Chapter 4

TRANSMITTER TYPE T.4188

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LIST OF ILLUSTRATIONS

INTRODUCTION

1. The transmitter RF circuit consists of a power amplifier incorporating two paralleled beam tetrodes operating in Class C, and two buffer amplifiers. The coil unit tuning the three stages is driven by a mechanical drive unit incorporating a tuning motor controlled by a bridge circuit.

2. The transmitter can be set to any of 24 frequencies (in two frequency bands) by inserting crystals of the required operating frequencies into the associated control and drive unit. The equipment is then tuned from the control and drive unit in conjunction with controls on the remote control unit (*Chap.* 7).

3. These tuning positions, when set up, may be re-selected at the remote control unit as required. Thus only the control and drive unit need be accessible for setting-up purposes.

4. The following transmitter controls are available on the front panel of the control and drive unit. (Control unit Type 4190 or Type 4243).

(1) The setting potentiometers POT. 1 and POT. 2 for the transmitter unit (and additional potentiometers for the wire aerial coupling unit when used—Sect. 3).

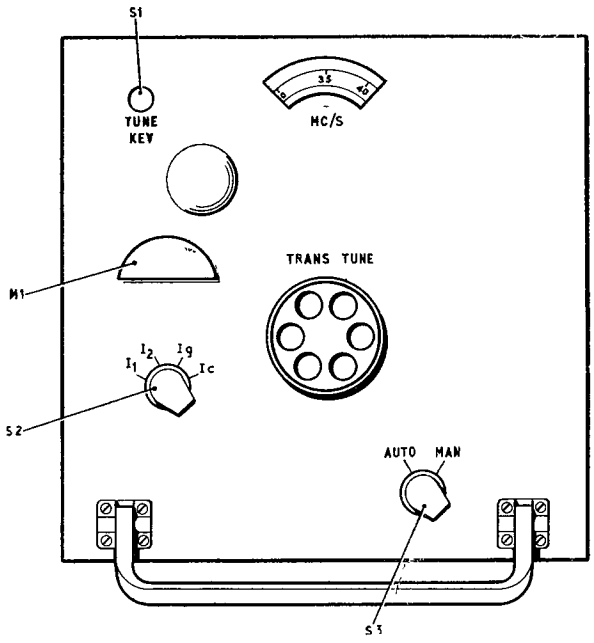


Fig. 1. Front panel of transmitter Type T.4188

(2) The meter and meter switch. The readings are P.A. grid and cathode currents, and aerial excitation.

(3) A TEST/TUNE key is used in setting-up the transmitter.

GENERAL DESCRIPTION

Construction

5. The complete transmitter consists of a composite chassis on which is mounted a front panel measuring 8 in. by 8 in. and bearing the controls necessary for the manual checking of the transmitter circuits (*fig.* 1).

6. A removable dust cover is fitted over the whole unit and is fixed by a quick release fastener at the rear of the unit. The depth of the unit is 12½ in.

7. The sub-units of the transmitter are mounted on the main chassis assembly Type 4210 ; this is a cast aluminium chassis to which is attached the front panel of the transmitter. Incorporated in the cast aluminium chassis are the mountings for the P.A. valves and the buffer amplifier valves (*fig.* 2). The mounting for the P.A. valves is a separate cast aluminium chassis which plugs into the main chassis.

8. At the side of the chassis assembly is bolted the coil unit or tuning unit Type 4218. This is a cast chassis on which is mounted the three variable coils tuning the amplifier stages. The coils are ganged by means of a shaft running under the centre-line of the coils below the chassis and having a chain sprocket wheel on the front panel end.

9. The drive unit mechanical Type 4212 is bolted to the right-hand front of the chassis assembly Type 4210. The drive unit includes the tuning motor with its associated gears and the potentiometer and relays that constitute the remote tuning head. Connection is made between the drive unit and the drive shaft of the coil unit by means of a silver-nickel chain running on special sprocket wheels

10. From the front of the main chassis assembly behind the drive unit are mounted the input valve V1 and the time delay relay RL10/1 mounted on a valve base (*fig.* 2). Underneath RL10/1 are the two relays, RL4/2 and RL5/2 and on the raised step to the rear of the relays is mounted the driver valve V2.

11. Behind the screen are the two valves of the P.A. stage, these are mounted on a raised cast box which leads the air blast from below through the valve anodes. The box is directly above the air blower MG2, attached to the underside of the chassis (*fig.* 3), which draws the cooling air through the air filter to discharge it directly into the box.

12. The air blower, the valve box, the filter housing and the three main units may all be separated with the aid of a screwdriver. All electrical connections are made by plugs and sockets.

Front panel

13. The front panel is illustrated in fig. 1. The function of the controls is described in para. 33 to 38.

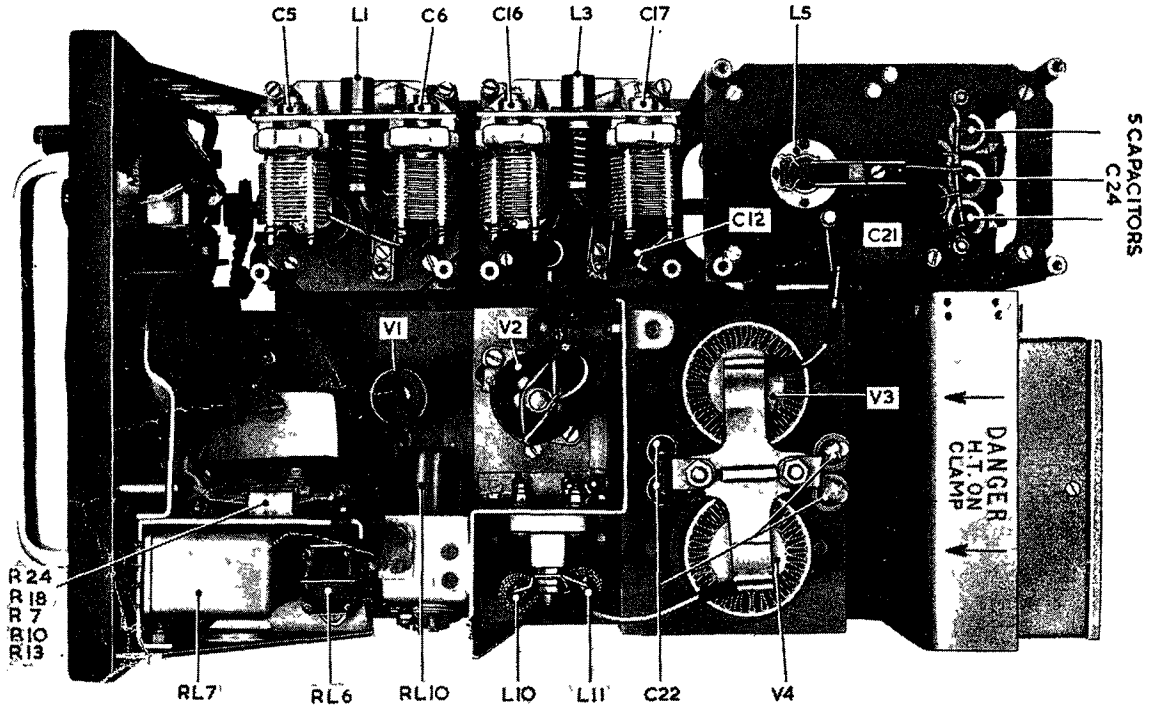


Fig. 2. Top of transmitter chassis

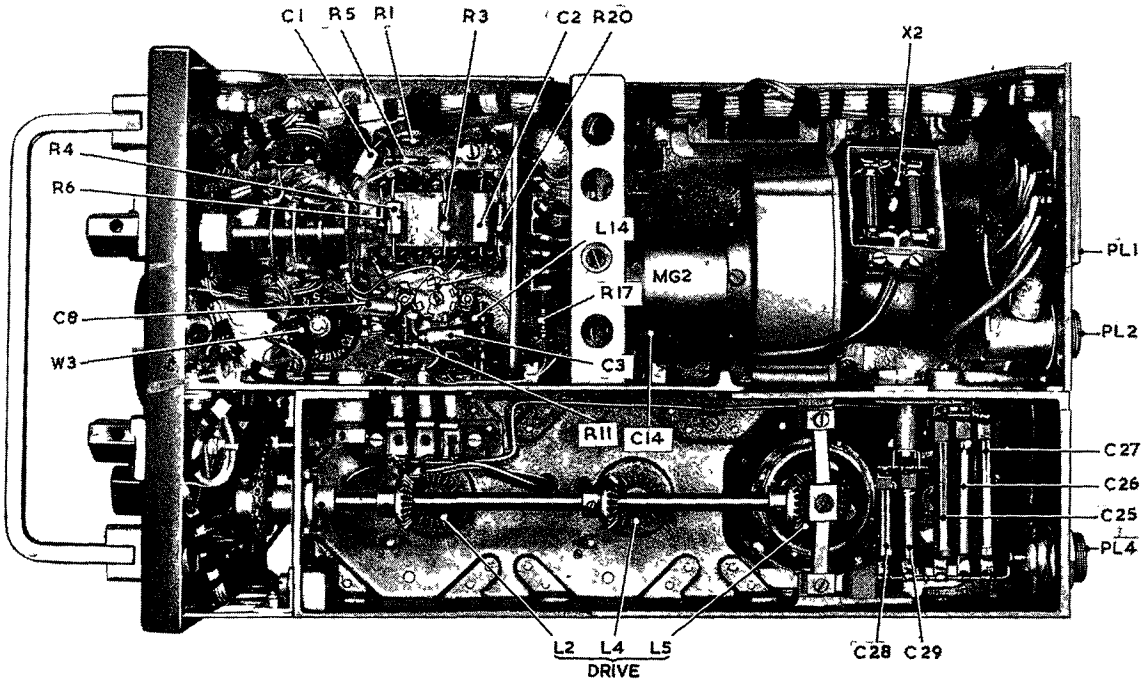


Fig. 3. Underside of transmitter chassis

Interconnection in ARI.5874

14. The interconnection of the transmitter Type T.4188 within the installation is made by one multipole and three coaxial plugs fixed to the rear face of the chassis. In common with other units of the installation these plugs connect directly into a back-plate at the rear of the transmitter mounting assembly (*Chap* 10).

15. The back-plate is interconnected to the remainder of the installation by means of connectors permanently wired to the back-plates of other units of the installation. Some details of the plugs at the rear of the transmitter are given below; a more complete account of these, the back-plates and the connectors is given in Chap. 10.

(2D) PL1 28-pole plug — Control and power supplies

(2B) PL2 Coaxial plug — RF input

(2E) PL3 Coaxial plug — 600V MOD. HT

(2C) PL4 Coaxial plug — RF output

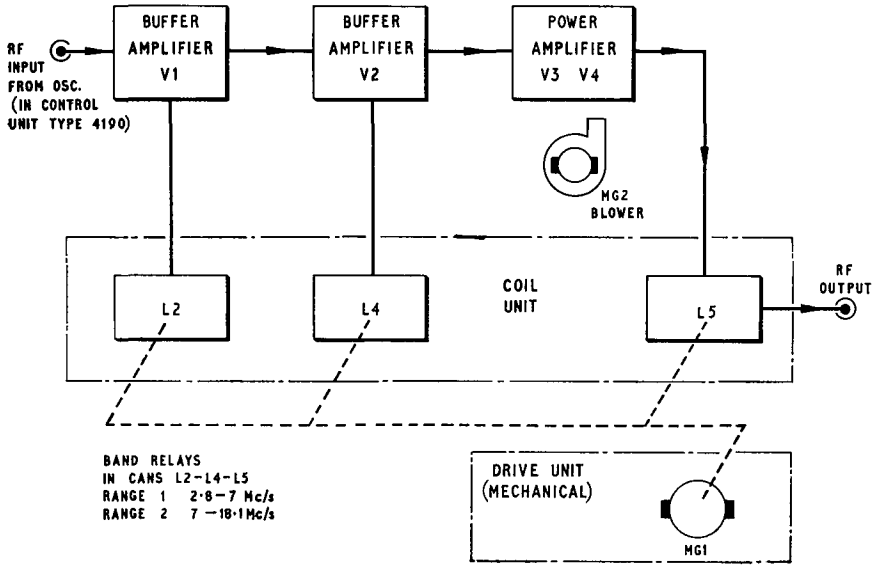


Fig. 4. Block diagram of transmitter circuit

Note . . .

The references in parenthesis are the back-plate codings for the associated sockets

CIRCUIT DESCRIPTION

RF circuits

16. The function of the transmitter unit as a whole is to amplify the output from the oscillator in the control unit Type 4190 (or Type 4243—Sect. 3) This raises the input level from 2 volts RMS (nominal) into 70 ohms to the output level of 100 watts into 70 ohms at fundamental frequency.

17. A circuit diagram of the transmitter is given in fig. 7, this is simplified

in the block diagram (*fig.* 4). The input from the coaxial plug PL2 through C1 and R3 is connected to the grid of the input pentode V1 ; the 82-ohm resistor R1 is the terminating resistance of the input cable.

Buffer amplifiers

18. The 300–volt HT supply is connected to the screen of V1 through resistors R11 decoupled by C8; the anode is shunt-fed by choke L14. The tuned anode circuit is isolated by C3 and consists of the variable inductor L2 tuned by the preset C6 and stray capacitance. Trimming is by the use of the iron-cored coil L1 and C6. The valve is cathode-biased by R4 and R5; resitor R8 is a damping resistor connected across L1 and L2.

19. Coupling to the buffer stage is by C9 and R15 to the grid of the beam tetrode V2. The 300-volt HT supply is taken to the screen grid by R16, C11 and to the anode by shunt feed through R14 and L6.

20. The valve operates in Class AB and is biased by grid leak R15 and cathode resistors R22 and R23. The anode is tuned in a similar manner to the preceding stage by L4 and C17, and is trimmed by L3 and C17.

Power amplifier

21. The power amplifier stage has two air-blast cooled beam tetrodes V3 and V4 operating in parallel in Class C. The grids are driven from the driver stage through C13. The screen grid potential and the anode potential are obtained from the power and radio unit Type 4192 from the 300V and 600V supplies, respectively.

22. When the transmitter is modulated in the R/T and MCW conditions the anode and screen grid supplies are modulated by the output transformer 3T3 in that unit. The screen potential is taken through resistors R30 and R31 and decoupled by C20. In " SAFE " conditions the screen potential is further reduced by the introduction of the dropping resistor 3R43 switched in by relay 3RL11 (*Chap* 5)

23. The anodes of V3 and V4 are shunt-fed by the chokes L10–L13 connected in series-parallel. The grid circuits include the anti-parasitic chokes L7 and L8. The grid bias supply to the stage is a combination of fixed bias from the 28-volt battery supply to which the cathode return is connected ; grid-leak bias through L9 and R27, R24 and cathode-bias from resistors R25 and R26 in parallel.

P.A. valves (CV2519)

24. A special type of valve is used in the P.A. stage. Details of the valve and its connections are given in fig. 5 and fig. 7.

RF output

25. The anode circuit is matched to the low-impedance output by means of the pi-circuit C22, L5 and C25, C26, C27. The coil L5 is variable and ganged to the preceding stages.

Band changing

26. To cover the frequency range the transmitter has two bands, 2·8 to 7 Mc/s and 7 to 18 Mc/s. The transmitter circuits are arranged to be normally on the higher of these bands, but the band change relays RL1/3, RL2/2 and RL3/2, when operated, switch in capacitors at the three tuning stages and thus switch the transmitter to the lower band.

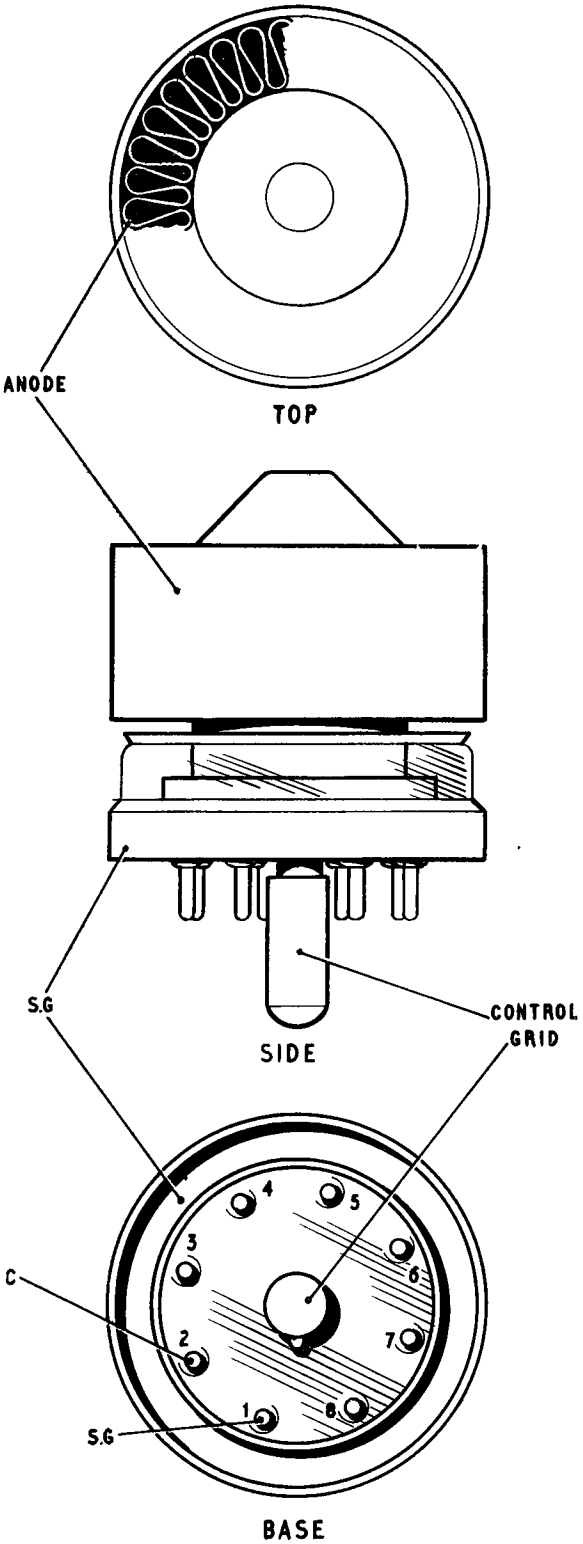


Fig. 5. CV 2519 connections

27. These capacitors are switched in by the following relay contacts :—

(1) Anode of V1. Relay contact 3B switches in capacitor C4 and trimmer C5.

(2) Anode of V2. Relay contact 2B switches in capacitors C15, C35 and trimmer C16.

(3) Output circuit. The input and output shunt elements of the pi-circuit are increased by the addition of capacitors C24 (relay contact 1A) and C28, C29 (relay contact 1B). Relay RL1/3 is a special high voltage type for band changing in the P.A. stage (*fig.* 6).

Valve heaters

31. The heaters of V2, the coil of relay RL10/1 and the heater of V1 are connected in series with the 19V supply from pin 27 of PL1; the resistor R19 is in parallel with the heater of V1. The heaters of the P.A. valves V3 and V4 are series connected to a nominal 12V supply obtained from the series dropping resistor 3R41 in the power and radio unit Type 4192 (*Chap.* 5). The blower motor MG2 is directly connected to the 28V supply via pin 11 of PL1 and starts up at the same time as the heaters are connected.

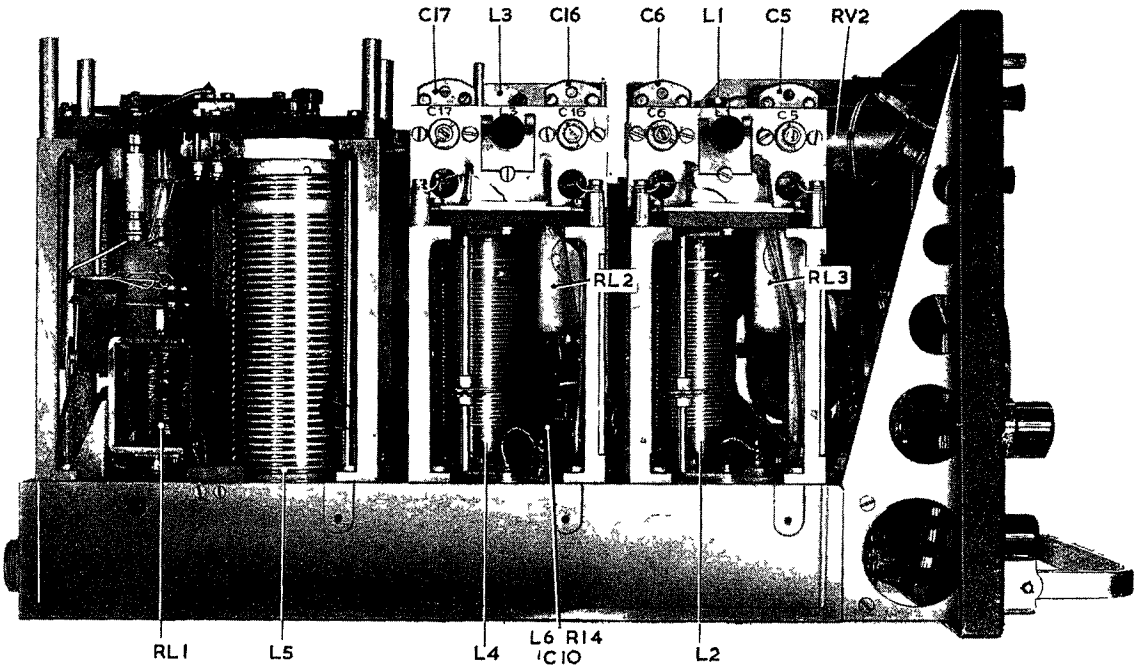


Fig. 6. Left side of transmitter chassis

Keying circuit

28. When the key line is earthed (this can be achieved by use of the TUNE KEY switch S1—*fig.* 1) the relay RL4/2 is energized ; the contact 4A closes and connects the 300-volt DC supply to the first two stages of the transmitter. At the same time contact 4A also connects this supply via pin 17 of PL1 to the crystal oscillator in the control unit Type 4190 (via 3SK1 and 3SK2—*Chap.* 3).

29. The P.A. stage of the transmitter is normally biased nearly to cut-off by the cathode resistor R13 but when contact 4B closes R13 is short-circuited and the P.A. stage is then able to operate normally.

30. When the intertune line is earthed relay RL5/2 is energized and the contacts 5A and 5B reverse the conditions created by the operation of relay RL4/2 (*para.* 28 and 29) and put the transmitter in the " space " condition.

Time delay relay

32. The thermal relay RL10/1 is connected in parallel with the resistor R20 and with a time delay of 30 seconds after switching on the heaters the relay closes contact 10A allowing HT to be applied to the transmitter.

Function of front panel controls

TUNE KEY—S1

33. When the tune key is pressed the transmitter is in the " mark " condition for tuning purposes.

METER SWITCH S2

34. The meter switch has four positions marked I_1, I_2, I_g, and I_c.

(1) In the I_1 position the meter reads the cathode current of valve V1. The meter M1 is connected across R5 to earth so that the meter reads the

cathode current of this stage through R6. (Meter reading X10 = cathode current in milliamps).

(2) In the I_2 position the meter reads the cathode current of valve V2. The meter M1 is connected across R23 to earth so that the meter reads the cathode current of this stage through R21. (Meter reading X20 = cathode current in milliamps).

(3) In the I_g position the meter reads the grid current of the P.A. stage. The meter M1 is connected across R24 to earth so that the meter reads the grid current of this stage through R18 . (Meter reading X10 = grid current in milliamps).

(4) In the I_c position the meter reads the cathode current of the P.A. stage. The meter M1 is connected across R7 to the 28V supply in the cathode lead of the P.A. stage so that the meter reads the cathode current of this stage through R10. (Meter reading X100 = cathode current in milliamps). This can be used to check the transmitter by pressing the TUNE KEY switch S1 when S3 is in the AUTO position.

AUTO/MANUAL SWITCH (S3)

AUTO position

35. The AUTO position is used for the normal operation of the equipment.

(1) In the AUTO position the switch connects the control detector circuit from pin 14 of PL1 to the detector contact on the potentiometer RV2 of the transmitter remote control head. The connection within the transmitter is made via SK2 and PL6, pin 2.

(2) Additionally, the HT ON circuit is connected between pins 8 and 4 on PL1 facilitating remote control of HT. This circuit may be interrupted by relay contact 10A (*para.* 32).

(3) In the AUTO position the tuning motor MG1 is mechanically engaged with the coil drives.

MANUAL position

36. The MANUAL position is used in bench testing and for checking the bridge resetting when the equipment is in use. In the MANUAL position the circuit is affected as follows :—

(1) The HT ON circuit is opened to prevent manual operation with the HT applied.

(2) The bridge circuit is disconnected to prevent operation on MANUAL.

(3) The motor drive from MG1 is disconnected to allow the mechanism to be turned manually by means of the finger dial on the front of the transmitter.

Calibrated frequency dial

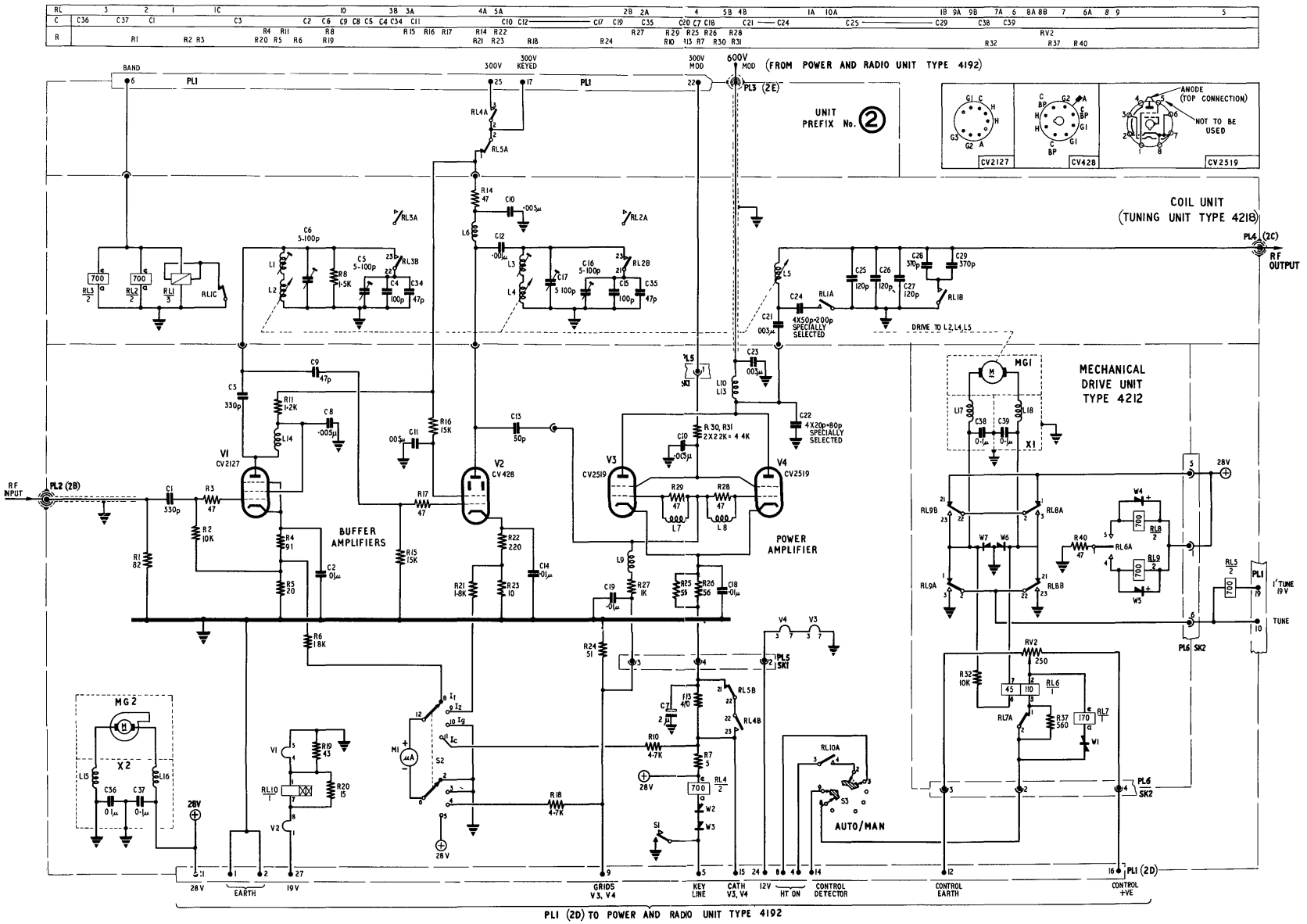
37. The front panel also displays a dial calibrated in the two frequency bands and ganged to the tuning circuits. This is used to check the tuning position against harmonic operation.

Meter—M1

38. The meter on the front panel is a microammeter 0–500. The scale reading is 0 — 5 with a f.s.d. of 500 microamps. Its resistance is 180 ohms. The actual readings are in milliamps and the multiples are indicated in para. 34.

Drive unit mechanical Type 4212

39. The drive unit mechanical Type 4212 is the remote tuning head connected to the transmitter proper by means of the plug and socket PL6 and SK2, it is also mechanically connected by the sprocket chain and lever to switch S3. The operation of the remote control circuit is fully described in Chap. 2.



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