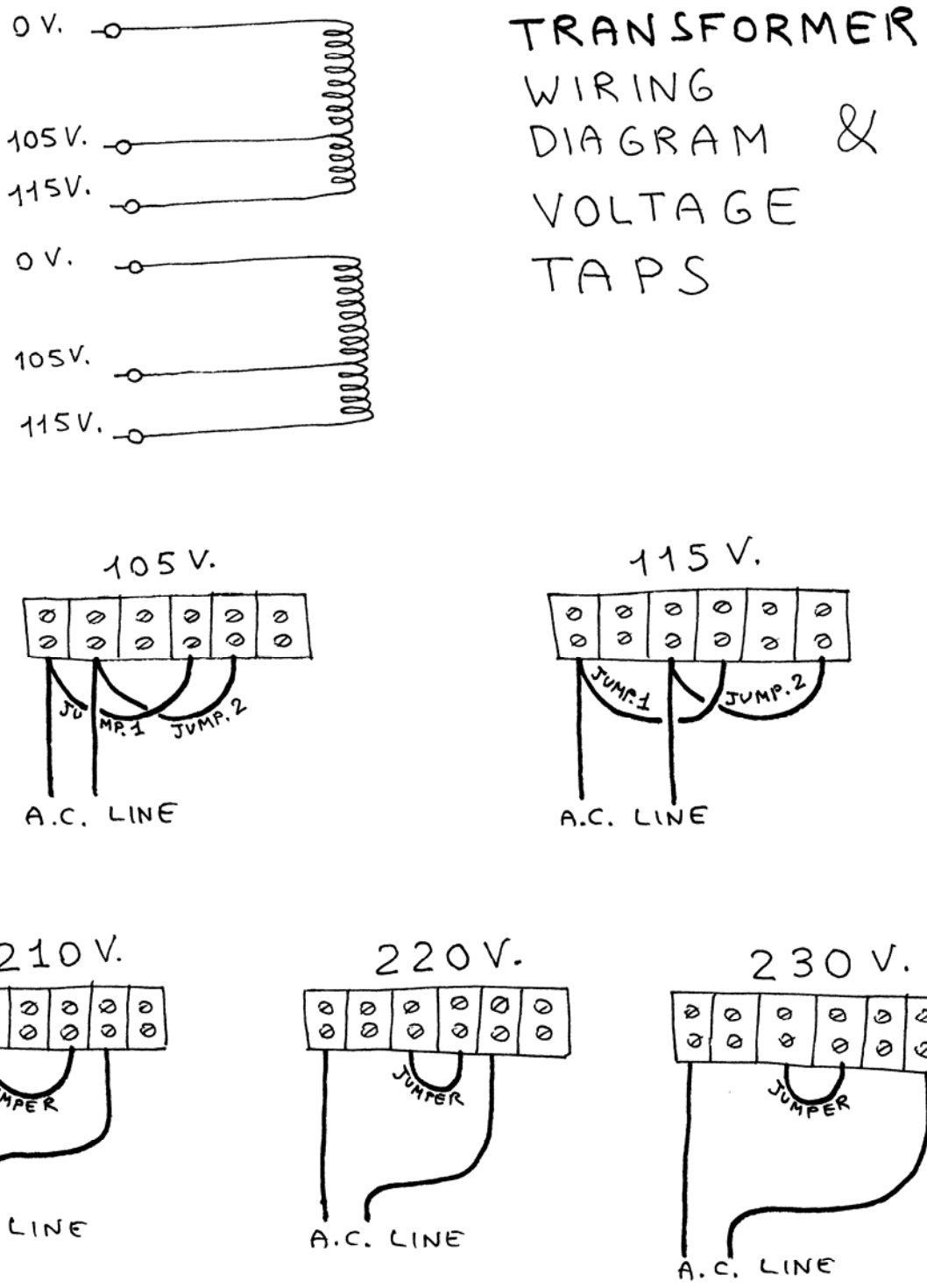

FIGURE 4 AC POWER CONNECTIONS

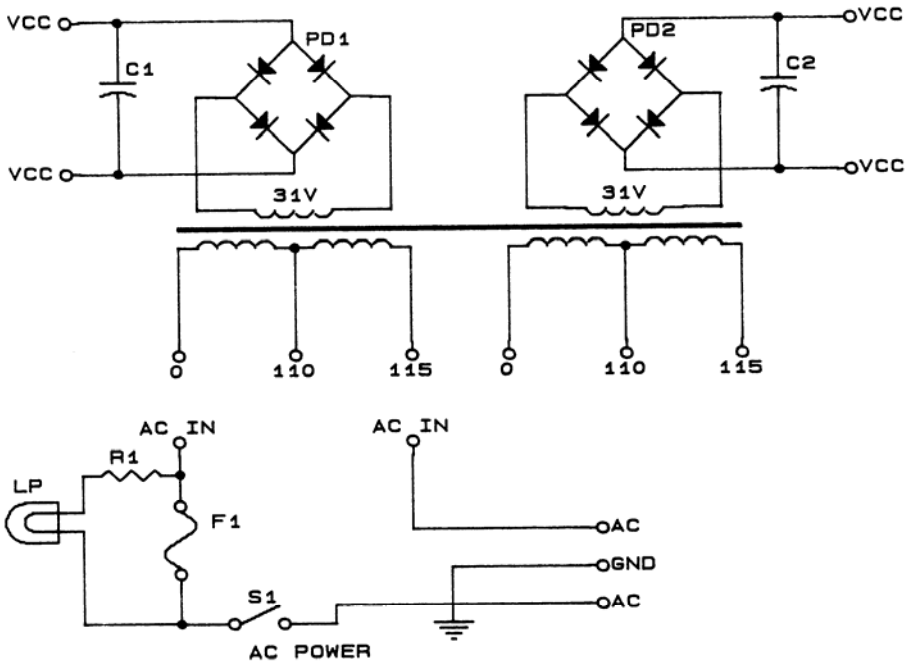

FIGURE 5 SCHEMATIC, UNREGULATED POWER

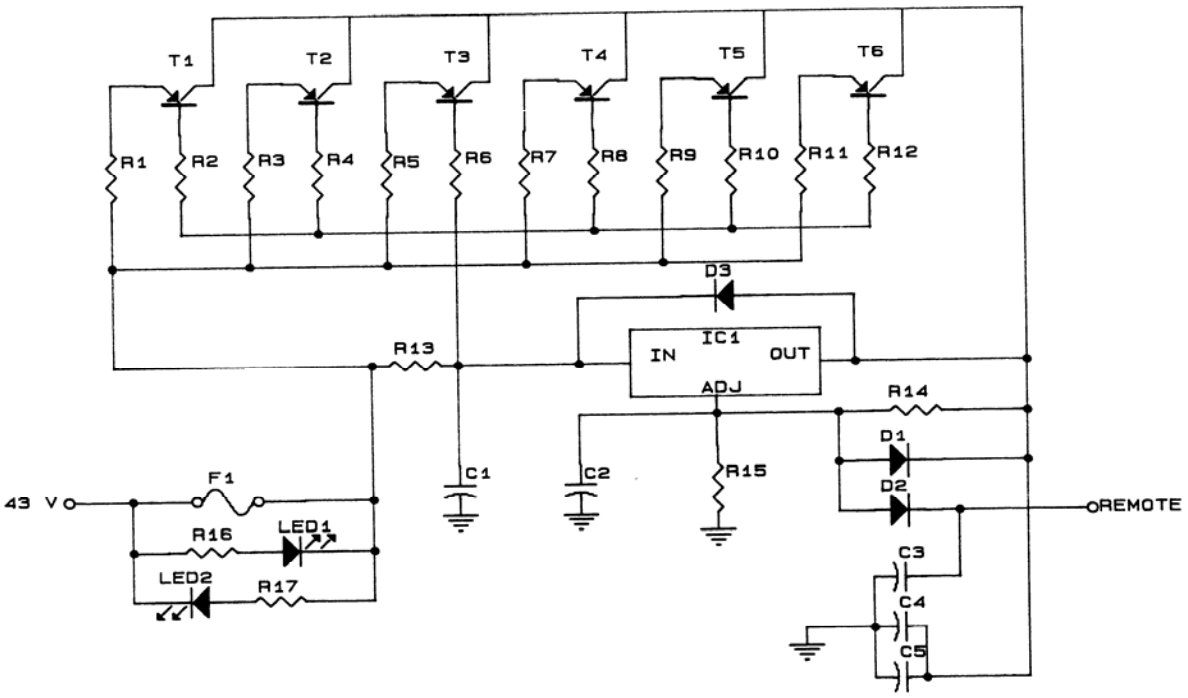

FIGURE 6 SCHEMATIC, REGULATED POWER

PARTS LIST
POWER SUPPLY

UNREGULATED

C1	Capacitor Elec. 10 nF 63Vdc
C2	Capacitor Elec. 10 nF 63Vdc
F1	Fuse 6 amps (220 Vac) 15 amps (120 Vac)
PD	Bridge Rectifier 100piv 25 amps
S1	AC Power Switch 15 amp
TRF	Transformer, Power 31 Vac 20 amp, 18Vac 1 amp, tapped primary

REGULATED

C1	Capacitor Elec. 10µF 63Vdc
C2	Capacitor Elec. 10µF 35Vdc
C3	Capacitor Ceramic 4.7nF
C4	Capacitor Elec 100µF 63Vdc
C5	Capacitor Ceramic 47nF
D1	Diode 1 N4003
D2	Diode 1 N4003
F2	Fuse 20 amp
I1	IC, Regulator LM317HVK
LED1	Indicator LED, Red
LED2	Indicator LED, Green
R 1	Resistor WW 0.22 ohm 5 watt
R2	Resistor 5.6 ohm 1/2 watt
R3	Resistor WW 0.22 ohm 5 watt
R4	Resistor 5.6 ohm 1/2 watt
R5	Resistor WW 0.22 ohm 5 watt
R6	Resistor 5.6 ohm 1/2 watt
R7	Resistor WW 0.22 ohm 5 watt
R8	Resistor 5.6 ohm 1/2 watt
R9	Resistor WW 0.22 ohm 5 watt
R10	Resistor 5.6 ohm 1/2 watt
R11	Resistor WW 0.22 ohm 5 watt
R12	Resistor 5.6 ohm 1/2 watt
R13	Resistor WW 4.7 ohm 5 watt
R14	Resistor 220 ohm 1/2 watt
R15	Resistor 4.7K ohm 1/2 watt
R16	Resistor 2.2K ohm 1/2 watt
R17	Resistor 2.2K ohm 1/2 watt

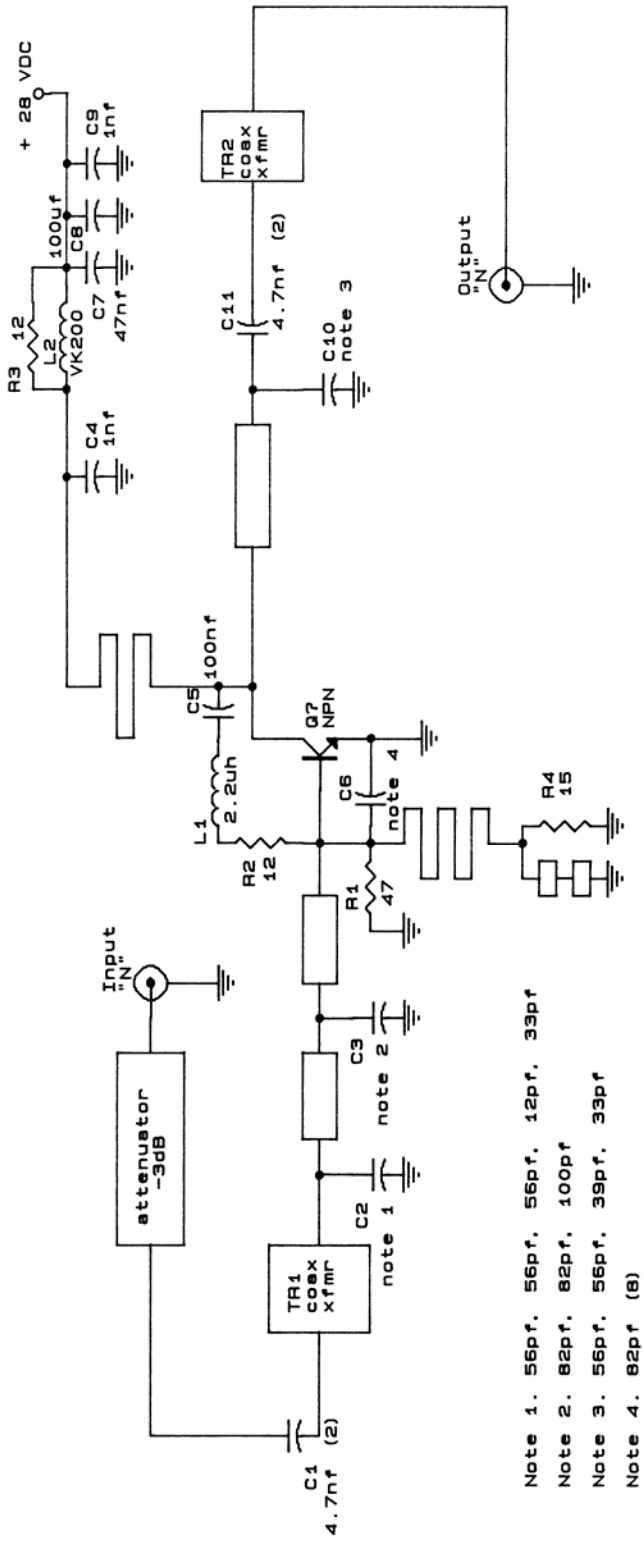

FIGURE 7 SCHEMATIC DRIVER AMPLIFIER PJ250LD ONLY

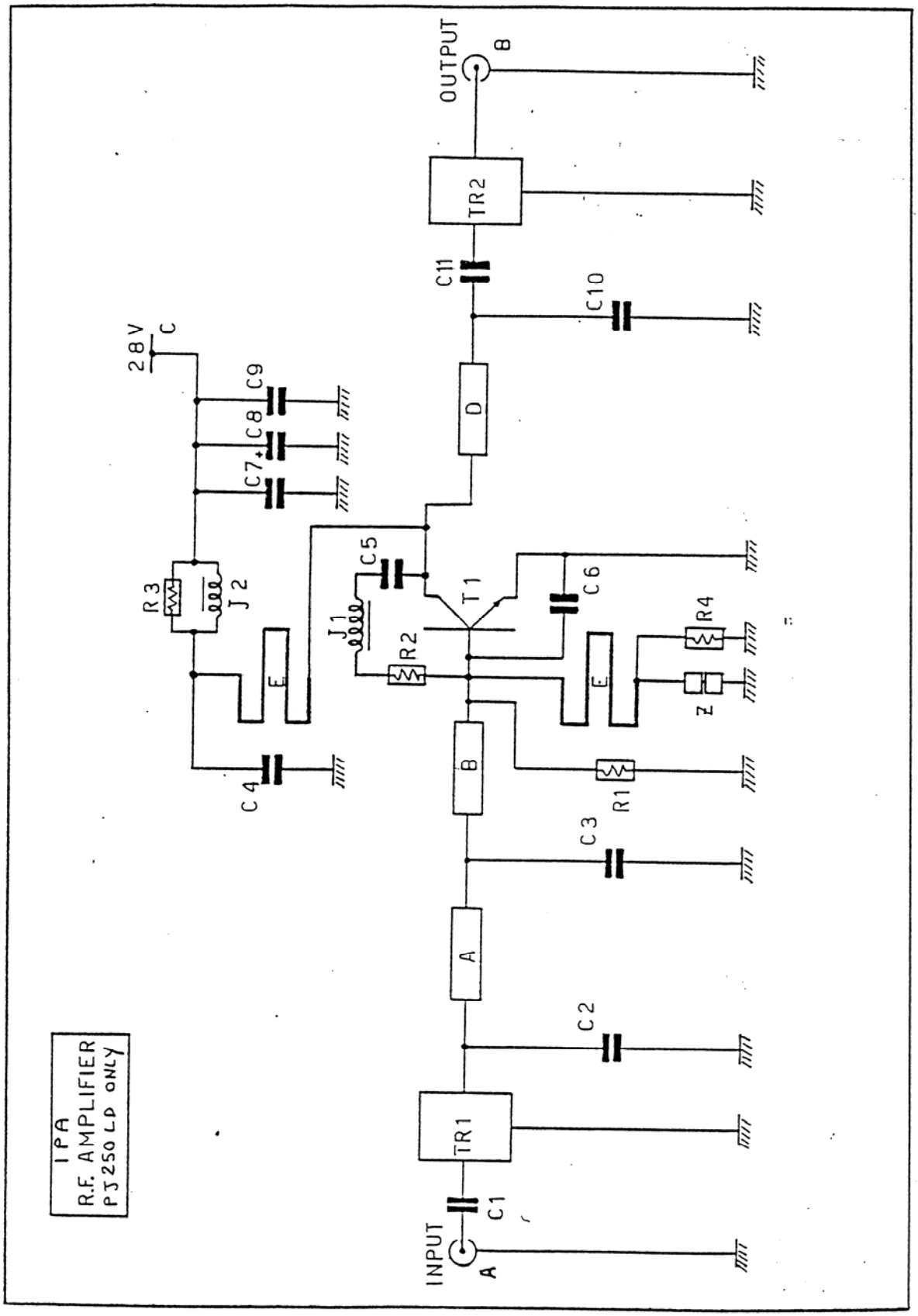
IPA
R.F. AMPLIFIER
PJ250 LD ONLY
INPUT
A
OUTPUT
B
28V
C
TR1
TR2
A
B
D
E
T1
J1
J2
R1
R2
R3
R4
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11

FIGURE 7a

PARTS LIST
RF DRIVER BOARD (PJ250 L/D ONLY)

C1	Capacitor, Ceramic, Group of 2 - 4.7nF, 4.7nF
C2	Capacitor, Ceramic, Group of 5 - 56pF, 56pF, 56pF, 12pF, 33pF
C3	Capacitor, Ceramic, Group of 3 - 82pF, 82pF, 100pF
C4	Capacitor, Mica, Unelco 1nF
C5	Capacitor, Ceramic, 100nF
C6	Capacitor, Ceramic, group of 8 - 82pF each
C7	Capacitor, Ceramic, 47nF
C8	Capacitor, Elec 100µF 35Vdc
C9	Capacitor, Ceramic 1nF
C10	Capacitor, Ceramic, Group of 4 - 56pF, 56pF 39pF, 33pF
C11	Capacitor, Ceramic, Group of 2 - 4.7nF, 4.7nF
J1	Inductor 2.2µH
J2	Inductor VK200
T1	Transistor, RF Power, PT9783
TR1	Transformer RF Broadband 4:1
TR2	Transformer RF Broadband 4:1
Z	Ferrite Bead

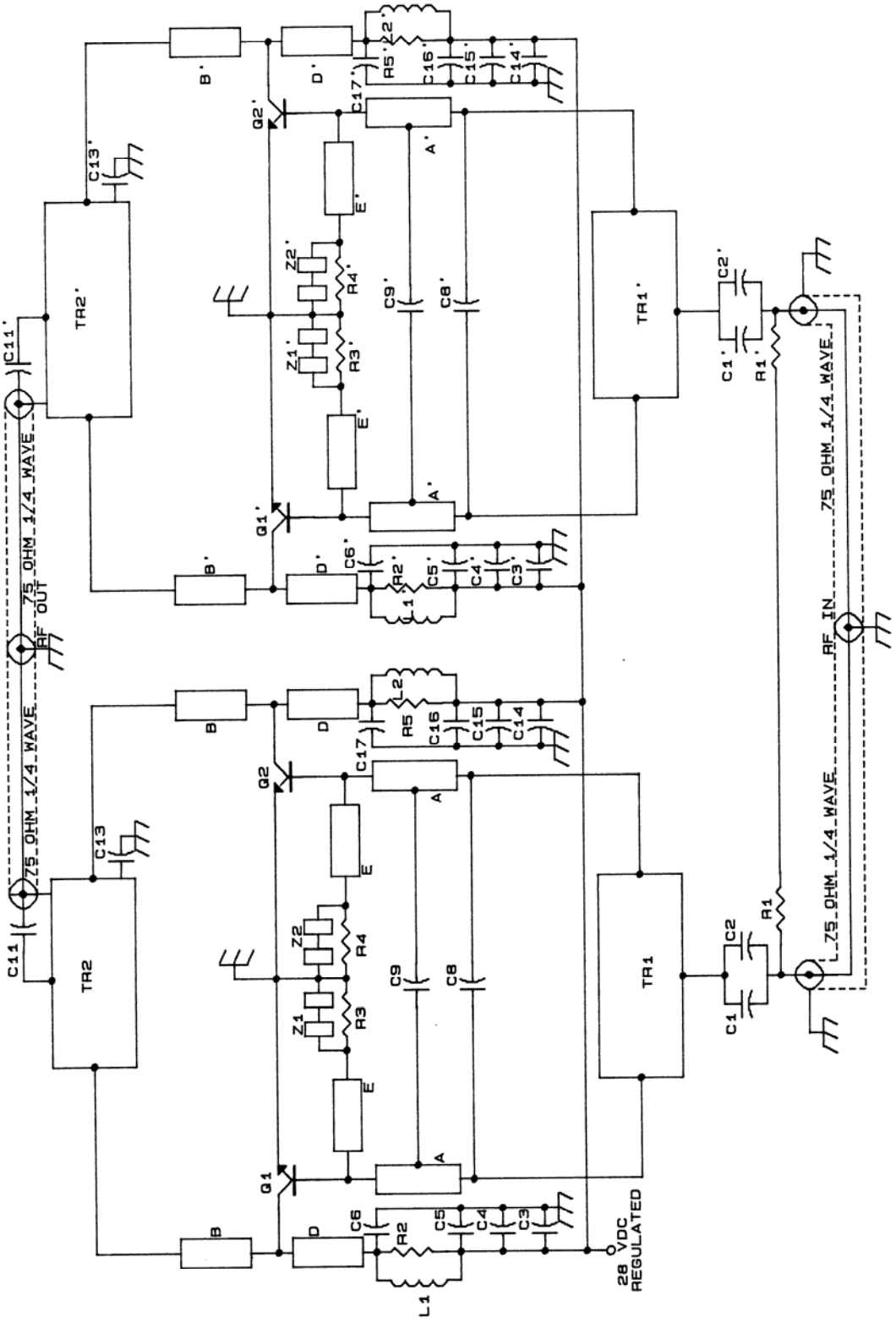

FIGURE 8 SCHEMATIC, POWER AMPLIFIER

PARTS LIST
RF POWER AMPLIFIER

NOTE: The PJ200 Power Amplifier is one section or half of the PJ250 Amplifier, therefore the parts list and schematic are common. The second half of the PJ250 Amplifier is a mirror image of the first half.

C1	Capacitor, Ceramic 4.7nF
C2	Capacitor, Ceramic 4.7nF
C3	Capacitor, Ceramic 47nF
C4	Capacitor, Elec 100µF 35Vdc
C5	Not Used
C6	Capacitor, Mica 1nF SEMCO
C7	Capacitor, Ceramic chip 470pF
C8	Capacitor, Ceramic chip 12pF
C9	Capacitor, Ceramic chip 47pF
C10	Capacitor, Ceramic, Group of 2 33pF each
C11	Capacitor, Mica 1nF SEMCO
C12	Not used
C13	Capacitor, Mica 1nF SEMCO
C14	Capacitor, Ceramic 47nF
C15	Capacitor, Elec 100µF 35Vdc
C16	Not used
C17	Capacitor, Mica 1nF SEMCO

L1	Inductor VK200
L2	Inductor VK200

R1	Resistor 47 ohm 1 watt
R2	Resistor 12 ohm 1/2 watt
R3	Resistor 12K ohm 1/2 watt
R4	Resistor 12 ohm 1/2 watt
R5	Resistor 12 ohm 1/2 watt

T1	RF Power Transistor MRF317
T1'	RF Power Transistor MRF317
T2	RF Power Transistor MRF317
T2'	RF Power Transistor MRF317

TR1	RF Transformer Broadband 4:1
TR2	RF Transformer Broadband 4:1

Z1	Ferrite Bead
Z2	Ferrite Bead

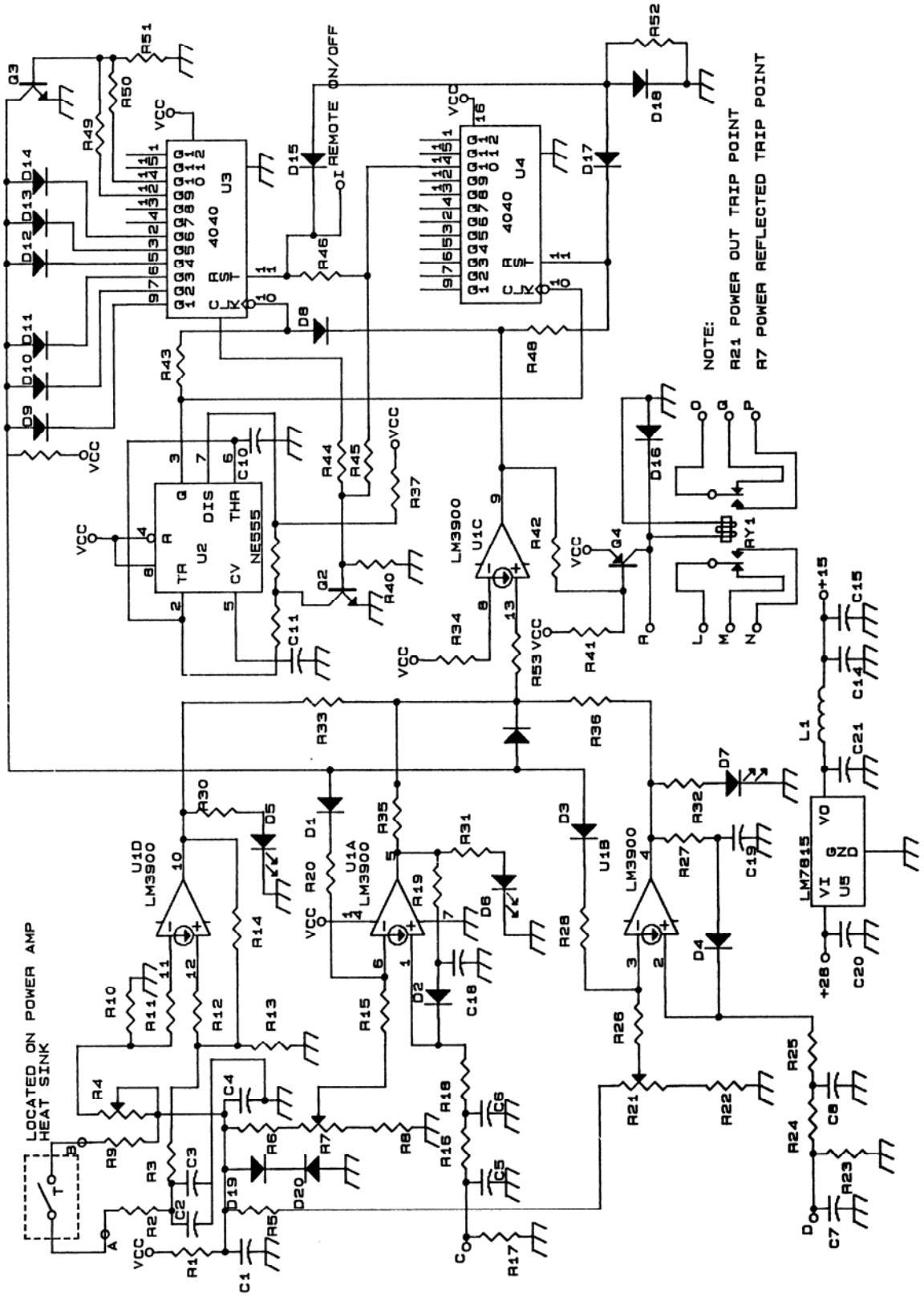

FIGURE 9 SCHEMATIC, ALARMS CARD

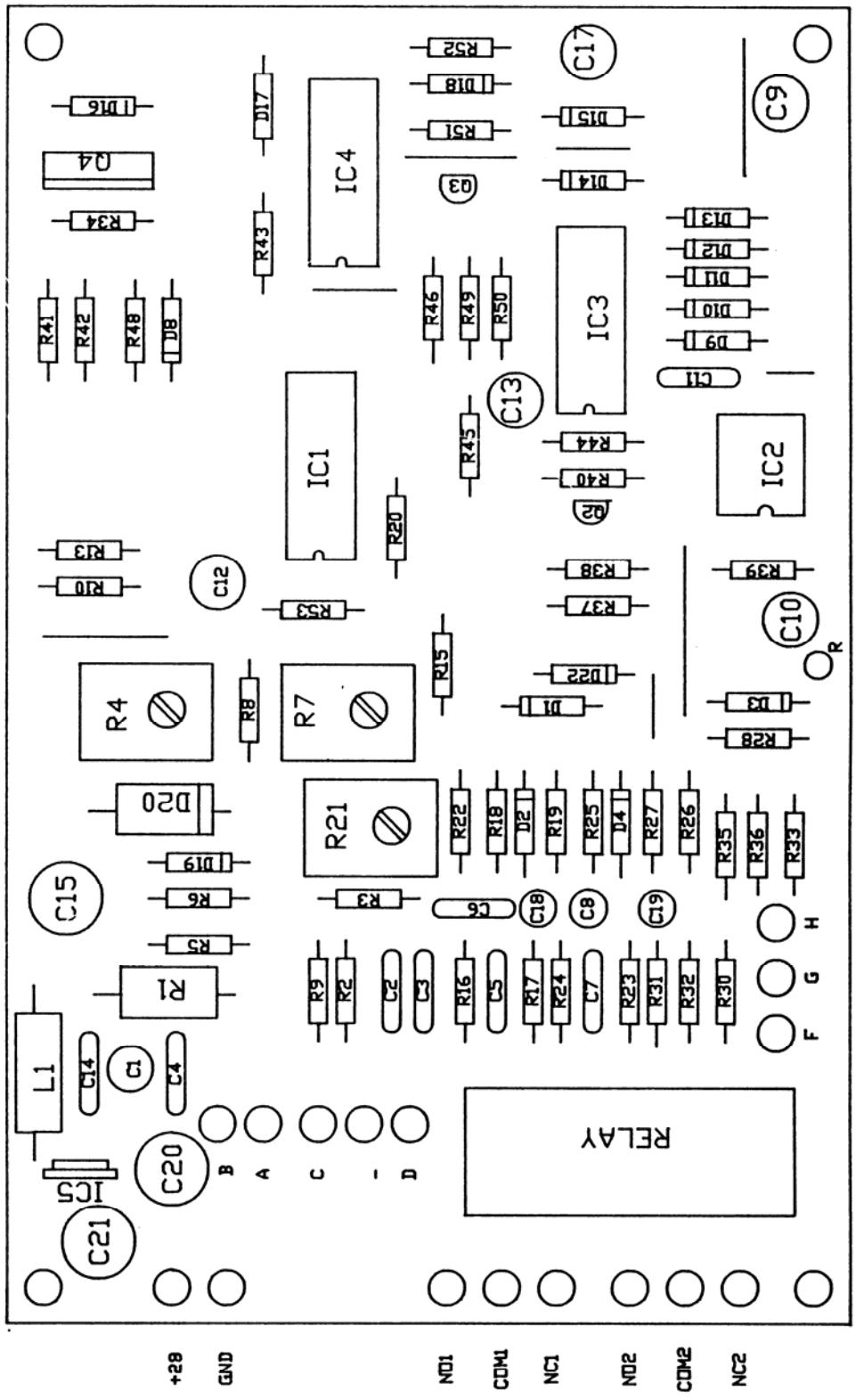

FIGURE 10. COMPONENTS ARRANGEMENT, ALARMS CARD

PARTS LIST
ALARMS PROTECTION CARD

C1	Capacitor, Elec 10µF 16Vdc
C2	Capacitor, Ceramic 47nF
C3	Capacitor, Ceramic 47nF
C4	Capacitor, Ceramic 4.7nF
C5	Capacitor, Ceramic 47nF
C6	Capacitor, Ceramic 4.7nF
C7	Capacitor, Ceramic 4.7nF
CB	Capacitor, Elec 33µF 35Vdc
C9	Capacitor, Elec 4.7µF 25Vdc
C10	Capacitor, Elec 2.2µF 25Vdc
C11	Capacitor, Ceramic 47nF
C12	Capacitor, Elec 4.7µF 25Vdc
C13	Capacitor, Elec 4.7µF 25Vdc
C14	Capacitor, Ceramic 47nF
C15	Capacitor, Elec 100µF 25Vdc
C16	Capacitor, Elec 4.7µF 25Vdc
C17	Capacitor, Elec 10µF 25Vdc
C18	Capacitor, Elec .47µF 25Vdc
C19	Capacitor, Elec .47µF 25Vdc
C20	Capacitor, Elec 22µF 35Vdc
C21	Capacitor, Elec 4.7µF 35Vdc

D1	Diode 1 N914
D2	Diode 1 N914
D3	Diode 1 N914
D4	Diode 1 N914
D5	Diode LED Red
D6	Diode LED Red
D7	Diode LED Red
D8	Diode 1 N914
D9	Diode 1 N914
D10	Diode 1 N914
D11	Diode 1 N914
D12	Diode 1 N914
D13	Diode 1 N914
D14	Diode 1 N914
D15	Diode 1 N914
D16	Diode 1 N914
D17	Diode 1 N914
D18	Diode 1 N914
D19	Diode 1 N914
D20	Diode, Zener 6.8V
D21	Diode LED Red
D22	Diode 1 N914

IC1	Quad OP Amp LM3900
IC2	Integrated Circuit NE555
IC3	IC Counter MC4040
IC4	IC Counter MC4040
IC5	IC Regulator LM7815

L1	Inductor 220µH

Q1	Transistor BC237
Q2	Transistor BC237
Q3	Transistor BC140
Q4	Transistor BC140

R1	Resistor 680 ohm 1/2 watt
R2	Resistor 100 ohm 1/4 watt
R3	Resistor 2.2K ohm 1/4 watt
R4	Resistor 22K ohm Pot
R5	Resistor 1 K ohm 1/4 watt
R6	Resistor 1 K ohm 1/4 watt
R7	Resistor 22K ohm Pot
R8	Resistor 330 ohm 1/4 watt
R9	Resistor 47 ohm 1/4 watt
R10	Resistor 100K ohm 1/4 watt
R11	Resistor 100K ohm 1/4 watt
R12	Resistor 100K ohm 1/4 watt
R13	Resistor 10K ohm 1/4 watt
R14	Resistor 330 ohm 1/4 watt
R15	Resistor 100K ohm 1/4 watt
R16	Resistor 22K ohm 1/4 watt
R17	Resistor 100K ohm 1/4 watt
R18	Resistor 82K ohm 1/4 watt
R19	Resistor 100K ohm 1/4 watt
R20	Resistor 22K ohm 1/4 watt
R21	Resistor 22K ohm Pot
R22	Resistor 2.2K ohm 1/4 watt
R23	Resistor 10K ohm 1/4 watt
R24	Resistor 22K ohm 1/4 watt
R25	Resistor 82K ohm 1/4 watt
R26	Resistor 100K ohm 1/4 watt
R27	Resistor 100K ohm 1/4 watt
R28	Resistor 22K ohm 1/4 watt
R29	Not used
R30	Resistor 1.2K ohm 1/4 watt
R31	Resistor 1.2K ohm 1/4 watt
R32	Resistor 1.2K ohm 1/4 watt
R33	Resistor 1.2K ohm 1/4 watt
R34	Resistor 220K ohm 1/4 watt

R35	Resistor 22K ohm 1/4 watt
R36	Resistor 22K ohm 1/4 watt
R37	Resistor 22K ohm 1/4 watt
R38	Resistor 220K ohm 1/4 watt
R39	Resistor 10K ohm 1/4 watt
R40	Resistor 10K ohm 1/4 watt
R41	Resistor 2.2K ohm 14 watt
R42	Resistor 10K ohm 1/4 watt
R43	Resistor 47K ohm 1/4 watt
R44	Resistor 10K ohm 1/4 watt
R45	Resistor 10K ohm 1/4 watt
R46	Resistor 47K ohm 1/4 watt
R47	Resistor 10K ohm 1/4 watt
R48	Resistor 47K ohm 1/4 watt
R49	Resistor 10K ohm 1/4 watt
R50	Resistor 10K ohm 1/4 watt
R51	Resistor 10K ohm 1/4 watt
R52	Resistor 47K ohm 1/4 watt
R53	Resistor 22K ohm 1/4 watt
RY1	Relay, Double Pole, Double Throw, 5 Amp Contacts

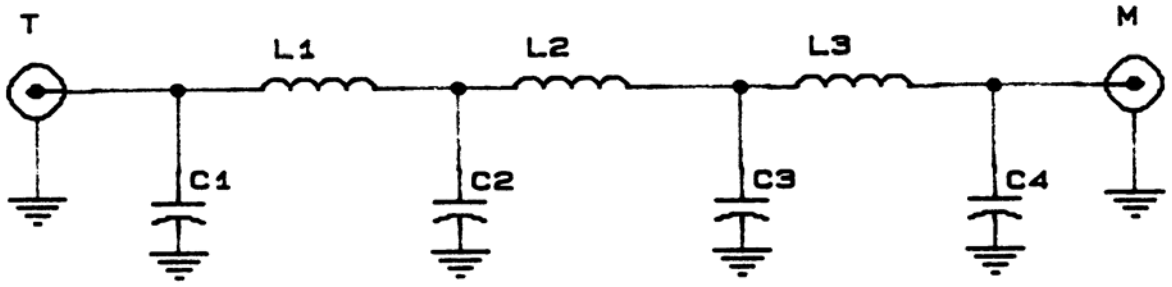

FIGURE 11. SCHEMATIC, LOW PASS FILTER

PARTS LIST
LOW PASS FILTER

L1	Coil 1.5mm wire, 8.6mm diameter
L2	Coil 1.5mm wire, 8.6mm diameter
L3	Coil 1.5mm wire, 8.6mm diameter
C1	27pF (Capacitor is part of divider)
C2	54pF (Capacitor is part of divider)
C3	54pF (Capacitor is part of divider)
C4	27pF (Capacitor is part of divider)

Caution: Do not change the pressure on the dividers by tightening the divider screws. Doing so will result in detuning the low pass filter with resulting damage to the RF amplifier due to mismatch.

PARTS LIST
DIRECTIONAL COUPLER

C1	Capacitor, Ceramic 1.8pF
C2	Capacitor, Variable 30pF
C3	Capacitor, Feedthru 1nF
C4	Capacitor, Feedthru 1nF
D1	Diode 1 N4148
D2	Diode 1 N4148
R1	Resistor 470 1/2 watt
R2	Resistor 47 ohm 1/2 watt
R3	Resistor 4.7K ohm 1/4 watt
R4	Resistor 47 ohm 1/2 watt
R5	Resistor 3.3K ohm 1/4 watt
R6	Resistor 22K ohm Pot
R7	Resistor 47 ohm 1/2 watt
R8	Resistor 3.3K ohm 1/4 watt
R9	Resistor 22K ohm Pot
TR1	Transformer, Toroid Broadband

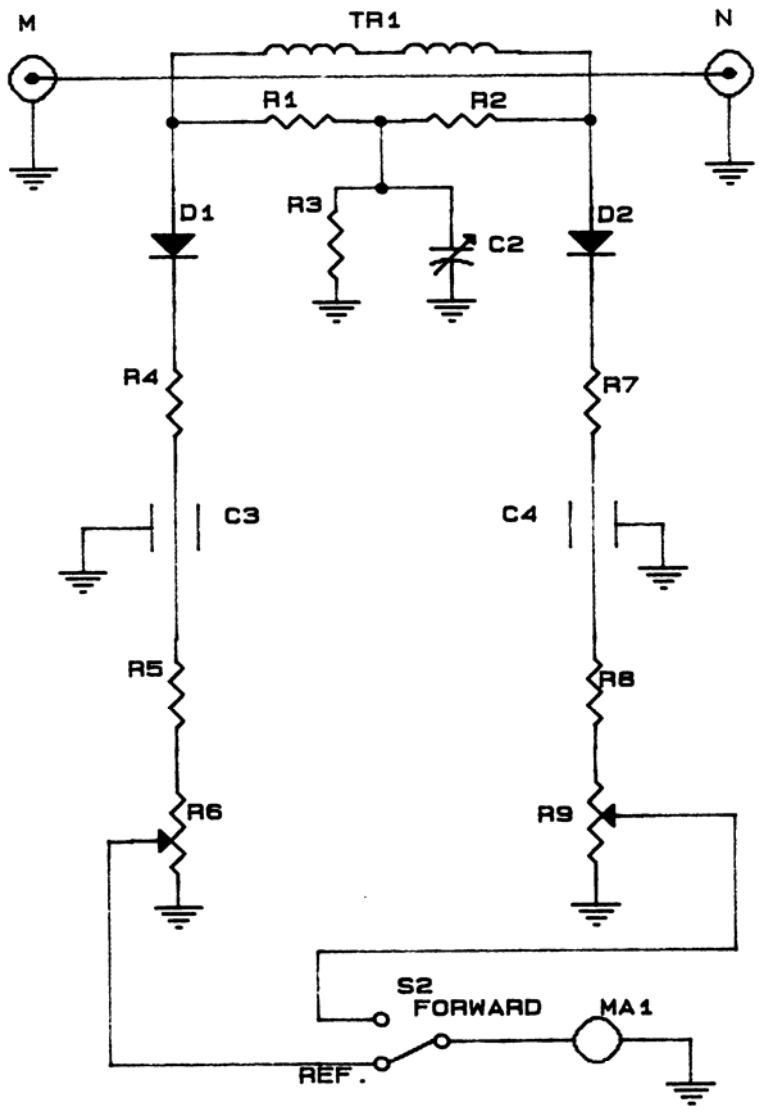

FIGURE 12. SCHEMATIC, VSWR BRIDGE

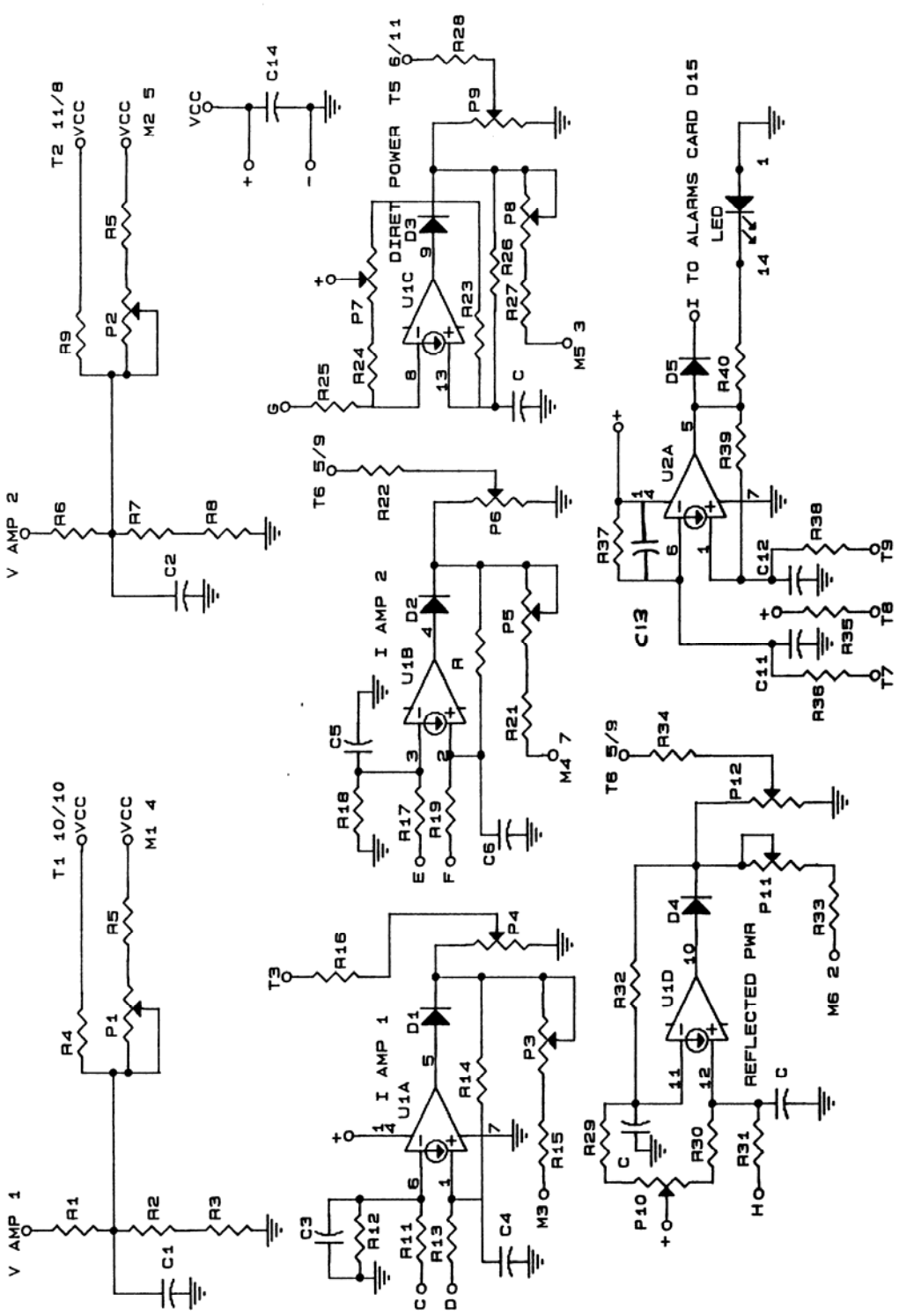

FIGURE 13. SCHEMATIC, TELEMETRY CARD

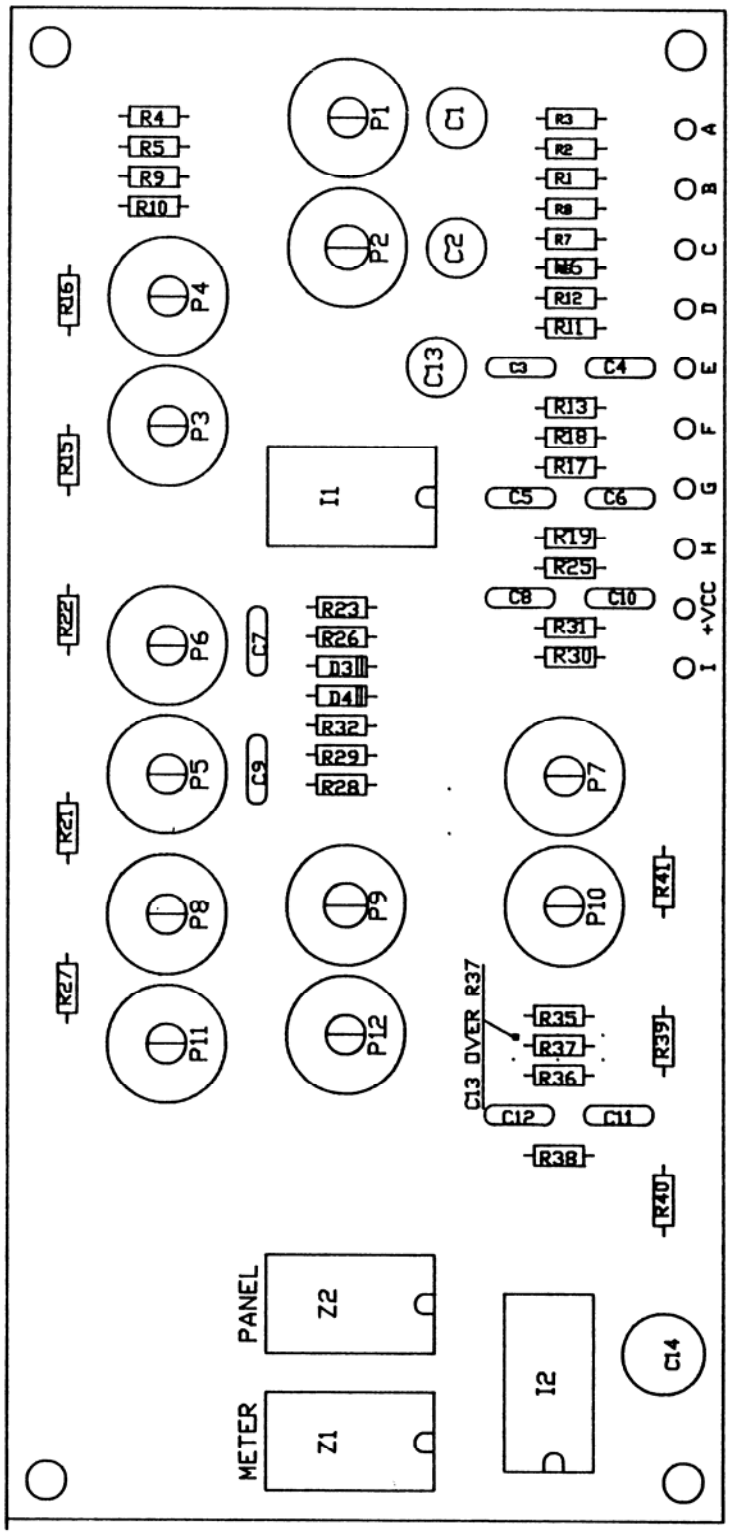

FIGURE 14. COMPONENTS ARRANGEMENT, TELEMETRY CARD

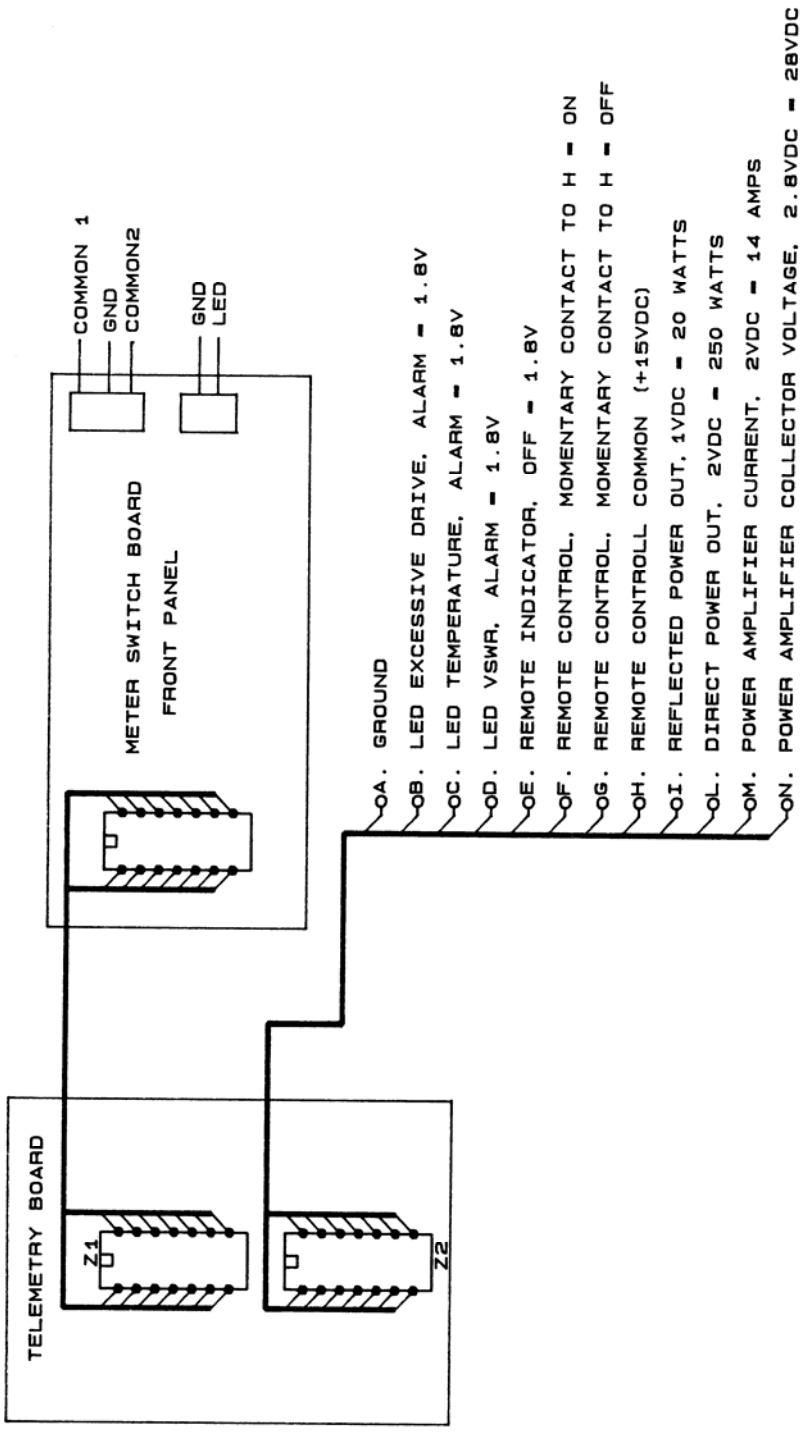

FIGURE 15. WIRING DIAGRAM, TELEMETRY INTERCONNECT

PARTS LIST
TELEMETRY CARD

C1	Capacitor Elec 10µF 25Vdc
C2	Capacitor Elec 10µF 25Vdc
C3	Capacitor, Ceramic 47nF
C4	Capacitor, Ceramic 47nF
C5	Capacitor, Ceramic 47nF
C6	Capacitor, Ceramic 47nF
C7	Capacitor, Ceramic 47nF
C8	Capacitor, Ceramic 47nF
C9	Capacitor, Ceramic 47nF
C10	Capacitor, Ceramic 47nF
C11	Capacitor, Ceramic 47nF
C12	Capacitor, Ceramic 47nF
C13	Capacitor, Elec 10µF 25Vdc
C14	Capacitor, Elec 100µF 25Vdc
D1	Diode 1 N4148
D2	Diode 1 N4148
D3	Diode 1 N4148
D4	Diode 1 N4148
D5	Diode 1 N4148
IC1	Quad OP Amp LM3900
IC2	Quad OP Amp LM3900
P1	Pot 22K ohm
P2	Pot 22K ohm
P3	Pot 22K ohm
P4	Pot 2.7K ohm
P5	Pot 22K ohm
P6	Pot 4.7K ohm
P7	Pot 470K ohm
P8	Pot 200K ohm
P9	Pot 4.7K ohm
P10	Pot 470K ohm
P11	Pot 100K ohm
P12	Pot 4.7K ohm
R1	Resistor 27K ohm 1/4 watt
R2	Resistor 2.7K ohm 1/4 watt
R3	Resistor 330 ohm 1/4 watt
R4	Resistor 1 K ohm 1/4 watt
R5	Resistor 2.2K ohm 1/4 watt
R6	Resistor 27K ohm 1/4 watt
R7	Resistor 2.7K ohm 1/4 watt
R8	Resistor 330 ohm 1/4 watt
R9	Resistor 1 K ohm 1/4 watt
R10	Resistor 2.2K ohm 1/4 watt
R11	Resistor 3 Meg ohm 1/4 watt
R12	Resistor 10 Meg ohm 1/4 watt
R13	Resistor 3 Meg ohm 1/4 watt
R14	Resistor 10 Meg ohm 1/4 watt
R15	Resistor 2.2K ohm 1/4 watt
R16	Resistor 1 K ohm 1/4 watt
R17	Resistor 3 Meg ohm 1/4 watt
R18	Resistor 10 Meg ohm 1/4 watt
R19	Resistor 3 Meg ohm 1/4 watt
R20	Resistor 10 Meg ohm 1/4 watt
R21	Resistor 2.2K ohm 1/4 watt
R22	Resistor 1 K ohm 1/4 watt
R23	Resistor 2.2 Meg ohm 1/4 watt
R24	Resistor 2.2 Meg ohm 1/4 watt
R25	Resistor 2.2 Meg ohm 1/4 watt
R26	Resistor 1 Meg ohm 1/4 watt
R27	Resistor 2.2K ohm 1/4 watt
R28	Resistor 1 K ohm 1/4 watt
R29	Resistor 2.2 Meg ohm 1/4 watt
R30	Resistor 2.2 Meg ohm 1/4 watt
R31	Resistor 2.2 Meg ohm 1/4 watt
R32	Resistor 1 Meg ohm 1/4 watt
R33	Resistor 2.2K ohm 1/4 watt
R34	Resistor 1 K ohm 1/4 watt
R35	Resistor 2.7K ohm 1/4 watt
R36	Resistor 180K ohm 1/4 watt
R37	Resistor 1 Meg ohm 1/4 watt
R38	Resistor 180K ohm 1/4 watt
R39	Resistor 470K ohm 1/4 watt
R40	Resistor 1.2K ohm 1/4 watt