B.R. 2169

TYPE 619
AND
RECEIVER OUTFIT CAT

SERVICE MANUAL
ISSUE 2

1963

ANY SUGGESTIONS FOR AMENDMENTS OR ADDITIONS TO THIS BOOK SHOULD BE SUBMITTED TO THE CAPTAIN SUPERINTENDENT, ADMIRALTY SURFACE WEAPONS ESTABLISHMENT, THROUGH THE USUAL CHANNELS.

Weapons Department, Admiralty
October, 1963 (W.50597/62)

Admiralty, S.W.1.
October, 1963.

W.50597/62

B.R. 2169 "Type 619 and Receiver Outfit CAT Service Manual Issue 2 1963" having been approved by My Lords Commissioners of the Admiralty is hereby promulgated.

B.R.2169 "Handbook for Type 619 and Receiver Outfit CAT 1954" is hereby superseded and should be disposed of in accordance with instructions in B.R.1.

By Command of Their Lordships.

To:

Flag Officers and
Commanding Officers
of H.M. Ships and
Vessels concerned.

When an amendment to this handbook is incorporated the brief details required below are to be filled in.

AMENDMENT No.	AUTHORITY (P Series No.)	DATE OF INSERTION	INITIALS
Changes 1-11 and Amendment 12 incorporated in this reprint.			
Amdt. 13	642/74.	7-2-76.	[illegible]

Continued Overleaf

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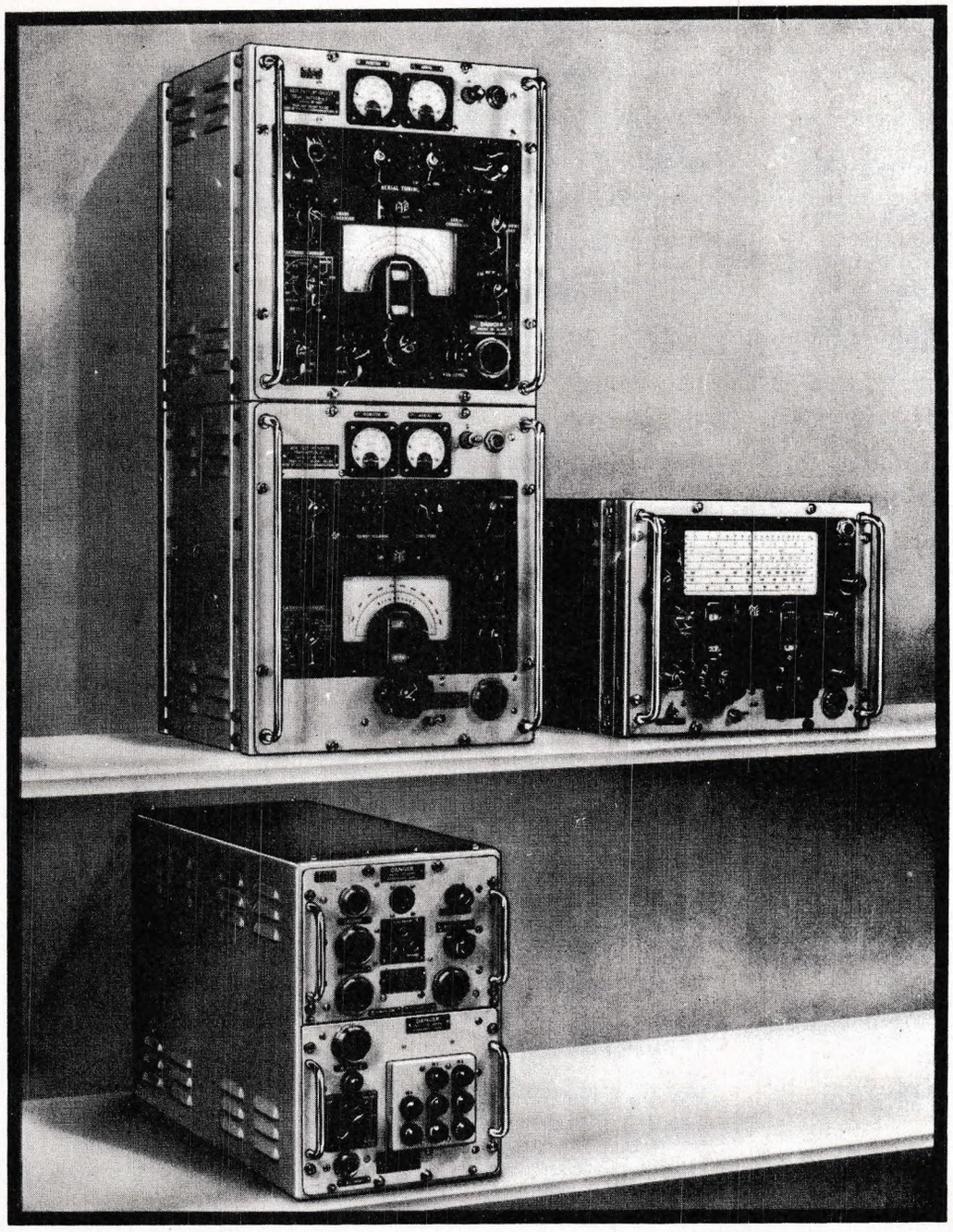

PART 1

TECHNICAL DESCRIPTION

CONTENTS LIST

TYPE 619 AND RECEIVER OUTFIT CAT

SUMMARY OF DATA

TYPE OF TRANSMISSION AND RECEPTION

H.F. TRANSMITTER	C.W. or M.C.W. or R/T
M.F. TRANSMITTER	C.W. or M.C.W.
RECEIVER OUTFIT CAT	C.W. or M.C.W. or R/T

FREQUENCY RANGE

H.F. TRANSMITTER 1.5 - 16 Mc/s	Range 1	1.5 - 3.3 Mc/s
	Range 2	3.3 - 7.3 Mc/s
	Range 3	7.3 - 16 Mc/s
M.F. TRANSMITTER 330 - 550 kc/s		
RECEIVER OUTFIT CAT 60 kc/s - 31 Mc/s	Range 1	60 -125 kc/s
	Range 2	100-255 kc/s
	Range 3	255-675 kc/s
	Range 4	0.675 Mc/s - 1.5 Mc/s
	Range 5	1.5 Mc/s - 3.4. Mc/s
	Range 6	3.4. Mc/s - 7.2. Mc/s
	Range 7	7 Mc/s - 15 Mc/s
	Range 8	15 Mc/s - 31 Mc/s

MAJOR UNITS

	Dimensions	Weight	
H.F. TRANSMITTER	$14\frac{1}{2}$" x $13\frac{1}{2}$" x 14" 37 x 34 x 35 cm	63 lb (28.6kg)	AP 100337
M.F. TRANSMITTER	$14\frac{1}{2}$" x $13\frac{1}{2}$" x 14" 37 x 34 x $35\frac{1}{2}$ cm	48 lb (21.8kg)	AP 100338
RECEIVER OUTFIT CAT	$10\frac{1}{2}$" x $13\frac{1}{2}$" x 14" 27 x 34 x $35\frac{1}{2}$ cm	44 lb (20 kg)	AP 100339
POWER SUPPLY UNIT	14" x $9\frac{1}{2}$" x $23\frac{1}{2}$" $35\frac{1}{2}$ x 24 x 60 cm	118 lb (53.6kg)	AP 100340A
POWER SUPPLY UNIT	8 7/8" x 5 1/8" x 14" $22\frac{1}{2}$ x 13 x $35\frac{1}{2}$ cm	25 lb (11.4kg)	or AP 399015

VARIATIONS OF INSTALLATION

TYPE 619 - H.F. TRANSMITTER, M.F. TRANSMITTER AND POWER SUPPLY UNIT

TYPE 619H - H.F. TRANSMITTER AND POWER SUPPLY UNIT

TYPE 619L - M.F. TRANSMITTER AND POWER SUPPLY UNIT

Where the RECEIVER OUTFIT CAT only is required, the POWER SUPPLY UNIT provided with Type 619, 619H or 619L equipment is replaced by the POWER SUPPLY UNIT (Receiver only).

FREQUENCY CONTROL AND STABILITY

H.F. TRANSMITTER

(a) Master oscillator ±0.1%

(b) Crystal oscillator ±0.02%

M.F. TRANSMITTER

Master oscillator ±0.1%

The above tolerance allow for ±10% fluctuation in the supply voltages and are not dependent on aerial load.

R.F. OUTPUT

H.F. TRANSMITTER	Approximately 40 watts
M.F. TRANSMITTER	Approximately 15 watts

MODULATION

H.F. TRANSMITTER	75-95% in M.C.W. at 800-1200c/s
M.F. TRANSMITTER	60-95% in M.C.W. at 800-1200c/s

KEYED SPEED

H.F. AND M.F. TRANSMITTERS	Up to 40 w.p.m.

RECEIVER OUTFIT CAT

OVERALL SENSITIVITY

For 2 watts output the required input (dependent on frequency) is as follows:-

C.W.	10 - 30 db above 1μV
M.C.W.	20 - 30 db above 1μV

INTERMEDIATE FREQUENCY

460 kc/s (Ranges 1, 2, 4 and 5)

460 kc/s and 1.4 Mc/s (Ranges 3, 6, 7 and 8)

I.F. SELECTIVITY

Bandwidth when used as single superheterodyne for 6 db down

WIDE	6.0 kc/s
INTERMEDIATE	4.0 kc/s
NARROW	950 kc/s
VERY NARROW	700 c/s

Bandwidth as double superheterodyne for 6 db down

WIDE	8 kc/s
INTERMEDIATE	4.6 kc/s

OUTPUT

Simultaneous outputs of 2 watts into 500Ω load and 60mW into 100Ω load.

POWER SUPPLY

This equipment requires an available supply of 100-125 or 200-250 volts a.c. at 50-60 c/s. Before despatch all tappings are set to 250 volts a.c. supply.

Outfits DWH, DWJ and DWK can be employed as converters with an available supply of 24V, 110V and 220V d.c. respectively.

POWER CONSUMPTION

The approximate consumption of the power supply unit is as follows:-

With Type 619 and Receiver Cat	270 watts
With Type 619H	200 watts
With Type 619L	200 watts

AERIAL

Wire or whip aerial.

CHAPTER 1

GENERAL DESCRIPTION

CHAPTER 1

GENERAL DESCRIPTION

1. The Marine equipment designated TYPE 619 and RECEIVER OUTFIT CAT provides general purpose amplitude modulated H.F. and M.F. transmitters, a sensitive a.m. receiver and separate power supply unit.

2. The flexibility and wide frequency range of this seaborne equipment makes it suitable for all types of ship installation. The unit construction, of compact design, permits vertical stack mounting in which the units are secured to one another without the necessity of additional rack mountings, or alternatively side-by-side mounting may be employed.

3. The H.F. transmitter has continuous tuning over 3 bands within the frequency range 1.5 - 16 Mc/s and also eight crystal controlled frequencies within the same frequency range. This transmitter has a power output of approximately 40 watts with C.W., M.C.W. or R/T facilities.

4. The M.F. transmitter has continuous tuning over the single frequency range of 330-550 kc/s and has a power output of 15 watts with C.W. or M.C.W. facilities.

5. The Receiver employs either a single or double superheterodyne circuit, depending on frequency range, and has continuous tuning in eight bands over the frequency range 60 kc/s to 31 Mc/s. This receiver is provided with switched selectivity and the r.f. gain can be manually adjusted when the a.g.c. is switched out of circuit. Two audio outputs, 100Ω and 500Ω, can be used simultaneously for speaker and headset operation. The receiver is muted during transmission to provide simplex working.

6. The power supply unit, consisting of two chassis mounted in a single cabinet, provides the required operating supplies for one selected transmitter plus the receiver and it also houses the relays which complete the selected speech patch and protect the transmitter P.A. valves by withholding the h.t. supplies until the bias supply circuit is completed. A switch on the power supply unit provides receive, standby and transmit facilities whereby the required potentials are switched to the units concerned.

7. The power supply unit contains 20 diode rectifiers (A.P. 399015 modified) but earlier versions containing either 16 diode rectifiers (A.P. 399015) or valve rectifiers (A.P. 100340) are also described in the manual.

8. All the operators controls are mounted on the front panels of the equipment. Although primarily designed for operating from normal a.c. supplies, suitable conversion units enable the equipment to be operated from a d.c. supply. The heavy gauge cabinets give good rigidity in stack mounting combined with the complete unit protection required for seaborne installation. Each unit can be quickly removed from its cabinet by releasing the chrome front panel screws and withdrawing the unit.

9. The Type 619 and Receiver Outfit CAT has been designed to operate in arctic and tropical conditions, is Admiralty patterned and widely used in N.A.T.O. and other navies.

CHAPTER 2

BRIEF TECHNICAL DESCRIPTION

CONTENTS LIST

ILLUSTRATIONS

CHAPTER 2

BRIEF TECHNICAL DESCRIPTION

H.F. TRANSMITTER (A.M.)

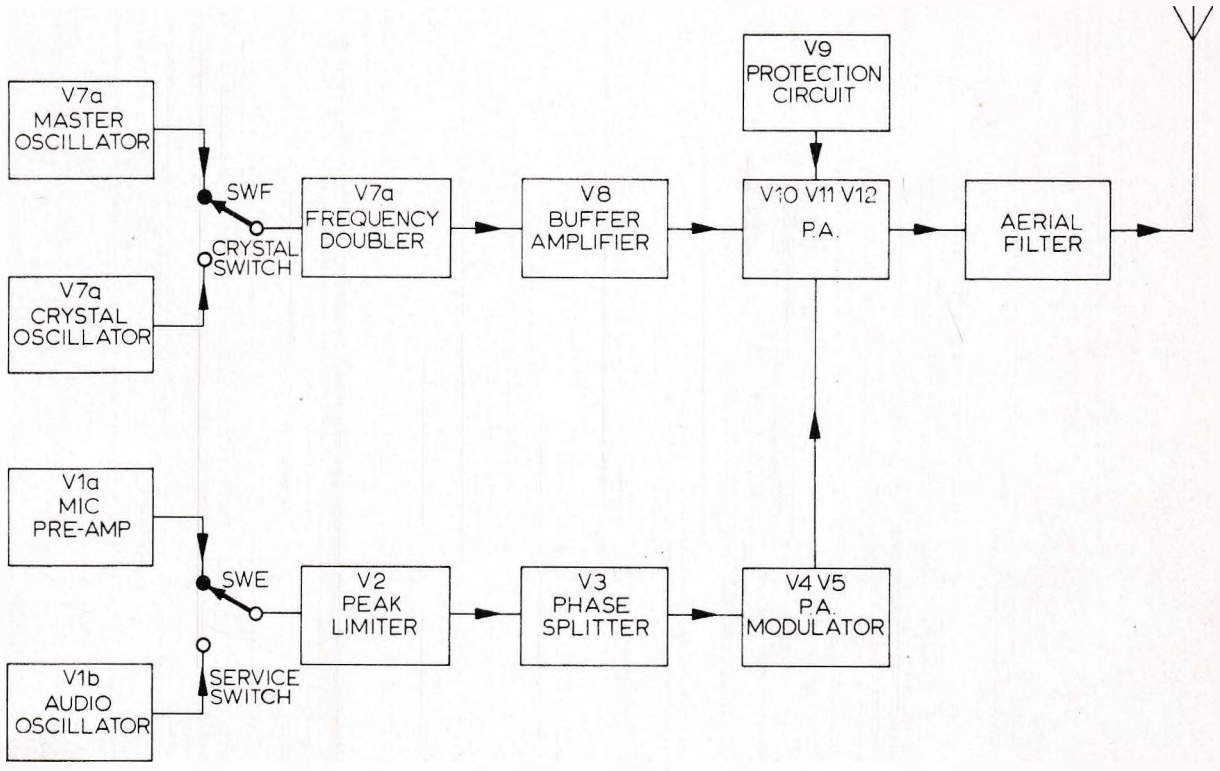

Fig.2.1 H.F. Transmitter Block Diagram

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.)

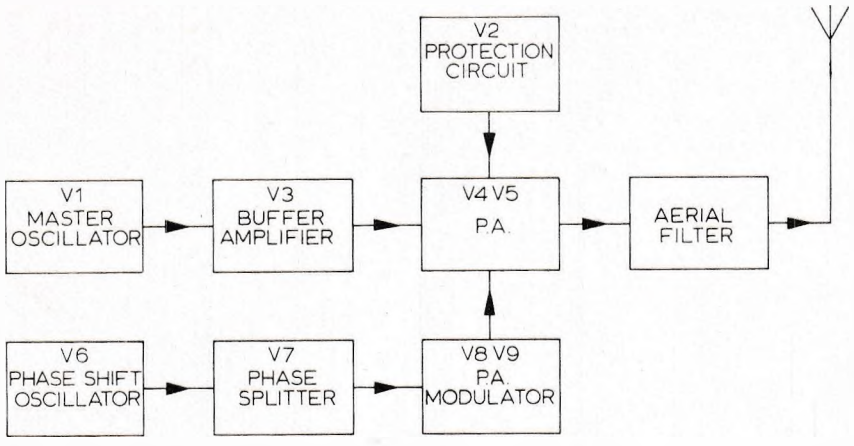

Fig.2.2 M.F. Transmitter Block Diagram

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.

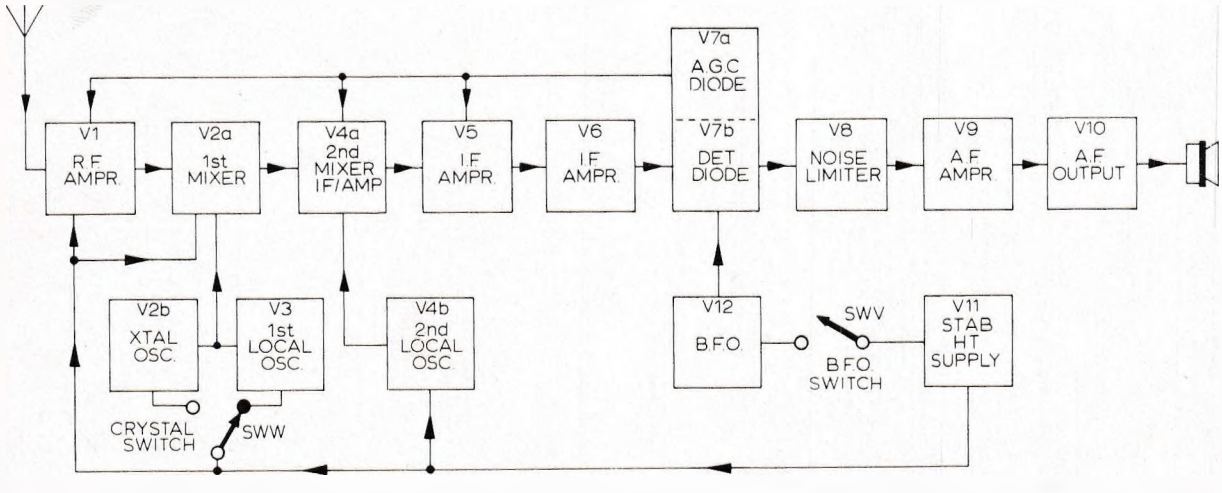

Fig.2.3 Receiver Block Diagram

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 appropriate transformer via the switch SWA. Either 20 rectifiers type CV7476, sixteen rectifiers type CV7476, or 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 3

DETAILED DESCRIPTION

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ILLUSTRATIONS

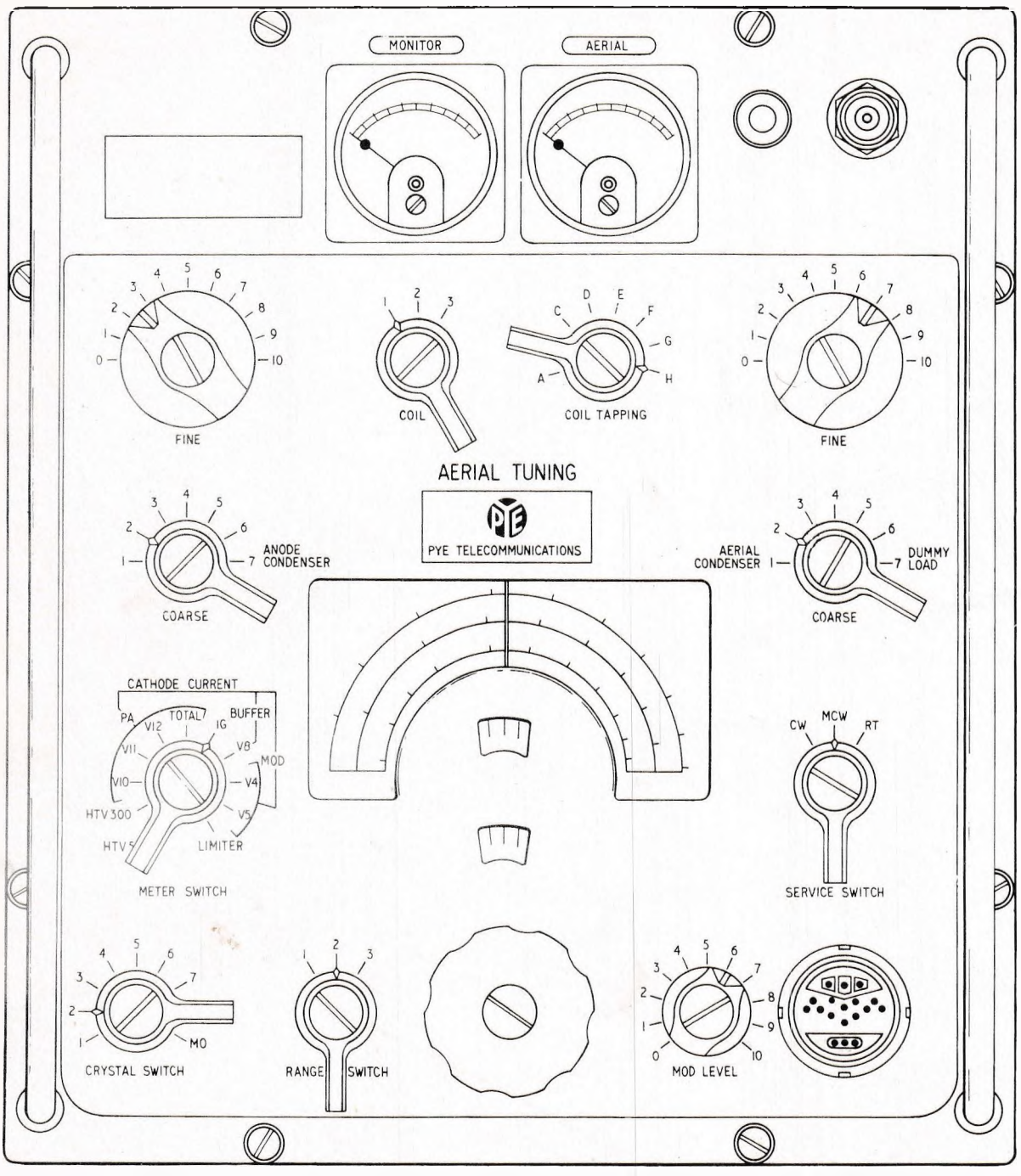

Fig. 3.1 H.F. Transmitter Front Panel Layout

CHAPTER 3

DETAILED CIRCUIT DESCRIPTION

H.F. TRANSMITTER

Valve Complement

1.	V1	Microphone pre-amp/audio oscillator	CV492	12AX7
	V2	Peak Limiter	CV140 or CV4025	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 pre-amplifier 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.

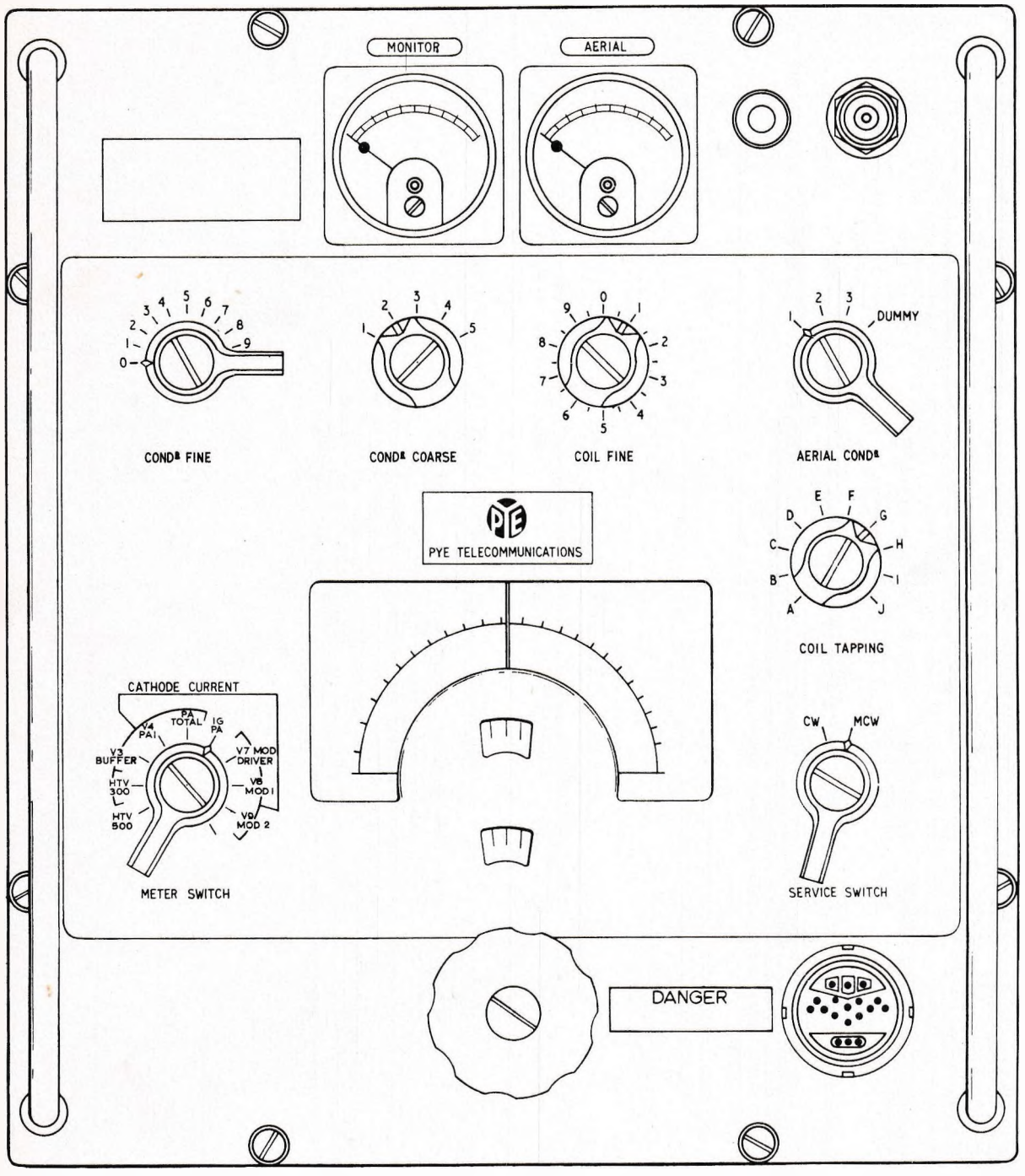

Fig. 3.2 M.F. Transmitter Front Panel Layout

M.F. TRANSMITTER (A.P. 100338)

33. The M.F. transmitter has a frequency range of 330 - 550 kc/s and is for C.W. or M.C.W. operation.

34. Valve Complement

V1	R.F. Oscillator	CV138	EF91
V2	Clamp Valve	CV2129 or CV4039	5763
V3	Buffer Amplifier	CV138	EF91
V4	R.F. Power Amplifier	CV428	5B/251M
V5	R.F. Power Amplifier	CV428	5B/251M
V6	Phase Shift Oscillator	CV138	EF91
V7	Phase Splitter	CV492	12AX7
V8	Modulator Power Amplifier	CV428	5B/251M
V9	Modulator Power Amplifier	CV428	5B/251M

R.F. Oscillator

35. The r.f. oscillator V1 functions as an electron coupled oscillator. The oscillator coil L2 is connected between the control grid of V1 and ground via C18 with a tapping taken to V1 cathode.

36. The oscillator circuit comprising L2, C13, C14, C16, C17 is tuned to the carrier frequency. Grid 2 of V1 acts as the oscillator anode and is at r.f. ground potential via C24, thereby isolating the oscillator section from the anode load R21. The oscillator output is coupled to the control grid of V3 by C23.

Keying

37. When the morse key is pressed, relay RLH/1 operates. Consequently contact RLH1 makes and breaks in sympathy with the morse key, thereby providing h.t. keying to the anode and grid 2 of V1.

Buffer Amplifier

38. The Buffer Amplifier V3 isolates the r.f. oscillator from the r.f. power output stage and also functions as a normal amplifying stage.

The r.f. choke L3 is the anode load of V3, the output from which is capacity coupled via C29 to the control grids of V4 and V5, the r.f. power amplifiers.

R.F. Power Amplifiers

39. V4 and V5, the r.f. power amplifiers, operate in parallel (Class C). The anode voltage of V4 and V5 is derived from the 500 volt d.c. supply via R55/R46 the p.a. choke L4 and the modulation transformer TR1. The anode and screen supply is therefore modulated when the transmitter operates in M.C.W. working.

40. Positive bias is applied to the cathodes of V4 and V5 via R54 and R56 whilst a high negative potential is applied to the control grids, due to grid current flowing.

41. Parasitic stoppers are fitted in the anode, grid 2 and cathode leads, the last of these also providing self bias. The grid 2 voltages of V4 and V5 are held at the same potential as the anode voltage of the clamp valve V2.

Protection Circuit

42. Open circuiting, short circuiting or detuning of the transmitter load will cause excessive current to flow through V4 and V5. To prevent damage to the power amplifiers, which would result from these conditions, the clamp valve V2 limits the grid 2 voltage of the r.f. power amplifiers V4 and V5.

43. A rise in the cathode current flowing through V4 and V5 drives the control grid of V2 positive. Heavy current then flows through V2, which reduces the anode voltage of V2 and consequently the grid 2 voltages of V4 and V5. With the grid 2 voltages reduced, the current flowing through V4 and V5 is limited and damage to the r.f. power amplifiers prevented.

44. The pre-set control RV48 sets the operating level of the protection circuit whereby the control grid voltage of V2 should be slightly negative. This control grid voltage is obtained from the -ve 50 volt bias supply via R37, R28 and from the positive cathode bias of V4 and V5 via R47 and the pre-set control RV48.

45. When the transmitter is idling, without the morse key being operated, further protection to the r.f. power amplifier valves is afforded by relay contact RLH1, which switches in an additional positive voltage to the control grid of V2 via R36. This will increase the current flowing through V2, decrease the V2 anode voltage, decrease the grid 2 voltage on V4 and V5 and consequently reduce the current flowing through V4 and V5.

Aerial Matching Unit

46. The output from V4 and V5 is fed via C34 to the aerial matching unit and the effective load should be 1.5kΩ approximately.

47. With reference to Fig. 4, it is seen that the tuned circuit comprising the three variables L5 - L6 in series with C35 and C36 - 43, is in parallel with the aerial and trunk impedances.

The Modulator Circuit

48. The modulator circuit is switched in when the SERVICE switch SWP is at M.C.W. the grid 2 supply to V6, V8 and V9 being switched into circuit.

Phase Shift Oscillator

49. The resistance-capacity network between anode and grid of V6 provides a phase shift of 180° at 1000 c/s. V6 oscillates at this frequency and a portion of this audio oscillation is fed to the resistance network comprising R10, RV11 and R12 via C47. The audio oscillation is then fed from the slider of RV11 to the control grid of V7a via C15.

Phase Splitter

50. V7 functions as a phase splitter. V7b control grid is held at audio ground potential by C21 and the voltage at both cathodes is half the control grid voltage applied to V7a. The outputs from V7a and V7b, which are equal but in opposite phase, are fed to the output stage via C19 and C20.

Power Amplifier

51. In the output stage V8 and V9 are connected in push-pull (Class AB1) and the output is fed to the modulation transformer TR1 (primary). The carrier is modulated as the h.t. supply to the power amplifier anodes is in circuit through the secondary of TR1.

Relays

52. The two relays incorporated in the transmitter are RLH/1, the keying relay, and RLJ/2 the aerial changeover relay. Both relays operate when the morse key is pressed.

53. Relay RLH/1 operates and contact RLH1 completes the h.t. supply circuit to the master oscillator V1. Contact RLH1 also changes the value of the control grid bias of V2, the clamp valve, by switching out R36. With the key not pressed, the additional positive voltage applied to the clamp valve V2 reduces the grid 2 voltage to the power amplifiers and consequently the current flowing through V4 and V5.

54. RLJ/2 operates and changes over the aerial connection from the receiver input to the M.F. transmitter output.

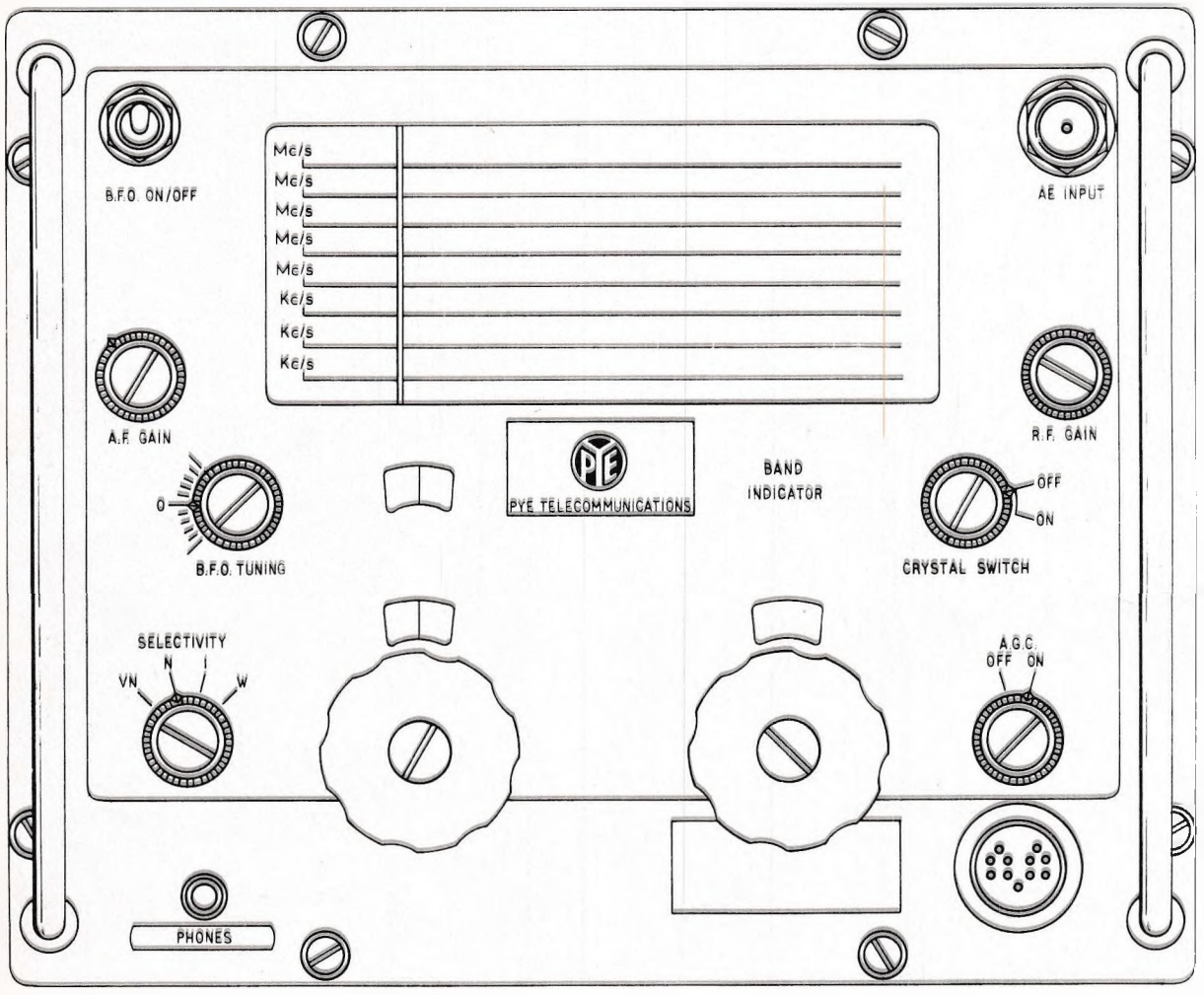

Fig. 3.3 Receiver Front Panel Layout

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

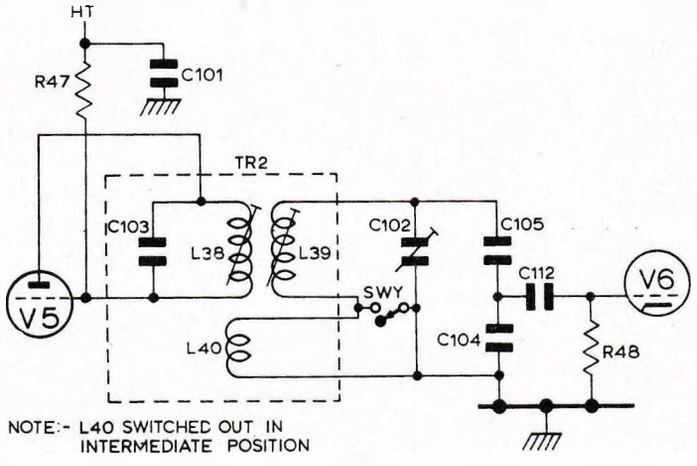

Fig.3.4 Receiver I.F. Selectivity. Wide and Intermediate

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

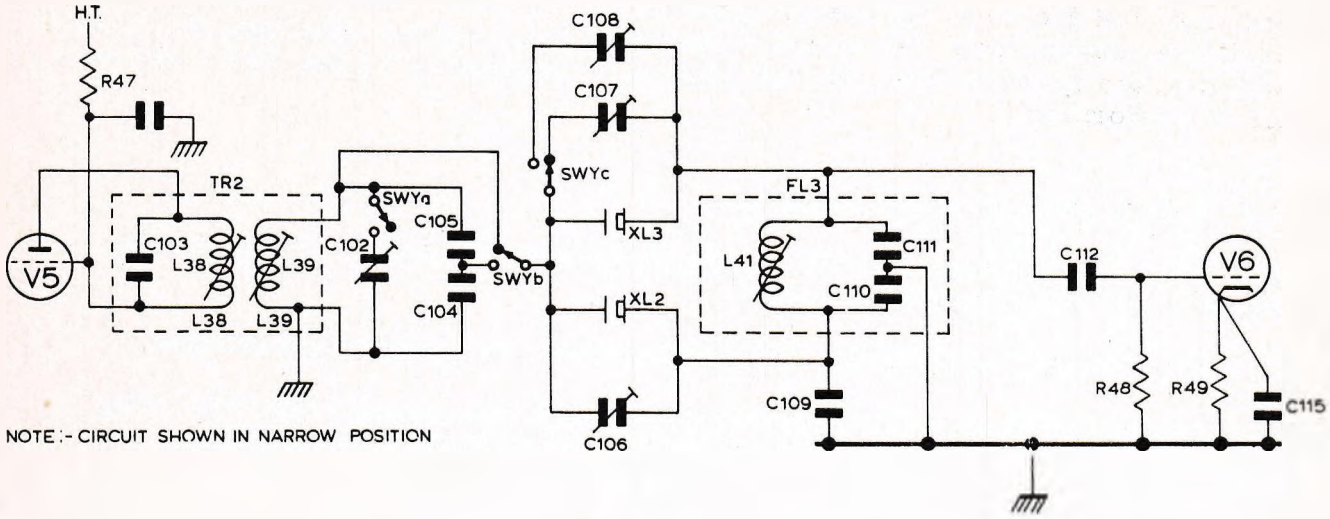

Fig.3.5 Receiver I.F. Selectivity. Narrow and Very Narrow

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 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.

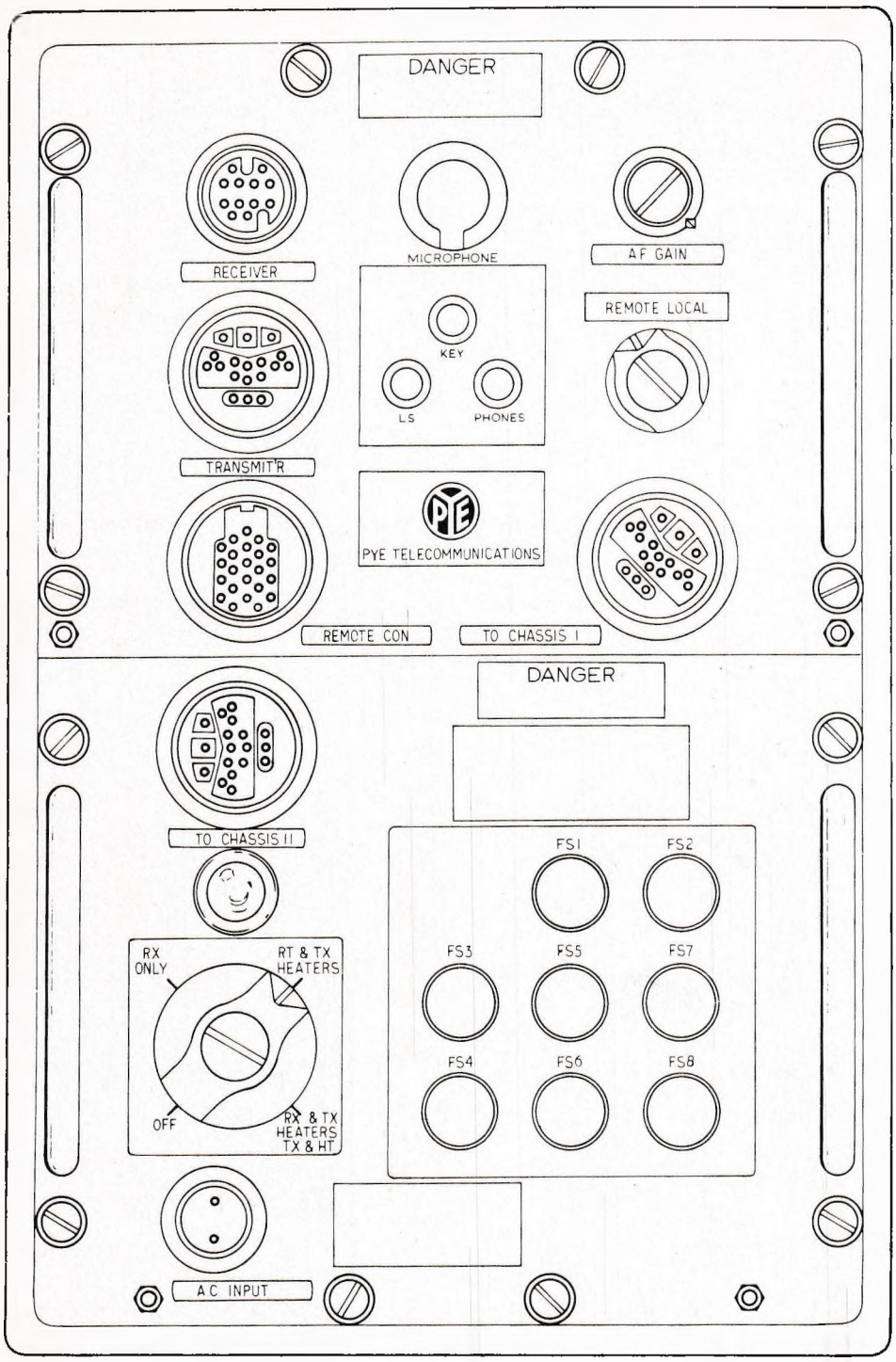

Fig. 3.6 P.S.U. Front Panel Layout (A.P. 399015)

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*	MR17*	MR3	MR13		Transmitter h.t. (500V)
MR18*	MR20*	MR4	MR14		
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	
250	A1	D2	D1 to A2	

TABLE 1

96. The available a.c. supply is fed via PL.A 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.

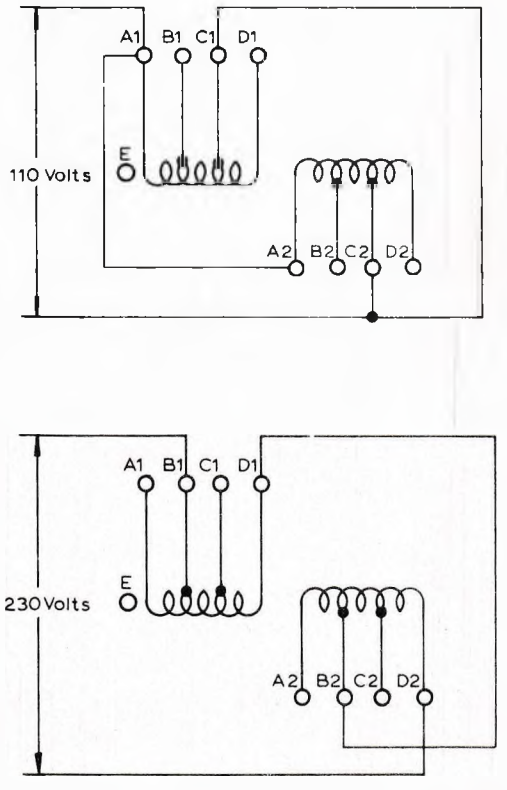

Fig. 3.7 A.C. Supply Connections

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. 100340A 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.

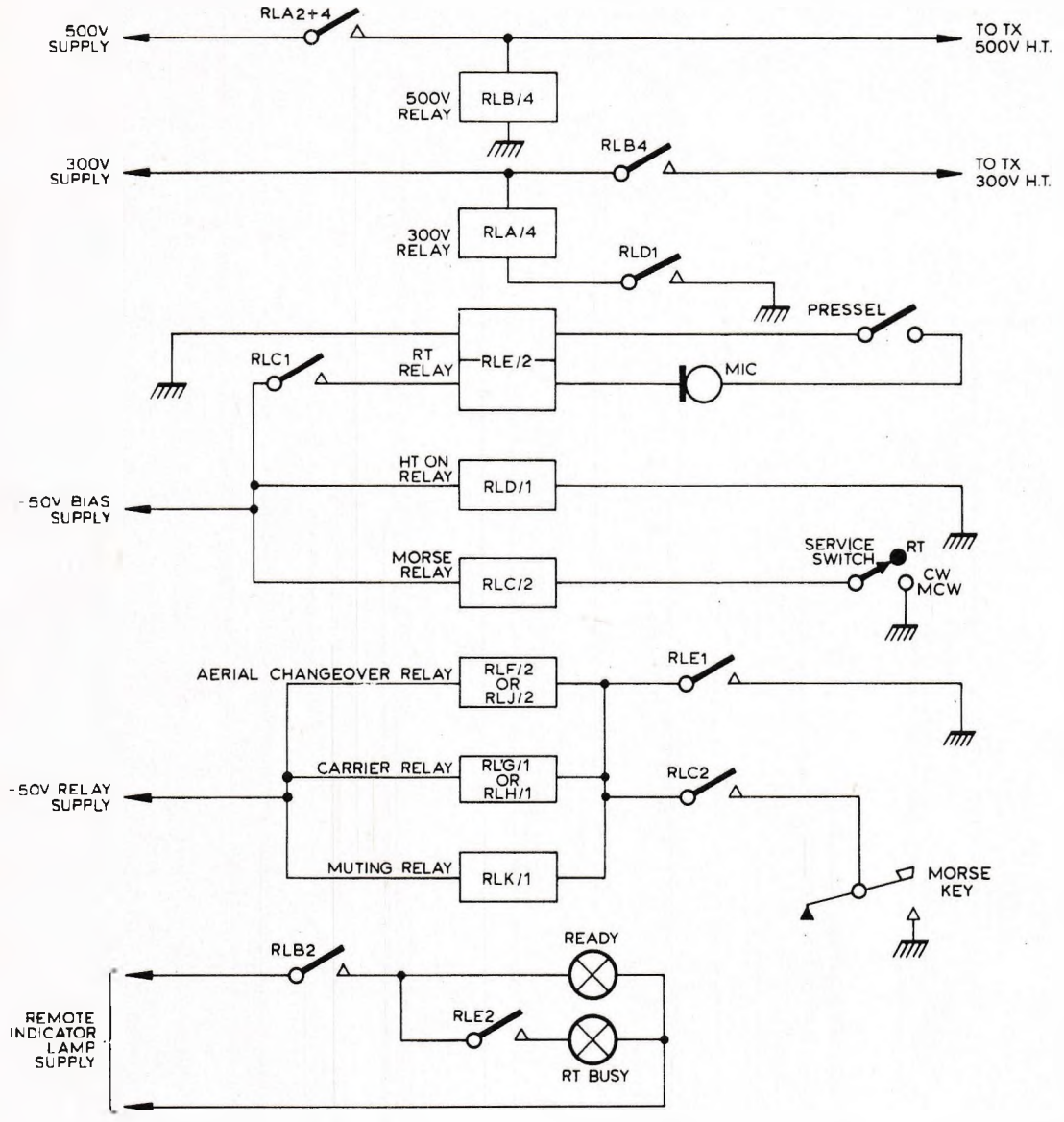

Fig. 3.8 Relay Operations

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

INSTALLATION

CONTENTS LIST

ILLUSTRATIONS

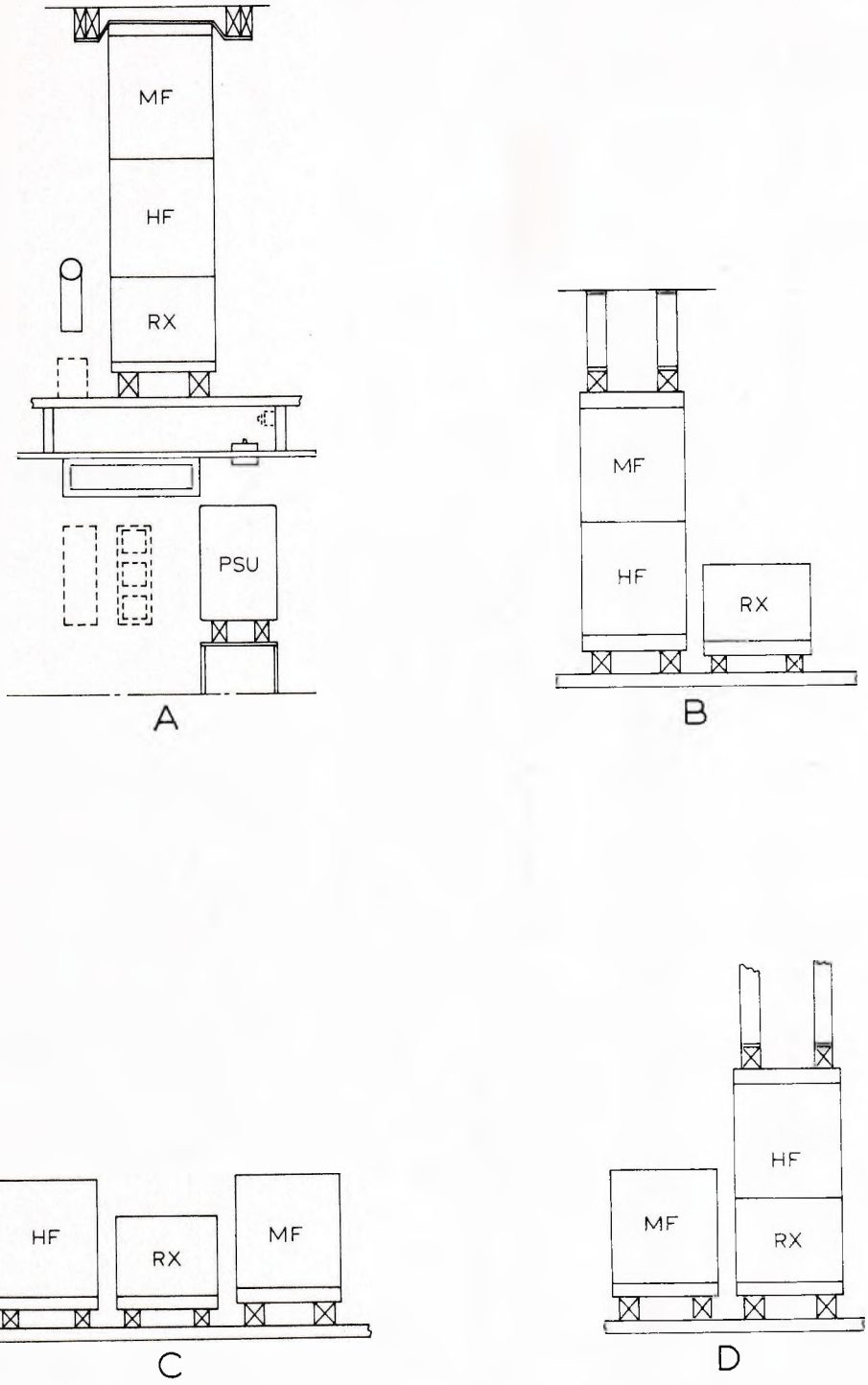

Fig. 4.1 Installation Diagram

CHAPTER 4

INSTALLATION

1. Prior to the commencement of installation, withdraw units from their cabinets after releasing the front panel securing screws. Visually check each unit, ensuring that all valves and crystals are firmly seated.

2. With reference to the Power Supply Voltage Adjustment table (see Power Supply Unit) ensure that the soldered connections to TR1, TR2 and TR3 correspond with the available supply voltage.

3. Re-assemble units and with reference to Fig. 4. 1 arrange the required installation in the following manner, noting that the P. S. U. is installed below bench top level in B, C and D (as shown in A).

Stack Mounting

4. Place equipment in two or three unit stack, as required, and unscrew the bolts securing the tie bars. The tie bars are located in the two vertical recessed channels on each side of both transmitters. Slide down the bars into channel of equipment immediately below. Replace the securing bolts and tighten. The stack should now be strapped together and completely rigid.

Ship Mounting

5. Seaborne equipment must be provided with anti-shock mountings and four mountings are fitted at the base of each stack or separate unit. The type of anti-shock mounting is governed by the weight of the stack or unit and after determining the type of stack (see Fig. 4. 1) reference to the Articles required for Installation will show the correct mountings to be employed. Special mounting channel assemblies are fitted to the base of the lowest mountings. The Power Supply Unit is the only unit with direct fitting of anti-shock mountings. The mounting channel assemblies are bolted to the base of the appropriate unit, across the front and the rear.

6. To prevent cabinet distortion, fit channel assemblies in the following manner. Leave securing bolts slack and then fit anti-shock mountings. Tighten up bolts securing anti-shock mountings and then tighten up bolts securing channel assemblies.

Top Staying

7. Where the height of the stack exceeds its base dimension on seaborne equipment, top staying must be fitted.

8. Channel assemblies are fitted to the recessed channels, across the top unit at front and rear with securing bolts left slack. Anti-shock mountings are then fitted to the channel assemblies and the bolts tightened. Finally tighten the bolts securing the channel assemblies. The top staying is adjusted to give rigidity but care must be taken to avoid cabinet distortion by over-tightening.

Aerial

9. The location of the installation will determine the type and size of aerial used, but a T or inverted L wire aerial up to 150 ft maximum length is preferred. Alternatively, space limitations may necessitate the use of a whip aerial which should be at least 20 ft.

Installation Procedure

10. With the voltage tappings on the mains transformers TR1, TR2, and TR3 in the Power Supply Unit correctly adjusted to match the available a.c. supply, carry out the following procedure:-

1. Check that all fuses are fitted and correctly rated in accordance with the reversible label on the front panel of the P.S.U.
2. Fit the following interconnecting cables.

   (1) The Chassis 1 and Chassis 2 Power Supply Unit interconnecting cable which is Connection Flexible 5".

   (2) The Power Supply Unit to Receiver interconnecting cable, Connection Flexible 8' from socket SKE on Chassis 2 to 12 way plug PLN on receiver.

   (3) The Power Supply Unit to Transmitter cable. Connection Flexible 8' from socket SKG on Chassis 2 to 18 way plug PLH on H.F. transmitter (or Plug PLK on M.F. transmitter).

   (4) Insert the blanking off plug into Remote Control Socket SKC on Chassis 2 of Power Supply Unit, if local control is to be employed or fit Connection Flexible 10' from the Equipment Junction Box into Remote Control socket SKC if remote control is to be employed.

   (5) Insert microphone plug into socket SKF on Chassis 2 of Power Supply Unit.

   Insert morse key, phones and/or loudspeaker jack plugs into appropriate jack sockets on Chassis 2.

   (6) Connect coaxial link from the receiver aerial input to the coaxial plug of the transmitter to be used.

   (7) Connect aerial to appropriate transmitter aerial terminal.

   (8) With the main a.c. supply switch at OFF connect the a.c. supply to the a.c. input plug on Chassis 1 of Power Supply Unit using connection Flexible 10'.

SEE

A3 DIAGRAMS

CHAP 4 – 4_2

SEE

A3 DIAGRAMS

CHAP 4 – 4_2A

SEE

A3 DIAGRAMS

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PART 2

MAINTENANCE

CONTENTS LIST

PART 2

CHAPTER 1

CONTENTS LIST

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 possib le 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 over-loading 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 t ransmission.

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).

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 LP1 should light.

(3) Rotate main a.c. supply switch to RX ONLY. Check that LP1 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

SERVICING

CONTENTS LIST

ILLUSTRATIONS

CHAPTER 3

SERVICING

DISMANTLING PROCEDURE

1. (1) Remove all interconnecting cables, a.c. supply lead and aerial.

(2) Each unit may be withdrawn from its cabinet after releasing the captive chrome headed front panel screws of the appropriate unit. The Power Supply Unit comprises two separate units, mounted in a single cabinet.

(3) Although the H.T. and M.F. transmitter cabinets are of identical size, they are not interchangeable. Both cabinets are clearly marked to avoid incorrect installation which would result in reduced power output from the M.F. transmitter due to eddy current losses.

Slow Motion Drives

2. Both transmitters employ the same type of geared slow motion drive with a reduction ratio of 36 to 1.

3. The receiver employs a slow motion drive with a reduction ratio of 48 to 1 and the indicator is driven by a nylon cord.

Replacing the receiver nylon drive cord

4. When it is necessary to replace the receiver nylon drive cord the following procedure should be employed:-

(1) With all controls fully counterclockwise remove control knobs and metal housings.

(2) Remove the aerial input plug PLM.

(3) Remove AF gain control RV42.

(4) Remove the B.F.O. ON/OFF switch and A.G.C. ON/OFF switch.

(5) Remove the MUTE control RV15.

(6) Remove the seven screws securing the escutcheon to the front panel.

(7) Remove escutcheon. Slacken grub screws on tuning capacitor rotor spindle.

(8) Remove twelve screws securing front panel to chassis.

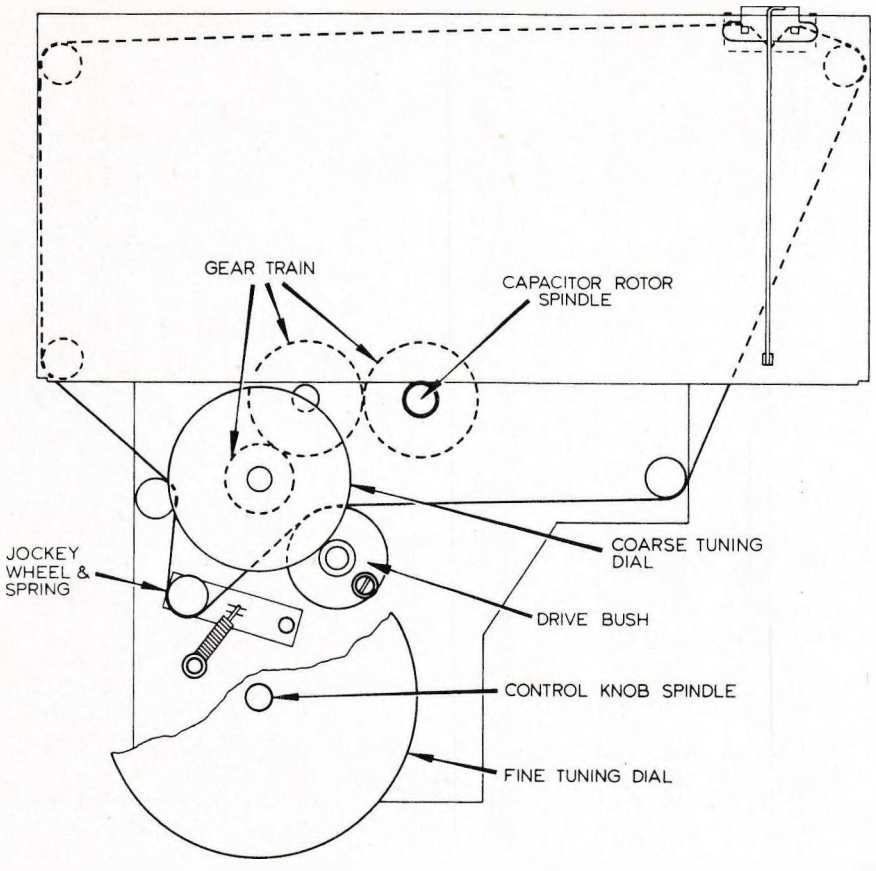


Fig.2.3.1 Receiver Drive Cord Replacement

(9) Remove the PHONES escutcheon.

(10) Remove two screws securing jack JKE and filter FL4, rotate 90° and draw clear of front panel.

(11) Remove Plug PLN and Filter FL5 (see para 5).

(12) Remove front panel and drive assembly.

(13) Remove five screws securing drive assembly to front panel and separate.

(14) Remove the fine logging dial which is secured by pin and grubscrew.

(15) Remove the coarse logging dial which is secured by circlip.

(16) Remove drive bush which is secured by pin and grubscrew.

(17) Remove old drive cord.

(18) Seal end of replacement drive cord, tie securing knot and thread through the rear hole in the drive bush.

(19) With the drive fully counterclockwise, fit drive bush onto spindle, with holes exactly at top centre and secure.

(20) Wind drive cord 3 times counterclockwise around drive bush and then round the pulley train back to the drive bush (Fig.2.3.1).

(21) Wind one turn counterclockwise and thread through the front hole in the drive bush. Seal end of cord and pulling cord tight enough to tension the jockey wheel spring, secure under the retaining screw and washer.

(22) Replace coarse and fine logging dials with zero positions at top centre. Fit drive assembly to front panel. Adjust scale indicator by sliding carriage along cord to extreme left hand side. Align at zero with logging dials.

(23) Replace remaining components in reverse order.

Filter FL5 and Supply plug PLN

5. This filter and supply plug are secured to each other and must be removed together as follows:-

(1) Carefully remove the eight connections to the eight feedthrough capacitors at the rear of the filter.

(2) Unscrew the nut securing the supply plug.

(3) Carefully remove filter and plug from the front panel.

NOTE

(a) Care must be taken not to fracture the brittle ceramic feed-through capacitors.

(b) If sufficient clearance is not obtained to permit easy withdrawal of filter and plug, slacken off the nuts securing the oscillator coil assembly to the chassis. Tilt the filter and supply plug assembly and remove.

Lubrication of Slow Motion Drives

6. All gear trains should be lightly oiled with Oil OM-13 (A.P. E9/4422). Excessive lubrication should be avoided.

ROUTINE MAINTENANCE PROCEDURE

SERVICE CHECKS

Field Procedure

7. (1) Disconnect all interconnecting cables and aerial and remove units from cabinets.

(2) Carry out a physical inspection for obvious defects, taking care not to disturb unit components.

(3) Check all interconnecting cables and plug and socket connections for wear and replace if necessary.

(4) Check that all valves and crystals are firmly seated.

(5) Check that power transformer tappings correspond with the available a.c. supply voltage. (see SUPPLY VOLTAGE ADJUSTMENTS Table 1)

(6) Check aerial installation (where applicable).

(7) Replace units in cabinets and reconnect aerial and all interconnecting cables as detailed in the INSTALLATION instructions.

(8) Check stack installation for rigidity. Ensure that all securing bolts are tight and that the shock proof mountings are firmly secured.

(9) Carefully carry out the Operating Instructions checking all controls and relay operations.

(10) Check the power output of the M.F. transmitter as described in Performance Checks.

(11) Check the power output of the H.F. transmitter as described in Performance Checks.

(12) Check the sensitivity of the receiver as in Performance Checks.

PERFORMANCE CHECKS

8. The following Performance Checks and Alignment Procedure are intended for Base Station maintenance.

9. The purpose of these instructions is to bring the equipment up to full specification.

TEST EQUIPMENT REQUIRED

10.

(1)	Wavemeter	G92	A.P.53059	
(2)	Oscilloscope	CT436	6625-99-914-2605	
(3)	Signal Generator A.F.	CT433	6625-99-943-4059	
(4)	Resistor Fixed Film		5905-99-519-6909	1 No.
	Clip Mounting for Resistors		5905-99-011-9869	2 No.
(5)	Wattmeter A.F.	CT44	6625-99-949-0510	
(6)	Avo 8 SX		6625-99-943-1524	
(7)	Signal Generator R.F.	CT452	6625-99-972-7357	
(8)	Attenuator Fixed 20 dB 50 ohm		5905-99-580-0510	

(9) Frequency Swept Oscillator XT381 or equivalent (if available)

H.F. TRANSMITTER PERFORMANCE CHECKS

Dial Calibration

11. (1) Check that the frequency radiated is within ± 1% of dial indication at the following frequencies:-

Range 1 1.5 Mc/s and 3.3 Mc/s

Range 2 3.3 Mc/s and 7.3 Mc/s

Range 3 7.3 Mc/s and 16 Mc/s

Plus any two intermediate readings on each range and any fixed frequencies employed (crystal controlled).

(2) SET AERIAL CONDENSER COARSE at DUMMY LOAD.

(3) SET CRYSTAL Switch at MO. or 1-8, as appropriate for checking fixed frequencies.

(4) Short circuit SKC NU and L all to chassis.

(5) Couple wavemeter to the junction of L24 and L25 via a suitable capacitor. Check calibration at stated frequencies.

Power Output

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

(2) Set SERVICE Switch at C.W.

(3) Connect 50 ohm load resistor (519-6909) between aerial terminal and chassis.

(4) Set Valve Voltmeter CT54 to the 48 volt range and connect the probe directly across the 50 ohm load resistor.

(5) Short circuit SKC NU and L all to chassis.

(6) Load the transmitter at the following frequencies and note the voltage reading. Typical readings and power output are shown below:-

	Freq. Mc/s	Meter Reading			Power Output Watts
		Monitor	Aerial	CT54	
Range 1	1.5	300	30	39	30
	2.0	270	130	40	32
	2.5	280	130	41	35
	3.3	320	160	42	35
Range 2	3.3	250	140	39	30
	4.5	240	210	39	30
	7.3	300	250	40	32
Range 3	7.3	240	90	38	29
	10	290	140	38	29
	16	320	90	37	27

NOTE Brackets can be soldered on to the resistor clips as shown in Fig. 2.3.2 to facilitate connecting the dummy load resistor to the transmitter aerial and earth terminals.

Modulation Depth (M.C.W.)

13. (1) Set SERVICE switch at C.W.

(2) Set CRYSTAL switch at M.O.

(3) Short circuit V2a and V2b cathodes

(4) Connect the Dummy Load Resistor between the aerial terminal and chassis

(5) Short circuit SKC, NU and L all to chassis

(6) Couple oscilloscope to dummy load

(7) Load transmitter at 2 Mc/s

(8) Move SERVICE switch to M.C.W. and check that the depth of modulation is 75 - 95%.

Oscillator Frequency (M.C.W.)

14. (1) After checking the depth of modulation check the M.C.W. oscillator frequency.

(2) Connect A.F. signal generator and check that oscillator frequency is between 800 - 1200 c/s.

Audio Gain

15. (1) Set SERVICE switch at C.W.

(2) Set CRYSTAL switch at M.O.

(3) Short circuit SKC NU and L all to chassis

(4) Short circuit V2a and V2b cathodes

(5) Connect r.f. power output meter between aerial and chassis

(6) Couple oscilloscope to dummy load and load the transmitter at 2 Mc/s

(7) Connect A.F. signal generator 600Ω output between PLH-R and chassis, with A.F. signal generator output set at 0.135V at 400 c/s

(8) Set MOD LEVEL control to maximum

(9) Move SERVICE switch to R/T and check that depth of modulation is greater than 90%.

Frequency Response

16. (1) After checking the depth of modulation check that the frequency response is flat within 4db at 250 c/s, 1000 c/s and 2500 c/s relative to 400 c/s.

(2) Also check that response at 3500 c/s and 5000 c/s is not greater than -18db and -39db respectively relative to the peak response.

Control Circuits

17. With all shorting links removed, check operation of local and/or remote control circuits for microphone, keying and headphone operation.

Keying

18. At 40 w.p.m. the received signal should be intelligable.

Fixed Frequency

19. Check the transmitter for correct operation at all crystal controlled frequencies.

Dummy Load

20. (1) Set AERIAL CONDENSER COARSE at DUMMY LOAD

(2) Short circuit SKC NU and L to chassis

(3) Load the transmitter at the following frequencies and check that the Total P.A. Cathode current and aerial meter readings are approximate to typical readings appended (C.W.).

		P.A. TOTAL	AERIAL METER
Range 1	2 Mc/s	315-390	250-350
Range 2	4.5 Mc/s	310-380	250-350
Range 3	10 Mc/s	320-380	100-180

M.F. TRANSMITTER PERFORMANCE CHECKS

21. With the interconnecting supply cable between the Power Supply Unit and H.F. transmitter connected:-

(1) Set SERVICE switch at C.W.

(2) Short circuit SKC NU and L all to chassis

(3) Connect r.f. power output meter in series with a 70pF capacitor to the aerial and earth connections with the r.f. power output meter at the earth connection.

(4) Load transmitter at frequencies listed and check that power output is at least as great as that quoted in appended table.

300 kc/s	9 watts
350 kc/s	10 watts
400 kc/s	12 watts
450 kc/s	13 watts
500 kc/s	14 watts
550 kc/s	14 watts

Oscillator Frequency (M. C. W.)

22. With the r.f. power output meter and SKC shorting links still connected:-

(1) Couple oscilloscope to transmitter load

(2) Set up transmitter at any convenient frequency

(3) Set SERVICE switch at M. C. W.

(4) Using the A. F. signal generator check that the M. C. W. oscillator frequency is within the limits 800 - 1200 c/s.

(5) Set modulation preset control to maximum and check that depth of modulation is at least 60%.

Keying

23. With the transmitter keyed at 40 w. p. m. check that the received signal is intelligible.

RECEIVER PERFORMANCE CHECKS

24. Check resistance to chassis from:-

(a) PLN (E) the receiver h.t. supply input.

With the R. F. GAIN control at minimum the resistance should be 14. 5kΩ approx.

(b) V11 anode, the stabilised h.t. line.

This resistance should be 16. 7kΩ.

Dummy Aerial

25. For the following procedures, the dummy aerial for test purposes should be:-

(a) Below 4 Mc/s. The 10Ω non-inductive resistor in series with a capacitor in the range 100 - 600pF.

(b) Above 4 Mc/s. The 75Ω non-inductive resistor.

Audio Gain

26. Connect the Power Supply Unit to the Receiver and the available a.c. supply to the Power Supply Unit.

(1) Set the A.F. GAIN control at maximum

(2) Connect output meter (100Ω) to headphone jack socket

(3) Inject a 400 c/s audio signal at the junction of RV42 and C98. Adjust the audio signal input voltage to give 60mW output.

(4) Check that the input is 18db (±2) down relative to a 10V reference level. Remove audio signal.

Last I.F. and Output Stages

27. With the A.F. GAIN at maximum and the output meter (100Ω) still connected to the headphone jack socket inject a 460 kc/s signal modulated 30% at 400 c/s into the control grid of V6. Adjust the signal input voltage to give 60mW output. Check that the voltage is 500mV ±2db.

Audio Frequency Response

28. (1) After checking the last i.f. and output stages vary the modulating frequency over the range 100 - 2500 c/s, maintaining the modulation depth at 30%.

(2) Check that the output is sustained within the limits 60mW ±8db.

Output Variation with Change in Load impedance

29. (1) With the A.F. GAIN at maximum and the output meter (100Ω) connected to the headphone jack socket, inject a 460 kc/s signal modulated 30% at 400 c/s into the control grid of V6.

(2) Increase the output meter load impedance to 20kΩ and check that the reduced output does not exceed 0.35mW.

(3) Transfer the output meter (20kΩ load impedance) to the L.S. jack socket and check that the output does not exceed 75 mW.

I.F. Sensitivity and Response

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

(2) Set CRYSTAL switch at OFF

(3) Set A.F. GAIN control at maximum

(4) Set R.F. GAIN control at maximum

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

(6) Connect Avo 8 (set at 0-50μA) between R52 and chassis.

(7) With reference to the appended table, in para 31, inject a 460 kc/s or 1.4 Mc/s unmodulated signal into the control grid of V2 and adjust the signal input voltage for a diode current of 16μA.

31. Check that the I.F. sensitivity is within limits when the range switch, selectivity switch and injected signal frequency are as stated.

Signal Freq.	Receiver Range	I.F. Sensitivity. Max db above 1μV			
		Wide	Intermediate	Narrow	Very Narrow
460 kc/s	4	16	12	17.5	18
1.4 Mc/s	3	22.5	18	25	27.5

TABLE 4

32. Check the i.f. bandwidth as follows:-

(1) Increase the signal input to V2 control grid by (a) 6db (b) 30db and (c) 60db above that required for mid band response as shown in the appended table and vary the signal input frequency to obtain diode readings of 16μA on either side of the intermediate frequency.

(2) Note the variation in frequency (bandwidth) which should be within the following limits when the range switch, signal frequency and selectivity switch positions are as stated.

Signal Frequency		460 kc/s				1.4 Mc/s	
Selectivity		W	I	N	VN	W	I
Bandwidth in kc/s between points on response curves worse than mid-band response by:-	6dB	6 MIN	4 MIN	0.95 MIN	0.7 MIN	8 MIN	4.6 MIN
	30dB				1.5 MAX		
	60dB	21.0 MAX	16.5 MAX	11.0 MAX	10.5 MAX	26.0 MAX	21.0 MAX

TABLE 5

B.F.O.

33. With SELECTIVITY switch at N and Avo 8 (0-50μA) connected between R52 and chassis.

(1) Set B.F.O. switch at ON

(2) Inject a 460 kc/s unmodulated signal into the control grid of V4a. Adjust the signal input voltage for a convenient diode current reading.

(3) Check that the diode current reading is at minimum when the B.F.O. tuning control is at mid position

(4) Remove the 460 kc/s signal and check that the diode current reading due to B.F.O. injection is 55μA ±10%.

RECEIVER SENSITIVITY

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

(2) Set CRYSTAL switch at OFF

(3) Set A.F. GAIN control at maximum

(4) Set R.F. GAIN control at maximum

(5) Connect output meter (100Ω load impedance) into headphone jack socket.

(6) With reference to the appended table 6 set range, frequency and selectivity to appropriate setting.

M.C.W.

35. (1) Inject an r.f. signal at the selected frequency modulated 30% at 400 c/s into the receiver via the appropriate dummy aerial (see DUMMY AERIAL para. 25) and then adjust the voltage to give an output reading of 60mW.

(2) Check the M.C.W. sensitivity figures against figures quoted in Table 6.

(3) Remove modulated r.f. signal.

C.W.

36. (1) Set B.F.O. switch at ON.

(2) Inject an unmodulated r.f. signal at the stated frequencies and by adjusting the signal input voltage and B.F.O. tuning control obtain an output reading of 60mW.

(3) Check the sensitivity in db/μV against figures quoted in Table 6.

RANGE	FREQUENCY	SELECTIVITY	SENSITIVITY db Above 1 μV input	
			M.C.W.	C.W.
1	60 kc/s	N	-	10
1	120 kc/s	N	-	10
2	105 kc/s	N	-	20
2	204 kc/s	I	20	20
3	270 kc/s	I	30	20
3	630 kc/s	I	30	20
4	710 kc/s	I	20	10
4	1.48 Mc/s	I	20	10
5	1.62 Mc/s	W	20	10
5	3.3 Mc/s	W	20	10
6	3.6 Mc/s	W	28	18
6	* 7.0 Mc/s	W	20	10
7	7.4 Mc/s	W	26	16
7	14.7 Mc/s	W	26	16
8	15.7 Mc/s	W	36	26
8	30.7 Mc/s	W	30	20

TABLE 6

*Change Dummy aerial for frequency greater than 4 Mc/s (75 ohm).

Image Ratio

37. Inject the appropriate image frequency as shown in the following Table 7. Adjust the signal input and B.F.O. tuning control to obtain an output of 60mW. Check that the image ratio at each frequency is with the limits given in Table 7.

RANGE	FREQUENCY	IMAGE FREQUENCY Mc/s	IMAGE RATIO	I.F. BREAKTHROUGH	
				460 kc/s	1.4 Mc/s
			LIMIT (minimum in db)	LIMIT (minimum in db)	LIMIT (minimum in db)
1	60 kc/s	0.98	90	90	
1	120 kc/s	1.04	85	90	
2	105 kc/s	1.025	90	90	
2	240 kc/s	1.16	83	85	
3	270 kc/s	3.07	90	90	90
3	630 kc/s	3.43	87	90	75
4	710 kc/s	1.63	87	85	
4	1480 kc/s	2.4	68	90	
5	1.62 Mc/s	2.54	73	85	
5	3.3 Mc/s	4.22	55	85	
6	3.6 Mc/s	6.4	75	90	90
6	7.0 Mc/s	9.8	61	90	90
7	7.4 Mc/s	10.2	65	90	90
7	14.7 Mc/s	17.5	48	90	90
8	15.7 Mc/s	18.5	55	90	90
8	27.2 Mc/s	33.5	34	90	90

TABLE 7

I.F. Rejection

38. Inject a signal at the appropriate i.f. frequency and adjust the signal input and B.F.O. tuning control to obtain an output of 60mW. Check that the i.f. breakthrough is within the limits given in Table 7.

Signal-to-noise Ratio

39. Equipment

(1) Signal Generator Type CT452
Wattmeter Absorption Type CT44
Attenuator Fixed 20 dB 50 ohm 5905-99-580-0510
R.F. Lead (see Note)
A.F. Lead (see Note).

NOTE The construction of the R.F. Lead is as follows:

Coaxial Cable UR70
BNC Plug
Burndept Plug.

The A.F. Lead can be a Cable Assembly 5995-99-972-6016 or can be made up from a Plug Telephone 5935-99-940-1759.

40. Procedure

(1) Set the controls as follows:

A.F. Gain	-	Adjust as required	
R.F. Gain	-	Adjust as required	
AGC	-	OFF	
CRYSTAL	-	OFF	
BFO	-	ON	
SELECTIVITY	-	Range 1 and 2	N
		Range 3 to 8	I.

(2) Connect the R.F. output of the Signal Generator via the R.F. lead and the 20 dB Fixed Attenuator to the Aerial Input of the Rx. Set the Signal Generator to 60 kHz, 100 µV.

(3) Connect the wattmeter via the A.F. lead to the Loudspeaker socket on the Rx and set the wattmeter to 300 ohm on the 20 mWatt range.

(4) Tune the receiver for maximum reading on the wattmeter and with the audio gain control set the meter reading +10 mWatt (ie the Red Centre Zero).

(5) Switch the Signal Generator carrier off and read the noise level on the wattmeter.

(6) Repeat the measurements at the frequencies shown in Table 8 for Ranges 1 to 4. Note that on Ranges 3 and 4 the Selectivity is set to the Intermediate position. The signal-to-noise ratio should be not less than 10 dB.

(7) On Ranges 5 to 8 the Signal Generator should be set to 10 µV.

(8) On Ranges 5 to 8 after tuning for maximum signal at each test frequency the R.F. gain control should be reduced slightly to avoid the risk of overload before setting the A.F. gain control to the reference signal level of 10 mWatt.

(9) The signal-to-noise ratio on Ranges 5 to 8 should be not less than 10 dB.

TABLE 8

Range	Frequency	Selectivity	Input µVolts	S/NR
1	60 kHz 120 kHz	N N	100 100	Not less than 10 dB
2	105 kHz 240 kHz	N N	100 100	
3	270 kHz 630 kHz	I I	100 100	
4	710 kHz 1.480 MHz	I I	100 100	
5	1.62 MHz 3.3 MHz	I I	10 10	
6	3.6 MHz 7.0 MHz	I I	10 10	
7	7.4 MHz 14.7 MHz	I I	10 10	
8	15.7 MHz 27.2 MHz	I I	10 10	

42. (1) Inject a 20 Mc/s r.f. signal at 30 db above 1μV modulated 30% at 400 c/s into the aerial via a 75Ω non inductive resistor, and tune the receiver for maximum A.F. output.

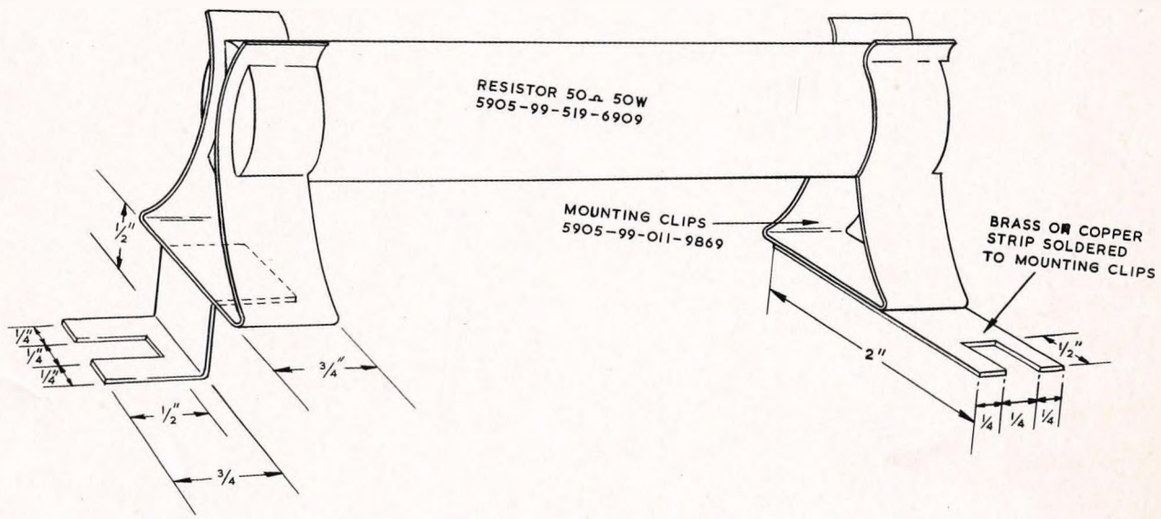
(2) Adjust the A.F. GAIN control for an output reading of 15mW.

(3) Increase the signal input by 60db and ensure that the increase in output is less than 8db.

(4) Change the signal input to a 400 kc/s r.f. signal at 40db above 1μV modulated 30% at 400 c/s.

(5) Tune the receiver to 400 kc/s.

(6) Adjust the A.F. GAIN for an output reading of 15mW. Increase the signal input by 60db and ensure that the increase in output is less than 5db.



DETAILS OF DUMMY LOAD RESISTOR

FIG. 2.3.2

CHAPTER 4

ALIGNMENT PROCEDURES

CONTENTS LIST

ILLUSTRATIONS

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.

	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	$8\frac{1}{2}$	1	G	$5\frac{1}{2}$
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	$8\frac{1}{2}$
16.0	1	$6\frac{1}{2}$	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%.

M.F. TRANSMITTER

Master oscillator

18. (1) Set transmitter controls up for operation at 330 kc/s with aerial matching controls set as in Table 14.

(2) Couple wavemeter, set at 330 kc/s, to the buffer anode choke L3.

(3) Adjust L2 for minimum beat.

(4) Set transmitter controls up for operation at 550 kc/s with aerial matching controls set as in Table 14.

(5) Adjust C16 for minimum beat.

(6) Repeat, alternately, until scale indication agrees with the injected frequency ±100 c/s.

Frequency in Kc/s	Anode Condenser		Coil	
	Coarse	Fine	Tapping	Fine
330	4	3	B	2
350	4	2	B	9
400	4	2	D	$8\frac{1}{2}$
450	3	6	F	$5\frac{1}{2}$
500	3	5	G	7
550	3	4	H	$4\frac{1}{2}$

TABLE 14

Clamp Valve Setting

19. (1) Set SERVICE switch at C.W.

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

(3) Rotate all aerial matching controls counterclockwise

(4) Switch on and with morse key pressed adjust RV48, the clamp valve setting control, located at the rear of the chassis, for a monitor meter reading of 300μA. Release morse key and check that meter reading is less than 240μA.

(5) Restore controls to normal operating positions.

Aerial Metering Circuit

20. (1) Set SERVICE switch at C. W.

(2) Set AERIAL CONDENSER at DUMMY LOAD

(3) Set aerial matching controls as given in Table 14 for a frequency of 330 kc/s.

(4) Switch on and adjust L1 for maximum reading on the aerial meter.

(5) Set aerial matching controls as given in Table 14 for a frequency of 550 kc/s.

(6) Adjust C9 for maximum reading on aerial meter.

(7) Repeat, alternately, until no further improvement in meter reading is obtained.

Modulation Level Adjustment

21. (1) Set SERVICE switch at C. W.

(2) Set AERIAL CONDENSER at DUMMY LOAD

(3) Set Monitor METER switch at P. A. TOTAL

(4) Load transmitter at operating frequency for a monitor meter reading at 200μA.

(5) Couple the oscilloscope to the aerial coil and adjust for a suitable trace.

(6) Readjust aerial tuning and then set SERVICE switch at M. C. W.

(7) Adjust the modulation preset control RV11, located at the rear of the chassis for 60% modulation and observe that waveform is sinusoidal.

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

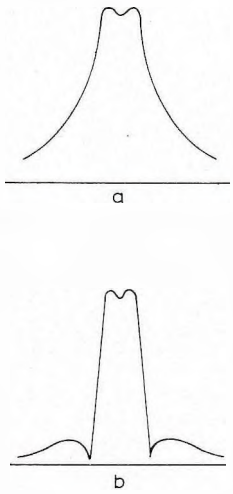


Fig.2.4.1 Receiver I.F. Alignment Response Curves

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.

B.F.O.

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 65μA.

1st Oscillator

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 I

(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

POWER UNIT (Contd.)

INDUCTORS

Code			Part No.
L1	5H choke	140mA	5950-99-972-0454
L2	5H choke	140mA	5950-99-972-0454
L3	5H choke	270mA	5950-99-971-9339
L4	5H choke	140mA	5950-99-972-0454
L5	20H choke	70mA	5950-99-972-0454
L6	5H choke	140mA	5950-99-972-0454
L7	20H choke	70mA	5950-99-972-0454
L8	5H choke	140mA	5950-99-972-0454

RELAYS

RLA	H.T. switching relay	5945-99-053-0143
RLB	H.T. switching relay	-053-0143
RLC	RT/CW/MCW relay	-053-0317
RLD	Bias relay	-012-8201
RLE	Microphone relay	-580-3719

SWITCHES

SWA	A.C. main switch	A.P.102087
SWB	Remote/local switch	A.P.102088

JACKS PLUGS AND SOCKETS

JKA	3 point P.O. jack	5935-99-972-9862
JKB	3 point P.O. jack	-972-9862
JKD	3 point P.O. jack	-972-9862
PLA	2 way fixed plug	-920-3528
PLB	18 way plug	-920-8677
SKC	25 way socket	-999-3524
SKD	18 way fixed socket	-920-8777
SKE	12 way socket	-972-9114
SKF	Microphone socket	-972-6713
SKG	18 way socket	-920-8776

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

POWER UNIT (Continued)

RESISTORS

Code					Part No.
R1	22k	Wirewound (A.P.100340A only)	6W	± 5%	5905-99-024-4129
R2	22k	Wirewound (A.P.100340A only)	6W	± 5%	-024-4129
R3	33k	Wirewound (A.P.100340A only)	6W	± 5%	-024-4141
R4	33k	Wirewound (A.P.100340A only)	6W	± 5%	-024-4141
R5	33k	Wirewound (A.P.100340A only)	6W	± 5%	-024-4141
R6	33k	Composition (A.P.100340A only)	1W	±10%	-021-2261
R7	33k	Composition (A.P.100340A only)	1W	±10%	-021-2261
R8	33k	Composition (A.P.100340A only)	1W	±10%	-021-2261
R9	220k	Composition (A.P.100340A only)	0.75W	±10%	-022-3081
R10	220k	Composition (A.P.100340A only)	0.75W	±10%	-022-3081
R11	47k	Composition	0.5W	±10%	-022-1069
R12	22kΩ	Wirewound	6W	± 5%	-014-0250
R13	18kΩ	Wirewound	6W	± 5%	-014-0248
R14	27kΩ	Wirewound	6W	± 5%	-014-0252
R15	47Ω	Composition	0.5W	±10%	-022-1069
R16	27kΩ	Wirewound	6W	± 5%	-014-0252
R17	22kΩ	Wirewound	6W	± 5%	-014-0250
R18	47Ω	Composition	0.5W	±10%	-022-1069
R19	27kΩ	Wirewound	6W	± 5%	-014-0252
R20	470Ω	Composition	1W	±10%	-011-1438
R21	22kΩ	Wirewound	6W	± 5%	-014-0250
R22	150Ω	Composition	1W	±10%	-011-1431
R23	220Ω	Composition	0.5W	±10%	-022-1153
R24	220Ω	Composition	0.5W	±10%	-022-1153
R25	1.2kΩ	Composition	0.5W	±10%	-022-2018
R26	220kΩ	Composition (A.P.399015 only)	0.5W	±10%	5905-99-022-3081
R27	220kΩ	Composition (A.P.399015 only)	0.5W	±10%	-022-3081
R28	180Ω	Wirewound (A.P.399015 only)	3W	± 5%	-014-0439
R29	180Ω	Wirewound (A.P.399015 only)	3W	± 5%	-014-0439
R30	100kΩ	Composition (A.P.399015 only)	0.5W	±10%	-022-3039
R31	100kΩ	Composition (A.P.399015 only)	0.5W	±10%	-022-3039
R32	390Ω	Wirewound (A.P.399015 only)	3W	± 5%	-014-0447
R33	390Ω	Wirewound (A.P.399015 only)	3W	± 5%	-014-0447
R34	100kΩ	Composition (A.P.399015 only)	0.5W	±10%	-022-3039
R35	100kΩ	Composition (A.P.399015 only)	0.5W	±10%	-022-3039
R36	33kΩ	Composition (A.P.399015 only)	0.5W	±10%	-022-2195
R37	33kΩ	Composition (A.P.399015 only)	0.5W	±10%	-022-2195
R38	33kΩ	Composition (A.P.399015 only)	0.5W	±10%	-022-2195
R39	22kΩ	Wirewound (A.P.399015 only)	6W	± 5%	-014-0250
R40	22kΩ	Wirewound (A.P.399015 only)	6W	± 5%	-014-0250
R41	33kΩ	Wirewound (A.P.399015 only)	6W	± 5%	-014-0254
R42	33kΩ	Wirewound (A.P.399015 only)	6W	± 5%	-014-0254
R43	33kΩ	Wirewound (A.P.399015 only)	6W	± 5%	-014-0254
* R44	2.2kΩ	Composition (A.P.399015 only)	0.5W	±10%	-022-2048
* R45	2.2kΩ	Composition (A.P.399015 only)	0.5W	±10%	-022-2048
RV1	25kΩ	Variable resistance	1W	±10%	-027-2302

* Modified version of A.P.399015 only

RECEIVER (Cont.)

Code	MECHANICAL ITEMS (Cont.)	Part No.
	Scale window	B148621
	Switch spindle	A148622
	Switch spindle extension	A148623
	Tapped washer (for captive screw)	A148508
	Trimming tool (double ended)	A.P.103095
	Valveholder B7G	5935-99-056-0127
	Valveholder B8G	-056-1140
	Valveholder B9A	-056-0131
	Valve can and spring B7G	-056-3003
	Valve can and spring B9A	-056-3009
	Valve retainer	A.P.65027
	Window	A148613

RECEIVER (Cont.)

VALVES (Cont.)

Code		Part No.
V7	CV4025	-000-4025
V8	CV4025	-000-4025
V9	CV131 or CV4015	-000-0131 or 000-4015
V10	CV4055	-000-4055
V11	CV395	-000-0395
V12	CV131 or CV4015	-000-0131 or 000-4015

TRANSFORMERS

TR1	I.F. Transformer	460 kc/s	A.P.103106
TR2	I.F. Transformer	460 kc/s	A.P.103105
TR3	I.F. Transformer	460 kc/s	A.P.103104
TR4	I.F. Transformer	460 kc/s	A.P.103102
TR5	I.F. Transformer	1.4 Mc/s	A.P.103103
TR6	Audio output transformer		A.P.67374

FILTERS

Code			Part No.
FL1	Filter coil	460 kc/s	A.P.102016
FL2	Filter coil		A.P.102017
FL3	Crystal filter coil		A.P.102018
FL4	Phone jack screen filter		A.P.103091
FL5	Feedthrough filter		A.P.103090

MISCELLANEOUS

XL1	Crystal	To order	
XL2 XL3	Double crystal filter unit		A.P.102010
LP1	Lamp 6.3V 0.11 amp		X951147
LP2	Lamp 6.3V 0.11 amp		X951147
SWT	Range switch	Wafers a,b,c,d,	A.P.101983
		Wafers e,f,g,h,j,	A.P.102007
		Wafers l,m,n,p,	A.P.102006
		Wafers q,r,s,t.	B404047
SWV	B.F.O. switch	Type 152	10F/10338
SWW	Crystal/M.O. switch		A.P.102009
SWX	A.G.C. switch		A.P.102020
SWY	Selectivity switch		A.P.102019
RLK	Muting relay		5945-99-012-8201
PLM	Co-axial plug		5935-99-054-0018
PLN	12 way plug		-972-9109
JKE	Jack socket		-972-9862

RECEIVER (Cont.)

RESISTORS (Cont.)

Code						Part No.
R46	330Ω	Composition		0.25W	±10%	-022-1173
R47	2.2kΩ	Composition		0.5W	±10%	-022-2048
R48	1MΩ	Composition		0.25W	±10%	-022-3164
R49	330Ω	Composition		0.25W	±10%	-022-1173
R50	2.2kΩ	Composition		0.5W	±10%	-022-2048
R51	2.2MΩ	Composition		0.25W	±10%	-022-3206
R52	150kΩ	Composition		0.25W	±10%	-022-3059
R53		Not used				
R54	47kΩ	Composition		0.25W	±10%	-022-2215
R55	680kΩ	Composition		0.25W	±10%	-022-3140
R56	470kΩ	Composition		0.25W	±10%	-022-3122
R57	470kΩ	Composition		0.25W	±10%	-022-3122
R58	1MΩ	Composition		0.25W	±10%	-022-3164
R59	470kΩ	Composition		0.25W	±10%	-022-3122
R60	47kΩ	Composition	Part of B.F.O. Assy A.P.101982	0.25W	±10%	-022-2215
R61	33kΩ	Composition		0.5W	±10%	-022-2195
R62	47kΩ	Composition		0.25W	±10%	-022-2215
R63	4.7kΩ	Composition		0.25W	±10%	-022-2089
R64	100Ω	Composition		0.25W	±10%	-022-1110
RV15	1kΩ	Variable				-011-9497
RV22	5kΩ	Variable				A.P.606181
RV42	2.5MΩ	Variable				5905-99-012-4809
RV53	100kΩ	Variable				-026-2170

INDUCTORS

L1	Aerial tuning	range 1		A14865 col A
L2	Aerial tuning	range 2		A14865 col B
L3	Aerial tuning	range 3		A148659 col A
L4	Aerial tuning	range 4	Part of Aerial Coil Unit	A148659 col B
L5	Aerial tuning	range 5	A.P. 103100	A148659 col C
L6	Aerial tuning	range 6		A148660 col A
L7	Aerial tuning	range 7		A148660 col B
L8	Aerial tuning	range 8		A148660 col C
L9	Filter coil		Part of FL1 A.P.102016	A148811
L10	Oscillator tuning	range 1		A148665 col A
L11	Oscillator tuning	range 2		A148665 col B
L12	Oscillator tuning	range 3		A148665 col C
L13	Oscillator tuning	range 4		A148666
L14	Oscillator tuning	range 5	Part of Osc. Coil Unit A.P. 101981	A148665 col D
L15	Oscillator tuning	range 6		A148667 col A
L16	Oscillator tuning	range 7		A148667 col B
L17	Oscillator tuning	range 8		A148667 col C
L18	Oscillator booster	range 8		A148668

H.F. TRANSMITTER (Contd.)

CAPACITORS (Contd.)

Code						Part No.
C46	230 pF	Ceramic tubular			± 2%	A.P.102045
C47	230 pF	Ceramic tubular			± 2%	A.P.102045
C48	230 pF	Ceramic tubular			± 2%	A.P.102045
C49	390 pF	Ceramic tubular			± 2%	A.P.102043
C50	390 pF	Ceramic tubular			± 2%	A.P.102043
C51	390 pF	Ceramic tubular			± 2%	A.P. ~~102043~~
C52	390 pF	Ceramic tubular			± 2%	A.P.102043
C53	390 pF	Ceramic tubular			± 2%	A.P.102043
C54	390 pF	Ceramic tubular			± 2%	A.P.102043
C55	390 pF	Ceramic tubular			± 2%	A.P.102043
C56	390 pF	Ceramic tubular			± 2%	A.P.102043
C57	292.5 pF	Ceramic tubular			± 2%	A.P. ~~102042~~
C58	292.5 pF	Ceramic tubular			± 2%	A.P.102042
C59	292.5 pF	Ceramic tubular			± 2%	A.P.102042
C60	292.5 pF	Ceramic tubular			± 2%	A.P.102042
C61	292.5 pF	Ceramic tubular			± 2%	A.P.102042
C62	292.5 pF	Ceramic tubular			± 2%	A.P.102042
C63	292.5 pF	Ceramic tubular			± 2%	A.P.102042
C64	292.5 pF	Ceramic tubular			± 2%	A.P.102042
C65	292.5 pF	Ceramic tubular			± 2%	A.P.102042
C66	292.5 pF	Ceramic tubular			± 2%	A.P.102042
C67	292.5 pF	Ceramic tubular			± 2%	A.P.102042
C68	292.5 pF	Ceramic tubular			± 2%	A.P.102042
C69	390 pF	Ceramic tubular			± 2%	A.P.102043
C70	390 pF	Ceramic tubular			± 2%	A.P.102043
C71	390 pF	Ceramic tubular			± 2%	A.P.102043
C72	390 pF	Ceramic tubular			± 2%	A.P.102043
C73	45 pF	Ceramic			± 2%	A.P.102050
C74	25-225 pF	Trimmer				A.P.102052
C75	0.01/uF	Tubular		200 V	± 25%	5910-99-014-3128
C76	15 pF	Disc ceramic			± 20%	-012-7093
C77	15 pF	Disc ceramic			± 20%	-012-7093
C78	15 pF	Disc ceramic			± 20%	-012-7093
C79	0.01/uF	Tubular)	Part of Aerial Monitor Box A.P.102029		± 20%	-012-0113
C80	3-30 pF	Trimmer)				-016-7006
C81	3-30 pF	Trimmer)				-016-7006
C82	3-30 pF	Trimmer)				-016-7006
C83		Not used				
C84	18 pF	Silver mica	Part of Aerial Monitor Box Assy A.P.102029	350 V	± 10%	-972-1845
C85	3-30 pF	Trimmer)		75 V		-016-7006
C86	3-30 pF	Trimmer)		75 V		-016-7006
C87	3-30 pF	Trimmer)		75 V		-016-7006
C88	22 pF	Silver mica		350 V	± 10%	A.P.102048
C89	0.01/uF	Tubular		200 V	± 25%	5910-99-014-3128
C90	0.01/uF	Tubular		200 V	± 25%	-014-3128
C91	0.01 uF	Tubular		200 V	± 25%	-014-3128
C92	330 pF	Ceramic			± 20%	-972-9100

RECEIVER (Cont.)

CAPACITORS (Cont.)

Code					Part No.
C135	1000pF	Ceramic	Part of Filter Unit A.P. 103090	+80% -20%	A.P.103093
C136	1000pF	Ceramic		+80% -20%	A.P.103093
C137	1000pF	Ceramic		+80% -20%	A.P.103093
C138	1000pF	Ceramic		+80% -20%	A.P.103093
C139	1000pF	Ceramic		+80% -20%	A.P.103093
C140	1000pF	Ceramic		+80% -20%	A.P.103093
C141	1000pF	Ceramic		+80% -20%	A.P.103093
C142	1000pF	Ceramic		+80% -20%	A.P.103093
C143	1000pF	Ceramic		+80% -20%	A.P.103093
C144	1000pF	Ceramic		+80% -20%	A.P.103093
C145	1000pF	Ceramic		+80% -20%	A.P.103093
C146	1000pF	Ceramic		+80% -20%	A.P.103093
C147	1000pF	Ceramic	Part of Filter Unit A.P. 103091	+80% -20%	A.P.103093
C148	1000pF	Ceramic		+80% -20%	A.P.103093
C149	1000pF	Ceramic		+80% -20%	A.P.103093
C150	1000pF	Ceramic		+80% -20%	A.P.103093
C151	1000pF	Ceramic	Part of Mixer Coil Assy A.P. 101979	+80% -20%	911-4871
C152 to C199		Not used			
C200	100pF		Part of Aerial Assy A.P. 103100	±10%	5910-99-012-7305
C201	100pF			±10%	-012-7305
C202	100pF			±10%	-012-7305
C203	100pF			±10%	-012-7305
C204	100pF			±10%	-012-7305
C205	33pF	Ceramic		±10%	-012-7305
C206	33pF	Ceramic		±10%	-012-7305
C207	33pF	Ceramic		±10%	-012-7305
C208	10pF	Ceramic		±10%	-012-7089

H.F. TRANSMITTER (Cont.)

RESISTORS (Cont.)

Code					Part No.
R41	15kΩ	Composition	0.25W	±10%	5905-99-022-2151
R42	100kΩ	Composition	0.25W	±10%	-022-3037
R43	100kΩ	Composition	0.25W	±10%	-022-3038
R44	47Ω	Composition	0.25W	±10%	-022-1067
R45	47Ω	Composition	0.25W	±10%	-022-1067
R46	100Ω	Composition	0.25W	±10%	-022-1109
R47	12kΩ	Composition	1W	±10%	-011-1484
R48	1.2kΩ	Composition	0.5W	±10%	-022-2018
R49	560Ω	Composition	0.25W	±10%	-022-1205
R50	47Ω	Composition	0.5W	±10%	-022-1069
R51	47Ω	Composition	0.5W	±10%	-022-1069
R52	12Ω	Composition	0.25W	±10%	-022-1008
R53	12Ω	Composition	0.25W	±10%	-022-1008
R54		Not used			
R55	12Ω	Composition	0.25W	±10%	-022-1008
R56	47Ω	Composition	0.5W	±10%	-022-1069
R57		Not used			
R58	12Ω	Composition	0.25W	±10%	-022-1008
R59	12Ω	Composition	0.25W	±10%	-022-1008
R60	12Ω	Composition	0.25W	±10%	-022-1008
R61	180Ω	Wirewound	4.5W	± 5%	-014-0322
R62	47Ω	Composition	0.5W	±10%	-022-1069
R63		Not used			
R64	1.2kΩ	Composition	0.5W	±10%	-022-2018
R65	9.1kΩ	Wirewound	4.5W	± 5%	-014-0363
R65a	9.1kΩ	Wirewound	4.5W	± 5%	-014-0363
R66	47Ω	Composition	0.5W	±10%	-022-1069
R67	12Ω	Composition	0.25W	±10%	-022-1008
R68	6.8kΩ	Composition	0.25W	±10%	-022-2109
R69	1MΩ	Composition	0.5W	± 5%	-022-3161
R70	12kΩ	Composition	0.25W	±10%	-022-2142
R71	1MΩ	Composition	0.5W	± 5%	-022-3161
R72	470kΩ	Composition	0.5W	± 5%	-022-3120
R73	2.2kΩ	Composition	0.25W	± 5%	-022-2043
R74	2.2kΩ	Composition	0.25W	± 5%	-022-2043
R75	2.2kΩ	Composition	0.25W	± 2%	-013-5754
R76	1Ω	Wirewound	4.5W	± 5%	-014-0267
R77	1Ω	Wirewound	4.5W	± 5%	-014-0267
R78	33Ω	Composition	0.25W	±10%	-022-1046
R79	47kΩ	Composition	0.25W	±10%	-022-2214
R80	100kΩ	Composition	0.25W	±10%	-022-3037
R81	47kΩ	Composition	0.25W	±10%	-022-2214
R82	68Ω	Composition	0.25W	±10%	-022-1088
RV3	1kΩ max.	Variable resistance			-011-9497
RV4	5kΩ max.	Variable resistance			-011-9491
RV5	5kΩ max.	Variable resistance			-011-9491

RECEIVER (Cont.)

CAPACITORS (Cont.)

Code					Part No.
C46	3-30pF	Trimmer			-016-7006
C47	3-30pF	Trimmer			-016-7006
C48	3-30pF	Trimmer			-016-7006
C49	3-30pF	Trimmer			-016-7006
C50	3-30pF	Trimmer			-016-7006
C51	3-30pF	Trimmer			-016-7006
C52	3-30pF	Trimmer			-016-7006
C53	3-30pF	Trimmer			-016-7006
C54	5000pF	Tubular			-014-3137
C55	2200pF	Ceramic	Part of Mixer Coil Assy A.P. 101979	±20%	-580-0329
C56	2200pF	Ceramic		±20%	-580-0329
C57	1000pF	Ceramic		±20%	-911-4871
C58	330pF	Ceramic		±20%	-972-9100
C59	62pF	Ceramic		±10%	911-4659
C60	15pF	Ceramic		±10%	5910-99-012-7113
C61	5.6pF	Ceramic		±10%	012-6771
C62	27pF	Ceramic		±10%	012-7099
C63	33pF	Ceramic		±10%	012-7101
C64	100pF	Ceramic		±10%	011-5525
C65	100pF	Ceramic		±10%	011-5525
C66	330pF	Ceramic		±20%	5910-99-972-9100
C67	0.1µF	Tubular			011-9827
C68	0.01µF	Tubular			011-5625
C69		Variable			
C70	0.1µF	Tubular			5910-99-011-5625
C71	0.1µF	Tubular			011-5625
C72	0.1µF	Tubular			011-7818
C73	470pF	Mica	Part of I.F. Transformer A.P. 103102	± 2%	972-1850
C74	470pF	Mica		± 2%	972-1850
C75	470pF	Mica	Part of I.F. Transformer A.P. 103103	± 2%	972-1850
C76	470pF	Mica		± 2%	972-1850
C77	4µF	Electrolytic		+50% -20%	012-4895
C78	0.1µF	Tubular			011-5625
C79	100pF	Ceramic		±10%	011-5525
C80	0.01µF	Tubular			011-5625
C81	270pF	Ceramic		±20%	999-4105
C82	0.02µF	Tubular			-011-5629
C83	0.1µF	Tubular			011-9827
C84	0.1µF	Tubular			011-5625
C85	2200pF	Ceramic		±20%	580-0329
C86	3-30pF	Trimmer			016-7006
C87	100pF	Ceramic		±10%	011-5525
C88	100pF	Ceramic		±10%	011-5525
C89	2000pF	Mica	Part of Osc. Coil A.P. 102015	± 2%	915-0208
C90	2000pF	Mica		± 2%	915-0208
C91	0.1µF	Tubular			011-7818

H.F. TRANSMITTER (Cont.)

MISCELLANEOUS

Code		Part No.
AE	Aerial Coaxial Socket	5935-99-913-8550
FL1	Input filter coil	A.P.102064
LP1	Lamp, Neon, Indicator	6240-99-996-1110
M1	Meter 0-500μA	A.P.65035
M2	Meter 0-500μA	A.P.65035
PLH	Plug 18 way	A.P.208676
PLJ	Plug coaxial	5935-99-054-0101
RLF	Aerial changeover relay	A.P.103096
RLG	Keying relay	5945-99-053-0040
SWE	Service switch	A.P.102059
SWF	Crystal switch	A.P.102066
SWG	Range switch	B149139
	Monitor switch	B149153
SWH	Anode switch	A.P.102041
SWJ	Anode course switch	A.P.102039
SWK	Coil tapping switch	A.P.102039
SWL	Aerial course switch	A.P.102040
SWM	Meter switch	A.P.102060
TR1	Modulation transformer	5905-99-972-0450

COMPLETE ASSEMBLIES AND ASSEMBLY COMPONENTS

Aerial tuner assembly	D149034
Aerial condenser subassembly	B149083
Mounting plate	B149104
Pillar	A149105
Anode condenser subassembly	A149086
Mounting plate	A149117
Current transformer subassembly (inc L22)	B149086
Cable clip $1\frac{1}{8}$"	Insuloid X15
3 way tagstrip	SRDE 106452
Switch gear subassembly	B149084
Drive pin 3/32" x $\frac{5}{8}$"	Mills G.P.1
Gear plate (assembly)	A149106
Spindle	A149109
Support plate (assembly)	A148997
Anode cap assembly (2 off)	A.P.102034
Anode cap assembly (3 off)	A.P.102035
Bearing bracket assembly	A149037
Bearing bracket	A149142
Bearing bush	B148692
Connector assembly	A149047
Actuating arm	A149140
Bush	B148692
Connector assembly	A149036
Actuating arm	A149140
Bush	A149141

M.F. TRANSMITTER (Contd.)

MECHANICAL ITEMS

	Code	Part No.
Barbed leadthrough insulator		Oxley Type 156
Bellows coupling (Aerial tuning coil assembly)		A148942
Bellows coupling		A.P.102025
Captive screw 2 B.A.		A148507
Cursor window		A148619
Dial lock knob		A148624
Dial lock pin		A148625
Earthing ring		A148938
Escutcheon (engraved)		D148929
Holder, high speed relay		5935-99-053-9001
Knob (3 off)		5955-99-097-0186
Knob (1 off)		-097-0138
Knob (4 off)		-097-0177
Pin 1/16" x 5/16"		Mills G.P.1
Scale (engraved)		B148943
Slow motion drive		A149000
Stand-off insulator		W & R Type T55-01/1
Tapped washer (for captive screw)		A148508
Valveholder B7G		5935-99-056-0127
Valveholder B8G		-056-1140
Valveholder B9A		-056-0131
Valve can B7G		5935-99-056-3003
Valve can B8G		-056-3007
Valve can B9A		-056-3009
Valve retainer		A.P.65027

H.F. TRANSMITTER (Cont.)

MECHANICAL ITEMS

Code		Part No.
	Bellows coupling	A.P.102025
	Bellows coupling	A148942
	Calibrated scale	B149079
	Captive screw	A148507
	Coupler	A149060
	Cursor window	A148619
	Dial lock pin	A149063
	Dial lock pin	A148625
	Earthing ring	A148938
	Engraved escutcheon	D149066
	Knob dial lock	A148624
	Knob	5355-99-097-0185
	Knob $1\frac{1}{8}$" diameter	-097-0186
	Knob $2\frac{1}{4}$" diameter	-097-0188
	Knob	-097-0177
	Stand off insulator	5970-99-056-0881
	Stop pin	A149173
	Tapped washer (for captive screw)	A148508

M.F. TRANSMITTER (Cont.)

RESISTORS (Cont.)

Code					Part No.
R46	15Ω	Composition	0.25W	±10%	-022-1011
R47	5.6kΩ	Composition	0.25W	±10%	-022-2100
R48		Not used			
R49	47Ω	Composition	0.5W	±10%	-022-1069
R50	18kΩ	Wirewound	6W	± 5%	-011-3427
R51	15Ω	Composition	0.25W	±10%	-022-1011
R52	1MΩ	Composition	0.25W	±10%	-022-3164
R53	47Ω	Composition	0.5W	±10%	-022-1069
R54	75Ω	Wirewound	4.5W	± 5%	-011-3460
R55	15Ω	Composition	0.25W	±10%	-022-1011
R56	22Ω	Composition	0.5W	±10%	-022-1027
R57	47Ω	Composition	1W	±10%	-011-1424
R58	1Ω	Wirewound	3W	±5%	-011-9770
R59	100Ω	Composition	0.25W	±10%	-022-1109
RV11	5kΩ	Variable resistance			-011-9491
RV48	5kΩ	Variable resistance			-011-9491

VALVES AND SEMICONDUCTORS

V1	CV4014	5960-99-000-4014
V2	CV4014	-000-4014
V3	CV4039	-000-4039
V4	CV428	-000-0428
V5	CV428	-000-0428
V6	CV4014	-000-4014
V7	CV4004	-000-4004
V8	CV428	-000-0428
V9	CV428	-000-0428
MR1	CV425	-000-0425
MR2	CV425	-000-0425

INDUCTORS

L1	Monitor coil		A.P.102082
L2	R.F. osc. coil		A.P.102084
L3	Buffer amp anode coil		A.P.102083
L4	P.A. anode choke		A.P.102085
L5	Aerial loading coil	Part of Aerial Coil Assy C148911	A148965
L6	Aerial coil stator		B148964

M.F. TRANSMITTER (Cont.)

RESISTORS

Code					Part No.
R1	4.7kΩ	Composition	0.25W	±10%	5905-99-022-2088
R2	120kΩ	Composition	0.25W	±10%	-022-3049
R3	120kΩ	Composition	0.25W	±10%	-022-3049
R4	10kΩ	Composition	0.25W	± 2%	-021-9702
R5	120kΩ	Composition	0.25W	±10%	-022-3049
R6	150kΩ	Composition	0.25W	±10%	-022-3058
R7	68kΩ	Composition	0.25W	±10%	-022-3016
R8	680Ω	Composition	0.25W	±10%	-022-1214
R9	220kΩ	Composition	0.25W	±10%	-022-3079
R10	470kΩ	Composition	0.25W	±10%	-022-3121
R11		Not used			
R12	1.8kΩ	Composition	0.25W	±10%	-022-2037
R13	2.2kΩ	Composition	0.25W	±10%	-022-2046
R14	1MΩ	Composition	0.25W	±10%	-022-3164
R15	68kΩ	Composition	0.25W	±10%	-022-3016
R16	220kΩ	Composition	0.25W	±10%	-022-3079
R17	1.5kΩ	Composition	0.25W	±10%	-022-2025
R18	68kΩ	Composition	0.25W	±10%	-022-3016
R19	220kΩ	Composition	0.25W	±10%	-022-3079
R20	1.8kΩ	Composition	0.25W	±10%	-022-3037
R21	68kΩ	Composition	0.25W	±10%	5905-99-022-3016
R22	1MΩ	Composition	0.25W	±10%	-022-3164
R23	220kΩ	Composition	0.25W	±10%	-022-3079
R24	47kΩ	Composition	0.25W	±10%	-022-2214
R25	220kΩ	Composition	0.25W	±10%	-022-3079
R26	15kΩ	Composition	0.25W	±10%	-022-2151
R27	220kΩ	Composition	0.25W	±10%	-022-3079
R28	8.2kΩ	Composition	0.25W	±10%	-022-2121
R29	68kΩ	Composition	0.25W	±10%	-022-3016
R30	47Ω	Composition	1W	±10%	-011-1424
R31	220Ω	Composition	0.5W	±10%	-022-1153
R32	47Ω	Composition	1W	±10%	-011-1424
R33	560kΩ	Composition	0.25W	±10%	-022-3134
R34	33kΩ	Composition	0.25W	±10%	-022-2193
R35	2.2kΩ	Composition	0.25W	±10%	-022-2046
R36	560kΩ	Composition	0.25W	±10%	-022-3134
R37	10kΩ	Composition	0.25W	±10%	-022-2130
R38	15Ω	Composition	0.25W	±10%	-022-1011
R39	27kΩ	Wirewound	6W	± 5%	-011-3431
R40	220Ω	Composition	0.25W	±10%	-022-1151
R41	680Ω	Composition	0.25W	±10%	-022-1214
R42	33kΩ	Composition	0.5W	±10%	-022-2195
R43	33kΩ	Composition	0.5W	±10%	-022-2195
R44	1.8kΩ	Composition	0.25W	±10%	-022-2037
R45	330kΩ	Composition	1W	±10%	-011-1518

M.F. TRANSMITTER - A.P.100338

CAPACITORS

Code					Part No.
C1	15pF	Disc	750V	± 5%	5910-99- 012-7093
C2	15pF	Disc	750V	± 5%	- 012-7093
C3	15pF	Disc	750V	± 5%	- 012-7093
C4	0.01µF	Tubular	350V	±25%	-011-5625
C5	470pF	Silver mica	350V	±10%	-012-3949
C6	300pF	Variable			A.P.102055
C7	470pF	Silver mica	350V	±10%	5910-99-012- 3949
C8	470pF	Silver mica	350V	±10%	-012- 3949
C9	3-30pF	Trimmer	75V		-016-7006
C10	120pF	Silver mica	350V	± 5%	-012- 3927
C11	0.01µF	Tubular	350V	±25%	-011-5625
C12	0.01µF	Tubular	350V	±25%	-011-5625
C13	300pF	Variable			A.P.102055
C14	300pF	Variable			A.P.102055
C15	0.01µF	Tubular	350V	±25%	5910-99-011-5625
C16	3-30pF	Trimmer	75V		-016-7006
C17	100pF	Silver mica	350V	± 2%	-012-3923
C18	220pF	Silver mica	350V	±10%	- 972-1846
C19	0.01µF	Tubular	350V	±25%	-011-5625
C20	0.01µF	Tubular	350V	±25%	-011-5625
C21	0.01µF	Tubular	350V	±25%	-011-5625
C22	0.01µF	Tubular	350V	±25%	-011-5625
C23	15pF	Silver mica		± 2%	- 972-1832
C24	0.01µF	Tubular	350V	±25%	-011-5625
C25	0.1µF	Tubular	150V		-011-9827
C26	0.01µF	Tubular	350V	±25%	-011- 7818
C27		Not used			
C28	0.01µF	Tubular	350V	±25%	-011-5625
C29	0.01µF	Tubular	350V	±25%	-011-5625
C30	2µF	Tubular	200V	±25%	-011-9839
C31	2000pF	Disc		±20%	- 972-9622
C32	0.1µF	Tubular	150V		-011-9827
C33	0.1µF	Tubular	150V		-011-9827
C34	0.01µF	Moulded mica		±10%	A.P.101220
C35	1500pF	Variable			A.P.102075
C36	2000pF	Moulded mica		±10%	5910-99 -012-4153
C37	2000pF	Moulded mica		±10%	-012-4153
C38	2000pF	Moulded mica		±10%	-012-4153
C39	2000pF	Moulded mica		±10%	-012-4153
C40	2000pF	Moulded mica		±10%	-012-4153
C41	2000pF	Moulded mica		±10%	-012-4153
C42	2000pF	Moulded mica		±10%	-012-4153
C43	2000pF	Moulded mica		±10%	-012-4153
C44	100pF			±10%	A.P.102069
C45	100pF			±10%	A.P.102069
C46	120pF			±10%	A.P.102070
C47	0.01µF	Tubular	350V	±25%	5910-99-011-5625

M.F. TRANSMITTER (Cont.)

MISCELLANEOUS

Code		Part No.
	Aerial terminal unit	A.P.102030
LP1	Lamp, Neon, Indicator	6240-99-996-1110
M3	Monitor meter	A.P.65035
M4	Aerial meter	A.P.65035
PLL	Aerial plug	5935-99-054-0101
PLK	Plug 18 way	A.P.208676
RLH	Keying relay	5945-99-012-8201
RLJ	Aerial changeover relay	A.P.103096
SWN	Meter switch	A.P.102077
SWP	C.W.-M.C.W. switch	A.P.102076
SWQ	Anode course switch	A.P.102078
SWR	Aerial switch	A.P.102080
SWS	Coil course switch	A.P.102079
TR1	Modulation transformer	5905-99-972-0457

COMPLETE ASSEMBLIES AND ASSEMBLY COMPONENTS

Aerial tuning coil assembly	C148911
Tuning coil subassembly	B149964
Coupling coil subassembly	A148965
Bush	A148968
Locating bracket	A148969
Mounting plate	B148966
Shaft	A148967
Spacer	A148485
Anode cap assembly (2 off)	A148909
Anode cap assembly (1 off)	A148910
Condenser bank assembly (C36-C43)	B148915
Component strip assembly (*R1-R32)	B148919
Component strip assembly (*R2-R35)	B148918
Component strip assembly (*R20-R59)	B148916
Component strip assembly (*R26-R56)	B148917
Dial lock spring assembly	A148913
Rubber band	A148775
Spring arm	A148774
Dial lock spring assembly (curved)	A148914
Curved spring	A148983
Rubber band	A148775
Locking dial assembly	A148906
Oscillator coil screen assembly	A148920
Potentiometer mounting bracket assembly	A148925
Scale back plate assembly	B148927
Scale plate	B149026
Trimmer mounting plate assembly	A148924
Tuner unit assembly (for assembly components see H.F. Transmitter)	C148926

* Minimum and Maximum resistor code quoted for identification purposes only.

H.F. TRANSMITTER (Cont.)

Code	COMPLETE ASSEMBLIES AND ASSEMBLY COMPONENTS (Cont.)	Part No.
	Component strip assembly (*R1 - R48)	B149041
	Component strip assembly (*R9 - R38)	B149039
	Component strip assembly (*R28 - R74)	B149042
	Component strip assembly (*R41 - R43)	A149043
	Component strip assembly (*R46 - R70)	B149040
	Crystal retaining spring assembly	C149049
	Crystal unit assembly	C149048
	Crystal socket	A.P.102008
	Dial lock spring assembly	A148913
	Rubber pad	A148775
	Spring arm	A148774
	Dial lock spring assembly (curved)	A148914
	Rubber pad	A148775
	Curved spring	A148985
	Dial lock spring assembly (near C74)	A149046
	Rubber pad	A149159
	Spring arm	A149158
	Locking dial assembly (small)	A149050
	Locking dial assembly (large)	A149051
	Meter plate assembly	A149044
	Parasitic choke assembly	A149059
	Rectifier mounting plate assembly	A149056
	R.F. choke assembly	A149053
	Scale back plate assembly	B148927
	Scale plate	B149026
	Tuning unit assembly	C148926
	Gear plate subassembly (back)	A149004
	Gear plate subassembly (front)	B149005
	Gear subassembly (small)	A148999
	Gear subassembly (compound)	B148998
	Logging dial subassembly (large)	A148706
	Logging dial subassembly (small)	A149003
	Stop bush assembly 2 pin	A149001
	Stop bush subassembly 1 pin	A149002
	Support plate subassembly	A148997
	Mills pin	Mills G.P.3
	Pinion	A149006
	Spindle (short)	A149007
	Spindle (long)	A149008
	Spring	A148728
	Spring	A149009

* Minimum and maximum resistor code quoted for identification purposes only.

RECEIVER

CAPACITORS

Code						Part No.
C1	3-30 pF	Trimmer	)			5910-99-016-7006
C2	3-30 pF	Trimmer	)			-016-7006
C3	3-30 pF	Trimmer	)			-016-7006
C4	3-30 pF	Trimmer	)			-016-7006
C5	3-30 pF	Trimmer	) Part of Aerial Coil Assy			-016-7006
			) A.P.103100			
C6	3-30 pF	Trimmer	)			-016-7006
C7	3-30 pF	Trimmer	)			-016-7006
C8	3-30 pF	Trimmer	)			-016-7006
C9		Not used				
C10		Not used				
C11		Not used				
C12	100 pF	Ceramic		500 V	± 10%	-012-7093
C13	15 pF	Ceramic			± 10%	-012-7113
C14	470 pF	Silver mica	) Part of 460 kc/s I.F.		± 2%	-915-0057
C15	470 pF	Silver mica	) Filter A.P.102016		± 2%	-915-0057
C16		Variable				A.P.102001
C17	100 pF	Ceramic	)	500 V	± 10%	5910-99-012-7113
C18	33 pF	Ceramic	)		± 10%	-012-7101
C19	3-30 pF	Trimmer	)			-016-7006
C20	3-30 pF	Trimmer	)			-016-7006
			)			
C21	3-30 pF	Trimmer	)			-016-7006
C22	3-30 pF	Trimmer	)			-016-7006
C23	3-30 pF	Trimmer	)			-016-7006
C24	3-30 pF	Trimmer	)			-016-7006
C25	3-30 pF	Trimmer	)			-016-7006
			)			
C26	3-30 pF	Trimmer	)			-016-7006
C27	82 pF	Mica	)		± 2%	-012-3920
C28	100 pF	Mica	) Part of Osc. Coil		± 2%	-012-3923
C29	100 pF	Mica	) Assy A.P.101981		± 2%	-012-3923
C30	500 pF	Mica	)		± 2%	-911-4646
			)			
C31	1100 pF	Mica	)		± 2%	A.P.101997
C32	850 pF	Mica	)		± 2%	A.P.101992
C33	1500 pF	Mica	)		± 2%	-012-4103
C34	3900 pF	Mica	)		± 2%	-012-4262
C35	5.6 pF	Ceramic	)		± 10%	5910-99-012-7086
			)			
C36	10 pF	Ceramic	)		± 10%	-012-7089
C37	56 pF	Mica	)		± 10%	-012-3916
C38	10 pF	Ceramic	)		± 10%	5910-99-012-7089
C39	220 pF	Mica	)		± 10%	-012-3937
C40		Variable				A.P.102001
C41	0.1/uF	Tubular				5910-99-011-7818
C42	0.1/uF	Tubular				-011-9827
C43	0.02/uF	Tubular				-011-5629
C44	0.1/uF	Tubular				-011-9827
C45	47 pF	Mica	Part of I.F. Filter A.P.102017			-911-4041

H.F. TRANSMITTER (Cont.)

Code	VALVES AND SEMICONDUCTORS		Part No.
V1	CV492		5960-99-000-0492
V2	CV140		-000-0140
V3	CV492		-000-0492
V4	CV428		-000-0428
V5	CV428		-000-0428
V6	CV287		-000-0287
V7	CV2128		-000-2128
V8	CV2129		-000-2129
V9	CV138		-000-0138
V10	CV428		-000-0428
V11	CV428		-000-0428
V12	CV428		-000-0428
MR1	A.P.102062		6131-99-943-1893
MR2	CV425	Part of Aerial Monitor	5960-99-000-0425
MR3	CV425	Box Assy A.P. 102029	-000-0425
MR4	CV425		-000-0425

INDUCTORS

L1	Osc. coil 1		A149128 col A
L2	Osc. coil 2		A149128 col B
L3	Osc. coil 3		A149128 col C
L4	Buffer grid coil 1		A149129 col A
L5	Buffer grid coil 2	Part of Coil Assy	A149129 col B
L6	Buffer grid coil 3	A.P. 102027	A149129 col C
L7	Buffer anode coil 1		A149130 col A
L8	Buffer anode coil 2		A149130 col B
L9	Buffer anode coil 3		A149130 col C
L10	R.F. choke		A149053
L11	Aerial coil A		A.P.102031
L12	Aerial coil B		A.P.102032
L13	Aerial coil C		A.P.102033
L14	Aerial coil D		A.P.102037
L15	Aerial coil E		A.P.102038
L16	Aerial monitor coil (voltage) 1		A149149 col A
L17	Aerial monitor coil (voltage) 2		A149149 col B
L18	Aerial monitor coil (voltage) 3		A149149 col C
L19	Aerial monitor coil (current) 1		A149150 col A
L20	Aerial monitor coil (current) 2		A149150 col B
L21	Aerial monitor coil (current) 3		A149150 col C
L22	Current transformer primary coil		A149144
L23	Not used		
L24	Parasitic stopper		A149059
L25	Parasitic stopper		A149059
L26	Parasitic stopper		A149059
L27	Parasitic stopper	Part of Anode Cap Assy	A149059
L28	Parasitic stopper	A.P. 102034	A149059

RECEIVER (Cont.)

CAPACITORS (Cont.)

Code					Part No.
C92	470pF	Mica		± 2%	5910-99-915-0057
C93	470pF	Mica	Part of TR3 A.P.103104	± 2%	-915-0057
C94	0.02µF	Tubular			-011-5629
C95	1000pF	Tubular			-011-5549
C96	0.1µF	Tubular			-011-7818
C97	4µF	Electrolytic		+50% -20%	-012-4895
C98	1000pF	Tubular			-011-5549
C99	0.1µF	Tubular			-011-7818
C100	0.1µF	Tubular			-011-9827
C101	0.1µF	Tubular			-011-7818
C102	3-30pF	Trimmer			-016-7006
C103	470pF	Mica	Part of I.F. Transformer A.P.103105	± 2%	-972-1850
C104	850pF	Mica		± 2%	A.P.101992
C105	1000pF	Mica		± 2%	5910-99-580-6436
C106	2-8pF	Trimmer			-016-7002
C107	2-8pF	Trimmer			-016-7002
C108	2-8pF	Trimmer			-016-7002
C109	10pF	Ceramic		±10%	-012-7089
C110	1000pF	Mica	Part of Coil I.F. Crystal A.P. 102018	± 2%	-110-2398
C111	1000pF	Mica		± 2%	-110-2398
C112	100pF	Ceramic		±10%	-011-5525
C113	0.01µF	Tubular			-011-5525
C114	0.02µF	Tubular			-011-5629
C115	0.1µF	Tubular			-011-9827
C116	0.1µF	Tubular			-011-7818
C117	470pF	Mica	Part of TR1 A.P. 103104	± 2%	-972-1850
C118	470pF	Mica		± 2%	-972-1850
C119	2.7pF	Mica		±0.5pF	A.P.102002
C120	100pF	Ceramic		±10%	5910-99-011-5525
C121	100pF	Ceramic		±10%	-011-5525
C122	10pF	Ceramic		±10%	-012-6774
C123	0.1µF	Tubular			-011-9827
C124	100pF	Ceramic		±10%	-011-5525
C125	1000pF	Mica		± 2%	-580-6436
C126	3.8-50pF	Trimmer			A.P.101999
C127	2200pF	Ceramic		±20%	5910-99-580-0329
C128	5.6pF	Ceramic		±10%	-012-6771
C129	0.1µF	Tubular			-011-9827
C130	0.1µF	Tubular			-011-9827
C131	1000pF	Ceramic	Part of Filter Unit A.P.103090	+80% -20%	A.P.103093
C132	1000pF	Ceramic		+80% -20%	A.P.103093
C133	1000pF	Ceramic		+80% -20%	A.P.103093
C134	1000pF	Ceramic		+80% -20%	A.P.103093

H.F. TRANSMITTER (Cont.)

CAPACITORS (Cont.)

Code						Part No.
C93	0.01µF	Tubular		200V	±25%	-014-3128
C94	0.01µF	Tubular		200V	±25%	-014-3128
C95	0.01µF	Tubular		200V	±25%	-014-3128
C96	18pF	Silver mica	Part of Coil Assy	350V	±10%	-972-1845
C97	18pF	Silver mica	A.P. 102027	350V	±10%	-972-1845
C98	0.01µF	Tubular		200V	±25%	5910-99-014-3128

RESISTORS

R1	2.7kΩ	Composition	0.25W	±10%	5905-99-022-2058
R2	11kΩ	Wirewound	6W	± 5%	-011-3422
R3		Not used			
R4	680kΩ	Composition	0.25W	±10%	-022-3143
R5	1.8kΩ	Composition	0.5W	±10%	-022-2039
R6	56kΩ	Composition	0.5W	±10%	-022-3009
R7	15kΩ	Wirewound	6W	± 5%	-011-3425
R8	3.3kΩ	Composition	0.25W	±10%	-022-2067
R9	68kΩ	Composition	0.5W	±10%	-022-3018
R10	680kΩ	Composition	0.25W	±10%	-022-3143
R11	56kΩ	Composition	0.5W	±10%	-022-3009
R12	47kΩ	Composition	0.25W	±10%	-022-2214
R13	470kΩ	Composition	0.5W	±10%	-022-3123
R14	3.3kΩ	Composition	0.25W	±10%	-022-2068
R15	120kΩ	Composition	0.25W	±10%	-022-3049
R16	120kΩ	Composition	0.25W	±10%	-022-3049
R17	120kΩ	Composition	0.25W	±10%	-022-3049
R18	47kΩ	Composition	0.25W	±10%	-022-2214
R19	22kΩ	Composition	0.5W	±10%	-022-2174
R20	68kΩ	Composition	1W	±10%	-011-1493
R21	100kΩ	Composition	0.25W	±10%	-022-3037
R22		Not used			
R23	100kΩ	Composition	0.25W	±10%	-022-3038
R24	33kΩ	Composition	0.25W	±10%	-022-2193
R25	270kΩ	Composition	0.25W	±10%	-022-3091
R26	2.2kΩ	Composition	0.25W	±10%	-022-2046
R27	27kΩ	Composition	0.5W	±10%	-022-2186
R28	1MΩ	Composition	0.25W	±10%	-022-3164
R29	2.2kΩ	Composition	0.25W	±10%	-022-2046
R30	12kΩ	Composition	0.5W	±10%	-022-2144
R31	680Ω	Composition	0.5W	±10%	-022-1216
R32	33Ω	Composition	0.25W	±10%	-022-1046
R33	330kΩ	Composition	0.5W	±10%	-022-3102
R34	3.3kΩ	Composition	0.25W	±10%	-022-2067
R35	56kΩ	Composition	0.5W	±10%	-022-3009
R36	3.3kΩ	Composition	0.25W	±10%	-022-2068
R37	330kΩ	Composition	0.5W	±10%	-022-3102
R38	1MΩ	Composition	0.25W	±10%	-022-3164
R39	10kΩ	Composition	0.5W	±10%	-022-2132
R40	12kΩ	Composition	0.25W	±10%	-022-2142

RECEIVER (Cont.)

RESISTORS

Code						Part No.
R1	2.2kΩ	Wirewound		4.5W	± 5%	5905-99-011-3495
R2	68kΩ	Composition		0.5W	±10%	-022-3018
R3	33kΩ	Composition		0.5W	±10%	-022-2195
R4	4.7kΩ	Composition	Part of Osc. Coil Assy A.P. 101981	0.5W	±10%	-022-2090
R5	2.2kΩ	Composition		0.5W	±10%	-022-2048
R6	680kΩ	Composition		0.25W	±10%	-022-3143
R7	10kΩ	Composition		0.25W	±10%	-022-2131
R8	68Ω	Composition		0.25W	±10%	-022-1089
R9	100kΩ	Composition		0.25W	±10%	-022-3038
R10	47kΩ	Composition		0.25W	±10%	-022-2215
R11	47Ω	Composition		0.25W	±10%	-022-1068
R12	10kΩ	Composition		0.5W	±10%	-022-2132
R13	1.2kΩ	Composition		0.25W	±10%	-022-2017
R14	47Ω	Composition		0.25W	±10%	-022-1068
R15	47kΩ	Composition	Part of Aerial Coil Assy A.P. 103100	0.25W	±10%	-022-2215
R16	820Ω	Wirewound		3W	± 5%	-011-3318
R17	10kΩ	Composition		0.5W	±10%	-022-2131
R18	470kΩ	Composition		0.25W	±10%	-022-3122
R19	220Ω	Composition		0.25W	±10%	-022-1152
R20	100kΩ	Composition		0.25W	±10%	-022-3038
R21	10kΩ	Wirewound		6W	± 5%	-011-3421
R22		Not used				
R23	2.2kΩ	Composition		0.5W	±10%	-022-2048
R24	120Ω	Composition		0.5W	±10%	-022-1123
R25	4.7kΩ	Composition		0.25W	±10%	-022-2089
R26	270kΩ	Composition		0.25W	±10%	-022-3092
R27	10kΩ	Composition		0.5W	±10%	-022-2132
R28	4.7kΩ	Composition		0.5W	±10%	-022-2090
R29	470kΩ	Composition		0.25W	±10%	-022-3122
R30	100kΩ	Composition		0.25W	±10%	-022-3038
R31	270kΩ	Composition		0.25W	±10%	-022-3092
R32	100kΩ	Composition		0.25W	±10%	-022-3038
R33	150Ω	Composition		0.25W	±10%	-022-1131
R34	15kΩ	Composition		0.25W	±10%	-022-2152
R35	1.2kΩ	Composition		0.25W	±10%	-022-2017
R36	1.2kΩ	Composition		0.25W	±10%	-022-2017
R37	2.2MΩ	Composition		0.25W	±10%	-022-3206
R38	470kΩ	Composition		0.25W	±10%	-022-3122
R39	2.2kΩ	Composition		0.5W	±10%	-022-2048
R40	2.2MΩ	Composition		0.25W	±10%	-022-3206
R41	47kΩ	Composition		0.25W	±10%	-022-2215
R42		Not used				
R43	100kΩ	Composition		0.25W	±10%	-022-3038
R44	220kΩ	Composition		0.25W	±10%	-022-3080
R45	220kΩ	Composition		0.25W	±10%	-022-3080

H.F. TRANSMITTER - A.P.100337

CAPACITORS

Code						Part No.
C1	0.01/uF	Tubular		350 V	± 20%	5910-99-011-5552
C2	3-30 pF	Trimmer)	Part of Coil Assy			-016-7006
C3	3-30 pF	Trimmer)	A.P. 102027			-016-7006
C4	3-30 pF	Trimmer)				-016-7006
C5		Variable				A.P.102054
C6	2/uF	Feedthrough		150 V	+50% -20%	5910-99-014-5004
C7	0.01/uF	Tubular		350 V	± 20%	-014-3130
C8	220 pF	Ceramic			± 20%	-972-7247
C9	2/uF	Electrolytic		350 V	± 20%	-014-5011
C10	470 pF	Silver mica		350 V	± 5%	-972-1850
C11	470 pF	Silver mica		350 V	± 5%	-972-1850
C12	470 pF	Silver mica		350 V	± 5%	-972-1850
C13	150 pF	Silver mica		350 V	± 5%	-972-2954
C14	15 pF	Silver mica		350 V	± 5%	-972-1832
C15	0.01/uF	Tubular		200 V	± 25%	-014-3128
C16	0.01/uF	Tubular		350 V	± 25%	-014-3130
C17	3-30 pF	Trimmer)	Part of Coil Assy	75 V		-016-7006
C18	3-30 pF	Trimmer)	A.P.102027	75 V		-016-7006
C19	0.01/uF	Tubular		350 V	± 20%	-011-5552
C20	3-30 pF	Trimmer	Part of Coil Assy A.P.102027	75 V		-016-7006
C21	0.01 uF	Tubular		200 V	± 25%	-014-3128
C22	0.01/uF	Tubular		350 V	± 25%	-014-3130
C23	10 pF	Ceramic		750 V	± 10%	-012-7089
C24	0.01 uF	Tubular		200 V	± 25%	-014-3128
C25	0.1/uF	Tubular		200 V	± 20%	-011-7818
C26	0.01/uF	Tubular		200 V		-014-3128
C27	3-30 pF	Trimmer)	Part of Coil Assy	75 V		-016-7006
C28	3-30 pF	Trimmer)	A.P.102027	75 V		-016-7006
C29	3-30 pF	Trimmer)		75 V		-016-7006
C30	0.01/uF	Tubular		350 V	± 20%	-011-5552
C31	0.01/uF	Tubular		350 V	± 20%	-011-5552
C32	220 pF	Ceramic			± 20%	-972-7247
C33	0.01 uF	Tubular		350 V	± 25%	-014-3130
C34	0.01/uF	Tubular		200 V	± 25%	-014-3128
C35	0.01/uF	Tubular		500 V	± 20%	-011-5525
C36	0.01/uF	Tubular		200 V	± 25%	-014-3128
C37	0.01/uF	Tubular		500 V	± 20%	-011-5525
C38	50/uF	Electrolytic		50 V	+ 100% - 20%	-012-4907
C39	0.01/uF	Tubular		500 V	± 20%	-011-5525
C40	0.01/uF	Tubular		350 V	± 20%	-011-5552
C41	20-250 pF	Variable				A.P.102053
C42	5000 pF	Block mica		2000 V	± 20%	5910-99-012-3461
C43	230 pF	Ceramic tubular			± 2%	A.P.102045
C44	230 pF	Ceramic tubular			± 2%	A.P.102045
C45	230 pF	Ceramic tubular			± 2%	A.P.102045

RECEIVER (Cont.)

INDUCTORS (Cont.)

Code			Part No.
L19	Filter coil	Part of FL2 A.P. 102017	A148812
L20	Mixer tuning	range 1	A148641
L21	Mixer tuning	range 2	A148642 col A
L22	Mixer tuning	range 3	A148642 col B
L23	Mixer tuning	range 4	A148642 col C
L24	Mixer tuning	range 5	A148642 col D
L25	Mixer tuning	range 6	A148643 col A
L26	Mixer tuning	range 7	A148643 col B
L27	Mixer tuning	range 8	A148643 col C
		Part of Mixer Coil Unit A.P. 101979	
L28	Crystal osc. anode choke		A.P.102089
*L29	Tuning coil	Part of TR4 A.P. 103102	
*L30	Tuning coil		
*L31	Tuning coil	Part of TR4 A.P. 103103	
*L32	Tuning coil		
L33	2nd Osc. 2nd Harmonic filter coil		A.P.102023
L34	1.86 Mc/s Oscillator coil		A.P.102015
*L35	Tuning coil	Part of TR3 A.P. 103104	
*L36	Tuning coil		
*L37	Tuning coil		
*L38	Tuning coil	Part of TR2 A.P. 103105	
*L39	Tuning coil		
*L40	Tuning coil		
*L41	Coil		A.P.102018
*L42	Tuning coil	Part of TR1 A.P. 103106	
*L43	Tuning coil		
L44	B.F.O. coil assy		A148755
L45	Heater choke assy		A148756
*L46	Feedthrough filter choke	Part of FL5	
*L47	Feedthrough filter choke		
*L48	Feedthrough filter choke		
*L49	Feedthrough filter choke		
*L50	Feedthrough filter choke		
*L51	Feedthrough filter choke		
*L52	Feedthrough filter choke		
*L53	Feedthrough filter choke		
*L54	Feedthrough filter choke	Part of FL4 A.P. 103091	
*L55	Feedthrough filter choke		

* Not available as separate item

VALVES

V1	CV4009	5960-99-000-4009
V2	CV2128	-000-2128
V3	CV4058	-000-4058
V4	CV2128	-000-2128
V5	CV131 or CV4015	-000-0131 or 000-4015
V6	CV131 or CV4015	-000-0131 or 000-4015

BR2169
Part 2

PARTS LISTS

AND

DIAGRAMS

RECEIVER (Cont.)

Code	COMPLETE ASSEMBLIES AND ASSEMBLY COMPONENTS		Part No.
	B.F.O. assembly		A.P.101982
	Component strip assembly	(*R1-R23)	C148573
	Component strip assembly	(*R14-R33)	A148571
	Component strip assembly	(*R24-R45)	B148574
	Component strip assembly	(*R39-R47)	A148576
	Component strip assembly	(*R50-R63)	B148575
	Coupling assembly		A148593
	Half coupling		A148803
	Half coupling		A148804
	Crystal holder assembly		C148580
	Bearing socket subassembly		A148684
	Crystal socket		A.P.102008
	Lug plate subassembly (5 way)		A148638
	Mills pin 3/32" x $\frac{1}{2}$"		Mills G.P.1
	Mounting plate subassembly		B148687
	Toggle arm subassembly (with cutout)		A148682
	Toggle arm subassembly (with pin)		A148683
	Top plate crystal holder		Part Salford QC110-2
	Dial lock arm assembly		A148586
	Spring arm		A148774
	Rubber pad		A148775
	Range dial assembly		B148585
	Dial subassembly		B148768
	Click plate		A148770
	Mills pin 3/32" x $\frac{5}{8}$"		Mills G.P.1
	Switch mounting plate assembly		A148590
	Trimmer mounting strip assembly		A148578
	Tuning unit assembly		D148583
	Volume control bracket assembly		A148587

* Minimum and maximum resistor code quoted for identification purposes only.

MECHANICAL ITEMS

Bellows coupling	A.P.102025
Captive screw	A148507
Cursor window	A148619
Dial lock knob	A148624
Dial lock pin	A148625
Dial lamp holder	A.P.102026
Escutcheon	D148611
Flexible coupler	Stretton 529
Knob metal mounting	5355-99-091-0183
Knob retaining cap	-097-0184
Knob (6 off)	-097-0173
Knob (2 off)	-097-0188

POWER UNIT A.P.100340A AND 5895-99-418-1573 POWER SUPPLY (A.P.399015)

CAPACITORS

Code					Part No.
C1	8µF	(A.P.100340A only)	600/400V	±20%	5910-99-011-2825
C2	8µF	(A.P.100340A only)	600/400V	±20%	-011-2825
C3	4µF	(A.P.100340A only)	1000/650V	±20%	-011-2535
C4	4µF	(A.P.100340A only)	1000/650V	±20%	-011-2535
C5	8µF	(A.P.100340A only)	600/400V	±20%	-011-2825
C6	0.5µF		1000/750V	±20%	-011-1377
C7	4µF		1000/750V	±20%	-011-2535
C8	0.5µF		350V	±20%	-011-7820
C9	8µF		600/400V	±20%	-011-2825
C10	0.5µF		500V	±20%	-011-7825
C11	8µF		200/100V	±20%	-011-2884
C12	8µF		200/100V	±20%	-011-2884
C13	8µF		200/100V	±20%	-011-2884
C14	8µF		200/100V	±20%	-011-2884
C15	4µF		200/100V	±20%	-011-2883
C16	8µF		200/100V	±20%	-011-2884
C17	0.05µF	(A.P.399015 only)	500V		-014-3139
C18	0.05µF	(A.P.399015 only)	500V		-014-3139
†C19	0.01µF	(A.P.399015 only)	1000V		-011-5503
†C20	0.01µF	(A.P.399015 only)	1000V		-011-5503
C21	0.05µF	(A.P.399015 only)	500V		-014-3139
C22	0.05µF	(A.P.399015 only)	500V		-014-3139
C23	0.05µF	(A.P.399015 only)	350V		-014-3152
C24	0.05µF	(A.P.399015 only)	350V		-014-3152
C25	0.05µF	(A.P.399015 only)	350V		-014-3152
C26	0.05µF	(A.P.399015 only)	350V		-014-3152
C27	0.02µF	(A.P.399015 only)	750V		-014-3159
C28	0.02µF	(A.P.399015 only)	750V		-014-3159
C29	0.05µF	(A.P.399015 only)	500V		-014-3139
C30	0.05µF	(A.P.399015 only)	500V		-014-3139
C31	0.02µF	(A.P.399015 only)	750V		-014-3159
C32	0.02µF	(A.P.399015 only)	750V		-014-3159
C33	0.05µF	(A.P.399015 only)	500V		-014-3159
C34	0.05µF	(A.P.399015 only)	500V		-014-3159
C35	8µF	(A.P.399015 only)	600V		-011-2825
C36	4µF	(A.P.399015 only)	1000V		-011-2535
C37	8µF	(A.P.399015 only)	600V		-011-2825
C38	8µF	(A.P.399015 only)	600V		-011-2825
C39	4µF	(A.P.399015 only)	1000V		-011-2535
*C40	0.02µF	(A.P.399015 only)	750V		-011-7826
*C41	0.02µF	(A.P.399015 only)	750V		-014-3159
*C42	0.02µF	(A.P.399015 only)	750V		-014-3159
*C43	0.02µF	(A.P.399015 only)	750V		-014-3159
*C44	0.05µF	(A.P.399015 only)	1000V		-911-4759
*C45	0.05µF	(A.P.399015 only)	1000V		-911-4759

† Not fitted to modified version of A.P.399015
* Modified version of A.P.399015 only

L25	Mixing 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

POWER UNIT (Contd.)

VALVES (A.P.100340 only)

Code		Part No.
V1	CV2218	5960-99-000-2218
V2	CV2218	-000-2218
V3	CV378	-000-0378
V4	CV378	-000-0378
V5	CV493 or CV4005	-000-0493 or 000-4005
V6	CV493 or CV4005	-000-0493 or 000-4005
V7	CV493 or CV4005	-000-0493 or 000-4005

SEMICONDUCTORS (A.P.399015 only)

MR1	CV7476	5960-99-037-3668
MR2	CV7476	-037-3668
MR3	CV7476	-037-3668
MR4	CV7476	-037-3668
MR5	CV7476	-037-3668
MR6	CV7476	-037-3668
MR7	CV7476	-037-3668
MR8	CV7476	-037-3668
MR9	CV7476	-037-3668
MR10	CV7476	-037-3668
MR11	CV7476	-037-3668
MR12	CV7476	-037-3668
MR13	CV7476	-037-3668
MR14	CV7476	-037-3668
MR15	CV7476	-037-3668
MR16	CV7476	-037-3668
*MR17	CV7476	-037-3668
*MR18	CV7476	-037-3668
*MR19	CV7476	-037-3668
*MR20	CV7476	-037-3668

* Modified version of A.P.399015 only

TRANSFORMERS

TR1	Receiver h.t. and l.t.	5950-99-972-0455
TR2	Transmitter h.t.	5950-99-972-0456 (A.P.100340A only) 5950-99-580-1744 (A.P.399015 only)
TR3	Transmitter l.t.	5950-99-972-0453
TR4	Microphone	5950-99-972-0452

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

H.F. Transmitter

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

M.F. Transmitter

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

POWER UNIT (Contd.)

Code	MISCELLANEOUS		Part No.
FS1	3 amp fuse	(A.P.399015 only)	5920-99-972-6150
	1 amp fuse	(A.P.100340A only)	A.P.2027
FS2	3 amp fuse	(A.P.399015 only)	5920-99-972-6150
	1 amp fuse	(A.P.100340A only)	A.P.2027
FS3	1.5 amp fuse	(A.P.399015 only)	5920-99-972-6912
	1 amp fuse	(A.P.100340A only)	A.P.2027
FS4	1.5 amp fuse	(A.P.399015 only)	5920-99-972-6912
	1 amp fuse	(A.P.100340A only)	A.P.2027
FS5	1.5 amp fuse	(A.P.399015 only)	5920-99-972-6912
	1 amp fuse	(A.P.100340A only)	A.P.2027
FS6	1.5 amp fuse	(A.P.399015 only)	5920-99-972-6912
	1 amp fuse	(A.P.100340A only)	A.P.2027
FS7	1.5 amp fuse	(A.P.399015 only)	5920-99-972-6912
	250mA fuse	(A.P.100340A only)	A.P.102357
FS8	1.5 amp fuse	(A.P.399015 only)	5920-99-972-6912
	500mA fuse	(A.P.100340A only)	-059-0108
FS9	250mA fuse	(A.P.100340 only	A.P.102357
FS10	250mA fuse	(A.P.100340A only)	A.P.102357
FS11	250mA fuse	(A.P.100340A only)	A.P.102357
FS12	4 amp fuse	(A.P.100340A only)	A.P.19346
FS13	4 amp	(A.P.100340A only)	A.P.19346
LP1	Lamp, Neon, Indicator		6240-99-996-1110
	Cap nut		A148506
	Captive screw		A148507
	Fuse panel assembly		B404036
	Fuse panel		B404034
	Post		B404035
	Knob (chassis 2 - Remote/local)		5355-99-097-0186
	Knob (chassis 2 - A.F. Gain)		-097-0173
	Knob (chassis 1)		-097-0185
*	Locating pin 1 13/32" (1 off)		A148463
*	Locating pin 1 17/32" (3 off)		A148463
*	Locating pin 2BA		A148463
	Phone jack mounting plate		A148548
	Phone jack identity plate		A148549
	Retaining cap		5355-99-097-0184
	Switch plate assembly		A148541
	Switch plate		B148554
	Tapped washer (for captive screw)		A148508
	Terminal strip 5 way		5940-99-940-2362
	10 way		-940-2361
	20 way		-940-2367

* State size when ordering.

SEE

FIG 1 TO 13