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A.P.101B-1703-1B3, Sect.8, Chap.3 A.L.25, Oct.68

Chapter 3

A.R.I.5874

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Major items of equipment Connectors for A.R.I.5874

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Introduction

1. The A.R.I.5874 forms a general purpose airborne H.F. communication system and is used with the fixed wire aerial. Basically the equipment includes a 24-channel crystal-controlled transmitter and receiver operating in the H.F. band 2.8 to 18.1 Mc/s. The installation is under

the control of the signaller and may be operated on CW, MCW, or R/T with a transmitter carrier output of approximately 100 watts.

 Power supplies to the equipment are supplied from fuse BR7 (Pre Mod.1452) or

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fuse BT7 (Post Mod.1452), at the wireless operator's station via a single-pole switch on the wireless operator's panel. Details of the installation are shown in fig.1 and 2 whilst fig.3(1) and (2) illustrates the fixed wire aerials. The equipment is described in A.P.116D-0117-1.



Equipment and controls

3. Control of the system is from a remote control unit, Type 4189, at the signaller's station. The operating equipment is installed on the shelf above the sonics stations.

4. Other controls consist of a transmitter output switch labelled LOW-HIGH and a morse key, Type F. An aerial plug board is fitted on the top shelf between formers 7 and 8 (above the aerial tuning unit) and provides for connecting the aerial tuning unit to the port fixed aerial or to the starboard fixed aerial (see also Chap.4 and Sect.9, Chap.7).

Method of connecting units

5. The units on the shelf are mounted in suitable trays or racks with backplates carrying the plugs and sockets of the associated cable connectors. Connection is made to the equipment by engaging the connectors with the corresponding sockets and plugs fitted at the back of the individual units.

6. Each backplate carries two locating spigots which align the units to the backplates and provide for accurate mating of the connectors. Even so, the multi-pole plugs and sockets are designed to tolerate a small amount of misalignment in order to improve mating.

Receiver, Type R4187

7. The receiver is composed of a number of individual units mounted on one main chassis assembly and includes a crystal oven, Type 12, which accomodates 24 crystals units, Type 'ZDH, at plus or minus 2.15 M c/s. off frequency. The receiver frequency is divided into

DESCRIPTION AND OPERATION

three bands with the following coverage; the crystal frequency + 2.15 M c/s. in each case.

Band 1 - 2.8 to 5.2 M c/s. Band 2 - 5.2 to 9.7 M c/s. Band 3 - 9.7 to 18.1 M c/s.

The operative band is selected by 'band' relays in the R.F. amplifier, the selected inductors being tuned by a motor driven ganged capacitor.

Receiver controls

8. The receiver controls are situated on the front panel assembly and consist of the following:-

- (1) Drum dial and tune control.
- (2) Tuning indicator lamp.
- (3) Selector unit, Type 4230, which includes two 12-way potentiometers PO'T.1 and POT.2, and twenty-four 3-position channel band switches.
- (4) Tune normal switch.
- (5) A.G.C. on-off switch.
- (6) Fuses F1 H.T., F2 19V, F3 -28V (and spares).

Access to the potentiometers and channel band switches is gained by removal of the cover carrying the channel frequency allocation card on the front panel.

9. The twenty-four channel band switches áre each selective to 2.8 to 5.2 Mc/s (up position), 5.2 to 9.7 Mc/s (mid position) and 9.7 to 18.1 Mc/s (down position). The two 12-way potentiometers can be adjusted for the selected channel by means of the twenty-four control knobs

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located below the band switches.

Air cooling

10. Situated in the front section of the receiver is an air filter which is used as an air inlet for the cooling system of the receiver. Air passage to the filter is provided by a louvred cover on the front panel of the receiver.

Transmitter, Type T.4188

11. The transmitter, Type T.4188, consists of a composite chassis upon which are mounted the various component parts. A removable dust cover is fitted over the assembly and is secured by a quick rerelease fastener at the rear. The controls necessary for the manual checking of the transmitter circuit are located on the front panel.

12. The transmitter can be set to any of twenty-four frequencies in the two frequency bands 2.8 to 7 Mc/s and 7 to 18 Mc/s by inserting crystals of the required operating value into the associated control and drive unit, Type 4243. The equipment is then tuned from the control and drive unit in conjunction with the signaller's control unit.

Front panel controls

13. Situated on the front panel of the unit are the transmitter controls used for manual checking purposes. These are as follows :-

- (1) Meter switch.
- (2) Microammeter (calibrated in milliamps.)
- (3) Tune key.
- (4) Auto/manual switch.
- (5) Calibrated frequency dial.



For normal operation of the equipment the auto/manual switch is left in the AUTO position; the manual position is used for bench testing.

Air cooling

14. In order to maintain adequate air cooling for the transmitter, an air blower is fitted on the underside of the main chassis. The blower draws cooling air through the air filter and discharges directly into the box.

Aerial tuning unit, Type 7180

15. The aerial tuning unit, Type 7180, provides a suitable combination of capacitive and inductive loads to match the impedance presented by the fixed wire aerial to that of the transmitter output. The unit contains two variable inductors and a selection of fixed capacitors operated by three remote control elements. The components are chassis mounted and a removable dust cover is fitted which fastens at the rear.

Front panel controls

16. The front panel controls which are used on manual operation are as follows:-

- (1) Three tuning knobs and associated dials input, coupling and output.
- (2) Two switches auto/manual and tune.
- (3) A meter providing indication of aerial excitation (AE.IND.).
- (4) Two variable resistors for preset adjustment of the aerial monitor circuit.
- (5) A red indicator lamp which is lit when the auto/manual switch is at MANUAL.

Rear panel

17. Three plugs are fitted on the rear panel. The plugs and their associated circuits are as follows :-

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8R, coaxial - transmitted R.F. input.

8W, high voltage - output to wire aerial.

8S, 28-way - channel selection control.

Control and drive unit, Type 4243

18. This control unit, which is used only with a fixed wire aerial system, is the control and drive unit of the transmitter, and includes all the control circuits necessary to operate the transmitter and the aerial tuning unit. The interior components are mounted on a rectangular chassis and the assembly is enclosed by a dust cover which is fastened at the rear.

19. Several relay controls are provided one of which is the aerial change-over relay, which changes the aerial feed to the aerial tuning unit from the receiver to the transmitter when the key is pressed. Three coaxial plugs connect the relay and enable the aerial to be connected through the relay contacts to either the transmitter or receiver.

Front panel controls

20. The controls provided on the front panel can be used, in conjunction with the remote control unit, to set up channels on any frequency in the band without access to the transmitter or aerial tuning unit. These channels can then be selected at the remote control unit.

21. The necessary band switches are selected, one per channel, by means of a motor operated multibank switch. When the band switches are in the out position, the transmitter tuned circuits are changed from 7 to 18 Mc/s to the 2.8 to 7 Mc/s. range.

A.P.4267E, Vol.1, Book 3, Sect.8, Chap.3 A.L.7, Dec.64

Power and radio unit, Type 4192

22. The power and radio unit is used to provide H.T. power for the transmitter circuits, and incorporates a rotary transformer, an audio amplifier, and modulating unit. Cooling air for the unit is provided by a fan on the front end of the rotary transformer and is drawn through an air filter box on the front panel. The chassis is enclosed by a removable dust cover which is fastened at the rear.

23. The rotary transformer is fed from the aircraft 28-volt supply and the H.T. outputs of 300-volt and 600-volt are applied to the audio amplifier and transmitter circuits. The input to the amplifier is from the microphone and key intercommunication circuits of the equipment.

24. Connected from the i/c junction box, via plug 3F at the unit, are the intercomm. mic-tel circuits, also the earthed side of the signaller's key and the earthed side of the signaller's transmitter LOW-HIGH output switch. The 28-volt aircraft supply and the 19-volt supply from the voltage regulator Type 228 are taken in at plug 3P.

Front panel controls

25. A sliding cover on the right hand side of the front panel provides access to three preset resistors in the audio amplifier. These circuit adjustments and their application are as follows :-

- DELAY Adjustment for the V.O.G.A.D. (voice-operated gain adjustment device) circuit, which provides compensation for under modulation.
- (2) SIDETONE Adjustment for the sidetone level from the transmitter.



Fig.3 (1) Fixed wire aerial system

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(3) MCW - Adjustment of the output level and modulator gain on MCW. Other controls on the panel include fuse F1 for the 28-volt supplies and fuses F2 and F5 for the 19-volt supplies.

Voltage regulator, Type 228

26. The voltage regulator, Type 228 is used to provide a stabilized 19-volt supply for the heater and relay circuits of the equipment. Basically the control panel is a variable carbon pile which is controlled by a magnet energised from the output circuit. The unit is chassis built and is enclosed by a dust cover which fastens at the rear. A blower unit, incorporated in the assembly, provides the necessary cooling air flow.

27. Supply to the voltage regulator of 28-volt d.c. is controlled by the signaller's H.F. power switch and the output supply of 19-volt is fed to the receiver at plug 4M, and to the power and radio unit at plug 3P. A voltmeter for checking the output is fitted on the front panel and other controls are as follows:-

- (1) A push-pull switch to light the voltmeter internally.
- (2) A CHECK switch for testing output level.
- (3) A SET switch for testing output level.
- (4) An ADJUST VOLTS potentiometer, which can be locked in position.

Remote control unit, Type 4189

28. The control unit, Type 4189, provides switching control for the operating units of the installation, and is used for both normal operation and setting up purposes. The controls on the front panel of the unit are as follows :- Power switch - OFF - STANDBY - TX STANDBY. Switches on receiver and heaters of transmitter, also blower motor TX. Switches on transmitter H.T.

Channel letter switch - Starts the channel selector motor and open circuits the motor relay when the channel has been selected.

Channel number switch - Selects one of the two 12 channel groups 1A to 1M or 2A to 2M.

Service switch - Selects one of the following services on both transmitter and receiver:-

R.T. Earths the R.T. - MCW line. MCW. Places transmitter on MCW by earthing MCW/CW relay.

CW1. Puts transmitter in CW condition by releasing R/T - MCW line. Puts receiver in CW1 condition by earthing receiver CW line.

CW2. Condition as for CW1 but additional relay in receiver operates which changes I.F. bandwidth.

INT. Gives intertune facility by switching on the transmitter oscillator and breaking the receiver mute line, thus enabling the receiver to be tuned back to the transmitter.

R.F. gain switch - Gain control of the receiver.

Dimmer switch - Dimmer for channel letter and number switches window lighting.

Tuning indicator - Tuning indicator dimmed by an iris. Glows when intertune is selected, but not when transmitter is switched to MANUAL.

Fine tuning - Controls a desynn motor affecting the frequency of the receiver

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by a variation of plus or minus 7 Kc/s. May also be used as a beat note control.

Meter - Calibrated 0-5, indicates aerial excitation when transmitter is on 'mark' but not when transmitter is switched to MANUAL.

NOTE . .

FINE TUNING control. The dial against this control reads error plus-or-minus in the range 2.8 to 9.7 Mc/s and minus-orplus for 9.7 to 18.1 Mc/s, i.e. the calibration changes sign at 9.7 Mc/s. The plus and minus signs are marked in pairs coloured yellow and white, respectively to correspond to the frequency ranges engraved on the control knob. A white band adjacent to the edge of the knob is intended as a logging scale for pencil marking.

Junction box, Type 4191

29. The junction box, Type 4191, is mounted on the shelf behind the aerial tuning unit. The box provides a means of interconnection for the transmitter and receiver circuits from the remote control unit.

Fixed wire aerials

30. The fixed wire aerial system consists of two aerial assemblies, one on each side of the aircraft. Reference to fig.3 will show that the aerial assemblies consist of the following items.

Aerial mast - Type Z5433 Aerial cable - Type 5048 Aerial tension unit - Type S.J.W.C. - 4063 (Pre.Mod.1369)

Aerial tension unit - Type 8-1 (Post Mod.1369) Aerial attachment hook - H.S.A. Part No. 5/T5385 Spark gap unit - Type B.S.142

31. The aerial masts (Chelton, Type Z5433, 2 off), each include a mast, Type 337, ball fitting, Type 315/A-17, and an insulated aerial lead-in. They are mounted on the upper fuselage between formers 8

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and 9, between stringers 4 and 5, port and starboard. A seating packer, H.S.A. Pt. No. 5/T5427 is fitted beneath each mast to allow it to conform to the contour of the fuselage. It should be noted (fig.3) that the forward five and the aft five attachment bolts (Pt.No.AS1248/9C) are slightly shorter than the other ten bolts (Pt.No. A.S. 1248/10C).

32. A spark gap unit, Type 3S142, is fitted inside the fuselage between each aerial lead-in and the airframe. The spark gaps which aid in discharging static, are of a tubular glass construction. They are attached to the lead-in on the base of the masts by special clips, H.S.A. Pt.No. 4/T5427.

General

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36. During the normal inspection periods the equipment of the A.R.I.5874 should be examined to ensure that :-

- All units are secure and that each mounting tray is free to move on its resilient mountings.
- (2) Flexible bonding leads are not damaged.
- (3) All dust covers enclosing the units are securely fastened at the rear.
- (4) All cable connectors fitted at the mounting tray back plates are secure and free from damage.

Voltage regulator, Type 228

37. The voltage regulator should be checked for correct voltage which should be 19 ± 1 volt on the meter. The procedure is as follows:-

(1) Ensure that the power supply switch on the signaller's control unit, Type 4189, is off.

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and to the airframe by special clips, H.S.A. Pt.No.3/T5427. Note that the spark gaps are fragile and require careful handling.

Aerial cable

33. The aerial cable is copper coated steel wire covered with polythene. The method of preparing the cable and making up is shown in fig.3 details B and C.

Tension unit

34. To enable the aerials to withstand wind and ice loadings, a tension unit, Type 4063, is fitted at the aft end of each aerial. The tensioning for the 52 ft. long aerial is approximately 50 lbs., or approximately 1 inch extension of the plunger on

SERVICING

- (2) Place the signaller's H.F. control switch to ON.
- (3) Observe the reading on the regulator voltmeter which should be 19± 1 volt.
- (4) Press the regulator switch labelled SET. The voltage should remain constant. Release the SET switch.
- (5) Press the regulator switch labelled CHECK. The voltage reading should not register below 18.
- (6) If necessary adjustment of the voltage can be made by moving the control knob, labelled ADJUST VOLTS. This should be done when the SET switch is pressed.
- (7) Finally place the signaller's H.F. control switch to OFF.

38. Setting up and operating instructions for all the equipment is contained in A.P.2535E, Vol.1.

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the tension unit. Should the strain on the aerial become excessive, a weak link incorporated in the tension unit will shear and the aerial cable will be released at the aft end, thereby preventing the aerial cable fouling flying controls. Part of the tension unit acts as an insulator between the aerial and the fin.

35. Two brackets and a block are mounted in each fin, to allow fitment of the aerial attachment hook, II.S.A. Pt.No. 5/T5385 (modified Chelton hook, Type 5372/A). The hook is secured into the block and locked with a taper pin; the open end of the hook being positioned outboard as shown in fig.3 detail D(4).

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Fixed aerials

39. The fixed aerials should be checked periodically for correct tensioning and damage, special attention being given to the following:-

- Chuck units should be free from corrosion and packed with Silicone compound M.S.4. When a unit is found defective it must be renewed.
- (2) Examine neoprene coating on the aerial masts for erosion, particularly on the leading edges. If the neoprene is eroded on any part of the leading edge and the fibre glass shell exposed, then the mast must be removed and a serviceable one fitted.

Tests of the insulation between the aerials and earth should be made using a 500-volt insulation tester. With the aerial feeder cables disconnected minimum permissible resistance under normally dry conditions is 40 megohms.

General

40. Before attemping to release connectors prior to removal of any of the units the precautions and general instructions outlined in Chap.1 should be noted.

41. The majority of the units are installed on S.B.A.C. racks and are ready for removal when the knurled nuts on the front of the racks are slackened off. The units should then be eased forward off the racks, using the carrying handles. Removal of the control unit, Type 4189, at the signaller's station is straightforward. Refitting is the reverse order of the above ensuring that plugs and sockets mate correctly and that all bonding is secure.

Fitting aerial cable

42. A new aerial cable may be fitted as follows:-

- (1) Remove the chuck cap, chuck unit ball fitting and ball socket cap.
- (2) Bare 5.5 inch of the aerial cable and assemble the chuck cap and ball socket cap on to the cables as shown in fig.3 detail C.
- (3) Insert the bared cable into the chuck unit ball fitting.

- (4) Fold the cables as shown in detailC to form a tight fit into the lead-in assembly.
- (5) Screw the chuck unit ball fitting into position with it held in-line with the aerial run and lock with .31 inch length of wire (detail B).
- (6) Clip the ball socket cap into position and fill chuck cap with Silicone compound M.S.4.
- (7) Attach aerial hook to block as shown in detail D.
- (8) Attach tension unit to the hook.
- (9) Pull out tail rod to full extent and remove the cover cap from the chuck unit.
- (10) Take the aerial cable in one hand and the tension unit in the other, hold cable taut and note the length of cable that will just reach the weak link (detail D (1)). Cut the cable at this point.
- (11) Push the chuck unit cover cap over the aerial cable, strip the insulation to show .75 inch of the conductor and insert the chuck.

- (12) Steady the tension unit by holding the barrel lightly in one hand and laying the forearm along the aerial cable.
- (13) Bear down on the cable with the forearm and extend the plunger approximately 1.25 in. and lock the plunger using a 5/16 in. B.S.F. spanner.
- (14) Release the forearm pressure and pull up unit and then push tail rod in as far as possible. Unlock the plunger.
- (15) The plunger extension should be between .8 and 1.0 inch. If this is not correct repeat (13) and (14).
- (16) Fill the chuck cover cap with Silicone compound M.S.4.

Cable extractor tool

43. This tool (Chelton Pt.No.5205) operates in the same manner as a spring loaded centre punch and is used to remove the aerial wire from the chuck units. The grooved end of the tool (fig.3) is fitted around the bared aerial conductor and positioned to enter the chuck mouth. Hand pressure on the internally sprung handle will cause the chuck jaws to be hammered open, thereby releasing the conductor.

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TABLE 1

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Major items of equipment

Item	Туре	Ref.No.	A.P. reference	
Receiver	R4187	100 /19064		
Transmitter	T4188	10D/19065		
Junction box	4191	10D/19066	50°	
Power and radio unit	4192	10D/19067		
Aerial tuning unit	7180	10D/19238	A.P.116D-0117-1	
Control unit (remote)	4189	101/16204	2	
Control and drive unit	4243	101/16207	*S	
Voltage control panel	228	5UC/6010		

TABLE 2

Connectors for A.R.I.5874

ltem	Cable form	Connecting	
2/T5670	Equipment wire, Type 2 (7/.0076 and 14/.0076)		
	Equipment wire, Type 3 (40/.0076)	Power and radio unit (3D) to transmitter (3D)	
	Equipment wire, Type 45 (14/.0076)	i o and radio unit (5D) to transmitter (2D)	
3/T5670	Uniradio 65	Power and radio unit (2E) to transmitter (2E)	
4/T5670	Equipment wire, Type 2 (14/.0076) Equipment wire, Type 3 (40/.0076)	Power and radio unit (3A) to control and drive unit (1A)	
5/T5670 6/T5670 7/T5670	Uniradio 65 Miniature 25C Miniature 25C	Control and drive unit (1L) to receiver (4L) Control and drive unit (1AE) to junction box (12AE) Junction box (12AD) to receiver (4AD)	

TABLE 2- continued

ltem	Cable form	Connecting		
8/T5670 9/T5670	Miniature 25C Miniature 6D, D.E.F.10	Junction box (12AH) to control unit (11AH) Power and radio unit (3F) to T.B.706 (A.B and C) and 707 (A,B and C)		
10/T5670 11/T5670 12/T5670	Uniradio 65 Uninyvin 16,20 and 22 Uninyvin 20 and 22	Control and drive unit (1C) to transmitter (2C) Voltage regulator to T.B.708(A) and T.B.709 (B and C) Power and radio unit (3P) to T.B.708 (A,B and C) and T.B.709 (B)		
13/T5670 2/T3776 3/T3776 7/T3776 13/T3776	Uninyvin 16 Metvinsmall 2.5 Uniradio 65 Uniradio 70 Equipment wire 14/.0076	Receiver (4M) to T.B.709 (A,B and C) Aerial tuning unit (8S) to control and drive unit (1S) Aerial tuning unit (8R) to control and drive unit (1R) Control and drive unit (1B) to transmitter (2B) Receiver (4N) to Power and radio unit (3N)		

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Fig.4 A.R.I. 5874