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Colin Hinson

In the village of Blunham, Bedfordshire.

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AIR PUBLICATION

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VOLUME I

ARI.5206

INSTRUCTION MANUAL

Prepared by direction of
the Minister of Supply

A. P. Rowlands

Promulgated for the information and guidance of all concerned
By Command of their Lordships

J. G. Lang

A D M I R A L T Y

A.R.I.5206

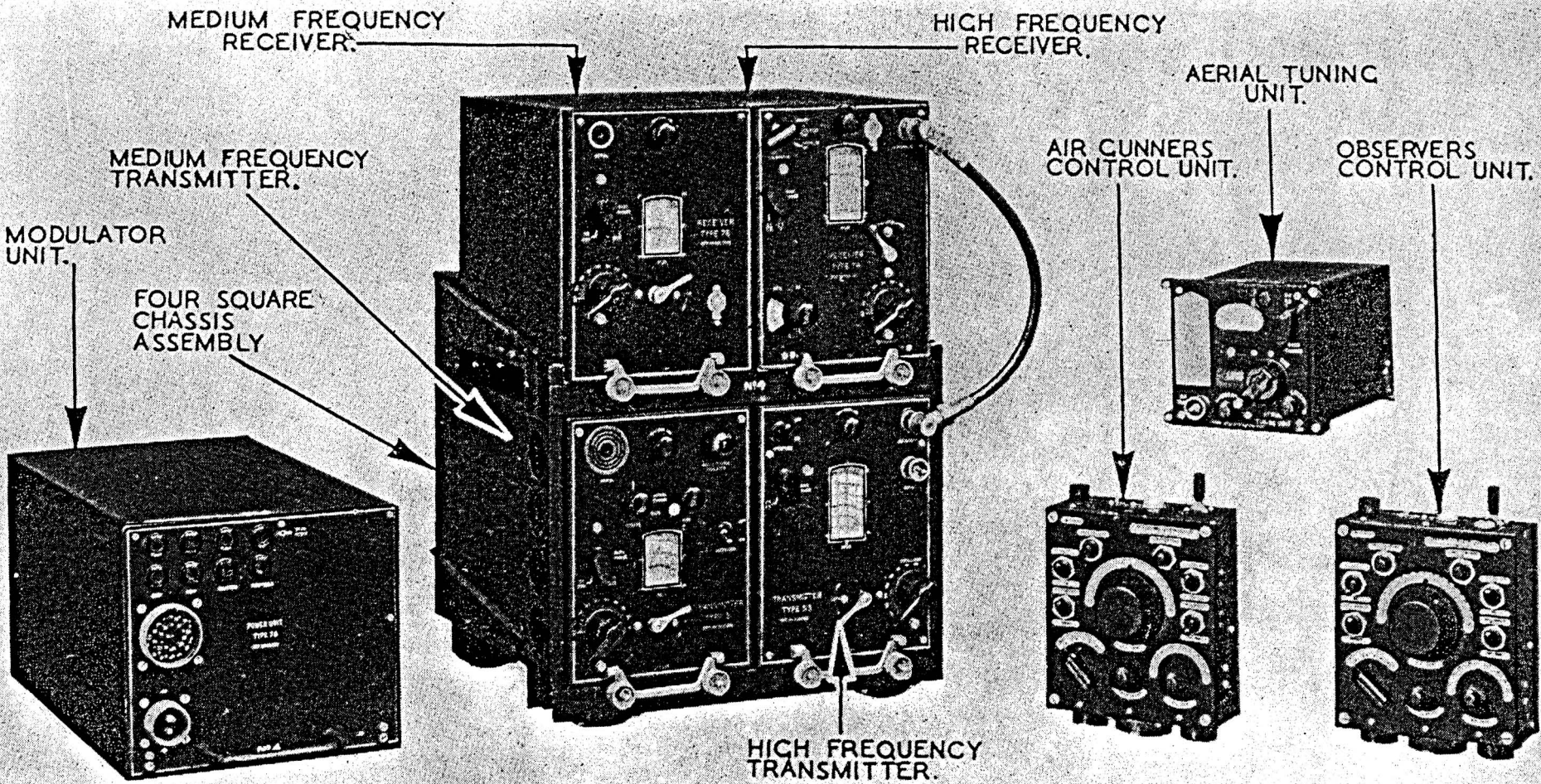
INSTRUCTION MANUAL

This Manual covers the normal routines for the operation and upkeep of the A.R.I.5206.

A detailed technical description of the A.R.I.5206, with instructions for fault location, is contained in Technical Manual No. T.M./101.

INSTRUCTION MANUAL No. I.M./101

APRIL, 1944



INTRODUCTION

The A.R.I.5206 is a combined medium frequency and high frequency transmitting and receiving equipment designed for operation in aircraft.

It is self-contained and consists of an assembly of transmitting and receiving units so arranged that the medium frequency units may be removed without affecting the operation of the remaining pair of high frequency units, or vice-versa.

The chief features of performance, and principles of operation are given below :—

System

Master oscillator/power amplifier for transmission ; super-heterodyne for reception.

Frequency Coverage and Method of Tuning

The equipment is intended for operation on two pre-set frequencies—one in the medium frequency range (505–150 kc/s) and one in the high frequency range (13–2.4 mc/s). The frequency can be set to a high degree of accuracy by dials calibrated directly in frequency. A built-in crystal calibrator provides checking frequencies at 100 kc/s intervals over the complete tuning ranges.

Frequency control is by high-stability auto-oscillators.

Services—Output—Transmission on Reduced Power

On high frequencies, C.W., M.C.W., and R.T. are available ; on medium frequencies C.W. service only.

Power output for transmission on the high frequencies is at least 25 watts on C.W. and at least 6 watts on M.C.W. and R.T. On the medium frequencies the output ranges from 8 to 14 watts. The actual output obtained from a given installation depends upon the characteristics of the aerials used and upon the working frequency.

Reduced power transmission is possible on C.W., and is 1/25th of full power.

Control Arrangements

The equipment is entirely remote-controlled (except for frequency setting) by an electrical system. Two control points can be provided and control may be passed over from one operator to the other at will.

The remote control facilities include change between high and medium frequencies. The actual frequencies are normally pre-set before flight, but may be changed in flight providing the units are accessible.

a fixed aerial of any capacity down to 50 $\mu\mu\text{F}$, the frequency range will, however, be reduced under these circumstances to a band covering approximately 505 to 300 kc/s.

Connection between the H.F. aerial system and equipment is by low impedance coaxial transmission line.

Plug-in matching units permit the H.F. receiver to be operated from the M.F. fixed aerial for emergency working.

Inter-communication Facilities

Inter-communication facilities between the two control points are provided.

Use of T.R.1366.

The A.R.I.5206 may be used in association with the audio circuits of the T.R.1366.

MAIN PERFORMANCE CHARACTERISTICS

Frequency Range

Medium frequencies : 505 – 150 kc/s (covered in two bands)
High frequencies : 13 – 2.4 mc/s (covered in two bands)

Setting Accuracy

Medium frequencies : ± 1 kc/s at worst part of scale.
High frequencies : ± 6 kc/s at worst part of scale.

Frequency Stability

Medium frequencies : $\pm .1\%$.
High frequencies : $\pm .03\%$.

Power Consumption

350 watts maximum.

Weights and Dimensions (“ Four-Square ” model)

Item	Weight	Approximate overall Dimensions in inches.		
		Height	Width	Depth
Chassis with four R.F. Units	48 lb. 12 oz.	19	13.1	14.2
Power Unit and Tray	29 lb. 1 oz.	9.1	9	17.5
Aerial Tuning Unit	3 lb. 9 oz.	4.8	5.3	11.0
Control Units (2)	7 lb. 10 oz.	8.2	5.75	3.3*
Aerial Link	4 oz.			
Total (less cables)	89 lb. 4 oz.			

*each unit.

The size of each of the R.F. units is 8.25 inches high, 6.26 inches wide, and 12.3 inches deep.

NOTE.—The weight of the “ Four-in-Line ” model will approximate to that of the “ Four-Square ” model.

Send/Receive—Dual Reception—Fine Tuning

Break-in keying is provided for C.W. and M.C.W. working, the "receive" condition being automatically obtained whenever the key is "up." "Press-to-Transmit" facilities are provided for R.T.

Reception is possible on both frequency ranges simultaneously.

Fine tuning by remote control, is possible on reception so that optimum results may be maintained under all conditions.

Construction and Layout (see Fig. 1, Appendix 2)

The equipment is composed of three main groups of apparatus :

- (a) Four R.F. units—two for reception and two for transmission, corresponding to the medium and high frequency ranges respectively. These units are mounted in a Chassis Assembly, which is obtainable in three models, one taking the R.F. units horizontally in line, one taking them in pairs one above the other, and a third taking two units only, horizontally in line.
- (b) The modulator unit containing I.F. and audio amplifiers and power pack.
- (c) Two remote control units and an aerial tuning unit. The latter is used for tuning the aerial when working on the high frequency range.

The Aerial Tuning unit is to be mounted as close as possible to its associated aerial so as to minimise "lead-in" losses. The Modulator unit can be located anywhere in the aircraft and need not be accessible in flight.

Cabling and Screening

All units and cables are screened and input filters are incorporated in the aerial circuits to exclude Radar interference.

Power Supplies

The equipment is supplied in two models—one for operation from a 13-volt battery and the other from a 26-volt battery. Units for 13-volt operation are denoted by the addition of the suffix A to their Type numbers.

Weight

The weight of the "Four-Square" equipment, excluding cables, is approximately 89 lb.

Aerial Arrangements

It is intended that a trailing aerial be used for medium frequency transmission, a fixed aerial for medium frequency reception, and a second fixed aerial for high frequency transmission and reception. For emergency working the M.F. transmitter may be operated into

TRANSMITTING

Output Power (normal)

Medium frequencies : At least 8 to 14 watts.

High frequencies : At least 25 watts on C.W.

At least 6 watts on M.C.W. and R.T.

Actual power output depends on aerial characteristics and working frequency.

Output Power (reduced)

Medium frequencies : .32 to .56 watt.

High frequencies : 1 watt.

Tone frequency for M.C.W

1,000 c.p.s.

RECEPTION

Range of Fine Tuning by Remote Control

Medium frequencies : $\pm .7\%$.

High frequencies : $\pm .5\%$.

Average Sensitivity and S/N Ratio.

Medium frequencies (at 500 kc/s) : With an input of 5 μ V the S/N ratio is at least 14 db. The output is not less than 10 mW.

High frequencies (C.W.) : With an input of 2 μ V the S/N ratio is at least 18 db. The output is not less than 10 mW.

High frequencies (R.T. and M.C.W.) : With an input of 5 μ V the S/N ratio is at least 15 db. The output is not less than 10 mW.

Intermediate Frequency

560 kc/s.

Output Level

The equipment is capable of delivering an output of 100 mW. per pair of telephones up to a total number of three pairs. The level in one pair of telephones is not changed by connection or disconnection of the others.

Output Impedance

The equipment is designed to operate into an impedance of 8,000 to 20,000 ohms or alternatively 50 to 150 ohms.

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APPENDIX

Chapter I

INSTALLATION

NOTE.—The “Four-Square” model of the A.R.I.5206 is illustrated in this Chapter, but the general principles of installation equally apply to the other models.

1.0 GENERAL

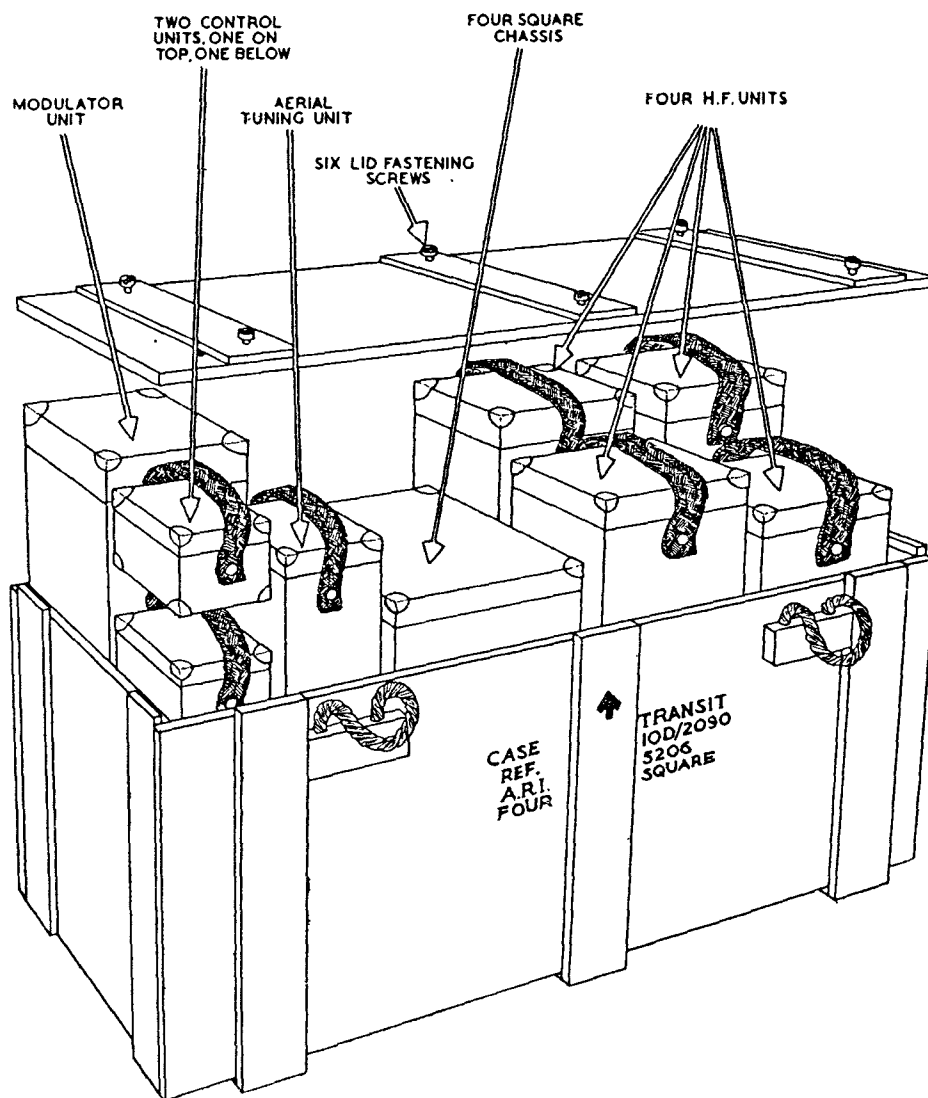
The following instructions assume that the A.R.I.5206 has been received in transit cases, and is to be installed in aircraft in which all mountings, cables and aerials have been fitted.

(1.1) To Prepare the Equipment for Installation

Materials Needed | — 6-in. Screwdriver.
| — 3-in. Screwdriver.

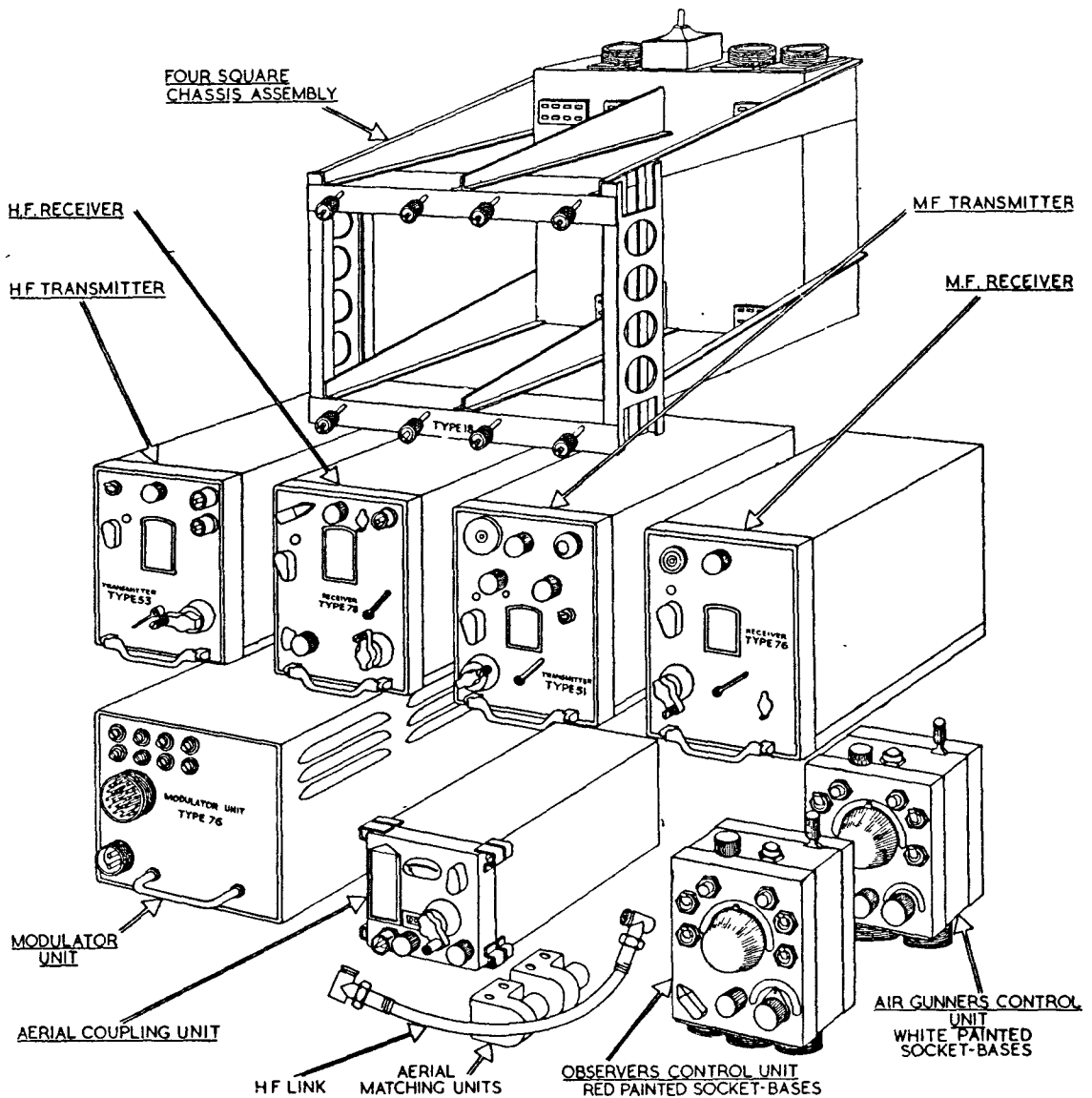
Action

(a) Remove the units from their Transit Cases (see A.1).



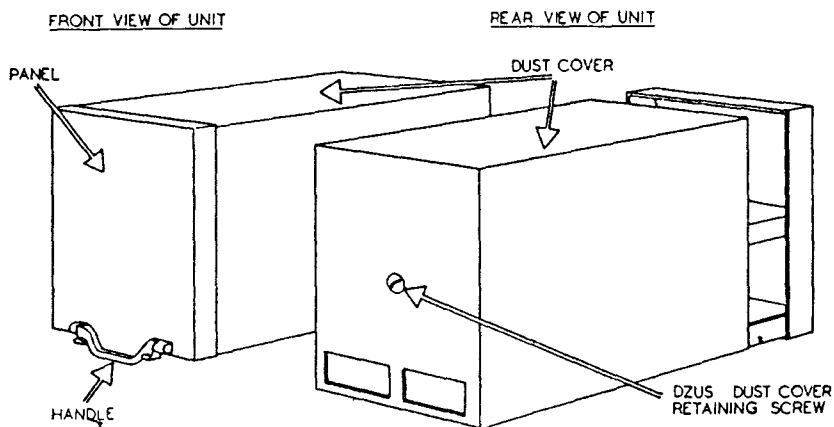
A.1.

(b) Identify the units, check that nothing is missing or damaged (see A.2).



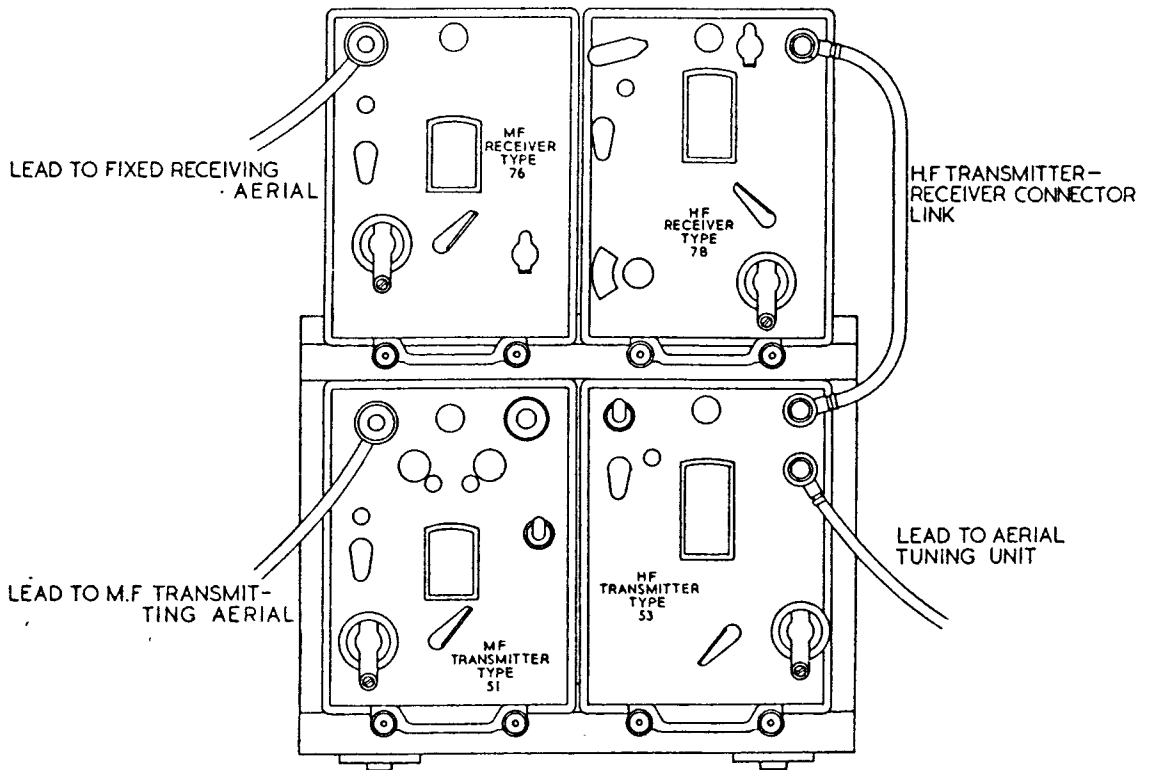
A.2.

(c) Give the DZUS Dust Cover Retaining Screws (situated at the rear of each R.F. Unit and the Modulator Unit) a $\frac{1}{4}$ turn anti-clockwise with the 6-in. screwdriver (see A.3).

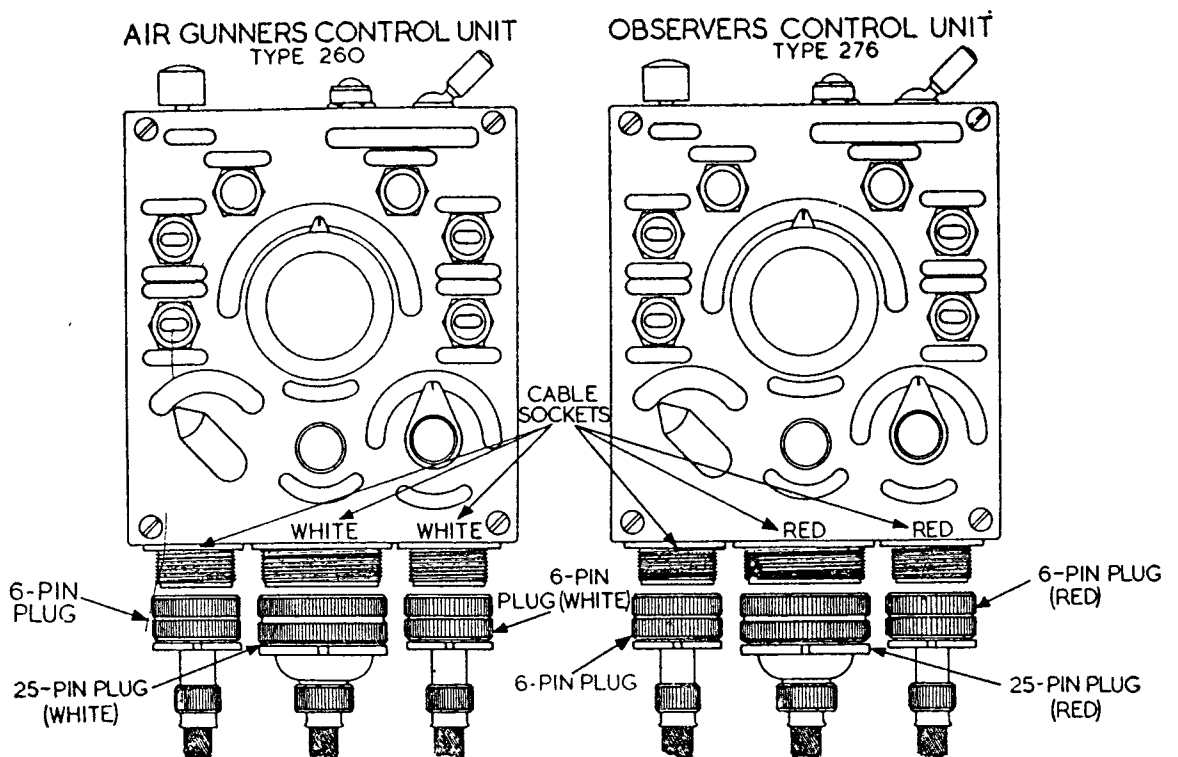


A.3.

- (g) Insert Aerial Plugs into Aerial Sockets on M.F. Transmitter and Receiver and the H.F. Transmitter (see A.14). Insert the link between the H.F. Transmitter and Receiver.



A.14.

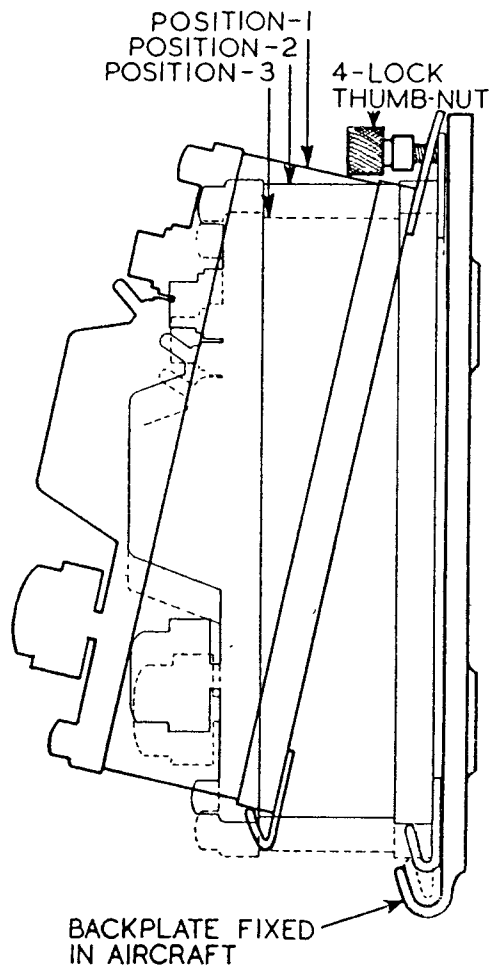


A.15.

(h) Fit Observer's and Air Gunner's Control Units in their appropriate mountings in the aircraft and secure by the knurled retaining screws (see A.16).

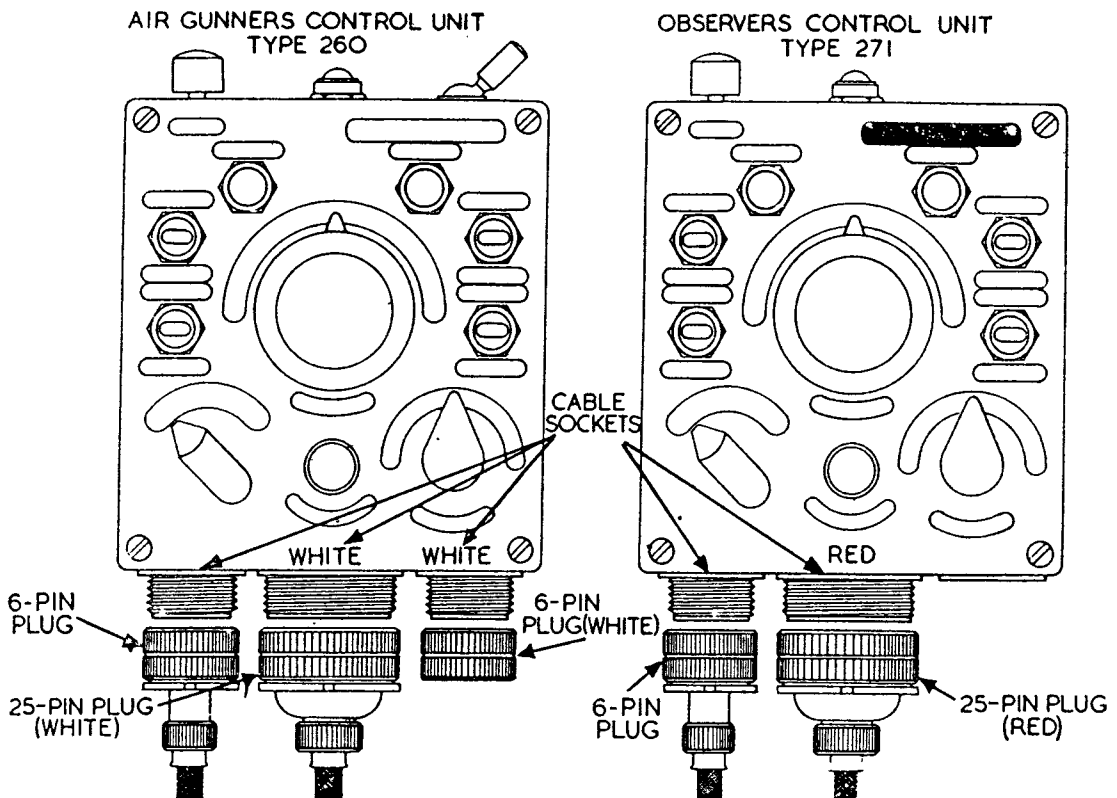
(j) Insert Cable Plugs into Cable Sockets on Control Units and screw locking rings home (see A.15 or A.17 according to type).

NOTE.—Where the A.R.1.5206 and T.R.1366 are used in combination three incoming cables are connected to the base of each control unit, but in cases where the A.R.1.5206 is used alone only two such cables are necessary. Accordingly a different type of Observer's Control Unit (Type 271) is fitted in the latter condition and, while the standard Air Gunner's Control Unit (Type 260) is retained, it is fitted with a special plug which is connected to the unused cable entry and completes the control circuit.

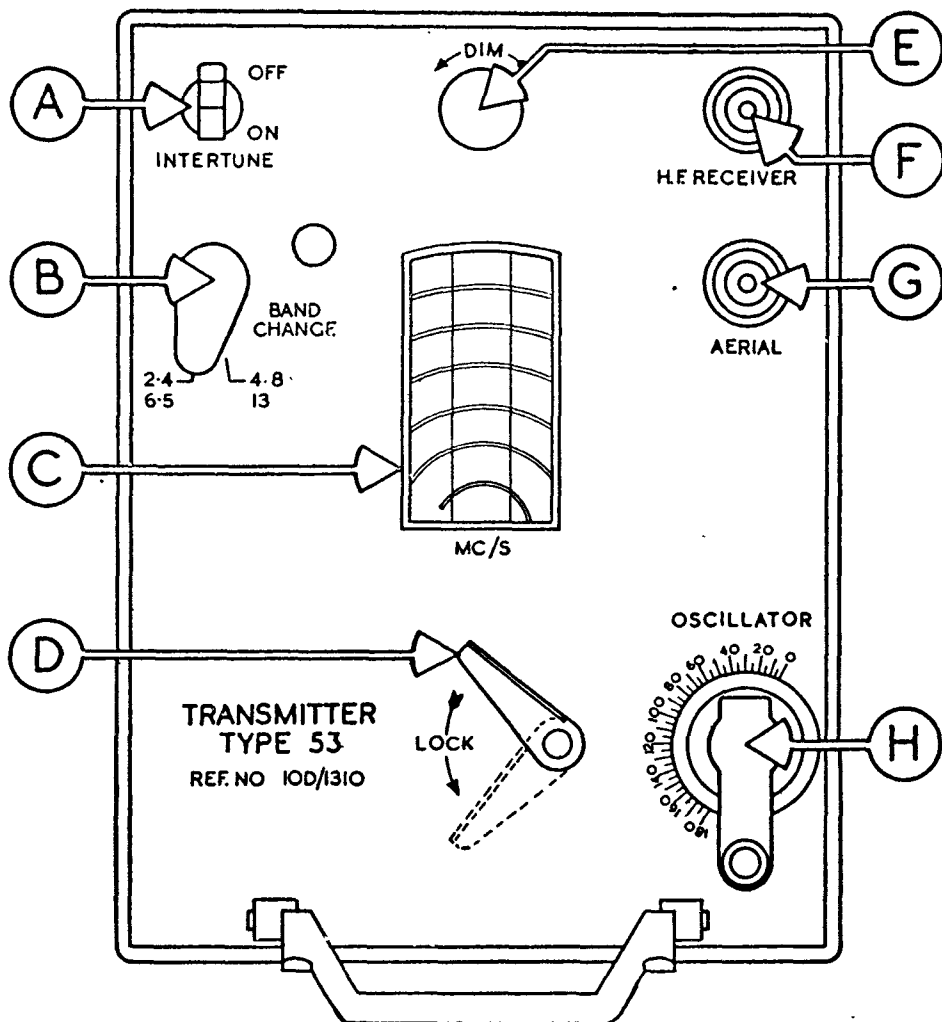


A.16.

Both types of control unit are illustrated in the accompanying sketches.



A.17.



D.7.

H.F. Receiver. A zero beat should now be registered in the telephones. (By swinging the Oscillator Control slightly, a beat note should be heard on either side of the testing frequency.) Leave the tuning control set exactly for zero beat.

- (q) Check that the settings of both transmitter and receiver do not differ by more than 6 kc/s from the engraved division at 2.4 mc/s on either dial. If the difference is greater than 6 kc/s the unit or units should be returned to the W/T workshop.
- (r) Repeat the procedure outlined in (j) to (q) at a frequency of say, 4 mc/s and then 5.5 mc/s.

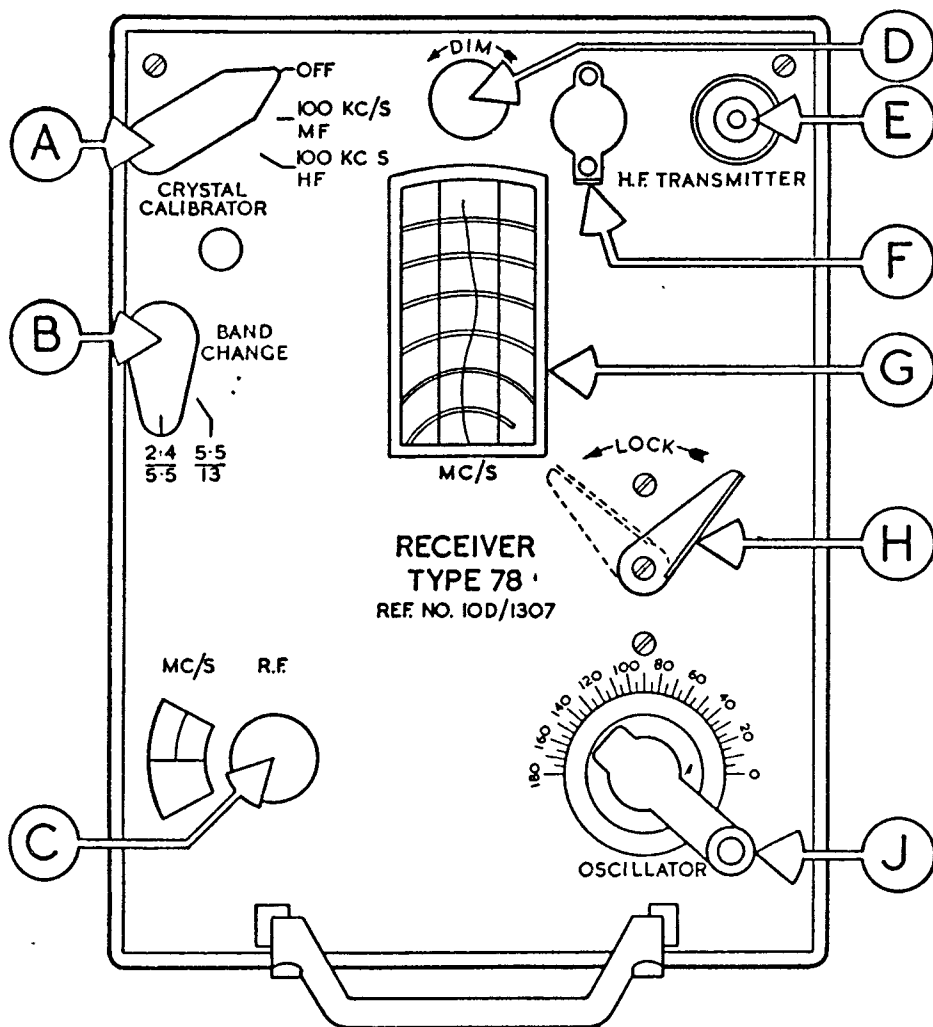
On the H.F. Transmitter and Receiver Units (see D.7 and D.8)

- (s) Turn the Band Change switches (B) on the H.F. Transmitter and Receiver to 4.8–13 mc/s and 5.5–13 mc/s ranges respectively.

- (t) Repeat the procedure outlined in (g) to (q) substituting frequencies of say 6.5, 9, and 13 mc/s. Should the indicated settings obtained at zero beat points on either unit fail to coincide with the dial engravings for the given frequencies by more than 6 kc/s, return the unit or units to the W/T workshop for attention.

To switch off after checking calibration

- (u) Check that the Crystal Calibrator switch on the H.F. Receiver and the Intertune switch on the H.F. Transmitter are in the OFF position.
- (v) Throw the Main switch on the Control Unit to OFF.



D.8.

Chapter III

OPERATING

NOTES ON OPERATING

(1) Main facilities of the A.R.I.5206 are :—

Transmission and Reception on Medium Frequency (C.W. only).
Transmission and Reception on High Frequency (C.W., M.C.W.
and R.T.).

Reception on Medium Frequency and High Frequency simultaneously.

Control either by Air Gunner or by Observer.

Intercommunication between Air Gunner and Observer.

Control of T.R.1366, if fitted (by Observer only).

(2) On account of the full facilities available a number of different control settings arise, and in consequence, various and different operations are necessary in changing from one condition to another.

For the sake of simplicity, therefore, the instructions are grouped into five main categories, and in each of the latter the sequence of operations is detailed.

The categories are :—

Intercommunication.

Operation on M.F.

Operation on H.F.

Dual Reception.

Operation of T.R.1366, if fitted.

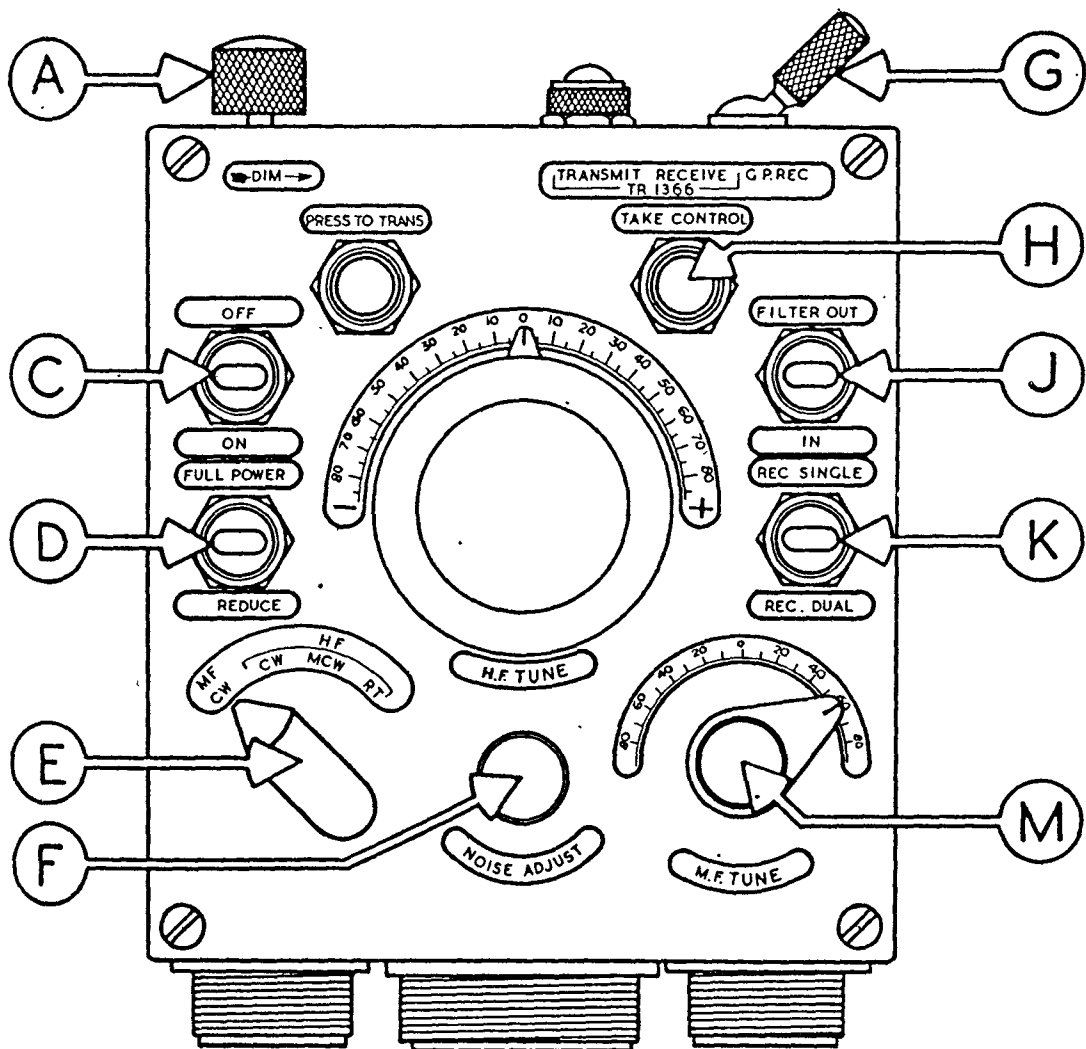
(3) Familiarity with the equipment will enable the operator to change between the various conditions without going through the whole of the instructions for the new condition wanted.

(4) The instructions cover the normal functions to be performed by the air crew using the A.R.I. 5206 during flight. Hence it is assumed that the equipment has been adjusted to the particular M.F. and H.F. frequencies to be used during the flight, but it is possible to change frequencies in the air as described in Chapter II.

NOTE.—The Observer's Control Unit has been selected for illustration, but the instructions are applicable to the Air Gunner's Control with minor exceptions. The exceptions mainly concern the operation of the T.R.1366 key (G) and these are described in notes at the end of the chapter and in section 5 dealing with the A.R.I.5206 and T.R.1366 in combination. Any other differences are described in the text.

1.0 TO OBTAIN INTERCOMMUNICATION (see C.1)

(a) Throw Main switch (C) to ON then press and release the Take Control button (H) (normally only necessary on Observer's Control Unit).



C.1.

2.0 TO SEND AND RECEIVE ON MEDIUM FREQUENCY (see C.1)

- (a) Throw Main switch (C) to ON. (If possible, this should be done five minutes before operating.)
- (b) Adjust Dim control (A) as required.
- (c) Press and release the Take Control button (H).

(2.1) To Receive

- (d) Throw Service switch (E) to M.F. C.W.
- (e) Throw Channel switch (K) to REC. SINGLE.
- (f) Adjust M.F. Tune Control (M) for best reception.
- (g) Set Noise Adjust (F) for best signal-to-noise ratio on weak signals.
- (h) If interference is experienced, throw Filter switch (J) to IN and re-adjust M.F. Tune Control for best reception.

4.0 TO RECEIVE ON HIGH AND MEDIUM FREQUENCIES SIMULTANEOUSLY (see C.3)

- (a) Throw Main switch (C) to ON. (If possible this should be done five minutes before operating.)
- (b) Adjust Dim Control (A) as required.
- (c) Press and release Take Control button (H).
- (d) Throw Service switch (E) to H.F.-C.W., M.F.-C.W. or H.F. R.T. (for telephony).
- (e) Turn M.F. Tune Control (M) to zero degrees.
- (f) Turn H.F. Tune Control (L) to zero degrees.
- (g) Throw Filter switch (J) to OUT.
- (h) Throw Channel switch (K) to REC. DUAL.
- (i) Set Noise Adjust (F) as required.

To Switch Off.

- (j) Throw Main switch (C) to OFF.

5.0 TO OPERATE THE A.R.I.5206 AND T.R.1366 IN COMBINATION

(See SPECIAL NOTE on following page).

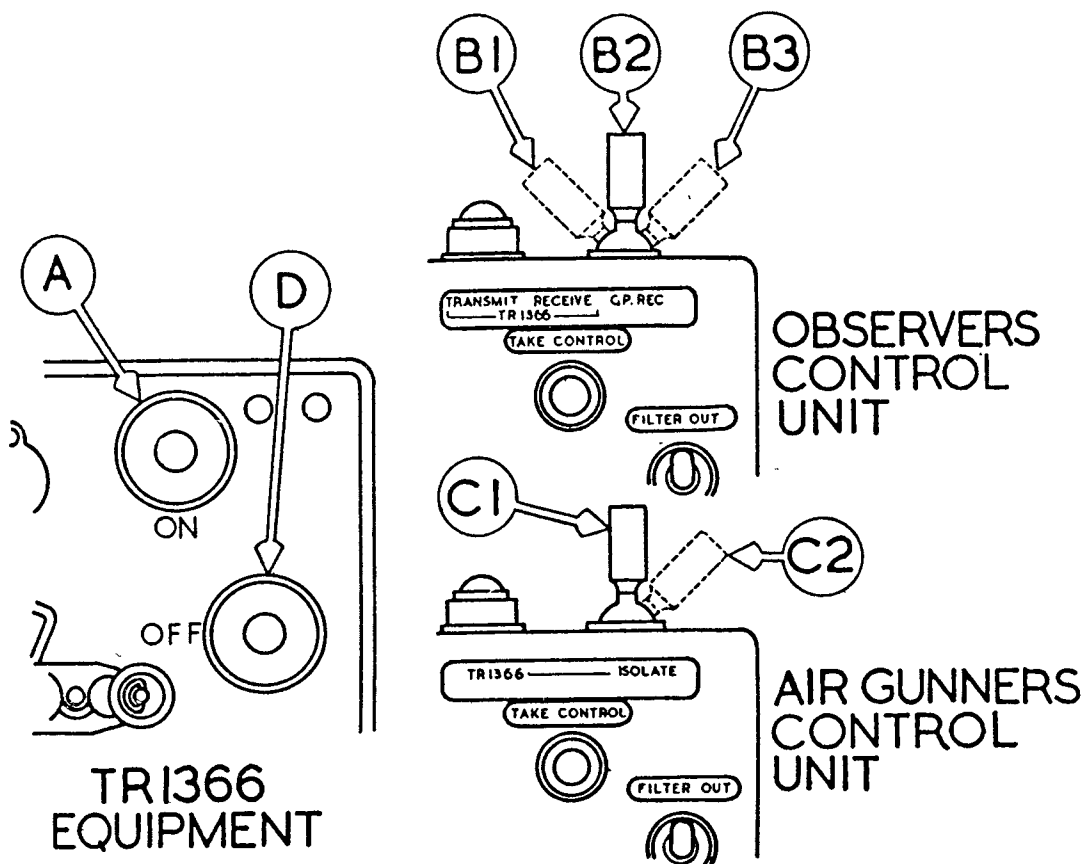
The procedure for operating the A.R.I.5206 and T.R.1366 in combination is laid down in the following table which shall be used in conjunction with the sketch C.4.

It is assumed that the A.R.I.5206 is running during all operations.

SWITCHING TABLE FOR OPERATION OF A.R.I.5206 AND T.R.1366 IN COMBINATION

Facilities.	Switch Positions to be selected.		
	T.R.1366 H.F. Unit.	Observer's Control Unit Type 276.	Air Gunner's Control Unit Type 260.
To :—			
Switch on	Press A		
Obtain Intercommunication ..		B.2	C.1
Transmit R.T. on T.R.1366 (from Type 276 Unit)		B.1	
Receive RT. on T.R.1366 (from Type 276 Unit)		B.2	
Operate A.R.I.5206 (from Type 276 Unit)		B.2	C.1 *
Operate A.R.I.5206 (from Type 260 Unit)		B.2	C.1 *
Listen-in to A.R.I.5206 Output without taking control of A.R.I.5206 (from Type 276 Unit)		B.3	
Isolate Type 260 Unit from Inter- communication Channel ..			C.2
Switch off	Press D		

* Then proceed as in Paragraphs 3 and 4 of this Chapter.



C.4.

SPECIAL NOTE

OPERATING DIFFERENCES BETWEEN AIR GUNNER'S AND OBSERVER'S CONTROL UNITS

Slight differences exist in the design and the operation of the Air Gunner's and Observer's Control Units ; these differences are outlined below :—

(a) T.R.1366 Switch

When the A.R.I.5206 is supplied for use with the T.R.1366, T.R.1366 Switch Keys are fitted to both Observer's (Type 276) and Air Gunner's (Type 260) Control Units.

The respective positions for the T.R.1366 switch key under these circumstances is outlined in Section 5.0 of this chapter.

It will be noted that, while the position of the switch on the Type 276 Control Unit will vary according to the service required, the position of the key on the Type 260 Unit will remain at RECEIVE except when the Air Gunner wishes to isolate himself from intercommunication.

When the A.R.I.5206 is supplied for use by itself the T.R.1366 switch is fitted to the Air Gunner's Control Unit only, and should always be left in the ISOLATE position.

