



AUTOMATIC DIRECTION FINDER SYSTEM

MODEL ADFS-210-1

OPERATING INSTRUCTIONS
AND MAINTENANCE MANUAL

MODEL ADF-210 AUTOMATIC DIRECTION FINDER

GENERAL DESCRIPTION

The ADF-210 is an automatic radio direction finder operating in the 11 meter (27 MHz) band. The system consists of a fixed mounted antenna array and a remote electronics package which contains the cathode ray tube display. A rapid response, unambiguous display of the relative bearing between the antenna array (ship or platform) and the beacon transmitter is generated by the system.

THEORY OF OPERATION

Operation of the Ocean Applied Research ADF-210 Automatic Direction Finder is based on the response or pattern of a pair of loop antennas which respond to the magnetic component of the transmitter's radiated field. A polar plot of the amplitude and phase response of a well-balanced and well-shielded loop is a sine function of the angle of the source relative to the orientation of the loop (see Figure 1). A pair of loops mounted at right angles to one another yield sine and cosine information.

A third non-directional vertical whip antenna provides a reference phase so that the 180° ambiguity of the loops can be eliminated from the final display.

The ADF-210 electronics accomplish the function of amplifying the signals from the three antennas and converting them (by heterodyning) to a lower frequency convenient for display on the X, Y, and Z axes of a cathode ray tube. Relative phase information between the three channels and amplitude between the two from the loops is retained during the heterodyning and amplifying processes. With the axial loops signal displayed on the Y axis, the transverse on the X axis, and the omnidirectional whip on the Z axis, a display is produced which yields a half of a narrow ellipse across half of the screen which looks like an arrow from the center of the cathode ray tube to the edge. The antenna is oriented so that the arrow points straight up (0°) for a signal from directly ahead of the ship.

INSTALLATION OF ADF-210

ANTENNA ASSEMBLY PROCEDURE

1. Insert the bare anodized aluminum base of antenna into the brown phenolic insulator and secure with screws provided (the screws are shipped taped inside the insulator).
2. Insert top section of antenna into bottom section and secure with set screws provided. (The set screws and allen wrench are taped to the antenna.) NOTE: While inserting top section of the antenna into the bottom, pull lightly on the antenna cables at the bottom to eliminate bunching up inside of the antenna. Cover and seal set screws by taping with Scotch 33 or equivalent plastic electrical tape.
3. Mount the rectangular plate provided to the top of the antenna with the screws provided.
4. Mount the loop antenna assembly to the mounting plate with screws that are in the mounting plate.
5. Connect antenna cables to loop assembly - red to red and brown to brown as marked.
6. With AquaSeal sealing compound provided with loop antenna assembly seal the antenna connections to prevent any moisture from entering connections.

INSTALLATION OF ANTENNA

1. Select a mounting location based on the following requirements:
 - a. Forward and on center line of boat.
 - b. The loops and approximately six feet of antenna mast must be above all other structures.
 - c. Place for securing guy lines (3 places).
 - d. Rigid bulkhead or post for securing base of antenna.
2. After selecting mounting location, proceed as follows:
 - a. With antenna mounts provided, clamp the antenna base securely with the red band on the loop antenna facing forward.
 - b. Secure guy lines to eliminate whipping of the antenna when boat is underway. (Check guy lines periodically as the line provided will stretch slightly at first.)

- c. Route cables to wheel house where the ADF-210 receiver unit is located.

INSTALLATION OF ADF RECEIVER UNIT

1. Select a location for the unit that will provide visibility of the scope face to the man at the wheel. (It is recommended that the unit be secured down with a bungy cord or similar hold-down to eliminate sliding around in heavy seas.)
2. Connect the power input cable provided to a 12 volt D.C. source. Connect the white wire to +12 volts and the black wire to ground or negative. Plug power cable into mating connector on rear panel of unit. NOTE: Incorrect polarity will damage unit.
3. Connect antenna cables to mating connectors on rear panel - red to red, brown to brown and yellow to yellow.
4. Refer to operating instructions for procedure to adjust antenna.

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ANTENNA ADJUSTMENT

It is necessary to adjust the position of the ADF-210 loop antennas relative to the ship to give maximum accuracy at a zero heading. To make this adjustment proceed as follows:

1. This adjustment must be made with the ship and beacon transmitter in open water well away from any structure or other ships that might cause errors due to reflected signals.
2. Place a floating beacon transmitter in the water. Attach a flag of some type for good visibility.
3. Move the ship away from the beacon far enough to reduce the relative field strength to less than 1 on the meter. (Approximately $\frac{1}{4}$ to $\frac{1}{2}$ mile).
4. Position the ship for a zero heading toward the beacon as accurately as possible.
5. With the ship on a zero heading, relative to the beacon, loosen the antenna clamps and rotate the entire antenna assembly for the most accurate indication relative to visual sighting. (Red band on loop antenna indicates forward position).

REAR PANEL CONTROL *

On the rear panel there is a screwdriver adjustment potentiometer. This potentiometer is located directly below the audio output jack. This is a control for adjusting the angle of blanking of the trace. The trace that is generated is a double ended trace with the unwanted half blanked out. (This portion can be seen by turning up the intensity to full brilliance). Adjust this control so that the trace is blanked off squarely with both sides of equal length. This adjustment need only be made at very infrequent intervals, primarily at the time of initial installation.

*See page 12 for addendum to instructions.

OPERATING INSTRUCTIONS
FOR
MODEL ADF-210 AUTOMATIC DIRECTION FINDER

Assuming that the ADF-210 has been properly installed the unit is ready for operation.

ON - OFF SWITCH

When the unit is turned on there will be a slightly audible high-pitched sound present within the unit. This is noise generated by the converter transformer and is normal.

CHANNEL SELECTOR SWITCH

The channel selector switch is used to select any one of ten (10) receiver crystals. The ADF-210 is supplied with five (5) standard radio control channels (A-26.995 mhz. B-27.045mhz. C-27.095 mhz. D-27.145 mhz. E-27.195 mhz) There is a frequency chart on the side of the unit identifying the frequency of each channel.

FIELD STRENGTH

The relative field strength of the received signal is displayed on a 0-1 ma meter on the front panel.

VOLUME CONTROL

The volume control should be adjusted for a comfortable listening level. Although it is not necessary to have the volume turned up at all, it is helpful in identifying a particular transmitter by correlation of the audible and visible signal.

POSITIONING CONTROLS (VERTICAL AND HORIZONTAL)

To position the display properly for minimum error, proceed as follows:

1. If there is a display present on the Cathode ray tube (either a strong usable signal or interference) it is necessary to change the crystal selector to a channel that has no signal (preferably a position that has no crystal installed) in order to obtain a small dot on the face of the Cathode ray tube.
2. Adjust the vertical and horizontal controls to position the dot in the center of the Cathode ray tube.

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3. Reset the channel selector back to the channel desired.

GAIN CONTROL

The gain control is used to adjust the length of the trace on the Cathode ray tube. The trace should be adjusted so that the point of the display appears to just touch the marks of the azimuth dial.

The length of the trace will vary, depending on distance from the transmitter and the power output of the transmitter. At long ranges it may not be possible to get full length trace, although even when the trace becomes very short, the directional information is still present.

FOCUS CONTROL

Adjust the focus control for a sharp round dot with the channel selector set to a quiet or open channel.

INTENSITY CONTROL

For most applications, the intensity control can be left on the fully counter clockwise position. If the ADF-210 is used on open flying bridge in sunlight, it will be necessary to turn the intensity up (clockwise).

It is not wise to have the intensity turned up any higher than necessary for good visibility because of possible burning of the Cathode ray tube face.

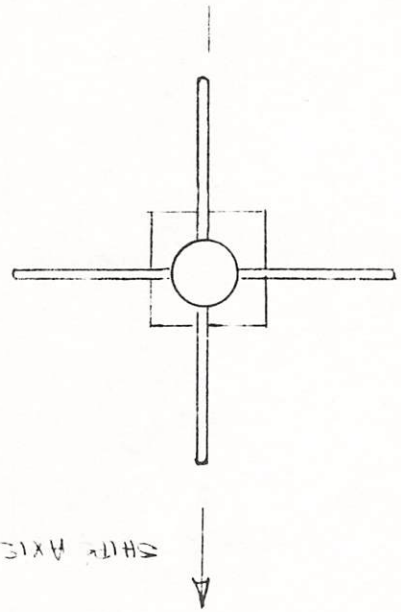
PHASE CONTROL

The phase control on the front panel is used to adjust the width or opening of the trace. This will vary, depending upon polarity of the transmitting antenna and the ADF-210 receiving antennas. This will be constantly varying to a degree because of the movement of the transmitter and the motion of the ship. (see diagram)

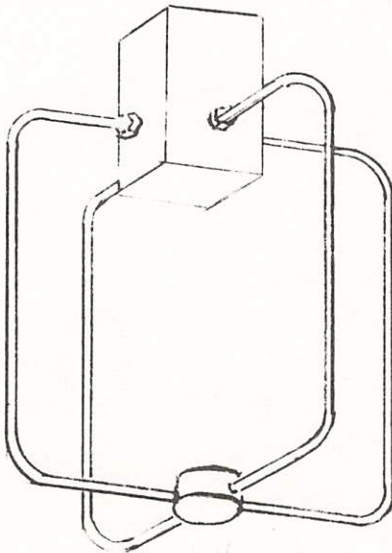
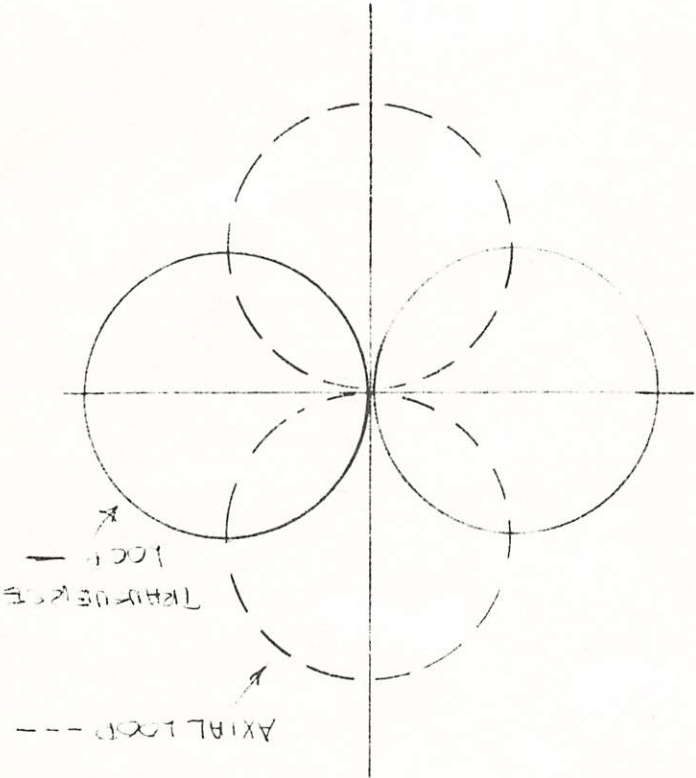
For best results, this control should be approximately centered with the dot on the control knob in the top center.

Fig 1

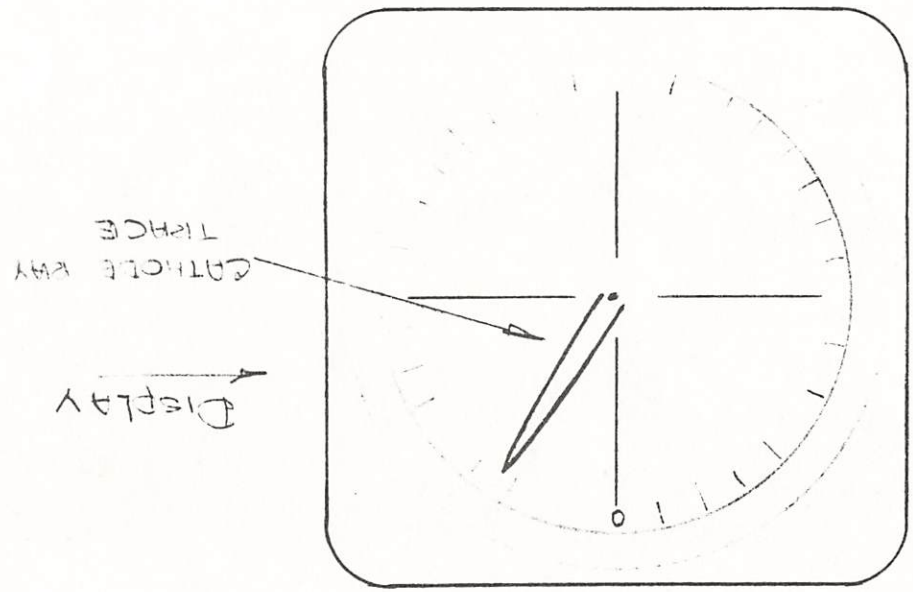
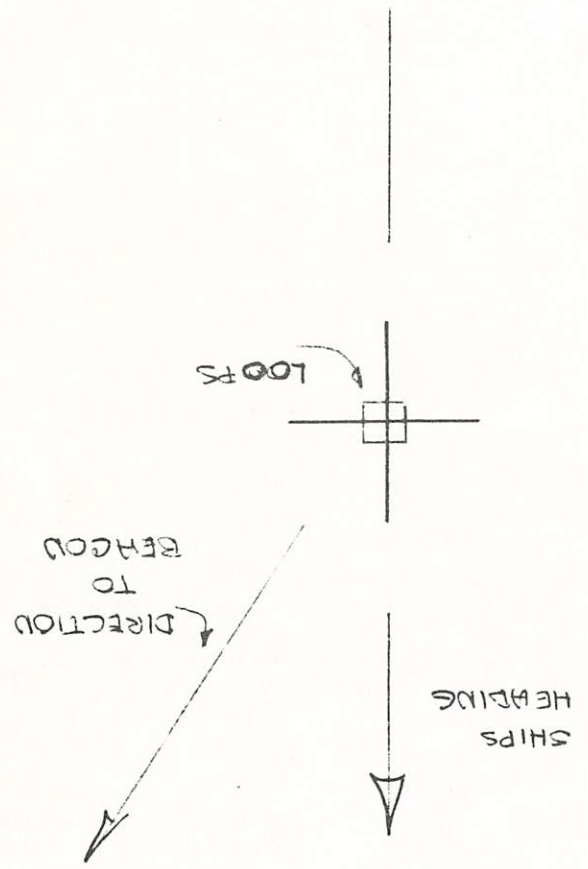
Top View



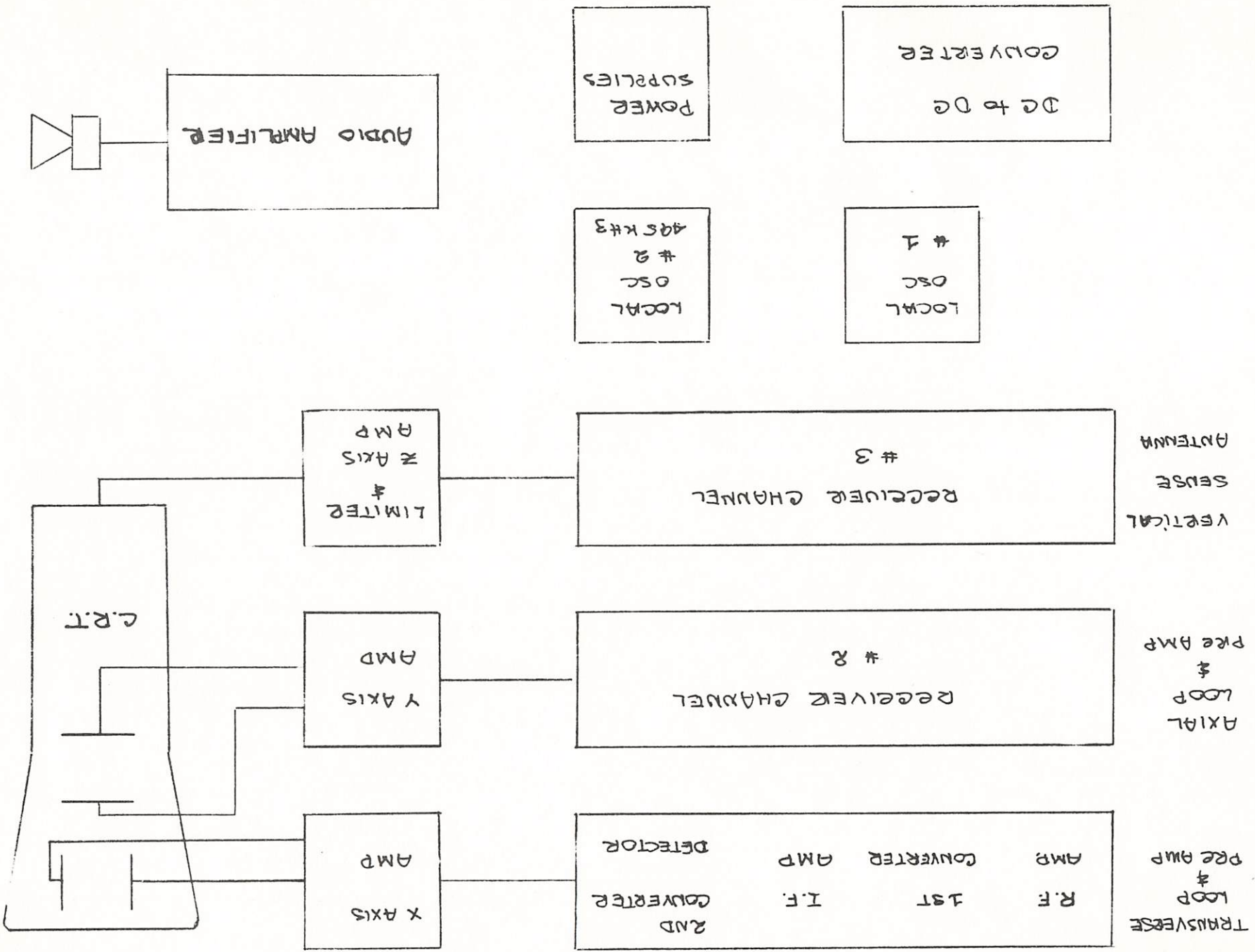
Amplitude Response



Loop Assembly



ADF 210 BLOCK DIAGRAM



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