

Chapter 3

CONTROL UNIT TYPE 4190

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INTRODUCTION

1. The control unit Type 4190 is used in aircraft installations of the ARI.5874 with suppressed aerial systems; for those aircraft fitted with ARI.5874 using fixed wire aerials, control unit Type 4243 is used, this is described in Sect. 3, Chap. 3. The control unit Type 4190 is the control and drive unit of the transmitter (when using a suppressed aerial) and includes all the control circuits for the automatic operation of the transmitter. The unit is better known as "the control and drive unit"

CONSTRUCTION

2. The chassis is constructed as a rectangular framework on which a detachable front panel is mounted. A loose dust cover is fitted and can be removed after releasing an Oddie fastener at the rear of the chassis.

Front panel controls and switches

3. An illustration of the front panel of the control

and drive unit is given in fig. 1. The panel is fitted with controls, which in conjunction with the remote control unit, can be used to set up channels on any frequency in the band without the necessity of access to the transmitter.

4. The upper half of the front panel is occupied by the channel potentiometer controls; these are part of two 12-way potentiometers (POT.1 and POT.2) described as resistance unit Type 4217. The potentiometers and associated mounting plate may be withdrawn through the front panel (Part 2).

5. Beneath the potentiometers is mounted an assembly of 24 frequency band switches used for setting up purposes. The assembly is known as switch unit Type 7289 (10F/17582) and consists of single-pole switches of the push button type. Twelve of the switch knobs are in white perspex (S2/1) and the remaining twelve in black ebonite (S2/2). The two rows of knobs are engraved A—M in each case.

6. The detachable front panel (panel, control Type 7246) may be completely disconnected from the remainder of the chassis after releasing a number of securing screws. This allows access to the front part of the chassis for servicing purposes.

Chassis layout

7. A selector motor MG1 (motor unit Type 4214) is mounted in the centre of the chassis and drives a shaft operating a multi-bank switch from which is made all the switching necessary for automatic channel selection of the transmitter circuits.

8. Three banks of the switch (S3A-B-C) associated with the control wiring are mounted at the front. Four banks, (S3E-F-G-H) at the rear and in the space between the two vertical banks of the crystal sockets, are used to select one of the 24 crystals for each channel. A further switch bank, (S3D) is used to indicate the chosen channel to the aerial selector unit of the suppressed aerial system (*Sect. 2*) by earthing one of 12 connections to the aerial selector unit.

9. A gear train from the same motor shaft engages with a gear train at the rear of the two 12-way potentiometers and thus turns these in unison to the selected channel position (*fig. 2*).

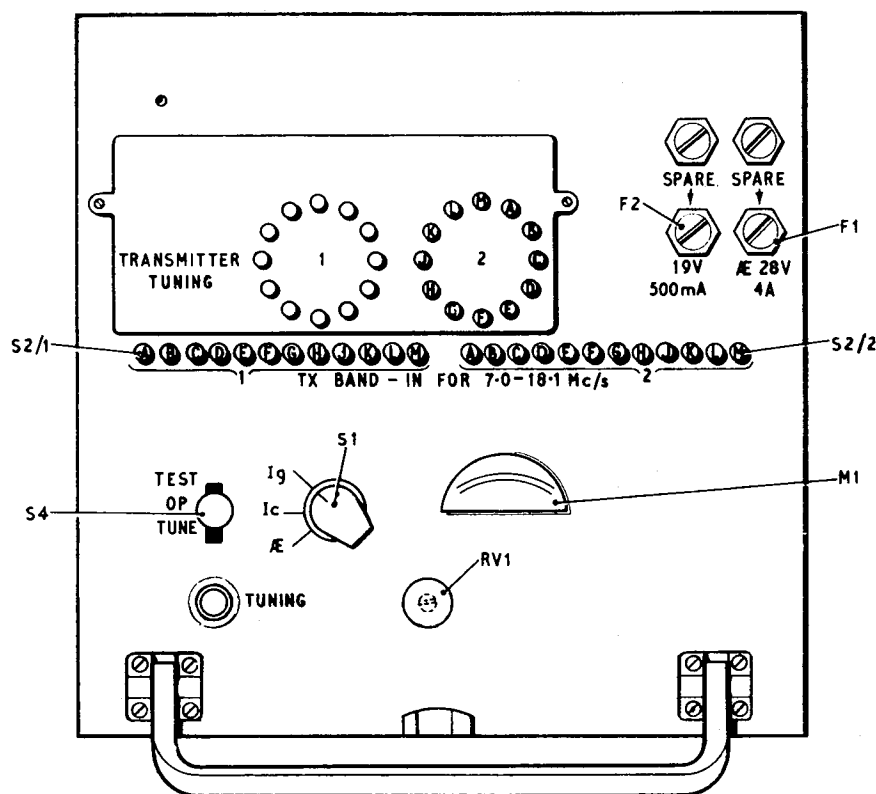


Fig. 1. Control unit Type 4190—front

10. Above the crystal sockets is mounted the small sub-chassis of the crystal oscillator (oscillator unit Type 4215), connection being made to the crystal switches by means of spring contacts.

11. Two crystal ovens, Type 13 and Type 14 (*fig. 3*) house the 24 crystal units which are switched in by the channel selection system and applied to the crystal oscillator circuit. The ovens are fitted with heaters and thermostatic control which keeps the crystal temperature at above 0 deg. C.

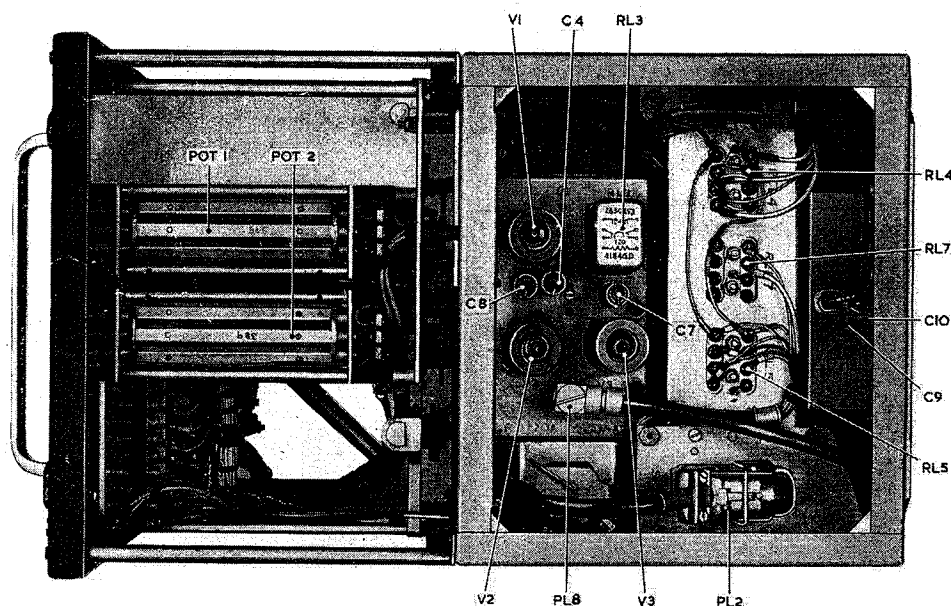


Fig. 2. Chassis with cover removed—top

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12. A number of relays are fitted to the control unit chassis, one of which acts as the low impedance aerial changeover relay. The latter is mounted on a panel at the rear of the chassis and is designated relay unit Type 4216. Three coaxial plugs are connected to this relay, thus enabling the aerial to be connected through the relay to either the transmitter or the receiver (*para.* 14).

13. On the back panel of the unit are mounted plugs and sockets for interconnection with other units of the installation, the connections are made through the back-plate of the control and drive unit. (*Chap.* 10).

14. 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 and sockets at the rear of the control and drive units are given below ; a more complete account is given in *Chap.* 10.

- | | | |
|-------|------------------|---|
| (1C) | PL5—coaxial plug | Aerial connection to transmitter. |
| (1AG) | PL6—coaxial plug | Connection from aerial to aerial-changeover relay (<i>para.</i> 12). |
| (1L) | PL7—coaxial plug | Aerial connection to receiver. |

Note . . .

The references in brackets refer to the back-plate and connector coding (*Chap.* 10).

CIRCUIT DESCRIPTION

15. The circuit of the control unit Type 4190 includes those parts of the transmitting circuit controlling the signal frequency and channel selection. The control unit also includes the channel letter switch controlling the channel selection of the associated aerial system. (*Sect.* 2 and 3).

16. A complete circuit diagram is given in *fig.* 5. The circuit can be divided into four parts three of which are indicated in the block schematic *fig.* 4.

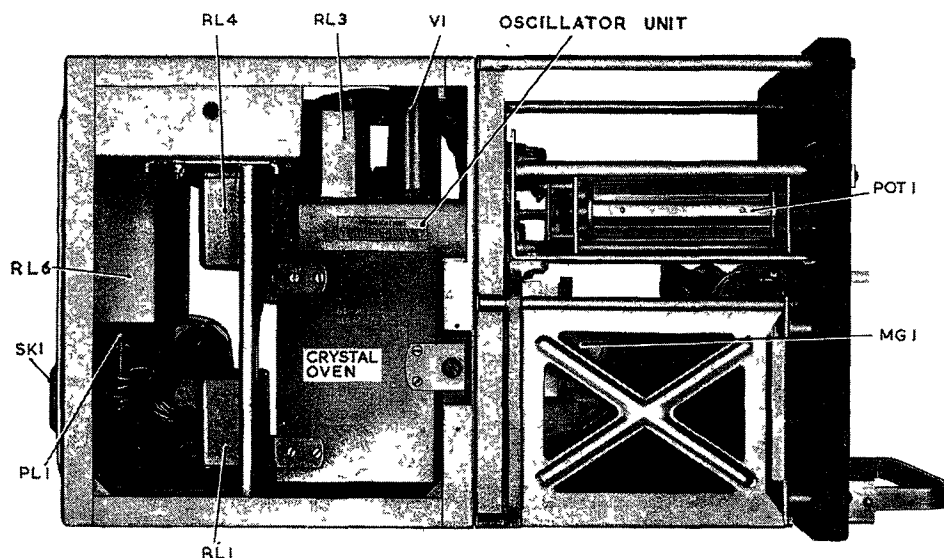


Fig. 3. Chassis with cover removed—side

- | | | |
|-------|--------------------|---|
| (1AF) | SK1—28-pole socket | Channel selections control to aerial selector unit. |
| (1AE) | PL1—28-pole plug | Connections to remote control unit. |
| (1A) | PL3—20-pole plug | Control and power supplies from power and radio unit. |
| (1B) | PL4—coaxial plug | Crystal oscillator output to transmitter. |

- (1) The crystal-controlled oscillator
- (2) The channel selector motor and channel selection circuits.
- (3) The transmitter metering circuits (*fig.* 5).
- (4) The aerial system channel selector switch.

Oscillator unit Type 4215

17. The oscillator unit Type 4215 includes three HF pentodes CV138. The oscillator V1 is triode-connected in an aperiodic Colpitts oscillator with feedback provided by the capacitors C1 and C2.

18. Any one of the 24 crystals can be selected for connection between grid and earth of V1, the selection being made as follows. The crystals are in two banks of twelve; those for the channels 1A—1M are selected by switch wafers S3E and S3F with S3E earthing all crystals with the exception of the one selected; S3F makes contact only with the crystal selected.

19. Switch wafers S3G and S3H operate similarly on the other crystal bank. Contact 3A of relay RL3/2 connects the oscillator grid to one or other of the crystal banks, the bank not in use being earthed by contact 3B.

20. The anode of V1 is coupled by C5 and R7 to the grids of the valves V2 and V3 connected in parallel and as a cathode-follower with load R11. The output through C6 is taken to plug PL4 at the rear of the control unit Type 4190 via SK3 on the oscillator chassis and is a nominal 2 volts RMS into a cable of 70 ohms impedance.

21. The valve heaters are connected in series with the 19V supply via PL9 and SK4 pin 1. The 300V supply to the anodes is connected via PL9 and SK4 and obtained from the keying relay 2RL4/2 in the transmitter unit (via relay 3RL1/2 in the power and radio unit).

Crystal units

22. Each bank of 12 crystal units is plugged into an enclosure which is thermostatically controlled to a temperature above 10 deg. C (nominal) by means of heaters. The heaters R15 and R16 are switched by the bimetal regulator. Regulator X3 will operate in the event of failure of X2. The heaters R17, R18 and the bimetal regulators X4 and X5 are the corresponding components in the second heated enclosure.

Control circuits

23. A full description of the channel selection and control circuits is given in Chap. 7, but a brief description of the control and switching circuits of the transmitter is given below:—

Front panel switches

Meter switch (S1)

24. The meter M1 is connected so that it may be switched to measure the grid current of the transmitter P.A. stage (Ig), the cathode current of the P.A. stage (Ic) and the aerial excitation (AE) from the metering circuit of the aerial system in use.

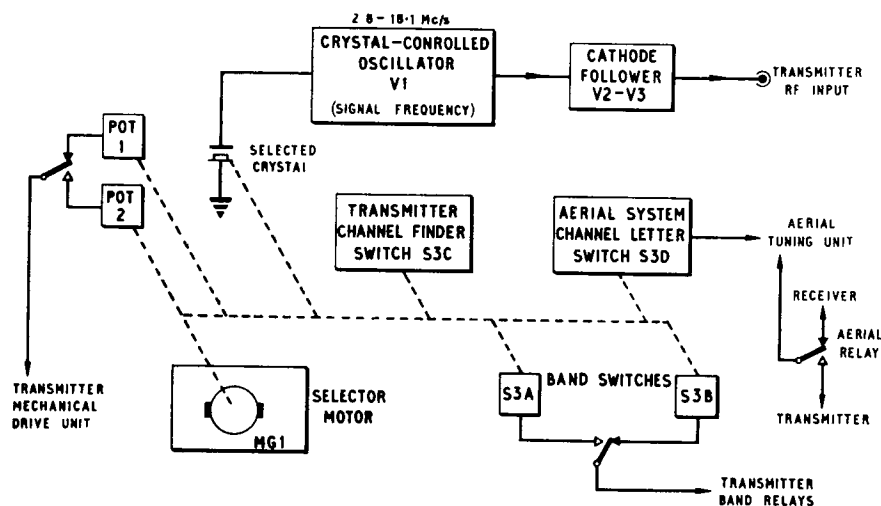


Fig. 4. Block schematic of control and drive unit

TEST/TUNE switch (S4)

25. This is a spring-loaded key switch which normally rests in the centre position. The circuit for the three positions is as follows:—

OPERATE (Centre) The "low power" line is open-circuited (S4D).

The "SAFE" line is open-circuited (S4D).

The "KEY" line is open-circuited (S4B).

TUNE (up)

The "KEY" line is earthed and the aerial changeover relay RL6/2 energized (S4B). The transmitter is switched to R/T by removing the earth from 3RL3 in the power and radio unit (S4E).

The "SAFE" relay RL7 is earthed (S4D) and removes the 19V supply from the INTERTUNE line to allow the transmitter to be adjusted (S4A).

Contact 7B removes the earth from the low power line (PL3/20) and allows tuning under "safe" power conditions only, i.e. at nearly full power.

TEST (down)

The earth is removed from the low power line.

The "key" line is earthed (S4C): this allows normal "key down" operation.

Band switches (S2/1 and S2/2)

26. The band switches are selected one per channel by means of the motor-operated switched S3B and S3A respectively. The two groups of switches S2/1 and S2/2 are selected by relay contact 4A and 4B.

27. When the band switches are in the OUT position they switch the 28V supply to the band change relays 2RL1/1, 2RL2/1 and 2RL3/1, thus changing the transmitter tuned circuits from the 7 to 18 Mc/s range to the 2.8 to 7 Mc/s range. (Chap. 4).

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TUNING lamp (LPI)

28. The TUNING lamp commences to glow when the TUNE line is earthed, i.e. whenever one of the tuning motors of the transmitter or receiver operates. It is permanently on when the transmitter is switched for MANUAL operation, and serves as a reminder should the transmitter be left in the MANUAL condition after setting up.

Selector circuit switches and relays**Selector switches (S3)****29.**

S3A-B As already stated these select the individual band switches of the groups S2/1 and S2/2.

S3C This is the searching bank when the channel is being chosen at the remote control unit. Six wires run from this switch sector to the channel letter pins 1 to 6 on PL1 and thence to the receiver, "Wire saving" switch banks are used. The method of selection of twelve channels on each band is explained in Chap. 7.

S3D This 12-way switch sector passes out the selected channel information to the aerial system by earthing one of the twelve wires connected to SK1.

S3J This is a cam-operated clicker switch associated with the channel selector switch S3D; its operation is explained in Chap. 7.

S3E-H These select the crystal unit for the channel required.

Relays

30. The relays are grouped by function as follows :—

- (1) Motor relays—RL1/2 and RL2/2
- (2) Number relays—RL3/2, RL4/2 and RL5/2
- (3) Aerial relay—RL6/2 (low-impedance send-receive aerial switching).
- (4) Low power relay RL7/2 (SAFE)

Motor relays

31. When power is first applied to the control and drive unit, the relays RL1/2 and RL2/2 are energized owing to the earth provided by the connection to S3C or S3J.

32. The motor MG1 starts when 19V is connected via relay contact 1A and rotates until the unearthed position on S3C is reached ("checked" by clicker

switch S3J). Relays RL1/2 and RL2/2 then release, thus interrupting the motor circuit (contact 1B), and at the same time, removing the earth from the tune line (contact 1B).

33. Relay contact 2B makes and switches the 19V supply to the tuning head of the transmitter, this prevents the tuning head from hunting during the rotation of the selector switch S3.

Number relays

34. The number relays operate when position 2 of the number switch is chosen. Contacts 4A and 4B operate and select the group of band switches S2/2. Relay contact 5A changes control of the transmitter from POT 1 to POT 2. Contact 5B relays the number position to the selector unit of the aerial coupling unit. Contacts 3A and 3B change over the crystal groups.

Aerial relay

35. The aerial relay RL6/2 is mounted in a fully-screened box on the rear panel of the control unit (relay unit Type 4216). Its function is that of an aerial changeover switch. The supply to the relay coil is filtered by means of L1, C9 and L2, C10.

36. If the low impedance mode of aerial switching is not required for use, the links on TSB at the rear of the unit between TSB1 and TSB2 and 4 should be removed.

37. The low impedance feeder from the aerial system enter at PL6 and on "space" conditions, contact 6A puts this to the receiver via PL7.

38. On "mark" the aerial is switched by contact 6A to the transmitter output which is connected to PL5; at the same time the receiver aerial is earthed by means of contact 6B.

Safe relay

39. The "safe" relay RL7 is operated by a "key" in the aerial selector unit of the suppressed aerial system. When the "key" is pressed an earth is put on point SK1/20.

40. Contact 7B opens to give "safe" operation and contact 7A closes the key line and places the transmitter on "mark".

