

Chapter 5

◀Revised up to modification NDS/55▶

OPERATION AND PRESENTATION OF OFFSET AND DIRECT TACAN MODES

LIST OF CONTENTS

	Para.		Para.
Introduction	1	Direct Tacan	16
Offset Tacan	4	Test point	19
Principle of operation	9		

LIST OF ILLUSTRATIONS

	Fig.		Fig.
Tacan presentation	1	Offset Tacan—principle of operation	5
Offset Tacan computer	2	Direct Tacan—schematic circuit	6
Tacan coupling (indicator) unit, Type 11920— circuit	3	Navigation display system—Offset Tacan mode schematic diagram	7
Offset Tacan—schematic circuit	4	Navigation display system—direct Tacan mode schematic diagram	8

Introduction

1. Tacan is a tactical air navigation system which gives the aircraft range and bearing in relationship to a radio beacon. For details of the principle of operation, reference should be made to A.P.2534N, Vol. 1.

2. The Tacan information which is presented on the navigation display, is shown when either TAC or DL is selected on the mode switch. A typical presentation is shown in fig. 1. Referring to fig. 3 of Chap. 1 of this section, it may be seen that the portion of the roller blind which indicates the range of the aircraft from the beacon consists of a series of concentric arcs which are spaced at 20 nautical mile intervals. A line which bisects these arcs, indicates the bearing of the aircraft when read against the compass card. The range is repeated, to the nearest nautical mile, on the range counter at the top left of the navigation display.

3. Tacan bearing and range information from the aircraft Tacan radio installation is fed, via a coupling (indicator) unit, Type 11920, to the navigation display system. The coupling unit (fig. 3) is provided with a bearing resolver RS3 and range potentiometer RV3 for this purpose. The coupling unit range and bearing dials, used when setting up the equipment, are also shown schematically in fig. 3.

Offset Tacan

4. By selecting the TAC mode, the position of the aircraft relative to a desired destination (within 200 nautical miles of a Tacan beacon) is presented directly on the navigation display. The range and bearing of this offset point, relative to the Tacan beacon in use, are set manually into the offset computer where they are indicated in magnitude by two counters, each appropriately marked (fig. 2).

5. Referring to fig. 4 and 7, an excitation voltage of 23V a.c. is fed from the navigation display amplifier to the offset range potentiometer RV1.

The wiper of the potentiometer is positioned by the gear train driven by the range setting control, so that its voltage, from minimum at zero range, is proportional to the offset range setting. The output from RV1 is fed, via a buffer amplifier and the mode switch in the navigation display, to energize the stator winding S1-S2 of the offset bearing resolver X1.

6. The angular position of the rotor of this bearing resolver is controlled by the bearing setting control. Since the energization of the stator winding is derived from the offset range potentiometer, the resultant output signal from the resolver will represent the cosine (Northing) and sine (Easting) elements of a vector formed by combining the range and bearing set into the offset computer. This is shown diagrammatically in fig. 5.

7. The signal from the offset computer, representing offset range and bearing is added vectorially to the signal from RS3 in the Tacan coupling unit, representing direct range and bearing as described in para. 9 to 15. The resultant range and bearing of the aircraft from the offset point is shown on the navigation display.

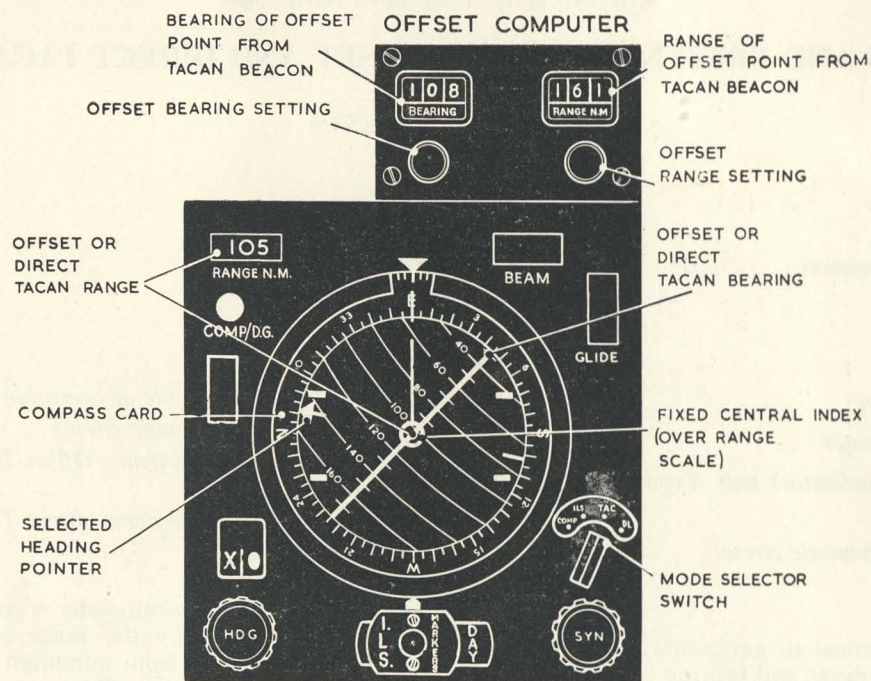
8. Should the range and bearing controls on the offset computer be set to zero, the range and bearing of the beacon to which the aircraft's Tacan equipment is selected would be indicated as direct Tacan.

Principle of operation

9. When operating in the offset Tacan mode (fig. 5), the bearing ϕ and range R of the desired destination of the aircraft are derived from:

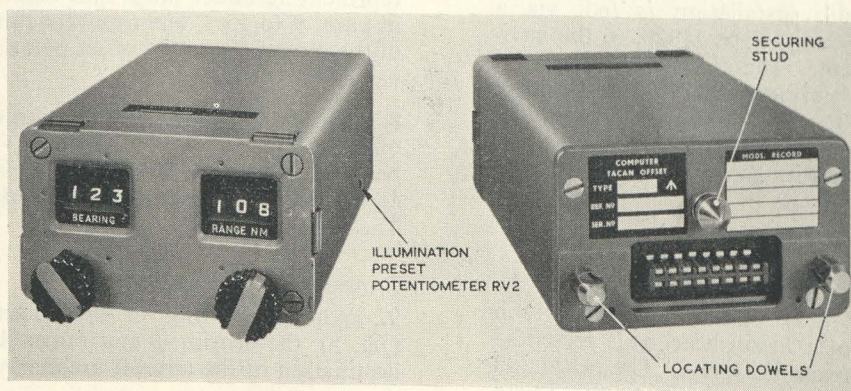
- (1) Tacan station bearing β and range T from the aircraft's Tacan equipment.
- (2) The range S and bearing α of the desired destination from the Tacan station. This information is set manually on the offset computer.

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NOTE:-
IN THIS ILLUSTRATION, THE OFFSET COMPUTER IS DEPICTED AS ADJACENT TO THE NAVIGATION DISPLAY FOR CONVENIENCE IN SHOWING THEIR ASSOCIATION WITH REGARD TO OFFSET TACAN. IN THE AIRCRAFT, THE OFFSET COMPUTER IS LOCATED BENEATH THE INSTRUMENT PANEL (FIG. 2, CHAP. I OF THIS SECTION).

◀Fig. 1. Tacan presentation▶



◀Fig. 2. Offset Tacan computer▶

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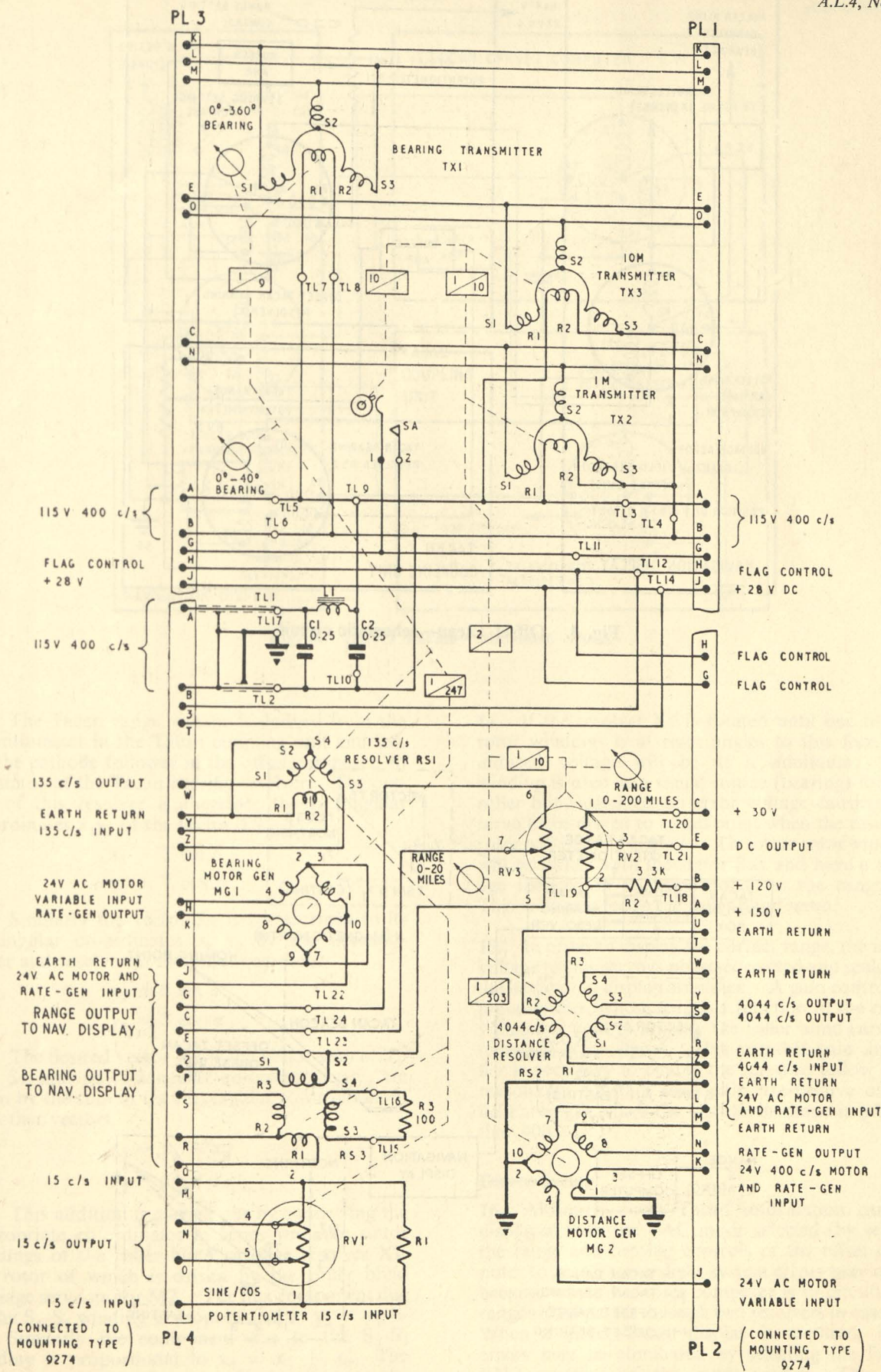


Fig. 3. Tacan coupling (indicator) unit, Type 11920—circuit

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incurrence of such errors (fig. 6). With the mode switch in the DL position, direct Tacan is displayed irrespective of any range and bearing settings on the offset computer (fig. 6 and 8).

17. In the DL mode, the Tacan range voltage (100 mV/mile) is fed to the buffer amplifier in the offset computer where it is scaled to 39 mV/mile. From the buffer amplifier the rescaled signal passes to T2 in the navigation display. The wiper of the roller blind potentiometer is connected electrically to the opposite side of T2 and mechanically coupled to the roller blind motor M1. Hence the Tacan range signal is compared with the voltage from RV1 and the error voltage, after amplification in the roller blind servo amplifier, energizes the roller blind servo motor until the Tacan range signal is backed off by the signal from RV1, when the roller blind will indicate Tacan range.

18. The Tacan bearing resolver in the Tacan coupling unit is fed with 20V a.c. The rotor output

is fed into the roller blind carriage resolver X1, by-passing the offset computer which has its stator windings de-energized. Therefore the only signal fed to X1 is the Tacan bearing signal. The error signal is picked off from the rotor winding R2-R3 of X1 and fed, via the gain-controlled pre-amplifier, to the roller blind carriage servo-amplifier. After amplification, it drives the roller blind carriage motor M2 until the position of the roller blind carriage indicates the Tacan bearing.

Test point

19. Tacan functions may be simulated at a plug-break which is a 12-pole connector (FS7C) located on a bracket on the aft face of the bulkhead on the starboard side of the main equipment bay. Tests are effected by a test set, Type 7 (Ref. No. 6C/2197). Details of the socket connections are given in Table 2, Chap. 7 of this section. Details of the tests are given in the appropriate chapter of A.P.4685T.

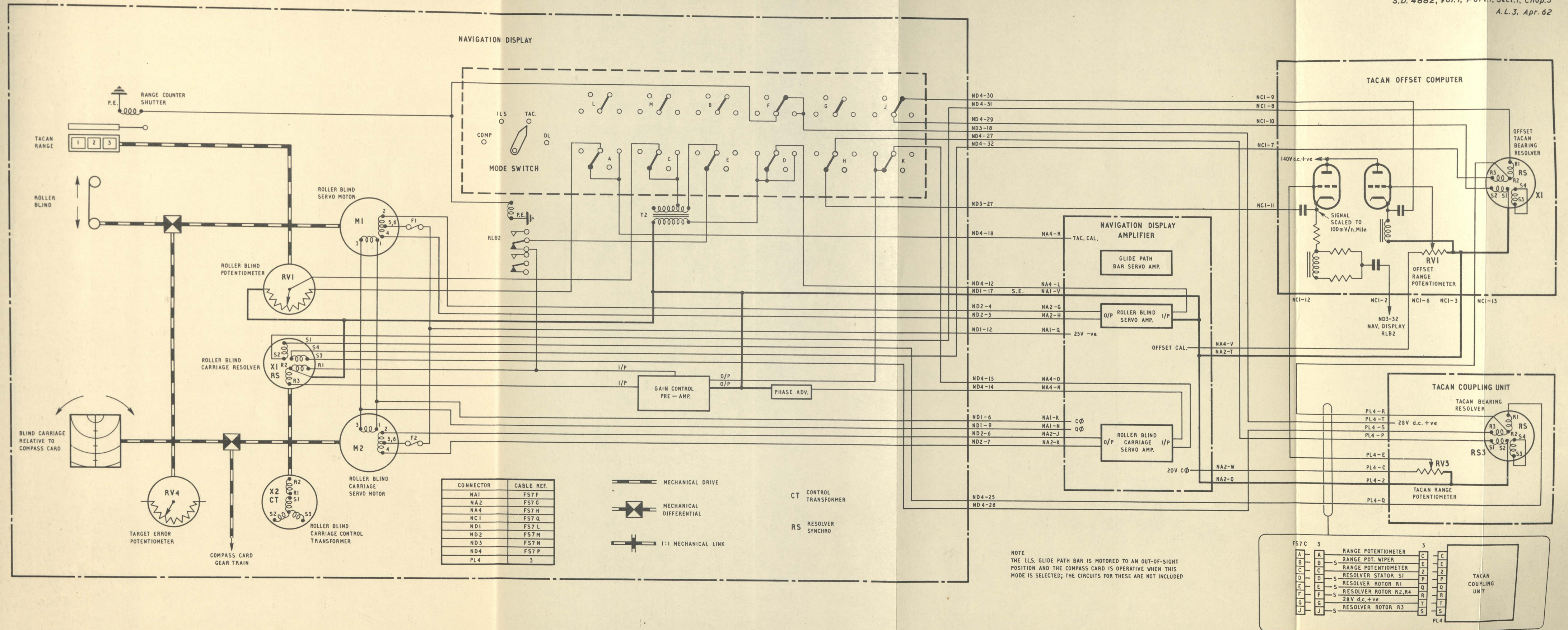


Fig. 7

(M.F.P.)

Navigation display system—offset Tacan mode schematic diagram

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Fig. 7

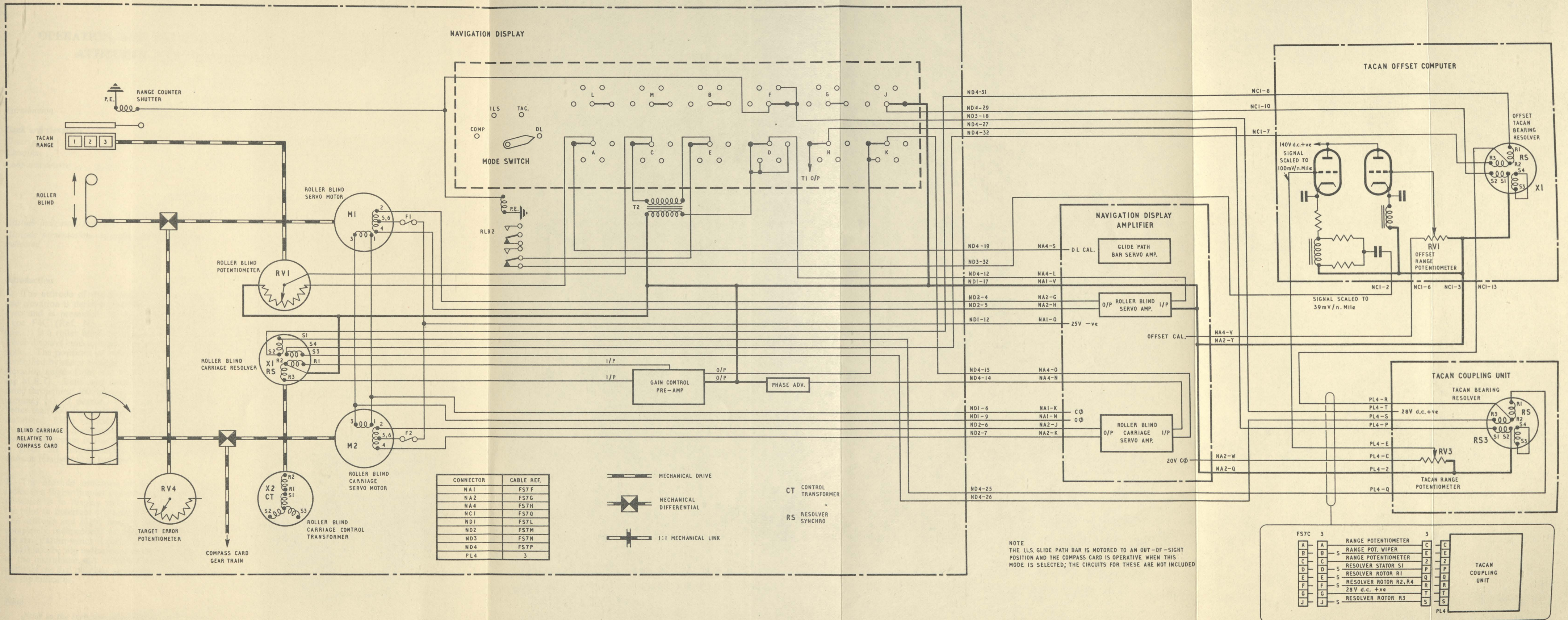


Fig. 8

(M.F.P.)

Navigation display system—direct Tacan mode schematic diagram
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Fig. 8

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