CHAPTER 1

TRANSMITTER AERIAL MATCHING

H.F. TRANSMITTER

1. On initial installation, or when the settings of the aerial matching controls for a required transmission frequency are not known, the following procedure is to be carried out:-

(1) Set SERVICE switch to C.W.

(2) Set METER switch to P.A. TOTAL

(3) Set REMOTE/LOCAL switch to required position

(4) Set following controls fully counter clockwise
ANODE CONDENSER COARSE AND FINE
AERIAL TUNING COIL AND TAPPING
AERIAL CONDENSER COARSE AND FINE

(5) Set AERIAL TUNING COIL switch to:-
Position 1 for transmission frequency 1.5 - 3 Mc/s.
Position 2 for transmission frequency 3 - 7 Mc/s.
Position 3 for transmission frequency 7 - 16 Mc/s.

(6) Set CRYSTAL switch to appropriate setting (Set to M.O. or if fixed frequency transmission is required, set to appropriate channel position 1 - 8).

(7) Set RANGE switch to required band.

(8) Accurately set tuning control to operating frequency and apply lock.

(9) Set main a.c. supply switch at RX and TX HEATERS TX and H.T. and allow an initial warming up period of 5 minutes before proceeding.

With Morse Key Pressed

(10) Rotate ANODE CONDENSER FINE until dip in monitor meter reading is located (approximately 100μA). If not located, progressively reduce AERIAL TUNING COIL by one position at a time, (turn clockwise) rotating ANODE CONDENSER FINE at each position until dip in meter reading is located.

NOTES

(a) The aerial tuning controls (AERIAL TUNING COIL and COIL TAPPING) are complimentary and with the controls fully counterclockwise, the aerial coil setting is at maximum.

(b) Twenty four progressive reductions are available. With the COIL switch at 1 rotating the COIL TAPPING switch through A-H provides the first eight positions.

(c) With the COIL switch at 2, rotating the COIL TAPPING switch through A-H provides positions 9-16.

(d) With the COIL switch at 3, rotating the COIL TAPPING switch through A-H provides positions 17-24.

(11) With the point of resonance (dip in meter reading) now located, carefully proceed to load the transmitter as follows:-

(12) Rotate AERIAL CONDENSER FINE and if necessary COARSE controls clockwise until monitor meter reading of 400μA is obtained.

(13) Rotate ANODE CONDENSER FINE and if necessary COARSE controls clockwise until point of resonance is relocated.

(14) Repeat 12 and 13 until the following readings are obtained at the resonant point (dip in meter reading).
Where transmission is for C.W. operation 300-400μA
Where transmission is for M.C.W. or R/T operation 250-300μA

(15) At certain frequencies, the meter reading at the resonant point may not be within the above limits. In this case proceed as follows:-

Reduce aerial COIL switch setting (clockwise) one position at a time and adjust ANODE CONDENSER COARSE and FINE controls until correct resonant point is located.

NOTES

(a) For correct matching the highest aerial meter reading must be obtained with the monitor meter reading within limits at the resonant point.

(b) As several resonant points are possible at different coil settings proceed as follows:-

(16) Note aerial meter reading at located resonant point.

(17) Reduce or if necessary increase aerial coil setting one position at a time (see NOTES to para 10) and adjust anode condenser controls to obtain resonant point. If resonant point is not within limits adjust as stated in (12) and (13). Obtain maximum aerial meter reading with monitor meter reading still within limits at resonant point. If overloading occurs reduce aerial condenser setting (counterclockwise).

(18) Release morse key and set service switch to C.W. M.C.W. or R/T for required transmission.

Dummy Aerial

2. To align the transmitter to the incorporated dummy aerial set AERIAL CONDENSER COARSE to DUMMY LOAD, and proceed as stated in previous instructions para. 1(1) to (18).

M.F. TRANSMITTER

3. On initial installation, or when the settings of the aerial matching controls for a required transmission frequency are not known, the following procedure is to be carried out:-

(1) Set SERVICE switch to C.W.

(2) Set REMOTE/LOCAL switch to required position.

(3) Set monitor METER switch to P.A. TOTAL.

(4) Tune to required frequency and apply lock.

(5) Set the aerial matching controls as follows:-

(a) Anode CONDENSER COARSE at 2.

(b) Anode CONDENSER FINE at 10.

(c) COIL TAPPING at A.

(d) COIL FINE at O.

(e) AERIAL CONDENSER at 3.

(6) Rotate a.c. supply switch to RX and TX HEATERS TX and HT.

With the Morse Key pressed

(7) Rotate COIL FINE and locate resonant point.

(8) If not located set COIL TAPPING at B and repeat (7).

(9) If not located set COIL TAPPING at C and repeat (7).

(10) If the point of resonance is still not located set COIL TAPPING at A and AERIAL CONDENSER at 1.

(11) Repeat (7) with the COIL TAPPING set at A-G respectively.

(12) If the point of resonance is still not located set COIL TAPPING at A and AERIAL CONDENSER at 1.

(13) Repeat instruction (7) with the COIL TAPPING set at A-K respectively. The resonant point should now have been located.

(14) Reduce AERIAL CONDENSER one position at a time (if possible) and tune to the point of resonance at each position by adjustment of COIL TAPPING and COIL FINE controls as detailed in para. 3(7)-(13).

(15) Select the lowest AERIAL CONDENSER setting at which point of resonance can be found. The monitor meter reading should be within the limits 200 - 250μA.

(16) (a) If meter reading is below limits.

Increase ANODE CONDENSER until monitor meter reads 300μA Retune to point of resonance by decreasing coil setting and rotating COIL FINE at each step until point of resonance, with meter reading within limits, is found.

(b) If meter reading is above limits.

Decrease ANODE CONDENSER until monitor meter reads 200μA. Retune to point of resonance by increasing coil setting and rotating COIL FINE until point of resonance with meter reading within limits is found.

(17) Slight adjustment, in both directions to COIL and ANODE CONDENSER settings should then be made so that the maximum reading on the aerial meter is obtained whilst maintaining the monitor meter reading at the resonant point.

(18) Release morse key and set SERVICE switch to C.W. or M.C.W. for required type of transmission.

Dummy Aerial

4. To align the transmitter to the incorporated dummy aerial set AERIAL CONDENSER to DUMMY LOAD and proceed as detailed in previous instructions, para.3(1)-(18).

CHAPTER 2

BRIEF TECHNICAL DESCRIPTION

H.F. TRANSMITTER (A.M.)

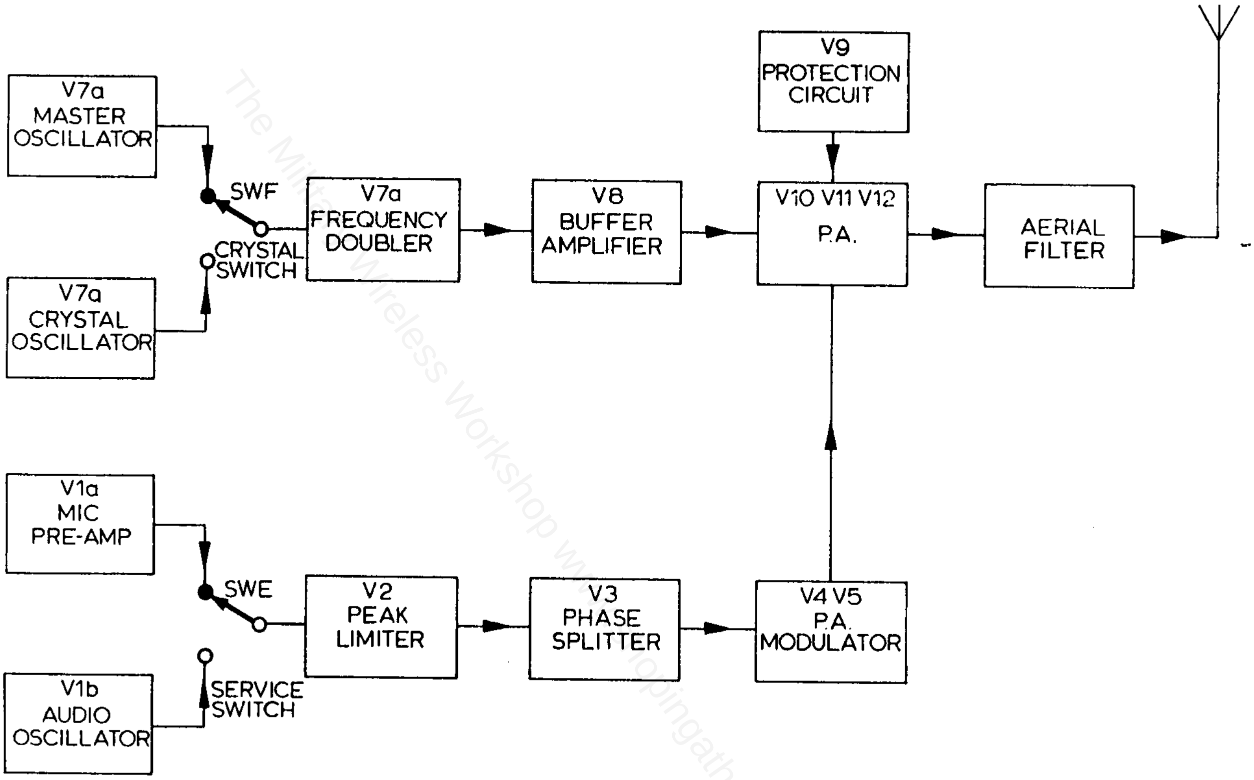


Fig.2.1 H.F. Transmitter Block Diagram

1. The r.f. circuit has oscillator, frequency doubler, buffer and power output stages.

2. Two methods of frequency selection are employed and are as follows:-
   (a) Variable tuning over the three bands utilising a Master Oscillator circuit.
   (b) Eight switched frequencies employing a Crystal Oscillator circuit.

3. The r.f. output is approximately 40 watts (dependent on aerial load). A clamp valve protective circuit is employed to prevent damage to the power amplifier valves under abnormal conditions.

4. The modulator circuit employs a microphone preamplifier (R/T) or audio frequency oscillator (M.C.W.), peak limiter, phase splitter and power output stages.

5. The H.F. transmitter provides C.W., M.C.W., or R/T emission with the receiver silenced during transmission.

M.F. TRANSMITTER (A.M.)

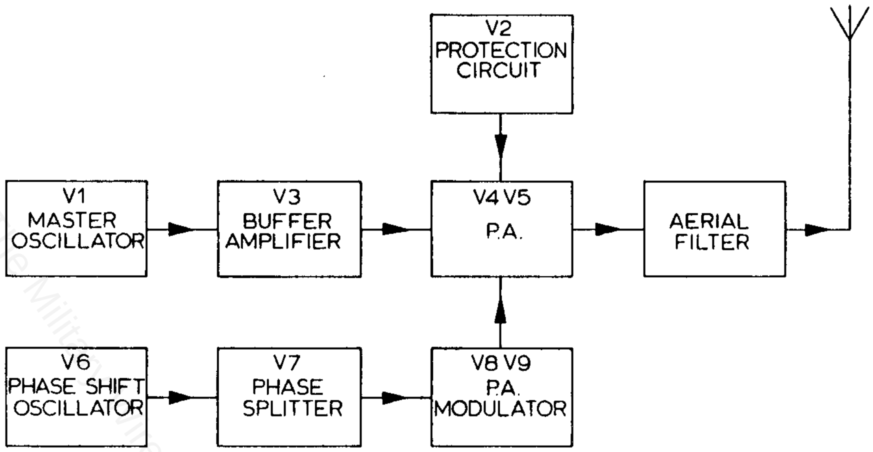


Fig.2.2 M.F. Transmitter Block Diagram

6. The r.f. circuit has oscillator, buffer amplifier and power amplifier stages.

7. Frequency control is by means of a master oscillator and the r.f. output is approximately 15 watts (dependent on aerial load). A clamp valve protection circuit is employed to prevent damage to the power amplifier valves under abnormal conditions.

8. The modulator circuit (M.C.W. working only) employs oscillator, phase splitter and power output stages. The output from this circuit modulates the anode supply of the r.f. output stage.

9. The M. F. transmitter provides C.W. or M.C.W. emission, with the receiver silenced during transmission.

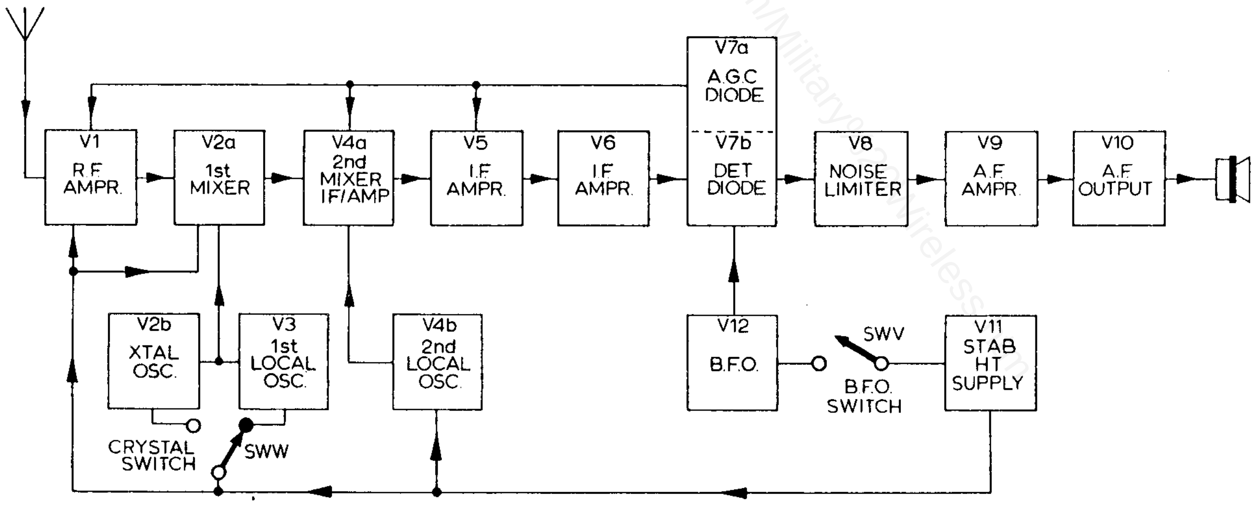


Fig.2.3 Receiver Block Diagram

RECEIVER OUTFIT CAT (A.M.)

10. Covering the entire frequency band from 60 kc/s to 31 Mc/s in eight wavebands, this receiver is employed in a single or double superheterodyne circuit, dependent on frequency range. The receiver is a single superheterodyne circuit (i.f. 460 kc/s) on the lower frequency ranges (1, 2, 4 and 5) and is a double superheterodyne circuit (i.f. 1.4 Mc/s and 460 kc/s) on the higher frequency ranges (3, 6, 7 and 8). The i.f. selectivity is switched in four bandwidths; WIDE, INTERMEDIATE, NARROW, VERY NARROW.

11. The receiver uses 12 valves excluding power supplies. The amplifier is followed by the first mixer and the oscillation injected into the first mixer is derived from either the crystal oscillator or first local oscillator. The i.f. output of either 460 kc/s or 1.4 Mc/s is fed to the grid of V4. If the input is 1.4 Mc/s, it is mixed with 1.86 Mc/s, derived from the triode section of V4, with a resultant output of 460 kc/s.

12. If the input is 460 kc/s, V4 is a conventional i.f. amplifying stage. The a.f. signal is then fed via the series noise limiter to the audio amplifier and output stages. Stabilised h.t. is supplied to the B.F.O. crystal and local oscillators, first mixer and r.f. amplifier. The receiver incorporates automatic gain control and has two separate audio outputs for 100Ω and 500Ω which can be simultaneously employed.

13. The receiver is automatically muted during transmission.

POWER SUPPLY UNIT

14. The power supplies are connected to the appropriate transmitter and to the receiver, by plug and socket from Chassis 2 of the Power Supply Unit. The transformer voltage tappings are for 100, 110, 115, 125, 200, 210, 215, 220, 225, 230, 235, 240 and 250 volts a.c. supply. The MAIN a.c. supply switch SWA can be set to 4 positions, as follows:-

- Position 1 - OFF
- Position 2 - RX only
- Position 3 - RX plus TX heaters
- Position 4 - RX and TX heaters TX and HT

Chassis 1

15. The a.c. supply is connected to the (7476.) appropriate transformer via the switch SWA. Either 20 rectifiers type CV7[illegible], sixteen rectifiers type CV7[illegible], or 7476, seven valve rectifiers are employed and each a.c. input has a separate fuse. The smoothing circuits are located on both chassis. Chassis 1 and Chassis 2 are interconnected by an 18-way cable with plug and socket connections.

Chassis 2

16. Besides containing the relays required to operate the signalling circuits Chassis 2 contains relays which protect the transmitting valves by ensuring that the -ve 50 volt grid bias supply is connected prior to the 500 volt and 300 volt h.t. supplies.

CHAPTER 2

OPERATING INSTRUCTIONS

CONTENTS LIST

CHAPTER 2

OPERATING INSTRUCTIONS

LIST OF CONTROLS

H.F. TRANSMITTER

Anode Condenser Coarse
Anode Condenser Fine with lock
Aerial Tuning Coil
Aerial Tuning Coil Tapping
Aerial Condenser Fine with lock

Meter Switch
Service Switch CW/MCW/RT
Crystal Switch
Range Switch
Tuning Control with lock
Mod. Level

PRESET

RV3 Microphone Input Level
RV4 Peak Limiter Level
RV5 Clamp Level

POWER UNIT

A.F. Gain
Remote/Local Switch
Main a.c. Supply Switch

M.F. TRANSMITTER

Anode Condenser Coarse
Anode Condenser Fine with lock
Aerial Condenser
Aerial Coil Tapping
Aerial Coil Fine
Meter Switch
Service Switch CW/MCW
Tuning Control with lock

PRESET

RV11 Mod. Level

RV48 Clamp Level

RECEIVER

B.F.O. on/off switch
B.F.O. Tuning
A.F. Gain
R.F. Gain
Crystal on/off switch
Selectivity Switch
Band Indicator
Tuning Control with lock
A.G.C. on/off switch

PRESET

RV22 Muting Level Control
RV53 Noise Limiter Control

OPERATING INSTRUCTIONS - PROCEDURE

1. (1) With interconnecting cables and aerial fitted to Power Supply Unit, Receiver and H.F. Transmitter, connect phones (and/or loudspeaker) and morse key to Power Supply Unit at appropriate jack sockets.

(2) Set the main a.c. supply switch on the Power Supply Unit at OFF and connect the available a.c. supply.

The indicator lamp LPl should light.

(3) Rotate main a.c. supply switch to RX ONLY. Check that LPl remains alight and that the dial lamps on the receiver are lit.

(4) After a short warming up period check the receiver for satisfactory operation.

Check operations of A.G.C. R.F. and A.F. GAIN controls.

Check Selectivity and B.F.O. circuit. Check receiver with CRYSTAL switch at ON.

Check that the noise limiter is operating satisfactorily.

NOTE

The noise limiter control RV53 is preset before despatch but may require resetting due to change in operating conditions.

(5) Rotate main a.c. supply switch to RX and TX HEATERS.

(6) Check that the receiver is still operating (the H.F. Transmitter is now at standby).

H.F. TRANSMITTER

2. (1) Select the transmission frequency

(2) Set CRYSTAL switch to M.O. or to correct channel setting for fixed frequency transmission

Set SERVICE switch at C.W.

Set RANGE switch

Set the Tuning Control to the operating frequency

Ensure that the REMOTE/LOCAL switch is in correct position

Set the six aerial matching controls to the known settings for the required transmission frequency.

NOTE

If settings are not known set controls as detailed in TRANSMITTER AERIAL MATCHING.

(3) If transmission is at a switched channel fixed frequency (crystal control) set METER switch at Ig P.A.

Rotate main a.c. supply switch to RX and TX HEATERS TX and H.T. Check that H.F. transmitter dial lamp LP1 lights.

Press morse key.

Carefully adjust tuning control for maximum reading on the monitor meter. Lock tuning control.

(4) If transmission is with crystal control (fixed frequency) or master oscillator proceed as follows:-

With main a.c. supply switch at RX and TX HEATERS TX and H.T. set METER switch at P.A. TOTAL.

Press morse key.

Check monitor and aerial meter readings, carefully adjust the ANODE CONDENSER FINE and AERIAL CONDENSER FINE for point of resonance combined with maximum aerial meter reading.

NOTE

Table 2 shows typical readings to be expected at different operating frequencies.

(5) Set Service switch to correspond with type of transmission.

(6) Where R/T transmission is to be employed

Set METER switch at LIMITER

Set MOD LEVEL at maximum (set at 10)

Operate the microphone pressel switch and with level speech into the microphone reduce the MOD LEVEL setting one step at a time until monitor meter reading commences to fall.

Operate pressel switch or morse key and ensure that the receiver is silenced. If necessary adjust the muting control RV22, located on the receiver.

RANGE	FREQUENCY	MONITOR METER (P.A. TOTAL)	AERIAL METER
1.	1.5 Mc/s	320 - 360	320 - 400
	2.0 Mc/s	315 - 390	250 - 350
	3.3 Mc/s	325 - 380	210 - 300
2.	3.3 Mc/s	315 - 390	250 - 370
	4.5 Mc/s	310 - 380	250 - 350
	7.3 Mc/s	310 - 380	200 - 250
3.	7.3 Mc/s	310 - 380	150 - 300
	10.0 Mc/s	320 - 380	100 - 180
	16.0 Mc/s	320 - 380	100 - 180

TABLE 2

Typical meter readings with correct aerial matching. Aerial disconnected, service switch at C W, AERIAL CONDENSER COARSE at DUMMY LOAD, CRYSTAL switch at M.O. and transmitter tuned to operating frequency.

M.F. TRANSMITTER

3. (1) With interconnecting cables and aerial connected to the Power Supply unit, Receiver and M.F. transmitter, connect phones (and/or loudspeaker) and morse key to the Power Supply Unit at the appropriate jack sockets.

(2) Set main a.c. supply switch at RX ONLY.

Check that the receiver dial lamps are alight and that the receiver is operating.

(3) Rotate main a.c. supply switch to RX and TX HEATERS. The receiver should still be operative. (The M.F. transmitter is now at standby).

(4) Select frequency to be transmitted.

Accurately set tuning control and apply lock.

Set SERVICE switch at C.W.

Set aerial matching controls to the correct settings for the transmission frequency.

If settings are not known, proceed as detailed in TRANSMITTER AERIAL MATCHING.

(5) Rotate switch to RX and TX HEATERS TX and H.T.

Set METER switch at P.A. TOTAL.

(6) Press morse key.

(7) Carefully adjust the ANODE CONDENSER FINE and COIL FINE controls for maximum aerial meter reading at the point of resonance Typical readings at different transmission frequencies are given in Table 3.

(8) Set SERVICE switch to correspond with type of transmission.

(9) Press morse key and check that receiver is silenced.

FREQUENCY	MONITOR METER (P.A. TOTAL)	AERIAL METER
330 kc/s	225	215
350 kc/s	230	225
400 kc/s	245	220
450 kc/s	235	200
500 kc/s	245	190
550 kc/s	240	160

TABLE 3

Typical meter readings with correct aerial matching. Aerial disconnected, service switch at C.W., AERIAL CONDENSER COARSE at DUMMY and transmitter tuned to operating frequency.

CHAPTER 3

DETAILED DESCRIPTION

CONTENTS LIST

ILLUSTRATIONS

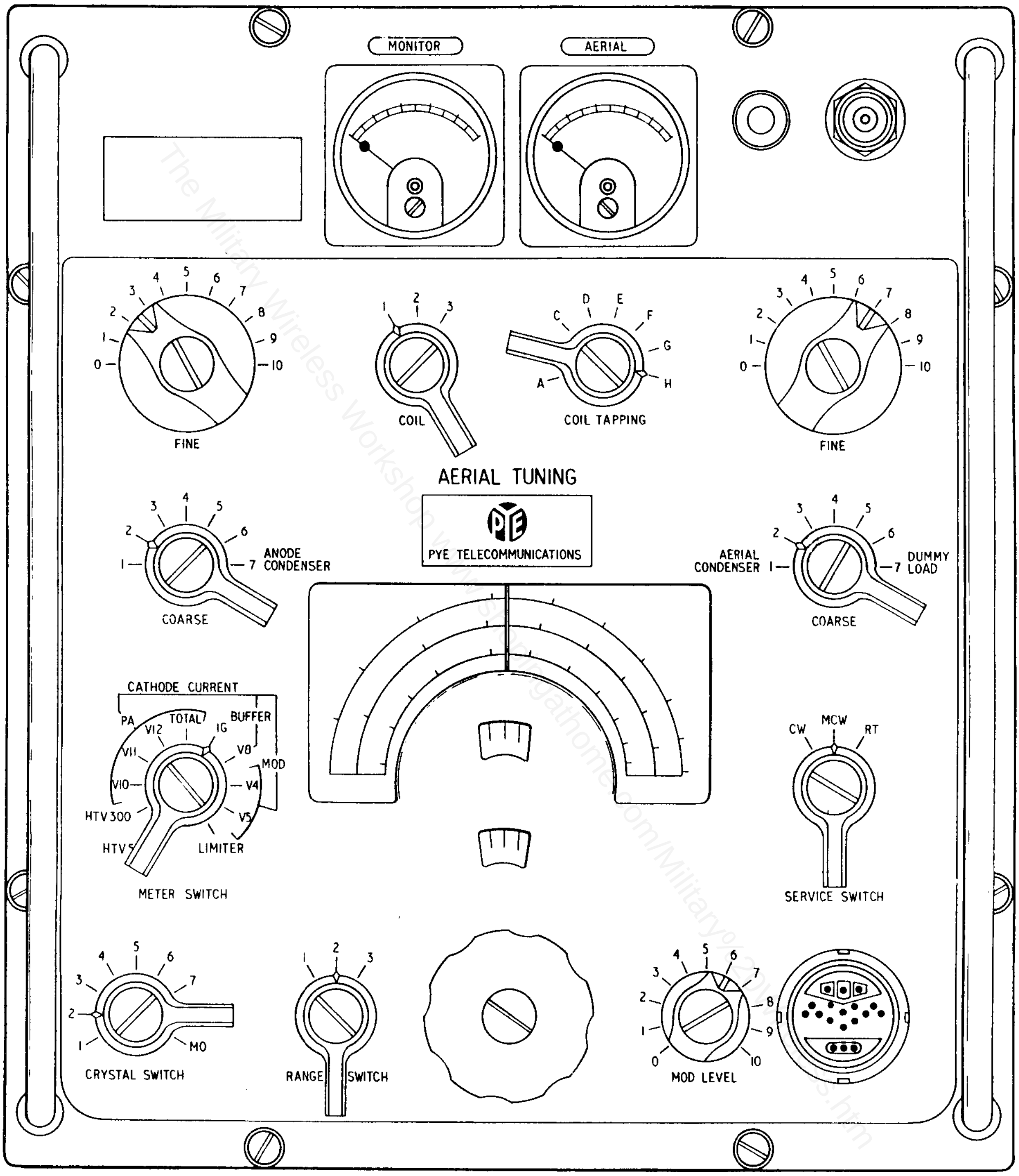


Fig. 3.1 H.F. Transmitter Front Panel Layout

CHAPTER 3

DETAILED CIRCUIT DESCRIPTION

H.F. TRANSMITTER

Valve Complement

1.

V1	Microphone pre-amp/audio oscillator	CV492	12AX7
V2	Peak Limiter	CV140 or CV4[redacted]5 4025.	EB91
V3	Phase Splitter	CV492	12AX7
V4	Power Amplifier	CV428	5B/251M
V5	Power Amplifier	CV428	5B/251M
V6	H.T. Stabiliser	CV287	QS150/15
V7	R.F. Oscillator/Frequency Doubler	CV2128	ECH81
V8	Buffer Amplifier	CV2129 or CV4039	5763
V9	Protection Circuit Clamp Valve	CV138	EF91
V10, V11, V12	Power Amplifiers in parallel	CV428	5B/251M

R.F. Oscillator

2. The r.f. oscillator V7a is controlled by either the Master Oscillator circuit or the Crystal Oscillator circuit and oscillates at half the required carrier frequency in either case.

Master Oscillator

3. With the CRYSTAL switch SWF at M.O. the Master Oscillator circuit is switched to form a Hartley Circuit and the Crystals are disconnected. C5(4), C5(3), appropriate coil L1, L2 or L3 and appropriate trimming capacitor C2, C3 or C4 control the oscillation frequency.

Crystal Oscillator

4. With the CRYSTAL switch SWF at CRYSTAL, the Master Oscillator is modified to form a Pierce circuit with eight switched crystal controlled frequencies.

5. The crystals not in use are grounded and the selected crystal is coupled to the control grid of V7a via C13; C14 couples the anode to control grid of V7a and the anode circuit is tuned to the crystal frequency by tuning the variable capacitor C5(3 and 4) in conjunction with L1, L2 or L3, and C2, C3 and C4.

Frequency Doubler

6. The output from the selected oscillator circuit is fed to the control grid of V7b, the frequency doubler, via C8. The anode circuit of V7b, comprising L4, L5 or L6 and C20, C18 or C17 (according to range) C97 and C5(2) is tuned to twice the oscillator frequency (2nd harmonic), which is equivalent to the required carrier frequency. The output of V7b is coupled by C23 to the control grid of V8.

Buffer Amplifier

7. The Buffer Amplifier V8 isolates the oscillator from the power amplifier stage and also provides r.f. amplification. The tuned anode circuit of V8, comprising L7, L8 or L9 and C29, C28 or C27 (according to range) and C5(1) is tuned to the carrier frequency. The amplified output is coupled by C23 to the control grids of V10, V11 and V12, the power output valves operating in parallel.

8. Operation of the morse key makes and breaks the ground return path of the -ve 50V relay supply to the transmitter relay coil RLG. When the relay RLG, is de-energised, contact RLG1 in the cathode circuit of V8 changes over, R20 is switched in and therefore V8 is biased beyond cut-off.

Power Amplifier

9. V10, V11 and V12 are beam tetrodes operating in Class C, the anode supply being derived from the 500 volt d.c. supply via the modulation transformer TR1. The cathodes are self biased to approximately +ve 75 volts via R46 and R47. The drive is of the order of 100V peak. Parasitic stoppers are fitted in each control grid and cathode circuit. The output is fed to the aerial filter via the coupling capacitor C42. Grid 2 of each of the beam tetrodes V10, V11 and V12 is connected to the anode of the clamp valve V9.

THE MODULATION CIRCUIT

Audio Section (M.C.W.)

10. With the SERVICE switch SWE at M.C.W., the microphone preamplifier V1a is not used, as C6 is switched out from the cathode of V1a and switched in to the cathode of V1b. V1b is now employed and a phase shift network between the anode and grid of V1b produces an audio oscillation at 1000 c/s. This phase shift network consists of C12, R17, C11, R16, C10 and R15. A proportion of the 1000 c/s oscillation produced (governed by the anode load) is fed to the cathode of V2a via C19.

Audio Section (R/T)

11. The output from the microphone is fed to the control grid of V1a via the low-pass filter FL1 and RV3 the MIC GAIN control. With the SERVICE switch SWE at R/T, C6 is switched in to the cathode of the microphone preamplifier V1a, providing normal stage gain.

12. V1b is not operative, as C6 is switched out of circuit from V1b cathode. The output of the preamplifier V1a is fed to the cathode of V2a via the coupling capacitor C19. Therefore the output from V1a or V1b (according to the position of SERVICE switch SWE) is fed to the cathode of V2a.

13. The remainder of the modulator circuit is common to both R/T and M.C.W. operation.

Peak Limiter

14. The audio frequency oscillation and audio input is clipped by V2, the peak limiter, to a level which will allow greater input without overloading. The reduction in level and consequently of peak voltages to a predetermined value will still give good speech intelligence.

15. V2a and V2b may be considered as two diodes in series, with a common anode load. The negative supply to both cathodes is obtained from the -ve 50 volts bias supply with the cathode potentials governed by the setting of RV4.

16. Without an applied signal, current flows through both diodes. Application of the audio signal varies the current flowing in V2a and the current flowing in V2b is varied in the opposite direction.

17. However, application of a large peak audio voltage prevents either V2a or V2b from conducting, according to polarity, and the peak voltage is clipped to a pre-set limit governed by the setting of RV4.

Phase Splitter

18. The output from the peak limiter V2 is fed via the coupling capacitor C21 to the control grid of V3a.

19. V3 functions as a phase splitter and the two equal amplified voltages of opposite phase are fed to the control grids of V4 and V5 via C30 and C31 respectively.

Power Amplifier

20. The peak voltage applied to the grids of V4 and V5 is controlled by the peak limiter control RV4 and this control should be set to provide approximately 17 volts peak per valve at full modulation.

21. The output of the modulator circuit is fed to the primary of the modulation transformer TR1 and as the 500 volt supply to the r.f. power amplifier anodes flows through TR1 secondary, the audio modulation is impressed on the 500 volt h.t. supply.

22. A portion of the audio voltage is fed to the diode bridge rectifier MR1 from a separate winding of the modulation transformer TR1 and is used for metering purposes. Parasitic stoppers are fitted in the anode, control grid and cathode circuits of the beam tetrodes V4 and V5 which operate in class AB1 push-pull.

Protection Circuit

23. A Protection Circuit utilising the clamp valve V9 is incorporated in the output stage to prevent the power amplifier valves being damaged by passing excessive current under abnormal conditions (i.e. aerial short circuit, open circuit or detuned).

24. Under these conditions the cathode bias of V10, V11 and V12 increases and the control grid voltage of V9 moves positivity as it is fed from the cathode bias supply network. V9 then conducts. The anode current of V9, passing through the anode load R65 and R65a effects a voltage drop across these resistors and consequently the V9 anode voltage is lowered.

25. As the grid 2 supply to V10, V11 and V12 is obtained from the anode of the clamp valve V9, the grid 2 supply voltage is lowered and therefore the current drawn by V10, V11 and V12 decreases.

26. The protection circuit is adjusted to its pre-set level by RV5, which controls the initial control grid voltage of V9. RV5 is set so that the anode current of V9 is negligible.

Aerial Filters

27. The power output stage is matched to the aerial by switched aerial filters. The selected pi-network resonates at the required carrier frequency, acts as an harmonic filter and allows a wide range of aerial impedances to be matched to the output stage.

Aerial

28. The aerial should be of any length exceeding 20ft; the required load on the output valves being 1kΩ approximately.

29. An integral dummy aerial is fitted and consists of R76, R77 and C73, all in parallel with C74 when the aerial condenser coarse switch is at Dummy.

30. Aerial metering provides a comparative reading of the r.f. output. Two circuits, both tuned to the carrier frequency, indicate the voltage across the aerial and the current flowing through the aerial circuit. The resultant outputs are rectified by MR2 and MR3 and the total measured by the aerial meter and is ganged to the carrier circuits to avoid the possibility of tuning to harmonics.

Monitoring

31. Monitoring circuits provide eleven check points to indicate the correct function of the transmitter.

32. The 0-500μA meter M1 is connected to suitable points in the circuit by the METER switch SWM to provide comparative readings of:-

(1) The transmitter h.t. supplies.

(2) The cathode current of the r.f. power amplifiers V10, V11 and V12.

(3) The total r.f. power amplifier cathode current.

(4) The total r.f. power amplifier grid current.

(5) The buffer amplifier cathode current.

(6) The cathode current of the modulator power amplifiers V4 and V5.

(7) The modulator output measured at MR1.

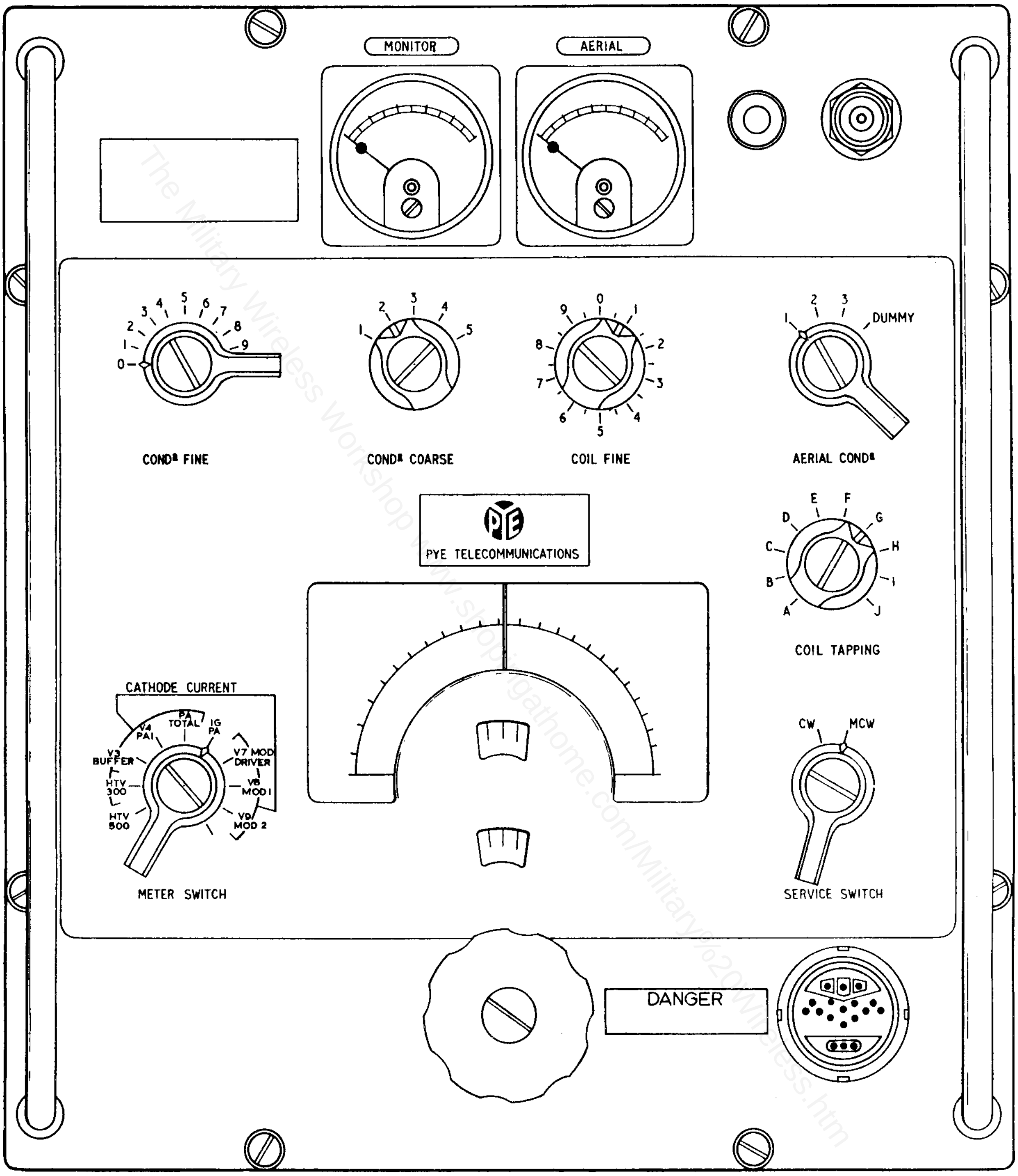


Fig. 3.2 M.F. Transmitter Front Panel Layout

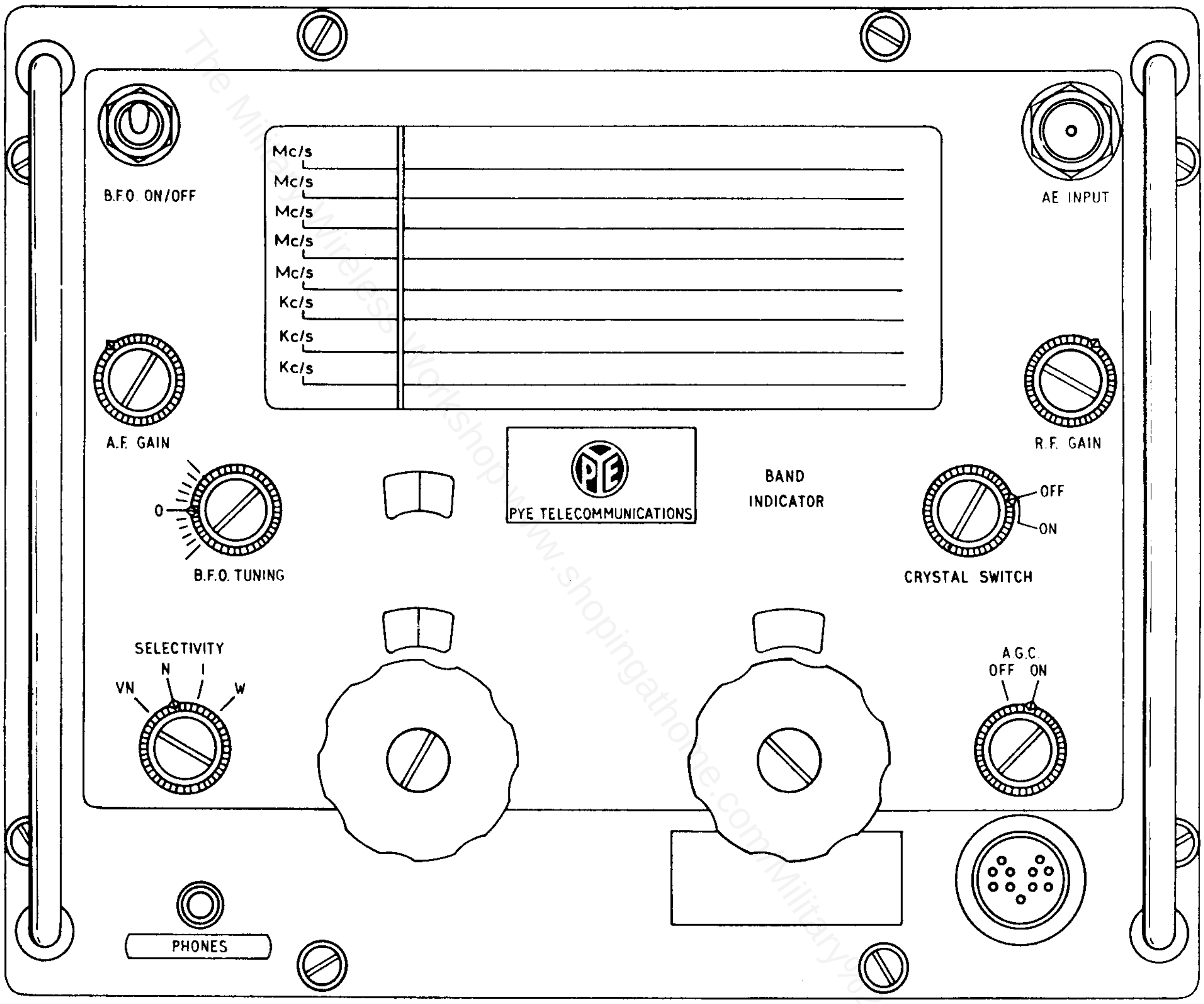


Fig. 3.3 Receiver Front Panel Layout

RECEIVER OUTFIT CAT

Valve Complement

55.

V1	R.F. Amplifier	CV454 or CV4009	6BA6
V2	1st Mixer/Crystal Osc.	CV2128	ECH81
V3	1st Local Oscillator	CV133 or CV4058	6C4
V4	2nd Mixer or 460 kc/s I.F. Amp.	CV2128	ECH81
V5	I.F. Amplifier	CV131	EF92
V6	I.F. Amplifier	CV131	EF92
V7	AGC/Detector	CV140 or CV4025	EB91
V8	Noise Limiter	CV140 or CV4025	EB91
V9	A.F. Amplifier	CV131	EF92
V10	A.F. Output	CV2127 or CV4055	6CH6
V11	H.T. Stabiliser	CV395	QS150/45
V12	B.F.O.	CV131	EF92

56. On ranges 1, 2, 4 or 5, an i.f. of 460 kc/s is employed and V4a functions as an i.f. amplifier. V4b is switched out. The output is then fed to the i.f. amplifier V5. On ranges 3, 6, 7 and 8, a 1st i.f. of 1.4 Mc/s is employed and V4a functions as a 2nd Mixer with the 2nd local oscillation of 1.86 Mc/s being obtained from V4b. The resultant 460 kc/s output (2nd i.f.) is then fed to the i.f. amplifier V5.

R.F. Amplifier

57. The r.f. gain of V1 is manually controlled by RV15 when the A.G.C. switch SWX is at OFF.

58. The control grid of V1 is connected to the slider of RV15 and is negative with respect to the cathode which is connected to the top of RV15. (See A.G.C. and R.F. Gain, Paragraphs 73-75). The aerial is connected to the grid of V1 via FL1 the 460 kc/s i.f. filter (except on range 3) and the appropriate aerial coil.

59. The appropriate tuned anode circuit switched in by the RANGE switch SWT incorporates high impedance transformer coupling and the secondary of the appropriate transformer is tuned by C16. Filter FL2 (tuned to 1.4 Mc/s) is employed on ranges 3 and 6 to attenuate the 1.4 Mc/s i.f. breakthrough. The output of the r.f. amplifier is fed to the control grid of the 1st Mixer V2a via C64.

1st Local Oscillator

NOTE: Some receivers which have been refurbished will have the alternative circuit shown in Fig. 6A in the oscillator section. These receivers may be identified by the serial number having been deleted and the code "R/EMD" inscribed on the tally plate.

60. With the CRYSTAL switch SWW at OFF, the 1st Local Oscillator circuit employing V3 is switched into circuit. To achieve maximum stability, the anode supply to V3 is obtained from the stabilised h.t. supply via R3 and R4.

61. The tuned oscillator circuit L10-L17, C19-C26 and C40 is a tuned anode circuit coupled to the control grid of V3 by windings L10-L17. The padders are C27 to C30 on ranges 1-4 whilst C31-C34 are employed on ranges 5-8. The oscillator output is injected into the 1st Mixer V2a via C65 and SWW the CRYSTAL switch.

62. The stabilised h.t. to the 1st Local Oscillator and the output from this circuit to the 1st Mixer are only switched in circuit when the CRYSTAL switch is at OFF.

Crystal Oscillator

63. With SWW at ON, the Pierce crystal oscillator circuit is switched in and the 1st Local Oscillator V3 switched out. The oscillator circuit of V2b comprises the crystal XL1 connected to the anode and control grid via C66 and C65 respectively. Stabilised h.t. is applied to the anode of V2b via R13, SWW the CRYSTAL switch (ON), R12 and the r.f. choke L28. The output from this feedback oscillator circuit is fed to the 1st Mixer V2a via C65.

1st Mixer

64. The r.f. signal applied to the control grid of V2a is mixed with the output from the selected oscillator (crystal or local oscillator) and applied to grid 3 of V2a. The resultant i.f. output at the anode of V2a is at 460 kc/s, if range 1, 2, 4 or 5 is in use, and at 1.4 Mc/s if range 3, 6, 7 or 8 is in use.

2nd Local Oscillator (1.4 Mc/s i.f. only)

65. If the i.f. output is at 1.4 Mc/s then V4b is employed as a 2nd Local Oscillator and is used in conjunction with V4a, the 2nd Mixer, to produce an i.f. output of 460 kc/s. The 2nd Local Oscillator circuit L34, C89 and C90 tuned to 1.86 Mc/s, is a Colpitt's oscillator and is coupled to the anode and control grid of V4b by C88 and C87 respectively. L33 and C86 act as a 2nd harmonic attenuator.

2nd Mixer (1.4 Mc/s i.f. only)

66. The 1.4 Mc/s output from the anode of V2a is transformer coupled (tuned to 1.4 Mc/s) to the control grid of V4a via C79. The 1.86 Mc/s oscillator output from V4b is fed to grid 3 of V4a, and the resultant 460 kc/s output at the anode of V4a, the 2nd Mixer, is coupled to V5 via TR3 a 460 kc/s i.f. transformer.

I.F. Amplifier (460 kc/s i.f. only)

67. When the i.f. output at V2a anode is 460 kc/s (range 1, 2, 4 or 5) V4a and V4b are employed as follows:-

V4b is short circuited at C89 and therefore V4b ceases to oscillate.

V4a functions as an i.f. amplifier, the 460 kc/s output from V2a being coupled to the control grid of V5 by TR3 the 460 kc/s i.f. transformer.

I.F. Amplifiers

68. On all frequency ranges, V5 and V6 act as 460 kc/s amplifiers coupled by the transformer TR2. The selectivity of the transformer couplings TR2 and TR3 is controlled by the SELECTIVITY switch SWY and the 4 positions are as follows:-

WIDE - INTERMEDIATE - NARROW - VERY NARROW

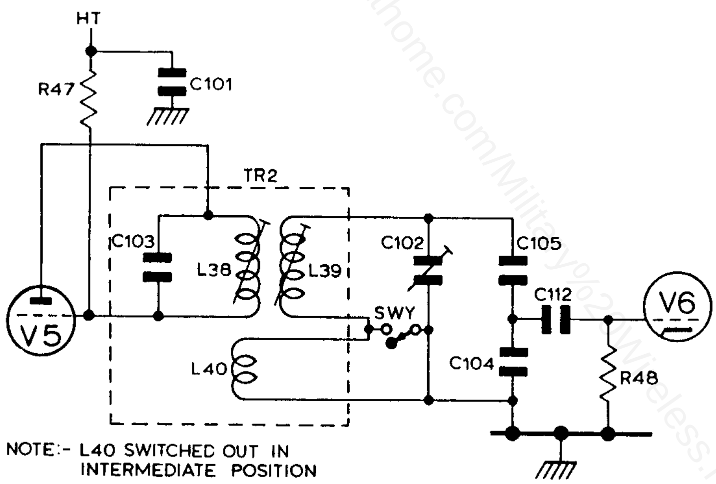


Fig.3.4 Receiver I.F. Selectivity. Wide and Intermediate

69. The TR2/TR3 coupling is as shown in Fig. 3.4 when switch SWY is at WIDE or INTERMEDIATE.

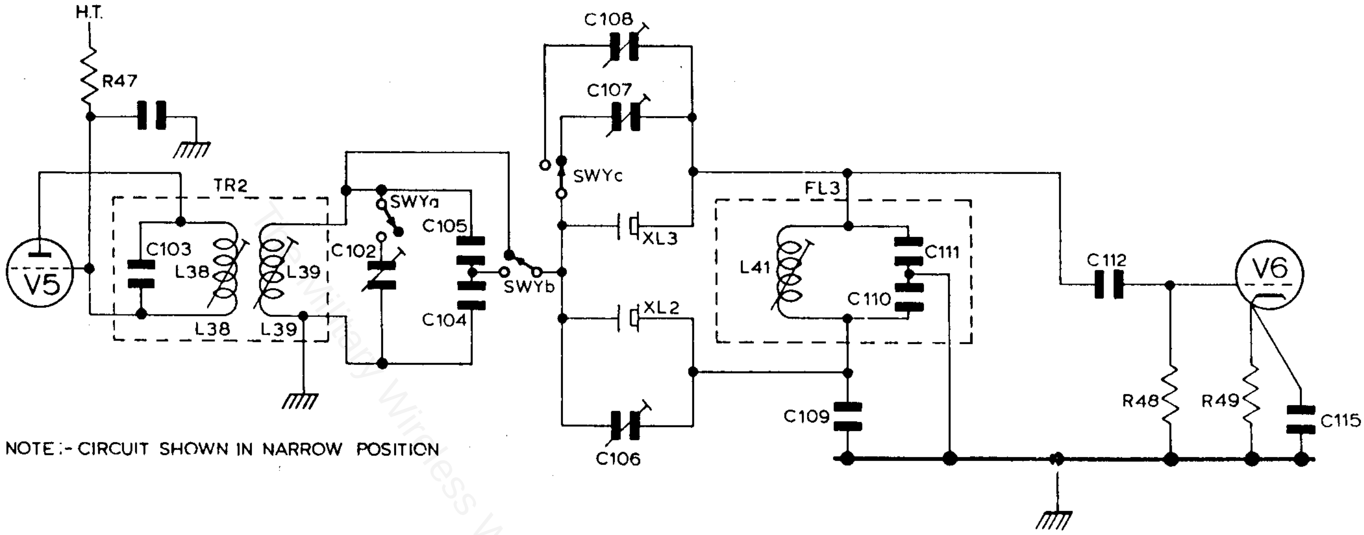


Fig. 3.5 Receiver I.F. Selectivity. Narrow and Very Narrow

70. The TR2/TR3 coupling is as shown in Fig. 3.5 when the switch SWY is at either NARROW or VERY NARROW. The coupling between V5 and V6 corresponds with the setting of switch SWY and the alternatives are as follows:-

(1) WIDE

The normal coupling is increased by the addition of link winding L40.

(2) INTERMEDIATE

This is the standard i.f. coupling (L40 switched out).

(3) NARROW

A band pass crystal circuit is inserted into the standard coupling with a filter FL3 switched in circuit between the secondary of TR2 and V6. The band pass crystal circuit employs two crystals XL2 and XL3 tuned 500 c/s apart at 460 kc/s. C106 and C107 balance unwanted capacitance inequalities. The outputs from XL2 and XL3 are fed across the balanced tuned split filter circuit FL3, which is tuned to 460 kc/s.

(4) VERY NARROW

The VERY NARROW selectivity circuit is similar to the NARROW circuit with the following exceptions:-

(a) C102 is switched into circuit as the voltage output from TR2, which is fed to the crystal gate, is across C104 only.

(b) The i.f. coupling TR1 between V6 and V7 remains constant and independant of SELECTIVITY switch SWY.

Signal Rectification

71. The i.f. signal is fed to V7b which functions as the signal rectifier. R54, RV53 and R52, in series, provide the diode load. On C.W., the 460 kc/s B.F.O. signal is also fed to the anode of V7b.

B.F.O.

72. The complete B.F.O. circuitry is enclosed in a screening can. V12 operates in an electron coupled circuit to generate the beat frequency for C.W. signals. Tuned to 460 kc/s, at the mid setting of C126, a variation of ±5 kc/s is obtained by adjustment of C126. The h.t. supply to V12 is derived from the 150V Stabilised supply at V11.

A.G.C. and R.F. Gain

73. V7a functions as the a.g.c. diode and the i.f. voltage at the anode of V6 is fed to V7a via C122. The cathode of V7a is positivity biased via R51 and R55 so that the peak signal voltage exceeds the cathode bias and the diode V7a passes current producing a negative voltage across the anode load R56 and R57.

A.G.C. On

74. With switch SWX at ON, the a.g.c. negative voltage across R56/57 is fed to the control grids of V4a and V5 via the low pass filter R58 and C113. Half the a.g.c. voltage is also fed to the control grid of V1 via the low pass filter R59 and C114. The cathodes of V1, V4a, V5 and the control grid of V4b are connected to ground via R14 and RLK1 (unoperated).

A.G.C. Off

75. With A.G.C. switch SWX at OFF, the a.g.c. line is switched out and the r.f. gain is adjusted manually by the R.F. GAIN control.

Noise Limiter

76. The rectified signal output at the junction of R52 and R53 is applied to the anode of V8a. As V8a is conducting when a signal is present, (without interference pulses) the a.f. component is fed to the amplifier via C98 and the audio gain control RV42.

77. When interference is present, the anode voltage of V8a is driven rapidly negative and V8a does not conduct for the duration of the pulse due to the large time constant of C99 and R44. The a.f. component is therefore cut off momentarily for the short duration of the interference pulse, but the normal speech waveform is unaffected. The shunt diode V8a improves the effectiveness of V8a at low signal levels.

A.F. Amplifier

78. The audio signal at RV42 is fed to the control grid of V9 via C95. After "CH 11" amplification, the a.f. signal is fed to the output valve V10 via the coupling C84 and R25.

A.F. Output

79. V10, the beam tetrode output valve, is capable of delivering 2 watts into the 500Ω load and 60mW into the 100Ω load. Negative feedback from the anode of V10 to the cathode of V9 via R31 and C81 is to compensate for varying output loads by maintaining a constant voltage on the cathode of V9.

Receiver Muting

80. On transmission, when the key or microphone pressel switch is operated, relay RLK/1 operates and contact RLK1 switches the cathode connection of V1, V4 and V5 to the slider of preset RV22.

81. The cathode voltage, which is obtained from the resistor chain R21, RV22 and RV15, can be pre-set by RV22, the mute control, so that up to 80 volts positive is applied to the cathodes of V1, V4 and V5. Thus a large comparative negative bias on the control grids prevents V1, V4 and V5 conducting and the receiver is muted.

Radiation

82. All leads to the 12 way connector are individually filtered by FL5 and the leads to JKE, the headphone jack, are filtered by FL4. The radiation field at one nautical mile is lower than 0.1µV/metre.

Power Supplies

83. The 245 volt h.t. supply and the 6.3V heater supply are obtained from the Power Supply Unit via the 12 way connector, Connection Flexible 8ft A.P. 101974. This connector also provides interconnection from the Power Supply Unit for the muting relay RLK/1 and the receiver output to the headphone and loudspeaker jacks, located on the Power Supply Unit.

Loudspeaker Unit

84. The loudspeaker assembly consists of loudspeaker, matching transformer with five tapping points, the volume control, the ON-OFF switch and the phone jack plug for connection of the unit to the power supply unit. This loudspeaker unit is normally employed with the Power Supply Unit (Receiver only).

Power Supply Unit (Receiver Only)

85. This unit provides the operating supplies for the receiver only and is suitable for use with an available a.c. supply of 100-150 volts or 190-240 volts. The a.c. supply is fed to the power transformer via two fuses. The ON/OFF indicator lamp LP1, with its series limiting resistor is across the a.c. supply and lights when the ON/OFF switch is set to ON.

86. The following outputs are obtained:-

(1) 6.3V a.c. at 3.5 amps for the receiver heaters.

(2) 5V a.c. at 2 amps for the rectifier heaters.

(3) 250-0-250V a.c. which is rectified and smoothed in the power supply unit (receiver only). The 245V d.c. output at 135mA provides the receiver h.t. supply.

87. The three jack sockets located on the front panel, are provided for metering, phone and loudspeaker facilities respectively.

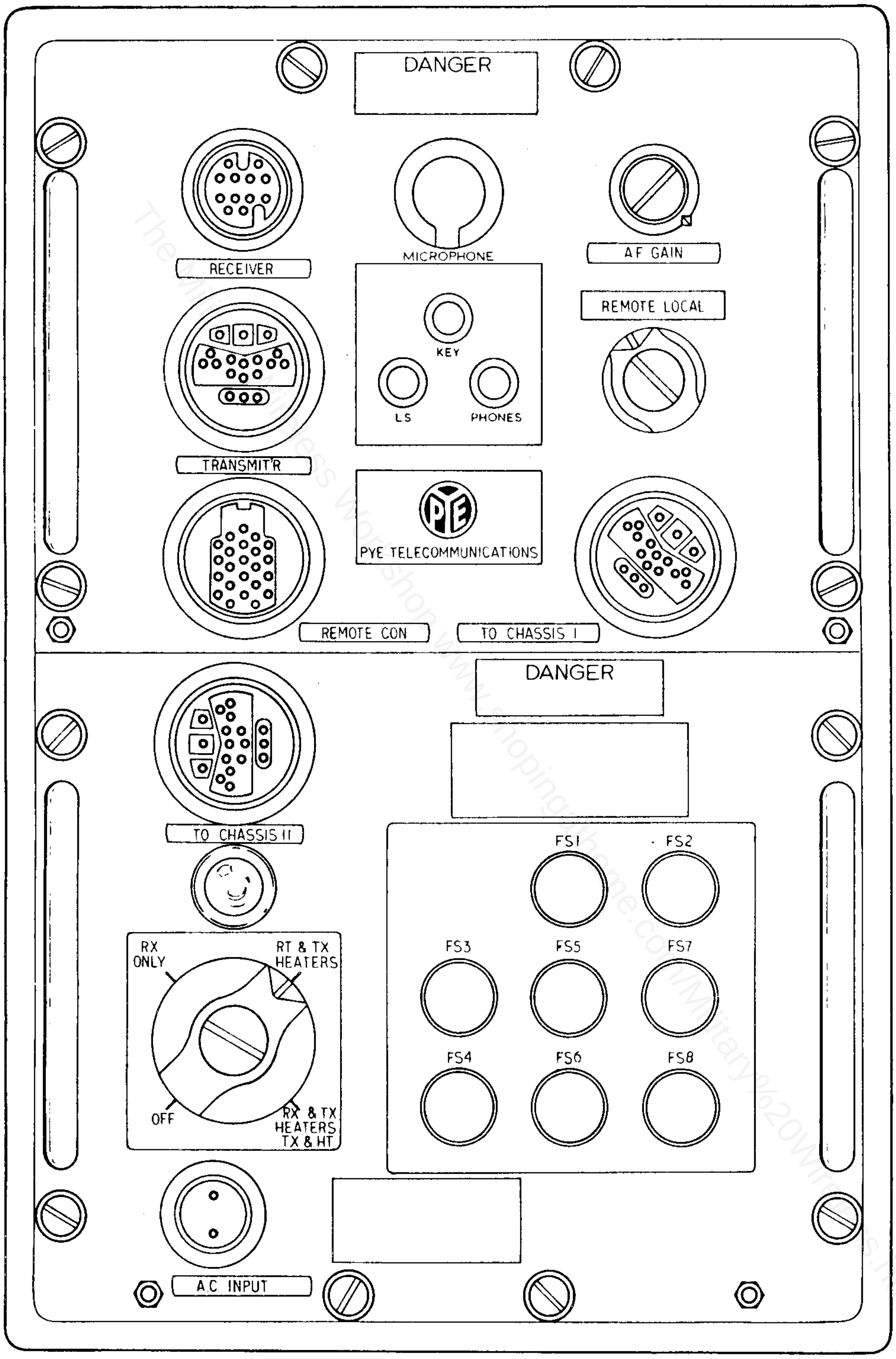


Fig. 3.6 P.S.U. Front Panel Layout (A.P. 399015)

POWER SUPPLY UNIT

A.P. 399015 or A.P. 100340

88. The Power Supply Unit consists of two separate chassis fitted into a single cabinet and the two chassis are interconnected by Connector Flexible 18-way.

89. Chassis 1, the lower chassis, contains the a.c. power transformers, input fuses, rectifiers and smoothing circuits.

90. Chassis 2, the upper chassis, contains the relays, smoothing circuits and distribution circuits.

91. The Power Supply Unit output sockets are located on Chassis 2 and are as follows:-

Receiver socket	- Utilising 12-way interconnecting cable.
Transmitter socket	- Utilising 18-way interconnecting cable to provide supplies to the selected transmitter.
Remote control socket	- Blanking plug used on local control or interconnecting cable on remote control.

CHASSIS 1 (A.P. 399015 PSU only)

92. Rectifier Complement

MR1	MR11			Receiver h.t.
MR2	MR12			
MR19* MR18*	MR17* MR20*	MR3 MR4	MR13 MR14	Transmitter h.t. (500V)
MR5	MR15			Transmitter h.t. (300V)
MR6	MR16			
MR7				-ve 50V bias supply
MR8				
MR9				-ve 50V relay supply
MR10				

* Type A.P. 399015 modified only

93. Transformer Complement

TR1	Receiver h.t. and heater supplies
TR2	Transmitter h.t., -ve 50V bias and -ve 50V relay supplies
TR3	Transmitter heater supplies

94. Fuse Complement

FS1 and FS2	3 amp (200-250V a.c.) fuses in series with a.c. supply. (5 amp for 100-125V a.c.)
FS3 and FS4	1.5 amp fuses in series with a.c. supply leads to TR1. (3 amp for 100-125V a.c.)
FS5 and FS6	1.5 amp fuses in series with a.c. supply leads to TR2. (3 amp for 100-125V a.c.)
FS7 and FS8	1.5 amp fuses in series with a.c. supply leads to TR3. (3 amp for 100-125V a.c.)

SUPPLY VOLTAGE ADJUSTMENTS

95. Each of the three transformer primaries is wound in two halves and each half winding has four tapped points as shown in Fig. 3.7.

The following table shows the connections to be made for matching the transformer primaries to the available a.c. supply.

INPUT VOLTAGE	INPUT CONNECTIONS		LINKS REQUIRED	
100	B1	C2	B1 to B2	C1 to C2
110	A1	C2	A1 to A2	C1 to C2
115	B1	D2	B1 to B2	D1 to D2
125	A1	D2	A1 to A2	D1 to D2
200	B1	C2	C1 to B2	
210	A1	C2	C1 to B2	
215	B1	C2	D1 to B2	
220	A1	C2	C1 to A2	
225	B1	C2	D1 to A2	
230	B1	D2	D1 to B2	
235	A1	C2	D1 to A2	
240	A1	D2	D1 to ~~B2~~ B2	
250	A1	D2	D1 to A2	

TABLE 1

96. The available a.c. supply is fed via PLA and two 3 amp fuses 200-250 volts a.c. (or 5 amp 100-125V a.c.) FS1 and FS2 to the a.c. supply switch SWA which is a four-position fully rotatable switch connecting the a.c. supply to the selected primary windings of TR1, TR2 and TR3.

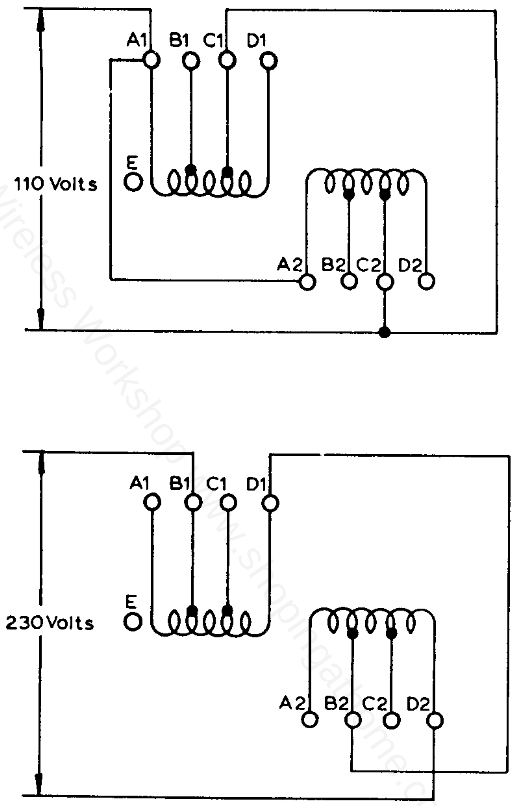


Fig. 3.7 A.C. Supply Connections

97. The four positions of the main a.c. supply switch SWA and the transformers switched into circuit are as follows:-

Position 1	OFF	
2	RX ONLY	TR1
3	RX and TX HEATERS	TR1 and TR3
4	RX and TX HEATERS TX and H.T.	TR1, TR2 and TR3

98. Each connection from the a.c. supply to the appropriate transformer primary is fitted with a 1.5 amp fuse, (200-250V a.c.) or 3 amp (100-125V a.c.) FS3 - FS8 inclusive.

TR1 Receiver Supplies

99. The a.c. power transformer TR1 has three secondary windings which provide the following:-

(1) 6.3 volts a.c. to the receiver heaters.

(2) 300-0-300 volts a.c. which is rectified by MR1, MR2, MR11 and MR12 and smoothed by L1 and L2, the associated capacitors C35 and C38 and the bleeder resistors R39 and R40. The 245 volt d.c. output provides the receiver h.t. supply.

(3) NOT USED.

TR2 Transmitter H.T. Supplies

100. The a.c. power transformer TR2 has four secondary windings which provide the following:-

(1) 600-0-600 volts a.c. rectified by MR3, MR13, MR4 and MR14 (and also MR19, MR17, MR18, MR20 in the modified power supply unit), is smoothed by L3, C36, C39 and the bleeder resistors, R41, R42 and R43. The 500 volt d.c. output provides one of the transmitter h.t. supplies.

(2) 300-0-300 volts a.c. rectified by MR5, MR15, MR6 and MR16 is smoothed by L4, C37 and resistance network R36, R37 and R38. The 300 volt d.c. output provides the second transmitter h.t. supply.

(3) 85-0-85 volts a.c. rectified by MR7 and MR8 is smoothed by the chokes L5 and L7 (chassis 2). The -ve 50 volts d.c. transmitter bias supply is taken from the centre tap of the secondary winding via R32.

(4) 80-0-80 volts a.c. is rectified by MR9 and MR10 and smoothed by L8, C14, C15 (all on chassis 2). The -ve 50 volts d.c. supply taken from the secondary centre tap via R33 provides the relay supply which is the operating potential for the two transmitter relays and the relay in the receiver.

TR3 Transmitter Heaters

101. The a.c. power transformer TR3 has three secondary windings which provide the following:-

(1) NOT USED

(2) 6.3-0-6.3 volts a.c. for supplying 6.3 volts a.c. and 12.6 volts a.c. to the transmitter heaters.

(3) NOT USED

Lamp Indication

102. LP1, the pilot lamp, is connected across the a.c. supply input with series resistors R26 and R27 to give visual indication when the a.c. supply is applied to the power supply unit.

POWER SUPPLY UNIT
CHASSIS NO. 1 (A.P. 100340 A.P.S.U. only)

103. The power intake of about 400 watts from connector, Part No.101970 is at plug PLA and must be 50-60 cycles, a.c. It may be at any voltage between 100 and 125, or between 200 and 250. For any other type of supply, an additional supply outfit is necessary. Both leads are fused on entry by FS12, FS13 (4 amp for 200 volts, 8 amp for 100 volts) and an indicating neon lamp LP1 on the front panel, across the a.c. supply, shows whether or not the a.c. supply is present and the fuses intact.

The supply voltage adjustments are as shown in Table 1 para 95.

Mains Switch SWA

104. A four position barrel click switch SWA connects the a.c. supply to the primaries of the three power transformers, TR1, TR2, TR3, through double pole fuses FS1 and FS6 (1 amp for 200 volts, 2 amp for 100 volts). It can be rotated in either direction from any position. If rotated clockwise from the "OFF" position it connects:-

Position 2 - TR1

Position 3 - TR1 + TR3

Position 4 - TR1 + TR3 + TR2

TR1 (Receiver Supplies)

105. Transformer TR1 has three secondary windings. One of these supplies 6.3 volts a.c. to the heaters of V1 and V2, the second 6.3 volts a.c. to the Receiver heaters, and the third 300 volts a.c. to the anodes of V1 and V2. Rectified supply is taken from the cathodes of V1 and V2, through fuse FS7 (250mA), smoothed by inductances L1 and L2 with associated capacitors C1 and C2, with bleeder resistors R1 and R2, and delivers 245 volts d.c. to the Receiver.

TR3 (Transmitter Heater Supply)

106. Transformer TR3 has three secondary windings. One supplies 6.3 volts a.c. to the heaters of V5, V6 and V7. The second centre tapped, supplies 5 volts a.c. to the heaters of V3, V4, and the third, centre tapped, supplies two 6.3 volt supplies to the heaters of the Transmitter of opposite phase to each other, so that a 12.6 volt supply can be obtained across them.

TR2 (Transmitter H.T. Supplies)

107. Transformer TR2 has four secondary windings:-

(a) 600-0-600V, supplying the anodes of V3, V4, from the cathodes of which are taken, through FS8 (500mA), the 500 volt supplies to the Transmitter. There are two degrees of smoothing: L3 with its associated capacitors C3, C4, and bleeder resistors R3, R4, R5; and L6 with capacitor C7, and resistors R12, R13, R14. The supply to the modulator valves of the Transmitter passes through L3 and thence to connection SKG (A), whilst that for the power amplifier valves passes through L6 in addition and connection SKG (B).

(b) 300-0-300V, supplying the anodes of V5, from the cathode of which is taken the 300 volts supply to the Transmitter. Fuse FS9 (250mA) is in the earth lead from the centre tap of the transformer secondary. The supply is smoothed by L4, with capacitors C5, C9 each with bleeder resistors.

(c) 85-0-85V, supplying the anodes of V6, whose cathode is earthed. A supply of -ve 50 volts is taken from the secondary centre tap through fuse FS10 (250mA), smoothed by L5, C11, and provides a biasing voltage for the Transmitter, at connection SKG (D). After further smoothing by L7, with C12, C13 and R19, this supply provides the potential for the microphone circuit in R/T, but is earthed through R20 and SKG (K) in C.W. and M.C.W.

(d) 80-0-80V, supplying the anodes of V7, whose cathode is earthed. A supply of -ve 50 volts is taken from the secondary centre tap through a fuse FS11 (250mA), smoothed by L8, with capacitors C14, C15, and bleeder resistor R21, and provides the potential for the two relays in the Transmitter, and one in the Receiver.

POWER SUPPLY UNIT

CHASSIS NO.2 (P.S.U. A.P.399015 & A.P.100340A)

108. The relays fitted to this chassis operate the signalling circuits and provide protection for the transmitting valves by ensuring that the -ve 50 volts d.c. bias supply is applied prior to the transmitter h.t. supplies.

Relay Operation C.W. or M.C.W.

109. With the main a.c. supply switch SWA at Position 4 (RX and TX HEATERS, TX and HT) the sequence of relay operations is as follows:-

(1) The -ve 50 volts bias supply energises RLC/2 and RLD/1.

(2) Contact RLD1 closes. Relay RLA/4 is energised.

(3) Contacts RLA2 and RLA4, which are in parallel, close and relay RLB/4 is energised. The 500 volt d.c. transmitter h.t. supply is switched to the appropriate transmitter.

(4) Contact RLB2 closes. If remote control is employed, LP2 the READY indicator lamp lights (LOCAL/REMOTE switch must be at REMOTE).

(5) Contact RLC1 opens, switching out the microphone circuit, as relay RLC/2 is energised (see 1).

Contact RLC2 closes, switching in the morse key circuit. Operation of the morse key results in relays RLF/G/K or RLH/J/K operating (according to transmitter in use.)

The appropriate contacts changeover the aerial, mute the receiver and switch on the transmitter.

Relay Operation R/T

110. With the main a.c. supply switch SWA at Position 4 (RX and TX heaters TX and HT) the sequence of relay operations is as follows:-

(1) The -ve 50 volt d.c. bias supply energises RLD/1.

(2) Contact RLD1 closes and RLA/4 is energised.

(3) Contacts RLA2 and RLA4, which are in parallel, close and relay RLB/4 is energised.

The 500 volt d.c. transmitter h.t. supply is switched to the transmitter in use.

(4) Contact RLB2 closes and LP2 the READY indicator lamp lights if remote control is employed (LOCAL/REMOTE switch must be at REMOTE).

(5) Contact RLB4 closes. The 300 volt d.c. transmitter h.t. supply is switched to the transmitter in use.

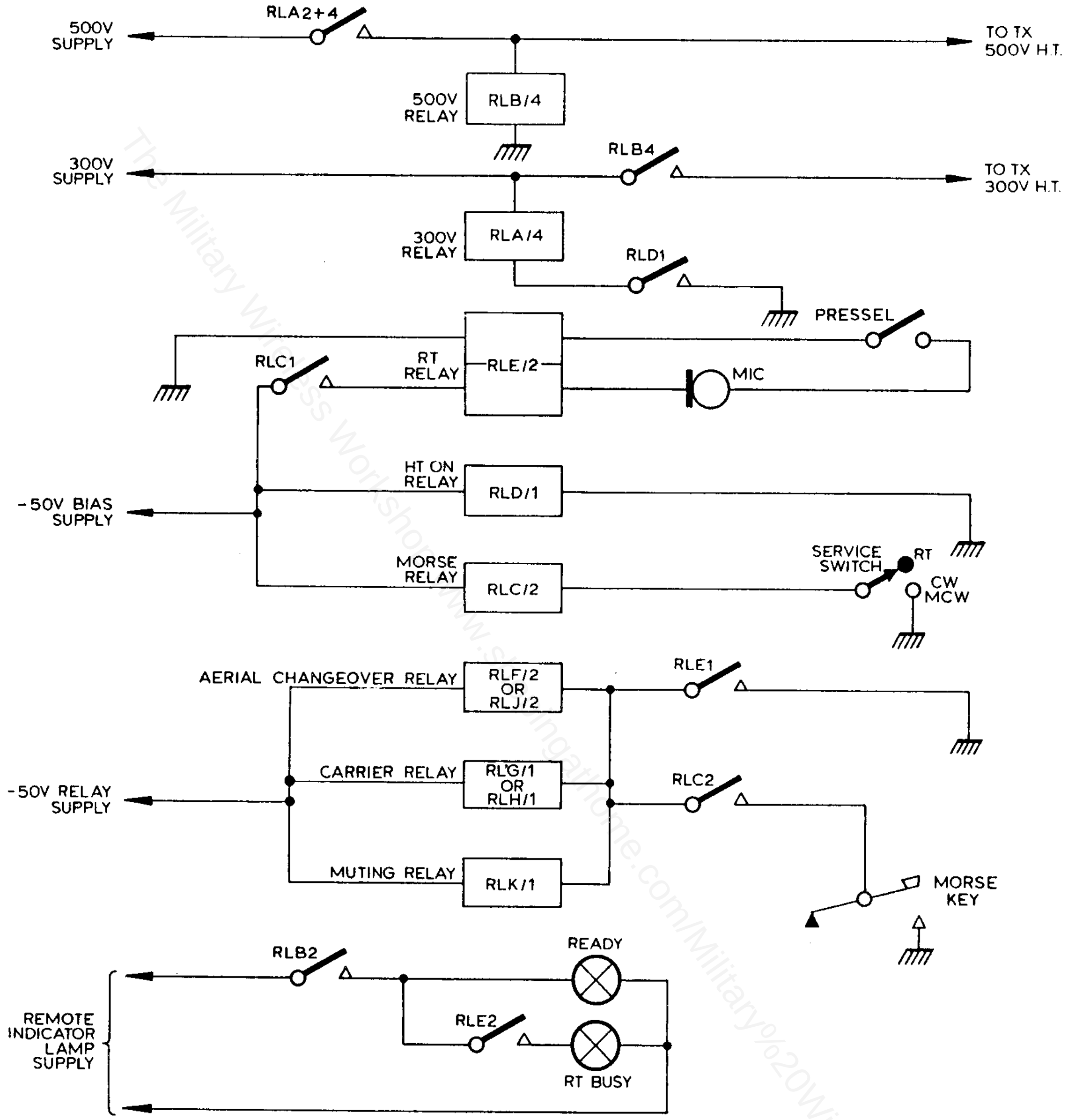


Fig. 3.8 Relay Operations

111. Operation of the pressel switch (either Local or Remote) results in the following sequence of operations:-

(a) The -ve 50 volt bias supply to the speech transformer TR4 primary is completed. Relay RLE/2 is energised.

(b) Contact RLE1 closes. The relays RLF/G/K operate; changing over the aerial, muting the receiver and switching on the transmitter.

(c) RLE2 closes and the remote indicator lamp supply is switched in to LP3, the RT BUSY lamp at the remote position (LOCAL/REMOTE switch must be at REMOTE).

REMOTE CONTROL

112. The equipment may be operated under local control, simple remote control or used with standard remote control outfits of the KH series.

(a) Local Control

The local control blanking off plug, which is inserted into the REMOTE CONTROL SOCKET on the Power Supply Unit when the equipment is under local control, incorporates links to complete the circuits of relays RLF/G/J/K. (See Paragraph 13).

(b) Simple Remote Control

Utilises a cable extension which plugs into the REMOTE CONTROL SOCKET on the Power Supply Unit, replacing the local control plug. The cable extension carries connecting leads to the remote control, consisting of leads from headphones, microphone, morse key, indicator lamp and the REMOTE ON/OFF switch SWC. The REMOTE ON/OFF switch is operative only when the LOCAL/REMOTE switch on the Power Supply Unit is at REMOTE.

(c) Remote Control (KH Series)

With this method of control, a 32-way junction box and 24 volt transformer are fitted.

The transformer provides the indicator lamp supply at the remote position. The junction box is provided as a terminating point for local and remote connecting leads. The control switch SWC is only operative when the LOCAL/REMOTE switch in the Power Supply Unit is at REMOTE.

113. The local control blanking off plug may be made up using the following items:-

5935-A.P.208794	Plug, free, 25 pole
5935-99-011-9121	Shield electrical
5935-99-097-0060	Gasket
5935-99-097-0130	Nut retaining

Using short lengths of equipment wire link pins G-M, H-K-V-Y, L-T-U and assemble the plug in the normal manner.

CHAPTER 4

ALIGNMENT PROCEDURES

H.F. TRANSMITTER

Master Oscillator

1. (1) When the tuning mechanism is fully counterclockwise (against the stop) check that the ganged capacitor is fully meshed and that the logging scales read zero.

(2) Check that the scale is correctly aligned by tuning the pointer to cover the outer scale markings at each of the frequencies shown, and note that the logging scale readings are as given.

LOGGING SCALE READINGS		
FREQ. Mc/s	LARGE SCALE	SMALL SCALE
7.3	0	90
10.4	8	159
16.0	17	144

TABLE 9

(1) Set CRYSTAL switch at M.O.

(2) Set SERVICE switch at C.W.

(3) Couple wavemeter to centre section of coil assembly

(4) Rotate a.c. supply switch to RX and TX HEATERS TX and H.T.

3. With reference to the appended Table 10 set wavemeter and tune transmitter to the lowest frequency of Range 1.

4. Carry out adjustments and then retune to highest frequency of Range 1. Carry out adjustments.

5. Proceed to Range 2 and subsequently Range 3 carrying out the adjustments in correct sequence i.e. at lowest and then highest frequency.

6. Repeat adjustments at alternate frequencies until the wavemeter indication and Scale reading are within 5 kc/s at all alignment frequencies.

The Military Wireless Workshop www.shopingathome.com/Military%20Wireless.htm

	Range 1		Range 2		Range 3	
Adjust wavemeter and TX tuning to frequency Mc/s	1.5	3.3	3.3	7.3	7.3	16.0
Adjust to zero beat note	L1	C2	L2	C3	L3	C4
Adjust to loudest beat note	L4	C20	L5	C18	L6	C17

TABLE 10

Buffer Amplifier

7. (1) Set CRYSTAL switch at M.O.

(2) Set SERVICE switch at C.W.

(3) Set monitor METER switch at P.A. Ig

(4) Set a.c. supply switch at RX and TX HEATERS TX and H.T.

8. Carry out adjustments detailed in appended table for maximum meter reading.

9. Commence with the lowest frequency on Range 1 and then proceed with highest frequency on Range 1.

10. Proceed to Range 2 and the Range 3, carrying out adjustments in correct sequence i.e. at lowest and then highest frequency.

11. Repeat adjustments at alternate frequencies until no further improvement in meter reading can be obtained.

	Range 1		Range 2		Range 3	
Tune to frequency Mc/s	1.5	3.3	3.3	7.3	7.3	16.0
1st Adjustment	L7	C29	L8	C28	L9	C27
2nd Adjustment	L4	C20	L5	C18	L6	C17

TABLE 11

Clamp Valve

12. (1) Set CRYSTAL switch at M.O.

(2) Set SERVICE switch at C.W.

(3) Set RANGE switch to 2 and tune to 3.3 Mc/s

(4) Set monitor METER switch at P.A. TOTAL

(5) Set a.c. supply switch at RX and TX HEATERS TX and H.T.

(6) Detune the aerial matching circuits and adjust RV5 for a meter reading of 450μA.

(7) Reset controls and restore aerial matching circuits.

Aerial Metering Circuit

13. (1) Remove Aerial

(2) Set CRYSTAL switch at M.O.

(3) Set SERVICE switch at C.W.

(4) Set monitor METER switch at P.A. TOTAL

(5) Set tuning control and aerial matching controls to correspond with alignment frequency.

14. The aerial matching controls, with AERIAL CONDENSER COARSE at DUMMY LOAD should be set to the positions in Table 12 for the required alignment frequency. Switch on, tune to alignment frequency and locate point of resonance by adjustment of the fine controls at each frequency before carrying out adjustments.

Frequency in Mc/s	Anode Condenser		Coil		Aerial Condenser Fine
	Coarse	Fine	Number	Tap	
1.5	4	9	1	D	9
2.0	4	8½	1	G	5½
3.3	3	4	2	C	8
4.5	2	8	2	F	9
7.3	2	9	3	B	3
10.0	2	1	3	C	8½
16.0	1	6½	3	G	8

TABLE 12

15. With reference to the appended Table 13 carry out adjustments on one range at a time. Adjust at lowest frequency and then at highest frequency of the range. Repeat until no further improvement in monitor meter reading can be obtained.

	Range 1	Range 2	Range 3
Alignment Frequency in Mc/s	1.5 3.3	3.3 7.3	7.3 16.0
1st Adjustment	L16 C80	L17 C81	L18 C82
2nd Adjustment	L19 C85	L20 C86	L21 C87

TABLE 13

Peak Limiter

16. (1) Set SERVICE switch at R/T

(2) Set AERIAL CONDENSER COARSE at DUMMY

(3) Set MOD LEVEL control at maximum

(4) Set aerial matching controls and tuning at 2 Mc/s (see Table 12)

(5) Connect short circuit between V2a and V2b cathodes

(6) Connect A.F. signal generator with 600Ω attenuator between microphone input (PLH-R) and earth (PLH-M)

(7) Couple oscilloscope to dummy load

(8) Set A.F. signal generator to 0.135V at 400 c/s

17. Switch all supplies on and check that modulation level is greater than 70% with the MOD LEVEL control at maximum and with level speech into microphone.

(1) Adjust the MOD LEVEL control for 70% modulation

(2) Remove short circuit from V2a and V2b cathodes

(3) Adjust the peak limiter control RV4, located at the rear of the chassis, for a reduction in the modulation level to 60%.

L6	Choke		5Ω
L7	Choke		20Ω
L8	Choke		5Ω
RLA	H.T. Relay Coil		6000Ω
RLB	H.T. Relay Coil		6000Ω
RLC	RT/CW/MCW Relay Coil		600Ω
RLD	Bias Relay Coil		1700Ω + 1700Ω
RLE	Microphone Relay Coil		100Ω + 100Ω

<u>H.F. Transmitter</u>

L1	Osc. Coil No.1		2.7Ω
L2	Osc. Coil No.2		1.25Ω
L7	Buffer Anode Coil		1.5Ω
L10	R.F. Choke		50Ω
TR1	Modulation Transformer	Primary	280Ω
		Secondary	65Ω
RLF	Aerial Changeover Relay Coil		800Ω
RLG	Keying Relay Coil		1700Ω + 1700Ω

<u>M.F. Transmitter</u>

L1	Monitor Coil		25Ω
L2	R.F. Oscillator Coil		25Ω
L3	Buffer Anode Coil		12.5Ω
L4	P.A. Anode Coil		70Ω
L6	Aerial Coil Stator		2.2Ω
TR1	Modulation Transformer	Primary	78Ω
		Secondary	68Ω

RLH	Keying Relay Coil		1700Ω + 1700Ω
RLJ	Aerial Relay Coil		800Ω

Receiver

L1	AE Tuning Range 1		146Ω
L2	AE Tuning Range 2		52Ω
L3	AE Tuning Range 3		23Ω
L4	AE Tuning Range 4		3.5Ω
L5	AE Tuning Range 5		1Ω
L9	FL1 Coil		4.5Ω
L10	Oscillator Tuning Range 1		14.5Ω
L11	Oscillator Tuning Range 2		12Ω
L12	Oscillator Tuning Range 3		4Ω
L13	Oscillator Tuning Range 4		7.5Ω
L14	Oscillator Tuning Range 5		1Ω
L19	FL2 Coil		3Ω
L20	Mixer Tuning Range 1	Primary	80Ω
		Secondary	220Ω
L21	Mixer Tuning Range 2	Primary	110Ω
		Secondary	105Ω
L22	Mixer Tuning Range 3	Primary	18.5Ω
		Secondary	24Ω
L23	Mixer Tuning Range 4	Primary	10Ω
		Secondary	4Ω
L24	Mixer Tuning Range 5	Primary	10Ω
		Secondary	1Ω

L25	Mixer Tuning Range 6	Primary	7.5Ω
		Secondary	5Ω
L26	Mixer Tuning Range 7	Primary	6.5Ω
L27	Mixer Tuning Range 8	Primary	2.5Ω
L28	Xtal Osc. Anode Choke		15Ω
L29	TR4 Primary		3Ω
L30	TR4 Secondary		3Ω
L31	TR5 Primary		0.75Ω
L32	TR5 Secondary		0.75Ω
L33	2nd Local Oscillator Coil		0.5Ω
L44	B.F.O. Coil		2Ω
L45	B.F.O. Choke		2Ω
RLK	Muting Relay Coil		1700Ω + 1700Ω
TR6	Audio Output Transformer	Secondary c-d	2Ω
		- e-f	40Ω
		Primary a-b	400Ω

I.F. Alignment

22. (1) Inject a 460 kc/s signal into the control grid of V4a from a suitable Frequency Swept oscillator via a 0.1μF coupling capacitor.

(2) Connect oscilloscope via a 1 MΩ resistor to the junction of R54/RV53 and chassis.

(3) Connect oscilloscope X plates to EXTERNAL of Frequency Swept oscillator.

(4) Set B.F.O. switch at OFF.

(5) Set A.G.C. switch at OFF.

(6) Set CRYSTAL switch at OFF.

(7) Set R.F. GAIN at maximum.

(8) Set SELECTIVITY switch at N

(9) Set RANGE switch at 3

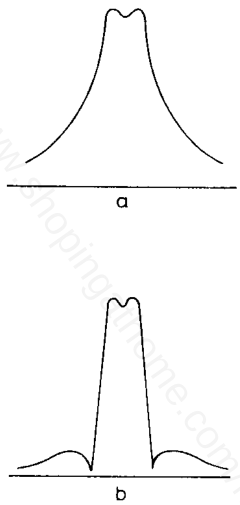


Fig.2.4.1 Receiver I.F. Alignment Response Curves

23. (1) Adjust the cores of FL3 for maximum amplitude.

(2) Adjust the primary and secondary cores of TR1, TR2 and TR3 for maximum amplitude, reducing the signal input as necessary to prevent overload.

(3) Reduce signal input bandwidth to 10 kc/s. Adjust C106 for symmetrical curve as shown in Fig.2.4.1.a

(4) Retune secondary core of TR2 to reduce curve saddle to minimum

(5) Retune cores of FL3 to maintain symmetrical response.

(6) Adjust C107 to give correct bandwidth and then repeat instructions (4) and (5).

(7) Set SELECTIVITY switch at VN and adjust C102 for maximum amplitude.

(8) Adjust C108 to give a response curve as shown in Fig. 2.4.1b.

(9) Retune FL3 to give minimum curve saddle.

(10) Reset signal input bandwidth to 20 kc/s and with the SELECTIVITY switch at I and then W ensure that the response curve remains symmetrical.

(11) With RANGE switch at 4, check that response curve remains symmetrical although the amplitude is reduced.

(12) Check response curve symmetry with SELECTIVITY switch at I and then W.

(13) Set SELECTIVITY switch at N.

Set RANGE switch at 3

Change frequency of signal input to 1.4 Mc/s but maintain bandwidth at 20 kc/s.

(14) Tune the primary and secondary cores of TR5 and the core of L34 for maximum amplitude. Check response curve symmetry with SELECTIVITY switch at I and W.

I.F. Alignment when Frequency Swept Oscillator is not available

24. The alignment procedure appended is for approximate alignment only and covers the WIDE and INTERMEDIATE positions of the SELECTIVITY switch.

(1) Inject a 100μV signal at 460 kc/s modulated 30% into the control grid of V4a via a 0.1μF capacitor.

(2) Set B.F.O. switch at OFF.

(3) Set A.G.C. switch at OFF.

(4) Set CRYSTAL switch at OFF.

(5) Set R.F. GAIN at maximum

(6) Set RANGE switch at 4

(7) Set SELECTIVITY switch at 1

(8) Connect 600Ω output meter to the loudspeaker jack socket on P.S.U.

25. (1) Tune primary and secondary cores of TR1, TR2 and TR3 for maximum meter reading, adjusting the signal input to prevent overload.

(2) Set SELECTIVITY switch at N

(3) Adjust frequency of signal input to obtain maximum meter reading.

(4) Set SELECTIVITY switch at I and readjust primary and secondary cores of TR1, TR2 and TR3 for maximum meter reading.

(5) Remove input signal and apply same signal to control grid of V2a.

(6) Adjust primary and secondary cores of TR4 for maximum meter reading.

(7) Set Range switch at 3 and alter frequency of signal input to 1.4 Mc/s.

(8) Adjust frequency of signal input to obtain maximum meter reading.

(9) Adjust primary and secondary cores of TR5 to give maximum meter reading.

<u>B.F.O.</u>

26. (1) Set SELECTIVITY switch at N

(2) Connect Avo 8 (0-50μA) between R52 and chassis

(3) Set the B.F.O. tuning control at scale zero and check capacitor vanes are half engaged.

(4) Inject a 460 kc/s C.W. signal into the control grid of V4a.

(5) Tune the oscillator to the centre of the passband.

(6) Switch off C.W. signal and check that diode current due to B.F.O. is between 45 and 65 μA.

<u>1st Oscillator</u>

27. (1) Set CRYSTAL switch at OFF.

(2) Set A.G.C. switch at OFF.

(3) Set SELECTIVITY switch at N

(4) Set R.F. GAIN at maximum

(5) Set B.F.O. switch at ON and B.F.O. tuning control at 0

28. With reference to Table 15 inject an unmodulated 100μV r.f. signal at the alignment frequencies into the control grid of V2a. Tune the receiver to the alignment frequency, carry out adjustments at lowest frequency and then highest frequency of each range. Repeat adjustments to ensure accuracy of alignment.

	Range 1		Range 2		Range 3		Range 4	
FREQUENCY	60 kc/s	125 kc/s	100 kc/s	260 kc/s	260 kc/s	660 kc/s	0.7 Mc/s	1.5 Mc/s
ADJUSTMENT	L10	C19	L11	C20	L12	C21	L13	C22

	Range 5		Range 6		Range 7		Range 8	
FREQUENCY in Mc/s	1.6	3.4	3.4	7.0	7	15	15	31
ADJUSTMENT	L14	C23	L15	C24	L16	C25	L17	C26

TABLE 15

R.F. Alignment

29. (1) Set B.F.O. at OFF

(2) Set A.G.C. switch at OFF

(3) Set CRYSTAL switch at OFF

(4) Set SELECTIVITY switch at 1

(5) Connect output meter to 100Ω or 500Ω output jack socket

30. With reference to Table 16 inject a 30μV r.f. signal modulated 30% at the alignment frequency into the receiver aerial input and with the receiver tuned to the frequency adjust the cores at the lowest frequency of the range and then the trimmers at highest frequency of that range. Align one range at a time, with all adjustments made for maximum reading on the output meter. Repeat on alternate frequencies until no further improvement is possible. During alignment adjust R.F. GAIN as necessary, to maintain reading on output meter. On range 8, slight adjustment of the tuning control during alignment may be necessary to obviate pulling.

	Range 1		Range 2		Range 3		Range 4	
FREQUENCY	60 kc/s	120 kc/s	105 kc/s	240 kc/s	270 kc/s	630 kc/s	710 kc/s	1.48 Mc/s
1st ADJUSTMENT	L20	C46	L21	C47	L22	C48	L23	C49
2nd ADJUSTMENT	L1	C1	L2	C2	L3	C3	L4	C4

	Range 5		Range 6		Range 7		Range 8	
FREQUENCY in Mc/s	1.62	3.3	3.6	7.0	7.4	14.7	15.7	30.7
1st ADJUSTMENT	L24	C50	L25	C51	L26	C52	L27	C53
2nd ADJUSTMENT	L5	C5	L6	C6	L7	C7	L8	C8

TABLE 16

Filter Alignment

31. FL1 & FL2

Connect 500Ω output meter to L.S. jack socket. Set up receiver for operation at 240 kc/s.

(1) Inject a modulated signal at 460 kc/s into aerial input and adjust signal input voltage for a convenient reading on the output meter. Adjust the core of FL1 for minimum audio output.

(2) Set up receiver for operation at 630 kc/s. Inject a modulated signal at 1.4 Mc/s into aerial input and adjust signal input voltage so that a convenient reading is obtained on the output meter. Adjust the core of FL2 for minimum audio output.

2nd Harmonic Filter

32. (1) Set A.G.C. switch at OFF

(2) Set CRYSTAL switch at OFF

(3) Set R.F. GAIN at maximum

(4) Set SELECTIVITY switch at Wide

(5) Select Range 6

(6) Connect Avo 8 (0-10V d.c. range) between R52 and chassis

(7) Inject a 100µV C.W. signal at 1.4 Mc/s into the control grid of V4a via a 0.1µF capacitor.

Note the d.c. output reading on the Avo 8 and record as reading 'A'

(8) Change signal input to a 5mV C.W. signal at 4.18 Mc/s. Carefully adjust the signal generator tuning to obtain a maximum output reading on the Avo 8.

(9) Adjust C86 for minimum output.

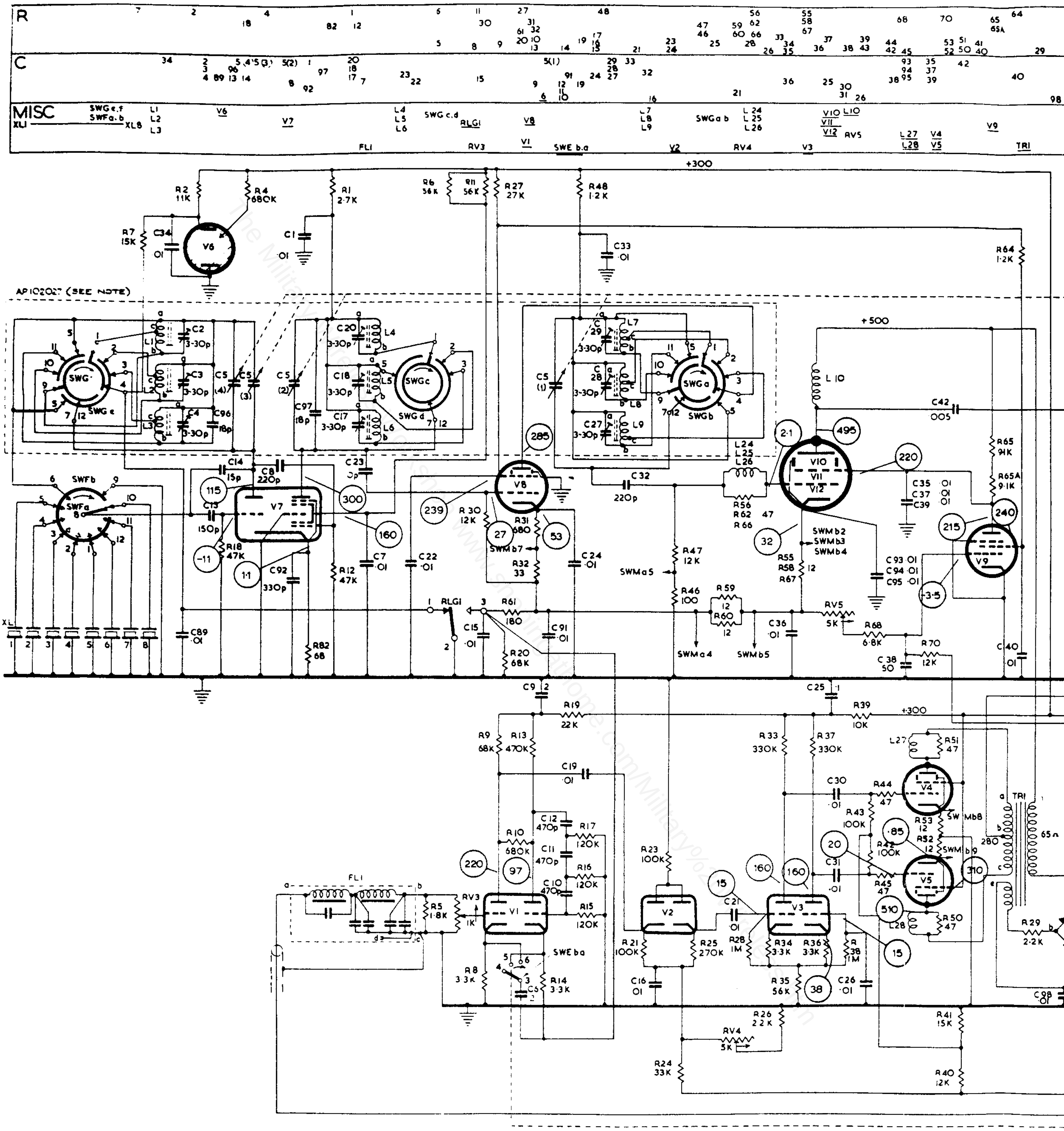
(10) Increase the signal input until the output reading on the Avo 8 is equivalent to reading 'A'. This signal input should be 30 db above 5mV.

As a final check, adjust the signal input frequency to 3.26 Mc/s and note that the rejection ratio is at least 30 db.

33. D.C. RESISTANCE OF INDUCTORS

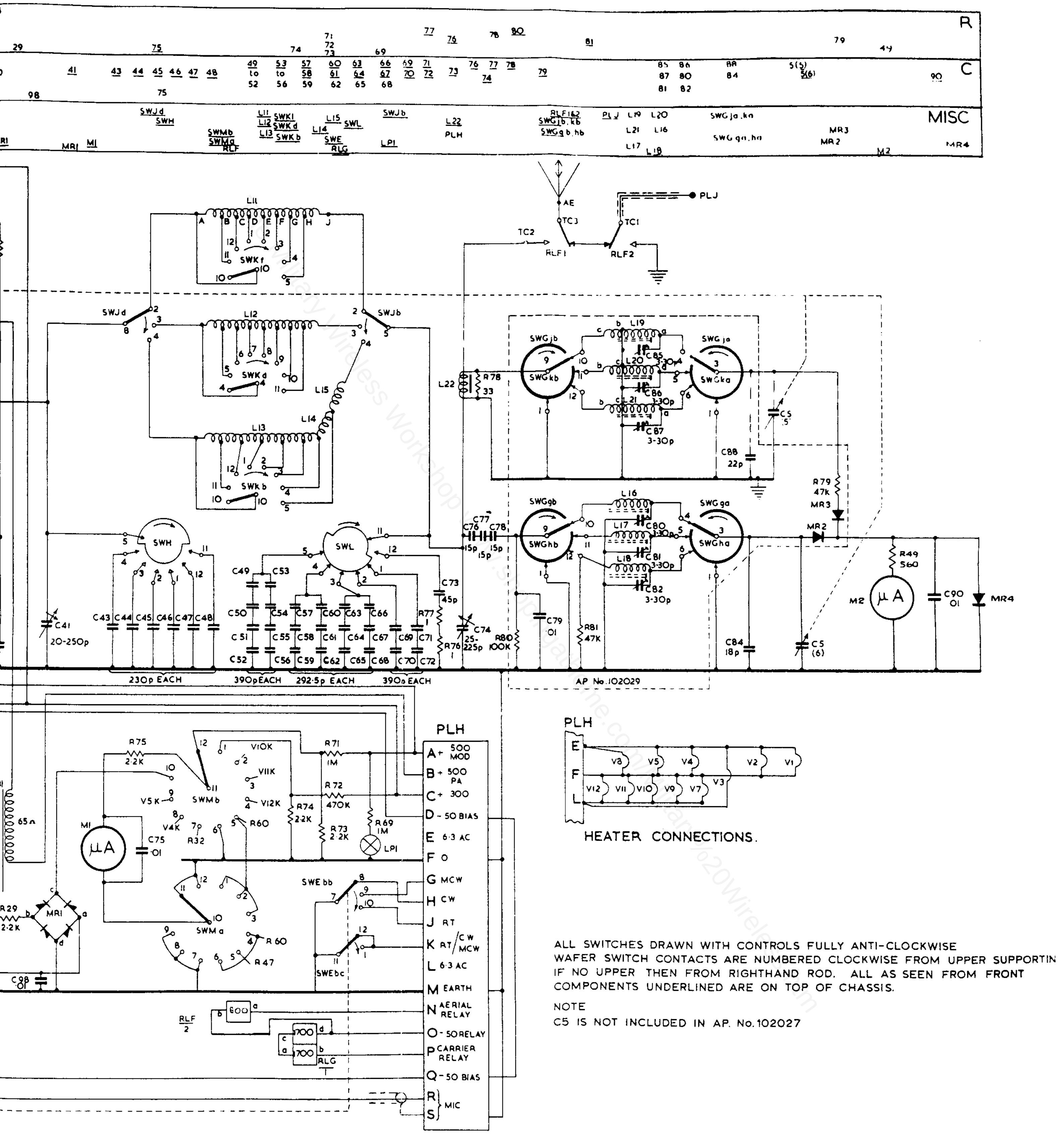
Power Supply Unit

TR1	Receiver H.T. & L.T.	300V	Secondary	250Ω
TR2	Transmitter H.T.	600V	Secondary	80Ω
		300V	Secondary	220Ω
		85V	Secondary	67Ω
		80V	Secondary	63Ω
TR4	Microphone		Primary	12Ω + 12Ω
			Secondary	23Ω
L1	Choke			5Ω
L2	Choke			5Ω
L3	Choke			5Ω
L4	Choke			5Ω
L5	Choke			20Ω



H.F TRANSMITTER CIR

AP100337

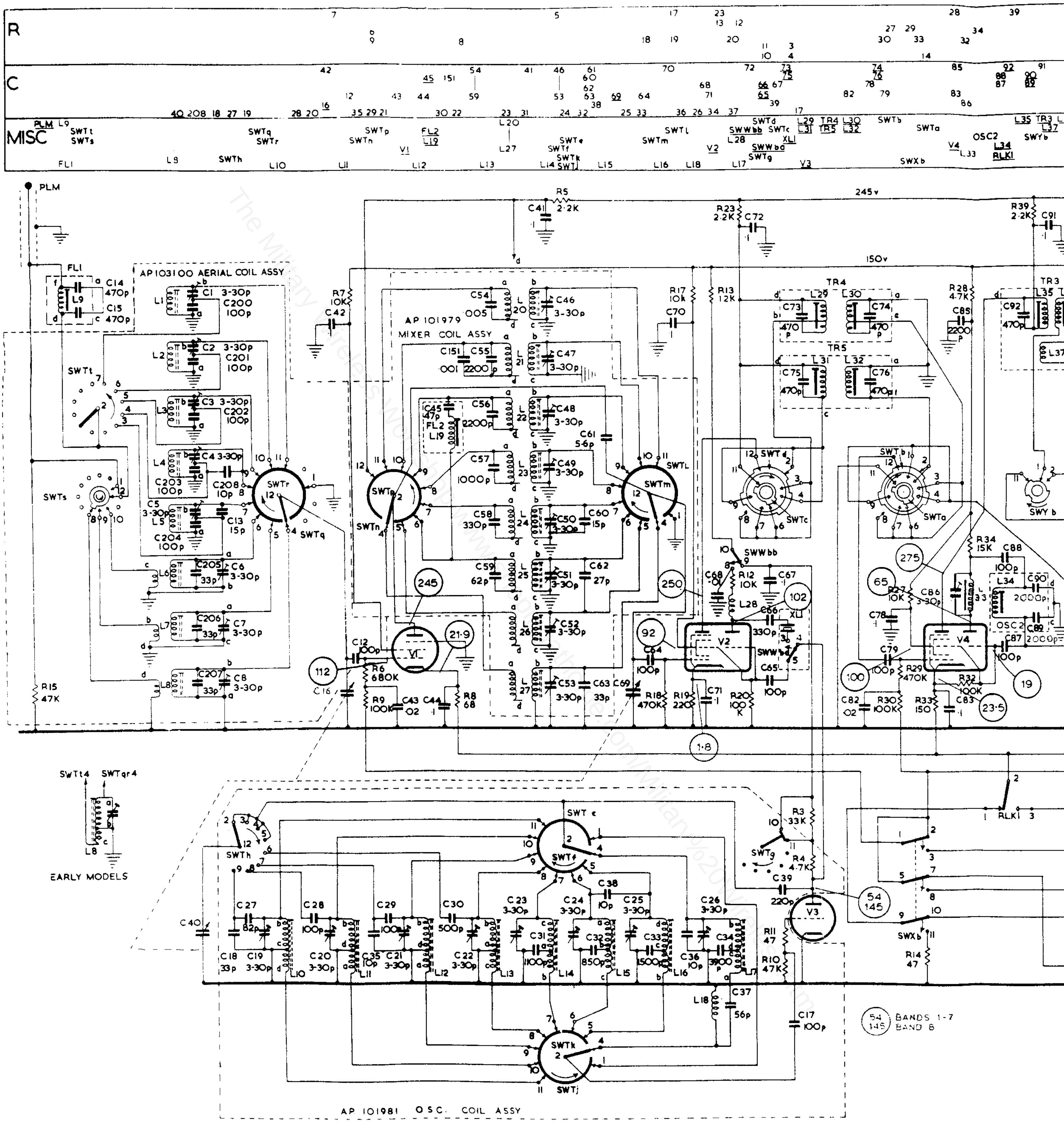


ALL SWITCHES DRAWN WITH CONTROLS FULLY ANTI-CLOCKWISE
WAFER SWITCH CONTACTS ARE NUMBERED CLOCKWISE FROM UPPER SUPPORTIN
IF NO UPPER THEN FROM RIGHTHAND ROD. ALL AS SEEN FROM FRONT
COMPONENTS UNDERLINED ARE ON TOP OF CHASSIS.

NOTE
C5 IS NOT INCLUDED IN AP. No.102027

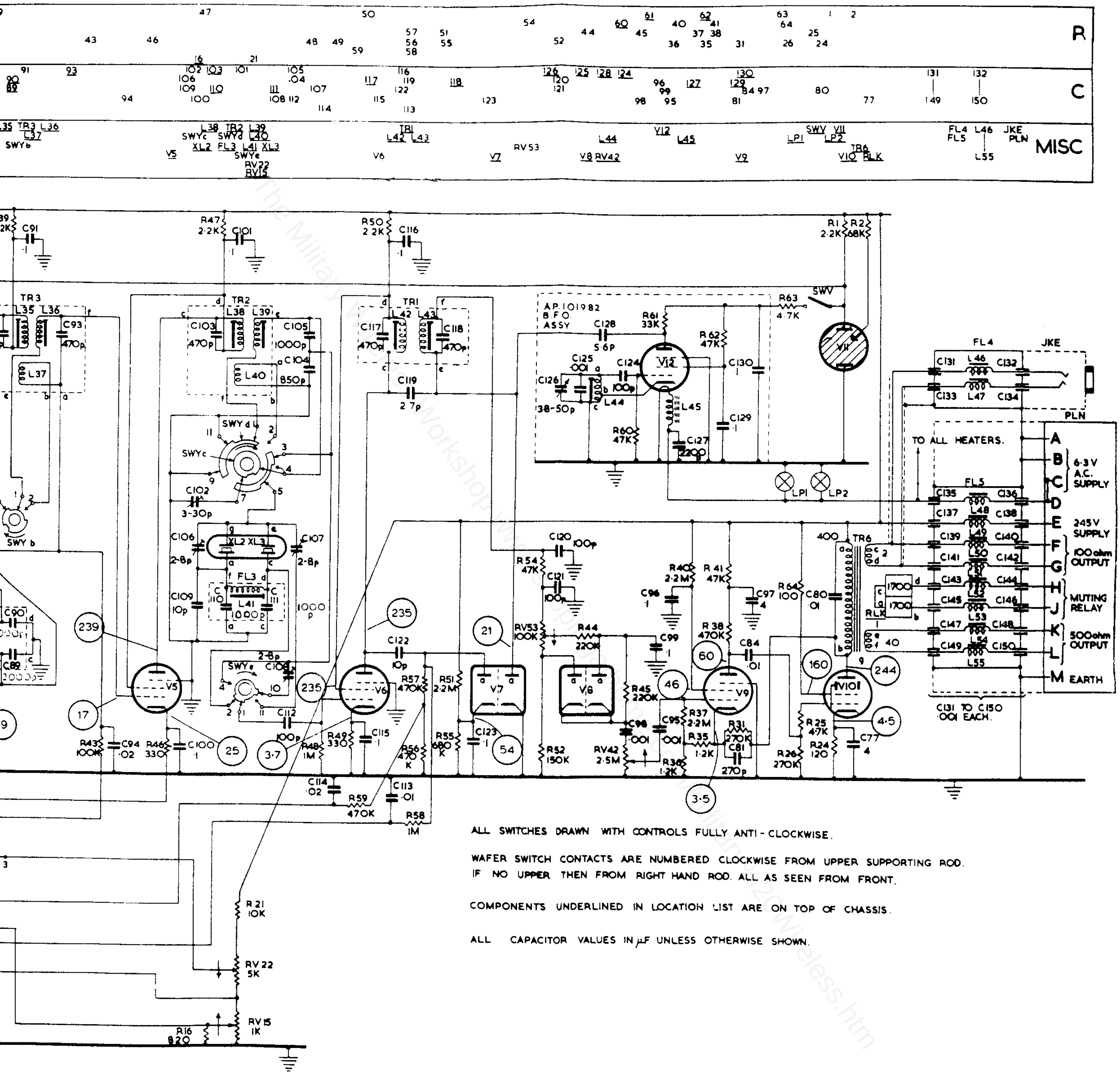
CIRCUIT DIAGRAM FIG.2

)0337



RECEIVER CIRCU

AP10033



ALL SWITCHES DRAWN WITH CONTROLS FULLY ANTI-CLOCKWISE.

WAFER SWITCH CONTACTS ARE NUMBERED CLOCKWISE FROM UPPER SUPPORTING ROD. IF NO UPPER THEN FROM RIGHT HAND ROD. ALL AS SEEN FROM FRONT.

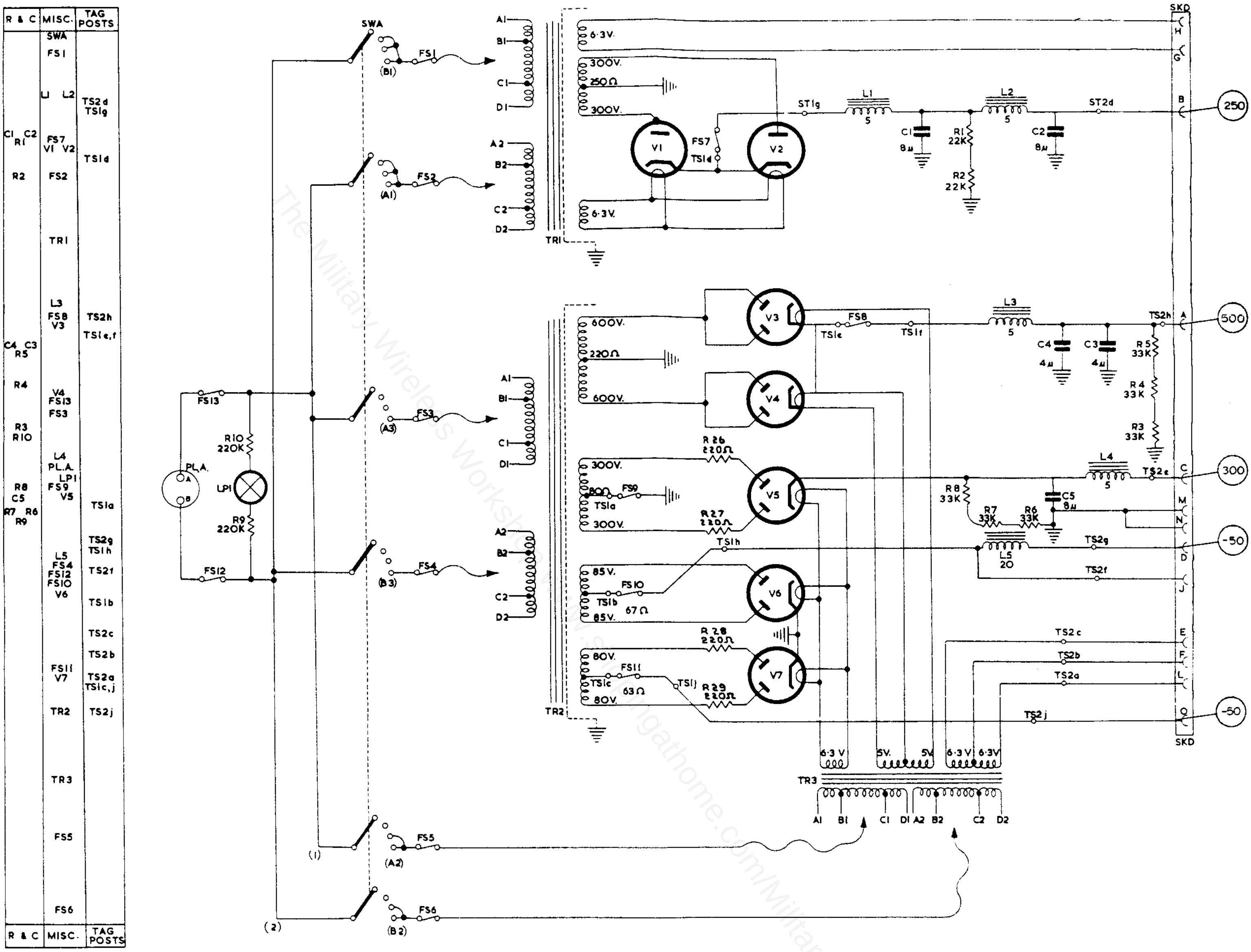
COMPONENTS UNDERLINED IN LOCATION LIST ARE ON TOP OF CHASSIS.

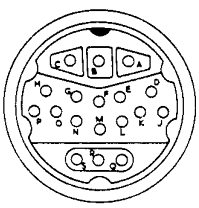
ALL CAPACITOR VALUES IN μF UNLESS OTHERWISE SHOWN.

RCUIT DIAGRAM

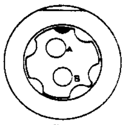
100339

FIG.6

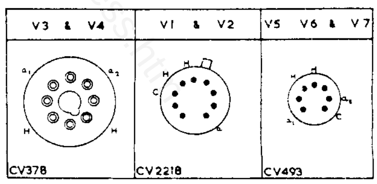




SKD
18 WAY



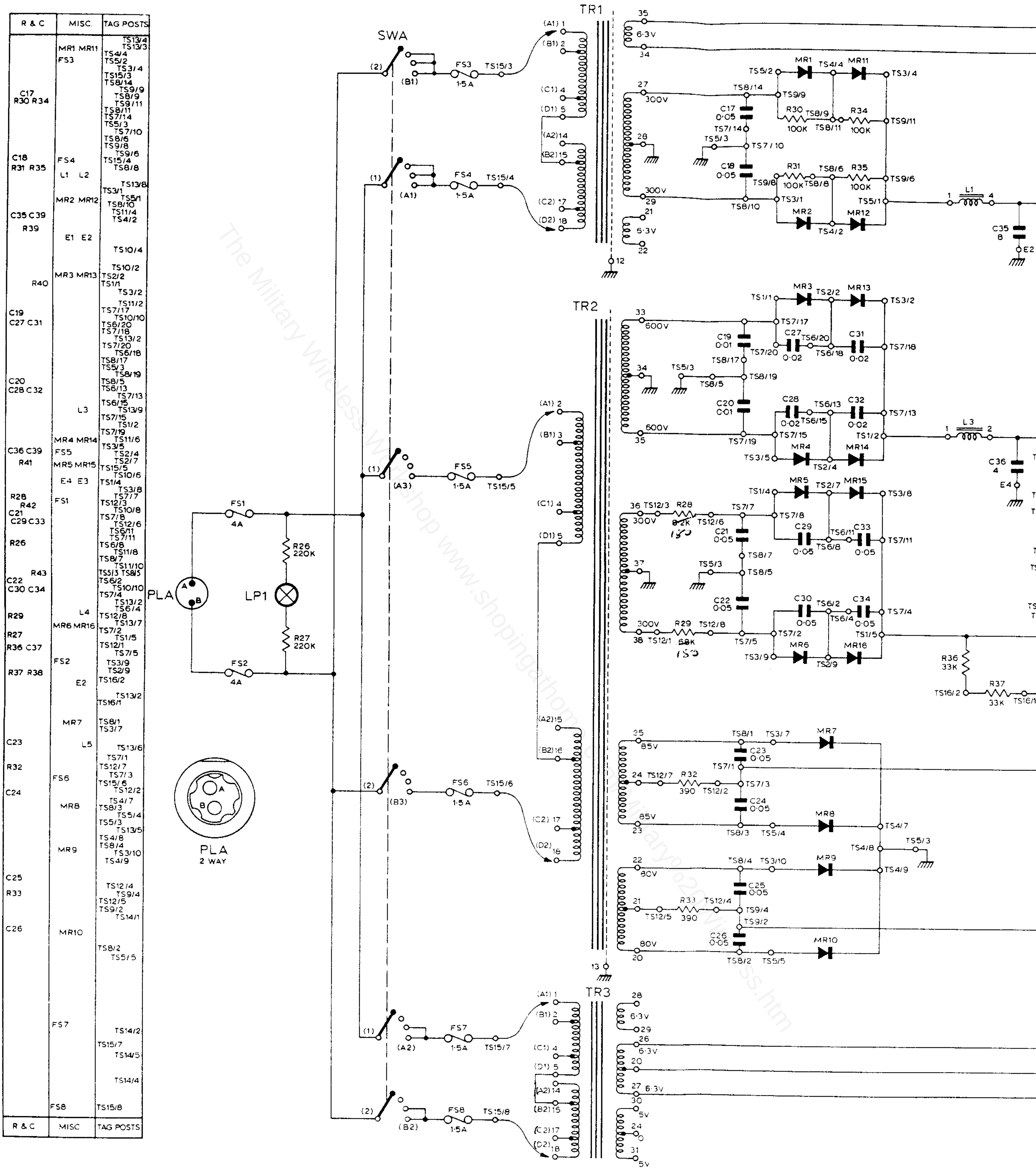
PL.A.
2 WAY



POWER SUPPLY UNIT CHASSIS 1 CIRCUIT DIAGRAM

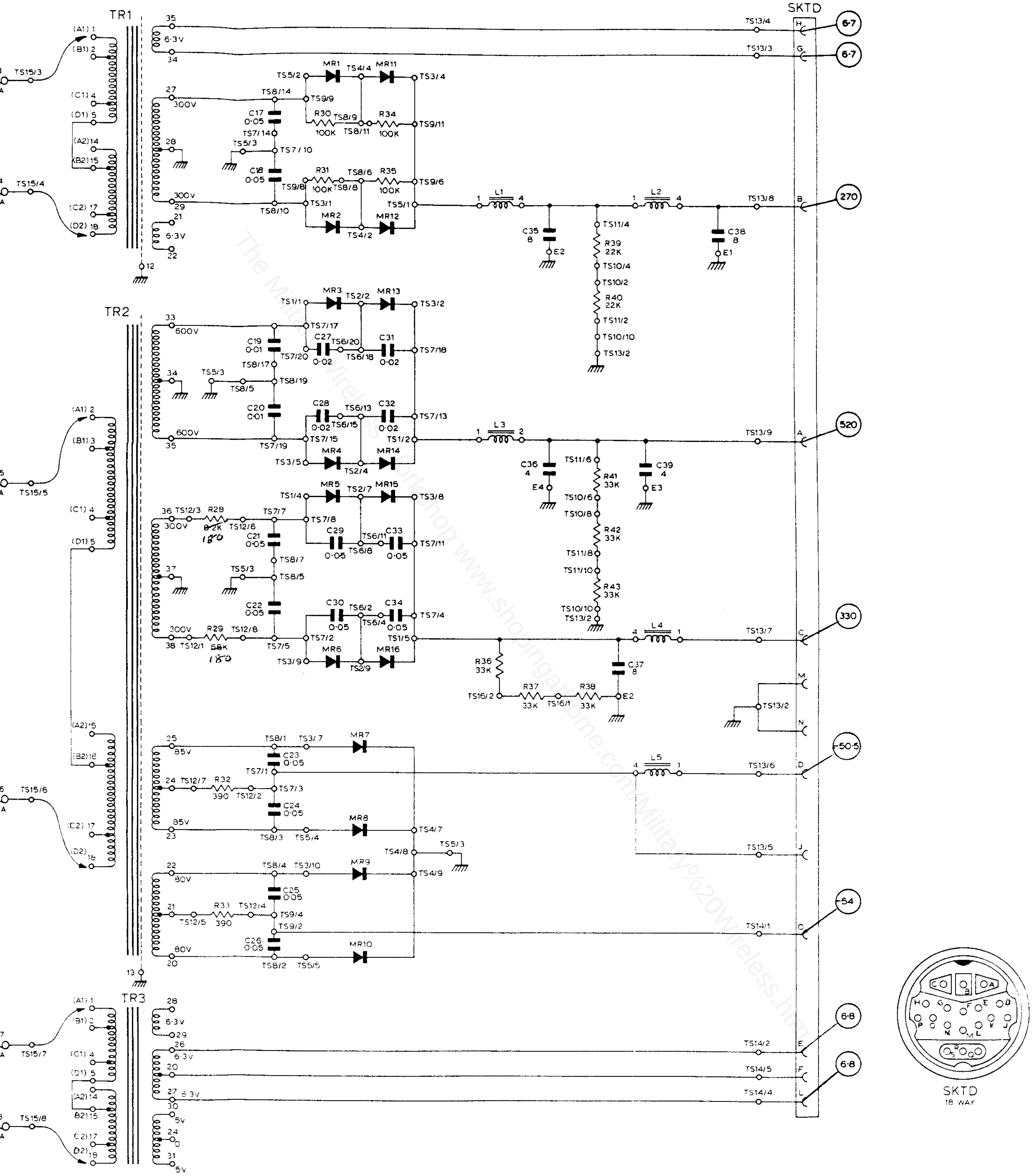
FIG.8

AP100340



POWER SUPPLY UNIT CHASSIS 1 CIRCUIT DIAGR

AP399015

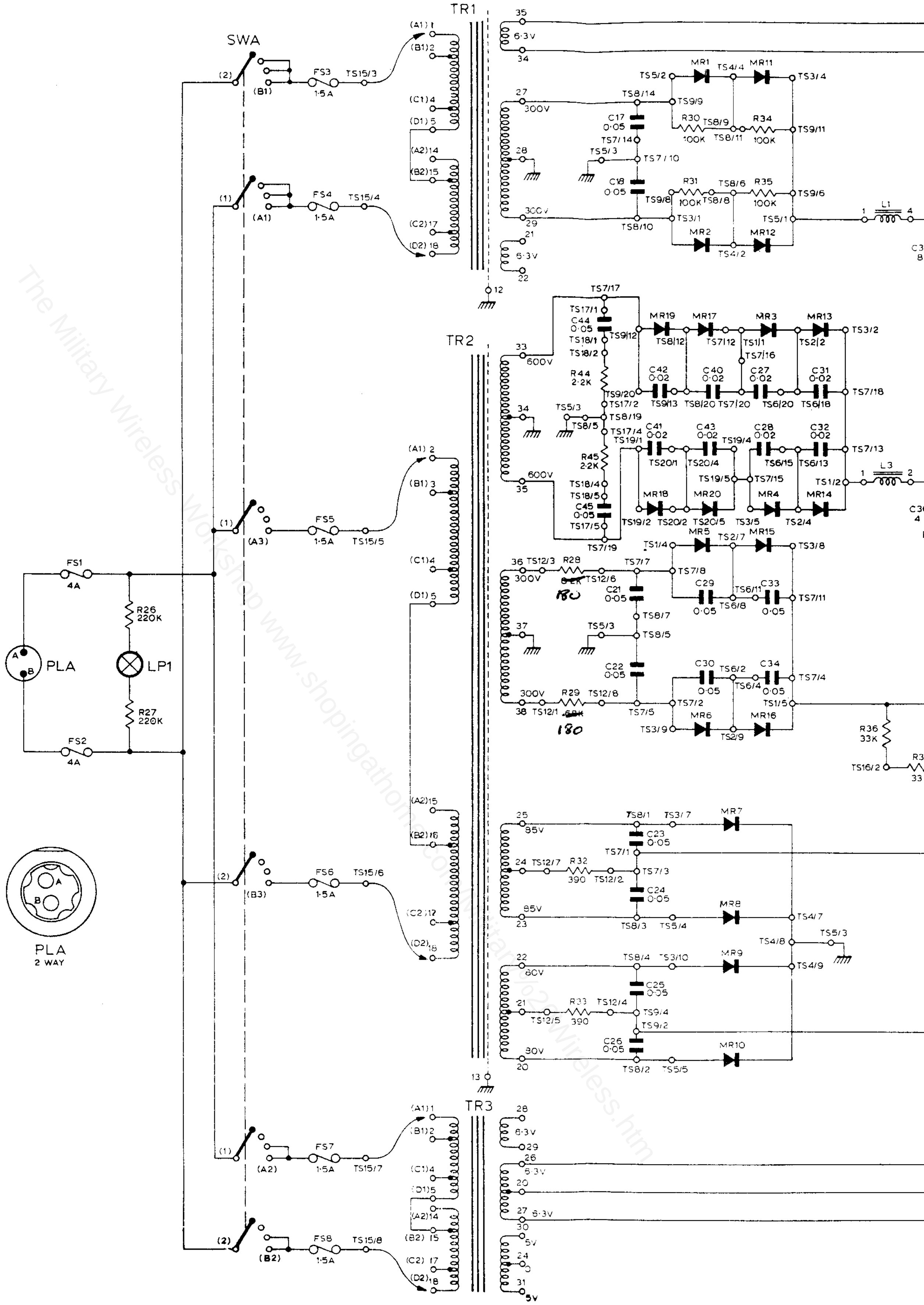


POWER SUPPLY UNIT CHASSIS 1 CIRCUIT DIAGRAM

AP399015

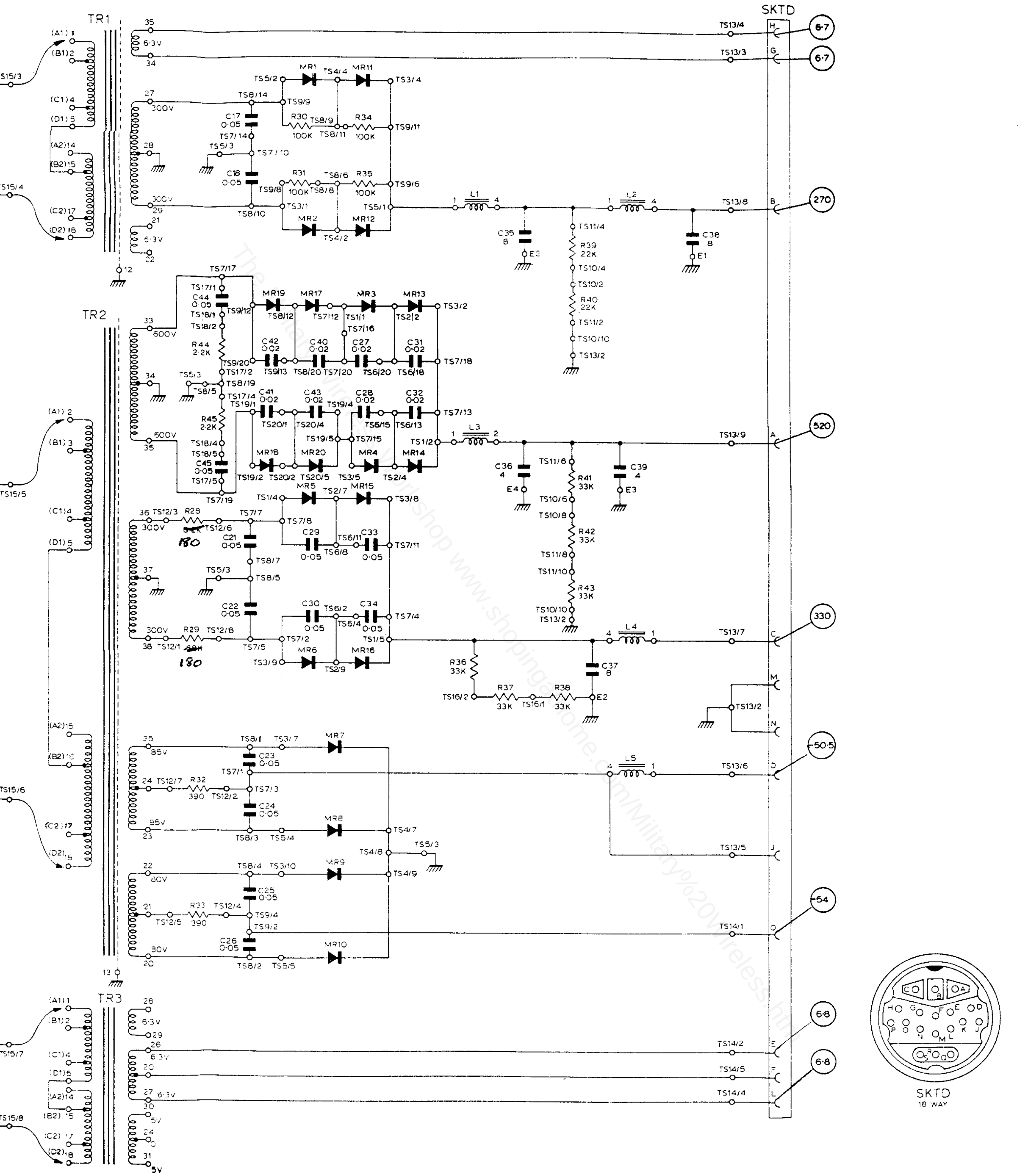
FIG.9

R & C	MISC	TAG POSTS
	MR1 MR11	TS13/4 TS13/3
	FS3	TS4/4 TS5/2 TS3/4 TS15/3 TS8/14 TS9/9
C17 R30 R34		TS8/9 TS9/11 TS8/11 TS7/14 TS5/3 TS7/10 TS8/6 TS9/8 TS9/6
C18 R31 R35	FS4	TS15/4 TS8/8
	L1 L2	TS13/8 TS3/1
	MR2 MR12	TS5/1 TS8/10 TS11/4
C35 C39 R39		TS4/2 TS10/4 TS10/2
	E1 E2	
		TS7/17
	MR19 MR17 MR3 MR13	TS17/1 TS10/10
R40 C44		TS18/1 TS9/12 TS8/12 TS7/12 TS1/1 TS2/2 TS18/2 TS3/2 TS7/16
R44 C42 C40 C27 C31		TS9/20 TS9/13 TS8/20 TS7/20 TS6/20 TS6/18 TS17/2 TS7/18 TS8/5 TS8/19 TS17/4
R45 C41 C43 C28 C32	L3	TS19/1 TS20/1 TS20/4 TS19/4 TS6/15 TS6/13 TS13/9 TS7/13 TS18/4 TS19/5 TS7/15 TS1/2
C45 C36 C39	MR18 MR20 MR4 MR14 FS5	TS18/5 TS19/2 TS20/5 TS3/5 TS17/5 TS2/4 TS7/19 TS20/2
R41	MR5 MR15	TS3/5 TS11/6 TS2/4 TS2/7
	E4 E3	TS15/5 TS10/6 TS1/4 TS3/3 TS7/7
R28 R42 C21 C29 C33	FS1	TS12/3 TS10/8 TS7/8 TS12/6 TS6/11 TS7/11
R26		TS6/8 TS11/8 TS8/7 TS11/10
R43 C22 C30 C34		TS5/3 TS8/5 TS6/2 TS10/10 TS7/4 TS13/2 TS6/4
R29	L4	TS12/8 TS13/7
	MR6 MR16	TS7/2 TS1/5
R27		TS12/1
R36 C37		TS7/5
	FS2	TS3/9 TS2/9
R37 R38	E2	TS16/2 TS16/1 TS13/2 TS16/1
	MR7	TS8/1 TS3/7
C23	L5	TS13/6 TS7/1
R32	FS6	TS12/7 TS7/3 TS15/6 TS12/2
C24	MR8	TS4/7 TS8/3 TS5/4 TS5/3 TS13/5 TS4/8
	MR9	TS8/4 TS3/10 TS4/9
C25		TS12/4
R33		TS9/4 TS12/5 TS9/2 TS14/1
C26	MR10	TS8/2 TS5/5
	FS7	TS14/2 TS15/7 TS14/5 TS14/4
	FS8	TS15/8
R & C	MISC	TAG POSTS



POWER SUPPLY UNIT CHASSIS 1 CIRCUIT DI...

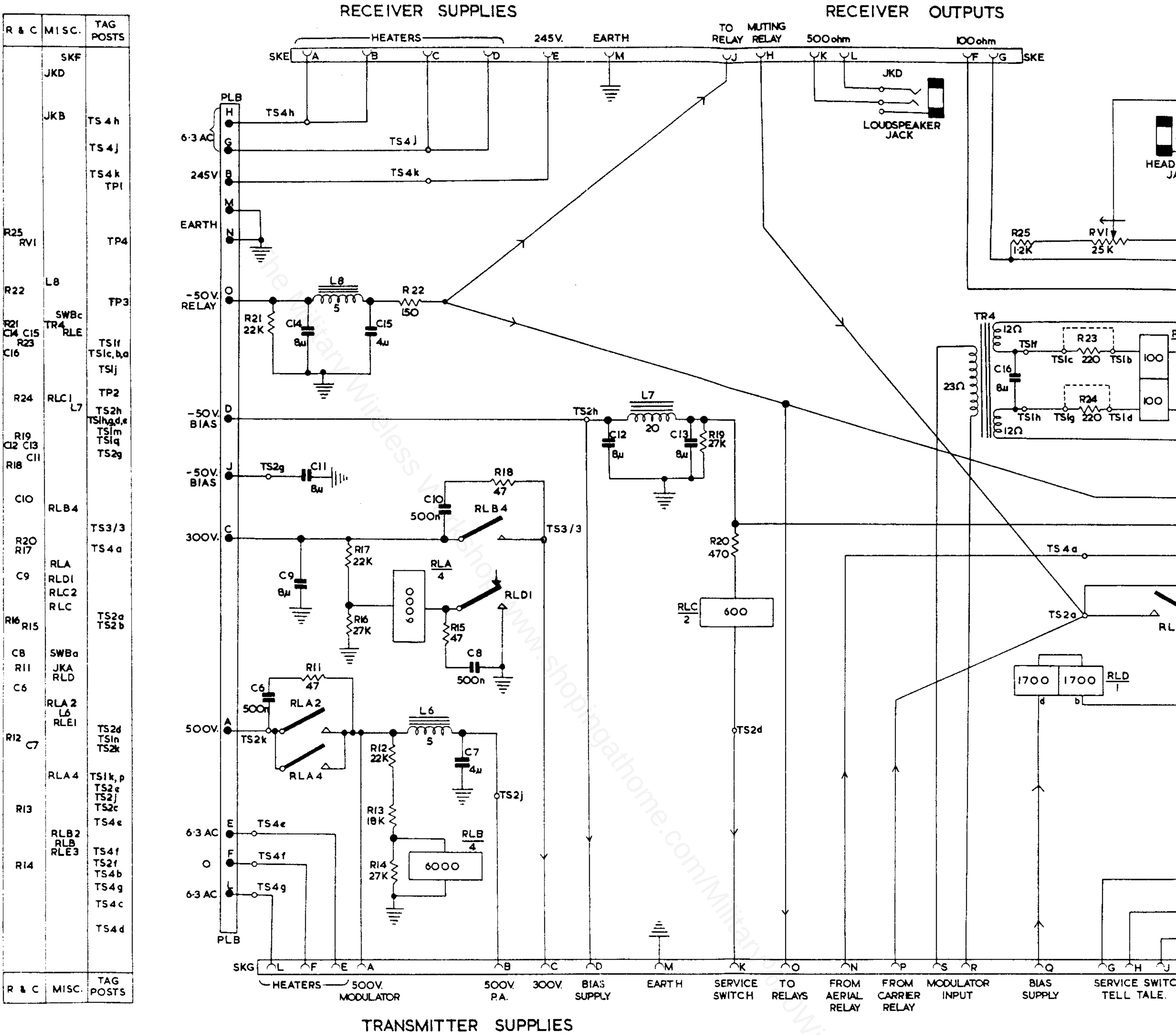
AP 399015 MODIFIED

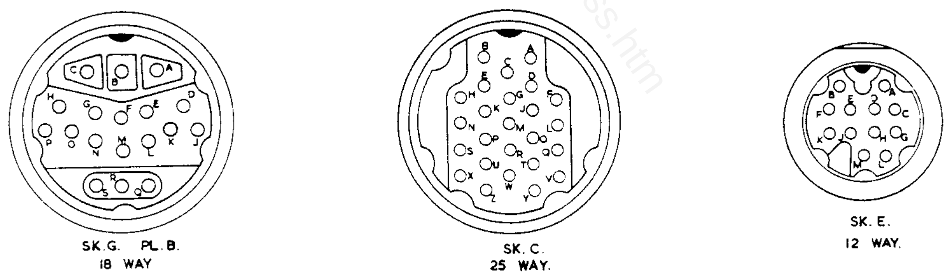


OWER SUPPLY UNIT CHASSIS 1 CIRCUIT DIAGRAM

AP 399015 MODIFIED

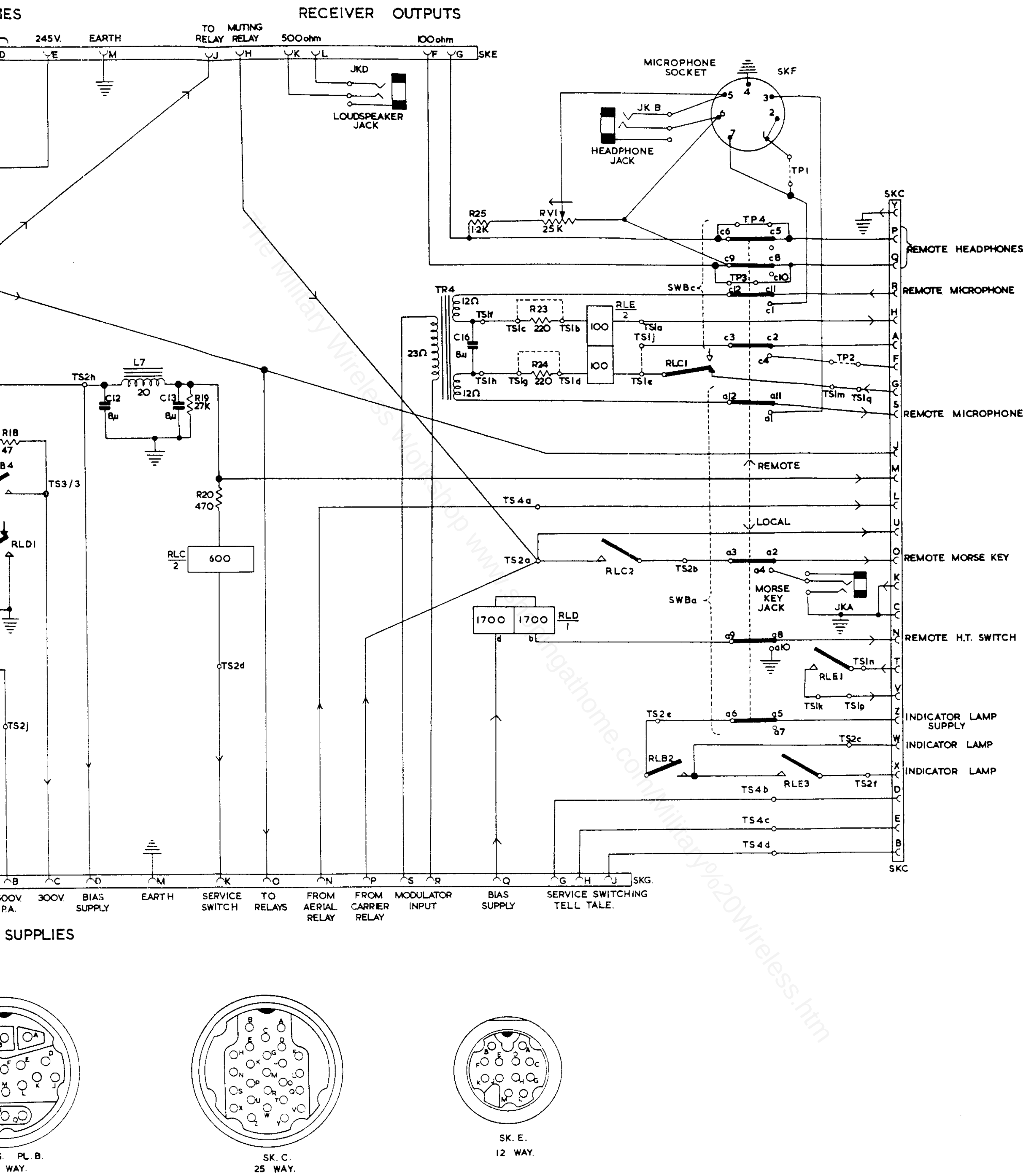
FIG. 10





POWER SUPPLY UNIT CHASSIS 2 CIRCUIT DIAGRAM

AP100340 OR AP399015



WER SUPPLY UNIT CHASSIS 2 CIRCUIT DIAGRAM

AP100340 OR AP399015

FIG. 12