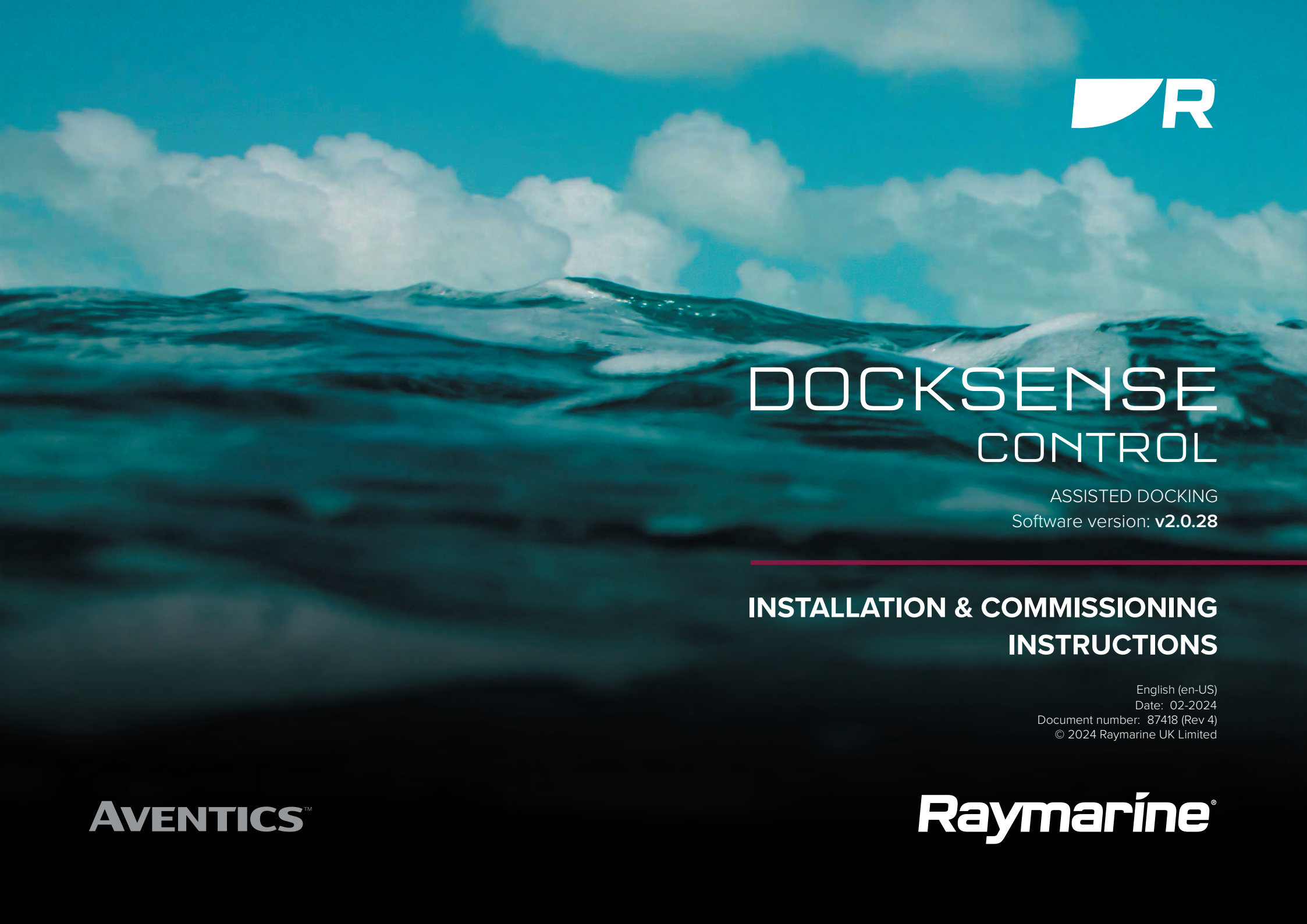


DOCKSENSE CONTROL

ASSISTED DOCKING

Software version: **v2.0.28**

INSTALLATION & COMMISSIONING INSTRUCTIONS

English (en-US)
Date: 02-2024
Document number: 87418 (Rev 4)
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AVENTICS™

Raymarine®

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CHAPTER 1: IMPORTANT INFORMATION

Warning: System requirements of use

THE DOCKSENSE® SYSTEM IS NOT DESIGNED TO OPERATE AUTONOMOUSLY.

The Raymarine DockSense® System ("System") is designed as an aid to assist in docking only; the user ("Captain") understands and agrees before engaging that the "System requirements of use" and "System limitations" contained in this publication apply.

At ALL times while the DockSense® System is engaged, the user ("Captain") MUST:

- Remain at the helm whilst the System is engaged, or the vessel is underway
- Maintain awareness of the boat's speed, position, direction of travel as well as the proximity of other vessels and objects in the proximity of the vessel
- Remain in full control of the boat, its movements and is responsible for maintaining a safe distance to prevent the vessel from collision
- Only use the System for its intended purpose (assist with a docking manoeuvre)
- Ensure there is enough space to undertake a safe docking manoeuvre
- Ensure that there are no people in the water within the proximity of the boat during the docking manoeuvre
- Remain responsible for the safety of all passengers onboard.

Warning: System limitations (Part 1)

IMPORTANT: The following statement consists of two parts, and MUST be read in conjunction with its counterpart statement (Part 2): System limitations (Part 2)

- The DockSense® System ("System") is designed as an aid to awareness only
- The System is designed to assist in a docking manoeuvre, aiding the Captain to avoid colliding their boat with a System-detected object
- During adverse conditions, the Boat's propulsion System may not be able to control the boat due to limitations in boat dynamics
- The System must be maintained:
  - Cameras cannot be obscured
  - Cameras must be cleaned regularly
- The System uses an optical camera system
  - Minimal levels of light and visibility are required for the System to function
  - Rain, fog, dusk or night will limit the System performance
  - Without appropriate light/visibility the System will not function correctly and should not be engaged

Warning: System limitations (Part 2)

IMPORTANT: The following statement consists of two parts, and MUST be read in conjunction with its counterpart statement (Part 1): System limitations (Part 1)

- The DockSense® System has been designed for the detection of solid pontoons or docking structures, caution should be taken as the System may not detect objects with small cross-sectional areas such as ropes or poles
- The System requires an object to protrude more than 400 mm / 16 in. above the water plane in order to be classified as an object
- The System will only identify objects that are above the water surface
- The System relies on movement of the boat to generate a view of the area around the boat
  - If the boat remains static, the System may experience blind spots
- While the System is engaged, system data is stored on the System's hard drive
  - The Data collected can only be accessed by Raymarine authorized personnel
  - Data retrieval will only be done in order to analyse the performance of a System.

Warning: Ensure safe navigation

This product is intended only as an aid to navigation and must never be used in preference to sound navigational judgment. Only official government charts and notices to mariners contain all the current information needed for safe navigation, and the captain is responsible for their prudent use. It is the user's responsibility to use official government charts, notices to mariners, caution and proper navigational skill when operating this or any other Raymarine product.

Warning: Risk of false object detection

Environmental conditions such as strong reflected light can cause false object detection on the DockSense® system. Always maintain a permanent watch of your vessel's surroundings; this will allow you to recognise false warnings and respond to situations as they develop. Failure to maintain a permanent watch puts yourself, your vessel and others at serious risk of harm.

Warning: Moving objects

The DockSense® system is designed to detect large static objects when performing docking maneuvers. Detecting small moving objects (such as kayaks) is not always guaranteed. Always maintain a visual watch of your vessel's surroundings. Failure to maintain a permanent watch puts yourself, your vessel and others at serious risk of harm.

Warning: Privacy

DockSense® systems are compliant with applicable Data Protection and Privacy laws. DockSense® systems do NOT store recorded footage from the cameras.

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.
- Certified installation by an approved installer is recommended. A certified installation qualifies for enhanced product warranty benefits. Contact your dealer for further details.

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.

Warning: Only use system when vessel engine is running

The vessel's engine must be running at ALL times while the system is in use. Loss of power to the system compromises system safety and potentially puts yourself, your crew and your vessel at risk of harm.

Warning: Ensure system power source is charged by vessel's engine under normal operation

The power source for the system MUST be one that is charged by the vessel's engine (under normal operation). Failure to ensure a constant source of power to the system potentially puts yourself, your crew and your vessel at risk of harm.

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.

Warning: Corrosion

To avoid accelerated galvanic corrosion of the product, ensure that a non-metallic isolation mount is used when fitting the product directly to large stainless steel platforms/mounts, or directly to steel construction vessels.

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: Product grounding

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

Warning: Positive ground systems

Do not connect this unit to a system which has positive grounding.

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: 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.

Cleaning the camera

The camera housing and lens require regular cleaning. You should clean the lens when system performance appears to deviate from its usual level, or when excessive contaminant buildup is seen on the lens. You should also ensure that the camera's protective cover is also unobstructed and operating correctly.

When cleaning this product:

- Do NOT wipe the lens window with a dry cloth, or with abrasive materials such as paper or scrub brushes, as this could scratch the coating.
- Do NOT use acid or ammonia based products.
- Do NOT pressure wash.

Particular care should be taken when cleaning the lens window, as this has a protective anti-reflective coating which may be damaged by improper cleaning.

1. Switch off the power to the unit.
2. Clean the camera body with a clean, soft cotton cloth. You can moisten the cloth and use a mild detergent if required.

3. Clean the camera lens.
    - Rinse the lens with fresh water to remove all dirt particles and salt deposits, and allow to dry naturally.
    - If any spots or smears remain, very gently wipe the lens window with a clean microfibre cloth or soft cotton cloth.
    - If necessary, use isopropyl alcohol (IPA) or a mild detergent to remove any remaining spots, marks, or salt deposits.

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.

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Open source license agreements

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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 (3.28 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 (6.56 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.

Suppression ferrites

- 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 the manufacturer 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.
- If your camera installation requires long cable runs, you may need to fit additional ferrites to maintain acceptable EMC performance.

Declaration of Conformity

Raymarine UK Ltd declares that the following products are in compliance with the EMC Directive 2014/30/EU:

- DockSense® Control Processor Module, part number: E70603

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

Declaration of Conformity

Raymarine UK Ltd declares that the following products are in compliance with the EMC Directive 2014/30/EU:

- DockSense® Stereo-Vision Camera, part number: E70602

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

Declaration of Conformity

Raymarine UK Ltd declares that the following products are in compliance with the Radio Equipment Directive (RED) 2014/53/EU:

- DockSense® AR250 compass, part number: E70615

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

Declaration of Conformity

Raymarine UK Ltd declares that the following products are in compliance with the Radio Equipment Directive (RED) 2014/53/EU:

- DockSense® AR270 compass, part number: E70641

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

Warranty registration

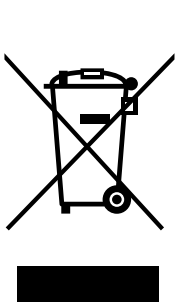
To register your Raymarine product ownership, please visit www.raymarine.com and register online.

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.com/en-gb/policies/recycling

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.

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.

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CHAPTER 2: DOCUMENT INFORMATION

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- 2.1 Product documentation — page 16

2.1 Product documentation

The following documentation is applicable to the DockSense Control System:

- **87418** — DockSense Control Installation instructions
- **81398** — DockSense Control Operation instructions
- **87406** — DockSense Processor Module Mounting template
- **87409** — DockSense AR250 / AR270 Compass Mounting template
- **87412** — DockSense Stereo-Vision Camera Mounting template
- **87298** — Axiom MFD Installation instructions
- **87414** — Axiom+ MFD Installation instructions
- **87319** — Axiom Pro MFD Installation instructions
- **87344** — Axiom XL MFD Installation instructions
- **81370** — LightHouse 3 Advanced Operation instructions

DockSense® Control documentation

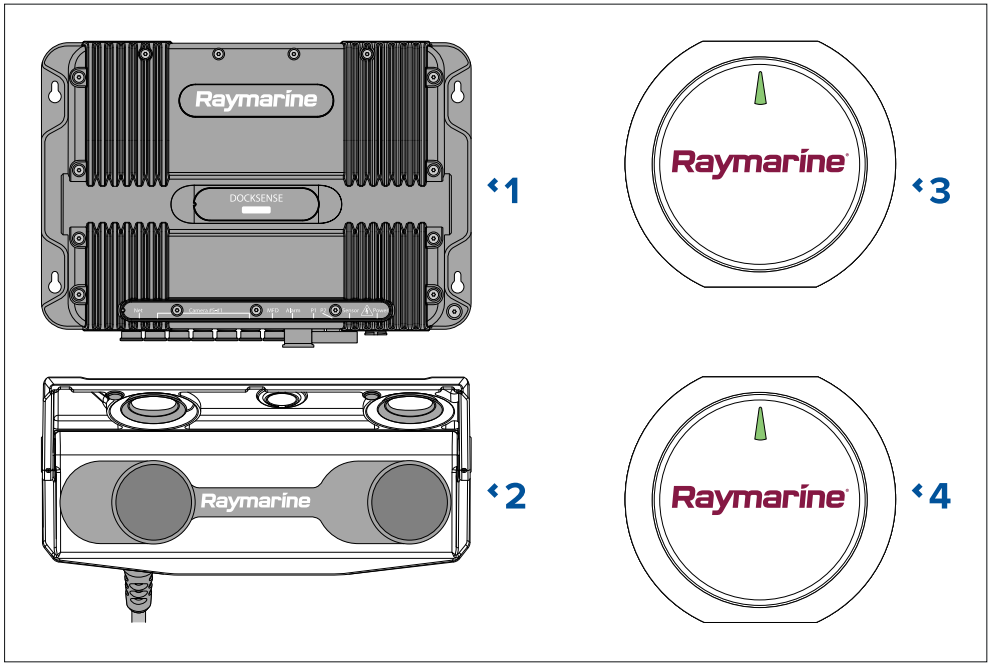
The latest versions of all English and any available translated documents are available to view or download on any device with a web browser. **Please check the links provided below to ensure you have the latest documentation.**

Digital manuals

https://bit.ly/ds-control

Applicable products

This document is applicable to the following products:



1. **DockSense® Control Processor Module** (E70603) — The DockSense® Control Processor Module receives data from the DockSense® Stereo-Vision Cameras and AR250 / AR270 Sensors. This data is processed and transmitted to a connected Multifunction Display (MFD).
2. **DockSense® Stereo-Vision Camera** (E70602) — Built with dual stereo lenses, DockSense® cameras are capable of distinguishing solid objects from the water and measuring your vessel's distance from the dock, using advanced depth perception technology.
3. **DockSense® AR250 GPS Compass** (E70615) — DockSense® AR250 Compass provides GPS data to the system.
4. **DockSense® AR270 AHRS Compass** (E70641) — DockSense® AR270 AHRS (Attitude Heading Reference Sensor) is the master compass and heading sensor in the system. It provides stabilization data to the system.

Applicable software version

Product software is updated regularly to add new features and improve existing functionality.

This document has been updated to reflect DockSense Control software version: **v2.0.28**.

Check the website for the latest software:

DockSense Control **software download link**
https://www.raymarine.com/en-us/download/docksense-processor-module-software

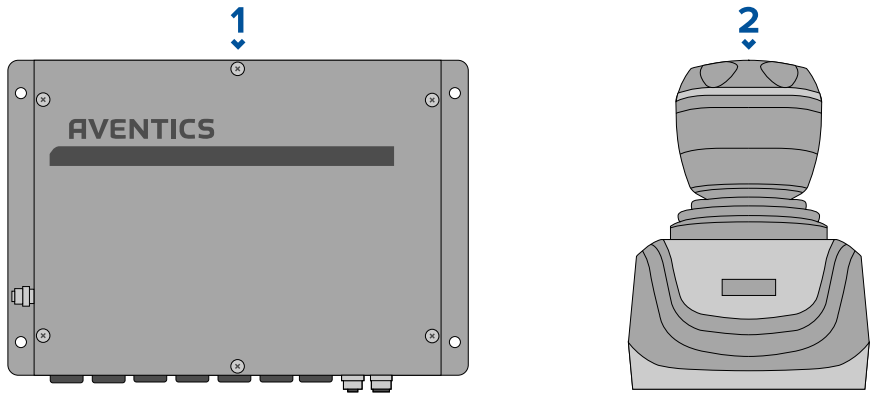
Additional system components

DockSense systems must be used in conjunction with the following items, available separately from Raymarine:

- Axiom / Axiom Pro / Axiom XL / Axiom+ Multifunction Display

Additional system components (Aventics)

DockSense Control systems must be used in conjunction with the following items, available separately from Aventics:



1. Aventics Marex 3D Controller
2. Aventics Marex 3D Joystick

Important:

Docksense is not compatible with the Marex-3D thruster balance feature. When commissioning the joystick, please ensure that thruster balance is disabled (set to 100%). For more information refer to your Aventics agent / Installer.

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.

Document conventions

The following conventions are used throughout this document:

System conventions:

- **DockSense® System** — Refers to the complete DockSense® system, consisting of a processor module, multiple cameras, and AR250 / AR270 sensors.
- **Processor module** — Refers to the “black box” central processing unit, which processes the data sent by the cameras and AR250 / AR270 sensors, and provides it to the multifunction display (MFD).
- **Stereo-Vision Camera**, or just “camera” — refers to one or many Stereo-Vision cameras, which provide the depth perception information to enable the system to distinguish between the water and solid objects.
- **AR250** / **AR270**, or just “compass” — refers to the stabilization sensors providing compass, attitude and heading data to the system.

User interface conventions:

- **Select** — The term ‘select’ refers to using the *[touchscreen]* or physical controls of a Raymarine multifunction display (MFD) to select an on-screen item.

CHAPTER 3: PRODUCT AND SYSTEM OVERVIEW

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- 3.1 Product overview — page 20
- 3.2 Compatible multifunction displays — page 24
- 3.3 System protocols — page 25

3.1 Product overview

DockSense® Control

DockSense® Control is an advanced object recognition and motion sensing system designed to assist you in docking maneuvers.



The DockSense® Control system uses intelligent machine-vision camera technology to analyze real-world imagery and create a “Virtual Bumper” around your vessel, which helps determine your distance from potential hazards. The DockSense® Control system reacts differently to objects that encroach on the Bumper, depending on the *[Mode]* the system is in:

- *[Manual Control Mode]* — When you are close to solid objects, the system will trigger visual and audible alerts. The captain retains full throttle control in this mode, via the joystick.
- *[Auto Mode]* — When you are close to solid objects, the system will trigger visual alerts and automatically adjust the throttle to prevent your vessel from hitting the dock.

Both *[Modes]* significantly reduce the risks and complexities inherent to maneuvering in tight-quarter environments, taking the stress out of this vital maneuver by creating a safer docking experience.

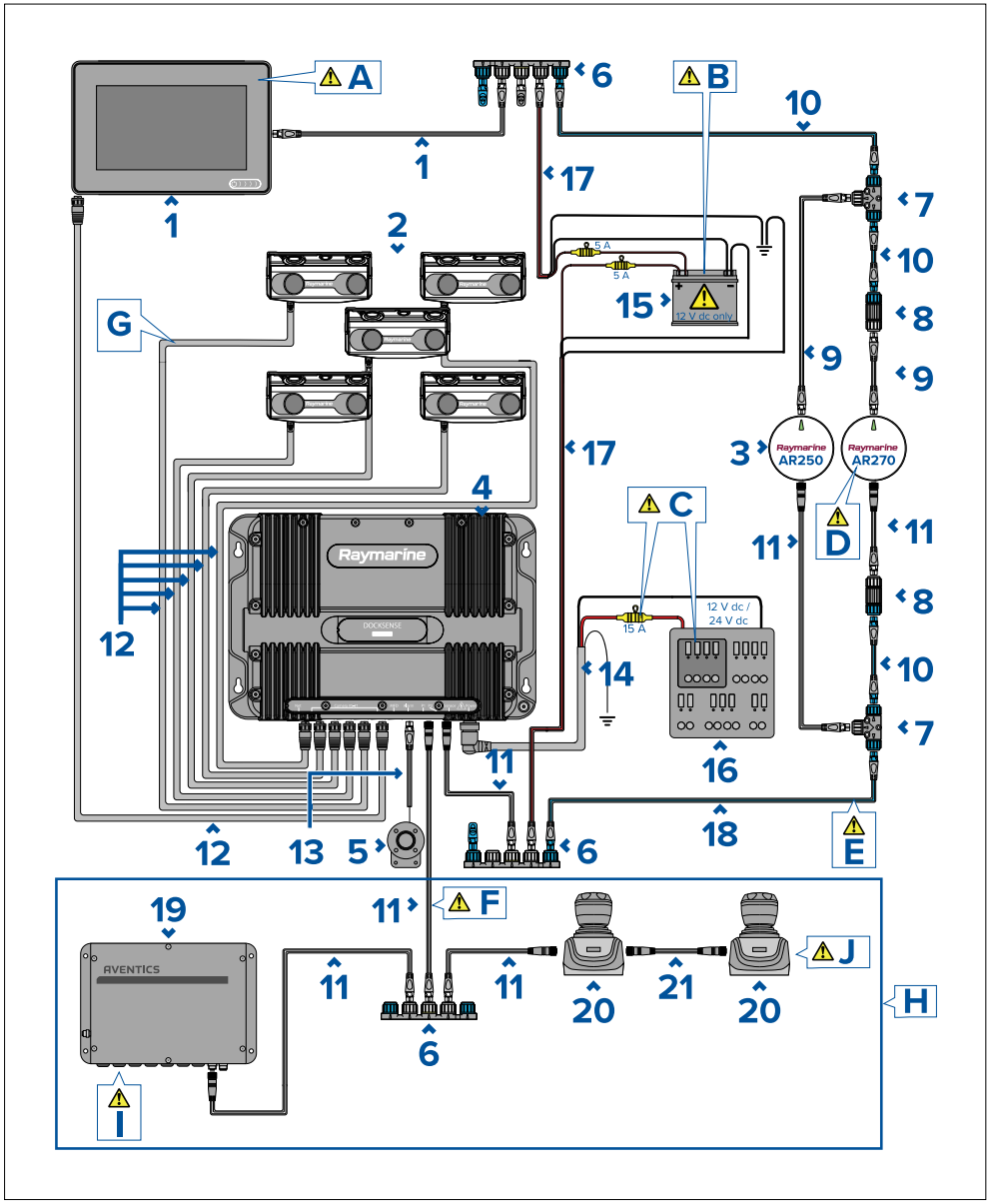
The DockSense® Control system is comprised of 4 core components:

1. **DockSense® Stereo-Vision Cameras** — *DockSense® Cameras are capable of distinguishing solid objects from the water; this allows the DockSense system to measure your vessel’s distance from the dock and other solid objects.*
2. **AR250 / AR270** — *These 2 sensors provide the DockSense® system with GPS and AHRS (stabilization) data.*
3. **DockSense® Control Processor Module** — *Located below deck, the Processor Module receives visual data from the cameras, and pitch and roll data from the connected AR250 / AR270 compasses. The Processor Module also receives and transmits data between the Aventics Joystick system. This data is processed and transmitted to the connected multifunction display (MFD) and then displayed in the DockSense® Control app.*
4. **Axiom Multifunction Display (MFD)** — *The MFD displays the DockSense® Control app, providing audible and visual alerts to help you to safely dock your vessel.*

System overview (example only)

The following illustration shows a connections overview for a typical DockSense® Control system.

The system configuration shown is an example only. Please consult your dealer for a suitable system for your specific vessel.



Note:

Power connections for Aventics equipment are not shown in this illustration. Please refer to your dealer / installer and Aventics documentation pack for more information.

1. Multifunction display (MFD)
2. DockSense® Stereo-Vision Cameras (the number of cameras is dependent on your specific vessel requirements)
3. AR250 / AR270
4. DockSense Processor Module
5. External Honk Alarm
6. SeaTalkng backbone 5–way connector
7. SeaTalkng backbone T-piece
8. SeaTalkng in-line terminator
9. SeaTalkng spur cable
10. SeaTalkng backbone cable
11. SeaTalkng -to-DeviceNet adaptor cable
12. RayNet cable
13. External Honk Alarm cable — see also Note F, below.
14. Processor Module power cable
15. 12 V dc power supply (for separately powering the SeaTalkng and DeviceNet backbones)
16. 12 / 24 V dc distribution panel or battery (powers DockSense® Processor Module)
17. SeaTalkng power cable
18. DeviceNet backbone
19. Aventics Marex 3D Controller
20. Aventics Joystick
21. DeviceNet cable

Important:

A — The MFD requires a 12 / 24 V dc power supply, protected by a suitable fuse. Refer to the relevant MFD Installation manual for the voltage and fuse details specific to your MFD variant.

Important:

B — The SeaTalkng and DeviceNet backbones both require a dedicated 12 V dc power supply, protected by a 5 A inline fuse.

Important:

C — The following fuses (not supplied) are required for circuit protection for the Processor Module:

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

Important:

D — There must be **greater** than 1 m (3.28 ft.) distance between the two compasses.

Important:

E — The total DeviceNet backbone cable length between the AR250/AR270 and the Processor Module must NOT exceed 20 m (65.6 ft.).

Important:

F — This SeaTalkng -to-DeviceNet adaptor cable allows communication between the DockSense Control Processor Module and the Aventics Joystick system.

Note:

G — The camera's RayNet cable provides both power and data signals to the cameras, via the Processor Module.

Note:

H — Aventics Joystick system. For more information refer to your Aventics system documentation.

Important:

I

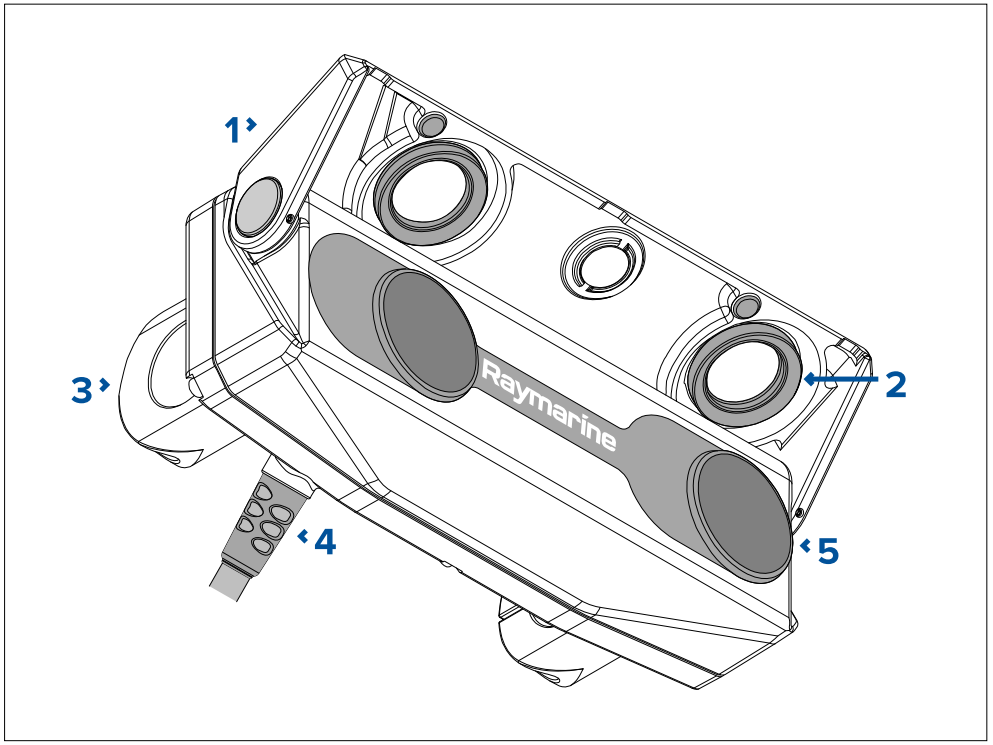
- The Aventics Marex 3D Controller requires its own dedicated power supply. For more information refer to your Aventics system documentation.
- The Aventics Marex 3D Controller has its internal terminator enabled from the factory. For more information on disabling the terminator, refer to your Aventics system documentation.

Important:

J — Aventics Joysticks can be chained to allow control of your DockSense system from multiple locations on your vessel. The final joystick in the chain must be fitted with an external terminator. For more information refer to your Aventics system documentation.

Stereo-Vision Camera

The DockSense® Stereo-Vision Camera is a dual-lens device, capable of depth perception and distinguishing between the water and solid objects. Data from the camera is transmitted to the Processor Module, which interprets and combines the visual information from all connected cameras into a synchronized, intelligent view of your vessel's immediate surroundings.



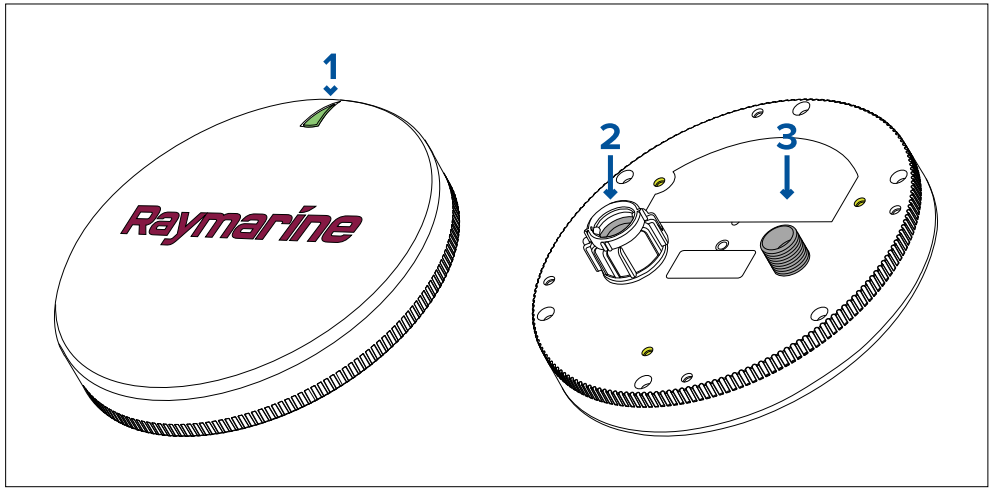
1. Environmental cover.
2. Lens protective seal.
3. Camera clamp.
4. RayNet captive cable (5 m (16.4 ft.))
5. Camera lens window.

The DockSense® Stereo-Vision Camera has the following key functions and features:

- Dual stereo camera lens provides depth perception and object detection.
- Environmental cover automatically opens and closes when the DockSense system is not in use.
- Lens protective seals prevent moisture or debris from damaging the camera lens when not in use.
- Automatic window heaters to de-ice the lens windows in cold weather.
- Data and power is provided to the camera via captive RayNet cable.
- Waterproof to IPx6.

AR250 / AR270 Compasses

The DockSense® AR250 and AR270 compasses provide GPS and AHRS data respectively, to the DockSense® system.



1. Diagnostics LED
2. SeaTalkng connector
3. DeviceNet connector

DockSense® AR250 key features

- Compatible with GPS, and GLONASS GNSS systems.
- Can be used as a source of GNSS (GPS) position and Heading data for other devices in your network. Please refer to the Multiple Data Sources (MDS) information in your MFD operation instructions for details.

DockSense® AR270 key features

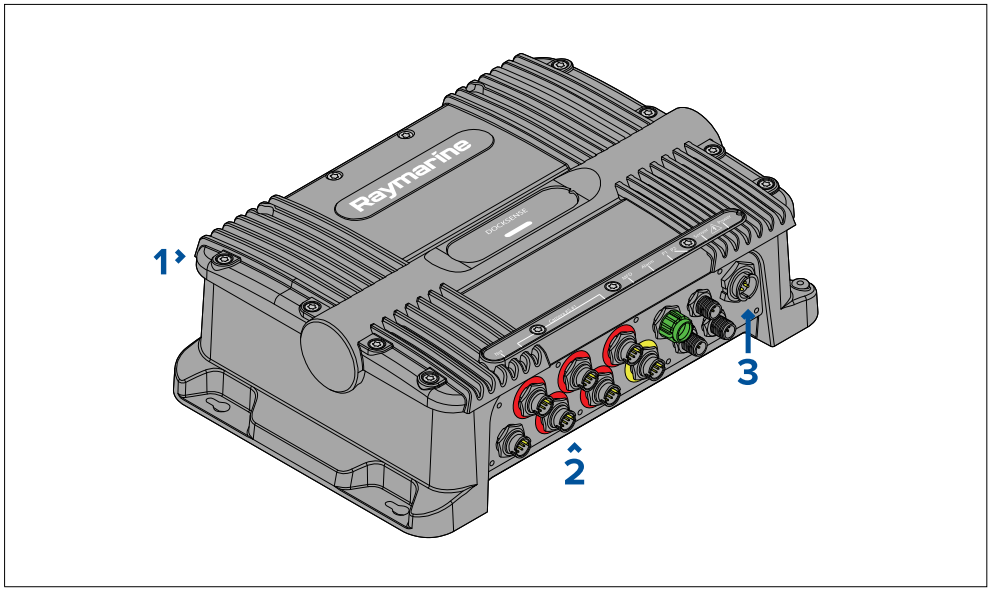
- 9–axis AHRS (Attitude and Heading Reference System) sensor.

Additionally, the AR250 / AR270 compasses have the following common functions and features:

- Pole, Rail, Surface or Bracket mountable. (A surface mount riser is supplied with each compass; additional mounting kits are available separately as accessories).
- NMEA 2000 compliant.
- Low power consumption.
- 12 V DC operation (protected up to 32 V DC).
- Waterproof to IPx6.

Processor Module

The DockSense® Processor Module receives visual data from the cameras, and pitch and roll data from the connected AR250 / AR270 compasses. The Processor Module also receives and transmits data between the Aventics Joystick system. This data is processed and transmitted to the connected multifunction display (MFD) and then displayed in the DockSense® Control app.



1. Protective housing.
2. Network connectors: RayNet, Alarm (honk), DeviceNet.
3. Power connector.

The Processor Module has the following key functions and features:

- Dedicated connection ports for each DockSense® Control system component.
- Visual data processing.
- Object detection and control system.
- System diagnostic alerts (via honk alarm).
- 12 V or 24 V dc operation.
- Waterproof to IPx6.

3.2 Compatible multifunction displays

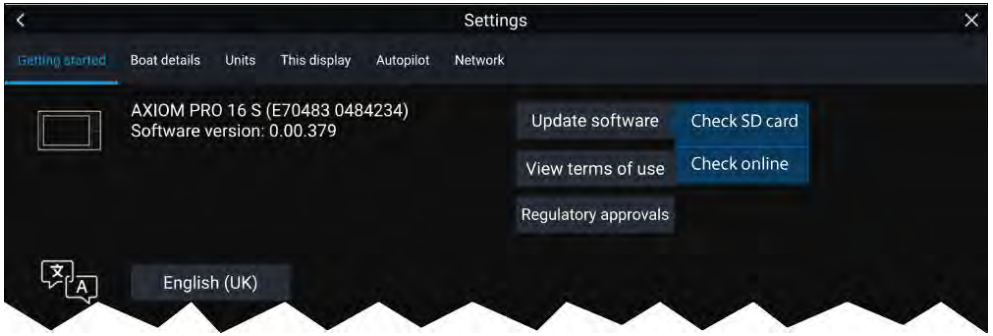
The DockSense® System is only compatible with the following Raymarine® multifunction displays.

- Axiom
- Axiom+
- Axiom Pro
- Axiom XL

Multifunction display software requirements

The DockSense® Control system requires a Raymarine® multifunction display (MFD) running LightHouse 3, later than version 3.14.88.

The latest software for your MFD can be obtained by visiting the Raymarine website (www.raymarine.com/software) and downloading to a MicroSD card, or by checking online with an MFD connected to the Internet:



3.3 System protocols

Your product can be connected to a number of different external devices, using the communication protocols described in the following section.

SeaTalk NG

SeaTalk NG (*Next Generation*) is an enhanced protocol for connection of compatible marine instruments and equipment. It replaces the older SeaTalk 1 and SeaTalk 2 protocols.

SeaTalk NG utilizes a single backbone which compatible equipment connects to using a spur. Data and power are carried within the backbone. Devices that have a low power draw can be powered from the network, although high current equipment will need to have a separate power connection.

SeaTalk NG is a proprietary extension to NMEA 2000 and the proven CAN bus technology. Compatible NMEA 2000, SeaTalk 1 and SeaTalk 2 devices can also be connected using the appropriate interfaces or adaptor cables as required.

NMEA 2000

The NMEA 2000 Data Interface Standard was developed by the NMEA® (*National Marine Electronics Association of America*). It is an international standard to enable equipment from many different manufacturers to be connected together and share information.

NMEA 2000 offers significant improvements over NMEA 0183, most notably in speed and connectivity. Up to 50 units can simultaneously transmit and receive on a single physical bus at any one time, with each node being physically addressable.

This disciplined multiple-talker, multiple-listener data network is therefore a significant improvement when compared to the NMEA 0183 single-talker, multiple-listener (simplex) serial communications protocol.

The NMEA 2000 standard was specifically intended to allow for a whole network of marine electronics from any manufacturer to communicate on a common bus via standardized message types and formats.

NMEA 2000 utilizes a single backbone which compatible equipment connects to using a spur. Data and power are carried within the backbone. Devices that have a low power draw can be powered from the network, although high current equipment will need to have a separate power connection.

DeviceNet

Electrically, NMEA 2000 is very similar to, and compatible with, the *Controller Area Network* ("CAN bus") technology used widely in the automotive industries, known as "DeviceNet". Specifically, at the protocol higher-level, NMEA 2000 is based on *Society of Automotive Engineers* (SAE) J1939, with specific messages for the marine environment. Due to their electrical compatibility, NMEA 2000 devices and DeviceNet devices can co-exist on the same physical network, and can also use the same cables. Typically, the DeviceNet cables used in NMEA 2000 networks are known as "*Micro-C*", or sometimes just "*Micro*".

SeaTalk HS

SeaTalk HS is a high speed ethernet-based marine network which allows compatible equipment (such as devices with an RJ45, RayNet, or RJ45 SeaTalk HS connector) to communicate rapidly and share large amounts of data.

Information shared via the SeaTalk HS network includes, but is not limited to:

- Shared cartography (between compatible displays).
- Digital radar data.
- Sonar data.

RayNet

Electrically, RayNet is identical to SeaTalk HS, and the two share the same underlying ethernet protocol.

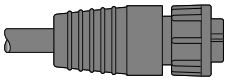
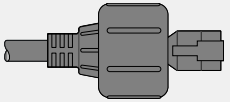
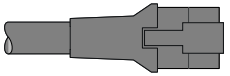
Connector types

SeaTalk HS connections can be made using one of three different connector types:

- RJ45
- Waterproof RJ45 SeaTalk HS
- Waterproof RayNet

All SeaTalk HS connector types are interchangeable, in terms of compatibility with devices featuring an RJ45 SeaTalk HS, RayNet, or RJ45 connector. However, the main difference between them is that RJ45 SeaTalk HS connectors are generally not waterproof, unless you select Raymarine cables which use the specific waterproof variant RJ45 connectors. However, all connections featuring RayNet connectors are waterproof.

The different SeaTalk HS connector types are shown below:

Connector	Description
	RayNet. This connector type is waterproof.
	Waterproof RJ45 SeaTalk HS for connection to (legacy) Raymarine equipment featuring a lockable RJ45 SeaTalk HS connector. Alternatively, these cables may be coupled with suitable adapter cables for waterproof connections to equipment featuring a RayNet connector.
	RJ45. This connector type is NOT waterproof.

Where required, adapter cables are available to connect RayNet devices to devices featuring an RJ45 or RJ45 SeaTalk HS connector.

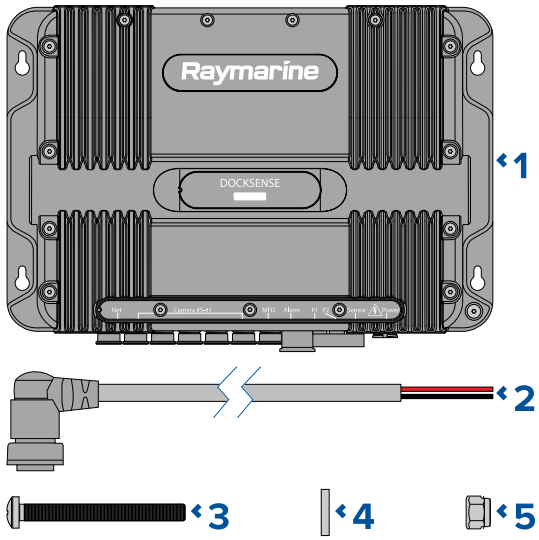
CHAPTER 4: PARTS SUPPLIED

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- 4.1 Processor Module parts supplied — page 28
- 4.2 Stereo-Vision camera parts supplied — page 28
- 4.3 AR250 / AR270 parts supplied — page 29

4.1 Processor Module parts supplied

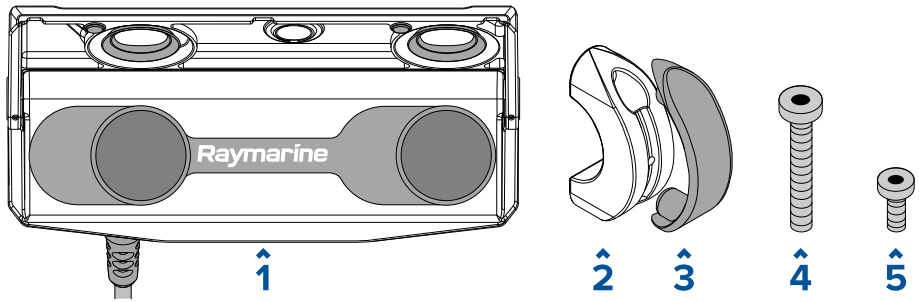
The parts supplied with the DockSense® Processor Module are shown below:



1. Processor Module
2. Power cable
3. Fixing bolts x4
4. Fixing washers x8
5. Fixing bolts x4

4.2 Stereo-Vision camera parts supplied

The parts supplied with the DockSense® Camera are shown below:



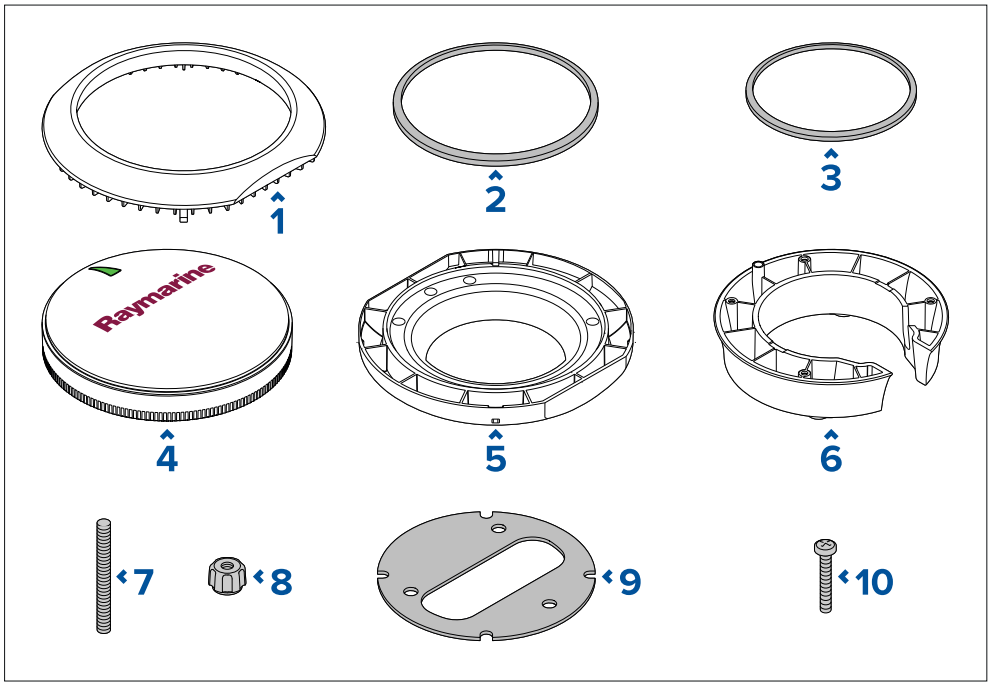
1. DockSense® Camera, including 5 m (16.4 ft.) captive RayNet power and data cable
2. Camera clamp x2
3. Camera clamp cover x2
4. Large camera clamp screws x4
5. Small camera clamp screws x2

Important:

RayNet extension cables (available separately) are required to complete the connection between each camera's captive cable, and the Processor Module. For suitable RayNet cables, refer to:
p.109 — RayNet to RayNet cables and connectors

4.3 AR250 / AR270 parts supplied

The parts supplied with the DockSense® AR250 and AR270 compasses are shown below:



1. Mounting trim (x1)
2. Large sealing ring (x1)
3. Small sealing ring (x1)
4. DockSense® AR250 / AR270 (x1)
5. Mounting tray (x1)
6. Deck riser (x1)
7. Threaded stud (x3)
8. Thumb screws (x3)
9. Sealing ring / Gasket (x1)
10. Fixing screws (x4)

The following list details the combinations of parts required for the 3 different mounting methods, which are illustrated fully in the following section:
p.44 — AR250 / AR270 compass mounting

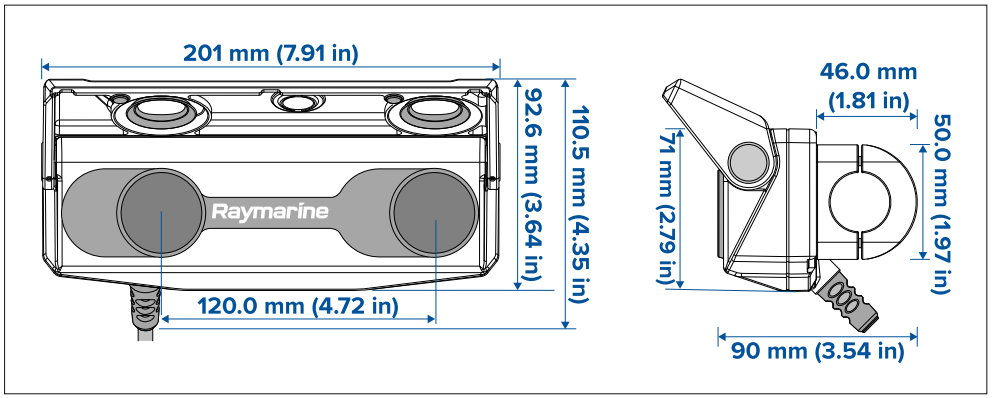
- **Surface mounting (through-surface cabling, without the AR250/270 enclosure)** — items 4, 7, 8, 9.
- **Surface mounting (through-surface cabling, with the AR250/270 in its enclosure)** — items 1, 2, 3, 4, 5, 10.
- **Surface mounting (above-surface cabling, with the AR250/270 in its enclosure)** — items 1, 2, 3, 4, 5, 6, 10. *Additionally, for this mounting method you will also need to supply your own fixings (x4) to secure the riser to the deck. These fixings are NOT supplied, as the type required is dependent on the mounting surface thickness and material.*

CHAPTER 5: PRODUCT DIMENSIONS

CHAPTER CONTENTS

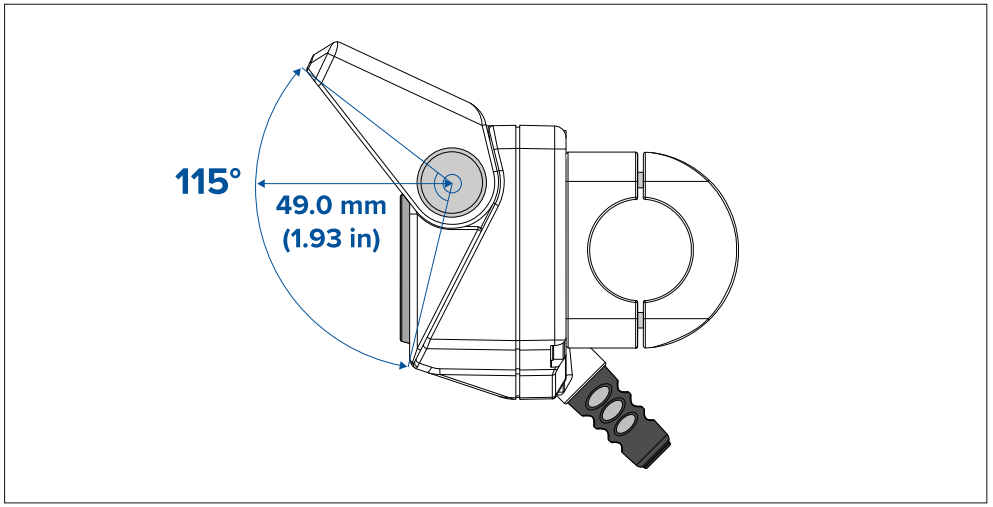
- 5.1 Dimensions — Stereo-Vision camera — page 31
- 5.2 Dimensions — AR250 / AR270 — page 31
- 5.3 Dimensions — Processor Module — page 31

5.1 Dimensions — Stereo-Vision camera

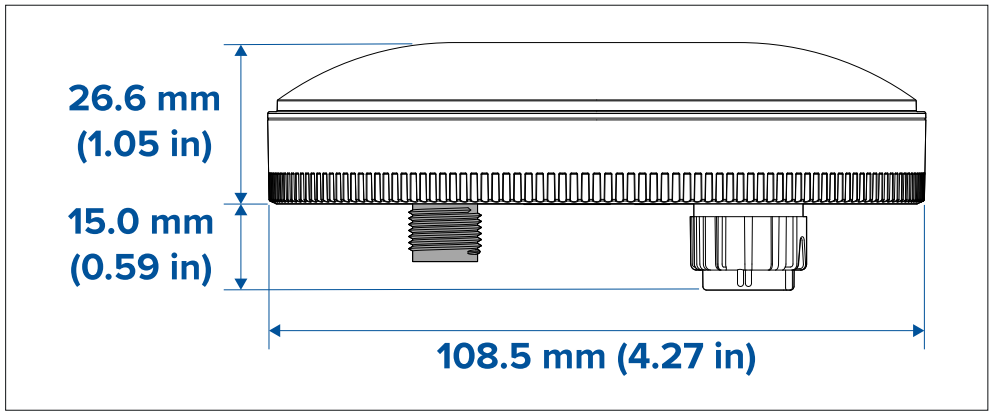


Camera shutter angle and dimension

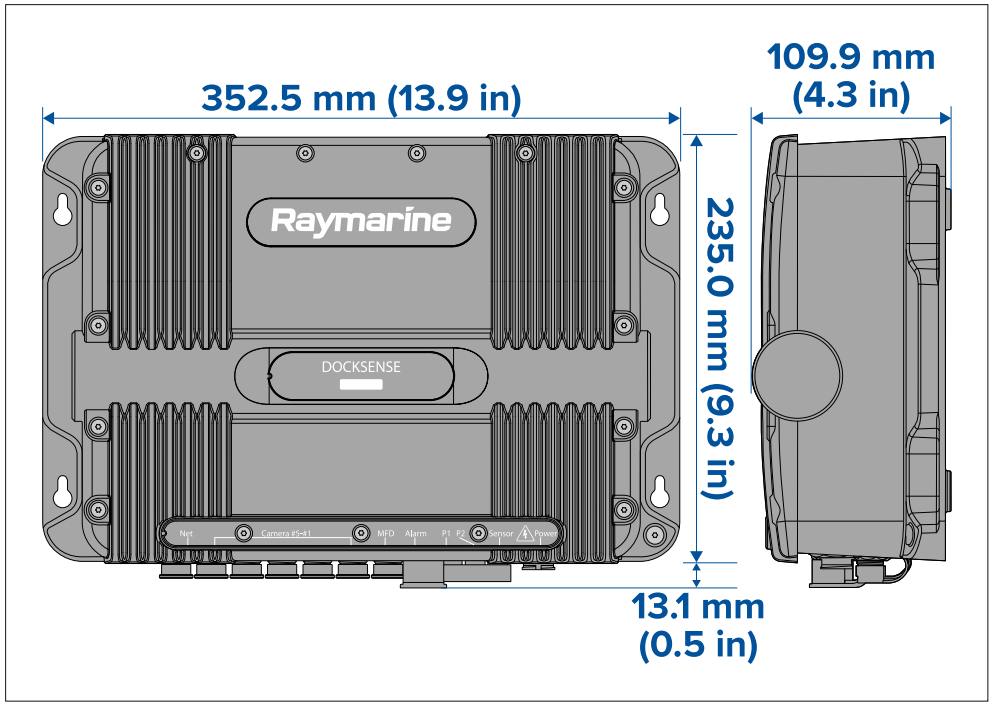
Stereo-Vision camera shutter opening and closing angle and dimension:



5.2 Dimensions — AR250 / AR270



5.3 Dimensions — Processor Module



CHAPTER 6: INSTALLATION SEQUENCE

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- 6.1 Installation & commissioning tasks — page 33
- 6.2 Aventics equipment — page 33

6.1 Installation & commissioning tasks

Installation and commissioning of the DockSense system requires the tasks to be completed in the following sequence.

Installation

1. Consider and observe the warnings and cautions provided in the following section: **p.9 — Important information**
2. Plan the locations for each system component, as well as all the associated cable routing. **The locations of the cameras and AR270 in particular are absolutely critical**, and must be located and positioned exactly as described in the **Configuration File** provided by Raymarine. Carefully consider the location requirements and EMC installation advice provided in the following section: **p.40 — Installation**
3. Mount the system components, according to the instructions provided in the following section: **p.40 — Installation**
4. Refer to the *Connections overview* for each system component, to determine the cables you require.
5. Install the cables, paying particular attention to the *Power connection* and *General cabling guidance* sections.

Important:

Both the Processor Module and the AR250/270 compasses require separate and dedicated power connections. The Processor Module itself requires a 12/24 V power connection from a distribution panel. The DeviceNet backbone connection to the Processor Module also requires its own 12 V power supply. Similarly, the AR250/270 compasses must be powered via a SeaTalkng backbone, which requires its own 12 V power supply. The cameras are powered by the Processor Module, via the RayNet connections.

Commissioning

After installing your DockSense components, you need to configure, calibrate and test the system.

Commission your DockSense system in the following order:

1. Install the DockSense boat Configuration File to your MFD.
2. Configure the Camera positions.
3. Calibrate the AR270.
4. Calibrate the vessel's center of gravity.
5. Calibrate the Cameras.
6. Test the DockSense system.

Important:

Before commissioning, ensure your DockSense system has been installed in accordance with Raymarine's requirements. For more information refer to:

- **p.35 — Camera and AR250 / AR270 Placement Position file**
- **p.34 — Location requirements**
- **p.42 — Mounting**

6.2 Aventics equipment

For instructions on how to install your Aventics equipment, please contact your dealer / installer and refer to the dedicated documentation packed with your Aventics equipment.

CHAPTER 7: LOCATION REQUIREMENTS

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- 7.1 Warnings and cautions — page 35
- 7.2 Switch off power supply — page 35
- 7.3 Potential ignition source — page 35
- 7.4 Camera and AR250 / AR270 Placement Position file — page 35
- 7.5 General location requirements — page 35
- 7.6 Compass safe distance — page 36
- 7.7 EMC installation guidelines — page 36
- 7.8 RF interference — page 36
- 7.9 Stereo-Vision Camera location requirements — page 37
- 7.10 AR250 / AR270 Location requirements — page 37
- 7.11 Processor Module location requirements — page 39

7.1 Warnings and cautions

Important:

Before proceeding, ensure that you have read and understood the warnings and cautions provided in the following section of this document:
p.9 — Important information

7.2 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.

7.3 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).

7.4 Camera and AR250 / AR270 Placement Position file

A DockSense Camera and AR250 / AR270 **Placement Position file** is supplied with your system. The placement file contains precise installation locations for your DockSense cameras and AR250 / AR270 compasses. This custom file is designed to help you install DockSense equipment in the best locations aboard your vessel.

Important:

You must follow the instructions provided in the position file and ensure the cameras and AR250 / AR270 are positioned in the exact locations specified. Failure to do so can prevent the DockSense calibration procedure completing correctly, and DockSense system will not work as intended.

The placement position file contains critical pieces of information for your installation:

- CAD drawings of your vessel with DockSense equipment installed.
- Precise coordinates to place DockSense equipment in optimal locations.
- DockSense camera pitch, roll and yaw angles.

Important:

Installing your DockSense cameras in the positions and angles described in the placement position file is essential.

If in doubt, refer to the general location requirements, as well as the specific location requirements provided for the Stereo-Vision cameras and AR250 / AR270 compasses.

7.5 General location requirements

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

Factors for consideration:

- **Ventilation** — To ensure adequate airflow:
  - Ensure that product is mounted in a compartment of suitable size.
  - Ensure that ventilation holes are not obstructed. Allow adequate separation of all equipment.

  Any specific requirements for each system component are provided later in this chapter.
- **Mounting surface** — Ensure product is adequately supported on a secure surface. Do not mount units or cut holes in places which may damage the structure of the vessel.
- **Cabling** — Ensure the product is mounted in a location which allows proper routing, support and connection of cables:
  - Minimum bend radius of 100 mm (3.94 in) unless otherwise stated.
  - Use cable clips to prevent stress on connectors.
  - If your installation requires multiple ferrites to be added to a cable then additional cable clips should be used to ensure the extra weight of the cable is supported.

- **Water ingress** — The product is suitable for mounting both above and below decks. Although the unit is waterproof, it is good practice to locate it in a protected area away from prolonged and direct exposure to rain and salt spray.
- **Electrical interference** — Select a location that is far enough away from devices that may cause interference, such as motors, generators and radio transmitters / receivers.
- **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.

7.6 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 must aim to maintain a distance of at least 1 m (3.3 ft) in all directions from any compasses.

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 on state.

7.7 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 (3.28 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 (6.56 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.

7.8 RF interference

Certain third-party external electrical equipment can cause Radio Frequency (RF) interference with GNSS (GPS), AIS or VHF devices, if the external equipment is not adequately insulated and emits excessive levels of electromagnetic interference (EMI).

Some common examples of such external equipment include LED lighting (e.g.: navigation lights, searchlights and floodlights, interior and exterior lights) and terrestrial TV tuners.

To minimize interference from such equipment:

- Keep it as far away from GNSS (GPS), AIS or VHF products and their antennas as possible.
- Ensure that any power cables for external equipment are not entangled with the power or data cables for these devices.
- Consider fitting one or more high frequency suppression ferrites to the EMI-emitting device. The ferrite(s) should be rated to be effective in the

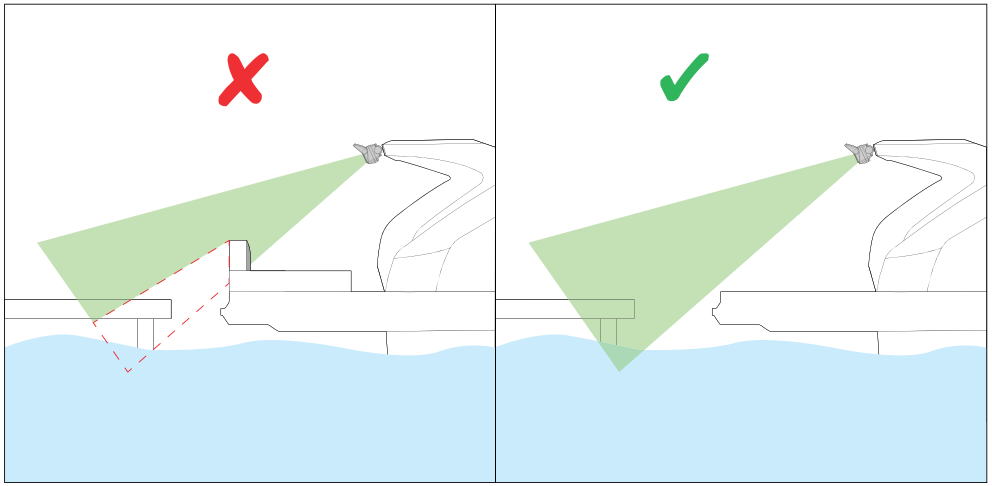
range 100 MHz to 2.5 GHz, and should be fitted to the power cable and any other cables exiting the EMI-emitting device, as close as possible to the position where the cable exits the device.

7.9 Stereo-Vision Camera location requirements

Important requirements to follow when selecting a suitable location to install the DockSense Stereo-Vision Cameras:

Incorrect camera placement can result in poor system calibration and prevent the DockSense system from functioning correctly.

- Install camera above decks, with an unobstructed view of the water / dock.



Important:

- In addition to the above, make sure your installation location follows the requirements listed in: **p.35 — General location requirements**
- You must follow your DockSense Camera and AR250 placement position file instructions when positioning this product. For more information refer to: **p.35 — Camera and AR250 / AR270 Placement Position file**

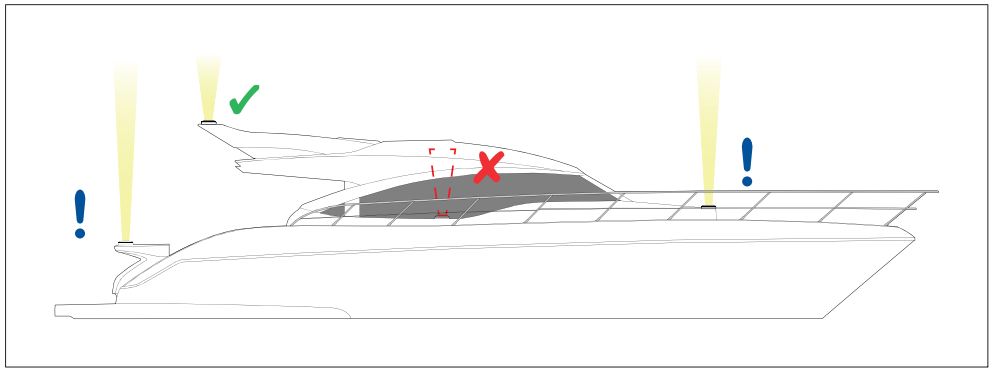
7.10 AR250 / AR270 Location requirements

Important requirements to follow when selecting a suitable location to install the AR250 / AR270 compasses:

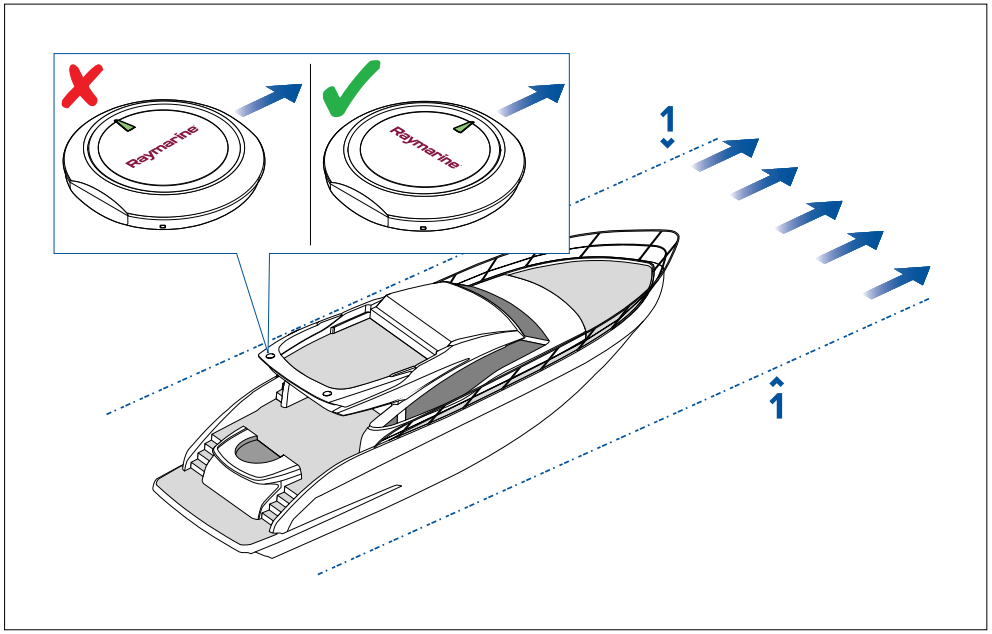
The optimum location is above decks with an unobstructed view of the sky.

The table below provides an explanation of the symbols shown in the following image:

Symbol	Description
✓	Above deck in a high position is the most suitable location.
✗	Above deck in a low position is acceptable, but not as effective as a higher location.
!	Below deck with an obstructed view of the sky. This is NOT a suitable location.



IMPORTANT: The sensor's LED 'arrow' must be pointing towards the vessel's bow and must be in parallel alignment with the longitudinal axis (centerline) of the vessel.

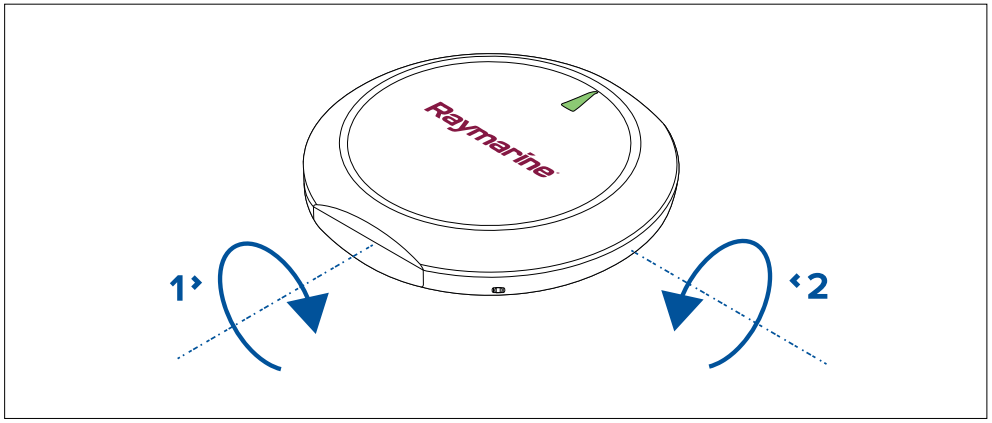


1. Vessel's longitudinal axis.

Additionally, the AR270 and AR270 sensors must also be mounted **On a horizontal and level surface, flat with respect to the water plane**. The sensors may be mounted upright or upside-down, but they must be level within 5° of pitch, and 5° of roll (compared with the vessel's neutral position when at rest and normally loaded).

Note:

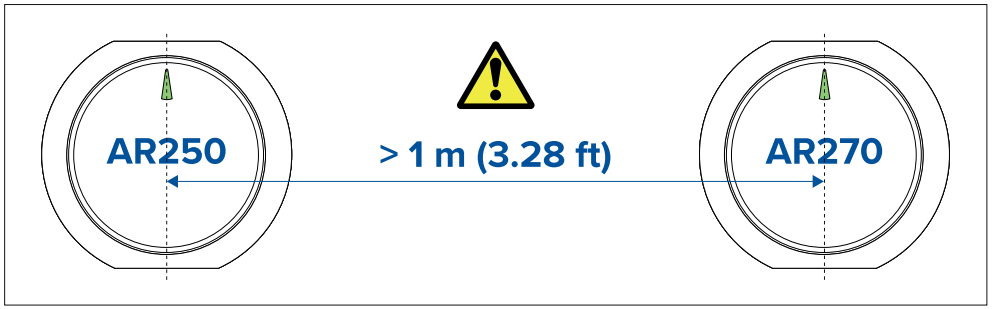
The AR270 and AR270 may be located fore/aft of each other – they don't have to be mounted port/starboard.



1. Roll
2. Pitch

Important:

Maintain **at least** 1 m (3.28 ft.) distance between the center of the AR250 and the center of the AR270.



Important:

In order to achieve adequate data bitrate transmission between the AR250/AR270 and Processor Module, **the maximum length of the DeviceNet backbone between the compasses and the Processor Module must NOT exceed 20 m (65.6 ft.)**. Additionally, the SeaTalkng to DeviceNet adaptor cables connected to each AR250/AR270 must not exceed 1 m (3.28 ft).

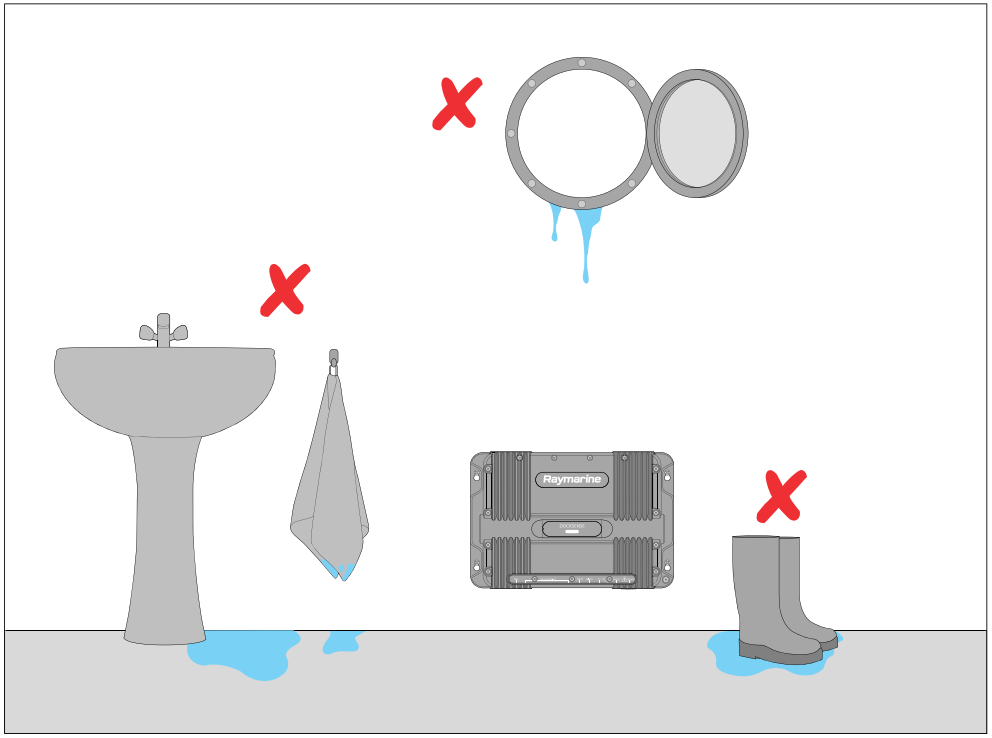
Important:

- In addition to the above, ensure your installation location adheres to the requirements listed in: **p.35 — General location requirements**
- You must follow your DockSense Camera and AR250 / AR270 placement position file when positioning this product. For more information refer to: **p.35 — Camera and AR250 / AR270 Placement Position file**

7.11 Processor Module location requirements

Important requirements to follow when selecting a suitable location to install the Processor Module:

- **Water ingress** — install product below decks in a protected area away from potential sources of water damage, such as kitchens and bathrooms, open windows and wet clothing.



Important:

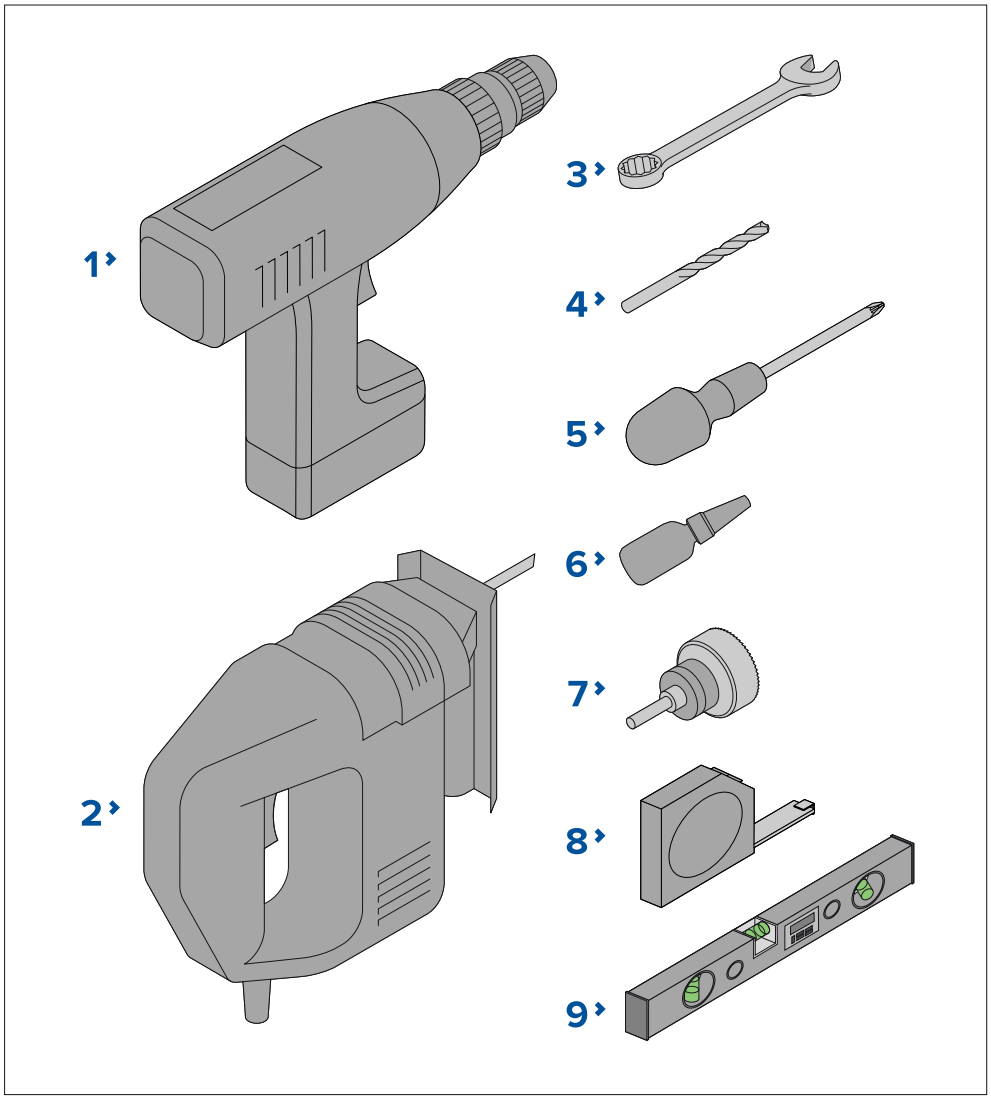
In addition to the above, make sure your installation location follows the requirements listed in: **p.35 — General location requirements**

CHAPTER 8: INSTALLATION

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- 8.1 Tools required — page 41
- 8.2 Mounting — page 42

8.1 Tools required

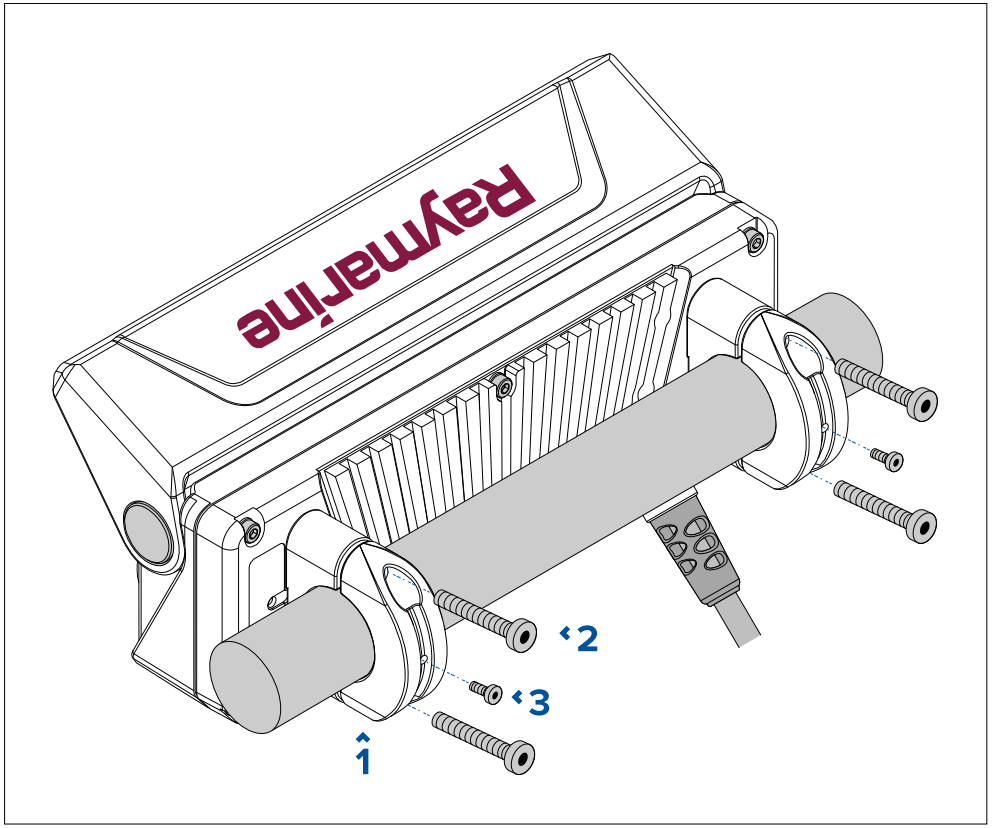


1. Drill
2. Jigsaw
3. 10 mm (0.39 in.) spanner
4. Drill bit (appropriate size dependent on thickness and material of mounting surface)
5. Pozidriv screwdriver
6. Thread-lock
7. 50 mm (2 in.) Hole saw
8. Tape measure
9. Electronic spirit level

8.2 Mounting

Camera mounting

The DockSense Camera can be mounted on your vessel's rails, using a mounting bracket supplied separately by Raymarine (A80660). Alternatively, it may be necessary to source your own custom mounting bracket (not supplied by Raymarine).



1. **Camera clamp** — grips to the vessel's rails or a mounting bracket. Clamps are compatible with Ø 1" (25.4 mm) or Ø 25.0 mm rails.
2. **Large screws** — secure the camera clamp to the rail or mounting bracket. Use a maximum torque of 2 N·m (1.48 lbf ft) for these screws.
3. **Small screws** — further secure the camera clamp to the rail or mounting bracket; only required if additional grip is required between the clamp and the rail. Use a maximum torque of 0.8 N·m (0.59 lbf ft) for these screws.

Ensure you follow your DockSense Camera and AR250 / AR270 placement position file when installing your product. For more information refer to:
p.35 — Camera and AR250 / AR270 Placement Position file

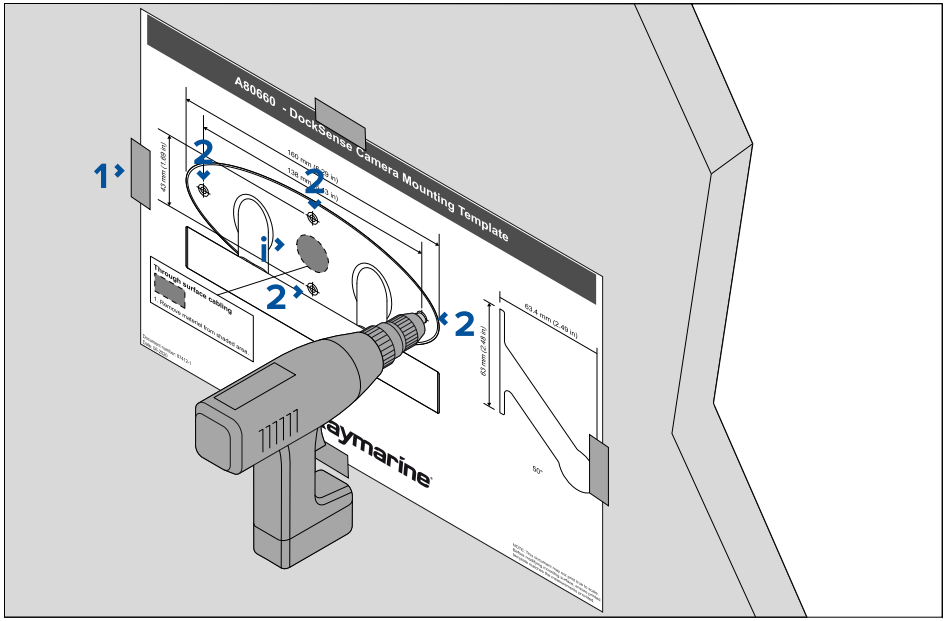
Ensure that the chosen location meets the product's location requirements. For more information refer to:
p.37 — Stereo-Vision Camera location requirements

Raymarine camera mounting bracket

A camera mounting bracket is available separately from Raymarine (part number A80660).

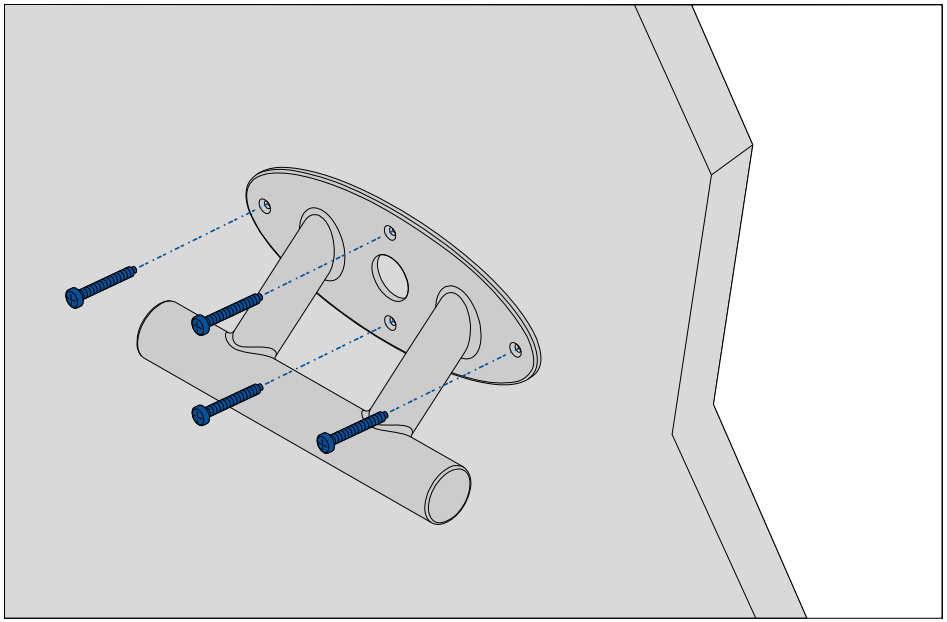
This bracket may not be suitable for all installations. It may be necessary to source your own custom mounting bracket for the camera.

1. Secure the supplied mounting template in the required location using adhesive tape.
2. Drill 4 holes at the marked location on the template. The correct torque to use is dependent on the mounting surface material and thickness.

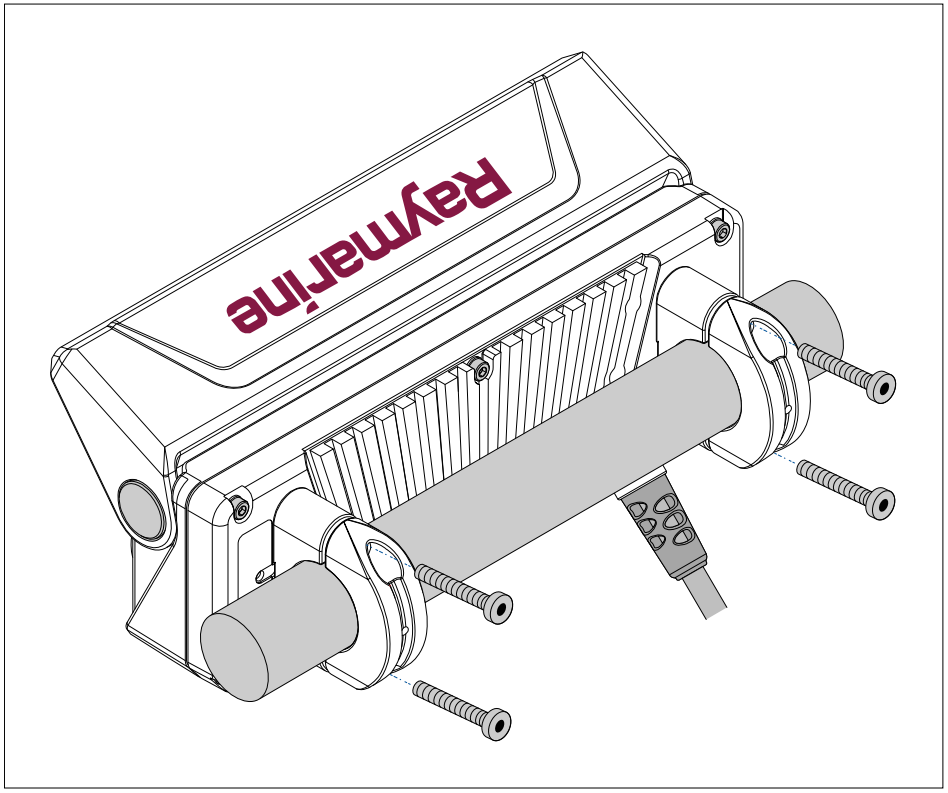


3. Remove the mounting template.

4. Screw and tighten the fixing screws until the mounting bracket is in place and secure.



5. Place the camera onto the mounting bracket and tighten the clamps enough to secure the unit, but leaving it loose enough to rotate on the mounting bracket.



6. Using a spirit level to guide, rotate the camera so it is aligned with the angle specified in the DockSense Camera and AR250 / AR270 placement position file.
7. **Once the camera is angled correctly**, tighten the large clamp screws until the camera is securely in place. Use a maximum torque of 2 N·m (1.48 lbf ft) for these screws.

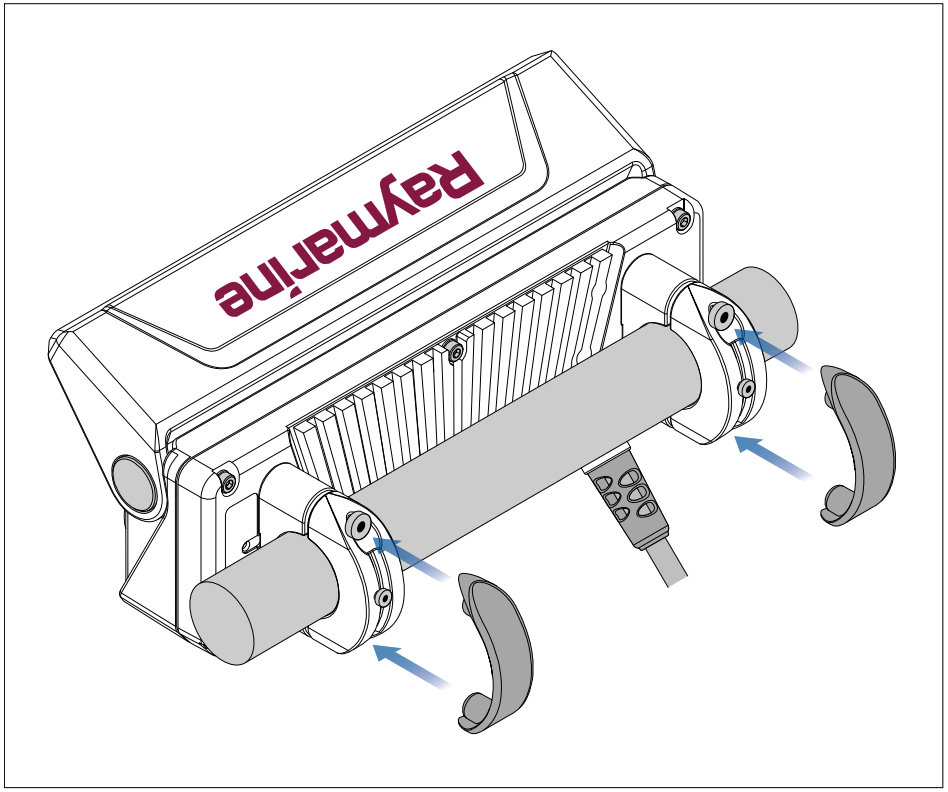
Important:

If additional grip is required between the clamp and the rail, use the smaller camera clamp screws to secure the camera further. Use a maximum torque of 0.8 N·m (0.59 lbf ft) for these screws.

Important:

Take care not to alter the angle of the camera when tightening the clamps.

8. Place the camera clamp covers onto the clamps, to cover the fixings.



AR250 / AR270 compass mounting

The supplied mounting bracket can be used to mount your product horizontally or vertically on a flat surface.

Ensure you use the exact locations specified in your DockSense **Placement Position file** when installing your products; for more information refer to **p.35 — Camera and AR250 / AR270 Placement Position file**

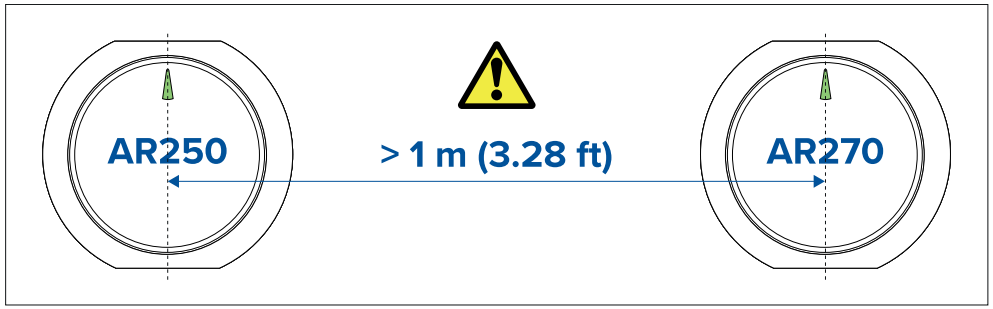
Ensure that the chosen location meets the product's location requirements, for more information refer to **p.37 — AR250 / AR270 Location requirements**

Important:

The maximum length of the DeviceNet backbone between the compasses and the Processor Module must NOT exceed 20 m (65.6 ft.).

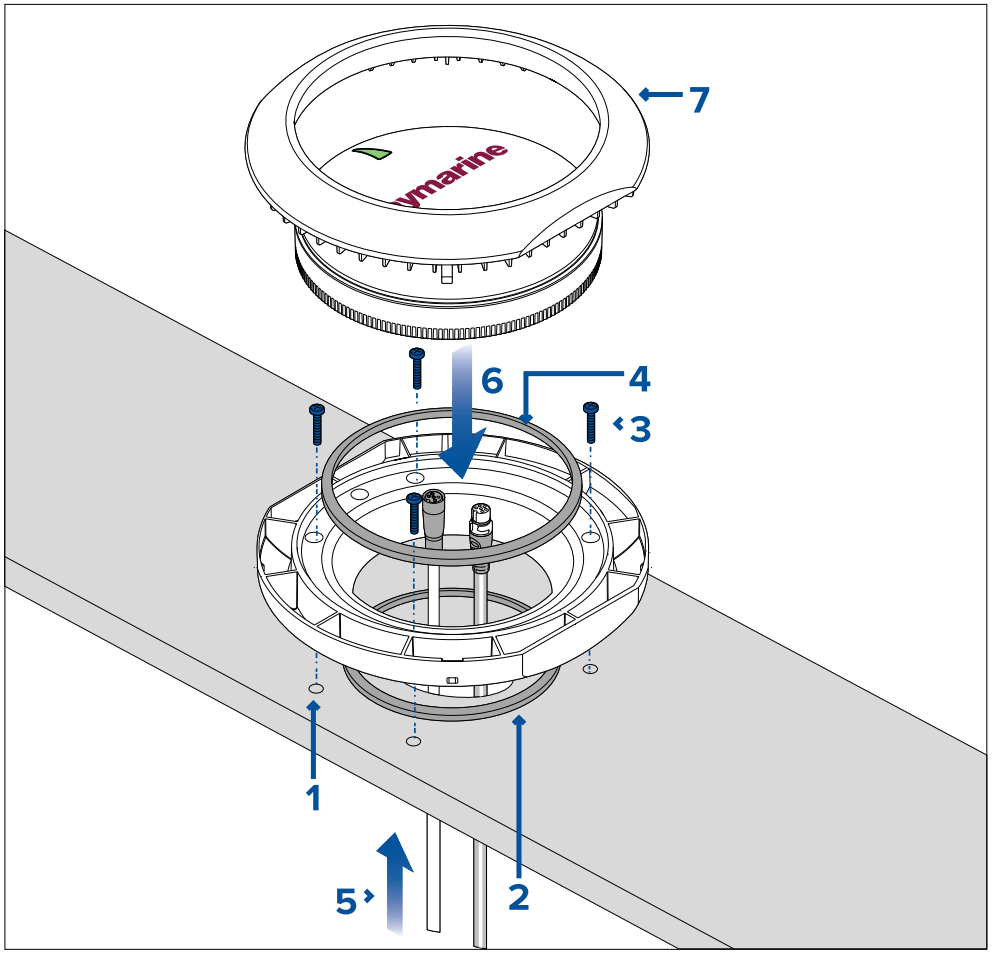
Important:

There must be **at least** 1 m (3.28 ft.) distance between the 2 compasses, in their final installation locations.



Through surface cabling

Mount your product with cables running through the mounting surface.

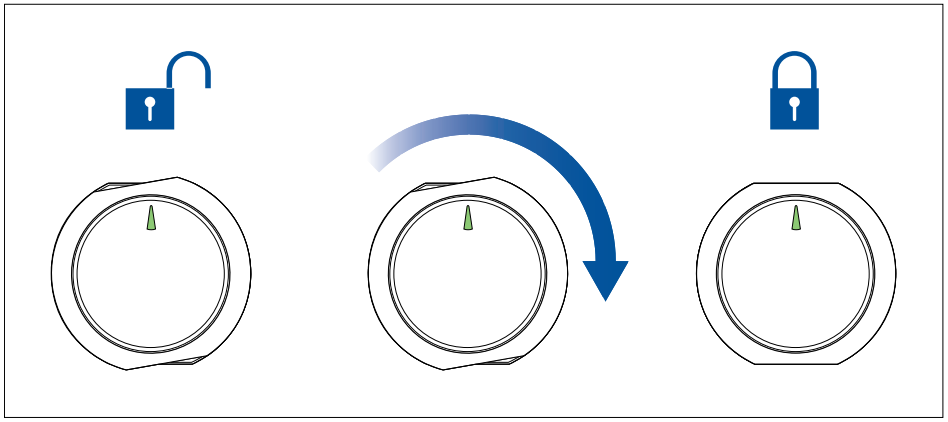


1. Using the supplied Mounting tray template (87170), drill 4 holes in the mounting surface, plus a 12 mm (15/32”) hole for the SeaTalkng cable and DeviceNet cable.
2. Place the small sealing ring in the groove located on the bottom of the mounting tray.
3. Secure the tray to the mounting surface using the 4 x fixings, supplied.
4. Place the large sealing ring into the groove on the upper side of the Mounting tray.
5. Pull the SeaTalkng cable and DeviceNet cable through the mounting surface hole and the Mounting tray. Plug in the cables to their connectors on the underside of the unit and secure by rotating the locking collars clockwise.
6. Insert the unit into the mounting tray, ensuring the tabs in the Mounting tray are slotted into the grooves around the edge of the unit.

Important:

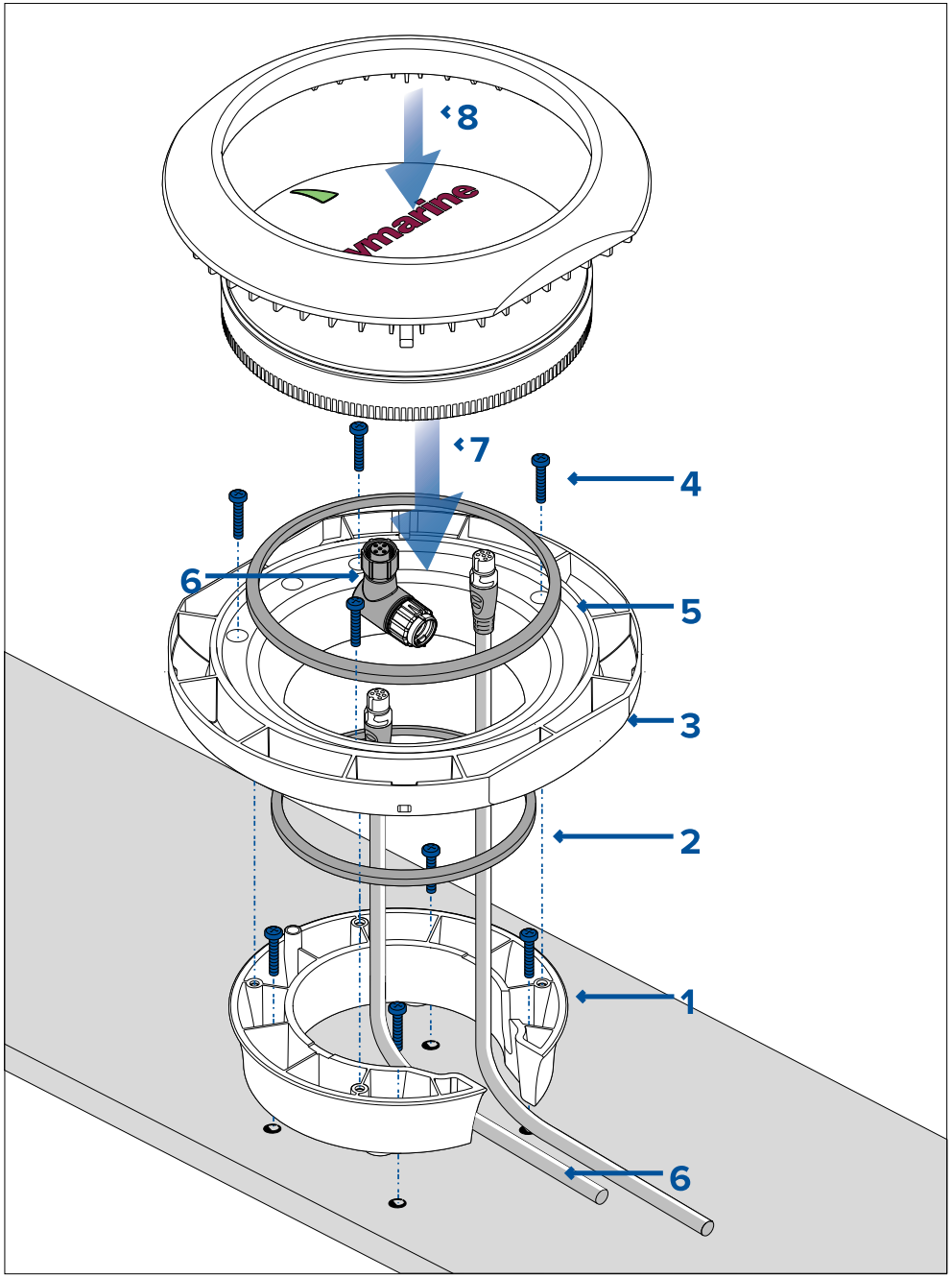
- The unit must be mounted with the LED ‘arrow’ on the top of the unit pointing towards the vessel’s bow and be in parallel alignment with the longitudinal axis (centerline) of your vessel.
- For more information refer to **p.37 — AR250 / AR270 Location requirements**

7. Place the Mounting trim over the unit slightly offset, and then twist the Mounting trim clockwise until it locks into position.



Surface cabling

Mount your product with cables running on top of the mounting surface with the supplied mounting riser.



Important:

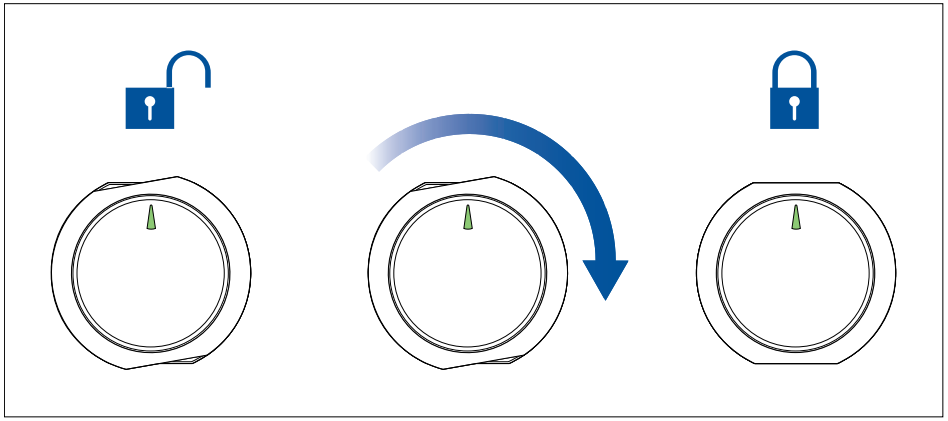
If required, a SeaTalkng to DeviceNet right-angled adaptor (A06084) is available separately, to assist in connecting the spur cable to the compass's DeviceNet port.

1. Use the supplied Deck mount riser template (87280) to drill 4 holes in the mounting surface. Secure the Riser to the mounting surface using 4x supplied fixings.
2. Place the small sealing ring in the groove located on the bottom of the mounting tray.
3. Position the Mounting tray on top of the Riser.
4. Secure the Mounting tray to the Riser using 4x supplied fixings.
5. Place the large sealing ring into the groove on the upper side of the Mounting tray.
6. Pull the SeaTalkng cables through the Riser and Mounting tray. Plug the SeaTalkng to DeviceNet adaptor (A06084) into the DeviceNet connector. Plug in the cables to their connectors on the underside of the unit and secure by rotating the locking collars clockwise.
7. Insert the unit into the mounting tray, ensuring the tabs in the Mounting tray are slotted into the grooves around the edge of the unit.

Important:

- The unit must be mounted with the LED 'arrow' on the top of the unit pointing towards the vessel's bow and be in parallel alignment with the longitudinal axis (centerline) of your vessel.
- For more information refer to **p.37 — AR250 / AR270 Location requirements**

8. Place the Mounting trim over the unit slightly offset, and then twist the Mounting trim clockwise until it locks into position.



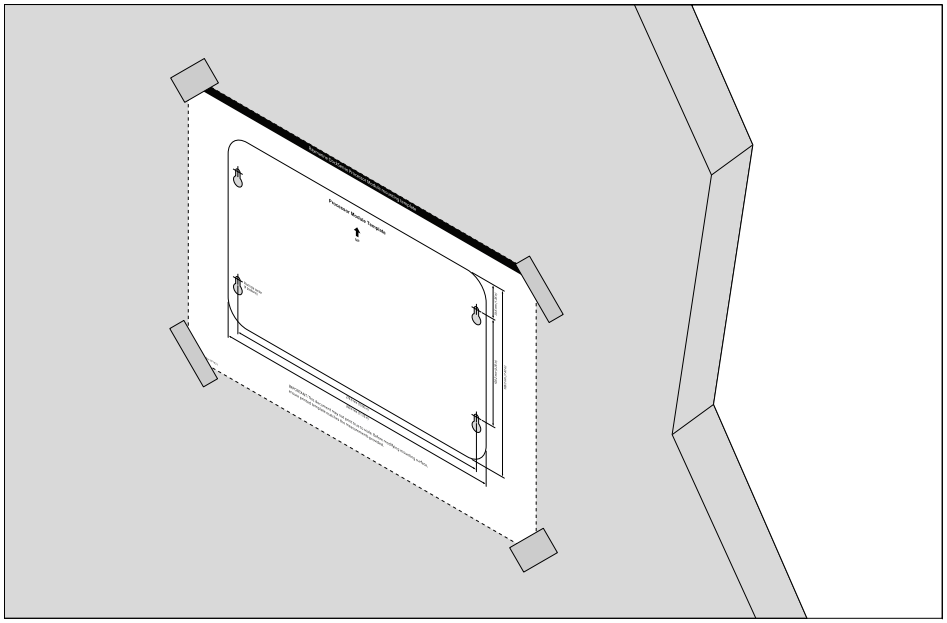
Processor Module mounting

Having chosen a suitable location, install the unit as follows:

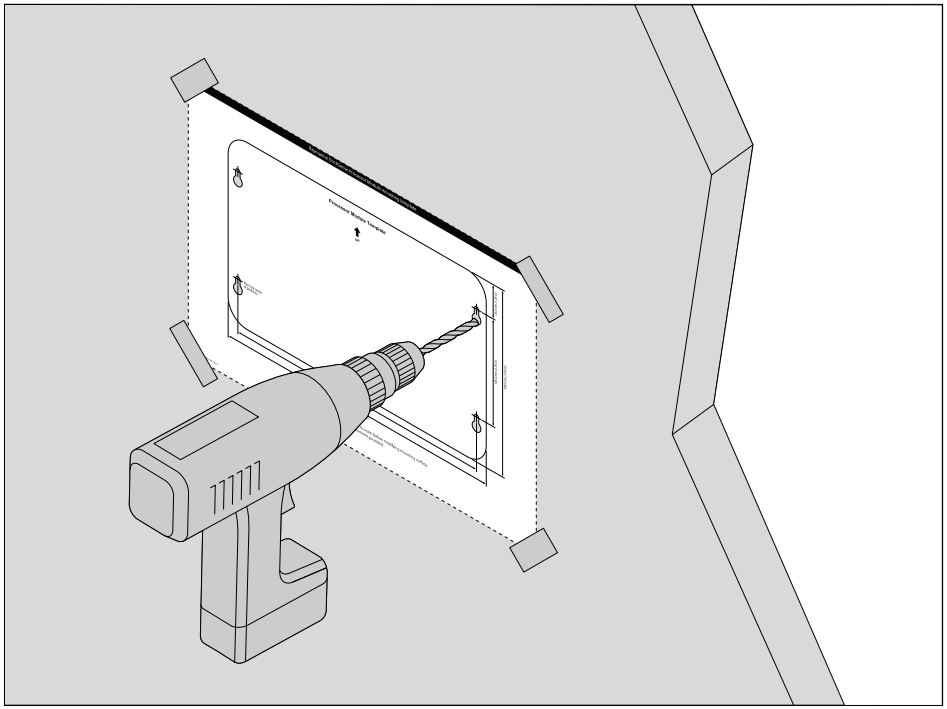
Note:

Raymarine recommends mounting the unit vertically.

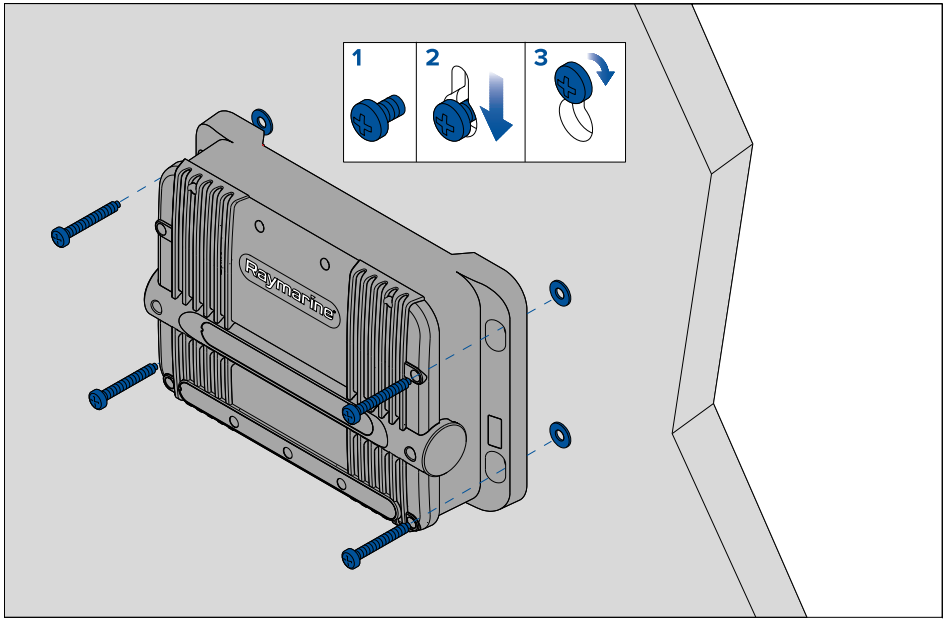
1. Secure the mounting template in the required location using adhesive tape.



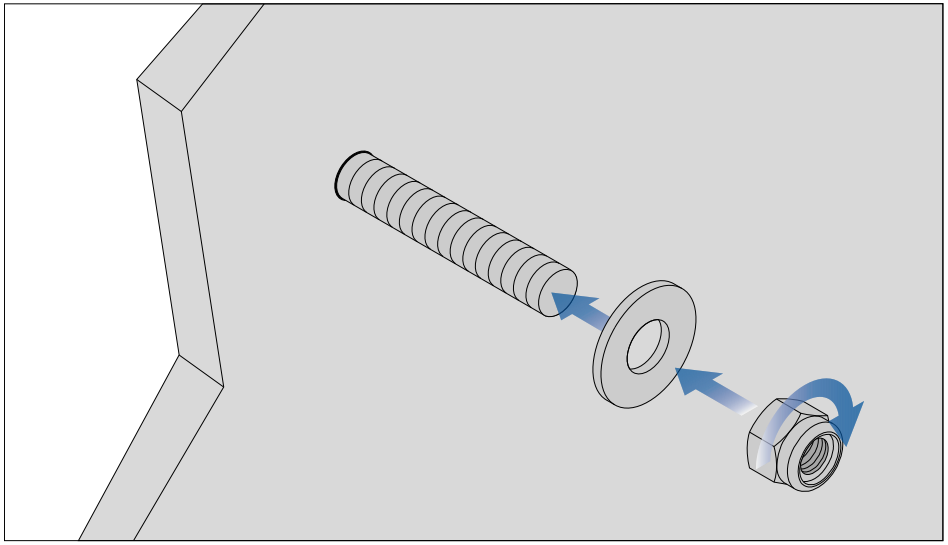
2. Drill 4 holes at the marked location on the template.



3. Remove the mounting template.
4. Push the screws through the Processor Module key slots and washers.
5. Push the screws into the drill holes.
6. Push the unit down to engage the key slots in the unit.



7. Place washers on the opposite side of the screws and tighten the locking nut to secure the unit to the mounting surface.



CHAPTER 9: PROCESSOR MODULE CONNECTIONS

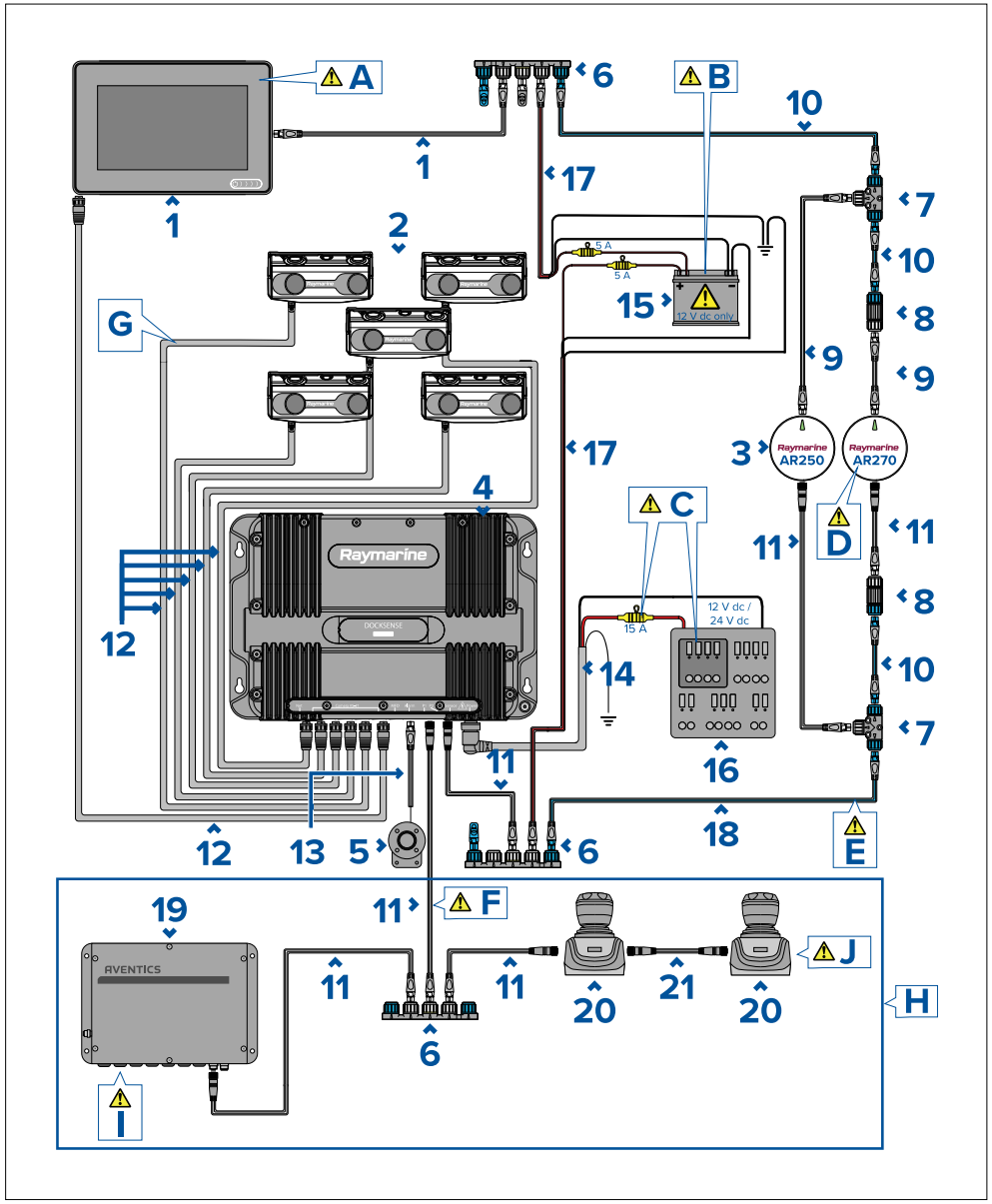
CHAPTER CONTENTS

- 9.1 System overview (example only) — page 50
- 9.2 General cabling guidance — page 52
- 9.3 Processor Module connections overview — page 53
- 9.4 Power connection — Processor Module — page 54

9.1 System overview (example only)

The following illustration shows a connections overview for a typical DockSense® Control system.

The system configuration shown is an example only. Please consult your dealer for a suitable system for your specific vessel.



Note:

Power connections for Aventics equipment are not shown in this illustration. Please refer to your dealer / installer and Aventics documentation pack for more information.

1. Multifunction display (MFD)
2. DockSense® Stereo-Vision Cameras (the number of cameras is dependent on your specific vessel requirements)
3. AR250 / AR270
4. DockSense Processor Module
5. External Honk Alarm
6. SeaTalkng backbone 5–way connector
7. SeaTalkng backbone T-piece
8. SeaTalkng in-line terminator
9. SeaTalkng spur cable
10. SeaTalkng backbone cable
11. SeaTalkng -to-DeviceNet adaptor cable
12. RayNet cable
13. External Honk Alarm cable — see also Note F, below.
14. Processor Module power cable
15. 12 V dc power supply (for separately powering the SeaTalkng and DeviceNet backbones)
16. 12 / 24 V dc distribution panel or battery (powers DockSense® Processor Module)
17. SeaTalkng power cable
18. DeviceNet backbone
19. Aventics Marex 3D Controller
20. Aventics Joystick
21. DeviceNet cable

Important:

A — The MFD requires a 12 / 24 V dc power supply, protected by a suitable fuse. Refer to the relevant MFD Installation manual for the voltage and fuse details specific to your MFD variant.

Important:

B — The SeaTalkng and DeviceNet backbones both require a dedicated 12 V dc power supply, protected by a 5 A inline fuse.

Important:

C — The following fuses (not supplied) are required for circuit protection for the Processor Module:

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

Important:

D — There must be **greater** than 1 m (3.28 ft.) distance between the two compasses.

Important:

E — The total DeviceNet backbone cable length between the AR250/AR270 and the Processor Module must NOT exceed 20 m (65.6 ft.).

Important:

F — This SeaTalkng -to-DeviceNet adaptor cable allows communication between the DockSense Control Processor Module and the Aventics Joystick system.

Note:

G — The camera's RayNet cable provides both power and data signals to the cameras, via the Processor Module.

Note:

H — Aventics Joystick system. For more information refer to your Aventics system documentation.

Important:

I

- The Aventics Marex 3D Controller requires its own dedicated power supply. For more information refer to your Aventics system documentation.
- The Aventics Marex 3D Controller has its internal terminator enabled from the factory. For more information on disabling the terminator, refer to your Aventics system documentation.

Important:

J — Aventics Joysticks can be chained to allow control of your DockSense system from multiple locations on your vessel. The final joystick in the chain must be fitted with an external terminator. For more information refer to your Aventics system documentation.

9.2 General cabling guidance

Cable types and length

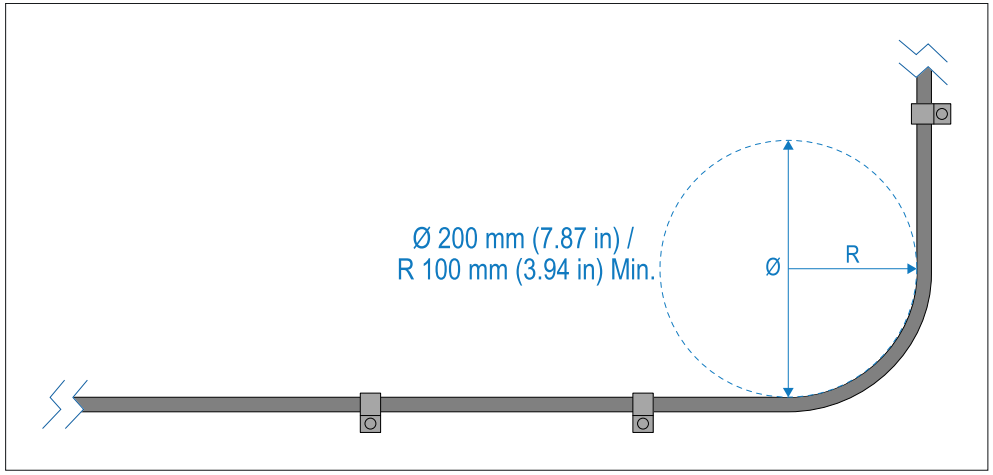
It is important to use cables of the appropriate type and length.

- Unless otherwise stated use only standard cables of the correct type, supplied by FLIR.
- Ensure that any non-FLIR cables are of the correct quality and gauge. For example, 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).



- 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:

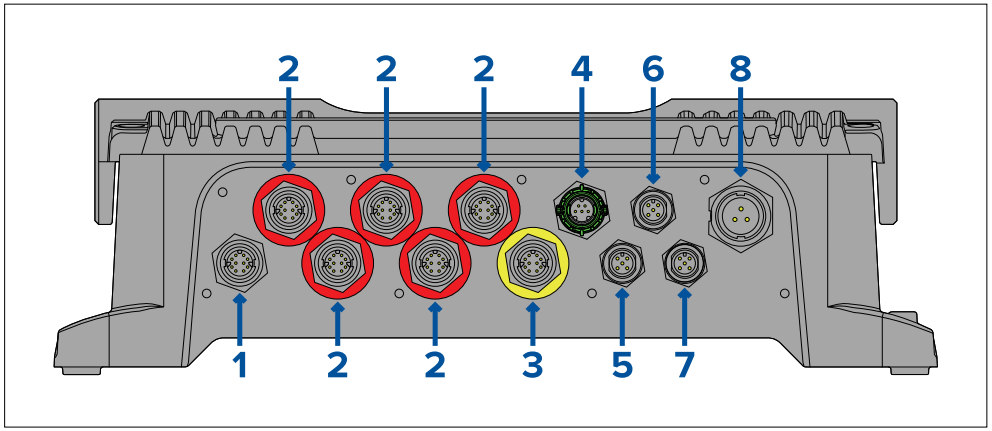
- Always use isolating transformers or a separate power-inverter to run PCs, processors, displays and other sensitive electronic instruments or devices.
- If using Weather FAX audio cables, always use an isolating transformer.
- If using a third-party audio amplifier, always use an isolated power supply.
- If using an RS232/NMEA converter, always ensure optical isolation on the signal lines.
- Always ensure that PCs 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.

9.3 Processor Module connections overview

The Control Processor Module (E70603) includes the following connectors:



1. **RayNet** — Connects to Stereo-Vision cameras (only used for systems featuring more than 6 cameras), via RayNet cables.
2. **RayNet** — DockSense Stereo-Vision cameras (1 to 5), via RayNet cameras.
3. **RayNet** — Connects to Raymarine Multifunction display (MFD), via RayNet cables.
4. **Honk alarm** — Connects to Raymarine Remote MFD alarm buzzer (Honk) (available separately as E26033)
5. **DeviceNet (P1)** — Connects to the Aventics Joystick system via DeviceNet backbone. For more information refer to **p.50 — System overview (example only)**

Note: This port requires power from the DeviceNet backbone for the Alarm (honk) connector to operate. A 2 m (6.6 ft) DeviceNet power cable is available separately for this purpose (A80692).

6. **DeviceNet (P2)**

Note: The DeviceNet connector is not currently active for connection to the Joystick port, and will be supported in future DockSense product releases.

7. **DeviceNet (Sensor)** — Connects to DockSense AR250 / AR270 compasses, via DeviceNet backbone.
8. **Power** — Connects to your vessel's power supply, ideally via the distribution panel. For power and fuse requirements, refer to: **p.49 — Processor Module Connections**

Note:

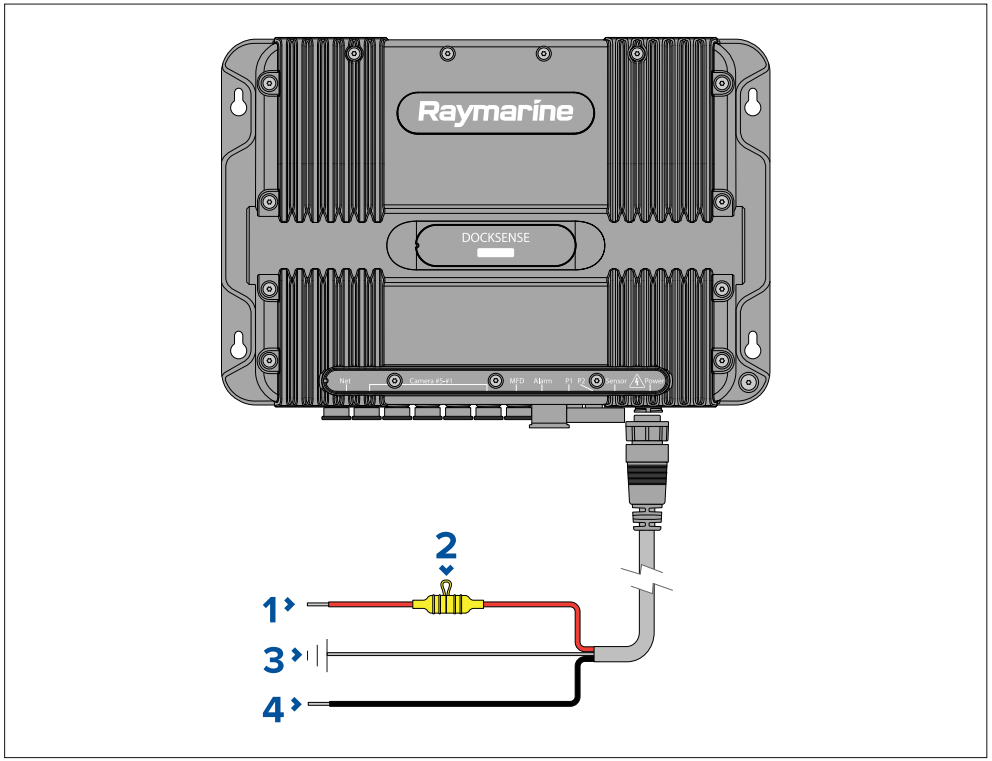
Do not connect the power cable to the same power supply used to start your vessel's engine.

For suitable cables, refer to:

- **RayNet:** **p.109 — RayNet to RayNet cables and connectors**
- **SeaTalkng and DeviceNet:** **p.110 —** SeaTalk NG **cables and accessories**

9.4 Power connection — Processor Module

The power cable of the Processor Module must be connected to a 12 V or 24 V dc isolated power supply. This can be achieved by connecting the product (ideally) to the vessel's distribution panel, or directly to a battery. The product is protected against reverse polarity.



	Description	Connects to
1	Red cable (positive)	Power supply's positive terminal.
2	Waterproof fuse holder containing a suitably-rated inline fuse (not supplied) must be fitted. For suitable fuse rating, refer to: *In-line fuse and thermal breaker ratings*.	Red cable (positive)

	Description	Connects to
3	Drain / Ground	Vessel RF ground, or negative battery terminal
4	Black cable (negative)	Power supply's negative terminal.

Important:

To prevent erratic behavior and potential data loss, ensure the product is supplied from a separate battery from that used for engine start.



Warning: Only use system when vessel engine is running

The vessel's engine must be running at ALL times while the system is in use. Loss of power to the system compromises system safety and potentially puts yourself, your crew and your vessel at risk of harm.



Warning: Ensure system power source is charged by vessel's engine under normal operation

The power source for the system MUST be one that is charged by the vessel's engine (under normal operation). Failure to ensure a constant source of power to the system potentially puts yourself, your crew and your vessel at risk of harm.

Inline fuse and thermal breaker ratings

The following inline fuse and thermal breaker ratings apply to your product:

Inline fuse rating	Thermal breaker rating
15 A	15 A (if only connecting one device)

Note:

- The suitable fuse rating for the thermal breaker is dependent on the number of devices you are connecting. If in doubt consult an Raymarine® technical support.
- Your product's power cable may have a fitted inline fuse. If not, you must fit an inline fuse to the positive wire of your product's power connection.

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.

Power cable drain wire connection

The power cable supplied with this product includes a dedicated drain wire for connection to a vessel's Radio Frequency (RF) ground point (if available), or the negative battery terminal.

The purpose of the drain wire is to drain excess voltage from the cable shield, giving it a path to safety. The drain wire protects the cable's inner signal conductors from electrical noise emitted by other cables and devices.

Although the drain wire is not intended to ground the product's internal circuits, it's important that the drain wire is connected to the vessel's common RF ground point, which should be used for all equipment in your system. If several items require grounding, the drain wires and dedicated ground connections (if available) of all equipment should first be connected to a single local point (e.g. within a distribution panel), and then this point connected via an appropriately-rated conductor to the vessel's RF common ground point. An RF ground point is typically a circuit with a very low-impedance signal at Radio Frequency, connected to the sea via an electrode immersed in the sea, or bonded to the inner side of the hull in an area that is underwater.

On vessels without an RF ground system, the drain wires and dedicated ground connections (if available) of all equipment should be connected directly to the vessel's negative battery terminal.

The dc power system should be either:

- Negative grounded ("bonded"), with the negative battery terminal connected to the vessel's RF ground.
- Floating, with neither battery terminal connected to the vessel's 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 or greater. If this is not possible, an equivalent stranded wire conductor may be used, rated as follows:

- for runs of <1 m (3.3 ft), use 6 mm2 (10 AWG) or greater.
- for runs of >1 m (3.3 ft), use 8 mm2 (8 AWG) or greater.

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

Power distribution

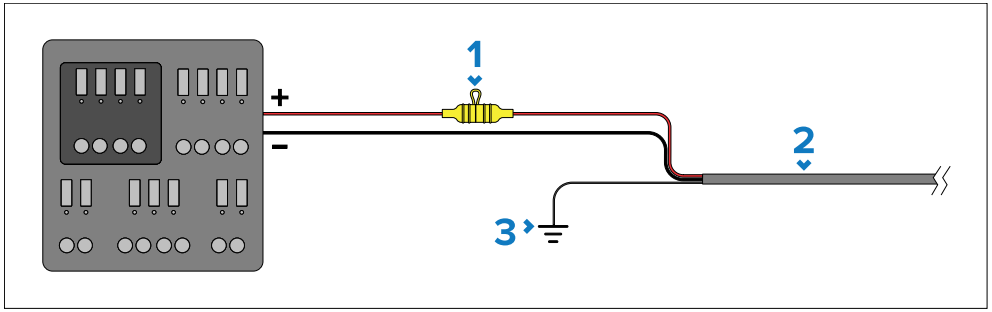
Recommendations and best practice for the power connection of products supplied with a drain wire as part of the supplied power cable.

- The product is supplied with a power cable, either as a separate item or a captive cable permanently attached to the product. Only use the power cable supplied with the product. Do NOT use a power cable designed for, or supplied with, a different product.
- Refer to the *Power connection* section for more information on how to identify the wires in your product's power cable, and where to connect them.
- See below for more information on implementation for some common power distribution scenarios:

Important:

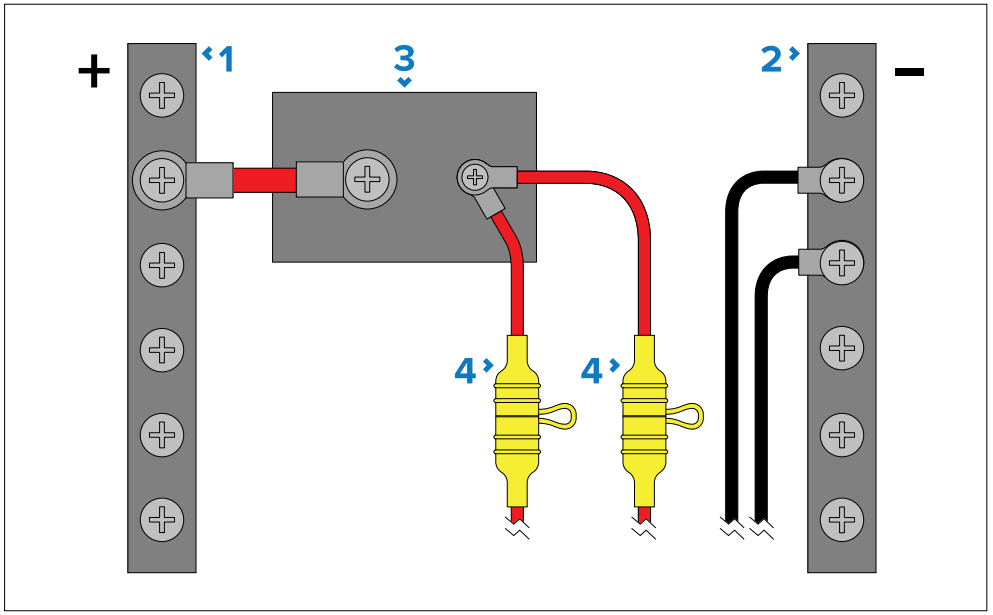
- When planning and wiring, take into consideration other products in your system, some of which (e.g. sonar modules) may place large power demand peaks on the vessel's electrical system, which may impact the voltage available to other products during the peaks.
- The information provided below is for guidance only, to help protect your product. It covers common vessel power arrangements, but does NOT cover every scenario. If you are unsure how to provide the correct level of protection, please consult an authorized dealer or a suitably qualified professional marine electrician.

Implementation — connection to distribution panel (Recommended)



	Description
1	Waterproof fuse holder containing a suitably-rated inline fuse must be fitted. For suitable fuse rating, refer to: *Inline fuse and thermal breaker ratings*.
2	Product power cable.
3	Drain wire connection point.

- It is recommended that the supplied power cable is connected to a suitable breaker or switch on the vessel's distribution panel or factory-fitted power distribution point.
- The distribution point should be fed from the vessel's primary power source by 8 AWG (8.36 mm^2) cable.
- Ideally, all equipment should be wired to individual suitably-rated thermal breakers or fuses, with appropriate circuit protection. Where this is not possible and more than 1 item of equipment shares a breaker, use individual inline fuses for each power circuit to provide the necessary protection.
- The power cable supplied with your product includes a drain wire, which must be connected to the vessel's common RF ground.

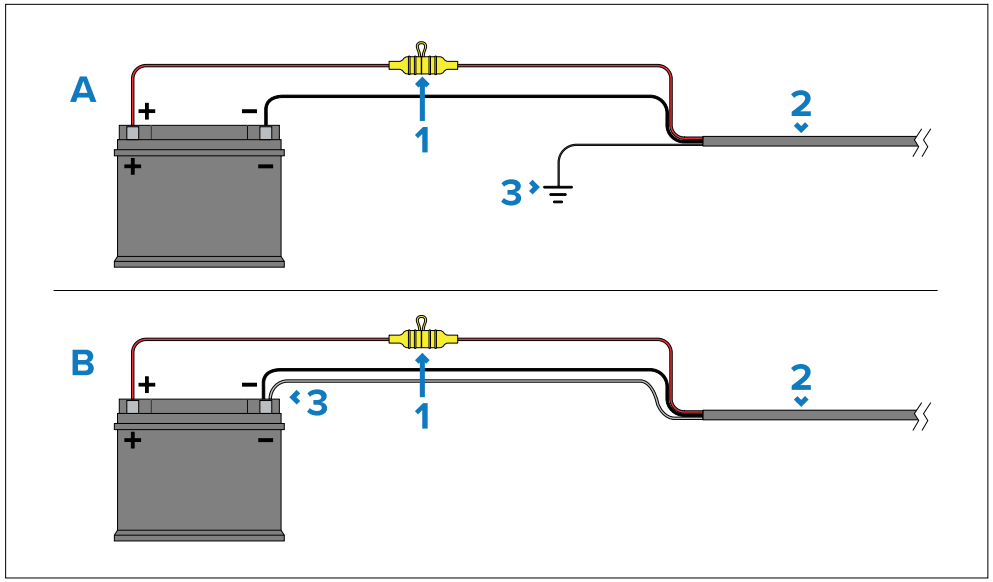


	Description
1	Positive (+) bar
2	Negative (-) bar
3	Circuit breaker
4	Waterproof fuse holder containing a suitably-rated inline fuse must be fitted. For suitable fuse rating, refer to: *Inline fuse and thermal breaker ratings*.

Important:

Observe the recommended fuse / breaker ratings provided in the product's documentation, however be aware that the suitable fuse / breaker rating is dependent on the number of devices being connected.

Implementation — direct connection to battery



- Where connection to a power distribution panel is not possible, the power cable supplied with your product may be connected directly to the vessel's battery, via a suitably rated fuse or breaker.
- If the power cable is NOT supplied with a fitted inline fuse, you MUST fit a suitably rated fuse or breaker between the red wire and the battery's positive terminal.
- Refer to the inline fuse ratings provided in the product's documentation.
- If you need to extend the length of the power cable supplied with your product, ensure you observe the dedicated *Power cable extensions* advice provided in the product's documentation.

	Description
1	Waterproof fuse holder containing a suitably-rated inline fuse must be fitted. For suitable fuse rating, refer to: *Inline fuse and thermal breaker ratings*.
2	Product power cable.
3	Drain wire connection point.

Battery connection scenario A:

Suitable for a vessel with a common RF ground point. In this scenario, the power cable's drain wire should be connected to the vessel's common ground point.

Battery connection scenario B:

Suitable for a vessel without a common grounding point. In this case, the power cable's drain wire should be connected directly to the battery's negative terminal.

Grounding

Ensure that you observe any additional grounding advice provided in the product's documentation.

More information

It is recommended that best practice is observed in all vessel electrical installations, as detailed in the following standards:

- BMEA Code of Practice for Electrical and Electronic Installations in Boats
- NMEA 0400 Installation Standard
- ISO 13297: Small craft — Electrical systems — Alternating and direct current installations
- ISO 10133: Small craft — Electrical systems — Extra-low-voltage d.c. installations
- ABYC E-11 AC & DC Electrical Systems on Boats
- ABYC A-31 Battery chargers and Inverters
- ABYC TE-4 Lightning Protection



Warning: Product grounding

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



Warning: Positive ground systems

Do not connect this unit to a system which has positive grounding.

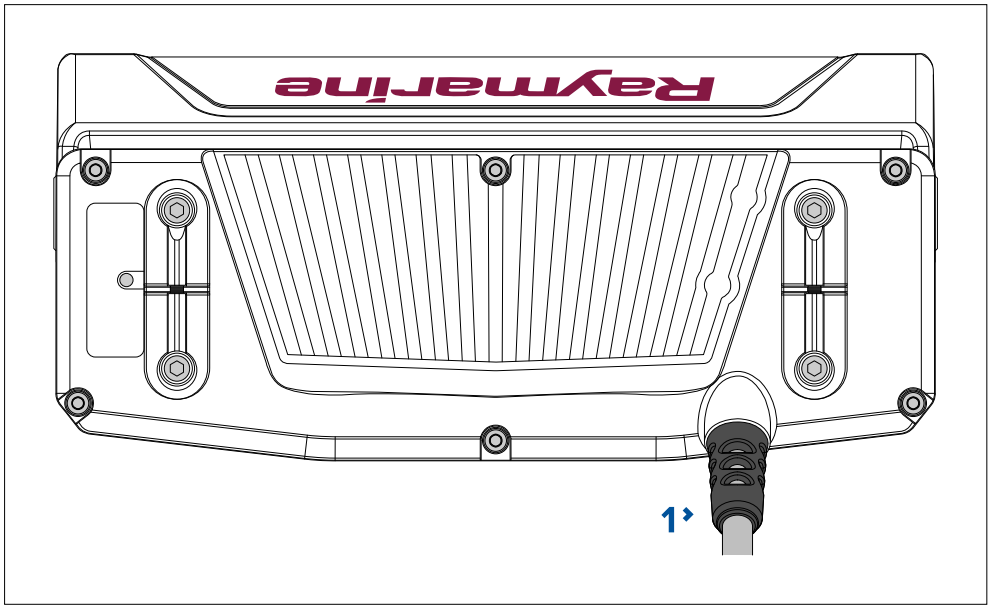
CHAPTER 10: CAMERA CONNECTIONS

CHAPTER CONTENTS

- 10.1 Camera connections overview — page 60

10.1 Camera connections overview

The Stereo-Vision camera includes the following connectors:



1. **Captive cable with RayNet connector** — 5 m (16.4 ft.). Connects to: Processor Module.

Important:

RayNet extension cables (available separately) are required to complete the connection between each camera's captive cable, and the Processor Module. For suitable RayNet cables, refer to:
p.109 — RayNet to RayNet cables and connectors

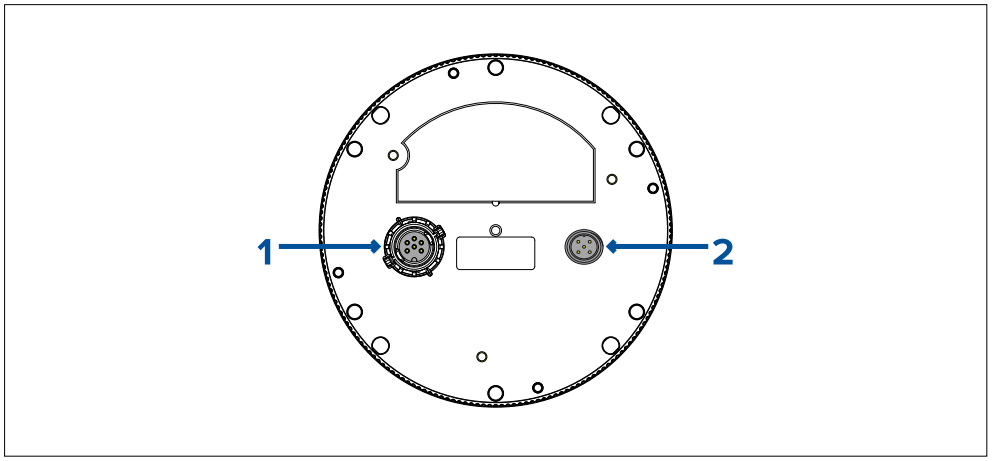
CHAPTER 11: AR250 & AR270 CONNECTIONS

CHAPTER CONTENTS

- 11.1 AR250 / AR270 connections overview — page 62
- 11.2 Connecting SeaTalk NG cables — page 62
- 11.3 SeaTalk NG power supply — page 62

11.1 AR250 / AR270 connections overview

The AR250 and AR270 compasses include the following connectors:



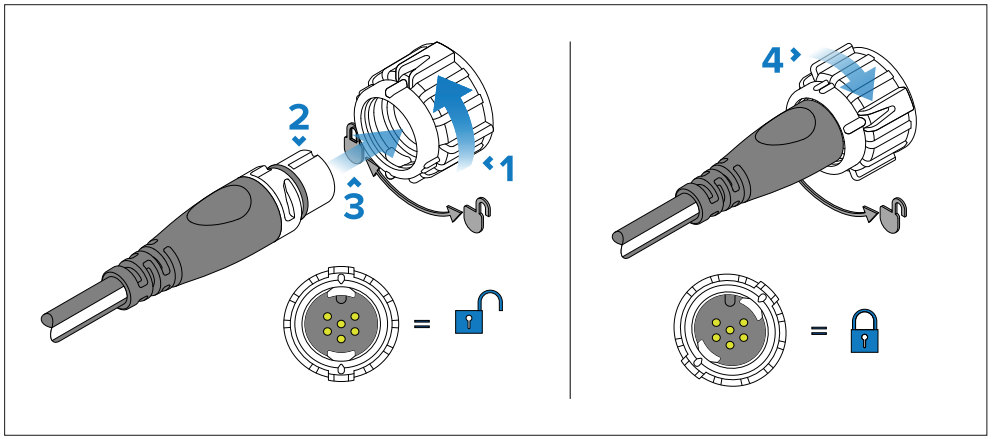
1. **SeaTalkng** — Connects to Raymarine Multifunction display (MFD), via SeaTalkng backbone.
2. **DeviceNet** — Connects to DockSense Processor Module, via DeviceNet backbone.

For suitable cables, refer to: **p.110 —** SeaTalk NG cables and accessories

Important additional requirements related to cabling for the AR250 / AR270:

- In order to achieve adequate data bitrate transmission between the AR250/AR270 and Processor Module, the maximum length of the DeviceNet backbone between the compasses and the Processor Module must NOT exceed 20 m (65.6 ft.).
- The SeaTalkng to Devicenet adaptor cables connected to each AR250/AR270 must not exceed 1 meter (3.28 ft).
- There must be **greater** than 1 m (3.28 ft.) distance between the 2 compasses.

11.2 Connecting SeaTalk NG cables



1. Rotate your product's SeaTalk NG connector locking collar counter clockwise, so that the connector is in the unlocked position.
2. Ensure the cable's connector is correctly oriented (groove pointing up).
3. Fully insert the cable connector.
4. Rotate the locking collar clockwise (2 clicks) until it is in the locked position.

11.3 SeaTalk NG power supply

Your product is supplied power via the SeaTalk NG backbone.

A SeaTalk NG backbone requires a single 12 V dc power supply. Power can be supplied to the SeaTalk NG backbone by one of the following methods:

- (1) Direct connection to a 12 V dc battery using an inline 5 amp fuse.
- Connection to a 12 V dc distribution panel using a 3 amp thermal breaker.
- (2) Connection to the SeaTalk NG connector of an Autopilot Control Unit (ACU) (not ACU-100 or ACU-150), or an SPX course computer (not SPX-5).
- For 24 V vessels, connection must be via a 5 amp, regulated, continuous 24 V dc to 12 V dc converter.

Note:

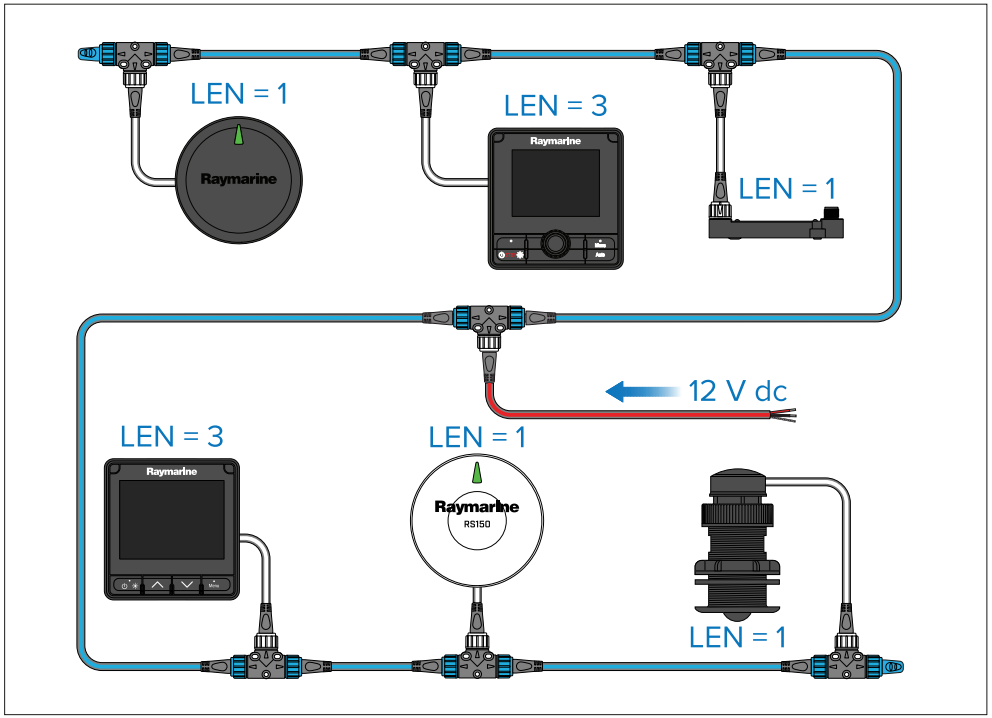
- (1) The battery used for starting the vessel's engine(s) should NOT be used to power the SeaTalk NG backbone, as this can cause sudden voltage drops when the engines are started.
- (2) The ACU-100, ACU-150 or SPX-5 cannot be used to power the SeaTalk NG backbone.
- The ACU's/SPX's SeaTalk NG connector includes a power switch that must be in the On position to provide power to the backbone.

SeaTalk NG power connection point

The 12 V dc power supply is connected to a spur connection on the SeaTalk NG network (backbone or 5-way connector).

Large systems

If a backbone cable is used as the primary interconnector for the SeaTalk NG network (rather than a 5-way connector), and the backbone length is **greater than** 60 m (197 ft), the power should be connected **at a point that creates a balanced current draw from each side of the backbone**. The NMEA 2000 Load Equivalency Number (LEN) is used to determine the position of the power connection point along the backbone.



In the example above, the backbone has an overall LEN of 10, so the optimum connection point in this scenario would be to have a current draw of 5 LEN either side of the connection point.

Small systems

If the backbone length is 60 m (197 ft) **or less**, the power may be connected at any point along the backbone.

Inline fuse and thermal breaker ratings

The SeaTalk NG network's power supply requires a suitably-rated inline fuse or thermal breaker to be fitted.

Inline fuse rating	Thermal breaker rating
5A	3A (refer to note below)

Note:

The suitable fuse rating for the thermal breaker is dependent on:

1. How many devices you have connected to your SeaTalk NG network, and;
2. How many devices are sharing the same thermal breaker that your SeaTalk NG network is connected to.

SeaTalk NG system loading

The maximum loading (LEN) for a SeaTalk NG system depends on the length of the backbone.

Unbalanced system loading:

- **Backbone Length**: 0 m (0 ft) to 20 m (66 ft) — **Maximum LEN**: 40
- **Backbone Length**: > 20 m (66 ft) to 40 m (131 ft) — **Maximum LEN**: 20
- **Backbone Length**: > 40 m (131 ft) to 60 m (197 ft) — **Maximum LEN**: 14

Balanced system loading:

- **Backbone Length**: 0 m (0 ft) to 60 m (197 ft) — **Maximum LEN**: 100
- **Backbone Length**: > 60 m (197 ft) to 80 m (262 ft) — **Maximum LEN**: 84
- **Backbone Length**: > 80 m (262 ft) to 100 m (328 ft) — **Maximum LEN**: 60
- **Backbone Length**: > 100 m (328 ft) to 120 m (394 ft) — **Maximum LEN**: 50
- **Backbone Length**: > 120 m (394 ft) to 160 m (525 ft) — **Maximum LEN**: 40
- **Backbone Length**: > 160 m (525 ft) to 200 m (656 ft) — **Maximum LEN**: 32

Power distribution — SeaTalk NG

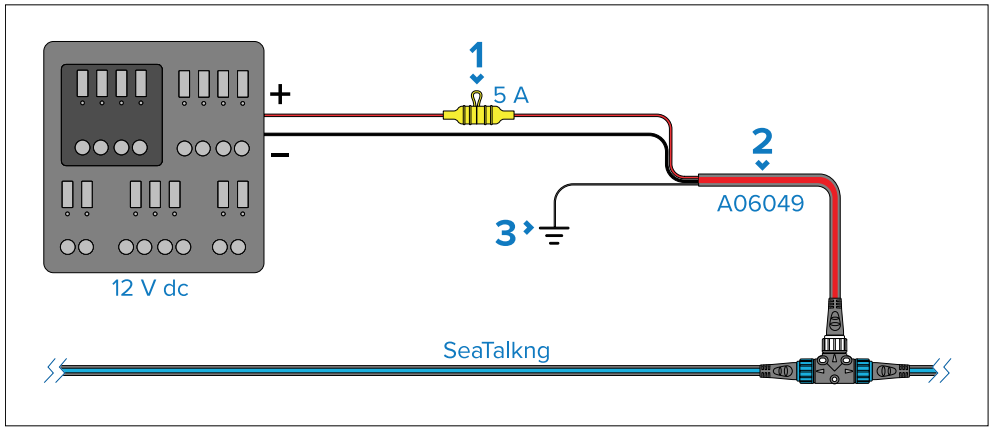
Recommendations and best practice.

- Only use approved SeaTalk NG power cables. Do NOT use a power cable designed for, or supplied with, a different product.
- See below for more information on implementation for some common power distribution scenarios.

Important:

- When planning and wiring, take into consideration other products in your system, some of which (e.g. sonar modules) may place large power demand peaks on the vessel's electrical system, which may impact the voltage available to other products during the peaks.
- The information provided below is for guidance only, to help protect your product. It covers common vessel power arrangements, but does NOT cover every scenario. If you are unsure how to provide the correct level of protection, please consult an authorized Raymarine dealer or a suitably qualified professional marine electrician.

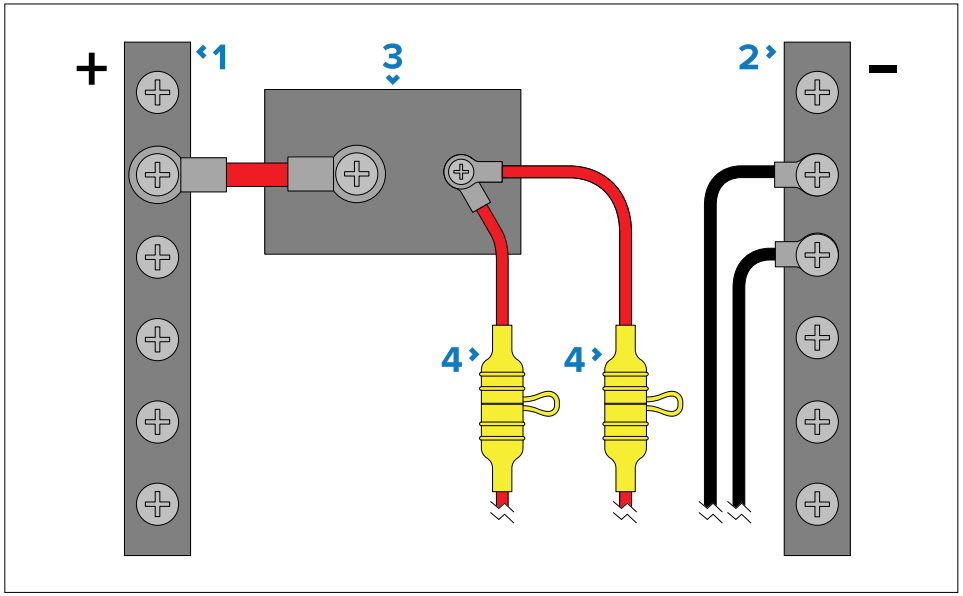
Implementation — connection to distribution panel (recommended)



1. Waterproof fuse holder with 5 A inline fuse must be fitted (not supplied).
2. SeaTalk NG power cable.
3. RF Ground connection point for drain wire.

- Ideally, the SeaTalk NG power cable should be connected to a suitable breaker or switch on the vessel's distribution panel or factory-fitted power distribution point. It is recommended that a 5 A inline fuse is fitted to the red (positive) wire of the SeaTalk NG power cable.
- The distribution point should be fed from the vessel's primary power source by 8 AWG (8.36 mm^2) cable.
- Ideally, all equipment should be wired to individual suitably-rated thermal breakers or fuses, with appropriate circuit protection. Where this is not

possible and more than one item of equipment shares a breaker, use individual in-line fuses for each power circuit to provide the necessary protection.



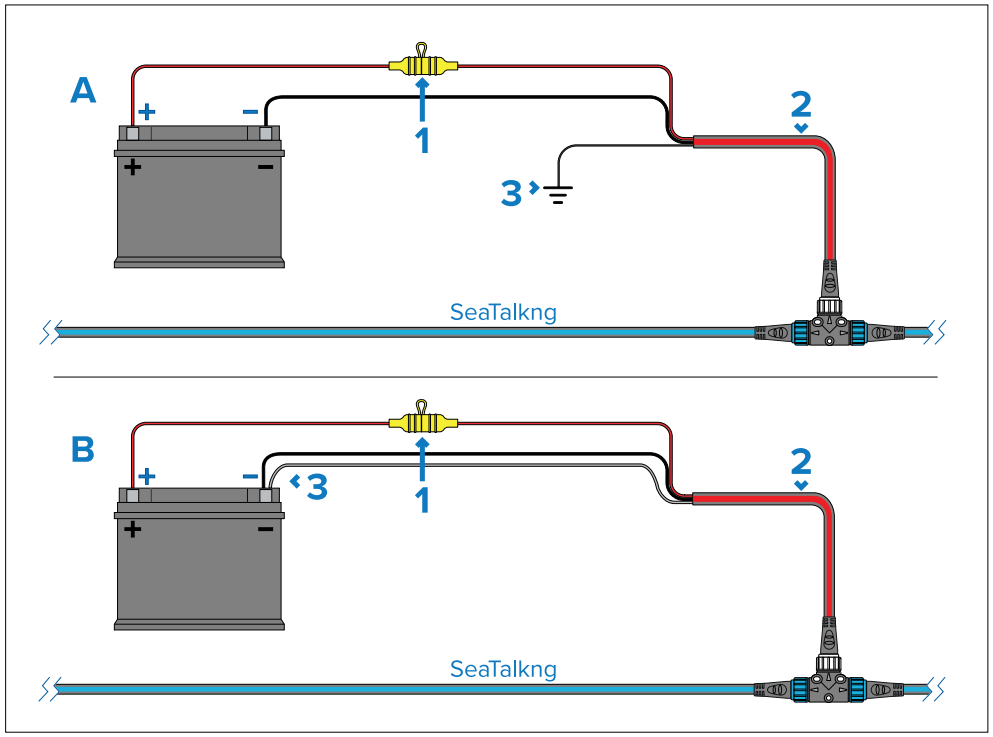
1. Positive (+) bar
2. Negative (-) bar
3. Circuit breaker
4. Waterproof fuse holder with 5 A inline fuse must be fitted (not supplied).

Important:

Observe the recommended fuse / breaker ratings provided in the product's documentation, however be aware that the suitable fuse / breaker rating is dependent on the number of devices being connected.

Implementation — direct connection to battery

- Where connection to a power distribution panel is not possible, the power cable may be connected to the vessel's battery.
- You MUST fit a 5 A inline fuse between the red wire and the battery's positive terminal.
- If you need to extend the length of the power cable, ensure you use suitably rated cable and that sufficient power (12 V dc) is available at the SeaTalk NG backbone's power connection.



1. Waterproof fuse holder with 5 A inline fuse must be fitted (not supplied).
2. SeaTalk NG power cable.
3. Connection point for drain wire.

Battery connection scenario A:

Suitable for a vessel with a common RF ground point. In this scenario, the power cable's drain wire should be connected to the vessel's common RF ground point.

Battery connection scenario B:

Suitable for a vessel without a common RF ground point. In this scenario the power cable's drain wire should be connected directly to the battery's negative terminal.

SeaTalk NG Power cable extension

If you need to extend the length of the SeaTalk NG power cable, ensure you use suitably-rated cable, and that sufficient power is available at the SeaTalk NG backbone's power connection point:

- For power cable extensions, a **minimum** wire gauge of 16 AWG (1.31 mm²) is recommended. For cable runs longer than 15 m (49.2 ft), you may need to consider a thicker wire gauge (e.g. 14 AWG (2.08 mm²), or 12 AWG (3.31 mm²).
- To ensure power cables (including any extension) are of a sufficient gauge, ensure that there is a continuous **minimum** voltage of **10.8 V dc** at the end of the cable where it enters the product's power connector, even with a fully flat battery at 11 V dc. (Do not assume that a flat battery is at 0 V dc. Due to the discharge profile and internal chemistry of batteries, the current drops much faster than the voltage. A "fully flat" battery still shows a positive voltage, even if it doesn't have enough current to power your device.)

Important:

Be aware that some products in your system (such as sonar modules) can create voltage peaks at certain times, which may impact the voltage available to other products during the peaks.

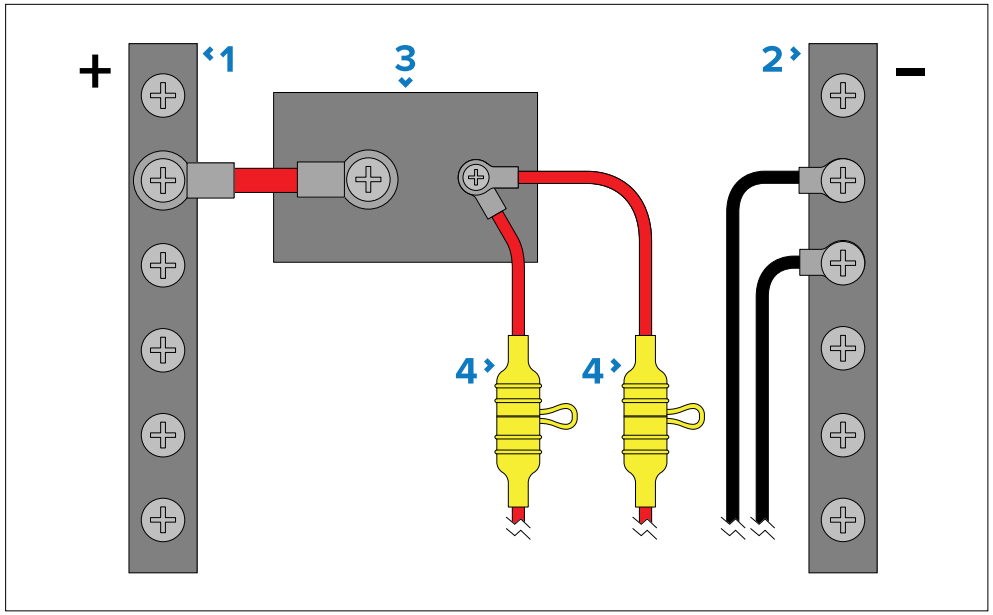
More information

It is recommended that best practice is observed in all vessel electrical installations, as detailed in the following standards:

- BMEA Code of Practice for Electrical and Electronic Installations in Boats
- NMEA 0400 Installation Standard
- ISO 13297: Small craft — Electrical systems — Alternating and direct current installations
- ISO 10133: Small craft — Electrical systems — Extra-low-voltage d.c. installations
- ABYC E-11 AC & DC Electrical Systems on Boats
- ABYC A-31 Battery chargers and Inverters
- ABYC TE-4 Lightning Protection

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.



	Description
1	Positive (+) bar
2	Negative (-) bar
3	Circuit breaker
4	Waterproof fuse holder containing a suitably-rated inline fuse must be fitted. For suitable fuse rating, refer to: *Inline fuse and thermal breaker ratings*.

Where possible, connect individual items of equipment to individual circuit breakers. Where this is not possible, use individual in-line fuses to provide the necessary protection.



Warning: Product grounding

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



Warning: Positive ground systems

Do not connect this unit to a system which has positive grounding.

CHAPTER 12: COMMISSIONING AND CALIBRATION

CHAPTER CONTENTS

- 12.1 Commissioning overview — page 69
- 12.2 DockSense boat Configuration File (.sense) — page 69
- 12.3 Configuring camera positions — page 72
- 12.4 Calibration — page 73
- 12.5 AHRS compass calibration — page 73
- 12.6 Center of gravity calibration — page 74
- 12.7 Camera calibration — page 76
- 12.8 System test — page 79
- 12.9 Configuration File export — page 83

12.1 Commissioning overview

After installing your DockSense components, you need to configure, calibrate and test the system.

Commission your DockSense system in the following order:

1. Install the DockSense boat Configuration File to your MFD.
2. Configure the Camera positions.
3. Calibrate the AR270.
4. Calibrate the vessel's center of gravity.
5. Calibrate the Cameras.
6. Test the DockSense system.

Important:

Before commissioning, ensure your DockSense system has been installed in accordance with Raymarine's requirements. For more information refer to:

- **p.35 — Camera and AR250 / AR270 Placement Position file**
- **p.34 — Location requirements**
- **p.42 — Mounting**

Important:

For the control system to be reliable the rudder must be centred. Ensure this has been completed before continuing with DockSense equipment commissioning. For more information refer to your Aventics dealer / installer.

Important:

- For instructions on commissioning Aventics components, please refer to your dealer / installer and Aventics documentation.
- Docksense is not compatible with the Marex-3D thruster balance feature. When commissioning the joystick, please ensure that thruster balance is disabled (set to 100%). For more information refer to your Aventics dealer / installer.

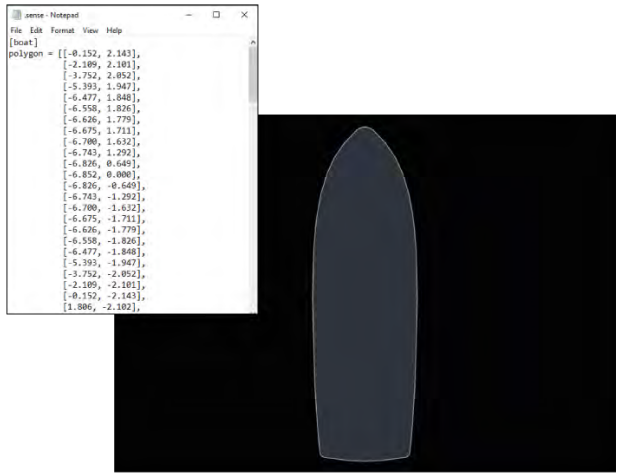
12.2 DockSense boat Configuration File (.sense)

Your DockSense boat Configuration File contains a series of coordinates and values that define your vessel's outline, as displayed in the DockSense app. The Configuration File also contains position data for your DockSense Cameras, AR250 / AR270 sensors, and the vessel's center of gravity.

The DockSense boat Configuration File must be installed to your MFD and selected as part of the configuration of the DockSense app.

Important:

- Ensure you have followed the instructions provided in your DockSense Camera and AR250 / AR270 **Placement Position file**; incorrect equipment installation will prevent the DockSense system from configuring and calibrating correctly. For more information refer to: **p.35 —** Camera and AR250 / AR270 Placement Position file



Downloading the Configuration File

Your DockSense boat Configuration File must be downloaded and transferred to a MicroSD card.

To download and transfer the file to your MFD you will need:

- A PC or Apple Mac with an internet connection and a card reader.
- A FAT32–formatted MicroSD card with SD card adaptor.
- An external card reader (RCR) accessory (Axiom XL only).

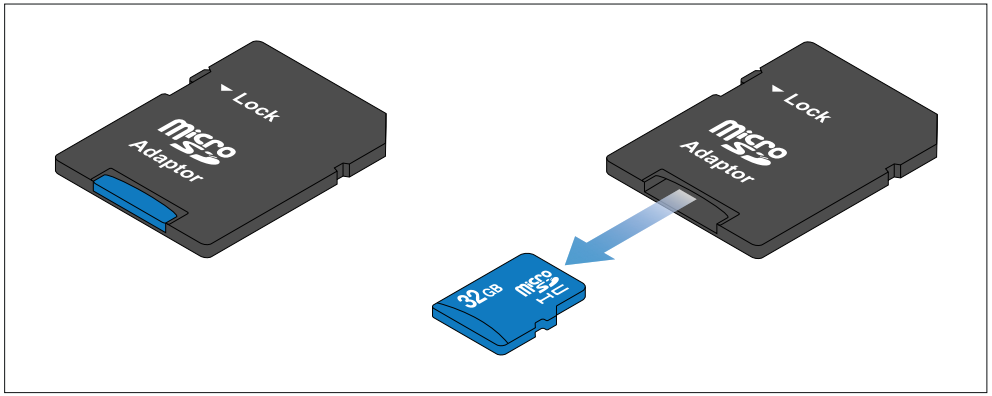
1. Locate your DockSense boat Configuration File and download it to your computer.
2. Insert the MicroSD card into your PC or Mac card reader.
3. Locate the downloaded file and transfer it to your MicroSD card.
   - PC users (Windows 7 & 10) — The default download directory is:*[C:\Users\Username\Download]*
   - Apple Mac users — The default download directory is: *[Users\Username\Download]*
4. Safely eject the MicroSD card from your PC or Mac and insert it into your MFD's card reader.

For more information on using your Axiom internal or external card reader refer to:

- Axiom / Axiom+ — **p.70 — Inserting a MicroSD card — Axiom® and Axiom®+ displays**
- Axiom Pro — **p.71 — Inserting a MicroSD card — Axiom® Pro displays**
- Axiom XL (External card reader / RCR) — **p.71 — Inserting memory card into external storage devices**

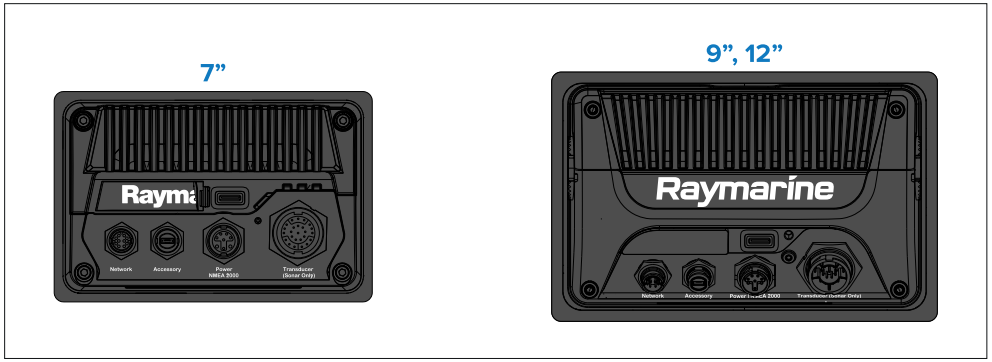
Removing MicroSD card from its adaptor

MicroSD memory and cartography chart cards are usually supplied inserted into an SD card adaptor. The card will need to be removed from the adaptor before inserting into your display.



Inserting a MicroSD card — Axiom® and Axiom®+ displays

Axiom® and Axiom®+ displays have a single slot MicroSD card reader located on the rear of the display.



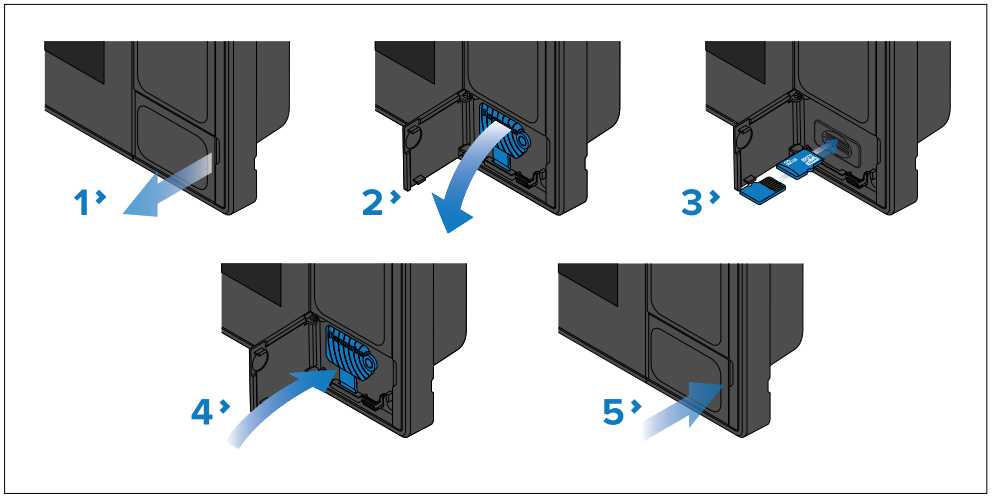
1. Pull back the microSD card reader cover as shown above.
2. Insert your microSD card with the contacts facing down.
3. Close the cover and ensure it is seated correctly.

Removing a MicroSD card

1. Select *[Eject SD card]* from the *[Import/export]* page: *[Homescreen > My data > Import/export > Eject SD card.]*

2. Open the card reader cover.
3. Remove the MicroSD card from the Rear of the display.
4. Ensure you close the card reader's cover.

Inserting a MicroSD card — Axiom® Pro displays



1. Open the card reader door.
2. Pull down the card slot cover.
3. Insert the card(s) into a card slot and push until they clicks into place.

Important:

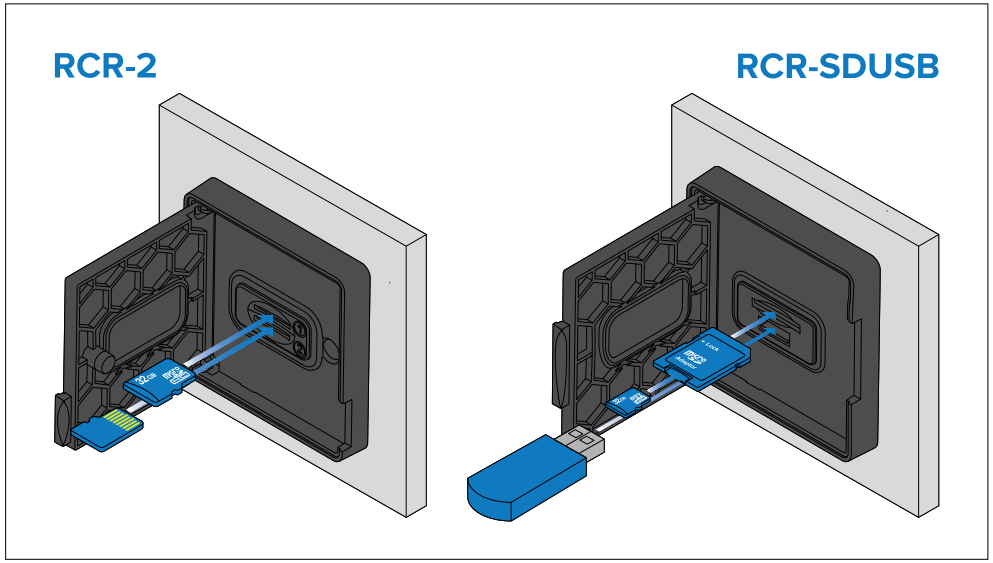
The upper card slot requires the memory cards contacts to be pointing downwards. The lower card slot requires the memory card contacts to be pointing upwards.

4. Close the card slot cover, ensuring it is seated correctly.
5. Close the card reader door.

Removing a MicroSD card

1. Open the card reader door.
2. Pull down the card slot cover.
3. Hold the *[Power]* button to access the *[Shortcuts]* menu, and then select the *[Eject SD Card]* option.
4. Push the card in until it clicks.
5. Pull the card free from the card slot.
6. Close the card slot cover, ensuring it is seated correctly.
7. Close the card reader door.

Inserting memory card into external storage devices



1. Open the card reader door.
2. Insert the storage device into a card slots as follows:
   - RCR-SDUSB slot 1 — With the contacts facing down, insert an SD card (or an SD card adaptor containing a MicroSD card) into the upper slot and push until it clicks into place.
   - RCR-SDUSB slot 2 — With the contacts facing down, insert a USB drive directly into the lower slot.
   - RCR-2 slot 1 — With the contacts facing down, insert a MicroSD card into the upper slot and push until it clicks into place.
   - RCR-2 slot 2 — With the contacts facing up, insert a MicroSD card into the lower slot and push until it clicks into place.

Important:

RCR-2 external card readers are not compatible with Axiom® 2 displays.

Removing external storage (SD and MicroSD)

With the card reader door open:

1. Use the display's **Power** button to access the *[Shortcuts]* menu, and then select the *[Eject SD Card]* option.
2. Push the card in until it clicks.
3. Pull the card free from the card slot.

Removing external storage USB drive

With the card reader door open and cover pulled down:

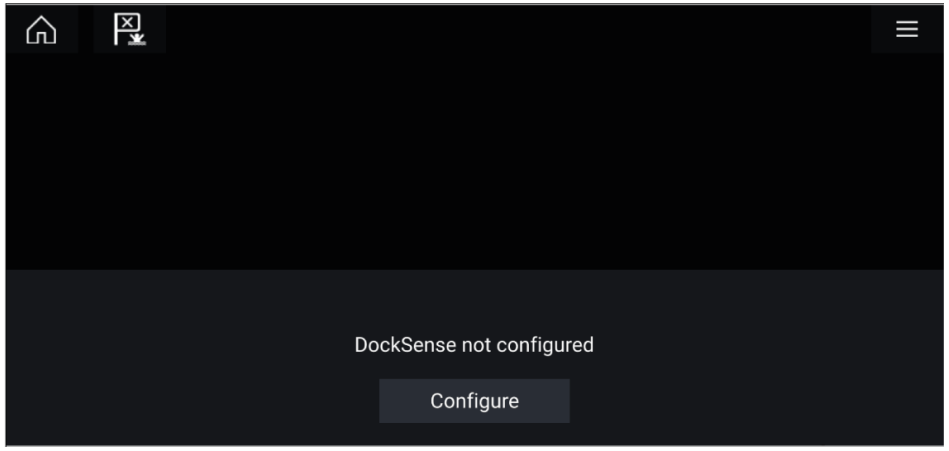
1. Pull the drive free from the card slot.

> **Caution: Ensure card reader cover or door is securely closed**
>
> To prevent water ingress and consequent damage to the product, ensure that the card reader door or cover is firmly closed.

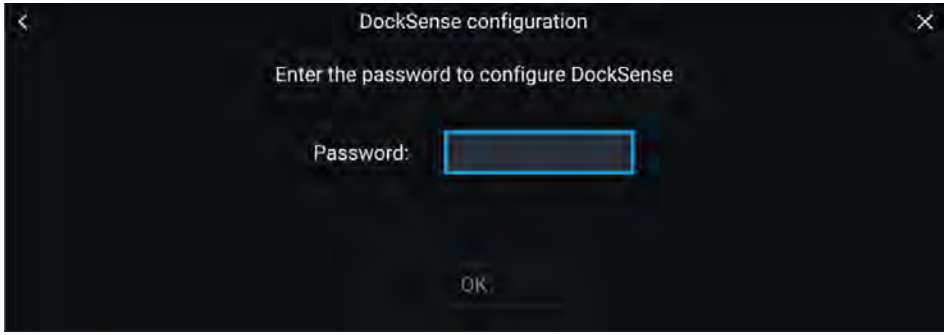
Installing the Configuration File

Use the DockSense app to install the DockSense boat Configuration File to your MFD.

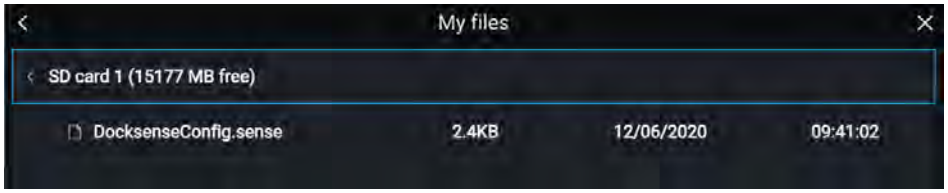
1. Open the DockSense app.
2. Select *[Configure]*.



3. Enter your DockSense *[Password]*, then select *[OK]*.



4. Select *[Configure]*.
5. From *[My files]*, select the MicroSD card, then select the *[DockSense boat Configuration File]* (.sense) file.



Your DockSense system is now configured to the selected Configuration File. Next, proceed to the next stages of system configuration and calibration.

12.3 Configuring camera positions

Configure the position of your DockSense cameras.

1. Select the camera position on the vessel diagram that corresponds to the current camera feed, e.g. if the camera feed is showing the starboard side of the boat then select the starboard camera.
   i. [Optional] Edit the camera's serial number.
2. Enter the camera's name, e.g 'Starboard Camera'.
3. Select *[Next]* to configure the next camera.

Repeat steps 1 to 3 for each camera until they have all been correctly configured.



Note:

Reconfigure your DockSense cameras at anytime from the settings menu: *[Menu > Settings > Advanced > Configure]*

12.4 Calibration

The correct operation of the DockSense system requires that the system components are accurately calibrated.

The system MUST be calibrated in the following strict order:

1. Calibrate the AR270.
2. Calibrate the vessel's center of gravity.
3. Calibrate the Cameras.

Important:

Your vessel should be steady when calibrating the AHRS system. Raymarine recommends calibrating when docked.

12.5 AHRS compass calibration

It's important to calibrate your DockSense AR270 AHRS compass, to account for irregularities in the unit's installed position which could impact the AHRS performance.

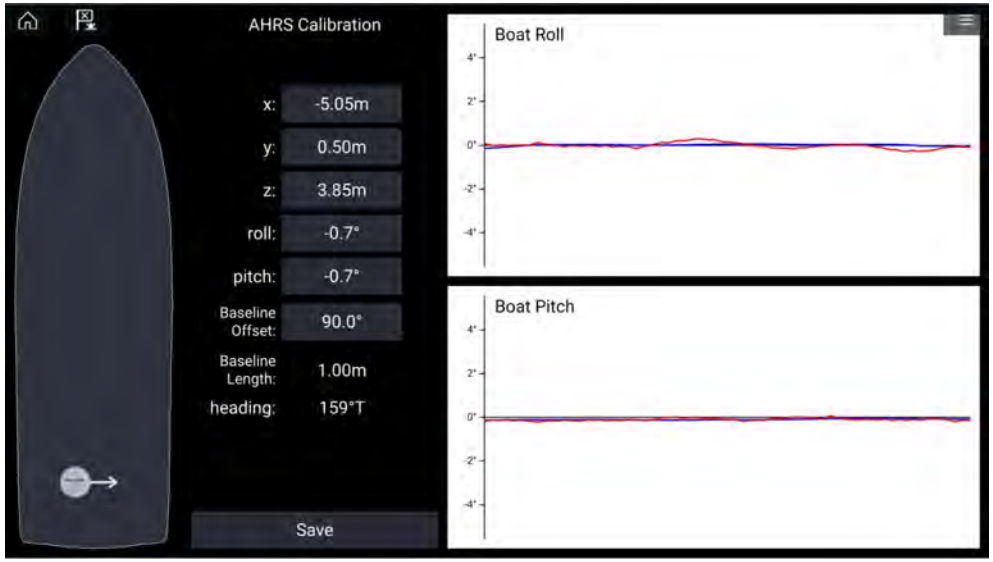
Important:

The values listed in the AHRS Calibration page must reflect the positional values of the DockSense system's "**Master compass**", which is the AR270.

Use the settings available in the AHRS Calibration page to modify the location and orientation values recorded in the AR270 Configuration File. Each setting must be modified to precisely match your AR270's physical installation location and orientation.

Important:

Your vessel should be steady when calibrating the AHRS system. Raymarine recommends calibrating when docked.



Accessing the calibration mode

In the DockSense app:

1. Select *[Settings > Advanced tab]*
2. Select *[Configure]*
3. Enter the password that protects your DockSense system configuration.
4. Select *[Save]*.
5. Select *[OK]*. *A warning will be displayed warning you that calibration should only be performed by trained persons. Select [Yes] to confirm this.*
6. Select *[Calibrate]*.
7. Before commencing, ensure the vessel is steady.

AR270 calibration

Each of the following settings must be adjusted so that it matches your AR270's precise installation location and orientation:

Position adjustment

- *[X]* — adjust the position along the X-axis.
- *[Y]* — adjust the position along the Y-axis.
- *[Z]* — adjust the position along the Z-axis.

Euler adjustment

- *[Roll]* — adjust the roll angle.
- *[Pitch]* — adjust the pitch angle.

Baseline Offset and Baseline Length adjustments

These values specify the physical installation position of the AR250 with respect to the AR270, in terms of the **Offset** (expressed as an angle in degrees (offset), and **Length** (expressed as a distance in meters).

- *[Baseline Offset]* — adjust so that the angle (shown by the arrow on the AHRS Calibration page) is pointing towards your AR250.
- *[Baseline Length]* — adjust this value so that the distance (Length) represents the distance between the physical installed positions of the AR250 and AR270 compasses.

Once all settings have been adjusted as appropriate, select *[Save]* to save the settings and continue with calibration.

Important:

You should aim to achieve a result in the graphs displayed in the AHRS Calibration page that looks similar to the graphs shown in the screenshot above. Both red and blue lines on both graphs should be very close to **0°**.

Important:

Moving the AR250 or AR270 after settings have been saved will require the calibration routine to be run again.

12.6 Center of gravity calibration

Calibrate your vessel's center of gravity.

The aim of Center of Gravity (CoG) calibration is to record the center of gravity that your vessel references, when steadily rocking from side-to-side on an open body of water. **The purpose of this calibration process is to determine where the vessel's pivot point is; this will be the center of gravity.**

Important:

DO NOT attempt to calibrate the center of gravity until the AHRS compass calibration has been completed; for more information refer to:
p.73 — AHRS compass calibration

Procedure

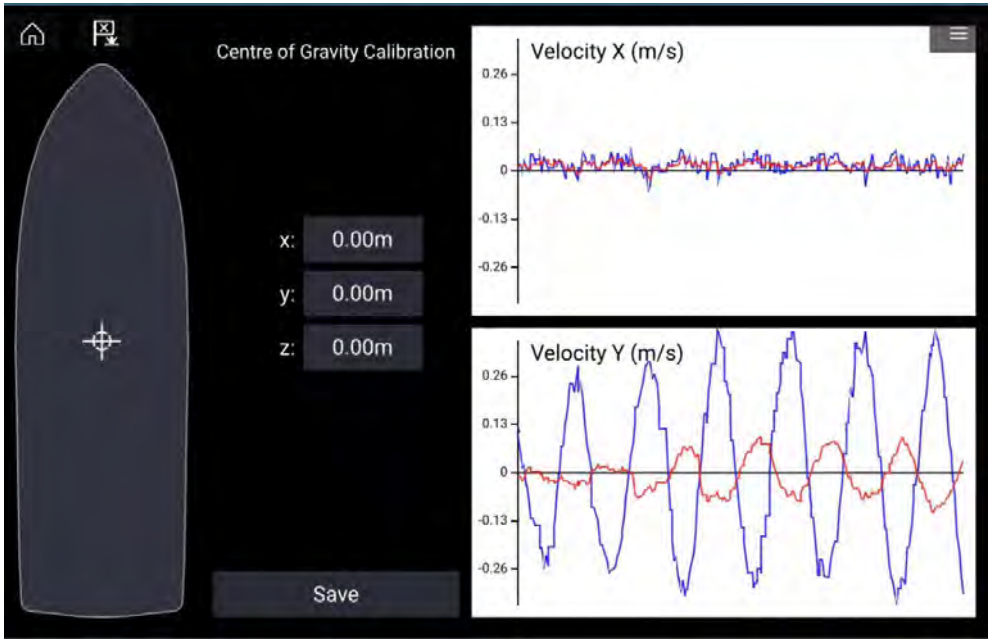
Finding your vessel's center of gravity involves physically rocking the vessel gently on its central pivot point. This is usually achieved by loosening the berthing ropes so that the vessel can be rocked easily, usually by holding the railings and rocking the vessel gently in its position in the water. It's important to ensure that the vessel is only rocking from side to side, and not pitching to the bow or aft. **It is useful to have at least 2 people for this procedure; one to rock the vessel, and another to observe the display showing the DockSense app in Calibration mode**. The graphs displayed in this mode will help you to confirm once the vessel has been rocked sufficiently to establish the vessel's center of gravity.

Important:

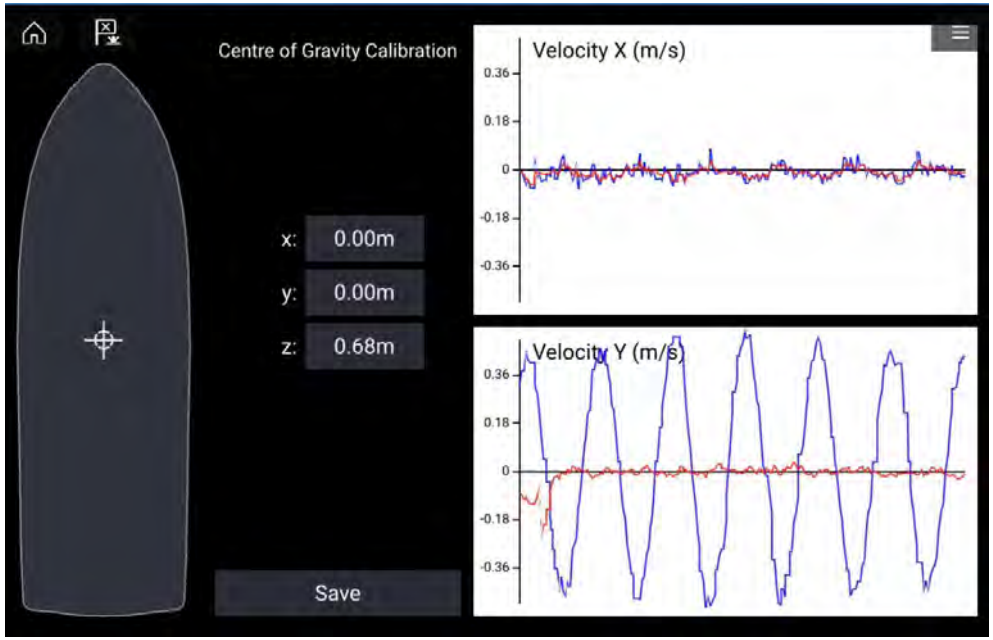
The progress bar may reset during the calibration process. This will be due to the oscillation not being consistent, or the vessel not being rolled enough. In this scenario, try to rock the vessel at a steady pace and steady amount, until the process is complete. When the rocking is not consistent, the progress will reset and the process will timeout after 2 minutes (assuming that no consistent rolling motion is observed within that time).

CoG is expressed in Calibration mode as a position across 3 axes: X, Y, Z. Two graphs show the **velocity** of the vessel (its movement in the X and Y axis, in terms of time, expressed as milliseconds (m/s)).

The following screenshot shows an example of an uncalibrated center of gravity (i.e. an unstable vessel):



The following screenshot shows an example of a correctly-calibrated center of gravity (i.e. stable vessel):



Center of Gravity — calibration graphs

The purpose of this calibration is to determine where the vessel's pivot point is; this will be the center of gravity.

To calibrate the Center of Gravity: For most vessels, the X and Y values from the Configuration File will be suitable, and it will be adequate to adjust only the Z value in the Calibration page. This value should be adjusted in small increments until the graphs are displayed as follows:

- The **blue line** on X/Y graphs is the velocity as detected by the AR270; when the boat is rocking, this line should show a sinusoidal pattern as its velocity goes back and forth.
- The **red line** on X/Y graphs is the velocity of the center of the boat; when the boat is rocking, this should be a constant (flat) line.

Once all settings have been adjusted as appropriate, select *[Save]* to save the settings and continue with the calibration process.

Important:

As part of the calibration process, it's important to perform a visual check of the 2 graphs displayed on the Center of Gravity Calibration page. A successful calibration is achieved when the red line in the "Velocity Y" graph is stable and as close to 0 as possible, while the blue line oscillates in the "Velocity Y" graph. The graphs should look similar to those shown in the screenshot above.

12.7 Camera calibration

Use the calibration settings to fine-tune each camera to ensure that they are detecting the water level correctly.

Each camera's field of view displays the water level gradient it is detecting. **If the water gradient is any color but white, this means that the gradient is not flat, and requires calibration.**

For more information about the water gradient, and some examples of adequate water gradient values for cameras, refer to: **p.78 — Water gradient**

Important:

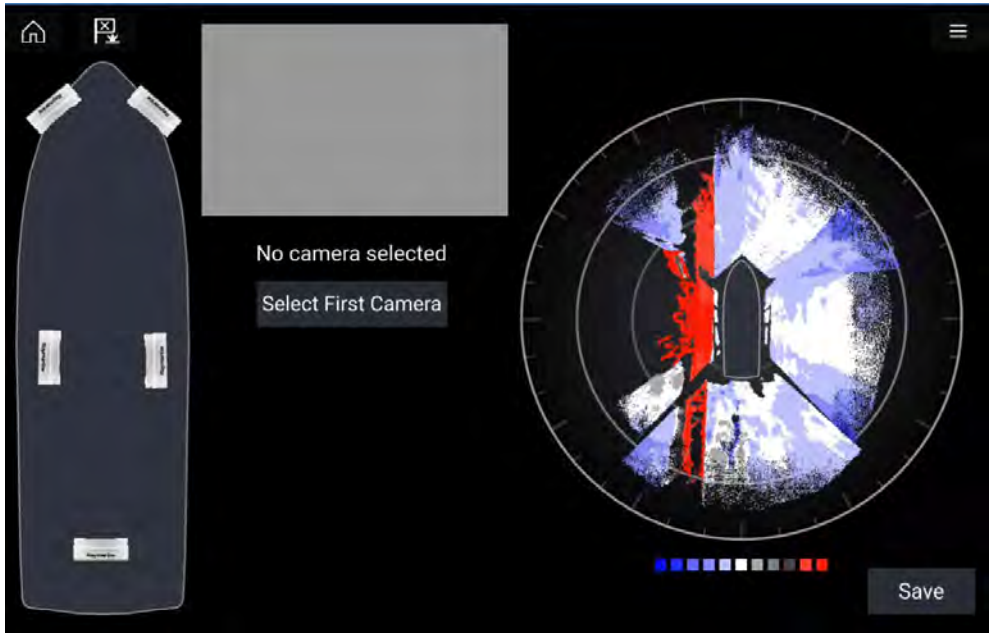
DO NOT attempt to calibrate the cameras until the AHRS compass and Center of Gravity calibration routines have been successfully completed.

Important:

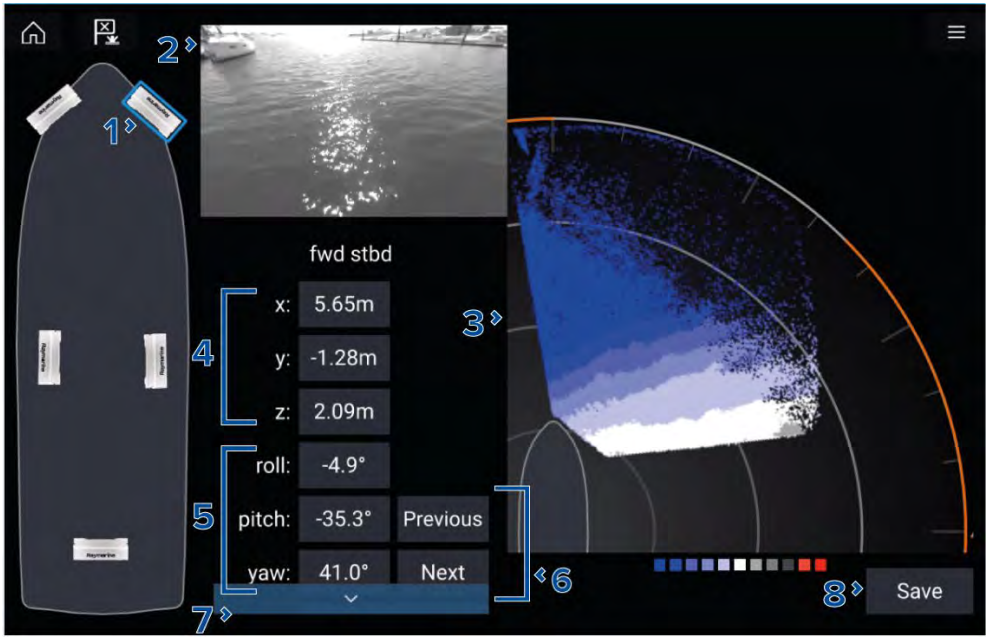
Before commencing camera calibration, ensure that:

- Your vessel is docked, in a location where the cameras have a clear view of the water with no large objects obscuring the camera's field of view.
- There are sufficient ripples on the surface of the water, for the camera to detect.
- The vessel is stationary.

To get started with camera calibration, touch the *[Select First Camera]* option, as shown in the following screenshot, and then select the camera you want to calibrate, in the vessel image on the left of the screen:



The following illustration and notes show **an example of an uncalibrated camera**, and explain each part of the calibration screen:

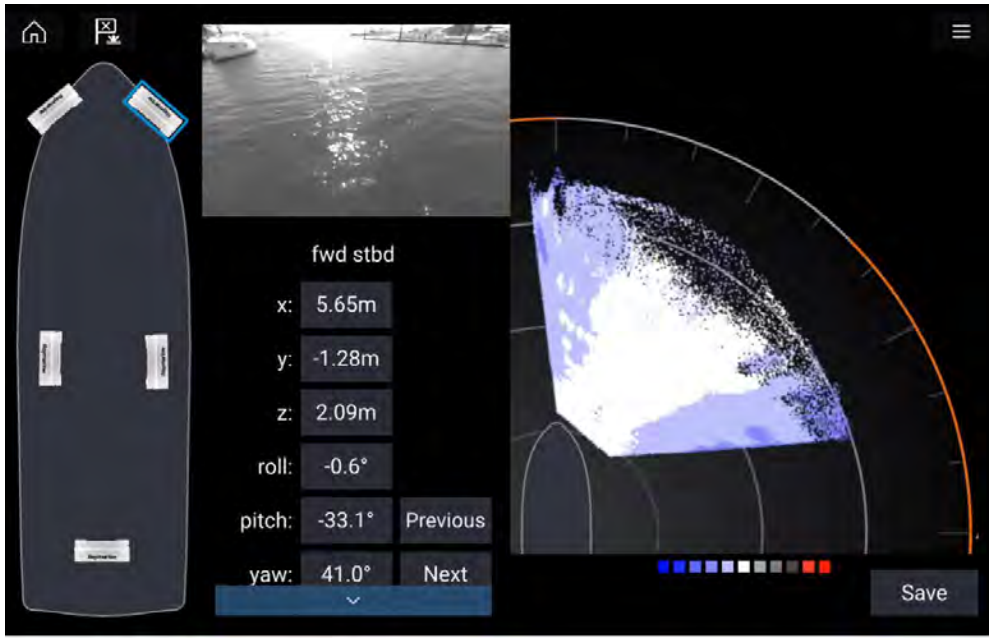


1. **Selected camera** — Shows the camera currently selected for calibration.
2. **Camera feed** — Feed of the selected camera
3. **Water gradient** — Displays the detected water level. For more information refer to: **p.78 — Water gradient**
4. **Location settings** — Adjust to change the camera's location as defined in the *[Configuration File]*.
5. **Euler settings** — Adjust the camera's orientation as defined in the *[Configuration File]*.
6. *[Previous]* and *[Next]* camera selection — Switch between cameras for calibration.
7. *[Deselect Camera]* (this item is off-screen in the screenshot above) — Return to the DockSense Homescreen.
8. *[Save]* — Save settings for all cameras and exit calibration.

Calibrated camera — example

Each camera's field of view displays the water level gradient it is detecting. **If the water gradient is any color but white, this means that the gradient is not flat, and requires calibration.**

The following screenshot shows an example of a calibrated camera:



For more information about the water gradient, and some examples of adequate water gradient values for cameras, refer to: **p.78 — Water gradient**

Camera calibration

During calibration, you need to calibrate the following camera parameters, **for each camera**, one camera at a time. Refer to the screenshot above for an example of a calibrated camera.

- *[Z axis]* — the camera's position along the Z-axis.
- *[Roll]* — the roll angle of the camera in its installed position.
- *[Pitch]* — the pitch of the camera in its installed position.

Important:

Once calibration is complete, ensure that you select *[Save]* to keep the settings. **Do this for each camera that you calibrate.**

Important:

Moving any cameras after settings have been saved will require the calibration routine to be run again.

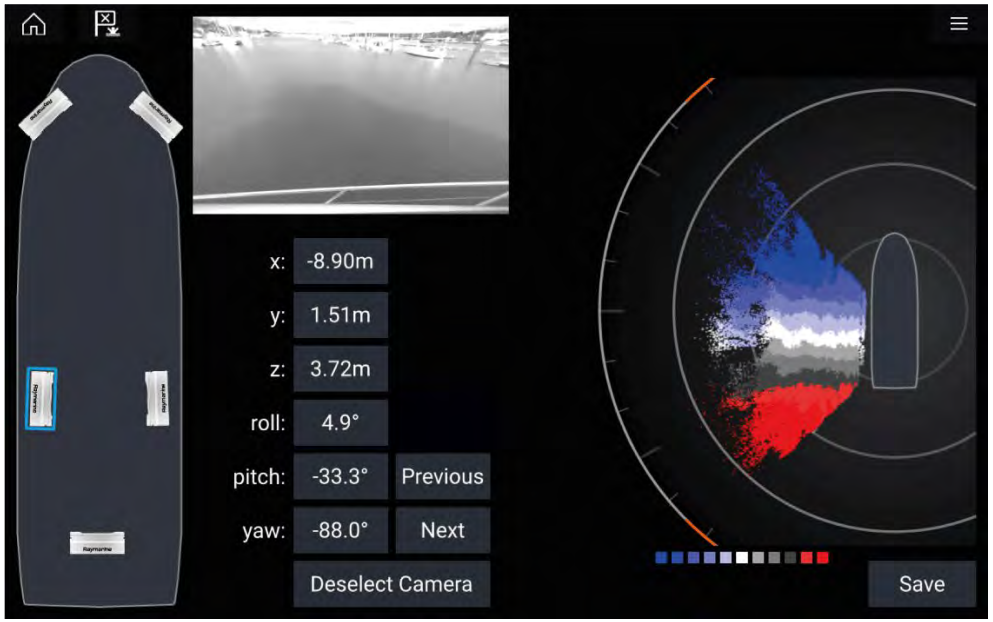
Water gradient

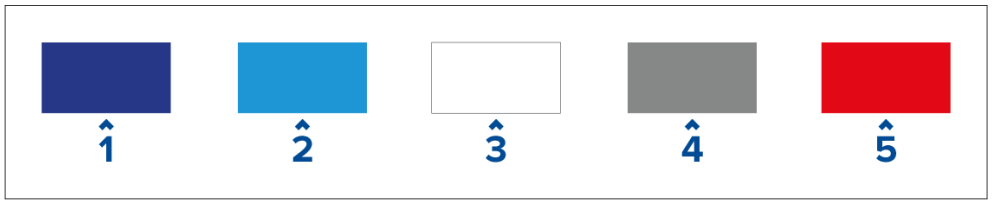
Use the calibration settings to fine-tune each camera to ensure that they are detecting the water level correctly.

Important:

Camera calibration should be carried out in clear daylight on a calm body of water, without obstacles in front of the camera.

Each camera's field of view displays the water level gradient it is detecting. If the water gradient is any color but white, it is not flat and requires calibration.

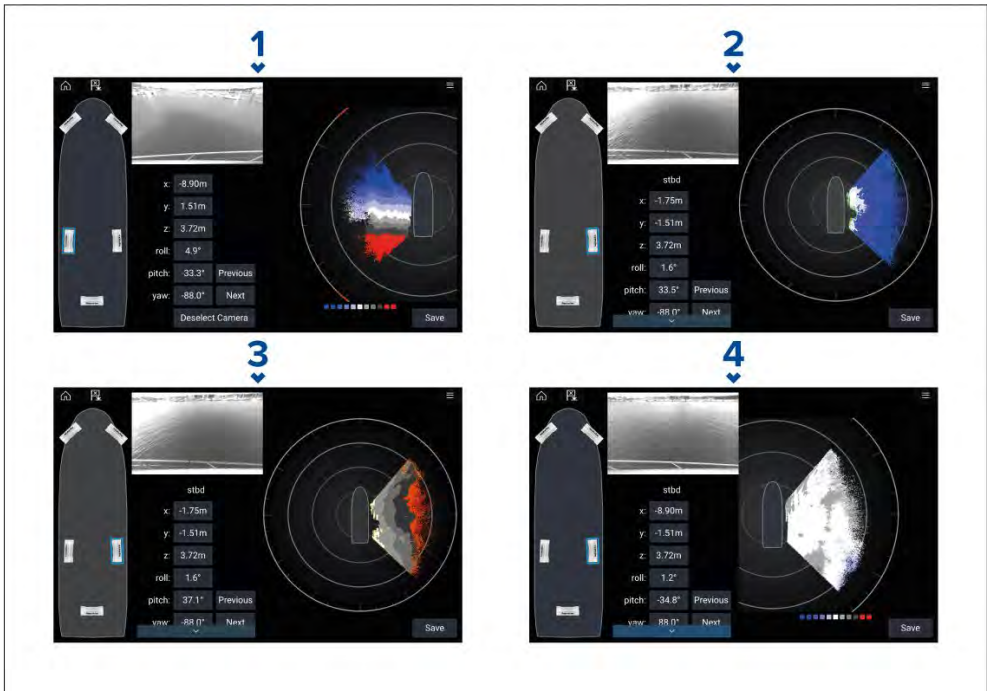




1. **Dark Blue** — The water level is too low.
2. **Light Blue** — The water level is low.
3. **White** — The water level is correct.
4. **Grey** — The water level is high.
5. **Red** — The water level is too high.

Water gradient examples

The images below show different types of water gradients and how to correct them.



1. The water gradient is changing from left to right. The left is too high and the back is too low; this can be corrected by adjusting the *[Roll]* setting.

2. The water gradient is changing from the back to the front. The back is too low; this can be corrected by adjusting the *[Pitch]* setting.
3. The water gradient is changing from the back to the front. The back is too high; this can be corrected by adjusting the *[Pitch]* setting.
4. The water gradient is acceptably flat / correct. Further fine-tune adjustments can be made to try to remove the gray patches.

12.8 System test

To complete the commissioning process you should test the DockSense system is functioning correctly.

DockSense Control system testing should be completed in the following order:

1. Performing docking maneuvers for each area of your vessel that is covered by a DockSense Camera's field of view.
2. Determining if your DockSense system is detecting solid objects and accurately measuring your vessel's distance from them.
3. Testing Manual Control mode and Auto mode are operational.
4. Recognizing and correcting any potential system installation, configuration, and calibration errors that are preventing DockSense Control from functioning as intended.
5. Completing all docking maneuvers without errors and passing the DockSense Control system.
6. Keeping an accurate record of system component locations and system settings.

Important:

Before testing your DockSense Control system ensure:

- DockSense Control equipment and Aventics equipment have been installed correctly. For more information refer to: **p.40 — Installation**
- DockSense Control system configuration and calibration has been completed correctly. For more information refer to **p.68 — Commissioning and calibration**
- Test precautions have been followed. For more information refer to **p.79 — Precaution**

Warning: System operation

Misuse of the DockSense system can result in property damage and bodily harm, ensure all system warnings and cautions have been read and abided before operation. For more information refer to **p.9 — Important information**

Precautions

Test precautions can help prevent potential damage and harm when testing your DockSense system.

Before testing your DockSense system, Raymarine recommends the following precautions are in place:

- The minimum number of crew members required for vessel operation are maintained throughout the DockSense system test.
- Your vessel is adequately protected from physical damage using fenders and bumpers.

Manual control testing procedure (docking maneuvers)

Perform docking maneuvers in *[Manual Control]* mode to test your DockSense Control system.

Note:

Testing should be performed:

- During daylight hours.
- In an open area with little to no disturbance from other moving vessels.

Testing should NOT be performed:

- On choppy water or during stormy conditions.
- In close proximity to other vessels or objects.

Important:

Before continuing, Raymarine recommends:

- Reading the **DockSense® Control Operation instructions** document number **81398**.
- Practice using the *[Virtual Arena]* feature before testing your full system.

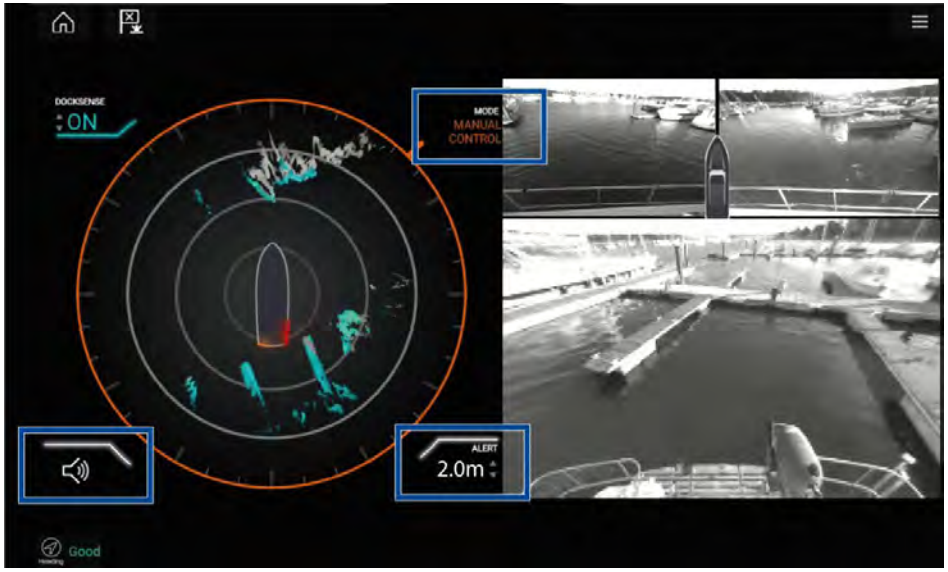
Important:

If at any point during the test you encounter system errors or issues that are preventing your DockSense Control system from functioning as intended:

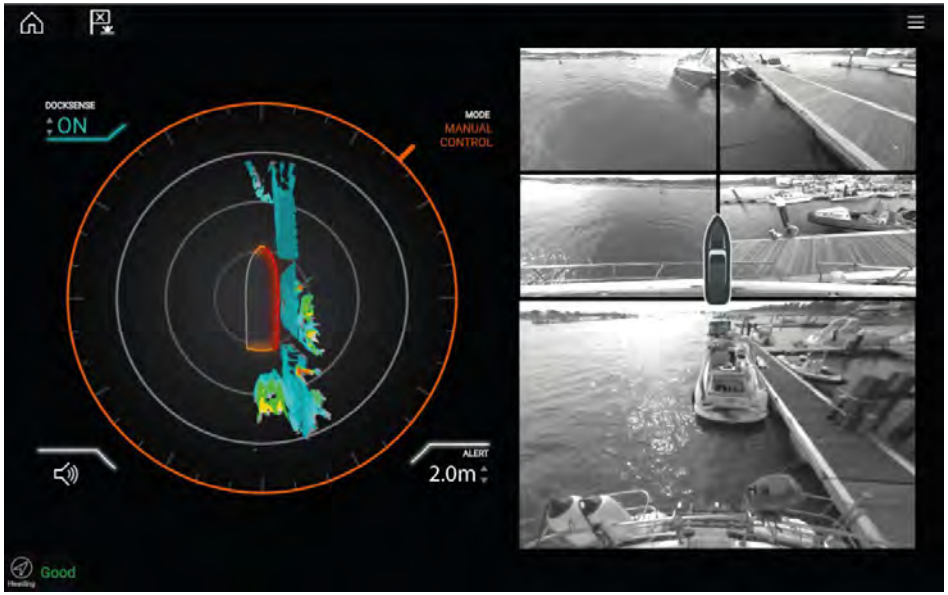
1. Stop the test.
2. Record notes and take screenshots of all errors and issues.
3. Refer to the *Troubleshooting* chapter for help with diagnosing the problem and finding solutions: **p.88 — Troubleshooting**
4. Make the suggested corrections to your DockSense system before reattempting the test.

To begin testing:

1. Open the DockSense app and check all cameras are displaying their video feeds correctly.
2. By default your system will be set to *[Manual Control]* mode. If required toggled to *[Manual Control]* mode using your Joystick.
3. Ensure *[Audible Alerts]* are active and the *[Alert Range]* is set to *[2m]*.



4. Choose a camera to test and maneuver your vessel so the dock is captured by the camera's field of view.

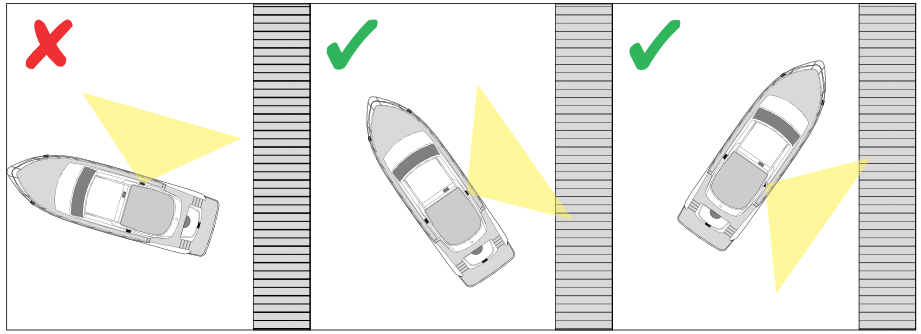


5. While maintaining a visual watch of your surroundings, approach the dock at a slow and safe speed.
6. The camera should begin to detect the dock and the DockSense app will alert you of your vessel's distance from the dock with the *[Visual Alerts]* and *[Audible Alerts]*. Determine if the DockSense app's alerts are accurate representations of your vessel's distance from the dock.

   If you believe the alerts are inaccurate then you might need to recalibrate your DockSense Camera; for more information refer to ***p.88 — Troubleshooting***

7. Steer your vessel away from the dock and repeat steps 4 and 5 multiple times for the same camera. With each new maneuver consider:

   - *Adjusting the [Alert Distance] setting to different values to check the system alerts at different levels of sensitivity.*
   - *Adjusting the angle of approach to the dock slightly, e.g. if you are testing the starboard side camera, angle the vessel so that the bow or stern protrudes towards the dock slightly. This can help determine if there are any blind spots or misalignments to the camera. Ensure that you are not orienting the vessel in a way that means the camera's field of view is no longer capturing the dock.*



8. Once you are satisfied the camera is functioning correctly, you can conclude the test.

Auto testing procedure (docking maneuvers)

Perform docking maneuvers in *[Auto]* mode to test your DockSense Control system.

Note:

Testing should be performed:

- During daylight hours.
- In an open area with little to no disturbance from other moving vessels.

Testing should NOT be performed:

- On choppy water or during stormy conditions.
- In close proximity to other vessels or objects.

Important:

Before continuing, Raymarine recommends:

- Reading the **DockSense® Control Operation instructions** document number **81398**.
- Practice using the *[Virtual Arena]* feature before testing your full system.
- Testing your DockSense Control system using *[Manual Control]* mode before attempting docking maneuvers with *[Auto]* mode. For more information refer to **p.79 — Manual control testing procedure (docking maneuvers)**

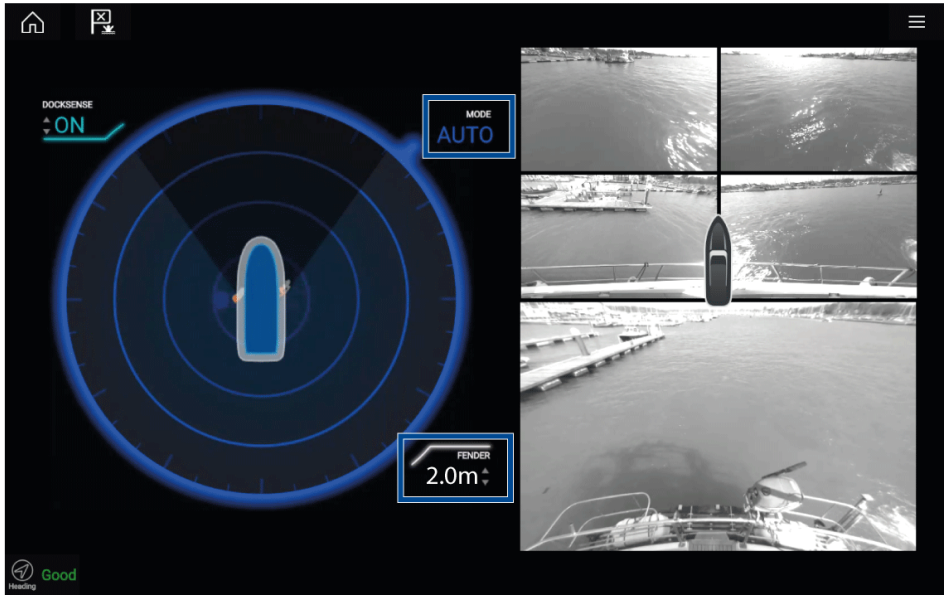
Important:

If at any point during the test you encounter system errors or issues that are preventing your DockSense Control system from functioning as intended:

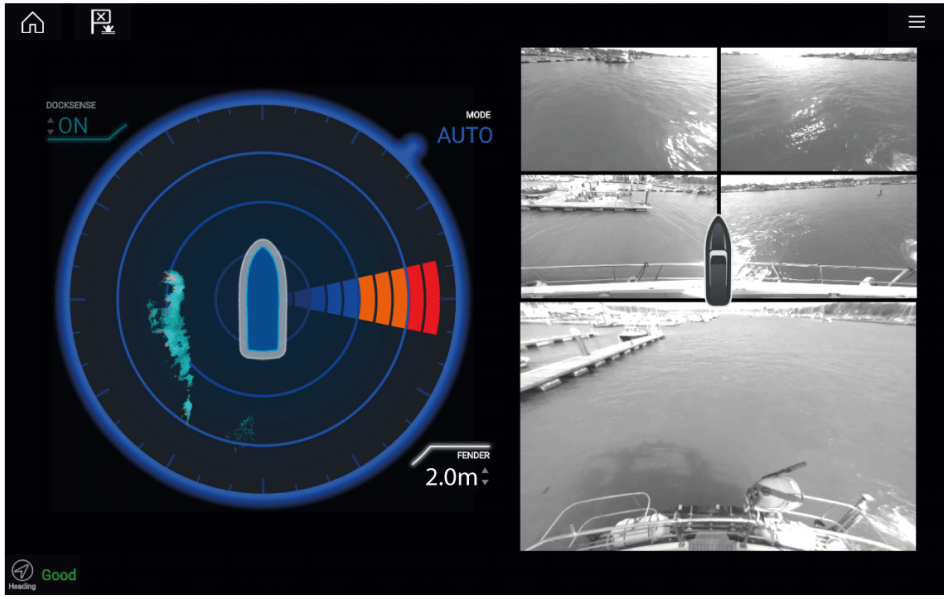
1. Stop the test.
2. Record notes and take screenshots of all errors and issues.
3. Refer to the *Troubleshooting* chapter for help with diagnosing the problem and finding solutions: **p.88 — Troubleshooting**
4. Make the suggested corrections to your DockSense system before reattempting the test.

To begin testing:

1. Open the DockSense app and check all cameras are displaying their video feeds correctly.
2. By default your system will be set to *[Manual Control]* mode, toggle to *[Auto]* mode using your Joystick.
3. Set *[Fender]* distance to *[2m]*.



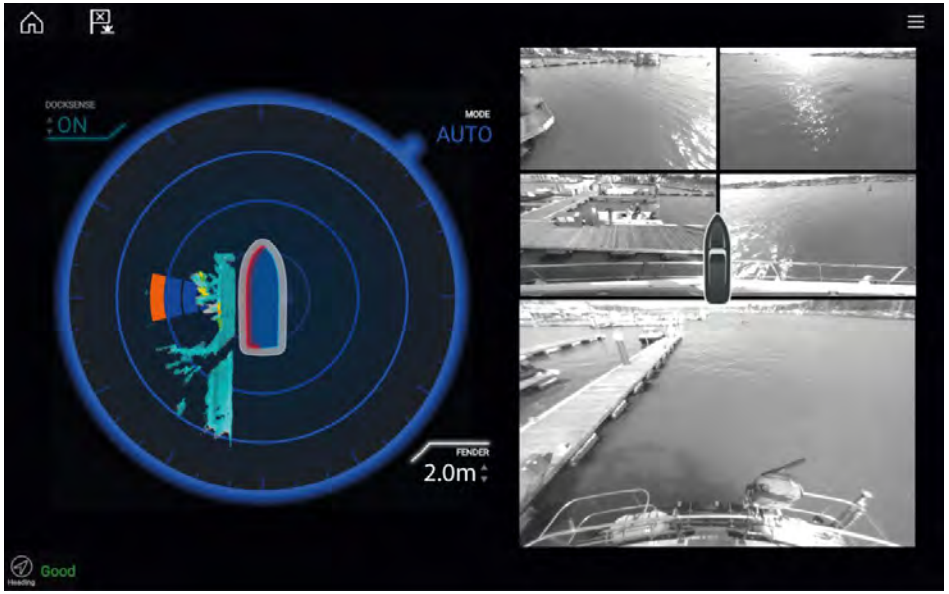
4. Choose a camera to test and maneuver your vessel so the dock is captured by the camera's field of view.



5. While maintaining a visual watch of your surroundings, approach the dock at a slow and safe speed.
6. The cameras should begin to detect solid objects and display them on the *[Map]*. Your translation and rotation effort will also display to indicate which direction your vessel is moving.
7. As you get closer to the dock, the DockSense system will begin to automatically decrease throttle towards detected objects. You can see how much engine effort is being applied by looking at the *[Translation effort bar]* and *[Rotation effort bar]*.

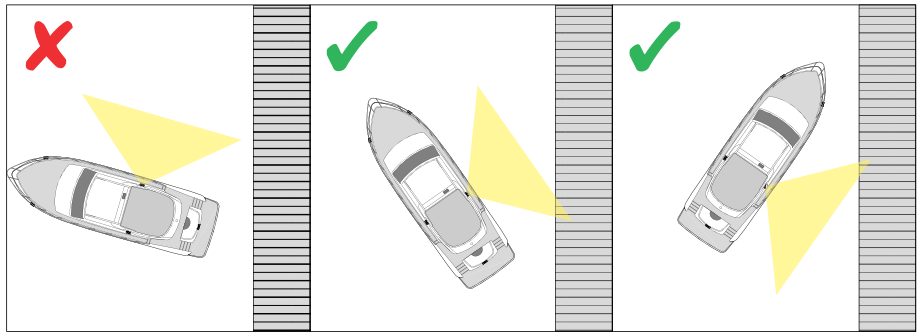
   If you believe the system's object detection is inaccurate then you might need to recalibrate your DockSense Camera; for more information refer to ***p.88 — Troubleshooting***

8. Your *[Vessel outline]* will display a *[Solid Red]* visual alert when solid objects are within the Virtual *[Fender]*. The system will prevent you from moving closer to the dock and will apply engine effort to keep you at least 2m away.



9. Steer your vessel away from the dock and repeat steps 4 and 5 multiple times for the same camera. With each new maneuver consider:

   - *Adjusting the [Fender] setting to different values to check the system functions correctly at different levels of sensitivity.*
   - *Adjusting the angle of approach to the dock slightly, e.g. if you are testing the starboard side camera, angle the vessel so that the bow or stern protrudes towards the dock slightly. This can help determine if there are any blind spots or misalignments to the camera. Ensure that you are not orienting the vessel in a way that means the camera's field of view is no longer capturing the dock.*



10. Once you are satisfied the camera is functioning correctly, you can conclude the test.

12.9 Configuration File export

After calibrating and testing your DockSense system you can export the Configuration File settings to a MicroSD card inserted into the MFD's card slot, for backup purposes.

[Menu > Settings > Advanced > Export configuration]

CHAPTER 13: MAINTENANCE

CHAPTER CONTENTS

- 13.1 Routine equipment checks — page 85
- 13.2 Product cleaning — page 85
- 13.3 Cleaning the camera — page 85

13.1 Routine equipment checks

It is recommended that you perform the following routine checks, on a regular basis, to ensure the correct and reliable operation of your equipment:

- Examine all cables for signs of damage or wear and tear.
- Check that all cables are securely connected.

13.2 Product cleaning

Best cleaning practices.

When cleaning products:

- Switch off power supply.
- Use a clean damp cloth to wipe clean.
- Do NOT use: abrasive, acidic, ammonia, solvent or other chemical based cleaning products.
- Do NOT use a jet wash.

13.3 Cleaning the camera

The camera housing and lens require regular cleaning. You should clean the lens when system performance appears to deviate from its usual level, or when excessive contaminant buildup is seen on the lens. You should also ensure that the camera's protective cover is also unobstructed and operating correctly.

When cleaning this product:

- Do NOT wipe the lens window with a dry cloth, or with abrasive materials such as paper or scrub brushes, as this could scratch the coating.
- Do NOT use acid or ammonia based products.
- Do NOT pressure wash.

Particular care should be taken when cleaning the lens window, as this has a protective anti-reflective coating which may be damaged by improper cleaning.

1. Switch off the power to the unit.
2. Clean the camera body with a clean, soft cotton cloth. You can moisten the cloth and use a mild detergent if required.
3. Clean the camera lens.
   - Rinse the lens with fresh water to remove all dirt particles and salt deposits, and allow to dry naturally.
   - If any spots or smears remain, very gently wipe the lens window with a clean microfibre cloth or soft cotton cloth.
   - If necessary, use isopropyl alcohol (IPA) or a mild detergent to remove any remaining spots, marks, or salt deposits.

CHAPTER 14: OPERATION

CHAPTER CONTENTS

- 14.1 DockSense® Control operation instructions — page 87
- 14.2 DockSense® Control documentation — page 87

14.1 DockSense® Control operation instructions

The DockSense® system is controlled via the **DockSense** app, accessible on the homescreen of a compatible Raymarine LightHouse 3 multifunction display (MFD).

For detailed operation instructions, refer to the dedicated **DockSense® Control Operation instructions**, document number **81398**.

14.2 DockSense® Control documentation

The latest versions of all English and any available translated documents are available to view or download on any device with a web browser. **Please check the links provided below to ensure you have the latest documentation.**



Digital manuals

https://bit.ly/ds-control

CHAPTER 15: TROUBLESHOOTING

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- 15.1 Troubleshooting — page 89
- 15.2 Diagnostics — page 89
- 15.3 Power up troubleshooting — page 89
- 15.4 GNSS (GPS) troubleshooting — page 90
- 15.5 Camera troubleshooting — page 90
- 15.6 Alarms list — page 91
- 15.7 LED diagnostics — page 94

15.1 Troubleshooting

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

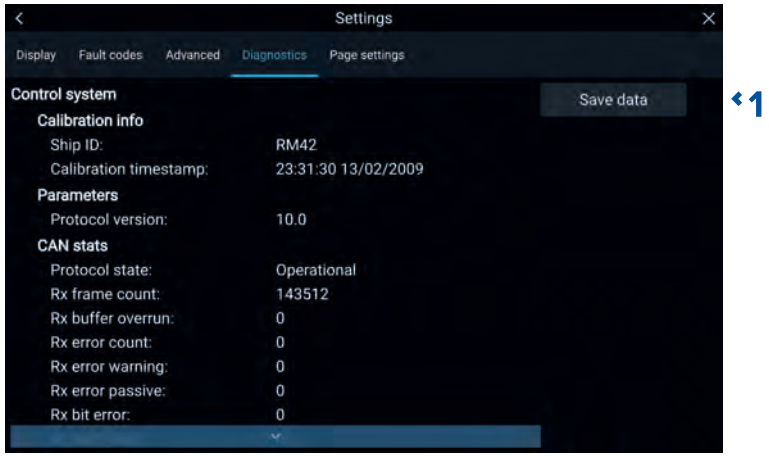
Before packing and shipping, all Raymarine® products are subjected to comprehensive testing and quality assurance programs. If you do experience problems with your product, this section will help you to diagnose and correct problems to restore normal operation.

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.

15.2 Diagnostics

Diagnostics information can help determine if your DockSense system is experiencing any errors.

All equipment diagnostics information can be accessed in the settings menu: *[DockSense app > Menu > Settings > Diagnostics]*



15.3 Power up troubleshooting

Before troubleshooting problems with your power connection, ensure that you have followed the power connection guidance provided in the product's installation instructions and performed a power cycle/reboot of the device. The troubleshooting information below can be used if you are experiencing problems with powering up your product.

Blown fuse / tripped breaker

1. Check the fuse, located inline with the power cable. Ensure that it has the correct rating (refer to *Connections* chapter), as an under-rated fuse can affect the power supplied to the product. If the fuse has blown, replace with a new fuse.
2. Check the condition of relevant / additional fuses and breakers and connections; replace if necessary.
3. 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 fully inserted into the unit 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 power cable near to the connector to see if this causes the unit to re-boot/lose 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.

Incorrect power connection

The power supply may be wired incorrectly, ensure the installation instructions have been followed.

Power source insufficient

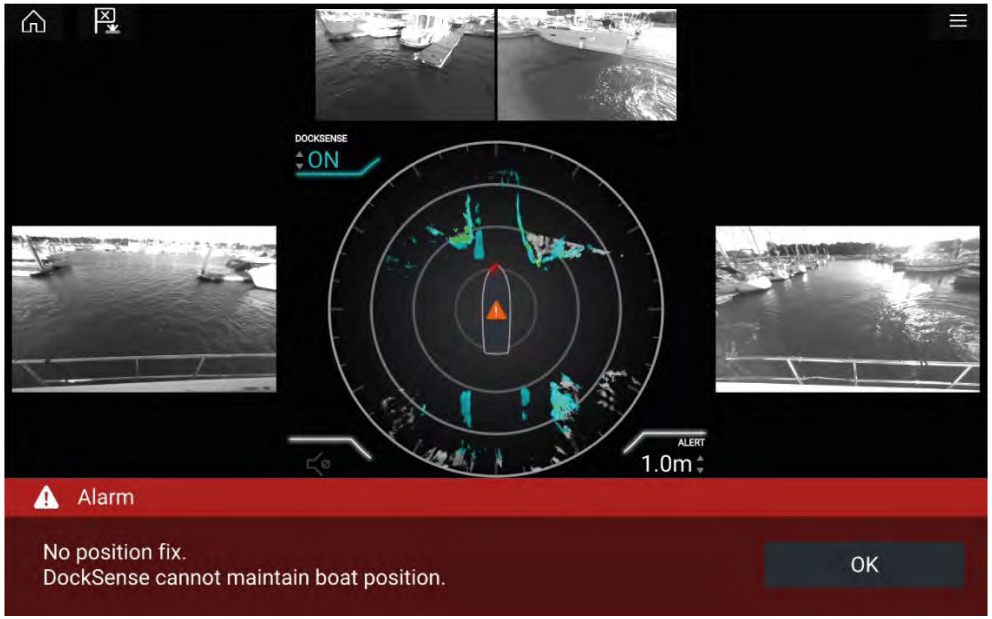
Check that your power supply (battery or distribution panel) is providing a minimum of 10.8 V to each component in the system.

15.4 GNSS (GPS) troubleshooting

Your DockSense system is reliant on a source of accurate heading at all times; if the GPS signal is poor then the heading cannot be relied on.

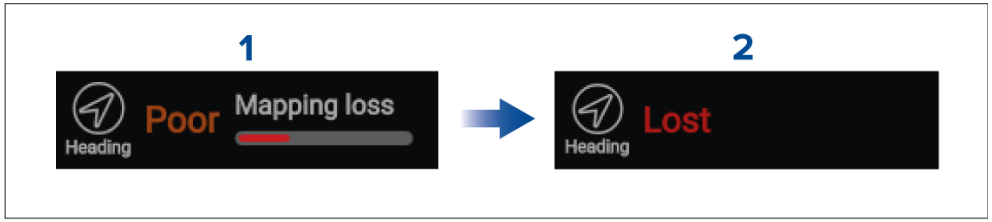
"No Fix" status icon is displayed on the multifunction display (MFD), or the system keeps losing position fix.

Ensure that the GPS compass is located in the exact position specified in the **Configuration File (.sense)** supplied with your DockSense system. In particular, the GPS compass requires a clear view of the sky, and both the GPS and AHRS compasses must be level / flat to the water plane, and must also be **at least** 1 m (3.3 ft) away from each other.



[Poor Heading] or *[Lost Heading]* status message displayed in DockSense app.

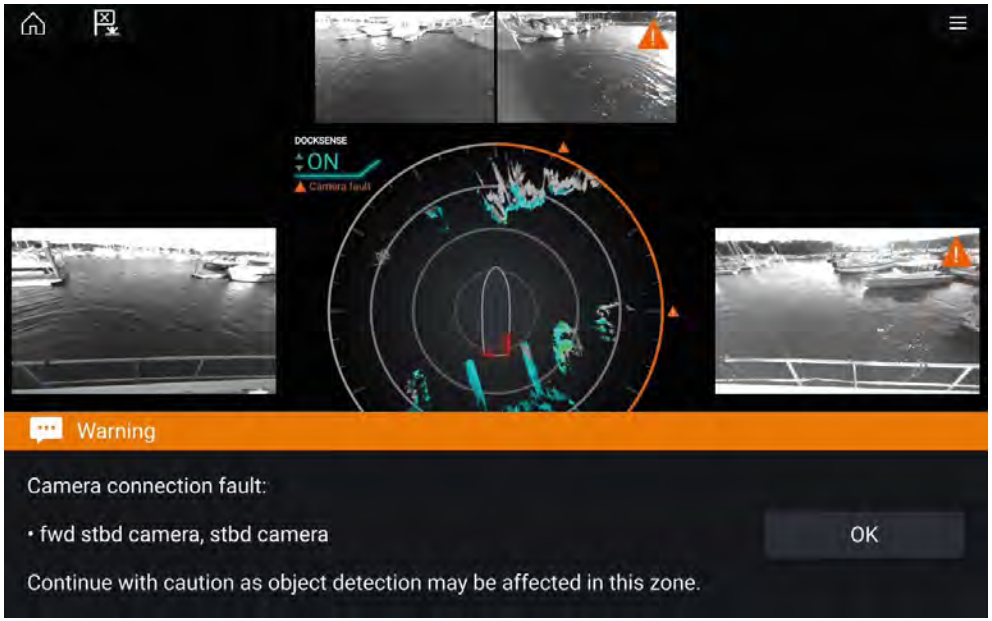
Be aware that the GPS compass can be affected by the number of satellites it sees in the sky. When the heading accuracy falls below a certain threshold, heading will be lost and the map will not be shown on screen in the DockSense app. The app displays a warning when the heading information is low quality. The indicator bar provides an indication of how long the map will be maintained, given the current heading quality (**1**), until it is lost (**2**). If heading quality is consistently poor, your installation will need to be reviewed by your dealer / installer.



15.5 Camera troubleshooting

"Camera connection fault" message and status icons displayed in DockSense app.

Ensure the affected camera(s) have been installed and connected in accordance with Raymarine's recommendations in **DockSense Alert Installation instructions (87405)** or **DockSense Control Installation instructions (87418)**, as appropriate. If this error is persistent, your installation will need to be reviewed by your dealer / installer.



Misaligned camera

If your DockSense system is not detecting solid objects correctly, it could mean your DockSense camera is misaligned. If the camera has been knocked out of position it will require realignment and recalibration. Contact your dealer / installer for more information.

"Camera imaging" message and status icons displayed in DockSense app.

This Alarm can be caused by:

- Poor environmental conditions, e.g. fog and low light levels
- Obscured camera vision

Ensure that the affected camera(s) are clean and no dirt is obscuring the lens. Ensure also that you're using the DockSense system in approved settings. For more information, refer to: System limitations (Part 1)

"Ice Alert" message and status icons displayed in DockSense app.

This message can appear if the camera shutter or lens are frozen. Activate *[Heater Boost]* from *[Advanced Settings]* and wait for the cameras to de-ice before using the DockSense app, *[Homescreen > Menu > Settings > Advanced]*.

"Shutter fault" message and status icons displayed in DockSense app.

The shutter on your DockSense camera has failed to open or close correctly. Check the camera shutter is not blocked or frozen when operating. If this error is persistent, your camera will need to be reviewed by your dealer / installer.

"Internal fault" message and status icons displayed in DockSense app.

Your camera has become damaged and is not guaranteed to function correctly. Your camera will need to be reviewed by your dealer / installer.

15.6 Alarms list

ID	**Alert**	**Scope** Determines if the Alarm can be triggered only when using the DockSense App (**App**), or anywhere on the MFD system (**Global**)	**Severity** The severity of the Alarm in the DockSense system: • **Information** — Important information. • **Warning** — Requires your attention. • **Alarm** — Potential Danger — take action.
AD001	Object detected Bumper/fender Infringement	App	Warning
AD002	Camera — Imaging problem (lens contaminated / dirty)	App	Warning
AD003	Camera — imaging problem (too foggy / dark)	App	Warning
AD004	Camera — shutter fault	App	Warning
AD005	Camera — ice alert	App	Warning
AD006	Camera — internal fault	App	Warning
AD007	Camera — not connected / connection lost	App	Warning

AD008	Camera — Calibration Error - Intrinsic	App	Warning
AD009	Camera — Calibration Error - Extrinsic	App	Warning
AD010	Compass — no position fix / position lost	Global	Alarm
AD011	Compass — no heading data / heading fault	Global	Alarm
AD012	Compass — no attitude data / attitude fault	Global	Alarm
AD014	Processor Module — connection to MFD lost	Global	Alarm
AD015	Processor Module — Engine (Velocity Controller) Connection Lost	Global	Alarm
AD016	Processor Module — CAN to Joystick Connection Lost	Global	Alarm
AD025	System — Self Intersecting Boat Polygon	App	Information
AD026	System — Mapping data timeout	Global	Alarm

AD027	System — Boat Polygon Too few points	App	Information
AD028	System — Boat Polygon Invalid Winding	App	Information
AD029	System — Boat Polygon Too many points	App	Information
AD030	System — Joystick Input not detected timeout	Global	Warning
AD031	System — low voltage detected	Global	Alarm
AD032	System — Incorrect Engine Parameters in .toml file	App	Information
AD035	System — connection to external alarm lost	Global	Alarm
AD036	System — System Faulted, cannot go into "AUTO" mode	App	Warning
AD037	Processor Module — MFD to Processor Module Lost Connection	Global	Alarm
AD038	Processor Module — Shut Down Warning	Global	Information

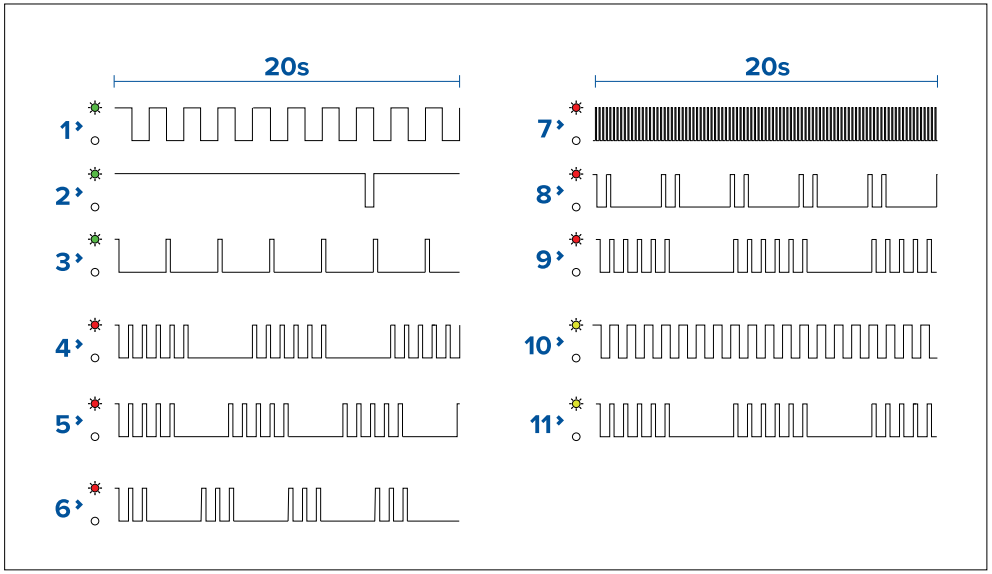
AD039	High Speed Warning	App	Warning
AD040	Location of GNSS receiver parameter missing from config file	Global	Alarm
AD041	Camera — running outdated firmware	App	Warning
AD042	Position of centre of gravity parameter missing from config file	Global	Alarm
AD043	Velocity controller tuning parameters missing from config file	Global	Alarm
AD044	Auto mode error — No instance of DockSense app open	Global	Alarm
AD045	Auto mode error — DockSense is not ready	Global	Alarm
AD046	Auto mode error — Camera shutters are closed	Global	Alarm
AD047	Aventics — Aventics protocol hasn't been checked	Global	Alarm
AD048	Aventics — Communication error between DockSense controller and Aventics system	Global	Alarm
AD049	Aventics — Aventics mode is not compatible with DockSense	Global	Alarm
AD050	Aventics — Aventics protocol is incompatible with DockSense controller's protocol version	Global	Alarm
AD051	Aventics — Aventics calibration not detected	Global	Alarm
AD052 & AD053	Aventics — Fault with <port/starboard> propulsion	Global	Alarm
AD054 & AD055	Aventics — Fault with <Port/starboard> propulsion issue detected	Global	Warning
AD056 & AD057	Aventics — Fault with <bow/stern> thruster	Global	Alarm
AD058 & AD059	Aventics — Fault with <Bow/stern> thruster issue detected	Global	Warning

AD060 & AD061	Aventics —Fault with rudder to <port/starboard>	Global	Alarm
AD062 & AD063	Aventics —Rudder to <port/starboard> issue detected	Global	Warning
AD064	Aventics —Alarm within Aventics Marex 3D system	Global	Alarm
AD065	Aventics —Propulsion is not ready	Global	Alarm
AD066	Aventics — Joystick is in the incorrect propulsion mode	Global	Alarm
AD067	System — Unable to generate DockSense mapping	Global	Alarm
AD068	System — High speed warning	Global	Alarm
AD069	System — DockSense controller software is incompatible with this display's version	Global	Alarm
AD070	Aventics — Conflict with Aventics and DockSense controller calibration data	Global	Alarm
AD071	System — Internal timeout STM	Global	Alarm
AD072	System — Internal timeout mapping	Global	Alarm
AD073	System — Internal timeout localisation	Global	Alarm
AD074	System — Waiting for joystick recentring	Global	Alarm

15.7 LED diagnostics

The LED lights on your system's equipment can help identify faults and errors.

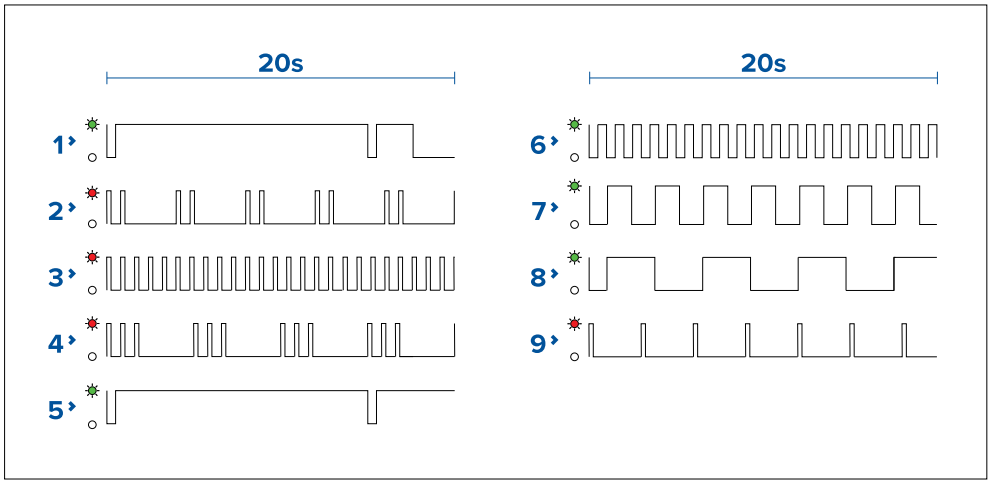
Processor module



1. Startup sequence

2. Normal operation
3. Power save
4. Over voltage
5. Under voltage
6. Over temperature
7. Unit requires reprogramming
8. Network Bus connection fault
9. Network Bus connected but not receiving data
10. Engine Bus connection fault
11. Engine Bus connected but not receiving data

AR250 / AR270



1. Normal operation
2. NMEA Bus not connected / fault
3. NMEA Bus connected but not receiving data
4. Private Bus no comms / not connected / fault
5. All sensors connected and ready
6. All sensors are initialising
7. GPS Initializing / not ready / no fix
8. Compass Linearizing
9. Internal fault / error

CHAPTER 16: TECHNICAL SUPPORT

CHAPTER CONTENTS

- 16.1 Raymarine product support and servicing — page 97
- 16.2 Learning resources — page 98
- 16.3 DockSense® Control operation instructions — page 98

16.1 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 display.

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: https://www.raymarine.com/en-us/support/product-registration

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** — https://raymarine.custhelp.com/app/home
- **Software updates** — http://www.raymarine.com/software

Worldwide support

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

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

United States (US):

- Help desk: https://raymarine.custhelp.com/app/home
- 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

16.2 Learning resources

Raymarine has produced a range of learning resources to help you get the most out of your products.

Video tutorials

Raymarine official channel on YouTube

- http://www.youtube.com/user/RaymarineInc

Training courses

Raymarine regularly runs a range of in-depth training courses to help you make the most of your products. Visit the Training section of the Raymarine website for more information:

- http://www.raymarine.co.uk/view/?id=2372

Technical support forum

You can use the Technical support forum to ask a technical question about a Raymarine product or to find out how other customers are using their Raymarine equipment. The resource is regularly updated with contributions from Raymarine customers and staff:

- https://raymarine.custhelp.com/app/home

16.3 DockSense® Control operation instructions

The DockSense® system is controlled via the **DockSense** app, accessible on the homescreen of a compatible Raymarine LightHouse 3 multifunction display (MFD).

For detailed operation instructions, refer to the dedicated **DockSense® Control Operation instructions**, document number **81398**.

CHAPTER 17: TECHNICAL SPECIFICATION (PROCESSOR MODULE)

CHAPTER CONTENTS

- 17.1 Physical specification — page 100
- 17.2 Power specification — page 100
- 17.3 Network specification — page 100
- 17.4 Environmental specification — page 100
- 17.5 Conformance specification — page 100

17.1 Physical specification

Specification	
Width:	352.5 mm (13.9 in).
Height:	235.0 mm (9.3 in).
Height (including connectors):	248.1 mm (9.8 in).
Depth:	109.9 mm (4.3 in).
Weight:	6.35 kg (14.0 lbs)

17.2 Power specification

Specification	
Nominal supply voltage:	12 V / 24 V dc
Operating voltage range:	10.8 V to 31.2 V dc
Power consumption:	100 W (Maximum)
Current:	10 A (nominal)
Fuse / breakers:	15 A

17.3 Network specification

Specification	
Network connectors:	• 7x RayNet type SeaTalkhs ™ connector (10/100 Mbits/s) • 3x DeviceNet Micro-C (male connector)
NMEA 2000 LEN (Load Equivalency Number):	1

17.4 Environmental specification

Specification	
Operating temperature:	–25 °C (–13 °F) to +55 °C (131 °F)
Storage temperature:	–30 °C (–22 °F) to +70 °C (158 °F)
Relative humidity:	up to 93% @ 40 °C (104 °F)
Waterproof rating:	IPx6

17.5 Conformance specification

Specification	
EMC Directive:	2014/30/EU
Europe, Australia & New Zealand:	EN 60945:2002
Australia & New Zealand	C-Tick, Compliance Level 2
Canada:	ICES-003
USA:	CFR47 Part 15

CHAPTER 18: TECHNICAL SPECIFICATION (CAMERA)

CHAPTER CONTENTS

- 18.1 Physical specification — page 102
- 18.2 Power specification — page 102
- 18.3 Network specification — page 102
- 18.4 Environmental specification — page 102
- 18.5 Conformance specification — page 102

18.1 Physical specification

Specification	
Width:	201.0 mm (7.91 in).
Height:	92.6 mm (3.64 in).
Height (including cable strain relief):	110.5 mm (4.35 in).
Depth:	90.0 mm (3.54 in).
Shutter opening angle:	115°
Shutter opening dimension:	49.0 mm (1.93 in).
Weight (without cable):	1.11 kg (2.45 lbs)
Weight (with cable):	0.91 kg (2.00 lbs)
Weight (bracket):	0.2 kg (0.44 lbs)

18.2 Power specification

Specification	
Power input:	Class 4 Power over Ethernet (PoE)
Nominal supply voltage:	48 V dc (via PoE)
Operating voltage range (Absolute):	44 V to 57 V dc
Operating voltage range (Protected):	8 V to 57 V dc
Power consumption:	30 W (Maximum)

18.3 Network specification

Specification	
Network connectors:	Captive RayNet type SeaTalkhs ™ connector (10/100 Mbits/s)
Cable length:	5 m (16.4 ft.)

18.4 Environmental specification

Specification	
Operating temperature:	–25 °C (–13 °F) to +55 °C (131 °F)
Storage temperature:	–30 °C (–22 °F) to +70 °C (158 °F)
Relative humidity:	up to 93% @ 40 °C (104 °F)
Waterproof rating:	IPx6
Camera lens de-icing function:	Automatic, 2 mm within 15 minutes @ –10 °C (14 °F)

18.5 Conformance specification

Specification	
EMC Directive:	2014/30/EU
Europe, Australia & New Zealand:	EN 60945:2002
Australia & New Zealand	C-Tick, Compliance Level 2
Canada:	ICES-003
USA:	CFR47 Part 15

CHAPTER 19: TECHNICAL SPECIFICATION (AR250)

CHAPTER CONTENTS

- 19.1 Physical specification — page 104
- 19.2 Power specification — page 104
- 19.3 Network specification — page 104
- 19.4 GNSS (GPS) Receiver specification — page 104
- 19.5 Environmental specification — page 104
- 19.6 Conformance specification — page 105

19.1 Physical specification

Specification	
Width:	108.5 mm (4.27 in).
Height:	26.6 mm (1.05 in).
Height (including connectors):	41.6 mm (1.64 in).

19.2 Power specification

Specification	
Nominal supply voltage:	12 V dc (Supplied by the backbone)
Operating voltage range:	9 V dc to 16 V dc (protected up to 32 V dc)
Power consumption:	30 mA (Maximum)
LEN (NMEA Load Equivalency Rating):	1

19.3 Network specification

Specification	
Network connectors:	• SeaTalkng: x1, for connection to Raymarine Multifunction display (MFD), via SeaTalkng backbone. • DeviceNet: x1, for connection to DockSense Processor Module, via DeviceNet backbone.

19.4 GNSS (GPS) Receiver specification

Specification	
Signal acquisition:	Automatic
Channels:	Simultaneously track up to 28 satellites.
Operating frequency:	1574 MHz to 1605 MHz
Update rate:	10 Hz
Sensitivity:	• Cold start = -147 dBm • Re-acquisition = -160 dBm • Tracking = -164 dBm
GNSS (GPS) satellite system compatibility:	• GPS • GLONASS • Galileo ready • Beidou ready
Satellite Differential Type (SBAS):	• WAAS (United States) • EGNOS (Europe) • MSAS (Japan) • GAGAN (India) • QZSS ready (Japan)
Differential acquisition:	Automatic
Position accuracy without SBAS (95%):	< 15 m
Position accuracy with SBAS (95%):	< 5 m
Speed accuracy (95%):	< 0.3 kt
Time to first fix from cold start:	< 2 minutes (< 60 seconds typical)
Time to first fix from hot start:	< 45 seconds
Geodetic Datum:	WGS–84
Antenna:	Internal

19.5 Environmental specification

Specification	
Operating temperature:	–25 °C (–13 °F) to +55 °C (131 °F)
Storage temperature:	–30 °C (–22 °F) to +70 °C (158 °F)

Specification	
Relative humidity:	up to 93% @ 40 °C (104 °F)
Waterproof rating:	IPx6 and IPx7

19.6 Conformance specification

Specification	
Radio Equipment Directive (RED):	2014/53/EU
Europe, Australia & New Zealand:	EN 60945:2002
Australia & New Zealand	C-Tick, Compliance Level 2
Canada:	ICES-003
USA:	CFR47 Part 15

CHAPTER 20: TECHNICAL SPECIFICATION (AR270)

CHAPTER CONTENTS

- 20.1 Physical specification — page 107
- 20.2 Power specification — page 107
- 20.3 Network specification — page 107
- 20.4 AHRS specification — page 107
- 20.5 Environmental specification — page 107
- 20.6 Conformance specification — page 107

20.1 Physical specification

Specification	
Width:	108.5 mm (4.27 in).
Height:	26.6 mm (1.05 in).
Height (including connectors):	41.6 mm (1.64 in).

20.2 Power specification

Specification	
Nominal supply voltage:	12 V dc (Supplied by the backbone)
Operating voltage range:	9 V dc to 16 V dc (protected up to 32 V dc)
Power consumption:	30 mA (Maximum)
LEN (NMEA Load Equivalency Rating):	1

20.3 Network specification

Specification	
Network connectors:	• SeaTalkng: x1, for connection to Raymarine Multifunction display (MFD), via SeaTalkng backbone. • DeviceNet: x1, for connection to DockSense Processor Module, via DeviceNet backbone.

20.4 AHRS specification

Specification	
AHRS (Attitude Heading Reference Sensor):	• 3–Axis digital accelerometer • 3–Axis digital compass • 3–Axis MEMS Gyro digital angular rate sensor
Magnetic compass accuracy:	• Static = ≤ 1° RMS • Dynamic = ≤ 3° RMS
Pitch, Roll and Yaw accuracy:	≤ 1°
Heading, Pitch, Roll and Rate of Turn update rate:	10 Hz

20.5 Environmental specification

Specification	
Operating temperature:	–25 °C (–13 °F) to +55 °C (131 °F)
Storage temperature:	–30 °C (–22 °F) to +70 °C (158 °F)
Relative humidity:	up to 93% @ 40 °C (104 °F)
Waterproof rating:	IPx6 and IPx7

20.6 Conformance specification

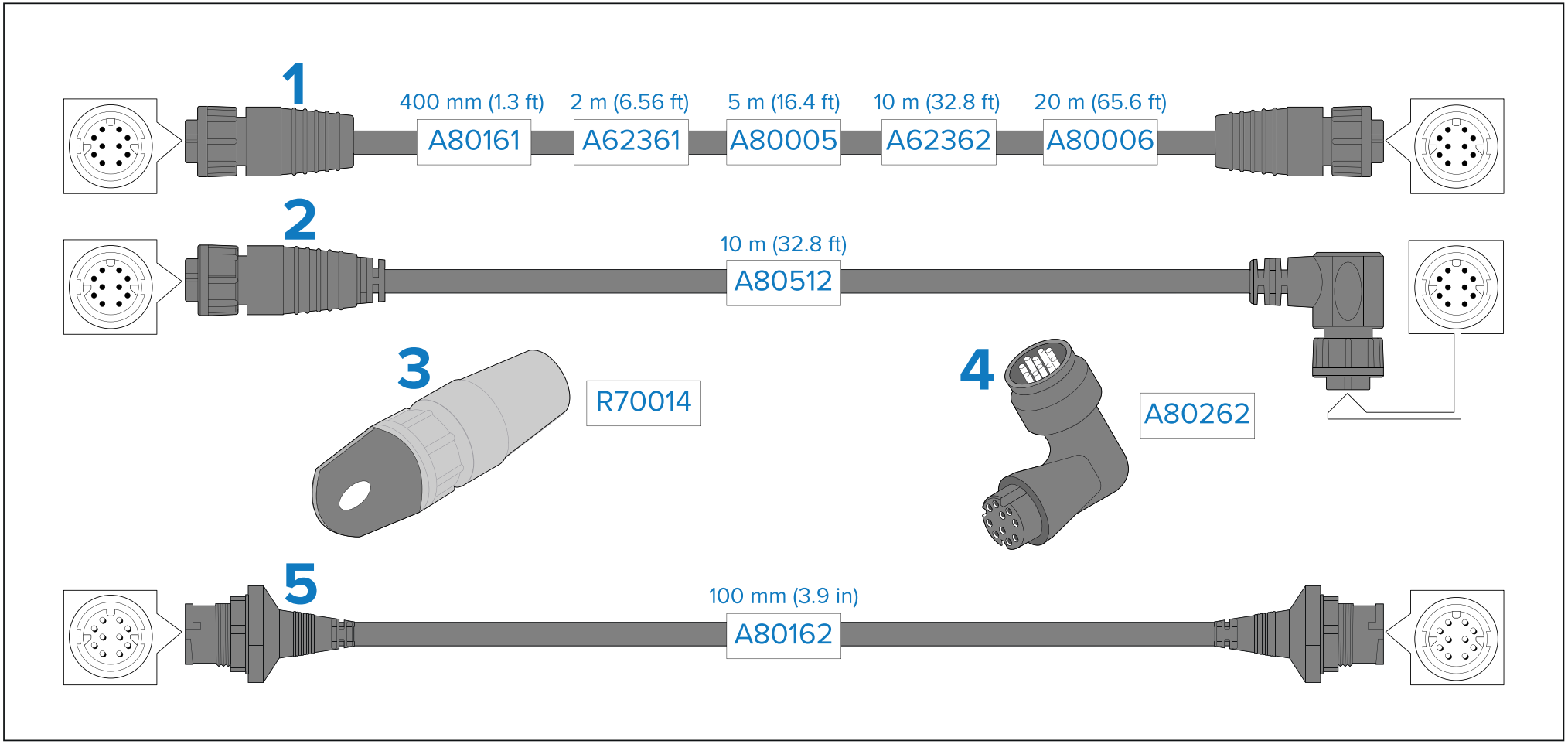
Specification	
Radio Equipment Directive (RED):	2014/53/EU
Europe, Australia & New Zealand:	EN 60945:2002
Australia & New Zealand	C-Tick, Compliance Level 2
Canada:	ICES-003
USA:	CFR47 Part 15

CHAPTER 21: SPARES AND ACCESSORIES

CHAPTER CONTENTS

- 21.1 RayNet to RayNet cables and connectors — page 109
- 21.2 SeaTalk NG cables and accessories — page 110
- 21.3 DockSense mounting bracket (A80660) — page 115

21.1 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.

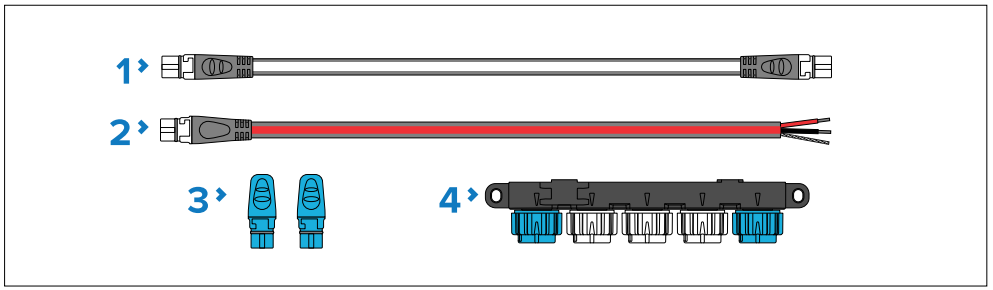
21.2 SeaTalk NG cables and accessories

SeaTalk NG cables and accessories for use with compatible products.

SeaTalk NG kits

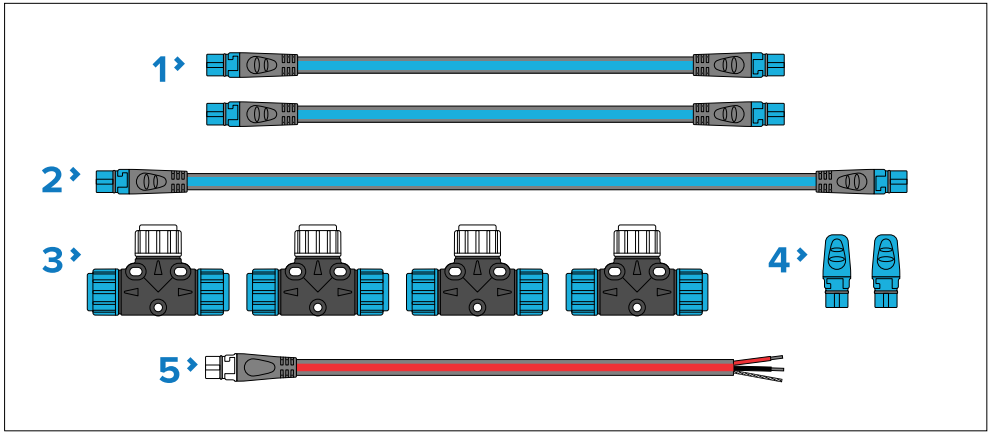
SeaTalk NG kits enable you to create a simple SeaTalk NG backbone.

Starter kit (part number: T70134) consists of:



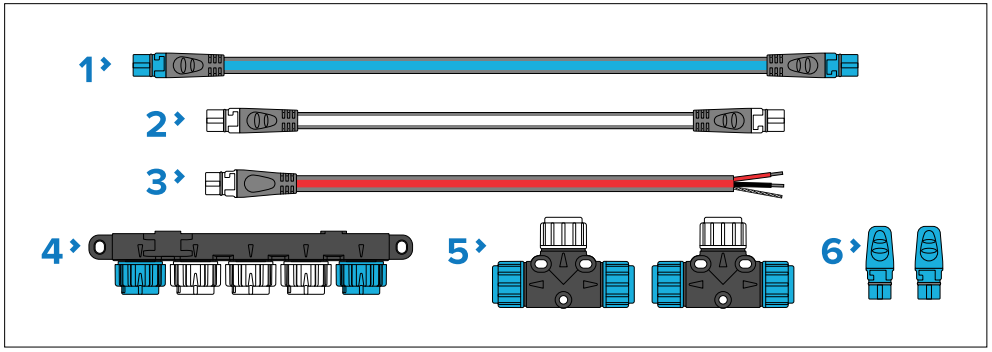
1. 1 x Spur cable 3 m (9.8 ft) (part number: **A06040**). Used to connect device to the SeaTalk NG backbone.
2. 1 x Power cable 2 m (6.6 ft) (part number: **A06049**). Used to provide 12 V dc power to the SeaTalk NG backbone.
3. 2 x Backbone terminators (part number: **A06031**). Terminators must be fitted to both ends of the SeaTalk NG backbone.
4. 1 x 5-Way connector (part number: **A06064**). Each connector block allows connection of up to 3 SeaTalk NG devices. Multiple connector blocks can be 'daisy chained' together.

Backbone kit (part number: A25062) consists of:



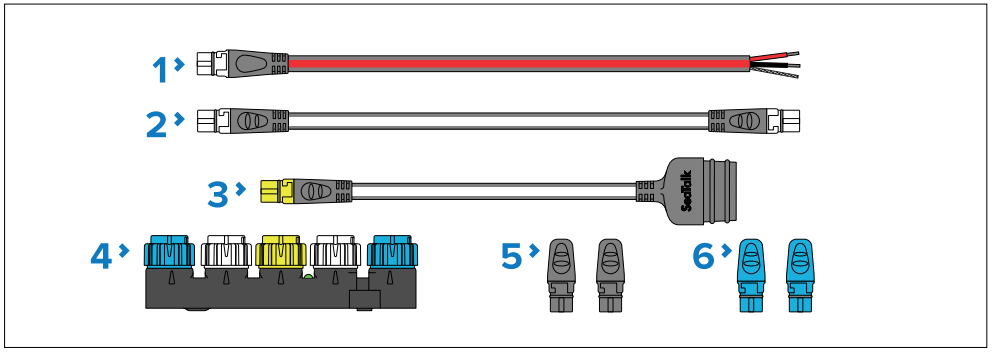
1. 2 x Backbone cables 5 m (16.4 ft) (part number: **A06036**). Used to create and extend the SeaTalk NG backbone.
2. 1 x Backbone cable 20 m (65.6 ft) (part number: **A06037**). Used to create and extend the SeaTalk NG backbone.
3. 4 x T-piece (part number: **A06028**). Each T-piece allows connection of one SeaTalk NG device. Multiple T-pieces can be 'daisy chained' together.
4. 2 x Backbone terminators (part number: **A06031**). Terminators must be fitted to both ends of the SeaTalk NG backbone.
5. 1 x Power cable 2 m (6.6 ft) (part number: **A06049**). Used to provide 12 V dc power to the SeaTalk NG backbone.

Evolution autopilot cable kit (part number: R70160) consists of:



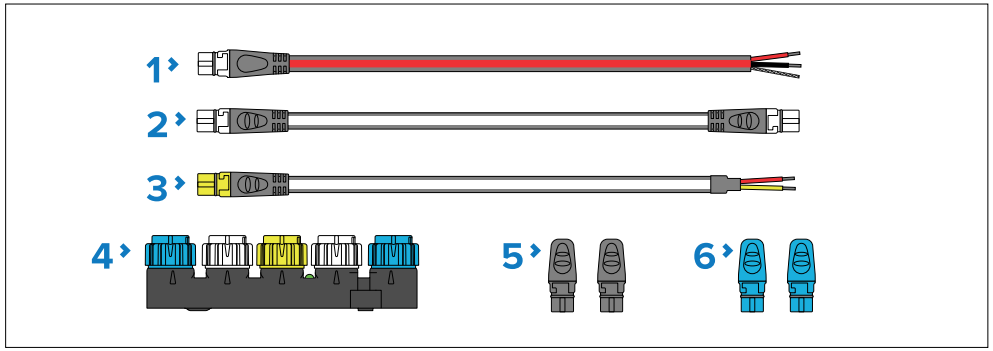
1. 1 x Backbone cable 5 m (16.4 ft) (part number: **A06036**). Used to create and extend the SeaTalk NG backbone.
2. 1 x Spur cable 1 m (3.3 ft) (part number: **A06040**). Used to connect device to the SeaTalk NG backbone.
3. 1 x Power cable 2 m (6.6 ft) (part number: **A06049**). Used to provide 12 V dc power to the SeaTalk NG backbone.
4. 1 x 5-Way connector (part number: **A06064**). Each connector block allows connection of up to 3 SeaTalk NG devices. Multiple connector blocks can be 'daisy chained' together.
5. 2 x T-pieces (part number: **A06028**). Each T-piece allows connection of one SeaTalk NG device. Multiple T-pieces can be 'daisy chained' together.
6. 2 x Backbone terminators (part number: **A06031**). Terminators must be fitted to both ends of the SeaTalk NG backbone.

SeaTalk 1 to SeaTalk NG converter kit (part number: E22158) consists of:



1. 1 x Power cable 2 m (6.6 ft) (part number: **A06049**). Used to provide 12 V dc power to the SeaTalk NG backbone.
2. 1 x Spur cable 1 m (3.3 ft) (part number: **A06039**). Used to connect a device to the SeaTalk NG backbone.
3. 1 x SeaTalk 1 (3 pin) to SeaTalk NG adapter cable 0.4 m (1.3 ft) (part number: **A22164**). Used to connect SeaTalk 1 devices to the SeaTalk NG backbone via the SeaTalk 1 to SeaTalk NG converter.
4. 1 x SeaTalk 1 to SeaTalk NG converter (part number: **E22158**). Each converter allows connection of one SeaTalk 1 device and up to 2 SeaTalk NG devices.
5. 2 x Spur blanking plugs (part number: **A06032**). Used to cover unused spur connections in 5-way blocks, T-piece connectors and SeaTalk 1 to SeaTalk NG converter.
6. 2 x Backbone terminators (part number: **A06031**). Terminators must be fitted to both ends of the SeaTalk NG backbone.

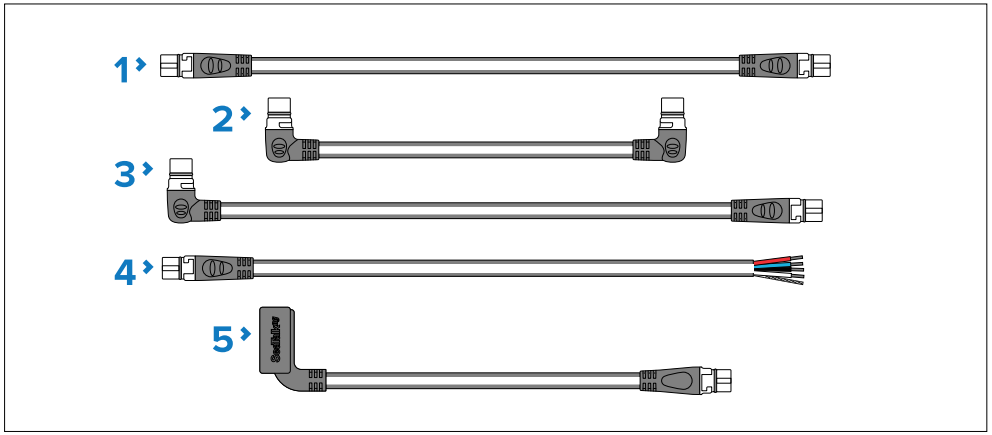
NMEA 0183 VHF 2-wire to SeaTalk NG converter kit (part number: E70196) consists of:



1. 1 x Power cable 2 m (6.6 ft) (part number: **A06049**). Used to provide 12 V dc power to the SeaTalk NG backbone.
2. 1 x Spur cable 1 m (3.3 ft) (part number: **A06039**). Used to connect a device to the SeaTalk NG backbone.
3. 1 x NMEA 0183 VHF stripped-end (2-wire) to SeaTalk NG adapter cable 1 m (3.3 ft) (part number: **A06071**). Used to connect an NMEA 0183 VHF radio to the SeaTalk NG backbone via the NMEA 0183 to SeaTalk NG converter.
4. 1 x SeaTalk 1 to SeaTalk NG converter (part number: **E22158**). Each converter allows connection of one SeaTalk 1 device and up to 2 SeaTalk NG devices.
5. 2 x Spur blanking plugs (part number: **A06032**). Used to cover unused spur connections in 5-way blocks, T-piece connectors, and the SeaTalk 1 to SeaTalk NG converter.
6. 2 x Backbone terminators (part number: **A06031**). Terminators must be fitted to both ends of the SeaTalk NG backbone.

SeaTalk NG spur cables

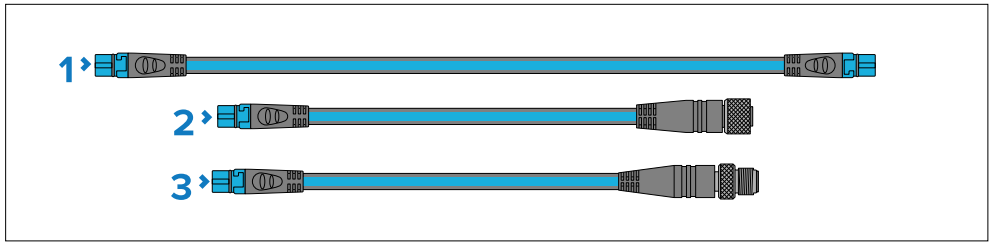
SeaTalk NG spur cables are required to connect devices to the SeaTalk NG backbone.



1. SeaTalk NG spur cables:
   - Spur cable 0.4 m (1.3 ft) (part number: **A06038**).
   - Spur cable 1 m (3.3 ft) (part number: **A06039**).
   - Spur cable 3 m (9.8 ft) (part number: **A06040**).
   - Spur cable 5 m (16.4 ft) (part number: **A06041**).
2. Elbow (right-angled) to elbow (right-angled) spur cable 0.4 m (1.3 ft) (part number: **A06042**). Used in confined spaces where a straight spur cable will not fit.
3. Elbow (right-angled) to straight spur cable 1 m (3.3 ft) (part number: **A06081**). Used in confined spaces where a straight spur cable will not fit.
4. SeaTalk NG to stripped-end spur cables (connects compatible products that do not have a SeaTalk NG connector, such as transducer pods):
   - SeaTalk NG to stripped-end spur cable 1 m (3.3 ft) (part number: **A06043**)
   - SeaTalk NG to stripped-end spur cable 3 m (9.8 ft) (part number: **A06044**)
5. ACU / SPX autopilot to SeaTalk NG spur cable 0.3 m (1.0 ft) (part number **R12112**). Connects the course computer to the SeaTalk NG backbone. This connection can also be used to provide 12 V dc power to the SeaTalk NG backbone.

SeaTalk NG backbone cables

SeaTalk NG backbone cables are used to create or extend a SeaTalk NG backbone.



1. Backbone cables:
   - Backbone cable 0.4 m (1.3 ft) (part number: **A06033**).
   - Backbone cable 1 m (3.3 ft) (part number: **A06034**).
   - Backbone cable 3 m (9.8 ft) (part number: **A06035**).
   - Backbone cable 5 m (16.4 ft) (part number: **A06036**).
   - Backbone cable 9 m (29.5 ft) (part number: **A06068**).
   - Backbone cable 20 m (65.6 ft) (part number: **A06037**).
2. SeaTalk NG to DeviceNet (female) Backbone cable 0.4 m (1.3 ft) (part number: **A80675**)
3. SeaTalk NG to DeviceNet (male) Backbone cable 0.4 m (1.3 ft) (part number: **A80674**)

SeaTalk NG power cables

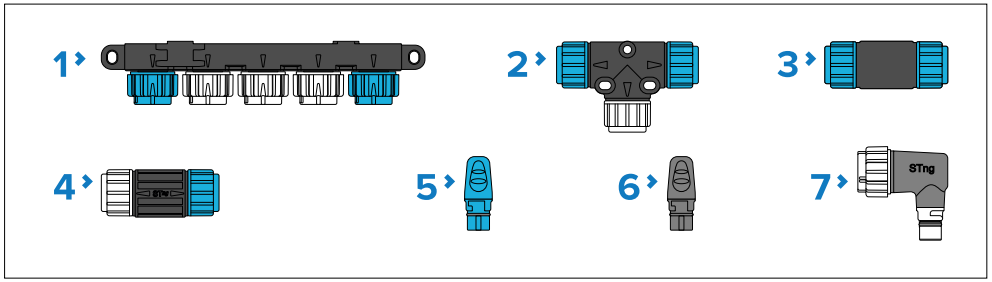
SeaTalk NG power cables are used to provide the SeaTalk NG backbone with a single 12 V dc power source. The power connection must include a 5 amp inline fuse (not supplied).



1. Power cable (straight) 2 m (6.6 ft) (part number: **A06049**).
2. Elbow (right-angled) power cable 2 m (6.6 ft) (part number: **A06070**).

SeaTalk NG connectors

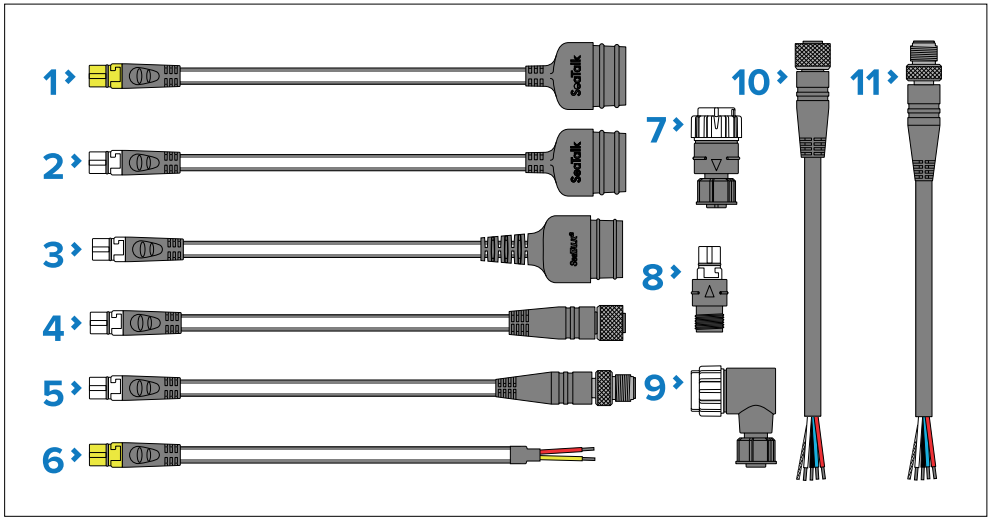
SeaTalk NG connectors are used to connect SeaTalk NG devices to the SeaTalk NG backbone and to create and extend the backbone.



1. 5-Way connector (part number: **A06064**). Each connector block allows connection of up to 3 SeaTalk NG devices. Multiple connector blocks can be ‘daisy chained’ together.
2. T-piece (part number: **A06028**). Each T-piece allows connection of one SeaTalk NG device. Multiple T-pieces can be ‘daisy chained’ together.
3. Backbone extender (part number: **A06030**). Used to connect 2 backbone cables together.
4. Inline terminator (part number: **A80001**). Used to connect a spur cable and SeaTalk NG device at the end of a backbone instead of a backbone terminator.
5. Backbone terminator (part number: **A06031**). Terminators must be fitted to both ends of the SeaTalk NG backbone.
6. Spur blanking plug (part number: **A06032**). Used to cover unused spur connections in 5-Way blocks, T-piece connectors, or the SeaTalk 1 to SeaTalk NG converter.
7. Elbow (right-angled) spur connector (part number: **A06077**). Used in confined spaces where a straight spur cable will not fit.

SeaTalk NG adaptors and adaptor cables

SeaTalk NG adaptor cables are used to connect devices designed for different CAN Bus backbones (e.g.: SeaTalk 1 or DeviceNet) to the SeaTalk NG backbone.

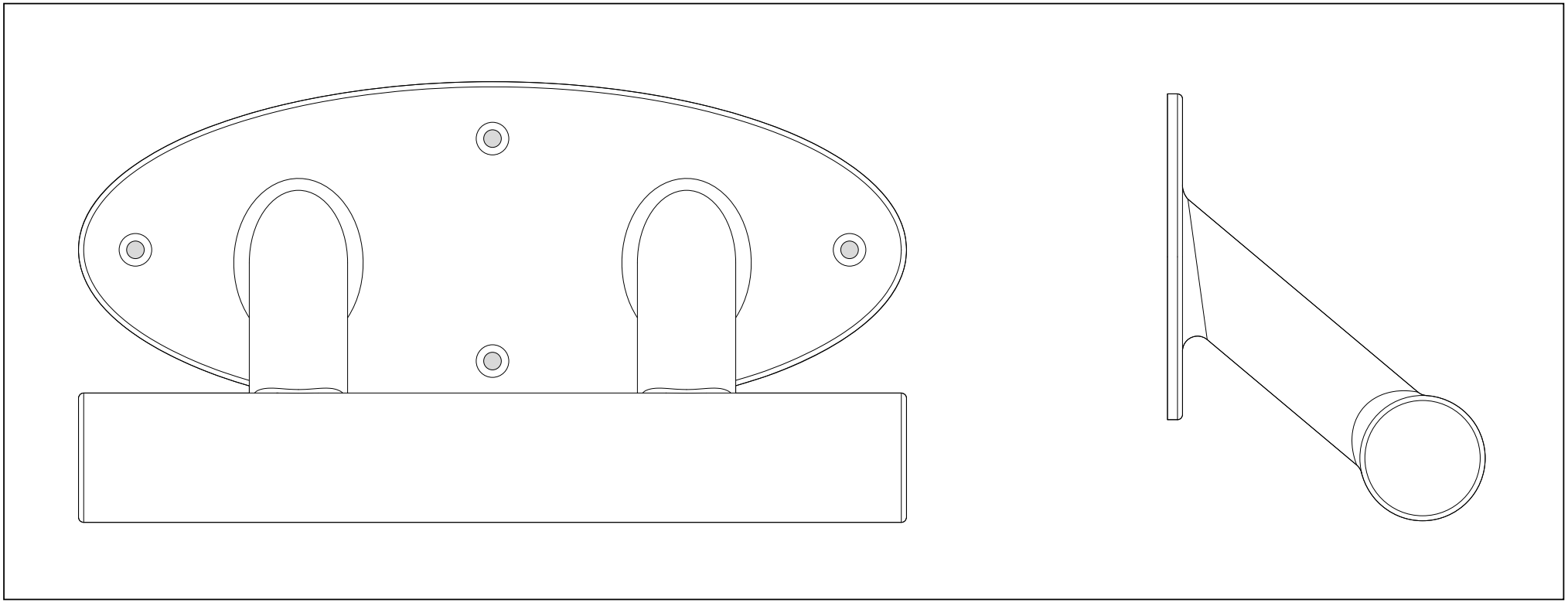


1. SeaTalk 1 (3 pin) to SeaTalk NG converter cable 1 m (3.3 ft) (part number: **A22164 / A06073**). Can be used to connect a SeaTalk 1 device to a SeaTalk NG backbone via the SeaTalk 1 to SeaTalk NG converter, or to connect a SeaTalk NG product directly to a SeaTalk 1 network.
2. SeaTalk 1 (3 pin) to SeaTalk NG adaptor cable 0.4 m (1.3 ft) (part number: **A06047**). Can be used to connect a SeaTalk 1 device to a SeaTalk NG backbone via the SeaTalk 1 to SeaTalk NG converter, or to connect a SeaTalk NG product directly to a SeaTalk 1 network.
3. SeaTalk 2 (5 pin) to SeaTalk NG adaptor cable 0.4 m (1.3 ft) (part number: **A06048**). Used to connect SeaTalk 2 devices or networks to a SeaTalk NG backbone.
4. SeaTalk NG to DeviceNet (female) adaptor cables connect NMEA 2000 devices that use a DeviceNet connector to the SeaTalk NG backbone, or connects SeaTalk NG devices to an NMEA 2000 network. The following cables are available:
   - SeaTalk NG to DeviceNet (female) adaptor cable 0.4 m (1.3 ft) (part number: **A06045**).
   - SeaTalk NG to DeviceNet (female) adaptor cable 1 m (3.3 ft) (part number: **A06075**).
5. SeaTalk NG to DeviceNet (male) adaptor cables. Connect NMEA 2000 devices that use a DeviceNet connector to the SeaTalk NG backbone, or connect SeaTalk NG devices to an NMEA 2000 network. The following cables are available:

- SeaTalk NG to DeviceNet (male) adaptor cable 0.1 m (0.33 ft) (part number: **A06078**).
- SeaTalk NG to DeviceNet (male) adaptor cable 0.4 m (1.3 ft) (part number: **A06074**).
- SeaTalk NG to DeviceNet (male) adaptor cable 1 m (3.3 ft) (part number: **A06076**).
- SeaTalk NG to DeviceNet (male) adaptor cable 1.5 m (4.92 ft) (part number: **A06046**).

6. NMEA 0183 stripped-end (2-wire) to SeaTalk NG adapter cable 1 m (3.3 ft) (part number: **A06071**). Used to connect an NMEA 0183 VHF radio to the SeaTalk NG backbone via the NMEA 0183 to SeaTalk NG converter.
7. SeaTalk NG (male) to DeviceNet (female) adaptor (**A06082**).
8. SeaTalk NG (female) to DeviceNet (male) adaptor (**A06083**).
9. SeaTalk NG (male) to DeviceNet (female) elbow (right-angled) adaptor (**A06084**).
10. DeviceNet (female) to stripped-end adaptor cable (0.4 m (1.3 ft)) (part number: **E05026**).
11. DeviceNet (male) to stripped-end adaptor cable (0.4 m (1.3 ft)) (part number: **E05027**).

21.3 DockSense mounting bracket (A80660)



The DockSense mounting bracket is an optional accessory used for mounting your DockSense cameras. For more information refer to Raymarine camera mounting bracket

Appendix A AR250 / AR270 supported NMEA 2000 PGNs

Transmit

- 59392 ISO Acknowledgement
- 60416 ISO Transport Protocol, Connection Management - BAM group function
- 60928 ISO Address Claim
- 126208 NMEA - Acknowledge group function
- 126464 PGN Lists
- 126992 System Time
- 126993 Heartbeat
- 126996 Product Information
- 126998 Configuration Information
- 129025 Position, Rapid Update
- 129026 COG & SOG Rapid Update
- 129029 GNSS Position Data
- 129033 Time and Date
- 129539 GNSS DOPs
- 129044 Datum
- 129540 GNSS Sats in View
- 129542 GNSS Pseudo range Noise Statistics
- 129547 GNSS Pseudo range Error Statistics

Receive

- 59904 ISO Request
- 60160 ISO Transport Protocol, Data Transfer
- 60416 ISO Transport Protocol, Connection Management - BAM group function
- 60928 ISO Address Claim
- 65240 ISO Commanded Address
- 126208 NMEA - Command group function
- 126208 NMEA - Request group function
- 129044 Datum

Appendix B Software release history

The list below is a cumulative list of the new features introduced in subsequent releases of the DockSense Control software, since the initial release (v1.0.27).

This list includes *new features* only. It does NOT include software maintenance items, such as bug fixes or performance improvements.

To download the software, and view the complete list of all software updates, including new features, bug fixes, and performance improvements, visit:

DockSense Control **software download link**
https://www.raymarine.com/en-us/download/docksense-processor-module-software

DockSense Control v2.0.28 new features:

(Software release date: *September 2021*)

- Added a new 'Virtual Arena' mode.
- Support for vessels > 24 m (80 ft).
- Support for private IP addresses in the 10.x range.

DockSense Control v1.0.27:

(Software release date: *August 2020*)

- Initial public release.

Appendix C Ethernet (IPv4) networking of Raymarine devices with third-party products

Raymarine uses a custom Ethernet (IPv4) networking configuration. Use the following information to help you understand how Raymarine's Ethernet (IPv4) implementation interacts with third-party Ethernet (IPv4) devices on your vessel, such as routers, switches, Access Points (APs) etc.

Important:

- Third-party networking products such as routers, switches, and Access Points (APs) *may* work when connected to Raymarine networks, when configured correctly. However, correct operation is not guaranteed. It's important to refer to the instructions provided by the relevant third-party device manufacturer, to ensure that your intended use of a third-party device is consistent with the device's design intent.
- Raymarine does not warrant that Raymarine products are compatible with products manufactured by any person or entity other than Raymarine.
- When using third-party products in your Raymarine electronics network, you should be aware of, and understand, the concepts and limitations described in the following Disclaimer: **p.12 —** Disclaimer

Overview

- Ethernet (IPv4) networking is a method for interconnecting multiple electronic devices, allowing many devices to function in a network and share data using only a single RJ45 or RayNet connection for each device.
- In order to function correctly, every Ethernet (IPv4) device (whether Raymarine or third-party) must have a unique IP address allocated to it, and it must not conflict with that of any other device.
- IPv4 addresses can be centrally-allocated to devices either **automatically**, using a method known as *DHCP* (Dynamic Host Configuration Protocol), or **manually** (i.e. allocated a static IP address). The most common method for allocating IPv4 addresses on vessel electronics networks is *DHCP*. In this configuration, the *server* device is known as a *DHCP server*.

Client / Server device	Example(s)
Raymarine IPv4 DHCP **client**	• Radar scanner (e.g. *Quantum*) • Sonar module (e.g. *CP470*) • IP camera (e.g. *CAM300*)
Raymarine IPv4 DHCP **server** and self-addressing device	• Multifunction display (MFD / Chartplotter), running LightHouse 3 or LightHouse 4 (e.g. *Axiom*) • Marine Router (e.g. *YachtSense Link Router*)
Third-party IPv4 DHCP **client**	IP camera
Third-party IPv4 DHCP **server**	• Router • Switch • Access Point (AP)

Note:

The DHCP server maintains a pool of IP addresses and "leases" an address to any DHCP-enabled client, when the client device first powers up and announces its presence on the network. Because the IP addresses are dynamic (leased) rather than static (permanently assigned), addresses no longer in use are automatically returned to the DHCP server's pool, for subsequent reallocation.

It's also possible to have multiple DHCP servers issuing addresses on an IPv4 network, but to avoid addressing conflicts, all DHCP servers must be carefully configured to only allocate IP addresses in distinct address ranges. The *subnet mask* must also be carefully configured, to ensure that devices can correctly communicate with one another.

Implementation

- Raymarine Ethernet (IPv4) devices expect to use a private **Raymarine IPv4 network**, which is designed to be internal to the vessel only. Raymarine has carefully chosen a specific IP address range (**198.18.0.0/21**) to ensure that it does not interfere with any external IP address ranges, or other legacy and real-world addressing constraints (including but not limited to marina Wi-Fi networks).

Note: Raymarine's IP address range is for **local traffic** within the **vessel's private Raymarine network only**, and does NOT traverse across Raymarine products to external networks, or to the Internet.

- In a Raymarine Ethernet (IPv4) network, IP addresses are self-allocated by certain Raymarine equipment in the following range: **198.18.0.32 to 198.18.3.255** (inclusive). **You must avoid placing any devices in this range using manual (static) IP addresses.**
- Whether your network includes only Raymarine Ethernet (IP) devices, or a mixture of Raymarine and third-party Ethernet (IPv4) devices, you have 3 options for configuring the Ethernet (IPv4) network and managing the IP addresses for your devices:

  1. Use a Raymarine device as the sole DHCP server to allocate IP addresses automatically to all Raymarine and third-party Ethernet (IPv4) devices on the network. **For the purposes of simplicity and reliability, this is the recommended option for most vessels.** The following Raymarine devices can act as DHCP servers:

     a. **Raymarine multifunction display (MFD)** / Chartplotter, running LightHouse 3 or LightHouse 4; or:

     b. **Raymarine YachtSense Link Router**

Note: If both a Raymarine MFD **and** YachtSense Link Router are present in the same network, the YachtSense Link Router MUST be configured as the DHCP server for that network. To facilitate this, the Raymarine MFD's DHCP setting defaults to *Automatic* as standard. On power up, if the YachtSense Link is detected in the RayNet system, any MFDs in the network will disable their own *DHCP Server*, to permit the YachtSense Link to manage the network's IP addresses. Only Raymarine MFDs running **LightHouse 4** are compatible with the YachtSense Link Router. Additionally, the most recent versions of the LightHouse 4 and YachtSense Link software must be used.

  2. Use a third-party Ethernet (IPv4) device (such as a router or Access Point) to allocate IP addresses automatically, as a sole *DHCP server*. To do this, refer to the *Configuring a third-party router as DHCP server* section, below.

Note: Any Raymarine LightHouse 3 or LightHouse 4 MFDs will still self-allocate their own IP address, even if a third-party DHCP server is being used to allocate IP addresses to other Raymarine or non-Raymarine *DHCP client* devices (Camera, Radar, Sonar etc.) on the network.

  3. Manually configure static IP addresses for your devices. The address range **198.18.0.32 to 198.18.3.255** (inclusive) is used by Raymarine equipment, and any other third-party equipment on the network should not be set to a static IP address in this range. It should instead be set elsewhere in the 198.18.0.0/21 range.

Adding third-party devices to your Raymarine Ethernet (IP) network

- It is recommended that any third-party products connecting to a Raymarine Ethernet (IPv4) network (e.g., a third-party IP camera) are configured as DHCP clients, so that they automatically get allocated a correct IP address within the range used by the **Raymarine IPv4 network**. If this is not possible, (for example, in the scenario that your third-party IP Camera requires a static IP address), you should configure the product to have a static IP address within the following range: **198.18.0.1 to 198.18.0.31** (inclusive).
- Any third-party router in your network should be performing IPv4 *Network Address Translation* (NAT) from the private address to another one on an upstream interface.

Configuring a third-party router as DHCP server

In the scenario that you wish to use a third-party DHCP server to allocate the IP addresses for your vessel's IPv4 network, use the following information to help you configure the third-party DHCP server to work with Raymarine Ethernet (IPv4) client devices:

1. Configure the third-party DHCP server / router to use Raymarine's subnet details, which are as follows:

   a. Set the DHCP server's IP address to **198.18.0.1**

   b. Set the *netmask* to /21, i.e. **255.255.248.0**

   c. Set the DHCP range from **198.18.4.0 to 198.18.7.254** (inclusive). If this is not possible, ensure that the address range is smaller than this (but within the range of **198.18.4.0 to 198.18.7.254** (inclusive)).

d. The address range **198.18.0.32 to 198.18.3.255** (inclusive) is used by Raymarine equipment, and therefore you must ensure that any other third-party equipment on the network is NOT set to a static IP address in this range.

2. It may be necessary to set the DHCP setting for **all** of the MFDs on the vessel to *[Off]*. However, the default option (*[Auto]*) will likely work fine in many cases. If for any reason the third-party DHCP server starts up after the MFD starts up, the user should manually set the MFD's DHCP switch to *[Off]*. This is because, when the MFD starts up, its DHCP *[Auto]* feature tries to detect if another DHCP server is already present on the network.
3. In case of failure of the third-party device, the MFDs can be easily configured to be the DHCP server again, by setting the MFD's DHCP setting back to *[Auto]*.

Adding third-party Wi-Fi Access Points / Wi-Fi routers to your Raymarine Ethernet (IPv4) network

- There is a large volume of multicast IPv4 traffic on the Raymarine Ethernet (IPv4) network. Many consumer Wi-Fi Access Points / Wi-Fi routers simply bridge all multicast traffic from the Ethernet interface to the Wi-Fi interface when there are connected Wi-Fi clients. This will result not only in poor Wi-Fi performance but also in a reduction of usable Wi-Fi spectrum to other Wi-Fi users and vessels in the vicinity. If using a third-party Wi-Fi Access Point or Wi-Fi router, Raymarine recommends that *IGMP Snooping* is enabled on the third-party device, and additional checks are performed, in order to ensure that your device is not bridging any unexpected multicast traffic to its Wi-Fi interface from the Raymarine Ethernet (IPv4) network.
- Raymarine's YachtSense Link Router is pre-configured with IGMP Snooping enabled, and therefore does not bridge internal multicast traffic on the wired network to the Wi-Fi network. No additional configuration is required in this respect.

Appendix D Document change history

Document	Changes
87418 (**Rev 04**) Date: 02-2024	• Technical specification chapters re-structured. • System protocols information added. • IP networking information added.
87418 (**Rev 03**) Date: 03-2023	• Update to AR250/AR270 location requirements, to clarify that the 1 m distance requirement is from the centers of the 2 units.
87418 (**Rev 02**) Date: 11-2021	• Two additional warnings added: “Only use system when vessel engine is running”; and “Ensure system power source is charged by vessel's engine under normal operation”. • Additional calibration topic added to highlight the relevant information. • Commissioning chapter renamed to "Commissioning and calibration".
87418 (**Rev 01**) Date: 08-2020	• Initial release.

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