

Chapter 5A

ARI-23180

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DESCRIPTION AND OPERATION

Introduction

1. This chapter provides descriptive information for the Long Range Navigation (LORAN) ARI-23180 installation, fitted to aircraft in the MR role. The equipment provides a navigational fix with respect to a chain of ground transmitting stations.

2. Ground stations associated with the Loran A mode transmit on spot frequencies in the band 1850 kHz to 1950 kHz. Ground

stations associated with the Loran C mode transmit on a carrier frequency of 100 kHz

Description

3. ARI-23180 includes five major units:-

- (1) Receiver, Type 1831.
- (2) Indicator, Type 1832.
- (3) Indicator, digital display Type 1833.

(4) Amplifier, Aerial Type 1953.

(5) Aerial, Chelton series.

Receiver, Type 1831

4. There are no operating controls on the receiver, which is mounted under the Nav-plotter's table. The transistorized unit incorporates all circuitry necessary for the processing of received signals.

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Indicator, Type 1832

5. The indicator, located at the Navigator's station, includes the cathode ray tube and all controls necessary for an operator to adjust the display of the received Loran signals and their selected comparison or tracking gates. A meter on this unit enables the index channel, the agc channel and the afc channel sampling voltages to be monitored.

Indicator, Type 1833

6. The digital display indicator, located at the Navigator's station indicates the time difference in microseconds between the master pulse and the selected slave pulses. This measurement is displayed on a five-digit readout. Also mounted on this unit are switches to select the basic mode of operation and pulse-repetition-rate. Another switch selects display of slave A or slave B transmissions or automatic display of slave A and slave B measurements alternately.

Aerial amplifier, Type 1953

7. The aerial amplifier is located in the nose-wheel bay and its primary function is to isolate the aerial, which represents a high impedance source. The amplifier also provides a gain of the order of 6 and has the essential features of a low capacitance high resistance input, low noise factor and low output impedance. The characteristics ensure a high signal-to-noise ratio with a minimum phase error within the frequency range.

Operation

8. The Loran system is a pulse technique hyperbolic position fixing aid. Loran group transmitting chains include a master station and

two, three or four slave stations. Transmissions propagated from the master station are received at each slave station and any receiver within the service area. Each slave station delays by a precise time interval known as the coding delay and then transmits its own signal.

9. A receiver within the service area will receive pulses from each slave station delayed in time from the master by an amount depending upon both location of the receiver and the coding delay of each slave station. Since the receiver is at a given time difference at any instant with respect to the master and slave stations, the time differences between the reception of pulses from these stations establish hyperbolic contours with the ground stations as foci. The intersection of the hyperbolic contours define the location of the receiver.

10. Loran A operates in the frequency band 1850 kHz to 1950 kHz and, in operation, individual measurements must be made on a master and two slave transmissions to obtain a fix. The received signals are displayed on a double-trace oscilloscope. This measurement is effected by first visually-aligning two gate waveforms with displayed pulses and then adjusting the display to bring both gated pulses into coincidence. The time difference may then be read directly in microseconds from the digital readout of the display. The operation must be repeated for the master station and each station in turn to obtain a fix.

11. Since the whole Loran C system operates on a single 100 kHz carrier frequency, identification of a particular chain must be provided by some means other than rf channel selection. This identification is provided by the use of 48 different pulse repetition rates. All stations in a

particular chain use the same prf. The 48-pulse repetition rates designated by letters H, L, S, SH, SL and SS. These designations correspond to group repetition intervals of 30 000, 40 000, 50 000, 60 000, 80 000 and 100 000 μ s. In addition, for each of these basic rates there are eight specific codes 0, 1, 2, 3, 4, 5, 6 and 7. To obtain the specific rate 0, 100, 200, 300, 400, 500, 600 or 700 μ s is subtracted from the basic rate according to whether the specific code is 0 to 7 respectively.

12. The primary stage of time measurements on Loran C is similar to that of Loran A. On the indicator crt, gates are aligned with the received pulse groups. This establishes the coarse time measurement. The second stage known as 'indexing' consists of aligning gates derived from the output of an internal 100 kHz pulse generator, with the 3rd cycle of the received master and slave pulses. Accurate time measurements are then made by automatic counting on the digital indicator of the 100 kHz pulse train between the master and slave gating points. The resulting time differences may then be read directly in microseconds on the digital display indicator.

Functional operation

13. The following paragraphs describe the functional operation of ARI-23180.

14. From the aerial, received signals are passed to the aerial amplifier Type 1953 via SKT2. The primary function of the aerial amplifier is to isolate the aerial, which is inherently a high impedance source, from the necessarily long and high capacitive feeder to the receiver.

15. The output from the aerial amplifier at SKT2 is fed to the receiver via SKT6. The rf stages of the receiver provide sufficient ampli-

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fication for signal sampling and processing. The rf stages of the receiver are controlled by agc but a manual gain control is used to adjust the gain prior to acquisition, when time gated samples of signal levels are not available to the agc loops.

16. The receiver, includes all circuitry necessary for the processing of master and slave signals in order to provide:-

- (1) A readout unit with time difference measurements corresponding to the aircraft's position.

WARNING . . .

Servicing personnel are warned that voltages in excess of 30V ac and 50V dc can be lethal.

General

22. All units comprising the Loran installation are easily accessible. When it is necessary to remove a unit, loose connectors are to be fitted with dust covers and secured to adjacent aircraft structure to prevent damage.

Receiver, Type 1832

23. To remove the receiver, disconnect all connectors on the front panel. Release the two receiver locking screws and remove the receiver from its mounting.

Indicator, Type 1832

24. To remove the indicator release the four quick-release fasteners located around the outside of the front panel; withdraw the indicator disconnect connectors PL1 and PL2 and remove indicator.

- (2) A crt unit with signal samples of the master and slave signals corresponding to the aircraft's position.

17. The indicator, Type 1833, displays in digital form, the time difference in microseconds between the master pulse and the selected slave pulse, corresponding to the aircraft's position in relation to the selected ground transmitting chain.

18. The indicator, Type 1832 provides visual display of received signals together with their selected comparison or tracking gates for the purposes of acquisition.

SERVICING

General

21. The security of components should be checked and all plugs, sockets, connections and terminal blocks examined for damage,

Power supplies

19. The installation operates on 28V dc and 115V ac supplies. The supplies are fed to the receiver and subsequently to the other components.

Test conditions

20. The test set, Type 1863 can be connected to the receiver when it is required to check functionally the whole of the Loran installation.

corrosion and the ingress of dust or moisture whenever the relevant unit is undergoing servicing.

REMOVAL AND INSTALLATION

Indicator, Type 1833

25. To remove the indicator release the four quick-release fasteners located around the outside of the front panel; withdraw the indicator, disconnect connectors PL1 and PL2 and remove indicator.

Digital indicator removal

26. Using the readout extractor, Type 53/1987, depress the indicator to be extracted and withdraw the complete assembly from the indicator, Type 1833.

Digital indicator insertion

27. Using the readout extractor, Type 53/1987 press the assembly into the indicator, Type 1833 and withdraw the extractor.

Aerial amplifier, Type 1953

28. To remove the aerial amplifier disconnect the four connectors located on the rear end of the unit and remove four securing screws visible on the underside face.

NOTE . . .

When replacing the aerial amplifier ensure that the unit to be fitted is marked DORSAL.

Aerial

29. The aerial used is the ADF aerial and should be removed as detailed in Chapter 5.

Installation

30. The installation procedure of all components is the reverse to that of removal.

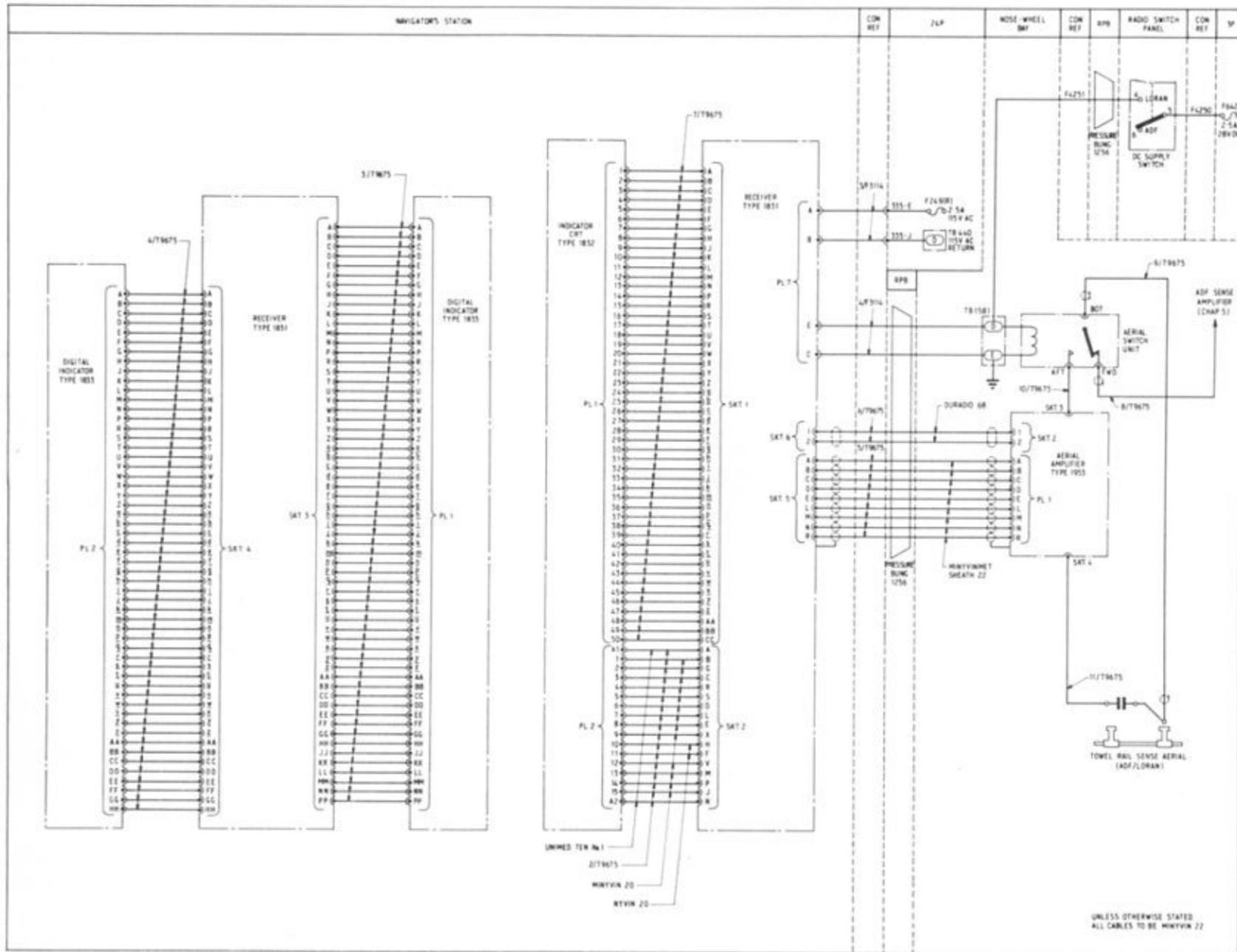


Fig. 1 Routing chart ARI 23180

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