Chapter 3C DYNAMIC FLIGHT REFERENCE SYSTEM

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LIST OF ILLUSTRATIONS

DESCRIPTION

General

1. This sub-chapter deals with the dynamic flight reference system, in which a master reference gyro unit supplies continuous flight attitude, heading, bank and elevation angle information to the attitude indicator, AI 23C system, flight control computer and the navigation display.

2. The main items of the dynamic reference system are:-

A reference gyro unit
Electronic unit
An amplifier
Navigation display unit
Speed display unit
Attitude indicator

3. The system operates in conjunction with the Tacan offset computer and coupling unit, the compass detector and the I.L.S.

4. Navigational information is presented by two roller blind displays which, together with a height and rate-of-climb display are installed in a rack housing at the centre of the cabin instrument panels.

5. A speed display unit, mounted above the rack assembly, presents information regarding indicated airspeed and Mach number.

6. Electrical connections to the displays are made through multiple plugs, at the rear of the units, which engage with sockets integral with the housing.

Master reference gyro system Mk.2

7. The M.R.G. Mk.2 consists basically of two parts, a gyro reference unit and an electronic unit. Both are located in the main equipment compartment and are interconnected electrically by plugs and sockets. The first part contains two low-drift gyro units, the erection of which is controlled by liquid levels. The gyro reference unit provides gyroscopic stabilization of the system and, in conjunction with its associated electronic unit, gives continuous flight attitude and heading information to the indicating instruments and equipment requiring such information for their operation.

8. The electronic unit, mounted adjacent to the gyro reference unit, contains the power pack, amplifiers, power supply circuits and mechanisms for operation of the system.

Note...

Dependent on the availability of equipment, the Mk.2 M.R.G. system can have a Type A or a Type B gyro reference unit and a Type A or Type B electronic unit fitted. Each unit is interchangeable, the only difference being that Type A is of American manufacture and Type B is made in Great Britain.

Should supplies of the Mk.2 M.R.G. not be available, provision is made by Mod.2342 to incorporate in the system a Mk.1 M.R.G. which does not have an electronic unit.

Control

9. Initial control of the M.R.G. is by the instrument master switch, the other controls being the M.R.G. ON/OFF switch, and the FAST ERECTION switch, which are both mounted on the instrument panel A3.

Note...

The latter switch must not be operated during the normal erection cycle, which is completed only when the amber power failure warning disc on the attitude indicator clears.

Distribution box

10. In addition to the wiring and equipment associated with the flight control system, the flight control distribution box, housed in the main equipment compartment, also contains two miniature relays, a Type B power failure switch, a relay delay unit, and a capacitor/resistor network assembly, which are used in the gyro circuit of the dynamic flight reference system. Interconnection between the units is via terminal blocks inside the box.

Navigation display unit

11. The Type C navigation display unit operates as a compass, heading indicator, and also for the display of I.L.S. and Tacan information. The presentation is illuminated by six 4-volt lamps, behind red filters, which are supplied from the a.c. lighting circuit. Electrical connections are made via four multi-pole sliding contact plugs which mate with sockets integral with the display rack housing. Warning of power supply failure is given by the power

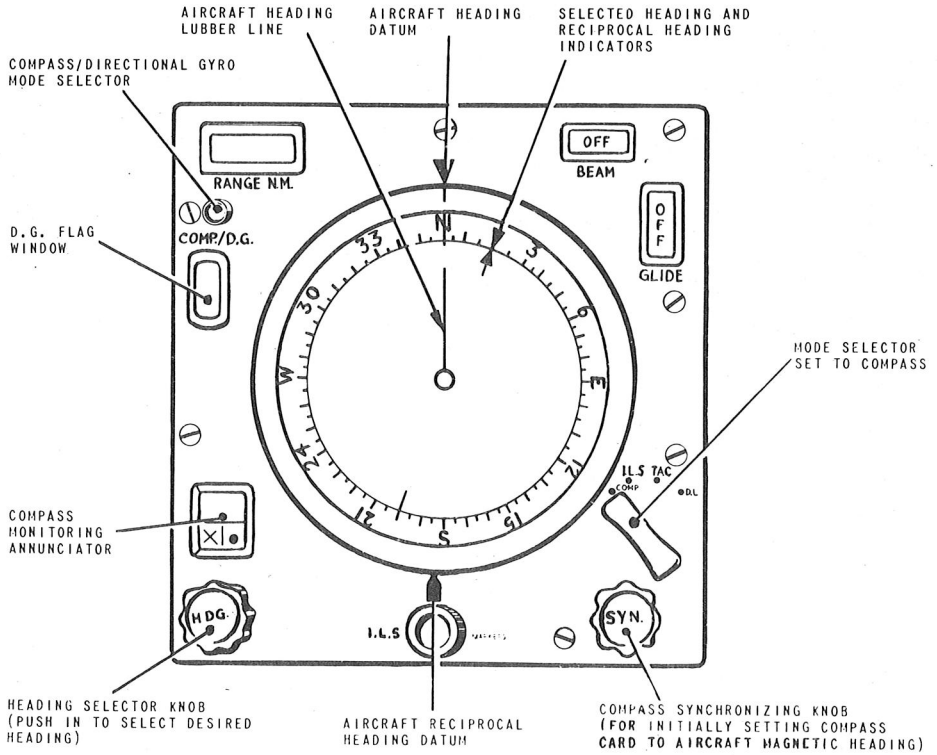

Fig. 1. Compass presentation

failure flag, incorporated in the Type F4 attitude indicator, which serves both instruments.

12. The navigation display can operate in any one of four modes: compass, I.L.S., Tacan (offset or direct), and D.L. (data link). Although data link is not used in this aircraft the D.L. mode should be used for direct Tacan presentation. Selection of the mode required is made by the mode switch on the face of the instrument.

13. The compass card, which is visible and operating in all modes, is an annulus having five and ten degree markings. When synchronized, the magnetic heading of the aircraft is read against a fixed lubber mark above the card. In the other three modes, information is presented on a roller blind behind the compass card.

Compass presentation

14. When selected for compass presentation *(fig.1)* the display can be used either as a compass or a directional gyro, the change-over being effected by the COMP/DG push switch on the face of the instrument. On selecting DG, the letters DG appear in a small window below the switch. A compass synchronizing control, marked SYN at the lower right corner of the display, is used to synchronize the system manually when setting the compass card to indicate aircraft heading. Depressing and rotating the SYN knob operates a differential control transformer which enables a suitable electrical angle to be added to the information from the gyro so that the compass card agrees with the magnetic reference.

15. A compass monitoring annunciator is fitted behind a small window above the HDG knob. Immediately after switching on, the compass card may be pointing in a random direction, and it will be necessary to set the card to indicate aircraft heading by manually synchronizing the system. If allowed to operate freely, the card will precess towards the synchronized heading at a rate of 3 deg per minute.

I.L.S. presentation

16. The I.L.S. provides the pilot with visual indication of the position of the aircraft relative to the runway. The system operates with glide path and localizer ground transmitters which transmit vertical and lateral beams forming the approach path, and marker beacons which indicate the distance from the touchdown point. For further details of the system as a whole, reference should be made to Sect.8, Chap.2, in

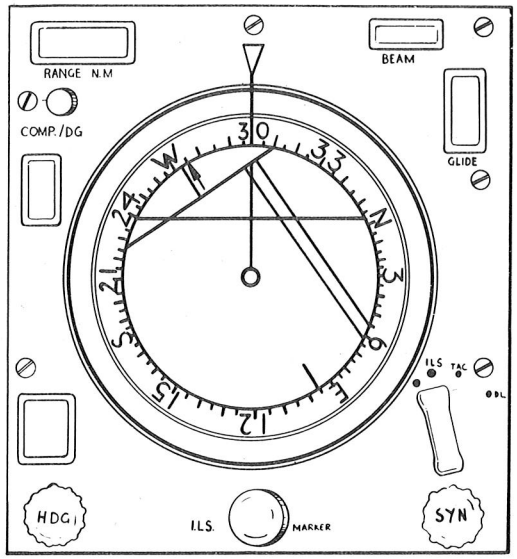

Fig. 2. I.L.S. presentation

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17. When the display is selected to the I.L.S. mode, the display shown in fig. 2 will be presented. The runway or localizer beam is represented on the display blind by a pair of parallel lines whose displacement from a localizer datum represents the aircraft bearing from the beam. Glide path is represented by a bar which is motored into position between the compass card and the roller blind. The bar indicates the position of the centre of the glide path beam relative to the aircraft, displacement being read with respect to the fixed central index on the cover glass which represents the nose of the aircraft (i.e. glide path bar above centre datum, aircraft is below beam).

Distance marker

18. A distance marker lamp at the lower centre of the display indicates the distance from the touchdown point by flashing intermittently as the aircraft passes through the cone of the marker beacon signals. The frequency and duration of the flashes provide visual identification of the marker beacon to which the system is tuned. The lamp is fitted with a manually-operated night screen.

Tacan presentation

19. During Tacan operation, the Tacan signal passes through the offset computer and enables the position of the offset point, such as an airfield relative to the Tacan beacon in use, to be set up in the computer by the pilot. The navigation display will then indicate the range and bearing of the offset point from the aircraft to enable a direct course to be flown without calcu-

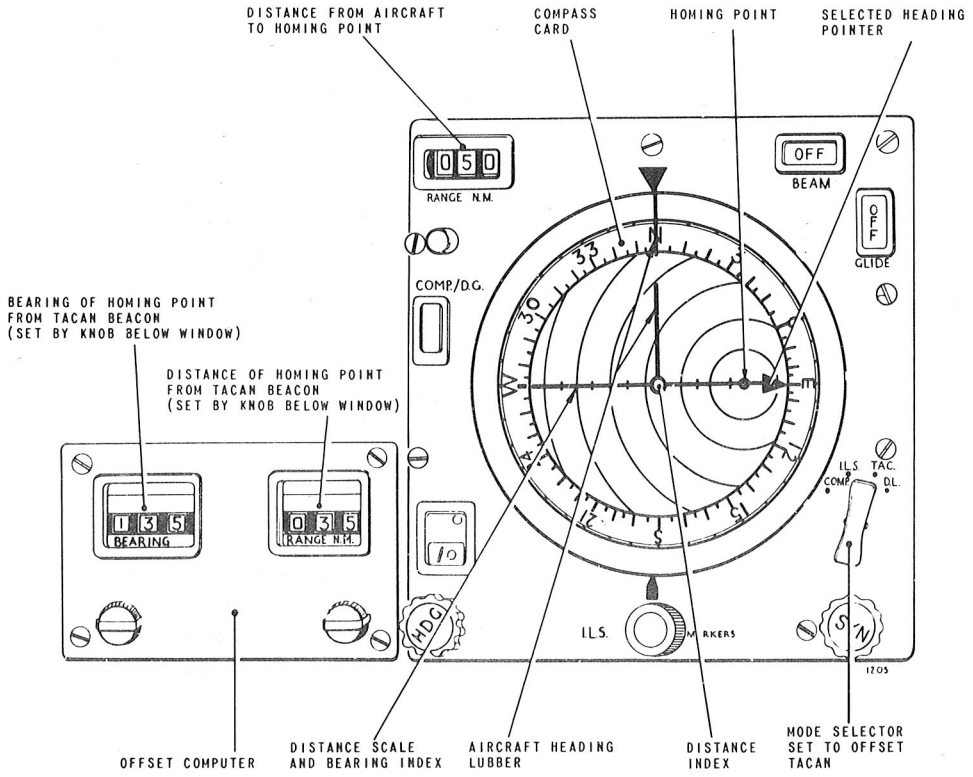

Fig. 3. Tacan presentation

lation. The electrical signals from the Tacan system are fed into the display system via a Tacan coupling unit.

Tacan offset computer

20. The Tacan offset computer is positioned on the starboard side of panel A1. The front face of the unit carries two windows through one of which bearing indications are shown in degrees and through the other, range in nautical miles. Below each window is an offset vector setting-knob appropriate to the functional indications shown above it. The indicators are illuminated by internal 4-volt lighting *(Sect.6, Chap.8)*.

Navigation display amplifier

21. The Type B amplifier unit, located in the main equipment compartment, incorporates a number of servo-amplifiers, correction controls for compass coefficients 'B' and 'C', Tacan display adjustment controls, and an integral power unit fed from the aircraft a.c. and d.c. supplies. Connections to the amplifier are made through Mk.4 connectors on its front panel, which also carries a 25-pole test socket and various adjustable controls used during compass swinging and setting up of the system.

Detector unit

22. The signal outputs from the Type C detector unit are, after amplification, used to monitor the azimuth gyro in the dynamic reference system. The detector unit comprises a gimbal mounted pendulous flux-gate element assembly and electromagnetic deviation corrector coils. Fluid damping is provided for the pendulous assembly.

23. The detector unit is fitted in an upright position in the aircraft fin. Locating bosses marked TOP and BOTTOM respectively, are provided for correctly positioning the instrument. Each boss is also marked FORE and AFT, to assist in adjustment of the unit to the fore- and aft datum of the aircraft. Around the periphery of each boss, a 20 deg scale divided into increments of 2 deg, facilitates rotational adjustment about the fore-and-aft centre line of the instrument. Connection to the unit is by a 10-pole plug and socket located beneath the unit in the fin.

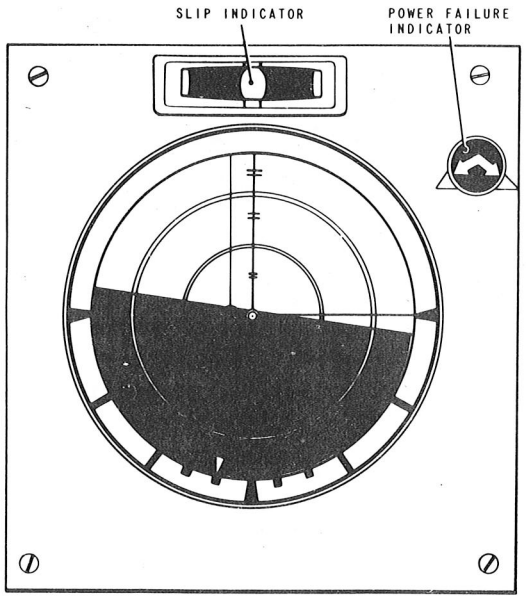

Fig.4. Attitude indicator

Attitude indicator

24. The Type F4 indicator in the display rack shows the attitude of the aircraft in flight. The indicator is servo-operated and displays M.R.G. bank and elevation angles on a linear scale. Flight director information is displayed by an annular index bead which moves in response to position signals from the flight director system. The attitude presentation and flight director presentation are completely independent of each other, except that the zero datum for the elevation graticule is also the zero datum for the flight director. A ball-in-tube slip indicator is mounted on the face of the instrument.

25. Electrical connections to the indicator are made via a sliding contact multi-pole plug which engages with a similar type of socket incorporated in the rack mounting. Above the connecting plug are two fuses which protect the A and C phases of the a.c. supply to the indicator. Failure of the power supplies is indicated by an amber disc, showing two arrows, which appear behind a small circular window on the face of the instrument. The failure indicator operates in conjunction with the power failure unit in the distribution box should the a.c. power supplies fail. Integral lighting of the unit is from the 4-volt instrument lighting system described in Sect.6, Chap.8.

REMOVAL AND ASSEMBLY

Display unit removal

26. Owing to the close fitting of the displays in the housing, a withdrawal tool is required for their easy removal. The tool used is a locally-manufactured strap assembly which can be secured to clips, top and bottom, of each display front panel *(fig.5)*. After fitting the strap assembly the display can be withdrawn by pulling on the strap.

Pitot/static leak tests

27. Should any of the units connected to the pitot or static system be disconnected and removed for servicing, it is essential that the pitot/static leakage tests, given in Chap.5 of this section, are done on replacement of the unit.

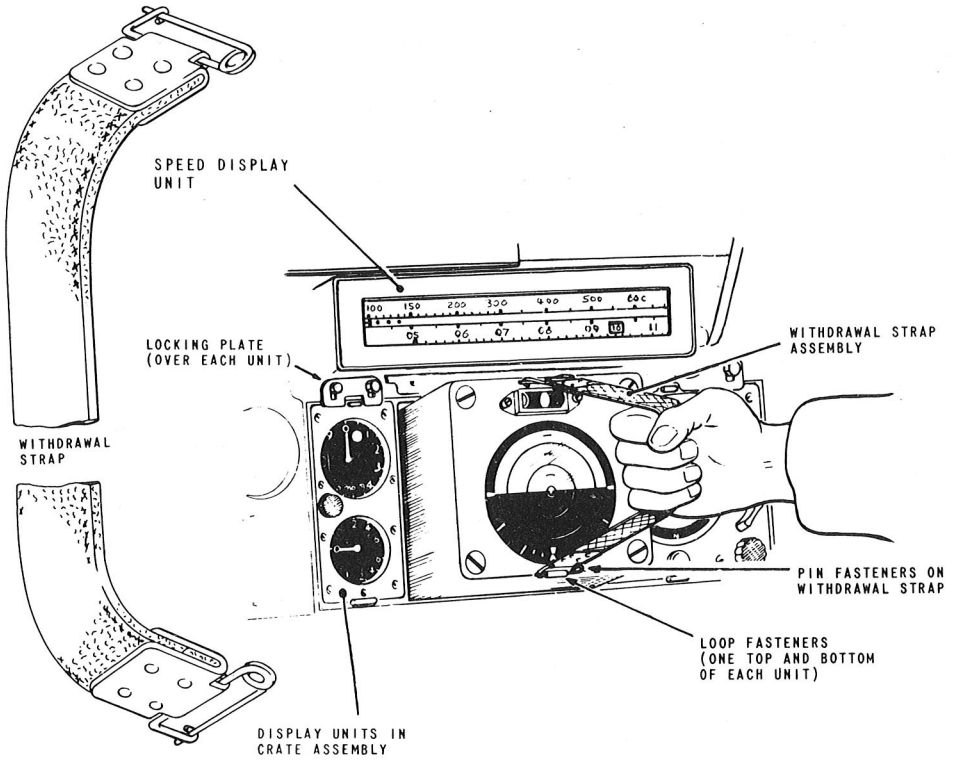

Fig.5. Display unit removal

FIG.6. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 1)

(illustration overleaf)

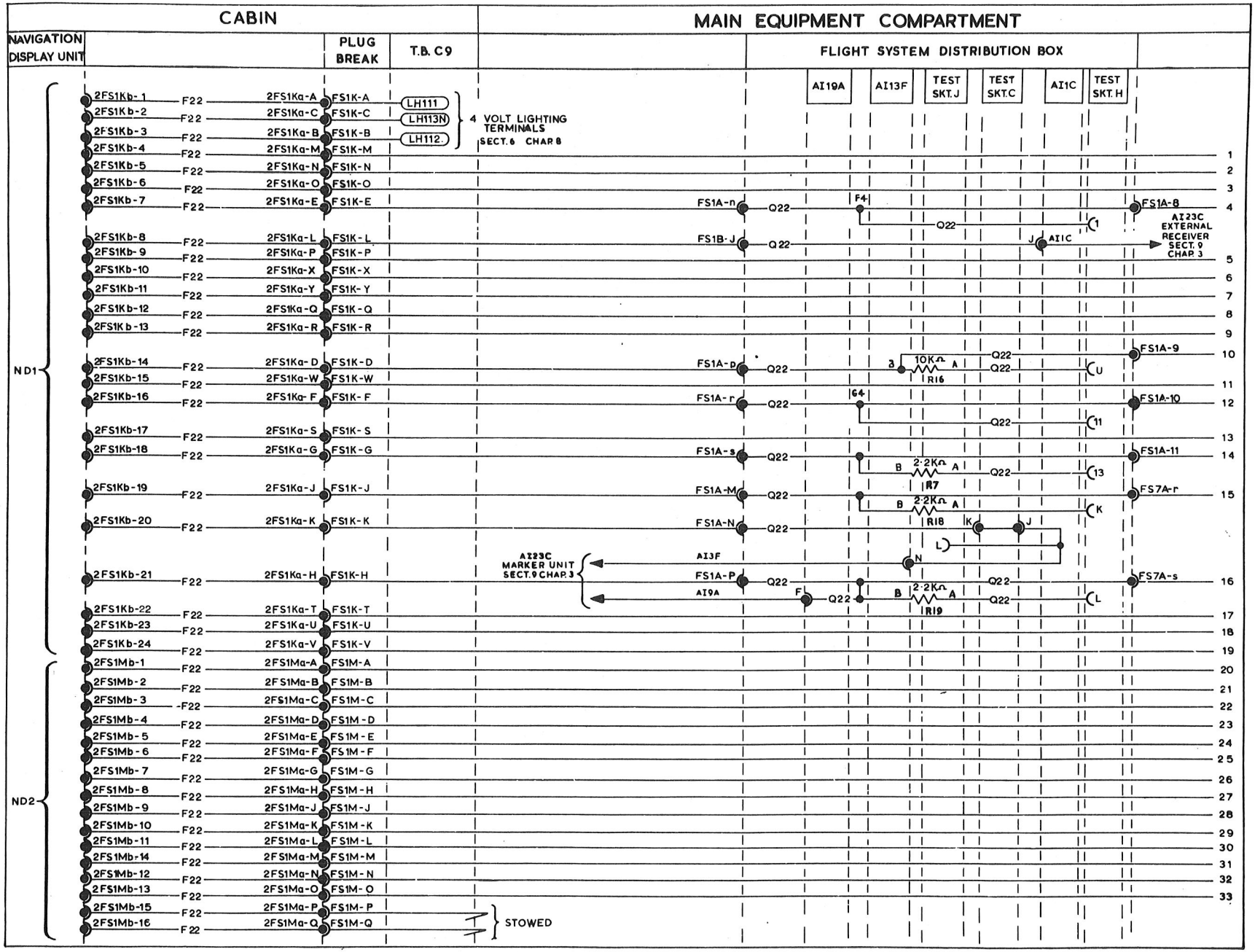

FIG.6. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 1)

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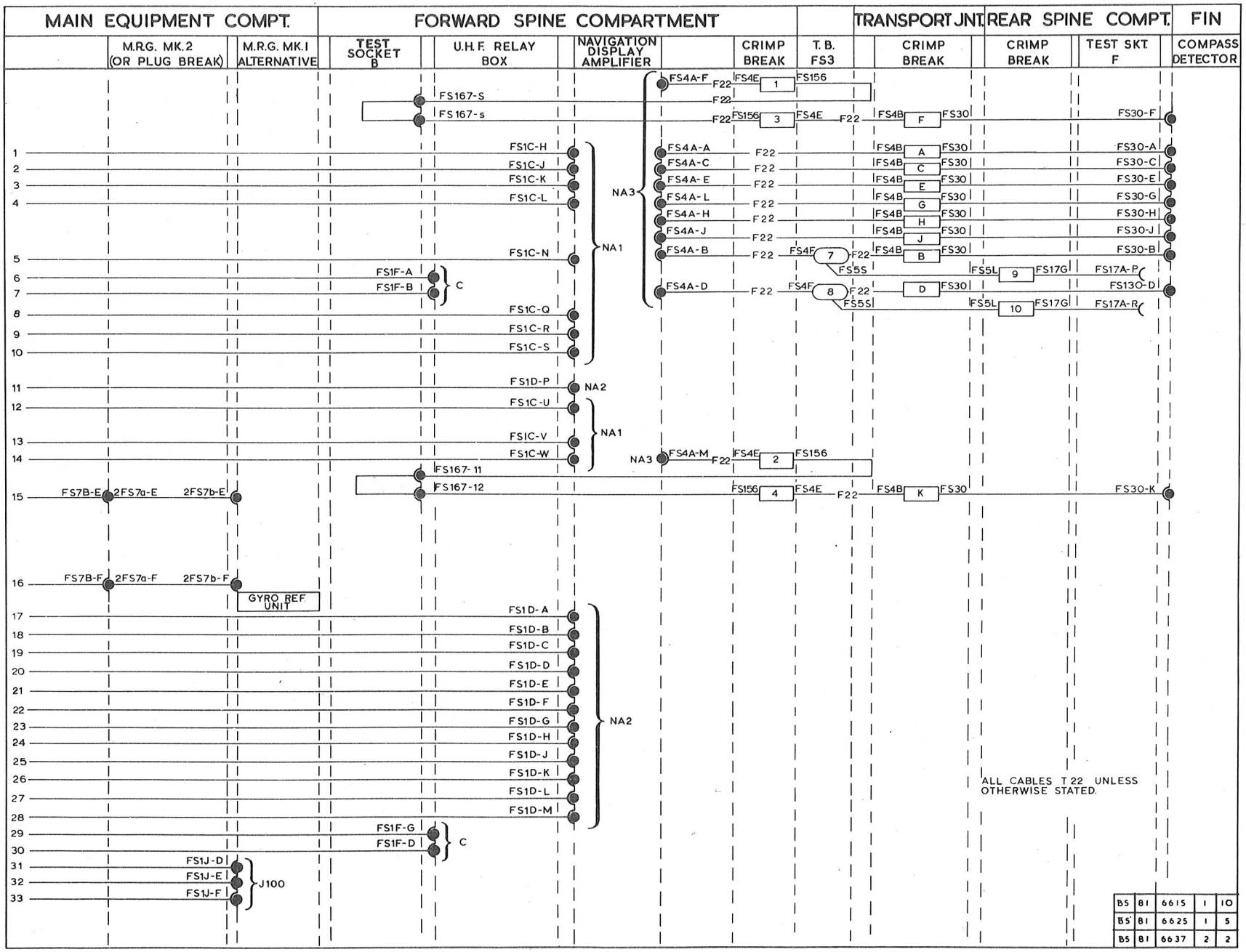

FIG.6A. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 1)

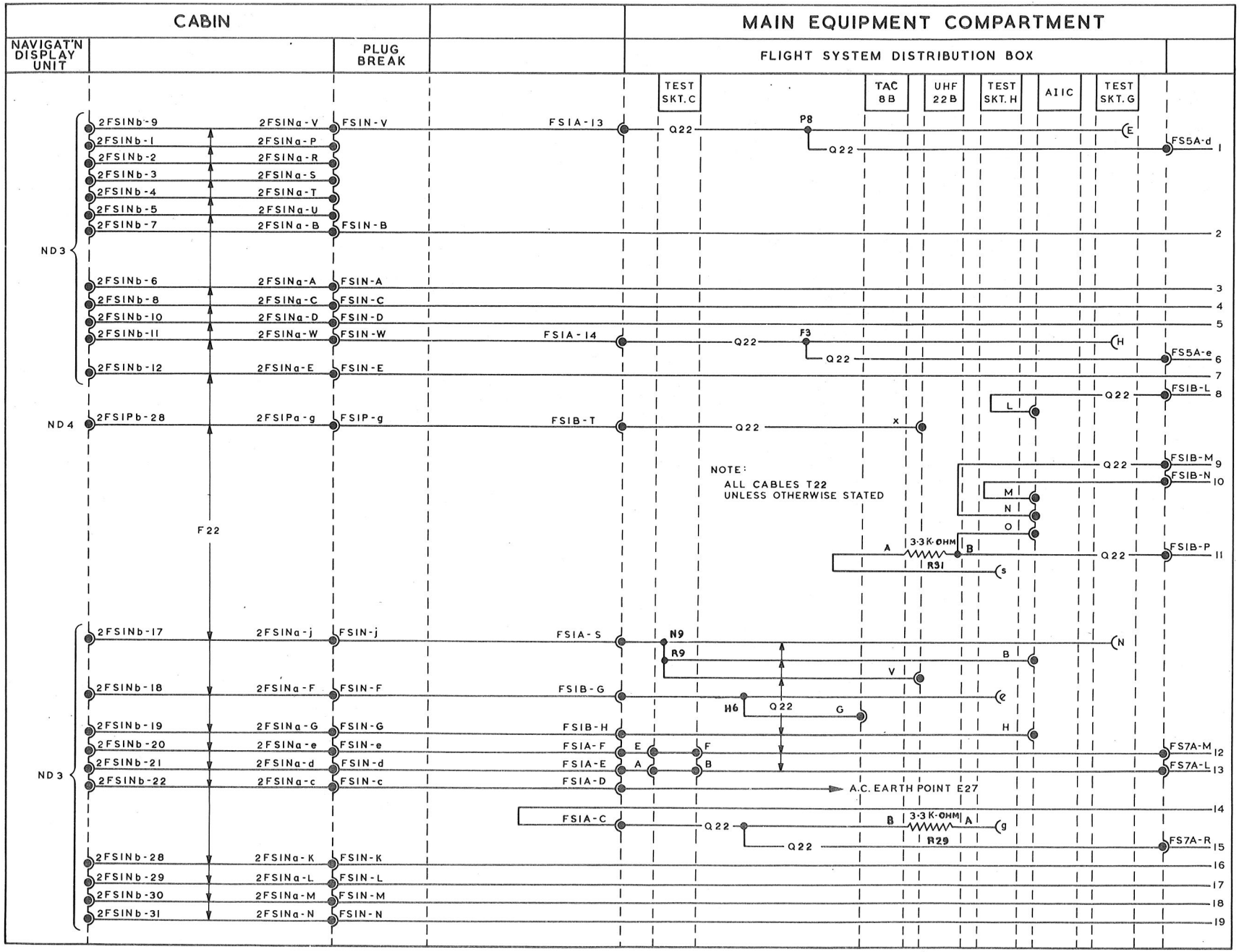

FIG.7. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 2)

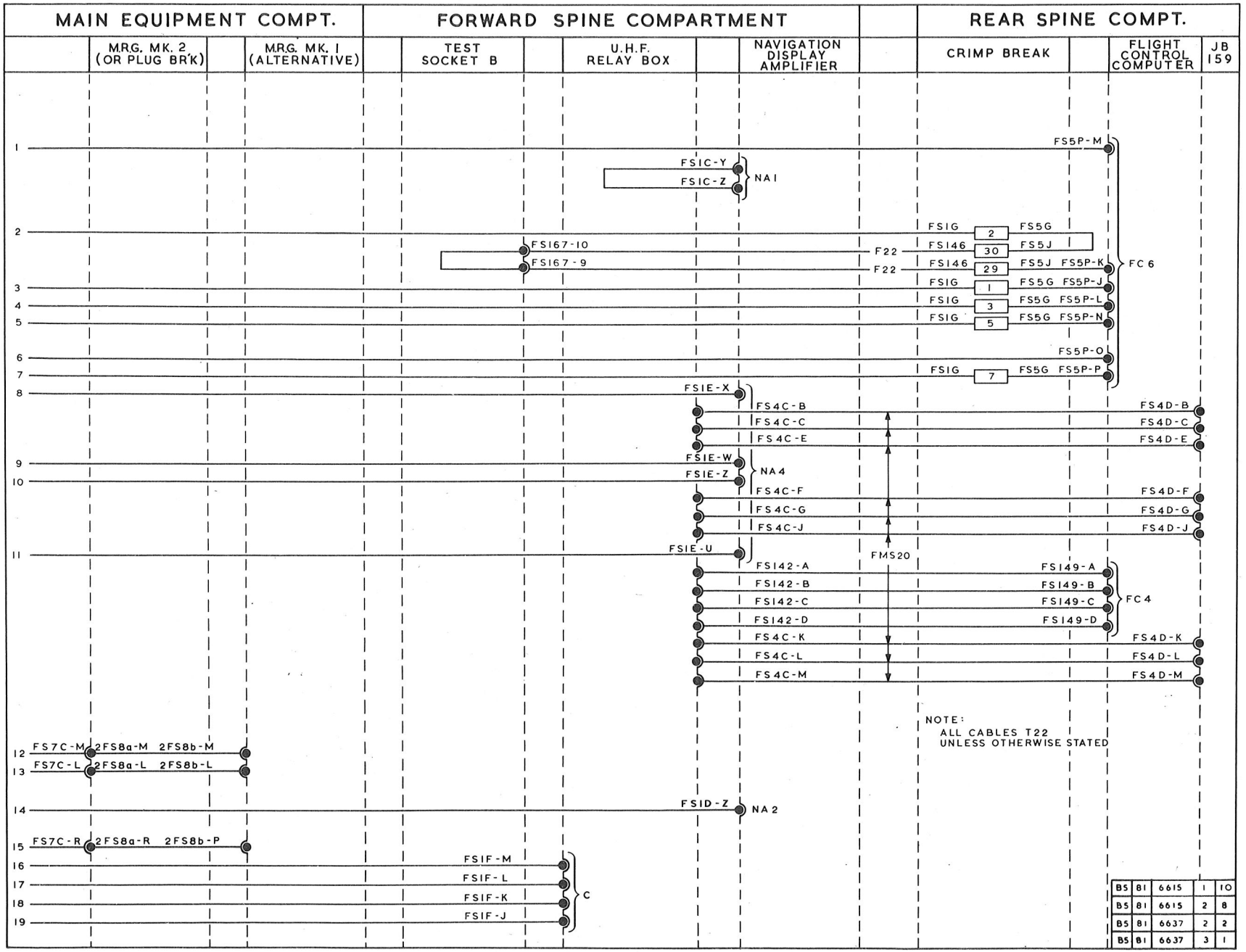

FIG7A. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 2)

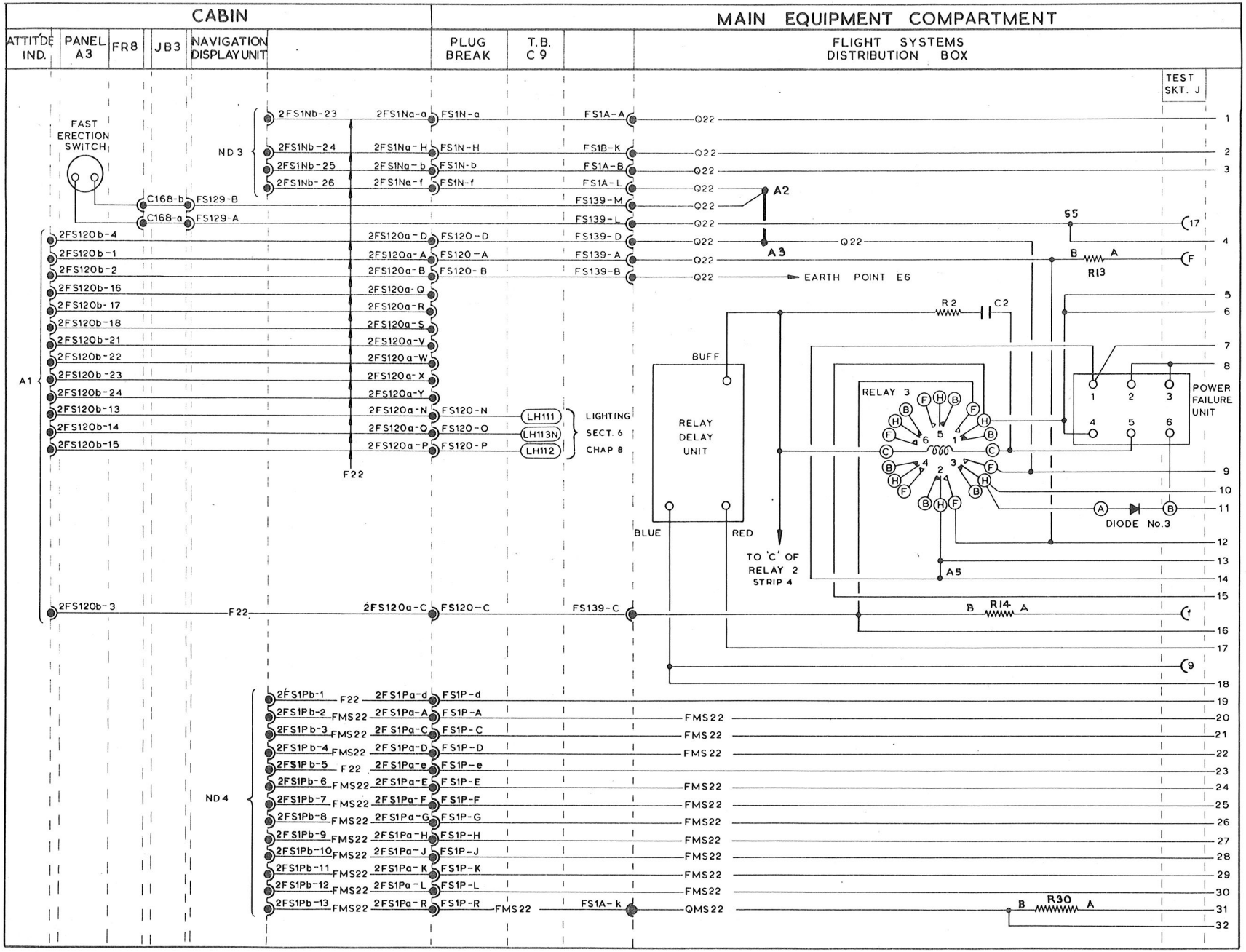

FIG.8. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 3)

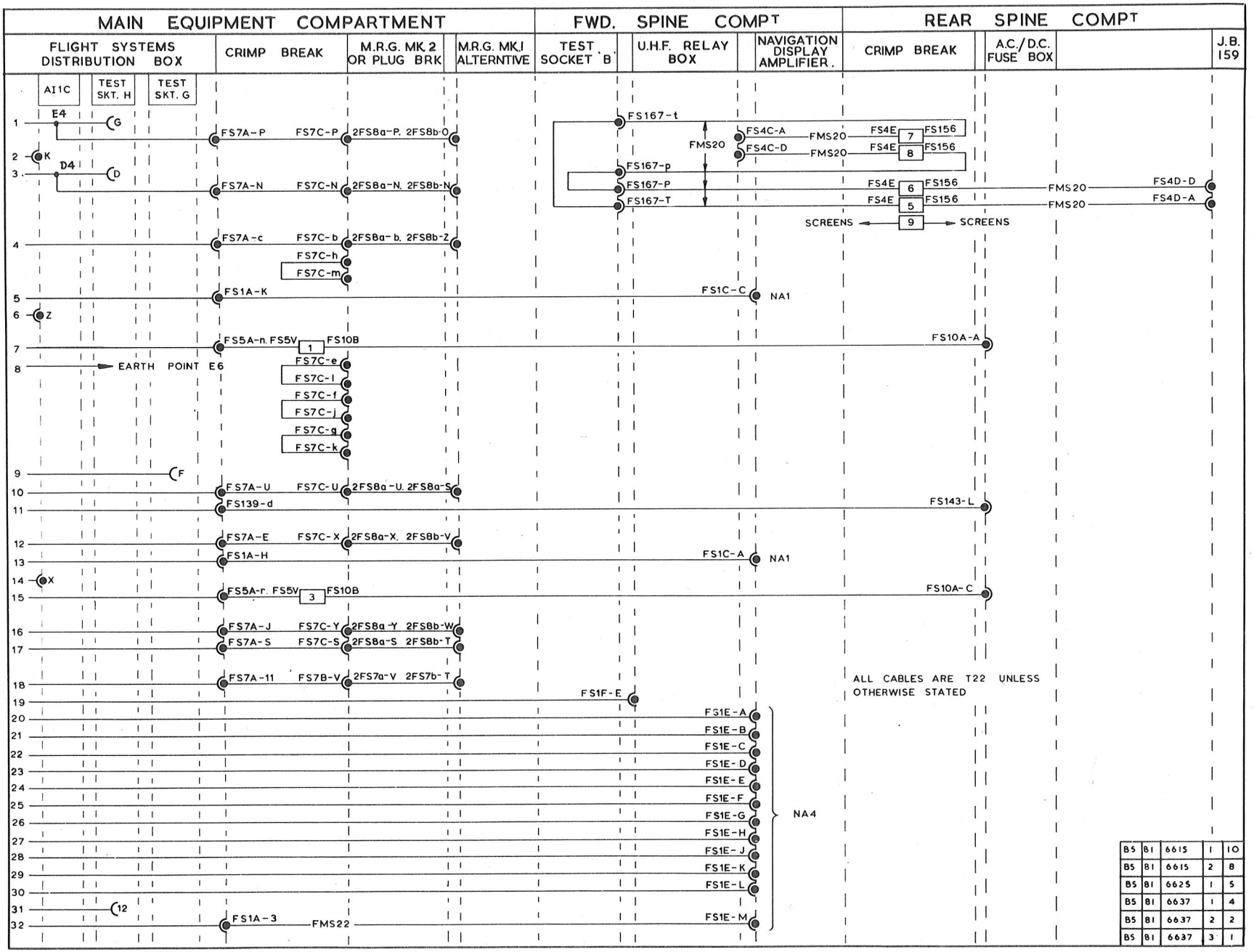

FIG.8A. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 3)

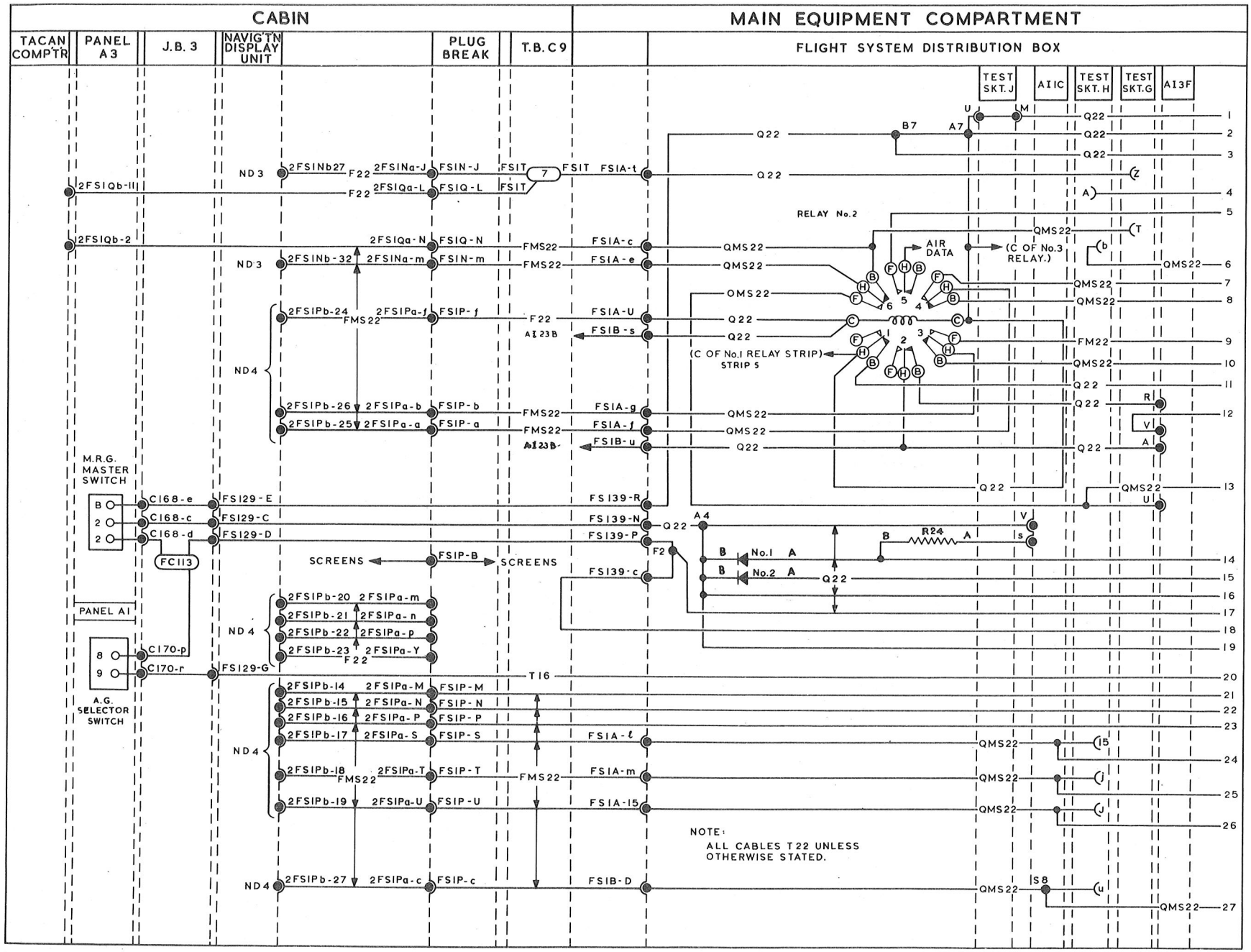

FIG.9. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 4)

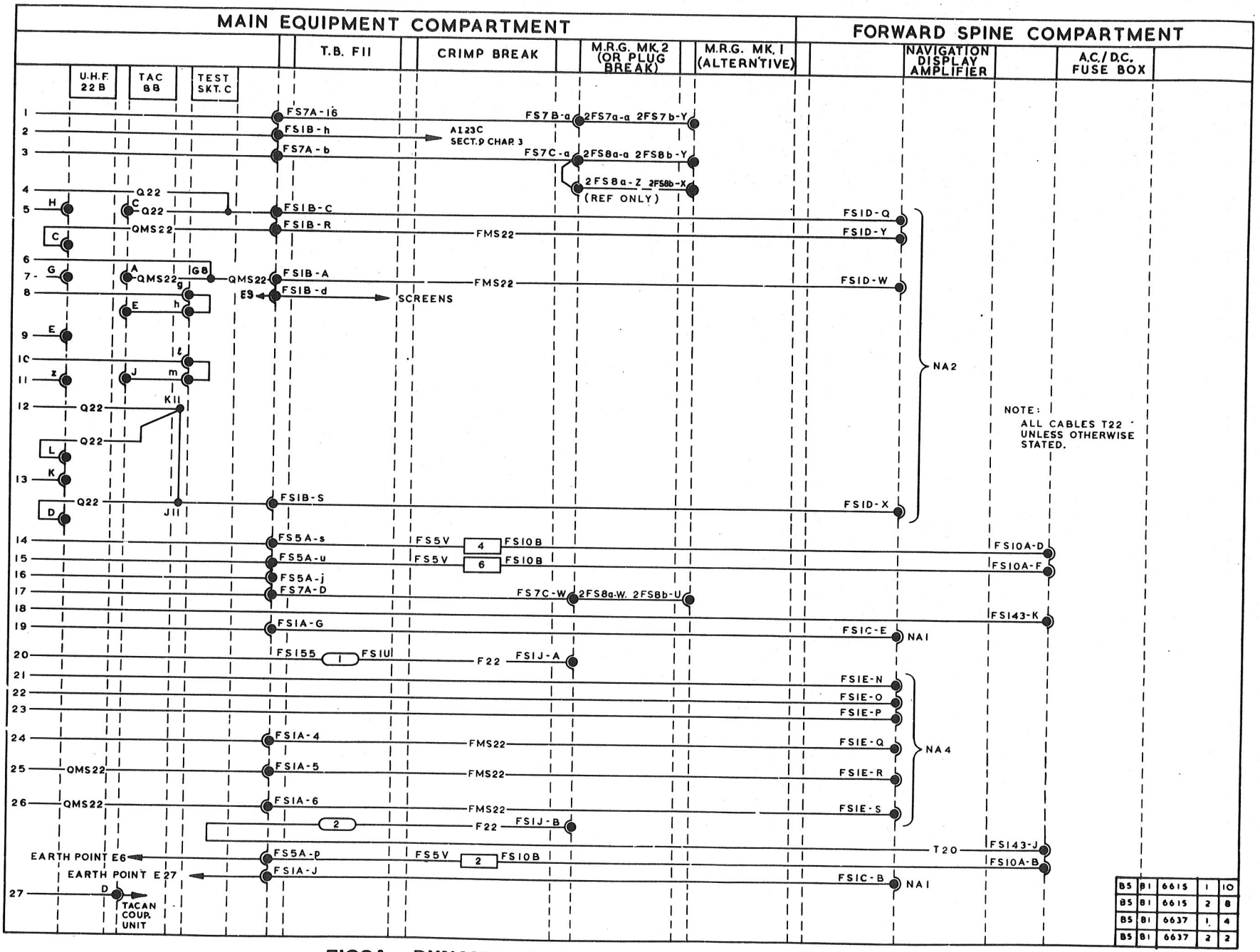

FIG9A. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 4)

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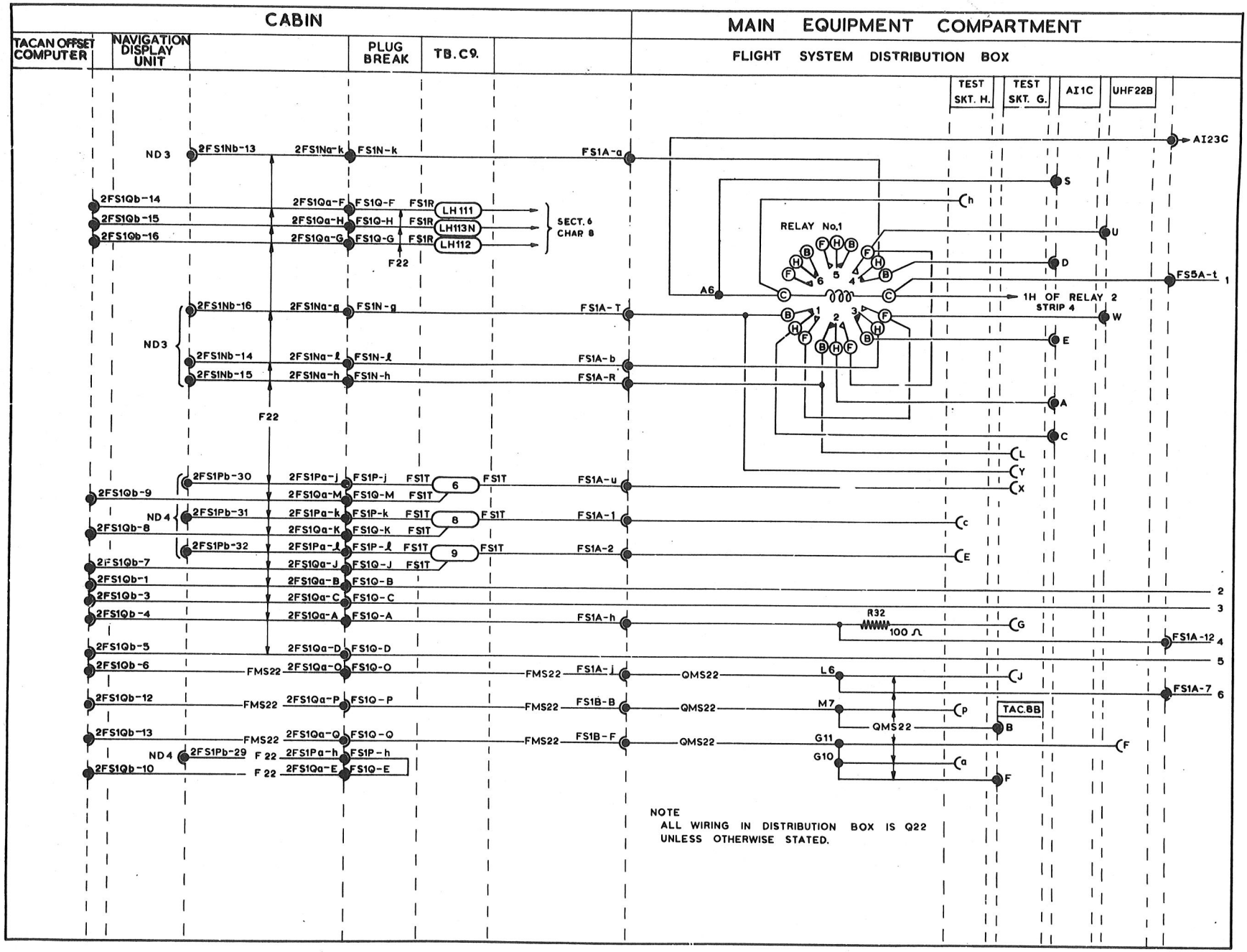

FIG.10. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 5)

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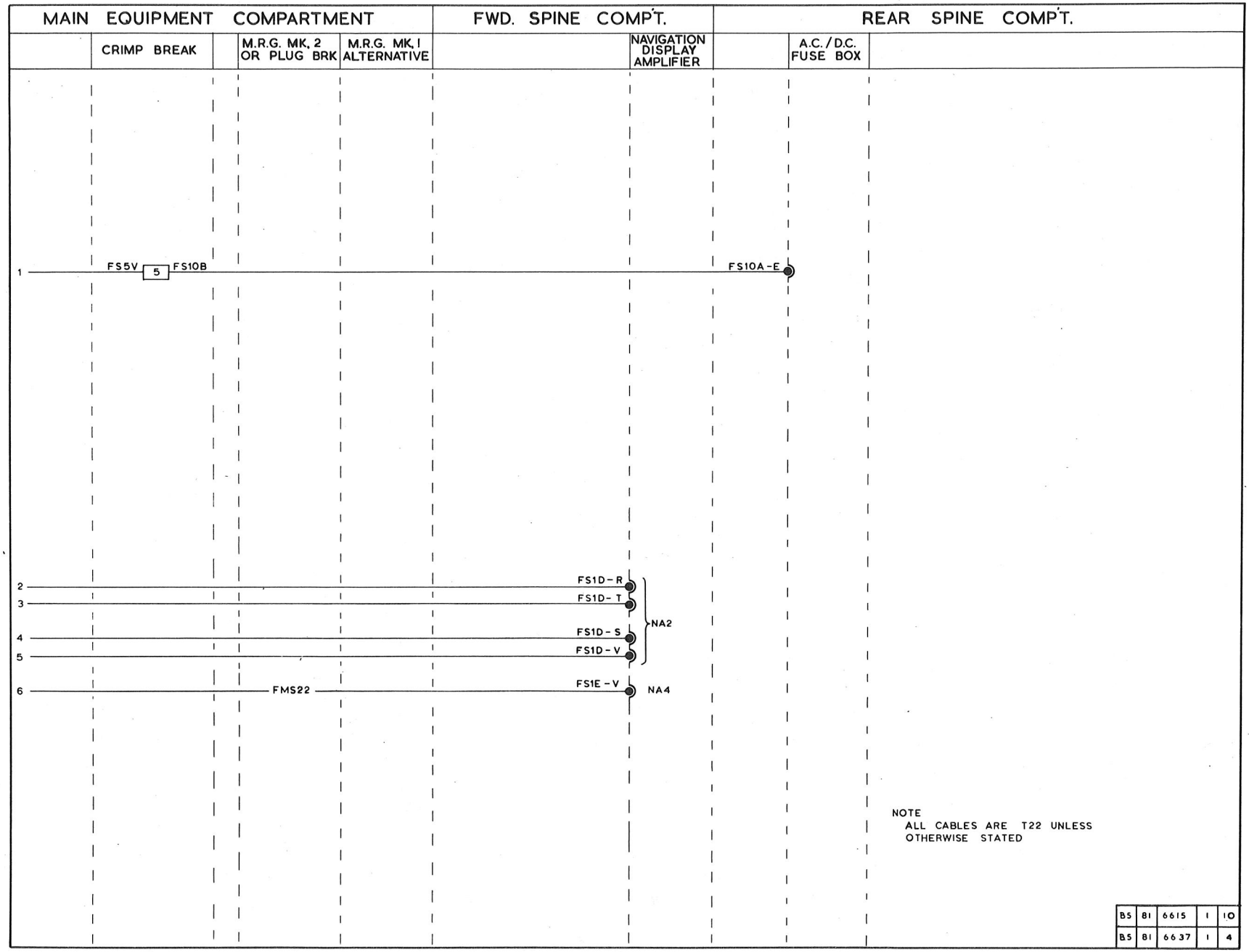

FIG.10A. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 5)

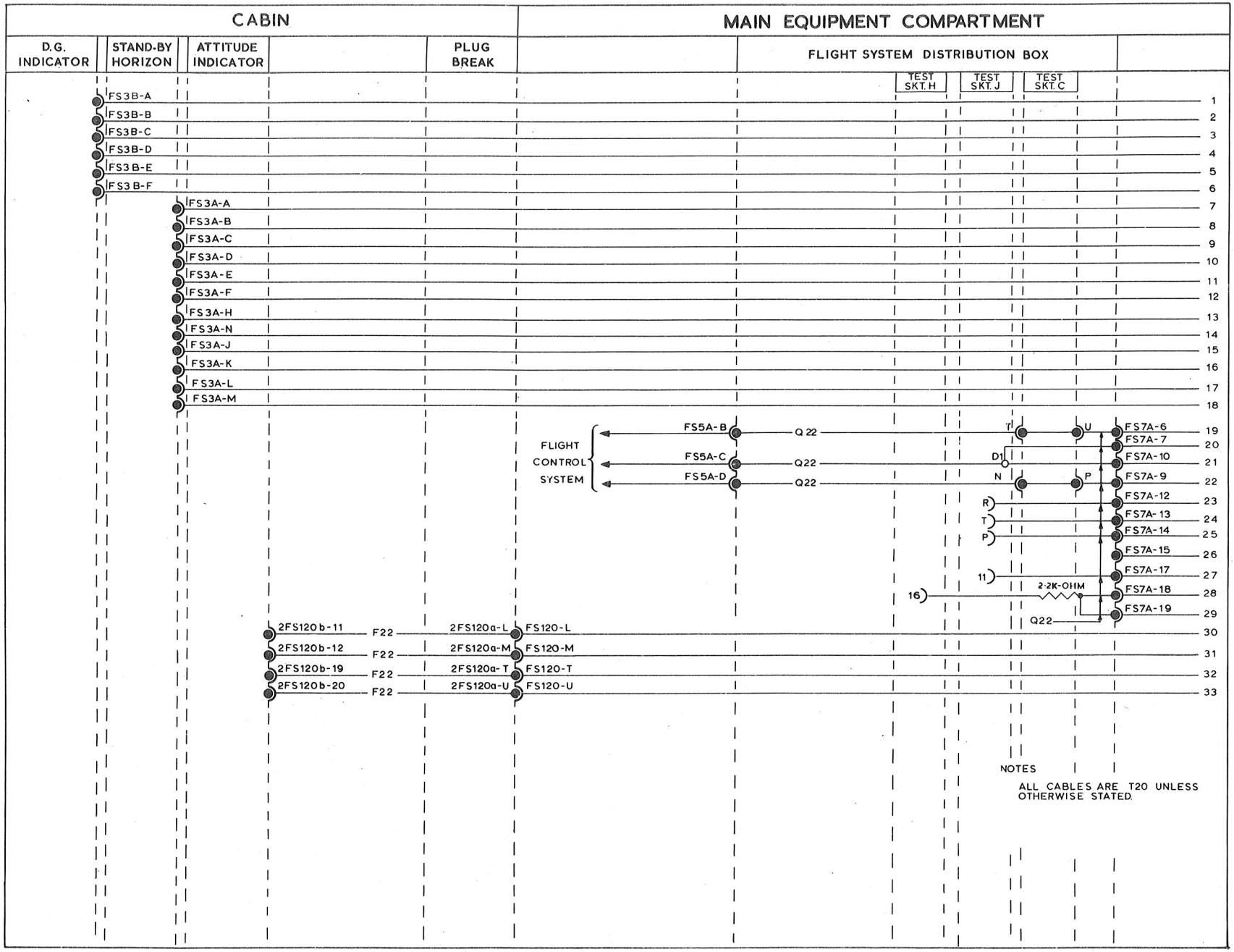

FIG.11. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 6)

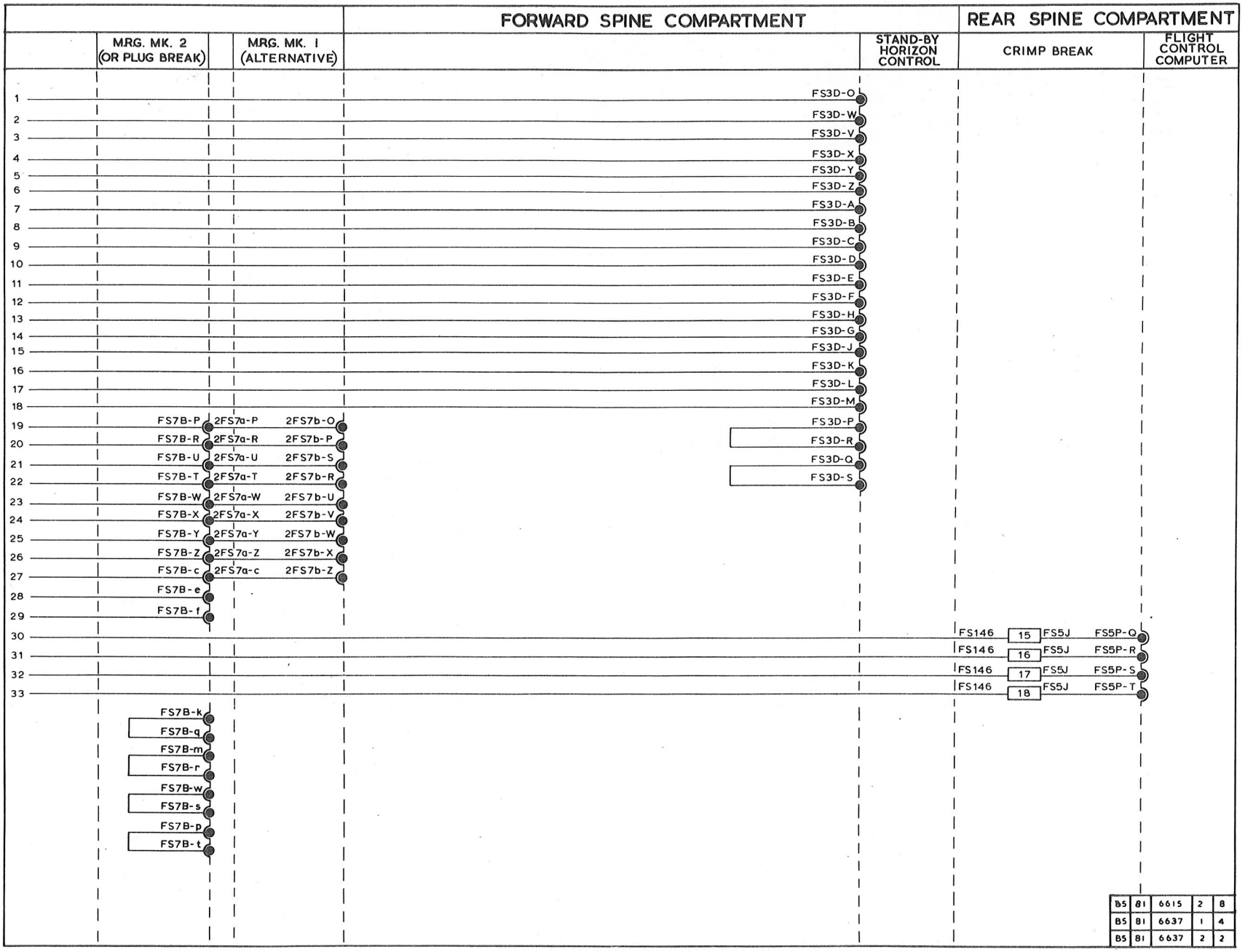

FIG.11A. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 6)

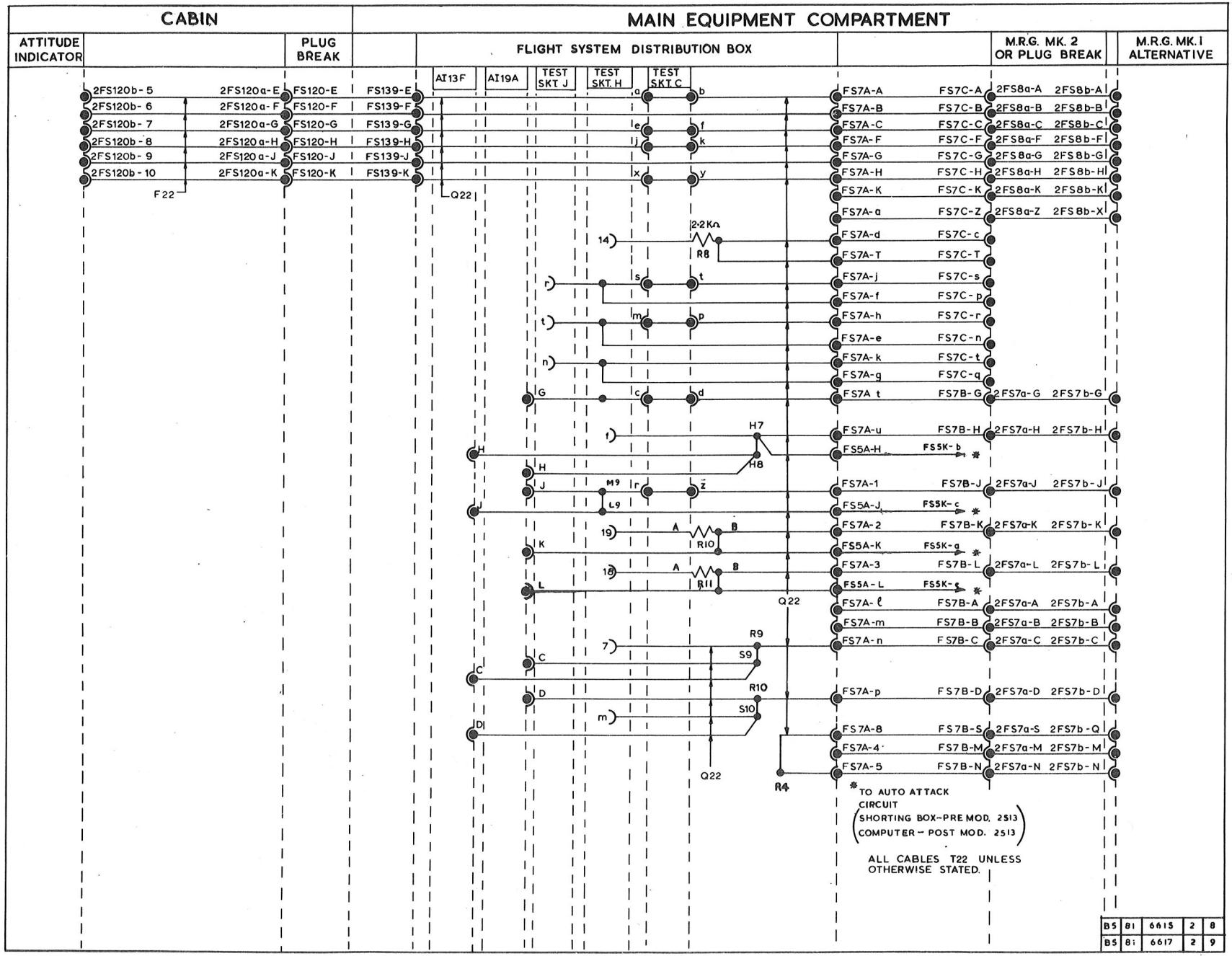

FIG.12. DYNAMIC FLIGHT REFERENCE SYSTEM (STRIP 7)