

STANDARD HORIZON

Nothing takes to water like Standard Horizon

SI-TEX Radar Antennas



Installation and connection Manual

STANDARD HORIZON

Nothing takes to water like Standard Horizon

SI-TEX RADAR INSTALLATION and CONNECTION MANUAL



MDS-1



MDS-8



MDS-9



MDS-10-4/MDS-10-5

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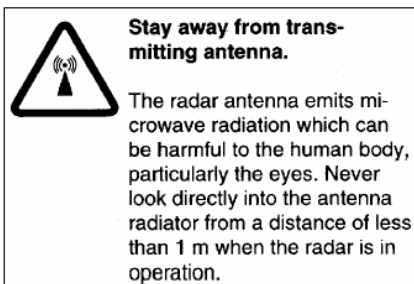
SAFETY PRECAUTIONS

HIGH VOLTAGE WARNING

Dangerously high voltages are present within the Radar scanner unit. There are no internal connections or adjustments necessary for installation. Only a qualified Radar service technician should remove the cover. Technicians must exercise extreme care when working inside the unit. Always remove power before removing the cover. Some capacitors may take several minutes to discharge, even after switching off the Radar. Before touching the magnetron or any high voltage components, ground them with a clip lead.

MICROWAVE RADIATION HAZARD

The microwave energy radiated by a Radar Antenna is harmful to humans, especially to one's eyes. Never look directly into an open waveguide or into the path of radiation from an enclosed Antenna. Radar and other radio frequency radiation can upset cardiac pacemakers. If someone with a cardiac pacemaker suspects abnormal operation, immediately turn off the equipment and move the person away from the Antenna. Turn off the Radar whenever it is necessary to work on the Antenna unit or on other equipment in the beam of the Radar.



WARNING

Radio Frequency Radiation Hazard

The Radar Antenna emits electromagnetic radio frequency (RF) energy, which can be harmful, particularly to your eyes. Never look directly into the Antenna aperture from a close distance while the Radar is in operation or expose yourself to the transmitting Antenna at a close distance.

MAGNETRON PREHEATING

When starting your Radar for the first time or when restarting it after a two month or longer not-operating period, preheat the magnetron at least 30 minutes in stand-by mode.

Please read through this Installation and Connection Manual before the first operation. If you have any questions, please contact SI-TEX (631) 996-2690 in the USA and Canada. Alternately USA customers should contact STANDARD HORIZON on 714-827-7600 or email to marinetech@yaesu.com; UK customers should contact STANDARD HORIZON on 01962 866667 or email marinesales@standardhorizon.co.uk; European customers should contact their local dealer or distributor for support.

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1. INTRODUCTION

1.0 CONVENTIONS USED

Please refer to the legend below:

[MENU]	If you see brackets around a bold and capital letter word this refers to a key press.
[CHART]	If you see brackets around a bold and small capital letter word this refers to a Soft Key press.
<u>GENERAL SETUP</u>	When a word(s) is in bold capital letters and underlined, this refers to a menu selection item.

1.1 INTRODUCTION

The Radar Antenna includes the necessary electronics to deliver Radar information to a compatible STANDARD HORIZON Chart Plotter, and is supplied with mounting hardware kit, interconnection cable and a Radar Junction Box. Menu operation and functions activation in this Installation and Connection Manual is related to the following Chart Plotter models with software capable to operate a Radar Antenna. Whenever it is necessary, a note has been inserted for those models with operational differences.

- CP180
- CP180i
- CPF180i
- CP190i
- CPF190i
- CP300
- CP300i
- CPF300i
- CP390i
- CPF390i
- CPV350
- CP500
- CP590
- CPV550

To confirm the Chart Plotter has the software to operate a Radar Antenna:

1. Turn on the Chart Plotter, select the Chart page.
2. Press **[MENU]** and look for a Radar selection.

If the Chart Plotter has a Radar selection, it has the software. If the Chart Plotter does not have the software, a Software CARD is available in the USA by contacting STANDARD HORIZON's Parts department on 714-827-7600 Extn. 6800 or by email at marineparts@yaesu.com. UK customers may contact STANDARD HORIZON on 01962 866667 or by email to service@yaesu.co.uk. See Par. 2.8 for software update procedure.

1.2 GENERAL INFORMATION

The SI-TEX Radar Antennas are compatible specific STANDARD HORIZON Chart

Plotters. The SI-TEX scanner Antennas operate on a frequency range of 9410+/-30MHz and can be operated from 10.8 to 41.6 VDC with power output from 2kW or 4kW depending on the SI-TEX Antenna model connected.

1.2.0 Product Support Inquiries

If you have any questions or comments, we invite you to contact:

- USA customers: STANDARD HORIZON on 714-827-7600 or by email marinetech@yaesu.com.
- UK customers: STANDARD HORIZON on 01962 866667 or email marinesales@standardhorizon.co.uk.
- European customers: their local dealer or distributor for support.
- SI-TEX (631) 996-2690 in the USA and Canada.

1.3 PACKING LIST

When the package containing the SI-TEX Radar Antenna is first opened, please check for the following contents.

SI-TEX Antenna (dome or open array) with 30Ft of routing cable

Fasteners, stainless steel

4 Bolts, hex metric M8 x 25U (approx. 3/8 dia. x 1 in. long)

4 Flat washer

4 Lock washer

1 Radar Junction Box

1 Template, for locating mounting holes

2 Fuses, 5A (spare)

1.3.0 Options

Flux Gate compass sensor (needed for chart overlay) check with your dealer for this item

Extensions cables, 15 or 20 meters

1.3.1 Replacement Parts

1 Radar Junction Box

Stainless Hardware Kit (4 Bolts, flat washer and lock washer)

2 Fuses, 5A (spare)

Contact SI-TEX directly of Replacement Parts at (631) 996-2690 in the USA and Canada.

2. INSTALLATION

This chapters illustrates the instructions on mechanical and electrical connections of the Radar and the necessary software settings to operate it.

WARNING

In order for the Radar Antenna to communicate with the Chart Plotter, the software must be configured as explained in the Par. 2.7.

2.0 INSTALLATION CONSIDERATIONS

Prior to the actual installation of the Radar Antenna, several factors must be considered to ensure maximum performance (see also Appendix B).

- a. The Antenna must be located so that passengers and crew are not exposed to the direct Radar beam.
- b. The Antenna should be mounted on the centerline of your vessel in a location that has an unobstructed view forward and the rest of the area around the scanner is as unobstructed as possible.
- c. A location as high as practical to improve maximum range is preferable, keeping in mind that minimum range objects may be overlooked if mounted too high. Large structure or stacks cause blind spots.
- d. Contamination from engine exhaust on the scanner housing reduces Radar performance.
- e. Antennas for GPS, radio communication or other equipment should not be in the Radar beam (use not-metallic extension poles to move the active area of Antennas above the Radar beam).
- f. In selecting a location, consider the suitability of the mounting surface. It must be flat and approximately levelled with the vessel's water line. The surface must support the weight of the scanner and have access to the under side for installation of the four mounting bolts.
- g. Consider the cable route from the Antenna to the Chart Plotter's location. Avoid routing the interconnecting cable through areas of possible damage from moving objects, machinery, and exposure to chemicals or high temperature.

NOTE

-
1. The recommended mounting surface thickness is 3/8 to 1/2 in. (9 mm to 13 mm).
If the mounting surface is thin, the mounting surface must be increased to the recommended surface thickness.
 2. If it is thicker, longer bolts must be purchased.
 3. The scanner will be damaged if bolts penetrate more than 9/16 in. (15 mm).
-

2.1 PREPARE THE RADAR FOR INSTALLATION

Unpack the Radar Antenna and check that the contents correspond to the packing list.

2.1.0 Cable

Do not remove the cover from the unit. There are no connections or adjustments inside the

unit that are needed for installation or operation. The cable must remain attached. For ease of handling, coil the cable and place it on top of the scanner. Then secure it with tape. Invert the scanner and make sure the four mounting holes are clear to accept bolts. Working at higher elevations may become necessary while installing the scanner unit. Observe safety measures and take sufficient precaution to avoid personal injury or damage to the equipment.

2.2 INSTALLATION PROCEDURE

Prepare the mounting surface by making sure it is clean and flat.

NOTE

It is a better to check the accuracy of the template by measuring the actual dimension between the hole locations. The reproduction process and moisture absorption can affect accuracy. Use the template provided to mark the location of four mounting holes. **Align the template squarely with the centerline of the vessel and with the arrow pointing forward.**

1. Drill four 3/8 in. (10 mm) diameter holes through the mounting surface.
2. Check that each bolt (with lock washer and flat washer) protrude through the mounting surface at least 5/16 in. (8 mm) but less than 9/16 in. (15 mm). The scanner will be damaged if bolts protrude more than 9/16 in. (15 mm).
3. Apply sealant around each mounting hole.
4. Place the Antenna on the mounting surface. Orient the Antenna with the index mark on the housing facing forward (cable gland facing aft).
5. Install and tighten four M8 x 25U (M8 x 1 in.) mounting bolts.
6. Uncoil the scanner cable.
7. Secure the cable near the scanner to support the weight of the cable and prevent strain on the watertight cable seal. If the cable is to pass through tubing or a bulkhead, protect the unfinished end.

NOTE

Do not use the unfinished wires or fabric braid to pull the cable. Attach a fish cord only to the cable jacket.

8. Route the cable to the operator's location, securing it at appropriate points along the way.
9. Make a drip loop and apply sealant at the entry point of an exterior bulkhead.

2.3 ELECTRICAL AND DATA CONNECTIONS

The cable from Antenna unit provides all power, data and control connections necessary for operation.

1. The large Black and White leads are for power connections and connect directly to a 10.8 - 31.2 VDC power for MDS-1 and to a 10.8 - 41.6 VDC power for MDS-8/MDS-9/MDS-10-4/MDS-10-5.
2. The five small wires (Black, Orange, Yellow, Brown, Orange) are connected to the Radar Junction Box.
3. The two remaining small wires (Green and Blue) connect to the Radar On/Off switch.

NOTE

The "On/Off control switch" controls the main power to the Radar Antenna.

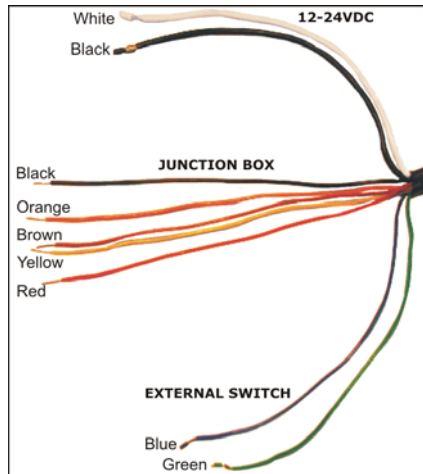


Figure 2.3 - Antenna Cable

2.4 CONNECTION PROCEDURE

NOTE

In the following procedure the small wires must be stripped and tinned, and then connected to the proper connections in the Radar Junction Box, and to pins on the On/Off control switch. If you are uncertain of your skill in completing these tasks, it is strongly advised to obtain the services of a qualified technician. It is essential to the operation and reliability of your Radar that these procedures are accomplished properly.

1. Arrange the free end of the Antenna cable so that the wires will reach their intended points for connections.
2. The two large wires must reach a power panel; the five leads in the braided fabric jacket must reach the Radar Junction Box and the two remaining leads must reach the desired location for the On/Off control switch.
3. If the leads must go in different directions, first route the five leads in the fabric braid to the Junction Box. Then extend the shorter leads using the same size or larger size wire.

Please note that the power supply level at the Junction Box should be at least 12V since due to the cable length the voltage at the Radar could drop below 10V.

The power supply cables should be of **adequate diameter** to feed the Radar, the Chart Plotter, the Junction Box and eventually any other instrument connected. The larger the diameter the better. A too small cable section could cause voltage drop over the cable with consequential overheating and danger of fire.

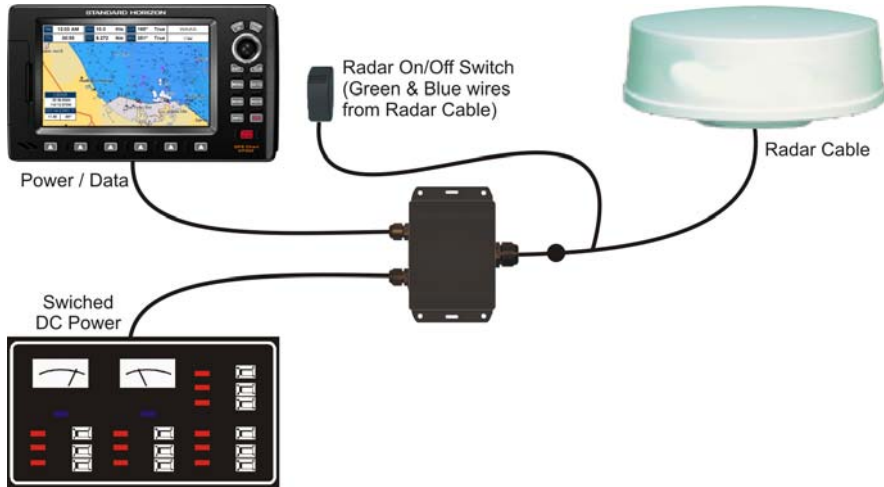


Figure 2.4 - Example of Connection Procedure for CP300

2.5 RADAR JUNCTION BOX CONNECTIONS

Referring to the diagram below, connect the color coded wires from the Radar cable to the designated place on Terminal Strip A in Radar Junction Box as follows.

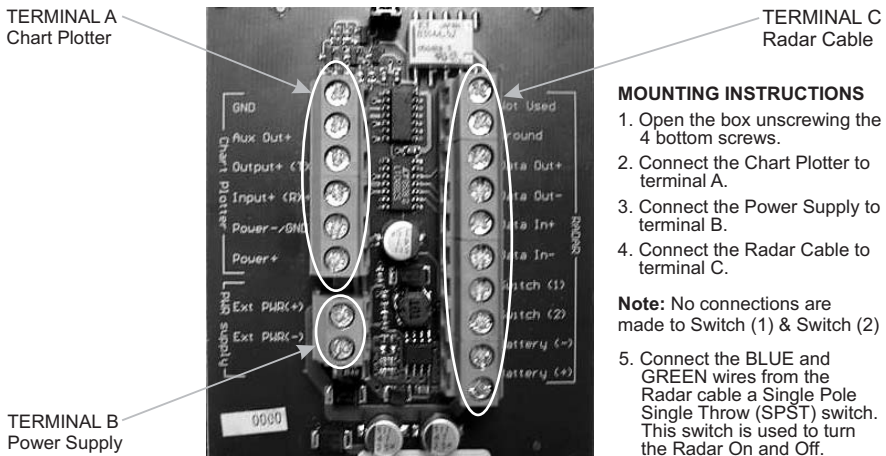


Figure 2.5 - Radar Junction Box

Terminal Strip A - Chart Plotter

This Terminal Strip is used to connect a compatible STANDARD HORIZON Chart Plotter to a Radar Antenna. Power – and Power+ connections are used to power the STANDARD HORIZON Chart Plotter when connected.

Terminal Strip B - Power supply

This Terminal Strip is used to connect the proper supply to power the Radar Antenna and STANDARD HORIZON Chart Plotter. Do not omit the in-line fuse unless a dedicated and fused terminal is available. If so, install a 5 Amp fuse.

Terminal Strip C - Radar Cable

This Terminal Strip is used to connect the Radar Antenna.

2.6 RADAR ANTENNA CONNECTIONS

2.6.0 Dome Connections

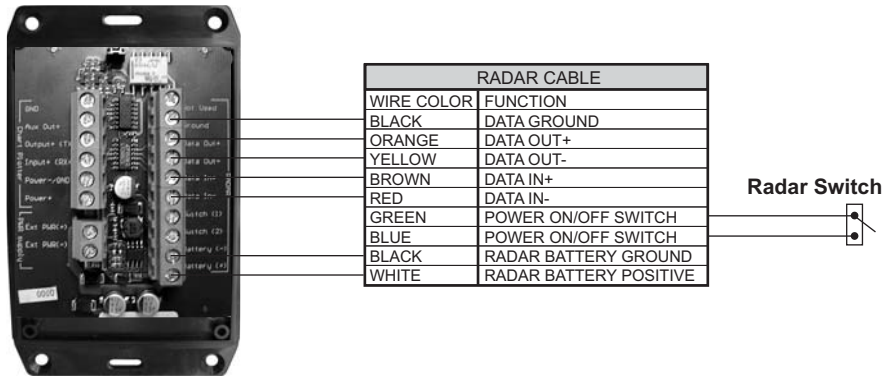


Figure 2.6.0 - Dome Connections

2.6.1 Open Array Connections

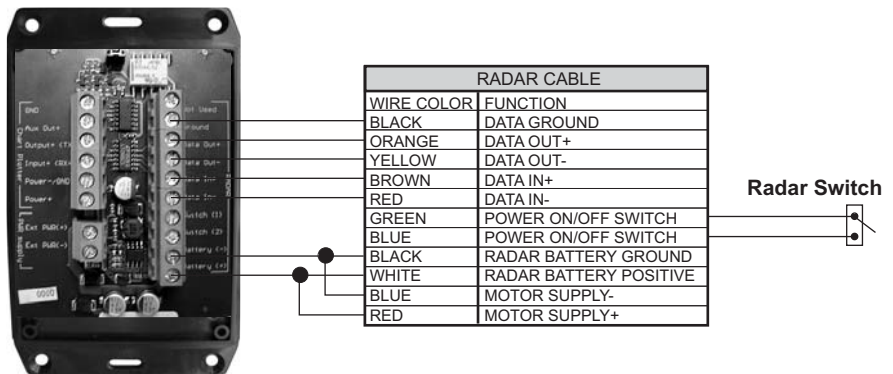


Figure 2.6.1 - Open Array Connections

NOTE

- When installing a Open Array Radar, it is important to connect:
- Red (motor+) and White to B+ connection
 - Blue (motor-) and Black to B- connection.

2.7 CHART PLOTTER CONNECTIONS AND SETUP

The following instructions refer to Dome Antennas; refer to Open Array for connections.

2.7.0 CP180/CP180i/CPF180i/CP190i/CPF190i Connections

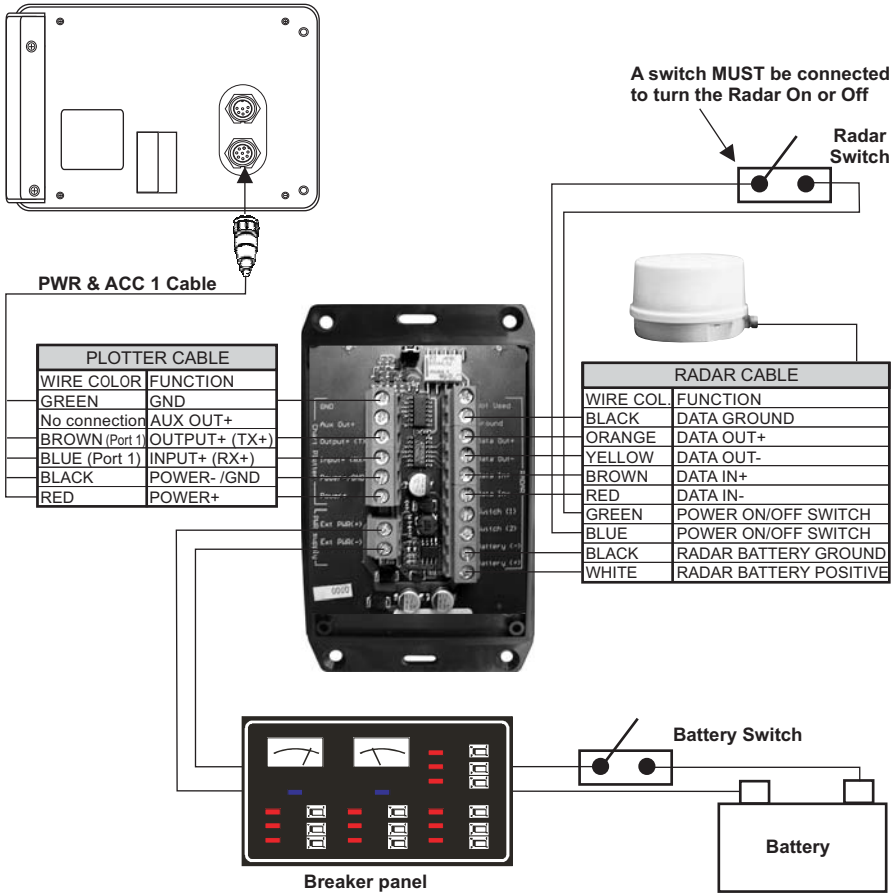


Figure 2.7.0 - CP180/CP180i/CPF180i/CP190i/CPF190i Connections

Port Setup

When an optional Radar Antenna is connected, Port1 of the NMEA In/Out Communication Setup menu must be changed to RADAR as shown below for communications.

1. From the Chart page, press **[MENU]**. Move the ShuttlePoint knob to highlight **SETUP MENU** and press **[ENT]**.

2. Move the ShuttlePoint knob to highlight **ADVANCED SETUP** and press [ENT].
3. Move the ShuttlePoint knob to highlight **IN/OUT CONNECTIONS** and press [ENT].
4. Move the ShuttlePoint knob to highlight **PORT 1 INPUT** and press [ENT].
5. Move the ShuttlePoint knob up/down to select **RADAR** and press [ENT].
6. Press [CLR] or move the ShuttlePoint knob to the left until the Chart page is shown.

2.7.1 CP300/CP300i/CPF300i/CP390i/CPF390i Connections

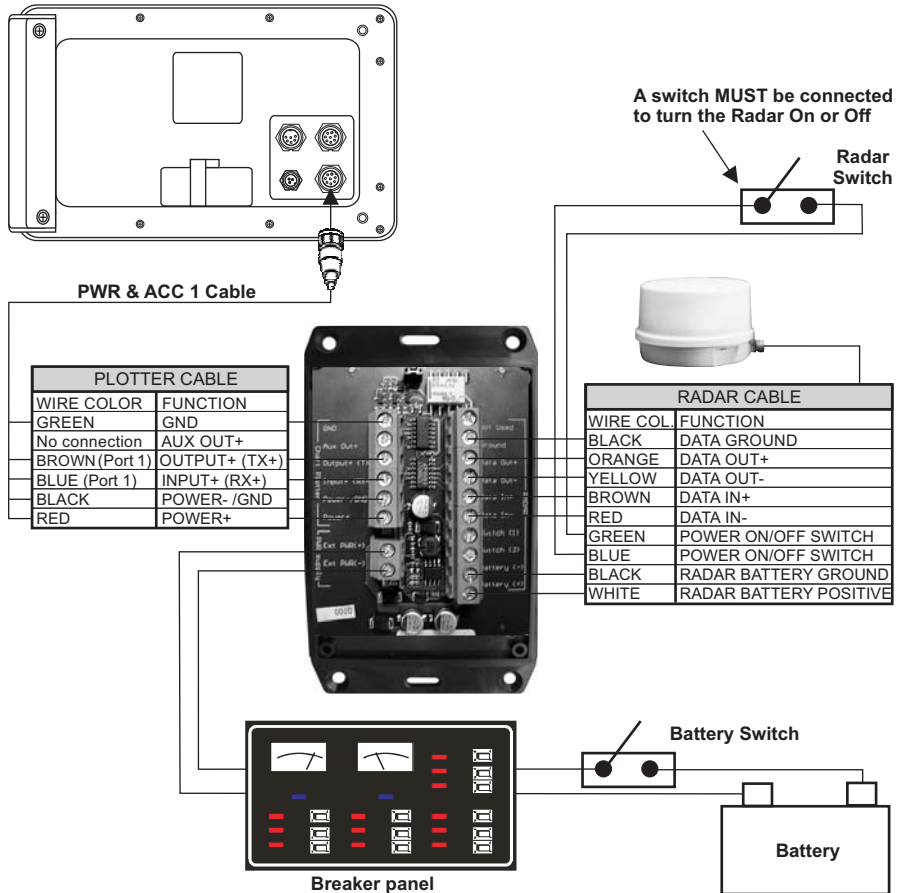


Figure 2.7.1 - CP300/CP300i/CPF300i/CP390i/CPF390i Connections

Port Setup

When an optional Radar Antenna is connected, Port1 of the NMEA In/Out Communication Setup menu must be changed to RADAR as shown below for communications.

1. From the Chart page, press **[MENU]**. Move the ShuttlePoint knob to highlight **SETUP MENU** and press **[ENT]**.
2. Move the ShuttlePoint knob to highlight **ADVANCED SETUP** and press **[ENT]**.
3. Move the ShuttlePoint knob to highlight **IN/OUT CONNECTIONS** and press **[ENT]**.
4. Move the ShuttlePoint knob to highlight **PORT 1 INPUT** and press **[ENT]**.
5. Move the ShuttlePoint knob up/down to select **RADAR** and press **[ENT]**.
6. Press **[CLR]** or move the ShuttlePoint knob to the left until the Chart page is shown.

2.7.2 CPV350 Connections

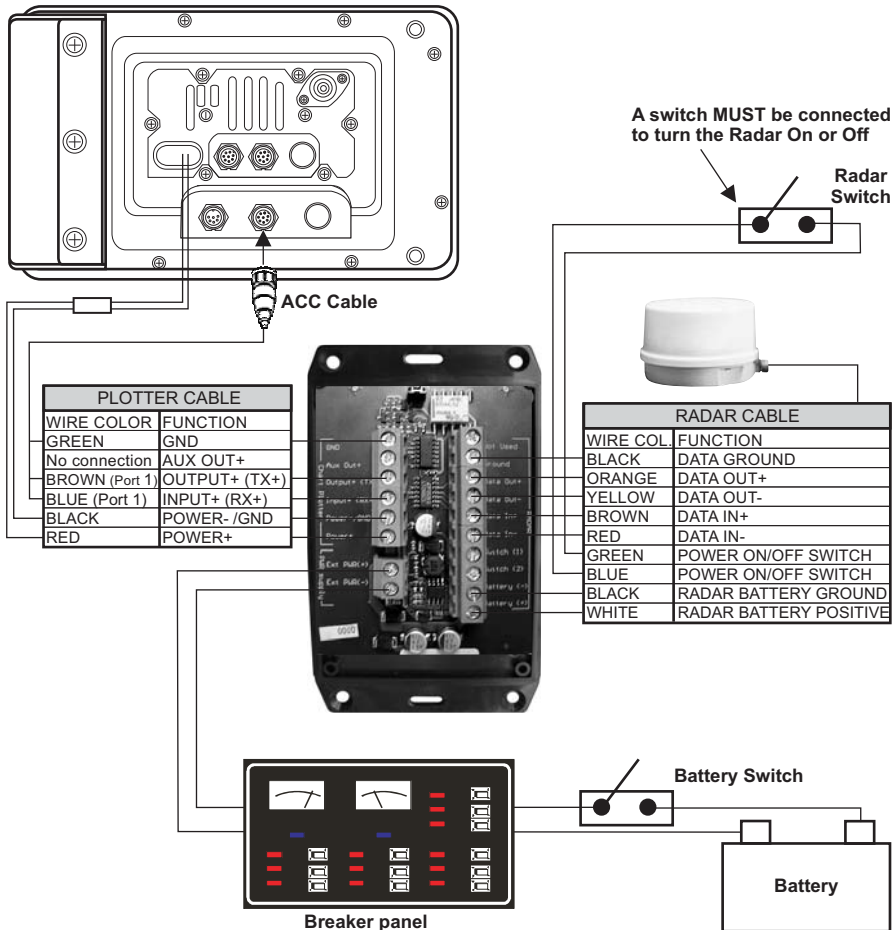


Figure 2.7.2 - CPV350 Connections

Port Setup

When an optional Radar Antenna is connected, Port1 of the NMEA In/Out Communication Setup menu must be changed to RADAR as shown below for communications.

1. From the Chart page, press **[MENU]**. Move the ShuttlePoint knob to highlight **SETUP MENU** and press **[ENT]**.
2. Move the ShuttlePoint knob to highlight **ADVANCED SETUP** and press **[ENT]**.
3. Move the ShuttlePoint knob to highlight **IN/OUT CONNECTIONS** and press **[ENT]**.
4. Move the ShuttlePoint knob to highlight **PORT 1 INPUT** and press **[ENT]**.
5. Move the ShuttlePoint knob up/down to select **RADAR** and press **[ENT]**.
6. Press **[CLR]** or move the ShuttlePoint knob to the left until the Chart page is shown.

2.7.3 CP500/CP590 Connections

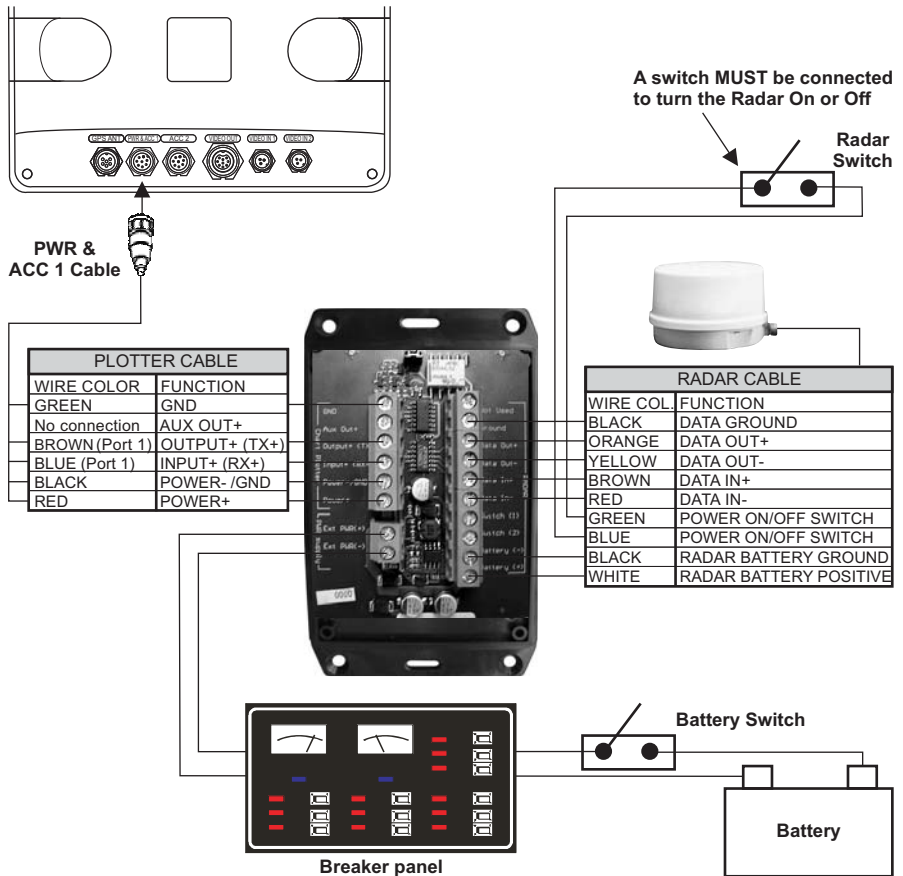


Figure 2.7.3 - CP500/CP590 Connections

Port Setup

When an optional Radar Antenna is connected, Port1 of the NMEA In/Out Communication Setup menu must be changed to RADAR as shown below for communications.

1. From the Chart page, press **[MENU]**. Move the ShuttlePoint knob to highlight **SETUP MENU** and press **[ENT]**.
2. Move the ShuttlePoint knob to highlight **ADVANCED SETUP** and press **[ENT]**.
3. Move the ShuttlePoint knob to highlight **IN/OUT CONNECTIONS** and press **[ENT]**.
4. Move the ShuttlePoint knob to highlight **PORT 1 INPUT** and press **[ENT]**.
5. Move the ShuttlePoint knob up/down to select **RADAR** and press **[ENT]**.
6. Press **[CLR]** or move the ShuttlePoint knob to the left until the Chart page is shown.

2.7.4 CPV550 Connections

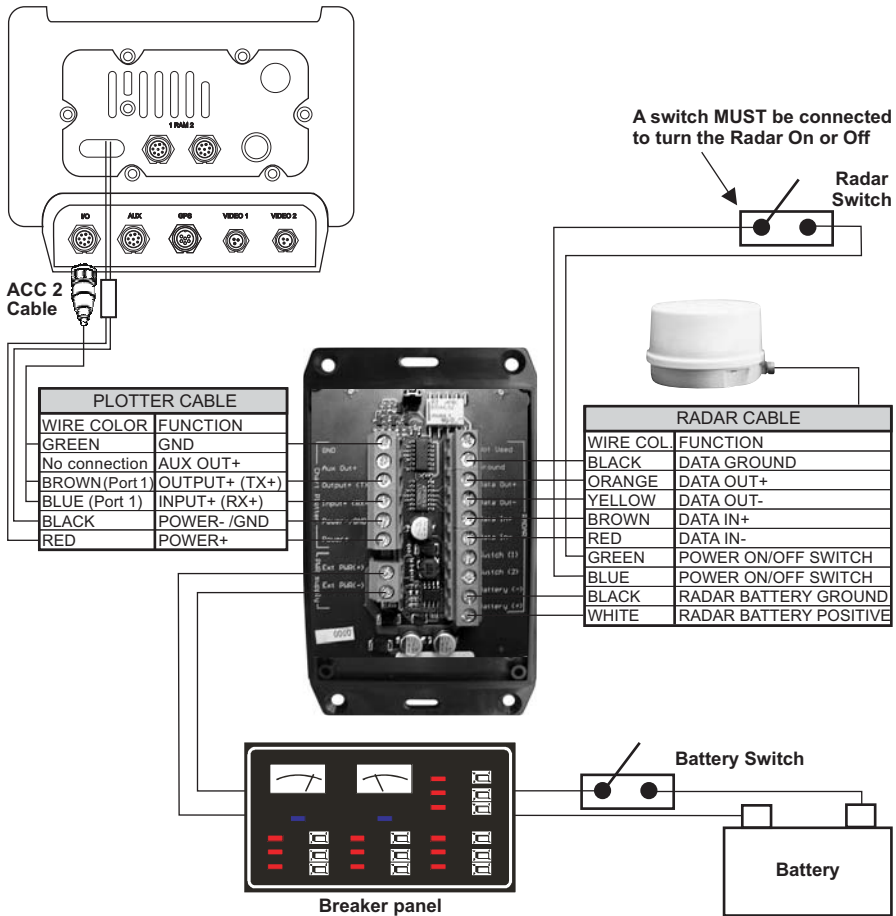


Figure 2.7.4 - CPV550 Connections

Port Setup

When an optional Radar Antenna is connected, Port1 of the NMEA In/Out Communication Setup menu must be changed to RADAR as shown below for communications.

1. From the Chart page, press **[MENU]**. Move the ShuttlePoint knob to highlight **SETUP MENU** and press **[ENT]**.
2. Move the ShuttlePoint knob to highlight **ADVANCED SETUP** and press **[ENT]**.
3. Move the ShuttlePoint knob to highlight **IN/OUT CONNECTIONS** and press **[ENT]**.
4. Move the ShuttlePoint knob to highlight **PORT 1 INPUT** and press **[ENT]**.
5. Move the ShuttlePoint knob up/down to select **RADAR** and press **[ENT]**.
6. Press **[CLR]** or move the ShuttlePoint knob to the left until the Chart page is shown.

2.8 CHART PLOTTERS SOFTWARE UPDATE

The Software CARD is used to update the software in the Chart Plotter to be compatible with the Radar.

NOTE

Updating the software in the Chart Plotters with this Software CARD will erase all Marks and Routes that you have stored. Please read carefully the following paragraphs.

2.8.0 Backing up Marks and Routes

If you have created Marks and Routes you will need to either make note and manually re-enter them or purchase an optional User C-CARD.

Refer to the Chart Plotters's Owner's Manual for backing up the points.

2.8.1 Installing Software




Once you have backed up your User Points:

1. Turn off the Chart Plotter and insert the Software CARD into any C-CARD slot on the Chart Plotter.
2. Press and hold **[PWR]** until the Chart Plotter beeps, then release the key.
3. Wait until the Start Up screen is shown, then remove the C-CARD.
4. The software is now updated and the Chart Plotter is compatible with the Radar.



Figure 2.8.1 - Example of Start Up screen

3. TECHNICAL SPECIFICATIONS

Features	MDS-1	MDS-8	MDS-9	MDS-10-4/MDS-10-5
				
Antenna	12.4 Inch-Dome	20 Inch-Dome	23.5 Inch-Dome	47.25/59.1 Inch-Open Array
Peak Power Output	2KW	2KW	4KW	4KW
Beam Width (degree) Horizontal	7°	4.7°	4.0°	2.4°/1.7°
Beam Width (degree) Vertical	25°	25°	25°	25°
Rotation (RPM)	30	30	24	24

3.0 MDS-1

3.0.0 Antenna Unit

- Power supply : 10.8 to 31.2 VDC
- Power consumption : 30W or less
- Preheat times : 90 sec
- Aerial : Radome 0.9Ft
- Peak power output : 2kW
- Transmitting frequency : 9445+/-30MHz
- Beam width (degree) Horizontal : 7°
- Vertical : 25°
- Side Lobes Within +/-10° : <=-20dB
- Rotation : 30rpm
- Pulse Length (µsec)/PRF (Hz) S : 0.1/2200
- M, M1 : 0.3/1100
- L, M2 : 0.8/550
- IF center frequency : 60MHz (Linear amplifier)
- IF bandwidth S : 6MHz
- M, M1 : 6MHz
- L, M2 : 3MHz
- Noise figure : 10dB nominal
- Operating Temperature : -25°C ~ +55°C
- Operation in wind (relative) : 100 knots
- Water Resistance : IPX6 (IEC60529)
- Preheat times output (by 5 sec step) : 85 sec to 5 sec

3.0.1 Dimensions and Mounting

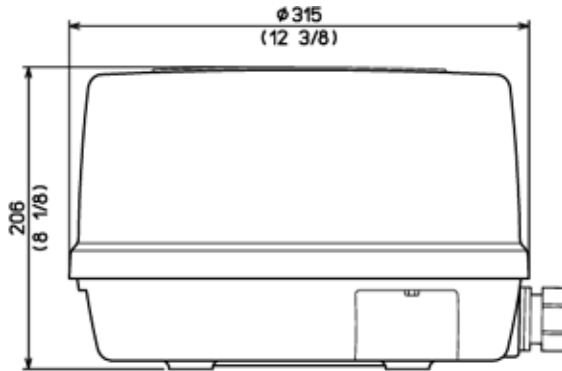
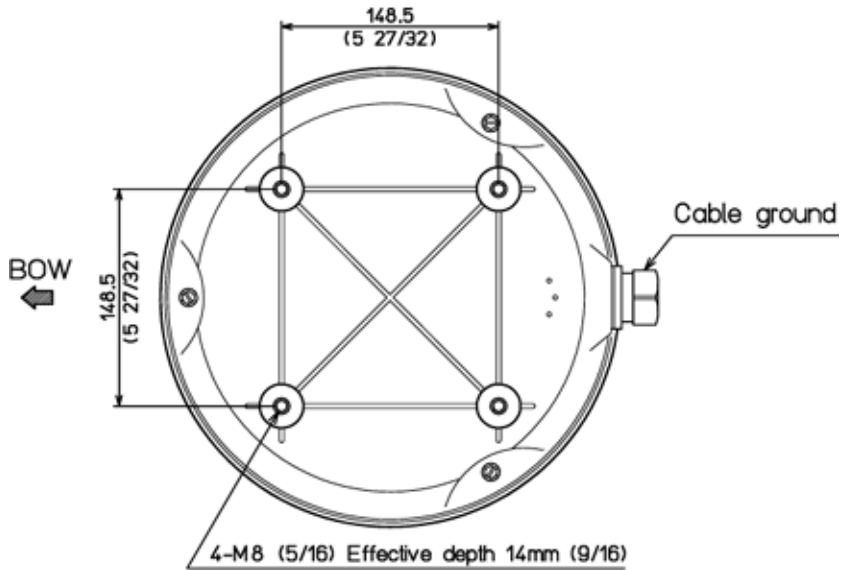


Figure 3.0.1 - Radar MDS-1 (I)



Weight: 4.5 kg (10 lb) without cable
Weight: 5.5 kg (12.5 lb) 10m cable included

Figure 3.0.1a - Radar MDS-1 (II)

3.1.0 Antenna Unit

- Power supply : 10.8 to 41.6 VDC
- Power consumption : 30W or less
- Preheat times : 90 sec
- Aerial : Radome 1.5Ft
- Peak power output : 2kW
- Transmitting frequency : 9445+/-30MHz
- Beam width (degree) Horizontal : 4.7°
- Vertical : 25°
- Side Lobes Within +/-10° : <=-20dB
- Rotation : 30rpm
- Pulse Length (μsec)/PRF (Hz) S : 0.1/2200
- M, M1 : 0.3/1100
- L, M2 : 0.8/550
- IF center frequency : 60MHz (Linear amplifier)
- IF bandwidth S : 6MHz
- M, M1 : 6MHz
- L, M2 : 3MHz
- Noise figure : 10dB nominal
- Operating Temperature : -25°C ~ +55°C
- Operation in wind (relative) : 100 knots
- Water Resistance : IPX6 (IEC60529)
- Preheat times output (by 5 sec step) : 85 sec to 5 sec

3.1.1 Dimensions and Mounting

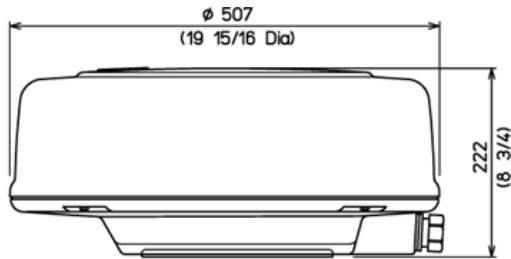
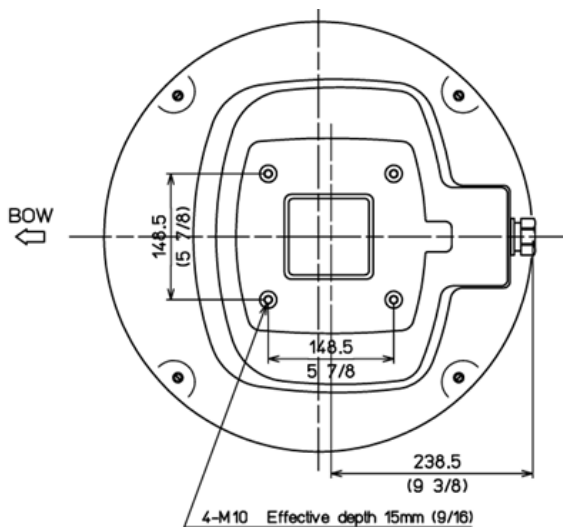


Figure 3.1.1 - Radar MDS-8 (I)



Weight: 8.1 kg (18.0 lb) 10m cable included
 Weight: 6.8 kg (15.0 lb) without cable

Figure 3.1.1a - Radar MDS-8 (II)

3.2 MDS-9

3.2.0 Antenna Unit

- Power supply : 10.8 to 41.6 VDC
- Power consumption : 45W or less
- Preheat times : 120 sec
- Aerial : Radome 1.8Ft
- Peak power output : 4kW
- Transmitting frequency : 9410+/-30MHz
- Beam width (degree) Horizontal : 4.0°
- Vertical : 25°
- Side Lobes Within +/-10° : <=-20dB
- Rotation : 24rpm
- Pulse Length (μsec)/PRF (Hz) S : 0.1/2000
- M, M1 : 0.25/2000
- L, M2 : 0.5/1000
- L, L1 : 1.0/500
- IF center frequency : 60MHz (Linear amplifier)
- IF bandwidth S : 6MHz
- M, M1 : 6MHz
- L, M2 : 3MHz
- L, L1 : 3MHz

- Noise figure : 6.0dB or less
- Operating Temperature : -25°C ~ +55°C
- Operation in wind (relative) : 100 knots
- Water Resistance : IPX6 (IEC60529)
- Preheat times output (by 5 sec step) : 115 sec to 5 sec

3.2.1 Dimensions and Mounting

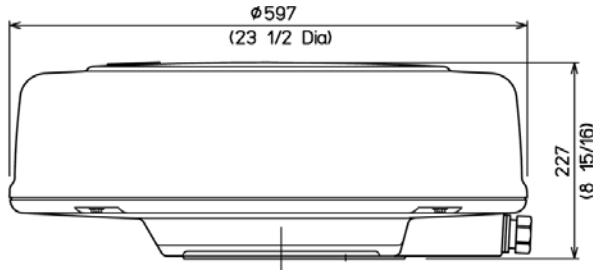
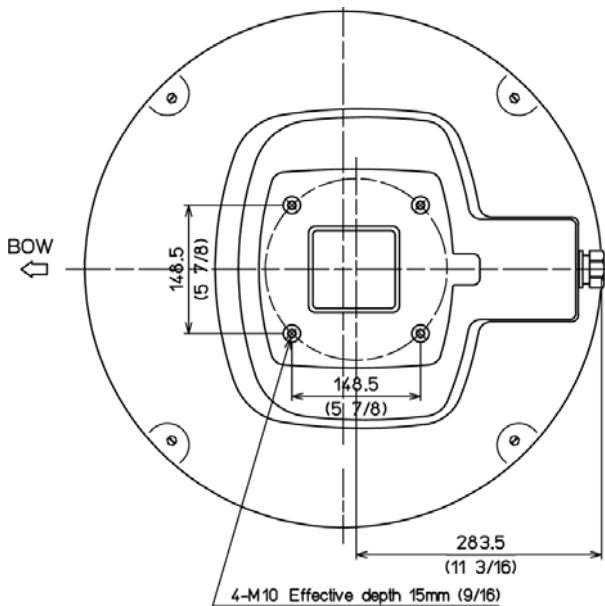


Figure 3.2.1 - Radar MDS-9 (I)



Weight: 9.7 kg (21.5lb) 10m cable included
 Weight: 8.4 kg (19.0lb) without cable

Figure 3.2.1a - Radar MDS-9 (II)

3.3.0 Antenna Unit

- Power supply : 10.8 to 41.6 VDC
- Power consumption : 80W or less
- Preheat times : 120 sec
- Aerial MDS-10-4 or MDS-10-5 : Open 4 or 5 Ft
- Peak power output : 4kW
- Transmitting frequency : 9410+/-30MHz
- Beam width (degree)
 - Horizontal : 2.4° or 1.7°
 - Vertical : 25°
- Side Lobes
 - Within +/-10° : <=-23dB
 - Outside +/-10° : <=-32dB
- Rotation : 24rpm
- Pulse Length (μsec)/PRF (Hz)
 - S : 0.06/4000
 - M, M1 : 0.15/2000
 - L, M2 : 0.4/1000
 - L, L1 : 1.0/500
- IF center frequency : 60MHz (Linear amplifier)
- IF bandwidth
 - S : 20MHz
 - M, M1 : 20MHz
 - L, M2 : 5MHz
 - L, L1 : 5MHz
- Noise figure : 5.0dB or less
- Operating Temperature : -25°C ~ +55°C
- Operation in wind (relative) : 70 knots
- Water Resistance : IPX6 (IEC60529)
- Preheat times output (by 5 sec step) : 115 sec to 5 sec

3.3.1 Dimensions and Mounting

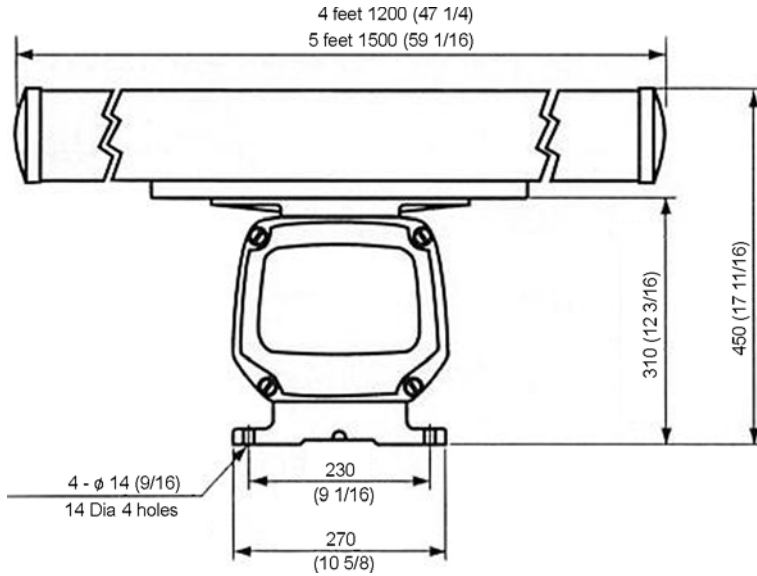


Figure 3.3.1 - Radar MDS-10-4/MDS-10-5 (II)

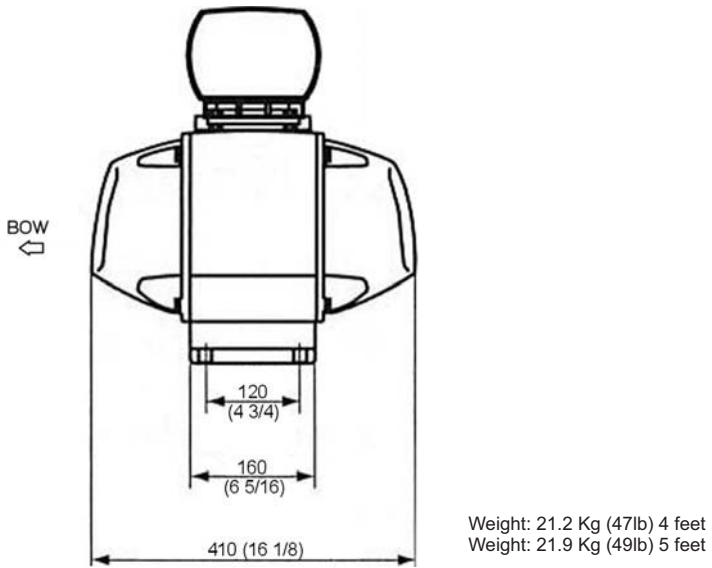


Figure 3.3.1a - Radar MDS-10-4/MDS-10-5 (III)

Appendix A. WHAT IS RADAR?

A.0 GENERAL

The word “radar” is an acronym for “RADio Detecting And Ranging.” In very simple terms, this is how it works. A radio transmitter sends a quick microwave pulse, and then a receiver listens for that signal’s echo when it is bounced back from something in its path. The returning signal is processed by a computer to determine its relative distance, position and bearing. This information is graphically displayed on a screen for you to see. Other boats or ships, navigational markers, landmasses and such are referred to as targets.

By knowing how long it takes for a signal to return, the distance to a target can be determined. As the Radar Antenna scans through a 360-degree rotation, it can show where the target is relative to your position. By repeated scans, you can see which direction another vessel is moving.

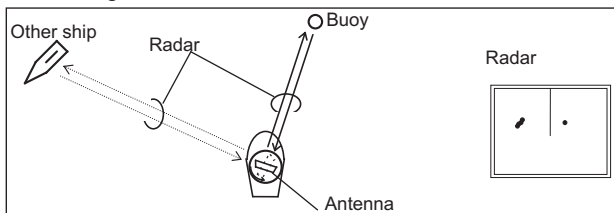


Figure A - Radar

A.0.0 Antenna

How Radar will perform is largely determined by its Antenna or scanner. Increasing the size of the Antenna improves long-range performance and target discrimination, or the ability to distinguish two separate targets at a distance. The critical factors are the Antenna’s beam width and side lobe level. Typically, a Radar Antenna will radiate a tightly focused beam from the front of the array. The longer the Antenna array is, the narrower the beam width will be. Additionally, it will also emit smaller amounts of energy to each side. The lower the Side Lobe level, the less the effect of a false echo.

A.0.1 Side Lobe

The beam in which the strongest radio signal is radiated from the Antenna is called the “main lobe”. Those beams that are radiated in other directions are referred to as the “Side Lobes”. The Side Lobe level refers to the difference in level (signal strength) between the largest Side Lobe and the main lobe.

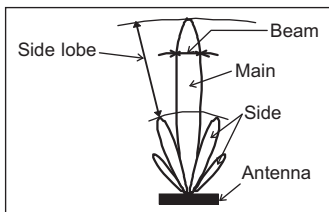


Figure A.0.1 - Antenna pattern

A.1 CHARACTERISTICS OF RADAR WAVE

Radio waves travel out from the Antenna while bending slightly along the earth's surface. The amount they bend depends on atmospheric conditions. The sight distance of a Radar generally is about 6% longer than the optical sight distance and is calculated using this equation: Radar sight distance (NM) = $2.22 (\sqrt{\text{antenna height (m)}} + \sqrt{\text{target height (m)}})$

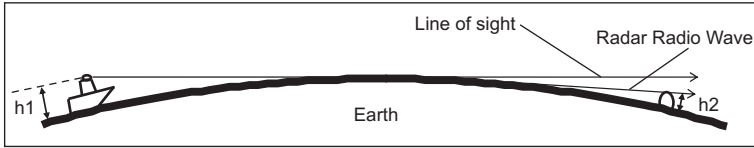


Figure A.1 - Radar wave

A.1.0 Targets difficult to display on screen

The intensity of the reflected radio signal from a target depends on the distance, height, and size of the target, as well as its material and shape, along with the Radar's transmitter power output and Antenna size. Targets made of fiberglass, wood, or other low-reflectance materials or those that have a small incident angle are difficult to display on a screen. Sandy beaches, and sandy or muddy shallows can be difficult to catch. Because there's not much to reflect a signal back to you, a coastline can actually be closer to your boat than it appears on the screen.

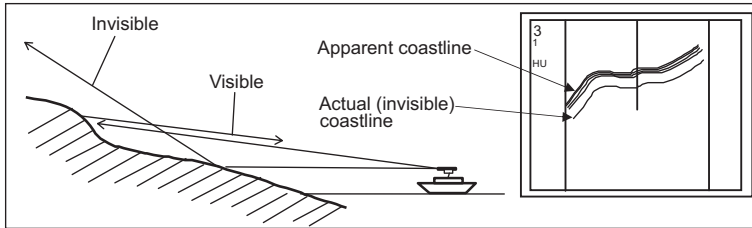


Figure A.1.0 - Targets difficult to display on screen

A.1.1 Shadow zones of radar

Radar waves propagate in a straight line. A high outcropping of land or a large ship will create a shadow zone behind it and prevent you from seeing targets on the other side. More importantly, if a mast or some part of the boat's superstructure is in the path of the Antenna's sweep, this will also create a shadow zone. No targets will be recognized behind it and it could create a dangerous situation.

A.1.2 False echoes

Sometimes Radar will display targets on screen that do not exist in the real world. You should be aware of how and why this happens.

Ghost echoes

Sometimes one large object very near your boat will appear as two different targets on screen. One is the actual Radar echo. The other is a ghost echo generated by a re-reflection of the original signal. It comes back to your own boat, bounces back to the target, and then is picked up by the Antenna on the second bounce. The actual echo appears at the correct distance and bearing on the screen. The ghost echo appears somewhere behind your boat. This type of false echo is also generated by re-reflection of waves from bridges, break walls or building along shore.

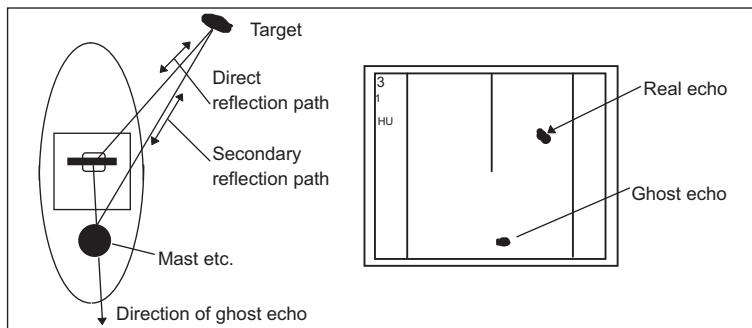


Figure A.1.2 - Ghost echoes

Multiple echoes

If there is a large vertical reflecting surface near your boat, as in the case when you pass alongside a large ship, Radar signals are repeatedly bounced back and forth between your boat and the other object. Two to four images appear on the screen at equal intervals in the same bearing. This is called a multiple echo. The image appearing closest to you is the real echo. Multiple echoes will disappear as you move away from the reflecting object or its bearing changes.

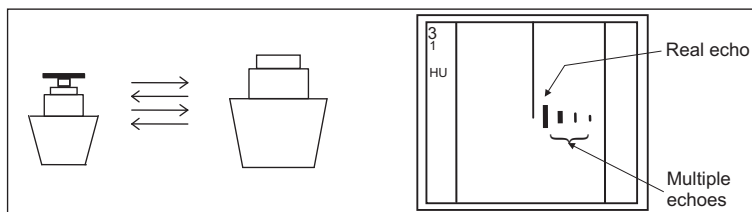


Figure A.1.2a - Multiple echoes

False echoes caused by Side Lobe

An Antenna's Side Lobe emissions are low power, and will not register distant targets. However, if there is a strong reflecting target near your boat, it sometimes may appear as a circular-arc false echo on the screen.

WARNING

When near large targets or land, your boat's mast may sometimes appear as circular-arc shaped false echo.

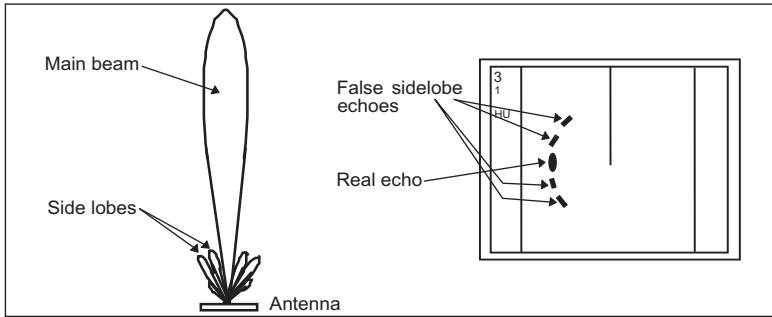


Figure A.1.2b - False echoes caused by Side Lobe

Distant false echoes caused by duct phenomenon

The duct phenomenon sometimes occurs when meteorological conditions create a temperature inversion between layers of air. When this happens, Radar waves propagate erratically and can reach a location considerably farther away from your boat than the Radar's maximum distance range. What appears on screen is a false echo that looks to be nearer than the actual target. Since the true echo from the distant target is outside the measurement capabilities of the Radar, its apparent distance will change when you change ranges, and you can conclude that it's a false echo.

Radar interference

If another boat's Radar is operating on the same frequency as yours, it can create interference on your display. The interference usually appears as spiral or radial patterns. This Radar has an interference rejection control to eliminate interference. Turn it on to reduce or eliminate the interference.

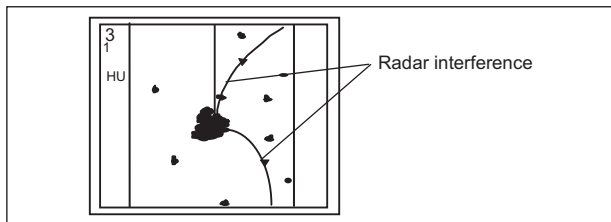


Figure A.1.2c - Radar interference

Appendix B. INSTALLATION

B.0 MORE INSTALLATION CONSIDERATIONS

B.0.0 Shifting from keel line

By shifting the scanner position from the keel line to the starboard side of the boat, it is possible to move shadow zones to the port side. This makes it possible to keep a clear view to the bow. The distance to be shifted can be calculated using the following equation:

$$L_s = 0.4R + D/2 \text{ [m]} \text{ (when } R < 15\text{m)}$$

$$L_s = 0.025R + D/2 \text{ [m]} \text{ (when } R \geq 15\text{m)}$$

where L_s = distance to be shifted from keel line

D = diameter of obstacle on keel line

R = distance from scanner to obstacle

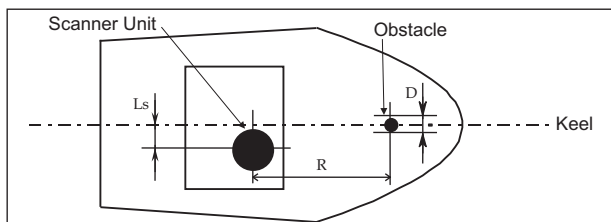


Figure B.0.0 - Shifting from keel line

B.0.1 Obtaining sufficient dip angle

Raise the scanner position so that there is a sufficient dip angle available between the line of sight from the scanner to the obstacle and the horizontal line. By raising the dip angle above 5° , it is possible to prevent mid- and long-distance shadow zones. The Radar cannot detect objects below the line of sight.

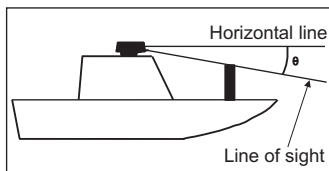


Figure B.0.1 - Obtaining sufficient dip angle

B.1 INSTALLING SCANNER UNIT

Use a mounting base such as the ones shown in Figure B.1, or you can install the scanner

directly to a roof or other flat surface. Be certain you keep the water drain tube clear. It's located at the bottom of the scanner unit.

NOTE

If the mounting bracket or surface has a curvature of more than 2mm, use spacers with the mounting bolts to prevent stress on the scanner housing.

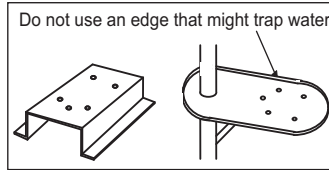


Figure B.1 - Installing scanner unit

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