Raymarine®

CYCLONE RADAR

Installation instructions

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Software updates

Check the Raymarine website for the latest software releases for your product.
www.raymarine.com/software

Product documentation

The latest versions of all English and translated documents are available to download in PDF format from the website: www.raymarine.com/manuals.
Please check the website to ensure you have the latest documentation.

Non-Controlled information

> **Important:**
>
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Contents

Chapter 1: Important information

Certified Installation

Raymarine recommends certified installation by a Raymarine approved installer. A certified installation qualifies for enhanced product warranty benefits. Contact your Raymarine dealer for further details, and refer to the separate warranty document packed with your product.

> **Warning: Product installation and operation**
> - This product must be installed and operated in accordance with the instructions provided. Failure to do so could result in personal injury, damage to your vessel and/or poor product performance.
> - Raymarine highly recommends certified installation by a Raymarine approved installer. A certified installation qualifies for enhanced product warranty benefits. Register your warranty on the Raymarine website: www.raymarine.com/warranty

> **Warning: Potential ignition source**
> This product is NOT approved for use in hazardous/flammable atmospheres. Do NOT install in a hazardous/flammable atmosphere (such as in an engine room or near fuel tanks).

> **Warning: Positive ground systems**
> Do not connect this unit to a system which has positive grounding.

> **Warning: Power supply voltage**
> Connecting this product to a voltage supply greater than the specified maximum rating may cause permanent damage to the unit. Refer to the product's information label for the correct voltage.

> **Warning: Switch off power supply**
> Ensure the vessel's power supply is switched OFF before starting to install this product. Do NOT connect or disconnect equipment with the power switched on, unless instructed in this document.

> **Caution: Power supply protection**
> When installing this product ensure the power source is adequately protected by means of a suitably-rated fuse or thermal circuit breaker.

> **Warning: High voltage**
> This product contains high voltage. Do NOT remove covers or attempt to access internal components, unless specifically instructed in the documentation provided.

> **Warning: Product grounding**
> Before applying power to this product, ensure it has been correctly grounded, in accordance with the instructions provided.

> **Warning: Radar scanner safety**
> Before rotating the Radar scanner, ensure all personnel are clear.

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 scanner from close range. Ensure personnel are clear of the scanner when it is powered on.

For safety reasons, the radar must be installed above head height, out of range of personnel.

Caution: Service and maintenance

This product contains no user serviceable components. Please refer all maintenance and repair to authorized Raymarine dealers. Unauthorized repair may affect your warranty.

Caution: Doppler limitations

When the target's speed is more than 60 knots Speed Over Ground (SOG), or the relative speed between your vessel and the target is greater than 120 knots, the direction of target returns from high speed vessels may be displayed incorrectly. Consequently, **the displayed target colors may be inverted, with targets colored red when they should be green, and vice versa.**

Transmitted power density levels

Cyclone (E70620)		
Configuration	**Calculated minimum compliance boundary (m) (rounded up to nearest 0.1 m)**	
	Worker / Occupational / Crew	**General Public**
3 ft Antenna (E70628)	0.2 m which is < Swept Volume (0.52 m)	0.3 m which is < Swept Volume (0.52 m)
4 ft Antenna (E70629)	0.2 m which is < Swept Volume (0.67 m)	0.4 m which is < Swept Volume (0.67 m)
6 ft Antenna (E70630)	0.2 m which is < Swept Volume (0.975 m)	0.4 m which is < Swept Volume (0.975 m)

Cyclone Pro (E70621)		
Configuration	**Calculated minimum compliance boundary (m) (rounded up to nearest 0.1 m)**	
	Worker / Occupational / Crew	**General Public**
3 ft Antenna (E70628)	0.2 m which is < Swept Volume (0.52 m)	0.5 m which is < Swept Volume (0.52 m)
4 ft Antenna (E70629)	0.3 m which is < Swept Volume (0.67 m)	0.5 m which is < Swept Volume (0.67 m)
6 ft Antenna (E70630)	0.3 m which is < Swept Volume (0.975 m)	0.5 m which is < Swept Volume (0.975 m)

IEEE statement

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

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

Water ingress

Water ingress disclaimer

Although the waterproof rating capacity of this product meets the stated water ingress protection standard (refer to the product's *Technical Specification*), water intrusion and subsequent equipment failure may occur if the product is subjected to high-pressure washing. Raymarine will not warrant products subjected to high-pressure washing.

Disclaimer

Raymarine does not warrant that this product is error-free or that it is compatible with products manufactured by any person or entity other than Raymarine.

Raymarine is not responsible for damages or injuries caused by your use or inability to use the product, by the interaction of the product with products manufactured by others, or by errors in information utilized by the product supplied by third parties.

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.

> **Note:** In areas of extreme EMC interference, some slight interference may be noticed on the product. Where this occurs the product and the source of the interference should be separated by a greater distance.

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

- Raymarine equipment and cables connected to it are:
  - At least 1 m (3.3 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 2 m (6.6 ft).
  - More than 2 m (6.6 ft) from the path of a radar beam. A radar beam can normally be assumed to spread 25 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.

Suppression ferrites

- Raymarine cables may be pre-fitted or supplied with suppression ferrites. These are important for correct EMC performance. If ferrites are supplied separately to the cables (i.e. not pre-fitted), you must fit the supplied ferrites, using the supplied instructions.
- If a ferrite has to be removed for any purpose (e.g. installation or maintenance), it must be replaced in the original position before the product is used.
- Use only ferrites of the correct type, supplied by Raymarine or its authorized dealers.
- Where an installation requires multiple ferrites to be added to a cable, additional cable clips should be used to prevent stress on the connectors due to the extra weight of the cable.

Connections to other equipment

Requirement for ferrites on non-Raymarine cables

If your Raymarine equipment is to be connected to other equipment using a cable not supplied by Raymarine, a suppression ferrite MUST always be attached to the cable near the Raymarine unit.

Compass safe distance

To prevent potential interference with the vessel's magnetic compasses, ensure an adequate distance is maintained from the product.

When choosing a suitable location for the product you should aim to maintain the maximum possible distance from any compasses. Typically this distance should be at least 1 m (3.3 ft) in all directions. However for some smaller vessels it may not be possible to locate the product this far away from a compass. In this situation, when choosing the installation location for your product, ensure that the compass is not affected by the product when it is in a powered state.

Japanese approvals - Technical Regulation Conformity Certification

This equipment contains specified radio equipment that has been certified to the *Technical Regulation Conformity Certification* under the Radio Law.

Declaration of Conformity (Cyclone)

FLIR Belgium BVBA declares that the radio equipment type Cyclone Open Array radars, part number E70620 when fitted with antennas, E70628, E70629 or E70630, are in compliance with the Radio Equipment Directive 2014/53/EU.

The original Declaration of Conformity certificate may be viewed on the relevant product page at www.raymarine.com/manuals.

Declaration of Conformity (Cyclone Pro)

FLIR Belgium BVBA declares that the radio equipment type Cyclone Pro Open Array radars, part number E70621 when fitted with antennas, E70628, E70629 or E70630, are in compliance with the Radio Equipment Directive 2014/53/EU.

The original Declaration of Conformity certificate may be viewed on the relevant product page at www.raymarine.com/manuals.

Declaration of Conformity (VCM100)

FLIR Belgium BVBA declares that the VCM100 Voltage Converter Module, part number E70648, is in compliance with the EMC Directive 2014/30/EU.

The original Declaration of Conformity certificate may be viewed on the relevant product page at www.raymarine.com/manuals.

Radar licensing

Installation and operation of this Radar may be subject to individual licensing of the equipment, operator or vessel.

In many countries, the licensing for the use of Radar equipment is included in the **Ship Station license** and **Operator's license** issued for VHF radios.

However, even if you already have a Ship Station license and Operator's license for a VHF radio, **some countries may require a separate license for Radar equipment use.**

Important:

It is your responsibility to determine whether a license is required in your area before operating this equipment.

For a list of license issuing authorities, refer to: **p.91 — Licensing issuing authorities**

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.

FCC Approval codes

Cyclone — FCC ID: PJ5-953LPSSR

Cyclone Pro — FCC ID: PJ5-953MPSSR

ISED Canada approval codes

Cyclone — IC:4069B-953LPSSR

Cyclone Pro — IC:4069B-953MPSSR

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.

Warranty registration

To register your Raymarine product ownership, please visit www.raymarine.com and register online.

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 will need this serial number when registering your product online. You should retain the label for future reference.

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 which contains materials, components and substances that may be hazardous and present a risk to human health and the environment when WEEE is not handled correctly.
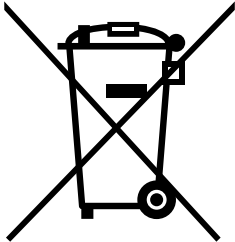
Equipment marked with the crossed-out wheeled bin symbol indicates that the equipment should not be disposed of in unsorted household waste.
Local authorities in many regions have established collection schemes under which residents can dispose of waste electrical and electronic equipment at a recycling center or other collection point.
For more information about suitable collection points for waste electrical and electronic equipment in your region, refer to the Raymarine website: www.raymarine.eu/recycling.

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. Please check the Raymarine website (www.raymarine.com) to ensure you have the most up-to-date version(s) of the documentation for your product.

Operation instructions

For detailed operation instructions for your product, refer to the documentation that accompanies your display.

All product documentation is available to download from the Raymarine website: www.raymarine.com/manuals.

Multifunction display software version

To ensure optimum performance and compatibility with external devices, your multifunction display must be using the latest software version.

Visit www.raymarine.com/software to download the latest software.

Chapter 2: Document information

Chapter contents

2.1 Document information

This document contains important information related to the installation of your Raymarine product.

The document includes information to help you:

- plan your installation and ensure you have all the necessary equipment;
- install and connect your product as part of a wider system of connected marine electronics;
- troubleshoot problems and obtain technical support if required.

This and other Raymarine product documents are available to download in PDF format from www.raymarine.com/manuals.

Applicable products

This document is applicable to the following products:

Cyclone Open Array Radar — Pedestal
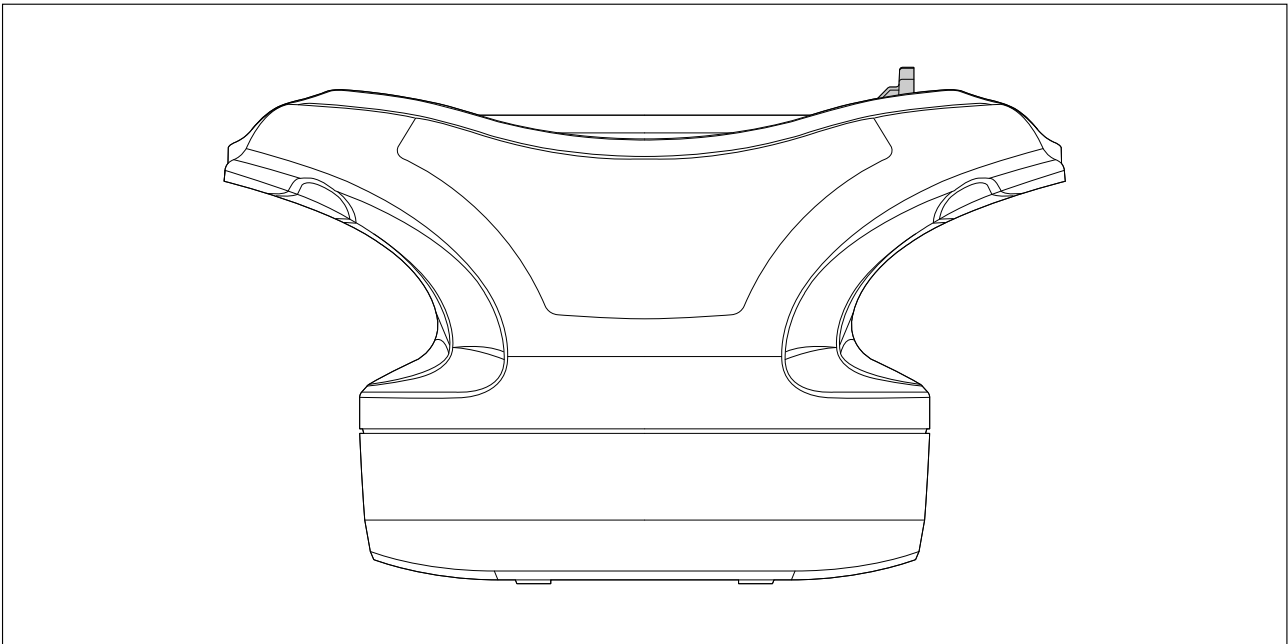
- **E70620**: Cyclone Pedestal (**55 W**)
- **E70621**: Cyclone Pro Pedestal (**110 W**)

Cyclone Open Array Radar — Antenna

1. **E70628**: Cyclone Antenna (**36 in Array**)
2. **E70629**: Cyclone Antenna (**48 in Array**)
3. **E70630**: Cyclone Antenna (**72 in Array**)

VCM100 Voltage Converter Module
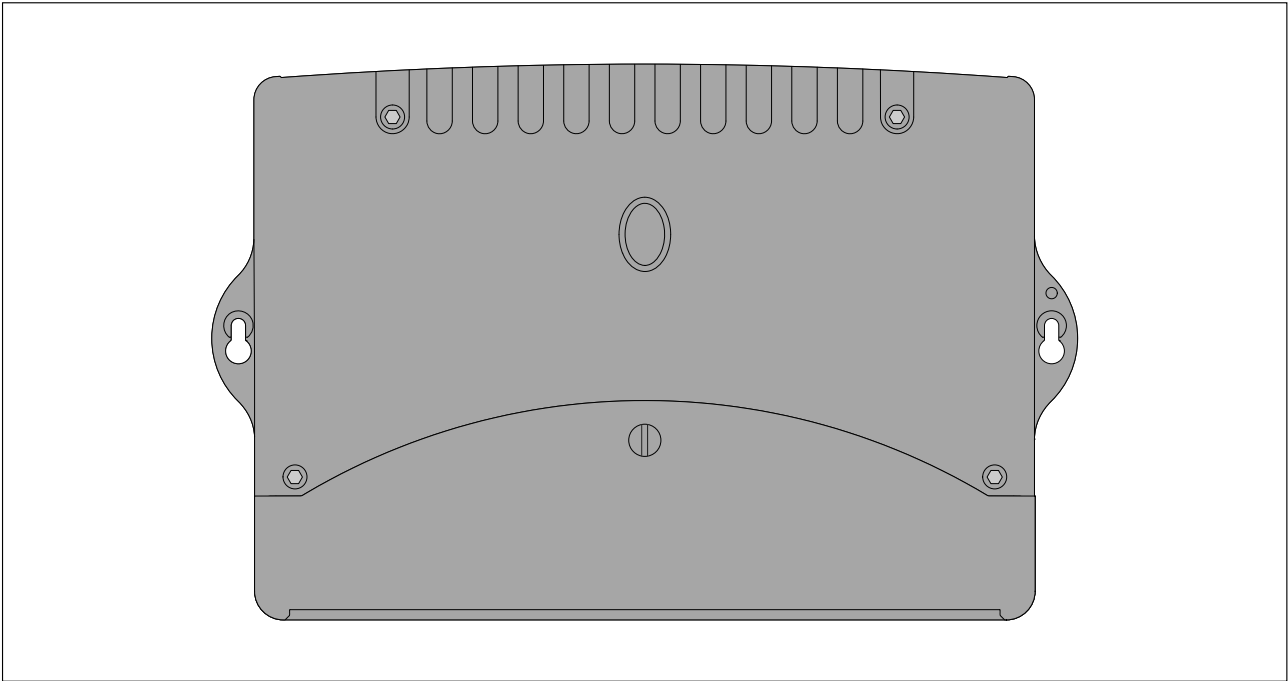
- **E70648**: VCM100 Voltage Converter Module

Document illustrations

Your product and if applicable, its user interface may differ slightly from that shown in the illustrations in this document, depending on product variant and date of manufacture.

All images are provided for illustration purposes only.

Product documentation

The following documentation is applicable to your product:
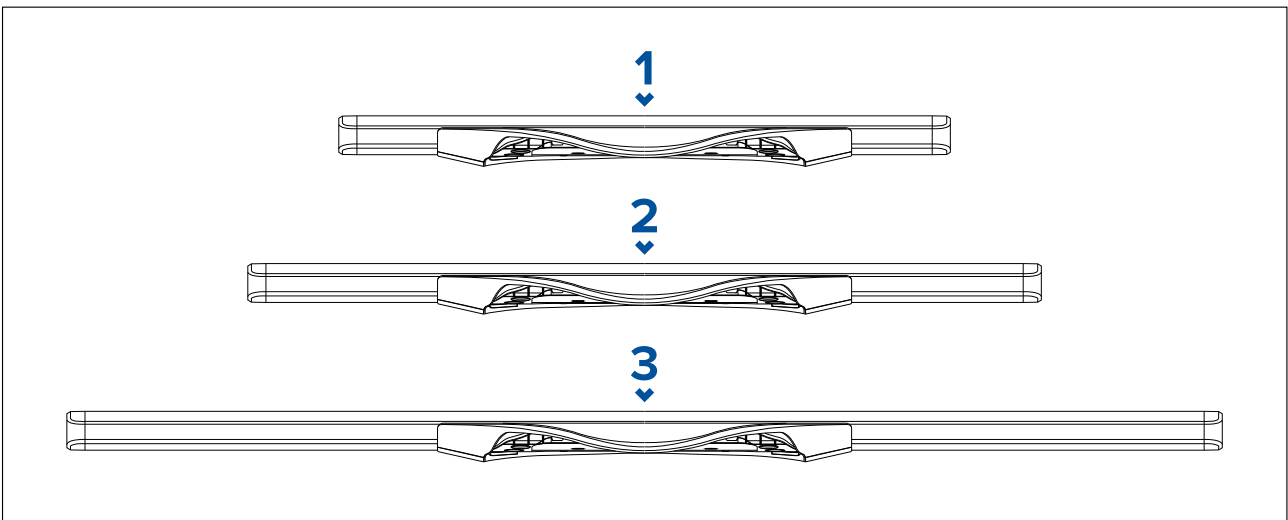
This and other Raymarine product documents are available to download in PDF format from www.raymarine.com/manuals.

- **87402** — Cyclone Open Array Radar Installation Instructions (this document)
- **87401** — Cyclone Open Array Radar Pedestal Mounting template

Operation instructions

For detailed operation instructions for your product, refer to the documentation that accompanies your display.

All product documentation is available to download from the Raymarine website: www.raymarine.com/manuals

- **81370** — LightHouse 3 MFD Advanced Operation Instructions

Chapter 3: Product and system overview

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3.1 Product overview

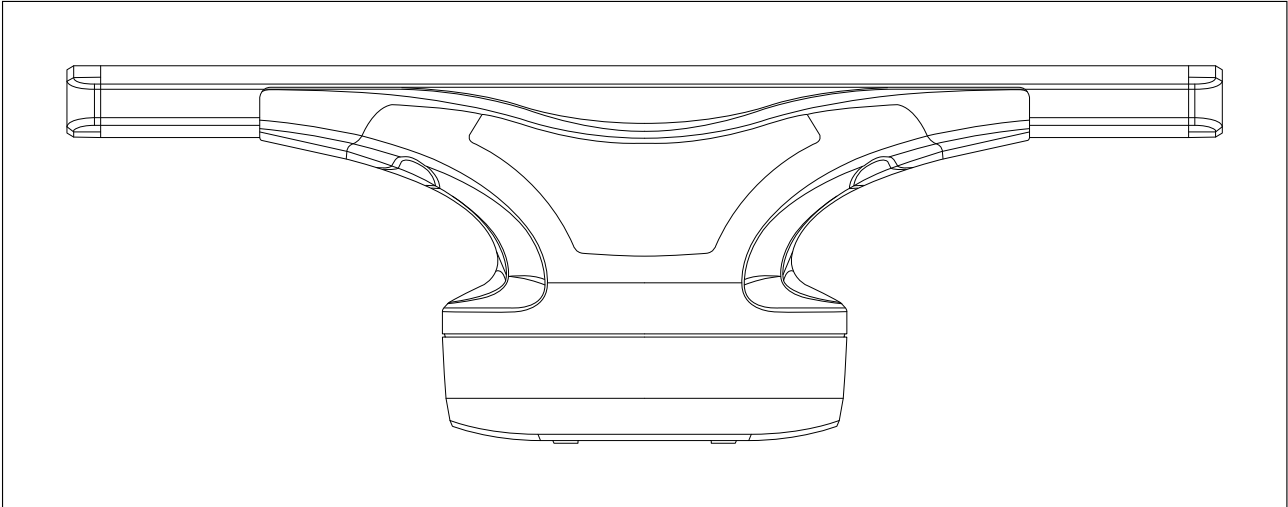The Cyclone and Cyclone Pro are Solid State open array Radar scanners. Cyclone provides a map-like representation of an extended area around your vessel, enabling you to identify birds, weather, other vessels, and land features such as coastlines and hills.

The Cyclone and Cyclone Pro Open Array Radars include the following features:

- Solid-state technology (no magnetron) for improved efficiency, and rapid start-up.
- Choice of 3, 4, or 6 ft antenna array.
- Choice of two power outputs — 55 W (Cyclone) or 110 W (Cyclone Pro).
- Low-profile design (335 mm / 13.1 in height), for greater installation flexibility.
- Instrumented range up to 96 Nm (dependent on model and installation location).
- Scanner rotation up to 60 RPM, for high-speed imaging.
- 100 knot wind rating, meeting the IEC 62388 standard for shipborne Radar.
- Narrow horizontal beam widths for enhanced target separation.
- CHIRP pulse compression for improved target range resolution, and reduced background noise.
- ARPA automatic target acquisition and tracking (up to 50 targets) and collision avoidance.
- Doppler display, making it easier to track approaching and receding objects.
- Enhanced Bird Mode — Radar gain and tuning are automatically optimized for identifying clusters of sea birds, to assist you in locating fishing spots.
- Weather detection.
- RangeFusion™ — short and long pulses are combined to provide a high-clarity Radar image for both short-range and long-range targets, simultaneously.
- Radar image display and control via Raymarine multifunction display.
- Real-time heading display.
- Data connection via RayNet cable.
- 12 V or 24 V operation (with VCM100 power converter)
- Waterproof to IPX 6.

Multiple radar scanners

You can use a **maximum of two radar scanners** at any one time, per networked system.

For example, you can install, and simultaneously use:

- A Cyclone Open Array radar, and another Raymarine radar (e.g. a Quantum Radome).
- Two Cyclone Open Array radars.

Note: You can use **only one Quantum radome** at any one time, per networked system.

For important information on how to position multiple radar scanners to avoid interference between the scanners, refer to:

Doppler Radar overview

Doppler Radar technology makes it easier to track moving objects with ground speed exceeding 3 knots.

The Doppler function highlights objects on the Radar display that are moving towards or away from the vessel (e.g. other vessels, but not land or buoys, for example). Stationary targets will not be highlighted.

Doppler Radar technology is particularly beneficial in a marine environment, where poor weather conditions and visibility can make object tracking challenging. With the integration of Doppler information on the Radar display, the process of matching on-screen Radar returns with real-world objects becomes a much simpler task.

Doppler Radar works by transmitting a microwave signal which is then reflected off a moving object at a distance. By analyzing how the object's motion has altered the frequency of the returned signal, the Doppler Radar can interpret the variation to provide highly accurate measurements of an object's direction of travel, relative to the Radar scanner.

3.2 VCM100 Voltage Converter Module

The VCM100 Voltage Converter Module converts the source of direct current from your vessel's power source to a safe level for the connected radar.

Important:

- The VCM100 is an **essential** component in your radar's system and MUST be used to supply power to the Cyclone radar. The model number of the VCM100 that is suitable for use with the Cyclone Radar is: E70648.

- Do NOT use older versions of the VCM100 with your radar. The model number of the older VCM100 that is NOT suitable for use with the Cyclone Radar is: E52091.
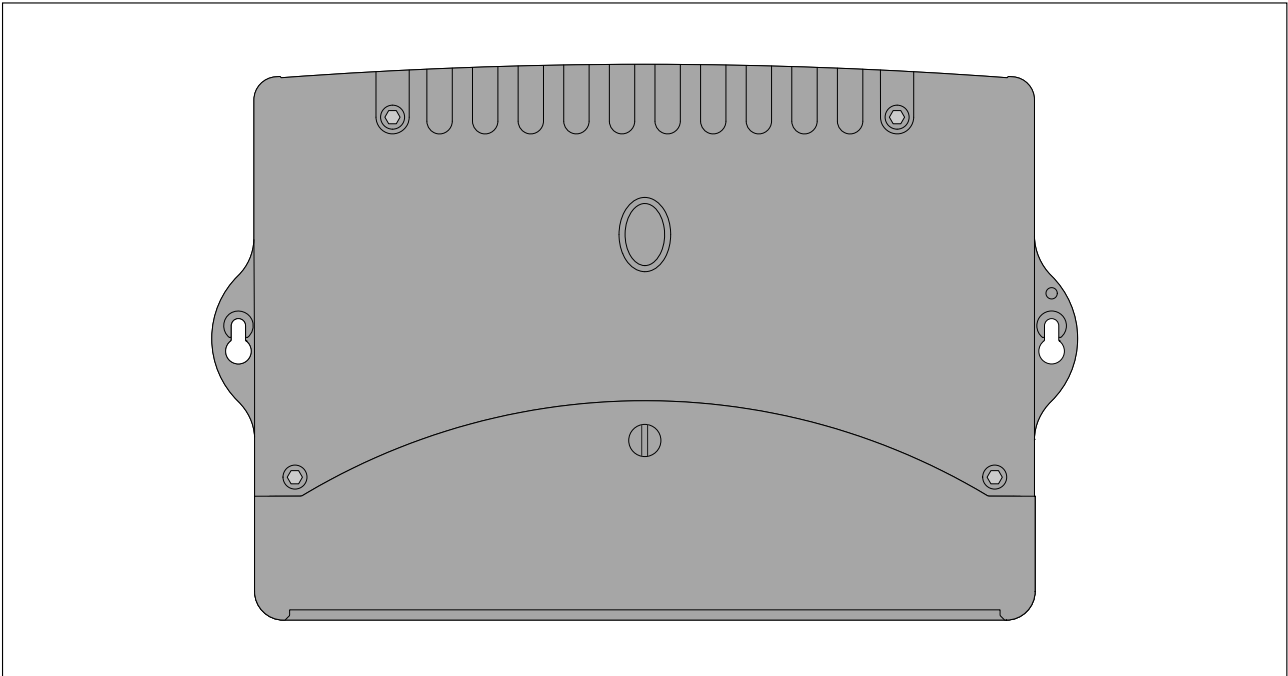
3.3 Compatible multifunction displays

This product is compatible with LightHouse™ 3 Multifunction Displays.

- Axiom
- Axiom+
- Axiom Pro
- Axiom XL

3.4 Lighthouse MFD software requirements

To use this product with a Raymarine LightHouse™ 3 MFD, ensure that your MFD is running software version 3.16 or later.

Note:

The latest MFD software can be obtained by visiting: www.raymarine.com/software

3.5 Required additional components

This product forms part of a system of electronics and requires the following additional components for full operation.

- Compatible Raymarine multifunction display. For a list of compatible multifunction displays refer to **p.24 — Compatible multifunction displays**
- Optional ARPA data source. For more information refer to **p.24 — Radar target acquisition data source requirements**
- Use of the Doppler Radar features requires data sources to be available on your system (e.g. connected to your multifunction display, via SeaTalkng ® or NMEA 0183). For more information refer to: **p.24 — Doppler data source requirements**.

Radar target acquisition data source requirements

Radar target acquisition requires the following data sources to be available on your system (e.g. connected to your multifunction display, via SeaTalkng ® or NMEA 0183).

Data type	Example data source
COG (Course Over Ground)	GPS or GNSS receiver (MFD internal receiver or external receiver).
SOG (Speed Over Ground)	GPS or GNSS receiver (MFD internal receiver or external receiver).
HDG / HDT (True Heading)	Compass or Autopilot sensor providing Fastheading data (e.g. Evolution EV-1 / EV-2).

Doppler data source requirements

Use of the Doppler Radar features requires the following data sources to be available on your system (e.g. connected to your multifunction display, via SeaTalkng ® or NMEA 0183).

Required data sources

Data type	Example data source
COG (Course Over Ground)	GPS or GNSS receiver (MFD internal receiver or external receiver).
SOG (Speed Over Ground)	GPS or GNSS receiver (MFD internal receiver or external receiver).

Recommended data source

Data type	Example data source
HDG / HDT (True Heading)	Compass or Autopilot sensor providing Fastheading data (e.g. Evolution EV-1 / EV-2).

Note:

A Heading data source is not essential for Doppler operation. However it will improve the performance of Doppler mode at slower speeds (< 15 knots), when tide set and leeway are present.

Chapter 4: Parts supplied

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4.1 Parts supplied (pedestal)

Parts illustrated are supplied in the pedestal box:
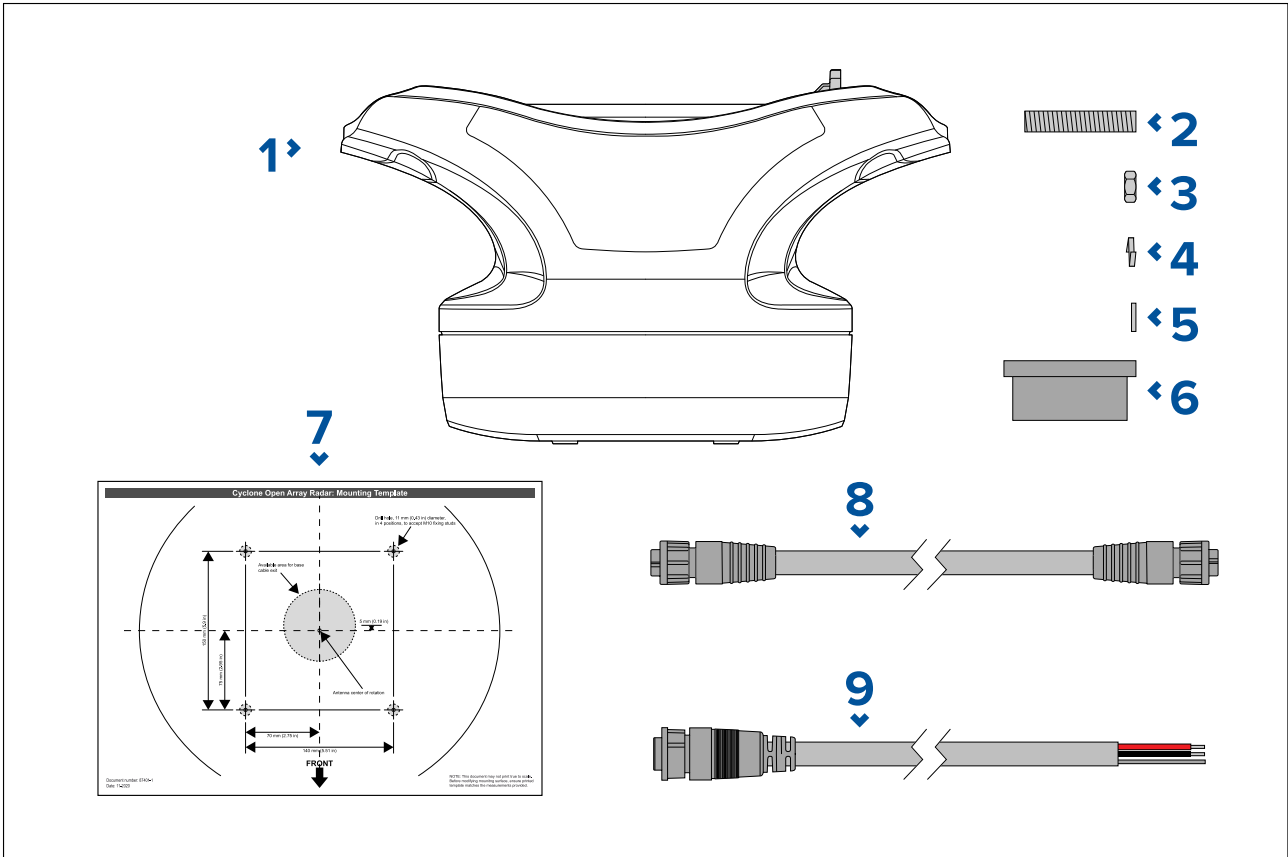
1. Radar pedestal
2. M10 stud x4
3. M10 nut x8
4. M10 spring washer x4
5. M10 plain washer x4
6. Cable gasket
7. Mounting template
8. Radar data cable
9. Power cable

Note:

Power and Data cables are only supplied with certain "topfill" system packs. For more information refer to **p.29 — Topfills / System packs — Cyclone**

4.2 Parts supplied (antenna)

Parts illustrated are supplied in the antenna box:

1. Radar Antenna
2. M8 Hex Bolt x4
3. M8 Plain Washer x4
4. M8 Spring Washer x4
5. O Ring x4

4.3 Topfills / System packs — Cyclone

Cyclone 3 ft Array - 15 m Cables (T70491)
- **E70620**: Cyclone Pedestal
- **E70628**: Cyclone 3 ft Antenna
- **A80653**: Cyclone Power Cable 15 m
- **A80659**: Radar data Cable 15 m
- **E70648**: VCM100

Cyclone 4 ft Array - 15 m Cables (T70492)
- **E70620**: Cyclone Pedestal
- **E70629**: Cyclone 4 ft Antenna
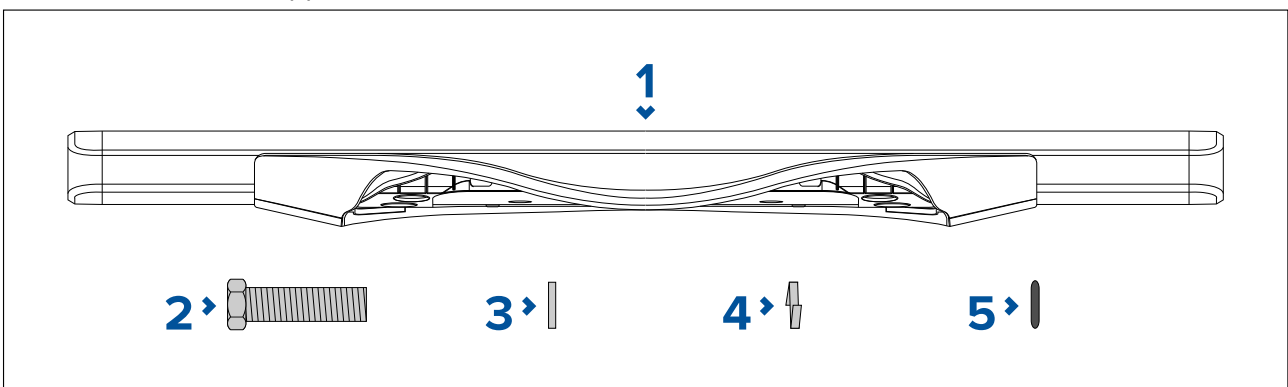- **A80653**: Cyclone Power Cable 15 m
- **A80659**: Radar data Cable 15 m
- **E70648**: VCM100

Cyclone 6 ft Array - 15 m Cables (T70493)
- **E70620**: Cyclone Pedestal
- **E70630**: Cyclone 6 ft Antenna
- **A80653**: Cyclone Power Cable 15 m
- **A80659**: Radar data Cable 15 m
- **E70648**: VCM100

4.4 Topfills / System packs — Cyclone Pro

Cyclone Pro 3 ft Array - 15 m Cables (T70494)
- **E70621**: Cyclone Pro Pedestal
- **E70628**: Cyclone 3 ft Antenna
- **A80653**: Cyclone Power Cable 15 m
- **A80659**: Radar data Cable 15 m
- **E70648**: VCM100

Cyclone Pro 4 ft Array - 15 m Cables (T70495)
- **E70621**: Cyclone Pro Pedestal
- **E70629**: Cyclone 4 ft Antenna
- **A80653**: Cyclone Power Cable 15 m
- **A80659**: Radar data Cable 15 m
- **E70648**: VCM100

Cyclone Pro 6 ft Array - 15 m Cables (T70496)
- **E70621**: Cyclone Pro Pedestal
- **E70630**: Cyclone 6 ft Antenna
- **A80653**: Cyclone Power Cable 15 m
- **A80659**: Radar data Cable 15 m
- **E70648**: VCM100

4.5 Parts supplied (VCM100)

Parts illustrated are supplied in the VCM100 box:
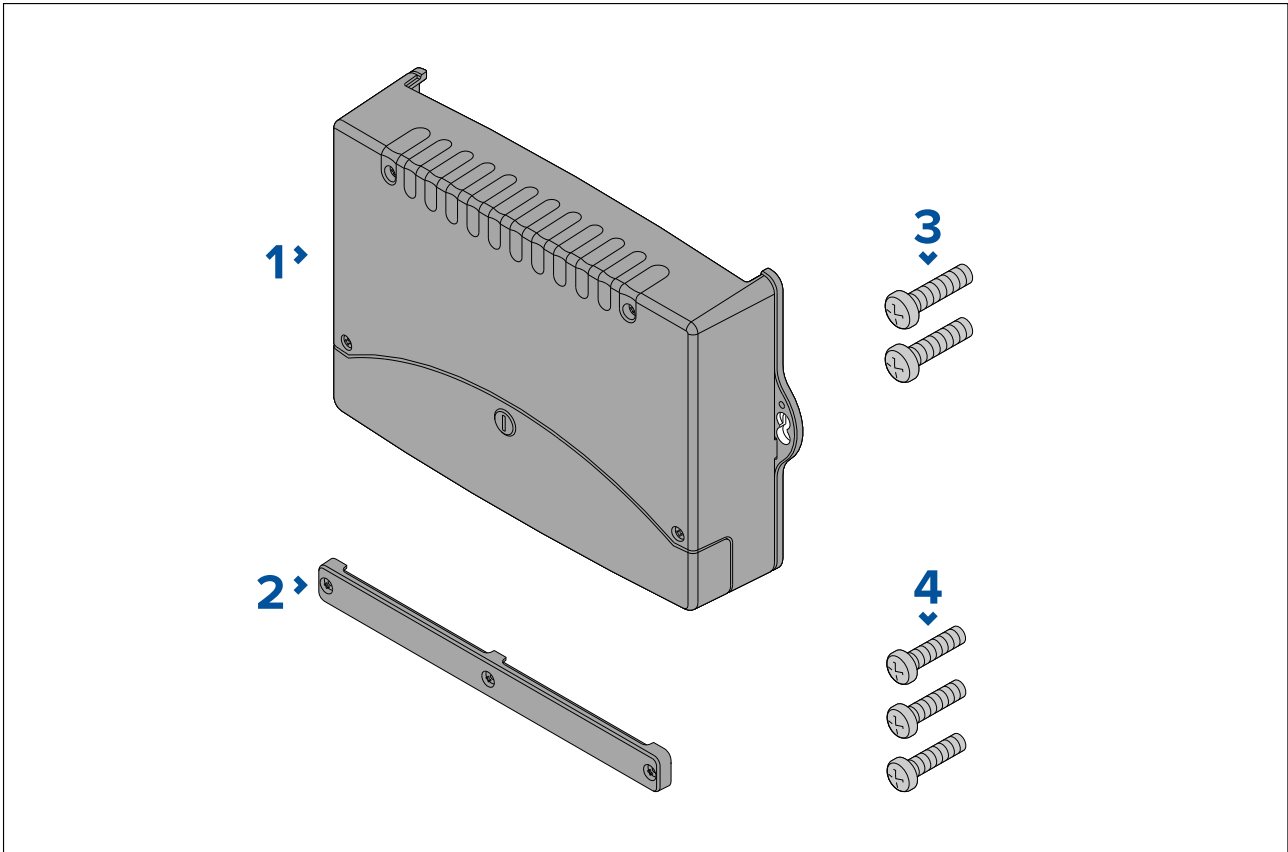
1. VCM100
2. Cable Clamp
3. VCM100 Mounting Screw x2
4. Cable Clamp Mounting Screw x3

Chapter 5: Product dimensions

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5.1 Cyclone series

A — Antenna size is determined by model:

- **E70628** – (36 in array) – 1031 mm (40.5 in)
- **E70629** – (48 in array) – 1336 mm (52.5 in)
- **E70630** – (72 in array) – 1945 mm (76.5 in)

5.2 VCM100 Voltage Convertor Module
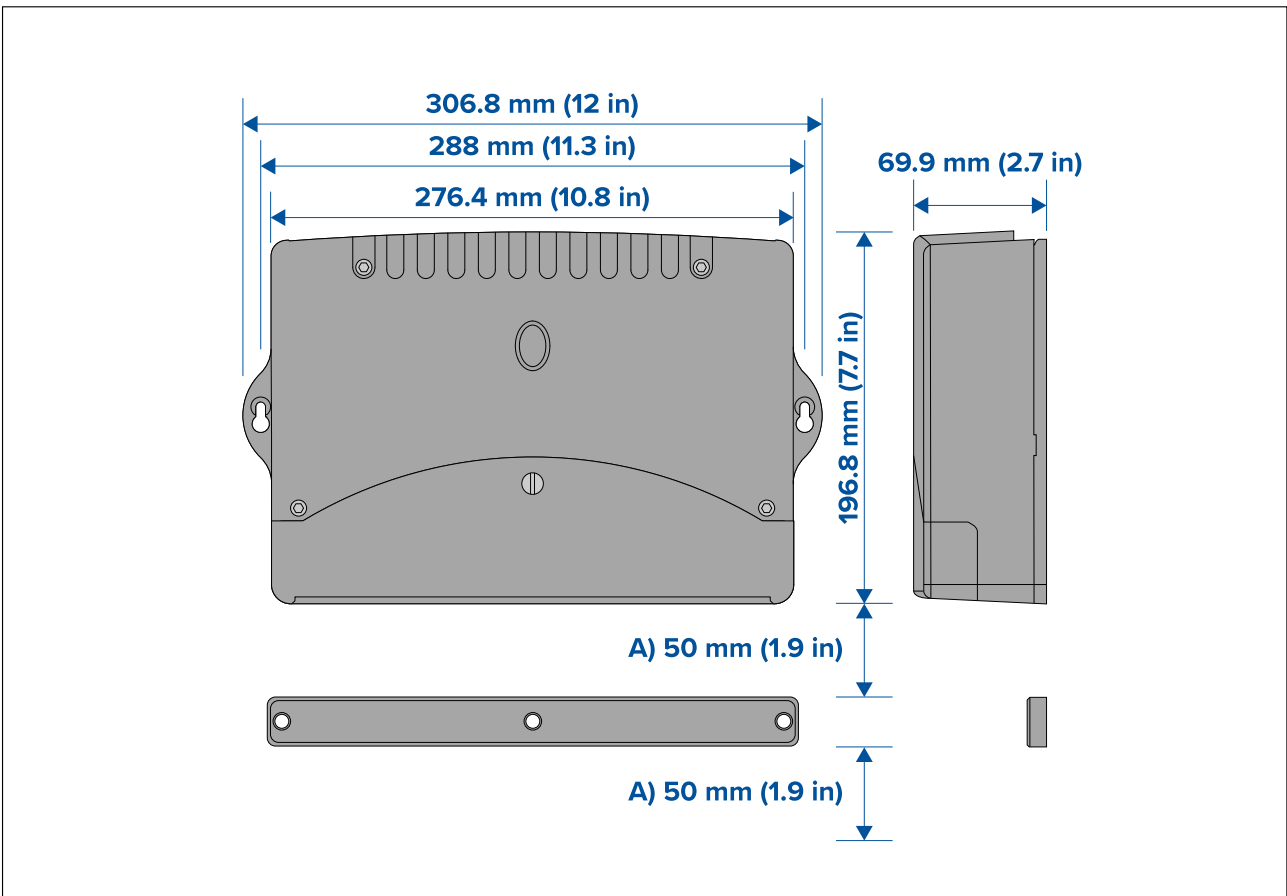
A) — Minimum cable clearance

Chapter 6: Location requirements

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6.1 Potential ignition source

This product is NOT approved for use in hazardous/flammable atmospheres. Do NOT install in a hazardous/flammable atmosphere (such as in an engine room or near fuel tanks).

6.2 Radar position overview

The optimum height for the Cyclone radar 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 vessel's pitching and rolling.
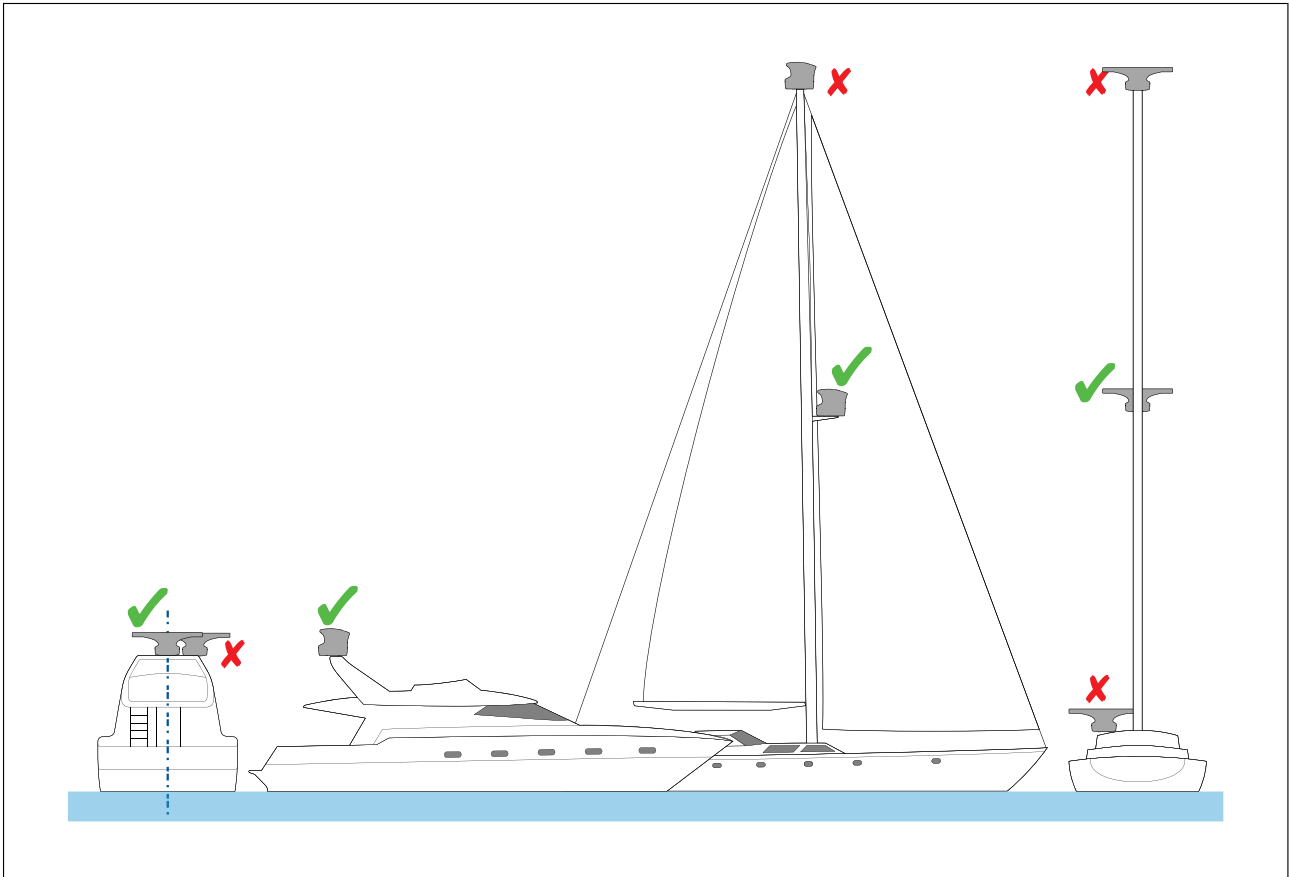
The scanner must also be mounted where it is:

- Above head height.
- Easily accessible.
- As near as possible to the vessel's centerline.
- On a rigid and stable platform, capable of securely supporting the scanner under seagoing conditions.
- For GPS, ensure unobstructed view of the sky. Avoid large structures above the antenna.
- 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 ft) from a magnetic compass or other scanners.

6.3 Radar scanner general location requirements

When selecting a location it is important to consider a number of factors.

Horizontal position

The radar scanner should be positioned as near as possible to your vessel's centerline.

Height

The radar scanner should normally be mounted as high as practical above the waterline:

- Mount the scanner above head height out of range of personnel, to avoid mechanical danger and minimize exposure to electromagnetic radiation.

- Radar operates at the line-of-sight, so a high mounting position gives better long range performance.

- Surrounding large objects, in the same horizontal plane, can interfere with the radar signal and cause blind areas or shadow sectors and false targets on the radar display (see below).

Do not mount the radar scanner so high that it is affected by the pitching and rolling of the vessel.

Shadow areas and false echoes

Mount the radar scanner away from large structures or equipment, such as engine stacks, searchlights, horns, or masts. These objects may cause shadow areas and false echoes. For example, if you mount the radar scanner on a mast, echoes from other targets may be reflected from the mast. Wet sails may also cause shadow areas, so radar performance may be reduced in the rain. It is particularly important to avoid shadow areas near the bow. Raising or even lowering the radar scanner may help to reduce these effects.

In shadow areas beyond the obstruction there will be a reduction of the beam intensity. There may be a blind sector if the beam intensity is not sufficient to obtain an echo from an object. This may occur even at close range. For this reason the angular width and relative bearing of any shadow area must be determined at installation.

You may be able to detect shadow areas or false echoes on your multifunction display. For example, sea clutter can be used as a good indicator of blind arcs. Dark sectors on the radar display indicate possible shadowed areas. This information should be posted near the display unit and operators must be alert for targets in these blind areas.

Access

The radar scanner should be easily accessible to allow maintenance to be carried out safely. Sufficient clearance must be allowed to fully open the scanner unit for maintenance and service.

Mounting platform

The radar scanner must be mounted on a rigid and stable platform. The platform must be capable of supporting the mass and inertia of the radar scanner under seagoing conditions. The platform should not twist (causing bearing errors) or be subject to excessive vibration or shock.

The platform must be free-draining, to prevent the pooling of water beneath the radar scanner.

The mounting site must be clear of the following:

- Ropes.

- Standing rigging.

- Running rigging.

- Heat.

- Fumes.

- People.

Magnetic compass

Mount the radar scanner at least 1 m away from a magnetic compass.

Multiple radar scanners

If two radar scanners are installed at different locations in a dual radar system, care should be taken to allow for the difference in position of the radars when switching between the two on your multifunction display. This is especially noticeable at short ranges on larger vessels.

To reduce possible interference between radar scanners in a dual radar system:

- Maximise the spacing between the scanners.

- If possible, locate the scanners so that they are aligned vertically, one directly above the other, with a minimum of 2 metres vertical separation.

- If the scanners can't be aligned one directly above the other, locate each scanner the same distance from the bow your vessel. Interference is more likely if the scanners are installed one in front of the other, even when separated vertically.

Cables

- 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.

- Where a cable passes through an exposed bulkhead or deckhead, use a watertight feed-through.

6.4 Compass safe distance

To prevent potential interference with the vessel's magnetic compasses, ensure an adequate distance is maintained from the product.

When choosing a suitable location for the product you should aim to maintain the maximum possible distance from any compasses. Typically this distance should be at least 1 m (3.3 ft) in all directions. However for some smaller vessels it may not be possible to locate the product this far away from a compass. In this situation, when choosing the installation location for your product, ensure that the compass is not affected by the product when it is in a powered state.

6.5 Radar scanner mounting angle

Ensure the Radar scanner rotates parallel to the water line.

The Radar beam from the Radar scanner is approximately 25° wide in the vertical direction, to give good target detection even when your vessel pitches and rolls.
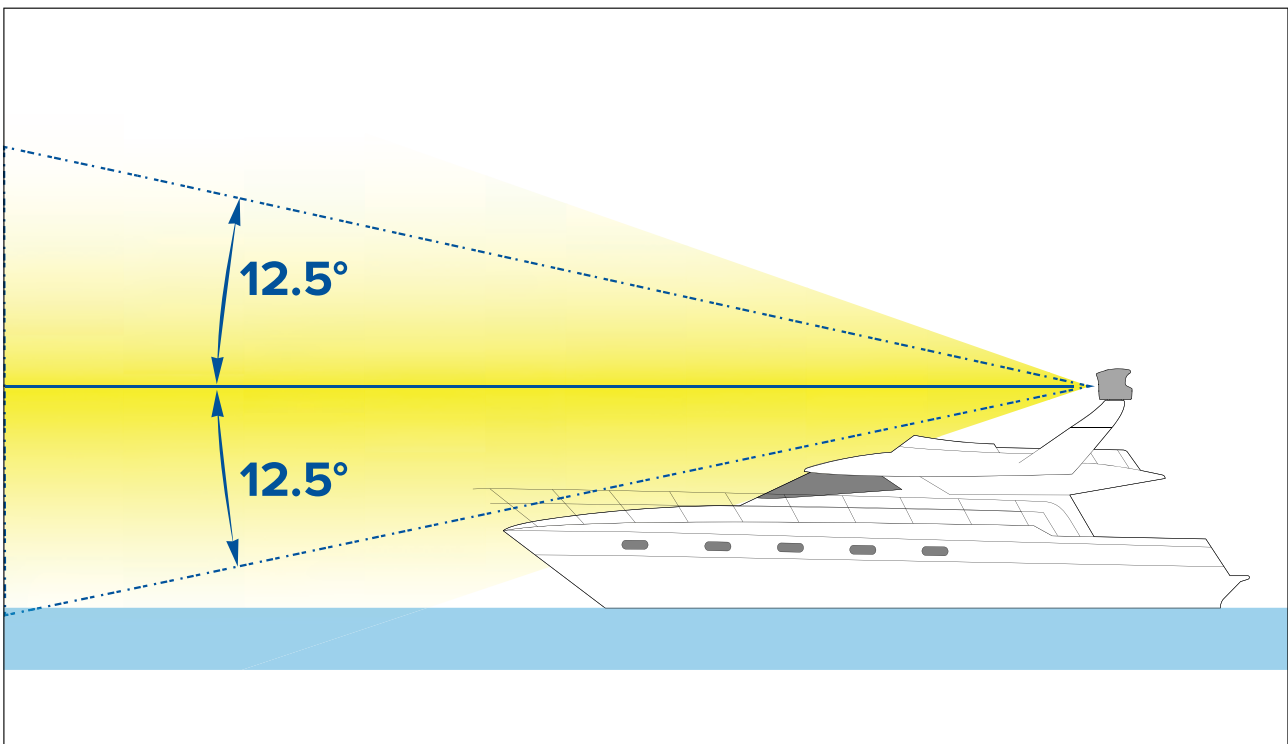
Planing hull vessels, and some displacement hull vessels, adopt a higher bow angle when the vessel is at cruising speed. This may raise the Radar's main radiation angle, and can cause poor detection of nearby targets. It may be necessary to compensate for the bow rise to ensure optimum target detection. This can be achieved by fitting a wedge or washers between the mounting platform and the base of the Radar scanner, so that the Radar beam remains parallel to the water line when the vessel's bow rises at cruising speed.
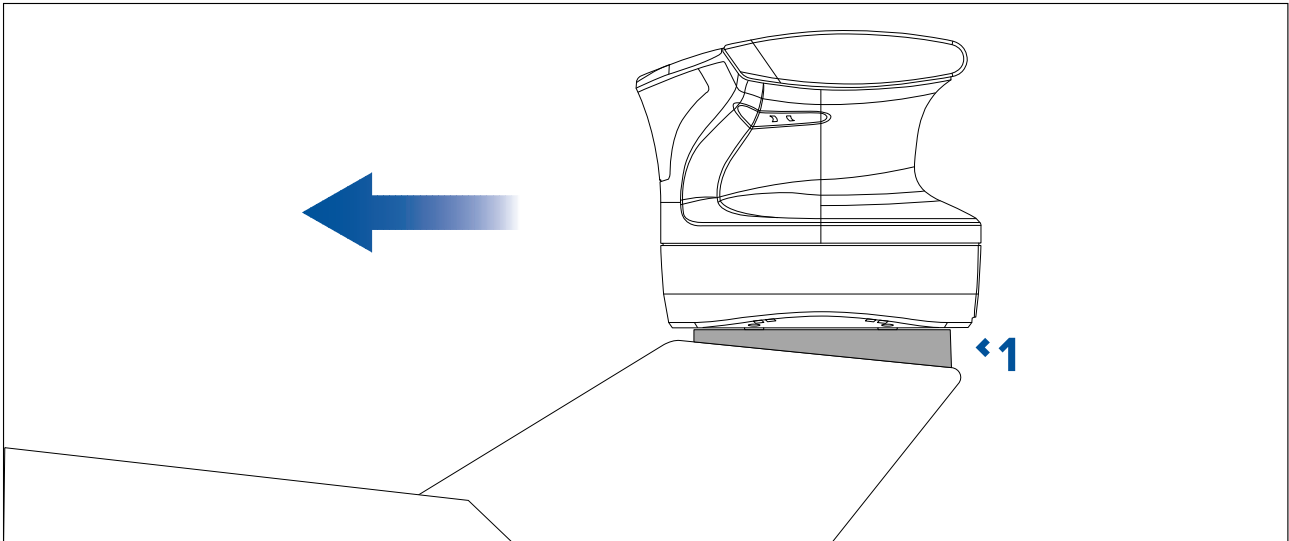
1.   Wedge or washers

6.6 Multiple Radar scanners — location requirements

Important location considerations when installing multiple radar scanners on the same vessel.

- Scanners should be mounted above each other, vertically separated by at least 0.5 m (1.6 ft). This applies to all installation locations on the vessel.
- Multiple scanners should be mounted in a way that minimizes interference between the vertical beamwidths of the 2 scanners.
- In all cases, you should aim to achieve as much physical separation as possible, to minimize any potential interference.

6.7 VCM100 location requirements

When selecting a mounting location it is important to consider a number of factors.

Ventilation

- Ensure that equipment is mounted in a compartment of suitable size.
- Ensure that ventilation holes are not obstructed. Allow adequate separation of equipment.

Mounting surface

Ensure equipment is adequately supported on a secure surface. Do not mount units or cut holes in places which may damage the structure of the vessel.

Cables

Ensure the unit is mounted in a location which allows proper routing and connection of cables:

- Minimum bend radius of 100 mm (3.94 in) unless otherwise stated.
- Use cable supports to prevent stress on connectors.
- The maximum length of cable between the battery and the VCM100 should not normally exceed 19.6 ft. (6 M). All power cable lengths should be kept as short as possible.

Water ingress

The VCM100 is splashproof, and suitable for mounting below decks only.

Electrical interference

Select a location that is far enough away from devices that may cause interference, such as motors, generators and radio transmitters/receivers.

Magnetic compass

Mount the VCM100 at least 3 ft (1 m) away from a magnetic compass.

Power supply

Select a location that is as close as possible to the vessel's DC power source. This will help to keep cable runs to a minimum.

Chapter 7: Cables and connections

Chapter contents

7.1 General cabling guidance

Cable types and length

It is important to use cables of the appropriate type and length.

- Unless otherwise stated only use cables supplied by Raymarine.
- Where it is necessary to use non-Raymarine cables, ensure that they are of correct quality and gauge for their intended purpose. (e.g.: longer power cable runs may require larger wire gauges to minimize voltage drop along the run).

Cable routing

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

- Do NOT bend cables excessively. Wherever possible, ensure a minimum bend diameter (Ø) of 200 mm (7.87 in) / minimum bend radius (R) of 100 mm (3.94 in).

Ø 200 mm (7.87 in) /
R 100 mm (3.94 in) Min.
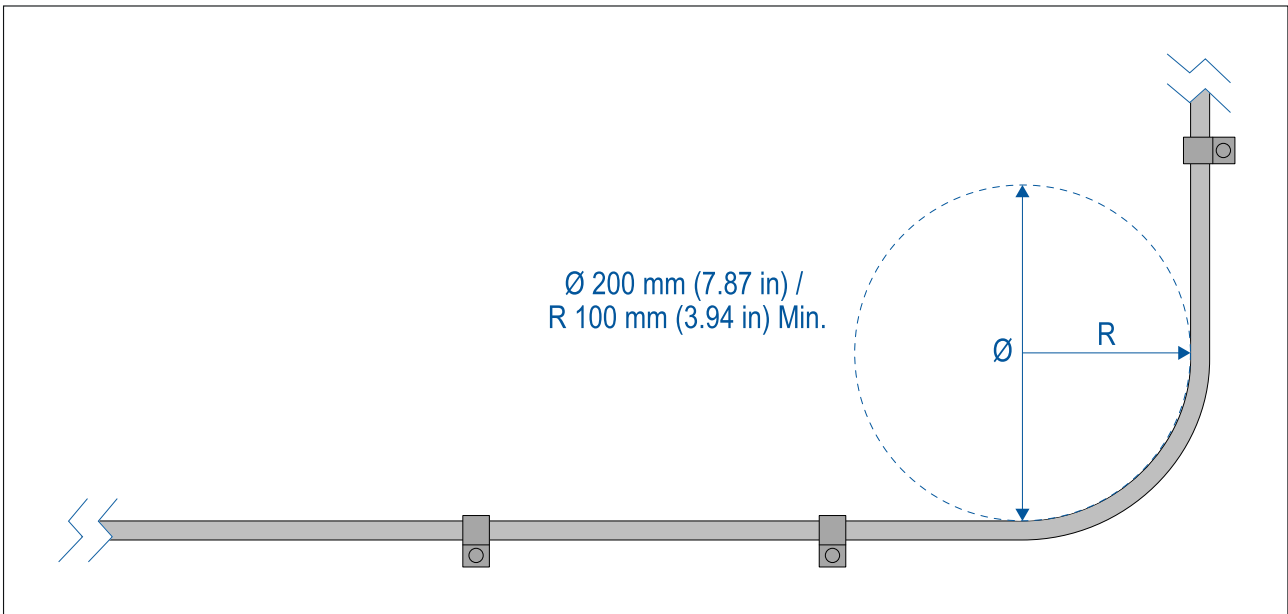
- Protect all cables from physical damage and exposure to heat. Use trunking or conduit where possible. Do NOT run cables through bilges or doorways, or close to moving or hot objects.
- Secure cables in place using cable clips or cable ties. Coil any excess cable and tie it out of the way.
- Where a 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,
  - antennas.

Strain relief

Use adequate strain relief for cabling to ensure that connectors are protected from strain and will not pull out under extreme sea conditions.

Circuit isolation

Appropriate circuit isolation is required for installations using both AC and DC current:

- Always use isolating transformers or a separate power-inverter to run PC's, processors, displays and other sensitive electronic instruments or devices.
- Always use an isolating transformer with Weather FAX audio cables.
- Always use an isolated power supply when using a 3rd party audio amplifier.
- Always use an RS232/NMEA converter with optical isolation on the signal lines.

- Always make sure that PC's or other sensitive electronic devices have a dedicated power circuit.

Cable shielding

Ensure that cable shielding is not damaged during installation and that all cables are properly shielded.

Suppression ferrites

- Raymarine cables may be pre-fitted or supplied with suppression ferrites. These are important for correct EMC performance. If ferrites are supplied separately to the cables (i.e. not pre-fitted), you must fit the supplied ferrites, using the supplied instructions.

- If a ferrite has to be removed for any purpose (e.g. installation or maintenance), it must be replaced in the original position before the product is used.

- Use only ferrites of the correct type, supplied by Raymarine or its authorized dealers.

- Where an installation requires multiple ferrites to be added to a cable, additional cable clips should be used to prevent stress on the connectors due to the extra weight of the cable.

7.2 Cyclone connections overview

The Cyclone Open Array Radar includes the following connectors:
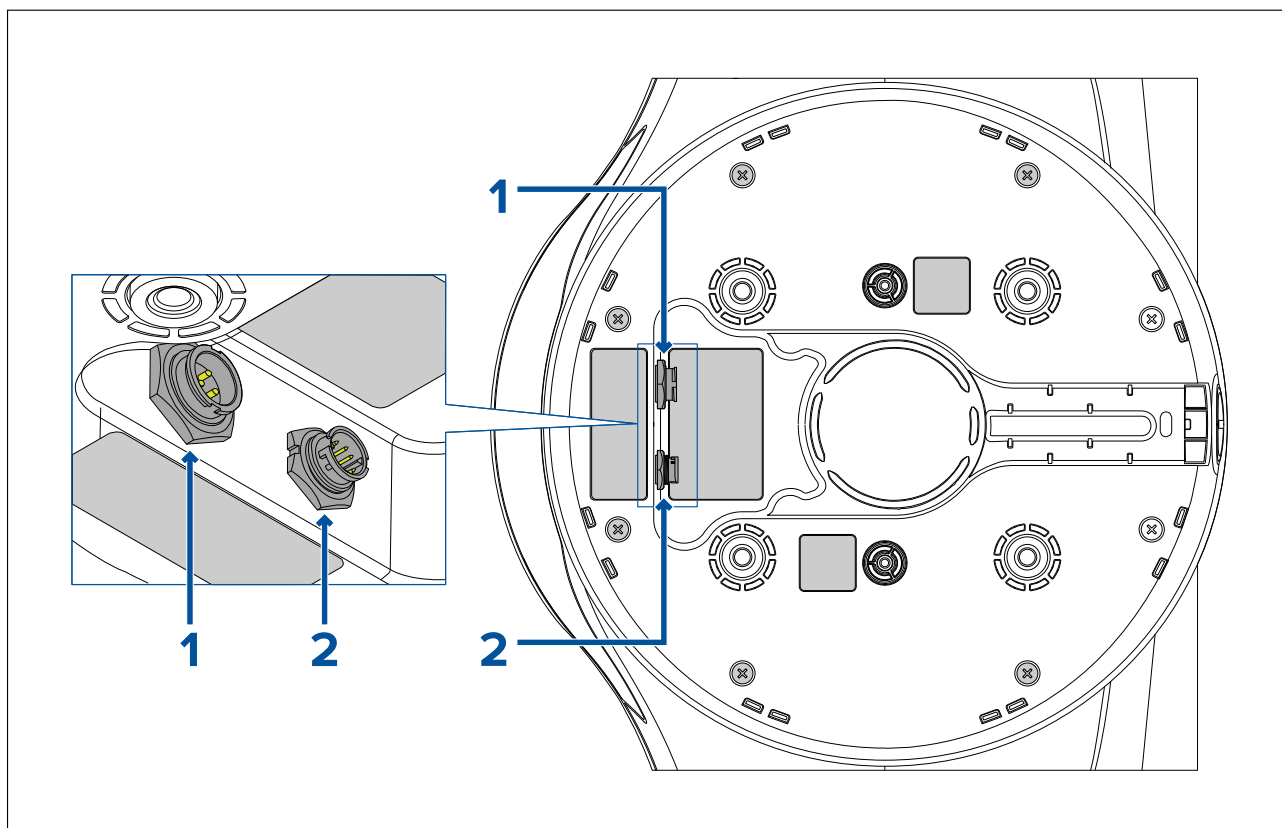
1. Power connector — Connects to the Cyclone power cable
2. RayNet connector — Connects to a (RayNet) Radar data cable

7.3 Cable routing options

You can route the power cable and data cable away from the radar in different ways.

The routing options allow for the cable to exit the radar in two different positions — the option you choose will depend on the radar mounting location.

1. **Rear cable exit** — if the radar is mounted on an extended flat surface, and the cable cannot be routed through the surface.

2. **Surface cable exit** — if the radar is mounted on a flat surface, and the cable can be routed through the surface.

Rear exit
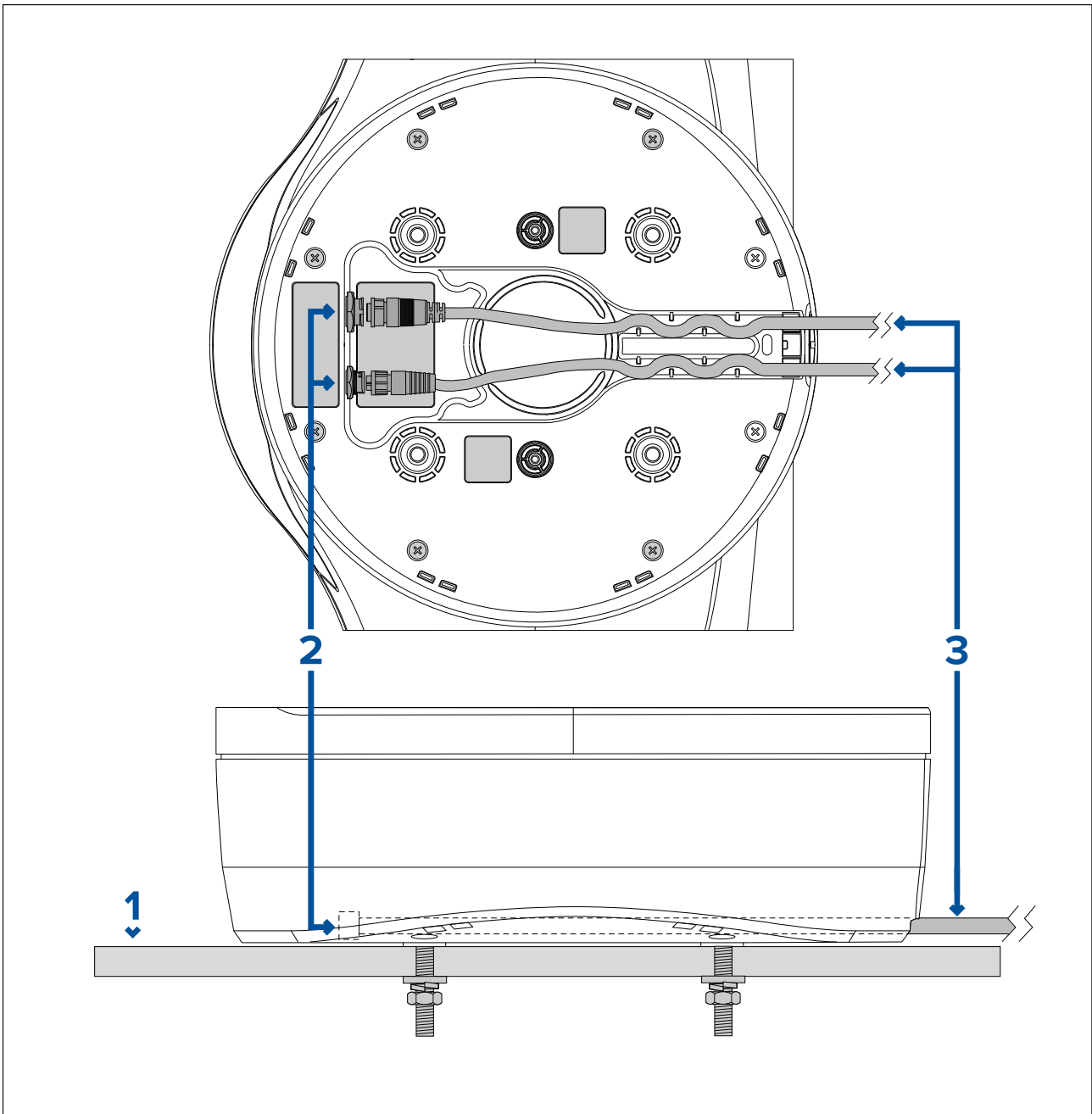
1. Mounting surface
2. Power and RayNet connectors
3. Power and RayNet cables

Through-surface cabling

In this mounting configuration, the Cyclone power and RayNet cables are passed through the mounting surface, via the cable exit aperture on the underside of the pedestal.

Important:

To prevent water ingress, the cable exit aperture on the underside of the pedestal must be completely **sealed with a suitable marine-grade sealant or adhesive**, as described in the following instructions:

1. Connect the power and RayNet cables to the pedestal. **Do NOT supply power to the cables at this time.**

2. **Before** laying the cables in the exit channels on the underside of the pedestal, apply sealant to each of the cable exit channels at the point where the cables pass through them, as shown in (4) in the illustration below.
3. Lay the cables in the channels.
4. Pass the cables through the aperture on the underside of the pedestal, and then through the supplied cable gasket.
5. Push the cables fully into the slits in the cable gasket, as shown in the illustration below.
6. Apply sealant all around the cables at the point where they enter the gasket, as shown in (6) in the illustration below. **Ensure 360° coverage all around the cable entries.**
7. Carefully insert the cable gasket into position in the underside of the pedestal.
8. Seal all around both the top and bottom perimeters of the cable gasket, as shown in (7), to ensure a watertight seal with the pedestal. **Take care to avoid disturbing the sealant around the cable entries.**
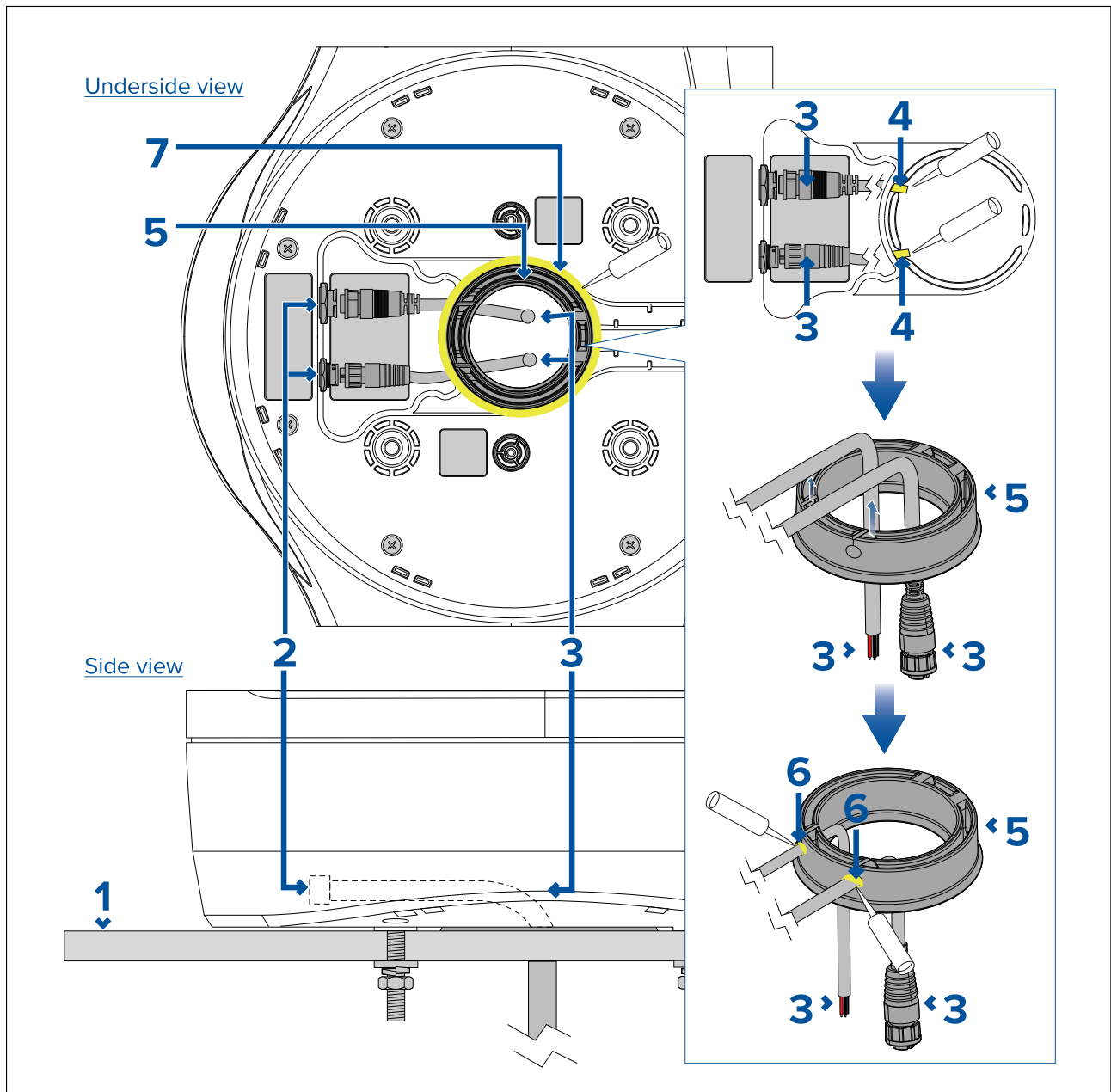
Chapter 8: Installation

Chapter contents

8.1 Warnings and cautions

Important: Before proceeding, ensure that you have read and understood the warnings and cautions provided in the Chapter 1 **Important information** section of this document.

8.2 Schematic diagram

A schematic diagram is an essential part of planning any installation. It is also useful for any future additions or maintenance of the system. The diagram should include:

- Location of all components.
- Connectors, cable types, routes and lengths.

8.3 Tools required

The following tools are required for installation.
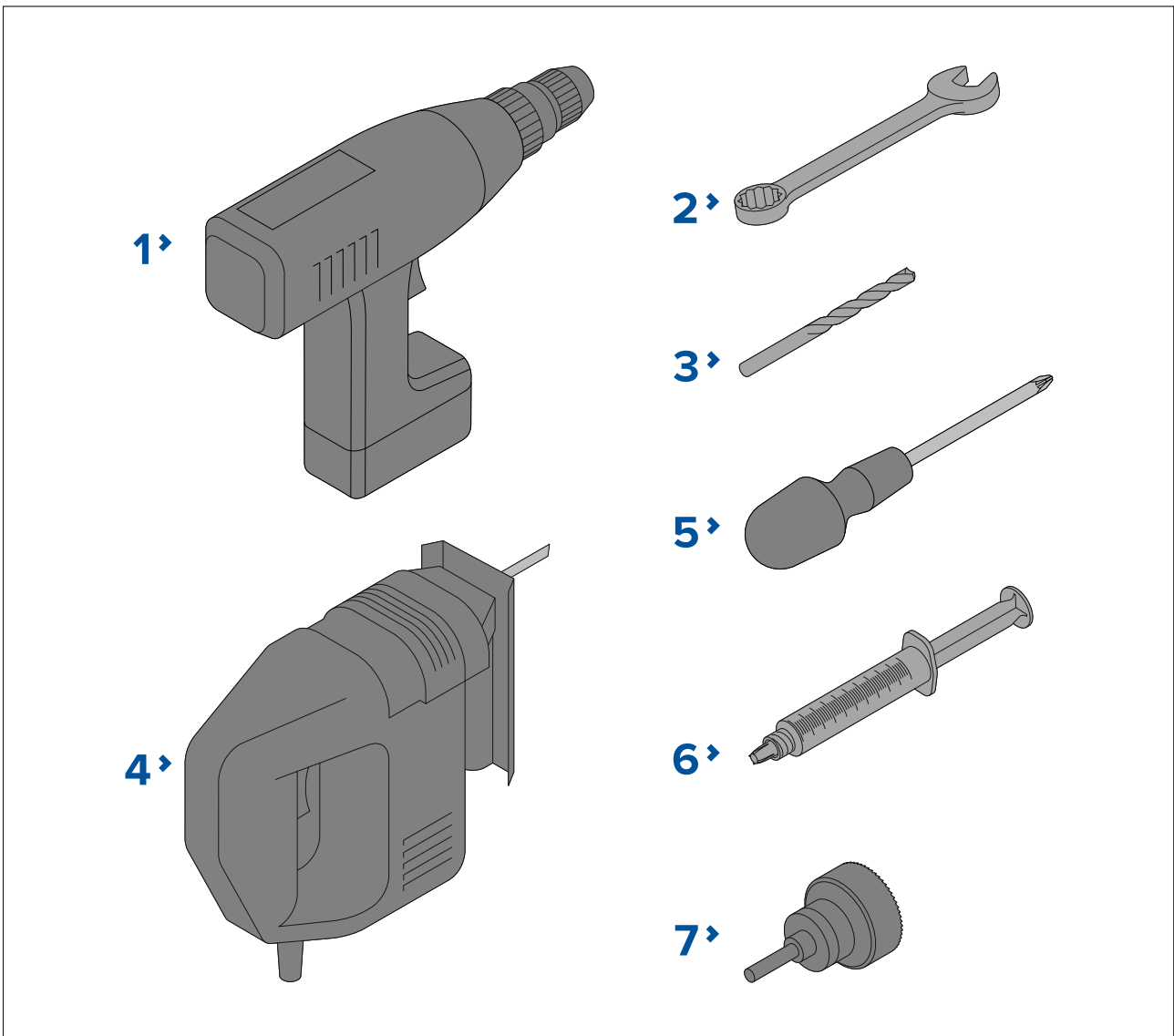
1. Drill
2. 13 mm (0.5 in) and 17 mm (0.6 in) spanner
3. Drill bit (appropriate size dependent on thickness and material of mounting surface)
4. Jigsaw
5. Pozi-drive screwdriver
6. Denso paste
7. 50 mm (2 in.) Hole saw

8.4 Mounting

Cyclone

Mounting the pedestal

Before mounting the unit, ensure that you have:

- Selected a suitable location.
- Identified the cable connections and route that the cables will take.

> **Important:**
>
> Prepare suitable lifting equipment (e.g. steel cable or chain) to lift the pedestal into place in its final mounting position, prior to securing the mounting bolts. The lifting equipment must be of a suitable gauge and strength capable of bearing the pedestal's weight of 16 Kg (as a minimum), and also capable of passing through the 20 mm eyebolt hole on the pedestal. Additionally, you must also carefully consider the impact force on the lifting equipment, in the event that the pedestal falls before it is secured to the mounting surface. **Do NOT attach the antenna to the pedestal prior to lifting.**

1. Check the selected location. A clear, flat platform is required for mounting the pedestal unit.

> **Important:**
>
> For more information refer to **p.33 — Location requirements**

2. Fix the supplied mounting template to the platform, using masking or self-adhesive tape.

> **Important:**
>
> Ensure the mounting template is orientated correctly.
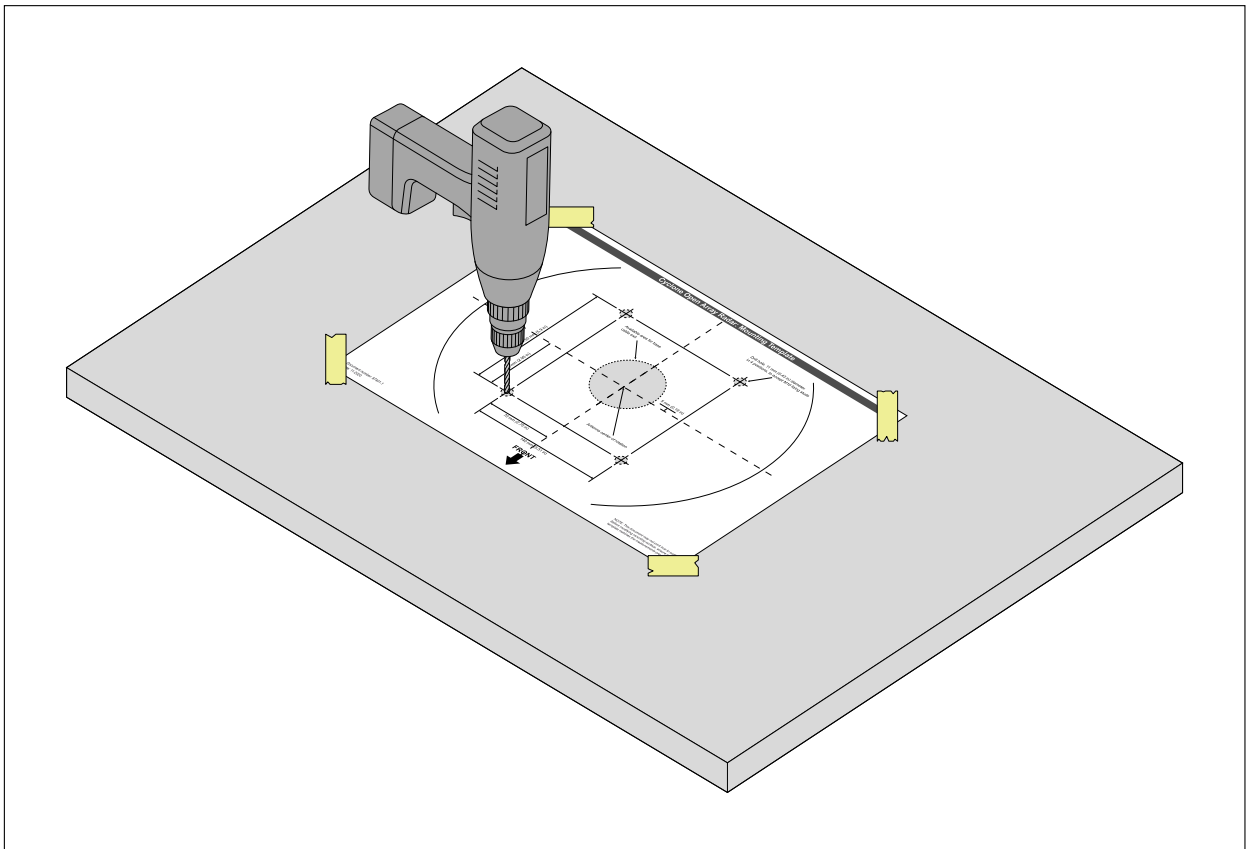
3. Using a 3 mm drill bit, drill the 4 holes, as indicated on the mounting template. Check that the holes have been drilled in the correct position.
4. Using an 11 mm drill bit, drill through the 4 holes.

5. If you plan to route your cables through the mounting surface, cut the cable hole out using a jigsaw.
6. Remove the mounting template.
7. The pedestal has a transit cover fitted over the open array. This cover must be left in place until the open array antenna is fitted to the pedestal.
8. Insert the studs no more than 11 mm into the holes in the pedestal base, and hand-tighten. If the supplied studs are not long enough for the mounting surface thickness, use M10 stainless steel, grade A4-70 studding of a suitable length.

Important:

Ensure the vents on the underside are not blocked.
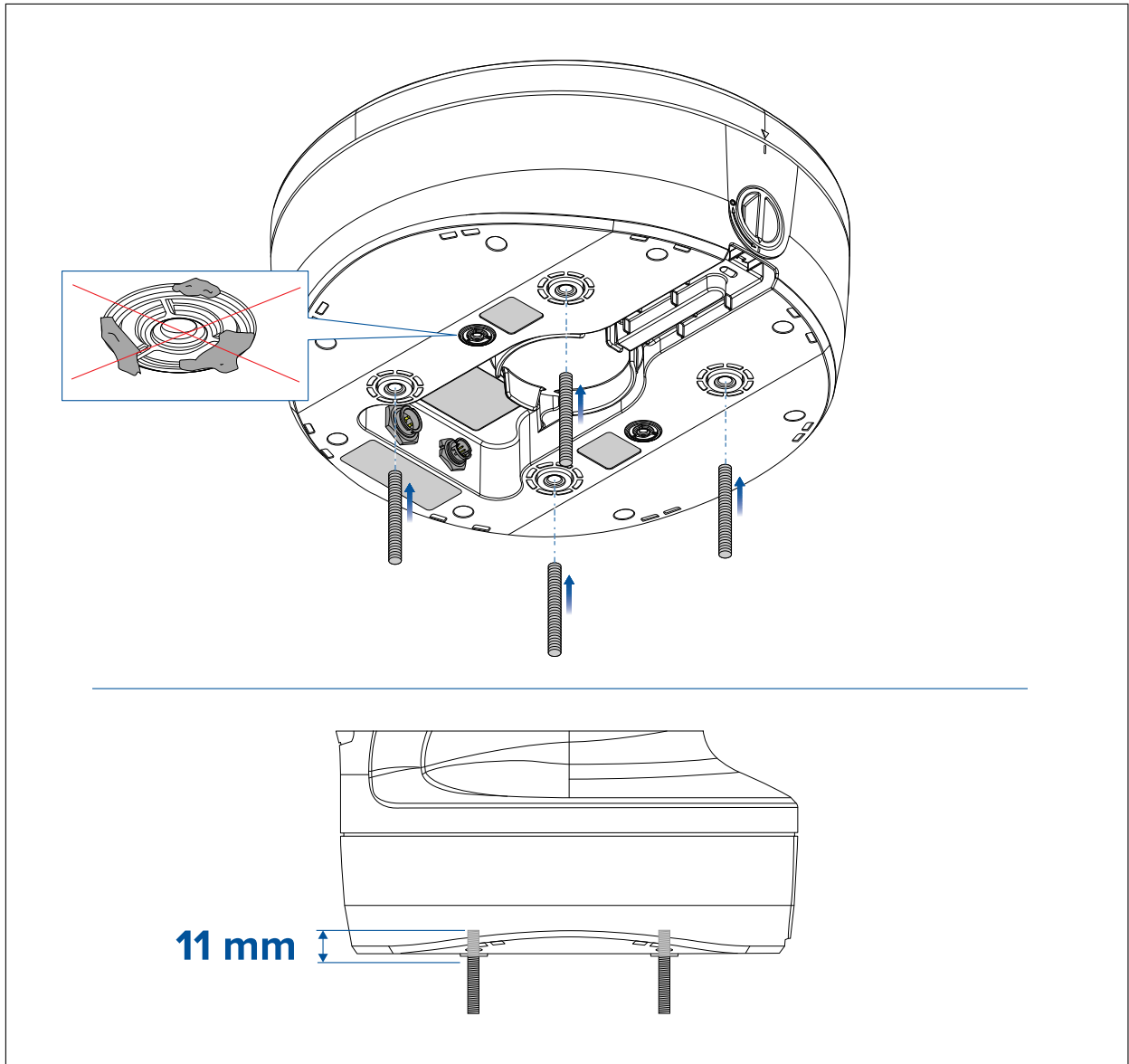
9. Pass a a suitable steel cable or chain through the 20 mm eyebolt holes. Once secure, lift the pedestal and test it fits correctly in its final mounting position.

Important:

Ensure the pedestal is orientated correctly.
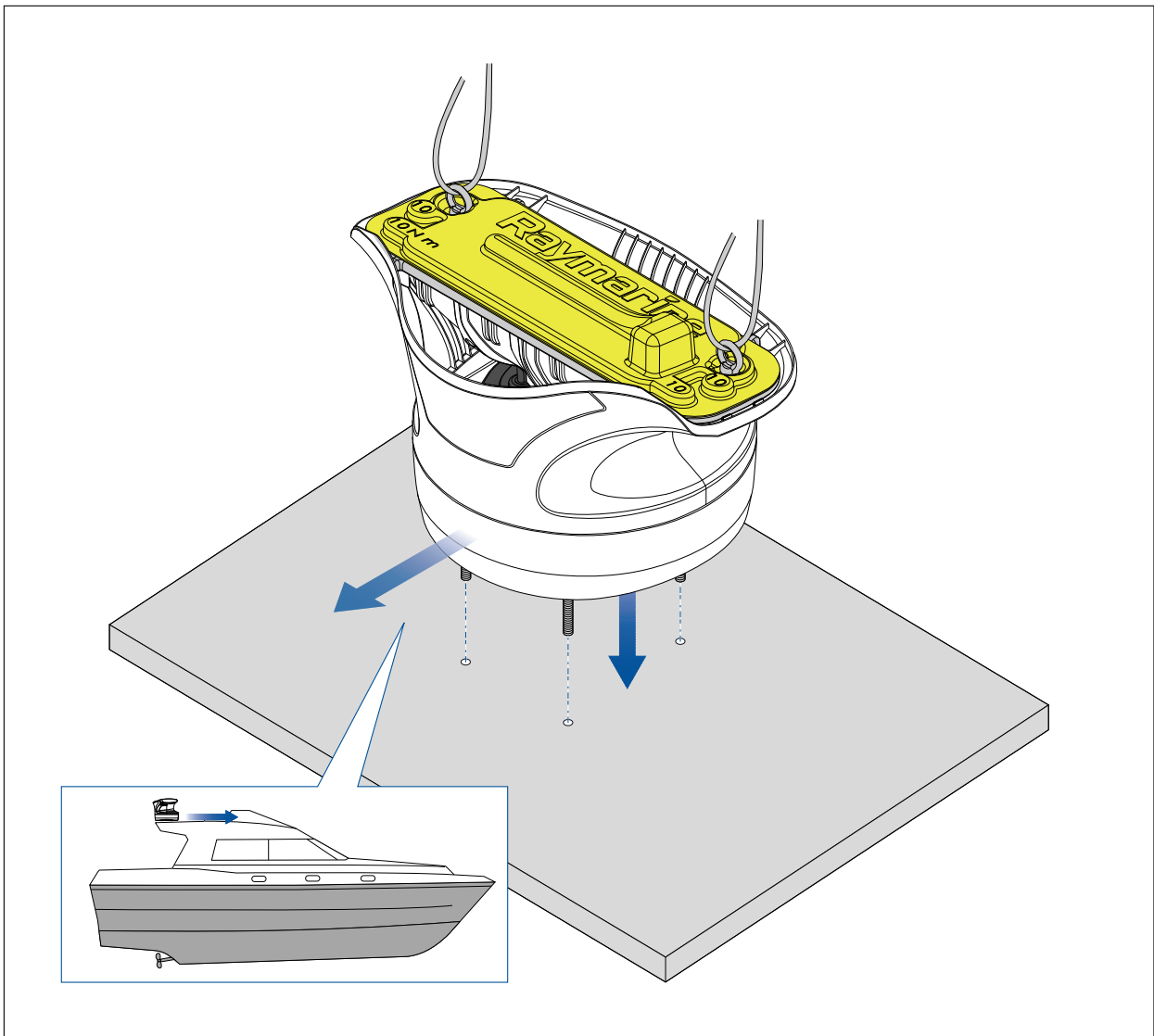
10. Lift the pedestal up and connect the power and data cables to the connectors on the underside of the pedestal. Organise the cables in accordance with your planned cable routing and place the pedestal back into position. **Ensure that you refer to the relevant cable routing instructions before proceeding to the next step:**

   i.   For **Rear exit cabling**, refer to:

   ii. For **through-surface cabling**, refer to:

Important:

Ensure that power is NOT supplied to the cables during the installation procedure.

11. Grease the 4 metal studs with Denso paste.

12. Referring to the following illustration, use the 4 nuts and associated washers to secure the pedestal to the platform. Tighten each nut to 30 Nm (22.1 lb ft).

6 mm
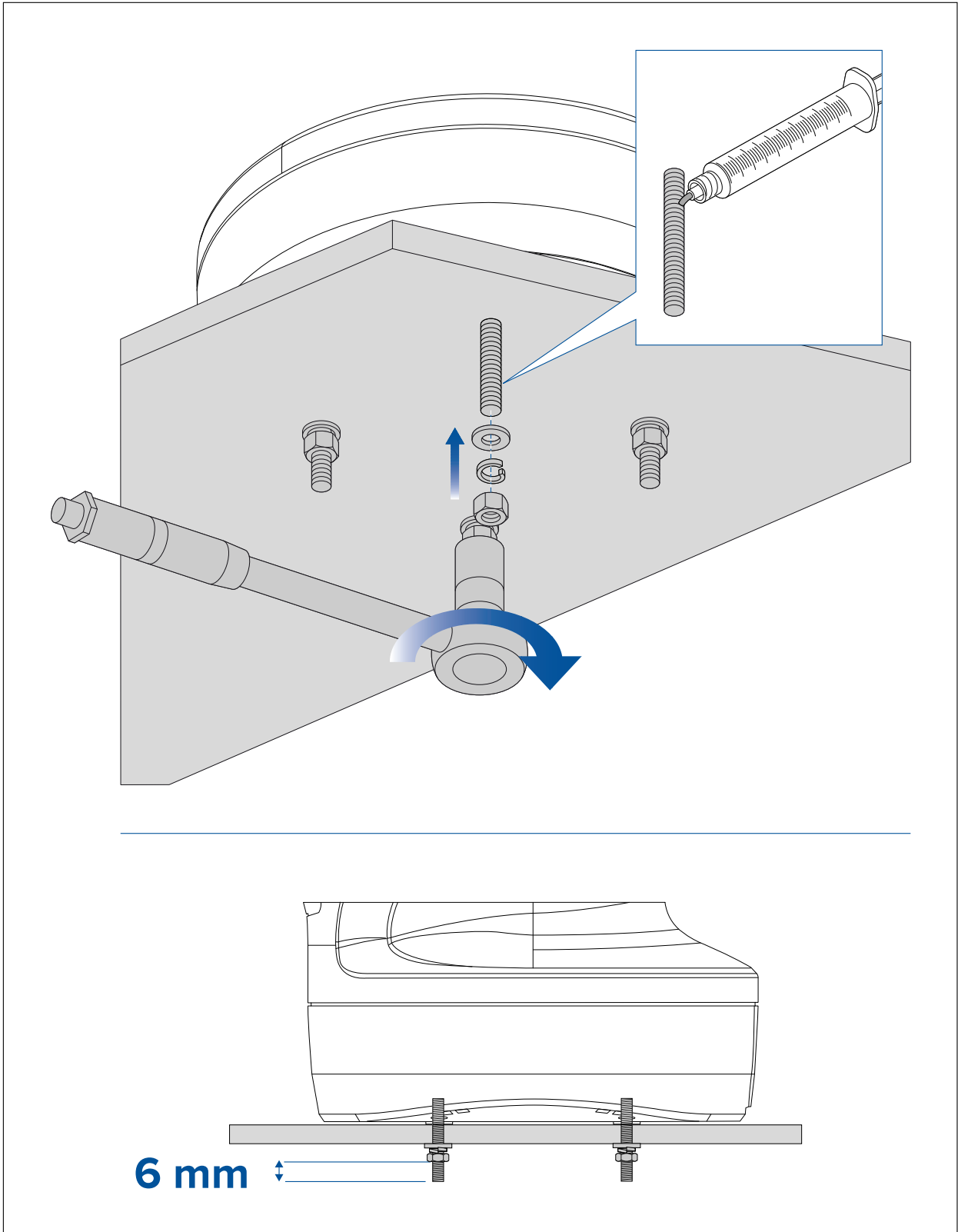
13. Ensure all 4 sets of nuts and washers are used to secure the pedestal to the mounting platform. There should be no more than 6 mm of excess stud below the nut. Cut-off any excess stud.

Attaching the antenna

Before attaching the antenna to the pedestal unit, ensure that:

- The pedestal base is securely fixed to the platform.
- Power and data cables are connected securely and routed correctly, but are NOT powered.
- The pedestal power switch is in the OFF position.

1. Unscrew the eyebolts and remove the transit cover.

Important:

Take care not to damage the open array's delicate contacts when removing the cover.
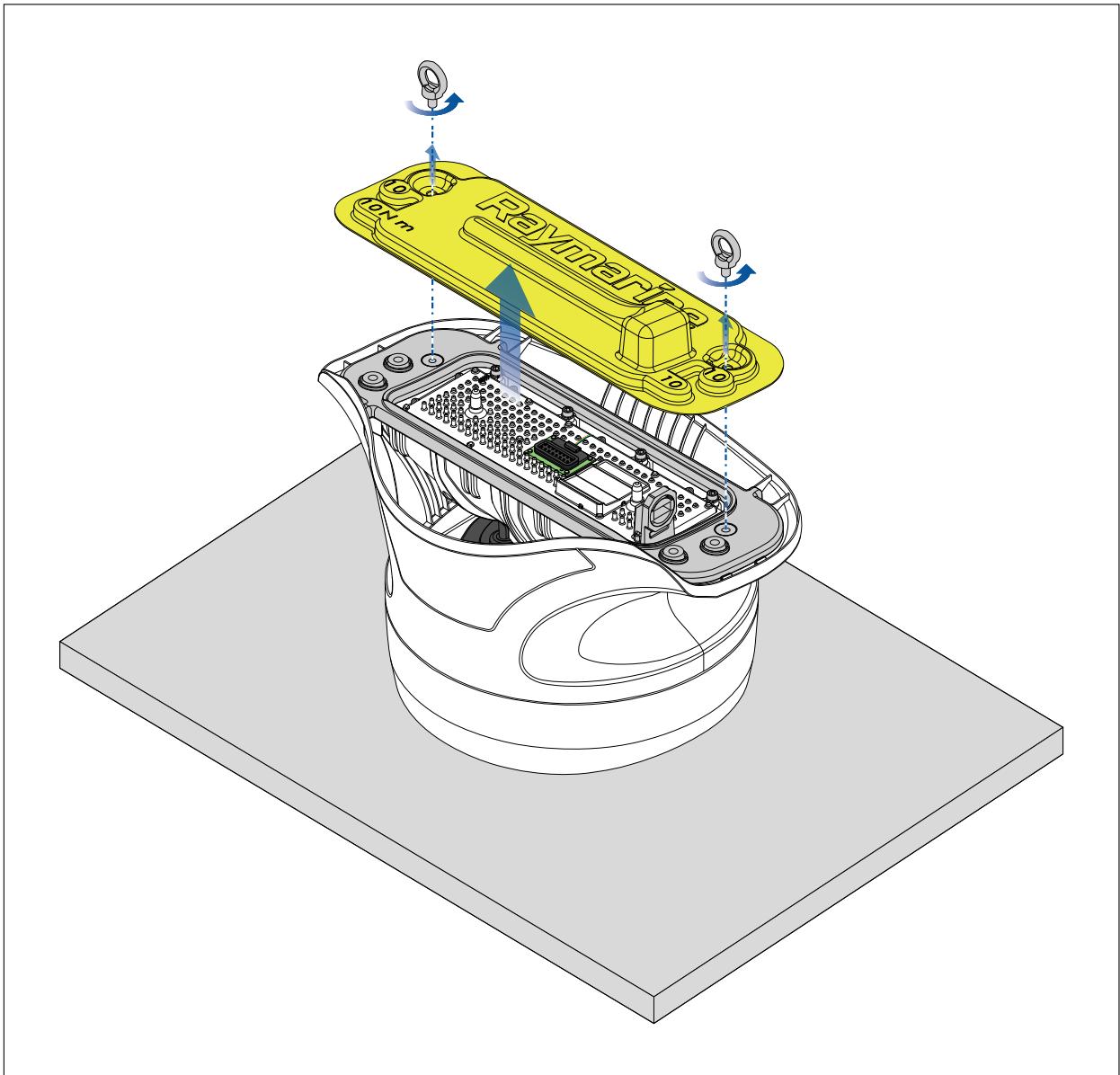
2. Referring to the following illustration, lower the antenna onto the pedestal, placing the front on first and clipping it in place.
3. Using the 4 hex bolts and associated washers and O rings, secure the antenna to the pedestal. Tighten each nut to 10 N m (7.4 lb ft).
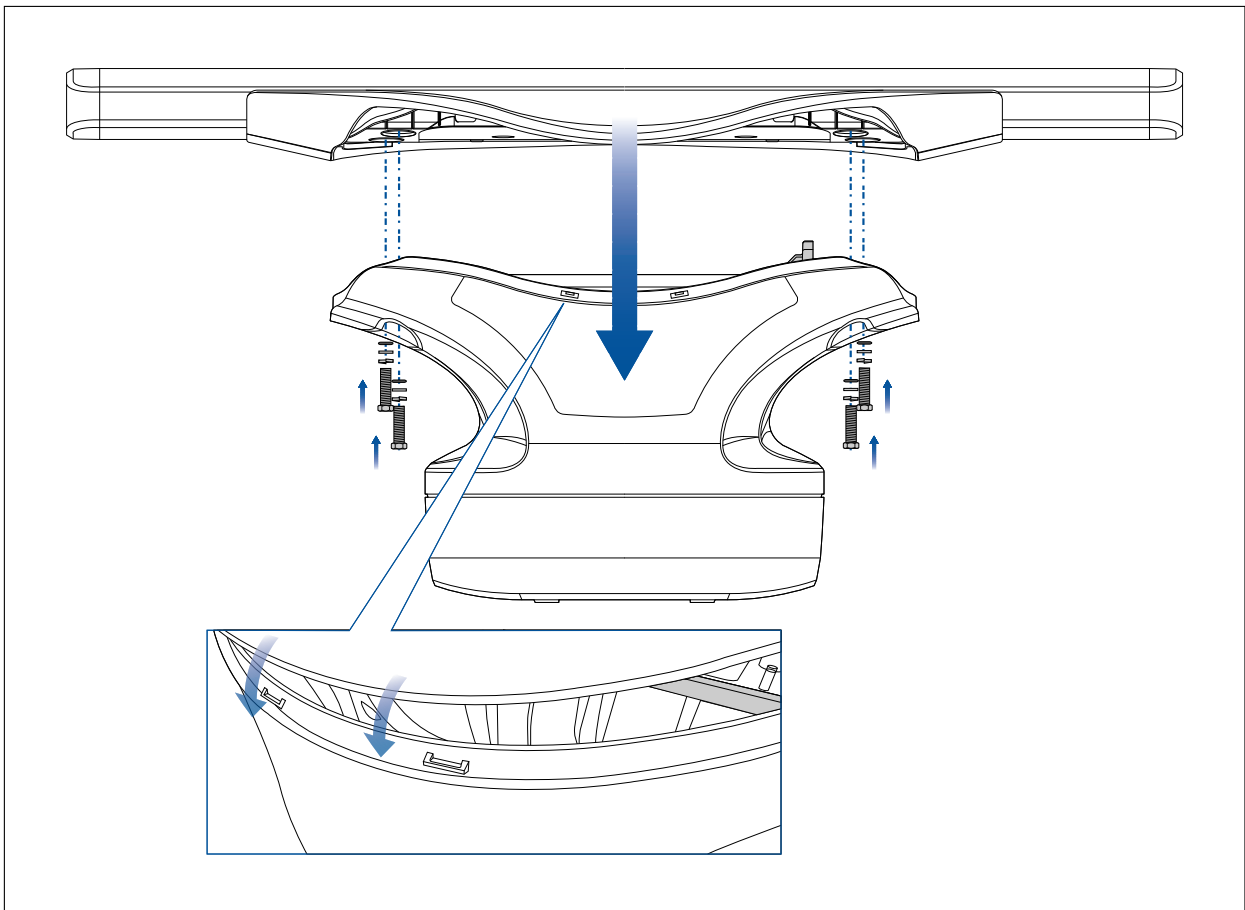
Radar scanner protection — sailing vessels

Additional considerations apply when installing the Radar scanner on a sailing vessel.

• When mounting the Radar scanner unit onto the mast, check that the unit is not fouled by the sails, especially when tacking.

• Depending on the type of sailing vessel and the design of the sailplan, a Radar scanner guard should be attached to the mast if the sails or rigging contact either the Radar scanner unit or the mounting bracket. Without a proper Radar guard, serious damage can result to the Radar mounting bracket and the Radar itself. In extreme cases, such damage could result in the Radar scanner unit being pulled off the mast. Therefore, it is recommended that a Radar scanner guard should be mounted additionally and separately to the Radar scanner mounting bracket.

• To prevent the risk of the Radar scanner unit falling in the event that it has been damaged, the security lanyard supplied with the mast bracket MUST be secured properly to the mast and to the Radar scanner unit, according to the instructions provided with the bracket. If a safety lanyard is not supplied with the mounting bracket, contact your local dealer for appropriate parts. Do NOT attach other equipment to either the Radar scanner unit or the bracket.

• Raymarine strongly recommends that you check the condition and security of the bracket mounting feet, the security lanyard(s), the Radar scanner guard, and the Radar scanner unit itself, on a yearly basis (or more frequently depending on environmental applications). Any fittings should be replaced as appropriate.

Mounting the VCM100

Before mounting the unit, ensure that you have:

• Selected a suitable location. See **p.33 — Location requirements**

Important: The VCM100 is splashproof, and suitable for mounting below decks only.

• Identified the cable connections and route that the cables will take.

Important:

Do NOT connect any cables to the power supply until the following steps have been completed.

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1. Check the selected location for the unit. The VCM100 requires a clear, flat area with suitable space for routing the cables below the unit.
2. Hold the VCM100 in place in the required mounting location.
3. Using a pencil, mark the drilling area inside the mounting lug on each side of the VCM100 unit.
4. Using a 3 mm drill bit, drill a hole through the pencil marks.
5. Align the VCM100 mounting lugs with the drill holes.
6. Hold the VCM100 in place.
7. Using a suitable screwdriver, screw the self-tapping mounting screws through the mounting lug holes, into the drilled holes.
8. Connect the cables, according to the instructions provided in this handbook.
9. Hold the cable clamp in place over the cables, approximately 50 mm (2") below the mounted VCM100 unit.
10. Using a pencil, mark the drilling area inside each mounting bracket hole.

    ENSURE THE CABLES DO NOT COVER THE HOLES.
11. Using a 3 mm drill bit, drill a hole through the pencil marks.
12. Hold the cable clamp in place, each hole aligned with the drill holes.
13. Using a suitable screwdriver, screw the self-tapping mounting screws through the bracket holes, into the drilled holes.
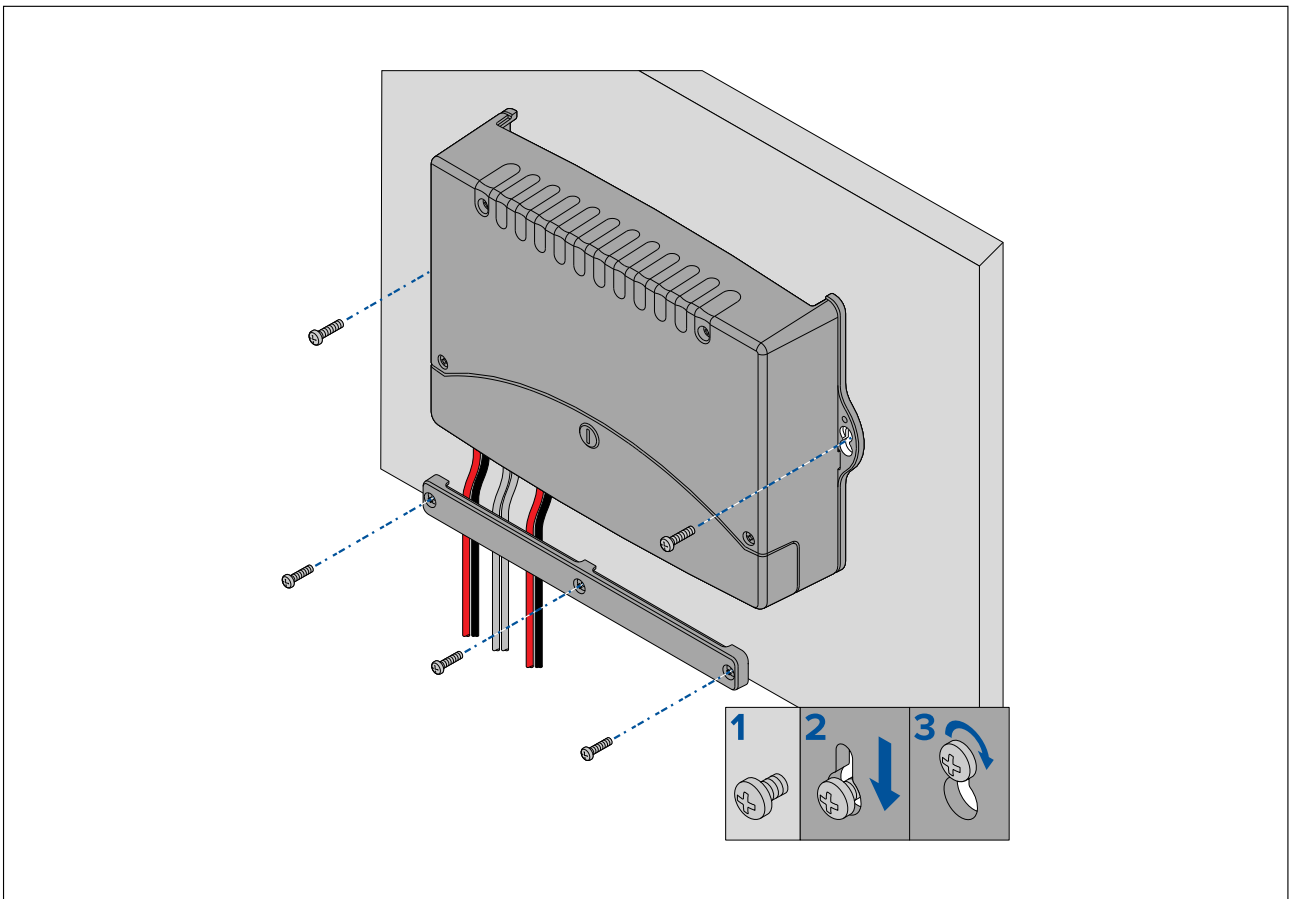
Chapter 9: System connections

Chapter contents

9.1 Typical system examples

The Cyclone Open Array Radar scanner can be connected to a variety of equipment as part of your marine electronics system.

Note: The following illustrations show the various products that can be connected in a typical system. These systems are shown as an example only and may differ from your planned installation.

- For information on how to connect the products, refer to: Chapter 7 **Cables and connections**
- For information on available cables and accessories, refer to: Chapter 16 **Spares and accessories**

Radar connected using RayNet switch
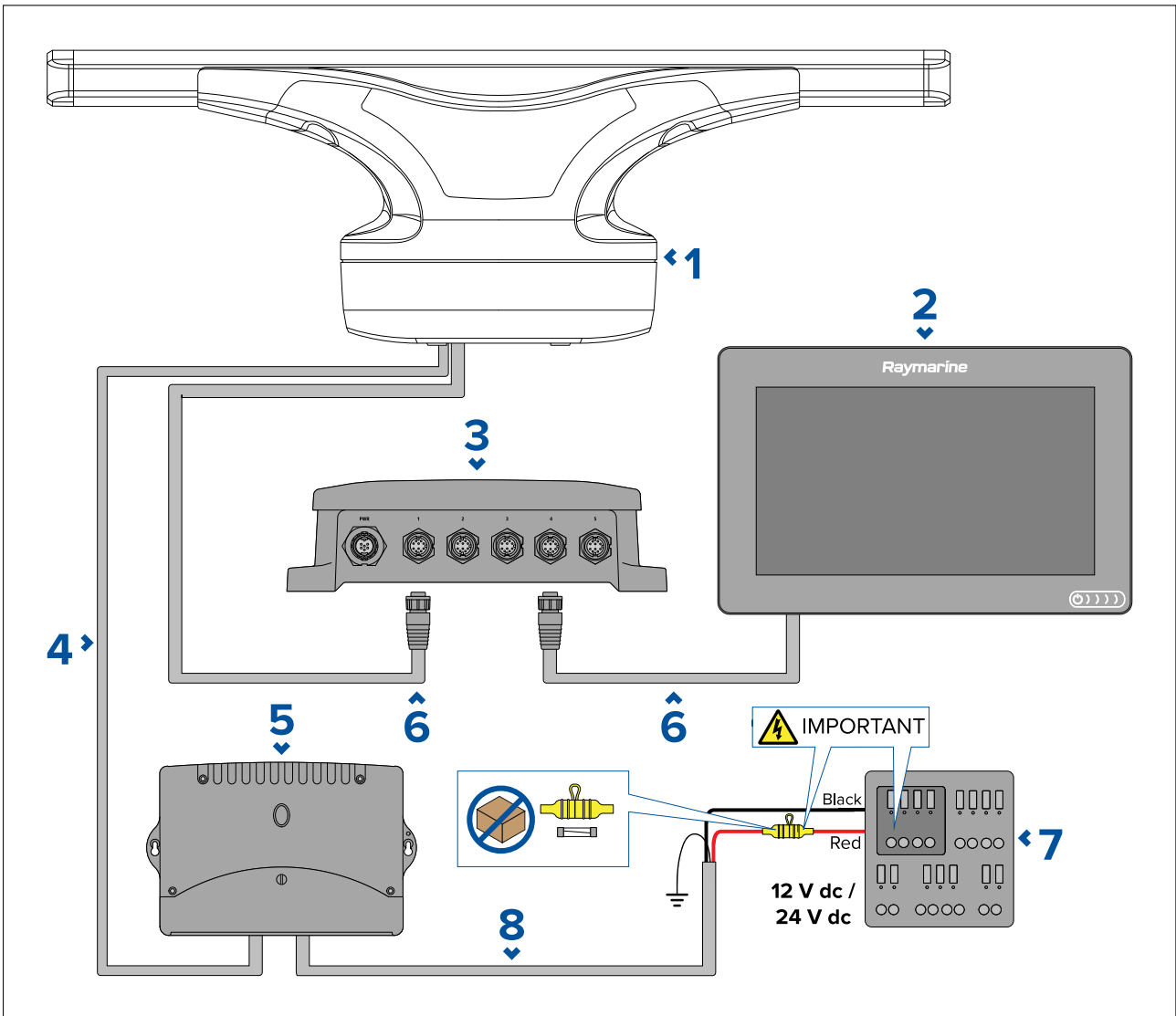
Note:

Some power connections are omitted from this illustration. The network switch and multifunction display each require a dedicated power connection.

Important:

Fuses (not supplied) are required for circuit protection for the Cyclone Radar. For suitable fuse ratings, refer to: **p.63 — Circuit breaker and fuse ratings**

1. Cyclone Open Array Radar
2. MFD
3. RayNet network switch
4. Cyclone power cable
5. VCM100 power converter
6. RayNet Radar data cable
7. 12 V dc / 24 V dc Power supply (Distribution Panel or Battery)
8. VCM100 power cable

Radar connected directly to RayNet multifunction display
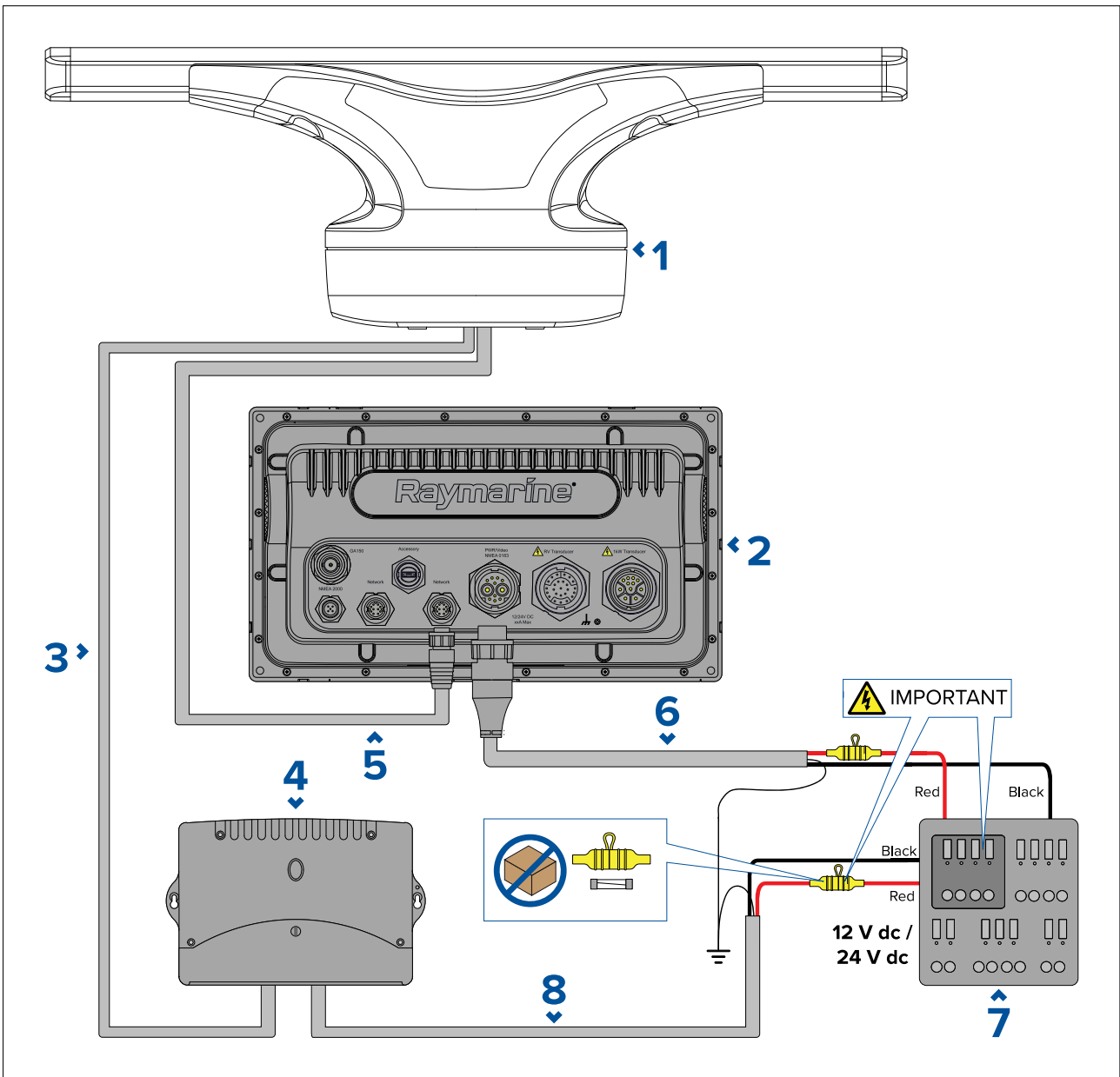
Important:

Fuses (not supplied) are required for circuit protection for the Cyclone Radar. For suitable fuse ratings, refer to: **p.63 — Circuit breaker and fuse ratings**

1. Cyclone Open Array Radar
2. MFD
3. Cyclone power cable
4. VCM100 power converter
5. RayNet Radar data cable
6. MFD power cable
7. 12 V dc / 24 V dc Power supply (Distribution Panel or Battery)
8. VCM100 power cable

Chapter 10: Power connections

Chapter contents

10.1 Radar power connections

The Cyclone Open Array Radar scanner must be powered via the supplied VCM100 Converter Module.
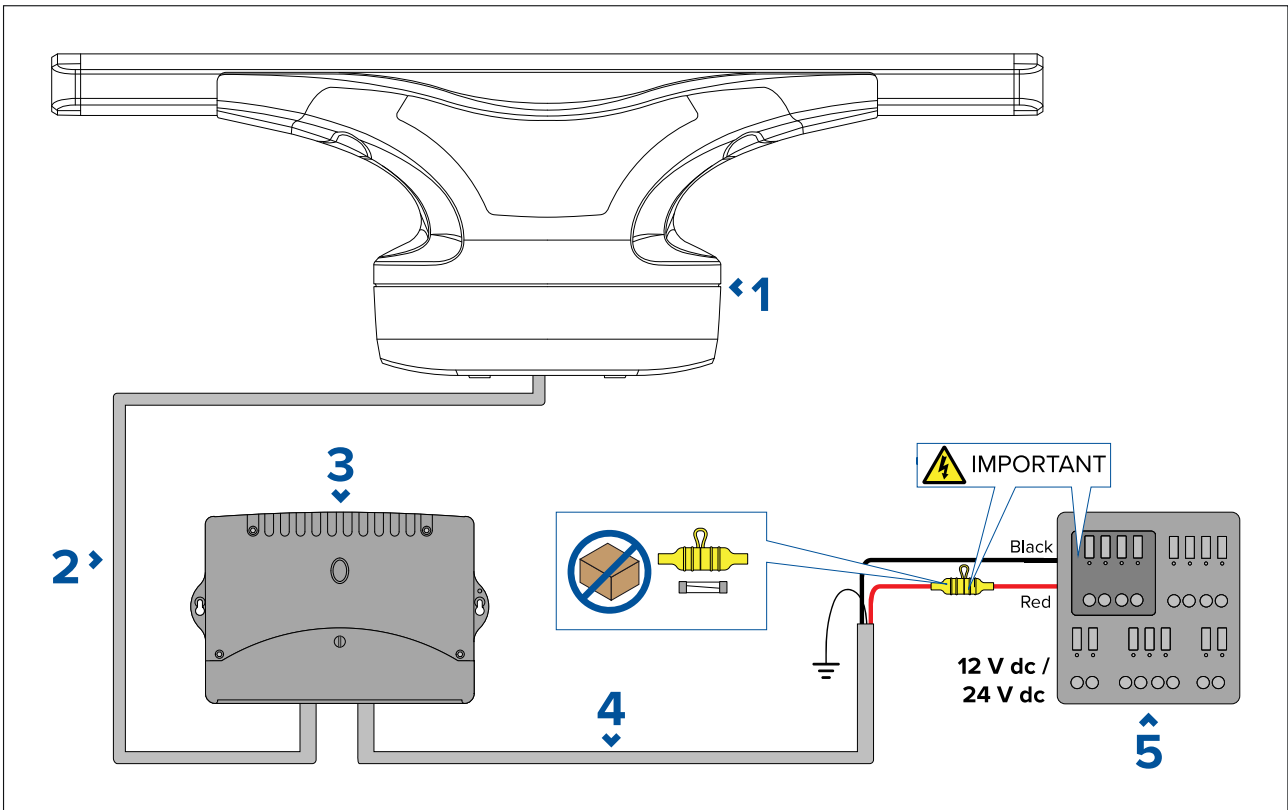
Important:

Fuses (not supplied) are required for circuit protection for the Cyclone Radar:

12 V dc

- 15 A thermal fuse at breaker (x1)
- 20 A inline fuse on RED power cable (x1)

24 V dc

- 8 A thermal fuse at breaker (x1)
- 10 A inline fuse on RED power cable (x1)

1. Cyclone Open Array Radar scanner
2. Cyclone power cable (A80653)
3. VCM100 power converter
4. Power cable from vessel power supply to VCM100 (power cable not supplied)
5. Vessel power supply

The Cyclone Open Array Radar is intended for use on vessel DC power systems operating at 12 or 24 Volts DC.

- All power connections must be made via the VCM100 Voltage Converter Module.
- The radar scanner must NOT be connected directly to a battery.
- The radar scanner must be connected directly to the VCM100 only.
- Only one radar scanner must be connected per VCM100 unit. Each radar scanner in your system requires a dedicated VCM100 unit.
- The power connection between the radar scanner and the VCM100 must be via an official Raymarine power cable (a power cable is supplied with the radar).
- Do NOT cut and re-join any part of the power cable. A range of cable lengths and cable extensions is available for longer cable runs (refer to **p.88 — Accessories**).

Note: The maximum length for the radar power cable (including all extensions) is 25 m (82 ft).

- The radar scanner must be connected to the POWER OUT terminals of the VCM100.
- The screen (drain) strands of the radar scanner's power cable must be connected to one of the VCM100 SCREEN terminals.

The following diagram illustrates the power connections of the supplied power cable.
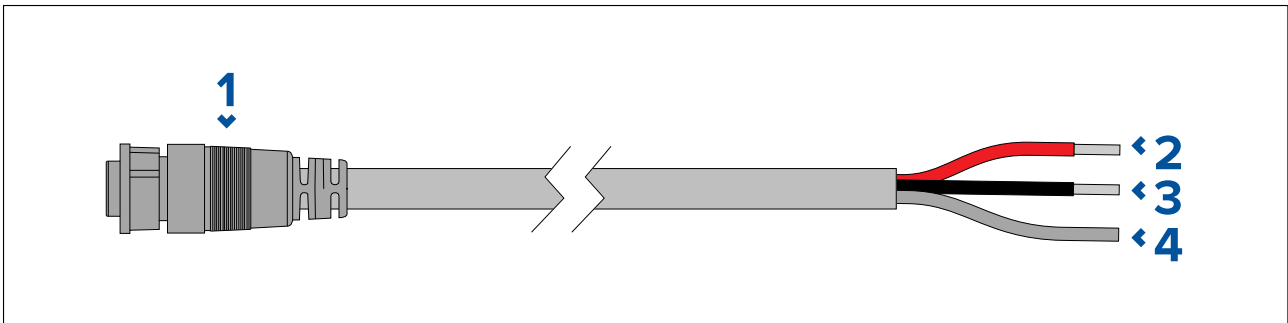
1. Power connector
2. Red wire — connect to the positive POWER OUT terminal of the VCM100.
3. Black wire — connect to the negative POWER OUT terminal of the VCM100.
4. Screen (drain) strands — connect to one of the SCREEN terminals of the VCM100.

> ### Warning: Positive ground systems
> Do not connect this unit to a system which has positive grounding.

VCM100 power connections

VCM100 power and grounding requirements.

The VCM100 is intended for use on ships' DC power systems operating from 12 to 24 Volts DC.

- The VCM100 must be connected to a battery isolator switch, or a DC distribution panel.
- The battery isolator switch or DC distribution panel must be connected to the POWER IN terminals of the VCM100.
- Do NOT connect additional power switches to the cable providing the power feed to the VCM100.
- All power connections between the VCM100 and the power source must have appropriate fuse protection.
- All power connections must be of high quality to minimize resistance and to remove the risk of accidental shorts.
- The VCM100 SCREEN terminals must be connected to your vessel's RF ground system.
- Do NOT connect the radar scanner or the VCM100 to a positively-grounded power system.

The following diagram illustrates the power connections of the VCM100.
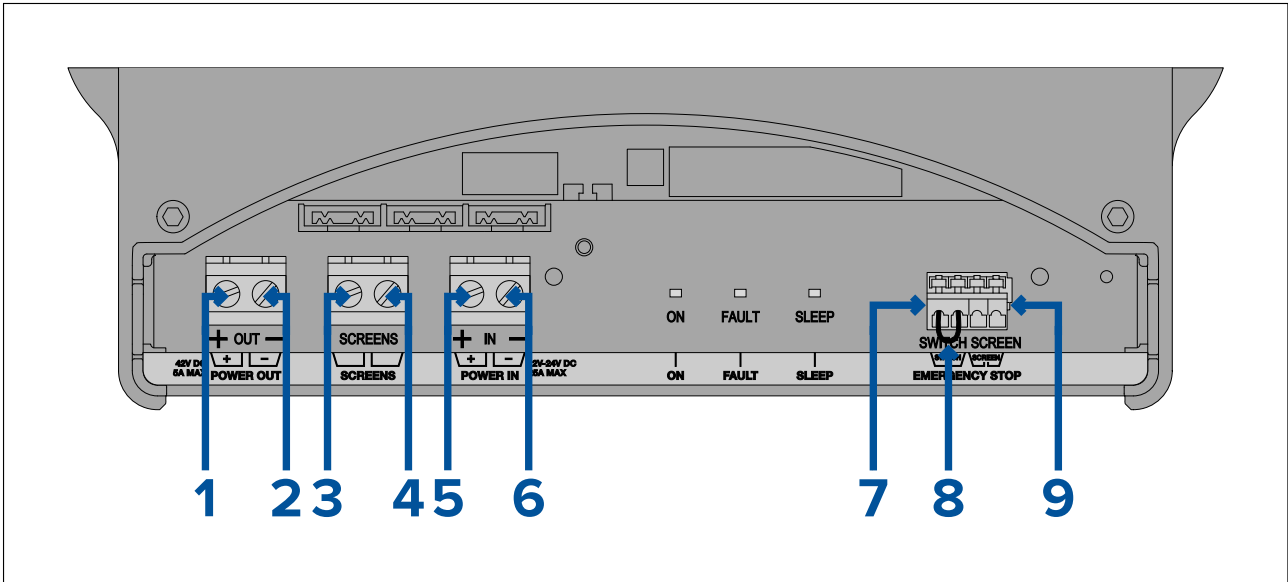
1. **POWER OUT (Positive)** — connect to the RED wire of the Radar's power cable.

2. **POWER OUT (Negative)** — connect to the BLACK wire of the Radar's power cable.

3. **SCREEN** — connect to the bare screen (drain) strands of the Radar's power cable.

4. **SCREEN** — connect to your vessel's RF ground system.

5. **POWER IN (Positive)** — connect to the positive terminal of the DC distribution panel or battery isolator switch.

6. **POWER IN (Negative)** — connect to the negative battery terminal.

7. **EMERGENCY STOP (Switch)** — if you have the optional VCM100 emergency stop button, remove the wire bridging link from the VCM100 EMERGENCY STOP terminals, and connect the emergency stop button SWITCH wire to the VCM100 EMERGENCY STOP SWITCH terminal.

8. **EMERGENCY STOP wire bridging link** — only remove if fitting the optional emergency stop button.

9. **EMERGENCY STOP (Screen)** — if you have the optional VCM100 emergency stop button, remove the wire bridging link from the VCM100 EMERGENCY STOP terminals, and connect the emergency stop button SCREEN (drain) wire to the VCM100 EMERGENCY STOP SCREEN terminal.

VCM100 power cable extension

The power cable can be extended for longer cable runs between the VCM100 and your vessel's DC distribution panel or battery isolator switch.

If you need to extend the power cable, use a splash proof junction box. The junction box should provide a terminal strip with sufficient space for power connections. The terminal strip should be a minimum of 30 Amp rating for power cores. It is essential that both power cores and the screen (drain) are connected and that the connection is of very low resistance as considerable power passes through this connection.

The following table provides recommended total power cable lengths and gauges. These figures relate to the maximum round-trip length of power cables from the battery or DC distribution panel to the VCM100. Exceeding these lengths may cause unreliable operation.

AWG (American Wire Gauge)	mm²	Maximum distance (12 volt supply)	Maximum distance (24 volt supply)
7	10.55	15 m (49.2 ft.)	55 m (180.4 ft.)
8	8.36	10 m (32.8 ft.)	40 m (131.2 ft)
10	5.26	8 m (26.2 ft.)	32 m (104.9 ft.)
11	4.17	6 m (19.6 ft.)	24 m (78.7 ft.)

Note: If the required extensions result in unacceptably large diameter cables, use two or more smaller gauge wires to achieve the required copper wire cross-section. For example, using two pairs of 2 mm² cables is equivalent to using two single 4 mm² cables.

VCM100 screen (drain) wire extension

The screen (drain) wire can be extended for longer cable runs between the VCM100 and your vessel's RF ground system.

Extensions to the screen (drain) wire should use an 8 mm braid or AWG 10 (5.26 mm²) multi-stranded cable.

Circuit breaker and fuse ratings

Battery isolator switch, thermal breaker, and fuse ratings.

All power connections between the VCM100 and its power source MUST be protected by a thermal circuit breaker or in-line fuse, fitted close to the power connection. The connection from the output of the VCM100 to the radar pedestal does not require a fuse or circuit breaker.

If you do not have a thermal circuit breaker or fuse in your power circuit (fitted to the DC distribution panel, for example), you MUST fit an in-line breaker or fuse to the positive wire of the power cable.

The following table provides suitable ratings for battery isolator switches, circuit breakers, and fuses.

Power supply	Device	Cyclone	Cyclone Pro
12 V	Isolator switch	30 A (minimum rating)	30 A (minimum rating)
	Thermal breaker	15 A	15 A
	Fuse	20 A	20 A
24 V	Isolator switch	15 A (minimum rating)	15 A (minimum rating)
	Thermal breaker	8 A	10 A
	Fuse	10 A	15 A

|	
⚠️	**Warning: Product grounding** Before applying power to this product, ensure it has been correctly grounded, in accordance with the instructions provided.

Chapter 11: System checks

Chapter contents

11.1 Radar scanner initial power on test

With all cables correctly and securely connected to the radar scanner, and access to a multifunction display (power OFF):

1. Ensure the radar scanner power switch is set to ON.
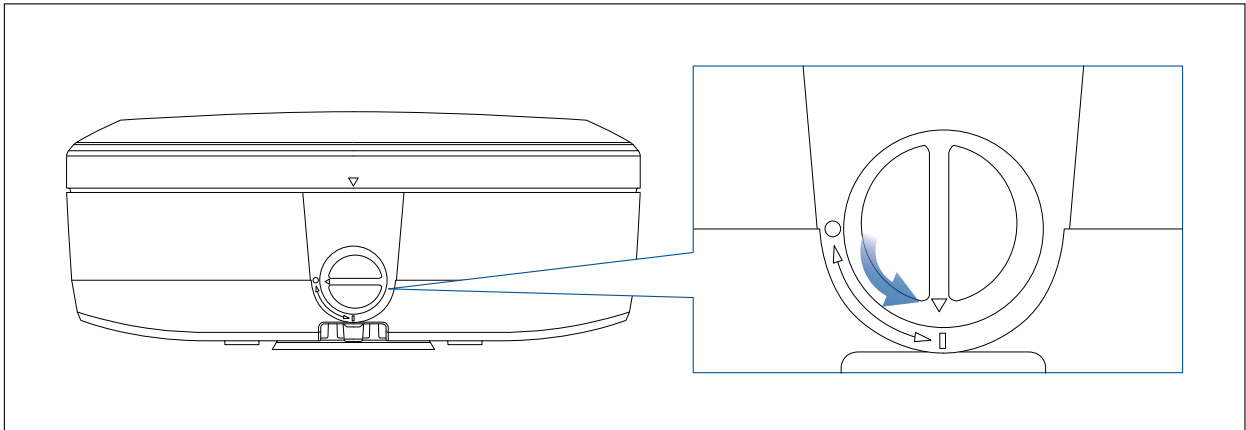
2. Power on the multifunction display.
    The radar scanner should enter Standby mode.
3.   If necessary, adjust the lighting and contrast on the multifunction display.

11.2 Radar check

⚠	**Warning: Radar scanner safety**
	Before rotating the Radar scanner, ensure all personnel are clear.

⚠	**Warning: Radar transmission safety**
	The radar scanner transmits electromagnetic energy. Ensure all personnel are clear of the scanner when the radar is transmitting.

Checking the radar — RayNet displays

These instructions apply to multifunction displays running LightHouse™ 3 software.

1. Select a Radar page.
    The '**Off/Not Connected**' message is displayed.
2. Select **On** to power up your radar.

    This process will take approximately 70 seconds.

    The scanner should now be transmitting and receiving.
3. Check that the radar screen is operating correctly.

Typical radar screen
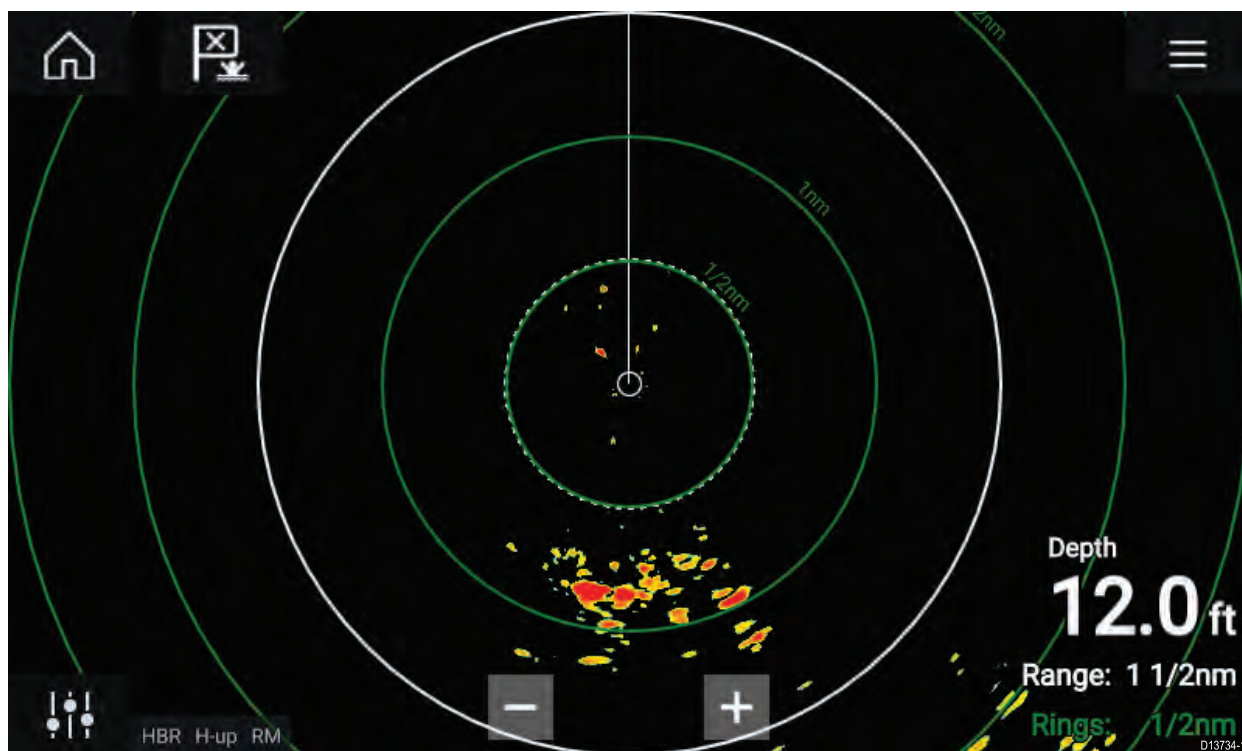
Points to check:

- *Radar sweep with echo responses are shown on screen.*
- *Radar status icon rotating in top right hand corner.*

Check and adjust bearing alignment

Bearing alignment

The Radar bearing alignment ensures that Radar objects appear at the correct bearing relative to your boat's bow. You should check the bearing alignment for any new installation.

Example misaligned Radar

1. Target object (such as a buoy) dead ahead.
2. Target displayed on the Radar display is not aligned with the Ship's Heading Marker (SHM). Bearing alignment is required.

Checking the bearing alignment

1. With your vessel under way: Align the bow with a stationary object identified on the Radar display An object between 1 & 2 NM distant is ideal.
2. Note the position of the object on the Radar display. If the target is not under the ships heading marker (SHM), there is an alignment error and you will need to carry out bearing alignment adjustment.

Adjusting the bearing alignment

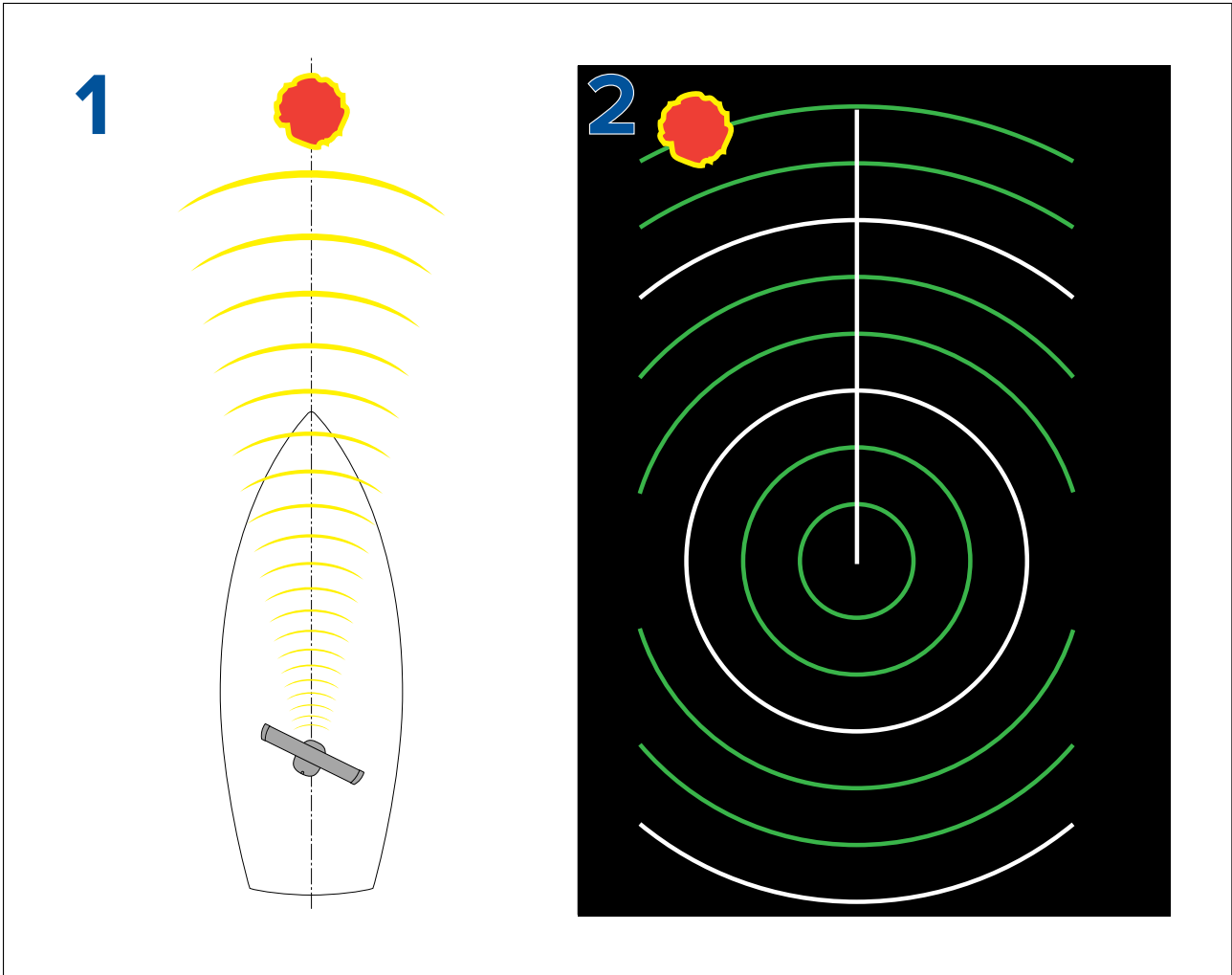These instructions apply to multifunction displays running LightHouse™ 3 software.

Once you have checked the bearing alignment you can proceed and make any required adjustments.

With the radar app displayed, adjust the **Bearing alignment** setting until the target object appears under the SHM.

Bearing alignment setting can be accessed from the Installation tab: **Menu** > **Installation** > **Bearing alignment**.

Chapter 12: Operation

Chapter contents

12.1 Operation instructions

For detailed operation instructions for your product, refer to the documentation that accompanies your display.

All product documentation is available to download from the Raymarine website:
www.raymarine.com/manuals

- **81370** — LightHouse 3 MFD Advanced Operation Instructions

12.2 Radar licensing

Installation and operation of this Radar may be subject to individual licensing of the equipment, operator or vessel.

In many countries, the licensing for the use of Radar equipment is included in the **Ship Station license** and **Operator's license** issued for VHF radios.

However, even if you already have a Ship Station license and Operator's license for a VHF radio, **some countries may require a separate license for Radar equipment use.**

Important:

It is your responsibility to determine whether a license is required in your area before operating this equipment.

For a list of license issuing authorities, refer to:

Chapter 13: Troubleshooting

Chapter contents

13.1 Troubleshooting

The troubleshooting information provides possible causes and corrective action required for common problems associated with installation and operation of your product.

Before packing and shipping, all Raymarine products are subjected to comprehensive testing and quality assurance programs. If you do experience problems with your product this section will help you to diagnose and correct problems to restore normal operation.

If after referring to this section you are still having problems with your product, please refer to the Technical support section of this manual for useful links and Raymarine Product Support contact details.

13.2 Power up troubleshooting

Product does not turn on or keeps turning off

Possible causes	Possible solutions
Blown fuse / tripped breaker.	1. Check condition of relevant fuses and breakers and connections, replace if necessary. (Refer to the *Technical Specification* section of your product's installation instructions for fuse ratings.)
	2. If fuse keeps blowing check for cable damage, broken connector pins or incorrect wiring.
Poor / damaged / insecure power supply cable / connections	1. Check that the power cable connector is correctly orientated and fully inserted into the display connector and locked in position.
	2. Check the power supply cable and connectors for signs of damage or corrosion, and replace if necessary.
	3. With the display turned on, try flexing the power cable near to the display connector to see if this causes the unit to restart or lose power. Replace if necessary.
	4. Check the vessel's battery voltage and the condition of the battery terminals and power supply cables, ensuring connections are secure, clean and free from corrosion. Replace if necessary.
	5. With the product under load, using a multi-meter, check for high voltage drop across all connectors / fuses etc, and replace if necessary.
Incorrect power connection	The power supply may be wired incorrectly, ensure the installation instructions have been followed.

Product will not start up (restart loop)

Possible causes	Possible solutions
Power supply and connection	See possible solutions from the table above, entitled 'Product does not turn on or keeps turning off'.
Software corruption	1. In the unlikely event that the product's software has become corrupted, try downloading and installing the latest software from the Raymarine website.
	2. On display products, as a last resort, attempt to perform a 'Power on Reset'. Be aware that this will delete all settings / presets and user data (such as waypoints and tracks), and revert the unit back to factory defaults.

13.3 Radar troubleshooting

Problems with the Radar and their possible causes and solutions are described here.

No connection can be made to the scanner

Possible Causes	Possible Solution
Radar powered down	• If the scanner unit has shut down, awaken it by using the **Power Up Radar** option on the Shortcuts page, accessible on your MFD by momentarily pressing the power button.
Radar not transmitting	Select Tx for the relevant Radar scanner from the Shortcuts page.
Damaged or disconnected Power cable / RayNet cable	1. Check that the cable connectors are fully inserted and locked in position. 2. Check the power supply cable and connectors for signs of damage or corrosion, replace if necessary. 3. With the unit turned on, try flexing the cable near to the display connector to see if this causes the unit to re-boot/loose power, replace if necessary. 4. Check the vessel's battery voltage, the condition of the battery terminals and power supply cables, ensuring connections are secure, clean and free from corrosion, replace if necessary. 5. With the product under load, using a multi-meter, check for high voltage drop across all connectors/fuses etc (this can cause the unit to reset/turn off), replace if necessary. 6. Check condition of relevant breakers and fuses, replace if necessary. . If breaker keeps tripping or fuses keep blowing, contact a Raymarine authorized dealer for assistance.
Open Array power switch in OFF position	Ensure Open Array power switch is in ON position.
Software mismatch between equipment may prevent communication.	Ensure all Raymarine products contain the latest available software, check the Raymarine website: www.raymarine.com/software for software compatibility.
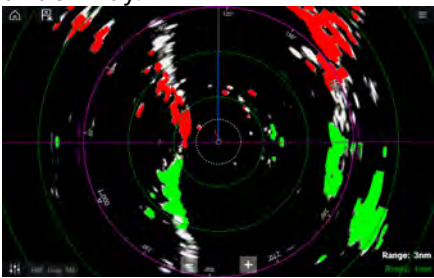
Displayed bearing is different to the true bearing.

Possible Causes	Possible Solution
Bearing alignment adjustment required	Carry out the Bearing Alignment procedure described in the latest version of the relevant **LightHouse™** Operations manual.

Radar will not initialize (Voltage control module (VCM) stuck in "sleep mode"

Possible Causes	Possible Solution
Intermittent or poor power connection	Check power connection at VCM. (Voltage at input = 12 / 24 V, Voltage at output = 42 V)

13.4 Doppler troubleshooting

Symptom	Example	Action
Doppler coloration is incorrect.	In the following example, **stationary** targets such as land are colored red or green when under way. 	1. Check bearing alignment, as described in this document and the MFD Operations manual. 2. At low speeds (< 15 knots) and if a source of Heading data is available on the system, the compass alignment may be incorrect. Check the compass alignment, as described in the manual for the relevant Heading (compass) device.

13.5 Cyclone LED indications

LED indications associated with the Cyclone Radar.

LED color / state	Possible causes
Green / flashing once every 30 seconds	Radar is powered on and operating normally.
Amber / solid	Radar scanner is in sleep mode / standby.
Amber / flashing once every 30 seconds	Internal fault. Refer to your dealer or Raymarine product support.
Red / flashing once every 30 seconds	Internal fault. Refer to your dealer or Raymarine product support.

13.6 VCM100 LED indications

LED indications associated with the VCM100.

LED name	LED color / state	Possible causes
On	Green / solid	Radar operating normally.
Fault	Red / solid	Fault condition.
Sleep	Yellow / flashing	Radar scanner in standby.
	Yellow / solid	Fault condition, unit self-recovers after 20 seconds.

13.7 Radar target acquisition data source requirements

Radar target acquisition requires the following data sources to be available on your system (e.g. connected to your multifunction display, via SeaTalkng ® or NMEA 0183).

Data type	Example data source
COG (Course Over Ground)	GPS or GNSS receiver (MFD internal receiver or external receiver).
SOG (Speed Over Ground)	GPS or GNSS receiver (MFD internal receiver or external receiver).
HDG / HDT (True Heading)	Compass or Autopilot sensor providing Fastheading data (e.g. Evolution EV-1 / EV-2).

13.8 Doppler data source requirements

Use of the Doppler Radar features requires the following data sources to be available on your system (e.g. connected to your multifunction display, via SeaTalkng ® or NMEA 0183).

Required data sources

Data type	Example data source
COG (Course Over Ground)	GPS or GNSS receiver (MFD internal receiver or external receiver).
SOG (Speed Over Ground)	GPS or GNSS receiver (MFD internal receiver or external receiver).

Recommended data source

Data type	Example data source
HDG / HDT (True Heading)	Compass or Autopilot sensor providing Fastheading data (e.g. Evolution EV-1 / EV-2).

Note:

A Heading data source is not essential for Doppler operation. However it will improve the performance of Doppler mode at slower speeds (< 15 knots), when tide set and leeway are present.

Chapter 14: Technical support

Chapter contents

14.1 Raymarine product support and servicing

Raymarine provides a comprehensive product support service, as well as warranty, service, and repairs. You can access these services through the Raymarine website, telephone, and e-mail.

Product information

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

* Product name.
* Product identity.
* Serial number.
* Software application version.
* System diagrams.

You can obtain this product information using diagnostic pages of the connected MFD.

Servicing and warranty

Raymarine offers dedicated service departments for warranty, service, and repairs.

Don't forget to visit the Raymarine website to register your product for extended warranty benefits: http://www.raymarine.co.uk/display/?id=788.

United Kingdom (UK), EMEA, and Asia Pacific:

* E-Mail: emea.service@raymarine.com
* Tel: +44 (0)1329 246 932

United States (US):

* E-Mail: rm-usrepair@flir.com
* Tel: +1 (603) 324 7900

Web support

Please visit the "Support" area of the Raymarine website for:

* **Manuals and Documents** — http://www.raymarine.com/manuals
* **Technical support forum** — http://forum.raymarine.com
* **Software updates** — http://www.raymarine.com/software

Worldwide support

United Kingdom (UK), EMEA, and Asia Pacific:

* Help desk: https://raymarine.custhelp.com/app/ask
* Tel: +44 (0)1329 246 777

United States (US):

* Help desk: https://raymarine.custhelp.com/app/ask
* Tel: +1 (603) 324 7900 (Toll-free: +800 539 5539)

Australia and New Zealand (Raymarine subsidiary):

* E-Mail: aus.support@raymarine.com
* Tel: +61 2 8977 0300

France (Raymarine subsidiary):

* E-Mail: support.fr@raymarine.com
* Tel: +33 (0)1 46 49 72 30

Germany (Raymarine subsidiary):

* E-Mail: support.de@raymarine.com
* Tel: +49 40 237 808 0

Italy (Raymarine subsidiary):

* E-Mail: support.it@raymarine.com
* Tel: +39 02 9945 1001

Spain (Authorized Raymarine distributor):

* E-Mail: sat@azimut.es

- Tel: +34 96 2965 102

Netherlands (Raymarine subsidiary):

- E-Mail: support.nl@raymarine.com
- Tel: +31 (0)26 3614 905

Sweden (Raymarine subsidiary):

- E-Mail: support.se@raymarine.com
- Tel: +46 (0)317 633 670

Finland (Raymarine subsidiary):

- E-Mail: support.fi@raymarine.com
- Tel: +358 (0)207 619 937

Norway (Raymarine subsidiary):

- E-Mail: support.no@raymarine.com
- Tel: +47 692 64 600

Denmark (Raymarine subsidiary):

- E-Mail: support.dk@raymarine.com
- Tel: +45 437 164 64

Russia (Authorized Raymarine distributor):

- E-Mail: info@mikstmarine.ru
- Tel: +7 495 788 0508

Chapter 15: Technical specification

Chapter contents

15.1 Technical specification

Approvals

Approvals	Certification
USA	47CFR Part 80 Certificate of Approval Cyclone: FCC ID: PJ5-953LPSSR Cyclone Pro: FCC ID: PJ5-953MPSSR
Canada	RSS138 Iss. 1 Technical Acceptance Certificate Cyclone: IC:4069B-953LPSSR Cyclone Pro: IC:4069B-953MPSSR
European Union & EFTA	Radio Equipment Directive 2014/53/EU Self-Declaration
Australia / New Zealand	ACMA Declaration of Conformity Compliance level 3

Physical (pedestal)

	Cyclone (E70620)	Cyclone Pro (E70621)
Dimensions	388 mm x 360 mm x 335 mm (to top of antenna)	388 mm x 360 mm x 335 mm (to top of antenna)
Weight	16 Kg	16 Kg

Physical (Antenna)

	3ft (E70628)	4ft (E70629)	6ft (E70630)
Length	1031 mm	1336 mm	1945 mm
Weight	7 Kg	9 Kg	12 Kg

Power

	Cyclone (E70620)	Cyclone Pro (E70621)
Supply voltage (Using VCM100)	• Nominal: 12 V dc or 24 V dc • Minimum: 10.2 V dc • Maximum: 31.2 V dc	• Nominal: 12 V dc or 24 V dc • Minimum: 10.2 V dc • Maximum: 31.2 V dc
Power consumption (typical)	70 W	95 W
Power consumption (max)	170 W	195 W
Power consumption (standby)	28 W	28 W
Maximum range scale	72 Nm	96 Nm
Boot up time	40 seconds	40 seconds
Standby to transmit	Less than 5 seconds	Less than 5 seconds

Environmental

	Cyclone (E70620)	Cyclone Pro (E70621)
Waterproof rating	IPX6	IPX6
Operating temperature range	-25°C to +55°C (-13°F to 131°F)	-25°C to +55°C (-13°F to 131°F)
Humidity	Up to 93% at 40°C (104°F)	Up to 93% at 40°C (104°F)
Maximum wind speed	100 Kts	100 Kts

Connectors

	Cyclone (E70620)	Cyclone Pro (E70621)
Power connection	1x Power connector	1x Power connector
Data connection	1x RayNet connector	1x RayNet connector

Range

Range (Nm)	Pulse width (ns)	PRF (Khz)
1/16	46	4.8
1/8	46	4.8
1/4	46	4.8
3/8	192	4.8
1/2	192	4.8
3/4	750	4.8
1	1020	4.8
1 1/2	1235	4.8
2	1675	4.8
3	2300	4.8
4	2710	4.8
6	3900	4.8
8	3900	4.8
12	17600	3.6
16	23600	2.4
24	35000	1.6
32	47000	1.2
48	79000	0.82
72, 96	79000	0.7

Transmitter

	Cyclone (E70620)	Cyclone Pro (E70621)
Transmitter frequency	9370, 9400, 9430 MHz (User Selectable)	9370, 9400, 9430 MHz (User Selectable)
Peak power output	55 W	110 W

Receiver

	Cyclone (E70620)	Cyclone Pro (E70621)
Receiver characteristic	Linear	Linear
Receiver noise	Less than 5 dB	Less than 5 dB

Antenna

	3ft (E70628)	4ft (E70629)	6ft (E70630)
Beamwidth (vertical)	25°	25°	25°
Beamwidth (horizontal)	2.83	1.99°	1.32°
Polarization	Horizontal	Horizontal	Horizontal
Rotation speed	12 RPM / 24 RPM/ 36 RPM / 48 RPM/ 60 RPM	12 RPM / 24 RPM/ 36 RPM / 48 RPM/ 60 RPM	12 RPM / 24 RPM/ 36 RPM / 48 RPM/ 60 RPM

ARPA target tracking

Target tracking	Tracking of 50 simultaneous ARPA targets.

Chapter 16: Spares and accessories

Chapter contents

16.1 Accessories

The following accessories are available for your product

- Cyclone Power Cable 5 m (16.4 ft) — A80651
- Cyclone Power Cable 10 m (32.8 ft) — A80652
- Cyclone Power Cable 15 m (49.2 ft) — A80653
- Cyclone Power Cable 25 m (82.0 ft) — A80654
- Radar Data Cable 5 m (16.4 ft) — A80656
- Radar Data Cable 10 m (32.8 ft) — A80657
- Radar Data Cable 15 m (49.2 ft) — A80658
- Radar Data Cable 25 m (82.0 ft) — A80659

Note: For more information on additional RayNet cables and adapters, refer to:

16.2 Network hardware

HS5 RayNet network switch (A80007)
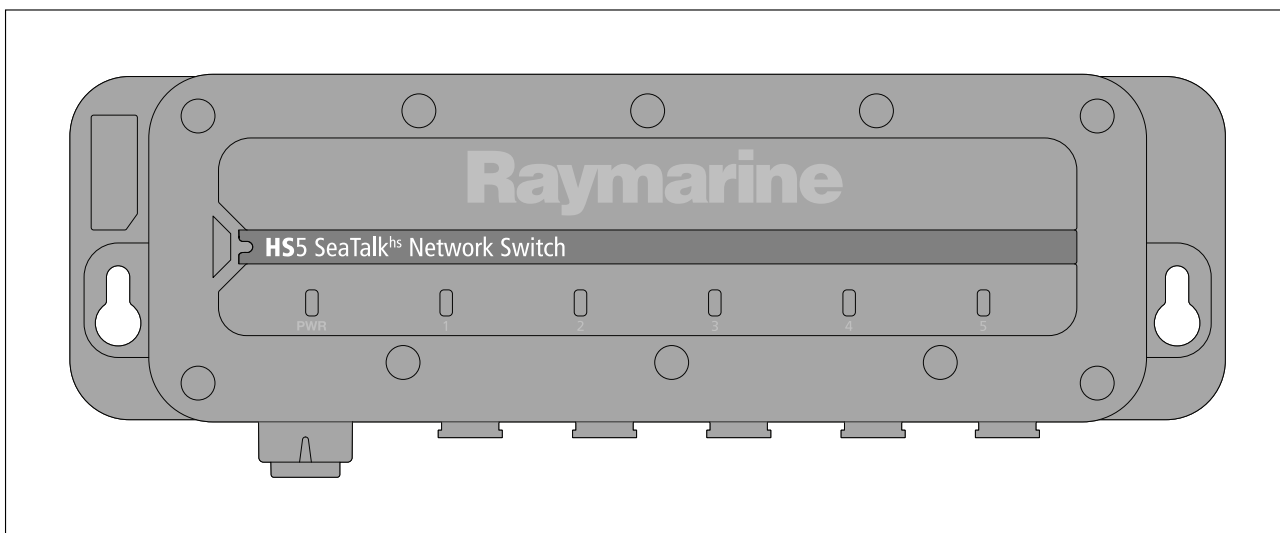
5–port switch for network connection of multiple devices featuring RayNet connectors. Equipment with RJ45 SeaTalk ^{hs} connectors can also be connected using suitable adapter cables.

16.3 RayNet to RayNet cables and connectors
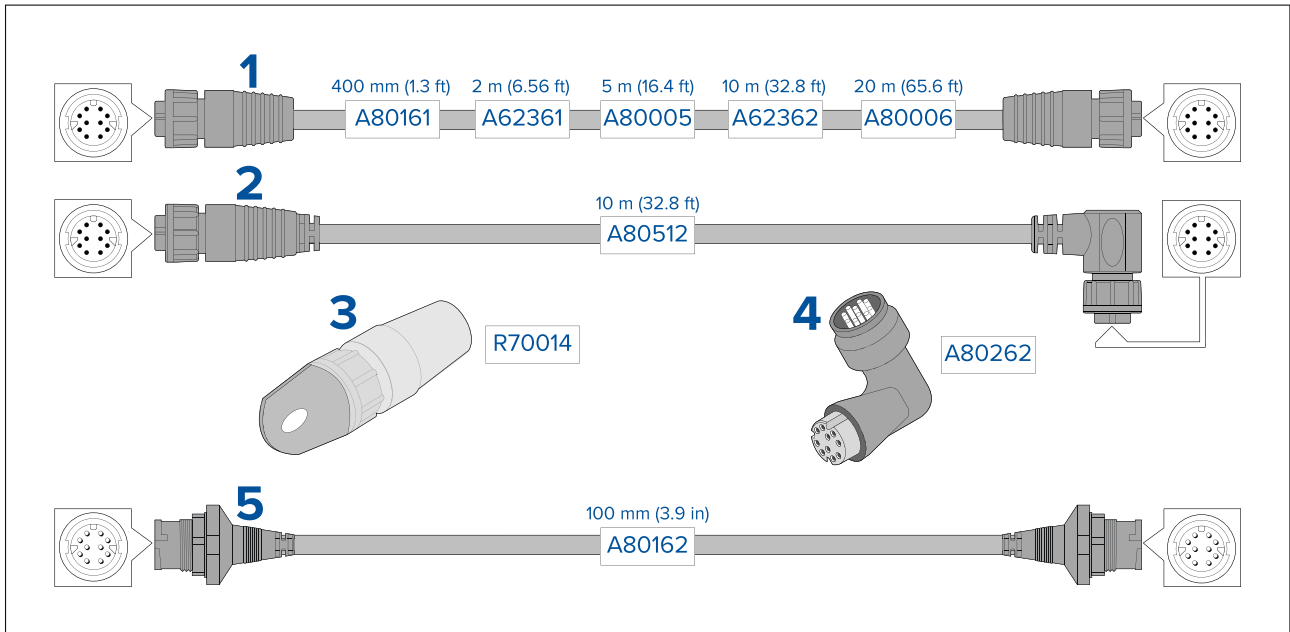
1. Standard RayNet connection cable with a RayNet (female) socket on both ends.

2. Right-angle RayNet connection cable with a straight RayNet (female) socket on one end, and a right-angle RayNet (female) socket on the other end. Suitable for connecting at 90° (right angle) to a device, for installations where space is limited.

3. RayNet cable puller (5 pack).

4. RayNet to RayNet right-angle coupler / adapter. Suitable for connecting RayNet cables at 90° (right angle) to devices, for installations where space is limited.

5. Adapter cable with a RayNet (male) plug on both ends. Suitable for joining (female) RayNet cables together for longer cable runs.

Appendix A Licensing issuing authorities

The following table lists the relevant issuing authority for licences in each region, along with a link to the relevant website. Many authorities allow you to apply for a license online.

Country	Code	Regulatory authority	Website
Argentina	AR	Ente Nacional de Comunicaciones	http://www.enacom.gob.ar
Australia	AU	Australian Communications and Media Authority	http://www.acma.gov.au/
Austria	AT	Austrian Regulatory Authority for Broadcasting and Telecommunications	http://www.rtr.at
Belgium	BE	Belgian Institute for Postal services and Telecommunications (BIPT)	http://www.bipt.be
Brazil	BR	Agencia Nacional de Telecomunicacoes	http://www.anatel.gov.br
Bulgaria	BG	Communications Regulation Commission	http://www.crc.bg
Canada	CA	Industry Canada	https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/home
China	ZH	Ministry of Information Industry	http://www.mii.gov.cn
Costa Rica	CR	Superintendencia de Telecomunicaciones	http://sutel.go.cr
Croatia	HR	Croatian Post and Electronic Communications Agency	http://www.hakom.hr/de-fault.aspx?id=7
Cyprus	CY	Office of Electronic Communications & Postal Regulation	http://www.ocecpr.org.cy/nqconten-t.cfm?a_id=767&tt=ocecpr&lang=gr
Czech Republic	CZ	The Czech Telecommunication Office	http://www.ctu.eu/main.php?pagei-d=178
Denmark	DK	Danish Energy Agency	https://ens.dk/en
Estonia	EE	Estonian Competition Authority	http://www.konkurentsi-amet.ee/?lang=en
Finland	FI	Finnish Communications Regulatory Authority	http://www.ficora.fi/en
France	FR	Autorité de Régulation des Communications Électroniques et des Postes	http://www.arcep.fr
Germany	DE	Bundesnetzagentur	http://www.bundesnetzagentur.de
Greece	EL	Hellenic Telecommunications and Post Commission	http://www.eett.gr/opencms/openc-ms/EETT_EN/index.html
Holland	NL	Autoriteit Consument & Markt	https://www.acm.nl/nl
Hong Kong	HK	Office of Communications Authority	http://www.ofca.gov.hk
Hungary	HU	National Media and Infocommunica-tion Authority	http://www.nmhh.hu
Iceland	IS	Post and Telecom Administration	http://www.pfs.is/de-fault.aspx?cat_id=101
Indonesia	ID	Indonesian Telecommunications Regulatory Authority	http://www.brti.or.id
Ireland	IE	Commission for Communications Regulation	http://www.comreg.ie
Isle of Man	IM	Communications Commission	http://www.gov.im/govern-ment/boards/cc.xml
Italy	IT	Autorità per le Garanzie nelle Comunicazioni	http://www.agcom.it

Country	Code	Regulatory authority	Website
Jamaica	JM	Spectrum Management Authority	http://www.sma.gov.jm
Japan	JP	Ministry of Internal Affairs and Communications	http://www.soumu.go.jp/english/index.html
Korea, South	KR	Korea Communications Commission	http://eng.kcc.go.kr
Lichtenstein	LI	Office for Communications	http://www.llv.li/amtsstellen/llv-ak-english-page.htm
Lithuania	LT	Communications Regulatory Authority	http://www.rrt.lt/en/home.html
Luxembourg	LU	Institut luxembourgeois de régulation	http://www.ilr.public.lu
Latvia	LV	Elektronisko sakaru direkcija	https://www.vases.lv/lv/content/juras-sakaru-atlaujas
Malaysia	MY	Malaysian Communications and Multimedia Commission	http://www.mcmc.gov.my
Malta	MT	Malta Communications Authority	http://www.mca.org.mt
Mexico	MX	Instituto Federal de Telecomunicaciones	http://www.ift.org.mx
New Zealand	NZ	Commerce Commission of New Zealand	http://www.comcom.govt.nz
Norway	NO	Norwegian Communications Authority	http://www.nkom.no
Panama	PA	Autoridad Nacional de los Servicios Públicos	http://www.asep.gob.pa/default.asp
Poland	PL	Prezes Urzędu Komunikacji Elektronicznej	http://www.uke.gov.pl
Portugal	PT	Autoridade Nacional de Comunicações	https://www.anacom.pt
Romania	RO	National Authority for Management and Regulation in Communications of Romania	http://www.ancom.org.ro/en
Russia	RU	Ministry of Telecom and Mass Communications of the Russian Federation	https://minsvyaz.ru/en
Saudi Arabia	SA	Communications and Information Technology Commission (Saudi Arabia)	http://www.citc.gov.sa
Singapore	SG	Info-communications Media Development Authority of Singapore	https://www.imda.gov.sg
Slovenia	SI	Agency for communication networks and services of the Republic of Slovenia	http://www.akos-rs.si/akos-ang
Slovakia	SK	Telecommunications Regulatory Authority of the Slovak Republic	http://www.teleoff.gov.sk/index.php?ID=9
South Africa	ZA	Independent Communications Authority of South Africa	http://www.icasa.org.za
Spain	ES	Comisión Nacional de los Mercados y la Competencia	https://www.cnmc.es/en
Sweden	SE	Swedish Post and Telecom Authority	http://www.pts.se
Switzerland	CH	Office fédéral de la communication	http://www.bakom.admin.ch/themen/frequenzen/00689/01563/index.html?lang=fr

Country	Code	Regulatory authority	Website
Taiwan	TW	National Communications Commission	http://www.ncc.gov.tw/english/index.aspx
Thailand	TH	National Broadcasting and Telecommunications Commission	http://nbtc.go.th/wps/portal/NTC/eng
Turkey	TR	Information And Communication Technologies Authority	http://eng.btk.gov.tr
United Arab Emirates	AE	Telecommunications Regulatory Authority	http://www.tra.ae
United Kingdom and Northern Ireland	UK(NI)	OFCOM	http://www.ofcom.org.uk
United States	US	FCC	https://www.fcc.gov/bureau-divisions/mobility-division/ship-radio-stations#block-menu-block-4

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