Chapter 4

◀*Revised up to modification NDS/55*▶

OPERATION AND PRESENTATION OF I.L.S. MODE

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Introduction

1. In order that the pilot may have visual indication of the aircraft's position relative to the runway, a system of ground beacons and airborne equipment provides a prescribed radio approach path which enables an aircraft to descend to a low altitude without sight of the ground. At night or in conditions of bad visibility, a successful approach can be made to a point at which the sight of the ground or landing lights permits a normal landing to be made. This system is known as the Instrument Landing System (I.L.S.) and the facility is available in the Lightning Mk. 2 aircraft.

2. The receiving equipment installed in this aircraft operates on transmissions from the ground beacons and controls a presentation on the navigation display. Distribution of signals from the aircraft receivers to user equipment in the instrument and flight control system is effected by a U.F.H. relay box which is located in the spine of the aircraft.

Ground layout

3. There are four main sources of information: the localizer, glide path and the two marker beacons. The aircraft localizer receiver provides information on lateral deviations from the approach path, the glide path receiver provides information on perpendicular deviations from the approach path and the marker receiver provides information which operates a distance marker lamp which indicates the distance from the touch-down point by flashing intermittently as the aircraft passes through the transmission cone of a marker beacon. The frequency and duration of the flashes is a visual repetition of the code given out by that beacon. ◀A filter slide forms part of the lampholder front and operates in a horizontal direction. It is marked NIGHT and DAY and enables the lamp to be shaded so as to reduce the intensity of illumination during darkness.▶A typical ground layout with its I.L.S. radio paths is shown in fig. 1. For further details reference should be made to A.P.2534E and F, Vol. 1.

Localizer

4. When ILS is selected on the navigation display mode switch, the display shown in fig. 2 is presented, compass indication still being given. The runway or I.L.S. localizer beam is represented on the roller blind by a pair of parallel lines which are marked at right angles to the blind movement. Displacement of these lines from a localizer datum represents the displacement of the aircraft from the beam. The localizer datum (*para.* 8) is a fixed index on the roller blind carriage and is visible through an aperture in the blind.◀The movements of the localizer indicator and of the glide path bar are limited so that they remain within the display area and four white marks on the bezel glass indicate the operating range of the glide path bar.▶

5. The I.L.S. localizer receiver produces a d.c. voltage output proportional to the angular displacement of the aircraft from the beam. This signal is fed through the U.H.F. relay box (*fig.* 7, *Chap.* 7 of this section) and then, via a magnetic amplifier modulator, to the roller blind servo amplifier (*fig.* 3).

◀**Note . . .**

A magnetic amplifier is required in this application in order to increase the amplitude of the I.L.S. equipment d.c. output to a sufficient level so that a limiting circuit may be included before applying the signal to a chopper modulator. This modulator superimposes the d.c. signal on to an a.c. carrier to enable the servo loop of the roller blind to operate. Reference should be made to A.P.4685, Vol. 1, Part 2, Sect. 2, Chap. 5 for details of the magnetic amplifier and modulator operation.▶

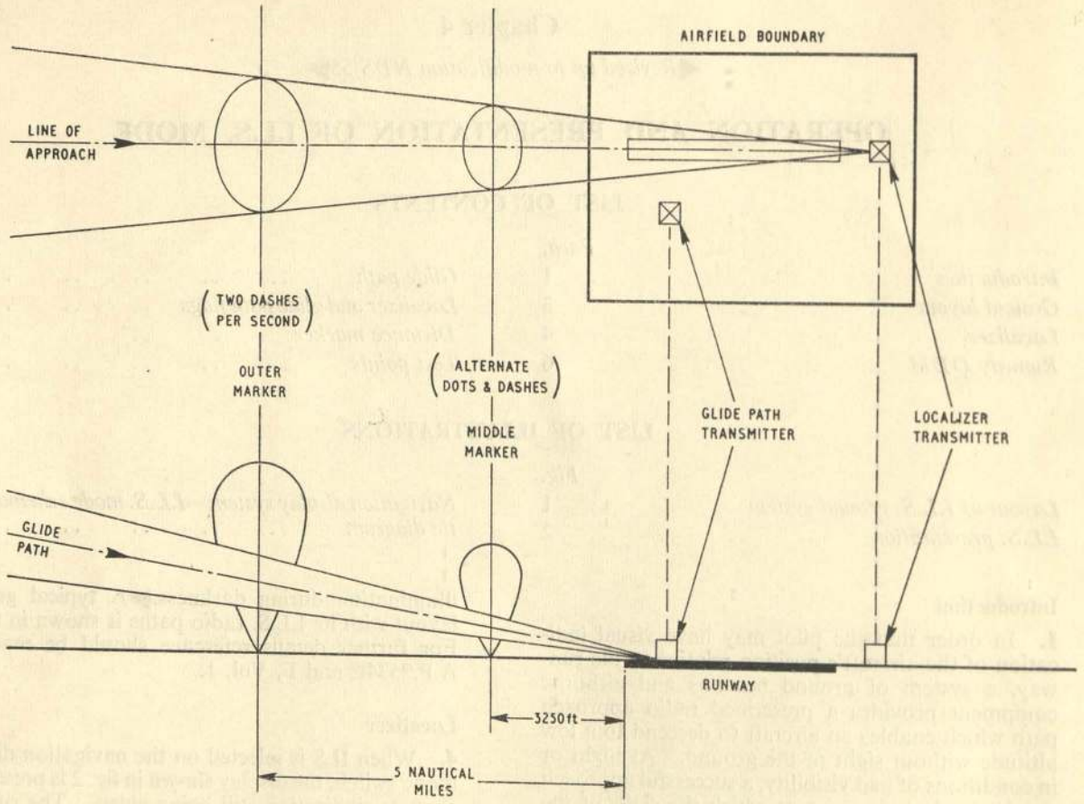


Fig. 1. Layout of I.L.S. ground system

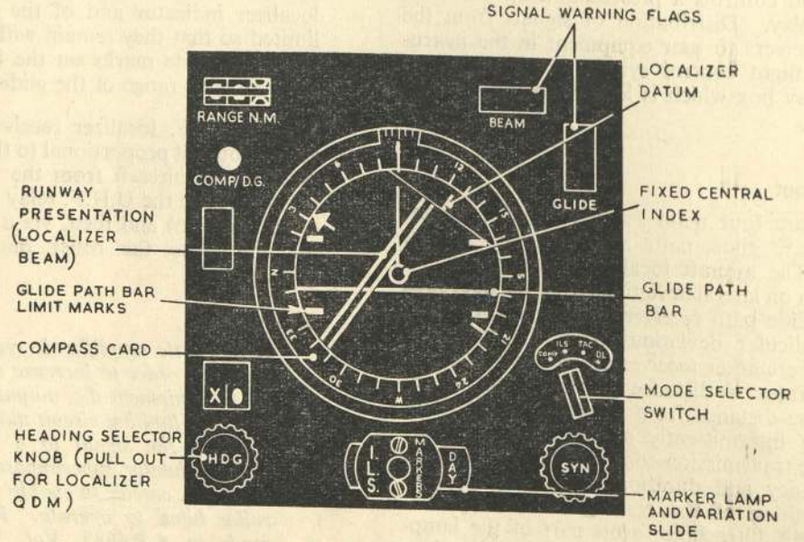


Fig. 2. I.L.S. presentation

Runway QDM

6. In order to present a plan view of the aircraft position relative to the localizer beam during an I.L.S. approach, the localizer datum marker may be set against the compass card, after first obtaining the QDM of the runway in use.

7. This is achieved by pulling out and then turning the HDG control. This control is then mechanically coupled to a control transmitter X10 whose transmission is passed to a control transformer X2. The error signal from X2 is amplified in the roller blind carriage servo-amplifier and via motor M2, drives the carriage and therefore the runway presentation to the desired position.

Glide path

8. A horizontal bar, representing the glide path, is motored into position between the compass card and the roller blind. The glide path 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. This index represents the nose of the aircraft.

9. The glide path servo system is similar to the localizer servo system already described, the potentiometer RV2, which is mechanically coupled to the glide path bar providing the position feedback signal.◀When a mode other than I.L.S. is selected, the chopper modulator is switched from the magnetic amplifier to the compass datum tapping on RV2 so that the glide path bar is motored out of sight. As the magnetic amplifier is no longer in circuit, the bar cannot then move into view even if a glide path signal is being provided by the I.L.S. equipment.▶

Note . . .

The compass datum tapping on RV2 is not shown in fig. 3. For circuit details of this, reference should be made to fig. 6, Chap. 7 of this section.

Localizer and glide path flags

10.◀Two I.L.S. signal failure warning devices are included and these are located at the top right hand of the display front (*fig.* 2). They are appropriately identified and take the form of translucent amber windows each bearing a letter (B for localizer and G for glide path). In the I.L.S. mode only, each window is illuminated by a lamp which is supplied from the 6·5V a.c. source which energizes the valve heaters of the gain-controlled pre-amplifier. When the localizer and glide path signals are large enough for reliable operation of the displays, the windows are obscured by shutters. In the event of either of these signals falling below operational level, the appropriate shutter is removed and the illuminated window exposed. The shutters are operated by moving-coil meter movements and are so arranged that each should not move with a current of 150μA but should operate (cover the amber window) with a current of 425μA.▶

◀**Note . . .**

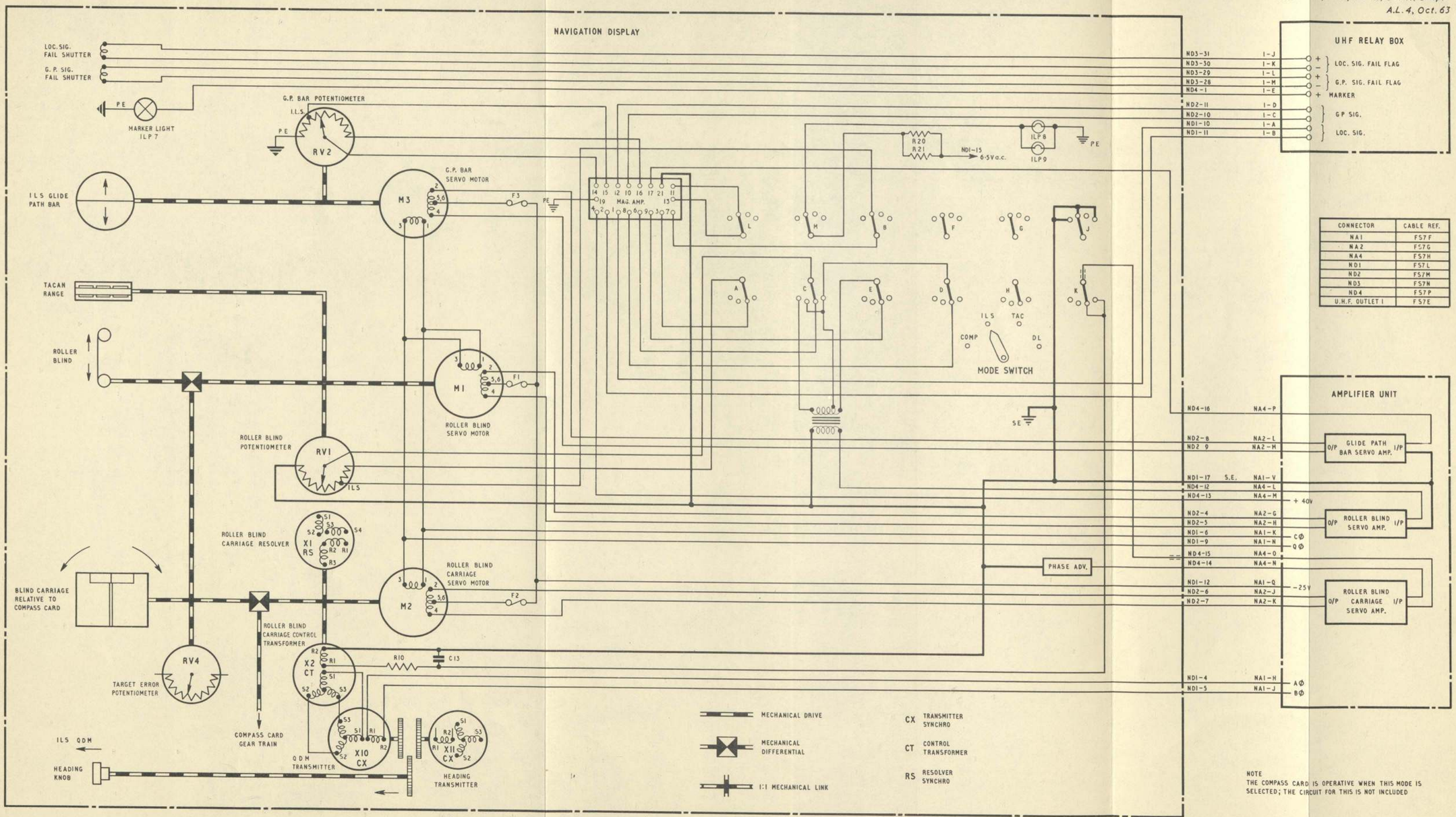
Prior to the inclusion of modification NDS/54 (i.e. for navigation displays, Types A and B) the fail indications consist of two flags, each bearing the word OFF. When the I.L.S. receivers are working and the I.L.S. signals large enough for reliable operation, the flags move to present a black presentation. When the signals fall below operational level, the word OFF is displayed. The indications are not separately illuminated but derive their illumination from the main display illumination lamps. The flags are driven by the same type of meter movements which operate between the same current limits as previously stated.▶

Distance marker

11. The distance marker is used to indicate the distance from the touch-down point. It is connected to the U.H.F. relay box and flashes intermittently as the aircraft passes through the cone of the radio marker beacons, the frequency and duration of the flashes being a visual repetition of the code given out by the marker beacons. A filter slide forms part of the lampholder front and operates in a horizontal direction. It is marked NIGHT and DAY and enables the lamp to be shaded depending upon the amount of ambient light, i.e. the amount of light from the lamp may be reduced from the daylight condition to a dim illumination during night conditions when an overbright flashing light could prove distracting.

Test points

12. Test points for I.L.S. display facilities are provided at the 25-pole test socket on the front of the navigation display amplifier. The I.L.S. output signals from the receivers may be simulated at connector 8A on the U.H.F. relay box, which is located in the spine of the aircraft. By disconnecting the cable and connecting a test set, Type 7 (Ref. No. 6C/2197) at this point, simulated signals can be fed to the navigation display. Connection details are given in Tables 1 and 4, Chap. 7 of this section. Details of the tests are given in the appropriate chapter of A.P.4685T.



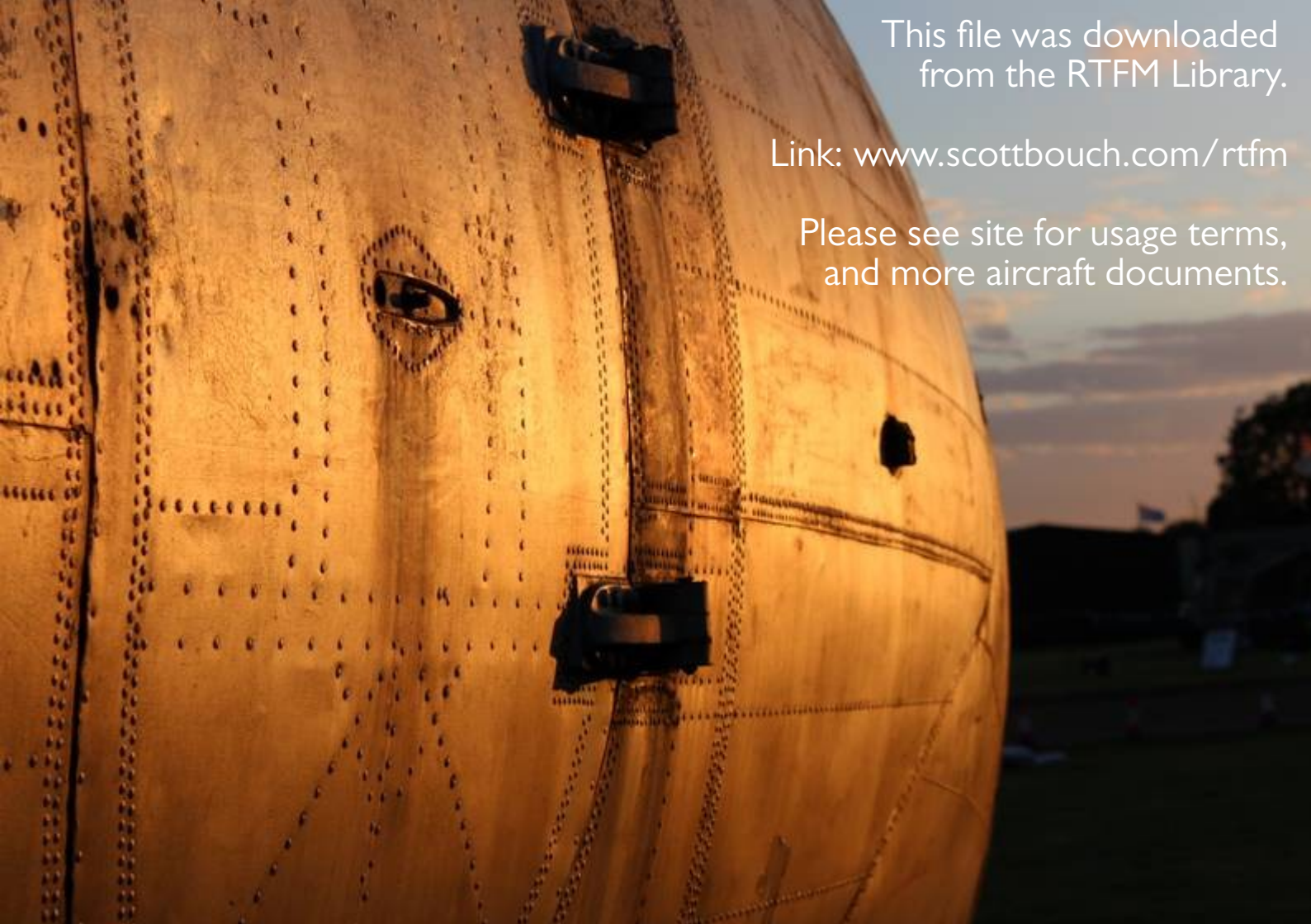
CONNECTOR	CABLE REF.
NA1	F57F
NA2	F57G
NA4	F57H
ND1	F57L
ND2	F57M
ND3	F57N
ND4	F57P
U.H.F. OUTLET 1	F57E

NOTE
THE COMPASS CARD IS OPERATIVE WHEN THIS MODE IS SELECTED; THE CIRCUIT FOR THIS IS NOT INCLUDED

Fig. 3
(M.F.P.)

Navigation display system — I.L.S. mode schematic diagram

Fig. 3



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