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A.L.158, Apr.77

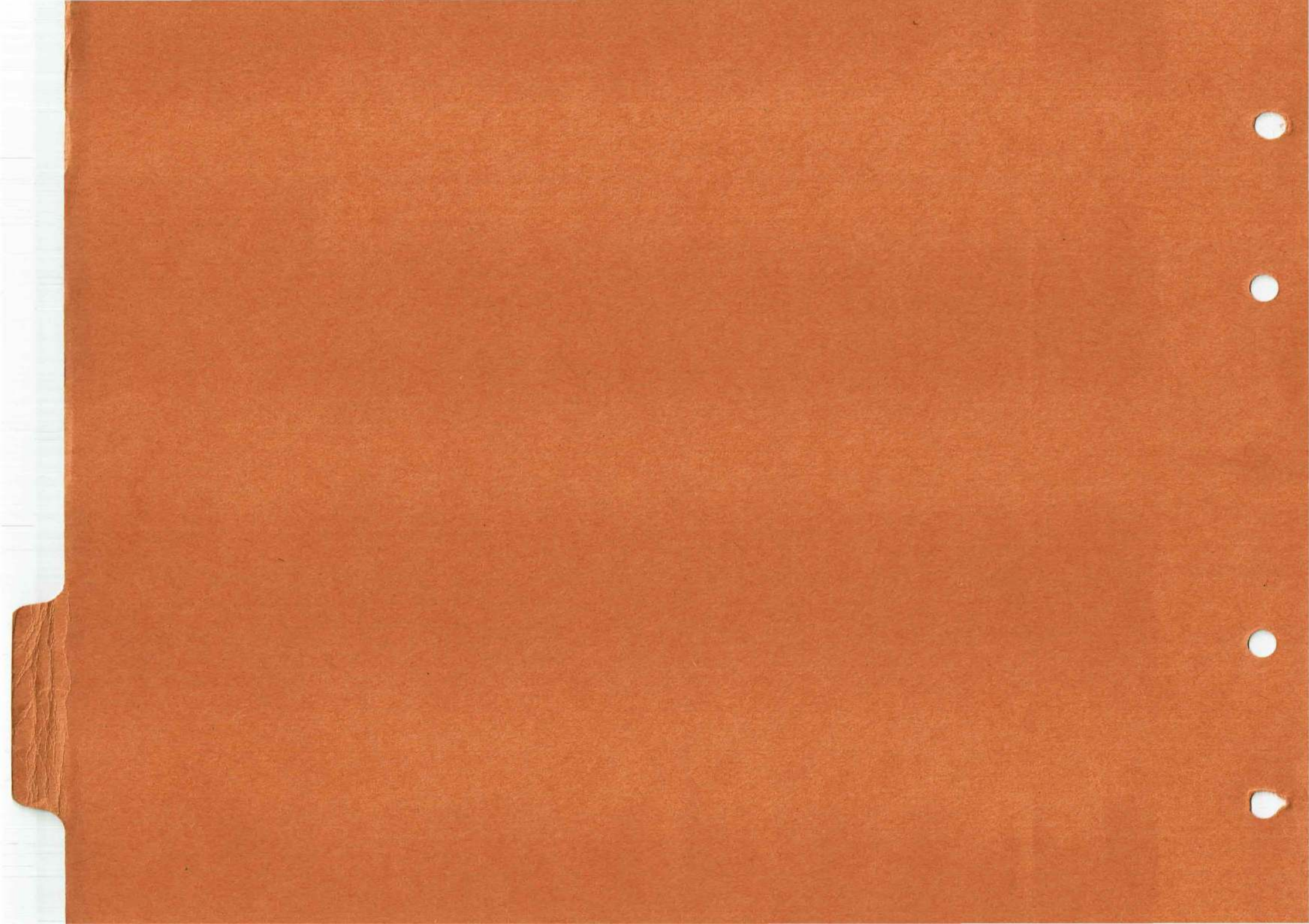
SECTION 6

RADIO AND RADAR INSTALLATIONS

LIST OF CHAPTERS OVERLEAF

SECT
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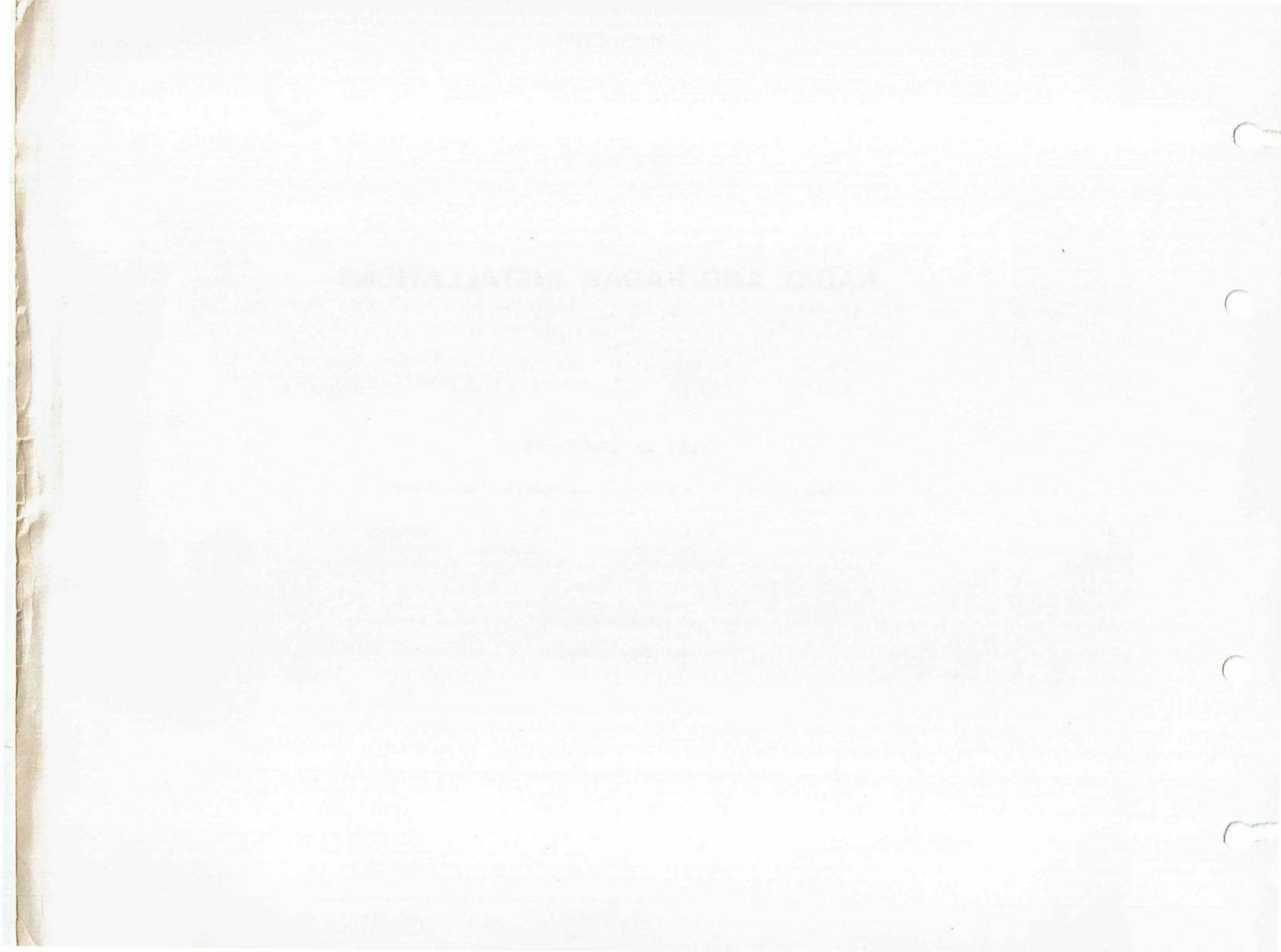
SECTION 6

RADIO AND RADAR INSTALLATIONS

LIST OF CHAPTERS

Note:- A list of contents appears at the beginning of each chapter

- 1 Radio installation
- 2 Radar installation



Chapter 1 – RADIO INSTALLATION
(completely revised)

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- Part 1 V.H.F./U.H.F. Communication System – PTR 175 (A.R.I.23143/1): Standby U.H.F. (A.R.I.23159/1)
- Part 2 Instrument Landing System (A.R.I.18011)
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- Part 5 Decca V.O.R. (A.R.I.23247/3)
- Part 6 Intercommunication (A.R.I.18089)

Note:- *A detailed list of contents will be found at the beginning of each part.*

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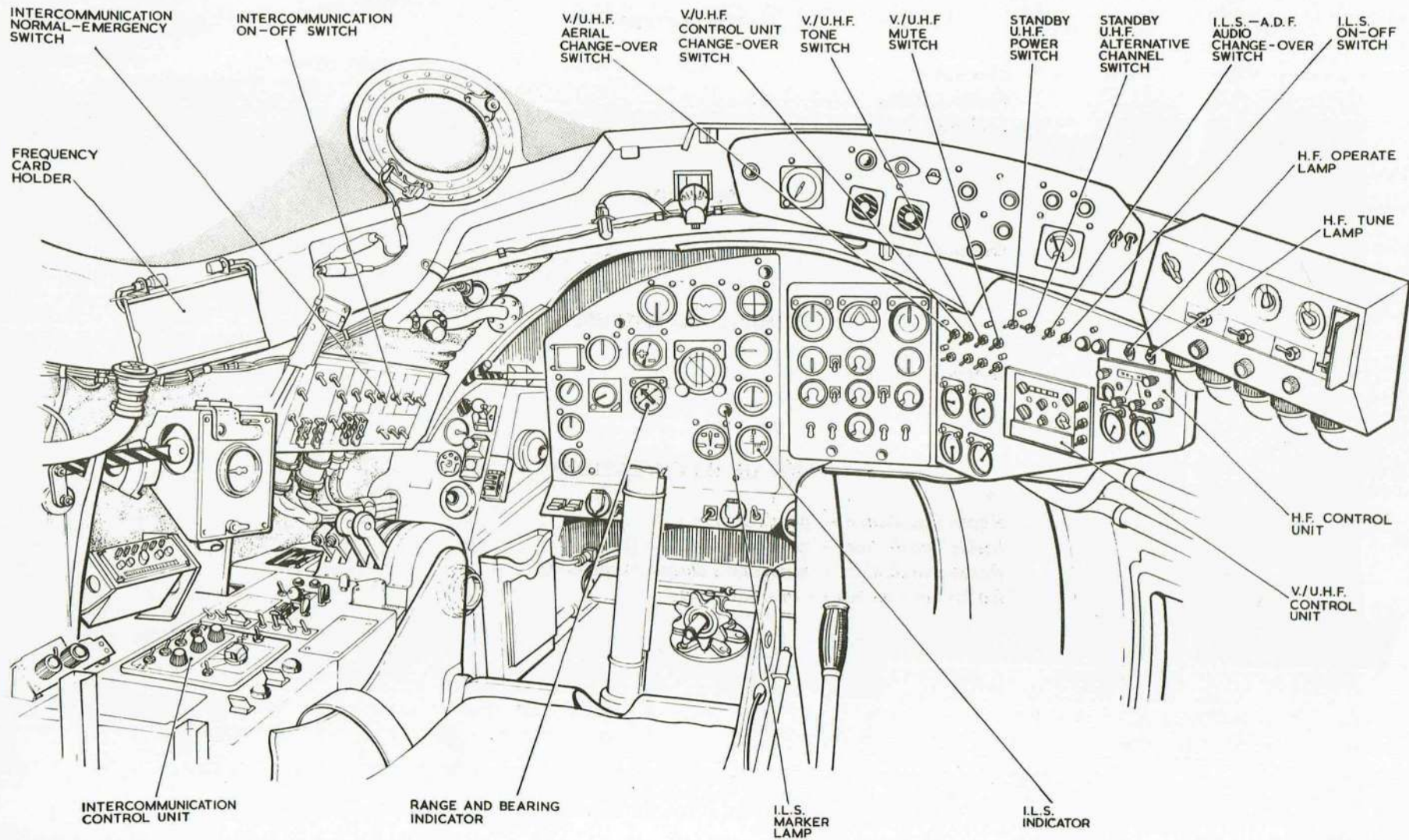


FIG. I. RADIO INSTALLATION-PILOT'S STATION

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DESCRIPTION**General**

1. Information covering the aircraft radio system is contained in Chapter 1 of this section. The installations covered are as follows:-

V.H.F./U.H.F. communication system — PTR 175 (A.R.I.23143/1): standby U.H.F. (A.R.I.23159/1)	(Pt.1)
Instrument landing system (A.R.I.18011)	(Pt.2)
Radio compass (A.R.I.23023/1)	(Pt.3)
H.F. communication system (A.R.I.23090/9)	(Pt.4)
Decca V.O.R. system (A.R.I.23247/3)	(Pt.5)
Intercommunication (A.R.I.18089)	(Pt.6)

2. A location diagram, an interconnection diagram, a table giving cable assembly pin connections and a table giving equipment details, covering type, location, reference number and publication reference, are included in each part.

3. Fig.1, fig.2, and fig.3 show the positions of the various indicators, switches and control panels at the pilot's and navigator's stations. Fig.4 shows the internal wiring of the radio junction box.

Power supplies

4. The radio installations require both a.c. and d.c. power supplies for their operation. Individual equipment power supplies are covered in each part. Detailed information on the power supplies is given in Sect.5, Chap.1, Group R and S.

Lighting

5. Illumination of the various controls and indicators, by integral lamps, bridge lamps or pillar lamps, is controlled by dimmer switches at the pilot's and the navigator's stations. The individual

dimmer switches control the lighting of the radio equipment as follows:-

MISC.INST. dimmer switch (Pilot's coaming panel)	— V/U.H.F. control unit H.F. control unit (Pilot's station)
INST.PANEL dimmer switch (Pilot's coaming panel)	— I.L.S. indicator (Pilot's station)
C.U.LIGHTS dimmer switch (Navigator's instrument panel)	— V/U.H.F. control unit (Navigator's station)
	V.O.R. control unit (Navigator's station)
PANEL LIGHTS dimmer switch (Navigator's instrument panel)	— V.O.R. indicator Radio compass indicator (Navigator's station)

6. Detailed information on lighting circuits is given in Sect.5, Chap.1, Group L.

SERVICING**General**

7. Servicing information regarding individual items of equipment can be found in the relevant publications listed in the Table 1 associated with each part.

REMOVAL AND ASSEMBLY**General**

8. Where appropriate, detailed removal and assembly information is given in the relevant part.

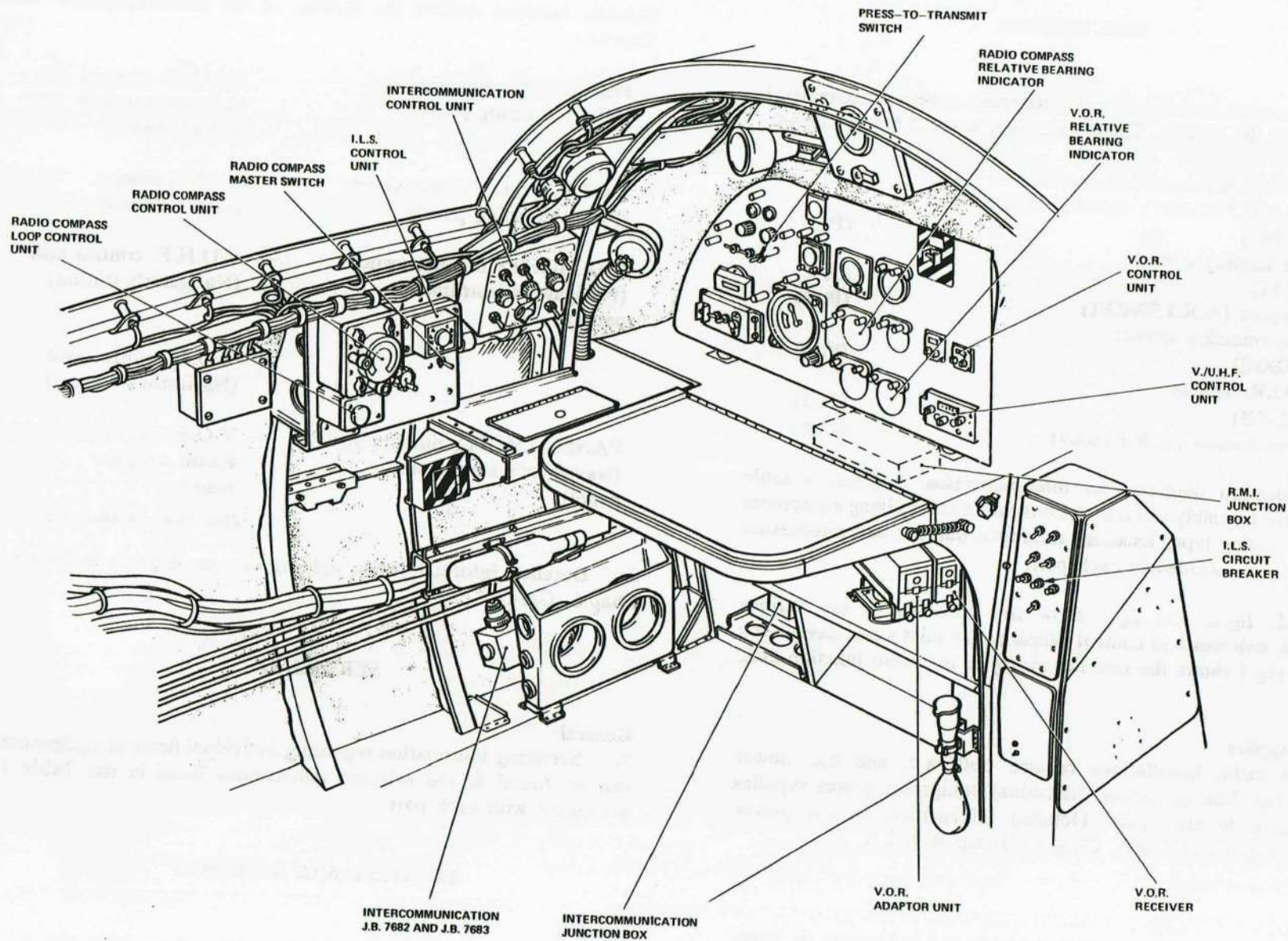


FIG.2. RADIO INSTALLATION - NAVIGATOR'S STATION (PORT)

◀ SEM/CAN/D167/STC INCORPORATED ▶

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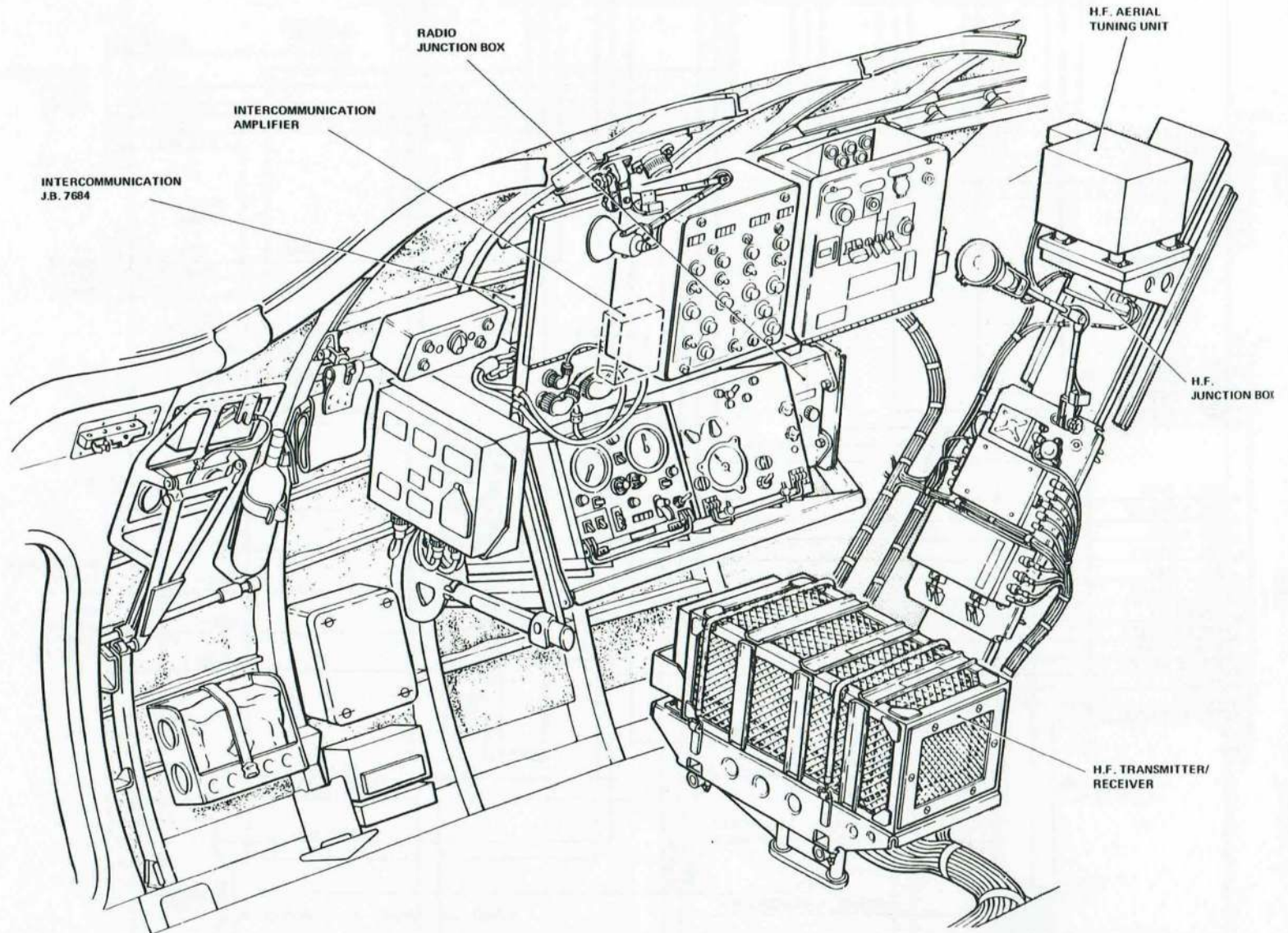


FIG.3. RADIO INSTALLATION - NAVIGATOR'S STATION (STARBOARD)

◀ SEM/CAN/0167/STC INCORPORATED ▶

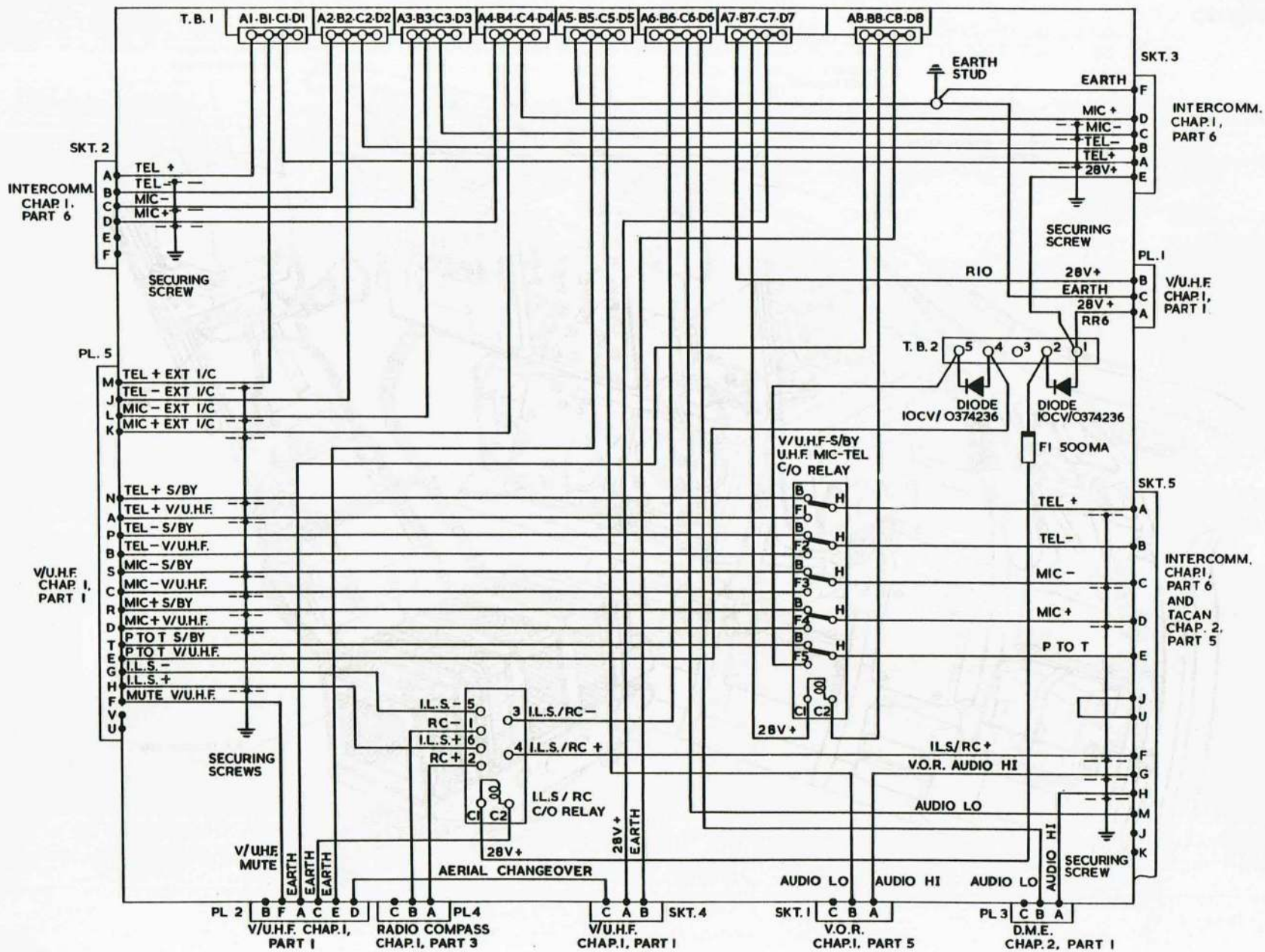


FIG.4. RADIO JUNCTION BOX - INTERNAL WIRING

SRIM 41534
SCSHQ140603A3

**Part 1 V.H.F./U.H.F. COMMUNICATION SYSTEM — PTR 175
(A.R.I.23143/1): STANDBY U.H.F. (A.R.I.23159/1)**

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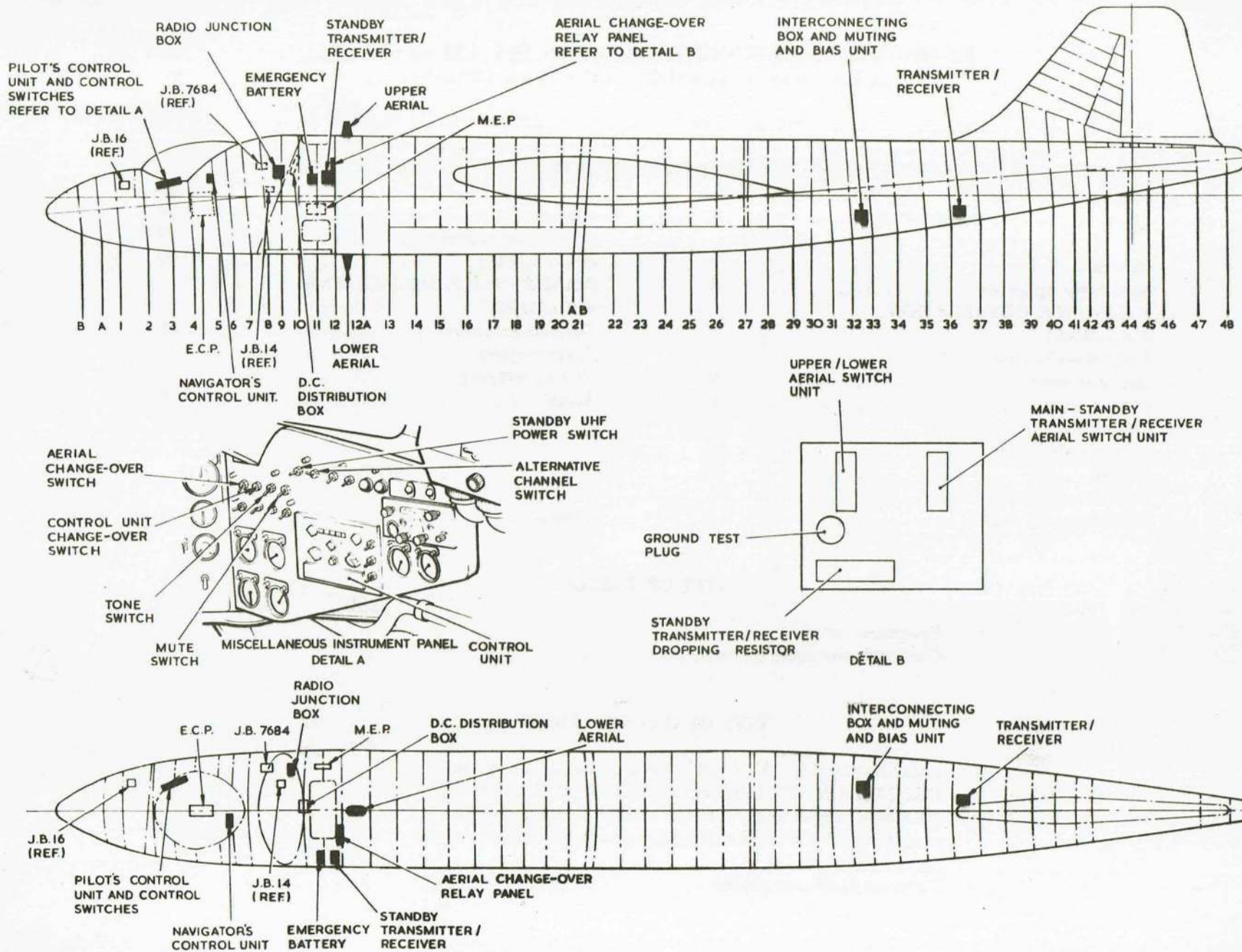


FIG.1. LOCATION DIAGRAM-V.H.F/ U.H.F COMMUNICATION SYSTEM
PTR 175 (A.R.I. 23143/1):STANDBY U.H.F (A.R.I. 23159/1)

EB78270071

DESCRIPTION**General**

1. The aircraft is equipped with two radio communications installations, the A.R.I.23143/1 V.H.F./U.H.F. PTR 175 and the A.R.I.23159/1 standby U.H.F.

2. The facilities provided by the A.R.I.23143/1 are as follows:-

U.H.F. communication:- 225.00 MHz to 399.95 MHz providing 3500 channels at 50 kHz spacing. V.H.F. communication:- 117.50 MHz to 135.95 MHz providing 370 channels at 50 kHz spacing.

Separate guard receiver providing guard frequency reception simultaneously with main receiver reception.

Emergency intercomm. on failure of the normal intercomm. facilities provided by the A.R.I.18089.

3. The facilities provided by the A.R.I.23159/1 are as follows:-

U.H.F. communication on the U.H.F. guard frequency of 243.00 MHz and on one other frequency within 1 MHz of the guard frequency.

Emergency operation in the event of main power supply failure, from an emergency battery which can provide up to 30 min operation.

4. The location of the main items of equipment are shown in fig.1 and interconnections in fig.2, Table 1 gives equipment details and Table 2 cable assembly details. Further detailed technical information is available in A.P.116D-0116-1 and A.P.116D-0107-1.

5. The installations comprise the following main items:

A.R.I.23143/1

Transmitter/receiver
Mounting tray
Interconnecting box
Muting and bias unit
Control unit C1607/4
Control unit C1607/7
Aerial switch units (2)
U.H.F. upper aerial
U.H.F. lower aerial

A.R.I.23159/1

Transmitter/receiver
Mounting tray
Resistor (voltage dropping)
U.H.F. standby ground test plug
Battery 24V

Associated equipment

6. Press-to-transmit, microphone and telephone connections to the two radio communications installations are controlled by the A.R.I.18089 Intercommunication system and are fully described in Part 6 of this Chapter.

V.H.F./U.H.F. INSTALLATION A.R.I.23143/1**Transmitter/receiver**

7. The transmitter/receiver is of modular construction, containing 17 sub-units. It is pressurized by pumping dry air or nitrogen into the T/R case via a Schraeder valve on the front panel, to a pressure of 4 to 5 lb/in². Cooling is effected by a motor, mounted on the front panel, driving two centrifugal blowers. The T/R is mounted on a shockmount tray located in the rear fuselage at frames 36 and 37.

8. In conjunction with the control unit, Type C1607/4 the transmitter/receiver can be selected to operate on any one of 19 preset channels, one of which is the guard frequency and is in addition to that provided by the separate guard receiver.

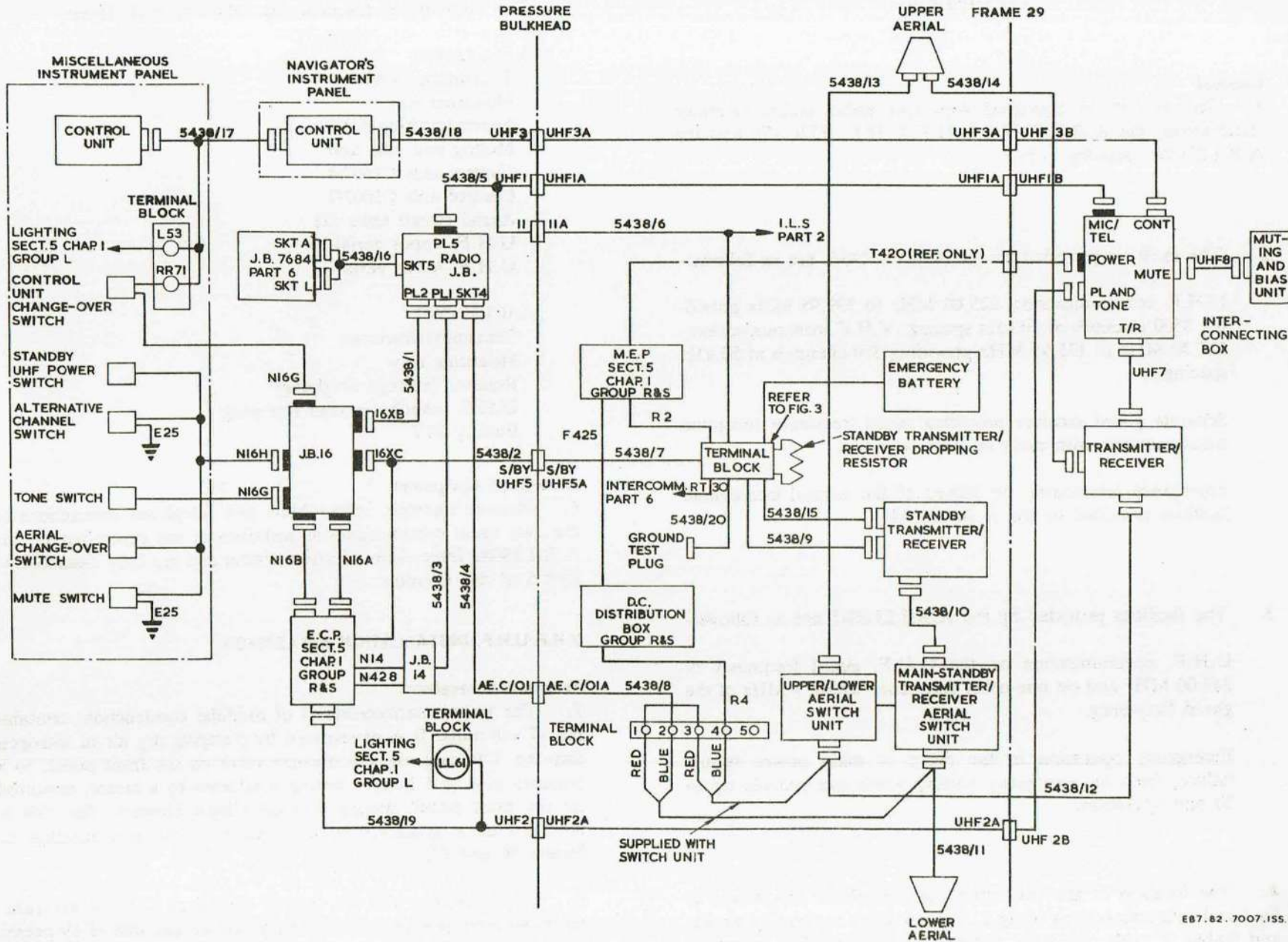


FIG. 2. INTERCONNECTION DIAGRAM - V.H.F./U.H.F. COMMUNICATION SYSTEM -
 PTR175(A.R.I. 23143/1): STANDBY U.H.F. (A.R.I. 23159/1)

◀ CROSS REFERENCES ADDED ▶

Guard receiver

9. The guard receiver, which forms one of the sub-units of the T/R, is a self contained receiver fed from the same aerial as the U.H.F. receiver but with reception limited to one channel between 238.00 MHz and 248.00 MHz. The receiver is normally tuned to the international U.H.F. distress frequency of 243.00 MHz.

Control units

10. A control unit C1607/4, mounted on the miscellaneous instrument panel, provides the pilot with control of the A.R.I.23143/1

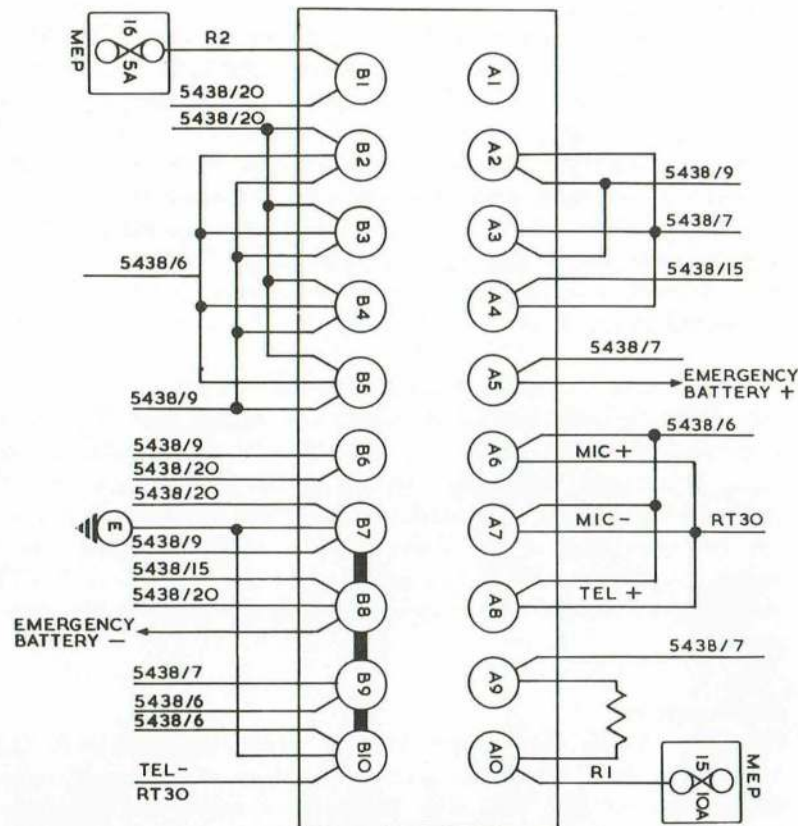


Fig.3. Terminal block connections

installation. A control unit C1607/7, mounted on the navigator's instrument panel, provides the navigator with frequency selection facilities only.

Control unit C1607/4

11. Control unit C1607/4 provides the following facilities:

(1) Manual frequency selection is effected by three identical knobs, the left hand knob controlling the hundreds and tens MHz selection, the centre knob controlling the units MHz selection and the right hand knob the hundreds and tens kHz selection. The selected frequency is displayed in the read-out window. For manual frequency selection the channel selector switch must be in the M (manual) position.

(2) Channel selection. A rotary switch with 20 positions labelled 1 to 18, G and M, selects one of the preset channels, the guard frequency or manual selection.

(3) Volume control. This control sets the level of the audio signal fed to the aircraft intercommunication system (Part 6).

(4) Function switch. The seven positions of the switch are as follows:

- (a) OFF - supplies disconnected.
 - (b) T/R - The power supply is on and the equipment is automatically in the receive condition. Operation of the press-to-transmit switch is required to change the T/R to the transmit condition.
 - (c) T/R + G. The guard receiver is switched on with the retention of normal transmit-receive facilities on the selected channel.
 - (d) ADF. This switch position is not operative in this installation.
 - (e) DL
 - (f) DL/T
 - (g) T/R on
D/L OFF
- } For use with data link system.
} Not operative in this installation.

(5) A two-position switch at the right-hand side of the control unit, identified G - D, is the Guard Data link change-over switch and should be left in the Guard position (G).

(6) Access to the frequency scale adjusters for the pre-setting of channels is obtained by pulling open the cover plate at the bottom of the front panel. Setting up instructions are contained in A.P.116D-0116-1, Chap.3.

Two panel lights, integral with the unit are controlled by the navigator's dimmer switch (*Sect.5, Chap.1, Group L*).

Control unit C1607/7

12. Control unit C1607/7 has three controls, operating as in the control unit C1607/4, for frequency selection. An indicator lamp, on the front panel, lights when the CONTROL NAV - PILOT switch on the miscellaneous instrument panel is in the NAV position. With the switch in this position control of frequency selection is from the control unit C1607/7. Two panel lights, integral with the unit are controlled by the navigator's dimmer switch (*Sect.5, Chap.1, Group L*).

Muting

13. A muting and bias unit fitted in the rear fuselage at frames 32 and 33 on the starboard side of the aircraft operates in conjunction with a MUTE switch on the miscellaneous instrument panel. Operation of the switch energizes a relay inside the muting bias unit and causes a bias to be applied, via the interconnecting box, to the a.g.c. line of the receiver, thereby inhibiting radio reception.

Tone

14. A TONE switch fitted on the miscellaneous instrument panel provides for a transmission of 1000 Hz tone from the transmitter/receiver.

Interconnecting box

15. The interconnecting box, mounted adjacent to the muting bias unit in the rear fuselage, is the main distribution point for the V.H.F./U.H.F. installation.

Aerials

16. Two radio communications aerials are fitted to the aircraft, an upper U.H.F. aerial, and a lower U.H.F. aerial. The U.H.F. aerials are located above and below the fuselage between frames 12 and 12A. The upper aerial is a combined V.H.F./U.H.F. aerial.

U.H.F. aerial switching

17. To ensure optimum radiation a choice of U.H.F. aerials is provided. Operation of a switch, labelled AERIAL - UPPER - LOWER, mounted on the miscellaneous instrument panel, connects either the upper or lower U.H.F. aerial to the A.R.I.23143/1 transmitter/receiver. The switch controls the earth return to the solenoid of the relay armature within the aerial switch unit. With the switch in the UPPER position the relay is energized and the T/R is connected to the upper U.H.F. aerial. With the switch in the LOWER position the relay is de-energized and the T/R is connected to the lower U.H.F. aerial.

18. A switch, located on the miscellaneous instrument panel, and essentially the main control switch for the standby U.H.F. system, controls the operation of the main-standby transmitter/receiver aerial switch unit. When the switch is in the OFF position the T/R aerial switch unit is energized and the main transmitter/receiver can be connected to the lower aerial through the upper-lower aerial switch unit. When the switch is at the NORM or BATT position, the standby transmitter/receiver is connected to the lower aerial.

Power supplies

19. The 28-volt d.c. supply for the transmitter/receiver is fed from a 40A fuse 165 in the main electrical panel via the interconnecting box to the T/R. The 28-volt d.c. supply for the aerial switch unit is fed from a 5A fuse 14 in the M.E.P. The 28-volt d.c. supply for the navigator's control unit is fed from fuse 230 in the E.C.P.

STANDBY U.H.F. INSTALLATION A.R.I.23159/1**Transmitter/receiver**

20. The U.H.F. standby installation consists of a crystal controlled transmitter/receiver primarily tuned to the U.H.F. international distress frequency of 243.00 MHz with facilities available for operation on an additional channel, by switching in alternative crystals. The alternative channel frequency is restricted to not more than 1 MHz above or below 243.00 MHz. The two channels are identified as guard and alt.

21. The transmitter/receiver is located in the upper equipment bay. The channel switch labelled ALT-GUARD is mounted on the miscellaneous instrument panel. Operation of the switch from GUARD to ALT energizes a relay within the transmitter/receiver which connects the alternative channel crystals into the transmitter and receiver oscillator circuits in place of the guard channel crystals.

Power supplies

22. Power supplies to the standby transmitter/receiver are controlled by a STANDBY UHF, BATT-NORM-OFF switch fitted on the miscellaneous instrument panel.

23. With the switch in the NORM. position the aircraft normal 28-volt d.c. supply from fuse 15 in the main electrical panel (M.E.P.) is fed, via a 2 ohm dropping resistor and the switch contacts, to the standby transmitter/receiver.

24. With the switch in the BATT position the 24-volt d.c. supply from the system emergency battery is fed via the switch contacts to the standby transmitter/receiver.

25. Further information on the power supplies can be found in Sect.5, Chap.1, Group R and S.

Ground test plug

26. A 12-way test plug, mounted on the aerial change-over relay panel at frame 12, provides for the connection of a test set (6625-99-943-4149) used in testing the installation.

Aerial

27. The lower U.H.F. aerial is used for U.H.F. standby communications. The aerial location and switching are described in para.16, 17 and 18.

SERVICING**WARNING**

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General

28. Refer to A.P.116D-0116-1 and A.P.116D-0107-1 for servicing information concerning the individual units of the radio communications system. It is necessary to periodically check the pressure inside the main transmitter/receiver which must be maintained at between 4 and 5 lb/in².

TABLE 1

Equipment details

Equipment	Type/Part No.	Ref.No.	Location	A.P. Reference
Main system				
Transmitter/receiver	P.TR175	5821-99-971-1781	Rear fuselage, frames 36-37	A.P.116D-0116-1
Mounting tray	MT 1477/ARC52	5821-99-942-8544	Rear fuselage, frames 36-37	
Interconnecting box	—	5821-99-932-6361	Rear fuselage, frames 32-33	
Muting and bias unit	—	5821-99-943-3247	Rear fuselage, frames 32-33	
Aerial switch unit (Upper/lower aerial change-over)	Type 1741	5945-99-932-1487	Upper equipment bay	
Aerial switch unit (Main/standby transmitter/receiver change-over)	Type 1741	5945-99-932-1487	Upper equipment bay	
Aerial switch unit (2 off)	Type 1741	5945-99-932-1487	Upper equipment bay	
Control unit	C 1607/4	5821-99-945-5739	Miscellaneous instrument panel	
Control unit	C 1607/7	5821-99-107-0030	Navigator's instrument panel	
Upper aerial	Type 12/12	10B/1124431	Upper fuselage frames 12-12A	
Lower aerial	Type 16-1	10B/2222399	Lower fuselage frames 12-12A	
◀ Switch (Aerial change-over)	—	5CW/4408100	Miscellaneous instrument panel	
Switch (Control unit change-over)	—	5CW/4408100		
Switch (Tone)	—	5CW/9240		
Switch (Mute)	—	5CW/9240		
Standby system				
Transmitter/receiver	D403M	5821-99-952-8931	Upper equipment bay	A.P.116D-0107-1
Mounting tray	—	5821-99-107-5369	Upper equipment bay	
Battery	19 VO7 LK	5J/1115903	Upper equipment bay	
Switch (power control)	—	5CW/4408138	Miscellaneous instrument panel	
Switch (Alternative channel)	—	5CW/4408107		

TABLE 2

Connector and cable assembly details

CONNECTOR 5438/1			CONNECTOR 5438/5				
Termination A	Pin	Pin	Termination A	Termination A	Pin	Pin	Termination B
Radio J.B. (PL2)	A	A	J.B.16 (16XB)	Radio J.B. (PL5)	A	A	B
	C	C			B	B	Pressure bulkhead (UHF 1A)
	D	D			C	C	
	E	E			D	D	
	F	F			E	E	
					F	F	
					G	A	
					H	B	
					J	C	
					K	D	
					L	E	B1 Pressure bulkhead (11)
					M	F	
					N	G	
					P	H	
					R	J	
				S	K		
				T	L		
				U	M		
CONNECTOR 5438/2			CONNECTOR 5438/6				
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
J.B.16 (16XC)	C	C	Pressure bulkhead (S/BY U.H.F.5)	Pressure bulkhead (11A)	A	A	B
	D	D			B	B	J.B.157
	E	E			C	B10	
	F	F			D	A6	
	J	J	B1 E.C.P.		E	A7	
	L	L			F	A8	B1 Standby U.H.F. terminal block
	K	R9			G	B2	
	M	R91			H	B9	
					J	B5	
					K	B4	
					L	B3	
CONNECTOR 5438/3			CONNECTOR 5438/4				
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Radio J.B. (PL1)	A	RR6	J.B.14	Radio J.B. (SKT4)	A	A	Pressure bulkhead (AE C/01)
	B	R10			B	B	
	C	E25			C	C	

J.B.157 is part of I.L.S. system, Part 2

continued. . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 5438/7				CONNECTOR 5438/11			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Pressure bulkhead (S/BY U.H.F.5A)	J	A5	Standby U.H.F. terminal block	Main – standby transmitter/receiver aerial switch unit	-	-	Lower aerial
	L	A4					
	C	A9					
	D	A3					
	E	B9					
	F	A2					
CONNECTOR 5438/8				CONNECTOR 5438/12			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Pressure bulkhead (AE c/o 1A)	A	1	Aerial change-over terminal block	Transmitter/receiver	-	-	Upper/lower aerial switch unit
	B	2					
	C	3					
CONNECTOR 5438/9				CONNECTOR 5438/13			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Standby transmitter/receiver	B	B7	Standby U.H.F. terminal block	Upper aerial	-	-	Upper/lower aerial switch unit
	D	B5					
	E	B3					
	F	B6					
	G	B4					
	H	A2					
	J	B2					
	M	A3					
CONNECTOR 5438/10				CONNECTOR 5438/14			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Standby transmitter/receiver	-	-	Main – standby transmitter/receiver aerial switch unit	Transmitter/receiver	-	-	Upper aerial
CONNECTOR 5438/15				CONNECTOR 5438/15			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Standby transmitter/receiver	A	A4	Main – standby transmitter/receiver aerial switch unit	Standby transmitter/receiver	A	A4	Standby U.H.F. terminal block
	B	B8					

continued . . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 5438/16				CONNECTOR 5438/17 — continued			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Radio junction Box (SKT5)	A	A	B1 J.B.7684 ◀ (SKT L)	Control unit (Pilot's)	T	T	◀ B ▶ Control unit (Navigator's)
	B	B			U	U	
	C	C			V	V	
	D	D			W	W	
	E	E			X	X	
	F	A	Y		Y		
	G	B	Z		Z		
	H	C	a		a		
	J	J	b		b		
	K	K	c		c		
	L	L	d		d		
	M	M	f		f		
	N	D	g		g		
P	E	h	h				
R	F	i	i				
S	G	P	L53				
T	H	P	RR71				
			B1 Lighting terminal block				

CONNECTOR 5438/17				CONNECTOR 5438/18			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Control unit (Pilot's)	A	A	Control unit (Navigator's)	Control unit (Navigator's)	A	A	Pressure bulkhead (U.H.F.3)
	B	B			B	B	
	C	C			C	C	
	D	D			D	D	
	E	E			E	E	
	F	F			F	F	
	H	H			H	H	
	J	J			J	J	
	K	K			K	K	
	M	M			M	M	
	N	N			N	N	
	R	R			R	R	
	S	S			S	S	

continued . . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 5438/18 — continued

Termination A	Pin	Pin	Termination B
Control unit (Navigator's)	R	R	Pressure bulkhead (U.H.F.3)
	S	S	
	T	T	
	U	U	
	V	V	
	W	W	
	X	X	
	Y	Y	
	Z	Z	
	a	a	
b	b		
c	c		
d	d		
f	e		
g	f		
h	g		
i	h		

CONNECTOR 5438/19 (U.H.F.2)

Termination A	Pin	Pin	Termination B
Pressure bulkhead (U.H.F.2)	A	LL61	Lighting terminal block
	C	RR13	B1 E.C.P.

CONNECTOR 5438/20

Termination A	Pin	Pin	Termination B
Ground test plug	A	B1	Standby U.H.F. terminal block
	B	B8	
	D	B5	
	E	B3	
	F	B6	
	G	B4	
	H	B7	
	J	B2	
	K	B2	

CONNECTOR U.H.F.1A (EB7-82-5479)

Termination A	Pin	Pin	Termination B
Pressure bulkhead	A	A	Frame 29 bulkhead
	B	B	
	C	C	
	D	D	
	E	E	
	F	F	

CONNECTOR U.H.F.1B (EB7-82-5481)

Termination A	Pin	Pin	Termination B
Frame 29 bulkhead	A	A	Interconnecting box (MIC/TEL)
	B	B	
	C	C	
	D	D	
	E	E	
	F	F	

continued. . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR U.H.F.2A (EB7-82-5485)

Termination A	Pin	Pin	Termination B
Pressure bulkhead	A	A	Frame 29 bulkhead
	B	B	
	C	C	
	D	D	
	E	E	
	F	F	

CONNECTOR U.H.F.2B (EB7-82-5487)

Termination A	Pin	Pin	Termination B
Frame 29 bulkhead	A	A	Interconnecting box (PL & TONE)
	B	B	
	C	C	

CONNECTOR U.H.F.3A (EB7-82-5491)

Termination A	Pin	Pin	Termination B
Pressure bulkhead	A	A	Frame 29 bulkhead
	B	B	
	C	C	
	D	D	
	E	E	
	F	F	
	H	H	
	J	J	
	K	K	
	L	L	
	M	M	
	N	N	
	P	P	
	R	R	
S	S		
T	T		
U	U		

CONNECTOR U.H.F.3A (EB7-82-5491) — continued

Termination A	Pin	Pin	Termination B
Pressure bulkhead	V	V	Frame 29 bulkhead
	W	W	
	X	X	
	Y	Y	
	Z	Z	
	a	a	
	b	b	
	c	c	
	d	d	
	e	e	
	f	f	
	g	g	
	h	h	

CONNECTOR U.H.F.3B (EB7-82-5493)

Termination A	Pin	Pin	Termination B
Frame 29 bulkhead	A	A	Interconnecting box (CONT)
	B	B	
	C	C	
	D	D	
	E	E	
	F	F	
	H	H	
	J	J	
	K	K	
	L	L	
	M	M	
	N	N	
	P	P	
	R	R	
S	S		
T	T		
U	U		

continued . . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR U.H.F.3B (EB7-82-5493) — continued

Termination A	Pin	Pin	Termination B
Frame 29 bulkhead	V	V	Interconnecting box (CONT)
	W	W	
	X	X	
	Y	Y	
	Z	Z	
	a	a	
	b	b	
	c	c	
	d	d	
	e	e	
f	f		
g	g		
h	h		
	i		

CONNECTOR U.H.F.7 (EB7-82-5497) — continued

Termination A	Pin	Pin	Termination B
Transmitter/ receiver	W	W	Interconnecting box (T/R)
	a	a	
	b	b	
	c	c	
	d	d	
	e	e	
	f	f	
	g	g	
	h	h	
	i	i	
	j	j	
	k	k	
	m	m	
	n	n	
	p	p	
	q	q	
	r	r	
	s	s	
	t	t	
u	u		
w	w		

CONNECTOR U.H.F.7 (EB7-82-5497)

Termination A	Pin	Pin	Termination B
Transmitter/ receiver	A	A	Interconnecting box (T/R)
	C	C	
	D	D	
	E	E	
	F	F	
	H	H	
	J	J	
	K	K	
	L	L	
	M	M	
	N	N	
	P	P	
	R	R	
S	S		
T	T		
U	U		
V	V		

CONNECTOR U.H.F.8

Termination A	Pin	Pin	Termination B
Interconnecting box (MUTE)	A	A	Muting and bias unit
	B	B	
	C	C	
	D	D	
	E	E	
	F	F	

Note. . .

For cable assemblies T420, F425, N428 and N14 refer to Sect.5, Chap.1, Group R & S.

Part 2 INSTRUMENT LANDING SYSTEM (A.R.I.18011)

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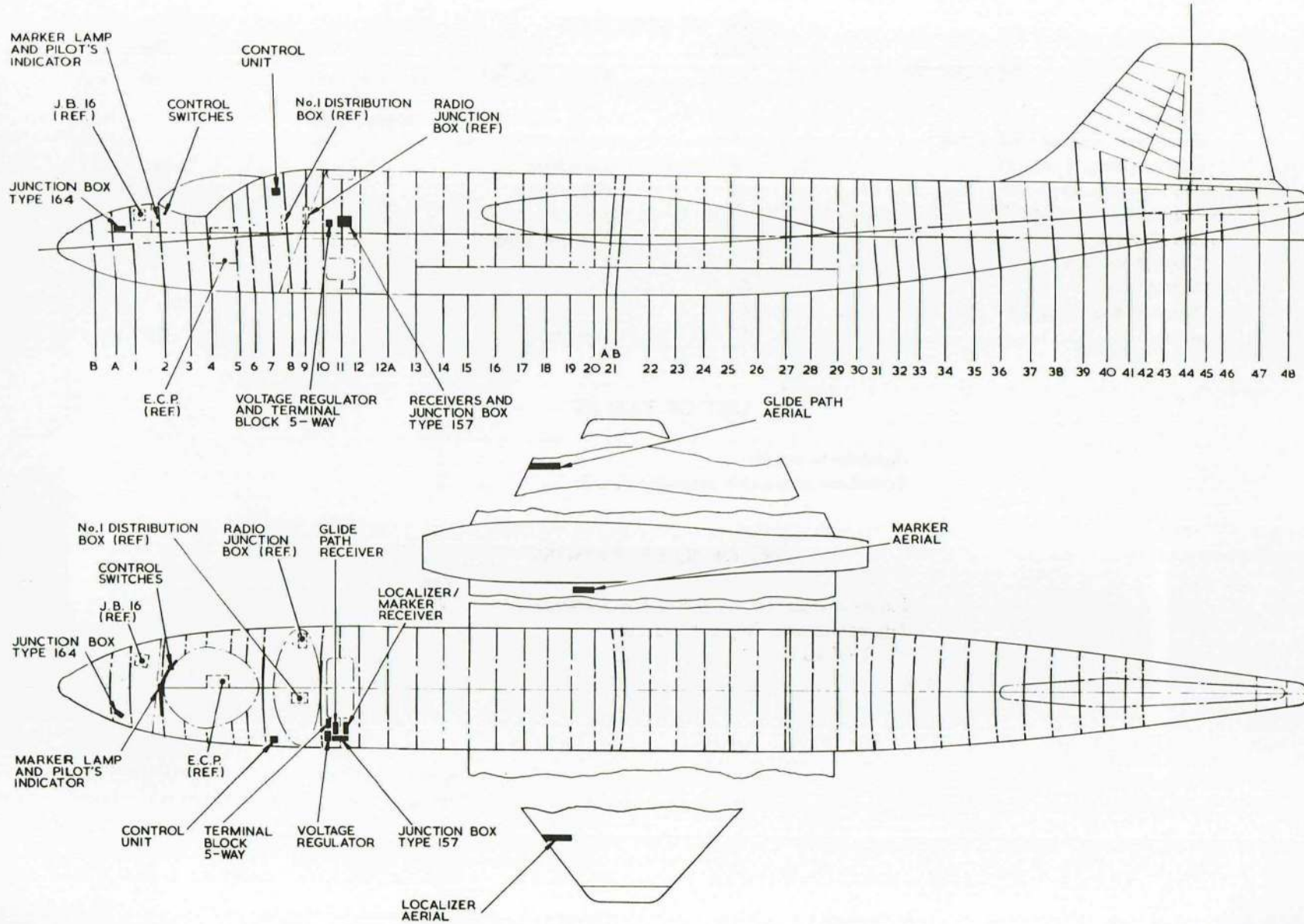
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EB7 | 82 | 7005 | 155 | 1

FIG. I. LOCATION DIAGRAM-I.L.S. (A.R.I. 18011)

DESCRIPTION

General

1. The Instrument Landing System (I.L.S.) (A.R.I.18011) provides radio guidance along a prescribed approach path to a low-altitude point within sight of the runway. The airborne installation, receiving transmissions from ground beacons, provides the pilot with visual indications of the aircraft's position relative to the runway and an audio signal identifying the beacon. 20 or 40-channel pairing is available depending on the receivers that are fitted (Table 1). ▶

2. The locations of the main items of equipment are shown in fig.1 and interconnections in fig.2. Table 1 gives equipment details and Table 2 gives connector and cable assembly details. Detailed technical information is given in A.P.116B-0408-1.

3. The installation includes the following main items of equipment:-

Receiver, Type R1964 (localizer and marker receivers)

Receiver, Type R1965 (glide path receiver)

Mounting, Type 933

Control unit, Type 705

Indicator unit, Type 7

Junction box, Type 164

Junction box, Type 157

Localizer aerial, Type 239

Glide path aerial, Type 238

Marker aerial, Type 237

Marker lamp

Receivers, Type R1964, R1965

4. The localizer/marker receiver, Type R1964, and the glide path receiver, Type R1965, are positioned side-by-side on mounting, Type 933, in the upper equipment bay. Mounted across the rear of mounting, Type 933, is the junction box, Type 157, and main connections to the receivers are made by the mating of two fixed 20-way plugs, one at the rear of each receiver, into fixed sockets in the junction box. Four locating pins ensure correct positioning of the receivers.

Junction box, Type 157

5. Connection of the junction box, Type 157, into a full system is via two 4-way Mk.4 plugs, one 6-way Mk.4 plug, one 6-way Mk.4 socket, one 12-way Mk.4 plug, one 3-way Mk.4 plug, one coaxial plug and one coaxial socket. The 6-way socket (11J4) is not used in this installation. Selector panels above the 20-way sockets (para.4) on the junction box provide for the introduction of resistors into the flag and indicator circuits to compensate for the absence of the optional second indicator.

Control unit, Type 705

6. The control unit, Type 705, is mounted on the port wall of the navigator's station. The unit contains the local oscillator circuits for the localizer and glide path receivers, a bank of 24 crystals and a channel selector switch. The channel selector is a continuous-action rotary switch, covering 12 positions, identified A to L, each of which selects two crystals for control of the localizer and glide path local oscillator frequencies respectively.

Indicator unit, Type 7

7. The indicator unit, Type 7, mounted on the flight instrument panel, presents a crossed-pointer indication. The vertical pointer pivots from the top and is operated by an output from the localizer receiver. The horizontal pointer pivots from the left-hand side and is operated by an output from the glide path receiver. Horizontal and vertical rows of dots indicate the zero positions of the pointers.

Alarm flags

8. Two flag movements, marked with a diagonal bar, are respectively positioned to cover the ends of the vertical and horizontal pointers in conditions of inadequate received signal strength.

Marker receiver

9. The marker receiver, embodied in receiver, Type R1964, is tuned to a fixed frequency of 75 MHz.

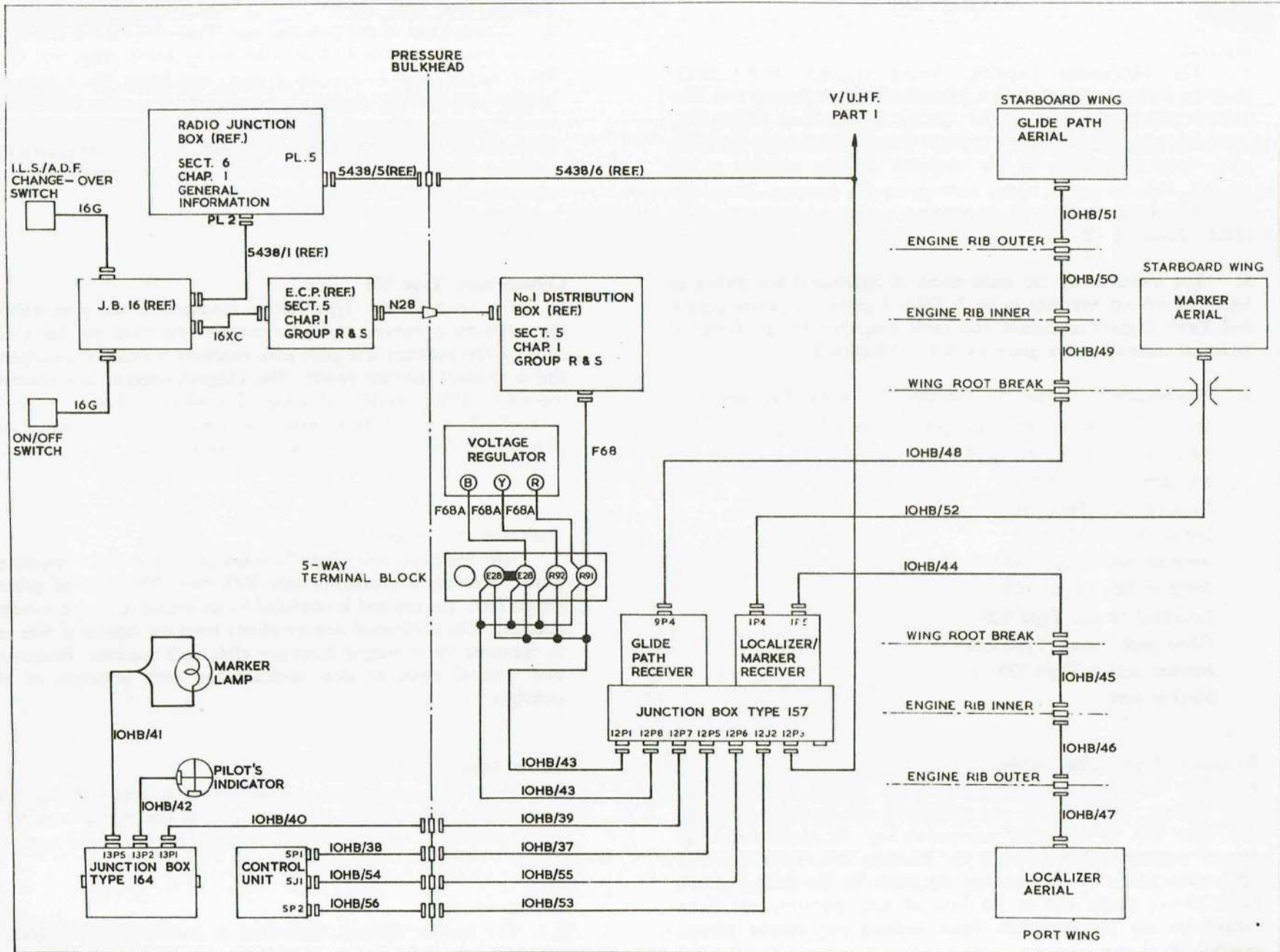


FIG. 2. INTERCONNECTION DIAGRAM - I.L.S. (A.R.I. 18011)

◀ CROSS REFERENCES ADDED ▶

Marker lamp

10. The marker lamp is positioned adjacent to the indicator unit and is coloured amber.

Junction box, Type 164

11. The junction box, Type 164, is positioned forward of the pilot's instrument panel. The junction box provides connections for feeding one or two indicators, Type 7, the marker lamp and the zero reader. In this installation, a wired blanking connector is fitted on the second indicator outlet.

Aerials

12. The localizer aerial, Type 239, is suppressed in the leading edge of the port wing. The glide path aerial, Type 238, is suppressed in the leading edge of the starboard wing. The marker aerial, Type 237, is suppressed in the skin of the underside of the starboard wing, inboard of the engine.

Power supplies

13. The I.L.S. equipment operates on 28-volt d.c., supplied from busbar PP2 via circuit breaker CB7 in the electrical control panel and is controlled by the ILS - ON/OFF switch on the pilot's miscellaneous instrument panel. A regulated 19-volt d.c. supply for heating the receiver valves is obtained from a voltage regulator, Type 60, in the upper equipment compartment connected across the 28-volt d.c. supply. The power supplies are described in Sect.5, Chap.1, Group R and S. A 5-way terminal block, mounted on the floor of the upper equipment compartment adjacent to the forward end of the junction box, Type 157, provides the interface between the power supply circuits and the voltage regulator. High tension supplies for the receivers, Type R1964 and R1965, are generated by rotary transformers, one in each receiver.

OPERATION**Localizer**

14. The line of approach to the runway in the horizontal plane is covered by the localizer beacon, sited at the far end of the runway.

The radiation pattern of the beacon takes the form of two horizontally-disposed major lobes, overlapping on the runway centre line. The left-hand lobe (looking towards the touch-down point) carries a modulation of 90 Hz and the right-hand lobe carries a modulation of 150 Hz. With the aircraft on course, 90 Hz and 150 Hz signals of equal amplitude are produced in the localizer receiver comparison circuits. Deviation to the left or right produces signals of unequal amplitude, the difference being converted, in the receiver, into a proportional positive or negative d.c. signal which deflects the vertical pointer in the indicator. The pointer provides 'fly left/fly right' indications, which enable the pilot to regain the correct course, indicated by return of the pointer to the vertical position.

15. At regular intervals, the localizer ground beacon transmits an identification signal in the form of a 100 Hz note, keyed and coded to distinguish the particular ground installation. In the localizer receiver, the identification signal is separated from the 90 Hz and 150 Hz signals, and after amplification, is routed, via the radio junction box and the I.L.S. - A.D.F. Change-over switch on the pilot's miscellaneous instrument panel to the communication control system for selective application to the telephones (*refer to Part 6 of this chapter*). In an emergency, speech may be transmitted from the ground station in lieu of the identification signal. The localizer beacon has a range of approximately 25 miles at a flight altitude of 2000 ft.

Glide path

16. The line of approach to the touch-down point in the vertical plane is covered by the glide path beacon, sited at the side of the runway. The radiation pattern of this beacon takes the form of two vertically-disposed major lobes, overlapping along the correct approach path. The upper and lower lobes carry modulation of 90 Hz and 150 Hz respectively. With the aircraft on course, 90 Hz and 150 Hz signals of equal amplitude are produced in the glide path receiver comparison circuits. Deviation above or below the correct approach path produces signals of unequal amplitude, the

difference being converted, in the receiver, into a positive or negative d.c. signal which deflects the horizontal pointer in the indicator. The pointer provides 'fly-up/fly-down' indications, which enable the pilot to regain the correct vertical approach path, indicated by return of the pointer to the horizontal position.

Marker

17. The marker receiver is tuned to a fixed frequency of 75 MHz and receives signals from outer, middle and, in some cases, inner marker beacons, positioned along the approach path to the runway. The carrier signal from each beacon has a distinctive coded tone modulation, which is detected and processed for both aural and visual presentation. The audio signal for the outer marker is a 400 Hz note, coded at two dashes per second, for the middle marker a 1300 Hz note, coded by alternate dots and dashes, and for the inner marker a 300 Hz note, coded at six dots per second. The audio signal, mixed with the localizer identification signal, is amplified in the localizer receiver audio amplifier and routed to the communication control system as described in para.15. The maximum flight altitude for reliable reception is approximately 3000 ft.

Marker lamp

18. The marker audio signals are rectified in the receiver to produce d.c. pulses; after amplification, these are fed to the marker lamp (*para.10*), which flashes in accordance with the coding of the particular marker beacon.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General

19. Servicing, other than that listed in the aircraft Supplementary Servicing Schedules, consists of regular inspection of the units and cable assemblies for physical damage and security of mounting. The cable assembly details given in Table 2 are for use during routine continuity checking and fault diagnosis.

TABLE 1

Equipment details

Equipment	Type	Ref.No.	Location	A.P. Reference	
◀ Receiver (localizer and marker)	R1964	10D/17818	Upper equipment bay] 116B-0408-1	
Receiver (glide path)	R1965	10D/17819	Upper equipment bay		
<i>alternative</i>					
Receiver (localizer and marker)	R1964	10D/6352827	Upper equipment bay		
Receiver (glide path)	R1965	10D/6352825	Upper equipment bay		▶
Mounting	933	10AJ/118	Upper equipment bay		
Control unit	705	10L/263	Navigator's station, port wall		
Indicator unit	7	10Q/61	Flight instrument panel		
Junction box	157	10D/17815	Attached to mounting, Type 933		
Junction box	164	◀ 10D/4042156 ▶	Frame 1 port		
Aerial (localizer)	239	10B/16708	Leading edge of port wing		
Aerial (glide path)	238	10B/16707	Leading edge of starboard wing		
Aerial (marker)	237	10B/16706	Underside of starboard wing, inboard of engine		
Connector (blanking)	3793	10HA/11992	J.B., Type 164, second indicator outlet		

TABLE 2

Connector and cable assembly details

CONNECTOR 10HB/37

Termination A	Pin	Pin	Termination B
Junction box 157 (12P5)	} Refer below	} Refer below	Pressure bulkhead

Pins A to F at each termination are connected pin to pin. Screens are connected to the shell at each end.

CONNECTOR 10HB/40

Termination A	Pin	Pin	Termination B
Junction box 164 (13P1)	} Refer below	} Refer below	Pressure bulkhead

Pins A to H and J to M at each termination are connected pin to pin. Screens are connected to the shell at each end.

CONNECTOR 10HB/38

Termination A	Pin	Pin	Termination B
Control unit 705 (5P1)	} Refer below	} Refer below	Pressure bulkhead

Pins A to F at each termination are connected pin to pin. Screens are connected to the shell at each end.

CONNECTOR 10HB/41

Termination A	Pin	Pin	Termination B
Junction box 164 (13P5)	} A	} Lamp	} Marker lamp

CONNECTOR 10HB/42

Termination A	Pin	Pin	Termination B
Junction box 164 (13P2)	} Refer below	} Refer below	Pilot's indicator

Pins A to H and J to M at each termination are connected pin to pin. Screens are connected to the shell at each end.

CONNECTOR 10HB/39

Termination A	Pin	Pin	Termination B
Junction box 157 (12P7)	} Refer below	} Refer below	Pressure bulkhead

Pins A to H and J to M at each termination are connected pin to pin. Screens are connected to the shell at each end.

continued. . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 10HB/43			
Termination A	Pin	Pin	Termination B
Junction box 157 (12P1)	A	E28	5-way terminal block
	B	E28	
	C	R92	
	D	R91	

CONNECTOR 10HB/46			
Termination A	Pin	Pin	Termination B
Engine rib inner, port	-	-	Engine rib outer, port

CONNECTOR 10HB/43			
Termination A	Pin	Pin	Termination B
Junction box 157 (12P8)	A	E28	5-way terminal block
	B	E28	
	C	R92	
	D	R91	

CONNECTOR 10HB/47			
Termination A	Pin	Pin	Termination B
Engine rib outer, port	-	-	Localizer aerial

CONNECTOR 10HB/44			
Termination A	Pin	Pin	Termination B
Wing root break, port	-	-	Localizer/marker receiver (1P5)

CONNECTOR 10HB/48			
Termination A	Pin	Pin	Termination B
Wing root break, stbd.	-	-	Glide path receiver (9P4)

CONNECTOR 10HB/45			
Termination A	Pin	Pin	Termination B
Wing root break, port	-	-	Engine rib inner, port

CONNECTOR 10HB/49			
Termination A	Pin	Pin	Termination B
Wing root break, stbd.	-	-	Engine rib inner, stbd.

continued. . .

TABLE 2 Connector and cable assembly details — *continued*

CONNECTOR 10HB/50				CONNECTOR 10HB/54			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Engine rib inner, stbd.	} -	-	{ Engine rib outer, stbd.	Control unit 705 (5J1)	} -	-	{ Pressure bulkhead (White)
CONNECTOR 10HB/51				CONNECTOR 10HB/55			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Engine rib outer, stbd.	} -	-	{ Glide path aerial	Junction box 157 (12P6)	} -	-	{ Pressure bulkhead (White)
CONNECTOR 10HB/52				CONNECTOR 10HB/56			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Marker aerial 237	} -	-	{ Localizer/marker receiver R1964 (1P4)	Control unit (5P2)	} -	-	{ Pressure bulkhead (Blue)
CONNECTOR 10HB/53				CONNECTOR 5438/1			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Junction box 157 (12J2)	} -	-	{ Pressure Bulkhead (Blue)	Radio junction box	} Refer to Chap.1, Part 1		{ J.B.16

continued. . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 5438/5				CONNECTOR 5438/6			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Pressure bulkhead	} Refer to Chap.1, Part 1		{ Radio junction box	} Junction box 157 (12P3)		} Refer to Chap.1, Part 1	{ Pressure bulkhead

Note . . .

For details of 16G, 16XC, N28, F68 and F68A refer to Sect.5, Chap.1, Group R & S.

Part 3 RADIO COMPASS (A.R.I.23023/1)

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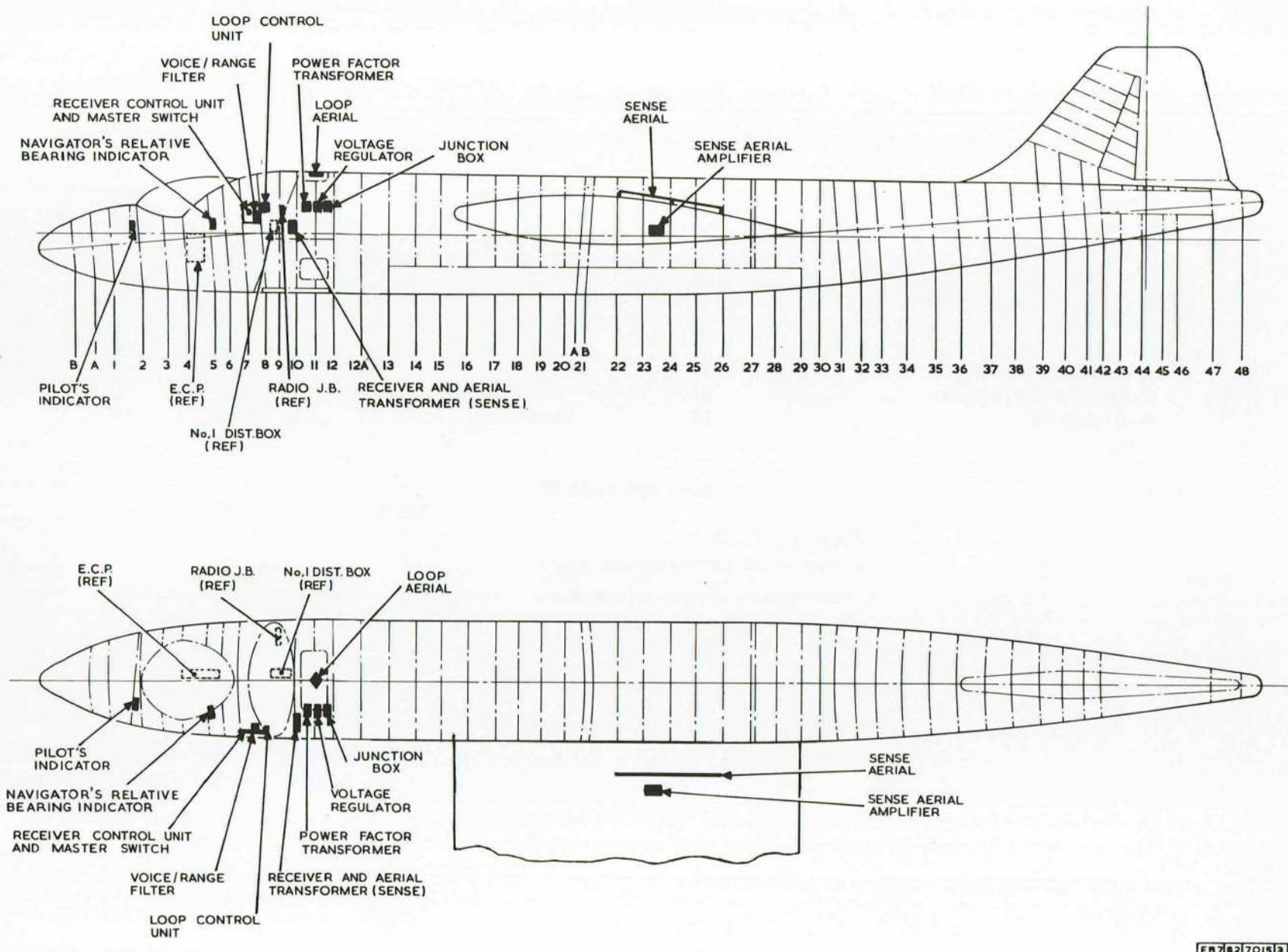
DESCRIPTION	<i>Para.</i>		<i>Para.</i>
<i>General</i>	1	<i>Power factor transformer</i>	14
<i>Receiver</i>	3	<i>Junction box</i>	15
<i>Receiver control unit</i>	5	<i>Identification signal</i>	16
<i>Loop aerial</i>	6	OPERATION	
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EB70270153

FIG.1. LOCATION DIAGRAM - RADIO COMPASS (A.R.I. 23023/1)

DESCRIPTION**General**

1. The Marconi airborne radio compass, or Automatic Direction Finder (A.D.F.), (A.R.I.23023/1) provides visual indication to the pilot and navigator of the bearing of a ground station relative to the aircraft heading. Bearings can be obtained automatically or by manual operation with remote control of the loop aerial. Ground station identification signals are fed into the communication control system. The installation comprises the following main items of equipment:-

Receiver, Type AD7092D
 Rack assembly, Type 182
 Backplate, Type 1332
 Receiver control unit, Type 1274
 Loop aerial, Type 1324A
 Loop control unit, Type 1342
 Sense aerial, Type 8071
 Sense amplifier, Type 1628
 Aerial transformer, Type 1343
 Bearing indicator, Type 1630
 Voltage regulator, Type 1555A
 Power factor transformer, Type 1571
 Junction box, Type 1629

2. The locations of the main items are shown in fig.1 and interconnections in fig.2. Table 1 gives equipment details and Table 2 gives connector and cable assembly details. Detailed technical information is given in A.P.116B-0107-1.

Receiver

3. The Type AD7092D receiver, is positioned in the upper equipment compartment. It operates in the frequency band 150 kHz to 2 MHz. Two integral motor drive units, with their associated switches, one operating the receiver frequency range selection, the other operating selectivity selection, are mounted inside the front panel of the unit and are accessible via removable covers.

4. The receiver, with backplate, Type 1332, is mounted in rack assembly, Type 182, all electrical connections being made at the rear panel. The main circuits of the receiver are as follows:-

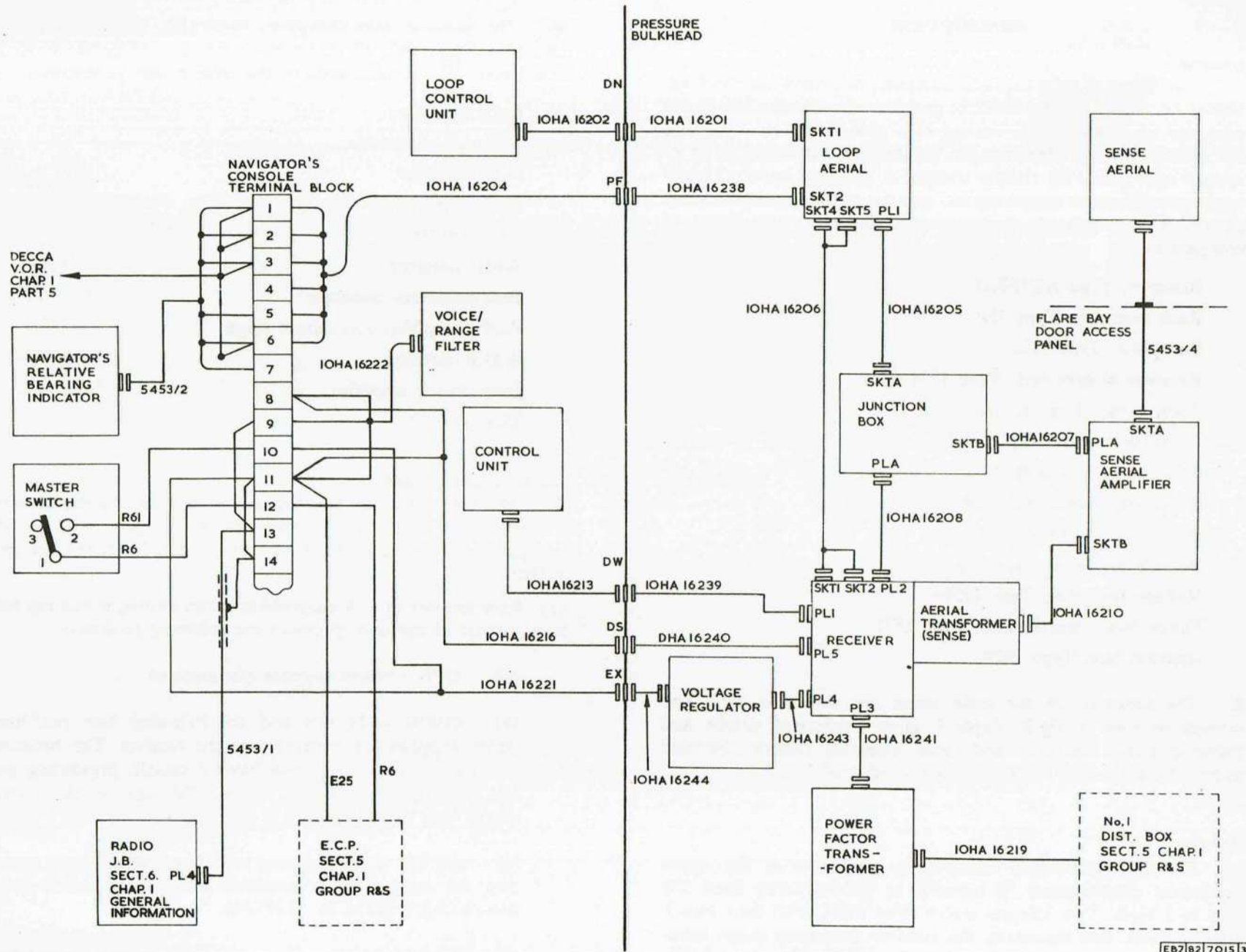
Loop amplifier
 Balanced modulator
 R.F. amplifier
 Frequency changer
 I.F. amplifier
 Audio detector
 Beat-frequency oscillator
 Audio amplifier and output stage
 A.D.F. detector
 Loop motor amplifier
 Vibrator unit

Receiver control unit

5. Remote control of the receiver is provided by the receiver control unit, Type 1274, mounted on the port wall at the navigator's station. The following controls and indicators are provided:-

(1) Function switch. A six-position rotary switch, at the top left-hand corner of the unit, provides the following facilities:-

- (a) OFF - Power supplies disconnected.
- (b) OMNI - In this and the following four positions, power supplies are connected to the receiver. The balanced modulator valves are biased beyond cut-off, preventing any automatic direction-finding action. The sense aerial is connected and the loop aerial is inoperative.
- (c) AUTO - The balanced modulator valves are in operation, the sense aerial is connected and fully automatic direction-finding facilities are available.
- (d) Figure of eight - One modulator valve is inoperative and the loop control circuits are operating.



EB78270153

FIG. 2. INTERCONNECTION DIAGRAM - RADIO COMPASS (A.R.I. 23023/1)

◀ CIRCUIT REFERENCES ADDED ▶

(e) Left SENSE – As for (d) except that the sense aerial is connected.

(f) Right SENSE – As for (e) except that the modulator valve mentioned in (d) is now inoperative, the other modulator valve being inoperative.

(2) RANGE switch. The four-position range switch, at the bottom left-hand corner of the unit, operates the frequency range switch drive unit (*para.3*) in the receiver, to select one of four sets of tuning inductors corresponding to the four frequency ranges of the receiver. Selection of any range lights one of four lamps to illuminate the corresponding tuning scale in the control unit.

(3) Tuning control. The crank-handled tuning control knob, at the bottom right-hand corner of the unit, alters the setting of the receiver tuning capacitor. The manually-applied setting is transmitted back, via an Aysynn system driving a pointer, to provide a reading on the selected frequency scale in the control unit.

(4) Selectivity switch. The selectivity switch, located at the top right-hand corner of the unit and idented RT/CW, controls the bandwidth of the intermediate frequency amplifier, providing selection of narrow, medium or broad bandwidth. In the CW position, the same bandwidth selection facilities are provided with introduction of the beat-frequency oscillator for c.w. reception.

(5) GAIN control. With AUTO selected on the function switch, the knob at bottom centre of the unit adjusts the level of the identification signal fed to the telephone circuits; with other operational modes selected, the control adjusts the h.f. gain of the receiver.

(6) Dial illumination. The switch, located at centre left of the unit and idented OFF/N/D, provides two levels of light intensity for day or night illumination of the tuning scale.

Loop aerial

6. The loop aerial, Type 1324A, is located in the upper equip-

ment compartment hatch. It consists of a nine-turn coil with an iron core, which is rotated about its vertical axis by a small two-phase a.c. motor to a point of minimum signal pick-up, i.e. a null point. The loop bearing is transmitted to the bearing indicators by an Aysynn system. Provision is also made for the loop to be rotated manually from the loop control unit.

Loop control unit

7. The loop control unit, Type 1342, is positioned directly below the receiver control unit on the port wall at the navigator's station. The large single knob operates a potentiometer, which controls loop movement in either direction. The loop control is operative only when the function switch on the control unit is selected to OMNI, Figure-of-eight or SENSE, although it is not used with OMNI selected.

Sense aerial

8. The sense aerial, Type 8071, is a centre-fed T-aerial, supported on insulators and mounted longitudinally on the inboard port upper wing surface.

Sense amplifier

9. The sense amplifier, Type 1628, is mounted in the port inner wing section beneath the sense aerial. The function of the amplifier is to match the impedance of the sense aerial to that of the coaxial cable connecting the aerial to the receiver.

Sense aerial transformer

10. The aerial transformer, Type 1343, is mounted on the receiver backplate and serves to match the input impedance of the receiver to that of the coaxial cable connecting the sense amplifier to the receiver.

Relative bearing indicator

11. A relative bearing indicator, Type 1630, mounted on the navigator's panel, provides indication of relative bearing, correct receiver tuning and signal strength. Relative bearing at the pilot's

position is displayed by the single pointer of the range and bearing indicator located on the flight instrument panel (*Chap.1, Part 5*).

Power supplies

12. The installation requires 28-volt d.c. and 26-volt, 400 Hz, single phase a.c. power supplies. The d.c. requirement is provided from busbar PP1 via fuse 233 in the electrical control panel. Following the fuse, the supply is controlled by a master switch annotated RADIO COMPASS ON-OFF located on the navigator's port panel and routed to the installation via terminals 10 and 11 (earth return) in the navigator's port console. A voltage regulator, Type 1555A, connected across the supply, provides a regulated 19-volt d.c. supply for heating the receiver valves and sense amplifier valve. The voltage regulator is mounted on the port wall of the upper equipment compartment. The 28-volt d.c. supply is also fed directly to the receiver for operation of a rotary transformer, mounted at the rear of the receiver case, which provides the high tension supply for the receiver.

13 The 26-volt, 400 Hz, single phase a.c. supply is provided by the power factor transformer (*para.14*), supplied from the 115-volt instrument power supply via fuses 102 and 104 in the No.1 distribution box which is located in the upper equipment compartment. The instrument power supplies are described in Sect.5, Chap.1, Group D.

Power factor transformer

14. The power factor transformer, Type 1571, is located in the upper equipment compartment. Its function is to improve the power factor loading on the a.c. supply to the receiver and to provide a step-down from 115-volt to 26-volt, for use in the receiver remote tuning control system and the indication repeater systems. When the receiver is switched on at the control unit, a relay in the transformer unit is energized and change-over of the relay contacts connects the 115-volt incoming supply (*para.13*) to the transformer primary, the secondary producing 26-volt which is fed to the receiver. Power factor correction is provided by a capacitor, connected across selected tapping points on the transformer primary. The tapping points are selected by the manufacturer according to the type of installation.

Junction box

15. The junction box, Type 1629, located in the upper equipment compartment provides a means of connecting power supplies to the sense amplifier, Type 1628, (*para.9*) and the loop aerial system.

Identification signal

16. After normal detection and amplification in the receiver, the ground station identification signal is routed, via the radio junction box and the I.L.S.-A.D.F. change-over switch on the pilot's miscellaneous instrument panel to the communication control system for selective application to the telephones (*refer to Part 6 of this chapter*).

OPERATION

Automatic direction finding

17. In automatic direction finding, the signals received by the motor-driven, self-aligning loop aerial are combined with the signals received by the sense aerial to initiate loop rotation to a position of zero signal. Since the r.f. voltages from the loop and sense aerials are unsuitable for operating the loop motor, they are processed to provide a low frequency power source which reverses phase in sympathy with the phase-reversal of the r.f. output as the loop aerial passes through the null points. This is accomplished by switching the loop output signal to provide in-phase and anti-phase loop signals during alternate half cycles of the 110 Hz switching signal. By mixing these with the sense aerial output signal, addition and subtraction of the r.f. voltages generates a signal, modulated at 110 Hz, which is then amplified and rectified. The rectified modulation signal is further amplified and phase-shifted 90 degrees to provide one of the drives for the two-phase loop motor. A second 110 Hz signal, taken directly from the modulator output, provides the complementary drive to the loop motor. Since the loop output reverses phase as the loop passes through a null point, so also does the derived 110 Hz driving supply to the loop motor, causing the loop to be driven in the appropriate direction to the correct null point.

(e) Left SENSE – As for (d) except that the sense aerial is connected.

(f) Right SENSE – As for (e) except that the modulator valve mentioned in (d) is now inoperative, the other modulator valve being inoperative.

(2) RANGE switch. The four-position range switch, at the bottom left-hand corner of the unit, operates the frequency range switch drive unit (*para.3*) in the receiver, to select one of four sets of tuning inductors corresponding to the four frequency ranges of the receiver. Selection of any range lights one of four lamps to illuminate the corresponding tuning scale in the control unit.

(3) Tuning control. The crank-handled tuning control knob, at the bottom right-hand corner of the unit, alters the setting of the receiver tuning capacitor. The manually-applied setting is transmitted back, via an Aysynn system driving a pointer, to provide a reading on the selected frequency scale in the control unit.

(4) Selectivity switch. The selectivity switch, located at the top right-hand corner of the unit and idented RT/CW, controls the bandwidth of the intermediate frequency amplifier, providing selection of narrow, medium or broad bandwidth. In the CW position, the same bandwidth selection facilities are provided with introduction of the beat-frequency oscillator for c.w. reception.

(5) GAIN control. With AUTO selected on the function switch, the knob at bottom centre of the unit adjusts the level of the identification signal fed to the telephone circuits; with other operational modes selected, the control adjusts the h.f. gain of the receiver.

(6) Dial illumination. The switch, located at centre left of the unit and idented OFF/N/D, provides two levels of light intensity for day or night illumination of the tuning scale.

Loop aerial

6. The loop aerial, Type 1324A, is located in the upper equip-

ment compartment hatch. It consists of a nine-turn coil with an iron core, which is rotated about its vertical axis by a small two-phase a.c. motor to a point of minimum signal pick-up, i.e. a null point. The loop bearing is transmitted to the bearing indicators by an Aysynn system. Provision is also made for the loop to be rotated manually from the loop control unit.

Loop control unit

7. The loop control unit, Type 1342, is positioned directly below the receiver control unit on the port wall at the navigator's station. The large single knob operates a potentiometer, which controls loop movement in either direction. The loop control is operative only when the function switch on the control unit is selected to OMNI, Figure-of-eight or SENSE, although it is not used with OMNI selected.

Sense aerial

8. The sense aerial, Type 8071, is a centre-fed T-aerial, supported on insulators and mounted longitudinally on the inboard port upper wing surface.

Sense amplifier

9. The sense amplifier, Type 1628, is mounted in the port inner wing section beneath the sense aerial. The function of the amplifier is to match the impedance of the sense aerial to that of the coaxial cable connecting the aerial to the receiver.

Sense aerial transformer

10. The aerial transformer, Type 1343, is mounted on the receiver backplate and serves to match the input impedance of the receiver to that of the coaxial cable connecting the sense amplifier to the receiver.

Relative bearing indicator

11. A relative bearing indicator, Type 1630, mounted on the navigator's panel, provides indication of relative bearing, correct receiver tuning and signal strength. Relative bearing at the pilot's

position is displayed by the single pointer of the range and bearing indicator located on the flight instrument panel (*Chap.1, Part 5*).

Power supplies

12. The installation requires 28-volt d.c. and 26-volt, 400 Hz, single phase a.c. power supplies. The d.c. requirement is provided from busbar PP1 via fuse 233 in the electrical control panel. Following the fuse, the supply is controlled by a master switch annotated RADIO COMPASS ON-OFF located on the navigator's port panel and routed to the installation via terminals 10 and 11 (earth return) in the navigator's port console. A voltage regulator, Type 1555A, connected across the supply, provides a regulated 19-volt d.c. supply for heating the receiver valves and sense amplifier valve. The voltage regulator is mounted on the port wall of the upper equipment compartment. The 28-volt d.c. supply is also fed directly to the receiver for operation of a rotary transformer, mounted at the rear of the receiver case, which provides the high tension supply for the receiver.

13 The 26-volt, 400 Hz, single phase a.c. supply is provided by the power factor transformer (*para.14*), supplied from the 115-volt instrument power supply via fuses 102 and 104 in the No.1 distribution box which is located in the upper equipment compartment. The instrument power supplies are described in Sect.5, Chap.1, Group D.

Power factor transformer

14. The power factor transformer, Type 1571, is located in the upper equipment compartment. Its function is to improve the power factor loading on the a.c. supply to the receiver and to provide a step-down from 115-volt to 26-volt, for use in the receiver remote tuning control system and the indication repeater systems. When the receiver is switched on at the control unit, a relay in the transformer unit is energized and change-over of the relay contacts connects the 115-volt incoming supply (*para.13*) to the transformer primary, the secondary producing 26-volt which is fed to the receiver. Power factor correction is provided by a capacitor, connected across selected tapping points on the transformer primary. The tapping points are selected by the manufacturer according to the type of installation.

Junction box

15. The junction box, Type 1629, located in the upper equipment compartment provides a means of connecting power supplies to the sense amplifier, Type 1628, (*para.9*) and the loop aerial system.

Identification signal

16. After normal detection and amplification in the receiver, the ground station identification signal is routed, via the radio junction box and the I.L.S.-A.D.F. change-over switch on the pilot's miscellaneous instrument panel to the communication control system for selective application to the telephones (*refer to Part 6 of this chapter*).

OPERATION

Automatic direction finding

17. In automatic direction finding, the signals received by the motor-driven, self-aligning loop aerial are combined with the signals received by the sense aerial to initiate loop rotation to a position of zero signal. Since the r.f. voltages from the loop and sense aerials are unsuitable for operating the loop motor, they are processed to provide a low frequency power source which reverses phase in sympathy with the phase-reversal of the r.f. output as the loop aerial passes through the null points. This is accomplished by switching the loop output signal to provide in-phase and anti-phase loop signals during alternate half cycles of the 110 Hz switching signal. By mixing these with the sense aerial output signal, addition and subtraction of the r.f. voltages generates a signal, modulated at 110 Hz, which is then amplified and rectified. The rectified modulation signal is further amplified and phase-shifted 90 degrees to provide one of the drives for the two-phase loop motor. A second 110 Hz signal, taken directly from the modulator output, provides the complementary drive to the loop motor. Since the loop output reverses phase as the loop passes through a null point, so also does the derived 110 Hz driving supply to the loop motor, causing the loop to be driven in the appropriate direction to the correct null point.

Manual loop control

18. In the figure-of-eight and sense modes (*para.5*), the loop is controlled manually from the loop control unit, using Desynn potentiometer resolvers, driven by the loop and manual control knob on the controller respectively, the output from the potentiometer in the control unit being fed back via the loop motor amplifier to provide the motor drive. The 110 Hz output from the modulator is used to power the transmitting potentiometer. Since phase-reversal of the motor drive signal occurs as the loop-driven potentiometer sliders pass through the position set at the control unit, the loop is driven in the appropriate direction to the null point, where the sliders of the two potentiometers are, relatively, at right angles.

SERVICING**WARNING**

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General

19. Servicing, other than that listed in the aircraft Supplementary Servicing Schedules, consists of regular inspection of the units and cable assemblies for physical damage and security of mounting. The cable assembly details given in Table 2 are for use during routine continuity checking and fault diagnosis.

TABLE 1

Equipment details

Equipment	Type	Ref.No.	Location	A.P. Reference
Receiver	AD7092D	◀ 10D/4306039	Upper equipment bay	116B-0107-1
Backplate	1332	10AR/1026	Upper equipment bay	
Rack assembly	182	10D/17031	Upper equipment bay	
Receiver control unit	1274	10L/16073	Navigator's station, port wall	
Loop aerial	1324A	10B/4306005	Upper equipment bay hatch	
Loop control unit	1342	10J/13152	Navigator's station, port wall	
Sense aerial	8071	10B/4693353	Port upper wing, inboard	
Sense amplifier	1628	10U/16964	Rib 4, inner wing, port	
Sense aerial transformer	1343	10K/18225	Receiver backplate	
Relative bearing indicator	1630	10Q/16314	Navigator's panel	
Power factor transformer	1571	10K/16244	Upper equipment bay	
Junction box	1629	10D/19525	Upper equipment bay	
Voltage regulator	1555A	5UC/4379169 ▶	Upper equipment bay	113D-07191-1

TABLE 2

Connector and cable assembly details

CONNECTOR 10HA/16210

Termination A	Pin	Pin	Termination B
Sense aerial amplifier (SKTB)	-	-	Receiver AD7092D (Sense aerial transformer)

Note. . .
Transformer plugs into SKT3 on receiver.

CONNECTOR 10HA/16206

Termination A	Pin	Pin	Termination B
Loop aerial 1324A (SKT4)	-	-	Receiver AD7092D (SKT1)
Loop aerial 1324A (SKT5)	-	-	Receiver AD7092D (SKT2)

Two coaxial cables in one sheath.

CONNECTOR 10HA/16208

Termination A	Pin	Pin	Termination B
Junction box 1629 (PLA)	See below		Receiver AD7092D (PL2)

Pins 1 to 12 at each termination are connected pin to pin.

CONNECTOR 10HA/16205

Termination A	Pin	Pin	Termination B
Junction box 1629 (SKTA)	See below		Loop aerial 1324A (PL1)

Pins 1 to 12 at each termination are connected pin to pin.

CONNECTOR 10HA/16201

Termination A	Pin	Pin	Termination B
Pressure bulkhead (DN)	A	1	Loop aerial 1324A (SKT1)
	B	2	
	C	3	
	D	4	
	E	5	
	F	6	

Pins 7 and 8 at termination B are not used. Screen is connected to pin 6 at termination B.

CONNECTOR 10HA/16202

Termination A	Pin	Pin	Termination B
Pressure bulkhead (DN)	A	1	Loop control unit 1342
	B	2	
	C	3	
	D	4	
	E	5	
	F	6	

Pins 7 and 8 at termination B are not used. Screen is connected to pin 6 at termination B.

CONNECTOR 10HA/16216

Termination A	Pin	Pin	Termination B
Pressure bulkhead (DS)	B	11	Navigator's console (Terminal block)
	C	8	

Pin A at termination is not used. Screen is connected to pin D at termination A and to terminal 11 at termination B.

continued. . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 10HA/16239 (10HA/16212 alternative)

CONNECTOR 10HA/16240 (10HA/16215 alternative)

Termination A	Pin	Pin	Termination B
Pressure bulkhead (DS)	B	2	Receiver AD7092D (PL5)
	C	3	

Pin A at termination A and pin 1 at termination B are not used. Screen is connected to pin D at termination A and to pin 4 at termination B.

CONNECTOR 10HA/16243

Termination A	Pin	Pin	Termination B
Voltage regulator 1555A	2	2	Receiver AD7092D (PL4)
	3	3	
	4	4	

Pins 1 and 2 are linked at both terminations.

CONNECTOR 10HA/16241 (10HA/16211 alternative)

Termination A	Pin	Pin	Termination B
Power factor transformer 1571	1	1	Receiver AD7092D (PL3)
	2	2	
	3	3	
	4	4	

CONNECTOR 10HA/16222

Termination A	Pin	Pin	Termination B
Voice range filter	1	9	Navigator's console (Terminal block)
	2	11	
	3	8	

Pin 9 at termination B is not used.

Termination A	Pin	Pin	Termination B
Pressure bulkhead (DW)	A	1	Receiver AD7092D (PL1)
	B	2	
	C	3	
	D	4	
	E	5	
	F	6	
	G	7	
	H	8	
	J	9	
	K	10	
	L	11	
	M	12	
	N	13	
	O	14	
	P	15	
	Q	16	
	R	18	
	S	19	
	T	21	
	U	22	
	V	23	
	W	24	
	X	26	
	Y	27	
	Z	28	

Pins 17 and 20 are linked together and pins 13 and 25 are linked together at termination B.

CONNECTOR 10HA/16213

Termination A	Pin	Pin	Termination B
Pressure bulkhead (DW)	A	1	Receiver control unit 1274
	B	2	
	C	3	
	D	4	

continued . . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 10HA/16213 — continued

Termination A	Pin	Pin	Termination B
Pressure bulkhead (DW)	E	5	Receiver control unit 1274
	F	6	
	G	7	
	H	8	
	J	9	
	K	10	
	L	11	
	M	12	
	N	13	
	O	14	
	P	15	
	Q	16	
	R	18	
	S	19	
	T	21	
	U	22	
V	23		
W	24		
X	26		
Y	27		
Z	28		

Pins 17 and 20 are linked together and pins 13 and 25 are linked together at termination B.

CONNECTOR EX 10HA/16221

Termination A	Pin	Pin	Termination B
Pressure bulkhead (EX)	A	10	Navigator's console (Terminal block)
	B	11	

CONNECTOR 10HA/16244 (10HA/16220 alternative)

Termination A	Pin	Pin	Termination B
Pressure bulkhead (EX)	A	1	Voltage regulator 1555A
		2	
	B	3	
		4	

CONNECTOR 10HA/16219

Termination A	Pin	Pin	Termination B
Power factor transformer 1571	3	Fuse 102	No.1 Dist. box
		Fuse 104	
	2	E	

Pin 1 at termination A is not used. Screens are connected to shell at termination A and to terminal E at termination B.

CONNECTOR GR/A 10HA/16207

Termination A	Pin	Pin	Termination B
Junction box 1629 (SKTB)	1	A	Sense amplifier 1628 (PLA)
		B	
	4	D	

Pins 3 and 5 to 8 at termination A and pins C, E and F at termination B are not used.

CONNECTOR 5453/4

Termination A	Pin	Pin	Termination B
Sense aerial 8071	-	-	Sense amplifier 1628 (SKTA)

continued. . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 10HA/16238 (10HA/16203 alternative)

Termination A	Pin	Pin	Termination B
Pressure bulkhead (PF)	A	1	Loop aerial 1324A (SKT2)
	B	3	
	C	2	
	D	5	
	E	6	
	F	11	

CONNECTOR 5453/2

Termination A	Pin	Pin	Termination B
Navigator's relative bearing indicator	A	1	Navigator's console (Terminal block)
	B	2	
	C	3	
	D	6	
	E	5	
	F	7	

Pins G, H, J, K, L and M at termination A and pins 4 and 7 to 10 at termination B are not used. Pins 3 and 12 are linked at termination B.

CONNECTOR 10HA/16204

Termination A	Pin	Pin	Termination B
Pressure bulkhead (PF)	A	1	Navigator's console (Terminal block)
	B	2	
	C	3	
	D	4	
	E	5	
	F	6	

CONNECTOR CS5453/1

Termination A	Pin	Pin	Termination B
Radio junction box (PLA)	A	13	Navigator's console (Terminal block)
	B	14	
	C	-	

Pins G, H, J, K, L and M at termination A are not used.

Part 4 H.F. COMMUNICATION SYSTEM (A.R.I.23090/9)**LIST OF CONTENTS**

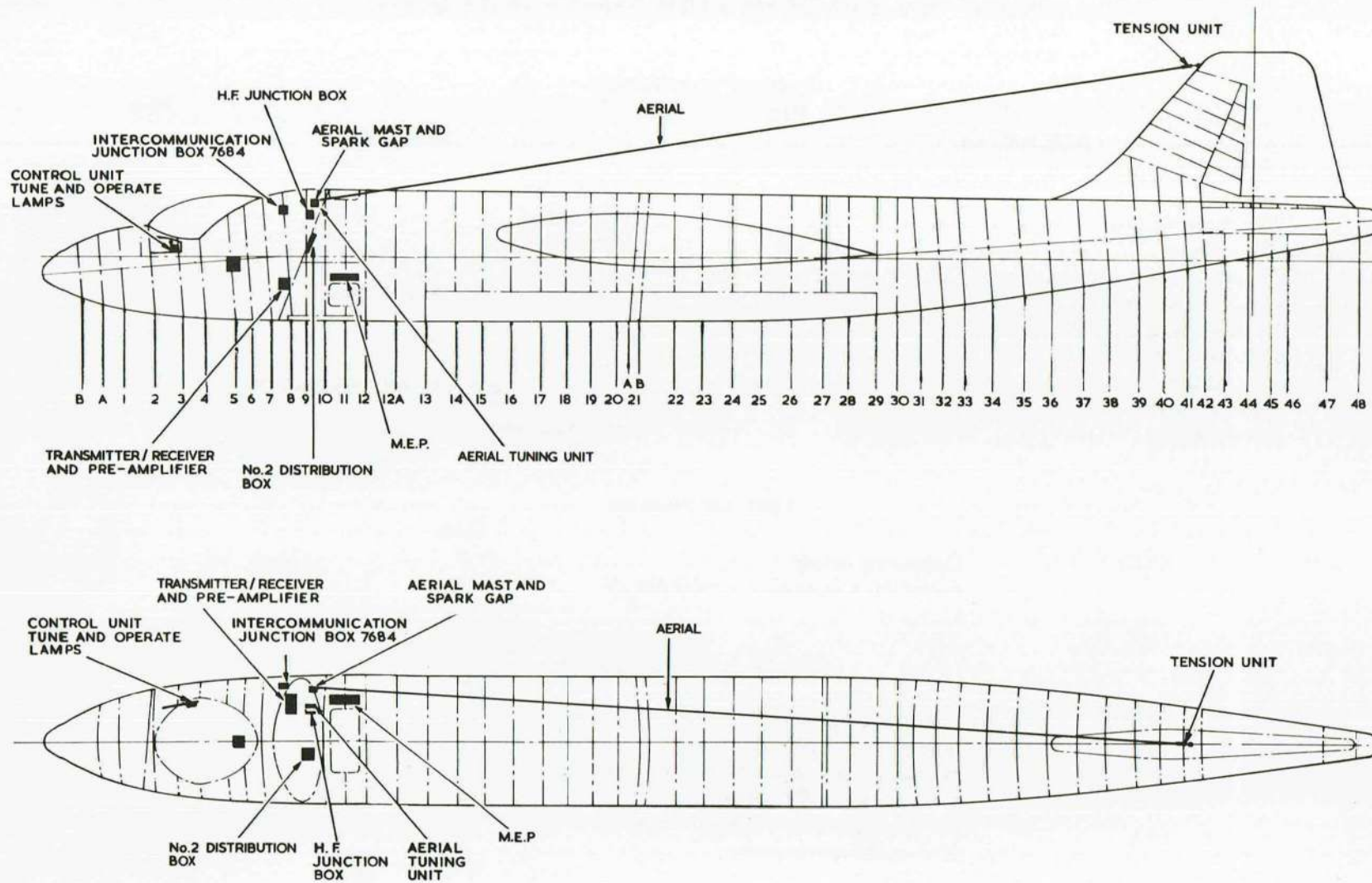
DESCRIPTION	<i>Para.</i>	OPERATION	<i>Para.</i>
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FIG. I. LOCATION DIAGRAM-H.F. COMMUNICATION SYSTEM (A.R.I. 23090/9)

DESCRIPTION

General

1. H.F. communication facilities are provided by the Collins Type 618T-3 installation (A.R.I.23090/9). 28,000 communication channels are available in the frequency band 2 to 29.999 MHz with 1 kHz channel spacing. The equipment has provision for operating in a single-sideband, suppressed-carrier mode, using the upper or lower sideband, or in a carrier-plus-upper-sideband mode which is compatible with conventional amplitude modulation.

2. The locations of the main items of equipment are shown in fig.1 and interconnections in fig.2. Table 1 gives equipment details and Table 2 gives connector and cable assembly details. Full specification, maintenance and fault diagnosis information is contained in the following Collins publications:-

Transmitter/receiver:	520-5970004 (Maintenance) 520-5970003 (Overhaul)
Control unit:	523-0760772 (Maintenance) 523-0759328 (Overhaul)
Aerial coupler:	523-0756805 (Maintenance) 523-0756808 (Overhaul)

3. The installation comprises the following main items of equipment:-

Transmitter/receiver, Collins Type 618T-3
Mounting, Collins Type 390J-1
Control unit, Collins Type 714E-3
Aerial tuning unit, Collins Type 490T-1
Mounting (for aerial tuning unit), Collins Type 790Y-1
H.F. junction box
Pre-amplifier, Type UA6002
Chelton aerial system from aircraft fin to aerial mast.

Transmitter/receiver

4. The transmitter/receiver (transceiver), Type 618T-3, is carried in the mounting, Type 390J-1, located within a crate at the navigator's starboard station. The front panel of the unit contains a rotary switch and meter, which together form a check facility for supply voltages within the unit. The first four switch positions are identified 1500V, 130V, 28V and PA MA and are used for voltage checks. The fifth switch position, identified CAL TONE, is used to compare the frequency of the transmitter/receiver with a standard time signal station.

Also on the front panel are jacket sockets for microphone and telephone connection during ground testing, the 400 Hz blower system air intake and the aerial connections.

5. The transmitter/receiver unit contains eleven plug-in modules, including an internal power supply assembly. All connections into the system, except aerials, are made via a 60-way Cannon connector at the rear of the unit, which mates with a 60-way socket on the shock-mounting tray.

Control unit

6. The control unit, Type 714E-3, is mounted on the miscellaneous instrument panel and provides facilities for remote control of the system as follows:-

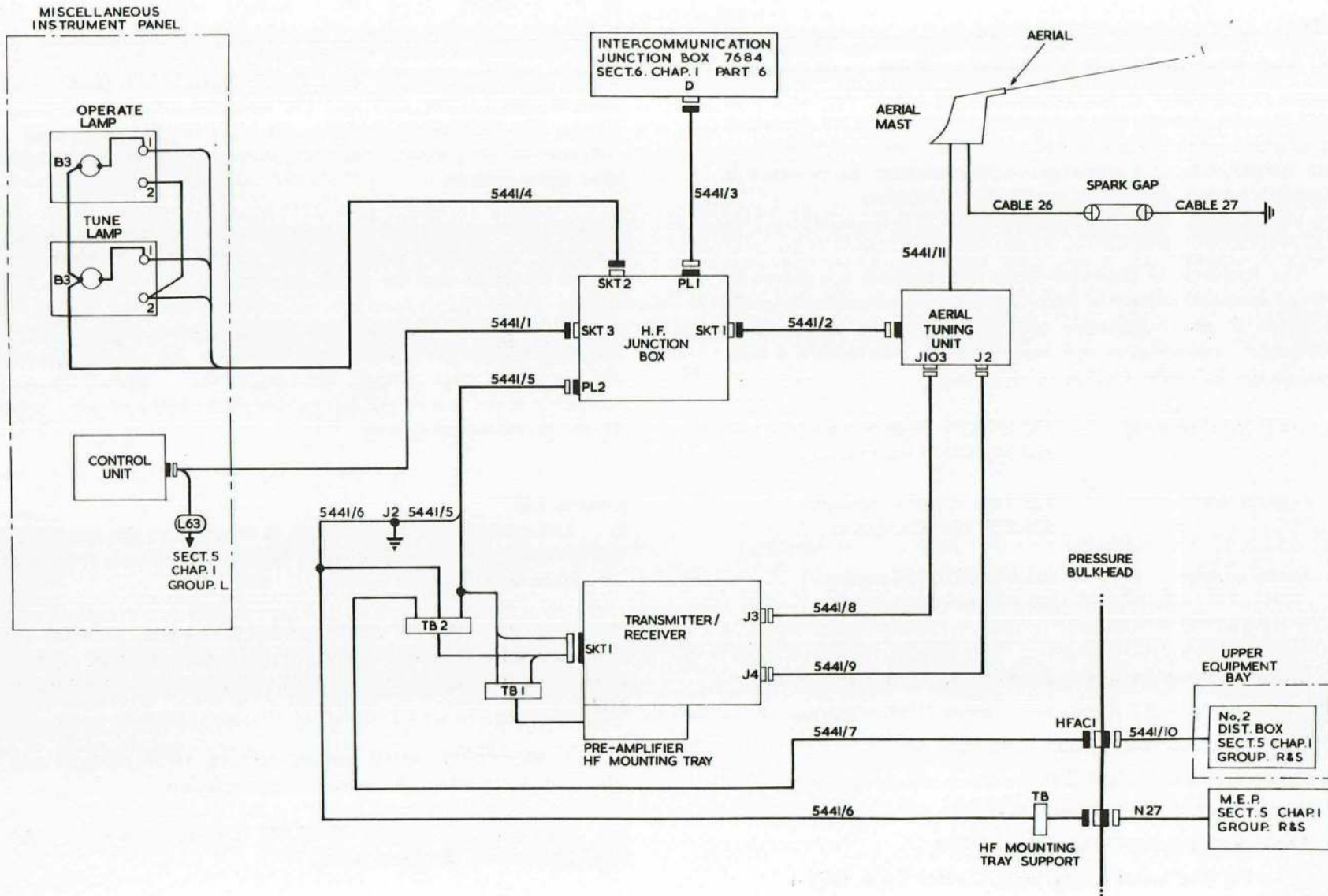
(1) Frequency selection is effected by four knobs, of which the first knob selects the first two digits, the others one digit each, to display the five-digit frequency read-out in MHz and fractions of MHz.

(2) A six-position rotary switch, identified OFF/USB/LSB/AM/DATA/CW, provides the mode-switching facility.

(3) A gain control, identified RF SENS, is located at a lower right-hand position on the front panel.

Aerial

7. The aerial is a fixed, insulated wire, suspended above the fuselage between a Chelton mast and the aircraft fin. The mast is



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FIG. 2. INTERCONNECTION DIAGRAM-H.F. COMMUNICATION SYSTEM (AR.I. 23090/9)

mounted on the starboard side of the fuselage aft of frame 8. The wire, attached to the mast by a chuck unit, terminates at the fin in a combined chuck and tension unit, which exerts a pull of approximately 50 lb on the wire. A spark gap, located inside the fuselage, adjacent to the base of the mast, is designed to dissipate excessively high r.f. voltages and lightning strikes on the aircraft, without damage to the installation.

Aerial tuning unit

8. The aerial tuning unit (aerial coupler), Type 490T-1, automatically matches the aerial impedance to the transmitter output impedance. The unit is mounted on the shockmount tray, Type 790Y-2, at the port side of the cabin, at the navigator's starboard station. The tuning unit, consisting of the main chassis and nine modules, has no manual controls.

Indicator lamps

9. Associated with the aerial tuning unit are two indicator lamps, one amber, idented TUNE, the other green, idented OPERATE; both lamps are mounted on the miscellaneous instrument panel, above the control unit. Press-to-test and iris-type dimming facilities are embodied in each lamp.

H.F. junction box

10. The H.F. junction box, mounted beneath the aerial tuning unit at the navigator's starboard station provides interconnection facilities for all units of the H.F. system. Fig.3 shows the internal wiring.

Pre-amplifier

11. The pre-amplifier, Type UA6002, is mounted on the transmitter/receiver mounting tray. Its function is to amplify the microphone audio signals before application to the transmitter modulator.

Audio control

12. Facilities for control of transmission and reception via the H.F. system are provided in the communication control system, described in Part 6 of this chapter.

Power supplies

13. The H.F. installation requires 28-volt d.c. and 115-volt, 400 Hz, single-phase a.c. supplies. The d.c. requirement is supplied from busbar P10 via a 40-amp fuse 164 and a 10-amp fuse 20 in the MEP. The a.c. requirement is supplied from No.7 inverter via fuse 133 in the No.2 distribution box. The power supplies are fully described in Sect.5, Chap.1, Group R and S.

OPERATION

Transmission

14. With the H.F. equipment selected at a station box (*refer to Part 6 of this chapter*) operation of the associated press-to-transmit switch connects the amplified microphone signals to a balanced modulator where they modulate a 500 kHz signal from the r.f. oscillator. The output of the balanced modulator contains upper and lower sidebands and the selection of USB or LSB at the mode selection switch introduces filtering action which removes the unwanted sideband. Selection of AM produces a transmission consisting of the upper sideband combined with the 500 kHz carrier from the r.f. oscillator. The DATA and CW switch positions are inoperative.

Aerial tuning

15. Automatic tuning of the aerial, by action of the aerial tuning unit, is initiated by a change of frequency selected at the control unit, the tuning cycle taking a maximum time of five seconds. The main tuning elements of inductance and capacitance are tuned by inter-related phasing and loading action. Initially the phasing action cancels the reactive component in the aerial, presenting a resistive load of less than 50 ohms to the transmitter; the loading action then adjusts the magnitude of the resistive load to 50 ohms.

Indicator lamps

16. The amber indicator lamp, idented TUNE, lights when tuning is in progress. The green indicator lamp, idented OPERATE, lights when the tuning operation is completed and the voltage standing wave ratio (v.s.w.r.) is less than 1.3 to 1. The TUNE lamp lights in response to reflected power from a high v.s.w.r. and extinguishes when the tuner has adjusted the v.s.w.r. to the working value.

RESTRICTED

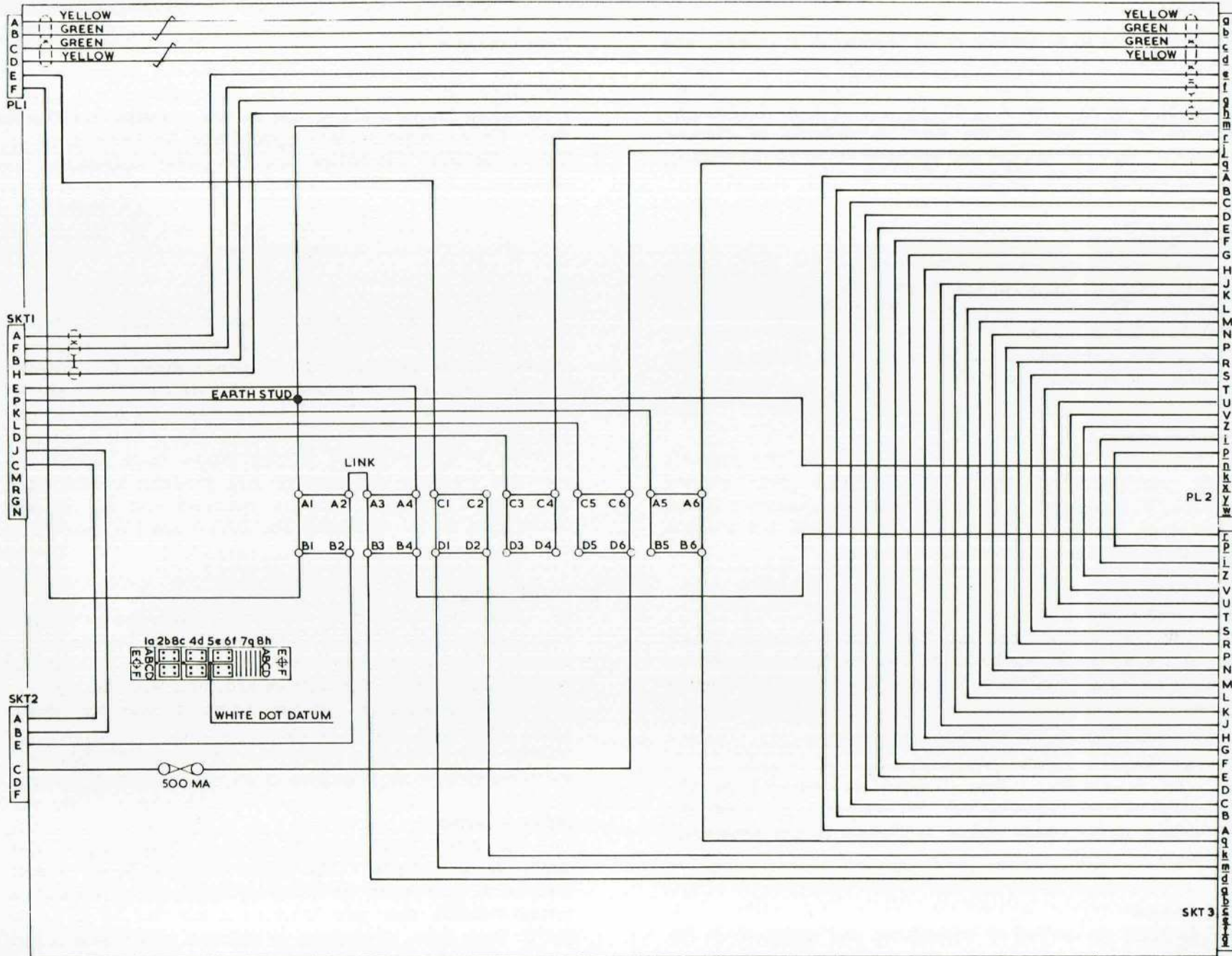


FIG.3. H.F. JUNCTION BOX - INTERNAL WIRING

SRIM DRAWING 32334

RESTRICTED

17. If the TUNE lamp does not light, the aerial tuning unit is not receiving r.f. power. If both lamps are lit together, either the aerial parameters are beyond the tuning range of the tuning unit or the tuning unit is faulty.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General

18. Servicing, other than that listed in the aircraft Supplementary Servicing Schedules, consists of regular inspection of the units and cable assemblies for physical damage and security of mounting. The cable assembly details given in Table 2 are for use during routine continuity checking and fault diagnosis.

REMOVAL AND ASSEMBLY

Aerial replacement

19. The following sub-paragraphs give detailed procedures for replacement of the aerial. The full procedure given in sub-para.(1) must be followed if the aerial wire is not already released by breakage, otherwise operations (d) to (g) suffice. Refer to fig.4. Type S tension units are used in this installation.

- (1) Release of wire tension and removal of aerial wire.

WARNING

Unless accidental wire release has already occurred, the aerial wire tension must be released before undertaking any dismantling at either end of the aerial. Failure to do so may result in injury or damage.

- (a) Ensure plunger is unlocked. Hold the barrel of the tension unit in one hand and use elbow pressure on the aerial

wire to compress the spring. Turn the plunger locking ring with a 5/16 in. BSF spanner to lock the plunger, leaving the aerial wire slack.

- (b) Press the tail rod collet forward to permit withdrawal of tail rod, then reinsert by one or two notches only.

- (c) Press down the aerial wire sufficiently to enable the spring to be relaxed when freed. Unlock the plunger, then gradually relieve the elbow pressure and allow the spring to relax.

- (d) Release the tail rod from the tension unit.

- (e) Pull back the chuck caps at the tension unit and forward mast.

- (f) Remove the wire from the chucks, using Chelton extractor tool Part No.5205-1. Remove the chuck caps from the wire, ensure undamaged and refit to mast and tension unit respectively.

- (g) Refit the aerial, using the procedure detailed in sub-para.(2) and (3), ensuring that the chucks are adequately lubricated with silicone grease, Type MS4.

Note. . .

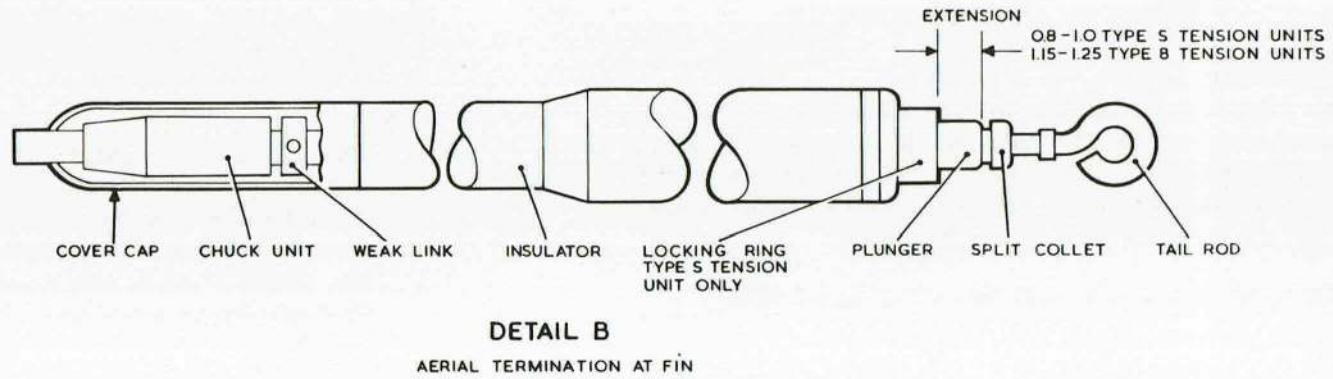
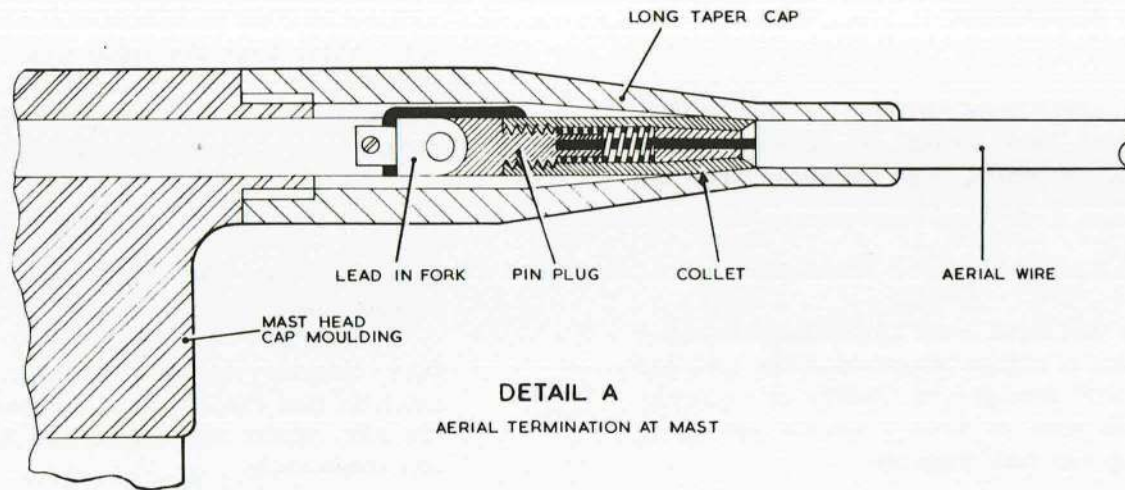
The original aerial cable may be used if it is cut and stripped in such a manner that the chucks grip on a newly stripped portion of the wire. If the tail rod adjustment is insufficient to accommodate the re-cut wire, a new length of aerial wire must be fitted. Approximately 42 ft of Chelton aerial wire, Part No.5048, is required. (5E/3756).

- (2) Assembly of aerial to mast (fig.4, Detail A).

- (a) Remove the chuck unit by withdrawing the split pin and shackle pin.

- (b) Remove 3½ in. of insulation from the end of the aerial wire.

RESTRICTED



NOTE...
ALL DIMENSIONS ARE IN INCHES

FIG. 4. H.F. AERIAL TERMINATIONS

RESTRICTED

- (c) Fit the long taper cap (*fig.4*) over the aerial wire (tapered end first).
 - (d) Push the bared end of the aerial wire through the chuck unit. Leave $\frac{1}{4}$ in. of bare conductor between the chuck and the insulation of the aerial wire.
 - (e) Bend the bared conductor UP through 90 degrees. Refit the chuck unit to the lead-in fork (*fig.4*) using shackle pin and split pin.
 - (f) Bend the conductor to lay along the lead-in fork and again DOWN to lay in the slot on the side of the fork.
 - (g) Secure the conductor with the square washer, screw and nut.
 - (h) Trim off the free end of the conductor. Pack the long taper cap with silicone compound MS4 and refit.
- (3) Assembly of aerial to fin attachment (*fig.4, Detail B, Type S tension unit*).
- (a) Press the collet against the end of the plunger to free the tail rod from the tension unit. Withdraw the tail rod complete and attach to the tail fixing. Check that the rod is free to move in both planes.
 - (b) With the plunger of the tension unit free from loading, measure and record the length of the plunger projection. Re-enter the tail rod into the plunger, 2 in. into the tension unit body.
 - (c) Remove the taper chuck cap and pass over the aerial wire.
 - (d) Haul up the wire hand tight and lay it along the

tension unit. With the tension unit and wire in line, cut the wire in line with the aft end of the chuck.

- (e) Strip 0.75 in. of insulation from the wire, taking extreme care to avoid cutting into the conductor.
- (f) Remove the tension unit from the tail rod and insert the wire into the chuck as far as it will go.
- (g) Offer the tension unit to the tail rod and push the tension unit over the tail rod as far as it will go.
- (h) Hold the barrel of the tension unit in one hand and using elbow pressure on the aerial wire, exert a downward load, extending the plunger about half as much again as the extension finally required. Lock the plunger by turning the plunger locking ring with a $\frac{5}{16}$ in. B.S.F. spanner.
- (j) Release the elbow pressure, pull up the unit and push the tail rod in as far as possible. Unlock the plunger.
- (k) Measure the length of the plunger projection. The difference between this length and that measured at (b) must lie between 0.8 in. and 1.0 in.; this corresponds to 50 lb. wire tension. If outside these limits, repeat operations (h) (j) and (k), but adjusting the amount of tail rod insertion by one or two notches until the difference value (the plunger extension) is within limits.
- (l) Re-check the plunger extension to ensure that no wire slip has occurred at either the tension unit chuck or the forward mast chuck. The aerial must be re-rigged if any slippage has occurred.
- (m) Fill the taper chuck cap with silicone compound MS4, pass over the assembly and refit.

TABLE 1

Equipment details

Equipment	Type/Part No.	Ref.No.	Location	Collins Publication	
				(Maintenance)	(Overhaul)
Transmitter/receiver	618T-3	110D/6043307	Navigator's starboard station	520-5970004	520-5970003
Mounting	390J-1	10AJ/9451643	Navigator's starboard station		
Control unit	714E-3	◀ 110L/1167500 ▶	Pilot's miscellaneous instrument panel	523-0760772	523-0759328
Aerial tuning unit	490T-1	110B/9397495	Navigator's starboard station	523-0756805	523-0756808
Mounting tray	790Y-2	—	—		
Pre-amplifier	UA6002	5831-99-9148966	Mounting tray 390J-1	A.P.116N-0101-1	
Aerial tension unit	S	10B/16897	Fin	A.P.116D-0117-1	
Aerial mast	Z5485	—	Fuselage, starboard, frames 8-9	A.P.116D-0117-1	
Aerial wire	5048	5E/3756	Fin to mast	A.P.116D-0117-1	
Spark gap assembly	—	10AE/9714017	Fuselage, starboard, frames 8-9	—	
H.F. junction box	—	Srim drawing 32332	Navigator's starboard station	—	

TABLE 2

Connector and cable assembly details

CONNECTOR TYPE 5441/1				CONNECTOR TYPE 5441/2			
Termination A	Pin	Pin	Termination	Termination A	Pin	Pin	Termination B
Control unit	A	A	B H.F. junction box (SKT 3)	Aerial tuning unit	A	A	H.F. junction box (SKT 1)
	B	B			C	C	
	C	C			D	D	
	D	D			F	F	
	E	E			G	P	
	F	F			H	H	
	G	G			J	J	
	H	H			K	K	
	J	J			L	L	
	K	K			B	B	
	L	L			E	E	
	M	M			Shell - screens - shell		
	N	N			CONNECTOR TYPE 5441/3		
	P	P					
	R	R					
	S	S					
	T	T					
	U	U					
	V	V					
	Z	Z					
	d	d					
	f	f					
	g	g					
	h	h					
	i	i					
	k	k					
m	m						
p	p						
q	q						
r	r						
e	L63	B1 Lighting TB	Termination A	Pin	Pin	Termination B	
				Intercommunication junction box 7684 (outlet D)	A	A	H.F. junction box (PL1)
					B	B	
					C	C	
					D	D	
					E	E	

continued. . .

TABLE 2 Connector and cable assembly details — *continued*

CONNECTOR TYPE 5441/4

Termination A	Pin	Pin	Termination B
H.F. junction box (SKT 2)	A	Term 1	Operate lamp
	B	Term 1	
	C	Term 3	Tune lamp
	E	Term 2	
	D	Not used	
	F	Not used	

CONNECTOR TYPE 5441/5

Termination A	Pin	Pin	Termination
H.F. junction box (PL2)	A	32	B Transmitter/ receiver H.F. mounting 390J-1 (SKT 1)
	B	33	
	C	34	
	D	35	
	E	36	
	F	38	
	G	39	
	H	40	
	J	41	
	K	45	
	L	46	
	M	47	
	N	48	
	P	49	
	R	50	
	S	51	
	T	52	
	U	59	
	V	25	
	X	Not used	

CONNECTOR TYPE 5441/5 — *continued*

Termination A	Pin	Pin	Termination	
H.F. junction box (PL2)	Y	Not used	B Transmitter/ receiver H.F. mounting 390J-1 (SKT 1)	
	Z	30		
	a	58		
	b	57		
	e	11		
	f	26		
	g	5		
	h	10		
	i	24		
	j	56		
	p	31		
	q	55		
	c	Term 4		B1 (390J-1) TB1
	d	Term 5		
	r	Term 2		B2 (390J-1) TB2 B3 (390J-1) J2
	m	J2		

CONNECTOR TYPE 5441/6

Termination A	Pin	Pin	Termination
Transmitter/ receiver H.F. mounting 390J-1 (T.B.2)	Term 5	Term R8	B H.F. (Terminal block)
	Term 3	Term R7	
	Earth stud J2	EHF	B1 Earth stud

continued. . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR TYPE 5441/7			
Termination A	Pin	Pin	Termination B
Pressure bulkhead (H.F. A.C.1)	A	Term 1	Transmitter/ receiver H.F. mounting 390J-1 (T.B.2)
	B	Term 2	
	C	Earth Stud J2	

CONNECTOR TYPE 5441/10			
Termination A	Pin	Pin	Termination B
Pressure bulkhead (H.F. A.C.1A)	A	RRG2	No.2 distribution box
	B	EG	
	C	Screen	

CONNECTOR TYPE 5441/8			
Termination A	Pin	Pin	Termination B
Aerial tuning unit (J103)	-	-	Transmitter/ receiver H.F. (J3) (Auxiliary receiver aerial)

CONNECTOR TYPE 5441/11			
Termination A	Pin	Pin	Termination B
H.F. aerial mast	-	-	Aerial tuning unit

Note. . .

For cable assembly N27 refer to Sect.5, Chap.1, Group R & S.

CONNECTOR TYPE 5441/9			
Termination A	Pin	Pin	Termination B
Aerial tuning unit (J2)	-	-	Transmitter/ receiver (J4 Aerial)

Part 5 DECCA V.O.R. (A.R.I.23247/3)

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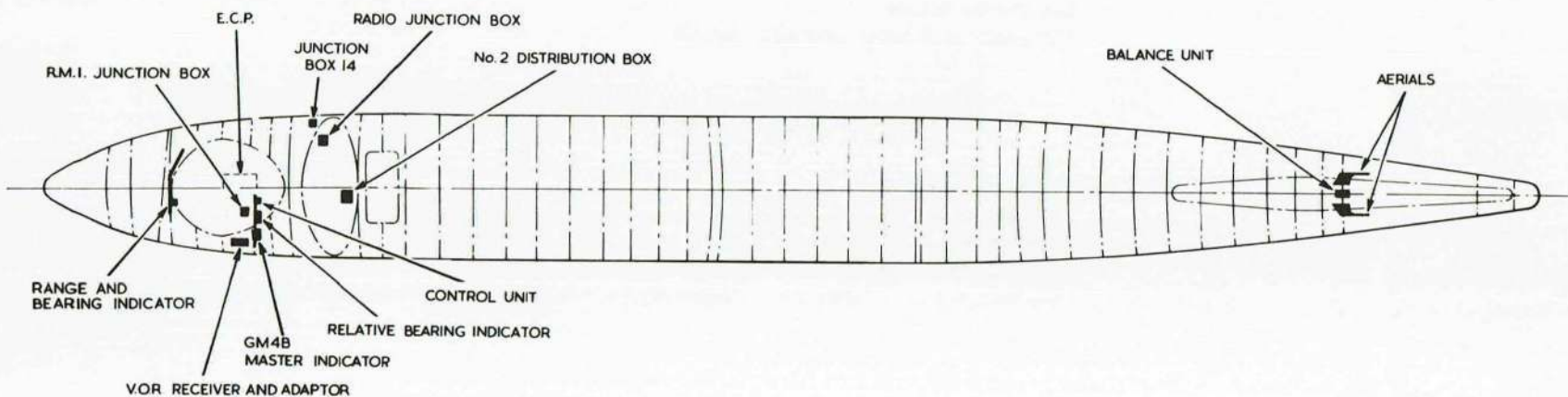
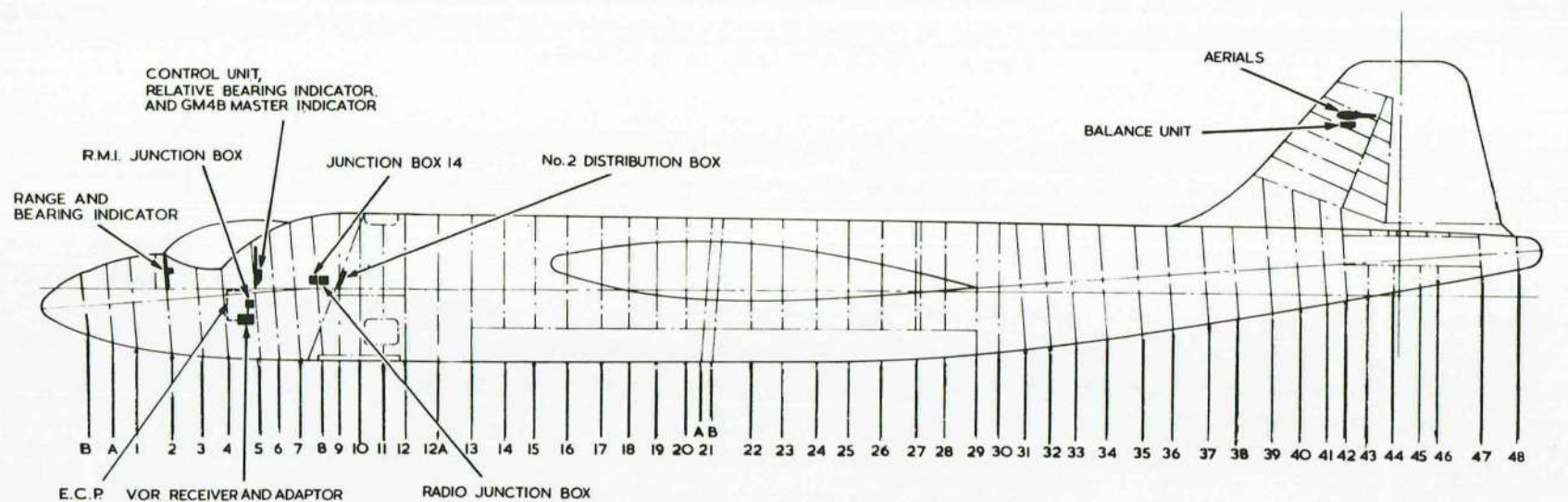
DESCRIPTION	Para.		Para.
<i>General</i>	1	<i>V.O.R. aerials and balance unit</i>	11
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FIG. I. LOCATION DIAGRAM-DECCA VOR.(A.R.I. 23247/3)

DESCRIPTION**General**

1. The Decca V.O.R. (A.R.I.23247/3) is an airborne navigation system which operates in conjunction with ground station V.O.R. (V.H.F. omnidirectional radio range) beacon transmissions in the frequency range of 108.0 to 117.95 MHz. Audio signals from the V.O.R. receiver are fed into the intercommunication system (*Part 6*) via the control unit and the radio junction box to provide identification signals of the selected V.O.R. ground station.

2. The locations of the main items of equipment are shown in fig.1 and interconnections in fig.2. Table 1 gives equipment details and Table 2 gives connector and cable assembly details. Detailed technical and servicing information on the equipment is contained in A.P.116B-0447-16.

3. The installation comprises the following main items of equipment:-

V.O.R. receiver
 V.O.R. adapter unit
 Mounting tray
 Control unit
 Range and bearing indicator
 Relative bearing indicator
 R.M.I. junction box
 Balance unit
 V.O.R. aerials

V.O.R. receiver

4. The V.O.R. receiver together with the V.O.R. adapter unit are located in a mounting tray on a shelf beneath the navigator's table. Electrical connections to the units are made via two 41-way sockets (SKT1 and 2) at the rear of the mounting tray and complementary mating plugs at the rear of each unit. The aerial connection from the balance unit is via a coaxial socket on the mounting tray.

V.O.R. adapter unit

5. The V.O.R. adapter unit receives heading information from the GM4B compass master indicator and navigational data from the V.O.R. receiver which is processed to provide reference outputs to the pilot's range and bearing indicator and the navigator's relative bearing indicator via the R.M.I. junction box.

Control unit

6. The control unit, idented NAV, is located on the right of the navigator's instrument panel. Electrical connections to the unit are made via a 32-pole plug on the rear of the unit. The front panel is edge-lit by integral 28-volt lamps, the brightness being controlled by the C.U. LIGHTS dimmer switch on the left of the navigator's instrument panel.

7. On the front panel of the unit are two controls. Each control comprises an outer switch and an inner frequency selector, functioning as follows:-

(1) The left-hand knurled outer switch, idented A-M-TEST provides selection of either automatic or manual V.O.R. The TEST position is non-effective in this installation.

(2) The right-hand knurled outer switch, idented 'VOL', controls the gain of the audio signals fed to the intercommunication system.

(3) The left-hand inner control selects the tens and units MHz part of the required frequency during manual operation.

(4) The right-hand inner control selects the hundreds and tens kHz part of the required frequency.

The frequency selected is displayed in a window in the front panel adjacent to and above the controls.

Range and bearing indicator

8. The range and bearing indicator is located on the pilot's instrument panel. It is supplied via the R.M.I. junction box with bearing information, to the double pointer, from the V.O.R. adapter unit, distance information from the D.M.E. distance/ground speed indicator (*Sect.6, Chap.2, Part 1*), and

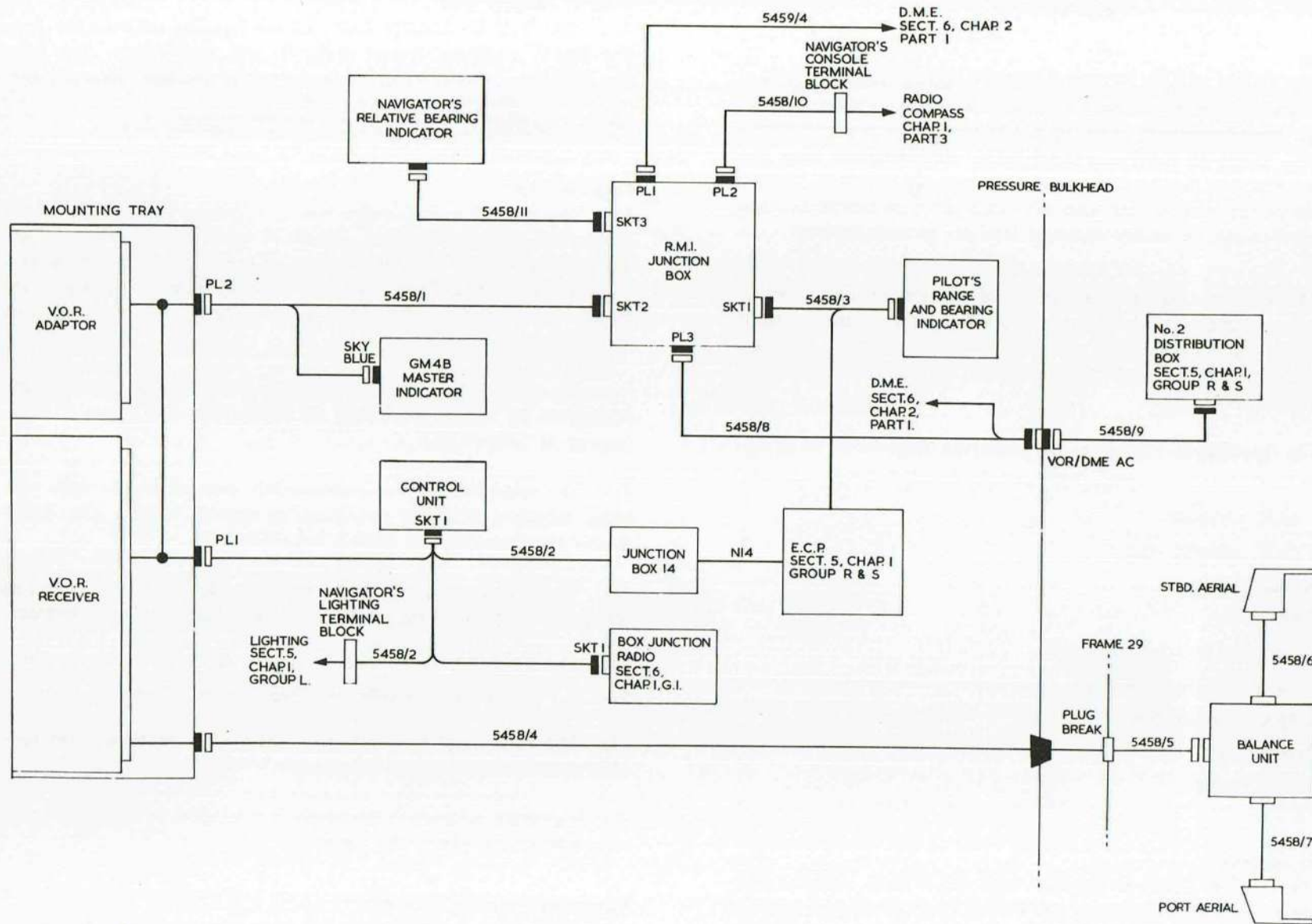


FIG. 2. INTERCONNECTION DIAGRAM-DECCA VOR.(A.R.I.23247/3)

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bearing information to the single pointer from the radio compass (*Part 3*). Electrical connections are made through a 32-pole plug at the rear of the unit. Illumination is by a bridge lamp mounted above the dial, the brightness being controlled by the MISC. INST. dimmer switch on the pilot's coaming panel.

Relative bearing indicator

9. The relative bearing indicator is located to the right of centre on the lower section of the navigator's instrument panel. It is supplied via the R.M.I. junction box with bearing information from the V.O.R. adapter unit. Electrical connections are made through a plug at the rear of the unit. Illumination is by red pillar lamps mounted above the dial, the brightness being controlled by the PANEL LIGHTS dimmer switch mounted on the left hand side of the navigator's instrument panel.

R.M.I. junction box

10. The R.M.I. junction box is mounted on the under surface of the navigator's table and performs the function of an interface between the pilot's and navigator's indicators, the V.O.R. adapter unit, the D.M.E. junction box (*Sect.6, Chap.2, Part 1*), and Radio compass (*Part 3*).

V.O.R. aeriels and balance unit

11. The V.O.R. aeriels are mounted symmetrically near the top of the aircraft fin, one element to port, the other to starboard. The signal from each element is fed via a balanced connector (supplied with the aerial) to a balance unit located just beneath the aerial assembly within the fin at rib 4. The output from the balance unit is fed via an unbalanced coaxial connector to the V.O.R. receiver mounting tray assembly. The balance unit transforms the balanced input to the unbalanced output.

Power supplies

12. The V.O.R. system is supplied with 28-volts d.c from fuses 66 and 231 in the E.C.P. In addition, the V.O.R. adapter unit and the indicators are supplied with 26-volts 400 Hz a.c. from fuses 136 and 137 in the No.2 distribution box.

OPERATION

Frequency selection

13. Selection of the system's operating frequency is made on the control unit (*para.6*). A two out of five code method is used to alter the solid state logic circuits in the receivers local oscillators. These logic circuits determine which crystals are selected according to the frequency required.

Principles of V.O.R. operation

14. The aerial of a V.O.R. ground beacon is omnidirectional. The signal radiated is a V.H.F. carrier amplitude modulated by a beacon identification signal and a 9960 Hz signal which is itself amplitude modulated at a frequency of 30 Hz, the 30 Hz reference signal. The amplitude of this 30 Hz modulation is slaved to the speed of a reflector which rotates around the aerial to produce a cardioid shaped transmitted beam rotating at 30 rev/min. This provides a further 30 Hz amplitude modulation (the 30 Hz variable signal) of the transmitted signal.

15. In the aircraft system, a comparison is made between the phases of the 30 Hz reference and 30 Hz variable signals. The phase of the variable 30 Hz reference signal received depends on the position of the aircraft relative to the ground beacon. The voltages resulting from the above comparison are used to control the indicator pointers.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General

16. Servicing, other than that listed in the aircraft Supplementary Servicing Schedules, consists of regular inspection of the units and cable assemblies for physical damage and security of mounting. The cable assembly details given in Table 2 are for use during routine continuity checking and fault diagnosis.

TABLE 1

Equipment details

Equipment	Type/Part No.	Ref.No.	Location	A.P. Reference
V.O.R. receiver	RV671	10D/6267139	Navigator's station	116B-0447-16
V.O.R. adapter unit	RVA671	10AC/6267142	Navigator's station	
Mounting tray	53APA/2	5826-99-631-3384	Navigator's station	
Control unit	BN671-4	◀ 5826-99-630-8289	Navigator's station	
Master indicator	E5	6B/3831 ▶	Navigator's station	
Range and bearing indicator	ID663U/A	10Q/6306137	Pilot's station	
Relative bearing indicator	9552	10Q/4418791	Navigator's station	
R.M.I. junction box			Navigator's station	
Balance unit	LRU13314A	10AD/1078789	Fin	
Aerials	Chelton 12-33S/N64	10B/6309635	Fin (port and stbd)	

TABLE 2

Connector and cable assembly details

CONNECTOR TYPE 5458/1				CONNECTOR TYPE 5458/2			
Termination A	Pin	Pin	Termination	Termination A	Pin	Pin	Termination B
Mounting tray (PL2)	D	D	B R.M.I. Junction box (SKT 2)	Mounting tray (PL1)	A	Not used	B Control unit (BN 671-4) (SKT 1)
	E	E			B	L	
	F	F			C	J	
	G	G			D	K	
	H	H			E	Y	
	J	J			F	Not used	
	K	K	G		d		
	L	C	H		a		
	M	E	J		b		
	N	D	K		Z		
	P	A	L		A		
	R	B	M		g		
	S		N		B		
	T		P		b		
U	Not used	R	E				
V		S	D				
t	Screens	T	C				
		U	W				
		V	F				
		W	G				
		X	X				
		Y	V				
		Z	P				
		b	h				
		a					
		E25					
		RR4	M				
		A-	H				
		B-	c				
		LL61	j				
		B1 Junction box 14					
		B3 Radio junction box (SKT 1)					
		B2 Navigator's lighting T.B.					

continued . . .

TABLE 2 Connector and cable assembly details — *continued*

CONNECTOR TYPE 5458/3			
Termination A	Pin	Pin	Termination B
	A	A	
	B	B	
	C	C	
	D	D	
	E	E	
	F	F	
	G	G	
	H	H	
	J	J	
	K	K	
	L	L	
	M	M	
	N	N	
	P	P	
	R	R	
	S	S	
	T	T	
	U	U	
	V	V	
	W	W	
	Y	Y	
	Z	Z	
	a	a	
	b	b	
	c	c	
	d	d	
	e	e	
	f	f	
	g	g	
	h	Not used	
	i	Not used	
	j	RR42	
	X	Fuse 66	

B
R.M.I.
Junction box
(SKT 1)

B1
E.C.P.

Pilot's
range and
bearing
indicator

CONNECTOR TYPE 5458/4			
Termination A	Pin	Pin	Termination B
Mounting tray	-	UR67	- Frame 29 plug break

CONNECTOR TYPE 5458/5			
Termination A	Pin	Pin	Termination B
Balance unit	-	UR67	- Frame 29 plug break

CONNECTOR TYPE 5458/6			
Termination A	Pin	Pin	Termination B
Balance unit (port)	-	UR43	- Starboard aerial

CONNECTOR TYPE 5458/7			
Termination A	Pin	Pin	Termination B
Balance unit (stbd)	-	UR43	- Port aerial

continued. . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR TYPE 5458/8

Termination A	Pin	Pin	Termination
Pressure bulkhead (VOR/DME AC)	A	A	B R.M.I. junction box (PL3)
	B	B	
	C	C	
	D	D	B1 D.M.E. junction box (PL2)
	E	B	
	F	A	

CONNECTOR TYPE 5458/10

Termination A	Pin	Pin	Termination B
R.M.I. junction box (PL2)	A	1	Navigator's console (Terminal block)
	B	2	
	C	6	
	D	3	

CONNECTOR TYPE 5458/9

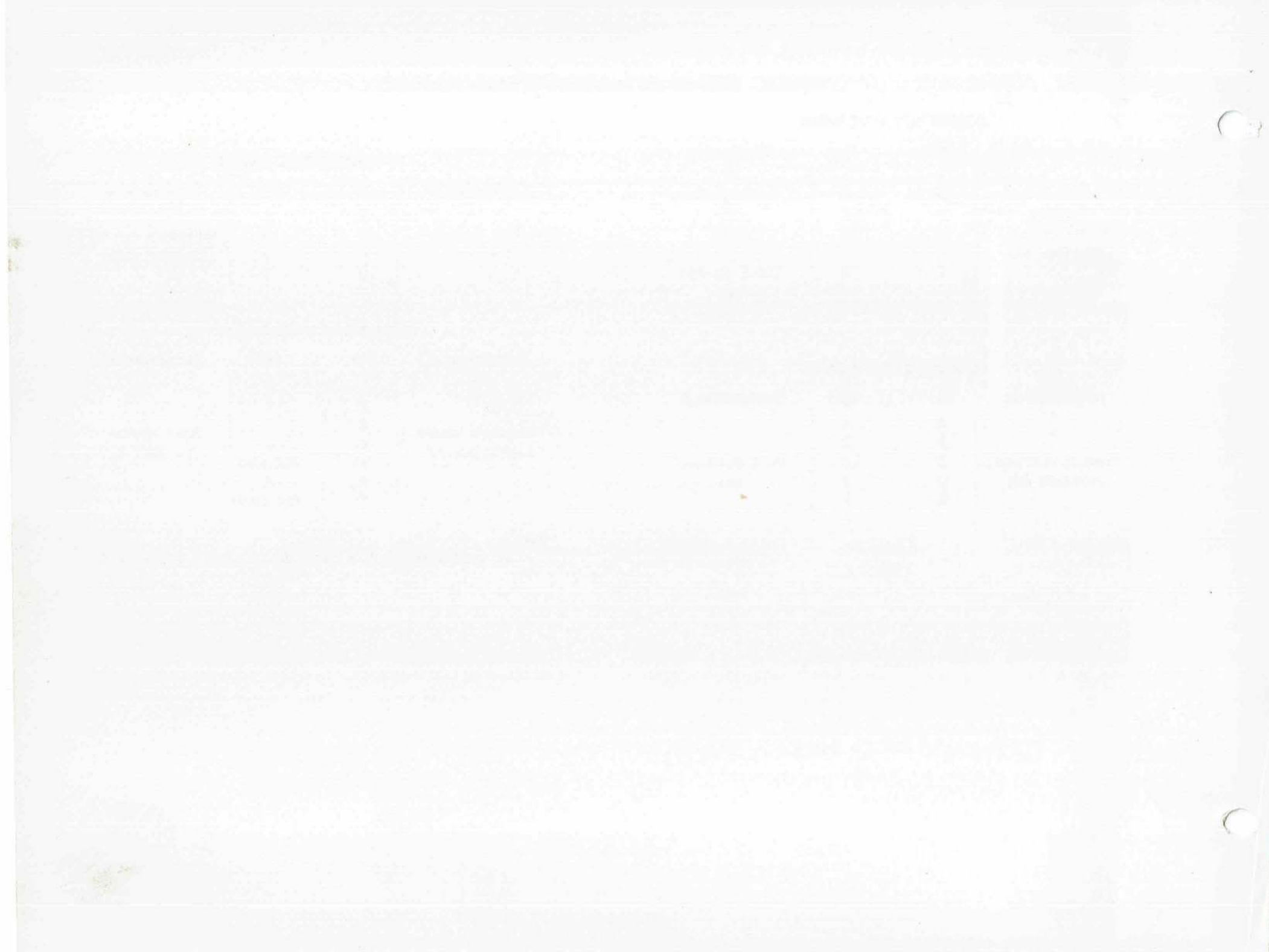
Termination A	Pin	Pin	Termination B
Pressure bulkhead (VOR/DME AC)	A	A	No. 2 distribution box
	B	B	
	C	C	
	D	D	
	E	E	
	F	F	

CONNECTOR TYPE 5458/11

Termination A	Pin	Pin	Termination B
Navigator's relative bearing indicator	1	B	R.M.I. junction box (SKT 3)
	2	E	
	3	C	
	4	D	
	5	Not used	
	6	A	
	7	Not used	

Note. . .

For cable assembly N14 refer to Sect.5, Chap.1, Group R & S.



Part 6 INTERCOMMUNICATION (A.R.I.18089)

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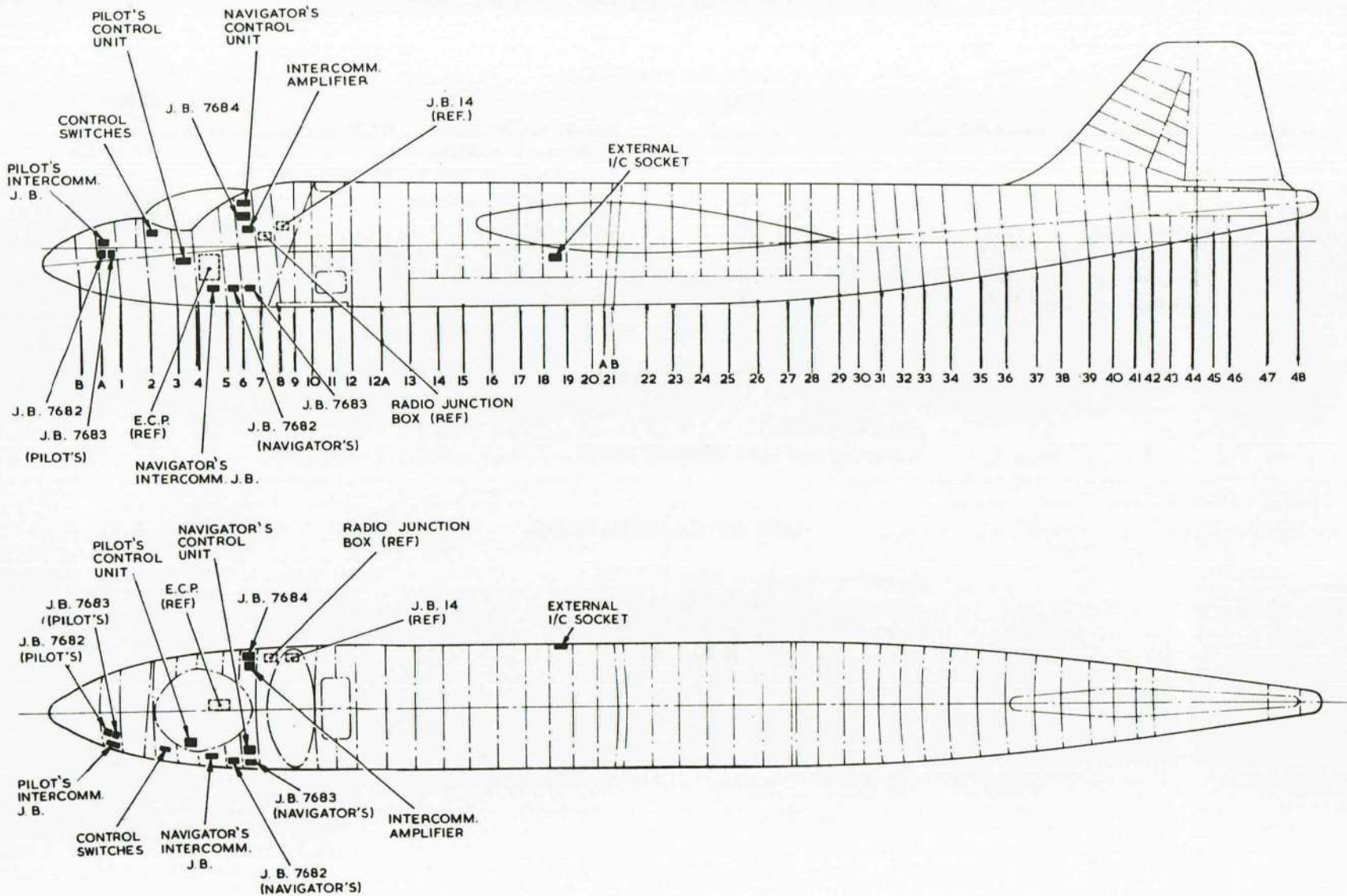
DESCRIPTION	Para.		Para.
		<i>I.L.S./A.D.F. change-over switch</i>	16
		<i>Intercomm. sockets</i>	17
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187 827003 1

FIG. 1. LOCATION DIAGRAM-INTERCOMMUNICATION (A.R.I. 18089)

DESCRIPTION

General

1. The A.R.I.18089 intercommunication installation provides facilities for distributing intercomm. signals between crew positions, independent selection of the available transmitter/receiver services at each crew position and the mixing of received signals without introducing adverse effects. Both the pilot and navigator are provided with press-to-transmit switches; the pilot's on the control column, the navigator's on his instrument panel. The following services are available to each crew member:-

IC	} Receive only
V.U.H.F.	
H.F.	
Decca V.O.R.	
I.L.S.	
Radio compass (A.D.F.)	
D.M.E.	

2. Detailed technical and servicing information on the equipment is contained in A.P.116N-0105-1.

3. The locations of the main items of equipment are shown in fig.1 and interconnections in fig.2. Table 1 gives equipment details and Table 2 gives connector and cable assembly details.

4. The installation comprises the following main items of equipment:-

Control unit. Type 7681A (2 off)
 Junction box. Type 7682 (2 off)
 Junction box. Type 7683 (2 off)
 Junction box. Type 7684
 Amplifier. Type A1961
 Mounting tray. Type 936
 Intercomm. junction box (2 off)

Control unit

5. Two control units are provided, one mounted on the pilot's port console, the other on the port wall at the navigator's station.

The following components are mounted on the front face of each unit:-

Three volume controls	LISTEN ONLY
Four switches	
SPEAK-LISTEN switch	
CALL switch	
100 mA fuse	
Spare fuse	

6. The four switches and three volume controls, collectively annotated LISTEN ONLY, provide independent selection, or mixing of two or more of the services interconnected with the intercomm. (D.M.E., V.O.R. and I.C).

7. The SPEAK-LISTEN switch is a six position rotary switch annotated in a clockwise direction as follows:-

- (1) OFF
- (2) D.M.E.
- (3) V.O.R.
- (4) H.F.
- (5) V.U.H.F.
- (6) I.C

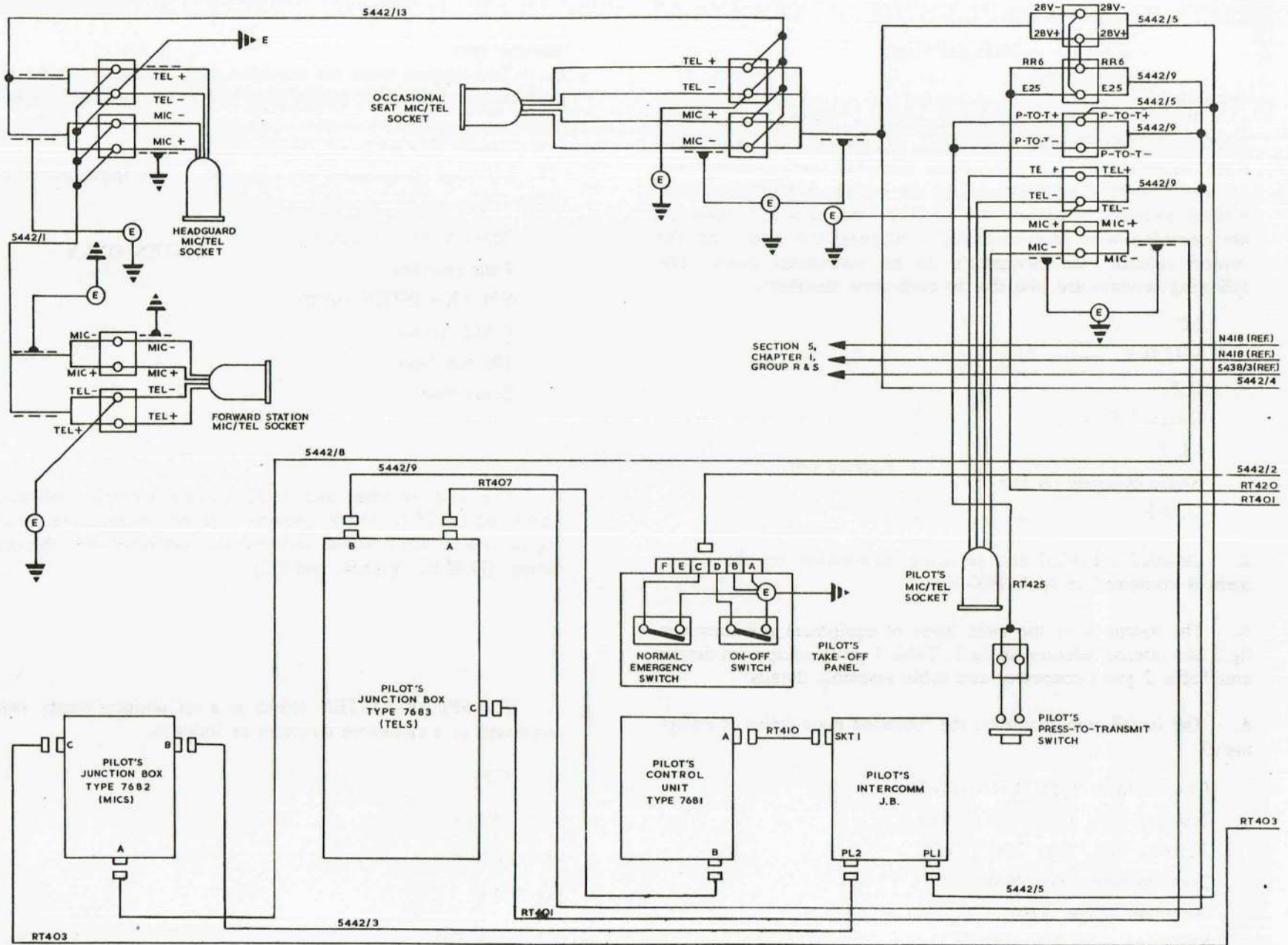


FIG. 2. INTERCONNECTION DIAGRAM — INTERCOMMUNICATION (A.R.I. 18089)

◀ CROSS REFERENCES ADDED ▶

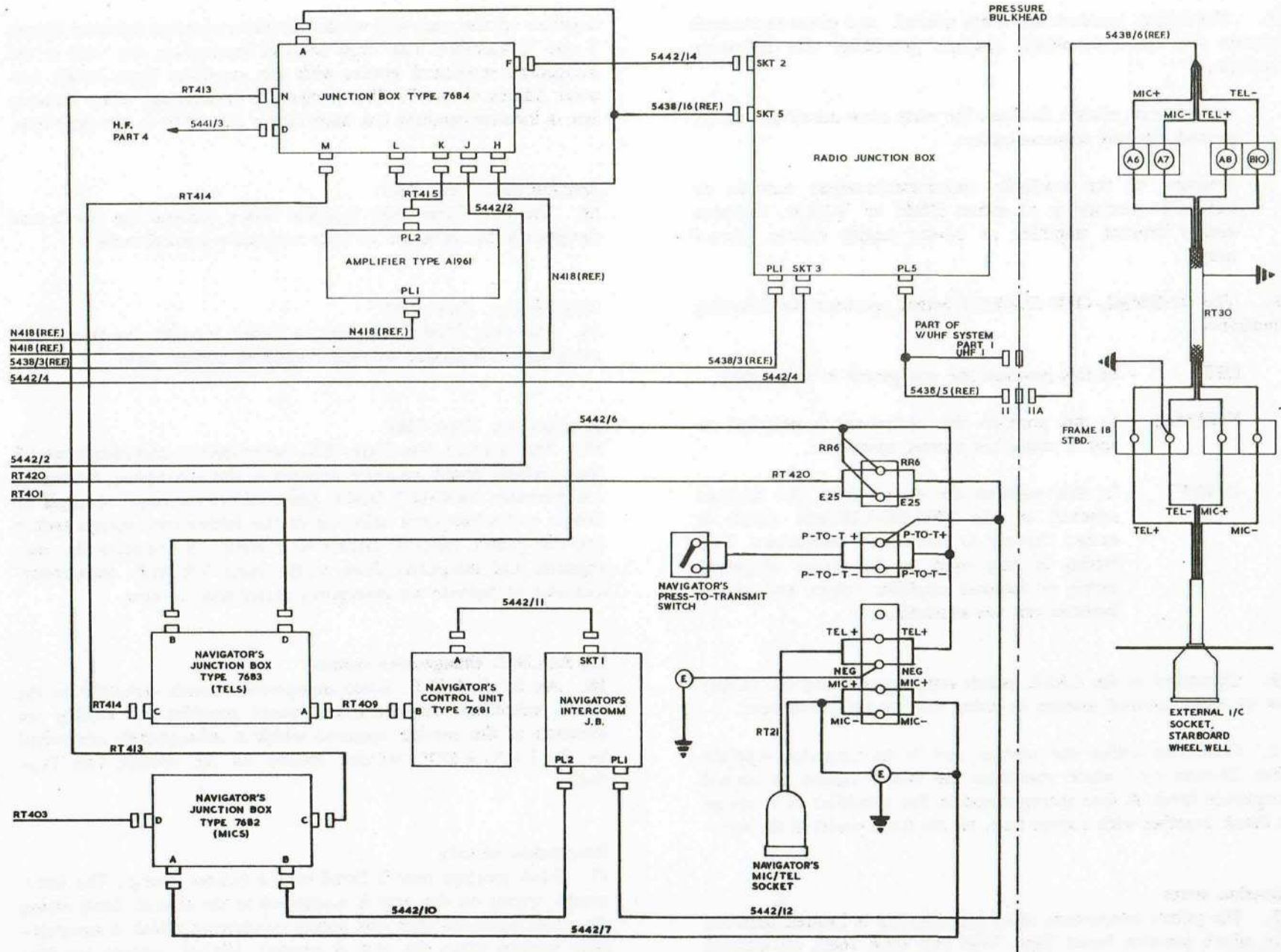


FIG. 2A. INTERCONNECTION DIAGRAM—INTERCOMMUNICATION (A.R.I. 18089)

◀ CROSS REFERENCES ADDED ▶

EB7 82 7003 1

8. The switch transfers the users mic/tel. and press-to-transmit circuits to the intercomm. system, providing the following facilities:-

Provision of mic/tel. facilities for each crew member and for ground external communication.

Selection of the available transmitter/receiver services or DIRECT monitoring of either DME or V.O.R. receivers during internal amplifier or power supply failure (*para.9 refers*).

9. The NORMAL-OFF-DIRECT switch provides the following facilities:-

OFF - In this position the equipment is inoperative.

NORMAL - In this position the equipment is switched on and is ready for normal operation.

DIRECT - In this position the signal from the receiver selected at the SPEAK-LISTEN switch is routed directly to the crew's telephones. This facility is only used in the event of power supply or internal amplifier failure and mixing facilities are not available.

10. Operation of the CALL switch superimposes the I/C facility on all other selected sources in order to alert crew members.

11. Contained within the control unit is an amplifier supplied with 28-volts d.c., which maintains the mixed signals at normal amplitude level. A fuse incorporated in the amplifier H.T. circuit is fitted, together with a spare fuse, on the front panel of the unit.

Junction boxes

12. The pilot's intercomm. relay junction box is located between the pilot's junction boxes Type 7682 and Type 7683, all situated between frames 1 and A on the port side of the nose. The navigator's junction boxes Type 7682 and Type 7683 are located

together on the port wall of the navigator's station between frames 5 and 7. Junction box Type 7684 is located on the wall at the navigator's starboard station with the amplifier Type A1961 between frames 6 and 7. The navigator's intercomm. relay junction box is located beneath the shelf under the table to the port side.

Junction box, Type 7682

13. The two Type 7682 junction boxes connect the pilot's and navigator's microphones to their respective control units.

Junction box, Type 7683

14. The two Type 7683 junction boxes connect the pilot's and navigator's telephones to their respective control units.

Junction box, Type 7684

15. The junction box Type 7684 interconnects and distributes all the available communication services to the intercomm. system. It also provides the CALL facility (*para.10*). In the event of amplifier failure and subsequent selection of the intercomm. master switch (on the pilot's take-off panel) to EMER., it connects the microphone and telephone lines to the main V/U.H.F. transmitter/receiver to provide an emergency intercomm. system.

I.L.S./A.D.F. change-over switch

16. An I.L.S./A.D.F. audio change-over switch mounted on the pilot's miscellaneous instrument panel provides the facility for selection of the service required which is subsequently controlled by the I.L.S./A.D.F. volume control on the control unit Type 7681.

Intercomm. sockets

17. Each ejection seat is fitted with a mic/tel. socket. The intercomm. wiring on the seat is connected to the aircraft fixed wiring via a quick-release plug and socket connection which is automatically broken when the seat is ejected. Mic/tel. sockets are also provided at the navigator's forward station, the occasional seat position and, for servicing purposes, a mic/tel. socket is mounted

on the head guard adjacent to the entrance door. Ground external communication is facilitated by a mic/tel. socket mounted on the fuselage wall in the starboard wheel bay, where its connector utilizes T.B. terminals of the V/U.H.F. system (*Part 1, this Chapter*).

Intercomm. NORMAL/EMERGENCY and ON/OFF switches

18. The intercomm. NORMAL/EMERGENCY switch on the pilot's take-off panel controls both the Type A1961 amplifier and the amplifier section of the V/U.H.F. set (A.R.I.23143/1) or the standby UHF set (A.R.I.23159/1) whichever is in use, via the Type 7684 junction box. When the switch is selected to NORMAL the intercomm. amplifier provides the intercomm. service. In the event of amplifier failure, selecting the switch to EMERGENCY connects the amplifier section of the V/UHF or standby UHF set then in use to the intercomm. system. The intercomm. ON/OFF switch, located on the pilot's take-off panel, controls the power supply to the Type A1961 amplifier via the Type 7684 junction box.

Power supplies

19. The 28-volt d.c. supply to the Type A1961 amplifier is fed

from fuse 87 in the ECP. Fuse 88 in the ECP supplies the energizing voltage for the control relays within the junction box Type 7684. The 28-volt d.c. supply to the radio junction box is fed from fuses 89 and 229 in the ECP. All intercomm. supplies from the ECP pass through J.B.14, which is located on the starboard wall at the navigator's station between frames 8 and 9.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General

20. Servicing other than that listed in the aircraft Supplementary Servicing Schedules, consists of regular inspection of the units and cable assemblies for physical damage and security of mounting. The cable assembly details given in Table 2 are for use during routine continuity checking and fault diagnosis.

TABLE 1

Equipment details

Equipment	Type/Part No.	Ref.No.	Location	A.P. Reference
Control unit (2)	7681	10L/16320	[Pilot's port console Navigator's port wall	116N-0105-1
Amplifier	◀ A1961	10U/2237295	Navigator's station, starboard	
Mounting tray	X936	10AJ/121	Navigator's station, starboard	
Junction box (2)	7682	10D/19820	[Nose, frames A-1, port Navigator's port wall ▶	
Junction box (2)	7683	10D/19821	[Nose, frames A-1, port Navigator's port wall	
Junction box	7684	10D/19822	Navigator's station, starboard	
Intercomm. junction box (2)	60MU	Dwg 32412	[Nose, frames A-1, port Beneath navigator's table	
External I/C socket	3570	10HA/9326	Fuselage wall, starboard wheel well	

TABLE 2

Connector and cable assembly details

CONNECTOR RT 21				CONNECTOR RT 401 — <i>continued</i>			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Navigator's seat mic/tel socket	MIC+	MIC+	Terminal blocks	Pilot's J.B.7683 outlet C	V	V	Navigator's J.B.7683 outlet D
	MIC-	MIC-			W	W	
	TEL+	TEL+			X	X	
	TEL-	NEG			Y	Y	
				Z	Z		

CONNECTOR RT 401				CONNECTOR RT 403			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Pilot's J.B.7683 outlet C	A	A	Navigator's J.B.7683 outlet D	Pilot's J.B.7682 outlet C	A	A	Navigator's J.B.7682 outlet D
	B	B			B	B	
	C	C			C	C	
	D	D			D	D	
	E	E			E	E	
	F	F			F	F	
	G	G			G	G	
	H	H			H	H	
	J	J			J	J	
	K	K			K	K	
	L	L			L	L	
	M	M			M	M	
	N	N			N		
	O	O			O		
	P	P			P		
	Q	Q			Q		
	R	R			R		
	S	S			S		
	T	T			T		
	U	U			U		

continued. . .

TABLE 2 Connector and cable assembly details — *continued*

CONNECTOR RT 407				CONNECTOR RT 409			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Pilot's J.B.7683 outlet A	A	A	Pilot's control unit Type 7681 outlet B	Navigator's control unit Type 7681 outlet B	A	A	Navigator's J.B.7683 outlet A
	B	B			B	B	
	C	C			C	C	
	D	D			D	D	
	E	E			E	E	
	F	F			F	F	
	G	G			G	G	
	H	H			H	H	
	J	J			J	J	
	K	K			K	K	
	L	L			L	L	
	M	M			M	M	
	N	N			N	N	
O	O	O	O				
P	P	P	P				
Q	Q	Q	Q				
R	R	R	R				
S	S	S	S				

continued. . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR RT 410				CONNECTOR RT 414			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Pilot's intercomm. J.B. (SKT.1)	A	A	Pilot's control unit Type 7681 outlet A	Navigator's J.B.7683 outlet C	A	A	J.B.7684 outlet M
	B	B			B	B	
	C	C			C	C	
	D	D			D	D	
	E	E			E	E	
	F	F			F	F	
	G	G			G	G	
	H	H			H	H	
	J	J			J	J	
	K	K			K	K	
	L	L			L	L	
	M	M			M	M	
	CONNECTOR RT 413						
Termination A	Pin	Pin	Termination B				
Navigator's J.B.7682 outlet C	A	A	J.B.7684 outlet N				
	B	B					
	C	C					
	D	D					
	E	E					
	F	F					
	G	G					
	H	H					
	J	J					
	K	K					
	L	L					
	M	M					

continued . . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR RT 415				CONNECTOR 5442/1			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Amplifier Type A1961 PL2	A	A	J.B.7684 outlet K	Forward station mic/tel terminal block	TEL+	TEL+	Headguard mic/tel terminal block
	B	B			TEL-	TEL-	
	C	C			MIC+	MIC+	
	D	D			MIC-	MIC-	
	E	E					
	F	F					

CONNECTOR RT 420				CONNECTOR 5442/2			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Navigator's station terminal block	RR6	RR6	Pilot's station termination block	J.B.7684 outlet J	A	A	Pilot's take- off panel
	E25	E25			B	B	
			C		C		
			D		D		

CONNECTOR RT 425				CONNECTOR 5442/3			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Crosstube terminal block starboard	P to T+	P to T+	Control Column base terminal block	Pilot's intercomm. J.B. PL2	A	A	Pilot's J.B.7682 outlet B
	P to T-	P to T-			B	B	
			C		C		
			D		D		
			E		E		
			F		F		
			G		G		
			H		H		
			J		J		
			K		K		
			L		L		
			M		M		

continued . . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 5442/4				CONNECTOR 5442/7			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Radio junction box. SKT 3	A	TEL+	Occasional seat mic/tel terminal block	J.B.7682 outlet A	A	MIC+	Navigator's mic terminal block.
	B	TEL-			B	MIC-	
	C	MIC-		Pilot's mic/tel terminal block			
	D	MIC+					
	E	28V+					
	F	28V-					
CONNECTOR 5442/5				CONNECTOR 5442/8			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Pilot's intercomm. J.B. PL1	A	28V+	Pilot's mic/tel terminal block	Pilot's J.B.7682 outlet A	A	MIC+	Pilot's mic terminal block
	B	28V-			B	MIC-	
	C	P to T					
CONNECTOR 5442/6				CONNECTOR 5442/9			
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B
Navigator's J.B.7683 outlet B	A	TEL+	Navigator's mic/tel terminal block	Pilot's J.B.7683 outlet B	A	TEL+	Pilot's mic/tel terminal block
	B	NEG			B	TEL-	
	C	RR6			C	RR6	
	D	E25			D	E25	
	E	P to T+			E	P to T+	
	F	P to T-			F	P to T-	

continued . . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 5442/10			
Termination A	Pin	Pin	Termination B
Navigator's intercomm. J.B. PL2	A	A	Navigator's J.B.7682 outlet B
	B	B	
	C	C	
	D	D	
	E	E	
	F	F	
	G	G	
	H	H	
	J	J	
	K	K	
	L	L	
	M	M	

CONNECTOR 5442/12			
Termination A	Pin	Pin	Termination B
Navigator's intercomm. J.B. PL1	A	28V+	Navigator's mic/ tel terminal block
	B	28V-	
	C	P to T+	

CONNECTOR 5442/13			
Termination A	Pin	Pin	Termination B
Occasional seat mic/tel terminal block	TEL+	TEL+	Headguard mic/tel terminal block
	TEL-	TEL-	
	MIC+	MIC+	
	MIC-	MIC-	

CONNECTOR 5442/11			
Termination A	Pin	Pin	Termination B
Navigator's control unit Type 7681 outlet A	A	A	Navigator's intercomm. J.B. SKT 1
	B	B	
	C	C	
	D	D	
	E	E	
	F	F	
	G	G	
	H	H	
	J	J	
	K	K	
	L	L	
	M	M	

CONNECTOR 5442/14			
Termination A	Pin	Pin	Termination B
J.B.7684 outlet F	A	A	Radio junction box SKT 2
	B	B	
	C	C	
	D	D	

CONNECTOR 5438/3*			
Termination A	Pin	Pin	Termination B
Radio junction box PL1	A	RR6	J.B.14
	B	R10	
	C	E25	

continued . . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 5438/5*				CONNECTOR 5438/6*			
Termination A	Pin	Pin	Termination	Termination A	Pin	Pin	Termination
Radio junction box PL5	A	A	B Pressure bulkhead (UHF1)	Pressure bulkhead (11A)	A	A	B J.B.157 (ILS TEL)
	B	B			B	B	
	C	C			B10	B1 Standby U.H.F. terminal block	
	D	D			A6		
	E	E			A7		
	F	F			A8		
	G	F	B2				
	H	A	B9				
	J	B	B5				
	K	C	B4	Not used			
	L	D	B3				
M	E						
N	F						
P	G						
R	H						
S	J						
T	K						
U	L						
	M						
CONNECTOR 5438/16*				CONNECTOR 5438/16*			
Termination A	Pin	Pin	Termination	Termination A	Pin	Pin	Termination
Radio junction box SKT 5	A	A	B1 J.B.7684 outlet A	Radio junction box SKT 5	A	A	B J.B.7684 outlet L
	B	B			B	B	
	C	C			C	C	
	D	D			D	D	
	E	E			B J.B.7684 outlet L		
	F	A	A				
	G	B	B				
	H	C	C				
	J	J	J				
	K	K	K				
	L	L	L				
M	M	M					
N	D	D					
P	E	E					

continued. . .

TABLE 2 Connector and cable assembly details — continued

CONNECTOR 5438/16* — continued

Termination A	Pin	Pin	Termination
Radio junction box SKT 5	R	F	B J.B.7684 outlet L
	S	G	
	T	H	

CONNECTOR RT30

Termination A	Pin	Pin	Termination B
Terminal block (S/BY UHF)	A6	MIC+	Terminal blocks Fr 18 stbd.
	A7	MIC-	
	A8	TEL+	
	B10	TEL-	

CONNECTOR N418

Termination A	Pin	Pin	Termination B
J.B.14	RR9	A	J.B.7684 outlet H
	E25	B	
J.B.14	E25	B	Amplifier A1961 PL1
	R3	A	

Note. . .

Connectors marked * are part of V/U.H.F. communication system.

Chapter 2 – RADAR INSTALLATION
(completely revised)

LIST OF CONTENTS

- General Information
- Part 1 D.M.E. (A.R.I.23238/5)
- Part 2 Decca Doppler 72 (A.R.I.5972/2) and G.P.I. Mk.4A
- Part 3 I.F.F./S.S.R. 1520 (A.R.I.23134/1)
- Part 4 Radar Altimeter (A.R.I.23219/4)

Note:- *A detailed list of contents will be found at the beginning of each part.*

GENERAL INFORMATION

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	DESCRIPTION	Para.		Para.
			<i>Lighting</i>	5
<i>General</i>	1		
<i>Power supplies</i>	4	<i>General</i>	6
			SERVICING	

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<i>Radar installation – navigator’s port station</i>	2
<i>Radar installation – navigator’s starboard station</i>	3
<i>Radar installation – navigator’s forward station</i>	4

DESCRIPTION

General

1. Information covering the aircraft radar systems is contained in this section. The installations covered are as follows:-

D.M.E. (A.R.I.23238/5)	(Pt.1)
Decca Doppler 72 (A.R.I.5972/2) and GPI Mk.4A	(Pt.2)
I.F.F./S.S.R. 1520 (A.R.I.23134/1)	(Pt.3)
Radar altimeter (A.R.I.23219/4)	(Pt.4)

2. A location diagram, an interconnection diagram, a table giving cable assembly pin connections and a table giving equipment details, covering type, location, reference number and publication reference, is included in each part.

3. Fig.1, fig.2, fig.3 and fig.4 show the positions of the various indicators, and control units at the pilot's and navigator's stations.

Power supplies

4. The radar installations require both a.c. and d.c. power supplies for their operation. Individual equipment power supplies are covered in each part. Detailed information on the power supplies is given in Sect.5, Chap.1, Group R and S.

Lighting

5. Illumination of the various controls and indicators is controlled by dimmer switches fitted on the pilot's coaming panel, above the port console and on the navigator's instrument panel. Detailed information on lighting circuits is given in Sect.5, Chap.1, Group L.

SERVICING

General

6. Servicing information on an individual item of equipment is given in the associated publication referred to in Table 1 of each part.

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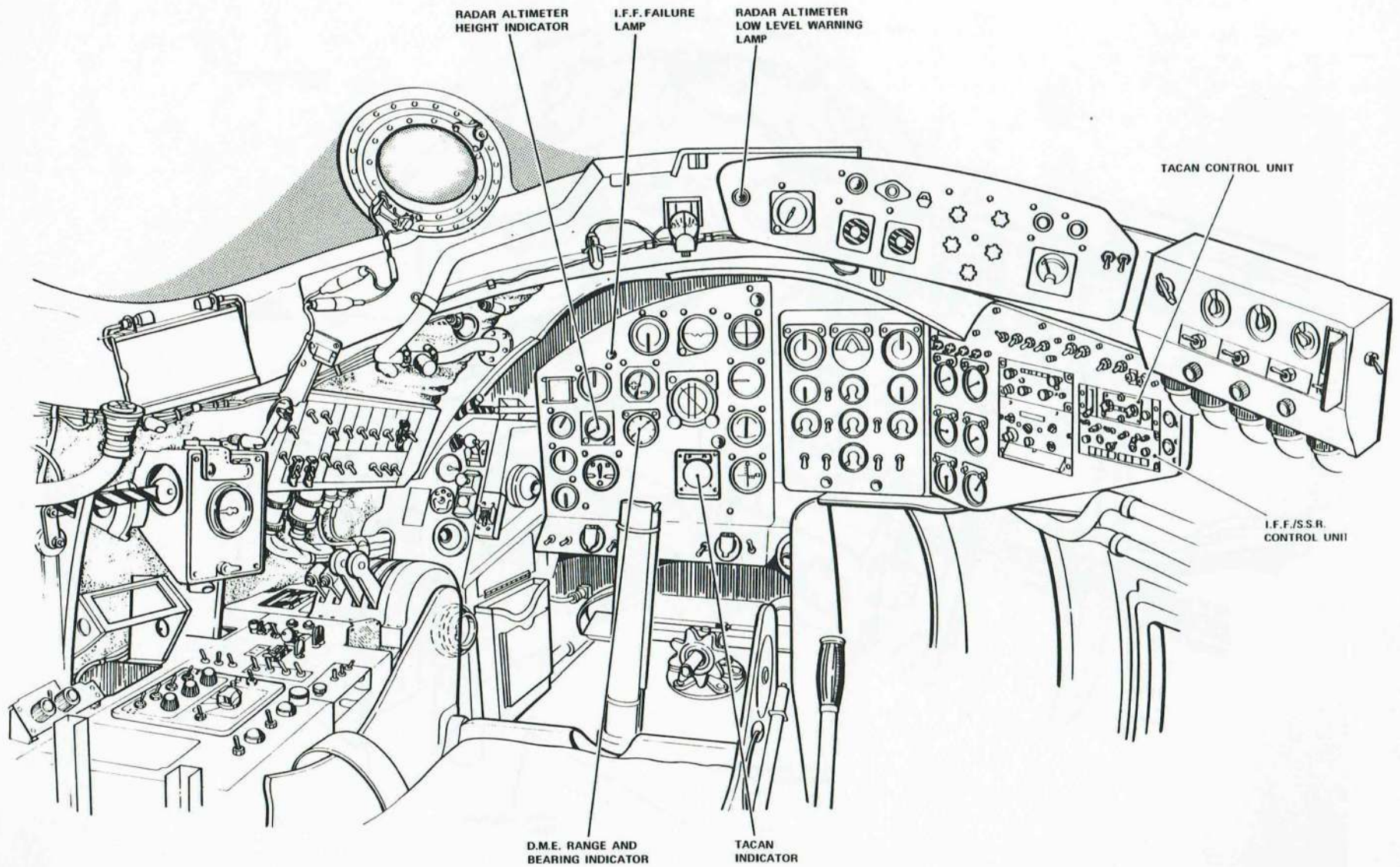


FIG. 1. RADAR INSTALLATION-PILOT'S STATION

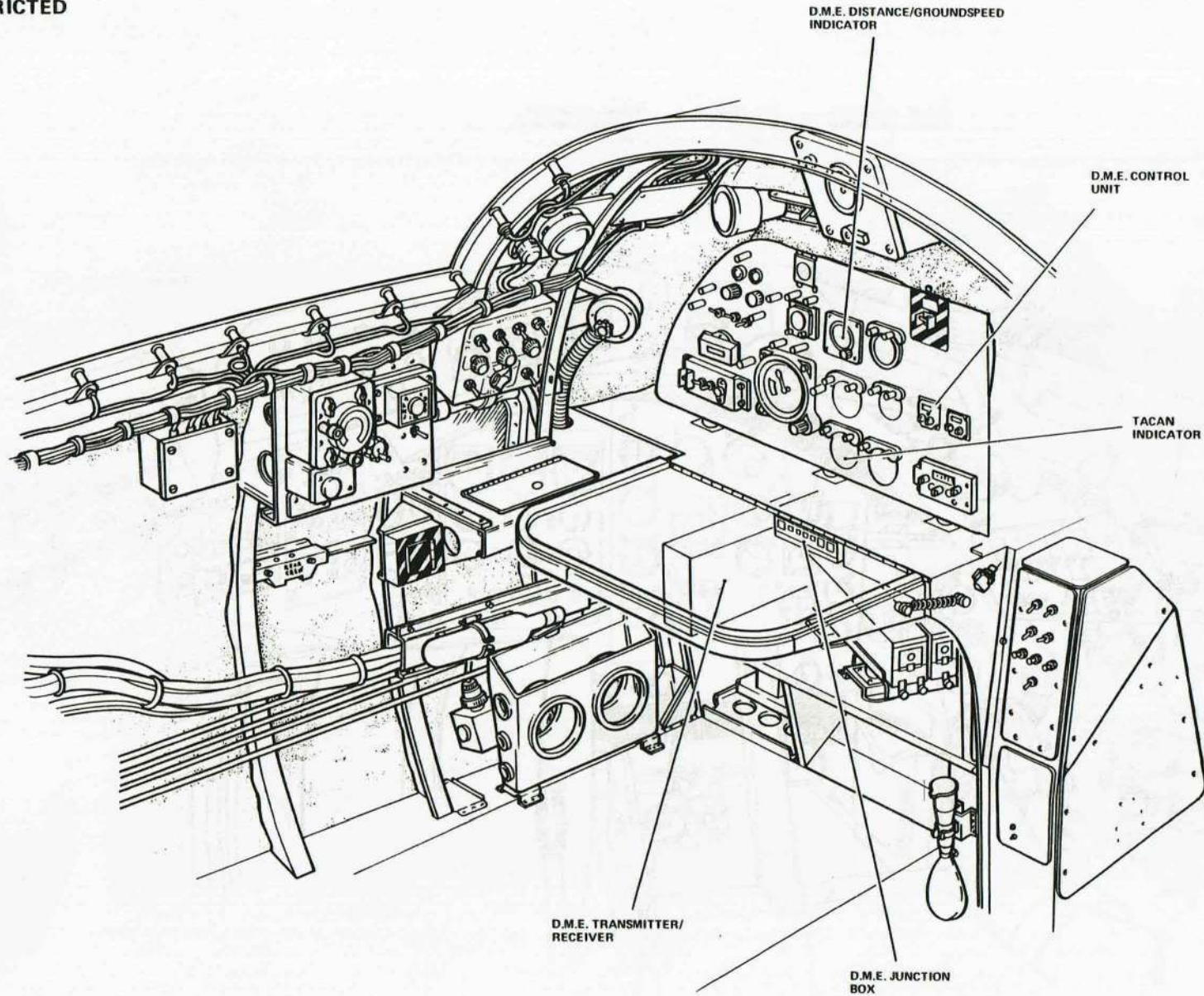


FIG. 2. RADAR INSTALLATION - NAVIGATOR'S PORT STATION

◀ SEM/CAN/0167/STC INCORPORATED ▶

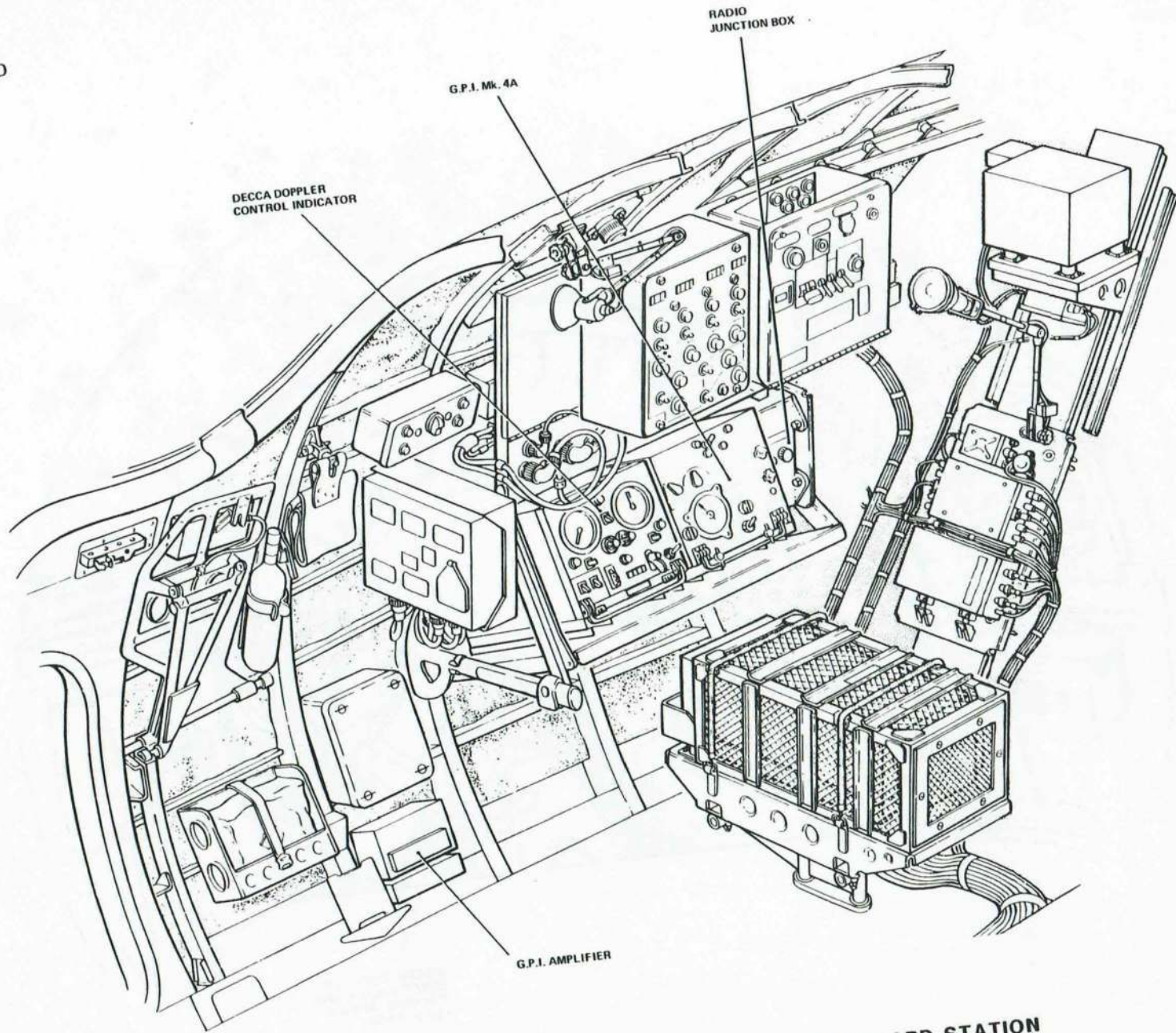


FIG.3. RADAR INSTALLATION - NAVIGATOR'S STARBOARD STATION

◀ SEM/CAN/0167/STC INCORPORATED ▶

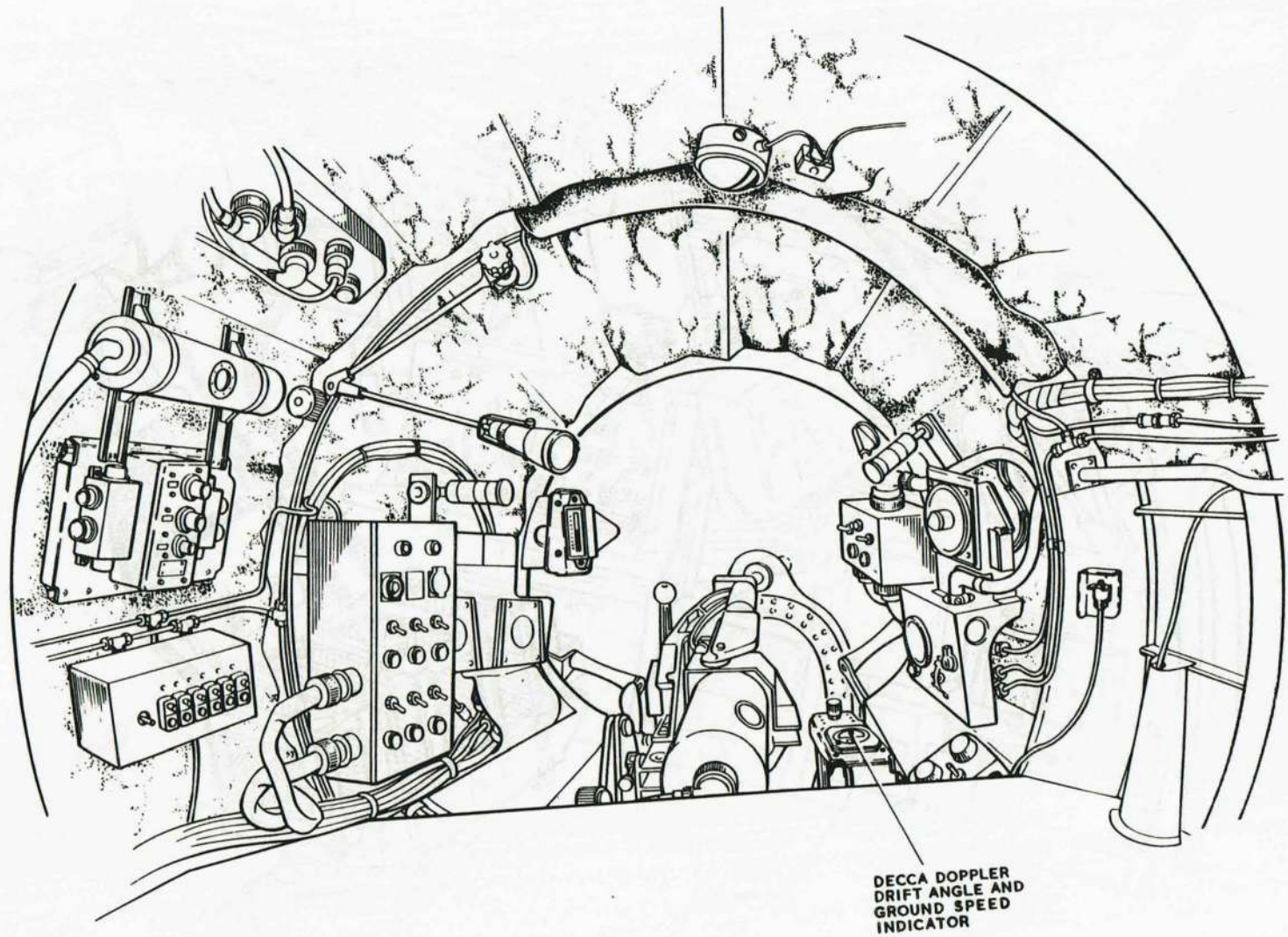


FIG. 4. RADAR INSTALLATION - NAVIGATOR'S FORWARD STATION

Part 1 D.M.E. (A.R.I.23238/5)

LIST OF CONTENTS

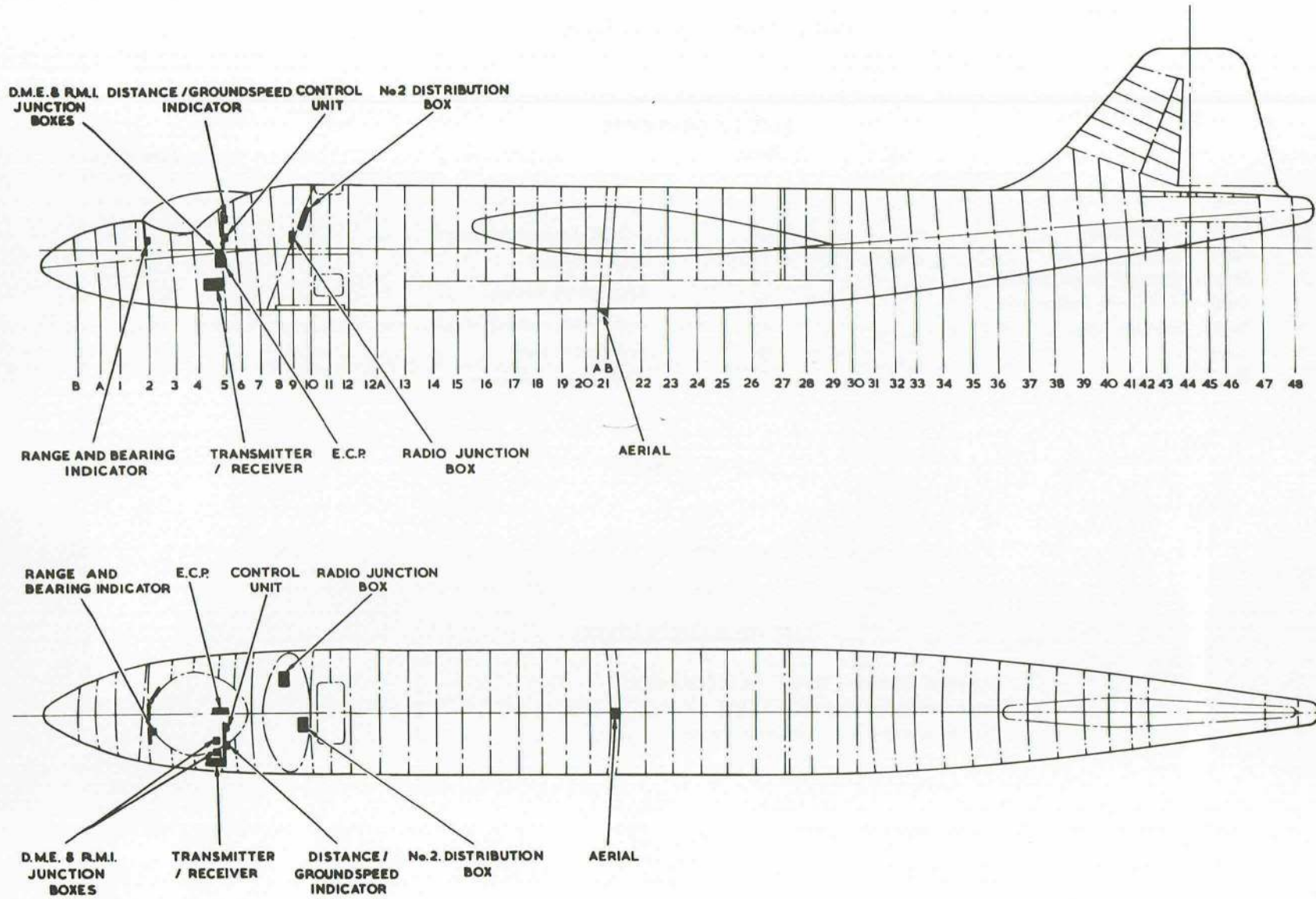
				<i>Para.</i>					<i>Para.</i>		
DESCRIPTION				OPERATION							
<i>General</i>	...	...	...	1	<i>Frequency selection</i>	...	...	...	...	22
<i>Transmitter/receiver</i>	...	...	...	5	<i>Search, lock-on and track</i>	...	...	...	...	23
<i>Control unit</i>	...	...	...	8	<i>Ground speed</i>	...	...	...	...	26
<i>Distance/ground speed indicator</i>	...	...	...	12	<i>Memory operation</i>	...	...	...	...	27
<i>Range and bearing indicator</i>	...	...	...	16	<i>Automatic stand-by mode</i>	...	...	...	...	28
<i>D.M.E. junction box</i>	19	<i>Self-test facility</i>	29	
<i>Aerial</i>	20	<i>Station identification</i>	30	
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LIST OF ILLUSTRATIONS

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SR7. 82. 7021. 156. 2.

FIG. I. LOCATION DIAGRAM-D.M.E. (ARI. 23238/5)

DESCRIPTION**General (fig.1 and 2)**

1. The D.M.E. (A.R.I.23238/5) is a navigational aid which measures the slant range distance between the aircraft and a ground station, the distance in nautical miles being displayed in digital form. The system operates in the L-band of frequencies and 100 channels are available (TACAN channels 17 to 59 inclusive and 70 to 126 inclusive). Propagation is line-of-sight and a maximum range of 196 nautical miles is achieved at 20,000 ft.
2. An audio output comprising a 1350 Hz tone is fed into the inter-communication system (*Sect.6, Chap.1, Part 6*). This provides a Morse code identification signal of the selected ground station.
3. The locations of the main items are shown in fig.1 and inter-connections in fig.2. Equipment details are given in Table 1, and connector and cable assembly details in Table 2. Full technical information on the equipment is contained in A.P.114J-1700-16.
4. The installation comprises the following main items of equipment:-
Transmitter/receiver (interrogator), Type MI 591083-1
Mounting tray, Type 53 - APH/2
Control unit, Type BD 671-MB
Distance/ground speed indicator, Type MI 591085-8
Range and bearing indicator, Type ID 663U/A
Junction box
Aerial, Type 10-203-1

Transmitter/receiver

5. The transmitter/receiver (interrogator) is located, on its mounting tray, on a shelf below the navigator's table. Electrical connection is made at the rear of the unit by a 32-way plug which mates with a corresponding socket on the mounting tray backplate. Connection to the aerial is made from the front panel of the unit via a coaxial connector. The suppression pulse connector is not used in this installation.
6. A push button, annotated SELF-TEST, is provided on the front panel to enable the built-in test facility to be used for servicing purposes.

7. As previously stated, the unit operates in the L-band of frequencies, the transmitter in the frequency ranges 1041-1083 MHz and 1094-1150 MHz, the receiver in the ranges 978-1020 MHz and 1157-1213 MHz. A channel spacing of 1 MHz is used on all ranges.

Control unit

8. The control unit is located on the navigator's instrument panel. Electrical connection is made at the rear of the unit via a mating plug and socket.
9. The front panel contains all the system controls and is edge lit by integral red lamps. The lamps are controlled by the C.U. LIGHTS dimmer switch on the navigator's instrument panel (*Sect.5, Chap.1, Group L*).
10. The function of the controls are as follows:-
 - (1) The left-hand knurled outer switch provides on/off control of the system and is annotated OFF-DME.
 - (2) The right-hand knurled outer switch controls the volume of the system audio identification signal fed into the intercommunication system.
 - (3) The left-hand inner control provides for the selection of whole numbers of the frequency in MHz.
 - (4) The right-hand inner control provides for the selection of the decimal parts of the frequency in MHz.
 - (5) Operation of the push-button annotated TEST, initiates the built-in self-test facility which checks out the system for range accuracy.

11. The frequency is displayed in a digital readout window in the front panel adjacent to and above the controls.

Distance/ground speed indicator

12. The distance/ground speed indicator is located on the navigator's instrument panel. Electrical connections are made by an 18-pole plug and a 15-pole plug situated at the rear of the instrument.

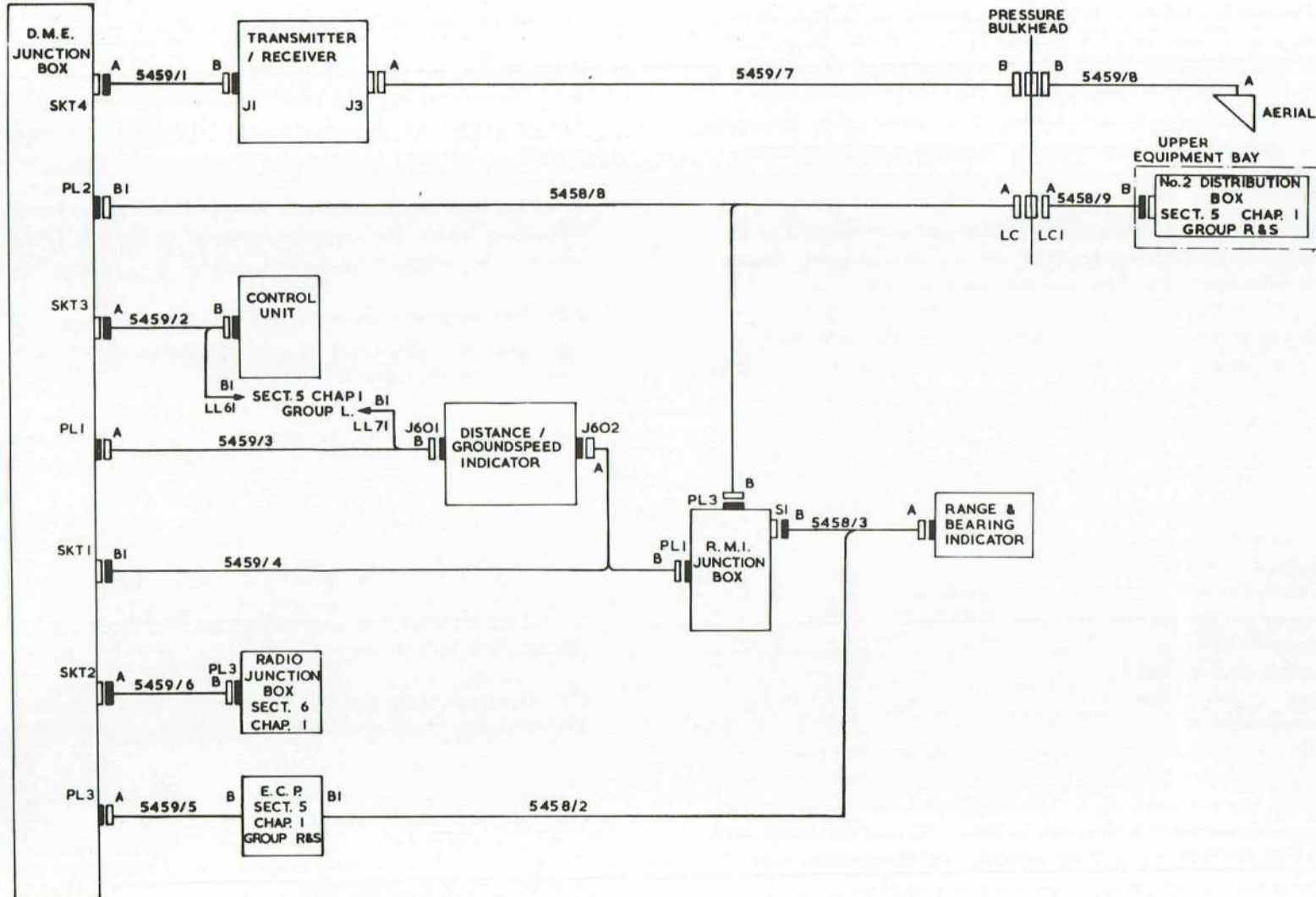


FIG. 2. INTERCONNECTION DIAGRAM-D.M.E. (A.R.I. 23238/5)

13. Illumination is provided by integral 28V red lamps and the brightness is controlled by the PANEL LIGHTS dimmer switch on the navigator's instrument panel.

14. The instrument consists of a three-digit distance display annotated NAUT MILES and a dial presentation calibrated in GROUND SPEED. An outer scale displays MINUTES TO STATION when the indicated distance is aligned with the DIST SET mark using the control knob situated at the lower right-hand corner of the instrument.

15. Whenever the equipment is switched off or spurious information is received, the distance counters are masked by a bar which drops across the numerals.

Range and bearing indicator

16. The range and bearing indicator is located on the pilot's instrument panel and is shared with the VOR and radio compass systems.

17. The indicator receives distance information from the distance/ground speed indicator which is displayed in a digital readout window. In the non-operative condition, the display is masked by an OFF flag.

18. Illumination is provided by a bridge lamp assembly and the brightness is controlled by the INST PANEL dimmer switch situated on the pilot's coaming panel.

D.M.E. junction box (fig.3)

19. The junction box forms the main interconnecting point for most of the components of the system and is located on the underside of the navigator's table.

Aerial

20. The L-band aerial is fitted on the underside of the front fuselage between frames 21A and 21B.

Power supplies

21. The installation operates on 28V d.c. and 115V, 400 Hz single phase a.c. supplies. The d.c. requirement is supplied from busbar PP2 via fuse 67 in the E.C.P. The 115V, 400 Hz supply is fed from fuse 134 in the No.2 distribution box. A 26V, 400 Hz supply for the synchro in the distance/ground speed indicator is taken from fuses 136 and 137 in the No.2 distribution box.

OPERATION

Frequency selection

22. Operation of the frequency controls on the control unit, causes the tuning mechanism in the transmitter/receiver to rotate, in steps, to select the appropriate crystals. Selection of a frequency higher than the one already set, causes the tuning mechanism to rotate in single steps. Selection of a lower frequency causes the mechanism to rotate rapidly through 100 channels in 10 channel steps, in approximately three seconds.

Search, lock-on and track

23. When the transmitter/receiver is tuning to the frequency of a new ground station, the nautical miles readout is masked by a bar on the navigator's distance/ground speed indicator and by a flag on the pilot's range and bearing indicator. This indicates that the reading is invalid. The new ground station is interrogated and the nautical miles readout rotates rapidly to display the new computed distance – this is called the search mode.

24. At the end of the search mode the system achieves the lock mode and the bar and the flag on the respective instruments disappear from view to display the new distance reading.

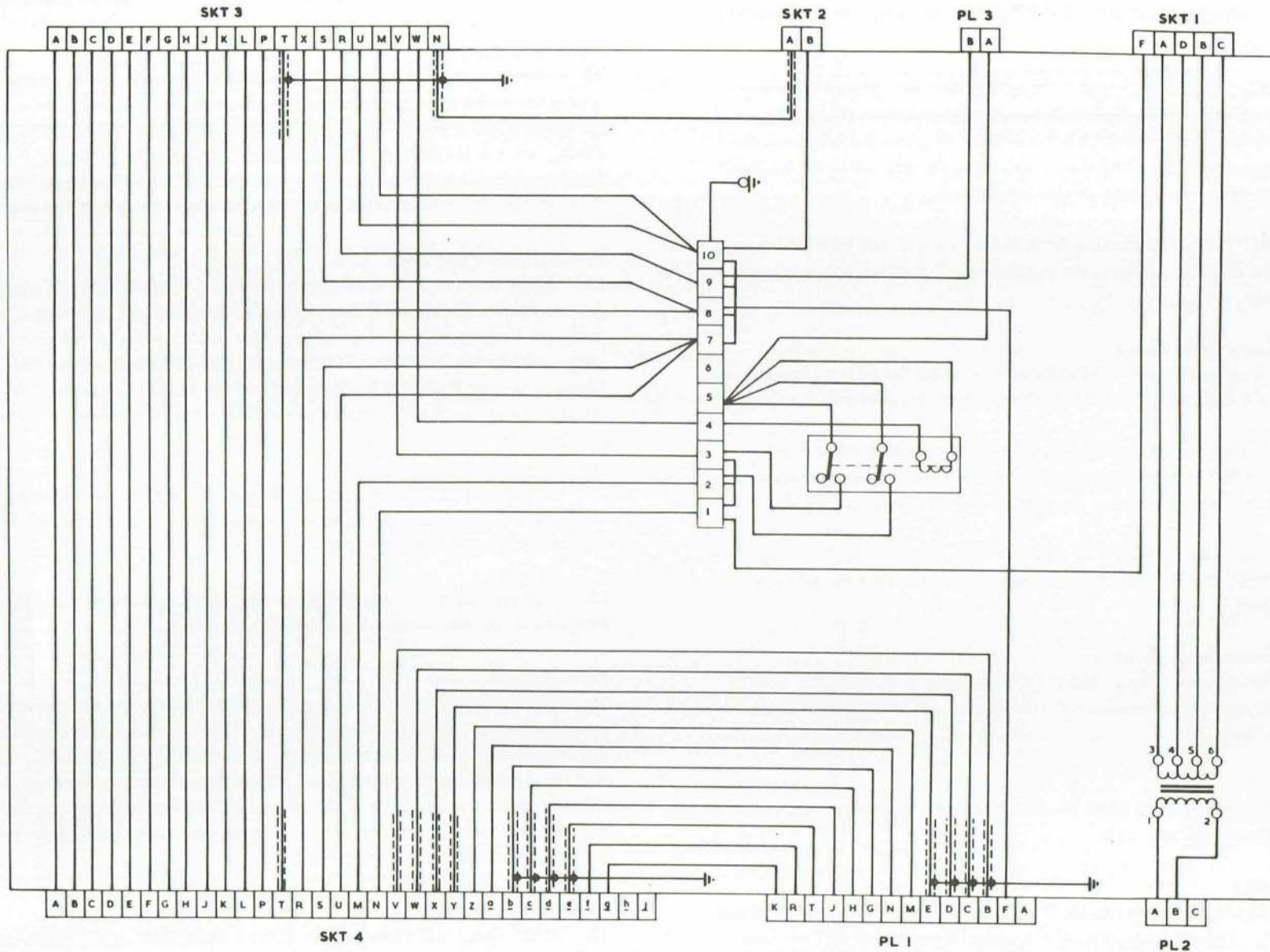
25. The reading continues to alter as the distance of the aircraft from the ground station changes – this is the track mode.

Ground speed

26. Ground speed is displayed by the pointer, on the distance/ground speed indicator, against a calibrated scale. The information is derived from the rate-of-change of distance between the aircraft and the ground station. The indicated ground speed is thus the closing (or opening) speed between the aircraft and the ground station and is the true aircraft ground speed only, when the aircraft is flying on a radial to (or from) the ground station.

Memory operation

27. If the signal fails during flight, the last known distance is displayed for a further 10 seconds. If the signal is regained during this memory period the distance indication automatically catches up and the system continues tracking. If the signal is not regained before the end of the memory period the system changes to the stand-by mode.



SRIM DRWG 32416

FIG.3. D.M.E. JUNCTION BOX - INTERNAL WIRING

Automatic stand-by mode

28. The automatic stand-by mode ensures that when a selected ground station is out of range or its signal is lost, the transmitter/receiver does not enter the search mode. This allows the system to be tuned in advance, to the next ground station. When the ground station comes within range, the system automatically enters the search mode and then locks on to the new ground station.

Self-test facility

29. The self-test facility enables the transmitter/receiver to check itself out for range accuracy. Two push-buttons are provided, one on the front panel of the transmitter/receiver, the other, on the control unit. Once pressed, either button must be held depressed until the completion of the self-test cycle. When a button is pressed, the transmitter/receiver, after

the 10 second memory period, enters the search mode momentarily and ends with a display of 196.0 nautical miles on the indicator. All but the R/F circuits of the transmitter/receiver are tested by this facility. On release of the button, the system reverts to the mode of operation in use before the button was pressed.

Station identification

30. Each ground station is identified by the transmission of Morse code characters, consisting of pairs of pulses, at a repetition frequency of 1350 pulse-pairs per second. The spacing between pulses in each pair is 12 μ s, each pulse being 3.5 μ s wide approximately. In the transmitter/receiver the pulse pairs are detected, converted into a 1350 Hz tone and fed into the intercommunication system.

TABLE 1

Equipment details

Equipment	Type/Part No.	Ref. No.	Location	A.P. Reference
Transmitter/receiver (interrogator)	MI-591083-1	5826-00-062-0766	Below navigator's table	A.P.114J-1700-16
Mounting tray	53-APH/2	5826-99-630-6133	Below navigator's table	
Control unit	BD 671-MB	5826-99-630-6127	Navigator's instrument panel	
Distance/ground speed indicator	MI-591085-8	5826-99-117-8696	Navigator's instrument panel	
Range and bearing indicator	ID-663U/A	5826-99-630-6137	Pilot's instrument panel	
Aerial	10-203-1	5985-99-625-1948	Lower front fuselage frames 21A - 21B	
DME junction box	—	—	Underside of navigator's table	—
Radio junction box	—	—	Navigator's starboard station	—
R.M.I. junction box	—	—	Underside of navigator's table	—

TABLE 2

Connector and cable assemblies

CONNECTOR 5459/1			CONNECTOR 5459/2					
Termination	Pin	Pin	Termination	Termination	Pin	Pin	Termination	
A DME Junction box (SKT4)	A	1	B Transmitter- Receiver	A DME Junction box (SKT3)	A	V	B Control unit	
	B	2			B	X		
	C	3			C	G		
	D	4			D	F		
	E	5			E	W		
	F	6			F	C		
	G	7			G	D		
	H	8			H	E		
	J	9			J	<u>f</u>		
	K	10			K	B		
	L	11			M	<u>c</u>		
	M	12			N	H		
	N	13			P	<u>b</u>		
	P	14			R	P		
	R	15			S	<u>h</u>		
	S	16			T	K		
	T	17			W	Z		
	U	18			X	M		
	V	20			U	Not used		
	W	21			L	Not used		
	X	22			V	Not used		
	Y	23			B1 Navigator's lighting TB	LL61		<u>j</u>
	Z	24						
	<u>a</u>	25						
	<u>b</u>	26						
	<u>c</u>	27						
	<u>d</u>	28						
	<u>e</u>	29						
	<u>f</u>	30						
	<u>g</u>	31						

Screens are connected to shell clamp at termination A.

Screens are connected to shell clamp at termination A

continued . . .

TABLE 2 Connector and cable assemblies — continued

CONNECTOR 5459/3		
Termination	Pin	Pin
A DME Junction Box (PL 1)	B	B
	C	C
	D	D
	E	E
	F	F
	H	H
	J	J
	K	K
	M	M
	N	N
B1 Navigator's lighting TB	R	R
	T	T
	LL71	P

Screens are connected to shell clamp at terminations A and B

Termination B
Distance/ground
speed indicator

CONNECTOR 5459/4			Termination
Termination	Pin	Pin	
A Distance/ground speed indicator	1	A	B RMI Junction box (PL 1)
	2	B	
	3	C	
	4	D	
	5	E	
	6	F	
	7	G	
	8	H	
	9	Not used	
	10	K	
B RMI Junction Box (PL 1)	11	A	B1 DME Junction Box (SKT 1)
	12	D	
	13	B	
	14	C	
	J	F	

Screens are connected to shells at termination A, B and B1.

CONNECTOR 5459/5			Termination B B
Termination A	Pin	Pin	
DME Junction Box (PL 3)	A	Fuse 67	ECP
	B	E25	

CONNECTOR 5459/6			Termination B B
Termination A	Pin	Pin	
DME Junction Box (SKT 2)	A	A	Radio Junction Box (PL 3)
	B	B	

Screen is connected to pin B at terminations A and B

CONNECTOR 5459/7			Termination B B
Termination A	Pin	Pin	
Transmitter/ receiver	—	—	Pressure bulkhead

CONNECTOR 5459/8			Termination B B
Termination A	Pin	Pin	
Aerial	—	—	Pressure bulkhead

continued . . .

TABLE 2 Connector and cable assemblies — continued

CONNECTOR 5458/8				CONNECTOR 5458/3				
Termination	Pin	Pin	Termination	Termination	Pin	Pin	Termination	
A Pressure Bulkhead	A	A	B RMI Junction box (PL3)	A Range and bearing indicator	A	A	B RMI Junction box (S1)	
	B	B			B1	B		B
	C	C			DME Junction box (PL2)	C		C
	D	D			D	D		
	E	B			E	E		
	F	A			F	F		
					G	G		
					H	H		
					J	J		
					K	K		
					L	L		
					M	M		
					N	N		
				P	P			
				R	R			
				S	S			
				T	T			
				U	U			
				V	V			
				W	W			
				Y	Y			
				Z	Z			
				a	a			
				b	b			
				c	c			
				d	d			
				e	e			
				f	f			
				g	g			
				X	Fuse 66	B1 ECP		

CONNECTOR 5458/9			
Termination	Pin	Pin	Termination
A Pressure Bulkhead	A	A	B No.2 Distribution box
	B	B	
	C	C	
	D	D	
	E	E	
	F	F	

Part 2 DECCA DOPPLER 72 (A.R.I.5972/2) AND G.P.I. MK.4A

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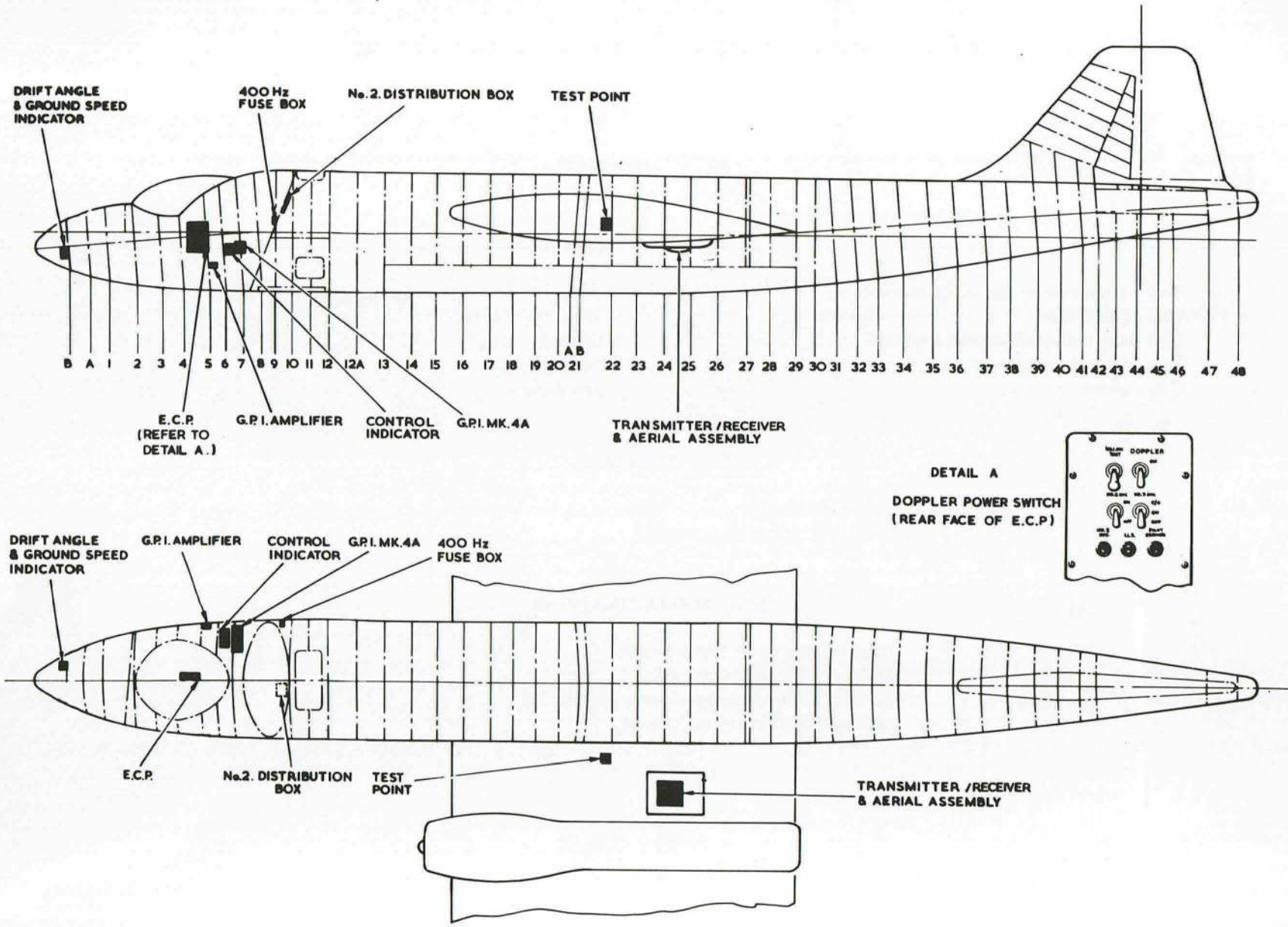


FIG. I. LOCATION DIAGRAM-DECCA DOPPLER 72 (A.R.I.5972/2) AND G.P.I. MK.4A.

U.B.7 82.7017.88.4

DESCRIPTION

General (fig.1 & 2)

1. The Decca Doppler 72 (A.R.I.5972/2) with G.P.I. Mk.4A is an airborne navigation radar installation, which operates in the J Band (1332 MHz). The doppler principle is used to measure the ground speed and drift angle of the aircraft at any altitude between 15 and 60,000 feet above the terrain being overflown. Ground speed, drift angle and distance flown are indicated at the navigator's starboard station, with a repeater for drift angle and ground speed at the navigator's forward station.

2. Included in the system is a G.P.I. Mk.4A which provides automatic and continuous indication of ground position from input information of drift and ground speed from the doppler system and heading information from the GM4B compass (Sect.5, Chap.2, Group F).

3. The doppler installation provides continuous indication of ground speed between 80 and 550 knots and a drift angle of between 1 and 30 degrees to port or starboard. Distance flown is indicated on a counter which is calibrated up to 999.9 nautical miles in increments of 1/10 of a mile. The installation is provided with a built-in test facility and also includes a test point adjacent to the transmitter/receiver and aerial assembly.

4. The locations of the main items of equipment are shown in fig.1 and the interconnections in fig.2: Table 1 gives equipment details and Table 2 gives connector and cable assembly details. Full technical information on the doppler system is contained in A.P.114E-1600-16, and on the G.P.I. Mk.4A in A.P.112B-0805-1.

5. The installation comprises the following main items of equipment:-

Transmitter/receiver and aerial assembly
Control indicator
Drift angle and ground speed indicator
Ground position indicator Mk.4A
G.P.I. amplifier.

Transmitter/receiver and aerial assembly

6. The transmitter/receiver and aerial assembly is located on the underside of the port wing between ribs 4 and 6. The unit comprises

two fixed slotted waveguide arrays; one transmitting and one receiving, producing a 3-beam Janus pattern (forward port, forward starboard and rear port), and solid-state transmitter and receiver assemblies mounted above their respective aerial arrays. The transmitting and receiving aerial arrays are separated by a metal septum and each array is covered by a glass fibre radome, which forms an integral part of the unit. Two location dowels provided on the mounting flange prevent incorrect insertion of the unit and also eliminate the need for re-alignment on replacement of the unit. Electrical connections are made via a 61-way plug situated on the right-hand side rear corner of the unit.

Control indicator

7. The control indicator, which is a rack-in type, is located on its rack at the navigator's starboard station. The unit houses all the controls and indicators necessary to operate the doppler system, apart from the main power supply control. Ground speed and drift angle information is displayed on pointer type indicators whilst distance gone is displayed on a digital counter-type display. Electrical connections are made via a 41-way plug at the rear of the unit. The following controls and indicators are provided:-

- (1) GROUND SPEED indicator located at the top left hand side of the unit, provides a continuous indication of the ground speed by means of a single pointer moving over a scale graduated from 80 to 550 knots.
- (2) DRIFT ANGLE indicator located at the top right hand side of the unit, provides a continuous indication of drift, either to port or starboard, by means of a single pointer moving to the left or right over a scale graduated from 0 to 30 deg.
- (3) DISTANCE GONE NM indicator located at the bottom centre of the unit. This indicator consists of a four-digit counter which displays the distance flown up to 999.9 nautical miles in increments of 1/10 mile. A thumb-wheel fitted adjacent to the counter enables the counter to be reset to 000.0 when required.
- (4) A clutch lever located adjacent to the distance-gone counter identified STOP-COUNTER-START is used to engage or disengage the distance-gone counter as required.
- (5) A three-position switch, located between the ground speed and drift angle indicators, identified DIM/LAMP TEST. In the LAMP TEST position,

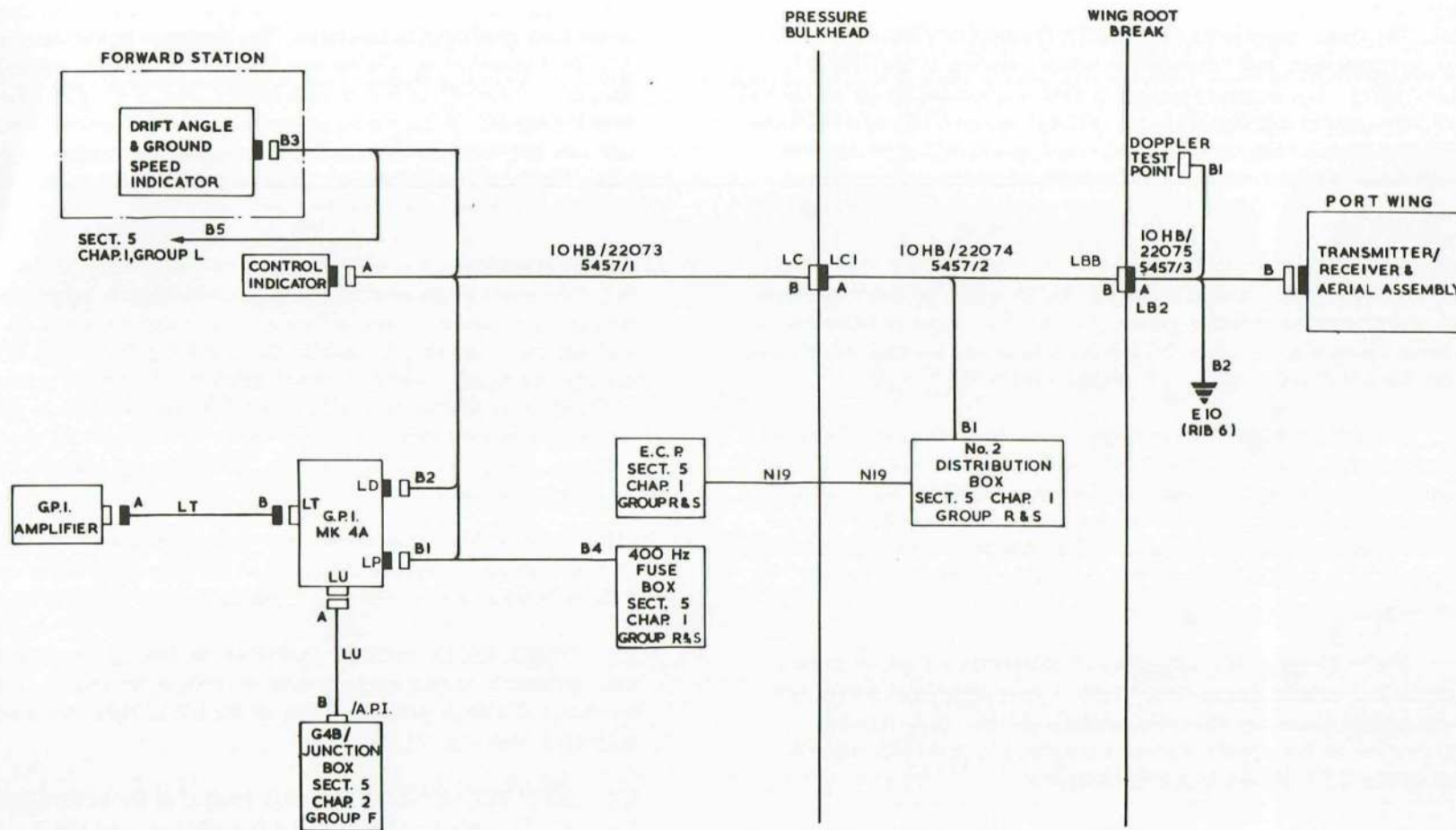


FIG. 2. INTERCONNECTION DIAGRAM-DECCA DOPPLER 72 (A.R.I.5972/2) AND G.P.I. MK.4A

M and T lamps and the integral panel lamps are illuminated. In the DIM position the lighting is subdued.

(6) Two mode lamps, located in the centre of the panel and identified M and T respectively provide indication of the mode of operation of the system. The green lamp T is illuminated when the system is tracking and the red lamp M is illuminated when the system is in the memory mode. The brightness of each lamp is controlled by rotation of the lamp housing.

(7) A 3-position, centre-off switch located below the ground speed indicator and identified DEC-INC is used to inch the ground speed pointer to a higher or lower position.

(8) A 3-position, centre-off switch located below the drift angle indicator and identified PORT-STBD is used to inch the drift angle pointer to port or starboard.

(9) A 3-position TEST switch, located at the lower left hand corner of the unit and identified PORT-STBD provides for the system built-in test facility. This test checks out the tracking circuit.

(10) A 3-position MODE switch, located adjacent to the TEST switch identified MEM-N-T/R TEST. This switch is used to select memory, normal or transmitter/receiver test modes.

(11) A 2-position switch located at the lower right hand corner of the unit and identified LAND-SEA. This switch is used to match the system operation to the type of terrain being overflown.

Drift angle and ground speed indicator

8. The drift angle and ground speed indicator is mounted on a bracket at the starboard side of the navigator's forward station at frame B. This indicator is a repeater of the control indicator. The drift angle is displayed by a single pointer which traverses a dial either to the left or right over a scale graduated from 0 to 30 deg. The ground speed is displayed on a three-digit counter.

9. Two warning flags are incorporated in the indicator dial. The black-and-yellow striped flag indicates a power or system failure. The other flag identified M, indicates that the system is operating in the memory mode.

10. Illumination of the indicator is provided by integral lamps, the brightness of which is controlled by a dimmer switch identified GS & DA INDICATOR and is fitted on the same mounting bracket as the indicator. Electrical connections to the indicator are made via a 32-way plug situated at the rear of the indicator.

Ground position indicator Mk.4A

11. The ground position indicator, which is fitted adjacent to the control indicator, is a mechanical computer used in conjunction with the doppler system and the GM4B compass system (*Sect.5, Chap.2, Group F*). It receives heading information from the compass and drift and distance-gone information from the doppler system. From this information, it computes the change of position in Northing/Easting, Latitude/Longitude or Along/Across track co-ordinates. The unit incorporates a storage system, thus permitting the freezing and correction of the position counters.

12. All controls necessary for the operation of the G.P.I. are located on the front face of the unit. Electrical connections to the unit are made via multi-pin connectors located at the rear of the unit.

G.P.I. amplifier

13. The G.P.I. amplifier is fitted on the wall at the navigator's starboard station between frames 5 and 6. The unit is a two-stage amplifier used in conjunction with the G.P.I. servo system to provide a power drive of the track angle. Electrical connections are made via a 6-pole plug mounted on one side of the unit.

Doppler test point

14. A fixed connector, mounted on a bracket in the underside of the port inner wing at rib 4 and identified DOPPLER TEST POINT, is provided for servicing purposes. The connector is covered by an access panel and identified DOPPLER TEST POINT INSIDE.

Power supplies

15. The doppler system requires power supplies of 115V, 400 Hz single-phase a.c. which is taken from fuse 141 in the No.2 distribution box, via contacts 3-3a of relay No.4. The relay is energized when the DOPPLER switch on the rear face of the E.C.P. is set to ON. The 28V d.c. for the relay coil is supplied from fuse 64 in the E.C.P. In addition, the system receives 115V, 400 Hz single-phase a.c. direct from fuse 124 in the 400 Hz fusebox.

16. The G.P.I. Mk.4A requires power supplies of 115V, 400 Hz three-phase a.c. which is taken from fuses 124 and 128 in the 400 Hz fusebox and a 28V, d.c. supply from fuse 118 also located in the 400 Hz fusebox. The 28V d.c. supply is routed through the G4B/A.P.I. junction box to the G.P.I. and this supply is also routed through the G.P.I. into the doppler system control indicator.

OPERATION

General

17. The transmitter/receiver and aerial assembly produces two signals 10.7 MHz apart, which feed the transmitting aerial. These signals are radiated as three beams in a Janus configuration. The two forward beams, port and starboard, are fed from one signal source and the rear beam, port only, is fed from the second signal source.

18. The return signals from each beam are accepted by the receiving aerial where it is mixed and processed by the receiver. Signals from the port beams produce a frequency related to the along-heading velocity and signals from the forward beams produce a frequency related to the across-heading velocity. These two frequencies are then resolved to produce ground speed and drift information which are displayed on the associated meters.

19. In addition, ground speed and drift information is fed into the G.P.I. Mk.4A, together with true heading information from the GM4B

compass. From this information, the G.P.I. computes along and across track co-ordinates. For normal operation the MODE switch on the control indicator should be set to the N position.

Memory code

20. When the equipment is initially switched on, or if the return signal falls below a pre-determined level, the equipment adopts a memory condition in which the M lamp on the front of the control indicator lights and the M flag on the drift angle and ground speed indicator appears. The displays are frozen at the last measured value. The equipment reverts to normal operation when the input signal returns to the correct level.

Test facility

21. Operation of the TEST switch to PORT and STBD respectively, checks out the indicators on the control indicator; the ground speed indicator reads between 414 and 429 knots and the drift angle indicator reads between 6 and 8 deg.

22. Operation of the MODE switch to T/R TEST initiates the built-in test facility in the transmitter/receiver and aerial assembly. The memory flag on the drift angle and ground speed indicator should go out of view, the memory lamp M on the control indicator goes out and the tracking lamp T comes on, the ground speed indicator should read between 342 and 355 knots, the drift angle indicator should read 0 deg.

23. Operation of the MODE switch to MEM checks out the memory system and the memory lamp M should light.



TABLE 1

Equipment details

Equipment	Ref.No.	Location	A.P. Reference
Transmitter/receiver and aerial assembly	5841-99-112-4924	Port under wing ribs 4 to 6	A.P.114E-1600-16
Control indicator	5841-99-618-1785	Navigator's - starboard station	
Drift angle and ground speed indicator	◀ 5841-99-618-1078 ▶	Navigator's - forward station	
Ground position indicator Mk.4A	6B/2649	Navigator's - starboard station	A.P.112B-0805-1
G.P.I. amplifier	6B/434645	Navigator's - starboard station	

TABLE 2

Connector and cable assemblies

CONNECTOR 10HB/22073

CONNECTOR 10HB/22073 — continued

Termination	Pin	Pin	Termination
A Control indicator	A	A	B Pressure bulkhead LC
	B	B	
	D	D	
	E	E	
	F	F	
	G	G	
	H	H	
	X	X	
	Y	Y	
	<u>b</u> *	J	
	<u>n</u>	N	
	<u>p</u>	P	
	C	<u>g</u>	
	J	A	
K	X		
L	U		
Z	Y		
<u>a</u>	T		
<u>k</u>	W		
<u>m</u>	H		
<u>s</u>	J		
t	K		
B5 DAGS indicator dimmer switch	L72	f	B3 Drift angle and ground speed indicator
A Control indicator	M	5	B2 G.P.I. Mk.4A backplate LD
	N	4	
	P	3	
	<u>e</u>	1	
	<u>f</u>	2	
	<u>q</u> *	6	
A Control indicator	S	Fuse 124	B4 400 Hz fusebox
	T	E.W.	

Termination	Pin	Pin	Termination
A Control indicator	R	4	B1 G.P.I. Mk.4A backplate LP
	<u>g</u>	6	
B4 400 Hz Fusebox	<u>h</u>	5	
	Fuse 128	3	
	E.W.	8	
	Fuse 124	7	

The screens of pins pFGH are connected to pin b and screens of pins PNM to pin q at termination A.

The screens of pins PFGH are connected to pin L at termination B.

CONNECTOR 10HB/22074

Termination	Pin	Pin	Termination
A Pressure bulkhead LC1	A	A	B Port wing root break LBB
	B	B	
	D	D	
	E	E	
	F	F	
	G	G	
	H	H	
	J	J	
	L*	*L	
	N	N	
	P	P	
B1 No.2 distribution box	X	X	
	Y	Y	
	SG51	S	
	EG	T	

* Screens are linked to pin L

continued. . .

TABLE 2 Connector and cable assemblies — continued

CONNECTOR LT 10HA/16524

Termination	Pin	Pin	Termination
A G.P.I. Amplifier	A	1	B G.P.I. MK.4A backplate LT
	B	2	
	C	3	
	D	4	
	E	5	
	F	6	

CONNECTOR TYPE 10HB/22075 — continued

Termination	Pin	Pin	Termination
A Wing root break LBB/1	P	G	B Transmitter/ receiver and aerial assembly
	S	C	
	T	E	
	X	LL	
	Y	MM	

* Screens are linked to pin L

CONNECTOR LU 10HA/16525

Termination	Pin	Pin	Termination
A G.P.I. Mk.4A backplate LU	1	White	B G4B/A.P.I. Junction Box
	2	Black	
	3	Red	
	4	Blue	
	5	Green	
	6	Yellow	

CONNECTOR TYPE 10HB/22075

Termination	Pin	Pin	Termination
A Wing root break LBB/1	A	F	B Transmitter/ receiver and aerial assembly
	B	D	
	D	CC	
	E	EE	
	F	Y	
	G	t	
	H	u	
	J	b	
	L*		
	N	g	

B2 Earth point - rib 6	<table border="0"> <tr> <td>E10</td> <td>c</td> </tr> <tr> <td>E*</td> <td>*k</td> </tr> <tr> <td>M</td> <td>U</td> </tr> <tr> <td>A</td> <td>T</td> </tr> <tr> <td>B</td> <td>S</td> </tr> <tr> <td>G</td> <td>P</td> </tr> <tr> <td>F</td> <td>N</td> </tr> <tr> <td>H</td> <td>R</td> </tr> <tr> <td>J</td> <td>p</td> </tr> <tr> <td>T</td> <td>n</td> </tr> <tr> <td>S</td> <td>m</td> </tr> <tr> <td>K</td> <td>M</td> </tr> <tr> <td>C</td> <td>q</td> </tr> <tr> <td></td> <td>r</td> </tr> <tr> <td></td> <td>s</td> </tr> </table>	E10	c	E*	*k	M	U	A	T	B	S	G	P	F	N	H	R	J	p	T	n	S	m	K	M	C	q		r		s	B Transmitter/ receiver and aerial assembly
E10		c																														
E*		*k																														
M		U																														
A		T																														
B		S																														
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K		M																														
C		q																														
	r																															
	s																															
B1 Test point	Link																															

*Screens are connected to pin k at termination B and to pin E at termination B1

CABLE ASSEMBLY N19

Refer to SECT.5, CHAP.1, GROUP R & S

123

1	2
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55	56
57	58
59	60
61	62
63	64
65	66
67	68
69	70
71	72
73	74
75	76
77	78
79	80
81	82
83	84
85	86
87	88
89	90
91	92
93	94
95	96
97	98
99	100

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1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

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1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

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Part 3 I.F.F./S.S.R.1520 (A.R.I.23134/1)

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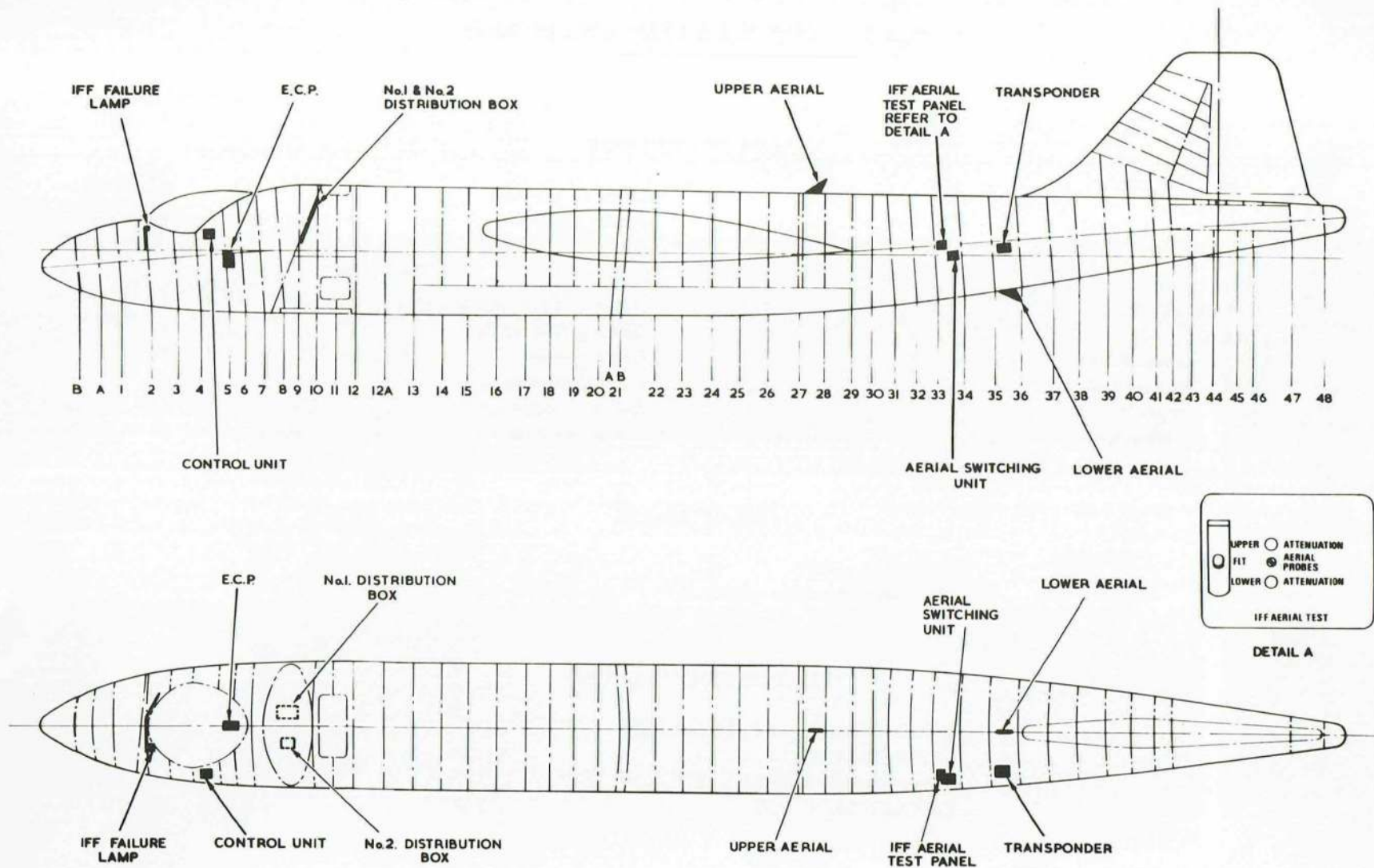


FIG.1. LOCATION DIAGRAM-I.F.F./S.S.R.1520 (A.R.I.23134/1)

DESCRIPTION

General (fig.1 & 2)

1. I.F.F./S.S.R.1520 (A.R.I.23134/1) forms the airborne part of a secondary surveillance radar system, which is designed to identify, as friendly or hostile, aircraft detected by a ground-based primary radar. In response to interrogation pulses, coded according to any one of six modes, transmitted from the ground station, the airborne equipment automatically transmits a coded reply appropriate to the interrogation mode. Reply codes include a code representative of the aircraft flight altitude and an emergency distress code.
2. The locations of the main items are shown on fig.1 and inter-connections on fig.2. Equipment details are given in Table 1 and connector and cable assembly details in Table 2. Detailed technical and servicing information on the equipment is contained in A.P.114J-0101-16.
3. The installation comprises the following main items of equipment:-
 - Transponder, Type 16928
 - Mounting tray, Type 16946
 - Control unit, Type 16929
 - Aerials, Type 10A-6(2)
 - Aerial switching unit, Type 16941
 - Aerial test switch
 - Aerial test probes
 - I.F.F. failure lamp

Transponder

4. The transponder, Type 16928, in its mounting tray, Type 16946, is located on the port side of the rear fuselage between frames 35 and 36. Electrical connections to the transponder are made via a 98-way socket at the rear of the mounting tray and a complementary mating plug at the rear of the transponder. Aerial connection is made via a coaxial socket on the front panel of the unit. Two Schraeder valves on the front panel permit pressurization of the unit with dry air or nitrogen to 4 lb/in². Coding switches on the front panel are used for setting up the reply code to a Mode 2 interrogation. No external cooling is required.

Control unit

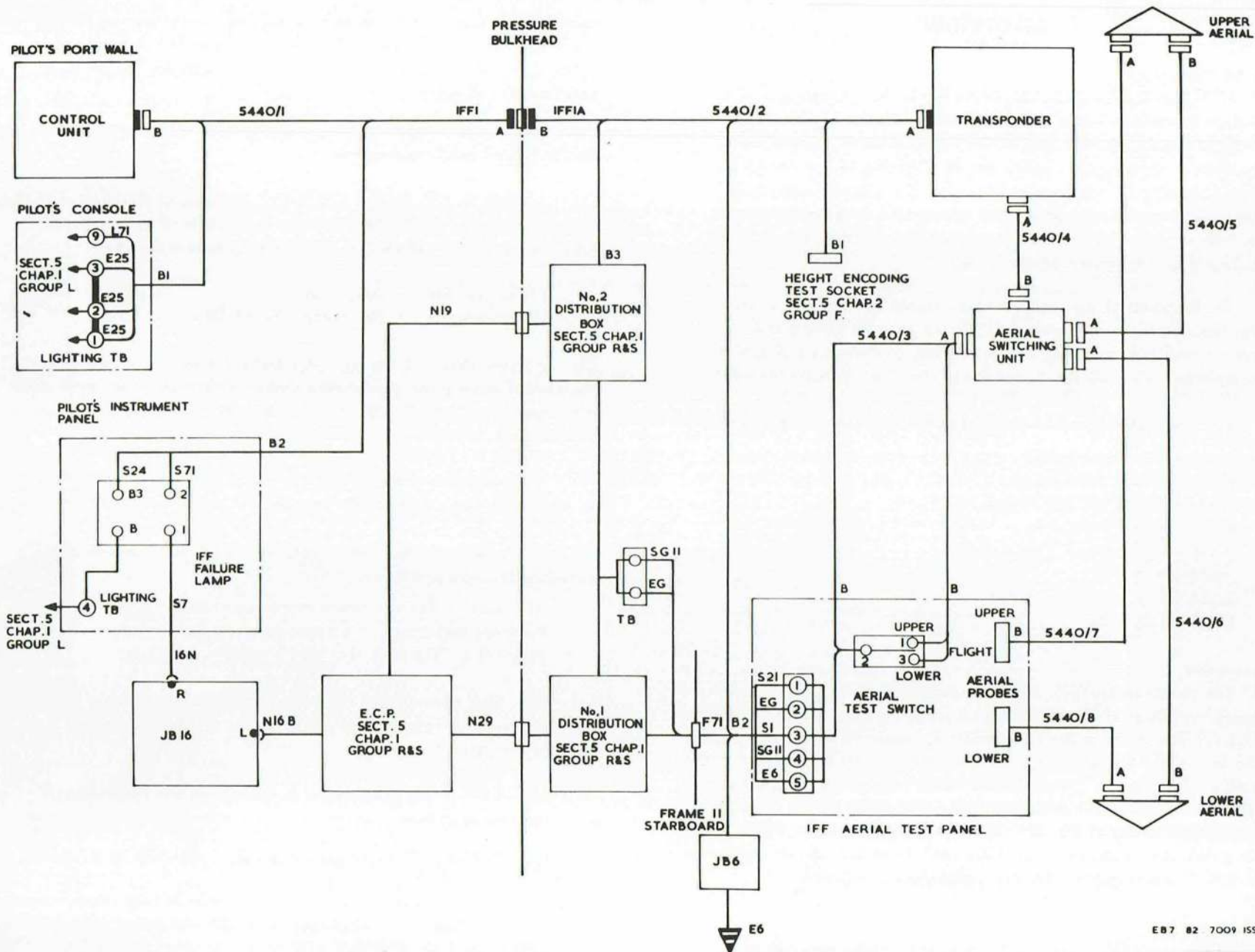
5. The control unit, Type 16929, is located on the port wall at the pilot's station. Electrical connections to the unit are made via a 55-way

socket at the rear. The front panel is edge-lit by two integral lamps; the brightness is controlled by the CONSOLE LIGHTS dimmer switch adjacent to the control unit. Control facilities provided on the front panel are as follows:-

- (1) Four toggle switches at the top left provide on/off selection of Modes 1, 2, C and D respectively.
- (2) A toggle switch, identified CIVIL/MIL, determines the content of the information pulses contained within the first frame of an emergency reply on receipt of a Mode 3/A or B interrogation as follows:-

CIVIL position	code 7700
MIL position	the switch-selected code

- (3) A toggle switch at top right, identified I/P, controls transmission of the identification pulse, producing a civil identification pulse reply to an interrogation in Mode 2, 3/A, B or D. A military identification pulse reply is given to a Mode 1 interrogation.
- (4) A three-position rotary switch, at centre left, selects Mode 3/A or B: the switch has a centre OFF position.
- (5) A centrally-mounted, rotary function switch has five positions, providing facilities as follows:-
 - (a) OFF – The a.c. power supply and the d.c. power supply to the aerial switching unit are disconnected and the transponder is inoperative. The main d.c. supply remains connected.
 - (b) SBY (Standby) – All power supplies are connected but transponder replies are inhibited, i.e. the transponder is in a state of readiness.
 - (c) LOW – The transponder is operational but with reduced receiver sensitivity.
 - (d) NORM – The transponder is fully operational in all modes.
 - (e) EMGY (emergency) – The transponder is fully operational in all modes with the addition of a special emergency reply to each interrogation on Mode 1, 2, 3A/ or B. To select the EMGY position, the switch knob must be pushed in before rotating.



EB7 B2 7009 ISS 2

FIG. 2. INTERCONNECTION DIAGRAM- IFF /SSR. 1520 (A.R.I. 23134/1)

(6) A press-to-test switch and lamp assembly, identified TEST, provides a means of initiating the internal self-test circuits in the transponder. If the transponder operation is satisfactory, the lamp is lit; if unsatisfactory, the I.F.F. failure lamp (*para.10*) is lit.

(7) Four code selection switches, identified MODE 1, at the lower left of the panel, provide facilities for setting up a four-digit reply code for a Mode 1 interrogation. The right-hand bank of four switches, identified MODE 3/A/B, provide facilities for setting up the reply code for a Mode 3/A or B interrogation. Each code selection switch is provided with an integral lamp for illumination of the selected code numeral.

Aerials

6. Two omni-directional aerials, Type 10A-6 are used to provide all-round coverage. The upper aerial is mounted on the centre line of the upper front fuselage between frames 27 and 28. The lower aerial is mounted on the centre line of the underside of the rear fuselage between frames 35 and 36.

Aerial switching unit

7. The aerial switching unit, Type 16941, is located adjacent to the IFF AERIAL TEST panel on the port side of the rear fuselage between frames 33 and 34. The unit is a solid state coaxial switch, used to connect the transponder alternatively to the upper and lower aerials at a rate of 40 ± 4 Hz when the aerial test switch (*para.8*) is in the FLT setting.

Aerial test switch

8. The aerial test switch is a guarded three-position switch, identified UPPER/FLT/LOWER, mounted on the I.F.F. AERIAL TEST panel. The switch is used for servicing purposes only, permitting selection, as required, of the upper or lower aerial for continuous connection to the transponder. In normal operating conditions, the switch is guarded in the FLT (flight) position.

Aerial test probes

9. Two aerial test probe connectors mounted on the I.F.F. AERIAL TEST panel provide for test points to enable the aerial system to be checked out for signal losses. To assist in the calculations, the test probe feeder attenuator value is marked adjacent to each test point.

I.F.F. failure lamp

10. An amber, iris-dimmed lamp, identified IFF FAIL, is mounted on the pilot's instrument panel. Lighting of the lamp, indicates failure of the transponder to reply correctly to a valid interrogation or to operation of the TEST switch on the control unit (*refer to para.5*). With the d.c. power connected and the function switch on the control unit selected OFF, the lamp remains lit to indicate non-availability; with the function switch at SBY, or the transponder not warmed up, the lamp flashes on for one second to indicate recognition of an interrogation. A press-to-test facility is embodied in the lamp for testing the IFF FAIL lamp and the TEST lamp on the control panel.

Mode C operation

11. In response to Mode C interrogation, the transponder transmits coded height information derived from the servo altimeter. The connections from the height encoder are routed through a plug break, provided for test purposes, located adjacent to the IFF AERIAL TEST panel. The height encoding system is described in Sect.5, Chap.2, Group F.

Power supplies

12. The installation operates on 28V d.c. and 115V, 400 Hz, single-phase a.c. supplies. The d.c. requirement is supplied from busbar PP1 via fuses 60 and 61 and busbar PP2 via fuse 80. Fuse 80 supplies power for lamp testing. Fuse 61 provides the main d.c. supply to the transponder. Fuse 60 provides the d.c. supply to the aerial switching unit, via contacts 1-1a of relay No.3 in the No.2 distribution box, the a.c. supply from fuse 129 being connected via contacts 3-3a of the relay. The relay is operated to connect the supplies when the function switch on the control unit is selected to any position other than OFF. The power supplies are described in Sect.5, Chap.1, Group R & S.

OPERATION

Standard I.F.F. interrogation

13. By international agreement, the standard interrogation signal transmitted by the ground station consists of two pulses, P1 and P3, radiated on a carrier frequency of 1030 MHz at a rate of 400 interrogations per second.

Interrogation modes

14. The ground station interrogations are transmitted in various modes, obtained by adjustment of the time interval between pulses P1 and P3. Six modes are available as follows:-

Mode	Spacing	Function
1	3 microseconds	Military identification
2	5 microseconds	Military identification
3/A	8 microseconds	Civil/military identification
B	17 microseconds	Civil identification
C	21 microseconds	Automatic altitude reporting
D	25 microseconds	Future expansion; not yet in use

15. The reception of interrogations on a carrier frequency of 1030 MHz, in any mode, will trigger the transponder to transmit an appropriately encoded reply on a carrier frequency of 1090 MHz, provided that the same mode is selected at the control unit.

Reply coding

16. The transponder reply codes are contained between two framing pulses spaced 20.3 microseconds apart. Between the framing pulses, twelve information pulses can be introduced at intervals of 1.45 microseconds. The presence or absence of any of the pulses is determined by the setting of the code selection switches at the control unit or, for Mode 2 interrogations, the setting of similar switches on the front panel of the transponder, the latter being preset before flight, or, for altitude reporting, the positions of the encoding switches driven by the servo altimeter.

Identification pulse

17. The transponder contains facilities for the transmission of an identification pulse at an interval of 4.35 microseconds after the second framing pulse, i.e. at 24.65 microseconds after the first framing pulse. Introduction of this pulse is controlled by the I/P - on/off switch on the control unit.

Side lobe suppression

18. Provision is made for the automatic suppression of transponder replies during spurious triggering by side lobes of the main ground station transmission. Two aerials are involved at the ground station. The rotating interrogation aerial transmits pulses P1 and P3 (*para. 13*) with

high power in the direction of interrogation accompanied by low power side lobes. A second rotating aerial with an omni-directional pattern, except for a trough in the direction of interrogation, transmits an extra pulse P2 at a spacing of 2 microseconds after P1.

19. By comparing the amplitude of P1 and P3 with that of P2, the transponder determines whether the interrogation is genuine or originates from a side lobe. For correct main lobe interrogation, the amplitudes of P1 and P3 are greater than that of P2 and a transponder reply is generated. During all interrogations originating from side lobes, P2 is greater than P1 and P3 and an internal inhibiting pulse is generated, preventing any reply transmission.

Transponder replies

20. The transponder replies fall into four categories:-

(1) Normal: consists of the framing pulses containing the selected (coded) information pulses in one group. When the I/P and EMGY (emergency) switches are not operated, this reply is given to any interrogation.

(2) Civil I/P: consists of the framing pulses, the information pulses and the identification pulse in one group. When the I/P switch is operated, this reply is given to an interrogation in any mode except Mode 1 or C. On reply to a Mode C interrogation, the identification pulse is transmitted automatically when information pulse D4 is selected by the altitude encoder with no operation of the I/P switch.

(3) Military I/P: consists of a normal reply repeated, i.e. two sets of framing pulses spaced 4.35 microseconds apart, each containing information pulses. When the I/P switch is operated, this reply is given to an interrogation in Mode 1.

(4) Emergency: consists of normal reply followed by three repeats, the repeats containing no information pulses. When the EMGY (emergency) switch is operated, this reply is given to an interrogation in Mode 1, 2, 3/A or B. The information pulses contained in the first frame for a Mode 3/A or B interrogation depend on the position of the CIVIL/MIL switch thus:-

- CIVIL - Code 7700
- MIL - Selected code

TABLE 1
Equipment details

Equipment	Type/Part No.	Ref.No.	Location	A.P. Reference
Transponder	16928	5895-99-956-3378	Rear fuselage, port side, frames 35-36	114J-0101-16
Mounting tray	16946	5820-99-107-5637	Rear fuselage, port side, frames 35-36	
Control unit	16929	5895-99-956-3379	Pilot's port wall	
Aerial (upper)	10A-6	10ZZ/353052	Centre line upper fuselage, frames 27-28	
Aerial (lower)	10A-6	10ZZ/353052	Centre line lower fuselage, frames 35-36	
Aerial switching unit	16941	5895-99-107-1521	Rear fuselage, port side, frames 33-34	
Aerial test switch	—	5CW/1047694	IFF AERIAL TEST panel — Rear fuselage, port side, frames 33-34	
Aerial test probes	CS5440/7 and /8	—		
I.F.F. failure lamp	C1101/C/7	5CW/4400657	Pilot's instrument panel	113D-1102-1

TABLE 2

Connector and cable assemblies

CONNECTOR 5440/1		CONNECTOR 5440/1 — <i>continued</i>						
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B	
Pressure bulkhead IFF 1	A	A	Control unit 16929	Pressure bulkhead IFF 1	j	j	Control unit 16929	
	B	B			k	k		
	C	C			m	m		
	D	D			n	n		
	E	E			p	p		
	F	F			q	q		
	G	G			r	r		
	H	H			s	s		
	J	J			v	v		
	K	K			FF	S24(B3)		B2 IFF failure lamp C1101/C/7
	L	L			GG	S71(2)		
	M	M		B1 Pilot's console lighting T.B.	3(E25)	t	B Control unit 16929	
	N	N			2(E25)	u		
	P	P			1(E25)	x		
	R	R			9(L71)	w		
	S	S						
	T	T						
	U	U						
	V	V						
	W	W						
	X	X						
	Z	Z						
	b	b						
	c	c						
	d	d						
	e	e						
f	f							
g	g							
h	h							
i	i							

continued. . .

TABLE 2 Connector and cable assemblies — continued

CONNECTOR 5440/2			CONNECTOR 5440/2 — continued					
Termination	Pin	Pin	Termination	Termination	Pin	Pin	Termination	
B Pressure bulkhead IFF 1A	A	88	A Transponder 16928	B Pressure bulkhead IFF 1A	j	53	A Transponder 16928	
	B	13			k	54		
	C	14			m	55		
	D	15			n	56		
	E	17			v	S61	B3 No.2 distribution box	
	F	18						
	G	19					A Transponder 16928	
	H	26						
	J	27				p		57
	K	28				q		70
	L	29			r	71		
	M	30			s	24		
	N	31			FF	44		
	P	32			GG	42		
	R	33			J	78		
	S	34			H	79		
	T	35			G	80		
	U	38			F	81		
	V	39			E	82		
	W	40			D	83		
	X	41			C	84		
	Z	43			B	85		
	b	45			A	86		
	c	46			K	92		
	d	47			L	25		
	e	48			M	91		
f	49							
g	50							
h	51							
i	52							
			B2		5(E6)	93		
			IFF test panel Terminal block		3(S1)	96		
					4(SG11)	22		
					2(EG)	23		

continued...

TABLE 2 Connector and cable assemblies — continued

CONNECTOR 5440/3				CONNECTOR 5440/7					
Termination	Pin	Pin	Termination	Termination A	Pin	Pin	Termination B		
A Aerial switching unit 16941	{ A B C D	(E6) 5	{ Terminal block Aerial test switch	{ B IFF test panel	Upper aerial 10A-6	—	—	IFF aerial test panel (UPPER)	
		(S21) 1							
		(S22) 3							
		(S23) 1							
CONNECTOR 5440/4				CONNECTOR 5440/8					
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B		
Transponder 16928 (AERIAL)	—	—	Aerial switching unit 16941 (TRANSPONDER)	Lower aerial 10A-6	—	—	IFF aerial test panel (LOWER)		
CONNECTOR 5440/5				CABLE ASSEMBLY 16N					
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B		
Aerial switching unit 16941 (UPPER)	—	—	Upper aerial 10A-6	Junction box 16	R	1	IFF failure lamp		
CONNECTOR 5440/6				CABLE ASSEMBLY N16B					
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination B		
Aerial switching unit 16941 (LOWER)	—	—	Lower aerial 10A-6	Junction box 16	L	L	E.C.P.		

CABLE ASSEMBLIES N19, N29, F71
Refer to SECT.5, CHAP.1, GROUP R & S

Part 4 RADAR ALTIMETER (A.R.I.23219/4)

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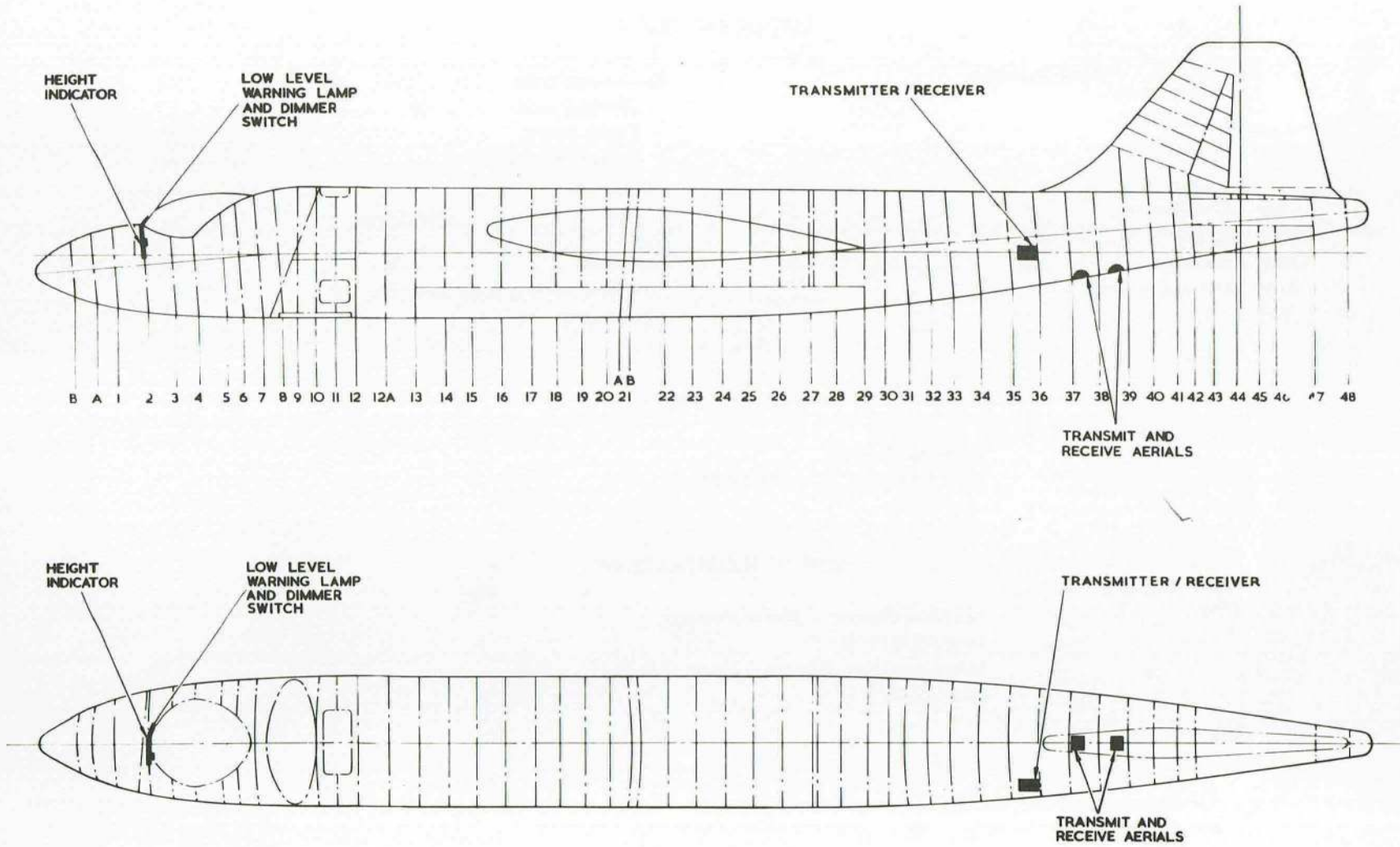
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FIG. 1. LOCATION DIAGRAM-RADAR ALTIMETER (A.R.I. 23219/4)

DESCRIPTION**General**

1. The radar altimeter, A.R.I.23219/4, is a low-altitude, terrain-tracking and altitude sensing system operating on a frequency of 4300 MHz. The system uses both wide and narrow pulse transmissions, narrow below 1000 feet and wide between 1000 and 5000 feet. Leading edge tracking of the return pulse provides a continuous indication of aircraft height from 0-5000 feet. A system self-test facility is provided.

Main components (fig.1 & 2)

2. The system includes the following main units:-

Transmitter/receiver and mounting rack
Height indicator
Aerials (2 off)

3. The location of the main units are given in fig.1. Interconnection details are given in fig.2. Equipment details are given in Table 1, cable assembly details in Table 2. Detailed technical and servicing information on the equipment is contained in A.P.116B-0208-1.

Power supplies

4. The system requires power supplies of 28V d.c. and 115V, 400 Hz single-phase a.c. The 28V d.c. supply to the transmitter/receiver is fed from fuse No.223 in the E.C.P. The 115V, 400 Hz, single-phase a.c. is fed from fuse No.130, in No.2 distribution box, to the transmitter/receiver and the height indicator. The single-phase a.c. supply is derived from No.6 inverter. Further information on power supplies is available in Sect.5, Chap.1, Group R & S.

Transmitter/receiver

5. The transmitter/receiver is located, on its mounting tray, on the port side of the rear fuselage between frames 35 and 36. The unit comprises a chassis assembly into which are fitted the plug-in modules necessary for the generation, reception and tracking to the radar pulses.

6. Connectors on the front of the unit provide electrical interconnection between the transmitter/receiver, the height indicator, aerials and power supplies. An elapsed time indicator is located on the front of the unit. An integral cooling fan (exhaust type) draws air from an inlet at the rear of the chassis.

Mounting tray

7. The mounting tray is bolted to four anti-vibration mounts attached to the airframe. Two clamps secure the transmitter/receiver to the rack.

Height indicator

8. The height indicator is mounted on the pilot's instrument panel and contains a null-balancing servo system which drives the altitude pointer over the dial. An amber low-level warning lamp (LOW) and a manually-set low-level warning index are also provided. A black-and-yellow striped flag indicates power off or signal invalidity (*para.19*). The dial is illuminated by integral lamps controlled by the aircraft's panel lighting system (*Sect.5, Chap.1, Group L*).

9. A control knob, mounted at the bottom left hand corner of the indicator, provides combined control of the 115V, 400 Hz single-phase supply, a push-to-test facility, and the low-level index setting.

10. Movement of the control knob in a clockwise direction from the OFF position switches on the equipment. Further rotation of the knob sets the low-level warning index against the required height.

11. To initiate the self-test facility, the control knob must be depressed and held depressed. When the system is operating satisfactorily, the height pointer will indicate a height of 100 ± 15 feet.

Low-level warning lamp

12. The remote amber low-level warning lamp is mounted on the pilot's coaming panel and idented RADAR ALT LOW LEVEL WARNING. The lamp is connected in parallel with the low-level warning lamp on the height indicator.

13. The intensity of both low-level warning lamps is controlled by the RAD ALT LOW LEVEL WARN LIGHT dimmer switch on the pilot's coaming panel (*Sect.5, Chap.1, Group L*). Under normal operating conditions the dimmer switch is shorted out by switch contacts in the INST PANEL lamps dimmer switch. When the instrument lamps are switched on, control of the low-level warning lamps is transferred to its own dimmer.

Aerials

14. Two identical, dielectric-loaded, flared-horn type aerials, one for

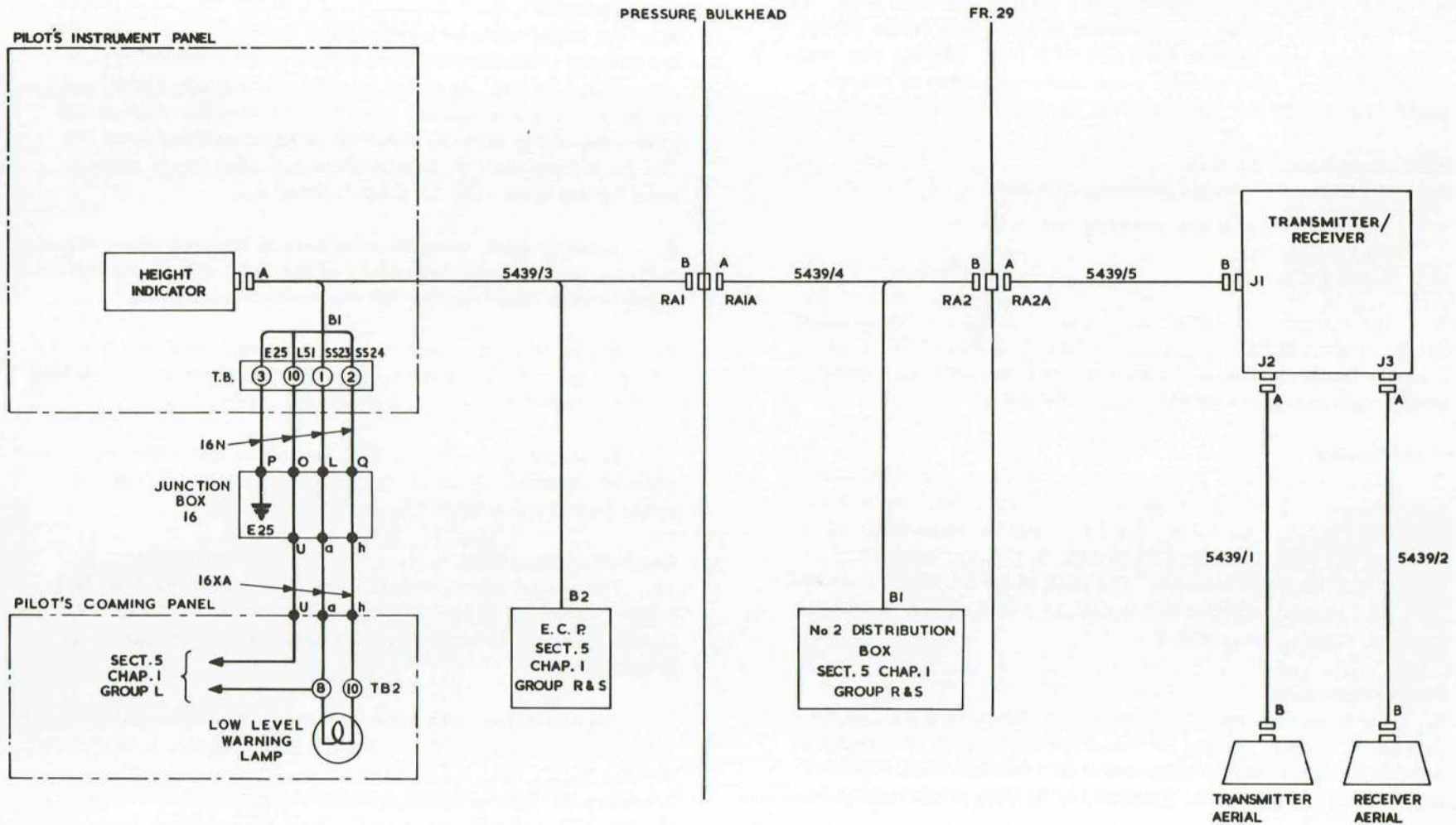


FIG. 2. INTERCONNECTION DIAGRAM-RADAR ALTIMETER (A.R.I. 23219/4)

transmission, the other for reception are flush mounted on the underside of the fuselage. The transmitter aerial is mounted between frames 37 and 38, the receiver aerial between frames 38 and 39. Each aerial is sealed by a fibreglass panel.

15. Since the total length of the connectors from the transmitter and receiver aerials to the transmitter/receiver is less than 20 feet, co-axial cable Type RG 214/U is used.

System operation

16. Within the transmitter/receiver the transmitted pulse is generated in a resonant cavity oscillator. A portion of the pulse is fed to a range computer to serve as a zero-time reference.

Tracking mode

17. Altitude information is derived by a tracking loop which locks on to the leading edge of the reflected ground return pulse and compares it with the zero-time reference. The result of this comparison is a transmitter/receiver output voltage which is proportional to the elapsed time between the transmission of a pulse and its reception back at the aircraft. This voltage, fed to the indicator, is over a range of 0 to -40V, scaled at 8mV per foot, covering altitudes from 0. to 5000 feet.

Search mode

18. If for any reason the returned signal level falls below the minimum level required to maintain the tracking condition, the equipment loses track and reverts to the search mode. In this mode the tracking circuit is caused to sweep from minimum to maximum range, periodically, until lock is regained and tracking recommenced.

Failure indication

19. In the tracking mode, the correct 'on track' condition results in the operation of an internal relay. Contacts of this relay close to feed 28V d.c. to the failure flag circuit, moving the flag to an out-of-view

position. In the search mode, the relay operation is such that the 28V d.c. supply is not made and the flag is displayed. Equipment failure or power supply failure also results in the display of the flag.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Self-testing

20. Depression of the indicator control knob initiates the self-test condition. Correct operation of the altimeter system is indicated by an altitude reading of 100 ± 15 feet on the indicator.

Low-level warning lamp assembly replacement

21. To replace the warning lamp assembly, proceed as follows:-

- (1) Remove the screws and washers securing the lens assembly to the indicator.
- (2) Ensure the aircraft 28V d.c. supply is disconnected.
- (3) Unsolder the lamp assembly leadwires from the indicator terminals.
- (4) Install a new lamp assembly by crimping the leadwires on to the terminals. Cut off excess leadwire.
- (5) Solder the leadwires to the terminals.
- (6) Refit the lens assembly to the indicator.

TABLE 1

Equipment details

Equipment	Type	Ref.No.	Location	A.P. Reference
Transmitter/receiver	HG 9050-D1	5841-00-0580338	Rear fuselage, frames 35-36	116B-0208-1
Mounting tray	1987638-1	5841-00-0639358		
Indicator	JG 206-D1	110Q/9331802	Pilot's instrument panel	
Aerials	LG 81A1	110B/8990817	Rear fuselage (lower) frames 37 and 39	
Low-level warning lamp	-	5CX/4330747	Pilot's coaming panel	

TABLE 2

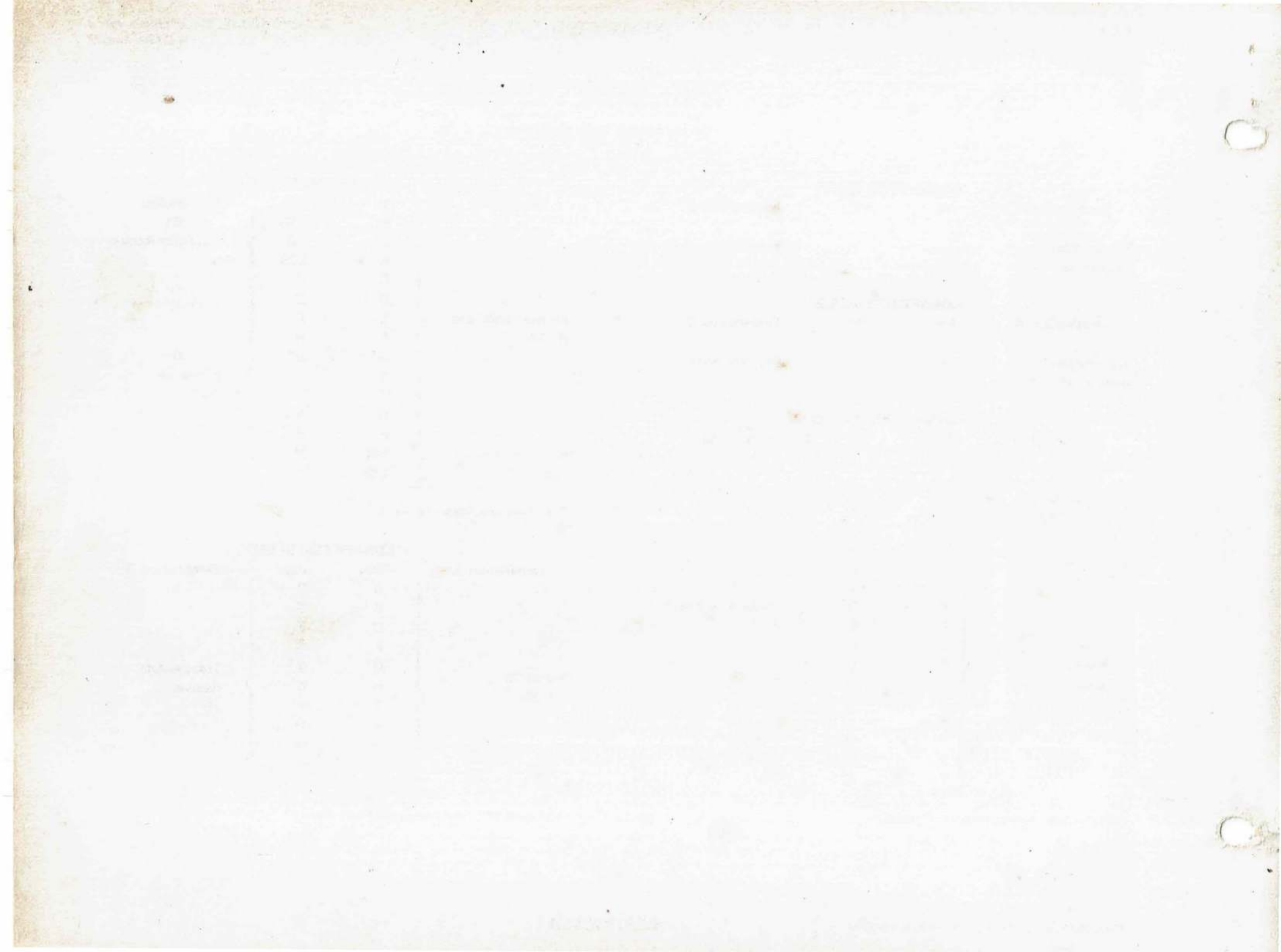
Connector and cable assemblies

CONNECTOR 5439/1		CONNECTOR 5439/2		CONNECTOR 5439/3		CONNECTOR 5439/4		CONNECTOR 5439/5				
Termination A	Pin	Pin	Termination B	Termination A	Pin	Pin	Termination	Pin	Pin	Termination B		
Transmitter/ receiver J2	—	—	Transmitter aerial	Transmitter/ receiver J3	—	—	Pressure bulkhead RA1A	A	A SSG1 B EG K E29 C C D D E F F H G* G* J J P P R R EG B E29 M E29 K	B1 No.2 distribution box B Frame 29 RA2		
Termination A	Pin	Pin	Termination B	Termination	Pin	Pin	Termination	Pin	Pin	Termination B		
Transmitter/ receiver J3	—	—	Receiver aerial	B1 No.2 distribution box	Fuse 223	J G*	Pressure bulkhead RA1	Termination A	Pin	Pin	Termination B	
Termination	Pin	Pin	Termination	B2 Electrical control panel (E.C.P.)	A B C D E F P R V* H U S T	J G* A B C D E F P R K L51 SS23 SS24 E25	B Pressure bulkhead RA1	B B T E C V* b c D M A U	B1 No.2 distribution box B Frame 29 RA2	B Pressure bulkhead RA1 B1 Instrument panel lighting TB	B B T E C V* b c D M A U	B Frame 29 RA 2A Transmitter/ receiver J1

* Screens are linked to pin G

* Screens are linked to pins V and G

* Screens are linked to pins V and G



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