

## Chapter 1

◀Revised up to modifications NDS/57 and RB/23▶

## INTRODUCTION

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**General**

1. The various units comprising the integrated flight instrument system in this aircraft can be divided into two sub-systems; one provides and displays dynamic information and the other provides and displays aerodynamic information. This section deals with the former sub-system in which, during all flight conditions, continuous heading, bank and elevation signals are derived from a centralized reference source, a master reference gyro (M.R.G.). The information obtained from this unit is presented by roller-blind type displays and in the case of heading information, by an annular type of compass card. Provision for the display of I.L.S., Tacan and flight director information is also included.

2. A schedule of units comprising the sub-system which includes the Navigation Display System Mk. 1, is given in Table 1.◀Reference should be made to Table 2-5 inclusive at the end of this chapter for unit modifications and a brief summary of each. Details of the functions of units affected by modifications are given in the appropriate chapters of A.P.4685, Vol. 1▶ To assist in the rapid location of the unit descriptions, in which all unit details and circuit diagrams are given, A.P. references are included. A circuit diagram of this dynamic sub-system is shown in fig. 7, Chap. 7 of this section. It should be noted that the unit circuits shown in this sub-system circuit diagram are abbreviated and only sufficient circuit information is given to show the functioning of the equipment.

3. The various modes in which the navigation display may be operated and the displays of attitude and flight director are dealt with in separate chapters of this section. Where necessary, in order to assist explanation of the system functioning, an abridged version of the unit description is given. Where it is considered that a more detailed account of a particular function would be helpful, the appropriate Air Publication reference is given. References are made to equipment not included in this sub-system, e.g., the flight control computer. This has been found necessary as the functions of these allied units are closely integrated with the operation of those in this sub-system.

**Location of units**

4. The navigation display, attitude indicator and Tacan offset computer are located in the cockpit (fig. 1 and 2). Other units, except the U.H.F. relay box and detector unit, are located in the main equipment bay (fig. 5). The U.H.F. relay box is located in the spine of the aircraft and the fluxgate detector unit is located in the leading edge of the starboard wing.

**Compass, I.L.S. and Tacan displays**

5. Magnetic heading information is derived from the detector unit and is presented by the compass card in the navigation display (Chap. 3 of this section). The navigation display also includes facilities for the presentation, at any one time, of either Tacan or I.L.S. displacement information, according to the position of a mode switch located at the bottom right of the instrument front. An offset computer provides the facility to convert the direct Tacan to an offset Tacan display (Chap. 5 of this section).

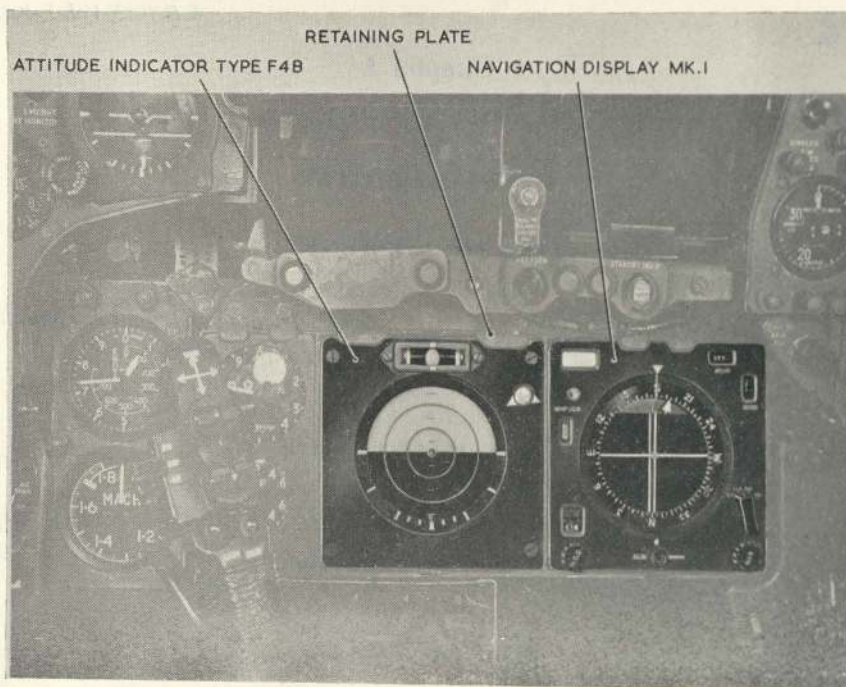


Fig. 1. Cockpit view of instruments

6. As previously stated, heading information is presented by an annular compass card on the navigation display. This card is visible and operating in all positions of the mode switch.
7. The other displays are presented on the navigation display by means of the roller blind. This blind is situated behind the compass card and is driven over rollers to present, in the centre of the card, the appropriate section bearing the Tacan or I.L.S. display (fig. 3). The roller blind mechanism is mounted on a carriage which has complete rotational freedom.
8. With COMP selected on the mode switch, the roller blind displays a plain black background, thereby accentuating the indications on the compass card and removing unwanted or distracting information.
9. When the mode selector switch is set to ILS, conventional I.L.S. outputs are fed, from a U.H.F. relay box, to the navigation display. The glide path bar is motored into position between the compass card and the roller blind and indicates the position of the centre of the glide path beam relative to the aircraft. Displacement is read with respect to the fixed central index on the cover glass which represents the nose of the aircraft. The position of the centre of the localizer beam relative to the aircraft is indicated by the runway presentation on the roller blind relative to the localizer datum on the roller blind carriage which represents the nose of the aircraft (Chap. 4 of this section).
10. When TAC or DL are selected, Tacan signals are fed from a Tacan coupling (indicator) unit, fitted with an additional bearing resolver and range potentiometer, to the navigation display. In the

TAC mode, Tacan range and bearing signals are modified in an offset Tacan computer and offset Tacan information is presented. In the DL mode, direct Tacan information is presented. The position of the roller blind carriage, in relation to the compass card, is determined by Tacan bearing information. The position of the roller blind, about the datum position, is determined by Tacan range information (Chap. 5 of this section).

#### Bank, elevation and flight director displays

11. The attitude of the aircraft, in terms of bank and elevation, is derived from the M.R.G. and is displayed on a roller blind type attitude indicator (Chap. 6 of this section). This indicator also embodies a flight director presentation and a ball-in-tube slip indicator. The flight director presentation takes the form of an index bead which moves in a vertical or horizontal direction in response to position signals from a flight control computer.
12. The roller blind and roller blind carriage are of the same type as used in the navigation display. The blind is divided into two sections, one pale grey and the other black, representing the sky and earth respectively (fig. 4). The blind is driven up or down relative to the bezel glass of the instrument with changes in aircraft elevation and the carriage is driven to maintain the pointer vertical, movement of the case representing bank angle. Straight and level flight is indicated when the division between the two sections lies coincident with the central zero datum on the bezel glass (which represents the nose of the aircraft) and when the bank pointer is coincident with the zero bank reference at the bottom of the dial.

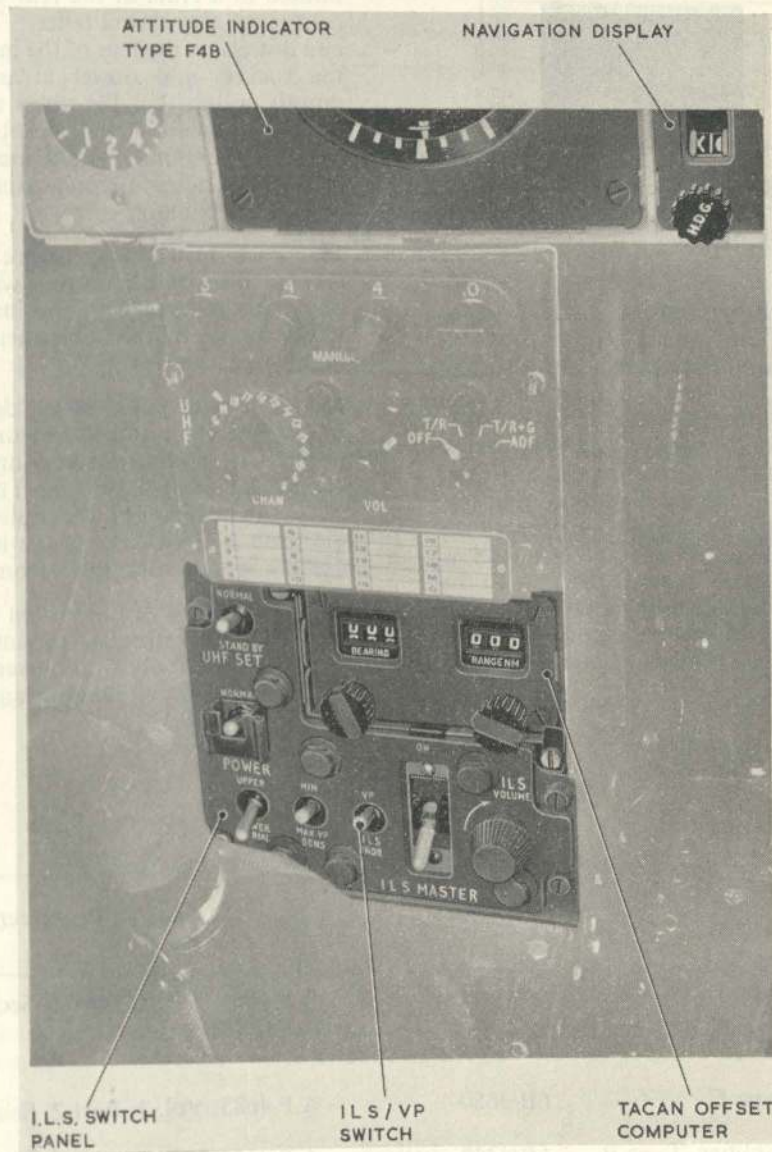


Fig. 2. Location of offset Tacan computer

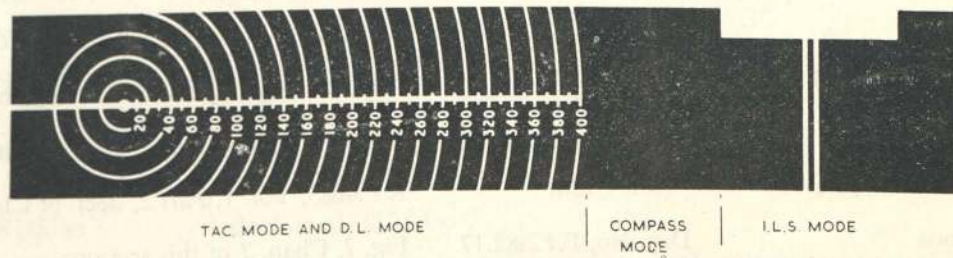


Fig. 3. Navigation display—roller blind laid flat

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TABLE 4

Modifications for offset Tacan computer, Types A and B

Computer type	Modification number	Modification
A	NDS/5	Resistors changed from Fibreloy to Eirie.
A	NDS/10	Instrument colour changed from black to grey.
A	NDS/23	Counters material changed from nylon to delrin.
A	NDS/32	To improve the screening of instrument internal illumination to prevent flare.
A	NDS/50	Fitting of preset potentiometer to illumination circuit for independent variation of illumination intensity.
B	NDS/50	

TABLE 5

Modifications for attitude indicator, Type F4C

Modification number	Modification
RB/19	Q factor of the servo amplifier tuned circuit reduced.
RB/21	Filter added to slip indicator.
RB/22	Fitting of preset potentiometer to illumination circuit for independent variation of intensity.
RB/23	Slip indicator datum mark added.
RB/26	Mounting plate thickness increased to improve clearance between adjacent bank synchro gears.
RB/27	Synchros changed to high temperature type.▶

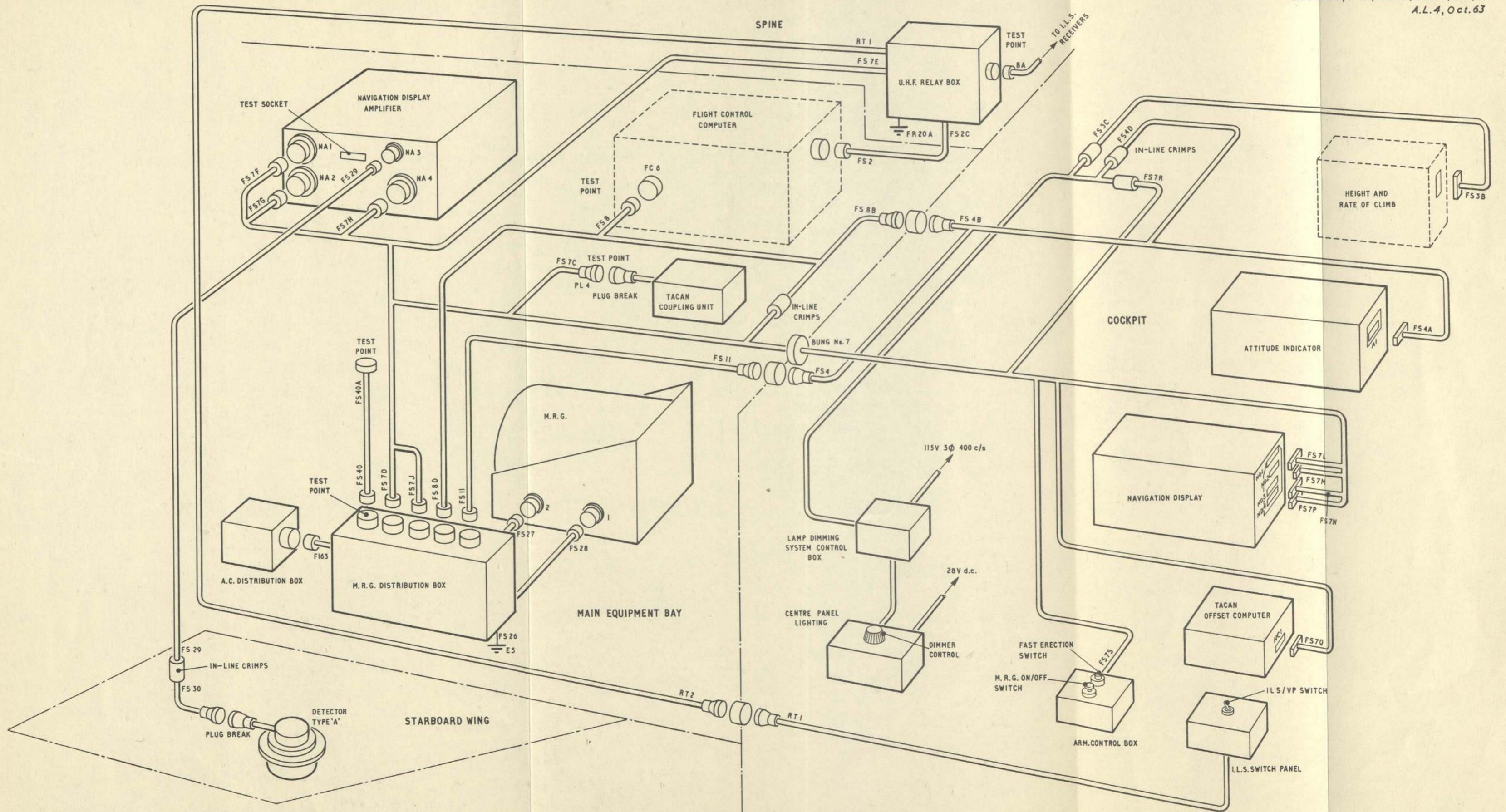


Fig. 5  
(M.F.P.)

Navigation display system interconnection diagram—Lightning Mk. 2  
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Fig. 5

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