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ALC Decoupling Filter 10-24Q1

107. The cut-off frequency of this filter is not critical, since its only purpose is to prevent any of the signal at the synthesiser output from being fed into the tuned ALC amplifier on module 10-17CB1. The attenuation at 100 kHz and above is at least 40 dB.

COMPRESSION AMPLIFIER AND RELAY DRIVE BOARD *(Fig 22, 23)*

General

108. The board contains the Compression Amplifier and Relay Drive circuit. The compression amplifier processes audio signals of widely varying amplitude and delivers an output of constant amplitude. The relay drive circuit latches the receive-transmit relays in the required state and, in addition, provides the break-in facility for CW operation.

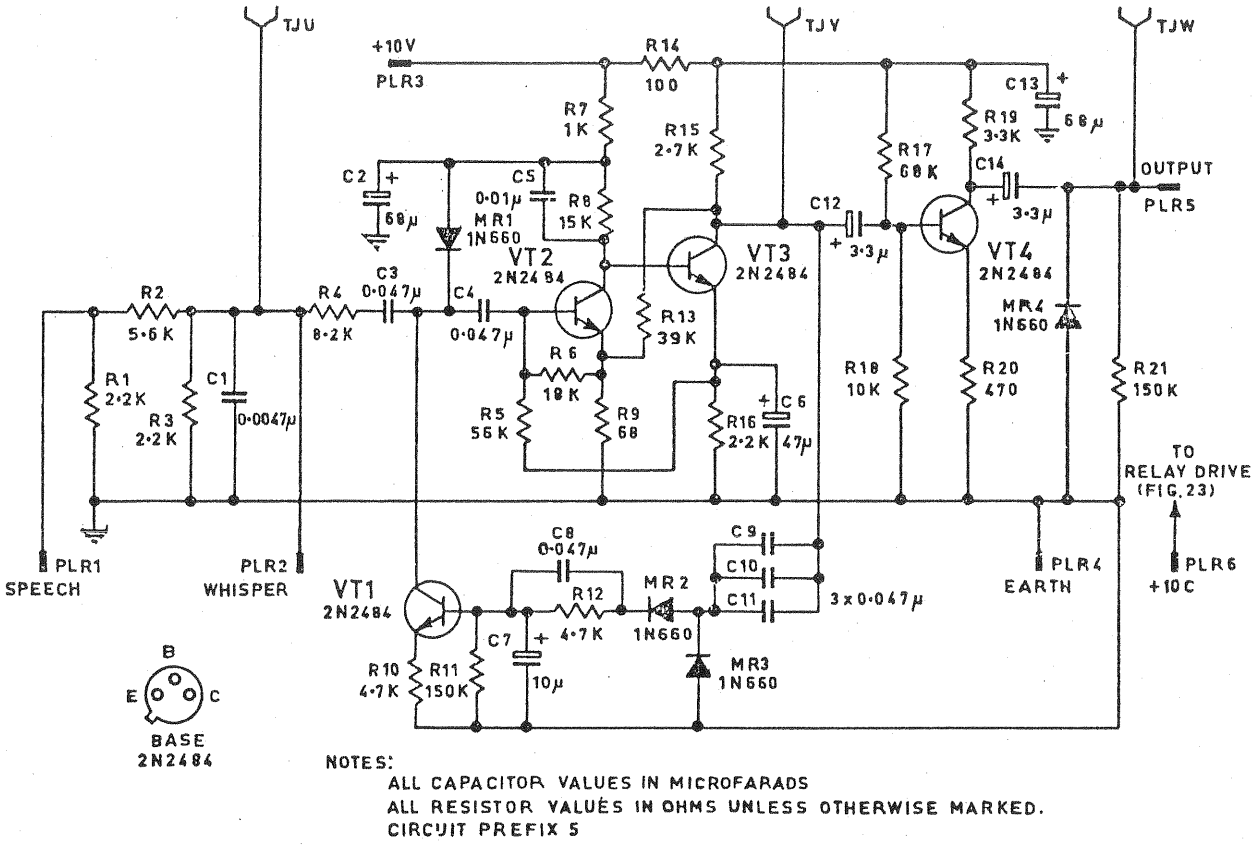


FIG 22 - COMPRESSION AMPLIFIER

Compression Amplifier

109. The amplifier is provided with two separate inputs, one for speech and the other for whisper. The speech input, applied at PLR1, is fed to the amplifier via an 11 dB attenuator pad comprising R1, R2 and R3. This arrangement gives a sensitivity of approximately 4 mV for an output level of 600 mV, and is intended to accept a range of input level from 4 to 80 mV. The whisper input, applied at PLR2, is fed directly to the amplifier. In this case the acceptable range of input level is 1 to 20 mV and the sensitivity is approximately 1 mV for an output level of 600 mV. Capacitor C1 bypasses stray RF currents that may be coupled into the microphone wiring.

110. The compression amplifier circuitry consists of a gain controlled amplifier, followed by a constant-gain stage and a peak-clipping arrangement.

111. The gain-controlled amplifier comprises a voltage-controlled attenuator (R4, MR1, VT1), a two-stage amplifier (VT2,VT3) and compression control detector (MR2, MR3).

112. The voltage-controlled attenuator operates as follows. When the output peaks at the collector of VT3 exceed a threshold determined by MR2 and MR3, C7 charges rapidly through R12 and VT1 conducts. The resultant current flow in MR1 lowers its impedance, thus attenuating input signals. The attack time of the compression control is determined by the values of R12 and C7; the recovery time by R11 and C7. To ensure that R11 alone controls the recovery time, minimum loading on the compression control detector circuit is effected by using a high-gain transistor for VT1. Capacitor C8 speeds up the attack time of the circuit.

113. The controlled attenuator is followed by a two-stage feedback amplifier. Bias stability is obtained by feedback from VT3 emitter to VT2 base. In order to provide a high input impedance, R6, which forms part of the bias network, is returned to VT2 emitter. The gain of the amplifier is determined by a second feedback loop and is approximately equal to the ratio R13 to R9. This feedback, from VT3 collector to VT2 emitter, decreases the output impedance and increases the input impedance. The time constant controlling the frequency response and hence loop stability is determined by C5.

114. The gain-controlled amplifier output is further amplified by a constant gain stage (VT4). The signal at the collector of VT4 has its peaks clipped to one quarter (−12 dB) of their original amplitude in order to increase the average power. The clipping is accomplished by a full wave clipper comprising MR4 and the base-emitter junction of transistor VT10 in the carrier gate trigger on the sidetone and audio board (para 201).

115. Transistors VT3 and VT4 are supplied from the common decoupling network R14, C13; VT2 is decoupled separately (R7, C2). Resistor R21 provides a discharge path across the clipper diode to ground. This prevents the output from floating at some potential between the clipping levels (±0.6V) thereby unbalancing the balanced modulator which is connected to the amplifier.

Relay Drive Circuit

116. The RT unit is switched between the receive and transmit conditions by four twin-coil magnetic latch relays, each having two sets of change-over contacts. One end of each coil is permanently connected to the 28 volts supply. The relay drive circuit grounds the other ends of the paralleled transmit or receive coils for a period of 20 msec which is sufficient to latch the relays in the required state. The circuit also provides a break-in delay of approximately 0.5 sec for morse keying.

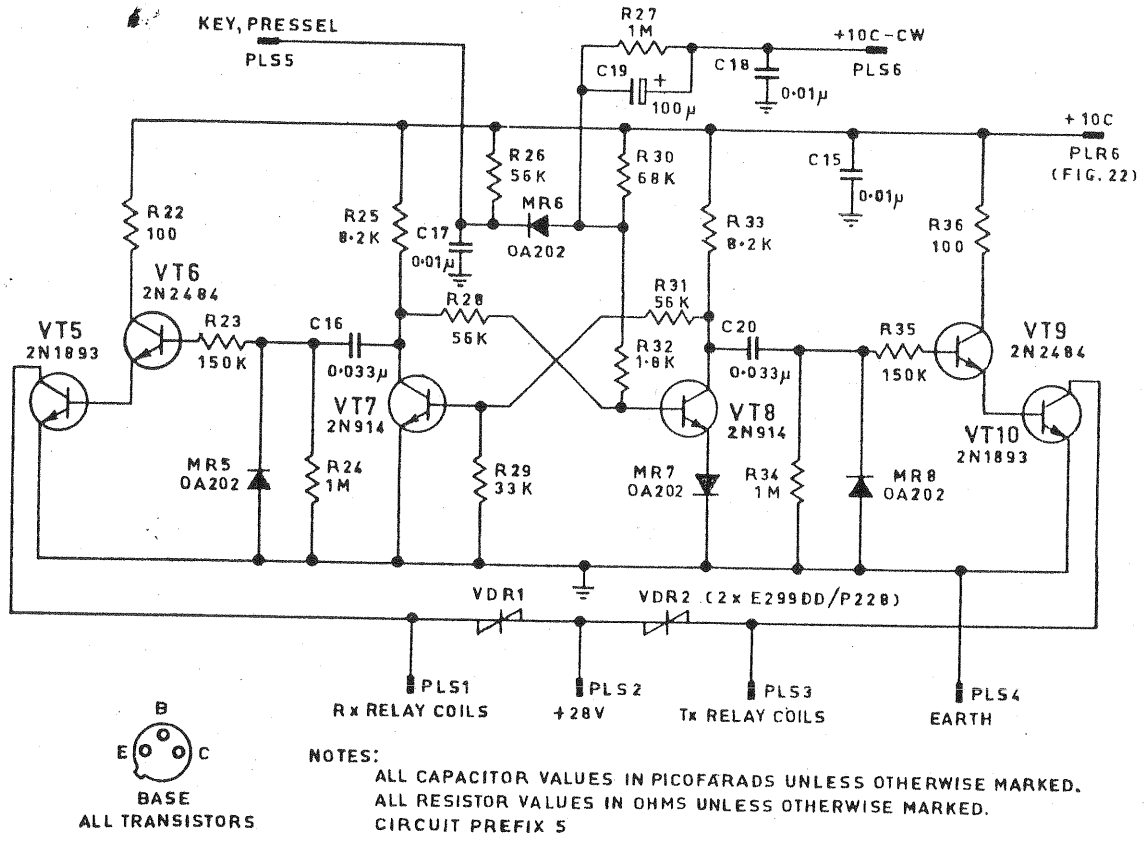
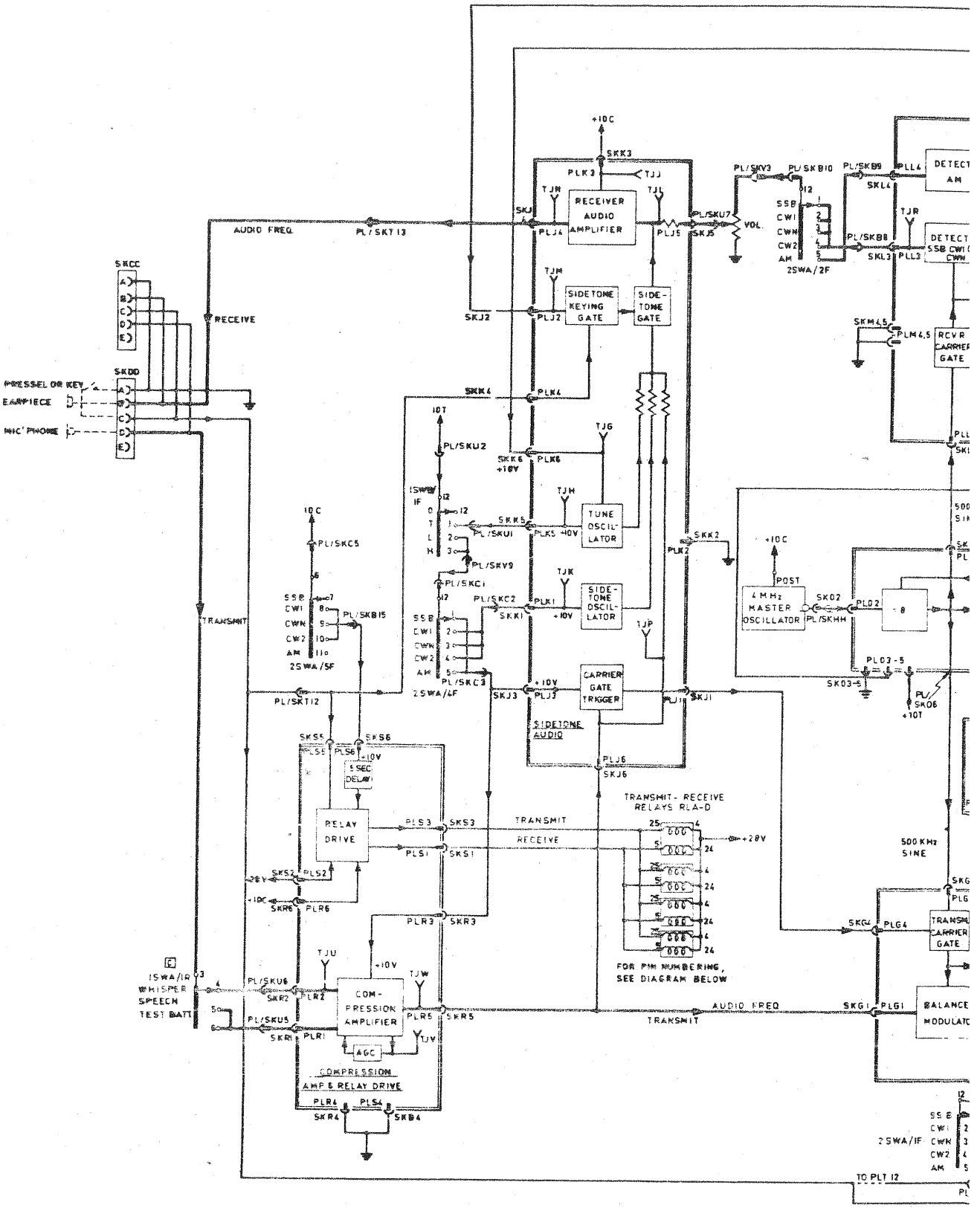


FIG 23 - RELAY DRIVE CIRCUIT

117. Before the pressel or key contact is closed, the RT set is in the receive condition. Transistor VT8 is switched on, VT9 and VT10 are off.


+10C
SKK3
PLK3
TJJ
TJN
TJL
RECEIVER AUDIO AMPLIFIER
SKJ4
PLJ4
PLJ5
SKJ5
PL/SKV3
PL/SKB10
PL/SKB9
PL/SKU7
VOL.
SSB
CW1
CWN
CW2
AM
2SWA/2F
SKL4
SKL3
PLL4
PLL3
DETECT AM
DETECT SSB CW1 CWN
TJR
AUDIO FREQ
PL/SKT13
RECEIVE
SKCC
SKDD
PRESSEL OR KEY
EARPIECE
MIC' PHONE
SKJ2
PLJ2
SIDETONE KEYING GATE
SIDE-TONE GATE
SKM4,5
PLM4,5
RCVR CARRIER GATE
SKK4
PLK4
SKK6
+10V
PLK6
TJG
10T
PL/SKU2
ISWA/IF
TUNE OSCIL-LATOR
SKK5
PL/SKU1
PLK5
+10V
TJH
PL/SKV9
PL/SKC1
PL/SKC2
SKK1
PLK1
SIDE-TONE OSCIL-LATOR
TJK
TJP
SKK2
PLK2
+10C
POST
4 MHz MASTER OSCILLATOR
SK02
PL/SKHH
PL02
÷8
PL03-5
SK03-5
PL/SK06
+10T
500 KHz SINE
PL/SKC5
SSB
CW1
CWN
CW2
AM
PL/SKB15
2SWA/5F
TRANSMIT
PL/SKT12
2SWA/4F
SKJ3
PLJ3
CARRIER GATE TRIGGER
SKJ1
PLJ1
SIDETONE AUDIO
PLJ6
SKJ6
SKS5
SKS6
PLS5
PLS6
+10V
5 SEC DELAY
RELAY DRIVE
PLS3
SKS3
TRANSMIT
RECEIVE
PLS1
SKS1
+28V
SKS2
PLS2
28V
+10C
SKR6
PLR6
PLR3
SKR3
TRANSMIT- RECEIVE RELAYS RLA-D
FOR PIN NUMBERING, SEE DIAGRAM BELOW
TJU
+10V
TJW
ISWA/IR
WHISPER
SPEECH
TEST BATT
PL/SKU6
SKR2
PLR2
COM-PRESSION AMPLIFIER
PLR5
SKR5
PL/SKU5
SKR1
PLR1
AGC
TJV
COMPRESSION AMP & RELAY DRIVE
PLR4
PLS4
SKR4
SKB4
AUDIO FREQ
TRANSMIT
SKG1
PLG1
BALANCE MODULATO
SKG4
PLG4
TRANSM CARRIER GATE
2SWA/1F
TO PLT 12

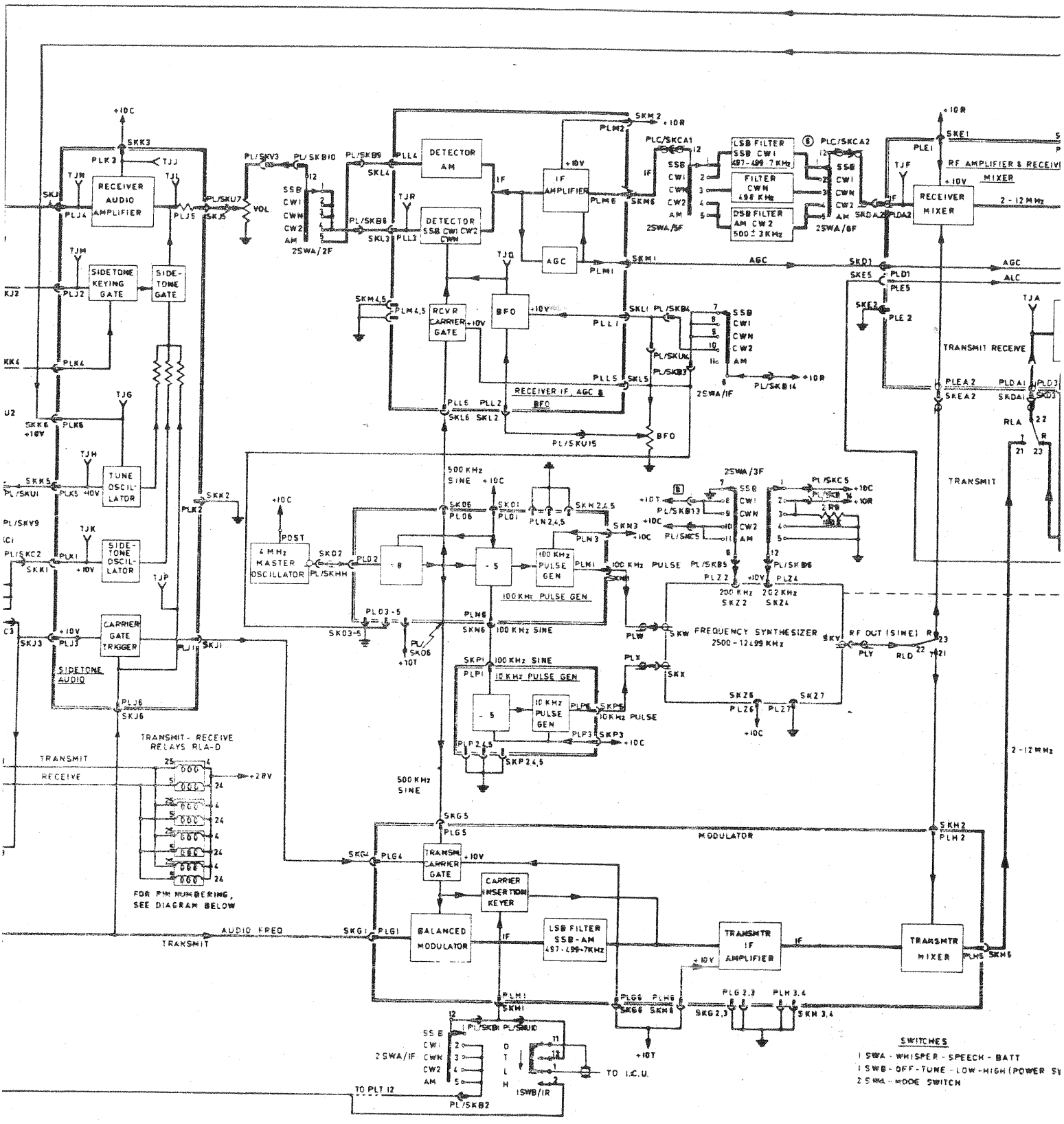


FIG 1002 PRC-F1 BLOCK SCHEMATI

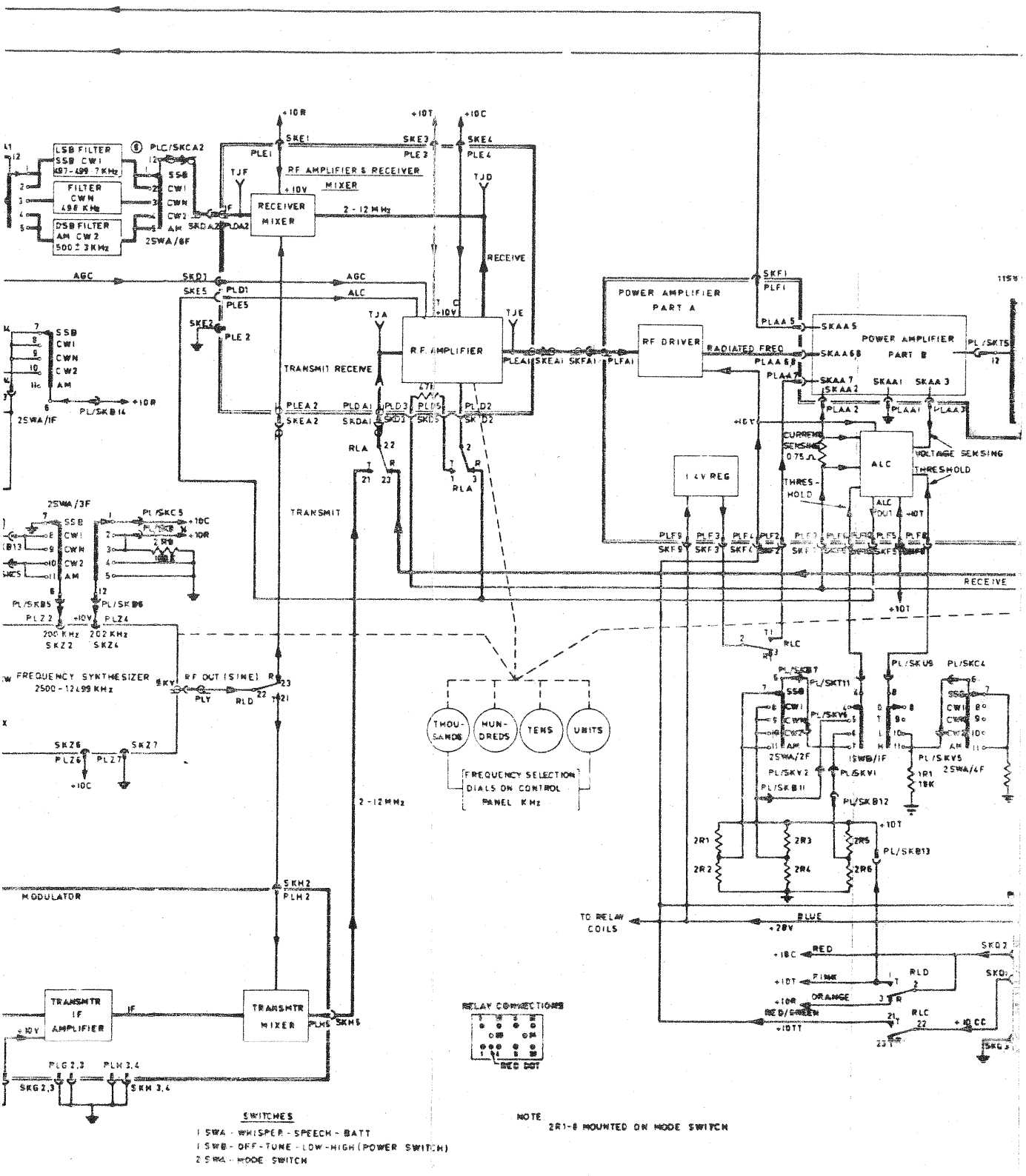


FIG 1002 PRC-F1 BLOCK SCHEMATIC

POWER SUPPLY PP–F1 (USED WITH RADIO SET GRC–F2) FIELD AND BASE REPAIR

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INTRODUCTION

General

1. The Power Supply PP–F1 provides power for the RT–F1/PRC (in the GRC–F2 configuration) with an additional facility to simultaneously charge the internal radio set battery BB–F1.

2. The Power Supply PP–F1 is designed for operation from the following sources:

   a. 20 to 40 V dc (without ripple) eg, a nominal 24 V storage battery not under charge.
   b. 24 to 40 V mean (with up to 2 V p–p of superimposed ripple of 500 Hz to 5 kHz) eg, a nominal 24 V dc vehicle generator with NEGATIVE earth system.

WARNING: Unregulated half-wave rectified ac power supplies are not to be used.

Repair Information

3. The Power Supply PP–F1 is a sealed equipment containing electronic component assemblies and printed circuit boards for which repair, adjustments, drying and seal testing are to be carried out only by qualified radio and electronic tradesmen using the test equipment and procedures detailed in this instruction.

CAUTION:
1. *When repairing printed circuit assemblies or replacing miniature components, precautions are to be observed as detailed in TELS A 521 and A 522.*
2. *Heat sinks are to be used for soldering and unsoldering of semiconductor components and extreme care exercised with ohmmeter measurements to prevent component damage by excessive current due to overvoltage or reversed polarity connexion.*

Repair Responsibility

4. Field repair entails physical inspection, repair, adjustment, drying and seal testing within the limits of the test equipment, repair parts and facilities available.

5. Base repair will entail the tasks listed for field repair plus further tests and repair to upgrade the complete equipment or assemblies to an 'as–new' condition.

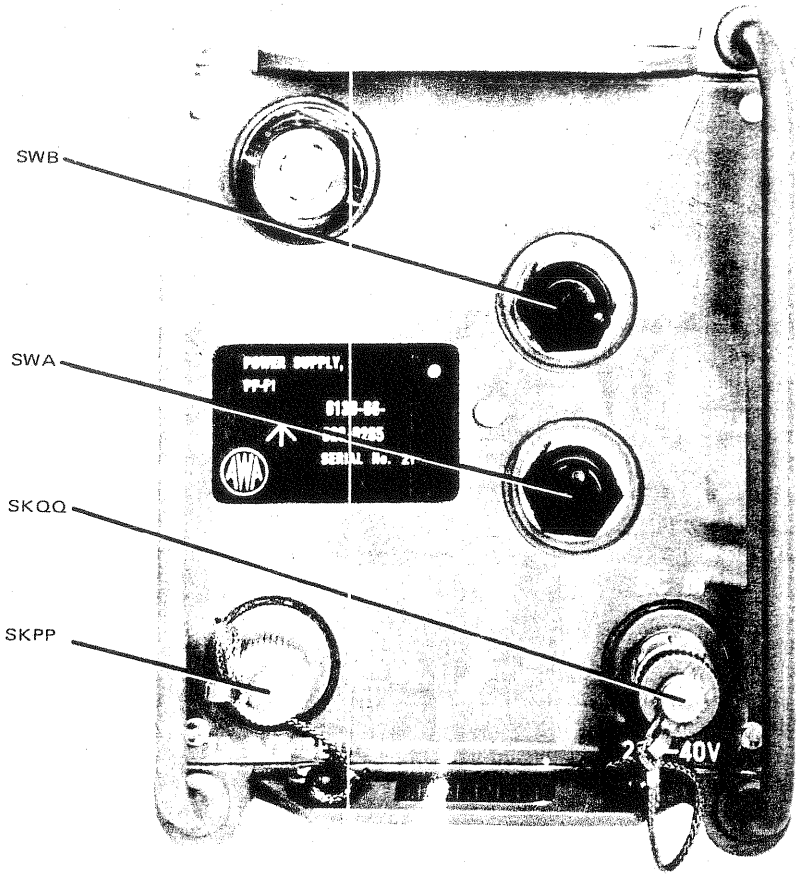


FIG 1 – POWER SUPPLY PP–F1, FRONT PANEL

FIELD REPAIR

Physical Inspection – Unopened Equipment

6. Inspect the equipment for damage or case corrosion; legible designations; positive switch action; and damage to input/output socket – protective caps and cables. Ensure that the humidity indicator is blue (if pink, dry out and seal test).

Functional Test – Unopened Equipment

7. Before attempting internal repair, carry out a functional test as detailed in TELS K 573 to verify that a fault condition exists in the equipment.

Drying and Seal Testing

8. Drying and seal testing is to be carried out after an equipment has been opened for repair or where the humidity indicator shows pink. The procedure for drying and seal testing is as detailed in paragraphs 9 and 10.

9. **Drying**

a. Open the Power Supply PP–F1, and place the complete assembly in the Dehumidifier oven, set to 120° F, for at least two hours.
b. Circulate dry air from the pump through the oven for the duration of the drying process.
c. Reduce the temperature of the Dehumidifier to allow the unit to cool before removal.
d. On removal, lightly smear the seal gasket with Silicone Grease XG 315, before reassembly.
e. Carry out an operational check to ensure that the drying process has not affected the equipment performance.
f. Seal test (see paragraph 10).

10. **Seal Testing**

a. Remove the humidity indicator bezel and connect the dehumidifier pump adapter, or the Apparatus Seal Testing, to this point.
b. Pressurize the unit to 5 lb/sq in.

c. Immerse the unit in water (containing a small amount of wetting agent) for a period of five minutes.
d. Check for the presence of bubbles at switch shafts and connectors. During immersion, check the case and front panel for pinholes, cracks or joint leakage.
e. If a defect is observed replace the faulty seal or part and repeat the test.

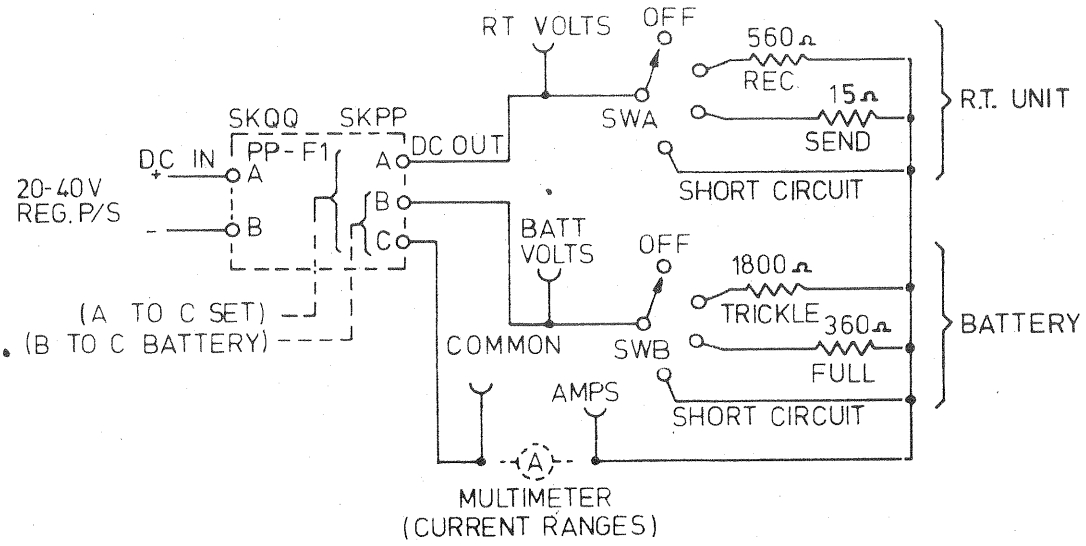


FIG 2 – DUMMY LOAD ELECTRICAL DA–F4 (CIRCUIT)

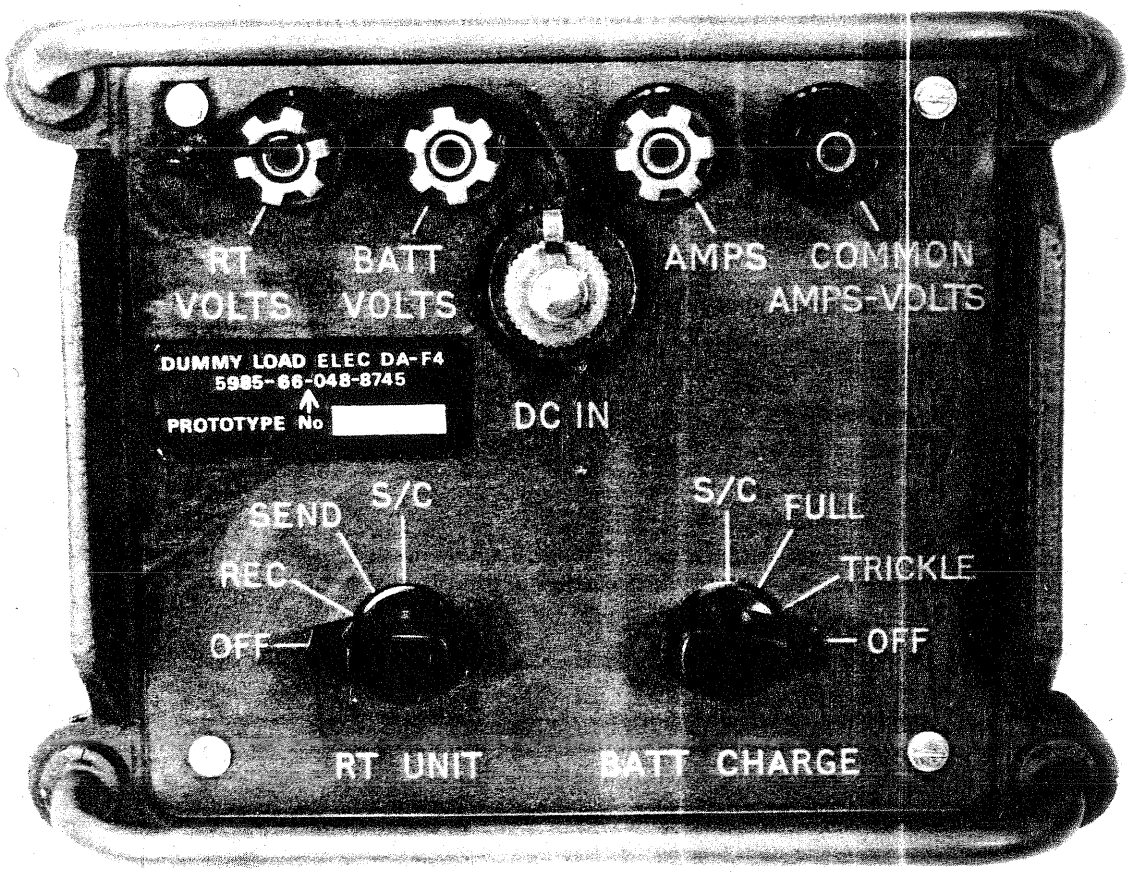


FIG 3 – DUMMY LOAD ELECTRICAL DA–F4 (FRONT PANEL)

OVERALL PERFORMANCE TESTS

11. Test Equipment Required.

a. Power Supply DC, 0 to 32 V.
b. Multimeter AVO 8 or equivalent (2 off).
c. Oscilloscope Tektronix 422 or equivalent.
d. Dummy Load Elec DA–F4 * .
e. Cable Assembly CX–F7 *.

NOTE. Items marked thus '*' are provided in the Interconnecting Set MX–F3.

12. Preliminary Test Set–Up and Adjustments.

a. Open the equipment by releasing the four 2BA captive screws at the rear of the front panel. Ease the case away from the panel assembly.
b. Connect the PP–F1 unit to the Dummy Load Elec DA–F4 as shown in Fig 2.

NOTE: An ammeter or shorting link must be connected between the AMPS and COMMON terminals for all DA–F4 'on load' tests.

c. Connect an AVO 8 (set to 1A dc range) between the AMPS and COMMON terminals of the Adapter.
d. Set DA–F4 switch SWA (RT UNIT) to SEND; switch SWB (BATT CHARGE) to FULL.
e. Set PP–F1 toggle switches to FULL and OFF.
f. Set Current Sensing pre-set control RV1 (Fig 5) fully clockwise.
g. Set DC Power Supply to 32 V output.
h. Switch on the PP–F1 and note that the current indication on load ammeter is approximately 0.85 A.
i. Check the voltage output at terminals, RT VOLTS and COMMON. Adjust RV2 (Fig 5) for a 28 V dc indication (on a separate voltmeter).
j. Connect the voltmeter (set to 10 V dc range) between the positive end of C 9 and the base of VT 10 (Fig 6); adjust RV 3 for a 6.6 V indication.
k. Reduce the input from the DC Power Supply to 18 V.
l. Reconnect the voltmeter to RT VOLTS and COMMON terminals of the DA–F4. Readjust RV 1 so that output just stabilizes at 28 V. * The input current to the PP- F1 (as indicated on the DC Power Supply panel meter) is approximately 2.0 A.

* *CAUTION: Do not advance RV 1 beyond the point where the output stabilizes at 28 V. The final setting for RV 1 is to be at 28 V with 18 V dc applied input and the RT–Unit and Battery positions fully loaded.*

m. On completion of the above procedure, the PP–F1 is correctly adjusted and performance tests detailed in paragraphs 13 to 20 may be carried out.

Input Current Test

13. **Performance Requirement.** For an input voltage of 20 to 40 V dc applied to the PP–F1, the input current is to be:

a. Not greater than 100 mA with the PP–F1 output unloaded.
b. 2.0 A(20 V) to 1.2 A (40 V) with the PP–F1 output short-circuited.

14. **Procedure.**

a. Set up equipment as shown in Fig 2.
b. Set DA–F4 switches SWA and SWB to OFF.
c. Connect an ammeter in series with the positive lead to the PP–F1.
d. Adjust the DC Power Supply input voltage from 20 to 32 V (40 V if available) and note that the input current does not exceed 100 mA over the full voltage range.
e. Switch off the DC Power Supply. Connect a shorting link between the AMPS and COMMON terminals of the DA–F4. Set DA–F4 switches SWA and SWB to S/C (short circuit). Reset the input ammeter to 10 A range.
f. Adjust the DC Power Supply input voltage from 20 to 40 V and note that the input current range is 2.0 to 1.2 A.

Output Voltage Test

15. **Performance Requirements.** For an input voltage of 20 to 40 V dc applied to the PP–F1, the PP–F1 output voltage is to conform with the following:

a. To RT–UNIT (no load/receive–send nominal loads) 28 V ±0.5 V.
b. To BATTERY (no load) 41 V ±2 V.
c. To BATTERY (nominal loads TRICKLE/FULL charge) 36 V ±3.6 V.

16. **Procedure.**

a. Set up equipment as shown in Fig 2.
b. Set DA–F4 switches SWA and SWB to OFF. Connect a shorting link between the AMPS and COMMON terminals of the DA–F4.
c. Connect a voltmeter (set to 30 V dc range) to RT VOLTS and COMMON terminals of the DA–F4.
d. Adjust the DC Power Supply input voltage from 20 to 40 V and note that the output voltage is 28 ±0.5 V over the full input voltage range.
e. Set DA–F4 switch SWA to REC and SEND respectively and repeat the procedure detailed in sub-paragraph d. The PP–F1 output voltage should remain constant at 28 ±0.5 V.
f. Transfer the voltmeter (set to 100 V dc range) to BATT VOLTS and COMMON terminals of the DA–F4. Set DA–F4 switch SWB (BATT CHARGE) to the OFF position; SWA to the S/C position.
g. Adjust the DC Power Supply input voltage to 20 V and note that the open-circuit battery charging voltage is 41 ±2 V.
h. Set DA–F4 switch SWB to TRICKLE and FULL respectively whilst noting that the output voltage at the BATTERY terminals is 36 ±3.6 V (for the full input voltage range of 20 to 40 V).

Output Ripple Test

17. **Performance Requirement.** For an input voltage of 40 V dc, the output voltage ripple content to the RT–UNIT (Receive) is not to exceed 80 mV peak–to–peak.

18. **Procedure.**

a. Set up equipment as shown in Fig 2.
b. Set DA–F4 Switch SWA (RT–UNIT) to REC; Switch SWB (BATT CHARGE) to TRICKLE. Connect a shorting link between the AMPS and COMMON terminals of the DA–F4. Connect an oscilloscope across DA–F4 terminals RT VOLTS and COMMON.
c. Adjust the DC Power Supply for 40 V dc and note that the ripple content displayed on the oscilloscope is less than 80 mV peak–to–peak.

Reverse Polarity Test

19. **Performance Requirement.** Current must not flow when a reversed polarity of 40 V dc is applied to the Power Supply PP–F1 in the 'On' condition.

20. **Procedure.** Check the Power Supply PP–F1 input circuit with an ohmmeter (set to high ohms range) to verify a good front–to–back ratio of diode MR 1 (Fig 6) before attempting reverse polarity tests with the power applied. Test as follows:

a. On verification of MR 1 serviceability, set the Power Supply PP–F1 to OFF. Connect an ammeter (set to highest A range – reverse polarity connexion) in series with the input lead to the PP–F1.
b. Set the DC Power Supply to minimum output and connect the PP–F1/ammeter leads in the reverse direction to the dc supply terminals.
c. Switch ON the PP–F1. The ammeter should remain at zero (switch to a lower current range to verify that no standing current exists). If the meter indicates current flow, SWITCH OFF IMMEDIATELY and implement replacement of diode MR 1 or faulty input components.
d. If no current flows, gradually increase the input voltage (NOT TO EXCEED 40 V DC) whilst monitoring the input. At the first sign of current flow, SWITCH OFF EQUIPMENT and proceed with repair action before repeating the test.

TABLE 1 – SUMMARY OF PERFORMANCE REQUIREMENTS – (FIELD REPAIR)

Test	*DC Input*		*RT Unit*	*Battery*
	Voltage	*Current*	*Voltage*	*Voltage*
Input Voltage – Full Load	18 to 32 V		28 ±0.5 V	
Input Current –	20 V	2 A ±0.2 A		
Full Load	32 V	1.2 A ±0.1 A		
Input Current – No Load	20 to 32 V	100 mA max		
Charge Volts – No Load	20			41 ±2 V
Charge Volts – On Load	20 to 32 V			36 ±3.6 V
Output Ripple	32 V		80 mV p–p (max)	
Reversed Polarity	32 V	Zero		

Fault Location

21. Field repair will normally entail the replacement of individual components and minor assemblies. The complete equipmen is to be back-loaded where repair involves extensive disconnexion, ie, main circuit board removal. Component locations are shown in Figs 4 and 5; wiring interconnexions and circuit detail in Fig 6. Table 2 provides a guide to fault symptoms and corrective action.

TABLE 2 – FAULT LOCATION CHART

Check	*Symptom*	*Probable Cause*	*Rectification Action*
1.	No output to RT unit or battery.	a. Input fault.	a. Check input available at C 1, C 19 to C 24. If not, check SWA, L 2, L 3, MR 1, C 12 to C 14.
		b. Reversed polarity input.	b. Check for reversed input connexions.
		c. Transistor switch not operating.	c. Check the waveform at the collectors of VT 1 to VT 4. If correct check output filter L 1, L 4, C 10, C 11, C 15 and C 16. If not operating check: (1) TR 1 windings 1, 2, 3 for open circuit and inductance. (2) R 4, VT 4. (3) Constant current drive VT 6, MR 3, MR 2, R 5 to R 8 and C 2.
2.	Output to RT unit satisfactory. No output from battery charge circuit.	Charge output circuit faulty.	Check for output voltage at C 9. Check TF 1 (winding 4). Check MR 6, MR 12, MR 13, VT 10, VT 11, RV 3 and R 22.
3.	Charges at trickle rate on FULL or TRICKLE	SWB circuit not connecting.	Check R 26 and SWB for continuity.
4.	Charge operation satisfactory but discharges battery when the PSU is switched OFF.	Faulty diode or leaky capacitor.	Check MR 13 and C 17.
5.	'Hash' radiated on R/T unit with PSU connected.	External noise pick-up on power supply unfiltered.	Check L 2, L 3, C 12, C 13 and 14.
6.	Output voltages satisfactory, but excessive ripple/spikes on RT input line.	Output filter defective.	Check L 1, R 21, L 4, C 10, C11, C 15 and C 16.
7.	Incorrect regulation with varying supply voltages.	a. Reservoir circuit defective.	a. Check C 5 to C 8.
		b. Sensing circuit defective.	b. Check R 20, RV 2, MR 10, MR 11, R 19, VT 9, MR 9, R 18, MR 8 and R 17.
8.	Poor regulation on varying loads.	As for Check 7, or current sensing circuit defective.	See Check 7; also VT 7, VT 8, R 14, R 15, RV 1, R 16, R 10, R 11, R 9, MR 4, MR 5, C 3, C 4 and C 18.

REMOVAL AND REPLACEMENT OF ASSEMBLIES

Printed Circuit Board 16CB1

22. **Removal.**

a. Remove the equipment case and place the main unit, face down, on the bench.
b. Remove the three 6BA shoulder pins and the four 6BA screws and washers securing 16CB1 to the mounting posts.
c. Unsolder the interconnecting wires from the terminal posts on the rear of the board.

23. **Replacement.**

a. Reconnect the wires to the terminal posts in accordance with the colour coding and terminal data provided in the circuit diagram Fig 6.
b. Secure the board in position with the four 6BA screws and washers and the three shoulder pins and washers (Fig 4). Ensure that the board is firmly secured before refitting the case.

Capacitor Assembly

24. Removal.

a. Unfasten circuit board 16CB1 (paragraph 22 (a and b)), lift it from the mounting posts and fold aside (Fig 4).
b. Unscrew the four 6BA screws securing the capacitor assembly.
c. Lift the assembly clear to gain access to connexions.
d. Unsolder the wires from the capacitor assembly.

25. Replacement.

a. Resolder the wires to the lugs in accordance with the colour code and terminal data (Fig 6).
b. Secure the assembly with the four 6BA screws.
c. Replace circuit board 16CB1 and secure it to the mounting posts (sub-paragraph 23b).

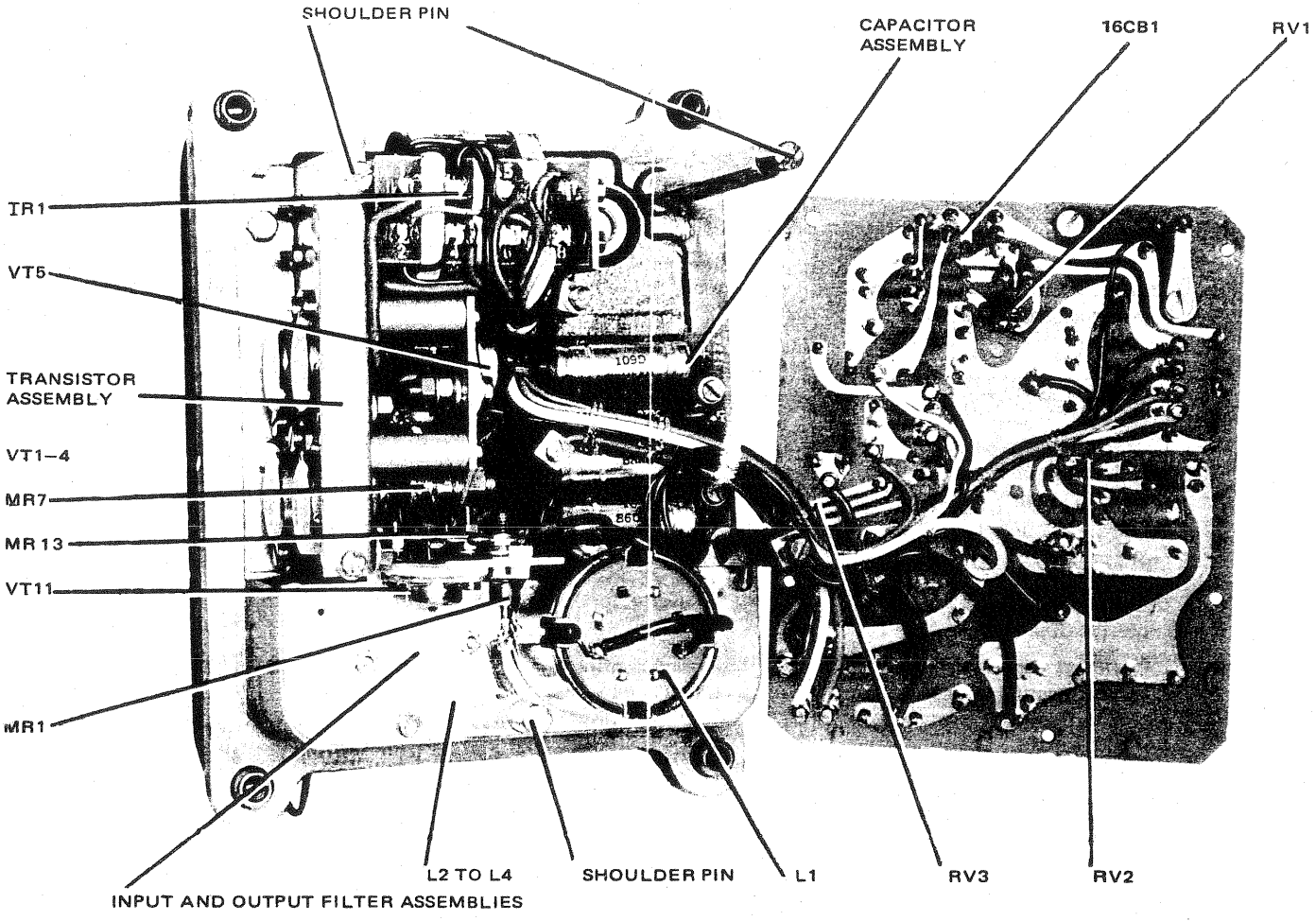


FIG 4 – REAR VIEW OF ASSEMBLIES (OPENED EQUIPMENT)

Input/Output Filter Assembly

26. Removal.

a. Unfasten and fold back circuit board 16CB1 (sub-paragraph 22b).
b. Cut the cable lacing tie and unsolder the wires connected to the top of the filter assembly.
c. Unscrew the four 6BA screws and ease the unit free from the mounting to gain access to the three wires terminated on the side plate of the assembly.
d. Unsolder the interconnecting wires and remove the filter from the unit.

27. **Replacement.**

a. Resolder the wire terminations on the side plate assembly lugs in accordance with the colour coding and terminal data in circuit diagram Fig 6.
b. Position the assembly on its mounting and secure with the four 6BA screws and washers.
c. Reconnect the remaining wires to the top lugs vide the colour code and terminal data in circuit diagram Fig 6.
d. Replace the cable lacing tie.
e. Secure circuit board 16CB1 in position (sub-paragraph 23b).

Transistor and Transformer Assembly

28. **Removal.**

a. Unfasten and fold back circuit board 16CB1 (sub-paragraph 22b).
b. Remove the two 4BA hex hd screws and the two 4BA ch hd screws and lift the assembly clear of its mountings.
c. Unsolder the interconnecting wires and remove the assembly.

29. **Replacement.**

a. Reconnect the wires to the lugs in accordance with the colour coding and terminal data provided in circuit diagram Fig 6.
b. Place the units in position at the rear of the front panel and fasten securely with the two 4BA ch hd screws and washers and two hex hd screws and washers.
c. Secure circuit board 16CB1 in position (sub-paragraph 23b).

Toggle Switch

30. **Removal.**

a. Unfasten and fold back circuit board 16CB1 (sub-paragraph 22b).
b. Unfasten the transformer and transistor assembly (sub-paragraph 28b).
c. Unsolder the switch connexions.
d. Remove the front panel retaining nut (11/16 inch AF) and washer. Ease the switch clear of the mounting, taking care not to damage the seal.

31. **Replacement.**

a. Smear Silicone Grease XG 315 lightly on the rubber seal.
b. Place the switch in position through the panel hole and secure with the retaining nut and washer.
c. Reconnect the wires in accordance with the circuit diagram (Fig 6).
d. Replace the transformer assembly (sub-paragraph 29b).
e. Secure circuit board 16CB1 in position (sub-paragraph 23b).

Connector DC IN or DC OUT

32. **Removal.**

a. Unfasten and fold back circuit board 16CB1 (sub-paragraph 22b).
b. Unfasten the filter assembly (sub-paragraph 26c) and unsolder the wires connected to VT 11 and MR 1.
c. Ease the filter assembly carefully from its mounting to provide access to the connector.
d. Unsolder the wires from the connector.

33. **Replacement.**

a. Lightly smear the seal with Silicone Grease XG 315 and place on the connector shaft.
b. Insert the connector through the front panel hole and secure in position with the slotted ring nut.
c. Reconnect the wires to the connector in accordance with the circuit diagram (Fig 6).
d. Reconnect the wires to MR 1 and VT 11 in accordance with the circuit diagram.
e. Replace the filter assembly in the mounting and secure in position with four 6BA screws and washers.
f. Replace the circuit board 16CB1 (sub-paragraph 23b).

Transistors — Removal and Replacement

34. Transistors VT 1 to VT 5 are mounted upon the assembly transformer and transistor frame with beryllium oxide heatsinks and insulating bushes to provide electrical insulation. VT 4 is mounted on the side plate of the filter assembly. Base connexion data is provided on the circuit diagram (Fig 6).

Transistors VT 1 to VT 5

35. **Removal.**

a. Gain access to the rear of the transistors by unfastening the circuit board, 16CB1 (sub-paragraph 22b), and the transformer and transistor assembly (sub-paragraph 28b).
b. Remove the two 4BA nuts, screws and washers securing the transistor to the assembly.

c. Unsolder the wires attached to the transistor, using a heat sink.
d. Gently extract the transistor from the mounting.

NOTE: To gain access to the fixing screws and wires, it may be necessary to separate the two mounting plates, by removing the three 4BA screws from the distance pieces.

36. Replacement.

a. Secure the transistor in the mounting with two 4BA screws, nuts and washers, ensuring that the heat sink insulating bushes are in position.
b. Connect the wires to the transistor (using a heat sink) vide the circuit diagram (Fig 6).
c. Assemble the two mounting plates (if previously separated) with the three 4BA screws and washers.
d. Replace the transformer and transistor assembly (sub-paragraph 29b).
e. Secure the circuit board, 16CB1, in position (sub-paragraph 23b).

Transistor VT 11

37. Removal.

a. Unfasten the circuit board, 16CB1 (sub-paragraph 22b) and loosen the filter assembly (sub-paragraph 26c).
b. Unsolder the wires from the transistor, using a heat sink.
c. Remove the two 4BA nuts, screws and washers holding the transistor, taking care not to damage the diode, (MR 13), connected to the top screw.
d. Extract the transistor with its heat sink.

38. Replacement.

a. Mount the transistor on the plate ensuring that the heat sink is correctly positioned. Secure with two 4BA screws, washers and nuts.
b. Replace MR 13 terminal lug on the top screw and secure with a 4BA nut and washer.
c. Solder the wires to the transistor (using a heat sink) vide the circuit diagram (Fig 6).
d. Replace the filter assembly (sub-paragraph 27b), and the circuit board, 16CB1 (sub-paragraph 23b).

BASE REPAIR

Overall Performance Tests

39. Base repair involves extended input voltage tests as detailed in Table 3 (18 to 40 V dc) using the same procedures as detailed for field repair (paragraphs 11 to 20). Test point waveforms are provided in Tables 5 and 6 to assist in fault location.

TABLE 3 – SUMMARY OF TEST REQUIREMENTS – (BASE REPAIR)

Test	*DC Input*		*RT Unit*	*Battery*
	Voltage	*Current*	*Voltage*	*Voltage*
Input Voltage – Full Load	18 to 40 V		28 ±0.5 V	
Input Current – Full Load	20 V 40 V	2 A ±0.2 A 1 A ±0.1 A		
Input Current – No Load	20 to 40 V	100 mA max		
Charge Volts – No load	20 V			41 ±2 V
Charge Volts – On Load	20 to 40 V			36 ±3.6 V
Output Ripple	40 V		80 mV p–p (max)	
Reversed Polarity	40 V	Zero		

Circuit Data

40. The basic power supply circuit operation is governed by the pulse repetition frequency (PRF) of the transistor switching circuit. The 'on-time' switching is of constant duration (25 μ sec approximately) whilst the 'off-time' period can vary with a change of load or input conditions, eg:

a. With the input voltage constant and the load current increased, the switching frequency (PRF) will increase.
b. With an increase in the input voltage and the load current constant, the switching frequency (PRF) will decrease.
c. With an input voltage of 20 to 40 V dc and the output short-circuited, the switching frequency (PRF) cannot exceed 20 kHz (ratio 1:1 'on-off' duration) and thus provides the desired overload protection against equipment damage.

Test Point Waveform Measurements

41. Waveforms in Tables 5 and 6 are typical of those measured at test points on a serviceable Power Supply PP–F1. All waveforms shown, irrespective of amplitude, have the same phase relationship to the response shown for Test Point 1 (TP1) Table 5. Table 4, Figs 5 and 6 indicate the test point location. Table 5 shows typical waveforms for fixed input and load conditions. Table 6 shows typical waveforms, voltages and current for various input and load conditions (full charge).

Test Set-Up – Waveform Measurements

42. **Fixed Input and Load Conditions (Table 5).**

a. Input voltage : 28 V dc.
b. DA–F4 (RT UNIT Output Load) 15 Ω.
c. DA–F4 (Charge Output Load) 360 Ω.
d. Equipment opened for repair as detailed in paragraph 12.

43. **Varied Input and Load Conditions (Table 6).**

a. Input voltage as indicated in Table 6, column 1.
b. Output load conditions as indicated in Table 6, column 3.
c. Control switched to ON and FULL.
d. Equipment opened for repair as detailed in paragraph 12.

TABLE 4 – TEST POINT LOCATIONS (Figs 5 and 6)

TP No	*Location*	*TP No*	*Location*
1	VT 1 to VT 4–C, Lug provided	14	VT 9–C, CB 1–MR 8 anode
2	VT 5–C, CB 1–5	15	VT 10–B, CB 1–R 23/RV 3
3	VT 5–B, CB 1–R 17	16	VT 10–E, CB 1–17
4	VT 6–B, CB 1–10	17	VT 10–C, CB 1–VT 10 (can)
5	VT 6–E, CB 1–11	18	VT 11–E, CB 1–18
6	VT 6–C, CB 1–9	19	VT 11–C, MR 13 anode
7	VT 7–E, CB 1–R 11	20	TR 1, WDG 3, CB1–8
8 *	VT 7–B, CB 1–R 12/R 13 Junction	21	TR 1, WDG 2, CB 1–12
9	VT 7–C, CB 1– R 9	22	TR 1, WDG 4, CB 1–14
10 *	VT 8B–E, CB 1–C 3+	23	MR 4 cathode
11	VT 8 A–E, CB 1–1	24	MR 10 cathode
12	VT 9–E, CB 1–MR 9 cathode	25	MR 12 cathode
13	VT 9–B, CB 1–R 19	26	SKPP–A

NOTE: 1. Transistors VT–C: Collector.
VT–E: Emitter.
VT–B: Base.
2. Items marked *: with AVO connected, the waveforms may be affected.
3. CB 1–5 indicates pin 5 of circuit board No 1.

Inductor and Transformer Checks

44. The impedance of inductors and transformers can vary between equipment due to the core permeability range and the resistance of the winding wire. Impedance checks, supplemented by visual examination, continuity checks (windings have a very low resistance) or substitution of the item, provide a guide to the serviceability of the component. Component detail is listed in TELS K 572 Table 1001.

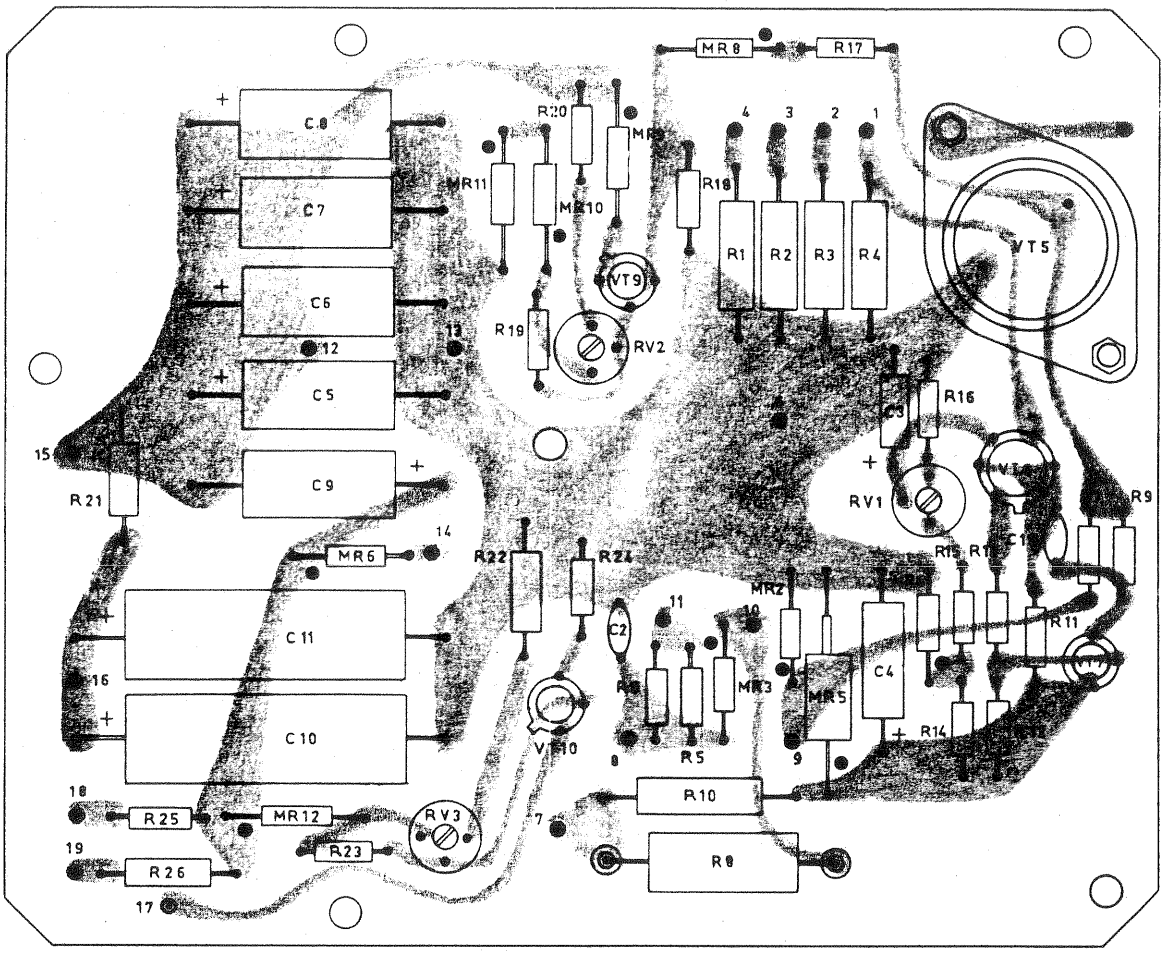
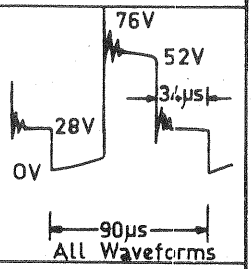
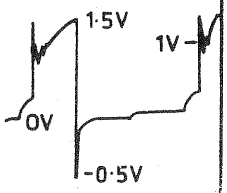
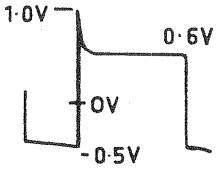
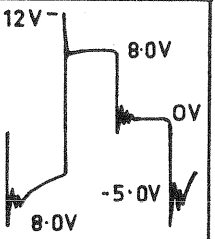


FIG 5 – CIRCUIT CARD 16CB1

TABLE 5 – FIXED INPUT AND LOAD WAVEFORMS

TP No	VDC TO EARTH	AVO RANGE	WAVEFORM
			NOTE: Phase is locked to TP1 waveform. Ref: a b c
TP1	27V	100V	
TP2	0·4V	2·5V	
TP3	0·27V	2·5V	
TP4	1·8V	2·5V	
TP5	1·15V	2·5V	AS TP4

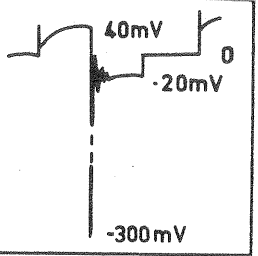
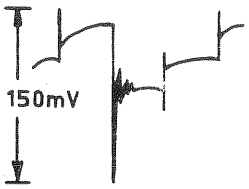
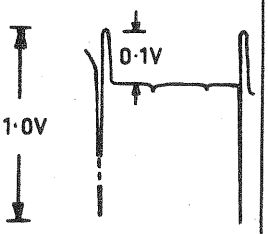
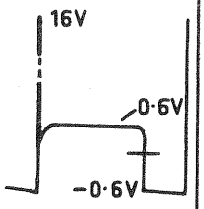
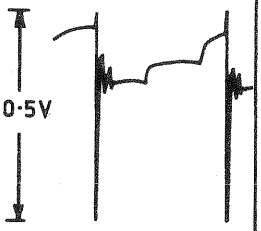
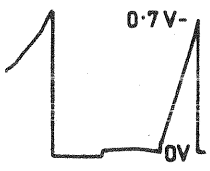
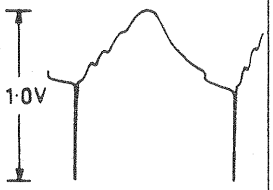
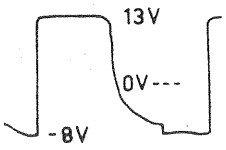
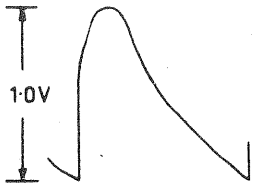
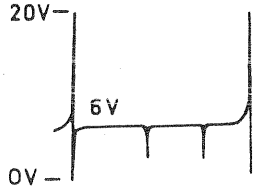
TP No	VDC TO EARTH	AVO RANGE	WAVEFORM a b c
TP6	0		
TP7	17·5V	25V	
TP8	17·3V	25V	
TP9	0·55V	2·5V	
TP10	0·7V	2·5V	
TP11	0·13V	2·5V	

TABLE 5 (contd)

TP No	VDC TO EARTH	AVO RANGE	WAVEFORM a↓ b↓ c↓
TP12	22V	25V	
TP13	21·5V	25V	AS TP12 EXCEPT AMPLITUDE 0·8V
TP14	9·0V	25V	
TP15	34·5V	100V	
TP16	35V	100V	AS TP15
TP17	6V	10V	

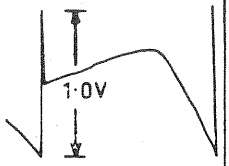
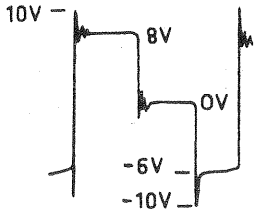
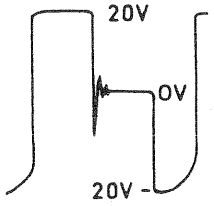
TP No	VDC TO EARTH	AVO RANGE	WAVEFORM a↓ b↓ c↓
TP18	36V	100V	AS TP15
TP19	28V	100V	
TP20	0·42V	2·5V	
TP21	28V	100V	AS TP15
TP22	-0·03V	2·5V	
TP23	6·35V	10V	MR4 Ref. Voltage
TP24	20·5V	25V	MR10-11 Ref. Voltage
TP25	41·5V	100V	AS TP15
TP26	28·0V	100V	PP-F1 Output to R/T Unit

TABLE 6 – WAVEFORMS VOLTAGES AND CURRENTS VARIOUS INPUT AND LOAD CONDITIONS (FULL CHARGE)

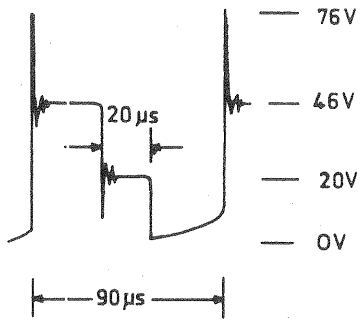
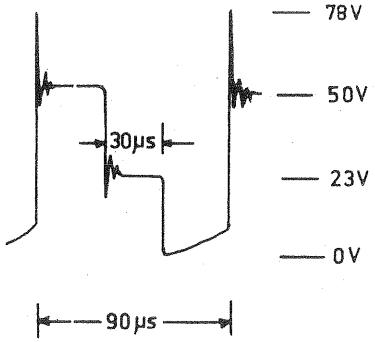
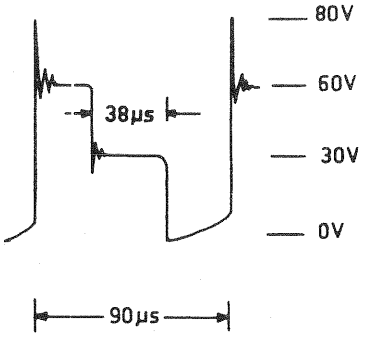
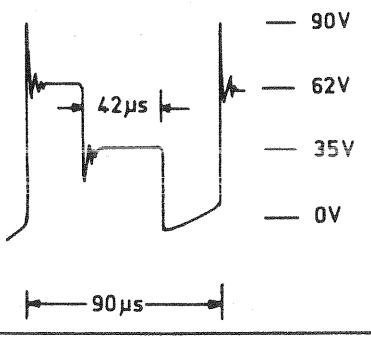
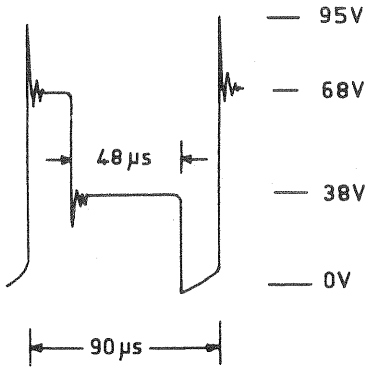
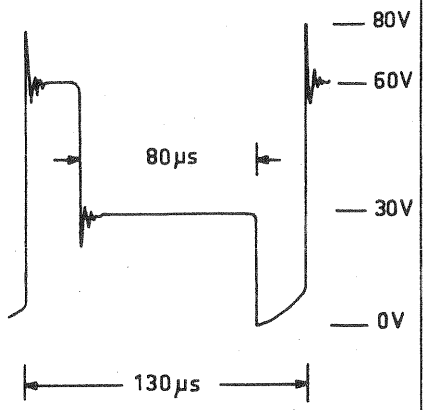
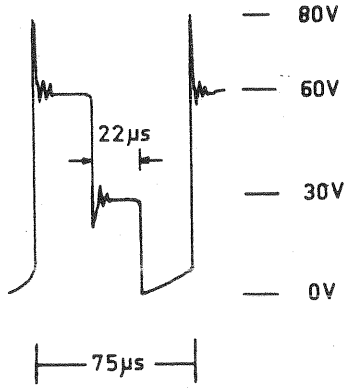
V in	Iin	I Load	V out	WAVEFORM (TP1)
20V	2·0A	0·8A	28V	
25V	1·6A	0·8A	28V	
30V	1·3A	0·8A	28V	
35V	1·15V	0·8A	28V	

TABLE 6 (contd)

V in	I in	I Load	V out	WAVEFORM (TP1)
40V	1·0A	0·8A	28V	
30V	0·9A	0·5A	28V	
30V	1·6A	1·0A	28V	

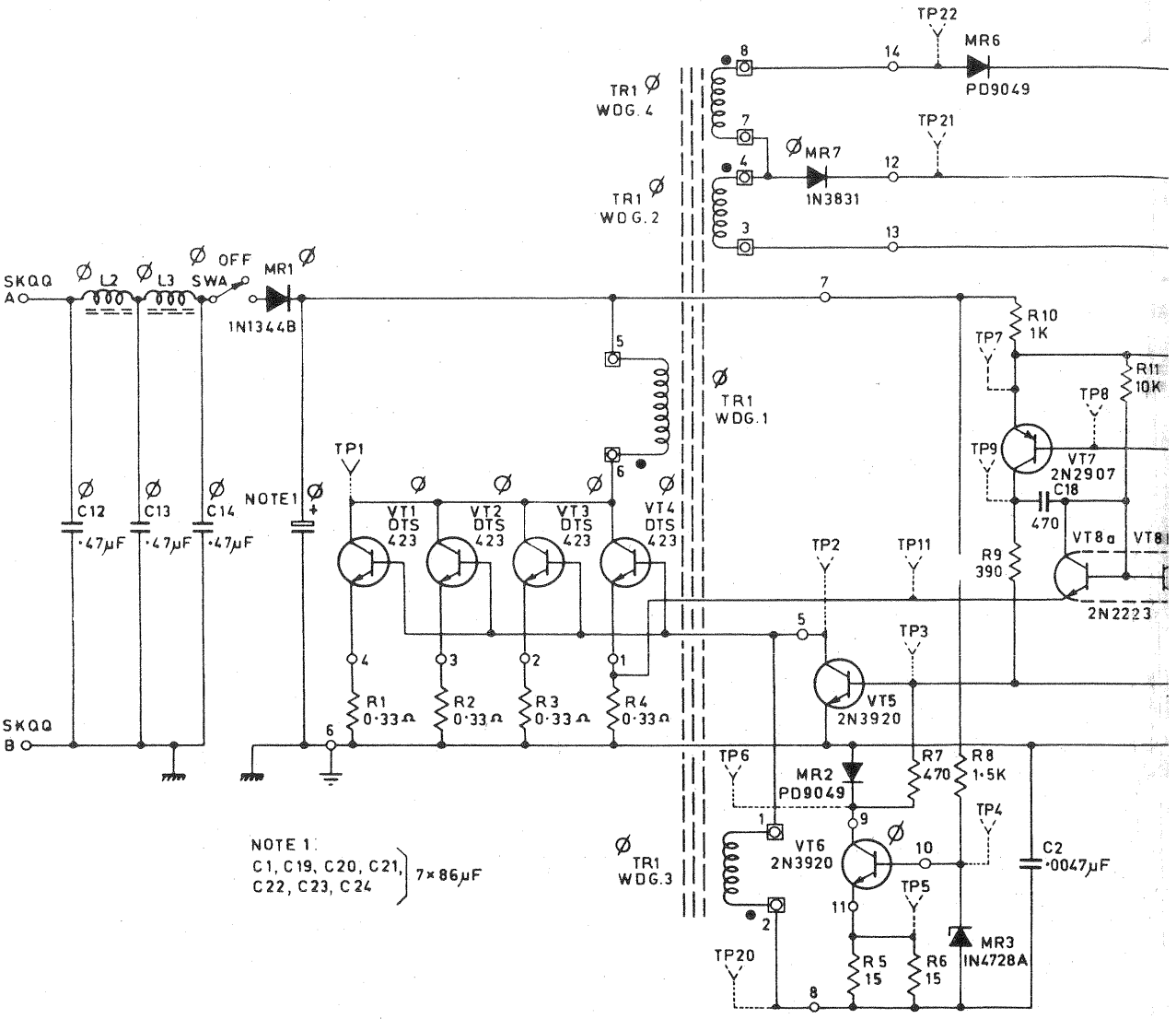


FIG 6 – SCHEMATIC DIA

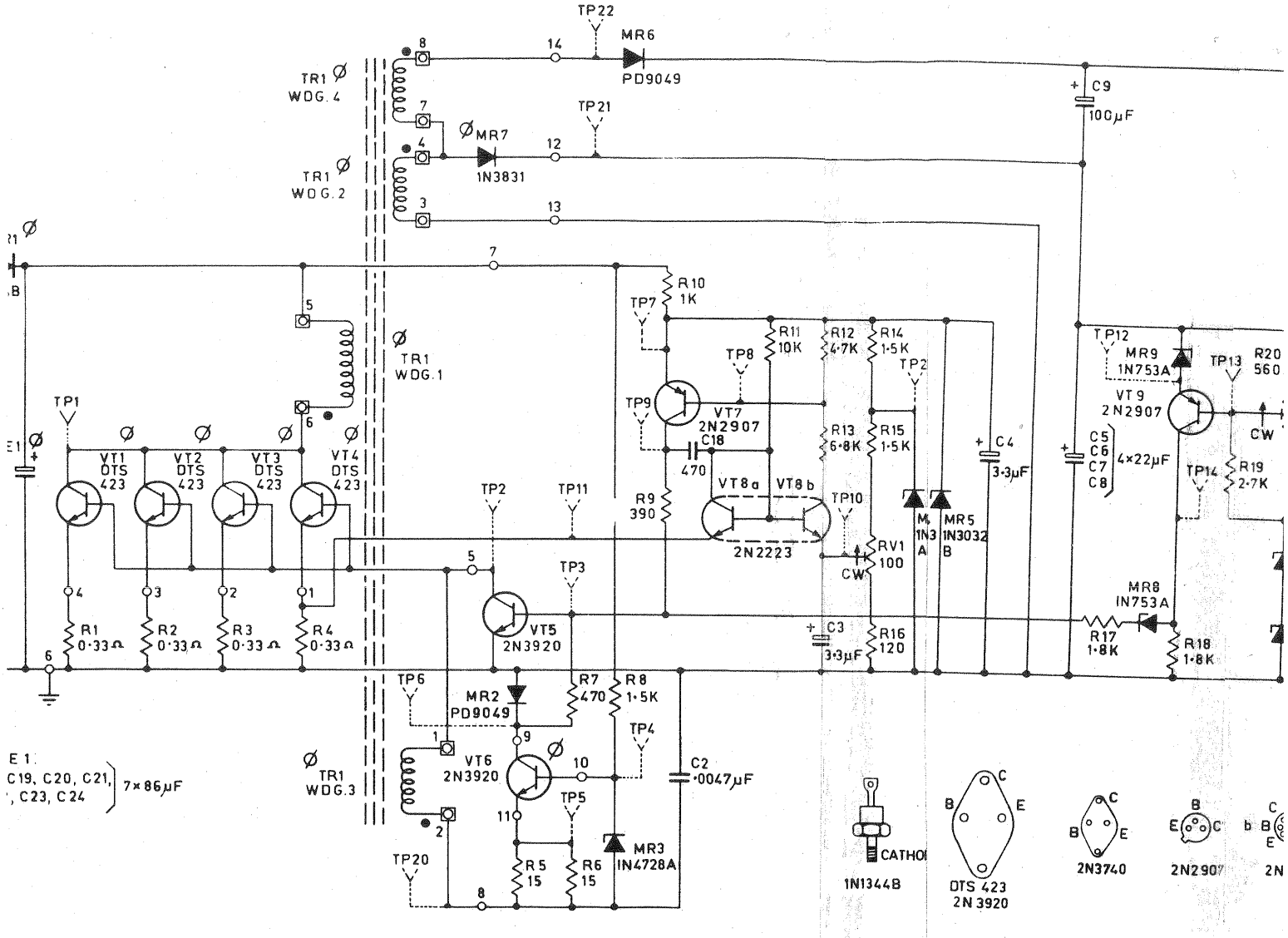


FIG 6 – SCHEMATIC DIAGRAM – POWER SUPPLY PP–F1

EN

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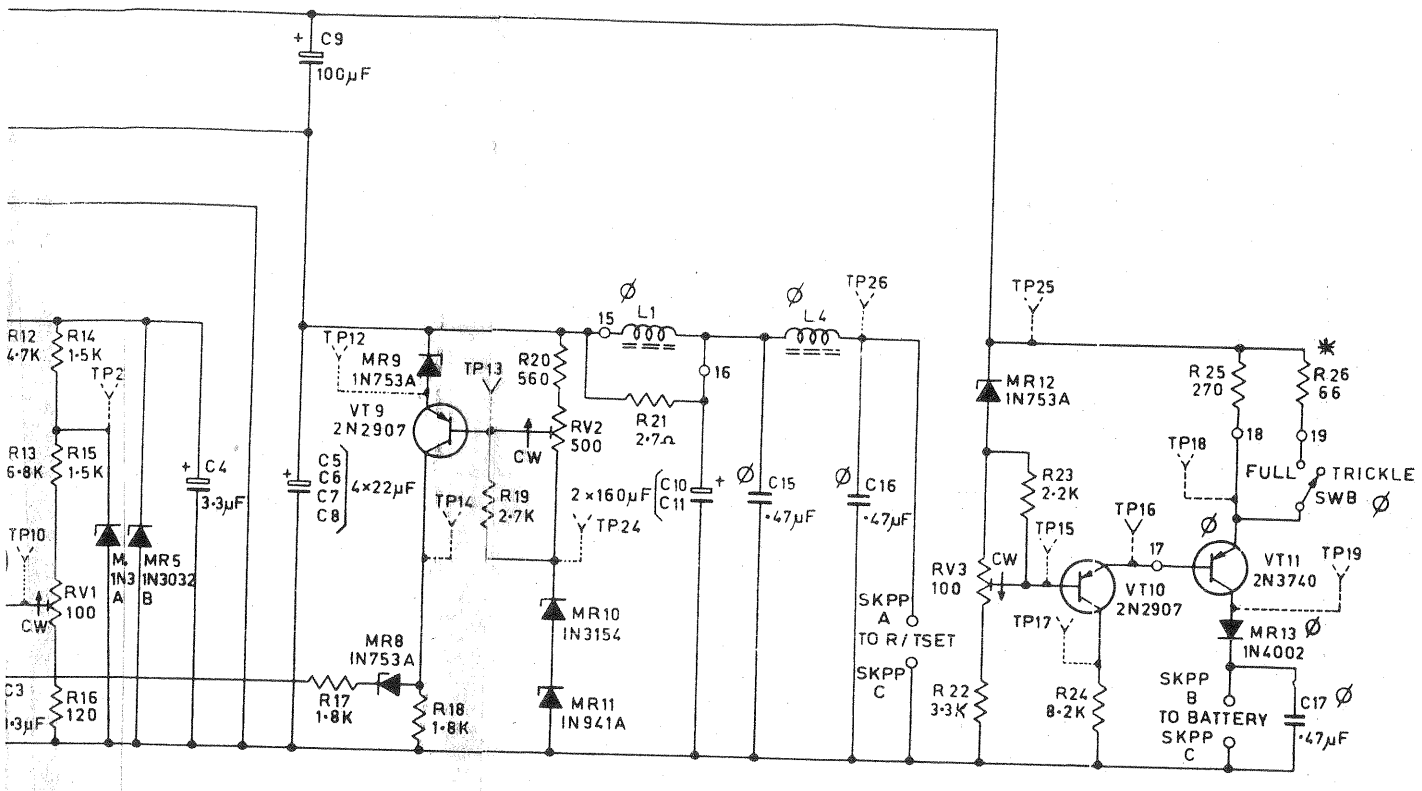
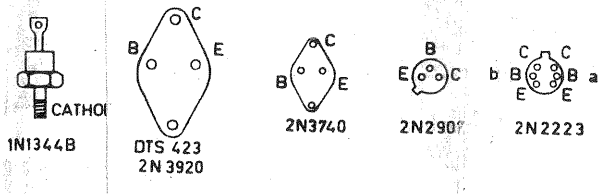




Ø COMPONENTS NOT MOUNTED ON PRINTED CIRCUIT BOARD

TP INDICATES MEASUREMENT POINTS SHOWN IN FIG 4 AND TABLE 4

* RESISTOR R 26 IS REPLACED BY THE PREFERRED VALUE ITEM (68Ω) IN LATE PRODUCTION EQUIPMENTS

RAM – POR SUPPLY PP–F1

EN

RECEIVER–TRANSMITTER RADIO RT–F1/PRC
REPLACEMENT OF FAULTY RESISTORS
BASE REPAIR

Introduction

1. Resistors (¼ watt, metal glaze, type RL07 early pattern, 51 Ω to 150 kΩ range) incorporated in circuits throughout Radio Set PRC–F1, exhibit appreciable tolerance drift resulting from moisture absorption. Whilst the increase in resistance has little effect on passive circuitry of the equipment, it can result in unreliability and malfunction of critical circuits which control equipment performance.

2. This instruction lists those critical circuit resistors in various RT–F1 modules and printed circuit boards (PCBs) which require replacement when found to be outside the specified tolerance rating. Complete replacement of all RL07 type resistors in the equipment is not intended at this stage, particularly when the majority of resistors (not listed in this instruction) can withstand a change in nominal value of up to 150% without causing serious detriment to equipment operation.

Repair Responsibility

3. Repair of RT–F1 circuit boards and modules by resistor replacement is restricted to the base repair facility nominated by AHQ and is NOT to be attempted at field repair level. Field repair of RT–F1 equipments is restricted to module and PCB replacement. Faulty modules and PCBs are to be back–loaded through normal RAAOC channels to the authorized base repair facility.

Repair Procedure

4. RT–F1 circuit boards and modules submitted for repair to the authorized base repair facility are to be subjected to preliminary circuit tests to isolate faulty RL07 resistors in critical circuits.

5. A proportion of RT–F1 circuit boards and assemblies incorporate improved reliability RL07 resistors which are physically identical to the early type. PCBs and modules of 'in–service' RT–F1 requipments could contain:

a. all resistors of the improved type,
b. a mixture of both types of RL07 resistors, or
c. only early pattern resistors.

6. If one or more resistors in a module or PCB are found to be outside the rated tolerance, then all resistors in the particular circuit sre suspect and require check–out to verify replacement action.

7. Where resistors listed in Tables 1 to 8 are found to be outside their rated tolerance, they are to be replaced with approved type resistors of the original value and tolerance specification. Resistors not listed in Table 1 are considered to be non–critical and at this stage may exceed the nominal resistance value by 150% before replacement action is warranted.

8. The following circuit boards and modules contain critical circuits which may require resistor replacement vide Tables 1 to 8:

a. 2CB1 (Mode Switch).
b. 3CB1 (IF Amplifier, AGC Circuit, AM Detector).
c. 6CB1 (Modulator).
d. 7–1CB1 (RF Driver and ALC).
e. 8CB1 (100 kHz Pulse Generator).
f. 9CB1 (10 kHz Pulse Generator).
g. 14CB1 (10 V Regulator and Battery Test Circuit
h. 18–2CB1 (Power Amplifier Part B).

TABLE 1 – CRITICAL RESISTORS – CIRCUIT CARD ASSEMBLY 2CB1

Circuit Ref No	*Value*	*Rating*	*Tolerance and Type*
R 1	3.3 k Ω	¼ W	± 2% Metal Glaze
R 2	3.3 k Ω	¼ W	± 2% Metal Glaze
R 3	3.9 k Ω	¼ W	± 2% Metal Glaze
R 4	2.7 k Ω	¼ W	± 2% Metal Glaze
R 5	10 k Ω	¼ W	± 2% Metal Glaze
R 6	1.8 k Ω	¼W	± 2% Metal Glaze

TABLE 2 – CRITICAL RESISTORS – CIRCUIT CARD ASSEMBLY, 3CB1

Circuit Ref No	*Value*	*Rating*	*Tolerance and Type*
R 18	3.9 k Ω	¼ W	± 5% Metal Glaze
R 48	8.2 k Ω	¼ W	± 5% Metal Glaze
R 49	1.5 k Ω	¼ W	± 5% Metal Glaze
R 51	10 k Ω	¼ W	± 5% Metal Glaze
R 52	6.8 k Ω	¼ W	± 5% Metal Glaze

TABLE 3 – CRITICAL RESISTORS – CIRCUIT CARD ASSEMBLY, 6CB1

Circuit Ref No	*Value*	*Rating*	*Tolerance and Type*
R 10	560 Ω	¼ W	± 5% Metal Glaze
R11	560 Ω	¼ W	± 5% Metal Glaze

TABLE 4 – CRITICAL RESISTORS – CIRCUIT CARD ASSEMBLY, 7–1CB1

Circuit Ref No	*Value*	*Rating*	*Tolerance and Type*
R 17	39 k Ω	¼ W	± 5% Metal Glaze
R 18	27 k Ω	¼ W	± 5% Metal Glaze
R 19	15 k Ω	¼ W	± 5% Metal Glaze
R 23	1 k Ω	¼ W	± 5% Metal Glaze
R 24	10 k Ω	¼ W	± 5% Metal Glaze
R 25	27 k Ω	¼ W	± 5% Metal Glaze

TABLE 5 – CRITICAL RESISTORS – CIRCUIT CARD ASSEMBLY, 8CB1

Circuit Ref No	*Value*	*Rating*	*Tolerance and Type*
R 2	18 k Ω	¼ W	± 2% Metal Glaze
R 3	4.7 k Ω	¼ W	± 2% Metal Glaze
R 4	4.7 k Ω	¼ W	± 2% Metal Glaze
R 7	4.7 k Ω	¼ W	± 2% Metal Glaze
R 8	3.9 k Ω	¼ W	± 2% Metal Glaze
R 11	3.3 k Ω	¼ W	± 2% Metal Glaze
R 17	15 k Ω	¼ W	± 2% Metal Glaze
R 19	5.6 k Ω	¼ W	± 2% Metal Glaze
R 20	1.5 k Ω	¼ W	± 2% Metal Glaze
R 21	56 k Ω	¼ W	± 2% Metal Glaze
R 34	33 k Ω	¼ W	± 2% Metal Glaze

TABLE 6 – CRITICAL RESISTORS – CIRCUIT CARD ASSEMBLY, 9CB1

Circuit Ref No	*Value*	*Rating*	*Tolerance and Type*
R 8	4.7 k Ω	¼ W	± 2% Metal Glaze
R 9	1.8 k Ω	¼ W	± 2% Metal Glaze
R 10	1.80 k Ω	¼ W	± 2% Metal Glaze
R 14	39 k Ω	¼ W	± 5% Metal Glaze
R 19	12 k Ω	¼ W	± 2% Metal Glaze

TABLE 7 – CRITICAL RESISTORS – CIRCUIT CARD ASSEMBLY, 14 CB1

Circuit Ref No	*Value*	*Rating*	*Tolerance and Type*
R 8	10 k Ω	¼ W	± 5% Metal Glaze
R 9	12 k Ω	¼ W	± 5% Metal Glaze
R 13	12 k Ω	¼ W	± 5% Metal Glaze

TABLE 8 – CRITICAL RESISTORS – CIRCUIT CARD ASSEMBLY, 18–2CB1

Circuit Ref No	*Value*	*Rating*	*Tolerance and Type*
R 2	560 Ω	¼ W	± 2% Metal Glaze
R 3	4.7 k Ω	¼ W	± 2% Metal Glaze

Identification of Replaced Resistors and Repaired Assemblies

9. To identify resistors replaced in modules/PCBs, all new resistors are to be marked with a spot of yellow polyurethane enamel (one pack Estapol or similar) on the exposed end (pigtail) of each resistor concerned.

10. To identify modules or PCBs containing new resistors, the assembly/circuit card reference on the unit is to be underlined with polyurethane enamel, ie, 8–CB1.

Assembly Test After Repair

11. If applicable, carry out alignment and performance tests of the module/PCB in isolation using base repair test jigs provided for this purpose.

12. On completion of alignment and isolation tests, install the repaired unit in a slave RT–F1 equipment and carry out relevant performance tests as detailed in TELS F 574–1, to verify serviceability of the repaired assembly.

Return to Depot Stock

13. All serviceable modules, and PCB scheduled for return to RAAOC depot stock are to be packaged separately and certified as detailed in TELS A 423 Issue 2.

END

TABLE 4 – RELAY DRIVE CIRCUIT DC VOLTAGES – (CONT'D)

Measurement	Terminal	DC Voltage	Meter Range	Remarks
11	VT9 base	OV	10V	(
12	VT9 emitter	OV	10V	(
				(Steady-state
13	VT9 collector	10.0V	10V	(values
				(
14	VT10 base	OV	10V	(
				(
15	VT10 collector	28V	100V	(
16	MR6 cathode	7.8V	10V	SSB/AM; key open
		OV	2.5V	SSB/AM; key closed
		7.8V	10V	CW; key open
		OV	2.5V	CW; key closed
17	PLR6	10.0V	10V	
18	PLS1	28V	100V	
19	PLS2	28V	100V	
20	PLS3	28V	100V	
21	PLS5	7.8V	10V	Key open
		OV	10V	Key closed
22	PLS6	0.25V	2.5V	SSB/AM
		10V	10V	CW

14. **Removal/Replacement of the Compression Amplifier and Relay Drive Circuit Board 5–CB1.** Removal and replacement of the circuit board is detailed in TELECOM F 574–2 paragraph 68.

15. **Component Replacement.** Heat sinks are to be used when transistors or minature components are replaced. Observe the precautions detailed in TELECOM A 521 and A 522 to prevent component damage.

Final Test

16. After Repair and before the module is sentenced as serviceable for return to depot stock, it shall be tested in a slave Radio RT–F1/PRC to ensure correct overall circuit operation.

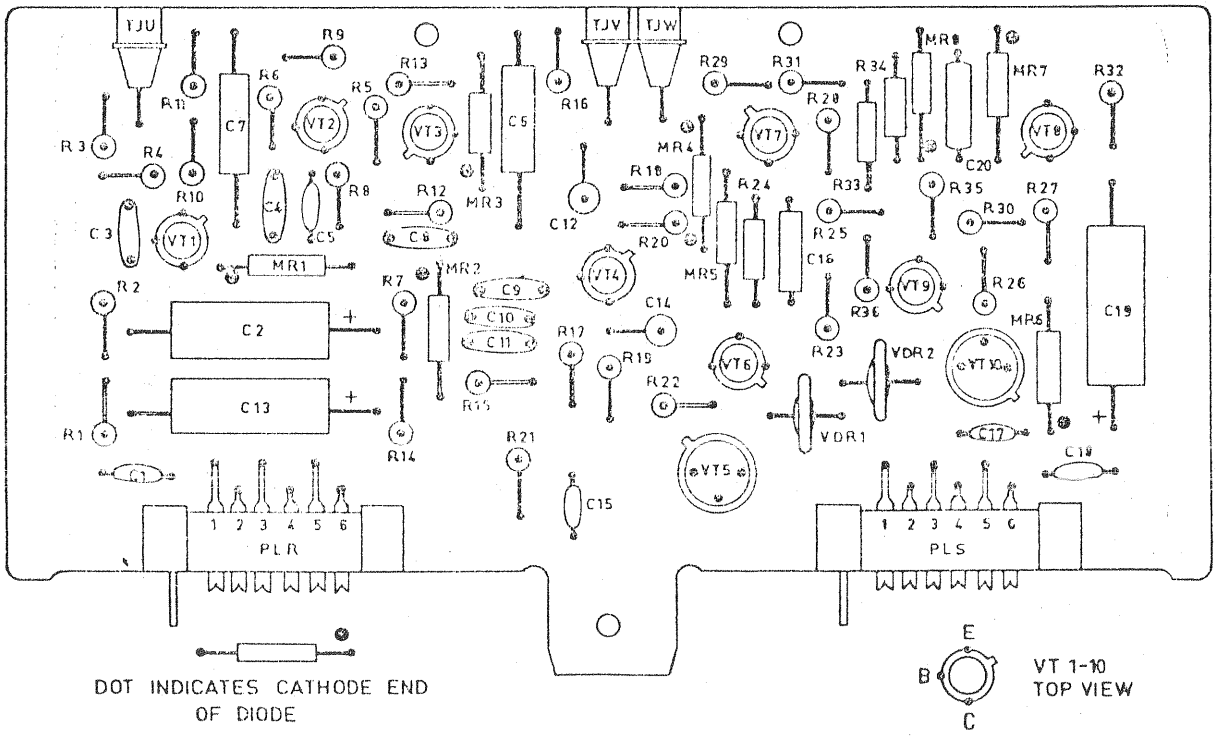


FIG 7 – COMPRESSION AMPLIFIER RELAY DRIVE – COMPONENT LAYOUT

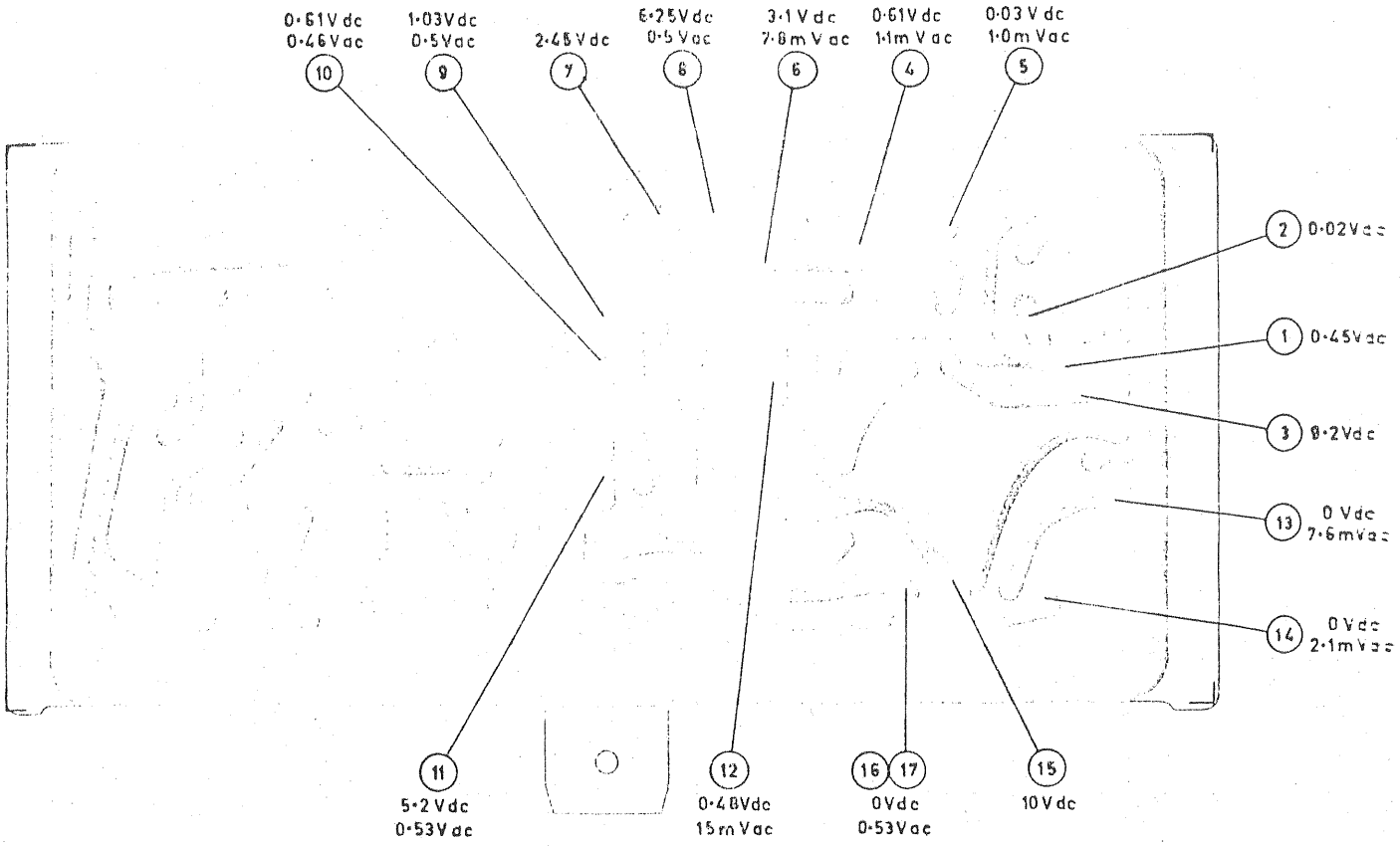


FIG 8 — SERVICING GUIDE COMPRESSION AMPLIFIER

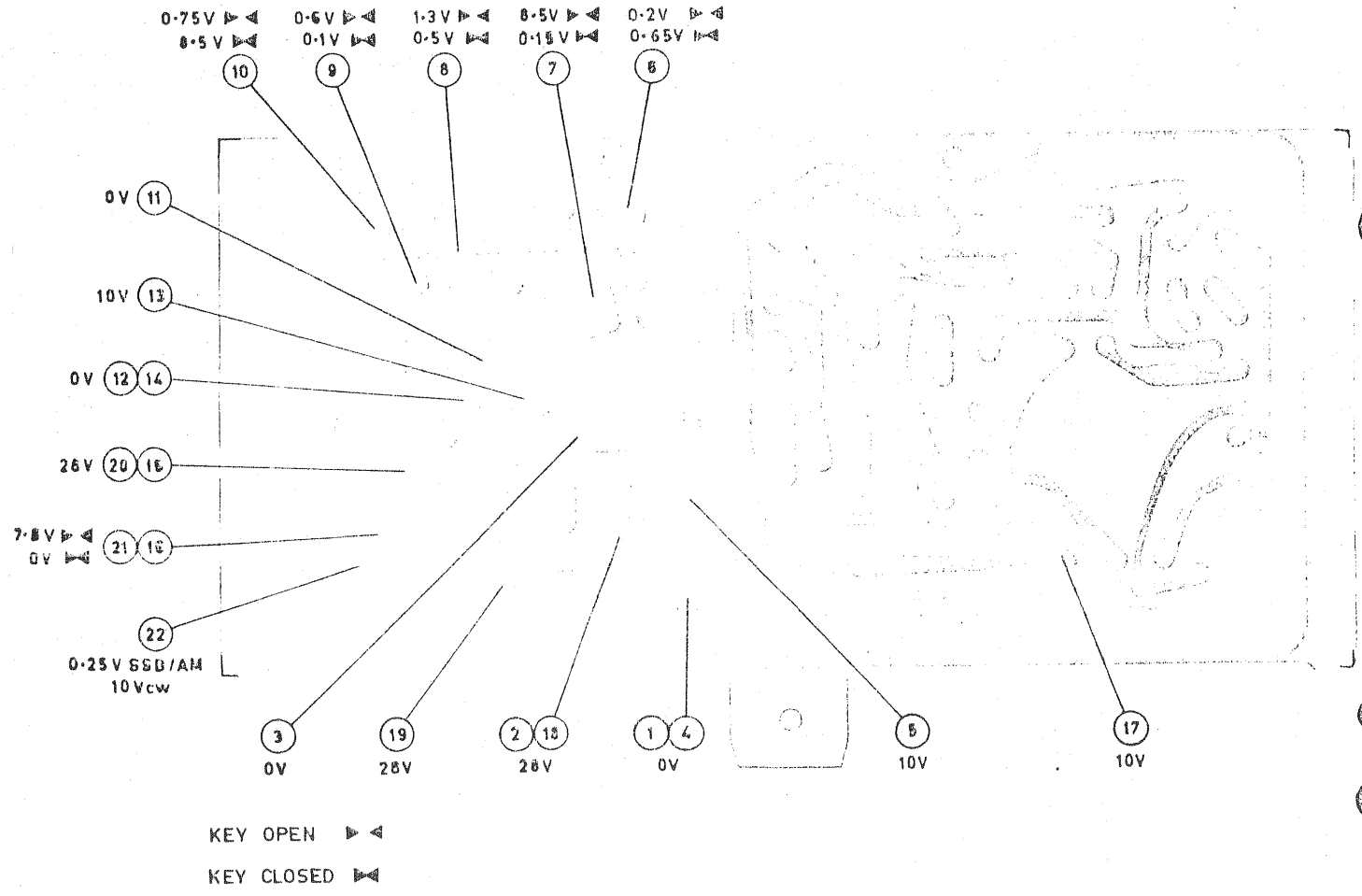
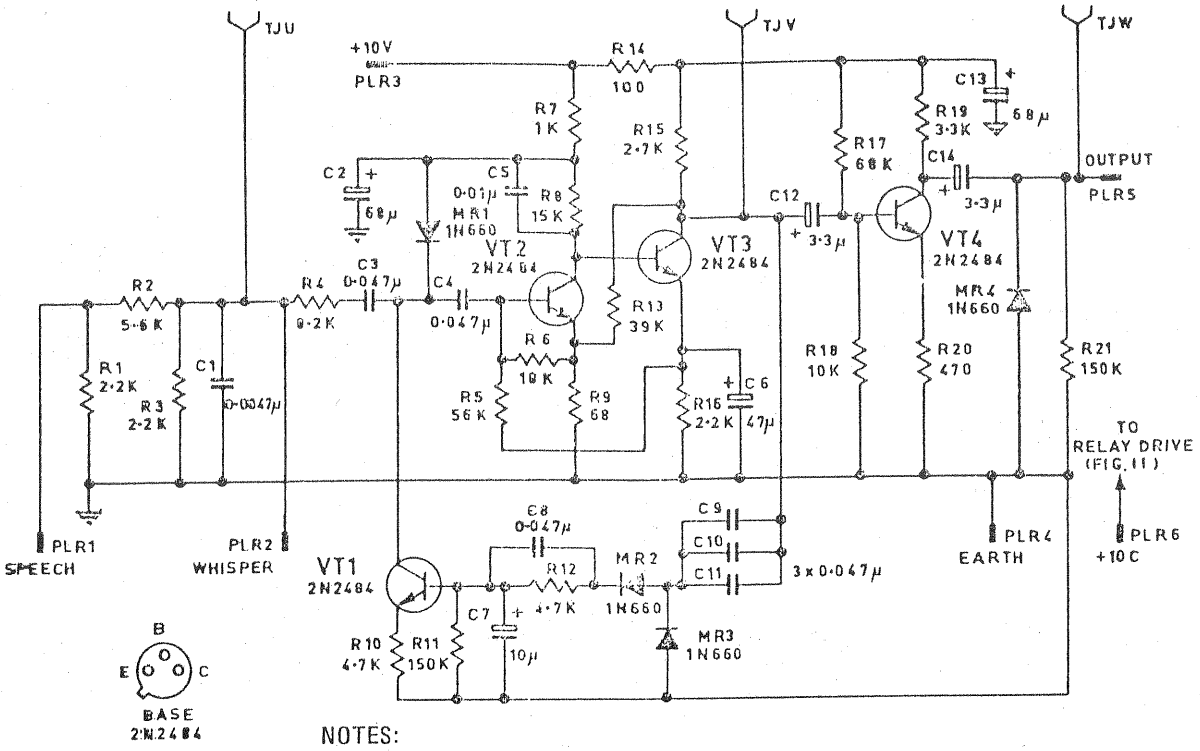


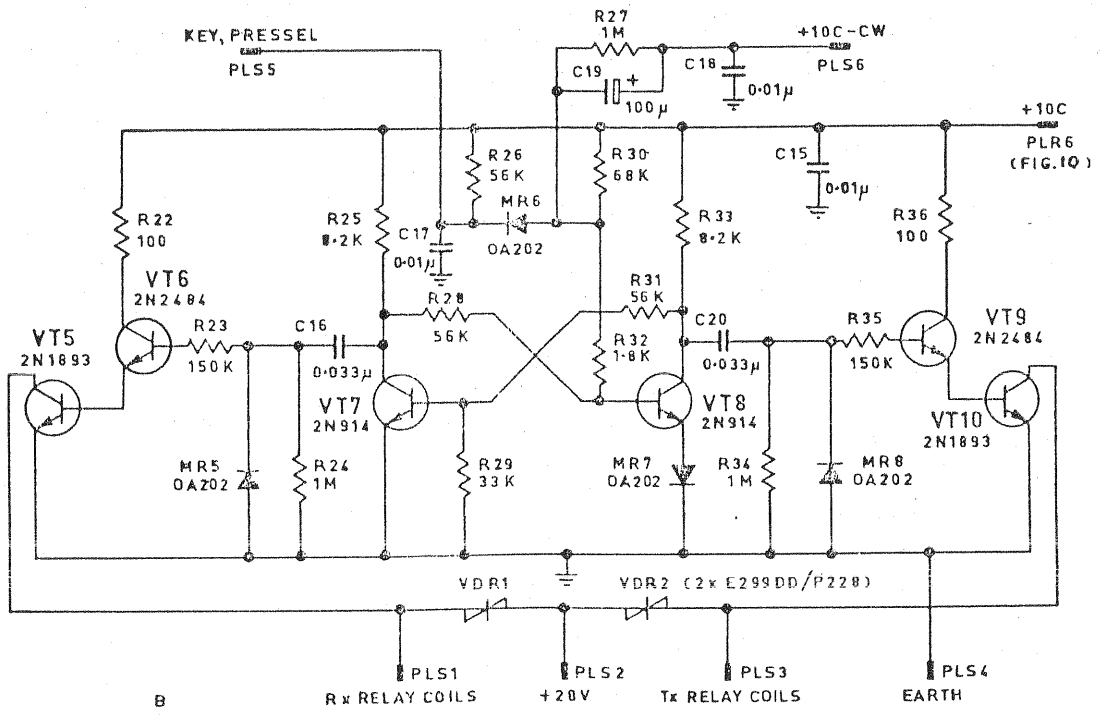
FIG 9 — SERVICING GUIDE RELAY DRIVE



NOTES:

1. ALL CAPACITOR VALUES IN MICROFARADS
2. ALL RESISTOR VALUES IN OHMS UNLESS OTHERWISE MARKED
3. CIRCUIT PREFIX 5

FIG 10 — COMPRESSION AMPLIFIER



NOTES:

1. ALL RESISTOR VALUES IN OHMS UNLESS OTHERWISE MARKED.
2. CIRCUIT PREFIX 5.

FIG 11 — RELAY DRIVE CIRCUIT

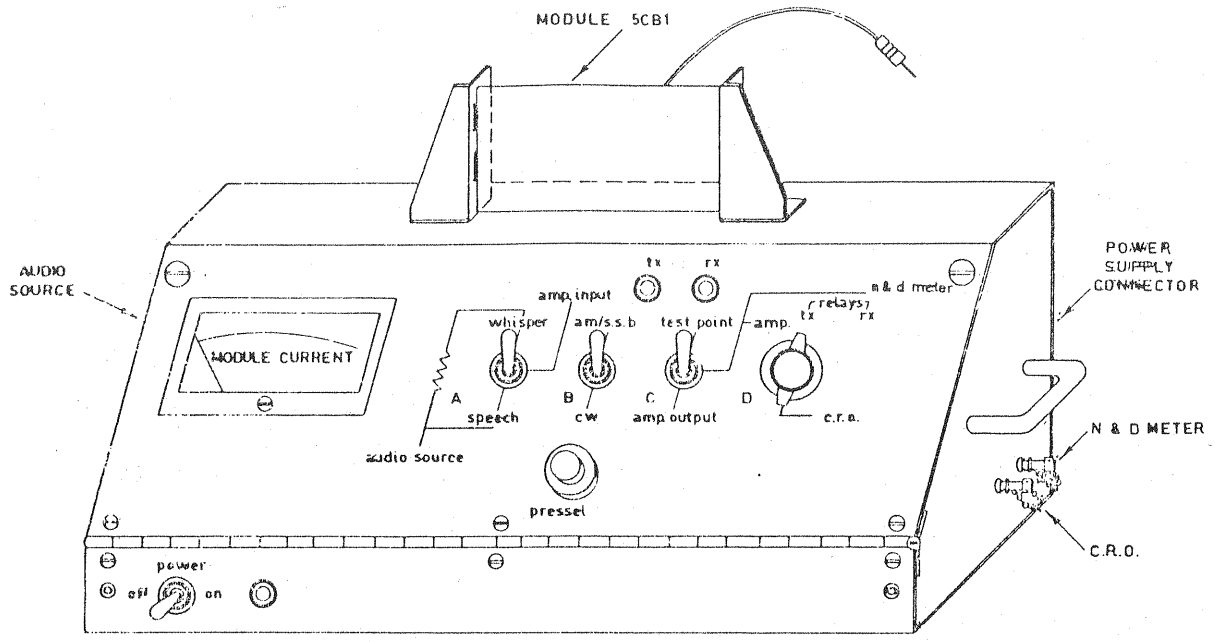


FIG 12 – TEST FIXTURE DIAGRAM

RECEIVER–TRANSMITTER RADIO RT–F2/PRC–F3 USED WITH RADIO SETS PRC–F3 AND GRC–F2

DATA SUMMARY

Introduction

1. The Receiver-Transmitter Radio RT–F2/PRC–F3 is a compact lightweight, general purpose, HF transceiver and is intended for use in the following operational roles:

   a. **Manpack Radio.** Radio Set PRC–F3 comprises RT–F2/PRC–F3 plus standard operator accessories (See Fig 1) antenna (whip and wire) and rechargeable, internal batteries.

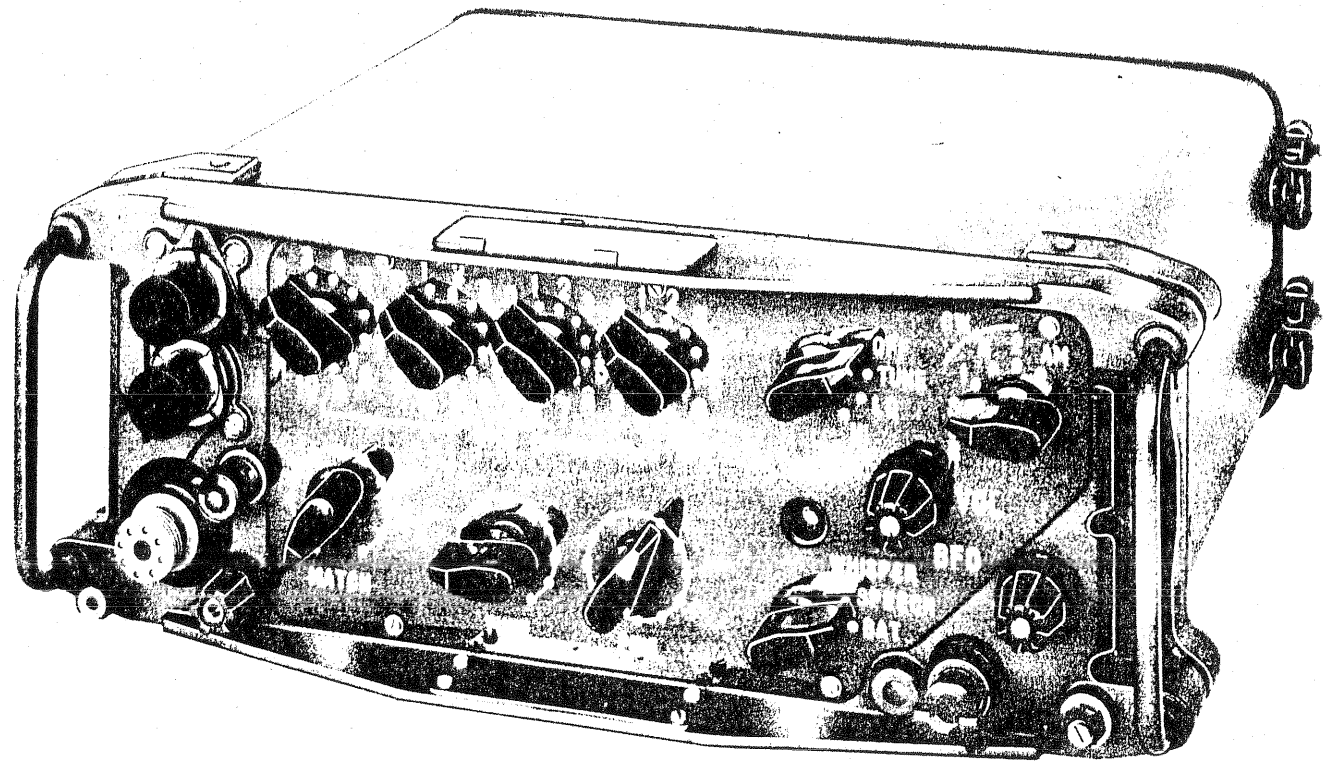
   b. **Ground Radio Station.** Radio Set GRC–F2 comprises Radio Set PRC–F3 plus Conversion Kit MK–F7.

   c. **Vehicle Radio Installation.** Comprises Radio Set GRC–F2 plus Installation Kit, Electronic Equipment MK–F8.

General

2. The Receiver-Transmitter configurations are capable of communication with most HF upper sideband and amplitude modulated equipments, eg. Radio Sets RT–F3/PRC, AN/PRC–47, AN/GRC–106, AN/PRC–64 and Radio Terminal AN/TSC–38.

3. The Receiver-Transmitter is of modular construction incorporating printed circuit board and discrete component techniques throughout. Tuning is manual; four, 10 position, digitized switches, provide for 10,000 discrete frequency channels at 1 kHz increments within the frequency range 2 to 11.999 MHz. Modulation modes are single sideband (SSB) voice suppressed carrier, amplitude modulation (AM) compatible and keyed carrier wave (CW) at the assigned or dial frequency. Encased in its panclimatically sealed, metal case, the RT unit can be operated within the temperature range –21 to + 71 degrees celsius and under extreme conditions of humidity, shock and vibration.



Physical Data

4. **Dimensions and Mass.**

a. Height	.	120 mm
b. Width	:	330 mm
c. Depth	:	300 mm
d. Mass (complete manpack station)	:	13.5 kg

Performance

6. **General Characteristics**

a. **Frequency.**

(1) range : 2 to 11.999 MHz.

(2) channels : 10,000 at 1 kHz intervals.

(3) stability/accuracy : within ± 2 rev/min of normal frequency of 90 days.

b. **Modes of Operation (Assigned Frequency is Dial Setting).**

(1) Single Sideband (SSB, A3J) : Transmit – Upper Sideband (USB) speech, suppressed carrier is located 2 kHz below assigned frequency; Receive – USB, bandwidth, nominally 4 kHz, is centred on the assigned frequency.

(2) Carrier Wave 1 (CW1) : Transmit – Keyed Carrier (morse or telegraphy) at the assigned frequency; Receive – As for SSB

(3) Carrier Wave Narrow (CWN) : Transmit – As for CW1; Receive – Bandwidth nominally 425 Hz is centred on assigned frequency.

(4) Amplitude Modulation (AM, A3) : Transmit – USB only speech plus carrier at assigned frequency; Receive – Normal double sideband (DSB), bandwidth nominally 6 kHz, is centred on the assigned frequency.

(5) Carrier Wave 2 (CW2) : Transmit – As for CW1, Receive – Bandwidth, nominally 6 kHz. is centred on the assigned frequency.

c. **Range of Operation.** : Point to point range varies widely with siting, antenna type, operating frequency, mode, power output and atmospheric conditions, eg, a radio set transmitting SSB high power into a 2.44 metre vertical rod antenna should provide reliable communications up to 40 km over average terrain.

7. **Receiver Performance.**

a. **Sensitivity for 1 mW Audio Output in 100 ohms.**

(1) SSB/CW1/CW2/CWN : 0.5 μV input

(2) AM : 2.0 μV input

b. **Signal plus Noise to Noise (S + N:N) Ratio Minimum.**

(1) SSB/CW1 : 10 dB

(2) CWN : 18 dB

(3) CW2/AM : 7 dB

c. **Selectivity/Bandwidth.** : 0 dB reference is 1 mW of audio output in a 100 ohm load :

L[illegible] Below 0 dB	Receive Mode Bandwidth		
	AM/CW2	SSB/CW1	CWN
3 dB	4.5 kHz	1.4 to 1.7 kHz	160 to 350 Hz
6 dB	6.0 kHz	2.5 kHz	300 to 600 Hz
12 dB	7.5 kHz	3.0 kHz	500 to 800 Hz
30 dB	12.0 kHz	4.0 kHz	1.2 kHz
60 dB	16.0 kHz	5.8 kHz	3.5 kHz

d. **Beat Frequency Oscillator (BFO).** : CW2 mode, variable tone, zero to 3 kHz.

e. **Cross Modulation.** (20 per cent) for wanted signal level of 200 micro volts and unwanted signal modulated 30 per cent at 1 000 Hz. Unwanted signal level is greater than 100 millivolts for the following test frequencies and signal separation:

(1) at 2.5 MHz and ± 30 kHz.

(2) at 11.5 MHz and ± 120 kHz.

f. **Desensitization AM Mode.** S + N/N ratio is not less than 20 dB for a wanted signal level of 200 microvolts modulated 30 per cent at 1 000 Hz and an unwanted signal level of 100 millivolts unmodulated for the following frequencies and signal separations:

(1) 2.5 MHz ± 50 kHz.

(2) 7.5 MHz ± 180 kHz.

(3) 11.5 MHz ± 200 kHz.

g. **Blocking (3 dB).** In the SSB mode, with wanted signal level of 1 mV and unwanted signal of 1 V at ± 10 kHz separation, the decrease in audio output is not greater than 3 dB.

8. **Transmitter Performance.**

a. **RF Power Output (Average).** Measured at the wire antenna terminals with a 50 ohm termination.

(1)	SSB (USB)	– high power	: 7 to 9 W
		– low power	: 0.5 W
(2)	CW modes	– high power	: 4 to 5 W
		– low power	: 0.5 W
(3)	AM	– high power	: 3.5 to 4.5 W
		– low power	: 0.3 W
(4)	AM Power Levels – carrier to sideband ratio		: < 3 dB

b. **RF High Power Output (Average).** Measured into the resistive element of simulated dummy antenna.

(1)	Antenna AS–F1 (flexible 8 ft, CU–F1 or CU–F1A1)	: 4 to 5 W
(2)	5 m Antenna via Coupler Antenna CU–F2	: 1.3 to 7.2 W
(3)	8 m Telescopic Antenna CU–F2	: 2.5 to 7.5 W
(4)	13 m Vertical Antenna via CU–F2	: 5.0 to 7.7 W
(5)	Antenna AS–F2 (dipole adjustable length, 2 to 12 MHz)	: 7.0 to 9.0 W
(6)	Antenna AS–F3 (end fed adjustable length, 2 to 12 MHz)	: 7.0 to 9.0 W
(7)	Low Power – Antenna Power Relative to High Power	: 0.1

c. **CW Keying Characteristics.**

(1)	Operating Speed – Telegraphy	: max speed 300 words per minute

d. **Modulator Sensitivity – Audio Input for Rated HI/LO RF Power Output.**

(1)	SSB/AM Speech normal	: 2 mV
(2)	SSB/AM Speech whisper	: 0.7 mV

9. **Special Facilities.**

a. Two audio output sockets.

b. Whisper modulation facility.

c. Audible Tone for antenna tuning.

d. Battery charge indicator.

10. **Power Requirements.**

a. **Input.**

(1)	Voltage	: 22 to 32 V dc
(2)	Current transmit (at max power output)	: less than 1 A
(3)	Current receive	: 30 mA

b. **Internal Battery:** Battery Storage BB–F1, Nickel-Cadmium, rechargeable 28 V (nominal) battery providing at least 6 hours operation on high power or 24 hours on low power assuming a 10:1 receive – transmit operating ratio.

c. **External dc Source.** 20 V to 40 V dc input to Power Supply PP-F1 (part of MK–F7/GRC–F2) charges the internal battery BB–F1).

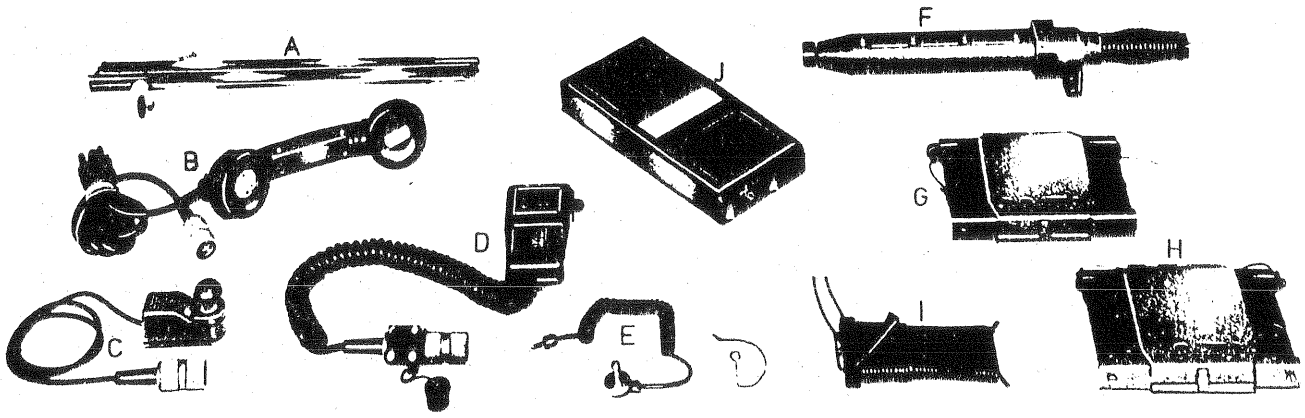
(1)	Full charge	: 100 mA
(2)	Trickle charge	: 20 mA

11. **Ancillary Equipment.**

a. Conversion Kit MK–F7 DSN 5820–66–029–4772; converts PRC–F3 to a ground station type GRC–F2.

b. Installation Kit Electronic Equipment MK–F8 DSN 5820–66–029–4771; converts ground station GRC–F2 for vehicular mounted role.

c. Regulator Set MX–F1 DSN 5820–66–029–4770; allows initial/routine charging of up to ten nickel-cadmium batteries BB–F1 at a time.



A. DSN 5985–66–026–4335 ROD ANTENNA AS–F1
B. DSN 5965–66–027–0544 HANDSET H–F2
C. DSN 5805–66–028–2839 KEY TELEGRAPH LIGHT WEIGHT (AUST) KY–F1A1
D. DSN 5965–66–028–2516 MICROPHONE DYNAMIC M–F1
E. DSN 5965–66–024–1843 HEAD SET H–F1
F. DSN 5985–66–038–8322 COUPLER ANTENNA CU–F1A1
G. DSN 5985–66–026–0781 ANTENNA AS–F2
H. DSN 5985–66–026–0781 ANTENNA AS–F2
I. DSN 5985–66–029–6146 ANTENNA FEEDER ASSEMBLY, 70 ohms
J. DSN 6140–66–026–0969 BATTERY STORAGE BB–F1

FIG 1 – RADIO SET PRC–F3 ACCESSORIES

Associated Information

12. **Stock Number/Designation.**

a. DSN 5820–66–049–7900 Radio Set, PRC–F3.

b. DSN 5820–66–054–1958 Receiver-Transmitter Radio RT–F2/PRC–F3.

13. **Associated Publications.**

a. AC in WM : PRC–F1 (GRC–F2) 25895 (26065)

b. RPS : PRC–F1 22112

c. CES : PRC–F1 (GRC–F2) 4090 (4091)

d. User Handbook : PRC–F1 7610–66–029–5013

e. EMEIS : TELECOMMUNICATIONS F 572 to F 579 PRC–F1
TELECOMMUNICATIONS J 820 to J 829 Handset H–F2
TELECOMMUNICATIONS J 870 to J 879 Headset H–F1
TELECOMMUNICATIONS J 880 to J 889 Microphone Dynamic M–F1
TELECOMMUNICATIONS K 560 to K 569 Regulator Battery Charger MX–F1
TELECOMMUNICATIONS K 570 to K 579 Power Supply PP–F1
TELECOMMUNICATIONS L 860 to L 869 Key Telegraph Lightweight (Aust) No 1 Mk 2 (Modified)
TELECOMMUNICATIONS L 130 to L 139 Coupler Antenna CU–F2
TELECOMMUNICATIONS L 140 to L 149 Coupler Antenna CU–F1

f. Specification : Army (Aust) 174 Issue 6

END

RADIO SET PRC–F3
UNIT REPAIRS

Introduction

1. The Receiver-Transmitter RT–3/PRC (the RT unit) of the Radio Set PRC–F3 is panclimatically sealed and operators are forbidden to break the seal and open the set.

General

2. Unit repairs are restricted generally to external components and accessories. Because of the self-contained and sealed nature of the equipment, unit repair is necessarily limited. Testing for correct operation is to be carried out as described in paragraphs 33 to 42.

Safety

3. **Power Sources.** The Radio Set must not be operated from any power source other than those for which it is designed, namely, the internal battery BB–F1 or the Power Supply PP–F1.

4. **Proximity to Transmitters.** The set must not be operated in close proximity to other radio transmitters operating in the same frequency range. If this is unavoidable the distance separating the antennas should be as great as possible, but should never be less than that tabulated below.

TABLE 1 – MINIMUM DISTANCE BETWEEN TRANSMITTERS

Nearby Transmitter Type	Possible Power Output	Minimum Antenna Spacing for 8 ft and 16 ft Vertical Antennas
PRC–F1/PRC–F3	10 watts	15 ft
PRC–47	100 watts	15 ft
GRC–106	400 watts	36 ft

Routine Maintenance – RT Unit

5. Examine the general condition of the set, paying particular attention to any dents or deformations of the case which could destroy the airtight seal with the front panel.

> CAUTION:
> 1. Painted surfaces are protected by an epoxy based paint and are not to be touched up with other paints.

6. Clean all plugs and sockets, ensuring that no foreign matter remains in the receptacle or the screw threads. All plug and socket pins must be straight and perpendicular to the connector body.

> CAUTION:
> 1. To avoid damage to contact surfaces, do not use abrasive materials or sharp tools.

7. Ensure that the dummy plug PLA is securely attached to the set with nylon cord. If this plug is lost, the RT unit cannot be operated from the internal battery.

8. Inspect the battery compartment. Ensure that the spring clips which secure the cover are operating correctly. Check that the synthetic rubber O ring is in place and is free from any signs of damage. Test the nine nuts and screws accessible in the battery compartment for tightness. A crinkle washer should be under each nut. Inspect the soldered joints.

9. Battery contact springs should stand at least 3/16 inch above the white plastic moulding. If the springs are bent or distorted they should be replaced (paragraph 28d). The contacts should be wiped with a soft cloth to remove any dirt or grease.

> CAUTION:
> 1. The contact surfaces are plated with precious metal and must not be cleaned with files or abrasives of any kind.

10. All knobs should be tested for tightness on the spindles. The grub screw fits in a hole in the spindle, which has a flat milled on the side to engage in a D shaped hole in the knob.

11. Clean the windows through which the battery test lamp and the humidity indicator are viewed. Examine the

Routine Maintenance – Accessories

14. **Handset.** Clean the outside of the handset, cable and plug. Unscrew the moulded caps and clean the inserts. Check that the rubber ring is in place under the insert. Inspect the cable wiring. If broken or damaged, it may be replaced as described in paragraph 29.

15. **Key.** This is a standard Key, Telegraph, lightweight (Aust) F1A1 (repair as described in TELECOM L 863–4), except for the cable plug. For repairs to wiring see paragraph 29.

16. **Microphone.** Clean the microphone, cable and plug. Examine the sealing between the two halves of the case, and around the Pressel switch and cable clamp. For wiring to the plug and handset adapter, see paragraph 31.

17. **Headset.** This is a sealed unit with a replaceable cable. Clean and protect when not in use.

18. **Coupler, Antenna CU–F1.** Inspect the coupler for mechanical damage. Clean out the collet at the top and the plug connector at the bottom. Make sure that the collar on the lower part of the housing is securely tightened. Test that the tuning indicator knob operates properly and that the coloured indicator inside the window moves correctly when the knob is turned.

19. **Antenna, AS–F1A1.** The 8 ft whip antenna sections must be inspected for damage and cleaned, paying attention to the ends, which must be clean and tight to make good electrical contact. For repairs to the nylon cord, see paragraph 32.

20. **Dummy Plug.** This is a three pin plug with a shorting link between pins A and B, to connect the internal battery to the +28V power input of the RT unit. Test the shorting link and check that the seal is in place in the plug cover.

21. **Battery.** When using the Installation Kit, Electronic Equipment MK–F8, the battery of the RT unit should be charged as follows:

a. Set the charge rate on the Power Supply PP–F1 to FULL for a period equal to 1.4 times the period of use since the last charge. For example, if the RT unit has been used for four hours, charge at the FULL rate for 5.6 hours.

b. At the end of this period, set the charge rate to TRICKLE and leave it in this position.

> CAUTION:
> 1. Do not leave the battery on full charge for longer than specified on the battery case.

Note:

1. Whenever possible, use should be made of the Regulator Set MX–F1. This equipment will charge up to ten batteries simultaneously. A description of this equipment, and the precautions to be observed when charging nickel-cadmium batteries, will be found in the User Handbook for the Regulator Set MX–F1.

> CAUTION:
> 1. The batteries must not be charged by any means other than either the power supply PP–F1 or the regulator set MX–F1.

22. **Cable, RF, RT Unit to Coupler CU–F2.** For information on this cable, and the correct procedure for fitting the BNC connector to the coaxial cable, refer TELECOM L 133.

23. **able, Electrical, Power Supply PP–F1 to RT Unit.** For repairs to this cable, refer to TELECOM K 573.

24. **Bag, Cotton Duck.** Clean the bag with water and a stiff brush.

25. **Transit Case.** Insp ect the sealing ring around the inside of the lid, and the small rubber O ring in the air valve. If necessary, lightly grease the eccentric movements of the spring clamps.

Apparatus and Tools

26. No special tools are needed. All work can be carried out using the tools contained in the Tool Kit, Wireless Mechanic, lightweight, DSN 5810–66–018–3581.

Test Equipment

27. The following items of test equipment are required:

a. Marconi Test Set	TF 1065A
b. Multimeter	AVO No 8 or Multimeter (Aust) No 2
c. Audio Oscillator	HP 208A
d. Signal Generator	AVO No 2

e. Dummy Loads as described in Table 3 (paragraphs 41).

Repair Instructions – RT Unit

28. Repair procedures are as follows:

a. Clean the outside of the RT unit thoroughly. Clean terminals, sockets as described in paragraph 6.

b. If dirt is present under the perspex cover panel, remove the knobs, unscrew the panel and clean the front panel of the RT unit and the rear of the perspex cover. If the perspex cover is damaged it may be replaced by the same procedure.

> CAUTION:
>
> 1. Do not use cleaning fluid or abrasives on the perspex panel, or the lettering may be damaged. Use a clean, soft damp cloth only.

c. Replace the perspex cover (if removed) and tighten all knobs.

d. The battery contact springs should be replaced if they become corroded, worn or damaged in any way. To replace, remove the rear cover and battery, unscrew four small nuts and replace the contacts, making sure that the lug on the + terminal spring and the earth strap on the – terminal spring are in place.

Repair Instructions – Accessories

29. **Handset.** The handset is of the standard pattern except for the microphone insert and the cable plug. The microphone insert is a dynamic type and may be replaced in a similar manner to the standard type. The five-pin cable plug consists of a hollow metal body with a moulded plastic insert carrying the contact pins. The insert is held between a shoulder in the body and the rear clamping nut by a plastic spacer. Three steel locating pins inside the body engage in slots on the corresponding socket on the RT unit, the pins being offset to prevent misalignment. The wiring may be inspected or renewed by unscrewing the cable clamp nut at the rear, pushing the insert back from the front end and then withdrawing the cable and insert. The wire ends are crimped into small brass sleeves which are a press fit in the hollow rear ends of the pins in the insert (Fig 1). A restraining cord in the cable is knotted and fitted into a slot in the plastic spacer.

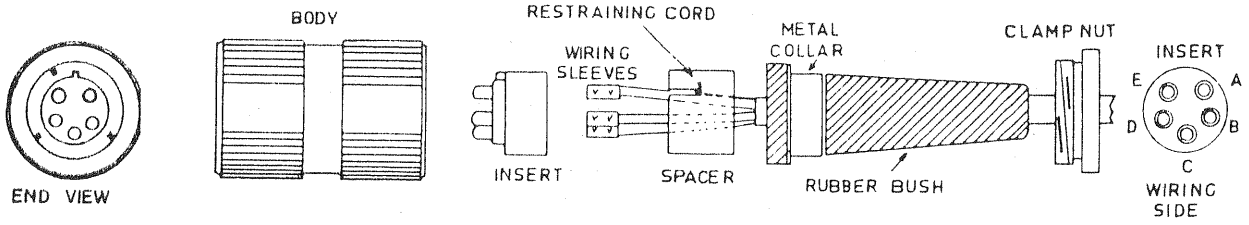


FIG 1 – FIVE PIN PLUG

> CAUTION:
>
> 1. The plastic spacer around the pins at the rear of the insert is an essential part of the plug and must be replaced or contact with the socket pins will not be made.

Note:

1. When reassembling, ensure that the locating key on the insert is in the keyway in the metal body. The pin connections are listed in Table 2.

30. **Microphone, Dynamic.** This component uses a replaceable dynamic insert of the same type as that used in the handset (paragraph 29). The moulded case is in two halves which may be separated after undoing four screws. The pressel switch spring, the rubber seal over the pressel button and the microswitch may be lifted from the case and replaced as necessary. Before reassembling, the Silastic cement between the two halves of the case, and around the pressel switch and the cable end should be removed and replaced with a fresh application of Silastic or other approved sealing compound.

31. **Microphone Cable and Adapter.** The cable plug is similar to that used on the handset, except that an adapter for the the headset plug is mounted at the rear, between the body of the connector and cable clamp. The adapter carries a socket into which the miniature plug on the headset cable is inserted. The arrangement is shown in Fig 2 and the wiring connections are listed in Table 2.

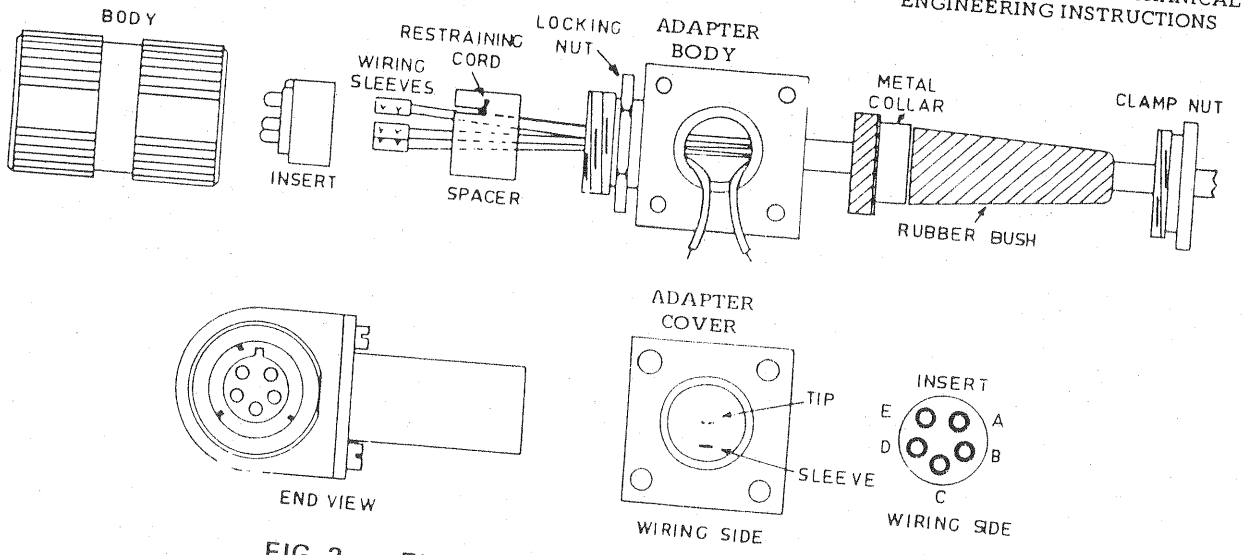


FIG 2 – FIVE PIN PLUG WITH ADAPTER

TABLE 2 – PLUG CONNECTIONS

Plug Pin	Function	Wire Colour		
		Handset Plug	Microphone Plug	Key Plug
A	Earth	Braid & White	Green (2 wires)	Red
B	Receiver	Red	Blue	–
C	Key/Pressel	Green	White	Braid
D	Microphone	Blue	Red	–
E	+12V	–	–	–
Headset Adapter				
Sleeve	Earth	Green		
Tip	Receiver	Blue		

32. **Antenna, AS–F1, Cord Replacement.** If the nylon cord which holds the sections of the whip antenna together is broken or frayed, it may be replaced as follows:

a. Remove the old cord.

b. Fit the antenna sections together to check the correct order.

c. Disassemble and lay out the sections in order.

Secure the free end of the new cord in an eye at the end of a 15 inch (minimum) length of suitable wire, eg, 22 SWG copper.

e. Feed the wire through the hole in the lowest section and pull the cord right through.

f. Feed the wire through the other sections in order, pulling the cord right through each time, and make a knot at the top of the last section.

Electrical Tests

33. **General.** If possible, power the RT unit with the Power Supply PP–F1 during the tests outlined hereunder. If the ıternal battery is used, it must be a known good battery, fully charged. Check the dummy plug PLA is in place on the EXT 'WR socket SKA and test the battery with the BAT lamp.

4. If the set has just been returned from a workshop or depot where the protective case may have been removed, rotate all ıe decade dials (kHz switches) through their complete range to ensure that they are all engaged with the synthesiser circuits.

5. **Transmitter Power Output Tests**

a. Connect the Audio Oscillator HP 208A to the microphone input SKCC and connect the Marconi Test Set TF1065A to the coaxial output socket SKEE. Connect the telegraph key to SKDD.

b. Set the MATCH switch to O, the Mode switch to SSB, the WHISPER–SPEECH–BAT switch to SPEECH and the Power switch to HI.

c. Set the audio oscillator frequency to 1 kHz and the output level to 2 mV.

d. Operate the key and measure the power output on each MHz band from 2 to 8. The output should be greater than 9 watts.

e. Repeat for the 9 to 11 MHz bands. The output should be greater than 7 watts.

f. Set the MHz switch to 2. An output greater than 9 watts should be obtained for all positions of the kHz by 100 switch.

g. Reset the kHz by 100 switch to O and repeat for all positions of the kHz by 10 switch.

h. Reset the kHz by 10 switch to O and repeat for all positions of the kHz switch. The power output in all cases should be greater than 9 watts.

36. Set the WHISPER–SPEECH–BAT switch to WHISPER and reduce the audio input level to 0.7 mV. The output should be greater than 9 watts at 2.0 MHz.

37. Set the Mode switch to AM and the Power switch to HI. The power output between 2 and 8 MHz should be greater than 5 watts, and greater than 4 watts between 9 and 12 MHz.

38. **Functional Tests.**

a. Remove the audio oscillator and plug in the handset.

b. With the Mode switch set to AM, operate the pressel and speak into the microphone. Check for the presence of sidetone in the earpiece and a reading on the power output meter.

c. Switch to SSB and check for sidetone and output as in sub paragraph 38 b.

d. Switch to CW_1, HI power. Operate the key and check for the presence of sidetone at approximately 2 kHz. The power output should be greater than 6 watts from 2 to 8 MHz and greater than 5 watts from 9 to 12 MHz.

e. Switch to CW_2 and repeat the procedure of sub paragraph 38 d at 2 MHz only.

39. **Antenna Matching and Tuning.**

a. Disconnect the test set from SKEE and connect it to the WIRE antenna (red) terminal. Earth the test set to the earth terminal of the RT unit.

b. Set the kHz switches to 2.0 MHz, the Power switch to TUNE, the Mode switch to CW1, and carry out the tuning and matching instructions as given in the PRC–F3 User Handbook. When the RT unit is matched into the test set, turn the Power switch to HI. The power output should be approximately 5 watts.

c. Repeat the procedure given in sub paragraph 40 b at 6 and 11 MHz.

d. Remove the test set and connect the Coup ler CU–F1A1 and the 8 ft whip antenna. Set the power switch to TUNE. A dip in the frequency of the tuning tone should be heard as the CU–F1A1 is tuned to the operating frequency. Carry out this test at 2, 6 and 11 MHz.

40. **Receiver Tests.**

a. Connect the AVO signal generator to the coaxial socket SKEE and the handset to SKCC or SKDD.

b. Set the signal generator to CW emission and the output to 10 uV.

c. On the RT unit, set the VOL control fully anticlockwise and the Mode switch to SSB. Set the Power switch to TUNE, LO or HI and advance the VOL control clockwise until receiver noise is heard in the handset.

d. Set the kHz switches to 2.0 MHz and tune the signal generator around 2 MHz until an audio tone is heard in the handset. Adjust the generator tuning until this tone is in the vicinity of 1 kHz.

e. If necessary, reset the generator output level to 10 uV. Adjust the VOL control and verify that adequate audio level is available in the earpiece.

f. Tune the RT unit successively to 2001, 2002, ... to 2009 kHz and adjust the generator tuning each time until the audio tone is in the vicinity of 1 kHz. The audio output should be maintained at approximately constant level.

g. Repeat the procedure of sub paragraph 40 f with the RT unit tuned in 10 kHz steps from 2010 to 2090 kHz.

h. Repeat sub paragraph 40 f with the RT unit tuned in 100 kHz steps from 2100 to 2900 kHz.

i. Repeat with the RT unit tuned in MHz steps from 2 to 11 MHz.

j. Turn the Mode switch to CW1 and repeat the procedure given in sub paragraphs 40 d and 40 e only.

k. Turn the Mode switch to CWN and repeat (sub paragraphs 40 d and 40 e), except that in this case, owing to the narrow band filter, the audio tone will be heard only around 2 kHz and the tuning will be very sharp.

l. Without disturbing the signal generator, turn the Mode switch to CW2 and adjust the BFO for a tone in the vicinity of 1 kHz. Check that adequate audio output power is available.

41. **Tests with Dummy Loads.** The following tests will verify the proper functioning of the internal coupling circuits of the RT unit. The dummy loads required are detailed in Table 3. These loads represent the design limits of the matching and tuning circuits. All antennas fall within these limits.

TABLE 3 – DUMMY LOADS FOR PRC–F3

Load No	Configuration	Details of Components
1	 33 Ohms 1500 pF	Resistor: 33 Ohms ±5%, 5W, metal oxide Welwyn F33 Capacitor: 1500 pF ±5%, metallised mica Simplex MS
2	 180 Ohms 20 uH	Resistor: 180 Ohms ±5%, 5W, metal oxide Welwyn F33 Inductor: 103 turns of 36 SWG enam copper on 3/16 in former, winding length 1/2 in
3	 33 Ohms 680 pF	Resistor: 33 Ohms ±5%, 5W, metal oxide Welwyn F33 Capacitor: 680 pF ±5%, metallised mica Simplex MS
4	 150 Ohms 6.0 uH	Resistor: 150 Ohms ±5%, 5W, metal oxide Welwyn F33 Inductor: 59 turns of 36 SWG enam copper on 3/16 in former, winding length 1/2 in
5	 33 Ohms 120 pF	Resistor: 33 Ohms ± 5%, 5W, metal oxide Welwyn F33 Capacitor: 120 pF ±5%, metallised mica Simplex MS
6	 100 Ohms	Resistor: 100 Ohms ±5%, 5W, metal oxide Welwyn F33

Note:

1. All capacitors 500 VDCW. All inductors wound on ceramic (or equivalent) formers.

a. Set up the RT unit with the handset plugged into SKCC. Set the Power switch to TUNE and the Mode switch to CW1.

b. Set the frequency to 2.0 MHz and fit Dummy Load No 1 to the Wire (red) terminal and earth.

c. Set the MATCH, TUNE and FINE controls fully anticlockwise.

d. Using the TUNE and FINE controls, adjust for the lowest pitch tuning tone.

e. Adjust the MATCH switch for lowest pitch tone.

f. Repeat sub paragraphs 41 d and 41 e until the lowest tone is achieved. Compare the switch positions with those detailed in Table 4.

g. Note that whilst manipulating the TUNE, FINE and MATCH controls, no sudden change in tone should be heard in any switch position except at one or two steps on either side of the correct matching or tuning setting. There may be changes in pitch BETWEEN switch positions. A discontinuity in pitch other than at the correct tuning position, or between switch positions, may indicate broken connections or faulty components in the internal coupling circuits.

h. Connect Load No 2 and repeat sub paragraph 41 c to 41 g.

i. Change the frequency to 5 MHz and fit Load No 3. Repeat sub paragraphs 41 c to 41 g.

j. Connect Load No 4 and repeat sub paragraphs 41 c to 41 g.

k. Change the frequency to 11.999 MHz and fit Load No 5. Repeat sub paragraphs 41 c to 41 g.

l. Fit load No 6 and repeat sub paragraphs 41 c to 41 g.

42. Table 4 details the approximate settings of the MATCH and TUNE controls when the RT unit is correctly matched to the dummy loads.

TABLE 4 – CONTROL SETTINGS WITH DUMMY LOADS

Frequency (MHz)	Dummy Load No	Match	Tune
2	1	At or near anticlockwise end	At or near clockwise end (position 11)
2	2	At or near clockwise end	At or near position 8
5	3	At or near anticlockwise end	At or near position 10
5	4	At or near clockwise end	At or near position 8
12	5	At or near anticlockwise end	At or near position 10
12	6	Near clockwise end (little change in tone)	At or near position 10

Note:

1. The position of the FINE tuning control is not critical.

E N D