Raymarine HD Digital Radome Antenna

User's Guide

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Chapter 1: Important Information

Warning: Product installation and operation

This product must be installed and operated in accordance with the Raymarine instructions provided. Failure to do so could result in personal injury, damage to your boat and/or poor product performance.

Introduction

This user guide describes how to install, connect and maintain your HD Digital Radome Antenna. The models covered are:

- RD418HD - 18” 4 kW Digital Radome Antenna.
- RD424HD - 24” 4 kW Digital Radome Antenna.

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 300 GHz.
- 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 300 GHz) 1998.

The HD Digital Radome Antenna is designed and manufactured to meet the rigorous demands of the marine environment. However, it must be installed, operated and maintained properly. Please carefully read and follow the recommended procedures in this user guide.

Warning: Radio Frequency Radiation Hazard

The radar scanner transmits electromagnetic energy at microwave frequencies which can be harmful, particularly to the eyes. Do NOT look at the antenna from close range. Ensure personnel are clear of the radome when the radar is turned on.

It is recommended that the radar is installed out of range of personnel, e.g. above head height.

Transmitted power density levels

- A power density level of 10 W/m^2 is likely at distances of 1 m or less from the radome.
- A power density level of 100 W/m^2 does not occur at any point.

IMO and SOLAS

The equipment described within this document is intended for use on leisure marine boats and workboats not covered by International Maritime Organization (IMO) and Safety of Life at Sea (SOLAS) Carriage Regulations.

Radar licensing

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 any difficulties, contact your local Raymarine dealer.

Warning: High voltages

This product contains high voltages. Do NOT remove any covers or otherwise attempt to access internal components, unless specifically instructed in this document.

Warning: Product installation and operation

This product must be installed and operated in accordance with the Raymarine instructions provided. Failure to do so could result in personal injury, damage to your boat and/or poor product performance.

FCC Notice - Radar

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

EMC conformance

Raymarine equipment and accessories conform to the appropriate Electromagnetic Compatibility (EMC) regulations for use in the recreational marine environment.

Correct installation is required to ensure that EMC performance is not compromised.

Product disposal

Dispose of this product in accordance with the WEEE 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 Raymarine products, we support its policy and ask you to be aware of how to dispose of this product.

Display compatibility

The HD Digital Radome Antenna can be connected to Raymarine multi-function displays (MFDs) as follows:

- Direct connection to E-Series and to wide screen versions of C-Series MFDs.
- Connection via a Raymarine SeaTalk^{hs} switch to:
  - Wide screen versions of C-Series MFDs.
  - All versions of E-series MFDs.
  - All versions of G-series MFDs.

Note: Some limitations of functionality in the above systems may occur, depending on the software status.

Display software

After fitting an HD Digital Radome Antenna, i.e. before it is used, you must ensure that any associated multi-function display (MFD), is using the latest software version.

To check the MFD software version, switch on the MFD and check the version number on the navigation warning screen. Note that if a scanner is not connected, the version number will only be displayed for 10 seconds.

You can download the latest MFD software, from the Raymarine website, at **www.raymarine.com**. Information on how to use the download to update the MFD software, is also available on the Raymarine website. Additional support information is available from Raymarine technical support.

Warranty registration

To register your HD Digital Radome Antenna ownership, please take a few minutes to fill out the warranty registration card found in the box, or visit www.raymarine.com and register on-line.

It is important that you register your product to receive full warranty benefits. Your unit package includes a bar code label indicating the serial number of the unit. You should stick this label to the warranty registration card.

Technical accuracy

To the best of our knowledge, the information in this document was correct at the time it was produced. However, Raymarine cannot accept liability for any inaccuracies or omissions it may contain. In addition, our policy of continuous product improvement may change specifications without notice. As a result, Raymarine cannot accept liability for any differences between the product and this document.

Chapter 2 Installation

Chapter contents

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- 2.2 Installation procedures on page 18
- 2.3 Post installation procedures on page 25

2.1 Planning

Warning: Product grounding

Before applying power to this product, ensure it has been correctly grounded, in accordance with the instructions in this guide.

Caution: Do NOT connect to positive ground system

Do NOT connect this product to a positively-grounded system.

EMC installation guidelines

Raymarine equipment and accessories conform to the appropriate Electromagnetic Compatibility (EMC) regulations, to minimize electromagnetic interference between equipment and minimize the effect such interference could have on the performance of your system

Correct installation is required to ensure that EMC performance is not compromised.

For **optimum** EMC performance we recommend that wherever possible:

- Raymarine equipment and cables connected to it are:
  - At least 1 m (3 ft) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 7 ft (2 m).
  - More than 2 m (7 ft) 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 product is supplied from a separate battery from that used for engine start. This is important to prevent erratic behavior and data loss which can occur if the engine start does not have a separate battery.
- Raymarine specified cables are used.
- Cables are not cut or extended, unless doing so is detailed in the installation manual.

Note: Where constraints on the installation prevent any of the above recommendations, always ensure the maximum possible separation between different items of electrical equipment, to provide the best conditions for EMC performance throughout the installation

Parts Supplied

Check that you have been supplied with the following parts:

Items Required

Dimensions - 18 inch antenna

Dimensions - 24 inch antenna

Antenna Position

The optimum height for the HD Digital Radome Antenna (the antenna) is a location that is high enough above the waterline to give a long range line-of-sight to the horizon, but not so high as to be adversely affected by the boat's pitching and rolling.

The antenna must also be mounted where it is:

- Above head height.
- Easily accessible.
- As near as possible to the boat's centerline.
- On a rigid and stable platform, capable of securely supporting the antenna under seagoing conditions.
- Clear of large objects such as the flybridge, large engine stacks, searchlights, horns, masts etc.
- Clear of heat and fumes.
- At least 1 m (3.3 ft) from a magnetic compass or other antennae.

Antenna Mounting Angle

The radar beam from the HD Digital Radome Antenna is approximately 25° wide in the vertical direction, to give good target detection even when your boat pitches and rolls.

Always mount the HD Digital Radome Antenna so that the scanner rotates parallel to the water line.

Planing hull boats and some displacement hull boats adopt a higher bow angle when the boat is at cruising speed, so on these boats it may be necessary to shim the rear of the HD Digital Radome Antenna, to compensate for the bow rise and ensure optimum target detection. The amount of shimming should be such that when the bow rises at cruising speed, the radar beam rotation is in the horizontal plane,

Cables

You need a digital cable, to connect both power and SeaTalk^{hs} to the HD Digital Radome Antenna.

The following digital cables are available:

Cable length	Part number
5 m (16 ft 5 in)	A55076D
10 m (32ft 9 in) ft)	A55077D
15 m (46 ft)	A55078D
25 m	A55079D

The following extension cables are available:

Extension length	Part number
2.5 m (8 ft 2 in)	A92141D
5 m (16 ft 5 in)	A55080D
10 m (32ft 9 in) ft)	A55081D

Important: Use only standard Raymarine cables. Do NOT make your own cables for use with the HD Digital Radome Antenna.

Mast Mounting

If the HD Digital Radome Antenna is mounted on a hollow mast, the cable may be run inside the mast for connection to the unit.

If you run the cable up a mast, take the appropriate measures to:

- Prevent the cable chafing where it enters and exits the mast.
- Minimize electrical interference by:
  - Not running the cable near other electrical equipment.
  - Not running the cable alongside power cables or antenna cables for other equipment.

Power requirement

The HD Digital Radome Antenna must be supplied with power by either a 12 V dc or a 24 V dc supply. Do NOT connect to a 32 V system.

If you are replacing an existing Radome scanner with an HD Digital Radome Antenna, you must also replace any existing cable with the appropriate digital cable, as described in section *2.7 Cables*.

If you connect to the power supply via an isolator switch, the minimum switch rating is:

- For a 12 V system, 20 A.
- For a 24 V system, 15 A.

Caution: Do NOT connect to positive ground system

Do NOT connect this product to a positively-grounded system.

Power Supply Protection

The power supply must be protected by a suitable thermal circuit breaker or fuse, fitted close to the power source. The protection requirements are the same for both 18” and 24” HD Digital Radome Antennae, and are as follows:

- In a 12 V system, protect the power supply with either a 10 A thermal breaker, or a 15 A fuse.
- In a 24 V system, protect the power supply with either a 5 A thermal breaker, or an 8 A fuse.

Power cable lengths

The total permitted lengths of power conductor run (i.e. power cable plus cable extension) from the power source to the HD Digital Radome Antenna are :

- for 12 V systems, 20 m (65 ft)
- for 24 V systems, 35 m (115 ft)

If you want to connect to a 12 V power system but a total power conductor run of more than 20 m is necessary, the use of a suitable voltage converter is recommended, to convert the 12 V supply voltage to 24 V, and thus enable you to extend the run up to 35 m. We recommend using a converter with a minimum 200 W output capacity.

Grounding

These grounding requirements are applicable for Raymarine equipment supplied with a separate drain wire or screen.

- The product power cable drain conductor (screen) must be connected to a common ground point.
- It is recommended that the common ground point is a bonded ground, i.e. with the ground point connected to battery negative, and situated as close as possible to the battery negative terminal. If a bonded ground system is not possible, a non-bonded RF ground may be used.

Bonded ground system (preferred)

RF ground system (alternative)

1. Power cable to product
2. Drain (screen)
3. Bonded (preferred) or non-bonded RF ground.
4. Battery

Implementation

If several items require grounding, they may first be connected to a single local point (e.g. within a switch panel), with this point connected via a single, appropriately-rated conductor, to the boat's common ground. The preferred minimum requirement for the path to ground (bonded or non-bonded) is via a flat tinned copper braid, with a 30 A rating (1/4 inch) or greater. If this is not possible, an equivalent stranded wire conductor maybe used, rated as follows:

- for runs of <1 m (3 ft), use 6 mm^2 (#10 AWG) or greater.
- for runs of >1 m (3 ft), use 8 mm^2 (#8 AWG) or greater.

In any grounding system, always keep the length of connecting braid or wires as short as possible.

Important: Do NOT connect this product to a positively-grounded power system.

References

- ISO10133/13297
- BMEA code of practice
- NMEA 0400

2.2 Installation procedures

Use the following procedures to install the HD Digital Radome Antenna (the antenna):

- Mounting the antenna.
- Connecting to your system.
- Post installation procedures.

> **Caution: Mounting Bolts**
>
> **Do NOT screw the antenna mounting bolts into the antenna base more than 25 mm (1 inch), or damage to the antenna could occur. If necessary, use shims or extra washers to prevent this happening.**

Mounting the Antenna

Use a mounting location that:

- Is robust enough to support the HD Digital Radome Antenna, under seagoing conditions.
- Meets the requirements described under *Antenna Position*

Then:

1. Prepare the mounting platform as in the following illustration.

2. Place the HD Digital Radome Antenna in position. If you are fitting it on a planing vessel, shim the rear of the antenna, so that the beam points slightly down in the forward direction when the boat is at rest, to compensate for the bow rising at cruising speed

3. Lightly coat the threads of the four mounting bolts, with the Denso Paste provided.
4. Ensuring that the bolts do not enter the antenna base more than 25 mm (1 inch), secure the antenna with the 4 bolts flat washers and spring washers provided, as illustrated. If necessary, use appropriate shims or extra washers to limit the length of bolt entering the antenna base.

5. Tighten the bolts to a torque of 20 Nm (177 lbf/inch).

Connecting

When connecting your HD Digital Radome Antenna, use the instructions given here and also refer to the installation instructions for the multi-function display (MFD) to which you are connecting.

Run the digital cable from the HD Digital Radome Antenna to the signal and power connection points:

- Run the signal connector to the appropriate MFD.
- Run the power cable to a suitable 12 V or 24 V connection point on the boat's power system. We recommend connection is made at the boats power distribution panel, wherever possible.

Caution: Pulling cables

Do NOT use cords or ropes, attached to cable connectors, to pull cables through restricted apertures (e.g. as in bulkheads), as this could cause damage to cables.

Routing cables

Cables must be routed correctly, to maximize performance and prolong cable life.

- Do NOT bend cables excessively. Wherever possible, ensure a minimum bend radius of 100 mm.

- Protect all cables from physical damage and exposure to heat. Use trunking or conduit where possible. Do NOT run cables through bilges or doorways, or close to moving or hot objects.
- Secure cables in place using tie-wraps or lacing twine. Coil any extra cable and tie it out of the way.
- Where a cable passes through an exposed bulkhead or deckhead, use a suitable watertight feed-through.
- Do NOT run cables near to engines or fluorescent lights.

Always route data cables as far away as possible from:

- other equipment and cables,
- high current carrying ac and dc power lines,
- antennae.

Connecting antenna

Ensuring that the arrow on the digital cable connector is aligned with the red triangular mark on the HD Digital Radome Antenna connector, connect the digital cable to the connector on the HD Digital Radome Antenna, and fully hand-tighten. Do NOT use a wrench or any other tool.

Note: If the antenna connector is disconnected after initial installation, we recommend that before reconnecting, you lightly coat the connector thread with Renolit Aqua 2 Calcium grease.

Connecting signal

Referring to the connection information for the multi-function display (MFD) to which you are connecting, and to the *Typical systems* diagrams given here, connect the digital cable signal connector to the appropriate MFD.

Typical Systems

Direct connection to display

Connection to networked displays (non G-series)

Connection to G-Series Display

Connecting power

When connecting power, refer to the *Planning* section and:

- Ensure that the total length of power cable will not exceed the maximum length, as described under *Power cable lengths*.
- Connect power only via the correct value thermal breaker or fuse, as described under *Power Supply Protection*.

> **Caution: Do NOT connect to positive ground system**
>
> **Do NOT connect this product to a positively-grounded system.**

Connection procedure

Connect the power cable part of the digital cable to either a 12 V or 24 V dc supply, as follows:

1. Red wire to the supply +ve, either at the output of the battery isolator switch or at a dc distribution panel.
2. Black wire to battery negative.
3. Drain connection (screen) to the common ground point (see *Grounding*)

Sharing a breaker

Where more than 1 piece of equipment shares a breaker you must provide protection for the individual circuits. E.g. by connecting an in-line fuse for each power circuit.

2.3 Post installation procedures

Before using the product, carry out the following:

- Mechanical checks.
- Switch on and initial setup.

Mechanical checks

Before switching on the HD Digital Radome Antenna:

- Ensure that:
  - All securing bolts are fully tightened and the appropriate mechanical locking washers are in place.
  - All connections are securely made.
  - All connecting cables and wires are secured and protected as necessary.
- Ask your local Raymarine authorized installer to check the installation.

Switch on & initial setup

Use the information given here in conjunction with the relevant information in your multi-function display (MFD) documentation, to switch on, and to carry out the initial checks and setup tasks.

1. Press and hold down the power key of your MFD until the unit beeps.

   The magnetron warm-up sequence should then start. When the warm-up is complete, the unit should enter standby mode.
2. Use the appropriate soft key on your MFD to power on the HD Digital Radome Antenna.
3. If necessary, at the MFD:
   - adjust the MFD brightness.
   - change the default language settings.
4. Ensure that all personnel are clear of the antenna, then switch to transmit mode.
5. Carry out the radar operations described in the relevant MFD Owner's Handbook and check that all functions appear to be satisfactory.
6. Check the bearing alignment to ensure that targets appear at their correct bearing relative to the boat's bow. Adjust the alignment as necessary
7. Check the display timing before using the system for navigation.

Checking for interference

Post installation check

If you have installed any system aboard a boat or made other changes to the boat's electronic systems (radar, VHF radio etc.), you need to check before casting off, that all electrical systems operate satisfactorily without any undue electrical interference, in order to conform with Electro Magnetic Compatibility (EMC) regulations. To do this:

1. Ensuring it is safe to do so, turn on all electronic systems aboard the boat.
2. Check that the electronic systems all operate satisfactorily.

Chapter 3: Maintenance & troubleshooting

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- 3.1 Safety on page 28
- 3.2 Maintenance on page 28
- 3.3 Troubleshooting on page 29
- 3.4 Raymarine technical support on page 30

3.1 Safety

Warning: Do not remove covers

Do not remove any cover from this product. There are no user serviceable parts inside.

Warning: Switch off power

Before commencing any maintenance task, switch off all power to the product.

3.2 Maintenance

Once a year:

1. Remove one of the antenna-securing bolts and associated washers.
2. Clean the bolt and washers.
3. Use Denso paste to lightly re-grease the bolt thread.
4. Replace the bolt and associated washers.
5. Repeat steps 1 to 5 for all antenna-securing bolts.
6. Tighten all antenna-securing bolts to a torque of 20 Nm (177 lbf/inch).

Periodically, carry out these other maintenance tasks:

- Ensure the antenna is firmly attached to the mounting surface
- Check that the cable connections are in good condition and securely attached.
- Examine all cables for signs of chafing, cuts or other damage. If the antenna connector shows any sign of corrosion:
    1. Disconnect it.
    2. Clean the connector.
    3. Lightly re-coat the connector threads with Renolit Aqua 2 Calcium grease.
    4. Reconnect and hand-tighten the connection until it is secure.

3.3 Troubleshooting

The troubleshooting information provides possible causes and corrective action required for common problems associated with marine electronics installations.

All Raymarine products are, prior to packing and shipping, subjected to comprehensive test and quality assurance programs. However, if you experience problems with the operation of your HD Digital Radome Antenna, this section will help you to diagnose and correct problems in order to restore normal operation.

If after referring to this section you are still having problems with your unit, please contact Raymarine Technical Support for further advice.

Troubleshooting procedure

Use the following table to identify problems and remedial actions.

Symptom	Action
No Data Source or **No Scanner** message on display.	Ensure the digital cable is securely connected at both ends and is in good condition. Ensure power supply thermal breaker has not tripped or fuse has not blown. If necessary, reset breaker or replace fuse ONCE ONLY. If breaker keeps tripping or fuse keeps blowing, contact Raymarine technical support for assistance. Ensure power supply maintains the correct voltage when the system is switched on. Ensure all products in the system have the correct software. Contact Raymarine technical support for assistance.
	If the HD Digital Radome Antenna is connected to the multi-function display (MFD) via a SeaTalk^{hs} switch, ensure that: • All relevant equipment is correctly connected to the SeaTalk^{hs} switch. • The SeaTalk^{hs} switch power supply is satisfactory. • The SeaTalk^{hs} switch is in good condition. • SeaTalk^{hs} cables are securely connected and in good condition.
Displayed bearing is different to the true bearing.	Carry out the bearing alignment procedure described in the installation guide for the relevant MFD.

3.4 Raymarine technical support

Raymarine provides a comprehensive customer support service, on the world wide web, through our worldwide dealer network and by telephone help line. If you are unable to resolve a problem, please use any of these facilities to obtain additional help.

Web support

Please visit the customer support area of our website at:

www.raymarine.com

This contains Frequently Asked Questions, servicing information, e-mail access to the Raymarine Technical Support Department and details of worldwide Raymarine agents.

Telephone support

In the USA call:
+1 603 881 5200 extension 2444

In the UK, Europe, the Middle East, or Far East call:
+44 (0)23 9271 4713

Product information

If you need to request service, please have the following information to hand:

- Product name.
- Product identity.
- Serial number.
- Software application version.

You can obtain this product information using the menus within your product.

Chapter 4 Technical specification

Approvals

Approvals:	Certification:
USA:	47CFR FCC Part 2 & Part 80 Certificate of Approval
Canada:	RSS138 Iss. 1 Technical Acceptance Certificate
European Union & EFTA:	R & TTE Directive 1999/05/EC Certificate of Opinion
Australia/New Zealand:	ACMA Declaration of Conformity Compliance level 3

General

Dimensions:	
18 in antenna (RD418HD) 24 in antenna (RD424HD):	Φ521 mm x 247 mm (20.5 in x 9.7 in) Φ652 mm x 247 mm (25.67 in x 9.7 in)
Weight:	
18 in antenna (RD418HD) 24 in antenna (RD424HD):	9.5 kg (21 lbs) 10 kg (22 lbs)
Supply voltage:	Either 12 V dc or 24 V dc nominal Minimum:10.8 V Maximum: 33 V
Power consumption:	60 W (25 W standby)
Environmental:	
Waterproof to: Operating temperature range: Humidity: Maximum wind speed:	IPX6 -10°C to +55°C Up to 95% at 35°C 100 kts
Maximum range scale:	48 Nautical miles (Nm)

Transmitter

Type:	Solid-state modulator, driving magnetron
Transmit frequency:	9405 MHz ±25 MHz
Peak power output:	4 kW
Duplexer:	Circulator
Standby mode:	Magnetron heater - ON Magnetron control - ON All other services - OFF

Range (Nm)	Expanded range (Nm)	Pulse width (ns)	PRF
1/8, 1/4		75	3 kHz
1/2		100	3 kHz
3/4	1/8, 1/4	150	3 kHz
	1/2	200	3 kHz
1 1/2	3/4	330	2 kHz
3		430	1.5 kHz
	1 1/2	520	1.3 kHz
6, 12, 24 & 48	3, 6, 12, 24 & 48	900	820 Hz

Antenna

Type:	Patch array
Beamwidth (nominal)	Horizontal: 4.9° (18 in antenna), 3.9° (24 in antenna) Vertical: 25°

Polarization:	Horizontal
Rotation speed:	24 rpm nominal 48 rpm with compatible displays

Receiver

Intermediate frequency:	70 MHz
Receiver characteristic:	Linear
Receiver noise:	Less than 5 dB (including low noise converter and IF amplifier)
Bandwidth:	Matched digital filter for each pulse length

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