Chapter 5 RADIO ALTIMETER

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General

1. The radio altimeter Mk.7C (post-Mod 1667 and 1820) or Mk.7B (pre-Mod 1667)-ARI 23172-provides a very accurate indication of aircraft height up to a range of 5000 ft, above any type of terrain; the indication is displayed to the pilot on a dial type indicator and, by selection, on a limit light display. The main units of the system are as follows:-

- Transmitter-receiver
- Amplifier

Aerial assembly

Control unit

Height indicator

- Limit lamps
- Junction box

The installation is fully described in A.P. 116B-0203-1, while information regarding the location of components is in Sect.8 of the SDM.

Note...

Although the radio altimeter is interconnected with the autopilot, the original provision of a height signal for a radio height lock mode is not required (Sect.7, Chap.7, this Cover) and the height signal line incorporates a compensating load resistance fitted in the autopilot computer.

Modification standard

2. This Chapter includes Mod 1146, 1168A, 1574, 1667 and 1820.

Function

3. A frequency modulated signal is transmitted to the ground and reflected back to the aircraft. During the time taken for the signal to return, the transmitter frequency changes whereas that of the reflected signal remains constant. The frequency of a portion of the reflected signal is compared with the transmitter frequency at that time, the difference being proportional to aircraft height.

DESCRIPTION

Transmitter-receiver

4. The function of the transmitter-receiver, A-BC, is to generate the signals for transmission and extract and pre-amplify the difference frequency which is dependent upon height. Power requirements are supplied from fuse 1A4 and fuse D5 in dist. box R-A providing 115 V, 400 Hz a.c. and 28 V d.c. respectively.

5. The component parts of the transmitterreceiver are housed in a cylindrical container which is pressurized to deter the ingress of dust and moisture. Dowels and knurled nuts secure the container to an anti-vibration mounting tray enclosed with the aerial system beneath a cover on the forward accessories bay door.

Amplifier

6. The transistorized amplifier, R-GW, in the radio bay, contains its own power supply unit and raises the level of the signal output from the transmitter-receiver to provide an output for the height indicator and limit lamps. The height indicator (para 14) is connected in series with a load resistor fitted in the autopilot computer (Sect. 7, Chap. 7, this Cover).

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Note

The height signal is routed through J.B. R-AW, and relay X is used for switching the signal via the weapons system performance recording system (Sect. 7, Chap. 10, this Cover) for recording purposes.

7. Carried at the rear of the amplifier mounting tray is a junction box having locating dowels to allow accurate alignment of the amplifier connectors. Plug and socket outlets on the junction box are for connection between the amplifier and the main junction box and a co-axial socket connects with a signal lead to the transmitter-receiver. The junction box also contains a zero height control which can only be adjusted when the amplifier is withdrawn from the mounting tray and connected to the junction box by jumper leads. This prevents further adjustment subsequent to installation.

Aerial assembly

8. The aerial assembly, contained with the transmitter-receiver beneath a cover on the forward accessories bay door, comprises a delay unit, A-CH, and two identical horn-type aerials, A-BB (transmitter) and A-BD (receiver) each with a duplexer unit. The polar diagram of the aerial horns is such that there are no erroneous height indications due to slant range effects within 20 deg of aircraft roll and 17 deg of pitch.

Delay unit

9. The delay unit consists of approximately 100 feet of small diameter coaxial cable wound on an aluminium former enclosed in a cast aluminium alloy cover. This unit is connected between the transmitter and receiver aerials and is used to produce an artificial signal for test purposes. The signal is introduced into the indicator circuit by operation of a switch, marked TEST on the control unit and, with the height indicator pre-adjusted to suit the residual height of the Buccaneer aerial installation, should produce a height indication of between 63 and 78 feet.

Duplexer units

The duplexer units each consist of a 10. solenoid-operated switch and a coupling unit mounted on each horn aerial. When the confidence test switch on the control unit is operated, the solenoid-operated switch units isolate the aerials from the transmitter-receiver and couple the transmitting and receiving systems together via the delay unit. To prevent ice formation jamming the switch units, the actuator mechanism is hermetically sealed by a canister screwed on to the assembly. The coupling units are co-axial-to-waveguide transformers and match the impedance of the transmission cables to the horn radiators which are flush-mounted and in intimate contact with the aircraft skin.

Cooling

11. At altitudes below 8000 ft a stream of cooling air, from the cabin air conditioning system, is directed into the cover enclosing the transmitter-receiver and aerial assembly. A continuous stream of cooling air, from the radio bay air conditioning system, is directed onto the amplifier unit. Details of the air conditioning system are contained in A.P.101B-1202-1A, Cover 2, Sect.3, Chap.8.

Control unit

12. The control unit P, on the pilot's port console panel C-G/1, contains the system ON-OFF switch, a rotary link selector switch, a confidence test switch and a range change switch. Three lamps which provide Plastek panel illumination, on the face of the unit, are controlled by the pilot's cabin floodlighting circuit (Cover 1, Sect. 6, Chap. 9B).

13. Limit height selections, which determine the height at which the limit lamps operate, appear in an illuminated window adjacent to the rotary selector switch and are as follows:-

Low range (ft)	High range (ft)
50	500
100	1000
200	2000
300	30.00
400	4000
	5000

In the OFF position the limit lamps are disconnected.

Height indicator

14. The moving coil, dial-type indicator, C-KB, on the pilot's starboard dashboard shroud, reads from 0-500 ft for an input from the amplifier (para 6) of 12 μ A/ft on the low range, and 0-5000 ft for an input of 1.2 μ A/ft on the high range. The indicator continues to read full scale deflection at up to twice the maximum indicated radio height of the aircraft. 15. There are two subsidiary indicator movements on the instrument. The first discloses additional zeros on the 500 ft scale when the high range is selected on the control unit so that the indicator has a maximum height indication of 5000 ft. The second removes the OFF flag when the equipment is switched ON and functioning correctly.

Limit lamps

16. Three lamps C-FR, C-FS and C-FT, mounted vertically in line on the starboard windscreen pillar and coloured amber, green and red respectively, indicate to the pilot that the aircraft is flying high, on, or low with respect to $\pm 5\%$ of the height limit selected on the control unit. The operation of the lamps is controlled by two relays in the amplifier but the lamps and associated mounting bracket are not part of the ARI.

17. Each lamp incorporates a press-totest and rotate-to-dim facility, and a resistance connected across contacts 1--3 of relay A (panel C-S) provides an automatic dimming facility for the green and amber lamps, whenever the relay is energized by selection of the pilot's cabin floodlighting switch to ON (*Cover* 1, *Sect.* 6, *Chap.* 9B).

Junction box

18. Most of the interconnections between the various units of the installation are made in the radio bay via the main junction box R-GR, which has three plug and two socket outlets. This unit is not part of the ARI.

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SERVICING

Deteriorating performance

19. Some deterioration in the performance of this installation, due to the effects of ageing, can be expected. First notice of this condition will be received when the equipment is reported, by a pilot, as unserviceable because of a reduced "hold-off" height indication.

Note

The condition cannot be detected by a confidence check and information on the "hold-off" height check procedure is contained in A.P.101B-1202-15A.

Remedial action

20. A reduced value for the "hold-off" height indication is caused, primarily, by increased spurious noise in the system and/ or increased leakage between the aerial horns, due to inefficient bonding. It is necessary, therefore, to thoroughly examine the aerial system for corrosion between joints and for bad electrical connections, between components and between components and airframe. Concurrently with this procedure the transmitter-receiver and the amplifier unit should be tested in accordance with the standard serviceability test requirements specified in A.P.116B-0203-1. Upon completion of the work, and normal functional tests, a flight test will be required to prove a satisfactory "hold-off" height indication.

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Function test

21. A function test of ARI 23172-radio altimeter is in A.P.101B-12024A3(R).