



**Overboard Recovery  
Communications  
Apparatus (ORCA<sup>®</sup>)  
DF-101 Direction Finder  
User's Manual**



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For technical support, contact BriarTek at 703-548-7892 or through our website at [www.briartek.com](http://www.briartek.com).

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## 1.0 DF-101 Introduction

The DF-101 direction finder is a phased interferometer signal processor and provides the relative bearing to a 121.5 MHz transmission. Each DF-101 consists of a display unit and an antenna array. This system is mounted pilothouse and small boat to assist in the location and recovery of an MOB.

## 2.0 DF-101 Parts Overview

- |  |   |
|--|---|
| <b>A</b> – Power On/Off (Red) Button                                     | <b>I</b> – Warning LED                                  |
| <b>B</b> – Power On/Off LED  | <b>J</b> – Signal Strength Indicator                    |
| <b>C</b> – Squelch Increase Button                                       | <b>K</b> – Numeric Bearing Indicator                    |
| <b>D</b> – Squelch Decrease Button                                       | <b>L</b> – Speaker (4 Ports)                            |
| <b>E</b> – Display Dimmer Button   | <b>M</b> – Circular Display Bearing Indicator (36 LEDs) |
| <b>F</b> – Speaker On/Off Button   | <b>N</b> – Data Connector                               |
| <b>G</b> – Speaker On/Off LED  | <b>O</b> – Power Connector                              |
| <b>H</b> – Clear (Depress Squelch Decrease [D] & Dim [E] Simultaneously) | <b>P</b> – DF101 Antenna Array                          |

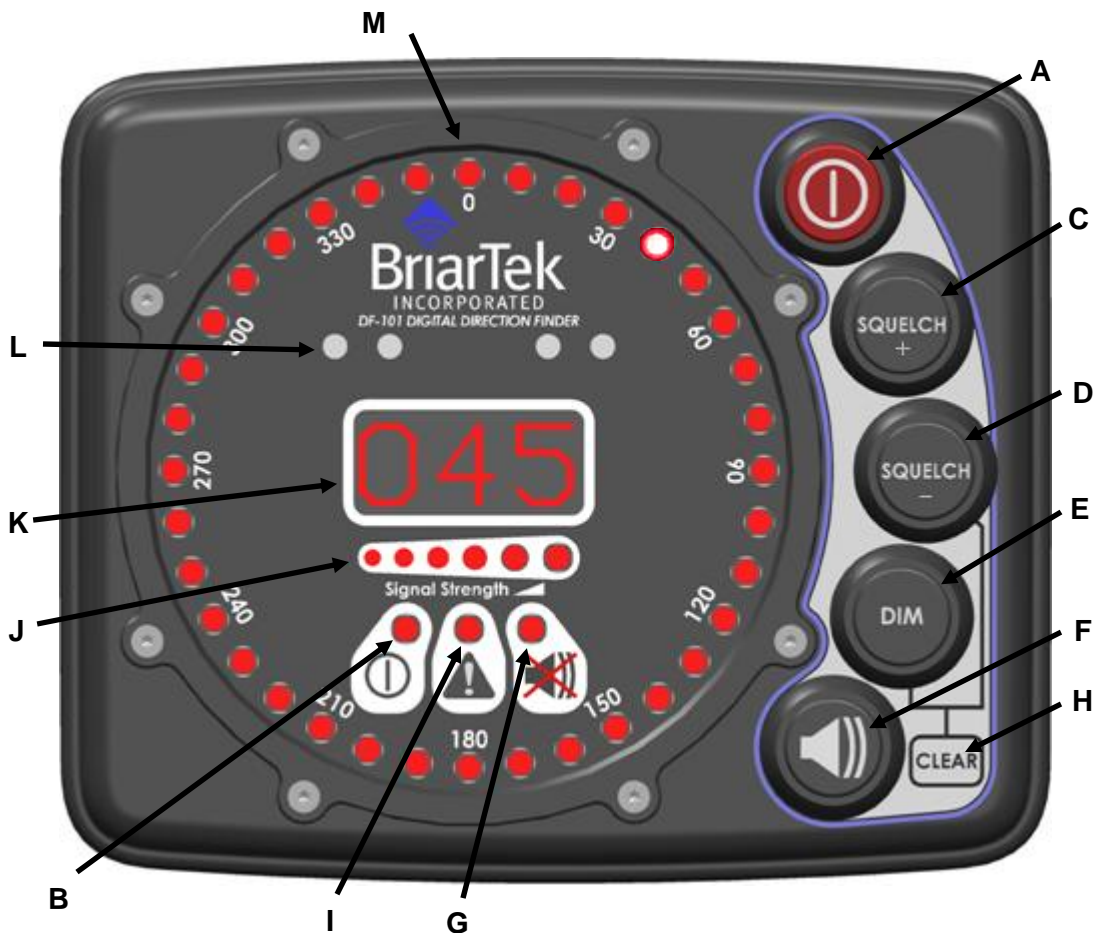


Figure 1. DF-101 Display (Front View)

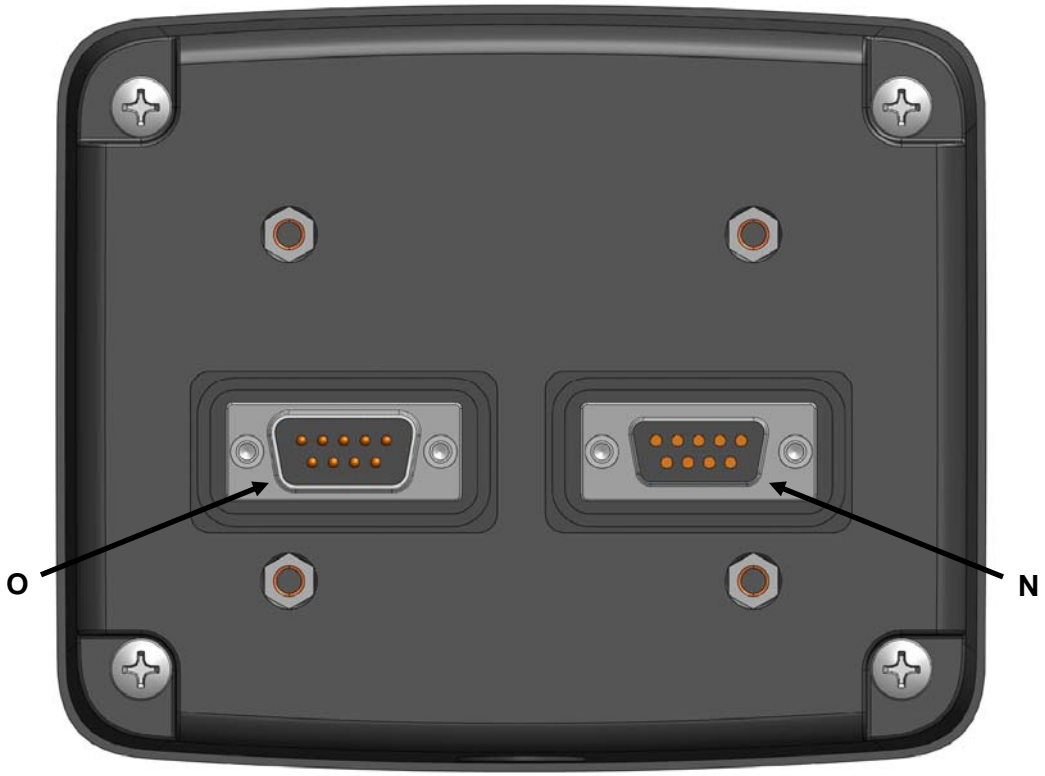


Figure 2. DF-101 Display (Back View)

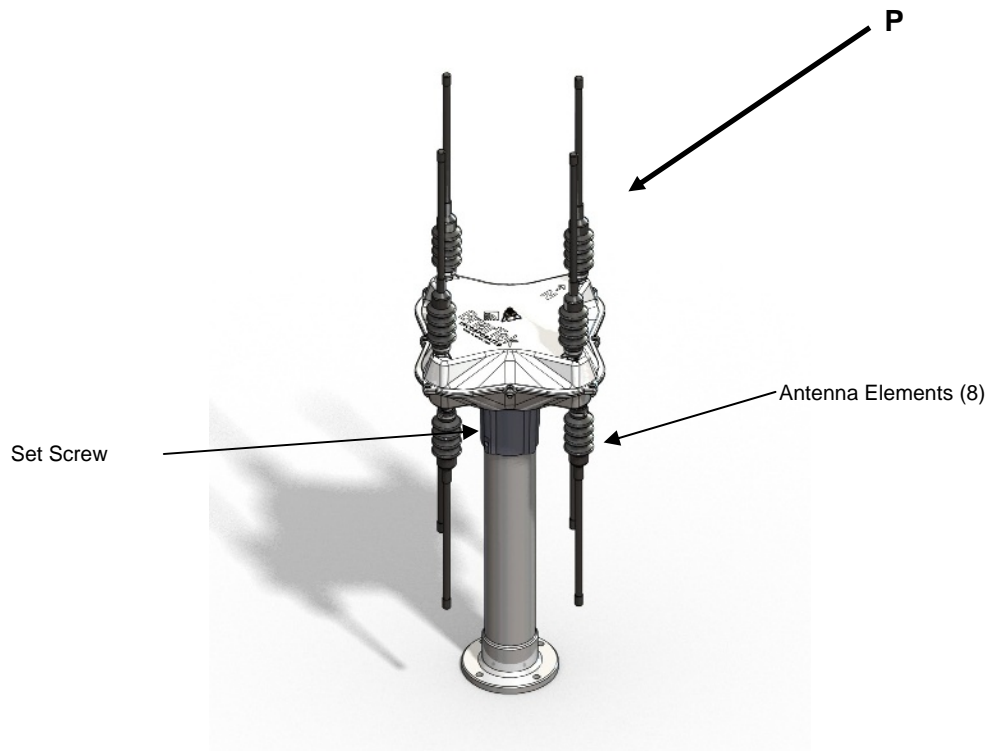


Figure 3. DF-101 Antenna Array



## 3.0 DF-101 Functions

### 3.1 Power On/Off

The Power On/Off button (A) provides power to the system and restores default settings. When button is held down for at least one second, the display will perform a system check to determine that the DF-101 is functioning properly. While it is performing this check, all LEDs will illuminate. After the system check is complete, the only remaining illuminated LEDs will be the Power On LED (B), the Speaker On/Off LED and the Numeric Bearing Indicator (K) will display "---". **Note: the illuminated Speaker On/Off LED indicates the speaker is off. Press the Speaker On/Off button to turn on the speaker.** Check to ensure the Warning LED (I) is not illuminated; if the Warning LED is illuminated, service is required. To turn the direction finder off, hold down Power button (A) for at least one second; all LEDs will extinguish.

### 3.2 Speaker

The speaker (L) provides the audible indication of the received distress signal. The Speaker On/Off button (F) toggles the speaker on and off. When the Speaker On/Off LED (G) is illuminated, the speaker is off.

### 3.3 Clear

Clear (H) is used to clear the DF-101 internal data used to calculate bearing; it resets to an un-averaged bearing value. Clear the display by depressing the Squelch decrease button (D) and Dim button (E) simultaneously. When the data is cleared, the bearing LEDs will illuminate in the same pattern as when the unit is first powered on.

### 3.4 Squelch

Squelch is used to filter undesired signals that may be present at or near 121.5 MHz. These signals are typically found in high traffic areas such as shipping channels, airport flight paths, and populated areas. It is also used to reduce interference noise from own ship RF emissions. Increasing squelch will cause a decrease in range of the DF. Therefore it is recommended that the squelch be decreased when operating away from high traffic areas in order to maximize system range.

**Changing the squelch level:** Press and hold the "Squelch +" button (C) or the "Squelch -" button (D) to enter squelch mode and increase/decrease the squelch level. While in squelch mode, a squelch value will be displayed on the numeric bearing indicator (K) as well as on the LED bearing indicators (M). Values for squelch are 0-360. Release squelch increase/decrease button when desired squelch level is achieved. The DF will return to bearing display mode five seconds after release of button.

### 3.5 Dim

The display dimmer button (E) enables the user to dim the display LEDs. The display has 3 levels of illumination. Push the button to decrease the illumination.

### 3.6 Signal Strength

The signal strength indicator LEDs (J) indicate the received signal strength on a graduated scale from 0 to 6 (0 indicating weak/no signal and 6 indicating strong signal).

### 3.7 Warning

The warning LED (I) alerts the user to a failure in the system. If this LED is illuminated, first turn off power (A) and check to ensure DB-9 data and power cable connections (N & O) are fully secured. Turn on power (A). If warning LED is still illuminated, see section 4.0, Maintenance and Troubleshooting procedures.

### 3.8 Default Settings

Default settings for the DF-101 are:

- Dim – High (brightest) value
- Squelch – Last saved value
- Speaker – OFF

**NOTE:** The system returns to the default settings when the DF-101 is turned on.

## 4.0 Installation Notes

The installation notes provided herein are intended to serve as a guide only. They do not serve as material required for the certification of technicians for the installation, repair or alteration of the ORCA<sup>®</sup> system.

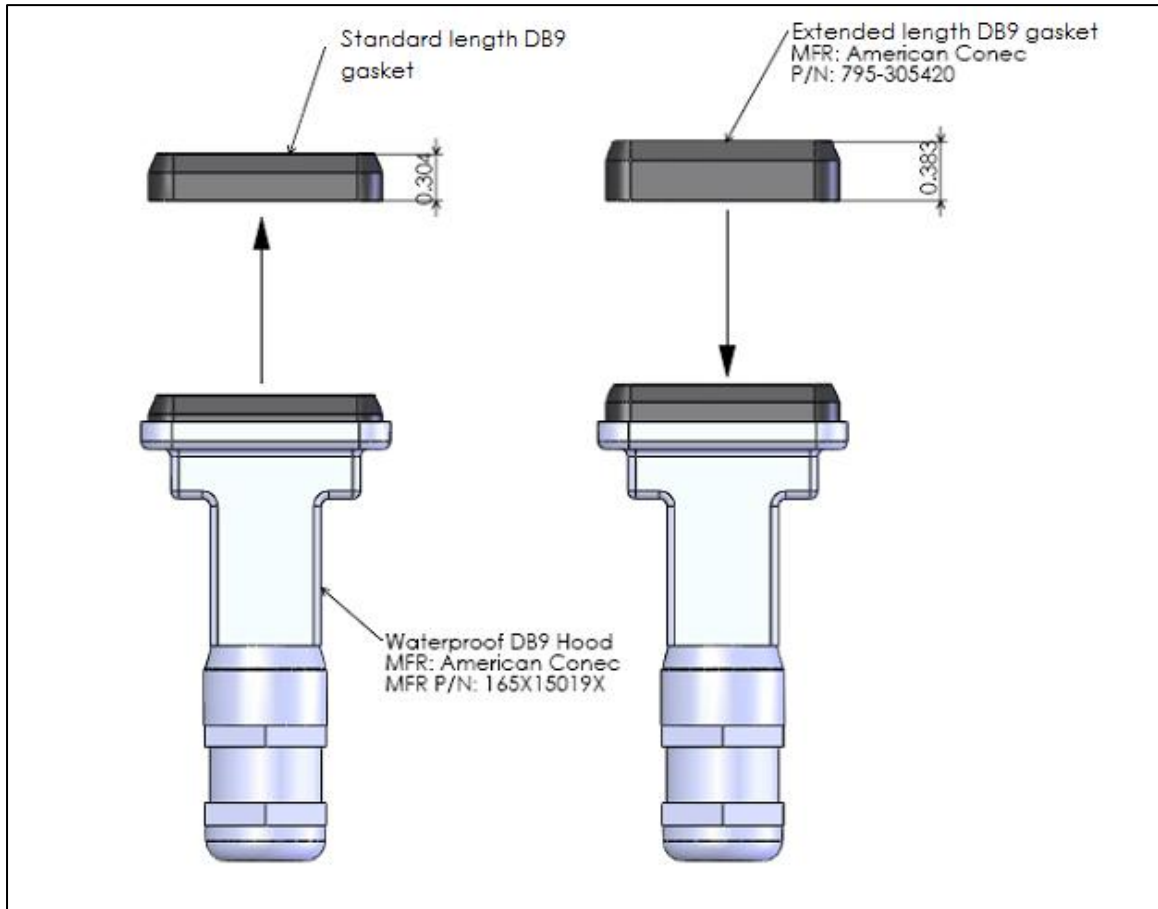
**NOTE:** When replacing a DF-100 (see figure 4) with a DF-101, ensure that the display and antenna are replaced. The DF-101 display does not function with the DF-100 antenna; the DF-101 antenna does not function with the DF-100 display.

\* not shown  
to scale



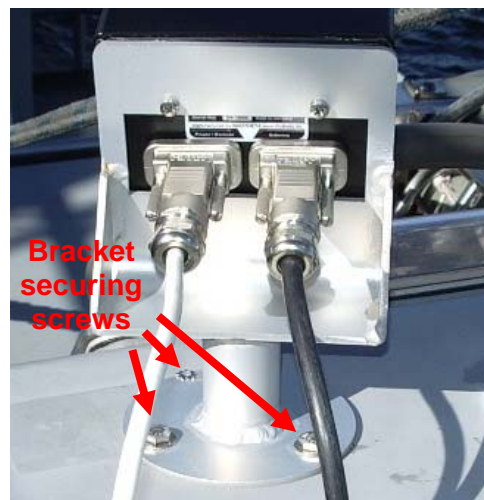
Figure 4. DF-100 display and antenna



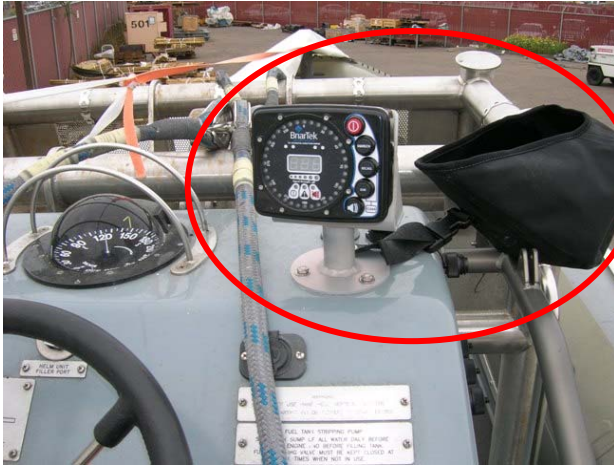


**Figure 7. Waterproof DB9 Gaskets**

- c. Install DF Display Hood. If installing in a location where it will be exposed to weather, the rubberized hood (optional) will help to protect it from corrosion due to rain or salt spray. Secure the rubberized DF display hood to the display bracket using a bracket securing screw. See figure 8. While the DF display is not in use, display should remain covered. See figure 10.



**Figure 8: DF display bracket**



**Figure 9: DF display hood  
– display uncovered**



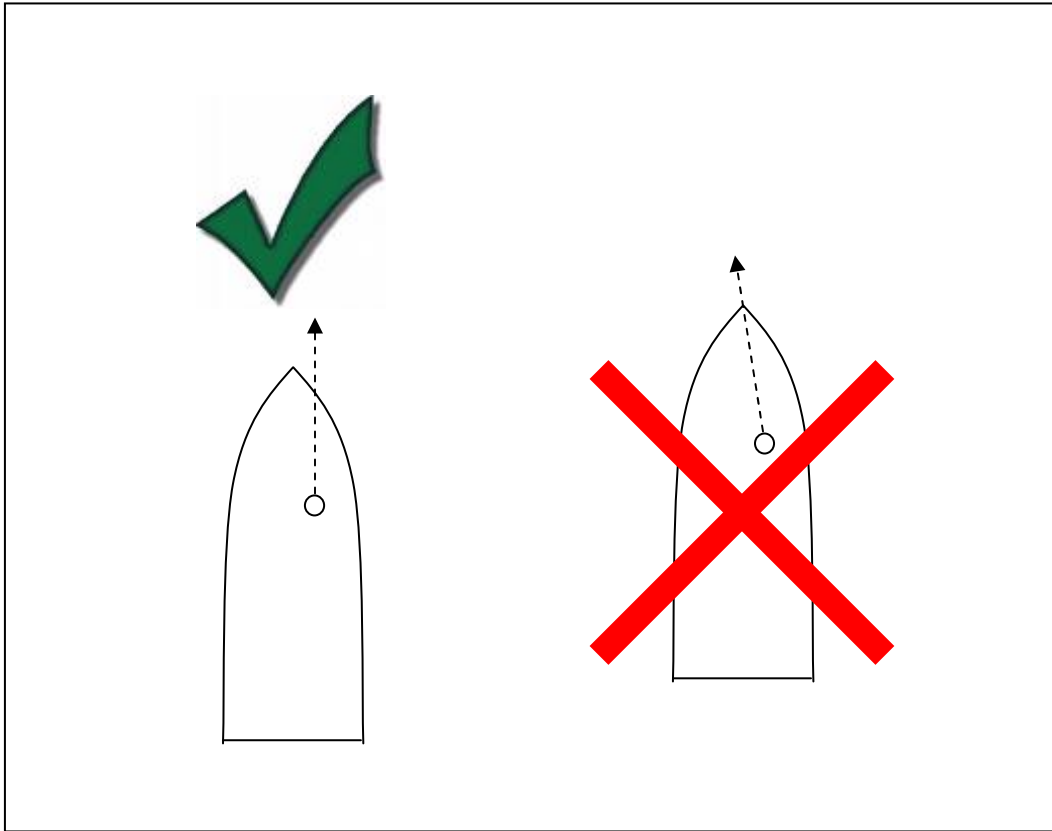
**Figure 10: DF display  
hood – display covered**

## 4.2 Antenna Array

General. In general, the antenna array should be installed at the highest point possible such as the vessel's mast and away from any obstructions that would interfere with the DF's line of sight to the MOB transmitter. In practical application it is recommended that the antenna array is mounted a minimum of 3' away from any adjacent objects (i.e., GPS antenna, VHF marine radio antenna, stanchion, etc...) and located such that adjacent objects are non-planar. Finally, the antenna should not be inverted as this will cause water to leak into the housing and will damage electronic components.

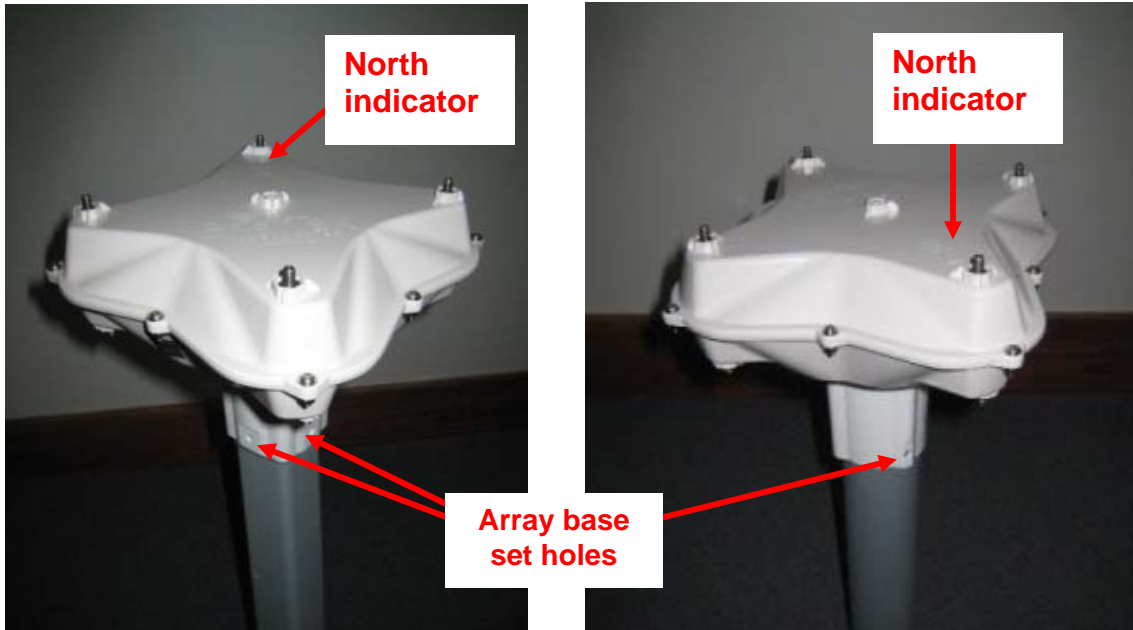
### a. Mounting the antenna array.

- (1) Place antenna array onto antenna mast. Dimensional requirements for mast fabrication are located in Section 9.0, DF-101 Specifications.
- (2) Orient antenna array. Position the antenna such that the two opposing antenna elements facing relative north point parallel to the bow of the vessel (see figure 11). Relative north of the antenna array can be identified by locating the raised "N" text on top of the antenna housing and adjacent to the top, forward looking antenna element. Additionally, there is a small pressure relief valve on the bottom side of the antenna housing adjacent to the bottom, forward looking antenna element.



**Figure 11. DF-101 antenna orientation**

- (3) Drill and tap mast to align with new array base as follows:
- i. Orient DF North Arrow to bow of vessel and use punch to mark new hole location(s) on antenna mast. See figure 12.
  - ii. Remove antenna array
  - iii. Using No. 7 (.201) drill bit, drill pilot holes (to be used for  $\frac{1}{4}$  x 20 tap)
  - iv. Tap each pilot hole with  $\frac{1}{4}$  x 20 tap using hand tap wrench. It is recommended to back off two turns for every turn forward until the hole is tapped through.



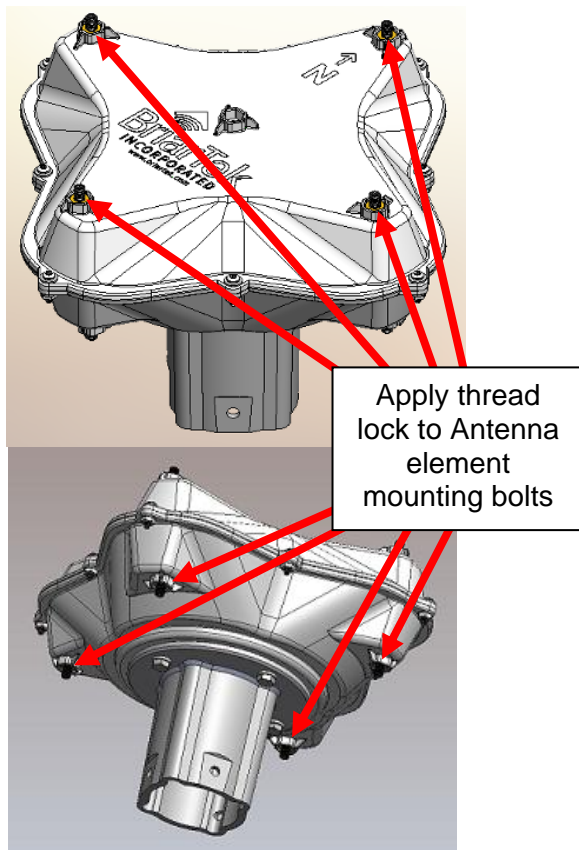
**Figure 12: Array base set holes**

- (4) Connect data cable. A waterproof DB9 connector with extended-length gasket (see figure 7) must be used to maintain the water tight integrity of the antenna array.
- (5) Secure antenna array. Install a lock washer and flat washer onto a  $\frac{1}{4}$ -20 x  $\frac{3}{4}$ " fastener. All material should be 316 CRES. Apply anti-seize to threads of  $\frac{1}{4}$ -20 fastener. Install fastener through the  $\frac{1}{4}$ " hole at the antenna array mounting base and into the tapped mast. Do not over-torque or threads will strip.
- (6) Fasten antenna elements (qty 8). Apply threadlock to the threads of the antenna elements and mounting bolts (see figures 13 & 14). Screw (hand-tighten) each element on mounting bolts. Do not over-torque the antenna elements. Wipe any excess threadlock from surrounding area.



**Figure 13: Thread lock on antenna element**





**Figure 14: Mounting bolts**



**Figure 15: Assembled DF antenna**

## 5.0 Recovery Boat Procedures (if DF is installed on recovery boat)

### 5.1 Set Up

- a. Upon manning the small boat, ensure the boat's power panel main breaker and ORCA<sup>®</sup> breaker are turned on.
- b. Locate the DF Display.
  - (1) Remove tethered display cover.
  - (2) Turn on power at the display. The display conducts a self-diagnosis for approximately 3-4 seconds. The system is ready when the "Power On" LED is illuminated.

### 5.2 Operation

- a. After the DF is ready to receive signal, and the boat is underway and making way, establish the general direction to the MOB by communicating with the ship's pilothouse.

**NOTE:** Do not immediately rely on the accuracy of the DF, as the signal coming from the ORCA<sup>®</sup> transmitter may reflect off the ship. This can produce a false bearing on the recovery boat DF display.



- b. Once there is some distance between the recovery boat and the ship (50-100 yards, depending on the position of the MOB relative to the ship), the DF display bearings will become more accurate and should be used to determine the bearing to the MOB.

## 6.0 General Guidance for Pilothouse Watch standers and Recovery Boat Personnel

- a. When the DF receives the MOB signal, the bearing indicator LED on the display will illuminate, indicating the relative bearing to the MOB. Circular display bearing accuracy is  $\pm 5$  degrees.

**NOTE:** Bearing indication may be sporadic, depending on weather conditions and sea state. Poor weather, high sea state, and interference from 121.5 MHz emitters (own ship or otherwise) will affect the ability of the DF to receive the signal.

- c. When the bearing to the MOB has been determined, steer the vessel (ship or recovery boat depending on which is recovering the MOB) toward the MOB by keeping the illuminated bearing indicator LED 10 to 20 degrees off the bow.
- d. As the vessel approaches the MOB, establish visual contact and effect recovery of the MOB.

**NOTE:** Recovery team must turn off transmitter to send "All Clear" signal.

- e. When the MOB is recovered, ensure recovery team turns off the transmitter. This will cause the transmitter to send "All Clear" signal to the receiver, indicating the MOB has been recovered.

## 7.0 Direction Finder Maintenance

### 7.1 Inspection

Inspect all components of the direction finder: display, antenna, and cables, for unusual wear and tear. If any parts are broken, missing or excessively worn, notify supervisor for repair or replacement.

### 7.2 Testing

- a. Ensure the direction finder is connected to power source and all breakers are on.
- b. Turn on display at power On/Off button if system is not already on.

**NOTE:** Ensure direct line of sight and a minimum distance of 10 feet between transmitter and antenna.

**NOTE:** Ensure pilot house watch standers are notified prior to activating transmitter.

- c. Activate ORCA<sup>®</sup> transmitter.
- d. When signal is detected by direction finder, bearing indicator LED(s) will illuminate on display. Ensure illuminated bearing indicator LED correlates with actual bearing. Move transmitter to different bearing and ensure correlation again.
- e. Deactivate ORCA<sup>®</sup> transmitter.

### 7.3 Antenna Element Replacement

- a. To replace a missing or broken antenna element, you will need the following materials:

Brush, wire

Cloth, cleaning, disposable

Solvent

Loctite or equivalent threadlock - (provided with antenna element when replacement is ordered)

- b. If antenna element is broken but still attached to the antenna housing, remove element.
- c. Ensure threaded antenna mount is free of debris and dried threadlock using wire brush. If necessary, to obtain complete removal of old threadlock, apply solvent in combination with wire brush. Using clean cloth, wipe all surfaces clean and dry.
- d. Place a few drops of threadlock on the threads of the antenna element mount.

**CAUTION:** Do not overtighten antenna element on mount. Overtightening may cause cracks in housing.

- e. Immediately screw antenna element to mount; hand-tighten only. Wipe any excess threadlock from surrounding area.
- f. Repeat steps b through e above for each antenna element requiring installation/replacement.

### 7.4 In-line Fuse Replacement

- a. Unscrew in-line fuse holder between power supply and DF display unit.
- b. Replace blown fuse with new fuse.
- c. Screw on fuse holder

### 7.5 Troubleshooting

See table beginning on following page.

<b>Problem</b>	<b>Possible Cause(s)</b>	<b>Solution(s)</b>
System does not turn on	“Power On” button is not pressed for required amount of time.	Press “Power On” button for at least one second
	Power surge	Ensure direction finder is plugged into energized power source.  Inspect in-line fuse and replace fuse if blown.
	Improperly assembled power cable	Check power cable for continuity
	System not energized	Verify breaker(s) and switch(es) are turned “ON”
	Water has penetrated the DF display housing	Check for corrosion on DB9 connectors on back of display. If corroded, contact manufacturer.
Display continuously points to the same bearing	An emitter from ownship or another ship is radiating at 121.5 MHz.	If possible, energize another DF to determine source of transmission.
	Damage to the cable jackets or leads	Check data cable for continuity.  Inspect the entire length of the cable for cut/frayed wire(s).
	Water penetration in the antenna housing	Check for corrosion on DB9 connector at the base of the antenna. If corroded, contact manufacturer.
	DF-100 display is connected to DF-101 antenna	Replace DF-100 display with a DF-101 display
Indicator displays errant bearings	Antenna is not installed with correct orientation.	Orient antenna so arrow on housing is pointing forward. Ensure all elements are attached and secure.
	Interference from an emitter other than an ORCA <sup>®</sup> transmitter.	Press the Squelch Increase button

	Multi-path: if the antenna is mounted adjacent to a large object, i.e. bulkhead, the signal from the transmitter may reflect off the surface of the object causing the display to indicate an errant bearing	If possible, mount the DF antenna in another location or maneuver vessel so signal is not reflecting off object
	Multiple transmitters are transmitting	Deactivate transmitters as appropriate
Numeric bearing indicator displays “232” and “485” alternately and/or Warning LED illuminated (communication error)	Data cable not connected	Inspect data cable connection at display and antenna array and ensure secure connection
	Damage to the data cable jacket or leads and/or improperly assembled cable	Check data cable for continuity
	Improperly assembled power cable	Check cable for continuity
	DF-100 antenna is connected to DF-101 display	Replace DF-100 antenna with a DF-101 antenna.
System is energized but no audio is heard when transmitter is activated	Speaker is disabled	Depress Speaker On/Off button until Speaker On/Off LED is extinguished
Display LEDs are difficult to read	Display is set to a low brightness setting	Press “Dim” button until display LEDs are sufficiently illuminated
System is energized but no bearing indication is displayed	Squelch setting is too high	Press Squelch Decrease button
	RF signal is too weak	Check that ORCA <sup>®</sup> transmitter is properly installed on life vest

## 8.0 Parts List

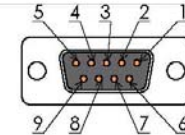
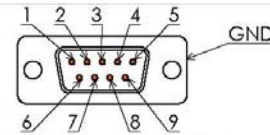
System	Subsystem	Part Number	Component Description (Nameplate Data)
ORCA <sup>®</sup>	Direction Finder	ORCADF-101	<b>Doppler Direction Finder:</b> Includes relative bearing display (P/N: ORCADF-D101), antenna array with 5086 aluminum base (P/N: ORCADF-A101), RigiFlex™ antenna elements – qty 8 (P/N: ORCADF-R/FANT1215), 121.5 MHz, 12 or 24 VDC power requirement
ORCA <sup>®</sup>	Direction Finder	ORCADF-A101	<b>Antenna Array:</b> Includes RigiFlex™ antenna elements – qty 8 (P/N: ORCADF-R/FANT1215), 5086 aluminum base, 121.5 MHz
ORCA <sup>®</sup>	Direction Finder	ORCADF-D101	<b>Relative Bearing Display:</b> Direction finder display unit with 360 degree LED bearing indicator
ORCA <sup>®</sup>	Direction Finder	ORCADF-R/FANT1215	<b>RigiFlex™ Antenna Element:</b> Helical and rigid brass antenna element, overmolded with threaded connector for mounting on ORCADF-A101.
ORCA <sup>®</sup>	Direction Finder	ORCADFB-H01	<b>DF Display Hood:</b> Polyurethane-coated nylon hood for DF display on small boat or other weather-exposed location, tether strap with grommet for mounting, plastic clip for quick release
ORCA <sup>®</sup>	Direction Finder	DFS-CKSER	<b>Serial Cable Kit:</b> serial cable, db9 connectors and heat shrink; for ship-mounted direction finder
ORCA <sup>®</sup>	Direction Finder	ORCADFS-DB01	<b>DF Display Bracket:</b> Stainless steel DF display bracket; adjustable angle

## 9.0 DF-101 Specifications

<b>System</b>	ORCA
<b>Sub System</b>	Direction Finder
<b>Part Number</b>	ORCADF-D101
<b>Description</b>	Direction Finder Display

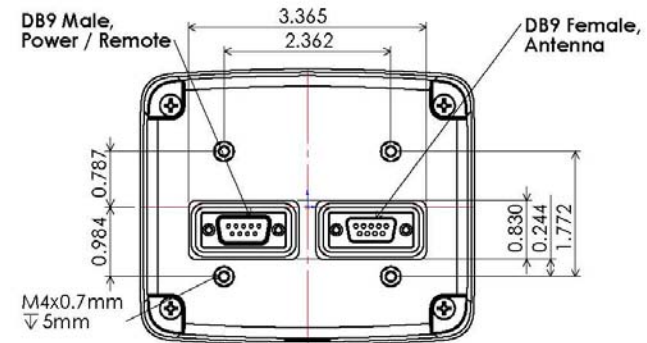
### SPECS:

- Relative bearing display
- LED illumination
- Overall weight: 11.6 oz (329 g)
- Operating frequency: 121.5 MHz
- Operating voltage: 12-24 VDC (+/- 10%)
- Current draw: max350 mA
- Accuracy: +5°
- Operating temperature range: -20°C (-4 °F) +60°C (140 ° F)
- Storage temperature: -50°C (-58° F) +70°C (158° F)
- Weatherproof applications require DB9 connectors with waterproof hood(Conec P/N: 165X15019X) and extended gasket(Conec P/N: 795-305420).



Pin	Designation
1	Power +, 12-24 VDC (+/- 10%)
2	RS-485 COM-
3	-
4	-
5	-
6	Power -, GND
7	RS-485 COM+
8	Audio out
9	-

Pin	Designation
1	Power +, 7.5 VDC
2	RS-485 COM- / RS-232 FROM display
3	RS-232 TO display
4	-
5	-
6	Power -, GND
7	RS-485 COM+
8	Audio in
9	-



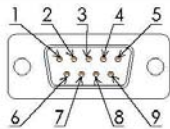
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		DIMENSIONS ARE IN INCHES		NAME		DATE	
		TOLERANCES: ±0.005		DRAWN			
		FRACTIONAL ±		CHECKED			
		ANGULAR: MACH ± BEND ±		ENG APPR.			
		TWO PLACE DECIMAL ±		MFG APPR.			
		THREE PLACE DECIMAL ±		QUAL			
		MATERIAL		COMMENTS:			
NEXT ASSY	USED ON	FINISH		BriarTek, Inc.			
APPLICATION	DO NOT SCALE DRAWING			ORCADF-D101			
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						SHEET 1 OF 1	

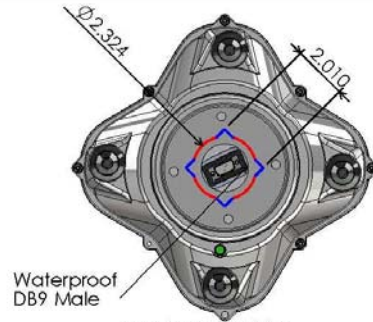
System	ORCA
Part Number	ORCADF-A101
Description	Direction Finder Antenna

**SPECS:**

- Operating Frequency: 121.5 MHz
- Operating Voltage: 7-12 VDC (powered via display)
- Current Draw: max 350 mA
- Weight: 68.7 oz (1949 g)
- Accuracy +5°
- Operating Temperature Range: -20°C (-4°F) +60°C (140°F)
- Storage Temperature: -50°C (-58°F) +70°C (158°F)
- Weatherproof applications require DB9 connector with waterproof hood (Conec P/N: 165X15019X) and extended gasket (Conec P/N: 795-305420)

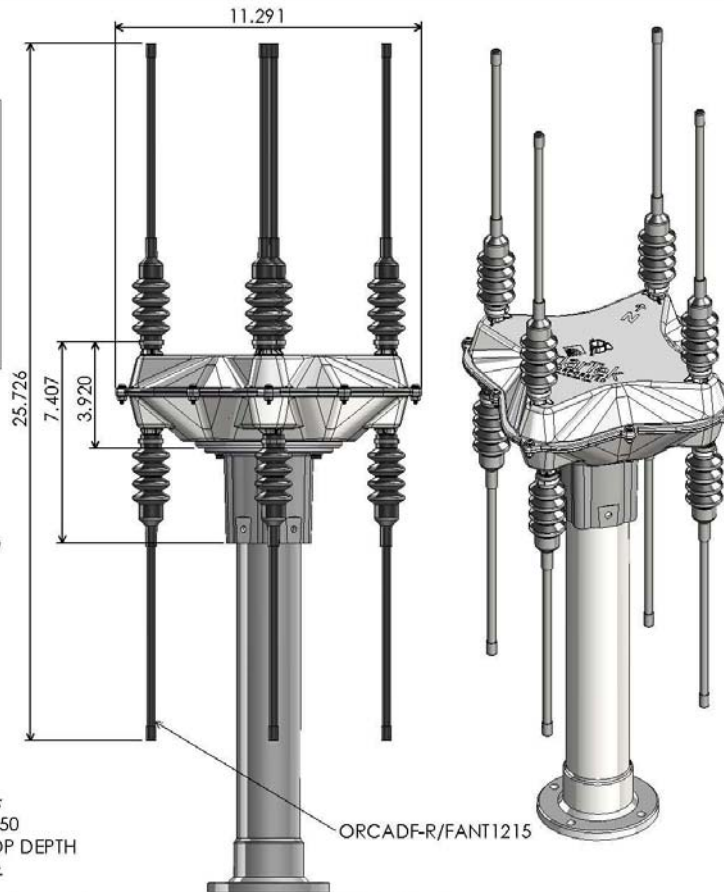


Pin	Designation
1	Power +, 7.5 VDC
2	RS-485 COM- / RS-232 FROM display
3	RS-232 TO display
4	-
5	-
6	Power -, GND
7	RS-485 COM+
8	Audio In
9	-



Waterproof DB9 Male

array base mounts to:  
 -round mast 2.318" diameter  
 -square mast 2"x2" square



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		DIMENSIONS ARE IN INCHES TOLERANCES: ±0.005		DRAWN	NAME	DATE	BriarTek, Inc.
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		NEXT ASSY USED ON		MFG APPR.			
APPLICATION		DO NOT SCALE DRAWING		COMMENTS:			REV.

## 10.0 Warranty

BriarTek will provide a one-year warranty on the ORCA<sup>®</sup> system following the date of original purchase.

If a component fails to function properly during its warranty period (one year), the manufacturer will proceed according to its warranty as follows:

BriarTek Inc. guarantees each product it distributes to be free from defective materials and workmanship and agrees to remedy any such defect, or to furnish a new or equal part in exchange (at its option) for a period of one year from the date the component is purchased. For an exchange of the product, please contact BriarTek at 703-548-7892 or on the web at [www.briartek.com](http://www.briartek.com) and a customer service representative will provide the necessary instructions.

This warranty is void if:

- ◆ any component has been subject to misuse or improper installation by a non-BriarTek employee or a non-BriarTek certified technician, or has been repaired or altered by a non-BriarTek employee or a non-BriarTek certified technician.
- ◆ any component fails to function properly after being put into service due to something other than defective materials or workmanship, i.e. excessive temperature, humidity or shock while component is in storage.



Notes: