



## Digital Radome Scanner

### Owner's Manual

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# Raymarine®



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# Important information

## Introduction

This handbook contains an explanation of how to install, connect and maintain your Digital Radome scanner and covers the following models:

- RD418D - 18" 4 kW Digital Radome scanner.
- RD424D - 24" 4 kW Digital Radome scanner.

Your radar has been designed and manufactured to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless installed, operated and maintained properly. Please carefully read and follow the recommended procedures for installation contained in this handbook.

When properly installed and operated, the use of this radar conforms to:

- IEEE C95.1 - 2005 - Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300GHz.
- ICNIRP Guidelines 1998 - International Commission on Non-Ionising Radiation Protection: Guidelines for limiting exposure to time-varying electric, magnetic and electro-magnetic fields (up to 300GHz) 1998.

## Intended use

This product is a radar scanner intended for use within a navigational radar system. The intended application is for leisure marine boats and work boats not covered by IMO/SOLAS carriage requirements.

Installation and operation of this radar may be subject to individual licensing of the equipment, operator or vessel. You are strongly advised to check with the requirements of the licensing authority of your national administration. In case of difficulty, contact your local Raymarine dealer.

## Safety notices



### WARNING

#### Radio Frequency Radiation Hazard

**The radar antenna emits electromagnetic energy at microwave radio frequencies which can be harmful, particularly to your eyes. DO NOT look at the antenna at close range. It is important that the radar is turned off whenever personnel are required to come close to the scanner assembly. It is recommended that the radar scanner is mounted out of range of personnel (above head height). The maximum power density level which is considered safe for general public exposure is 10 W/m<sup>2</sup>, and for occupational exposure it is 100 W/m<sup>2</sup>. The distances from the radar scanner within which these levels may be exceeded are given below:**

Model	Distance to 100 W/m <sup>2</sup> point	Distance to 10 W/m <sup>2</sup> point
RD418D	Max power density at any distance is <100 W/m <sup>2</sup>	1.0m (worst case)
RD424D	Max power density at any distance is <100 W/m <sup>2</sup>	1.0m (worst case)



## WARNING

### High Voltage

**The scanner unit contains high voltages. Adjustments require specialized service procedures and tools only available to qualified service technicians - there are no user serviceable parts or adjustments. The operator should never remove the scanner unit internal covers or attempt to service the equipment.**



## WARNING

### Product installation

**This equipment must be installed in accordance with the instructions contained in this handbook. Failure to do so could result in poor product performance, personal injury and/or damage to your boat.**

## FCC Notice

**Changes or modifications to this equipment, not expressly approved in writing by Raymarine Inc., could violate compliance with FCC rules and void the operator's authority to operate the equipment.**

## Waste Electrical and Electronic Equipment Directive



The Waste Electrical and Electronic Equipment (WEEE) Directive requires the recycling of waste electrical and electronic equipment. Whilst the WEEE Directive does not apply to some of Raymarine's products, we support its policy and ask you to be aware of how to dispose of this product.

The crossed out wheeled bin symbol, illustrated above, and found on our products signifies that this product should not be disposed of in general waste or landfill.

Please contact your local dealer, national distributor or Raymarine Technical Services for information on product disposal.

## EMC conformance

All Raymarine equipment and accessories are designed to the best industry standards for use in the recreational marine environment. The design and manufacture of Raymarine equipment and accessories conform to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised.

## Declaration of conformity

Raymarine UK Limited hereby declare that the products to which this manual relates comply with the appropriate requirements and provisions of the R&TTE Directive 1999/5/EC.

## Multi-function display software version

The Digital Radome scanner can be connected directly to a C-Series or E-Series display, or to a C-Series, E-Series or G-Series display via a SeaTalk<sup>hs</sup> switch.

The Digital Radome scanner is compatible with the following multi-function displays:

- C90W, C120W, and C140W C-Series displays.
- E80, E120 E-Series displays.
- G120, G150, G170, and G190 G-Series displays.

For operation of your scanner, the multi-function display unit requires the latest software version.

To find out whether your display is using the latest software version, switch on the display and check the version number on the navigation warning screen. However, if a scanner is not connected to the multi-function display, the version number will only be displayed for 10 seconds.

## Handbook information

The technical and graphical information contained in this handbook, to the best of our knowledge, was correct as it went to press. However, our policy of continuous improvement and updating may change product specifications without prior notice. As a result, unavoidable differences between the product and handbook may occur from time to time.

# Installation

## EMC installation guidelines

All Raymarine equipment and accessories are designed to the best industry standards for use in the recreational marine environment.

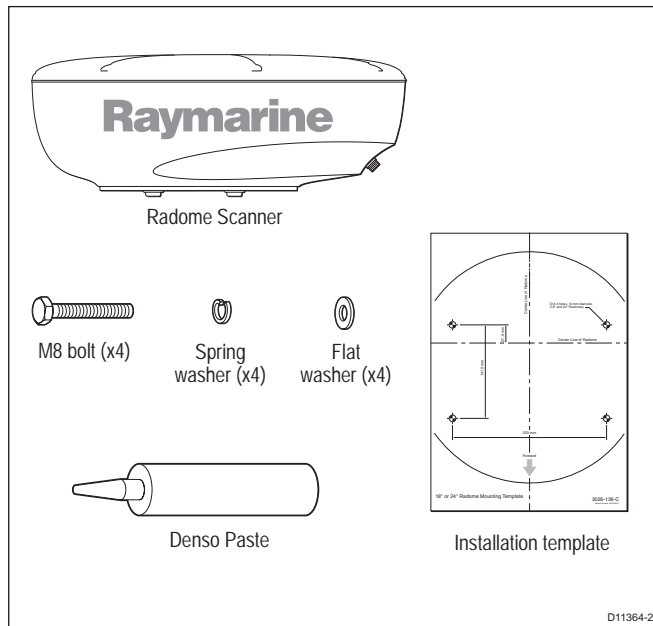
Their design and manufacture conforms to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised. Although every effort has been taken to ensure that they will perform under all conditions, it is important to understand what facts could affect the operation of the product.

The guidelines here describe the conditions for optimum EMC performance, but it is recognized that it may not be possible to meet all of these conditions in all situations. To ensure the best possible conditions for EMC performance within the constraints imposed by any location, always ensure the maximum separation possible between different items of electrical equipment.

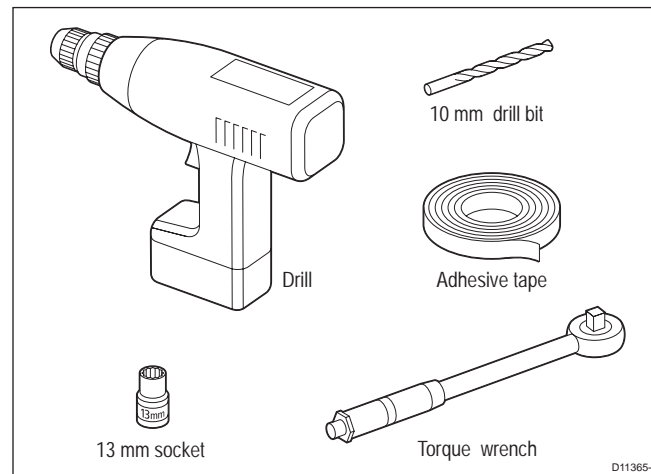
For optimum EMC performance, it is recommended wherever possible:

- Raymarine equipment and cables connected to it are:
  - At least 3 ft. (1m) from any other equipment transmitting or carrying radio signals. In the case of Single Side Band (SSB) radio, the distance should be increased to 7 ft. (2m).
  - More than 7 ft. (2m) from the path of a radar beam. A radar beam can normally be assumed to spread 20 degrees above and below the radiating element.
- The equipment is supplied from a separate battery to that used for engine start. Voltage drops below 10.8 V, and starter motor transients, can cause the equipment to reset. This will not damage the equipment, but may cause the loss of some information and may change the operating mode.
- Only Raymarine-specified cables must be used. Cutting and rejoining these cables can compromise EMC performance.

## Box contents



## Required tools

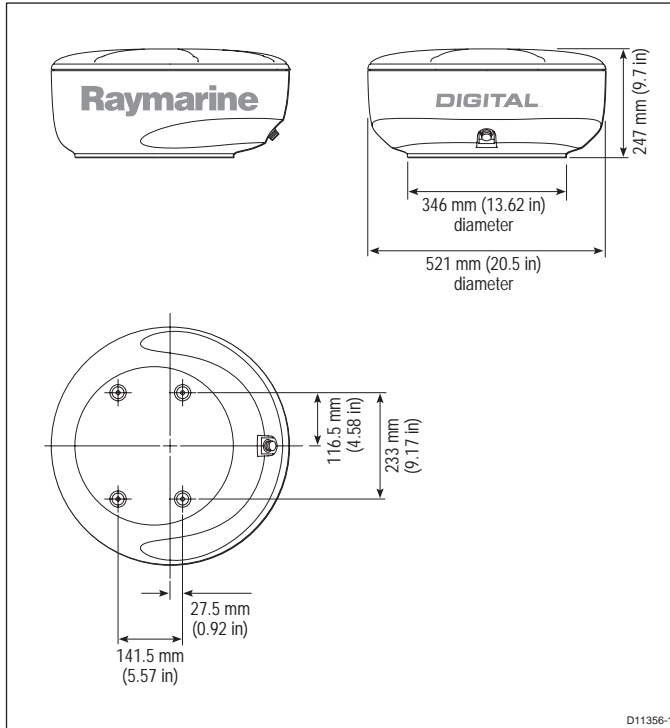


Components are dependant on your system package, but are either:

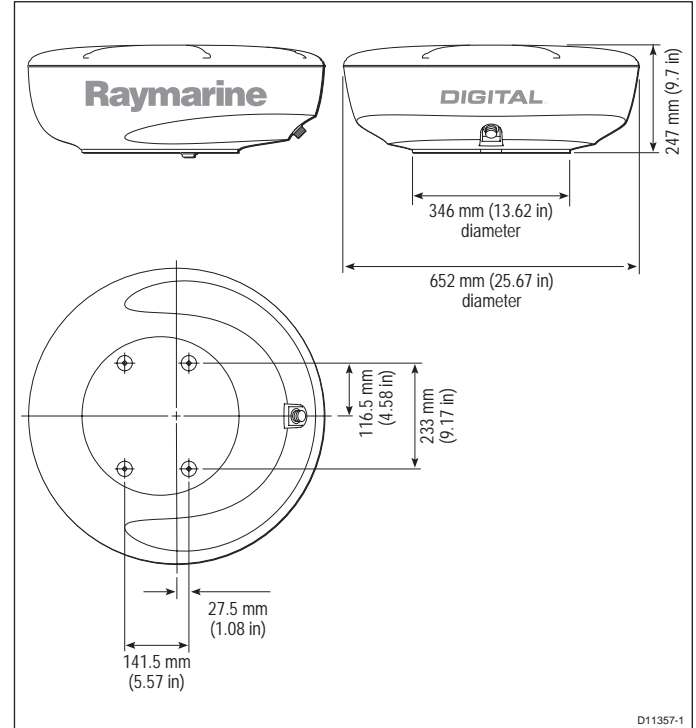
- 18" 4 kW Digital Radome scanner, or
- 24" 4 kW Digital Radome scanner.
- Fixing bolts and washers.
- Denso Paste.
- Handbook.

## Digital Radome scanner dimensions

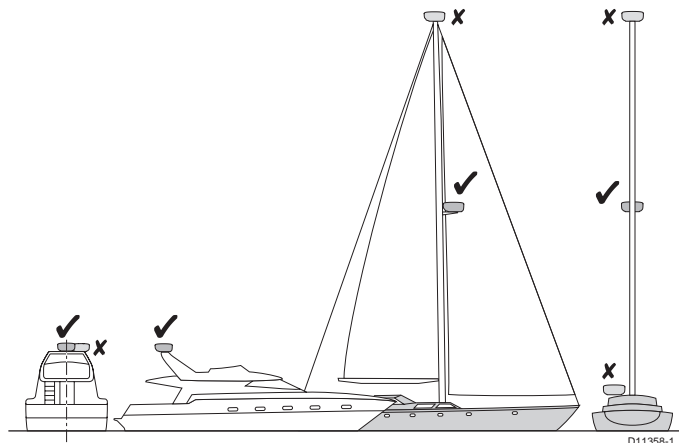
### 18" Digital Radome scanner



### 24" Digital Radome scanner



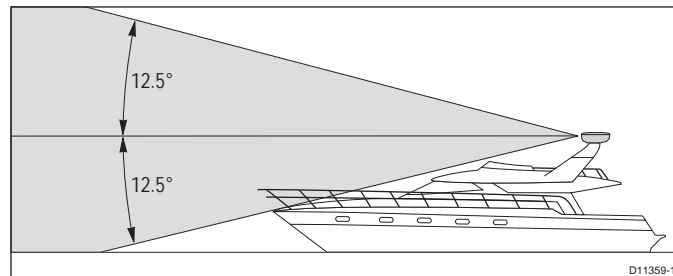
## Planning the installation



Mount the scanner as high as possible above the waterline for better long range performance, but make sure it:

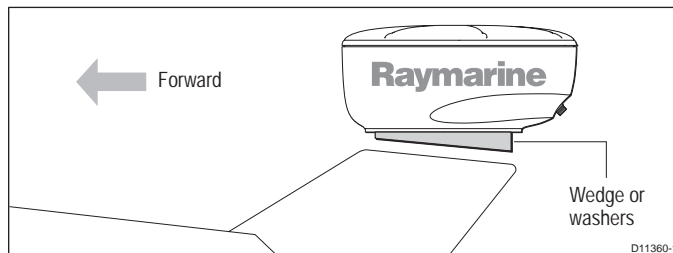
- is above head height.
- is easily accessible.
- is as near to the boat's centerline as possible.
- is on a rigid and stable platform.
- is clear of large objects such as the flybridge, large engine stacks, searchlights, horns or masts.
- is clear of heat and fumes.
- is at least 1 m away from a magnetic compass or other equipment antenna.

Don't put the scanner so high, that it is affected by the pitching and rolling of the boat.



Mount the scanner so that the array rotates parallel to the waterline.

The radar beam is approximately 25° wide in the vertical direction, giving good target detection when your boat pitches and rolls.



Planing hull and some displacement hull boats adopt a higher bow angle when the boat is at cruising speed, giving poor target detection. It may be necessary to lower the radar beam back towards the parallel, by shimming the rear of the radar, so that the beam points slightly down when the boat is at rest. Refer to the diagram on page 14 for more information.

## Cable requirements

You must consider the following points before installing the system cables:

- You need to connect the scanner to the multi-function display unit and power (and, if appropriate, via a SeaTalk<sup>hs</sup> switch).
- All cables should be adequately clamped and protected from physical damage and exposure to heat - avoid running cables through bilges or doorways, or close to moving or hot objects.
- Acute bends must be avoided. The digital cable for connecting the Digital Radome scanner to a multi-function display and power source has a minimum bend radius of 45mm (or diameter of 90mm).
- Where a cable passes through an exposed bulkhead or deckhead, a watertight gland or swan neck tube should be used.
- Avoid cutting and rejoining cables.

## Scanner cables

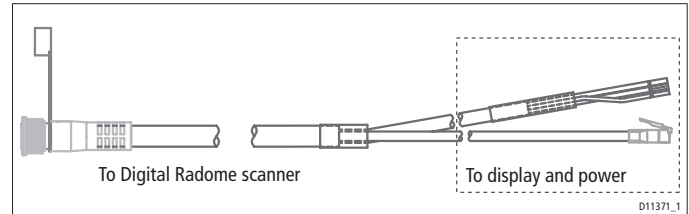
### Running the cable to the scanner

**DO NOT pull the cable through bulkheads using a cord attached to the connector. This could damage connections.**

The cable connector is at the rear of the scanner unit. If the unit is mounted on a hollow mast, the cable may be run inside the mast and connected to the unit. Make sure that the cable does not chafe where it enters and exits the mast. To minimize electrical interference try to avoid running radar cables near other onboard electrical equipment. It is also good practice to avoid running radar cables in parallel with other antenna or power cables.

## Digital cable

A digital cable, illustrated below, is required. This provides both power and SeaTalk<sup>hs</sup> signals to the Digital Radome scanner. It is fitted with a SeaTalk<sup>hs</sup> plug, and power cores for connecting to the scanner.



Digital cables are available in the following lengths:

- Part No. A55076 - 5 m cable.
- Part No. A55077 - 10 m cable.
- Part No. A55078 - 15 m cable.
- Part No. A55079 - 25 m cable.

The following extension cables are also available:

- Part No. A92141 - 2.5 m extension cable.
- Part No. A55080 - 5 m extension cable.
- Part No. A55081 - 10 m extension cable.

For boats with 12 V DC power systems, the maximum cable length is 25 m (including any extension). If you need to run a longer cable length with a 12v supply, please contact Raymarine technical support for further advice.

**Note:** *Do not make your own cables for use with the Digital Radome scanner. Only use official Raymarine cables.*

## Power cables

Digital Radome radar systems are intended for use on boat's DC power systems operating in the range 12 to 24 V DC. The Digital Radome scanners should not be used on nominal 32 V systems.

If you are replacing an existing (Analog) Radome scanner with a Digital Radome scanner, you must replace the existing cable with a digital cable, as described on page 9.

## Power requirements

**This radar is NOT recommended for use on 'positive' ground boats. The power cable earth screen must be connected to the boat's ground.**

The boat's power system should be either:

- Negative grounded, with the negative battery terminal connected to the boat's ground, or,
- Floating with neither battery terminal connected to the boat's ground.

The following diagram shows the cable's power and ground connections:



## Fuse requirements

The power connection to the Digital Radome scanner should be made at either the output of the battery isolator switch, or at a DC power distribution panel. The power connection must be protected by a thermal circuit breaker or fuse, fitted close to the power source. The following table details the fuse requirements for both 18" and 24" Digital Radomes:

**WARNING: If there is not a thermal circuit breaker or fuse in your power circuit (for example, fitted to your DC distribu-**

**tion panel), you must fit an inline breaker or fuse to the positive (red) connection of the power cable.**

Table 2-1: Fuse requirements

Power supply	Device	Rating
12 V	Isolator Switch	20 A
	Thermal Breaker	10 A
	Fuse	15 A
24 V	Isolator Switch	15 A
	Thermal Breaker	5 A
	Fuse	8 A

## Grounding the radar system

It is important that an effective radio frequency (RF) ground is connected to the radar system.

You must ground the radar by connecting the drain wire (screen) of the power cable to the nearest ground point of your boat's RF ground system. Full details can be found in the Owner's Handbook for your multi-function display unit.

If you need to extend the wire, the extension wire should be an 8 mm braid or 6 mm<sup>2</sup> (AWG 10) multi-strand cable.

If your vessel does not have an RF system, connect the drain wire to the negative battery terminal.

**Note:** Use only this ground connection.

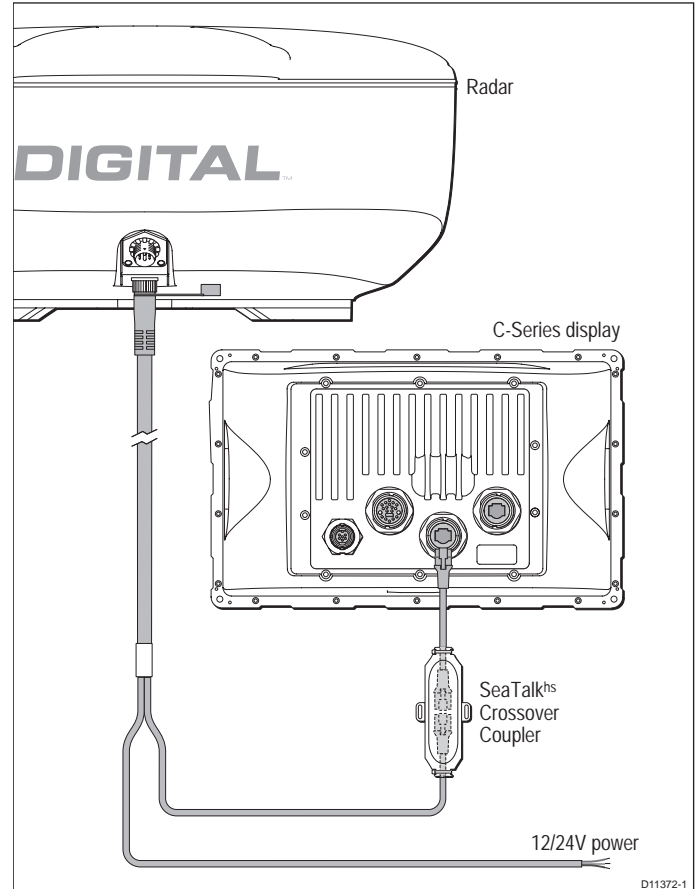
## Connecting the power and digital cables

The following must be observed:

- The threads of the Digital Radome digital cable external connector should be lightly greased with "Renolit Aqua 2 Calcium" grease if disconnected after the initial installation.
- Preferred connection of the power cable is directly to your boat's power distribution panel.
- Care should be taken to ensure a firm connection between the Digital Radome's external connector and the digital cable connector.
- The digital cable connection to the Digital Radome scanner must be hand-tightened only.

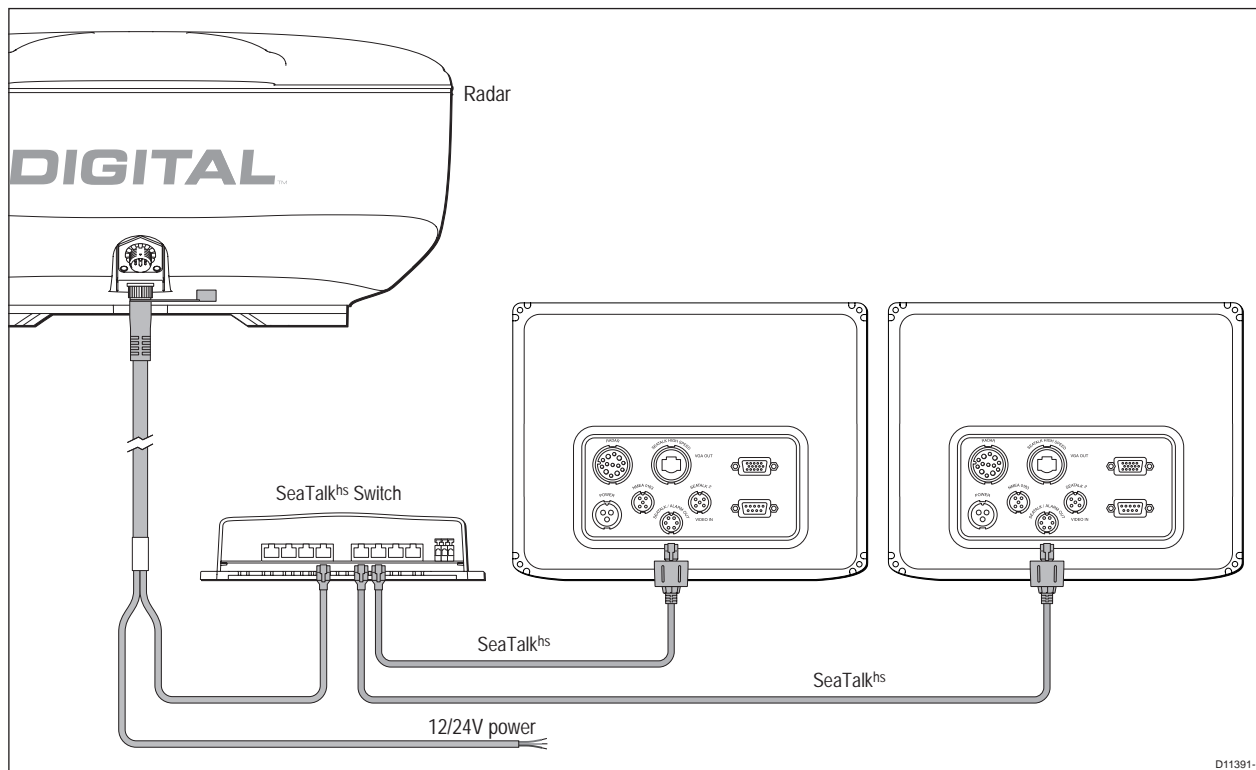
The following diagrams show the various configurations in which the Digital Radome scanner may be connected to your multi-function display:

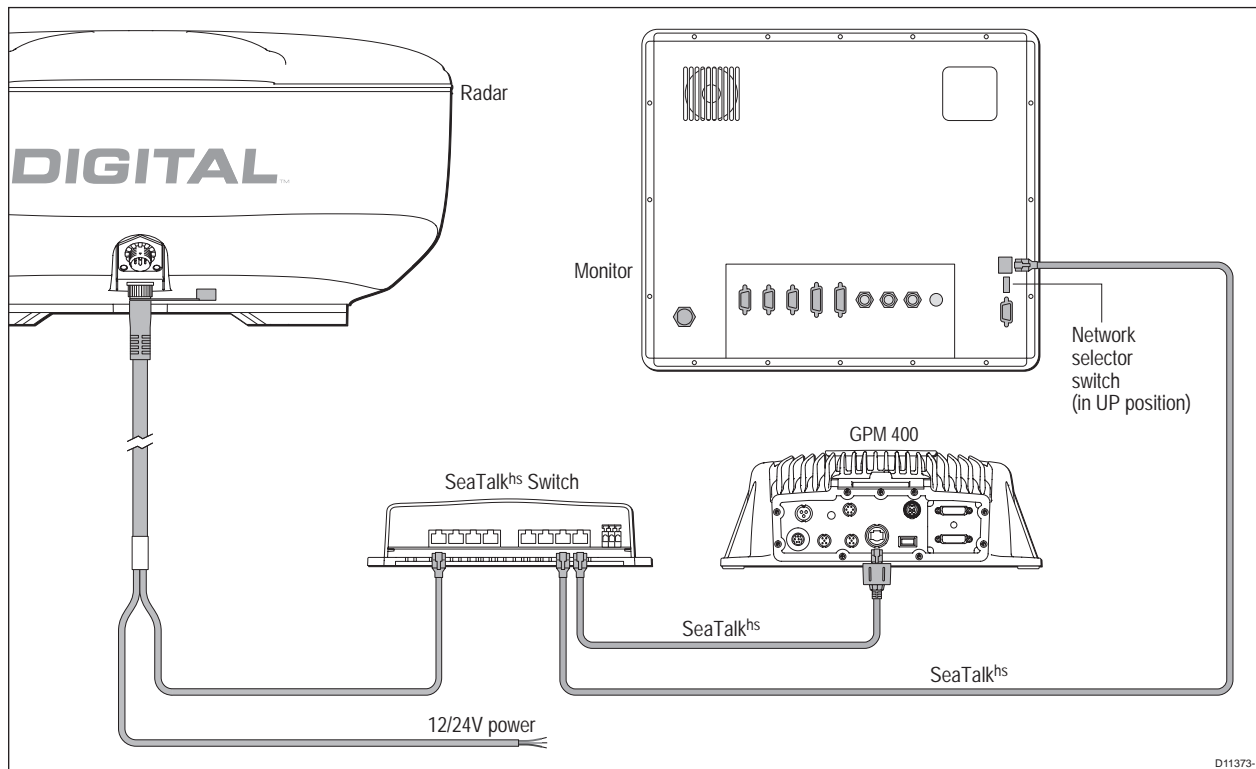
### Digital Radome connected directly to C-Series display



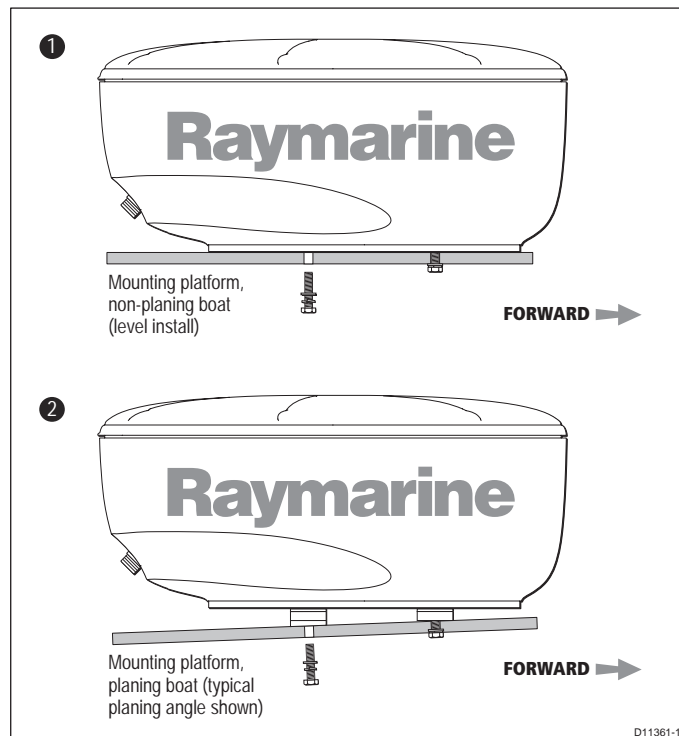
**Note:** you must use a SeaTalk<sup>hs</sup> Crossover Coupler for direct connections.

## Digital Radome connected to networked E-Series

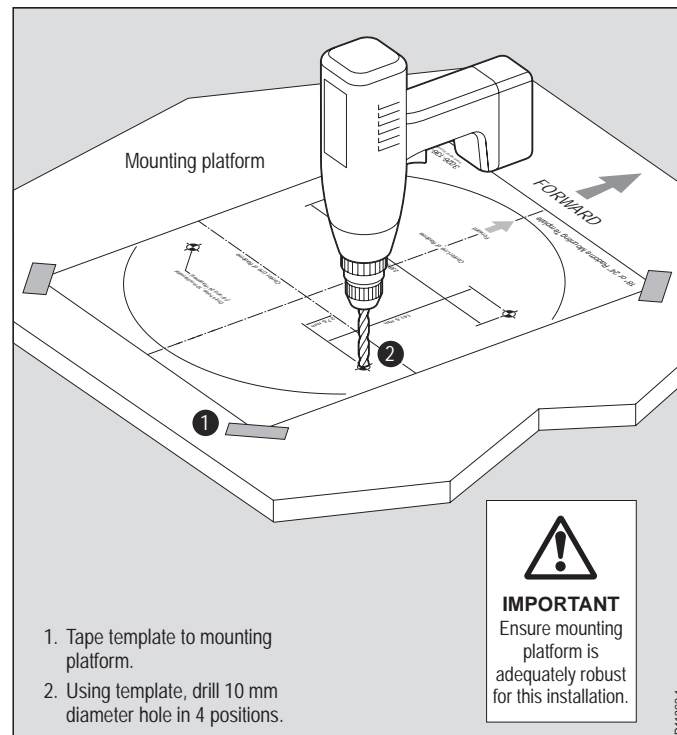


**Digital Radome connected to G-Series display**

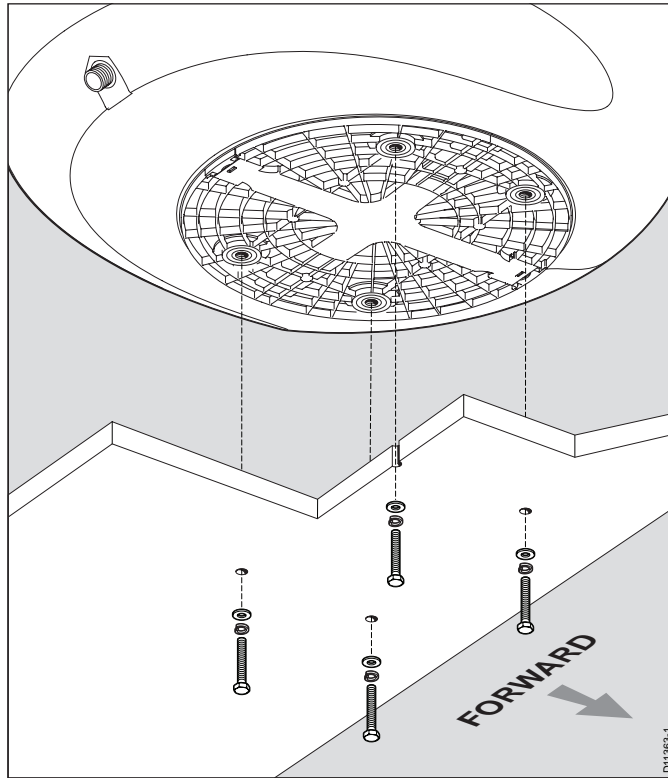
## Mounting the scanner



## Preparing the mounting holes

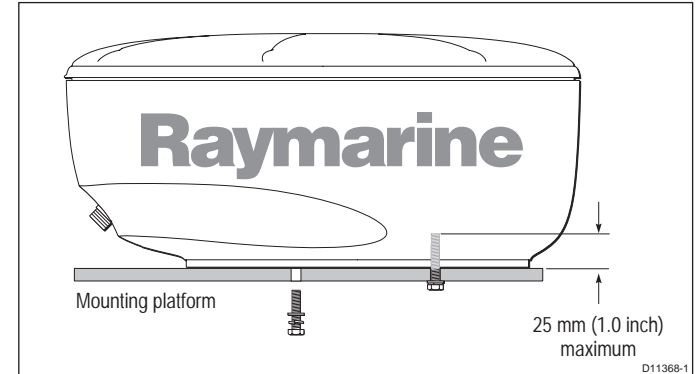


## Securing the scanner to the mounting platform



**Note:** The M8 bolts that secure the Digital Radome scanner to the mounting platform require a torque of 20Nm (177lbf.in). Use the supplied "Denso Paste" to lightly coat the mounting bolts.

To prevent damage to the base of the Digital Radome scanner, you must not insert more than 25mm (1 inch) of each bolt in to the base of the scanner, as shown in the following diagram:



## Setting up the scanner

### Before you go to sea

It is important to check the installation before you go to sea. This involves aligning the scanner and checking the system timing, using your multi-function display.

These checks are described in the following sections.

### EMC conformance check

Always check the installation before going to sea to make sure that it is not affected by radio transmissions, engine starting, etc.

## System checks

### System check

Before performing any functional tests, make sure:

- All securing bolts are fully tightened and mechanical locking washers as specified are in place.
- All connections have been made.
- All connecting wires are secured and protected as necessary.

If you have installed the radar yourself, ask your local Raymarine authorized installation dealer to check the installation.

## Set up, alignment and timing checks

### Switch on and initial set up

1. Press and hold the POWER key of your multi-function display unit until the unit beeps. The magnetron warm-up sequence should start, after which the unit should enter standby mode.
2. Power on the Digital Radome scanner, using the relevant softkey on your multi-function display.
3. If necessary, adjust the brightness on your multi-function display unit.
4. If necessary, change the default language settings.

### Transmission check

Ensure that all personnel are clear of the scanner and switch to transmit mode. Run through the radar operations as described in the relevant multi-function display unit's Owner's Handbook and check that all the expected data is displayed.

### Bearing alignment

With the system correctly installed, check the bearing alignment to ensure that targets appear at their correct bearing relative to the boat's bow. Adjust the alignment as necessary.

### Display timing adjustment

It is advisable to check the display timing before using the system for navigation. For instructions on how to do this, refer to the installation guide for your multi-function display.

# Maintenance and troubleshooting

## CAUTION: System power

**Always turn the radar system OFF before carrying out any routine maintenance on the scanner or nearby equipment.**

## Introduction

**DO NOT** remove the rear cover of the multi-function display or the external cover of the Digital Radome scanner. There are no user serviceable parts or adjustments. **DO NOT** attempt to service the equipment.

## Maintenance

Maintenance is limited to the following periodical checks:

- Examine the cables for signs of damage, such as chafing, nicks and cuts. If the connector is showing signs of corrosion, lightly grease the threads of the connector with "Renolit Aqua 2 Calcium" grease.
- Check that the cable connectors are firmly attached.
- Make sure the scanner is still securely attached to the mounting surface.
- Once a year, remove, grease and re-attach the mounting bolts securing the scanner.

## Troubleshooting

The following table will help you identify the most likely cause of a problem, and the corrective action required to restore normal operation.

Problem	Possible causes and solution
"No Data" or "No Scanner" message	<ol style="list-style-type: none"> <li>1. Check that the cable connecting the Digital Radome scanner to the multi-function display unit is firmly attached and undamaged.</li> <li>2. Check relevant scanner fuses and breakers.</li> <li>3. Check that the power source is of the correct voltage and sufficient current.</li> <li>4. Software mismatch between equipment may prevent communication. Contact Raymarine technical support.</li> </ol> <p><b>If using a SeaTalk<sup>hs</sup> Switch:</b></p> <ol style="list-style-type: none"> <li>5. Check that all radar scanners are correctly connected to the SeaTalk<sup>hs</sup> switch.</li> <li>6. Check the status of the SeaTalk<sup>hs</sup> switch.</li> <li>7. Check that SeaTalk<sup>hs</sup> cables are free from damage.</li> </ol>
The bearing displayed on the multi-function display is not the same as the actual bearing.	Perform the bearing alignment procedure described in the installation guide for the relevant multi-function display unit.

# Appendix A: Technical specification

## RD418D 18” Digital Radome scanner unit

General	
Approvals	
CE - conforms to	1999/5/EC
FCC - conforms to	47CFR Part 2 and Part 80
Industry Canada - conforms to	RSS138
Dimensions	Φ521 x 247 mm (20.5 x 9.7 in)
Weight	9.5 kg (21 lbs)
Input Voltage	12 - 24 V DC (from multi-function display unit)
Power Consumption	40 W (20 W Standby)
Environmental	Waterproof to IPX 6 Temperature range: -10° to +55°C Humidity limit: up to 95% at 35°C Maximum wind speed for satisfactory operation: 100 Kts
Maximum Range Scale	48 Nautical miles (Nm)

Transmitter			
Transmitter Frequency		9405 ± 25 MHz	
Peak Power Output		4.0 kW (nominal)	
Transmitter		Solid-state modulator driving Magnetron	
Range (Nm)	Expanded Range (Nm)	Pulse Width (ns)	PRF (kHz)
0.125, 0.25	N/A	75 ± 10ns	3.0
0.50, 0.75	0.125, 0.25	100 ± 10ns	3.0
N/A	0.5, 0.75	150 ± 10ns	3.0
1.5	N/A	250 ± 5%	3.0
3	1.5	350 ± 5%	2.0
N/A	3.0	450 ± 5%	1.5
N/A	N/A	600 ± 5%	1.3
6.0	6.0	1.0 μs ± 5%	740 Hz
Standby Mode		magnetron heater and control left on, all other services off	
Duplexer		Circulator	

<b>Antenna</b>	
Antenna Type	Patch array
Beam Width (nominal)	4.9° horizontal, 25° vertical
Polarization	Horizontal
Rotation Rate	24 rpm (nominal)

<b>Receiver</b>	
IF Frequency	60 MHz (nominal)
Receiver Characteristic	Logarithmic
Receiver Noise Figure	Less than 5 dB (including Low Noise Converter/Limiter & IF Receiver)
Receiver Bandwidth	12/3/0.7/0.5 MHz

# RD424D 24" Digital Radome scanner unit

General	
Approvals	
CE - conforms to	1999/5/EC
FCC - conforms to	47CFR Part 2 and Part 80
Industry Canada - conforms to	RSS138
Dimensions	Φ652 x 247 mm (25.67 x 9.7 in)
Weight	10.0 kg (22 lbs)
Input Voltage	12 - 24 V DC (from multi-function display unit)
Power Consumption	40 W (20 W Standby)
Environmental	Waterproof to IPX 6 Temperature range: -10° to +55°C Humidity limit: up to 95% at 35°C Maximum wind speed for satisfactory operation: 100 Kts
Maximum Range Scale	48 Nautical miles (Nm)

Transmitter			
Transmitter Frequency		9405 ± 25 MHz	
Peak Power Output		4.0 kW (nominal)	
Transmitter		Solid-state modulator driving Magnetron	
Range (Nm)	Expanded Range (Nm)	Pulse Width (ns)	PRF (kHz)
0.125, 0.25	N/A	75 ± 10ns	3.0
0.50, 0.75	0.125, 0.25	100 ± 10ns	3.0
N/A	0.5, 0.75	150 ± 10ns	3.0
1.5	N/A	250 ± 5%	3.0
3	1.5	350 ± 5%	2.0
N/A	3.0	450 ± 5%	1.5
N/A	N/A	600 ± 5%	1.3
6.0	6.0	1.0 μs ± 5%	740 Hz
Standby Mode		magnetron heater and control left on, all other services off	
Duplexer		Circulator	

**Antenna**

Antenna Type	Patch array
Beam Width (nominal)	3.9° horizontal, 25° vertical
Polarization	Horizontal
Rotation Rate	24 rpm (nominal)

**Receiver**

IF Frequency	60 MHz (nominal)
Receiver Characteristic	Logarithmic
Receiver Noise Figure	Less than 5 dB (including Low Noise Converter/Limiter & IF Receiver)
Receiver Bandwidth	12/3/0.7/0.5 MHz