Group 3.B

ELECTRICALLY OPERATED FLIGHT INSTRUMENTS

◀ (Including Mods.769 and 1232) ▶

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LIST OF ILLUSTRATIONS

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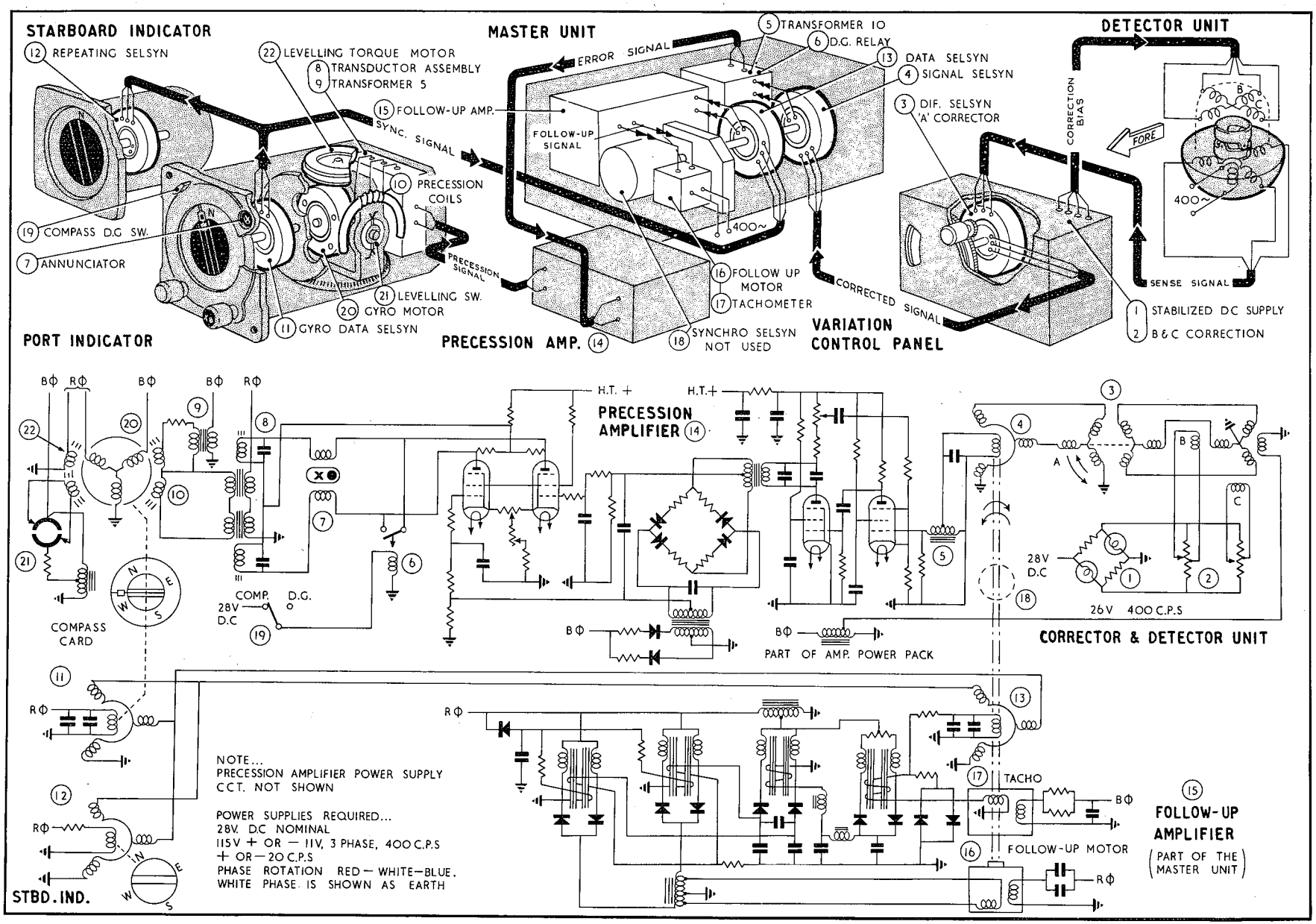

Fig.1 Gyro compass and repeater (theoretical)

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Introduction

1. This group contains a description of the electrically operated flying instruments installed in this aircraft, including the necessary routeing and theoretical diagrams of these installations. For a general description of the instrument installation as a whole, reference should be made to Group 1.A. The location and access to all the instruments and associated equipment is given in Group 1.C. Detailed information on the standard components used will be found in the appropriate Air Publications listed in Table 1.

Gyro compass and repeater

2. The gyro unit of the G4FT gyro compass installation is situated on the centre line of the pupil's flying instrument panel just below the artificial horizon and the compass repeater is located on the starboard instrument panel. The gyro unit is an electrically-operated directional gyro, which is orientated in the earth's magnetic field by a detector unit located in the port side of the tail plane. The compass repeater indication is provided by a Selsyn follow-up facility incorporated in the gyro unit. Both instruments will, therefore, give a continuous indication of the aircraft's magnetic heading at all times throughout flight. The installation, which is supplied with d.c. for compass correction and three phase a.c. from the a.c. supplies circuit, also incorporates a precession amplifier, a master unit and a variation control panel, all of which are mounted in the cabin on the forward face of frame 14. A schematic and theoretical diagram of the installation is given in fig.1. The schematic diagram indicates the signal path through the components and the symbols of the theoretical diagram are arranged immediately below the units in which they are contained. The working points on the schematic diagram are numbered and annotated. These numbers being repeated on the theoretical diagram for reference purposes. The diagram should be used in conjunction with A.P.1275B, Vol.1, Sect.11 to enable an understanding of the installation to be obtained. A routeing diagram of the installation is given in fig.2 and details of the a.c. supplies are contained in Sect.5, Chap.1.

Artificial horizons

3. The artificial horizon for the pupil's use is fitted on the pupil's flying instrument panel just above the gyro compass and that for the instructor's use is located in the centre of the starboard instrument panel. The instruments, which are interconnected by a junction box located just forward of the instrument panels, are electrically-operated gyroscopic units pro-

TABLE 1

Equipment type and Air Publication reference

Equipment Type	Air Publication
Gyro compass and repeater Gyro unit, Type B Repeater, Mk.2 Detector unit, Type A Master unit, Type B Variation control panel Precession amplifier, Type B	A.P.1275B, Vol.1, Sect.11
Artificial horizon, Mk.4 Artificial horizon, Mk.6C Levelling control unit, Type B Turn and slip indicator, Mk.2	A.P.1275A, Vol.1, Sect.13
Tail plane position indicator, Type 587 FL Tail plane and glap position transmitters, Type C Rudder and aileron trim indicators, Type 501 FL Rudder tab position transmitter, Type 470 FL Aileron tab position transmitter, Type 568 FL Flap position indicator, Type 19HSD *(Mod.769)*	A.P.1275A, Vol.1, Sect.16
Airstream direction detector Mk.2 *(Mod.1232)*	A.P.1275, Vol.1, Sect.27
Airstream direction detector master switch, C.W.C., Type XD.778, No.4	A.P.4343C, Vol.1, Book 1, Sect.1

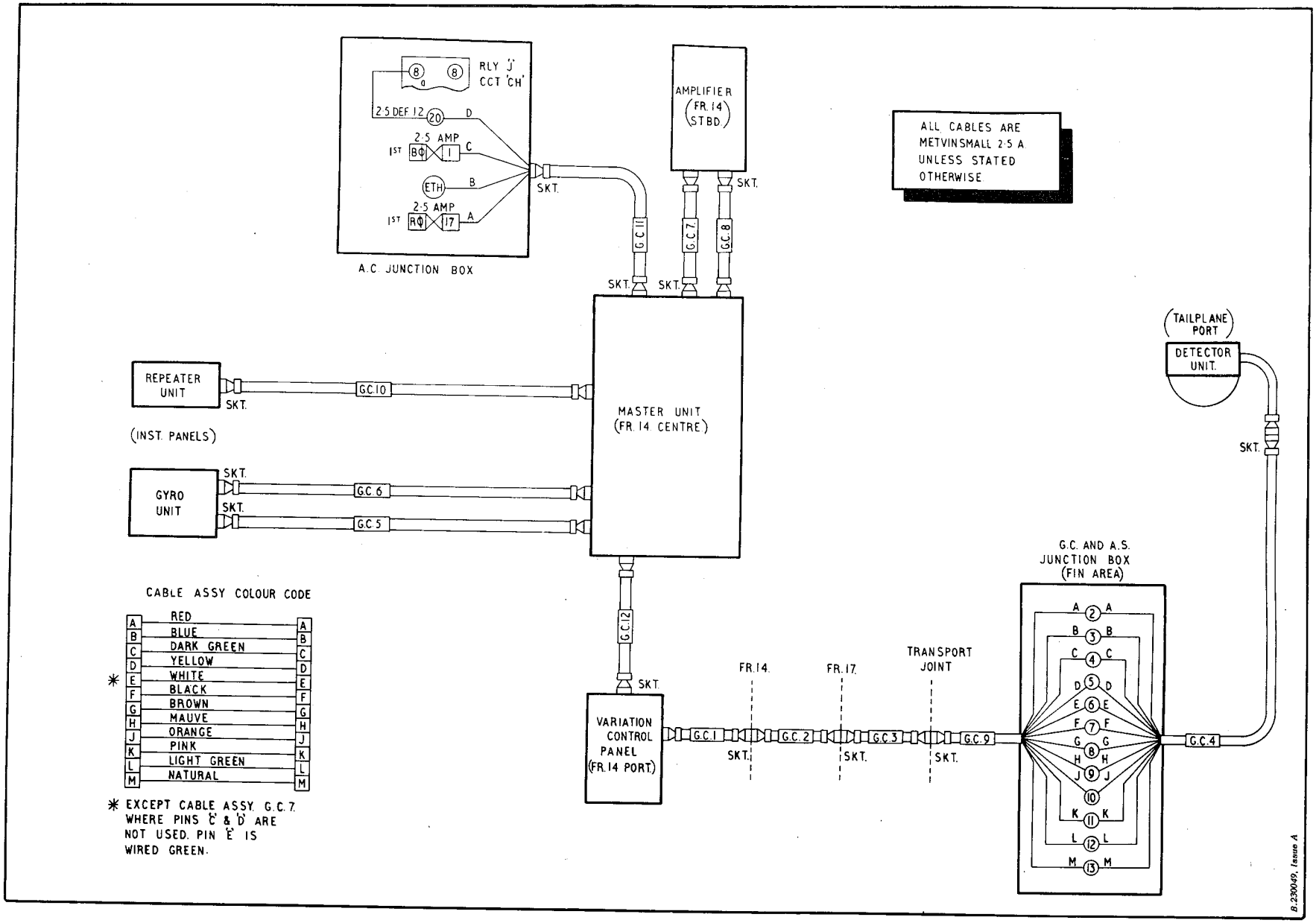

Fig. 2. Gyro compass and repeater (routeing)

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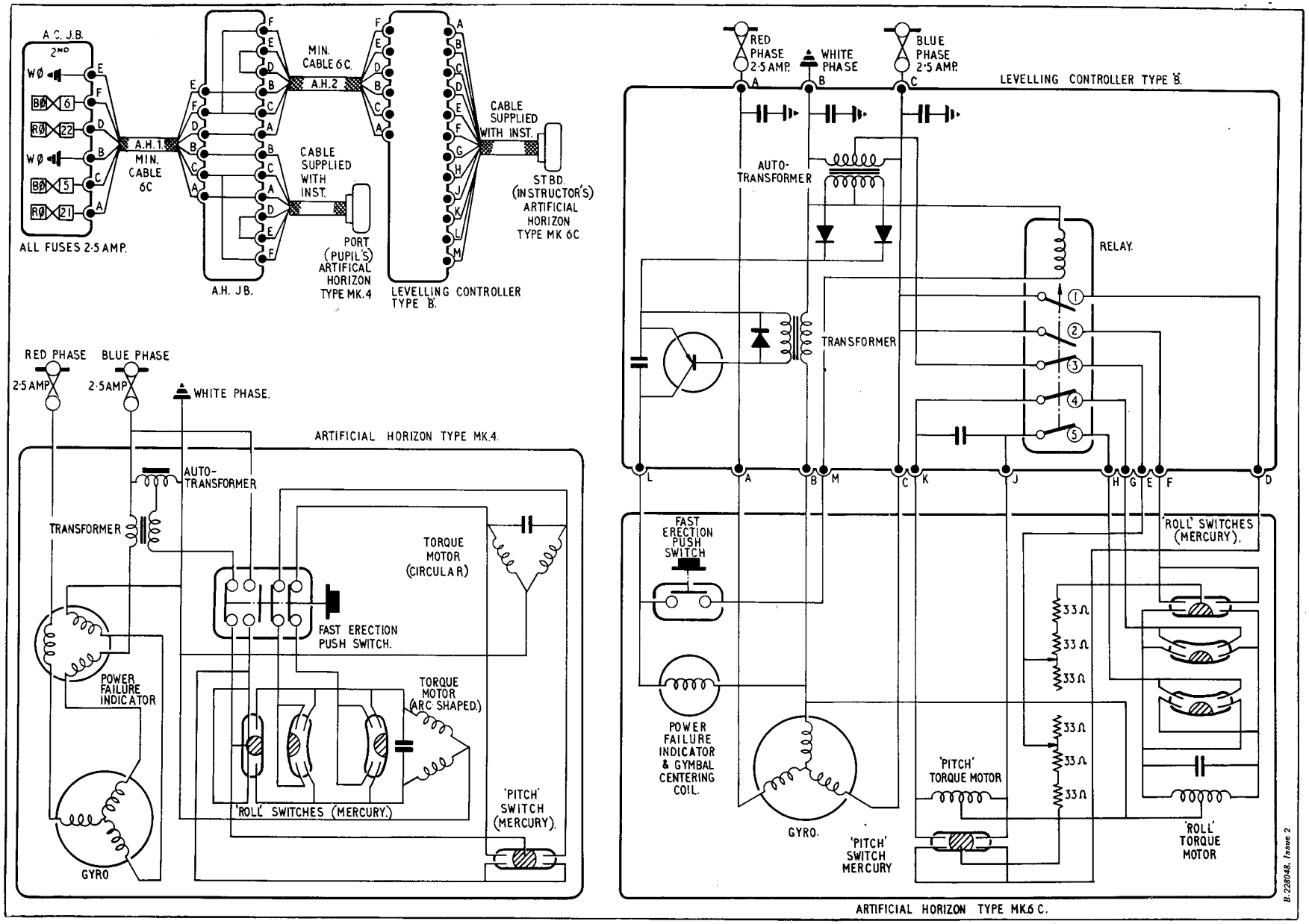

Fig.3 Artificial horizons (routeing and theoretical)

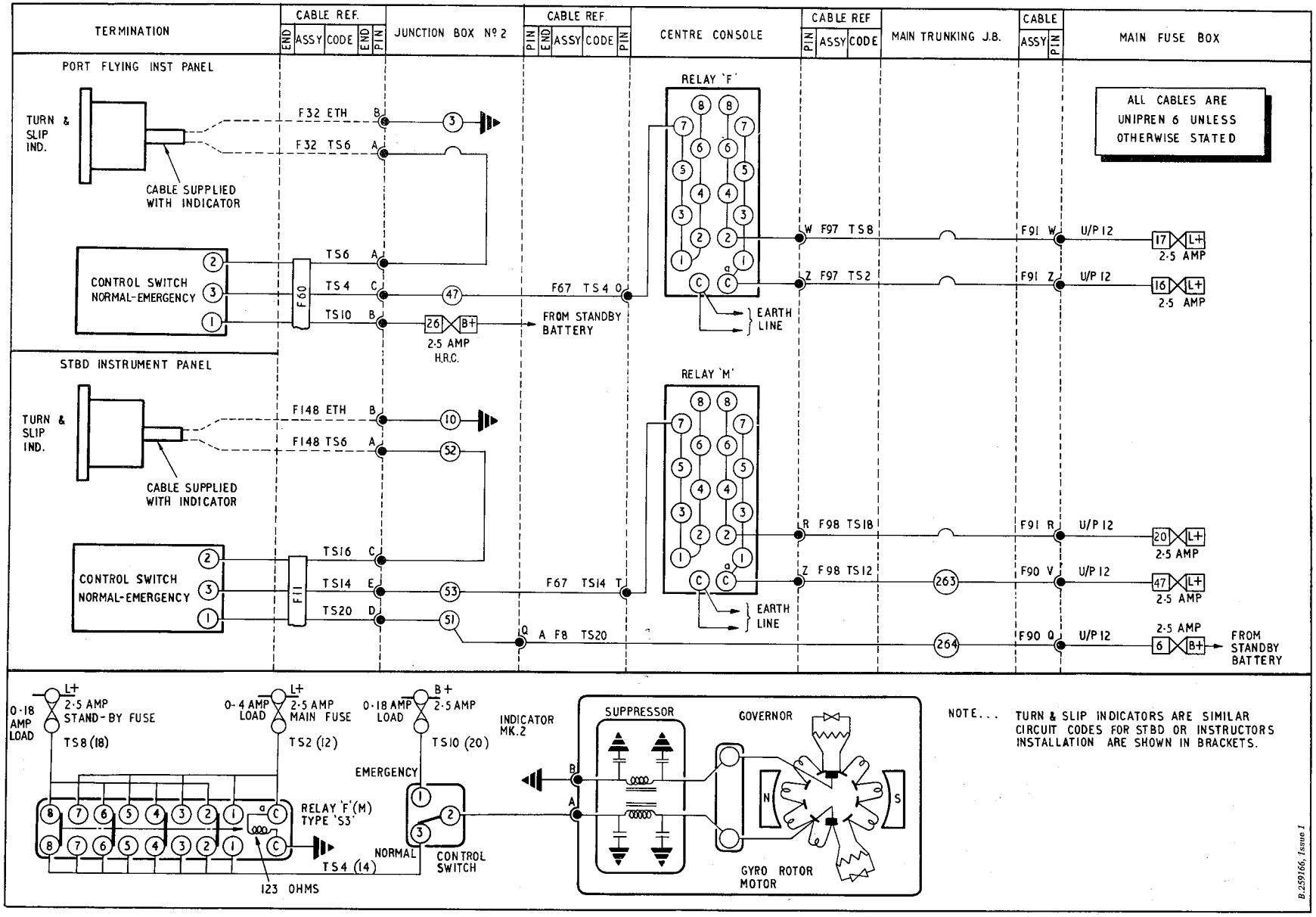

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Fig. 4. Turn and slip indicators (routeing and theoretical)

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viding a continuous indication of the aircraft's attitude in roll and pitch in relation to the natural horizon. They are supplied with three phase a.c. from the a.c. supplies circuit, as described in Sect.5, Chap.1, Group E.1. The a.c. supply feeds the pupil's instrument direct, but the supply to the instructor's instrument is fed via a levelling control unit employed to give automatic fast erection to the gyro, on the initial starting of the instrument. The control unit is situated on the cross strut at frame 3 adjacent to J.B.2. Manual fast erection of the gyro may be attained by use of the fast erection push switch located on the bottom left hand side of each instrument. A routeing and theoretical diagram of the installation is given in fig.3.

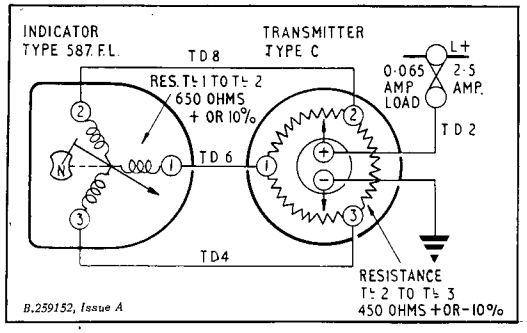

Fig.5 Tail plane position indicator (theoretical)

Turn and slip indicators

4. Two turn and slip indicators are provided, one on the pupil's flying instrument panel and the other on the starboard instrument panel, to show the lateral attitude of the aircraft and to indicate skid, side slip, or correct banking during a turn. Each instrument is independantly operated by an identical circuit as shown in fig.4. The normal supply to each instrument is controlled from the battery master switch through one of a pair of duplicated fuses. If a main fuse fails, the associated relay, F or M, will be de-energized and the instrument supplied from the standby fuse without interruption. In the event of complete electrical failure, operation of the control switches, one adjacent to each indicator, to EMERGENCY will provide a supply from the standby batteries.

Note . . .

Due to the fuse change-over facility of this circuit, it is important to check that the normal and standby circuit fuses are both serviceable, before each flight.

Tail plane position indicator

5. The incidence of the tail plane is shown on an indicator situated on the port side of the pupil's flying instrument panel just above the machmeter. The indicator is operated by a Desynn transmitter located in the dorsal fin just above the tail plane

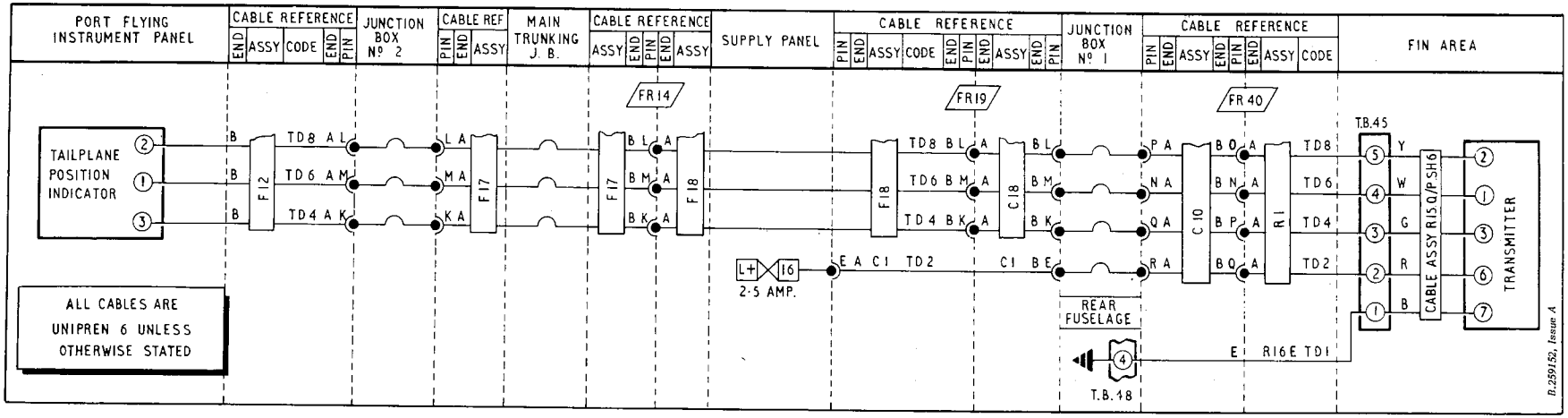

Fig.6 Tail plane position indicator (routeing)

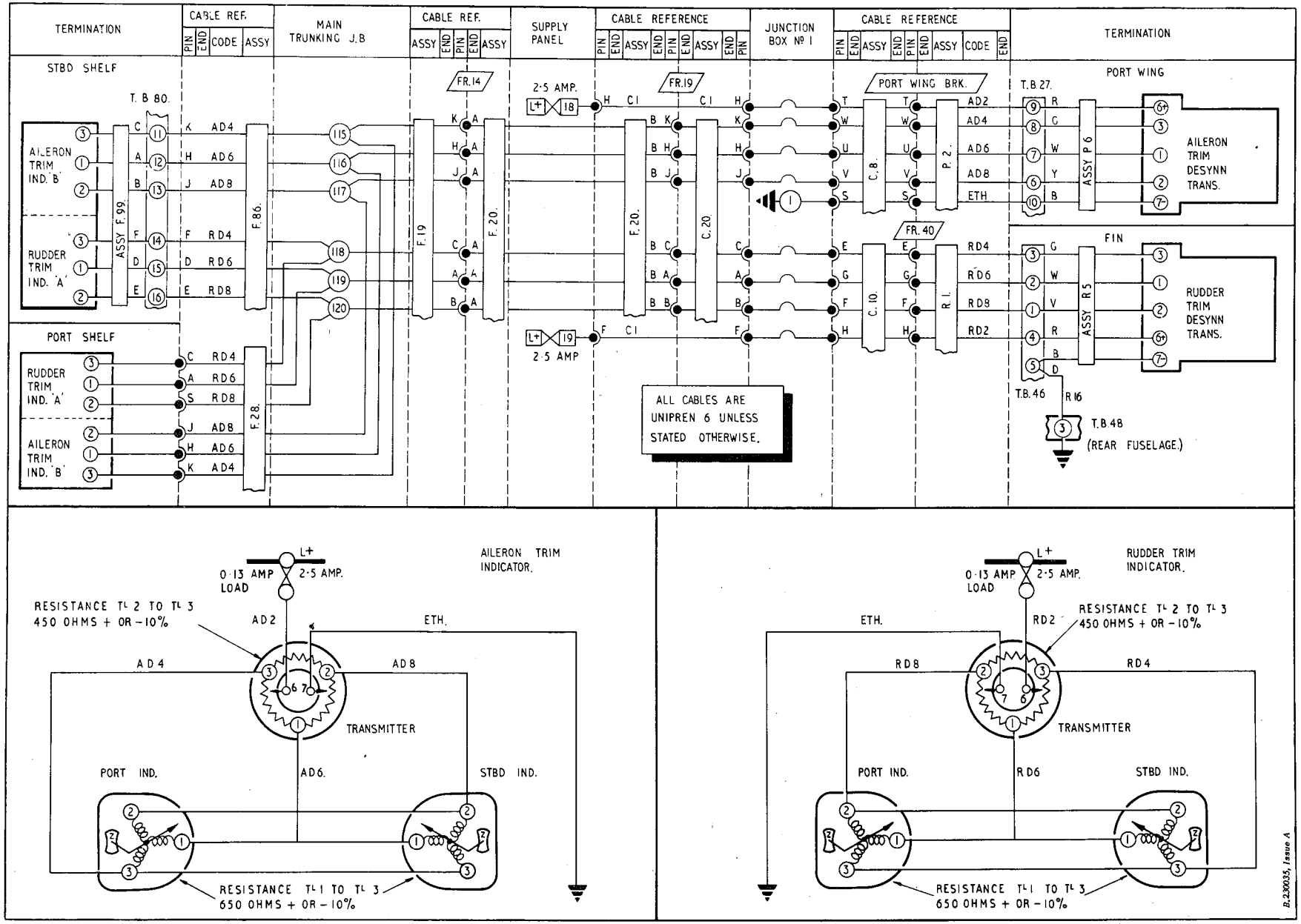

Fig.7 Rudder and aileron tab position indicators (routeing and theoretical)

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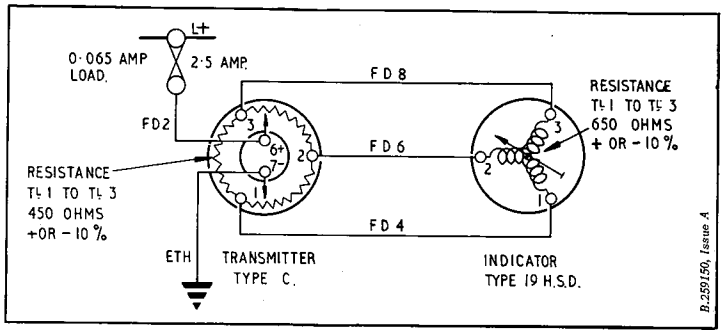

Fig.8 Flap position indicator (theoretical)

actuator and linked to the actuator by a short operating rod. A theoretical diagram of the circuit is given in fig.5 and a routeing diagram in fig.6. Details of the Desynn system will be found in the Air Publication listed in Table 1.

Rudder and aileron tab position indicators

6. The setting of the rudder and aileron trim tabs are shown on twin indicators located just forward of the trim switches on the cabin port and starboard shelves. The rudder portion of each indicator is operated by a Desynn transmitter, which is bolted to nose rib F in the leading edge of the fin and the aileron portion of each indicator is actuated by a further Desynn transmitter located adjacent to the tab actuator in the aileron structure. Both transmitters are actuated by cables connected to levers on the tab actuators. Routeing and theoretical diagrams of the electrical circuits of these indicators are given in Fig.7.

Flap position indicator

7. This indicator is located on the port side of the pupil's flying instrument panel just below the machmeter and is operated by a Desynn transmitter located in the port wheel bay and linked to the flap drum switch and interconnecting levers by a Bowden cable. A theoretical diagram of the circuit is given in fig.8 and details of the routeing of the electrical cables will be found in fig.9.

◀ Airstream direction detector

8. The airstream direction detector installation, *(A.D.D.)*, introduced by Mod.1232, enables the pilot to fly at the optimum approach angle, whilst concentrating his attention outside the cabin. The complete installation comprises a probe unit which transmits aircraft angle of attack information to the cabin mounted indicator and to the indicator lights box via the three tone audio generator. The ▶

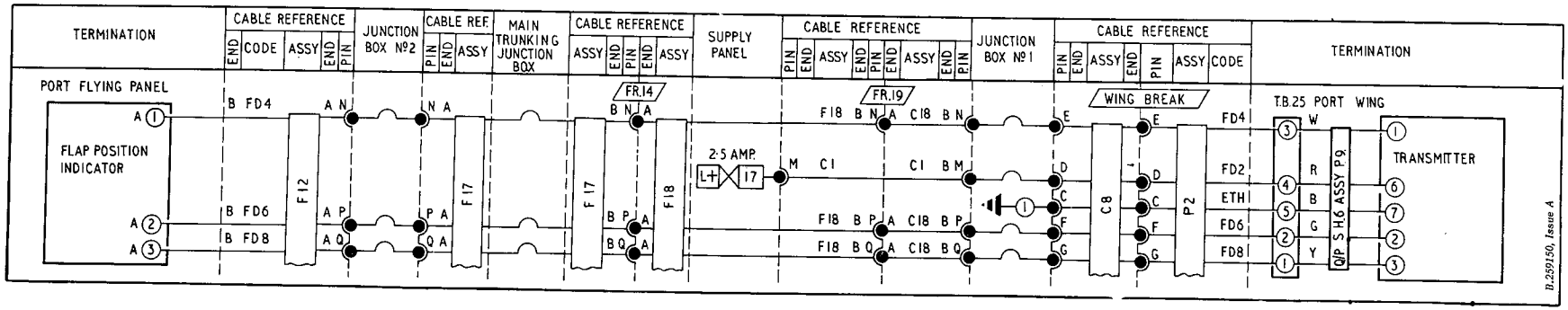

Fig.9 Flap position indicator (routeing)

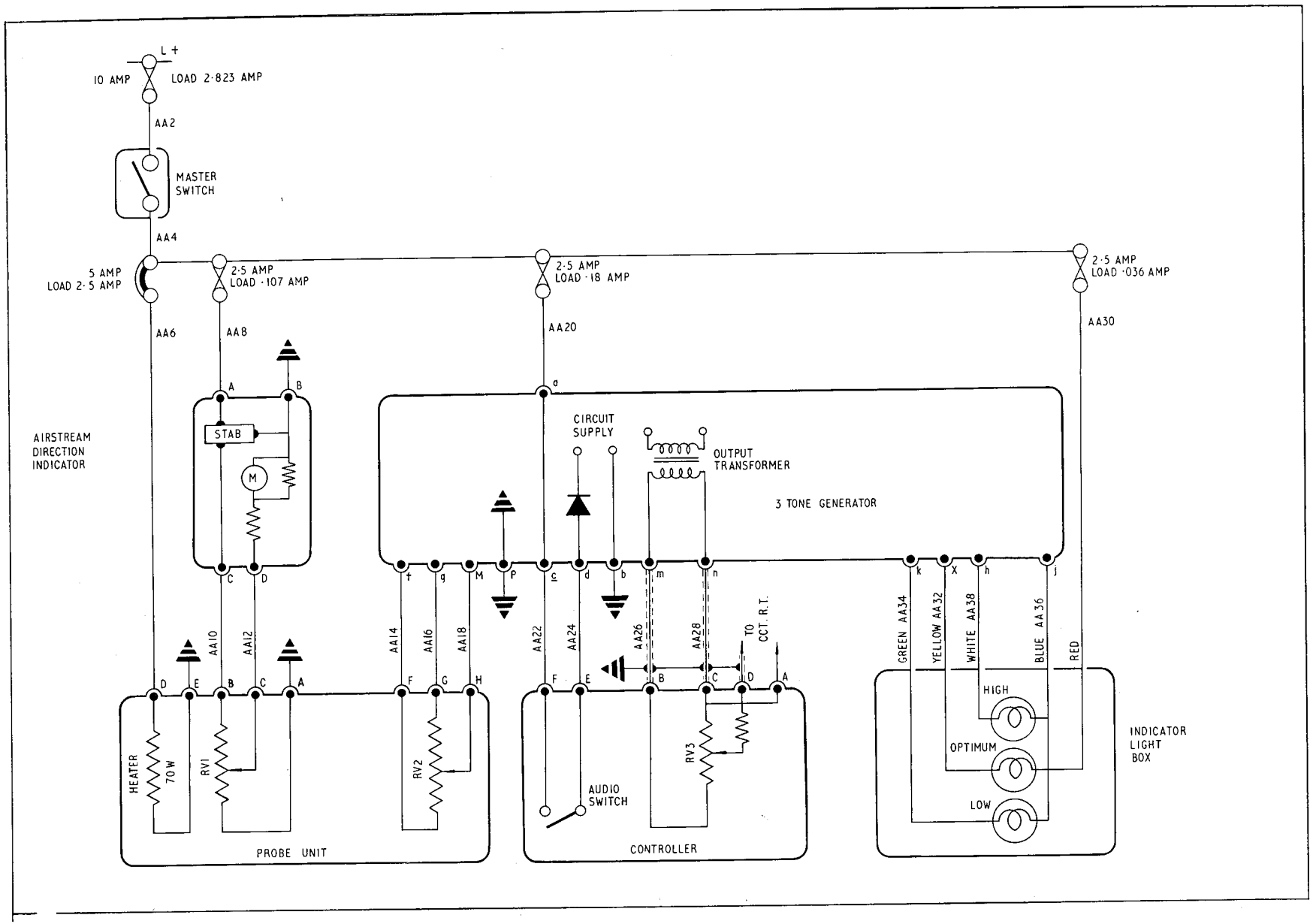

Fig. 10 Airstream direction detector (theoretical)

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◀ indicator and indicator lights provide a visual warning to the pilot, whilst the audio generator also gives an aural warning through the pilot's telephone circuit via a radio circuit and an audio control unit. An ON/OFF master switch is also incorporated for the installation and interconnection of components is by multi-pin plugs and sockets.

9. The stainless steel probe projects horizontally into the airstream from the port side of the fuselage centre line between frames 5 and 6 and is protected by a cylindrical metal cover. It is formed in two passages with the outer casing slotted to allow the airstream to pass to the inner end of the probe unit to a paddle chamber. Variations in angle of attack cause the paddle and probe to rotate, moving the wiper arms of two potentiometers which are attached to the inner end of the probe. Signals from the first potentiometer are used to operate the angle of attack indicator and the signals from the second potentiometer pass to the three tone generator for operation of the lights box and audio warning circuit. The probe has a 50 deg. movement and contains a 28V d.c. thermostatically controlled anti-icing heater. The mounting of the probe unit incorporates a vernier adjustment ring for accurate setting of the probe on initial installation.

10. Power supply for the installation is from a 10 amp. fuse in the main fuse box via the A.D.D. MASTER switch. This single pole switch is mounted on the port longeron at the aft face of frame 9 in the cabin and when selected ON, passes a supply to a 5 amp. circuit breaker which protects the circuit for heating the probe, and to three 2.5 amp. fuses which protect the 28V supplies to the angle of attack indicator, the three-tone generator, and the indicator lights respectively. The 5 amp. circuit breaker and three 2.5 amp. fuses are contained in the A.D.D. J.B. which is secured to a bracket on the lower starboard front face of frame 6. This J.B. is also the main earthing point for the A.D.D. installation. Theoretical and routeing electrical circuits are shown in figs.10 and 11.

11. The A.D.D. controller is mounted adjacent to the MASTER switch in the cabin and its function is to provide on/off switching and volume control necessary for control of the approach aid part of the installation. The on/off switch controls the 28V d.c. supply and the volume control knob forms part of an attenuator circuit operating into the three-tone generator.

12. The A.D.D. indicator and indicator lights box are mounted adjacent to each other on a bracket attached to the top of the port glare shield, so situated as to be in the pilot's angle of vision when concentrating on an approach to landing. The indicator, labelled ANGLE OF ATTACK has a 200 deg. needle movement reading from 0 deg. to 30 deg. angle of attack and receives its operating voltage signals from the first potentiometer on the probe unit. The indicator lights box consists of a visual display unit containing three lamps. The presentation is shown as an illuminated circle representing the optimum angle of attack and two illuminated arrowheads which indicate the direction of the airframe correction necessary to return to the optimum angle. The illumination brightness is manually controlled by an external lever which operates an optical dimming system consisting of fixed and moveable polaroid discs. The switching action to the lights box, which is produced by signals received from the three-tone generator is such that an overlapping action of both circle and arrowhead is obtained, allowing five indications with the three lamps. A detachable anti-glare hood is fitted to the lamp box.

13. The three-tone generator is mounted on a bracket on the starboard side of the nose bay between frames 5 and 6 and electrical connections are made by a single multi-pin plug. The function of the generator is to provide an audio and lights sequence presentation of the angle of attack for the approach condition. The audio signal is fed to the pilot's headphones via the radio circuit, and the visual signal is shown by the lights ▶

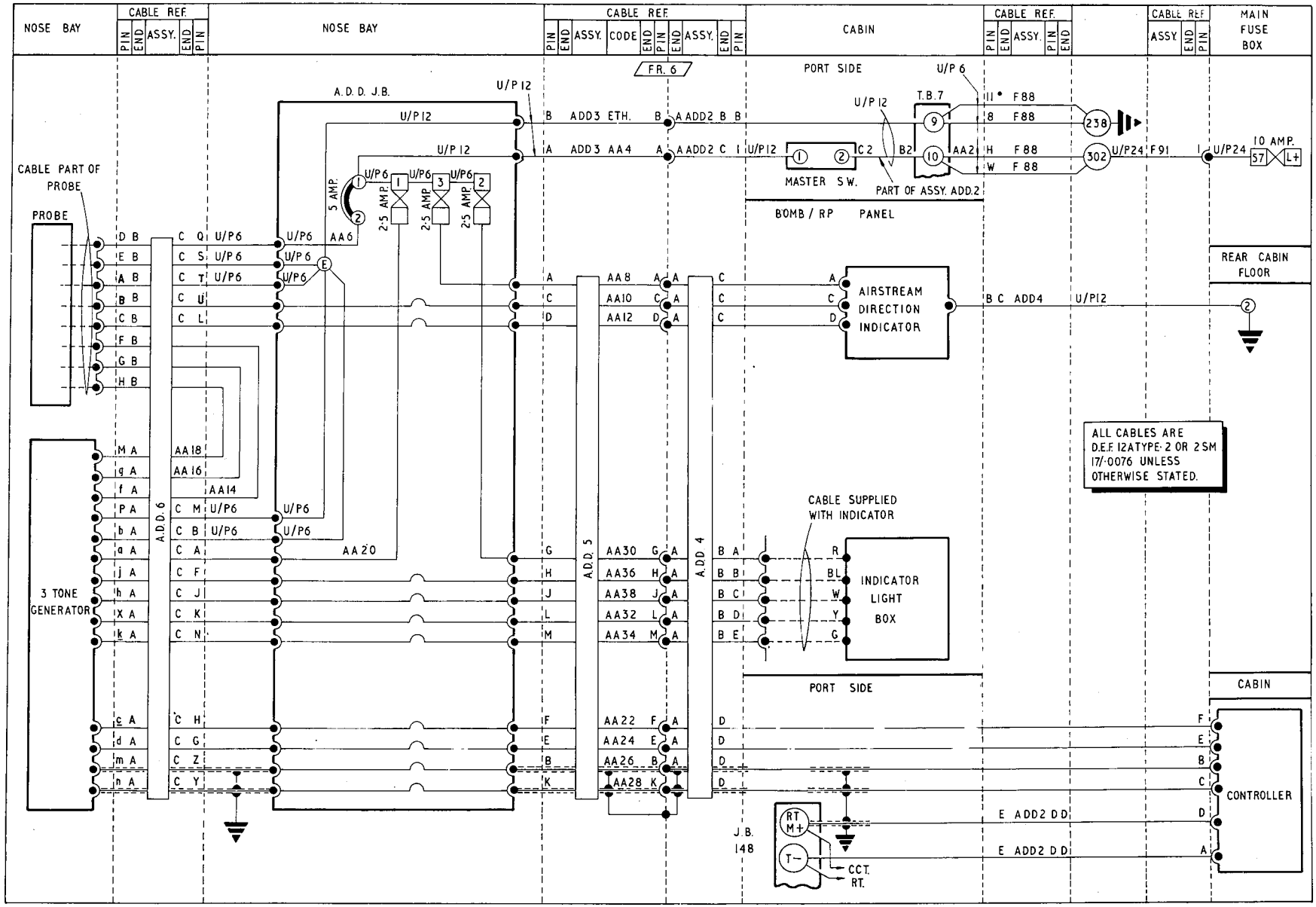

Fig.11 Airstream direction detector (routeing)

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◀ in the indicator lights box. The generator has a 28V d.c. supply and receives its operating signals from the second potentiometer in the A.D.D. probe unit. For further information on the A.D.D. installation reference should be made to the Air Publication listed in Table 1.

SERVICING

General

14. The necessary servicing to maintain the instruments in an efficient condition and the standard serviceability tests, which should be applied, together with the equipment to be used and the method of conducting the tests is contained in the appropriate Air Publications listed in Table 1. The method of adjusting the linkages to the various Desynn transmitters will be found in Book 1, Sect.3, Chap.4. Before servicing or removing any of the electrically-operated instruments, the aircraft must be rendered electrically safe, as described in Sect.5, Chap.1, Group A.1.

REMOVAL AND ASSEMBLY

General

15. The removal of the instrument panels carrying the electrically-operated flying instrument is described in Group 1.B. Once access has been obtained, the removal of the instruments from the panels should present no unusual difficulties. Access to the rudder tab Desynn transmitter may be gained by removing a door from the port side of the upper fin structure and access to the aileron tab transmitter is obtained by removing an access door from the upper surface of the aileron nosing, after the removal of the aileron.

A.D.D. junction box

16. The recommended method of removal of this junction box is as follows:-

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

(2) Unscrew A.D.D.6, A.D.D.5 and A.D.D.3 connections and fit approved blanking caps and covers.

(3) Undo the four screws securing the J.B. to its mounting, and remove the box from the aircraft.

A.D.D. three-tone generator

17. To remove this generator from the aircraft, proceed as follows:-

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

(2) Unscrew multi-pin connector A.D.D.6 and fit approved cap and cover.

(3) Undo the four bolts securing the generator to its mounting bracket, withdraw the unit upwards through its mounting and remove from the aircraft.

A.D.D. probe unit

18. Once access has been gained to the port side of the nose wheel bay, the recommended procedure for removing the probe unit is as follows:-

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

(2) Disconnect probe unit cable from A.D.D.6 and fit blanking caps and covers.

(3) Note vernier setting on adjustment ring for re-assembly, support probe unit body and undo the six retaining bolts.

(4) Remove the vernier clamp ring then withdraw the probe unit inboard, being careful to keep it horizontal to prevent damage to the probe until it is clear of the aircraft skin.

(5) Remove the seal from inside of housing, replace ring clamp assembly and secure it loosely with the six retaining bolts.

(6) Fit a blanking cap to probe orifice in the aircraft skin and cover the probe unit housing to prevent ingress of dust and moisture.

(7) The probe unit, complete with vernier adjustment ring may now be removed from the aircraft,

Note...

On re-assembly ensure a new seal is fitted to the inside of the probe unit housing and that the vernier adjustment ring is at the same setting as on removal, before tightening down the six retaining bolts. The retaining bolts must be tightened down uniformly to avoid distortion of the vernier adjustment ring. ▶