Chapter 2

RADAR INSTALLATION

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WARNING

An aircrew ejection seat is fitted to this aircraft. Before attempting to enter the cabin, therefore, ensure that the instructions given in the Lethal Warning Marker Card at the beginning of this volume have been followed. In the interests of safety, this is very important.

Introduction

1. This chapter describes the radar installation and includes information on the servicing required to maintain the installation in an efficient condition. Information on the removal of the various components, with illustrations showing the location and interconnection of the equipment, is also included. A detailed description, and technical information on the equipment used, is given in A.P.2887N, Vol.1.

DESCRIPTION

General

2. The aircraft radar equipment consists of an I.F.F. installation, the basic purpose of which is to enable the aircraft to automatically identify itself as friendly when challenged by appropriately-equipped air, sea or ground forces. The system also provides:-

(1) Identification of one specific friendly aircraft among many.

(2) Transmission of a specially coded reply *(emergency signal)* which indicates that the aircraft is in distress.

Operation of the system is effected by control units situated in the cabin. The location of the equipment is illustrated in fig.1.

3. The installation is designed for spot frequency operation on two separate channels within the 950 to 1,150 Mc/s band. One channel is employed for reception of interrogation signals, and the other for transmission of replies. The main item of the aircraft installation is a transmitter-receiver contained in one unit and known as a transponder. An interrogating pulse from a ground station is fed to the transponder receiver which produces a pulse to modulate the transponder transmitter. The resultant transmission or reply pulse is received by the ground station and displayed with the radar echo, but it appears at slightly greater range, due to delay introduced by both the interrogating equipment and the transponder. Selective coding of the interrogating pulses is used, the transponder decodes these pulses, and replies only to those interrogators transmitting the appropriate code.

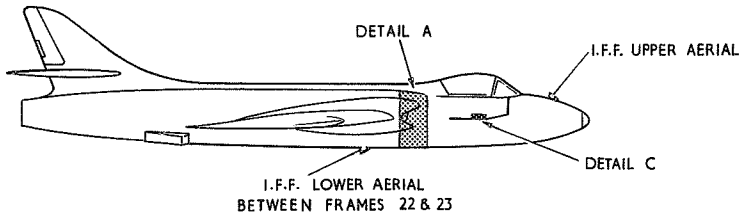
A.R.I.5848 installation *(Mk.10 I.F.F.)*

4. The Mk.10 I.F.F. installation embodies a Type 279/APX-6 transmitter-receiver which is carried on a shock-absorber type mounting rack located at the aft end of the top platform of the radio mounting structure in the radio bay. The installation uses either two Type 100A or 100B aerials, each of which is automatically connected, in turn, to the transmitter-receiver by a Type 6850 aerial switch unit. One aerial is situated on the top of the front fuselage just forward of the windscreen, and the other is mounted between frames 22 and 23 on the underside of the centre fuselage. The aerial switch is attached to the aft face of frame 16 on the port side, in the radio bay.

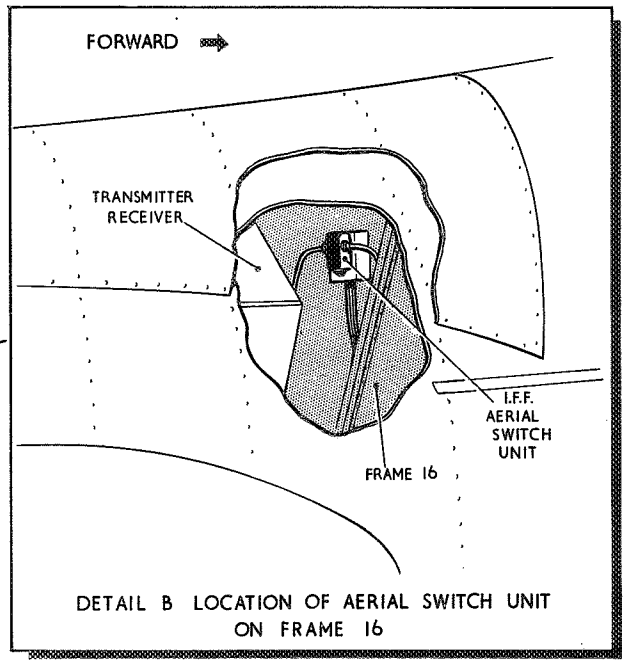
5. Remote operation of the installation is provided by a single-pole ON/OFF I.F.F. master switch and a Type 927 control unit. These are mounted together on the cabin starboard shelf. The installation includes a Type KY-95A/APX.25 coder unit, this is mounted on a Type X.6475 mounting tray fitted with anti-vibration mountings to a carrier attached to frame 16 in the radio bay. The coder is operated by a Type C.1128/APX.25 control unit situated on the cabin starboard shelf, adjacent to the Type 927 control unit.

6. The power supply for the installation is obtained from a Type 200 inverter which is mounted on the underside of the radio mounting structure in the radio bay. The inverter obtains its d.c. supply from a circuit breaker Type A6 mounted below the aircraft's electrical supply panel on the starboard side of the radio bay. To ensure that the transmitter-receiver is not operated above its altitude limitation, the supply to the inverter is automatically switched off by a Type PAD/A/14 altitude switch whenever the aircraft reaches an altitude of 45,000 feet. The supply is automatically reinstated when the aircraft descends to below 44,500 feet. The inverter's output is taken to the transmitter-receiver via a Type G.2 suppressor and fuse. The suppressor and fuse are mounted together on the forward face of the starboard fuel tank access door on frame 19. The altitude switch is mounted on the top diaphragm of frame 19. The power supplies are described in Sect.5, Chap.1, Group H.1.

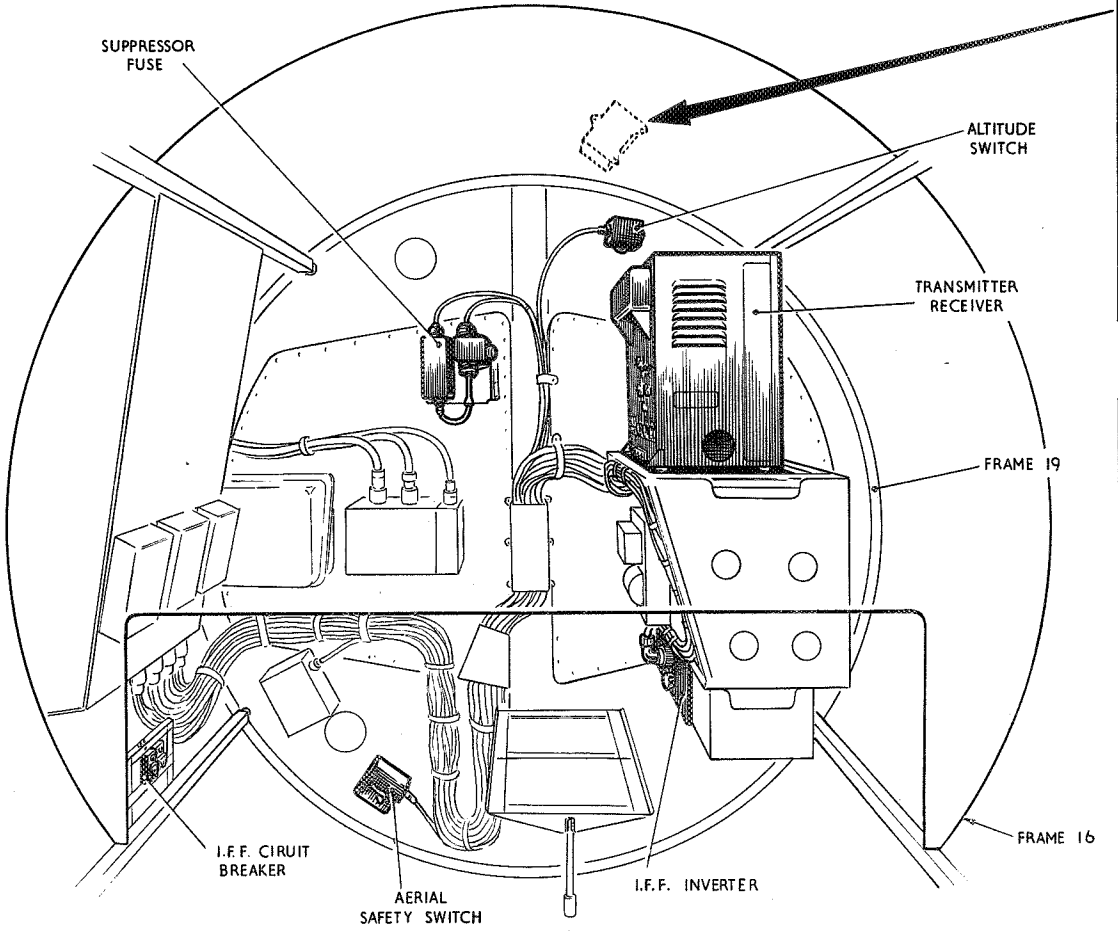
7. To enable the upper or lower aerial to be selected for test purposes, a single-pole changeover switch marked UPPER, LOWER and FLIGHT, is mounted on a bracket attached to the forward face of frame 19, below the starboard fuel tank access door in the radio bay. The switch is fitted with a spring-loaded safety cover to retain the switch toggle in the FLIGHT position on the completion of testing or servicing.



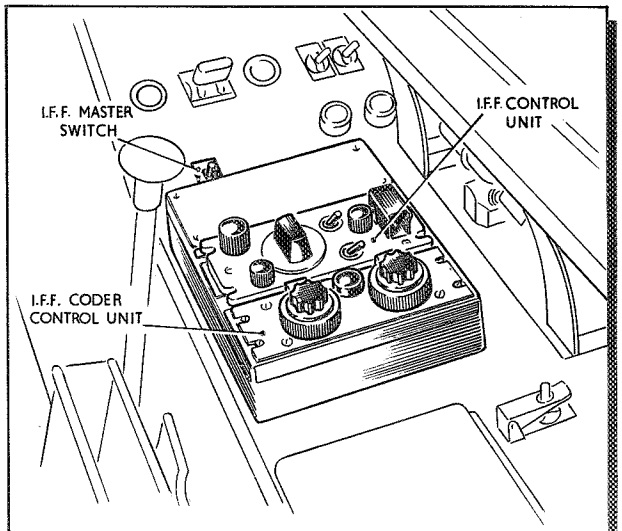
LOCATION OF RADAR EQUIPMENT



DETAIL B LOCATION OF AERIAL SWITCH UNIT
ON FRAME 16



DETAIL A EQUIPMENT BETWEEN FRAMES 16 & 19
(LOOKING AFT)



DETAIL C CABIN SHELF STARBOARD

Fig. 1 Radar installation - location

Interconnection

8. The various components of the radar installation are interconnected as shown in fig.2 by connectors strapped and clipped to the aircraft structure. These connectors are of the metal-braided and non-braided type fitted with standard and miniature plug and socket type breakdown points.

OPERATION

A.R.I.5848

9. Setting-up and operational instructions for the A.R.I.5848 installation are given in detail in A.P.2887N, which should be referred to when this information is required.

SERVICING

General

10. Servicing of the radar installation is given in A.P.2887N. Any units suspected of being unserviceable should first be carefully checked in situ and, if found to be faulty, removed from the aircraft and taken into the workshop for rectification action as necessary. The location of the radar equipment is illustrated in Fig.1 and the interconnection in fig.2. Wiring diagrams of the power supplies will be found in Group H.1 of Sect.5, Chap.1.

Power supply

11. If a fault is reported in the radar installation, the power supply should first be checked, in conjunction with the routeing and theoretical diagrams given in Group H.1 of Sect.5, Chap.1, to ensure that the fault is not located in the aircraft's electrical system. The voltage, both on and off load, must be tested and a check made to ensure that the connectors carrying the supply to the equipment are correctly assembled.

Cables and connectors

12. Servicing of cables and connectors consists of the standard continuity and insulation resistance tests and of periodical examinations throughout their entire length for signs of damage or deterioration of the insulation. If any signs of these defects are found, the complete cable or connector must be replaced. All the clips and straps securing the connectors to the structure must also be examined for signs of looseness and rectified as necessary to prevent chafing. All the plug and socket connections must be checked to ensure that they are fitted properly and that the fixings are tightened securely.

Final check

13. After servicing the radar installation, ensure that the equipment is left switched OFF and that all access doors, and panels, which were removed to gain access are correctly replaced and secured.

REMOVAL AND ASSEMBLY

General

14. The recommended procedure for removing the majority of the components comprising the radar installation is given in the following paragraphs. The method of assembly is, in general, the reverse of the removal sequence, but when there is any special assembly feature it is covered by a note in the appropriate paragraph. Before removing or replacing any components, the aircraft's electrical system must be rendered safe, as described in Group A.1 of Section 5, Chapter 1.

Transmitter-receiver

15. To remove the I.F.F. transmitter-receiver proceed as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1)*.

(2) Disconnect the connectors from the transmitter-receiver and fit approved caps and covers to the plugs and sockets. Stow the connectors clear of the set.

(3) Unscrew and disengage the two knurled catches securing the transmitter-receiver to the mounting rack and pull the unit inboard to release the two retaining spigots at the rear.

(4) Remove the transmitter-receiver from the aircraft.

Inverter

16. The recommended method of removing the I.F.F. inverter is as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1)*.

(2) Remove the aircraft's main batteries as described in Sect.5, Chap.1, Group B.1.

(3) Remove the cover from the inverter's control box and disconnect the two d.c. input leads from the terminal block. Replace the cover.

(4) Disconnect the output plug from the control box and also remove the air cooling pipe from the union at the commutator end cover.

(5) Release the inverter from its adaptor plate by removing the four attachments located one at each corner.

(6) Remove the inverter from the aircraft.

Upper aerial

17. The recommended method of removing the upper aerial is as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1).*

(2) Gain access to the aerial and disconnect the aerial connector from the socket at the base of the aerial unit.

(3) Remove the six screws securing the aerial to its mounting structure and withdraw the aerial, nut plate and sealing washer into the fuselage, taking care to retain the bonding strips.

(4) Remove the aerial from the aircraft.

Note . . .

When assembling the aerial, ensure that all contact surfaces are clean and that the bonding strips are replaced on the attachment screws before the sealing washer is fitted. When the aerial is in position, bend the bonding strips around the aerial base and fit them between the aerial base and nut plate.

Lower aerial

18. To remove the lower aerial, proceed as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1).*

(2) Remove the ten bolts from around the periphery of the aerial fairing and withdraw the fairing and aerial unit sufficiently to gain access to the aerial connector.

(3) Disconnect the aerial connector from the socket at the base of the aerial unit.

(4) Remove the aerial and fairing from the aircraft.

(5) If necessary, the aerial unit may be removed from its fairing by removing the ten bolts securing it to the fairing packing block.

Note . . .

When assembling the aerial, ensure that all surfaces in contact with the aerial unit are absolutely clean and free from paint, grease and jointing compound.

Aerial switch unit

19. To remove the aerial switch unit proceed as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1).*

(2) Remove all the connectors from the unit and fit approved caps and covers to the plugs and sockets. Stow the connectors clear of the unit.

(3) The unit may now be removed by unscrewing the three bolts securing it to the top diaphragm of frame 19.

Note . . .

When assembling the switch unit, ensure that the lower attachment point and diaphragm are cleaned locally, to ensure a good electrical contact. Assemble the earth lead at this point.

Coder unit

20. The recommended procedure for removing the coder unit is as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1).*

(2) Disconnect the cables from the coder unit and fit approved caps and covers to the plugs and sockets. Stow the connectors clear of the unit.

(3) Unscrew the knurled screw and disengage the clamping plate holding the unit to the mounting rack and remove the unit from the mounting tray.

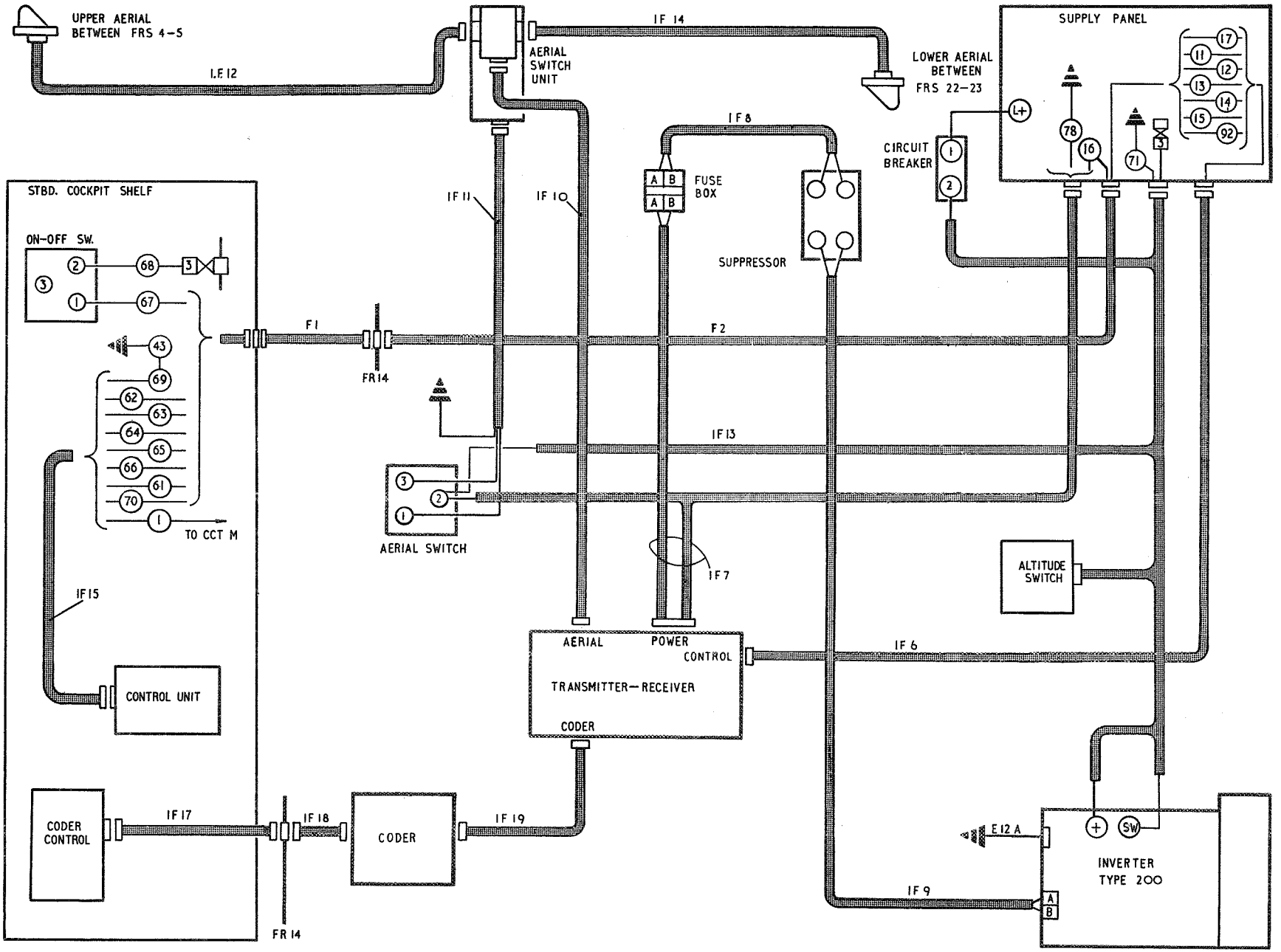


Fig.2 Radar installation - interconnection

I.F.F. master switch, control unit and coder control unit

21. When it is required to remove the master switch or control units from the cabin starboard shelf, the shelf should first be removed, as described in Section 5, Chapter 1, Group A.2. The method of removing the units will then be self-evident.

APPENDIX 1 - MOD.1009

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Modification 1009

1. This appendix contains a description of the aircrafts radar installation*(Mod 1009)* and includes information on the servicing necessary to maintain the installation in a serviceable condition, also the recommended procedures for removing the equipment from the aircraft. Complete descriptions and servicing information on the equipment used is given in AP 116B–0304–1.

DESCRIPTION

A R I 18107

2. This installation consists of a navigational aid, which when tuned to a ground or surface beacon, provides distance and bearing information indicating the position of the aircraft relative to the beacon to which the aircraft's equipment is tuned. This information is fed electronically to the indicator on the starboard instrument panel. Coded identification signals which

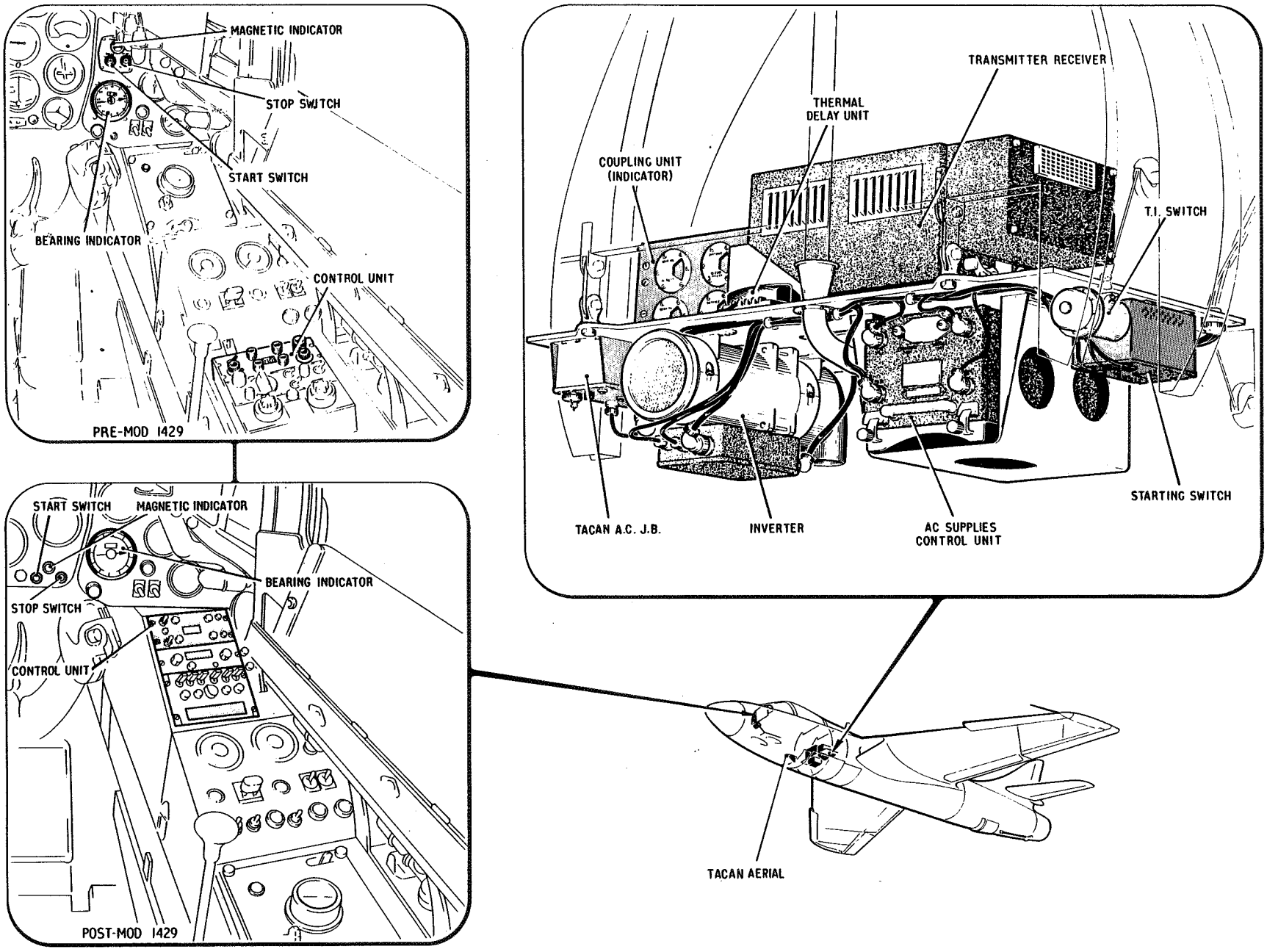

Fig.1 Tacan installation — location

▶ **(Mod 1429 added)** ◀

TABLE 1

Equipment type and Air Publication Reference

Equipment Type	Air Publication
Tacan A.R.I.18017 Transmitter-receiver R.T.220/A.R.N.21 or R.T.220C/A.R.N.21 Mounting tray M.T.-928/A.R.N.21 Coupling unit (indicator) Type 9546 Mounting Type 9545 Backplate Control unit, Type 9273 Indicator, Type 9547 Aerial, Type 100B	A.P.2534N, Vol.1.

are transmitted at intervals by the beacon are fed via a Type 148 junction box to the pilots headset, *(Chap.1)*.

3. This equipment comprises a transmitter-receiver R.T.220/ARN.21 or R.T. 220C/ARN.21 carried on a mounting tray M.T.-928/ARN.21, a coupling unit (indicator) Type 9546 carried on a Type 9545 mounting, a Type 9273 control unit, an indicator Type 9547 and a blade aerial, Type 100B. The transmitter-receiver and coupling unit are located on the Tacan panel, which is a hinged panel installed in the lower front fuselage between frames 14 and 16. The aerial projects downwards from the underside of the aircraft and is attached to an access door between frames 8 and 9 on the port underside of the fuselage. The control unit is located on the starboard cabin shelf and the indicator is mounted on the starboard instrument panel.

Power supplies and operating frequencies

4. The power supplies for the Tacan installation are taken from the aircraft a.c. circuit, and through a Type 26B control panel supplied by a Type 108 inverter mounted on the Tacan panel as described in Sect.5, Chap.1, Group H.1, Appendix 1. Both a.c. and d.c. supplies are routed to power supply relays on the transmitter-receiver mounting tray via the Tacan a.c. junction box, from which an a.c. supply is also fed to the coupling unit. A supply for the control unit illuminating lamps is provided from the cabin lighting circuit *(Sect.5, Chap.1, Group F.1)*. The operating frequency of the transmitter is in the frequency range of 1025 to 1150 Mc/s and the receiver operates in the 962 to 1024 and 1151 to 1213 Mc/s frequency range.

Tacan panel

5. This hinged panel which carries the transmitter-receiver and coupling unit, and the Type 108 inverter and a.c. control equipment is fitted in the lower front fuselage between frames 14 and 16 and is raised and lowered by a system of pulleys using the hoisting equipment described in para.20.

Transmitter-receiver and mounting tray

6. The transmitter-receiver is secured to the rear of the mounting tray by two locating spigots, and at the front by two wing nuts which engage with fittings on the transmitter-receiver. On the rear of the transmitter-receiver, a 45-pole connector mates with a socket connector on the mounting tray, the rear of which serves as a junction box. A housing across the rear of the tray carries two power control relays, and the connectors by which the cables from the control unit the coupling unit and the power supplies are connected with the transmitter-receiver. The aerial connection is made at the front of the transmitter-receiver.

7. Cooling air for the transmitter-receiver

GA11

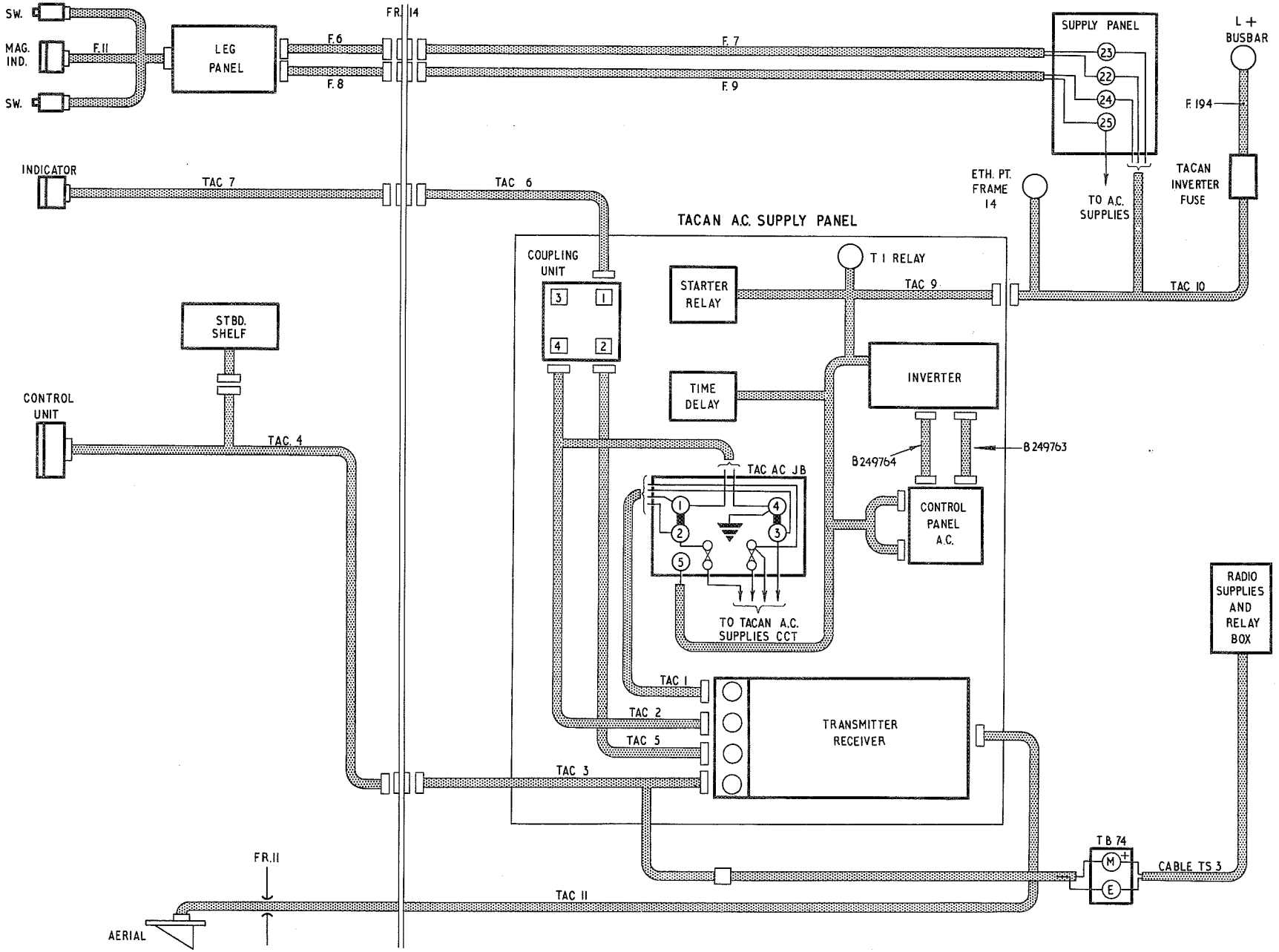

Fig.2 Tacan installation-interconnection

RESTRICTED

is provided from the cabin air discharge valve *(Book 1, Sect.3, Chap.8)*. A fan in the transmitter-receiver draws the cooling air through a polythene cloth air filter which is fitted to the base of the mounting tray; the air is exhausted through louvres in the dust cover that encloses the transmitter-receiver. To protect the equipment from unwanted radiations picked up in the control unit and power supply cables, filter units are housed in the mounting tray. The mounting tray is secured to the Tacan panel by anti-vibration mounts.

Coupling unit (indicator) and mounting

8. The coupling unit, which couples the Tacan installation to the indicator is contained in a box which is carried in a Type 9545 mounting. The mounting is fitted with a detachable backplate, which is attached to the mounting by screws that fit into captive nuts fixed to the mounting. Plugs in the rear of the coupling unit fit into mating sockets on the backplate. Two dowel locating pins are fitted to the backplate, and a lever operated quick release device holds the coupling unit in the mounting which is secured to the Tacan panel by anti-vibration mountings.

9. Two pairs of indicating dials on the face of the coupling unit, are used for setting up purposes. One pair indicates bearing, the other indicates distance. The upper bearing dial reads 0-360 degrees; the lower, a vernier dial reads 0-40 degrees. Similarly, the upper distance dial reads 0-200 miles, and the vernier dial reads 0-20 miles. Two independent gear trains are housed inside the unit, one for the bearing section and the other for the distance section. In each section a motor control (servo) supplied from the transmitter-receiver, drives gear assemblies that drive the dials and also drive the motors of their associated torque transmitters, potentiometers and resolvers; which form an electro-mechanical link between the transmitter-receiver and the indicator on the starboard instrument panel.

Control unit

10. The Tacan control unit which is mounted on the starboard cabin shelf, carries on its front panel the following controls:-

(1) A master two position toggle switch marked OFF and ON which controls the power supply to the equipment.

(2) A two-position toggle switch marked BRG. and DIST. BRG. In the BRG. position bearing information only is received and in the DIST. BRG. position the transmitter is energized so that both distance and bearing are indicated.

(3) Four channel selection push buttons. The right hand pair, mounted one above the other, control the 'units'. The left hand pair also mounted one above the other, control the 'tens'. Pressing the upper push buttons increases the 'unit' or 'tens' digits of the channel number, pressing the lower push button decreases the appropriate digit.

(4) The control marked VOL. is used to adjust the level of the identification signal in the pilots headset.

Any one of the 126 channels available can be selected by pressing the selector buttons as described, so that the number of the required channel appears in the window in the face plate. The figures are illuminated by interior lamps, supplied from the cabin lighting circuit *(Sect.5, Chap.1, Group F.1)*.

Indicator

11. The presentation of bearing and distance information is given on the indicator mounted on the starboard instrument panel, the bearing of the beacon from the aircraft is shown by the arrow head of the pointer and the bearing of the aircraft from the beacon, i.e. the reciprocal is indicated by the tail of the pointer. The distance of the aircraft from the beacon to which the equipment has been tuned is shown in a window on the dial of the indicator. The right hand digit shows the unit nautical miles and the next to the left digit shows the

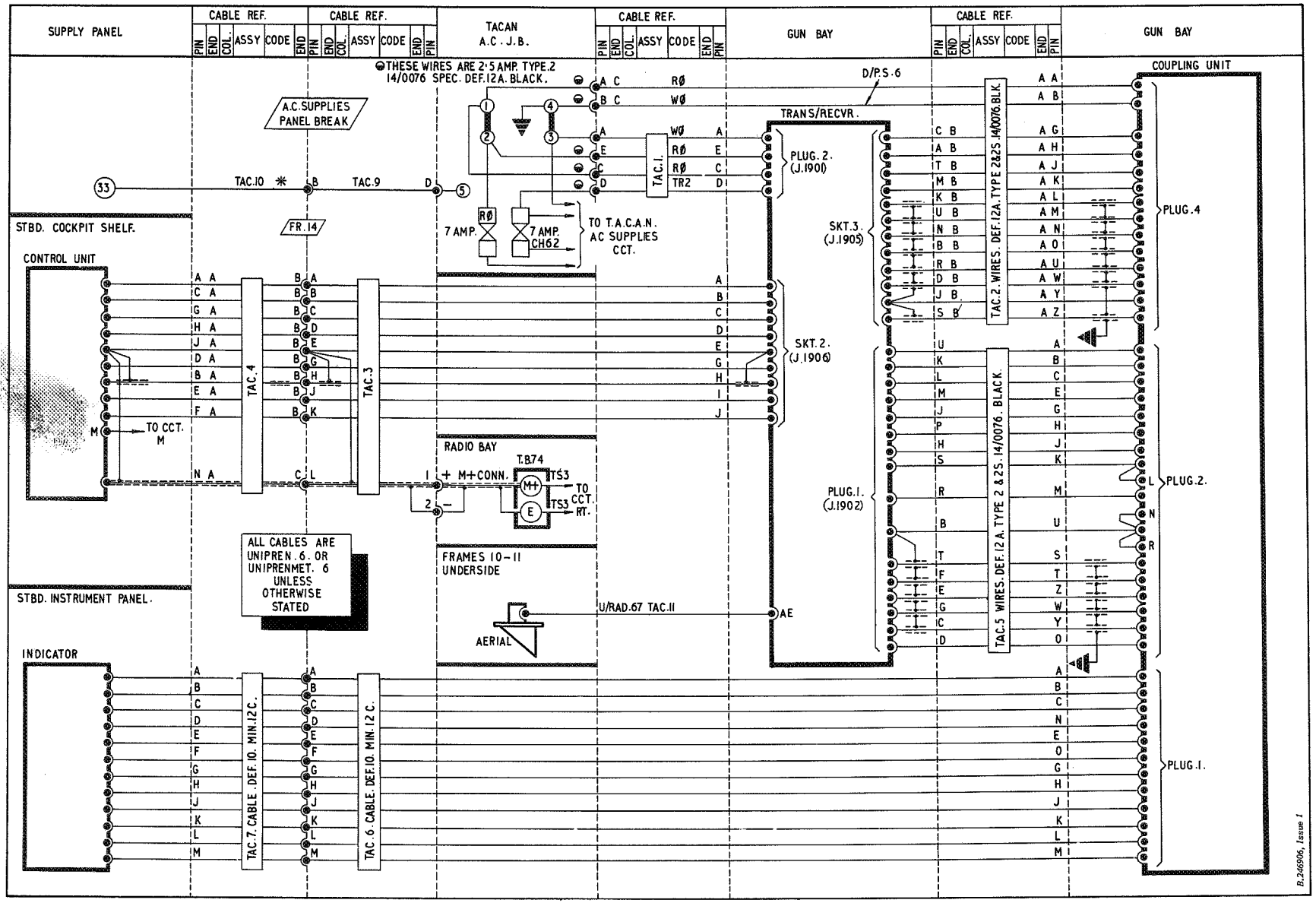

Fig.3 Tacan installation-routeing

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'tens' nautical miles. When the aircraft is over 100 nautical miles from the beacon a 'one' appears to the left of the 'tens' digit. When the installation is not locked to the beacon transponding signals the distance digits are partially masked by a flag across the distance window, the flag has a horizontal white line painted on it to improve visibility.

Operation

General

12. When the aircraft's a.c. and d.c. power supply services are operating, the Tacan equipment can be switched on by the use of the power control toggle switch on the control unit. In the B.R.G. position of the transmitter-receiver switch, the switch completes the energizing circuit of a power relay on the mounting tray, the relay supplies the transmitter-receiver equipment so that it operates to receive bearing information from the beacon. In the coupling unit the bearing train motor is supplied from the transmitter-receiver in such a manner that the reading on the bearing dials co-incides with the bearing of the Tacan beacon from the aircraft. The navigational resolver rotates synchronously with the 360 degree dial, and transmits signals proportional to the sine and cosine of the angle shown on the dial to the indicator on the starboard instrument panel.

13. With the control toggle switch in the DIST. BRG. position, a further power relay on the mounting energizes and supplies the transmitter-receiver equipment so that it transmits interrogating pulse signals. These signals are detected by the beacon, which transmits distance reply signals. In the aircraft, range circuits measure the time which elapse between the transmission of the interrogating pulses and the reception of the reply signals. Other circuits convert this time difference into nautical miles and figures representing these are displayed on the indicators. Power from the transmitter-receiver drives the distance train motor so that the distance dials on the coupling unit indicate the correct slant line distance from the aircraft to the beacon.

SERVICING

General

14. Information on the full servicing procedures for the Tacan installation is given in A.P.2534N, Vol.1. Any units suspected of being unserviceable should first be carefully checked 'in situ' and if found to be faulty, removed from the aircraft and taken in to the workshop for rectification action as necessary. The servicing in the aircraft consists of the normal tests for security and serviceability, as described in the following paragraphs.

Power supply

15. If a fault is reported in the Tacan installation the power supply should first be checked in conjunction with the routeing and theoretical diagrams given in Sect.5, Chap.1, Group II.1, Appendix 1, to ensure that the fault is not located in the aircraft's electrical system. The voltage both on and off load, must be tested and a check made to ensure that the connectors carrying the supply to the equipment are correctly assembled.

Cables and connectors

16. Servicing of cables and connectors consists of the standard continuity and insulation resistance tests and of periodic examination throughout their entire length for signs of damage and deterioration of the insulation. If any signs of these defects are found, the complete cable or connector must be replaced. All the clips and straps securing the connectors to the structure must also be examined for signs of looseness and any defects rectified as necessary to prevent chafing. All plug and socket connections must also be checked to ensure that they are fitted properly and that the fixings are tightened securely.

Security and serviceability check

17. The transmitter-receiver and mounting tray should be inspected to ensure that they are well secured and that the connectors are tight. The space below the mounting should be clear, to allow free circulation of air up through the air filter in the mounting

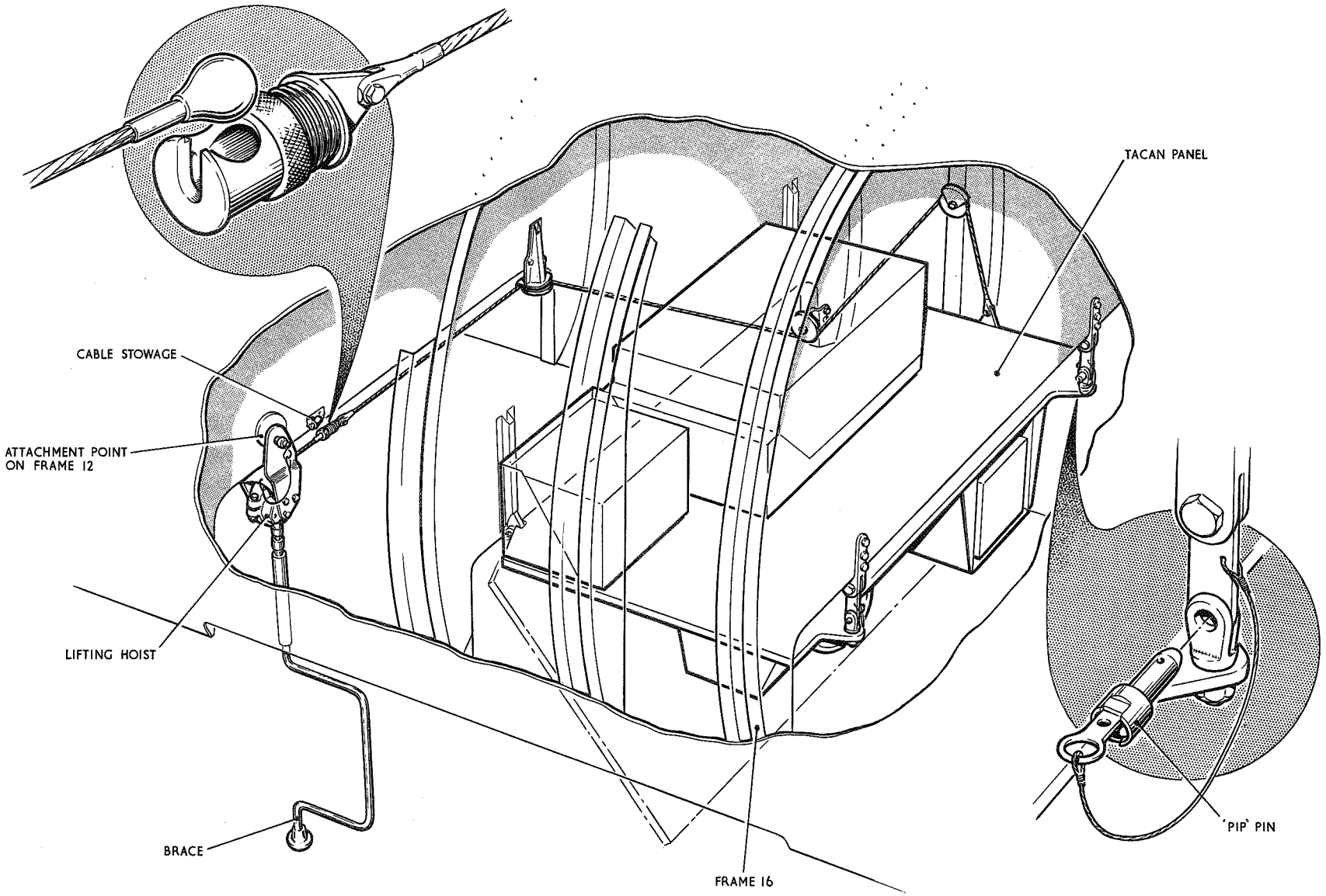

Fig.4 Lowering Tacan panel

tray. The coupling unit backplate, and mounting plate should be well secured, and all the connectors fully mated. The aerial and the control unit should also be inspected to ensure that they are secure. The control unit lamps should be checked by use of the aircraft dimmer switch in the cabin to ensure that they are serviceable and function correctly. The VOL. control knob should operate smoothly without binding, and the four channel push buttons should snap into place at each channel number.

Final check

18. After servicing the Tacan installation, ensure that the equipment is left switched OFF. Ensure that the Tacan panel is correctly secured and that all access doors and panels, which were removed to gain access are correctly replaced and secured.

REMOVAL AND ASSEMBLY

General

19. The recommended procedure for removing the components of the Tacan installation is given in the following paragraphs. In general the method of re-assembly is a reversal of the removal procedure, but when there is any special feature it is covered by a note in the appropriate paragraph. Before removing or replacing a component the aircraft must be rendered electrically safe as described in Sect.5, Chap.1, Group A.1. To gain access to the Tacan panel the Tacan bay access door must be removed as described in Book 1, Sect.3, Chap.1.

Tacan panel

20. To gain access to the equipment on the Tacan panel the panel must be lowered as follows:-

(1) Render the aircraft electrically safe as described in Sect.5, Chap.1, Group A.1.

(2) Attach the lifting hoist, Part No. B. 252863 to the attachment point on frame 12 as shown in fig.4 remove the panel hoisting cable from its stowage on frame 12. connect it to the hoist and winch tight, using the brace, Part No. B.223910

(3) Remove the two pip pins securing the panel and using the hoisting equipment carefully lower the panel.

Note . . .

When raising the panel, hoist into position as described, winch tight then after securing the panel with the two pip pins, remove the hoist and secure the hoisting cable on its stowage.

21. To remove the panel from the aircraft complete with equipment, lower the panel as described, then proceed as follows:-

(1) Ensure that the panel is adequately supported.

(2) Disconnect cable assemblies TAC.3, TAC.6, TAC.10 and TAC.11 fit approved caps and covers to the plugs and sockets and stow the cable assemblies clear of the panel.

(3) Disconnect the hoisting cable from the panel and remove the two hinge bolts. The panel complete with equipment may now be removed from the aircraft.

Tacan transmitter-receiver

22. The recommended method of removing the Tacan transmitter-receiver is as follows:-

(1) Render the aircraft electrically safe, as described in Sect.5, Chap.1, Group A.1, and lower the Tacan panel *(para. 20)*.

(2) Disconnect the aerial connector from the front of the transmitter-receiver, fit an approved cap and cover to the plug and socket, and stow the aerial plug clear of the transmitter-receiver.

(3) Remove the locking wire from the two wing nuts at the front of the mounting tray and unscrew the nuts until they are clear of the retaining catches on the transmitter-receiver.

(4) Disengage the rear of the transmitter-receiver from the spring loaded dowels on the mounting tray by using the handle to withdraw the transmitter-

receiver along the tray. Still using the handle, carefully remove the transmitter-receiver from the aircraft.

Transmitter-receiver mounting tray

23. To remove the mounting tray, remove the transmitter-receiver as described then proceed as follows:-

(1) Disconnect the connectors from the rear of the mounting tray, fit approved caps and covers to the plugs and sockets and stow the cables clear of the mounting tray.

(2) The tray can now be removed after unscrewing the bolts that secure it to the Tacan panel.

Coupling unit

24. The coupling unit can be removed as follows:-

(1) Render the aircraft electrically safe as described in Sect.5, Chap.1, Group A.1 and lower the Tacan panel *(para.20)*.

(2) The unit is released by means of the quick release lever underneath the Type 9545 mounting tray; by pulling the lever outwards and to the right, the coupling unit is free to be lifted out.

Note . . .

When replacing the coupling unit, the quick release lever must be pushed sideways and to the left over the dead centre position of the linkage, to hold the unit rigidly in the mounting.

Backplate

25. To remove the backplate from the Type 9545 mounting, remove the coupling unit as described in paragraph 23, then proceed as follows:-

(1) Disconnect the connectors from the backplate, fit approved caps and covers to the plugs and sockets, and stow the cables clear of the backplate.

(2) Release the backplate by unscrewing the 12 screws which secure it to the Type 9545 mounting.

Aerial

26. To remove the Tacan aerial proceed as follows:-

(1) Render the aircraft electrically safe as described in Sect.5, Chap.1, Group A.1.

(2) Remove the 12 countersunk headed screws from around the periphery of the aerial access door in the port undersurface of the front fuselage.

(3) Withdraw the aerial and access door sufficiently to gain access to the aerial connector and disconnect this connector from the aerial socket. Fit an approved cap and cover to the plug and socket.

(4) Remove the aerial from the access door by unscrewing the 12 nuts from the bolts securing the aerial base to the access door, taking care to retain the washers.

Note . . .

When re-assembling the aerial ensure good electrical bonding by checking that all mating surfaces are absolutely clean. Pay particular attention to the access door landing.

Control unit

27. To remove the control unit, proceed as follows:-

(1) Render the aircraft electrically safe, as described in Sect.5, Chap.1, Group A.1.

(2) Disengage the four dzus fasteners on the face of the control unit. Withdraw the unit from the starboard cabin shelf.

(3) Disconnect the connector from the rear of the unit, fit an approved cap and cover to the plug and socket, and remove the unit from the aircraft.

Indicator

28. To remove the indicator from the starboard instrument panel proceed as follows:-

(1) Render the aircraft electrically safe, as described in Sect.5, Chap.1, Group A.1.

(2) Remove the connector from the rear of the indicator, fit approved caps and covers to the plug and socket and stow the connector clear of the indicator.

(3) The indicator may now be removed by unscrewing the four stiffnuts securing it to the panel, taking care to retain the two distance pieces on the top screws.

Appendix 2

MOD.1319 - (A.R.I. 23134/3)

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Introduction

1. This appendix contains a description and the method of operation of the A.R.I.23134/3 *(I.F.F./S.S.R. – Identification Friend or Foe/ Secondary Surveillance Radar)*, which is fitted to all Mk.11 aircraft. Table 1 shows the equipment employed, and the illustrations will clarify the location of the various components, their cable interconnections and the operation of the control unit. Should any more detailed information on any component of the installation be required, a list of relevant Air Publications will be found in Table 1.

DESCRIPTION

General

2. The A.R.I.23134/3 is the airborne equipment which forms part of an I.F.F./ S.S.R. system. The purpose of the system is to enable the aircraft to identify itself rapidly and automatically when challenged by suitably equipped ground stations. When interrogated by a military *(I.F.F.)* or a civilian *(S.S.R.)* ground radar station the airborne equipment will respond by transmitting the appropriate signal. The A.R.I.23134/3 is designed for spot frequency operation on the two separate frequencies within the 950 MHz to 1150 MHz bands allocated to the system. One channel is employed for reception of the interrogating signals and the other for transmitting replies.

3. The interrogating signal pulse from the ground radar station is fed to the aircraft transponder receiver which produces a pulse to modulate the transponder transmitter. The resultant transmission or reply pulse is received by the ground radar station and shown on a read-out scale and displayed with the radar echo on the C.R.T. but it appears at a slightly greater range due to a delay introduced by both the interrogating equipment and the aircraft transponder. The interrogating pulses are selectively coded and the transponder will decode these pulses and reply with the appropriate code. One operating mode enables the aircraft altitude to be transmitted automatically by the airborne equipment.

TABLE 1

Equipment type and Air Publication reference

Equipment Type	Air Publication
Transponder Type X1 6928 Aerial switch unit, Type X1 6941 I.F.F./S.S.R. junction box Aerials, Type 100B	... ... A.P.114J - 0101 - 16

Aircraft equipment

General

4. The aircraft equipment consists of a transmitter/receiver (transponder), two aerials, an aerial switching unit, aerial test switch, warning lamp test panel, warning lamp, junction box and a control unit. The installation receives d.c. power from the I.F.F./S.S.R. circuit breaker below the supply panel. This circuit breaker also supplies d.c. to the Type 182 inverter, which in turn supplies 115v., 400 Mz. single phase a.c. to the transponder.

Inverter

5. The Type 182 inverter is mounted on a shock absorber mounting in the radio bay on the upper radio rack just forward of the transponder. The d.c. supply to the inverter is from the circuit breaker labelled I.F.F./S.S.R. on the circuit breaker panel just below the supply panel. The supply is from this circuit breaker to the inverter via the control relay in the

S S R J.B. The 115v., 400 Hz. single phase output from the inverter supplies the a.c. requirements of the transponder and, post-Mod 1387, also supplies the height encoding altimeter system a.c. test socket *(ref. Chap 2, Group 3 A, App 1)*.

Transmitter/receiver (transponder)

6. The transponder, mounted on a shock absorber mounting, is positioned on the upper radio rack in the radio bay, just aft of the Type 182 inverter. Electrical connection to the transponder is made by a 98 way plug on end B of cable assembly SSR2. Prior to Mod 1383 or 1387 being incorporated, ends E and F of SSR2 cable assembly are stowed at frame 19 in the radio bay but when either of the above modifications are incorporated *(ref. Chap 2, Group 3 A, App 1)*, end E of SSR2 is connected to cable assembly F200 end E of the height encoding system and Mode C of the IFF/SSR installation becomes operable. On the front of the transponder are the manual selection switches for setting Mode 2 *(para 13)*. The transponder is designed to operate within the temperature range of -55 deg.C to +125 deg.C at altitudes up to 100,000 ft. It is pressurized with nitrogen or dry air to 4 lb /in^2. Two CHARGE/CHECK/PURGE valves on the front panel are provided for this purpose.

Aerials

7. The installation uses two blade type aerials either Type 100A or 100B. The forward or upper aerial protrudes from the top of the nose wheel bay between frames 4 and 5 and the rear or lower aerial protrudes from below the rear fuselage between frames 22 and 23.

Aerial switching unit

8. This unit is situated on the upper aft face of frame 16 in the radio bay and contains solid state circuits which switch each aerial in turn to the transponder. The switching operation is controlled by the aerial test switch and is supplied via the control relay and 500mA fuse in the S S R junction box.

Note. . .

Failure of the d.c. supply, or a failure of the driver circuit, renders the switching action of the aerial switching unit inoperative. The transponder will then remain connected to the aerial socket marked UPPER. If one or both switching diodes fail, the transponder remains connected to the LOWER socket.

Aerial test switch

9. This switch is situated on the lower front face of frame 19 in the radio bay and is a three position switch marked UPPER, FLIGHT and LOWER. It is normally locked in the FLIGHT position but may be moved manually to the UPPER or LOWER position for testing or servicing operations. The UPPER and LOWER selections refer to whichever aerial is connected to the transponder. In the FLIGHT position the switching of aerials is controlled by the aerial switching unit.

Note. . .

The aerial test switch will not select upper or lower aerial if the power supply is disconnected or if the aerial switching unit is faulty.

S S R junction box

10. This J.B. is fitted to the upper front face of frame 19 on the starboard tank access door. It forms the interconnecting point between the power supplies and the various installation components and is also the main earthing point for the I F F / S S R equipment. The following items are contained in this J.B.

(1) 1 A fuse
Supply is taken through this fuse for the failure warning lamp test switch testing facility and also for the transponder self test and failure warning circuits.

(2) 500 mA fuse
This fuse is in the supply line from the junction box control relay to the aerial switching unit.

(3) Control relay
This relay, controlled by the FUNCTION CONTROL switch on the control unit, when energized, will supply the aerial switching unit through the 500mA fuse and also supply d.c. for the Type 182 inverter.

(4) Earth return terminal
The earth return from the various circuits of the installation is carried from the earth terminal in the S S R J.B. to a stud on the tank access door on the forward face of frame 19. This stud may be easily distinguished by its earth point marking of blue paint.

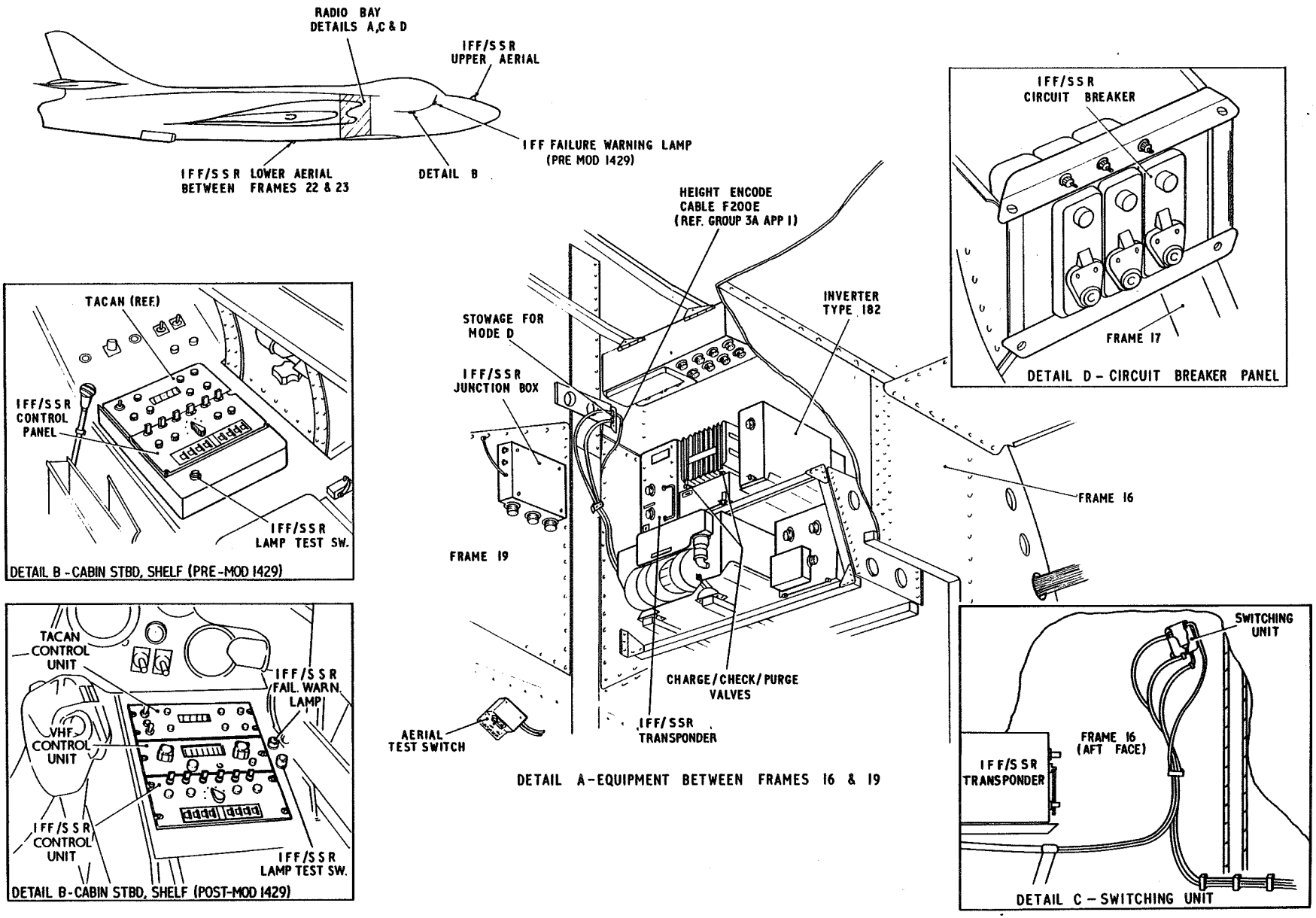

Fig.1 IFF/SSR equipment location

▶ (Mod 1429 added) ◀

Failure warning lamp test panel

▶ **11.** Pre-Mod 1429, this panel is situated on ◀ the cabin starboard shelf immediately aft of the control unit and is labelled IFF/SSR FAIL LAMP TEST. It provides a test facility for checking the serviceability of the amber failure warning lamp filament, and is of the press-to-test type. This switch also tests the serviceability of the green self-test lamp filament on the control unit. The amber failure warning lamp is mounted on a bracket on the starboard side of the cabin at frame 9 above the forward end of the starboard shelf and is labelled IFF/SSR FAIL. The conditions under which the warning lamp will illuminate are ▶ given in para 23. When Mod 1429 is embodied, the control unit, warning lamp and lamp test switch are located on the sloping portion of the cabin forward starboard shelf. ◀

Control unit

12. This unit which is attached to a mounting on the upper face of the cabin starboard shelf and labelled I F F / S S R is held in position by four Dzus fasteners. Electrical connection is by a 55 way socket on the underside of the unit. On the upper face of the control unit are all the controls required for the in-flight control of the installation.

13. This paragraph describes the function of all the switches on the I F F /S S R control unit.

(1) FUNCTION CONTROL switch
The in-flight operation of the I F F / S S R installation is controlled by this switch which has a rotary action and five positions. The positions and functions of these positions are as follows:-

(i) OFF – Installation inoperative.

(ii) SBY – With this position selected, the S S R J.B. control relay is energized and supply from the I F F /S S R circuit breaker is passed to the aerial switching unit, the inverter and to the transponder. The transponder will now accept interrogations only. After approximately one minute warming up time, the transponder is ready to transmit information when switched to NORM.

(iii) LOW – With this position selected, the transponder accepts selected interrogations and transmits information but the receiver sensitivity is reduced. This selection may be requested by ground radar to reduce clutter from long range replies.

(iv) NORM – In this position the transponder accepts selected interrogations and transmits information.

(v) EMGY/PUSH – *(The switch is pushed and turned to this position).* In this position the transponder accepts Modes 1, 2, 3A or 3B interrogations irrespective of their selection. Emergency transmissions are made of the selected code, followed by three repeats of the frame pulses. When switched from OFF to EMGY/PUSH the transponder immediately attempts emergency transmissions but 50 seconds should be allowed for the transmitter to warm up. The amber failure lamp will flash until replies are transmitted.

(2) The equipment can reply to three military Modes numbered 1, 2 and 3 and four civil Modes lettered A, B, C and D. Modes 3 and A are identical.

(i) MODE 1 – This is selected by a two position toggle switch, which when selected up enables the transponder to accept Mode 1 interrogations and to transmit information selected on the control unit Mode 1 selection switches.

(ii) MODE 2 – Selection is by a two position toggle switch which when selected up enables the transponder to accept Mode 2 interrogations and transmit information selected by the code selection switches on the front of the transponder. *(These switches are not accessible in flight).*

(iii) MODE 3A - OFF - B – This is a three position rotary switch. Position 3A enables the transponder to accept Mode 3A interrogations and to transmit information replies selected on the control unit Mode 3 code selection switches. Position B enables the transponder to accept Mode B in-

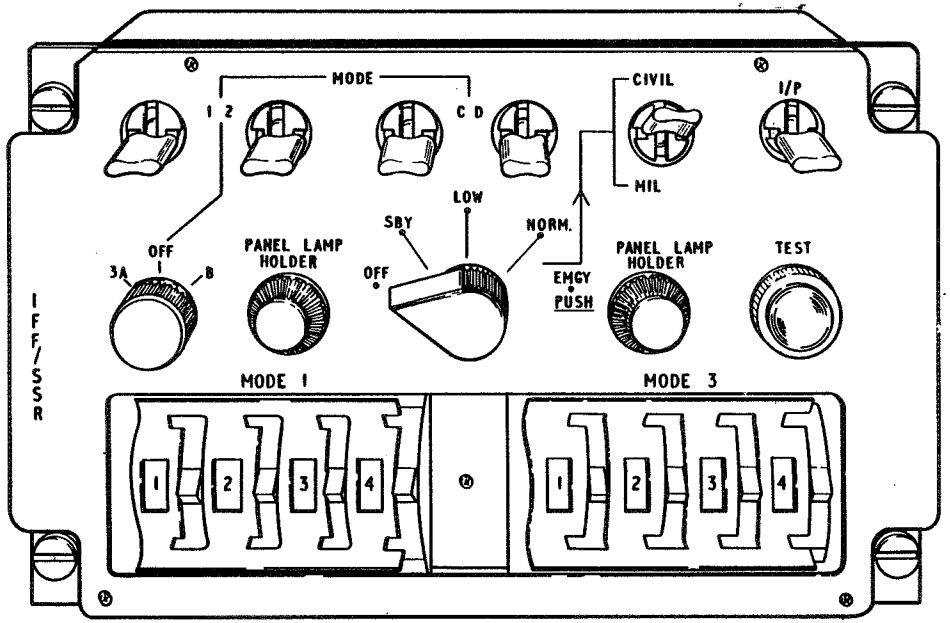

Fig.2 I F F /S S R control unit

terrogations and to transmit information selected on the control unit Mode 3 code switches. In the OFF position the transponder will not accept interrogations of Mode 3A or 3B.

(iv) MODE C – Selection is by a two-position toggle switch, which, when selected up, enables the transponder to accept Mode C interrogations and to transmit altitude information.

Note . . .

This facility is inoperable until Modification 1383 or 1387 is incorporated. (ref. Chap 2, Group 3 A, App 1).

(v) MODE D – Selection is by a two position toggle switch but operation of this Mode requires a separate coding unit which is not fitted to Hunter aircraft.

Note . . .

The cable end and connector for Mode D equipment is stowed at frame 19 in the radio bay.

(3) Code information may be selected on the control unit panel for Mode 1 and Mode 3A and B. Four switches are available on each of these Modes, providing code settings of 0000 to 7777, resulting in a combination of 4096 codes.

(i) MODE 1 – Code switches provide selection of Mode 1 code information for transmission.

(ii) MODE 3 – Code switches provide selection of Mode 3A or 3B code information for transmission, depending upon which Mode is selected.

(4) MODE 2 – This information is pre-set before flight by switches on the transponder and is allocated to the particular aircraft to which it is fitted.

(5) The CIVIL-MIL switch operates only with the function control switch in the EMGY/PUSH position.

(i) CIVIL – In this position the transponder is automatically selected as code 7700 followed by three repeats of the frame pulses and operates only in the Mode 3A or B.

(ii) MIL – In this position the transponder's reply in Modes 1, 2 and 3A is the selected code followed by three repeats of the framing pulse.

(6) The I/P switch operates the IDENTIFICATION of POSITION facility in the transponder and will be requested by a ground station. The switch is biased to the central OFF position. On selecting the switch to the up position the I/P facility operates and is timed to continue for twenty seconds after the switch returns to the central position.

(7) TEST – The test button is a combined push switch and lamp incorporating a double filament lamp with a green filter. When depressed, with the equipment operating, the self test facility of the transponder checks the receiver sensitivity, the transmitter power output level and the Mode serviceability.

14. The etched markings on the face of of the control unit are illuminated by two internal lamps, the holders of which protrude from the panel to facilitate replacement.

Operation

General

15. With the FUNCTION CONTROL switch on the control unit in the OFF position, the initial serviceability of the amber FAIL WARN lamp and the green SELF TEST lamp may be checked by depressing the I.F.F./S.S.R. FAIL TEST switch, when both lamps should glow until the switch is released.

16. With supply available at the I.F.F./S.S.R. circuit breaker, selection of the FUNCTION CONTROL switch on the control unit from OFF to SBY will provide an earth return for the coil of the control relay in the S.S.R. J.B. which will close and complete the circuit to bring the inverter on line and power the transponder. It will also complete the d.c. circuit to the aerial switching unit. The amber FAIL WARN lamp will glow but after an initial 50 second warming up period, will go out if the installation circuits are working properly, and the I.F.F./S.S.R. is ready for use.

TABLE 2

Modes of operation

Mode	Time interval	Function
1	3 μs	Military identification
2	5 μs	Military identification
3A	8 μs	Civil/military identification
B	17 μs	Civil identification
C	21 μs	Automatic altitude
D	25 μs	

Interrogation and reply

17. Interrogating pulses are transmitted in pairs by the ground station at a radiated frequency of 1030 MHz. The time interval between the interrogating pulses is set to a particular value at the ground station. Six separate time intervals are used and these are defined as MODES. These modes are shown in Table 2.

18. The interrogating pulses initiate a coded pulse train reply from the transponder at a frequency of 1090 MHz. The replies are known as CODES, which are pre-set on selector switches on the control unit and on the transponder. Every transponder reply contains two framing pulses spaced

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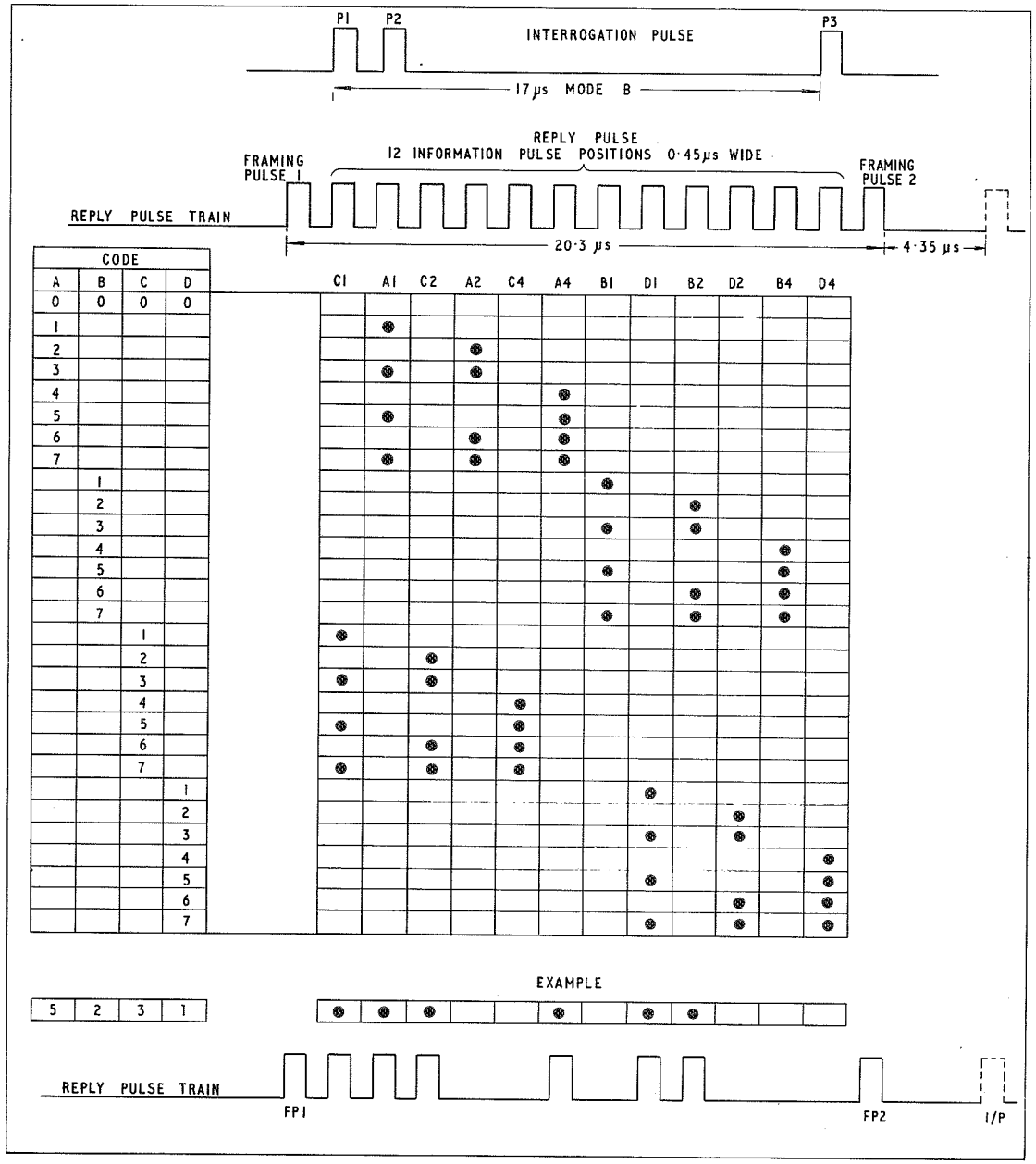

Fig.3 I.F.F./S.S.R. interrogation and reply pulse wave forms and codes

at 20.3 μs apart. Between these are twelve information pulse positions. The presence or absence of any of the information pulses is determined by the setting of the code selector switches. Up to 4096 different codes can be permutated from the twelve positions.

Identification pulse

19. An additional pulse is provided 4.35 μs after the second framing pulse. This pulse is transmitted only when the I/P switch on the control panel is operated at the request of the ground control.

Suppression pulse

20. While the transponder is transmitting a reply to an interrogation a suppression pulse is emitted to inhibit the Tacan installation, which operates in the same frequency band. Conversely, when the Tacan installation is transmitting, a pulse from the Tacan suppresses the I.F.F./S.S.R. installation.

Emergency

21. Two transponder codes are reserved for emergency use:-

Code 77 – Emergency
Code 76 – Loss of communication

When either code is set and the EMGY/PUSH switch operated, a special read-out and alarm is given on the ground controller's display.

Sidelobe suppression

22. Because of the configuration of the ground equipment transmitting aerial, the transponder in the aircraft may be triggered by spurious sidelobes in addition to the interrogator beam. This effect is overcome by one of two methods. The methods are known as 2 pulse sidelobe suppression and 3 pulse sidelobe suppression. In the 2 pulse method it is arranged that the two interrogating pulses are transmitted on separate aerials, the interrogator aerial and the control aerial. A comparator circuit in the transponder compares the relative strengths of the pulses and either replies or not, according to the relative signal strengths. In the 3 pulse method the interrogating pulses P1 and P3 are transmitted on the interrogator aerial and a third pulse, P2, is transmitted on the control aerial two microseconds after the P1 signal. The signal strengths of P1 and P3 are compared with that of P2 and the transponder will reply or not according to the relative signal strengths.

Failure warning lamp

23. During operation of the installation the amber failure warning lamp will glow in the following cases:-

(1) Function selector switch set to OFF.

(2) Function selector switch set to SBY and the transponder being interrogated *(warning lamp will flash).*

(3) If a fault occurs within the transponder.

(4) If the features of the self test check are not fulfilled.

Note. . .

The serviceability of the failure lamp may be checked at any time when there is supply to the S.S.R. J.B. by depressing the I.F.F./S.S.R. FAIL LAMP TEST switch.

Self test lamp

24. Correct functioning of the warmed-up equipment may be checked by use of the self test lamp/switch on the I.F.F./S.S.R. control panel in the following manner:-

(1) On the control unit select 1, 2, C and D switches down.

(2) Select 1 and 3 code switches to 0000 and the CIVIL/MIL switch to MIL.

(3) With the function control switch at SBY, depress the TEST lamp and it should remain out and the amber FAIL WARN lamp should flash.

(4) Select the function selector to LOW. Depress the TEST lamp and it should glow, the amber FAIL lamp should flash. Should the amber lamp remain steady this is not a failure indication in the LOW selection.

(5) Select the function selector to NORM. Depress the TEST lamp and it should glow. The amber lamp should remain out.

(6) Select the function selector to EMGY/PUSH. Depress the TEST lamp and it should glow. The amber lamp should remain out.

(7) Select the function selector switch to OFF and note that the amber warning light comes on.

SERVICING

General

25. Servicing of the I.F.F./S.S.R. installation is given in A.P.114J-0101-16. Any units suspected of being unserviceable should be carefully checked in situ, both for source of supply power and individual serviceability, before removal. Ensure every unit is secure and that the plugs and sockets are properly mated and securely tightened. Cables and connectors should be examined along their entire length for signs of damage or deterioration. All clips securing the cables to the aircraft structure must be inspected for signs of looseness. Insecure clips should be tightened as necessary to prevent chafing.

Aerial switching unit

26. The aerial switching unit contains solid state components and it is therefore not possible to check the continuity and operation of this switch by d.c. or low

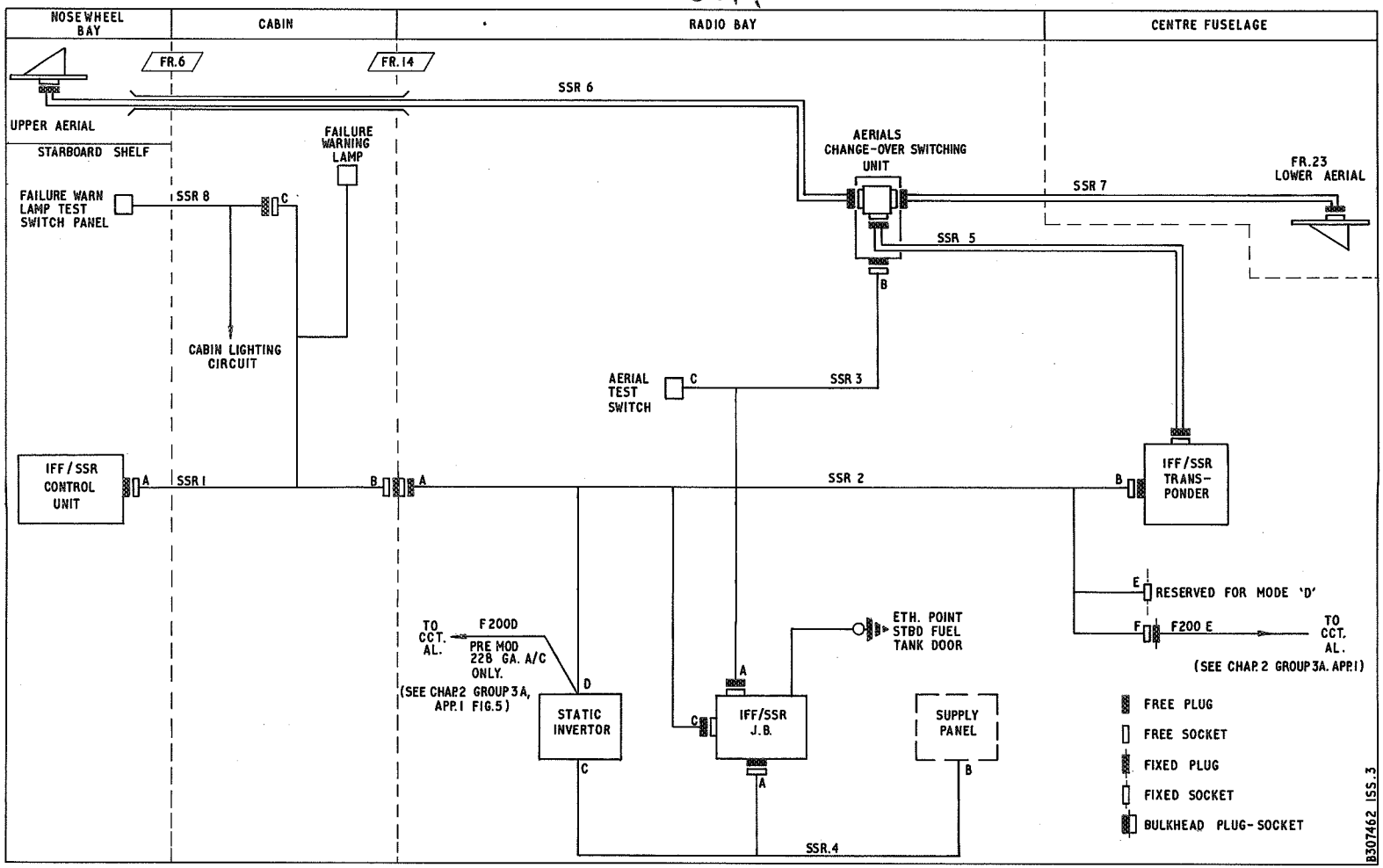

Fig.4 I.F.F./S.S.R. interconnections

◀ (To include Mods.1383/1387) ▶

frequency measurements. In particular the test unit used for aerial switches Type 6850 *(A.R.I.5848)* cannot be used to test this switching unit.

Note. . .

Failure ot the switching diodes in the aerial switching unit can occur if the peak R.F. voltage applied to the switch exceeds the diode breakdown voltage. It is essential therefore that R.F. power is applied to the switch only when the aerial terminals are correctly terminated either by a radiating aerial, or by a matched load.

Functional checks

27. A functional check of the installation can be made without special test equipment by using the built in self test equipment facility. *(See para.24).*

Test equipment

28. The ground test equipment required for the I.F.F./S.S.R. installation is as laid down in R.I.M.169 Part 5 and the performance test will require Test Set Cossor C.R.M.554.

REMOVAL AND ASSEMBLY

General

29. No difficulty should be experienced when removing any of the components comprising the I.F.F./S.S.R. installation, and the assembly is in general a reversal of removal but where there is any special feature it is covered by a note in the appropriate paragraph. Before removing or installing any components, the aircraft electrical system must be rendered safe as described in Sect.5, Chap.1, Group A.1 of this A.P.

Transmitter/receiver (transponder)

30. To remove the I.F.F./S.S.R. transponder from the aircraft proceed as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1).*

(2) Disconnect the connectors from the transponder and fit approved caps and covers to the plugs and sockets. Stow the connectors clear of the set.

(3) Unscrew and disengage the two knurled catches securing the transponder to the mounting rack and pull the unit inboard to release the two retaining spigots at the rear.

(4) Remove the transponder from the aircraft.

Inverter

31. The recommended method of removing the inverter Type 182 from the aircraft is as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1).*

(2) Gain access to the radio bay upper radio mountings.

(3) Remove inverter terminal block cover, unscrew the terminal connections and remove the leads. Replace cover and tape and stow the leads clear of the inverter.

(4) Unscrew the knurled nut and clear the retaining catch at the front of the unit and slide the inverter inboard to clear its mounting.

(5) Remove the inverter from the aircraft.

I.F.F./S.S.R. junction box

32. The recommended method for removing this J.B. from the aircraft is as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1).*

(2) Gain access to frame 19 in the radio bay.

(3) Disconnect the cable connectors from the J.B. and fit approved caps and covers to the plugs and sockets. Stow the cables clear of the unit.

(4) Disconnect earth terminal from stud on the starboard tank access door.

(5) The unit may now be removed from the aircraft by undoing the four bolts securing it to the mounting plate on the starboard tank access door.

Aerial switching unit

33. To remove the aerial switching unit from the aircraft proceed as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1).*

(2) Gain access to frame 16 in the radio bay.

(3) Remove all the connectors from the unit and fit approved caps and covers to the plugs and sockets. Stow the cables clear of the unit.

(4) The unit may now be removed by unscrewing the three bolts securing it to the top of frame 16.

Upper aerial

34. The recommended method of removing the upper aerial is as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1).*

(2) Gain access to the aerial in the nose wheel bay and disconnect the aerial connector from the socket at the base of the aerial unit.

(3) Remove the six screws securing the aerial to its mounting structure and withdraw the aerial, nut plate and sealing washer into the fuselage, taking care to retain the bonding strips.

(4) Remove the aerial from the aircraft.

Note. . .

When assembling the aerial, ensure that all contact surfaces are clean and that the bonding strips are replacel on the attachment screws before the sealing washer is fitted. When the aerial is in position, bend the bonding strips around the aerial base and fit them between the aerial base and nut plate.

Lower aerial

35. To remove the lower aerial from the aircraft, proceed as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1).*

(2) Remove the ten bolts from around the periphery of the aerial fairing and withdraw the fairing and aerial unit sufficiently to gain access to the aerial connector.

(3) Disconnect the aerial connector from the socket at the base of the aerial unit.

(4) Remove the aerial and fairing from the aircraft.

(5) If necessary, the aerial unit may be removed from its fairing by removing the ten bolts securing it to the fairing packing block.

Note. . .

When assembling the aerial, ensure that all surfaces in contact with the aerial unit are absolutely clean and free from paint, grease and jointing compound.

I.F.F./S.S.R. control unit and warning lamp test panel

36. The recommended procedure for removing either of these two units from the aircraft is as follows:-

(1) Render the aircraft electrically safe *(Sect.5, Chap.1, Group A.1).*

(2) Locate the units on the starboard shelf in the cabin.

(3) To remove the control unit, undo the four quick release fasteners securing it to the shelf, raise the unit and unscrew the connector on the underside. Fit approved caps and remove unit from the aircraft.

(4) To remove the warning lamp test panel, unscrew the four securing screws, raise the warning panel sufficiently to reach inside the shelf and unscrew cable S.S.R.8 from cable S.S.R.1C. Remove warning panel complete with cable S.S.R.8.

(5) Fit approved caps and covers to cable connector of S.S.R.8 and cable S.S.R.1C and remove warning panel from aircraft.

Note. . .

If servicing in this area necessitates the removal of the starboard shelf, the removal procedure is laid down in Sect.5, Chap.1, Group A.2 of this A.P.

APPENDIX 3 - MOD 1468

RADAR ALTIMETER - ARI 23232/17

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TABLE 1

Equipment List

Equipment	Type	Air Publication
Transmitter-receiver	SMITHS 0101 HRA/1	AP116B-0215 SERIES
Radar altitude indicator	SMITHS 0201 KIR 01 Mod 01	AP116B-0215 SERIES
Aerials (2 off)	SMITHS 0301-HAA-04	
Tone generator	RACAL W 697/1	
Amplifier	RACAL A 691/5	

INTRODUCTION

1. This appendix contains a description of the ARI 23232/17 (Radar Altimeter) introduced by Mod 1468. The Radar Altimeter installation provides continuous indication of the altitude of the aircraft up to a height of 5000 ft above the nearest terrain. Main components of the installation are listed, together with type or part number, in the Equipment List (Table 1) and are located in the aircraft as shown in Fig 1. A theoretical diagram is in Fig 3. In addition to the following information, complete descriptive and servicing details of the equipment are available in AP116B-0215-1A.

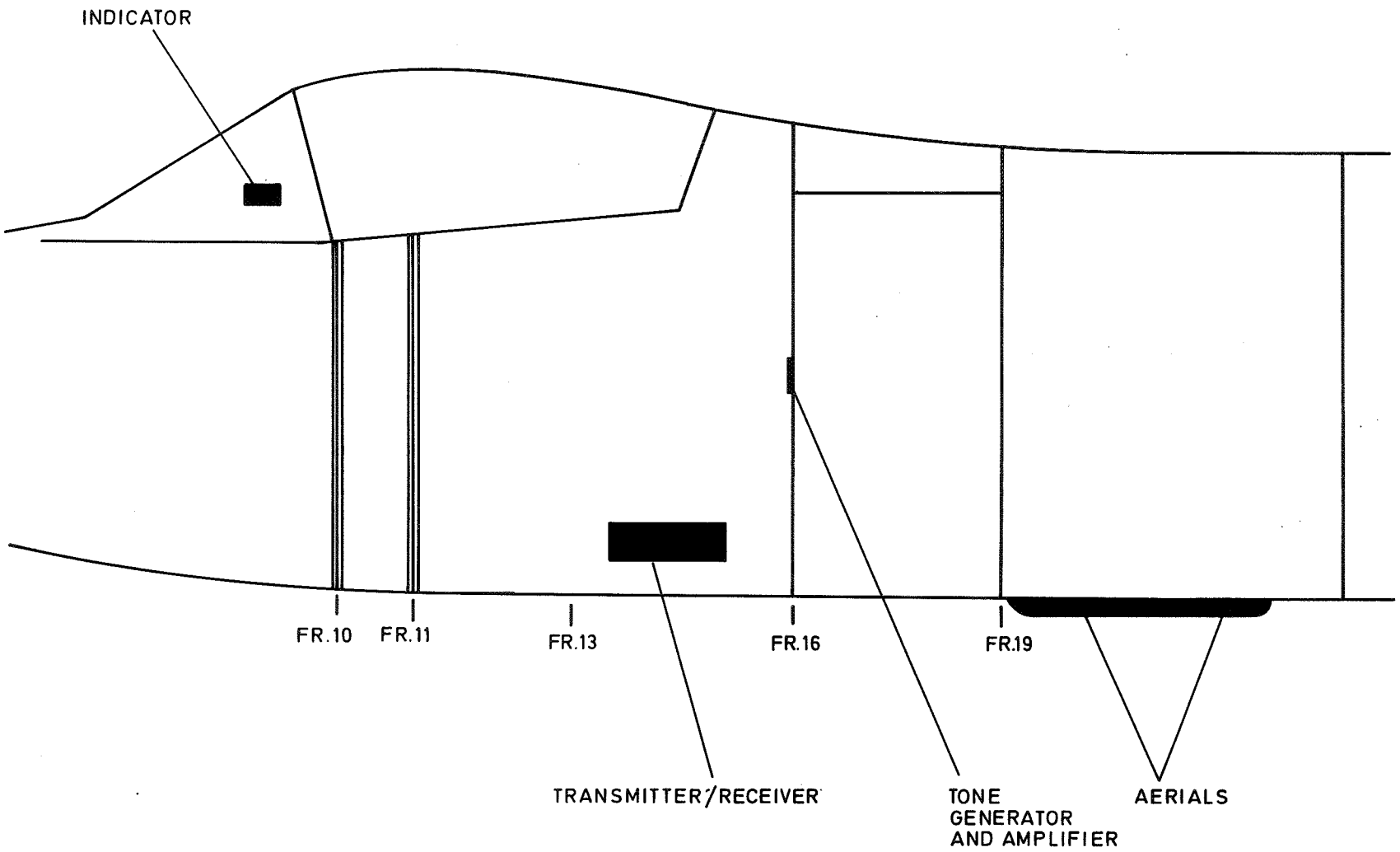

Fig. 1 Radar altimeter - location of equipment

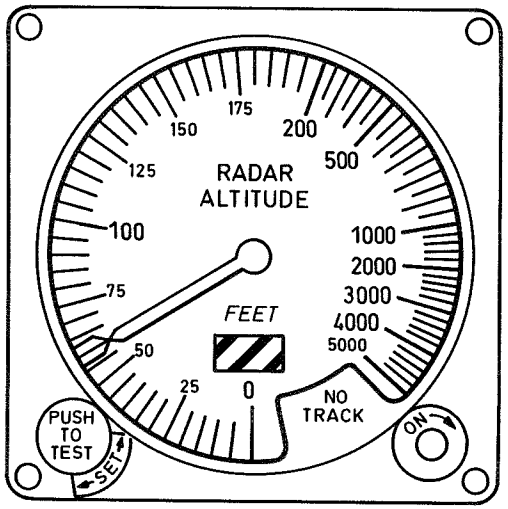

Fig 2 Radar Altimeter Indicator

DESCRIPTION

General

2. The ARI 23232/17 is a high resolution, short pulse radar system with low-level terrain tracking and altitude sensing capabilities and will operate normally in temperatures ranging from -40 deg C to +71 deg C. The equipment will track terrain ahead of, or adjacent to, the aircraft when it is nearer than the terrain below, thus providing warning of rapid changes in altitude.

3. Altitude information is derived from measurement of the time lapse between transmission of a 4300 MHz pulse and the echo return pulse, which is processed to produce a standard analogue output voltage. This voltage (external range), varying from zero volts at ground level to +40 VDC at 5000 ft., is proportional to the altitude of the aircraft above the local terrain and is used to drive a servo device in the indicator which positions the indicator pointer. A switched output of the indicator is used to operate the peripheral LOW warning lights and the LYRE BIRD tone generation in the event of the aircraft descending below the height set on the index bug. The system incorporates a manually controlled built-in test facility which can be used to check correct operation of the transmitter-receiver and indicator prior to and during flight or for bay servicing purposes.

Power supplies

4. The system is supplied with 115 VAC from B phase of the AC distribution panel and with 28 VDC from the starboard cockpit rear fuse box. The AC supply is routed via fuse 5 and the system master switch to the indicator. A separate DC supply is routed direct to the transmitter-receiver via fuse 11. A further DC supply is routed from fuse 12 to the tone generation panel and is used to power the tone generator and the amplifier. The supply for the instrument illumination is taken from fuse 5 which is used to supply the UV lights.

Transmitter-receiver

5. The transmitter-receiver is mounted in a rack in the gun pack adjacent to the AD 120 VHF transceiver. The unit is secured in the rack by two screw clamps which engage fittings on the front panel and by a full width knife-edge wedge at the rear. A 26 pole plug J1 and two co-axial connectors J2 RCVR ANT and J3 XMTR ANT on the front panel, provide for connection of the unit into the system. A receptacle marked TEST J4 on this panel, provided for test purposes, is used for the connection of an external shorting plug. This shorting plug, which is attached by a flexible strap to the front panel, must always be fitted for the equipment to operate. Depending upon the modification standard of the transmitter- receiver, the front panel may also house an elapsed time indicator.

Indicator

6. The indicator is located on the triangular shelf to the right of and above the pilots' main instrument panel. The indicator is secured by four screws and connected into the installation by a 19 pole plug on the back of the instrument case. In the front of the indicator is a circular dial with a peripheral scale and a centrally pivoted pointer. A triangular shaped marker (low altitude limit index), adjustable over the full indication range, is positioned on the outer edge of the scale and a fixed masking shield marked NO TRACK is positioned outside the scale extremities. An aperture in the lower centre of the dial displays a black and red striped failure flag. A low altitude warning indicator is mounted off the dial in the lower right corner of the case. A control knob at the lower left corner, marked PUSH TO TEST with SET position, serves as the setting control for the low altitude limit index and built-in test function switch. The ON-off function of the knob incorporated with the low altitude warning indicator is not used in this installation.

Aerials

7. The two aerials are mounted in a fairing on the underside of the centre fuselage on the aircraft centre-line between frames 19 and 24 and are connected by co-axial cables directly to the transmitter-receiver. The aerials do not require disconnecting in order to lower the fairing, which can be accomplished by releasing the four securing bolts and lowering it to the ground on the hinge fitted at the forward end.

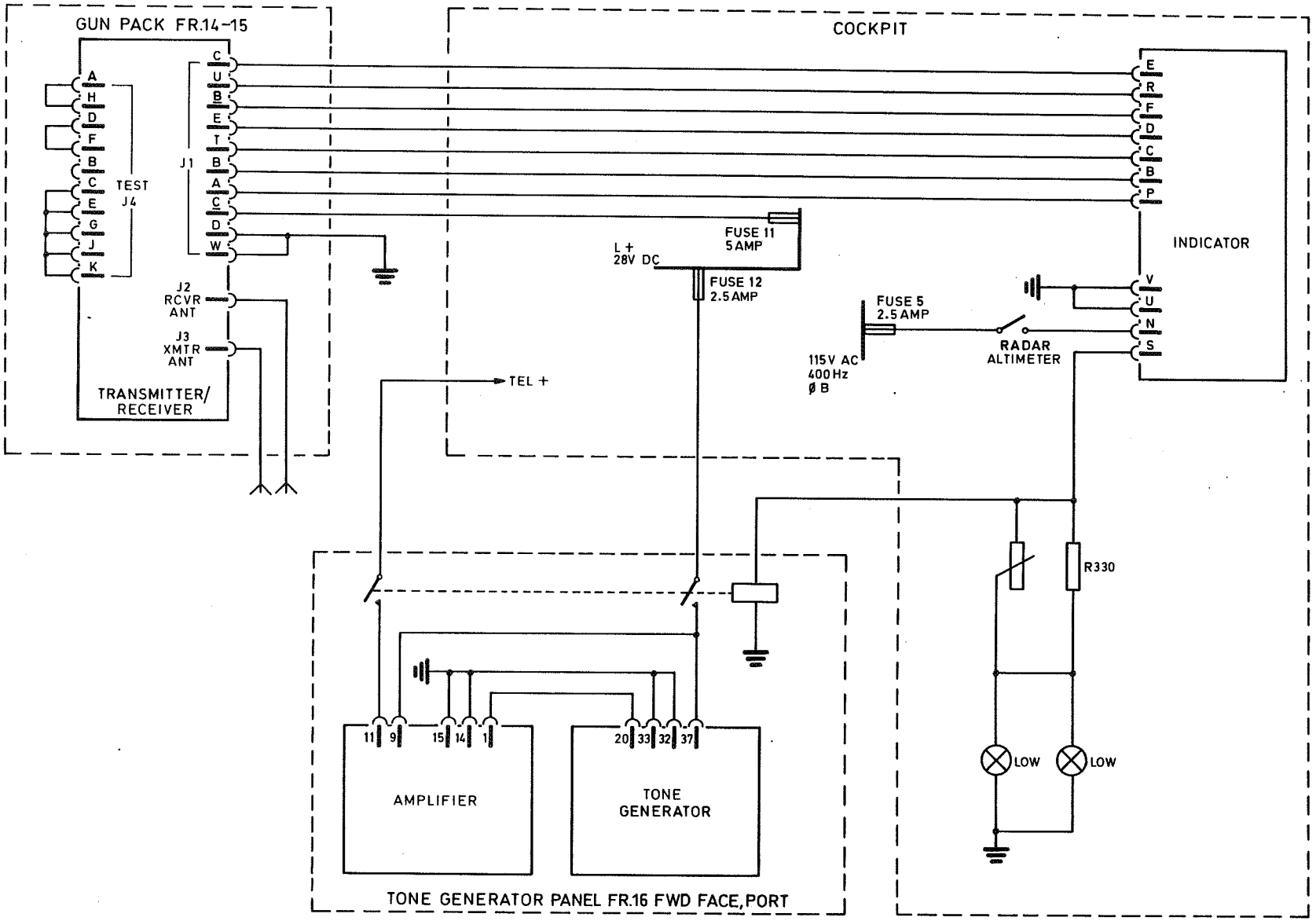

Fig. 3 Radar altimeter - theoretical

Warning light and tones

8. Two peripheral LOW warning lights, located in the pilots' line of sight, and a LYRE BIRD tone in the crew headset operate when the warning light located in the indicator is illuminated. They are designed to give extra warning when the aircraft descends below the setting of the low altitude index. The lights and the tone cancel automatically when the aircraft climbs above the index height. The intensity of the LOW lights can be controlled by the centre of the knob located adjacent to the indicator. The outer of the knob is used to control the lighting level of the indicator.

Tone generator and amplifier

9. The tone generator and amplifier are situated on a mounting plate on the forward face, port, of frame 16. Access is gained by lowering the inverter mounting platform.

OPERATION

General

10. The system is switched on by the operation of the RADAR ALTIMETER master switch from the OFF to the ON position. Clockwise rotation of the indicator SET knob will increase the height selected by the low altitude index to the desired low limit. Low altitude is indicated by the illumination of the amber light in the lower right hand corner of the instrument, which is activated by an internal transistor switch when indicated altitude falls below the pre- selected index. The switch circuit is arranged so that the warning will only appear when valid signals, indicated by the absence of the failure flag, are being received by the indicator. The failure flag is operated by a solenoid, controlled by a valid track signal from the transmitter-receiver, and is in view when the power is switched OFF, if the supply fails or loss of track occurs when the system is operating. Loss of track is further indicated by the pointer swinging behind the 'no track' mask.

11. The PUSH TO TEST function of the left control knob brings the self-test circuits into operation. With the system switched on, operation of the push- switch activates circuits in the transmitter-receiver which produce a simulated 100 ft. altitude signal. Use of this facility is detailed under Testing.

SERVICING

WARNING...

When servicing this equipment, personnel must observe the precautions detailed in Sect.2 Chap.4 regarding radio frequency hazards

General

12. Detailed servicing of the installation is covered in AP116B-0215-1A. Before any item of equipment suspected of being unserviceable as a result of system malfunction is removed from the aircraft, the installation should be examined and power supplies checked. Wiring continuity and insulation resistance should be checked, as required, using standard test equipment.

Examination

13. Ensure that all units of the installation are correctly fitted and that plug/socket connectors are correctly assembled and connected. Examine all units for damage and cables for signs of chafing. Ensure that cable clips are tight fitting and correctly fitted.

Testing

14. Testing the system in situ is limited to the use of the built-in test facility and functional checks as detailed in the following paragraphs.

15. Ensure that the area in the immediate vicinity of the aerials is clear of obstacles and that the aerial fairing is fitted correctly in the flight position.

16. With power available at the aircraft busbars and the RADAR ALTIMETER master switch in the OFF position, check that the failure flag is displayed and the pointer is in the 'no track' position.

17. Connect a headset to the socket provided on the ejection seat.

18. Test sequence

(1) Operate the RADAR ALTIMETER master switch to ON position and allow the equipment to warm up.

(2) Rotate the SET knob to position the low altitude index at 50 ft. Observe that after approximately 1 minute the failure flag clears, the indicator reads +2 ft. to +3 ft. and the low altitude warning light on the indicator illuminates. Observe also the two LOW lights illuminate and that the LYRE BIRD tone can be heard in the headset.

(3) Operate the centre dimmer switch control knob, located adjacent to the indicator, through its entire range and check that the lights cannot be extinguished. Return to the full brilliance position.

(4) Operate the test push-switch (PUSH TO TEST) and hold. Observe indication of 100ft +/- 10 ft. and that the low altitude warnings (light and audio) are cancelled as the pointer passes the index limit.

(5) Release the push-switch and observe that the pointer returns to between +2 ft. and +3 ft. and the low altitude warnings are reinstated.

(6) Set the RADAR ALTIMETER master switch to OFF position and observe that the low altitude warnings are cancelled, the pointer swings to the 'no track' position and the failure flag appears.

(7) Operate the instrument lighting dimmer switch (outer knob of dimmer switch located adjacent to radar altimeter indicator) and check that the lighting level varies with movement of the control.

(8) Remove headset on completion of tests.

REMOVAL AND INSTALLATION

General

19. Before an item of equipment is disconnected, the aircraft must be rendered electrically safe as described in Sect.5, Chap.1, Group A1. When an item of equipment is removed for servicing or repair, protective caps should be fitted to the receptacles on the unit and the free connectors on the aircraft should be suitably blanked or insulated and temporarily stowed. While removal and installation of this equipment should not present any difficulties, the following features should be noted.

Transmitter-receiver

20. The gun pack will have to be removed in order to gain access to the radar altimeter transmitter-receiver. Care must be exercised to ensure that the cabling to the radar altimeter transmitter-receiver and the AD120 VHF radio are disconnected and stowed before the gun pack is lowered. The routeing of the two radar altimeter aerial cables must be noted to ensure, that on re-assembly, they are clipped at the same location. The 1 inch long back or white sleeves must engage in the 'push-in' clips. Full functional checks of the radar altimeter and VHF radio are to be carried out after refitting the gun pack.

Mounting rack

21. If the mounting rack is removed and refitted or replaced, ensure that the areas under the bolt holes and the securing bolts and nuts are cleaned free of paint to ensure good electrical bonding.

Aerials

22. It is essential when installing an aerial that mating surfaces are perfectly clean and flush fitting to ensure good electrical bonding. Also, the words 'DO NOT PAINT' must be on the starboard side of the forward aerial and on the port side of the aft aerial.

23. Inspect the seal between the aerial fairing and the fuselage for signs of damage and fuel contamination. Replace the seal if any signs of damage are evident.

FAULT DIAGNOSIS AND RECTIFICATION

General

24. With the exception of basic power and wiring continuity checks using standard test equipment, diagnosis and rectification of faults must be in accordance with detailed procedures and instructions in AP114J-1901-1.