



EVOLUTION AUTOPILOT

EV-1 / ACU-100 / ACU-150 / ACU-200 / ACU-300 / ACU-400

INSTALLATION INSTRUCTIONS

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CHAPTER 1: IMPORTANT INFORMATION



Warning: Autopilot installation

Correct performance of the vessel's steering is critical for safety, therefore it is **STRONGLY RECOMMENDED** that this product is installed by an Authorized Raymarine Service Representative. You will only receive full warranty benefits if you can show that an Authorized Raymarine Service Representative has installed and commissioned your autopilot system.



Warning: Maintain a permanent watch

Always maintain a permanent watch, this will allow you to respond to situations as they develop. Failure to maintain a permanent watch puts yourself, your vessel and others at serious risk of harm.



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: 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, it **MUST** be correctly grounded, in accordance with the instructions provided.



Warning: Positive ground systems

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



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: 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.

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.

Caution: Product cleaning

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.

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.

Water ingress

Water ingress disclaimer

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

Disclaimer

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

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

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Suppression ferrites

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

Connections to other equipment

Requirement for ferrites on non-Raymarine cables:

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

For more information, refer to your third-party cable manufacturer.

Declaration of Conformity

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

- Evolution-Series EV-1, part number: E70096

The original Declaration of Conformity certificate may be viewed on the relevant product page at: <https://bit.ly/rym-docs>

Declaration of Conformity

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

- Evolution-Series ACU-100, part number: E70098

The original Declaration of Conformity certificate may be viewed on the relevant product page at: <https://bit.ly/rym-docs>

Declaration of Conformity

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

- Evolution-Series ACU-150, part number: E70374

The original Declaration of Conformity certificate may be viewed on the relevant product page at: <https://bit.ly/rym-docs>

Declaration of Conformity

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

- Evolution-Series ACU-200, part number: E70099

The original Declaration of Conformity certificate may be viewed on the relevant product page at: <https://bit.ly/rym-docs>

Declaration of Conformity

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

- Evolution-Series ACU-300, part number: E70139

The original Declaration of Conformity certificate may be viewed on the relevant product page at: <https://bit.ly/rym-docs>

Declaration of Conformity

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

- Evolution-Series ACU-400, part number: E70100

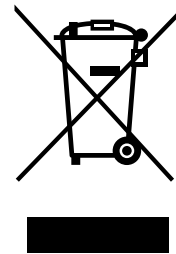
[Important information](#)

The original Declaration of Conformity certificate may be viewed on the relevant product page at: <https://bit.ly/rym-docs>

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: <https://bit.ly/rym-recycling>

Warranty registration

To register your Raymarine product ownership, please visit <https://bit.ly/rym-warranty> 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.

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 (<https://bit.ly/raymarine-home>) to ensure you have the most up-to-date version(s) of the documentation for your product.

CHAPTER 2: DOCUMENT INFORMATION

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- 2.1 Applicable products — page 14
- 2.2 Product documentation — page 14
- 2.3 Document illustrations — page 15

2.1 Applicable products

This document is applicable to the following products:

- EV-1 (**E70096**) — Attitude Heading Reference Sensor (AHRS)
- ACU-100 (**E70098**) — Actuator Control Unit (ACU)
- ACU-150 (**E70374**) — Actuator Control Unit (ACU)
- ACU-200 (**E70099**) — Actuator Control Unit (ACU)
- ACU-300 (**E70139**) — Actuator Control Unit (ACU)
- ACU-400 (**E70100**) — Actuator Control Unit (ACU)

2.2 Product documentation

The following documentation is applicable to your product:

Evolution-Series documentation

Document	Description
87180	Evolution-Series Autopilot System Installation Instructions
87181	Evolution-Series Drive-By-Wire (DBW) Autopilot System Installation Instructions
87192	ACU-100 and ACU-150 Mounting Template
87176	ACU-200, ACU-300, and ACU-400 Mounting Template
87170	EV-1 and EV-2 Mounting Template

Autopilot controller documentation

Installation, commissioning and operation instructions for your autopilot controller are listed below. Please select the appropriate document for your autopilot controller:

Document	Description
81355	p70 /p70R Installation and Operation Instructions
81365	p70s /p70Rs Installation and Operation Instructions
81406	LightHouse 4 Advanced Operation Instructions

Document	Description
81370	LightHouse 3 Advanced Operation Instructions
81360	LightHouse 2 Operation Instructions

All documents are available to download from the Raymarine website:
<https://bit.ly/rym-docs>

Autopilot drive unit documentation

Installation instructions for your autopilot drive unit are listed below. Please select the appropriate document for your autopilot drive unit:

Document	Description
87279	Tiller Drive Installation instructions Installation and commissioning instructions for the following Tiller Drive: Q047
81130	ST1000+ / ST2000+ Tiller Drive Owner handbook Installation and commissioning instructions for the following Tiller Drives: A12004, A12005
87287	Wheel Drive Installation instructions Installation and commissioning instructions for the following Wheel Drive: E12093
87039	Constant Running Hydraulic Pump Installation instructions Installation and commissioning instructions for the following Constant Running Hydraulic Pumps: E12171, E12172
81177	Hydraulic Linear Drive Installation instructions Installation and commissioning instructions for the following Hydraulic Linear Drives: E12207, E12208, M81202, M81203

Document	Description
81178	Hydraulic Pump Installation instructions Installation and commissioning instructions for the following Hydraulic Pumps: E12139, M81119, M81120, M81121, M81122, M81123, M81124
81175	Mechanical Linear Drive Installation instructions Installation and commissioning instructions for the following Mechanical Linear Drives: M81130, M81131, M81132, M81133, M81134
81174	Rotary Drive Installation instructions Installation and commissioning instructions for the following Rotary Drives: M81135, M81136, M81137
81176	IO Stern Drive Installation instructions Installation and commissioning instructions for the following Stern Drives: M81138, E12019
81180	Universal IO Stern Drive Installation instructions Installation and commissioning instructions for the following Stern Drive: E12026

All documents are available to download from the Raymarine website:
<https://bit.ly/rym-docs>

SeaTalk NG documentation

Document	Description
81300	SeaTalk NG reference manual: Planning and connection of systems based around the SeaTalk NG network.
87121	SeaTalk 1 to SeaTalk NG converter installation instructions: Installation and connection of the SeaTalk 1 to SeaTalk NG converter.

2.3 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.

CHAPTER 3: PRODUCT AND SYSTEM OVERVIEW

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- 3.1 Product overview — page 17
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3.1 Product overview

The Evolution-Series is a system of electronic components that give you autopilot control of your vessel's steering system.

In conjunction with a compatible Autopilot controller, the Evolution-Series components enable you to directly control the vessel's steering system and provide navigation commands, such as navigating to pre-determined tracks and waypoints for example.

The Evolution-Series system provides a number of features to ensure ease of installation and minimal setup:

- **Flexible mounting options** — The EV-1 sensor can be mounted horizontally on a flat deck or alternatively on a bracket, for mounting on a mast, wall or other vertical surface.

Note:

The arrow on the front of the EV-1 sensor must be parallel with the centerline of the vessel and pointing towards the vessel's bow.

- **Simple connections** — All Evolution-Series system components are connected to a single SeaTalk NG backbone.
- **High accuracy** — Accurate course-keeping, to within +/- 2 degrees, in all conditions.
- **Built-in heading and attitude sensor** — No additional fluxgate compass required.
- **Automatic setup** — No calibration required. The Rudder Gain, Rudder Damping, Counter Rudder, and compass calibration settings required by existing autopilots are no longer necessary.

The Evolution-Series system consists of the following components:

Component	Purpose
EV-1 AHRS (Attitude Heading Reference Sensor):	The primary heading sensor and course computer, incorporating an attitude 9-axis sensor. This sensor replaces the fluxgate compass typical in existing autopilot systems.
ACU (Actuator Control Unit):	Houses the main power and drive electronics for direct connection to a vessel's steering system.

3.2 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.

3.3 Multiple data sources (MDS)

MDS is a Raymarine scheme for managing multiple sources of identical data types on the same network (e.g.: in an MFD network you may have more than one source of GNSS (GPS) position data).

The MFD will automatically select a preferred data source (device) to use for that data type.

MDS can be used for the following data types:

- *Depth*
- *Speed through water*
- *Heading*
- *GPS*
- *GPS Datum*
- *Wind*
- *Time & Date*

If you do not want to use the automatically selected data source you can manually select your preferred data source.

Note:

For MDS to be available on your system, all products in the system that report data must be MDS-compliant. The system will report any products that are NOT MDS-compliant. It may be possible to upgrade the software for these non-compliant products, to make them compliant. Visit the Raymarine website to obtain the latest software for your products: <https://bit.ly/rym-software>

If MDS-compliant software is not available for the product and you do NOT want to use the system's preferred data source, you must remove any non-compliant products from the system. You should then be able to select your preferred data source.

Once you have completed setting up your preferred data sources, you may be able to add non-compliant products back into the system.

Multiple data source exceptions

With the Evolution-Series system, there are a number of important exceptions to the handling of multiple sources of certain types of data.

Specifically:

- **Heading data** — If a non-Evolution-Series source of heading data is designated by the user, the Evolution-Series system components will combine this heading data with its own gyro and accelerometer data, and then use the improved heading data. This combined heading data will also be available to other equipment on the SeaTalk NG bus.
- **Rudder angle data** — Where there are multiple sources of rudder reference information, the Evolution-Series system components will ignore rudder angle inputs from any rudder reference units that are NOT connected directly to the ACU-Series unit.

3.4 Required additional components

To complete your autopilot system, you will need the following components and data sources in addition to the Evolution-Series components.

Essential:

- A compatible autopilot controller. For more information, refer to:
 - [p.19 — Compatible autopilot controllers](#)

- [p.19 — Compatible autopilot controllers - MFDs](#)

- A drive unit appropriate for your vessel, EV-1 and ACU-Series unit. For more information, refer to documentation supplied with your ACU-Series unit: [p.13 — Document information](#)
- An ACU power cable (not supplied).
- A SeaTalk NG backbone.
- **Essential for ACU-300:** A rudder angle reference sensor / transducer (M81105).
- **Essential for ACU-300:** You must also ensure that the ACU-300 is running software version v3.13 or later.

Recommended:

- A rudder angle reference sensor / transducer (M81105). **Highly recommended** to ensure optimum autopilot performance.
- A compatible speed data source. The autopilot uses speed data when making calculations relating to navigation. As a minimum, this information must come from a GNSS (GPS) receiver providing SOG (Speed Over Ground) data, or ideally from a dedicated speed sensor.
- A compatible wind data source (only required for sailing vessels). The autopilot uses wind vane data to steer relative to a specified wind angle. This data must come from an analog wind transducer connected to the SeaTalk NG backbone.

Note:

The system components listed above are “recommended” as they help to provide optimum performance for autopilot systems when used in conjunction with the “essential” components listed. However, these “recommended” components are not included in all autopilot products or system packs. Consult the Raymarine website or your local dealer for a full list of the components included with your autopilot system.

Optional:

- A position data source. The autopilot uses position data when following routes and calculating the optimum course to steer. This data is typically supplied via a GNSS (GPS) receiver on the SeaTalk NG backbone.

Compatible autopilot controllers

A SeaTalk NG autopilot controller is required to operate your autopilot system. A SeaTalk 1 autopilot controller can be used when connected via a SeaTalk 1 to SeaTalk NG converter, but may have limited functionality.

More than one autopilot controller can be used to control your autopilot system.

SeaTalk NG autopilot controllers



Description	Required software version
1 p70s (E70328)	<i>Latest software version.</i>
2 p70Rs (E70329)	<i>Latest software version.</i>
3 p70 (E22166)	<i>v2.11 or later.</i>
4 p70R (E22167)	<i>v2.11 or later.</i>
5 ST70 (E22105)	<i>Latest software version.</i>
6 ST70+ (E22115)	<i>Latest software version.</i>

SeaTalk 1 autopilot controllers



Description	Required software version
1 ST6002 (E12098-P / E12100-P)	<i>Latest software version.</i>
2 ST7002 (E12099-P / E12182)	<i>Latest software version.</i>
3 ST8002 (E12119-P / E12183)	<i>Latest software version.</i>
4 S100 (repeat controller only) (E15024)	<i>Latest software version.</i>
5 SmartController (repeat controller only) (E15023)	<i>Latest software version.</i>

Compatible autopilot controllers - MFDs

You can operate your autopilot system from a Raymarine multifunction display / chartplotter.

LightHouse 4 multifunction display / chartplotter:

- Axiom 2 Pro
- Axiom 2 XL

LightHouse 3 multifunction display / chartplotter:

- Axiom
- Axiom+

- Axiom Pro
- Axiom XL

LightHouse 2 multifunction display / chartplotter:

- New a Series, New c Series, New e Series
- eS Series
- gS Series

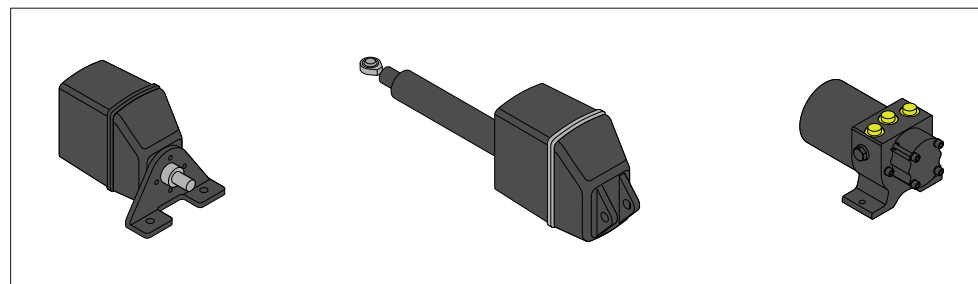
Compatible drive units

The drive unit interfaces with the vessel's steering system. The type of drive required depends on the type of vessel, the capacity of the associated steering system, and the intended use of the system (e.g. coastal waters or offshore).

Important:

- **Always choose your drive unit with safety in mind. Don't be tempted to choose a drive which will always be working at the limits of its design capabilities.**
- When determining your vessel displacement, always add 20% to the displacement of your vessel to account for the added weight of fuel, gear, provisions and people.
- Please note that the displacement figures provided are for guidance only, and your choice of drive unit should not be based on these figures alone. Consider also the intended duty cycle (hours of operation) of the autopilot system, as well as the likely water conditions.
- If you are intending to use the drive unit offshore, it is especially important to consider a larger system with spare capability, and also to ensure a backup system is in place.
- If you are in any doubt as to the correct drive unit for your vessel, contact Raymarine Technical Support or an authorized Raymarine dealer.

Raymarine autopilot systems accommodate hydraulic, mechanical and power assisted stern drive systems.



Hydraulic pumps:

Raymarine autopilots connect to hydraulic steering systems using a rugged hydraulic pump matched to the capacity of the hydraulic steering system.

To find a suitable pump, you'll need to know the size (in cc) of the hydraulic cylinder ram(s) mounted to the rudder on vessels featuring an inboard engine, or to the drive unit on vessels featuring outboard engines. Refer to your steering system documentation for this information. Alternatively, you can look on the cylinder ram itself for the brand and model number.

Once you have this figure, refer to the Cylinder Ram Size Chart on the Raymarine website to determine which hydraulic autopilot pump is compatible with your vessel's hydraulic steering system: <http://www.raymarine.co.uk/view/?id=209>.

Available types	Suitable ACU	* Max output
Type 0.5	ACU-100	7 A
Type 1 12 V dc only	ACU-150	12 A
Type 1 12 V / 24 V dc	ACU-200	15 A
Type 2	ACU-400	30 A
Type 3	ACU-400	30 A
Constant Running pump (solenoid)	ACU-300	5 A

Mechanical hydraulic linear drives:

Designed for larger mechanically-steered vessels over 20,000 kg, hydraulic linear drives consist of a reversing pump, reservoir and hydraulic ram.

A hydraulic linear drive unit connects to the rudder stock via an independent tiller arm. Accessory fittings from your steering system manufacturer may be required. The vessel's steering system must be capable of being back-driven from the rudder.

Correct drive selection depends on the maximum displacement of your vessel. Additionally, both the vessel's fitting structure and the tiller arm (or rudder quadrant) must be able to cope with the peak levels of thrust generated by the hydraulic linear drive. For peak thrust data, refer to the technical specification section of the Hydraulic Linear Drive installation instructions.

Available types	Suitable ACU	* Max output
Type 2 (for vessels with a maximum displacement of 22,000 Kg)	ACU-400	30 A
Type 3 (for vessels with a maximum displacement of 35,000 Kg)	ACU-400	30 A

Mechanical linear drives:

Used in sailing vessels, the mechanical linear drive moves the rudder directly by pushing the tiller arm or a rudder quadrant.

Correct drive selection depends on the maximum displacement of your vessel.

Available types	Suitable ACU	* Max output
Type 1 (for vessels with a maximum displacement of 11,000 Kg)	ACU-200	15 A
Type 2 Short (for vessels with a maximum displacement of 15,000 Kg)	ACU-400	30 A
Type 2 Long (for vessels with a maximum displacement of 20,000 Kg)	ACU-400	30 A

Mechanical rotary drives:

Designed for power and sailing vessel systems that can be driven from the helm position through a chain and sprocket e.g. cable and rod.

Optional drive sprockets and modification to the steering chain may be required.

Correct drive selection depends on the maximum displacement of your vessel.

Available types	Suitable ACU	* Max output
Type 1 (for vessels with a maximum displacement of 11,000 Kg)	ACU-200	15 A
Type 2 (for vessels with a maximum displacement of 20,000 Kg)	ACU-400	30 A

Universal stern drive:

For use with inboard / outboard (I/O) vessels with cable power-assisted steering.

Available types	Suitable ACU	* Max output
	ACU-200	15 A

Wheel drive — Power (Sport Drive)

Designed for smaller power vessels featuring a steering system that can be driven directly from the helm position.

Available types	Suitable ACU	* Max output
Power (for mechanically steered vessels with a maximum displacement of 2,000 Kg), or hydraulically steered vessels with a maximum displacement of 3,181 Kg)	ACU-200	15 A

Wheel drive — Sail

Designed for smaller sailing vessels featuring a steering system that can be driven directly from the helm position.

Important:

The Wheel drive is suitable for local coastal sailing only. For offshore use, consider a larger drive with ample spare capability, and ensure that a backup system is in place.

Available types	Suitable ACU	* Max output
Sail (for vessels with a maximum displacement of 7,500 Kg)	ACU-100	7 A

Tiller drive

Designed for smaller tiller-steered sailing vessels.

Important:

The Tiller drive is suitable for local coastal sailing only. For offshore use, consider a larger drive with ample spare capability, and ensure that a backup system is in place.

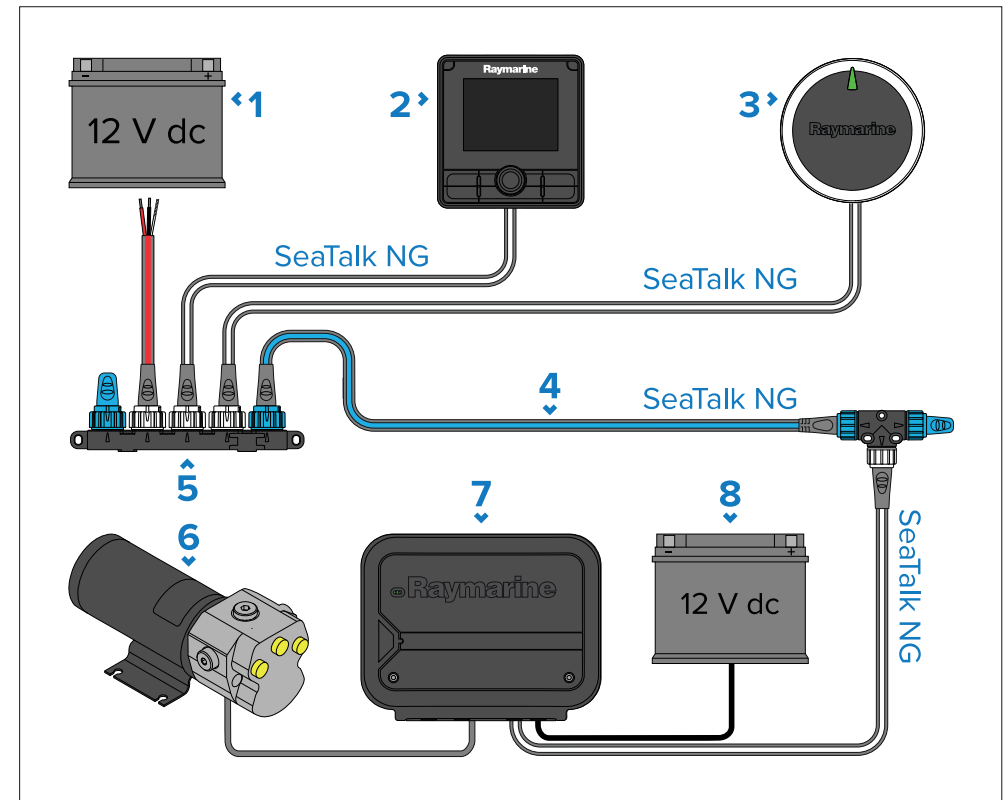
Available types	Suitable ACU	* Max output
Plus Tiller (for vessels with a maximum displacement of 6,000 Kg)	ACU-100	7 A

Note:

* Drive maximum continuous power output supported by the ACU.

3.5 Evolution-Series minimum system example (ACU-100 / ACU-150)

The following example provides an overview of an Evolution-Series *minimum system*, including the available connections and types of devices that **must** be connected to your Evolution-Series system when an ACU-100 or ACU-150 is present.



Note:

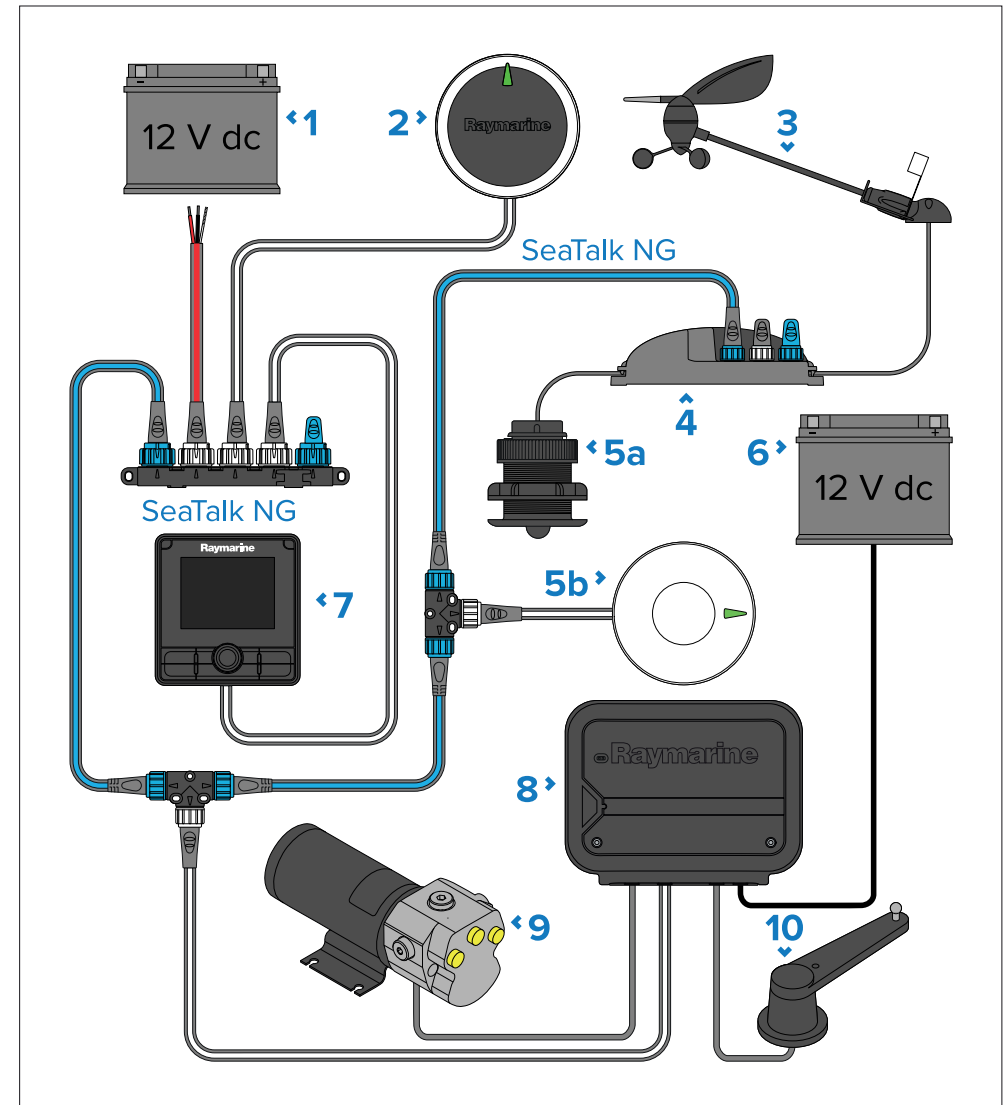
A rudder angle reference sensor / transducer is a highly recommended system component (not shown in the drawing above, but available separately as M81105).

1. 12 V dc power supply (providing power to the SeaTalk NG backbone).

2. Autopilot controller (p70Rs shown).
3. EV-1 sensor.
4. SeaTalk NG backbone.
5. SeaTalk NG 5-way block.
6. Drive unit (hydraulic pump shown).
7. ACU-100 / ACU-150.
8. 12 V dc power supply (providing power to the ACU-100 / ACU-150).

3.6 Evolution-Series recommended system example (ACU-100 / ACU-150)

The following example provides an overview of a *recommended system*, including the available connections and types of devices that can be connected to your system when an ACU-100 or ACU-150 is present.

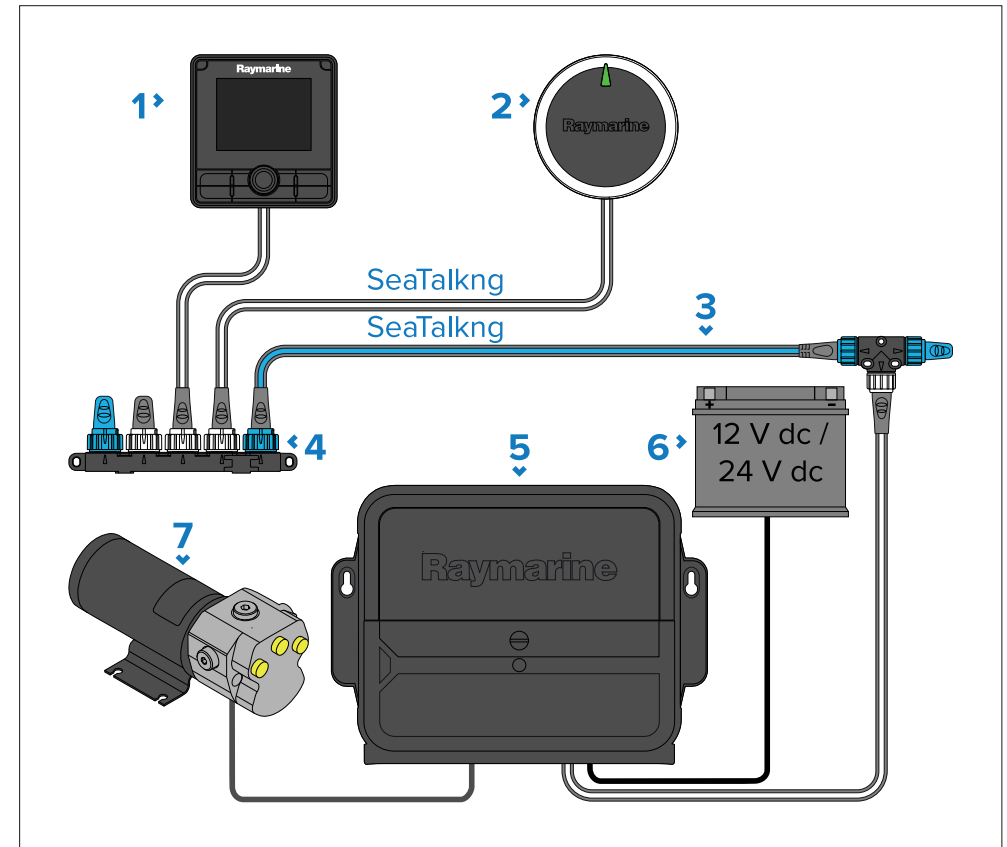


1. 12 V dc power supply (providing power to SeaTalk NG backbone).
2. EV-1 sensor.
3. Wind transducer (only required for Sailing vessels).
4. iTC-5 converter.
5. Speed data source:

- a. Speed transducer (providing STW data), or
 - b. GNSS (GPS) Receiver (providing SOG data).
6. 12 V dc power supply (providing power to the ACU-100 / ACU-150).
 7. Autopilot controller (p70Rs shown).
 8. ACU-100 / ACU-150.
 9. Drive unit (hydraulic pump shown).
 10. Rudder angle reference sensor / transducer (M81105).

3.7 Evolution-Series minimum system example (ACU-200 / ACU-400)

The following example provides an overview of an Evolution-Series *minimum system*, including the available connections and types of devices that **must** be connected to your Evolution-Series system when an ACU-200 or ACU-400 is present.



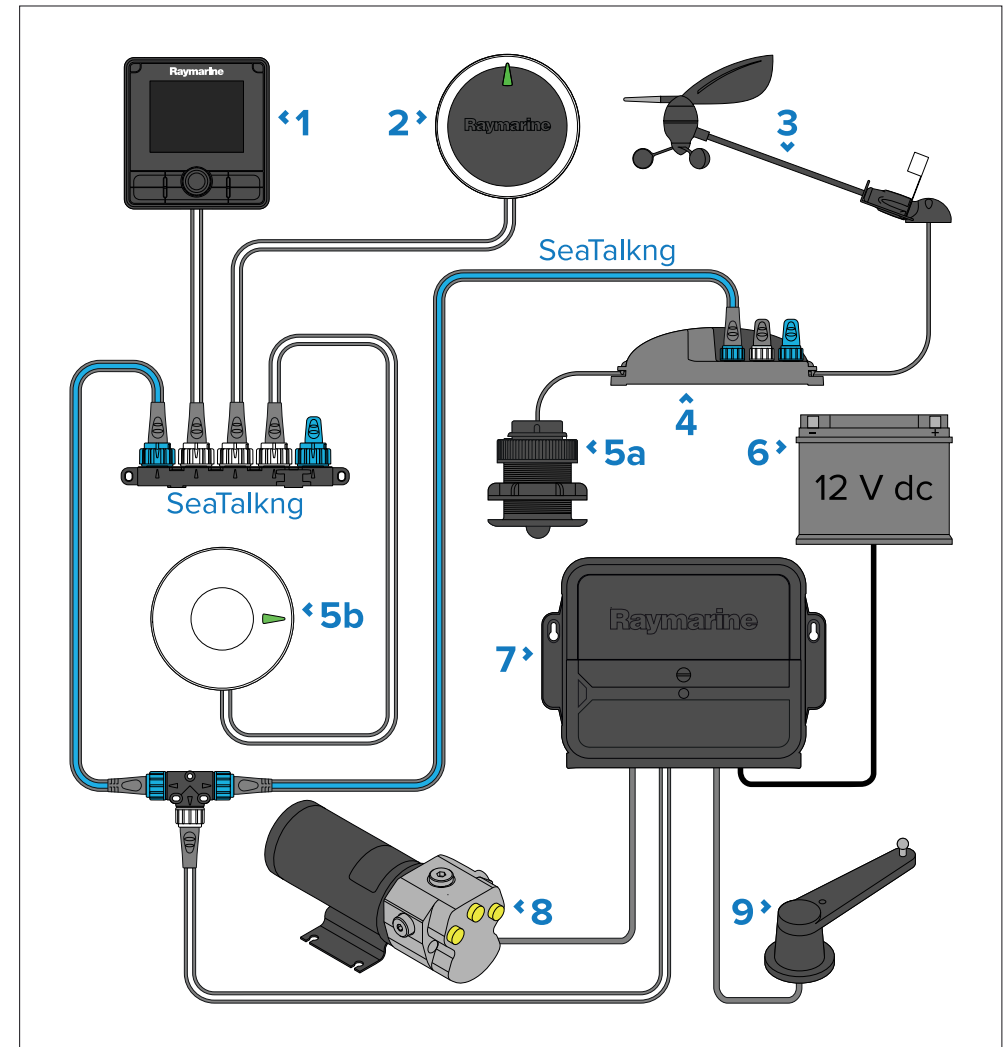
Note:

A rudder angle reference sensor / transducer is a highly recommended system component (not shown in the drawing above, but available separately as M81105).

1. Autopilot controller (e.g. P70Rs).
2. EV-1 sensor.
3. SeaTalk NG backbone.
4. SeaTalk NG 5-way block.
5. ACU-200 / ACU-400.
6. 12 V / 24 V dc power supply (providing power to the ACU-200 / ACU-400 and SeaTalk NG backbone).
7. Drive unit (e.g. hydraulic pump).

3.8 Evolution-Series recommended system example (ACU-200 / ACU-300 / ACU-400)

The following example provides an overview of an Evolution-Series *recommended system*, including the available connections and types of devices that can be connected to your autopilot system when an ACU-200 or ACU-400 is present, which **must** be connected to your Evolution-Series system when an ACU-300 is present.



1. Autopilot controller (e.g. P70Rs).
2. EV-1 sensor.
3. Wind transducer (only required for Sailing vessels).
4. iTC-5 converter.
5. Speed data source:
 - a. Speed transducer (providing STW data), or

- b. GNSS (GPS) Receiver (providing SOG data).
- 6. 12 V / 24 V dc power supply (providing power to the ACU and SeaTalk NG backbone).
- 7. ACU-200 / ACU-300 / ACU-400.
- 8. Drive unit (e.g. hydraulic pump).
- 9. Rudder angle reference sensor / transducer (M81105) — This is **essential for ACU-300** systems, and highly recommended for all other systems.

3.9 Software updates

Raymarine regularly issues software updates for its products, which provide new and enhanced features and improved performance and usability. It's important to ensure that you have the latest software for your products by regularly checking the Raymarine website for new software releases.

To check for the latest software updates and the software update procedure for your specific product(s) refer to: <https://bit.ly/rym-software>

Unless otherwise stated, software updates for Raymarine products are performed using a Raymarine MFD/chartplotter.

- Where applicable, you should always backup your user data and settings before performing a software update.
- To update SeaTalk NG products you must use the datamaster MFD/Chartplotter which is physically connected to the SeaTalk NG backbone.
- Ethernet (RayNet) products can be updated from any MFD/Chartplotter on the same network as the product to be updated.
- In order to perform a software update, any connected Autopilot or Radar must be switched to Standby.
- The MFD's/Chartplotter's "Check online" feature is only available when connected to the Internet.

Note:

If in doubt as to the correct procedure for updating your product software, refer to your dealer or Raymarine technical support.

Caution: Installing software updates

- The software update process is carried out at your own risk. Before initiating the update process ensure you have backed up any important files.
- Ensure that the product(s) has a reliable power supply and that the update process is not interrupted.
- Damage caused by an incomplete update is not covered by Raymarine warranty.
- By downloading the software update package, you agree to these terms.

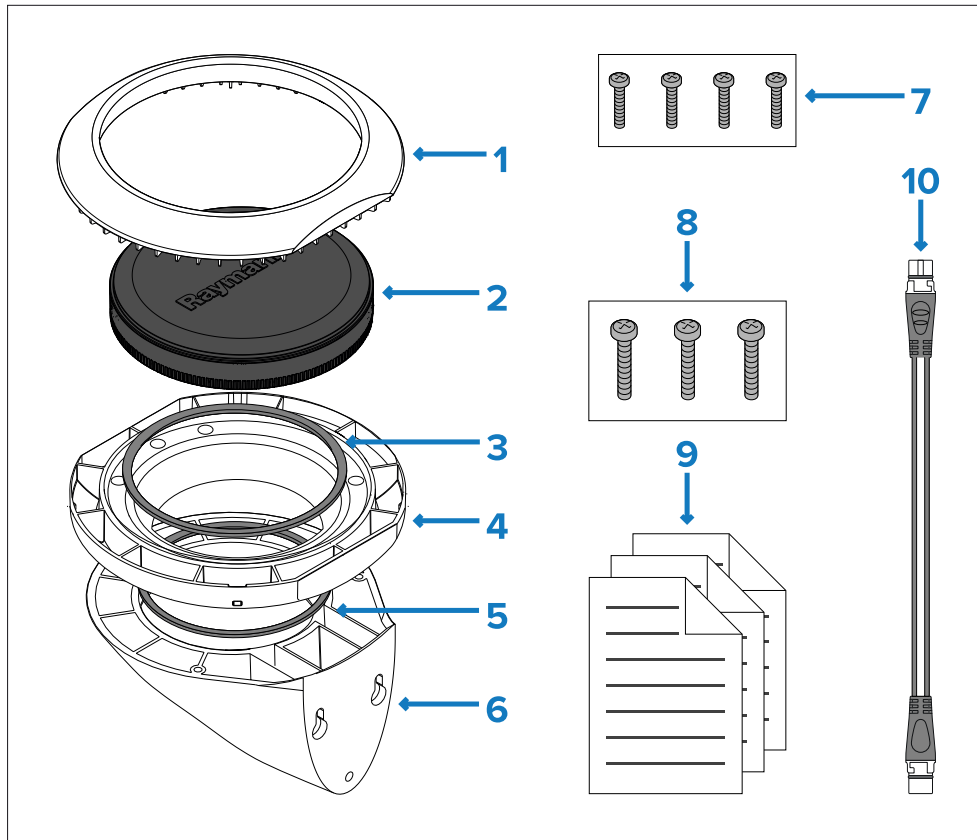
CHAPTER 4: PARTS SUPPLIED

CHAPTER CONTENTS

- 4.1 Parts supplied (EV-1) — page 28
- 4.2 Parts supplied (ACU-100 / ACU-150) — page 28
- 4.3 Parts supplied (ACU-200 / ACU-300 / ACU-400) — page 29

4.1 Parts supplied (EV-1)

The following parts are supplied with your product:



Description

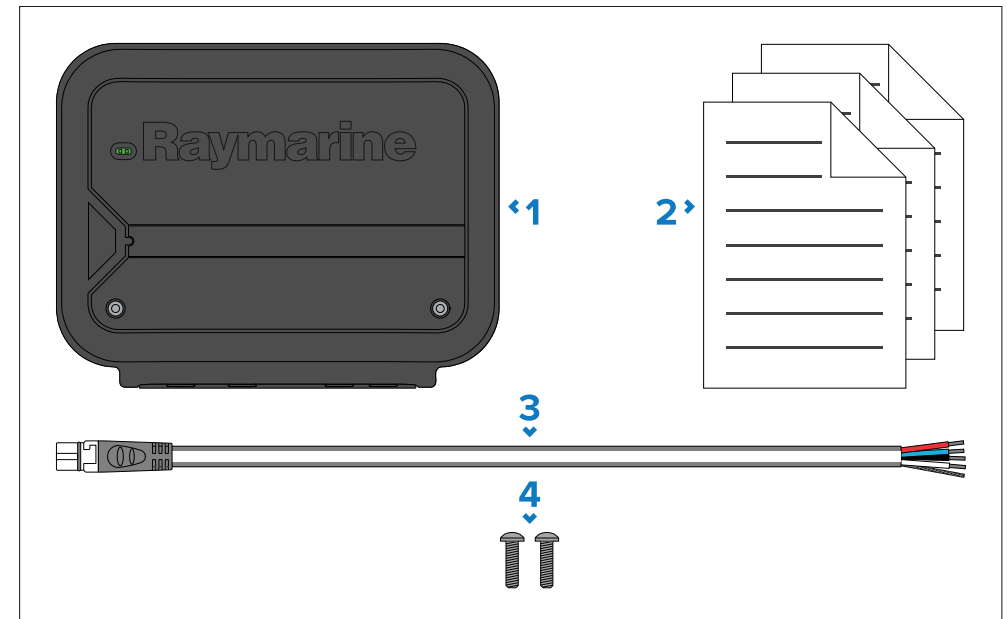
- 1** Mounting trim.
- 2** EV sensor.
- 3** Large sealing ring.
- 4** Mounting tray.
- 5** Small sealing ring.
- 6** Wall mounting bracket.
- 7** Screws for deck or bracket mounting.

Description

- 8** Screws for wall bracket.
- 9** Documentation pack.
- 10** SeaTalk NG spur cable, 1 m (3.3 ft).

4.2 Parts supplied (ACU-100 / ACU-150)

The following parts are supplied with your product:

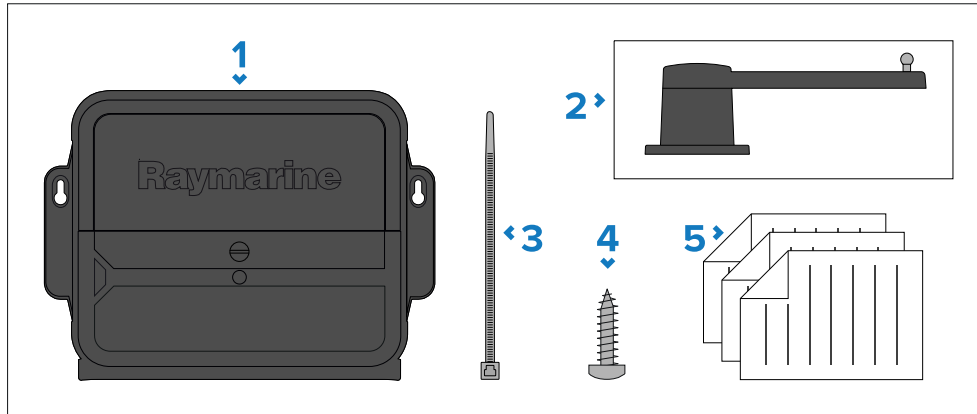


Description

- 1** 1x ACU-100 / ACU-150 unit.
- 2** 1x Documentation pack.
- 3** 2x Pan head type screws.
- 4** 1x SeaTalk NG to stripped-end spur cable, 1 m (3.3 ft).

4.3 Parts supplied (ACU-200 / ACU-300 / ACU-400)

The following parts are supplied with your product:



Description

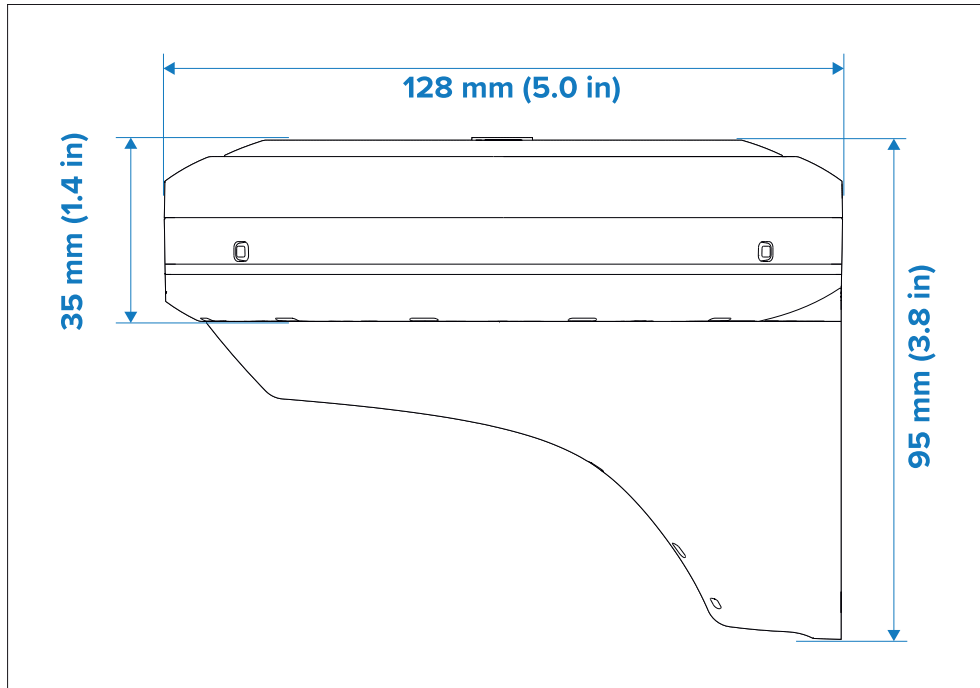
- 1 1x ACU-200 / ACU-300 / ACU-400
- 2 1x Rudder angle reference sensor / transducer. **Not supplied with all system packs** — please check with your dealer. Also available separately as M81105.
- 3 10x Cable ties.
- 4 2x Mounting screws
- 5 1x Document pack

CHAPTER 5: PRODUCT DIMENSIONS

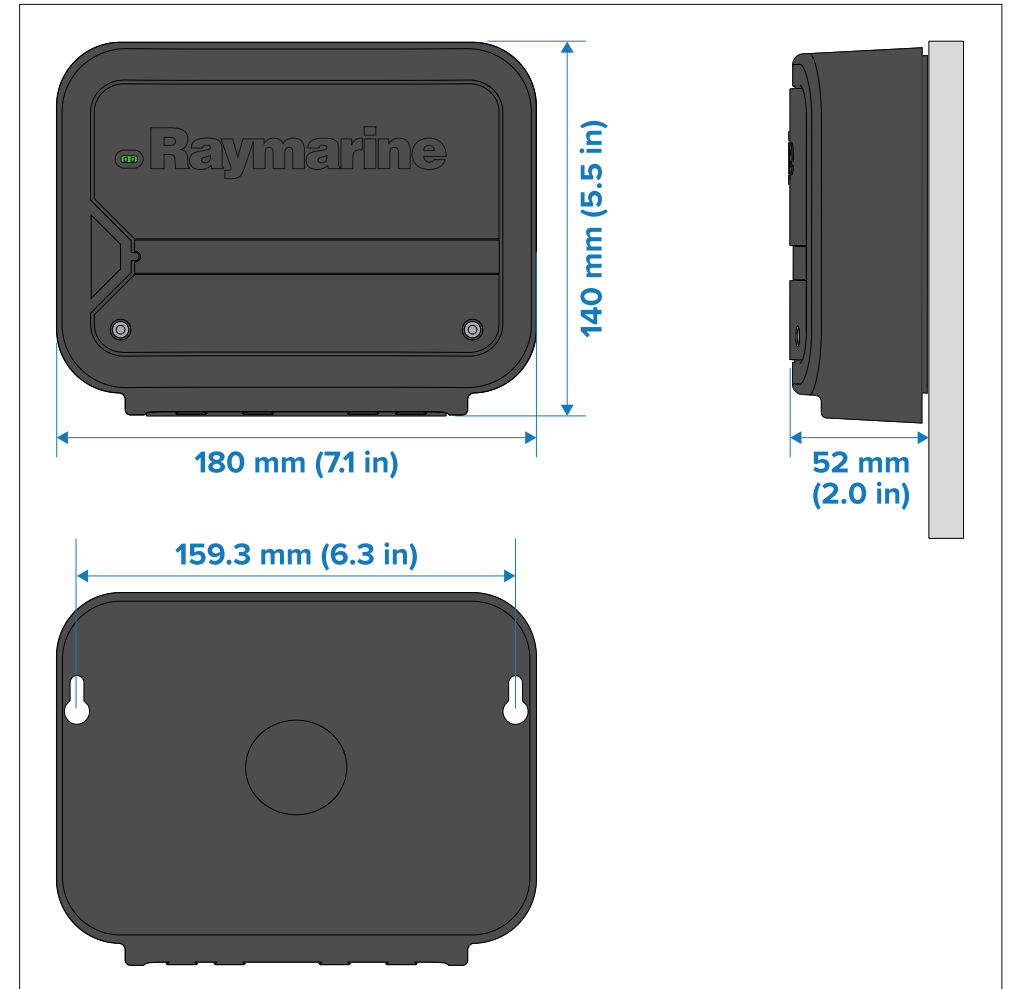
CHAPTER CONTENTS

- 5.1 Product dimensions (EV-1) — page 31
- 5.2 Product dimensions (ACU-100 / ACU-150) — page 31
- 5.3 Product dimensions (ACU-200 / ACU-300 / ACU-400) — page 32

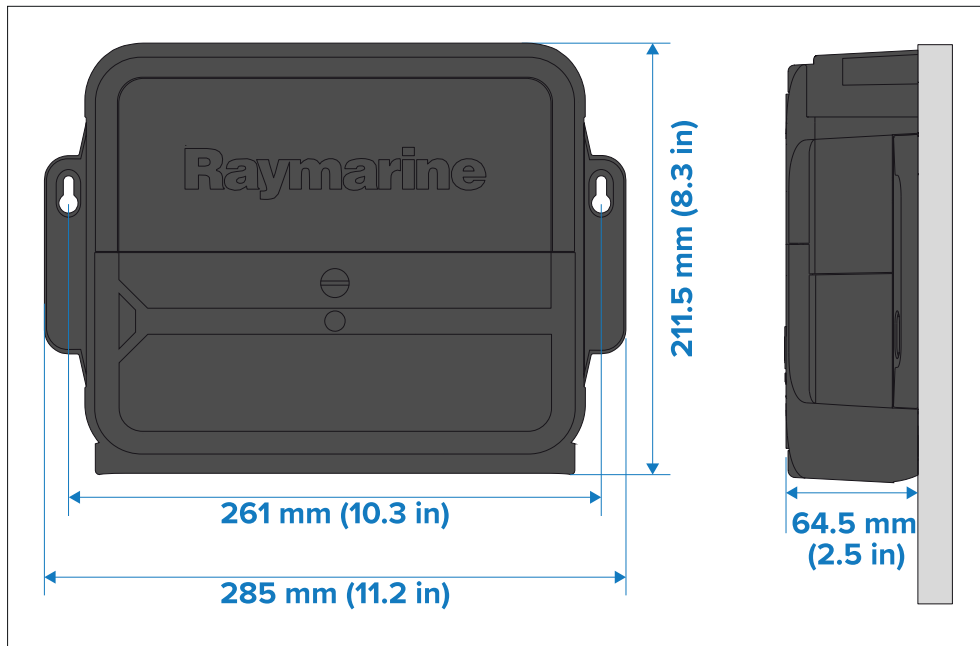
5.1 Product dimensions (EV-1)



5.2 Product dimensions (ACU-100 / ACU-150)



5.3 Product dimensions (ACU-200 / ACU-300 / ACU-400)



CHAPTER 6: LOCATION REQUIREMENTS

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- 6.1 Warnings and cautions — page 34
- 6.2 Location requirements (EV-1) — page 34
- 6.3 Location requirements (ACU-100 / ACU-150) — page 35
- 6.4 Location requirements (ACU-200 / ACU-300 / ACU-400) — page 35
- 6.5 Compass safe distance — page 35
- 6.6 EMC installation guidelines — page 36

6.1 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](#)



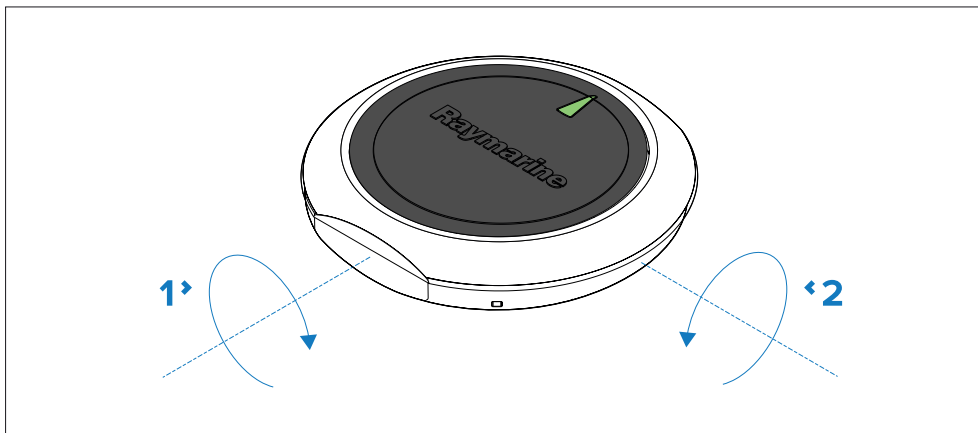
Warning: Potential ignition source

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).

6.2 Location requirements (EV-1)

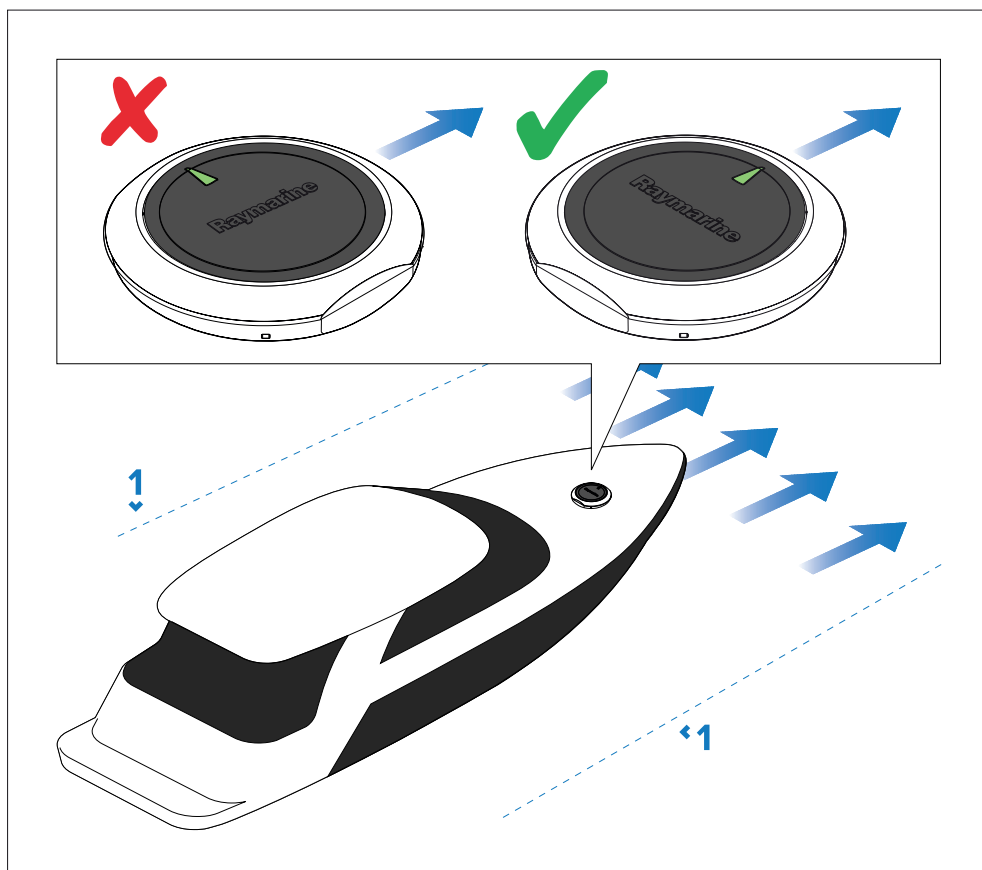
The installation location must take into account the following requirements:

- The unit can be installed above or below decks.
- The unit must be mounted on a horizontal and level surface. The unit may be mounted upright or upside-down, but the unit must be level within **5°** of pitch and **5°** of roll (compared with the vessel's neutral position when at rest and normally loaded).



1. Roll
2. Pitch

- The unit can be mounted on a vertical surface such as a bulkhead or mast etc, using the supplied bracket.
- The unit location must be at least 1 m (3 ft.) away from any source of magnetic interference, such as compasses and electrical cables.
- Choose a location where the unit will be safe from physical damage and excessive vibration.
- Choose a location where the unit will not be subjected to a load or force.
- Mount away from any source of heat or potential flammable hazards, such as fuel vapor.
- The unit should be mounted in a location where the diagnostics LED is viewable.
- The unit must be mounted with the LED 'arrow' on the top of the unit 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.

6.3 Location requirements (ACU-100 / ACU-150)

The installation location must take into account the following requirements:

- The unit should be installed above or below decks.
- The unit should be mounted on a vertical surface.
- The unit should be mounted in a location where the diagnostics LED is viewable.
- The unit should be located as close to the battery as practical.

[Location requirements](#)

- Choose a location where the unit will be safe from physical damage and excessive vibration.
- Choose a location where the unit will not be subjected to a load or force.
- Mount away from any source of heat or potential flammable hazards, such as fuel vapor.

6.4 Location requirements (ACU-200 / ACU-300 / ACU-400)

The installation location must take into account the following requirements:

- The unit should be installed below decks in a dry area.
- The unit should be mounted on a vertical surface.
- The unit should be mounted in a location where the diagnostics LED is viewable.
- The unit should be located as close to the battery as practical.
- Choose a location where the unit will be safe from physical damage and excessive vibration.
- Choose a location where the unit will not be subjected to a load or force.
- Mount away from any source of heat or potential flammable hazards, such as fuel vapor.

6.5 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.

6.6 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.

CHAPTER 7: MOUNTING

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- 7.1 Mounting (EV-1) — page 38
- 7.2 Mounting (ACU) — page 44
- 7.3 Drive unit installation — page 46

7.1 Mounting (EV-1)

Surface mounting

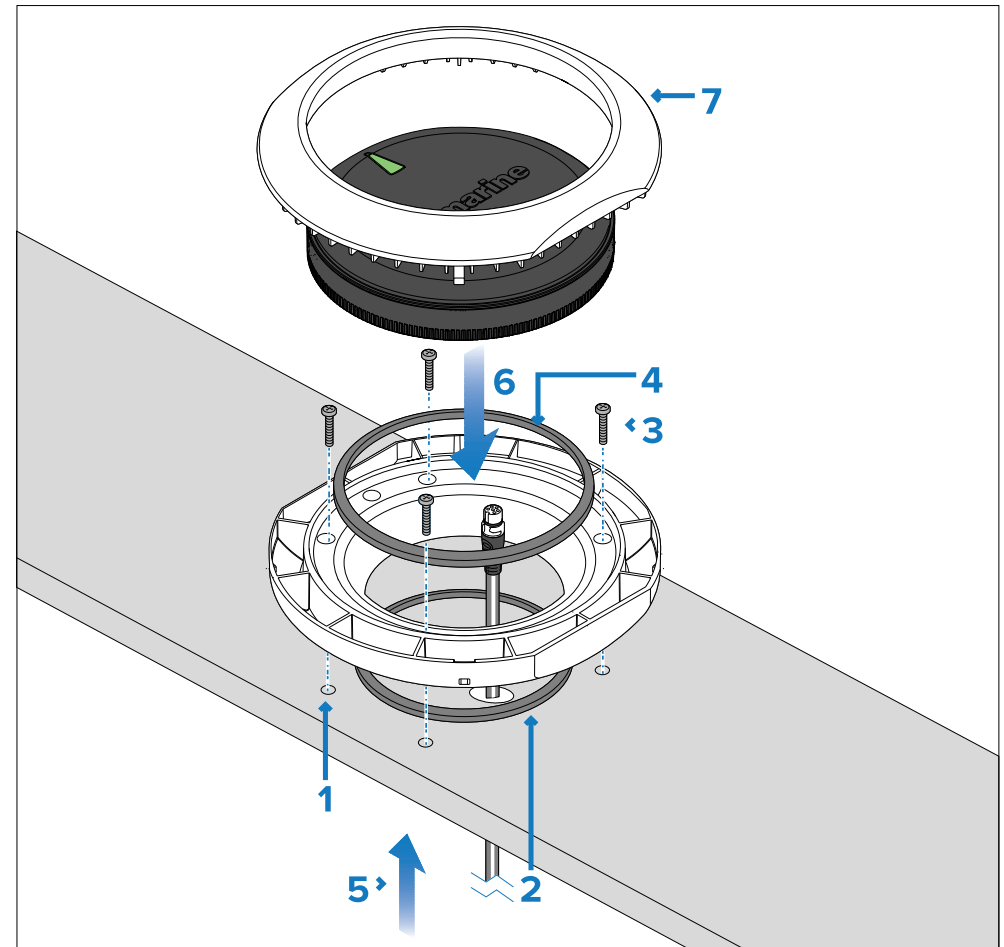
The supplied deck mounting kit is used to surface mount the unit.

Ensure that the chosen location meets the product's location requirements.

For more information, refer to: [p.33 – Location requirements](#)

Important:

The installation must only be performed with the vessel either on a hard standing, or tied-up alongside a pontoon or berth.



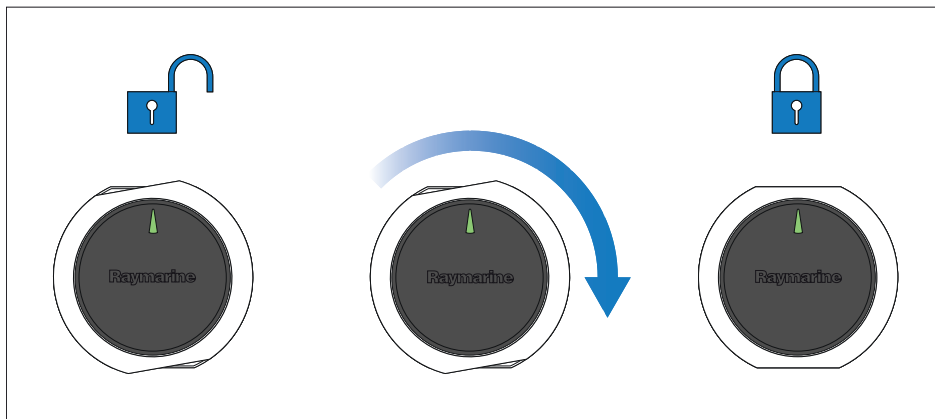
1. Using the mounting tray template (87170), drill 4 holes in the mounting surface, plus a 22 mm (7/8 in) hole for the SeaTalk NG cable.
2. Place the small sealing ring in the groove located on the bottom of the mounting tray.
3. Secure the tray to the mounting surface using the 4 fixings supplied.
4. Place the large sealing ring into the groove on the upper side of the mounting tray.
5. Pull the SeaTalk NG cable through the mounting surface hole and the mounting tray. Plug in the cable connector on the underside of the unit and secure by rotating the locking collar clockwise 2 clicks.

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' in parallel alignment with the longitudinal axis (centerline) of the vessel and be pointing towards the vessel's bow.

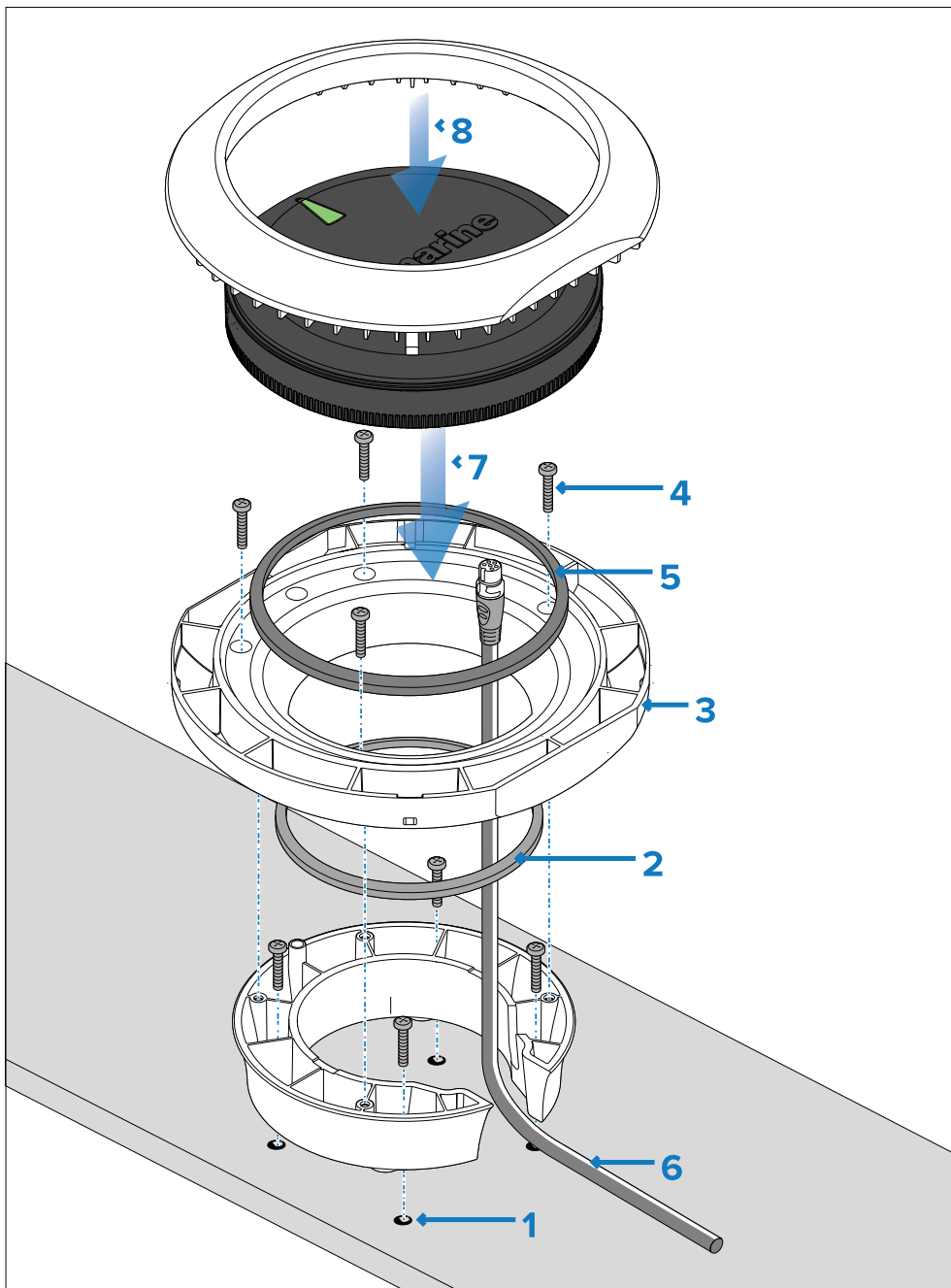
7. Place the mounting trim over the unit slightly offset, and then twist the mounting trim clockwise until it locks into position.



Surface mounting using the riser

The optional deck mounting kit (A80437) can be used to raise the product from the mounting surface, for installations where the cabling needs to be above-surface.

The wall bracket is not required when using the riser.



1. Use the deck mount riser template (87280) provided with the kit (A80437) to drill 4 holes in the mounting surface. Secure the riser to the mounting surface using the 4 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 3 supplied fixings.
5. Place the large sealing ring into the groove on the upper side of the mounting tray.
6. Pull the SeaTalk NG cable through the riser and mounting tray. Plug in the cable connector on the underside of the product and secure by rotating the locking collar clockwise 2 clicks.

Note:

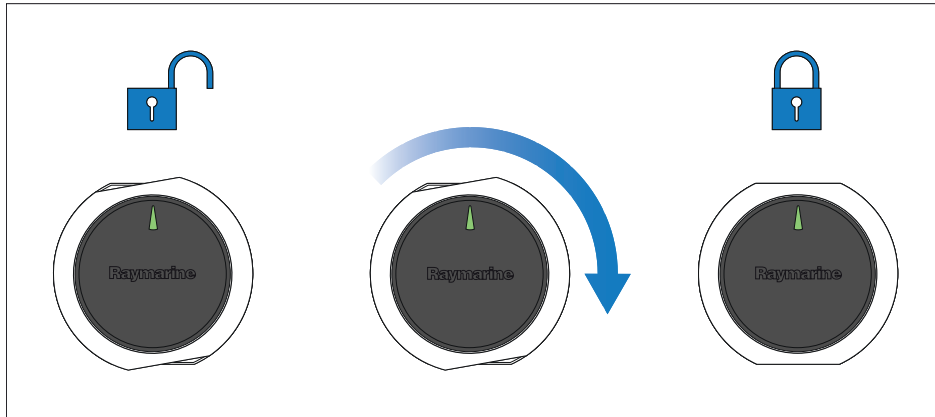
If there is not enough space in the riser to accommodate the cable and to plug the SeaTalk NG spur cable into the product, you may need to obtain a spur cable with a right-angled elbow connector (A06081) or a right-angled elbow adaptor (A06077).

7. Insert the product into the mounting tray, ensuring the tabs in the mounting tray are slotted into the grooves around the edge of the product.

Important:

When fitting the product to the tray, ensure that the orientation of the LED "arrow" at the top of the product is correct. For information on the correct LED orientation, refer to the *Location requirements* chapter.

- Place the mounting trim over the product slightly offset, and then twist the mounting trim clockwise until it locks into position.



Bracket mounting

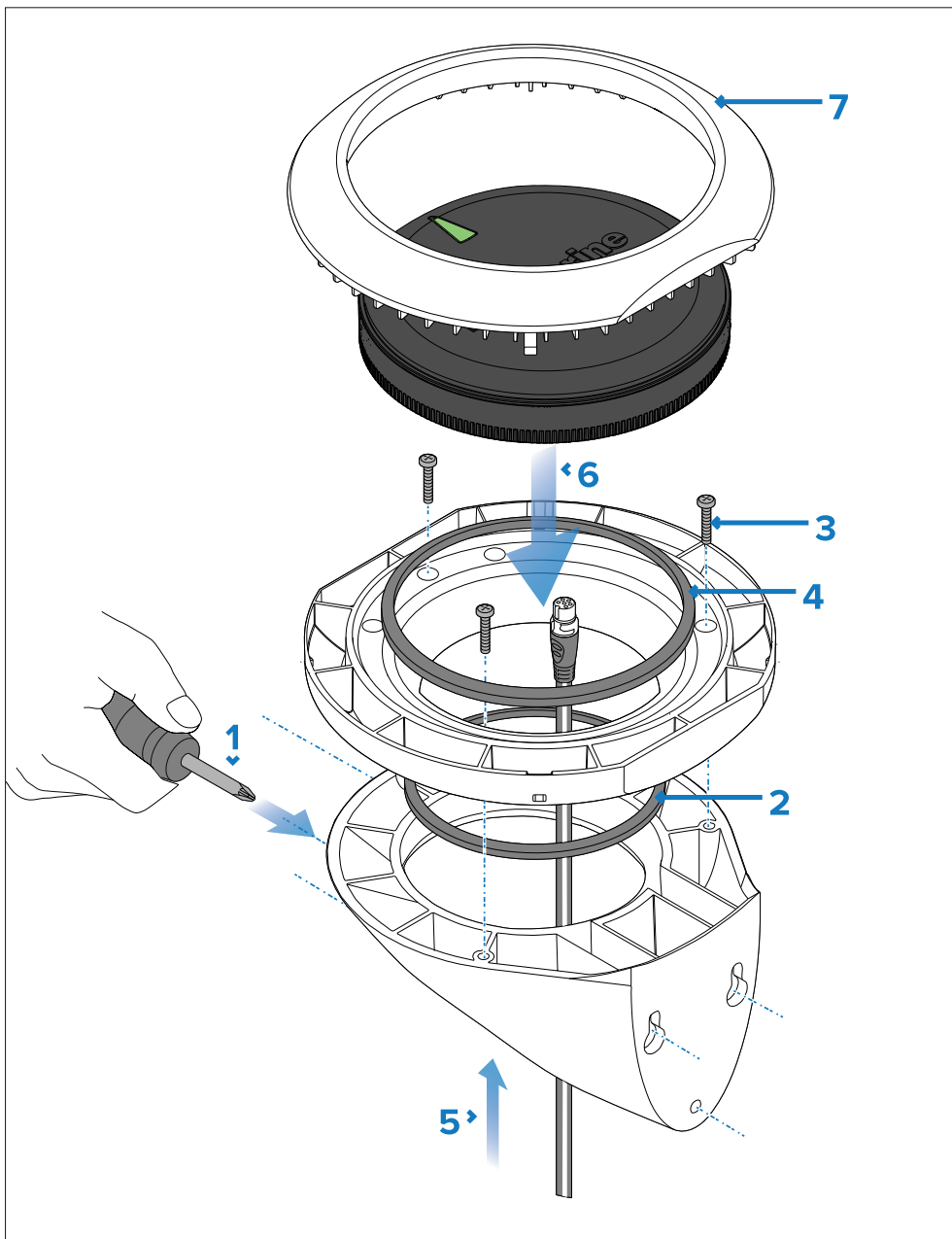
The supplied deck mounting kit is used to mount the unit on a vertical surface.

Ensure that the chosen location meets the product's location requirements.

For more information, refer to: [p.33 – Location requirements](#)

Important:

The installation must only be performed with the vessel either on a hard standing, or tied-up alongside a pontoon or berth.

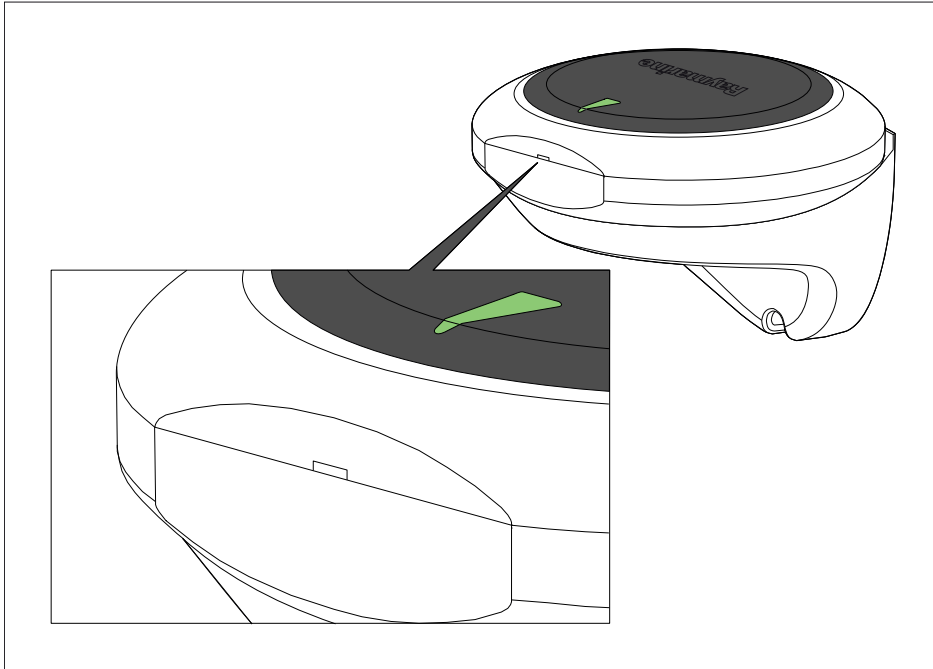


1. Use the mounting bracket template (87170) to drill 3 pilot holes in the vertical mounting surface. Secure the mounting bracket to the surface using the supplied screws.
2. Place the small sealing ring in the groove located on the bottom of the mounting tray.
3. Secure the tray to the bracket using 3 of the supplied screws in the positions indicated in the illustration above.
4. Place the large sealing ring into the groove on the upper side of the mounting tray.
5. Pull the SeaTalk NG cable through the center of the bracket and tray. Plug in the cable connector on the underside of the unit and secure by rotating the locking collar clockwise 2 clicks.
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.

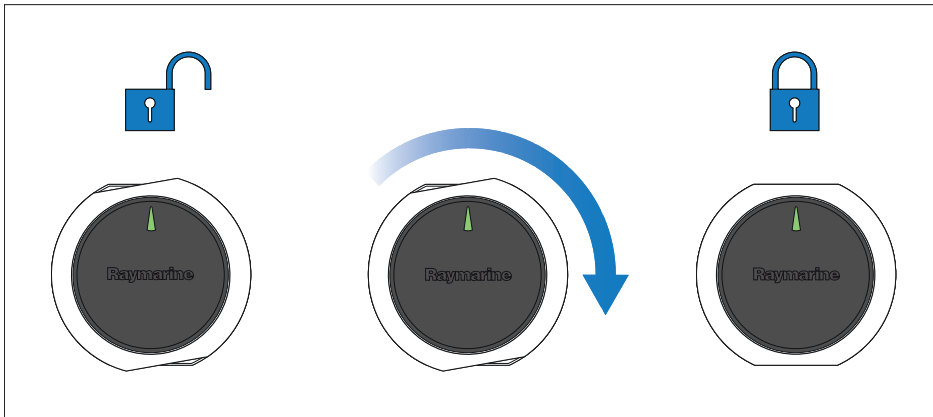
Important:

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

7. Orientate the mounting trim so that the release hole is accessible when mounted.

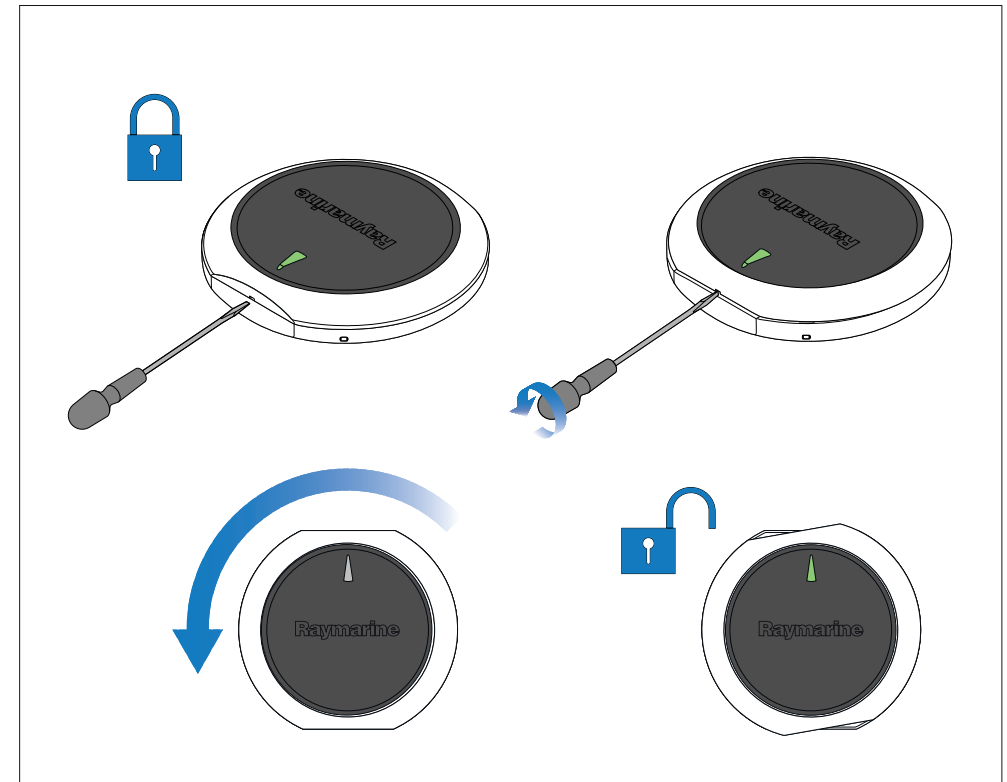


8. Place the mounting trim over the unit slightly offset, and then twist the Mounting trim clockwise until it locks into position.



Releasing the product from the bracket

Follow the steps below to release the product from the mounting bracket.



1. Insert the end of a small flat blade screwdriver (or similar tool) into the release hole located on the flat edge of the mounting bracket. Twist the screwdriver 90°, so that there is a small gap between the mounting trim and mounting tray.

Important:

To help prevent scratching the product, cover the tip of your screwdriver with a small piece of insulation tape.

2. With the screwdriver in place, twist the mounting trim counter-clockwise approximately 10°, and then lift away from the product.

7.2 Mounting (ACU)

Mounting the unit (ACU-100 / ACU-150)

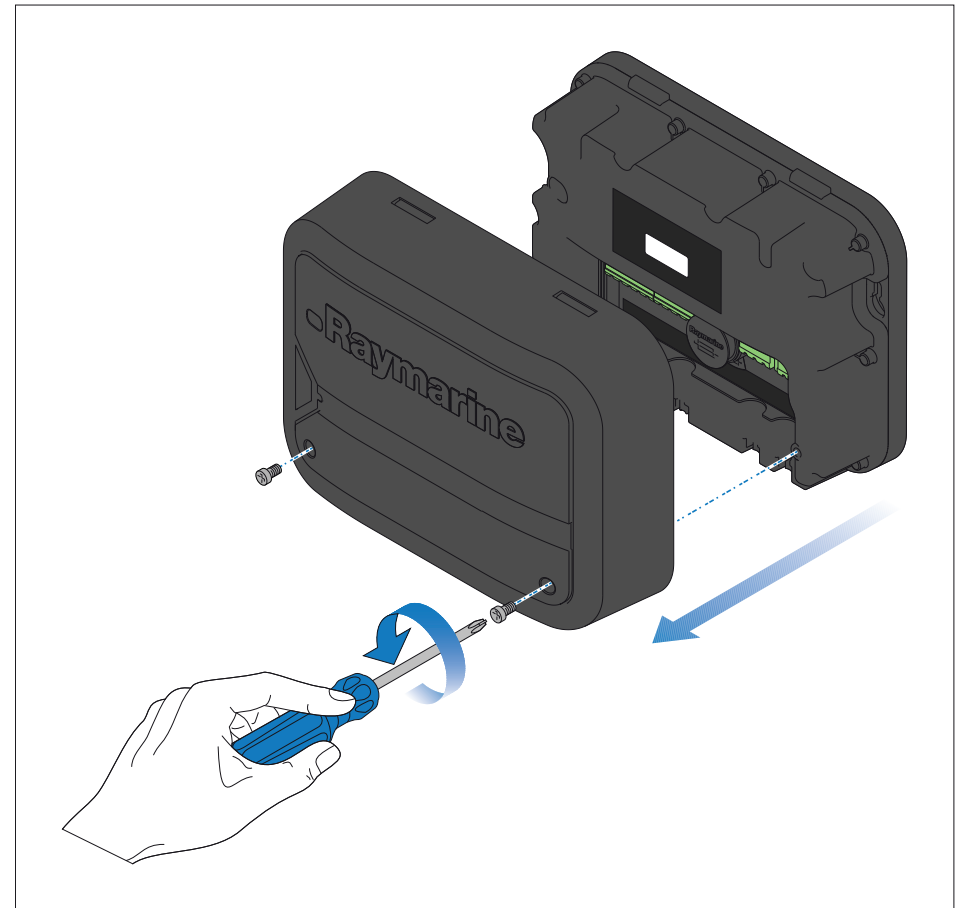
Before mounting the product, ensure that you have:

- Selected a suitable location, based on the location requirements found in this document.
- Identified the relevant cable connections and the route that the cables will take.

Important:

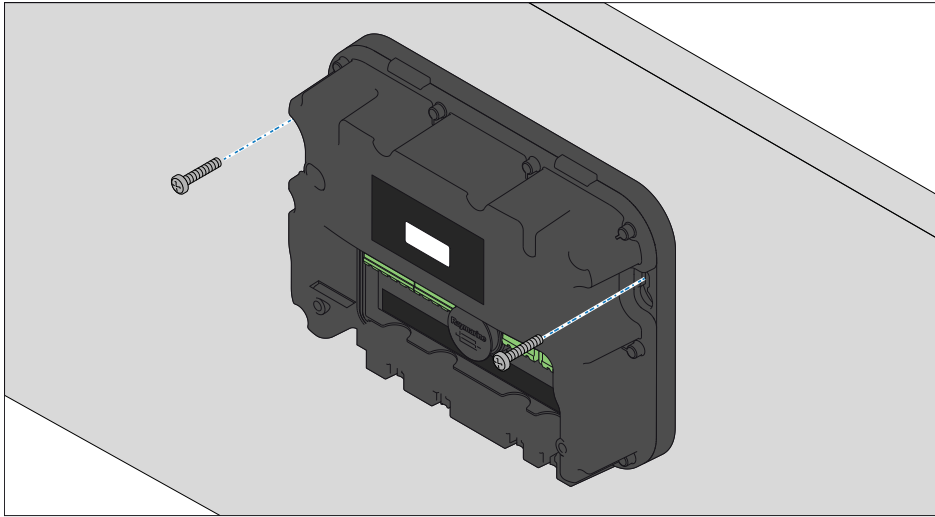
The installation must only be performed with the vessel either on a hard standing, or tied-up alongside a pontoon or berth.

1. Using an appropriate screwdriver, undo the screws located on the top cover and remove the top cover from the ACU.



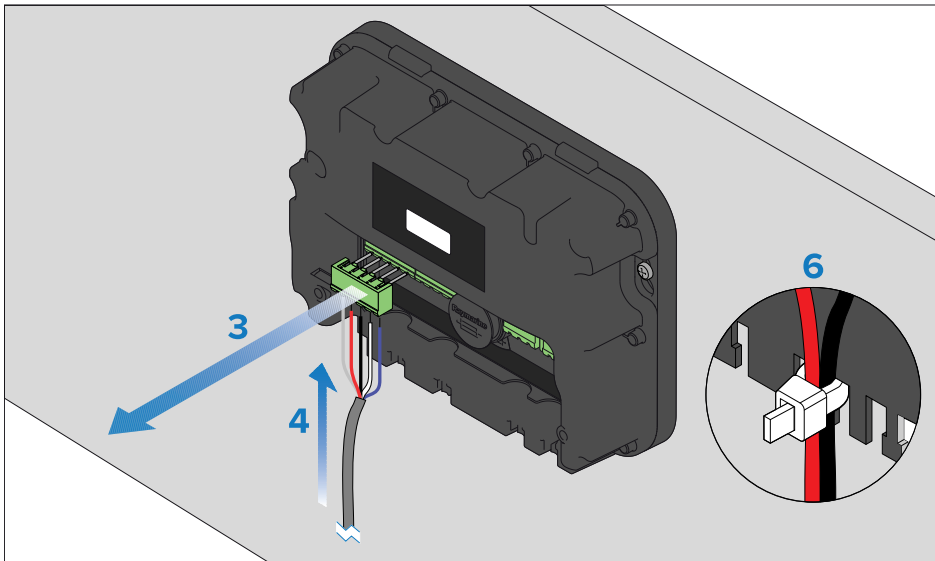
Once the cover is removed, the unit's mounting holes are accessible.

2. Mount the ACU in an appropriate location and secure to the mounting surface using the supplied screws.

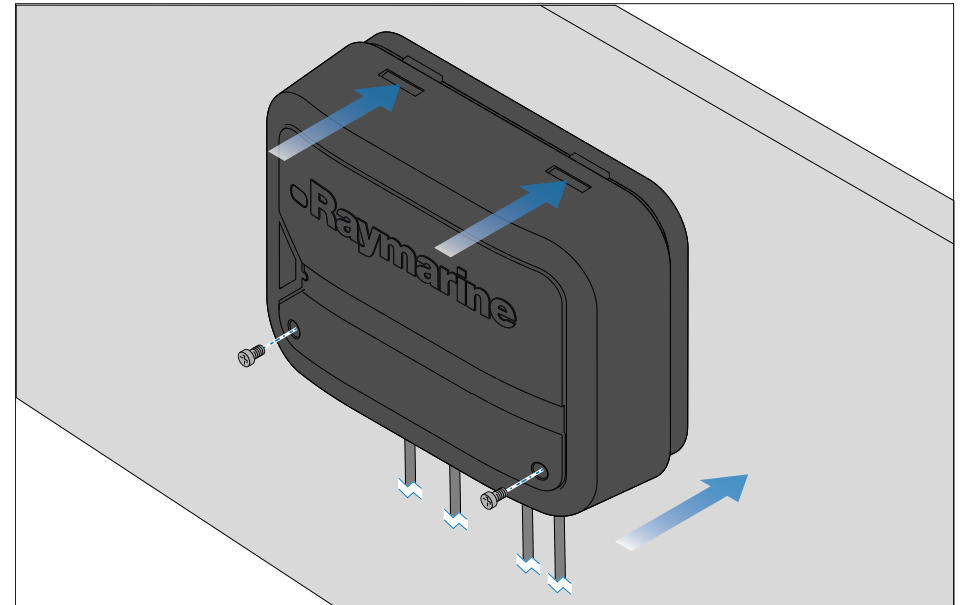


You should also mount the autopilot control head and rudder angle reference sensor / transducer (if appropriate) at this time.

3. To access the screw terminals for connecting the cables to the ACU, remove the screw terminal connectors from the sockets, as shown in the following illustration:



4. Insert the relevant wires from the SeaTalk NG spur cable into the SeaTalk NG screw terminals, as shown in the illustration above. Tighten the screws to secure the wires. Repeat for all required connections.
5. Push the screw terminals back into the connector panel, ensuring a tight connection.
6. Route the cables through the cable guides located on the lower lip of the unit. Raymarine recommends that you use cable ties to secure the cables to the unit.
7. Once all connections are made and the cables correctly routed in the guides, replace the ACU cover, ensuring a tight fit between the cover's rubber seal and the cables.
8. Using the supplied screws, secure the cover to the unit, ensuring that the clips are aligned and secured (along with an audible click):

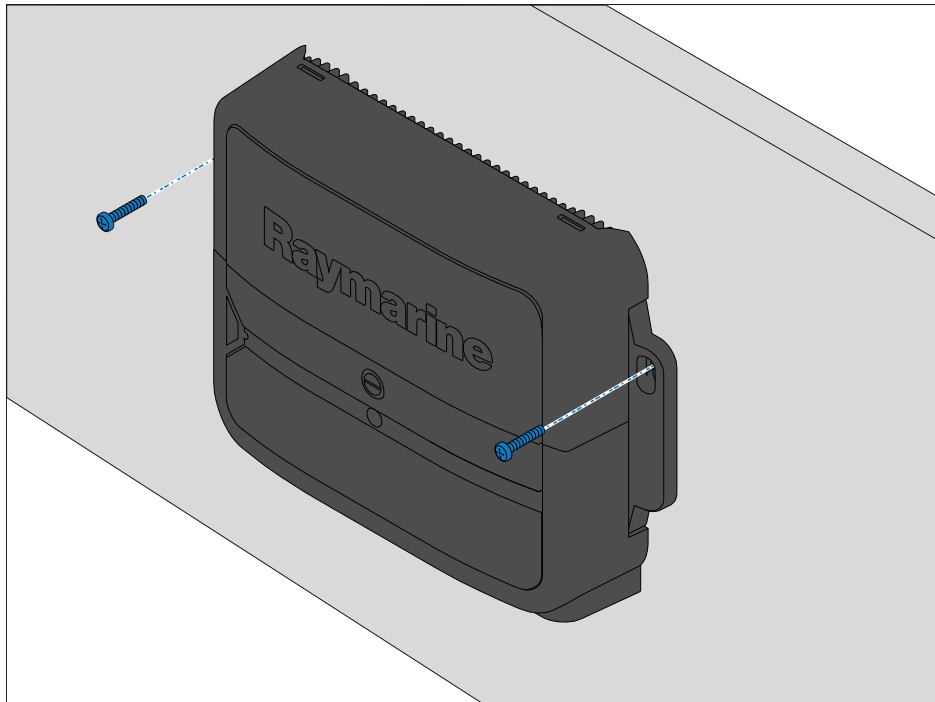


Mounting the unit (ACU-200 / ACU-300 / ACU-400)

Important:

The installation must only be performed with the vessel either on a hard standing, or tied-up alongside a pontoon or berth.

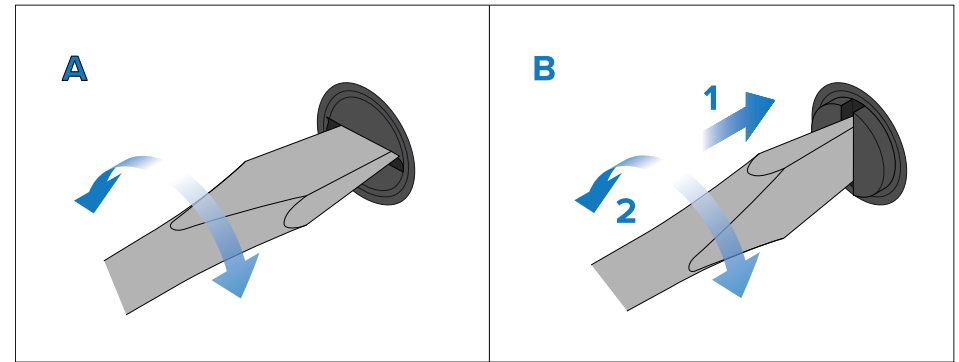
1. Mount the ACU in an appropriate location and secure with the screws supplied.



You should also mount the autopilot control head and rudder angle reference sensor / transducer (if appropriate) at this time.

2. Route the power, data and any other cables required for connection to the ACU.
3. Make all necessary connections into the ACU connector panel.

The connector panel is accessed by removing the front cover.



- A — Unlock cover panel
- B — Lock cover panel

7.3 Drive unit installation

For instructions on how to install the drive unit for your autopilot system, refer to the dedicated Installation Instructions supplied with the drive unit.

The documents are also available to download from the Raymarine website: <https://bit.ly/rym-docs>

CHAPTER 8: CABLES AND CONNECTIONS — GENERAL INFORMATION

CHAPTER CONTENTS

- [8.1 General cabling guidance — page 48](#)

8.1 General cabling guidance

Cable types and length

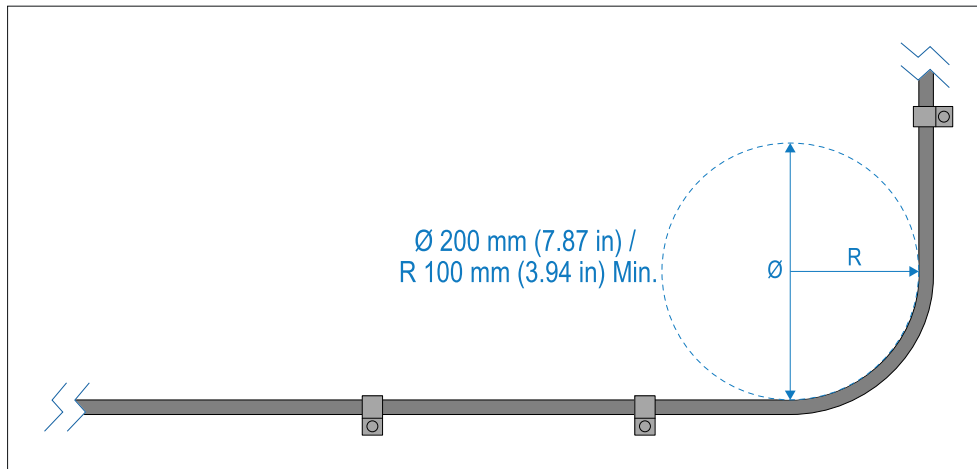
It is important to use cables of the appropriate type and length.

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

Cable routing

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

- Do NOT bend cables excessively. Wherever possible, ensure a minimum bend diameter (\emptyset) 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.

Cable shielding

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

Important:

Be aware that some **third-party** cables and adaptors (for example, certain Ethernet cables using RJ45 connectors) are not always shielded. To prevent breaks in cable shielding continuity and potential grounding issues, special attention is required to ensure that any cables, extension cables, adaptors, or other signal-coupling devices (such as multi-way connectors, junction boxes, terminal blocks etc.) used in cable runs **maintain all shield connections throughout the cable run.**

Suppression ferrites

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



Warning: Positive ground systems

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

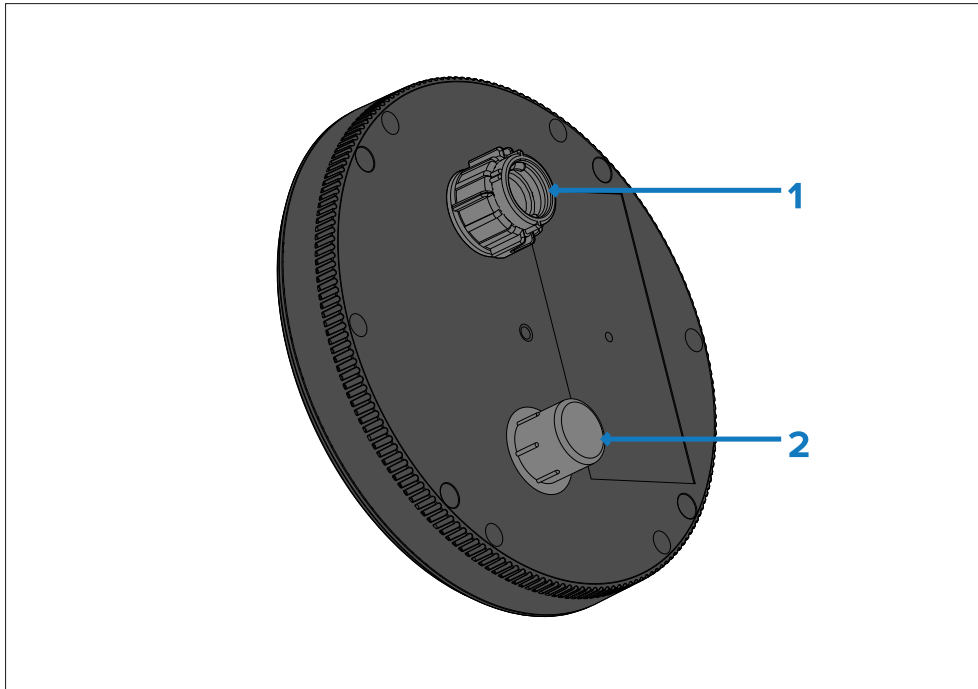
CHAPTER 9: CONNECTIONS (EV-1)

CHAPTER CONTENTS

- 9.1 Connections overview — page 51
- 9.2 Connecting SeaTalk NG cables — page 51
- 9.3 Power connection — SeaTalk NG — page 51
- 9.4 Inline fuse and thermal breaker ratings — page 52
- 9.5 SeaTalk NG power connection point — page 52
- 9.6 Power distribution — SeaTalk NG — page 53

9.1 Connections overview

The EV-1 contains the following connectors:

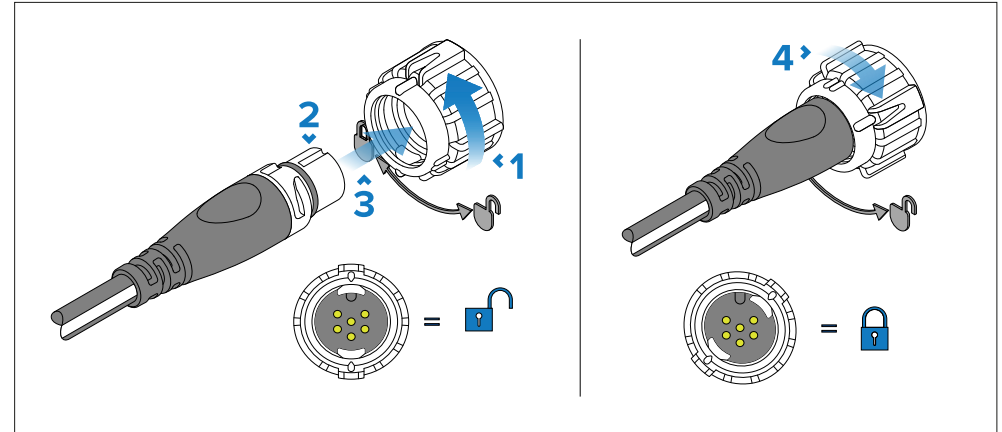


1. SeaTalk NG
2. DeviceNet⁽¹⁾

Important:

(1) The DeviceNet connection is not currently supported.

9.2 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.

9.3 Power connection — SeaTalk NG

The power for your product is provided by the SeaTalk NG network.

- The product must be connected to a spur connection on the SeaTalk NG network.
- The SeaTalk NG network must have only ONE, fused 12 V dc power source; this can be via either:
 - A distribution panel or battery connection; or
 - An ACU-200, ACU-300 or ACU-400 providing power to the SeaTalk NG network.

Important:

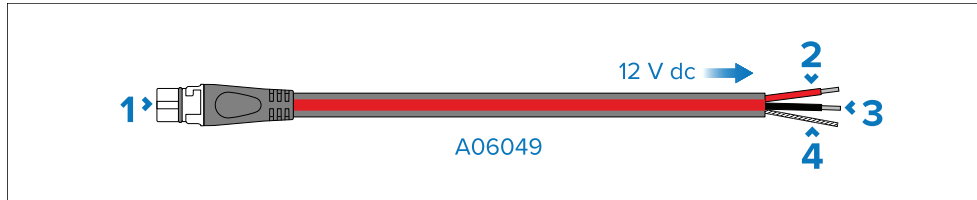
If your vessel has a 24 V power supply, a suitable voltage convertor is required.

SeaTalk NG power cable (A06049)

When powering the SeaTalk NG network from a battery or distribution panel, a SeaTalk NG power cable must be used, which is connected to the network using a spur connector.

Only use approved SeaTalk NG power cables. Do NOT use a power cable designed for, or supplied with, a different product.

All 3 cores of the SeaTalk NG power cable must be connected correctly:



1. **SeaTalk NG spur connector** — connects to the spur connection on the SeaTalk NG network.
2. **+ Red (positive) wire** — connects to the battery or distribution panel positive terminal. A waterproof fuse holder with 5 A inline fuse (not supplied) must be fitted to this red wire.
3. **- Black (negative) wire** — connects to battery or distribution panel negative terminal.
4. **Drain wire** — connects to the vessel's RF common ground point (if available), or the battery's negative (-) terminal.

9.4 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.



Warning: 12 Volt dc only

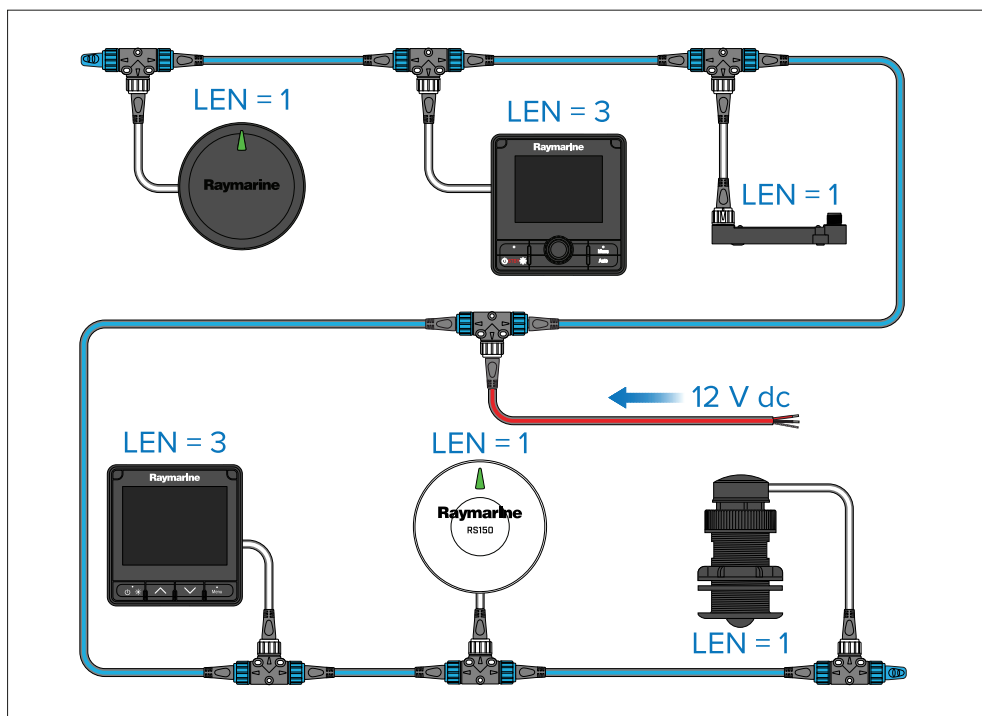
This product must ONLY be connected to a 12 V dc power source.

9.5 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.

9.6 Power distribution — SeaTalk NG

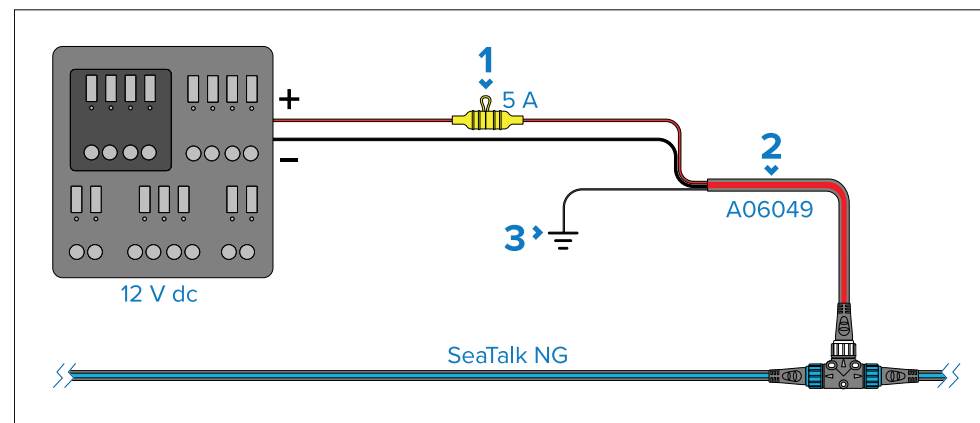
Recommendations and best practice.

- 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:

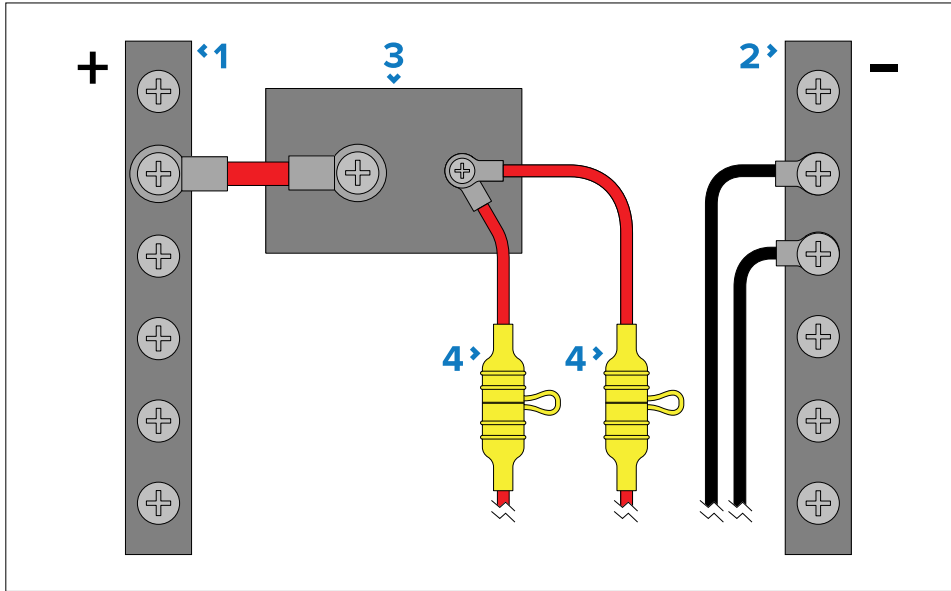
- When planning and wiring, take into consideration other products in your system, some of which (e.g. sonar modules) may place large power demand peaks on the vessel's electrical system, which may impact the voltage available to other products during the peaks.
- The information provided below is for 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 mm²) 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).

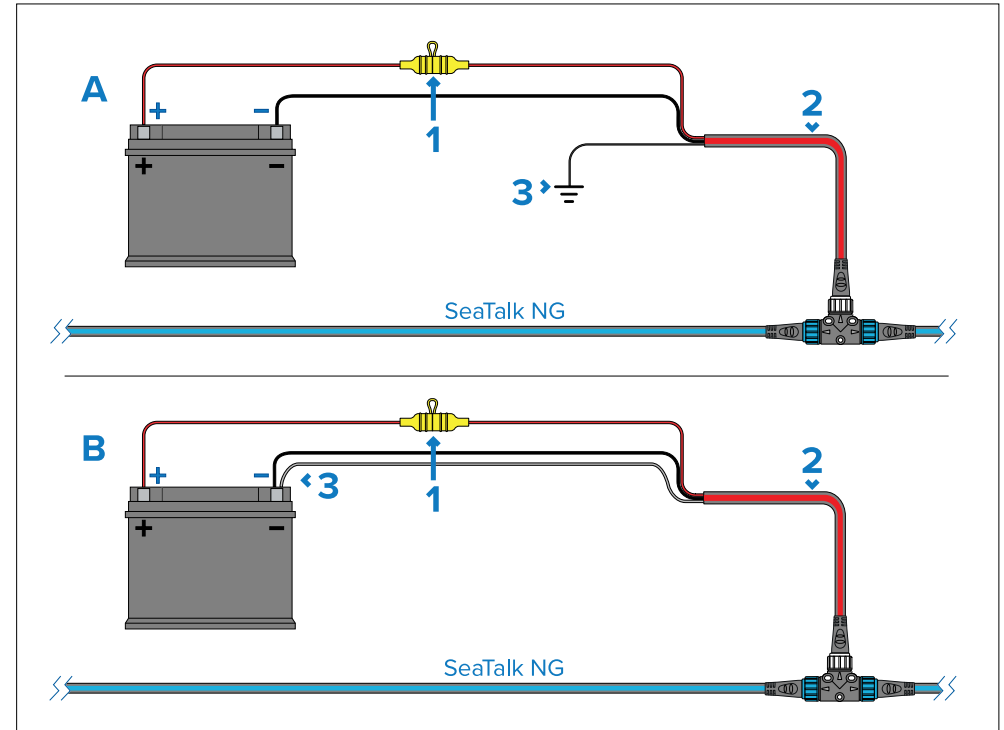
Important:

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

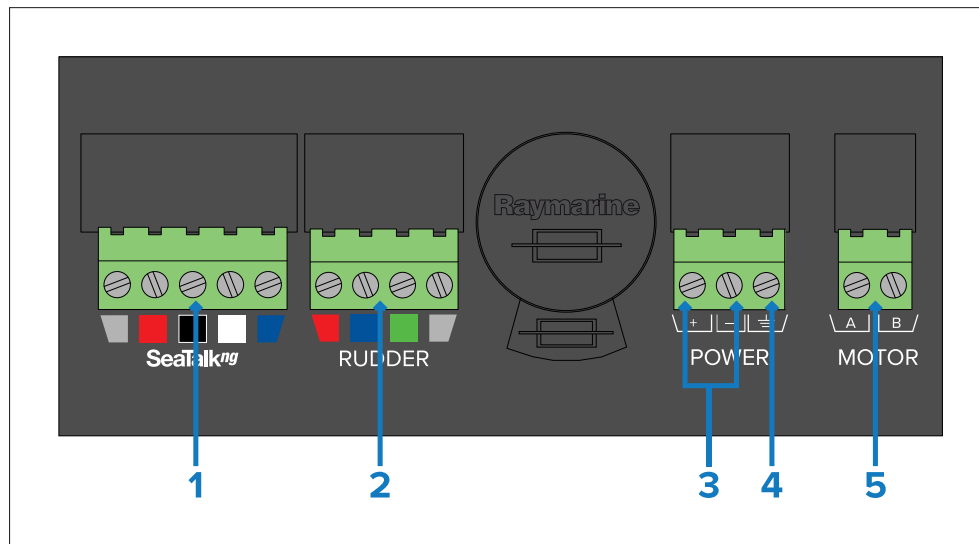
CHAPTER 10: CONNECTIONS (ACU-100 / ACU-150)

CHAPTER CONTENTS

- 10.1 Connections overview — page 57
- 10.2 Evolution-Series minimum system example (ACU-100 / ACU-150) — page 57
- 10.3 Evolution-Series recommended system example (ACU-100 / ACU-150) — page 58
- 10.4 Power connection — page 59
- 10.5 Grounding — Dedicated drain wire required — page 60
- 10.6 Power distribution — page 60
- 10.7 Power and drive cables — page 63
- 10.8 Drive (motor) connection — page 65
- 10.9 SeaTalk NG connection — page 66
- 10.10 Rudder angle reference sensor connection — page 67

10.1 Connections overview

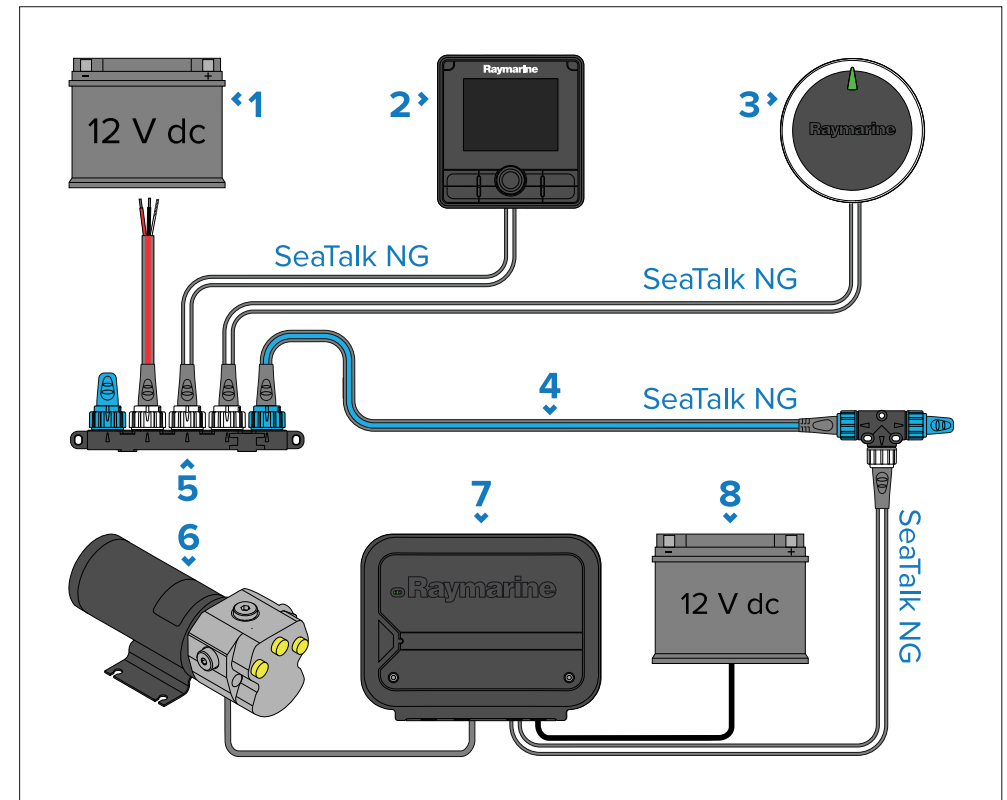
The ACU-100 and ACU-150 includes the following connections:



1. SeaTalk NG connection.
2. Connection for rudder angle reference sensor / transducer (M81105).
3. Power connection.
4. RF Ground connection (drain conductor).
5. Motor (drive) connection.

10.2 Evolution-Series minimum system example (ACU-100 / ACU-150)

The following example provides an overview of an Evolution-Series *minimum system*, including the available connections and types of devices that **must** be connected to your Evolution-Series system when an ACU-100 or ACU-150 is present.



Note:

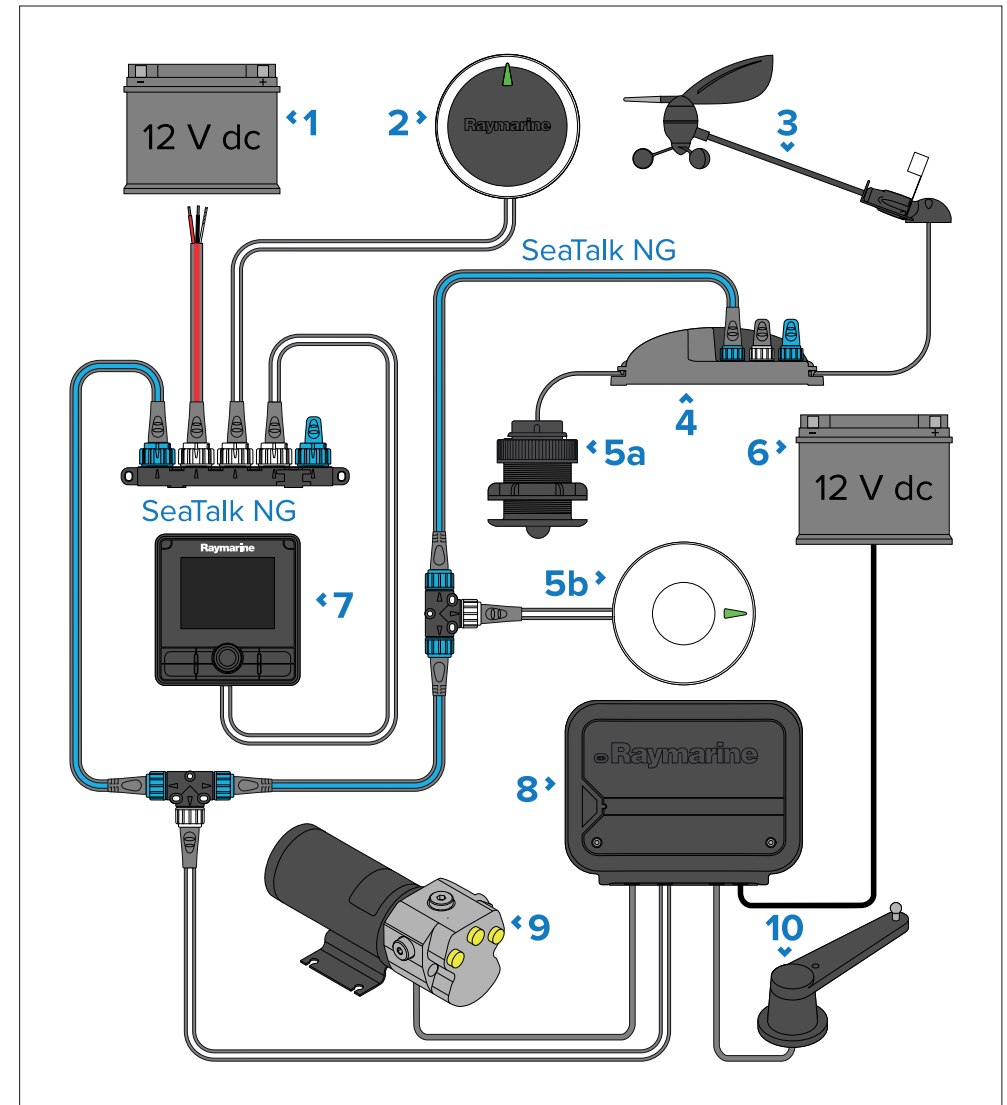
A rudder angle reference sensor / transducer is a highly recommended system component (not shown in the drawing above, but available separately as M81105).

1. 12 V dc power supply (providing power to the SeaTalk NG backbone).

2. Autopilot controller (p70Rs shown).
3. EV-1 sensor.
4. SeaTalk NG backbone.
5. SeaTalk NG 5-way block.
6. Drive unit (hydraulic pump shown).
7. ACU-100 / ACU-150.
8. 12 V dc power supply (providing power to the ACU-100 / ACU-150).

10.3 Evolution-Series recommended system example (ACU-100 / ACU-150)

The following example provides an overview of a *recommended system*, including the available connections and types of devices that can be connected to your system when an ACU-100 or ACU-150 is present.

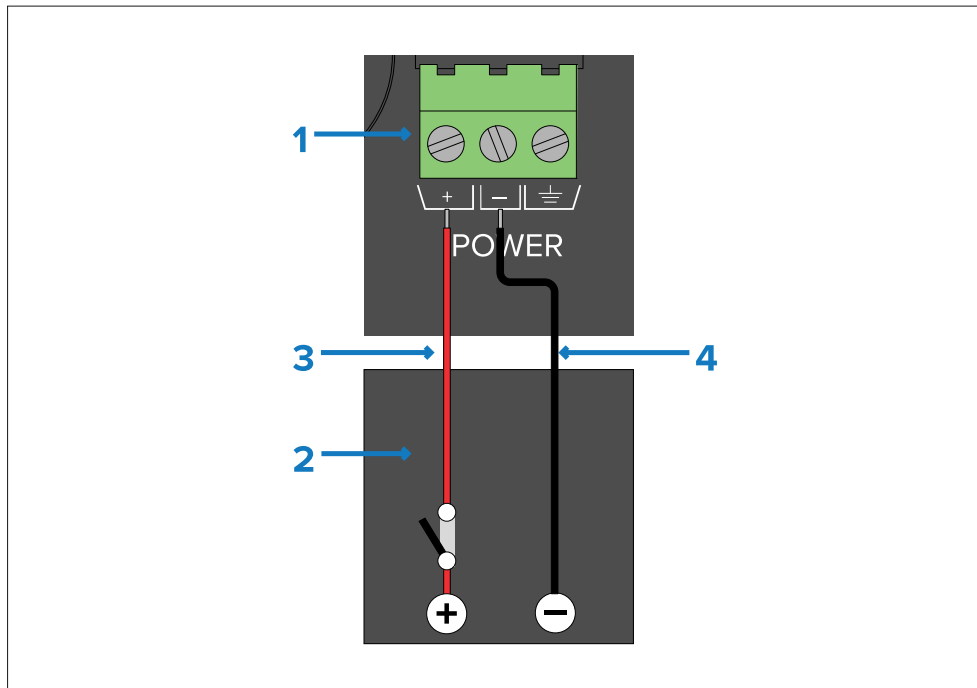


1. 12 V dc power supply (providing power to SeaTalk NG backbone).
2. EV-1 sensor.
3. Wind transducer (only required for Sailing vessels).
4. iTC-5 converter.
5. Speed data source:

- a. Speed transducer (providing STW data), or
- b. GNSS (GPS) Receiver (providing SOG data).
6. 12 V dc power supply (providing power to the ACU-100 / ACU-150).
7. Autopilot controller (p70Rs shown).
8. ACU-100 / ACU-150.
9. Drive unit (hydraulic pump shown).
10. Rudder angle reference sensor / transducer (M81105).

10.4 Power connection

Power to the ACU-100 and ACU-150 must be from an appropriately fused and rated supply.



1. ACU-100 / ACU-150 power connection panel.
2. Vessel power distribution panel.
3. Red wire (positive) — connects to the power supply's positive terminal.

Connections (ACU-100 / ACU-150)

4. Black wire (negative) — connects to the power supply's negative terminal.



Warning: Positive ground systems

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

Fuses and circuit protection

There are 3 levels of power protection in the autopilot system. The drive (motor) and associated cables are initially protected by the current sensing and stall condition detection within the ACU-Series unit's hardware and software. A second level of protection is provided to these parts and the ACU components by the ACU's internal power fuse. Protection for the entire autopilot system and its wiring back to the main power distribution panel is provided by your vessel's circuit breaker / fuse.

Power supply circuit protection

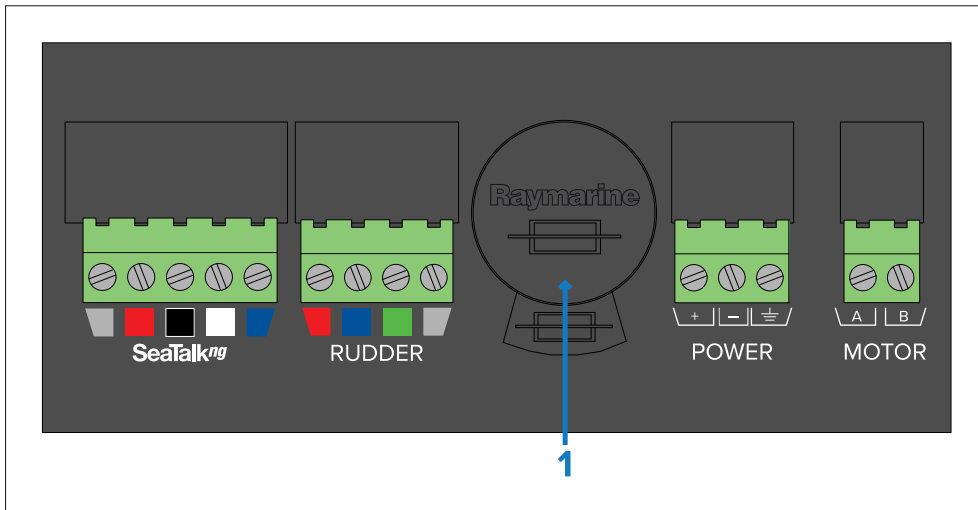
Protect the power supply for the Evolution-Series system at the distribution board with a fuse or circuit breaker that is suitable for the ACU. For guidance, refer to main power fuse rating stated on the ACU connector panel. If in doubt, consult your local dealer.

Internal fuses

The ACU-100 and ACU-150 uses standard automotive blade fuses. Spare fuses are located on the underside of the removable cover.

Note:

For clarity, only the power and fuse-related connections are shown in the illustration below.



1. Internal power fuse (accessible via the removable cover; twist and pull to access).

Internal fuse ratings:

ACU	Internal fuse rating
ACU-100	10A
ACU-150	15A

10.5 Grounding — Dedicated drain wire required

This product includes a dedicated drain conductor (screen) for connection to a vessel's RF ground point.

It is important that an effective RF ground is connected to the unit. The unit can be grounded by connecting the drain conductor (screen) to the vessel's RF ground point. On vessels without an RF ground system the drain conductor (screen) should be connected directly to the negative battery terminal.

The dc power system should be either:

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

If several items require grounding, they may first be connected to a single local point (e.g. within a switch panel), with this point connected via a single, appropriately-rated conductor, to the vessel's common RF ground point.

Implementation

The preferred minimum requirement for the path to ground is via a flat tinned copper braid, with a 30 A rating (1/4 inch) or greater. If this is not possible, an equivalent stranded wire conductor maybe used, rated as follows:

- For runs of <1 m (3 ft), use 6 mm² (#10 AWG) or greater.
- For runs of >1 m (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.

References

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

10.6 Power distribution

Recommendations and best practice.

- The product is NOT supplied with a power cable. For more information on the power cable requirement, refer to the following section: [p.63 — Power and drive cables](#)
- For more information on how to identify the wires in your product's power cable and where to connect them, refer to the *Power connection* section.
- For more information on the implementation of common power distribution scenarios, see below.

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.

Note:

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 — direct connection to battery

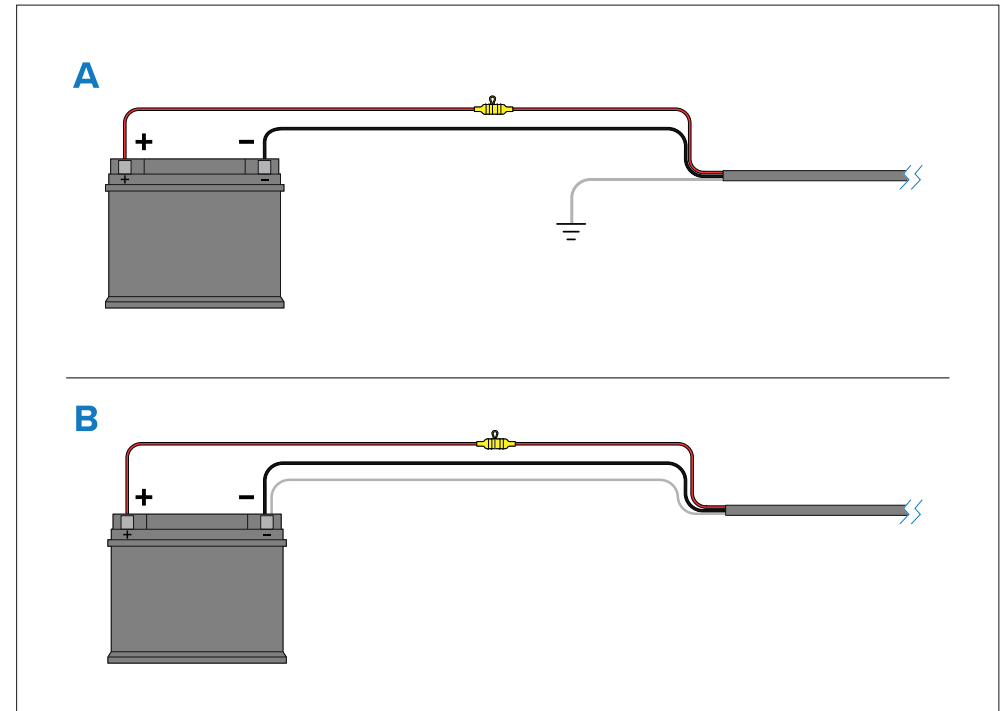
- The unit may be connected directly to the vessel's battery, via a suitably rated fuse or breaker.
- The unit also requires a separate RF Ground (drain) connection, refer to the following section: *Grounding — Dedicated drain wire required.*
- You **MUST** fit a suitably-rated fuse or breaker between the red wire and the battery's positive terminal. **This is required in addition to the internal fuse fitted to the ACU.**
- Refer to the table below for suitable fuse ratings.

Fuse ratings — battery connection via inline fuse

ACU-Series	Inline fuse rating
ACU-100	10A
ACU-150	15A
ACU-200	20A
ACU-300	15A
ACU-400	40A

Important:

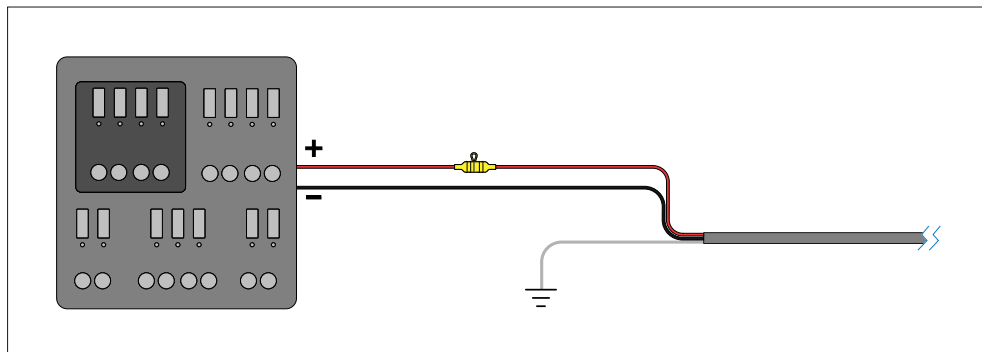
Be aware that the suitable fuse rating is dependent on the number of devices you are connecting.



Battery connection scenario

- A** Suitable for a vessel with a common RF ground point. In this scenario, if your product requires a separate RF Ground (drain) connection then it should be connected to the vessel's common ground point.
- B** Suitable for a vessel without a common grounding point. In this case, if your product requires a separate RF Ground (drain) connection then it should be connected directly to the battery's negative terminal.

Implementation — connection to distribution panel



- Alternatively, the unit's power connection may be connected to a suitable breaker or switch on the vessel's power distribution panel, or factory-fitted power distribution point.
- The distribution point should be fed from the vessel's primary power source by 8AWG (8.36mm²) cable.
- The unit also requires a separate RF Ground (drain) connection, refer to the following section: *Grounding — Dedicated drain wire required.*
- 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 in-line fuses for each power circuit to provide the necessary protection.
- In all cases, observe the recommended breaker ratings provided in the following table.

Thermal breaker ratings — connection via distribution panel

ACU-Series	Thermal breaker rating
ACU-100	10A
ACU-150	15A
ACU-200	20A
ACU-300	15A
ACU-400	40A

Important:

Be aware that the suitable fuse rating for the thermal breaker or fuse is dependent on the number of devices you are connecting.

Grounding

Ensure that you observe the dedicated grounding advice provided.

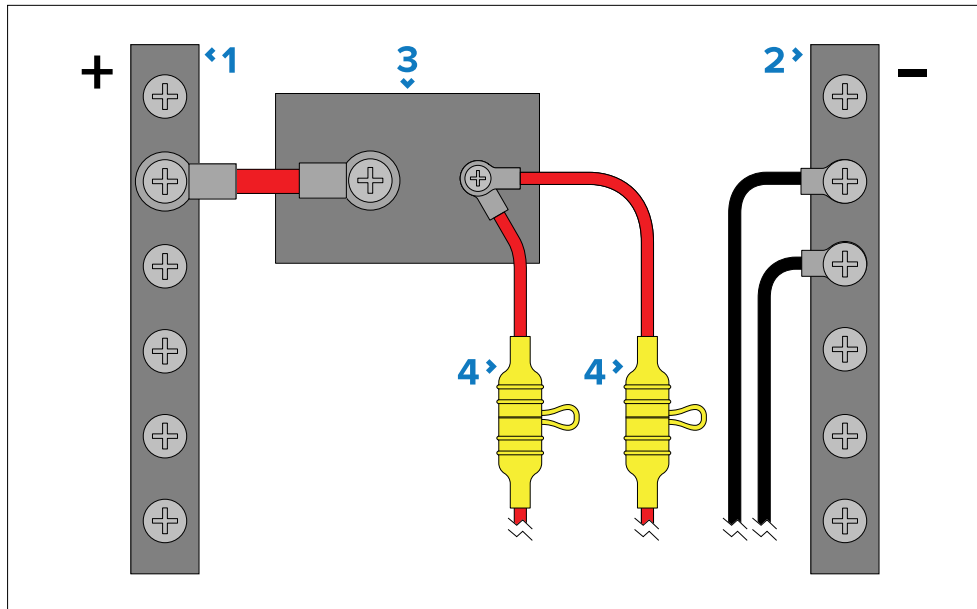
More information

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
- 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

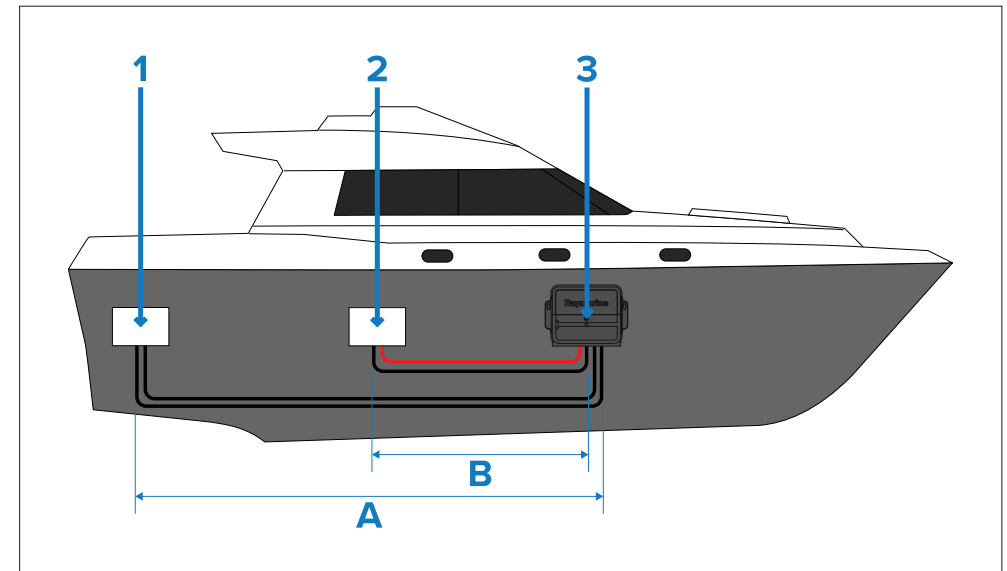
- 1 Positive (+) bar
- 2 Negative (-) bar
- 3 Circuit breaker
- 4 Waterproof fuse holder containing a suitably-rated inline fuse must be fitted. For suitable fuse rating, refer to: *Inline fuse and thermal breaker ratings*.

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.

10.7 Power and drive cables

Important electrical considerations when planning cable runs and equipment location.

The amount of electrical current available to the autopilot system components will be impacted by the length and gauge of the cables used to connect all the components. When determining the cable required for the power and drive connections it is necessary to consider the **combined** cable length of both connections.



1. Drive unit.
2. Power supply / distribution panel.
3. ACU (Actuator Control Unit).

Power and drive cable selection:

Type 0.5 hydraulic pump – (12 V):

Max. length (A+B)	Cable size
Up to 3 m (10 ft)	2.5 mm ² (14 AWG)
Up to 5 m (16 ft)	4 mm ² (12 AWG)
Up to 7 m (23 ft)	6 mm ² (10 AWG)

Max. length (A+B)	Cable size
Up to 10 m (32 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Type 1 drive / CR pump (ACU-300 only) — (12 V):

Max. length (A+B)	Cable size
Up to 3 m (10 ft)	2.5 mm ² (14 AWG)
Up to 5 m (16 ft)	4 mm ² (12 AWG)
Up to 7 m (23 ft)	6 mm ² (10 AWG)
Up to 10 m (32 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Type 2 drive — (12 V):

Max. length (A+B)	Cable size
Up to 5 m (16 ft)	6 mm ² (10 AWG)
Up to 7 m (23 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Type 2 drive — (24 V):

Max. length (A+B)	Cable size
Up to 3 m (10 ft)	4 mm ² (12 AWG)
Up to 5 m (16 ft)	6 mm ² (10 AWG)
Up to 10 m (32 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Type 3 drive — (12 V):

Max. length (A+B)	Cable size
Up to 5 m (16 ft)	10 mm ² (8 AWG)
Up to 7 m (23 ft)	16 mm ² (6 AWG)
Up to 16 m (52 ft)	25 mm ² (4 AWG)

Type 3 drive — (24 V):

Max. length (A+B)	Cable size
Up to 5 m (16 ft)	6 mm ² (10 AWG)
Up to 7 m (23 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Wheel drive; Sail — (12 V):

Max. length (A+B)	Cable size
Up to 3 m (10 ft)	2.5 mm ² (14 AWG)
Up to 5 m (16 ft)	4 mm ² (12 AWG)
Up to 7 m (23 ft)	6 mm ² (10 AWG)
Up to 10 m (32 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Wheel drive; Power (Sport Drive) — (12 V):

Max. length (A+B)	Cable size
Up to 3 m (10 ft)	2.5 mm ² (14 AWG)
Up to 5 m (16 ft)	4 mm ² (12 AWG)
Up to 7 m (23 ft)	6 mm ² (10 AWG)
Up to 10 m (32 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Tiller drive — (12 V):

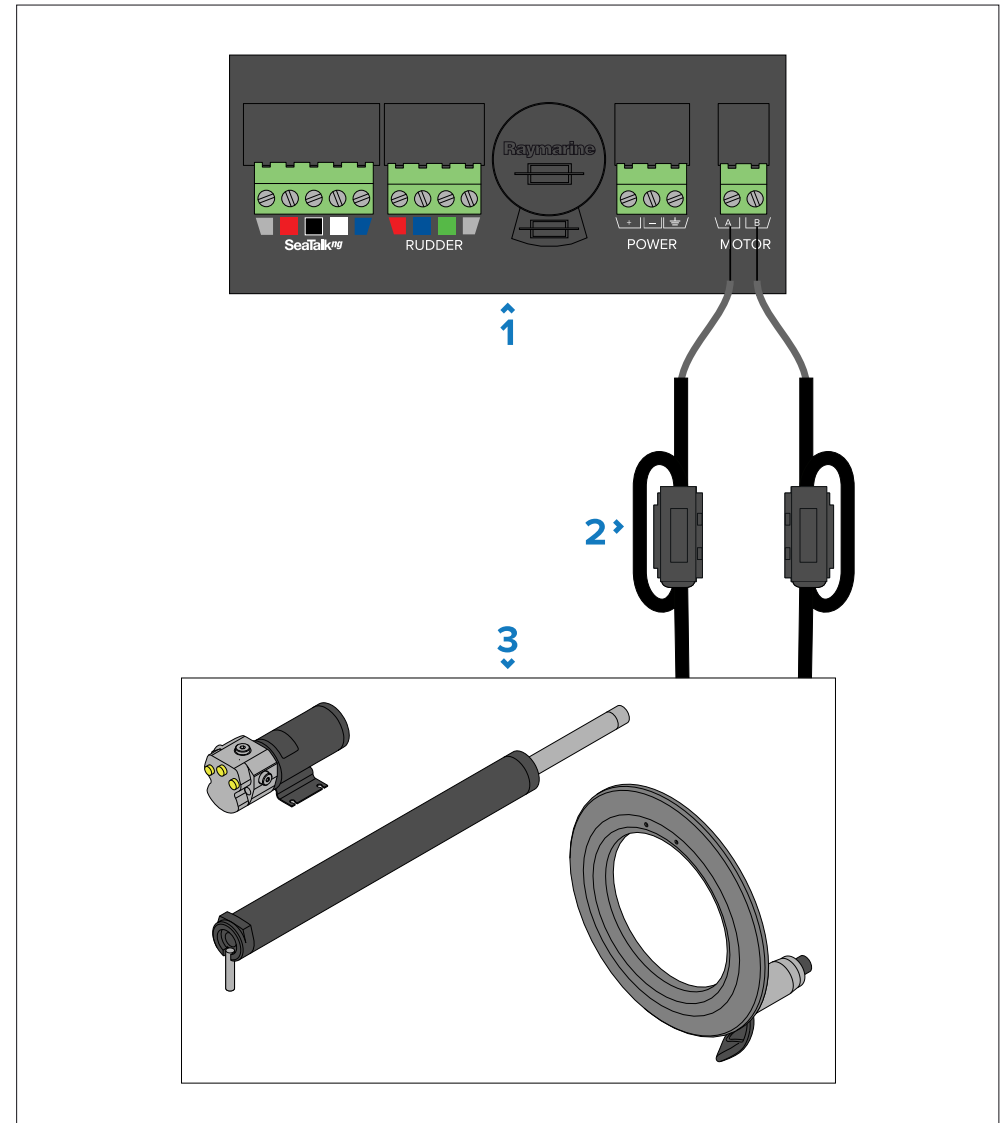
Max. length (A+B)	Cable size
Up to 2.5 m (8 ft)	1.0 mm ² (18 AWG)
Up to 4 m (13 ft)	1.5 mm ² (16 AWG)
Up to 6 m (22 ft)	2.5 mm ² (14 AWG)

Important:

Use of an incorrect power cable size will reduce the power supplied to the drive unit and could cause your autopilot to malfunction. If in doubt, use a heavier gauge cable. Keep cable runs to a minimum where possible, and also observe the guidance provided in the location requirements section of this document.

10.8 Drive (motor) connection

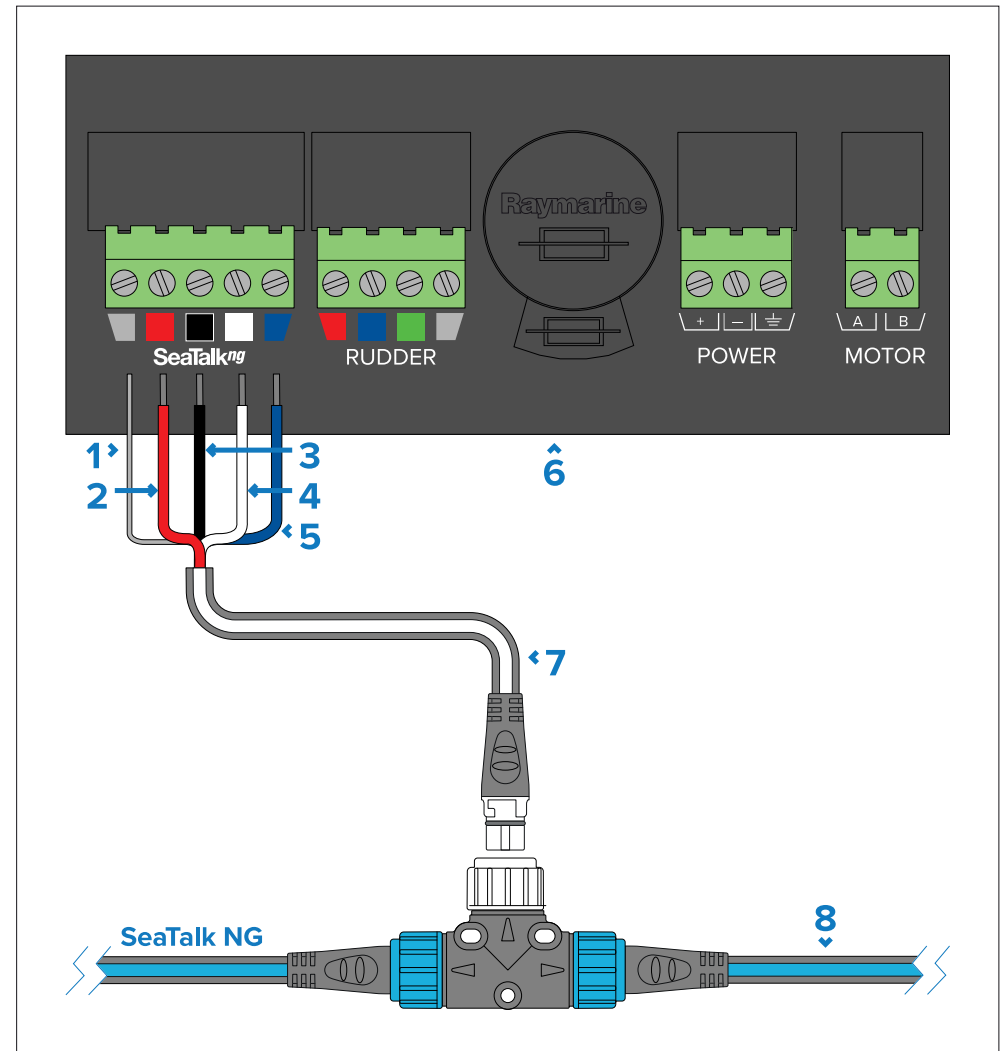
The motor connects to the connection panel of the ACU-100 and ACU-150.



2. Cable ferrite: 1x ferrite must be fitted to the “A” Motor cable, and 1x ferrite must be fitted to the “B” Motor cable. Each cable must be looped around the ferrite, as shown.
3. Motor drive (e.g. tiller drive, wheel drive or hydraulic pump).

10.9 SeaTalk NG connection

The ACU-100 and ACU-150 connects to the SeaTalk NG backbone using the supplied spur cable.



Important:

The connection colors for the motor cables may be different depending on the motor type. For more information, refer to the Installation Instructions for the relevant drive unit.

Important:

The ACU-100 and ACU-150 do NOT provide power to the SeaTalk NG backbone. The backbone requires a separate 12 V dc power supply.

1. Drain (screen).
2. Positive (+) 12 V dc (red wire).
3. Negative (-) 0 V dc (black wire).
4. CAN HI (white wire).
5. CAN LO (blue wire).
6. ACU-100 / ACU-150 connector panel.
7. SeaTalk NG spur cable (supplied).
8. SeaTalk NG backbone.

10.10 Rudder angle reference sensor connection

A rudder angle reference sensor / transducer can be connected to the ACU to provide rudder angle information to the autopilot system.

The connection of a rudder angle reference sensor / transducer is highly recommended, to help ensure optimum autopilot performance.

Note:

The rudder angle reference sensor / transducer is not included with all autopilot products or system packs. Consult the Raymarine website or your local dealer for a full list of the components included with your autopilot system. The rudder angle reference sensor / transducer is also available separately (M81105).

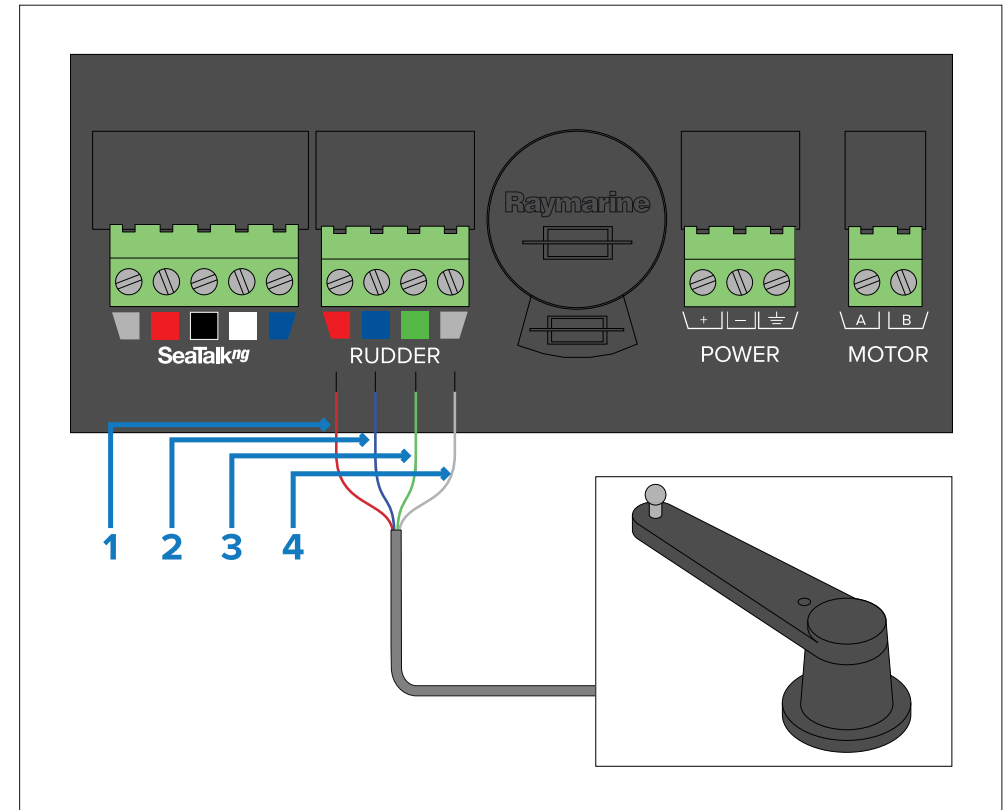
A rudder angle reference sensor / transducer converts its movement information to rudder angle in +/- degrees.

Certain environmental conditions such as cross-current can cause the autopilot system to steer persistently to port or starboard, even when the rudder is centered. With a rudder angle reference sensor / transducer connected to your autopilot system, you can use an autopilot control head to specify an offset angle in +/- degrees to compensate for inaccurate rudder angle information caused by such conditions.

The more accurate the rudder angle information, the more accurately the autopilot system can keep to a correct course.

[Connections \(ACU-100 / ACU-150\)](#)

The rudder angle reference sensor / transducer connection to the Raymarine connection panel is shown below.



1. Red wire.
2. Blue wire.
3. Green wire.
4. Gray (screen) wire.

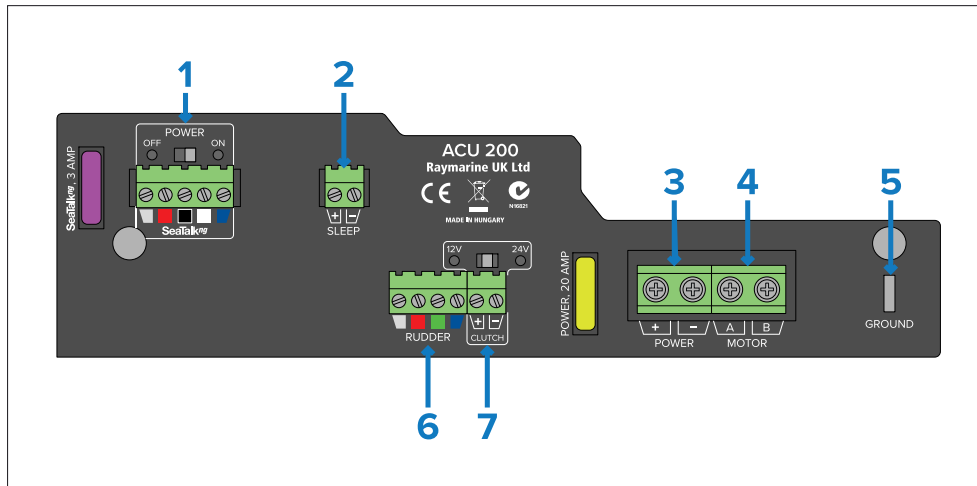
CHAPTER 11: ACU-200, ACU-300, ACU-400 CONNECTIONS

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- 11.1 Connections overview (ACU-200) — page 69
- 11.2 Connections overview (ACU-300) — page 69
- 11.3 Connections overview (ACU-400) — page 70
- 11.4 Evolution-Series minimum system example (ACU-200 / ACU-400) — page 70
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- 11.8 Power distribution — page 73
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11.1 Connections overview (ACU-200)

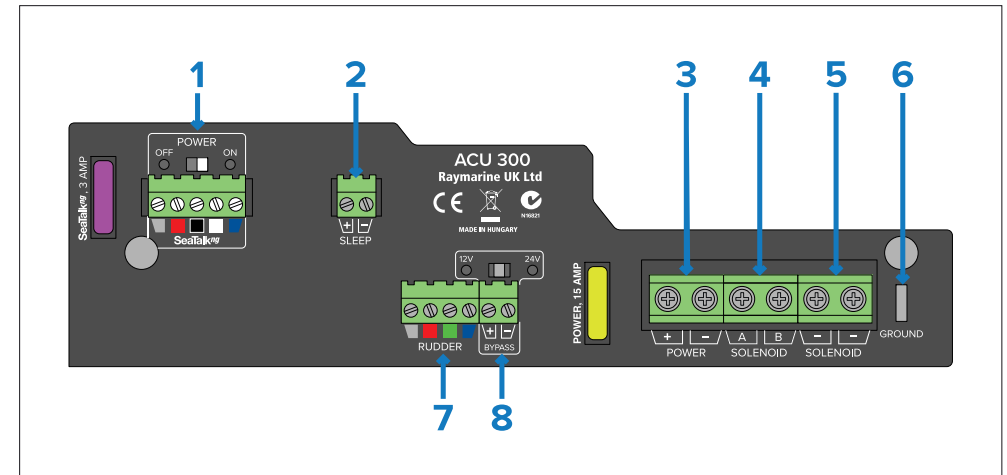
The ACU-200 includes the following connections:



1. SeaTalk NG connection.
2. Sleep switch connection.
3. Power connection.
4. Motor (drive) connection.
5. RF ground connection (drain conductor).
6. Connection for rudder angle reference sensor / transducer (M81105).
7. Clutch connection — selectable between 12 / 24 V dc to suit connected device.

11.2 Connections overview (ACU-300)

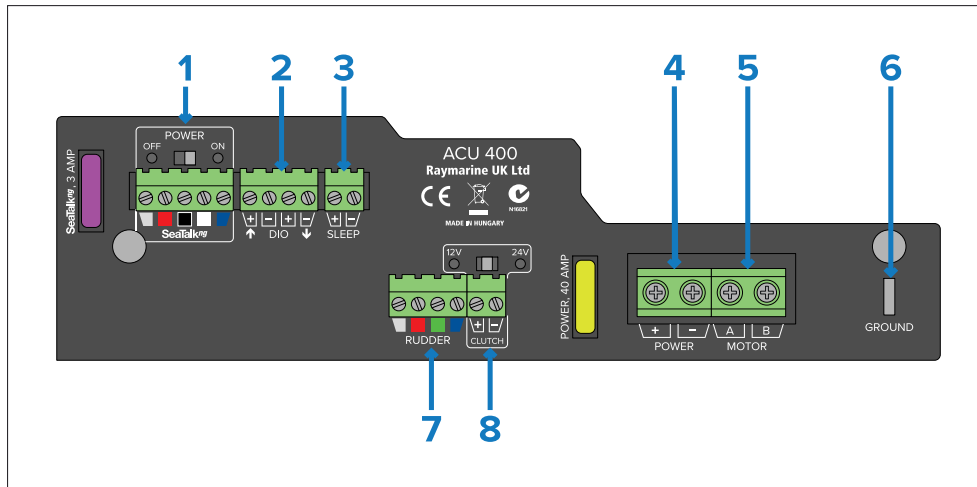
The ACU-300 includes the following connections:



1. SeaTalk NG connection.
2. Sleep switch connection.
3. Power connection.
4. Solenoid (Spool Valve) A and B drive out connection.
5. Solenoid (Spool Valve) drive return connection.
6. RF ground connection (drain conductor).
7. Connection for rudder angle reference sensor / transducer (M81105).
A rudder angle reference sensor / transducer is an essential system component for ACU-300 systems.
8. Bypass valve connection (solenoid drive output) — selectable between 12 / 24 V dc.

11.3 Connections overview (ACU-400)

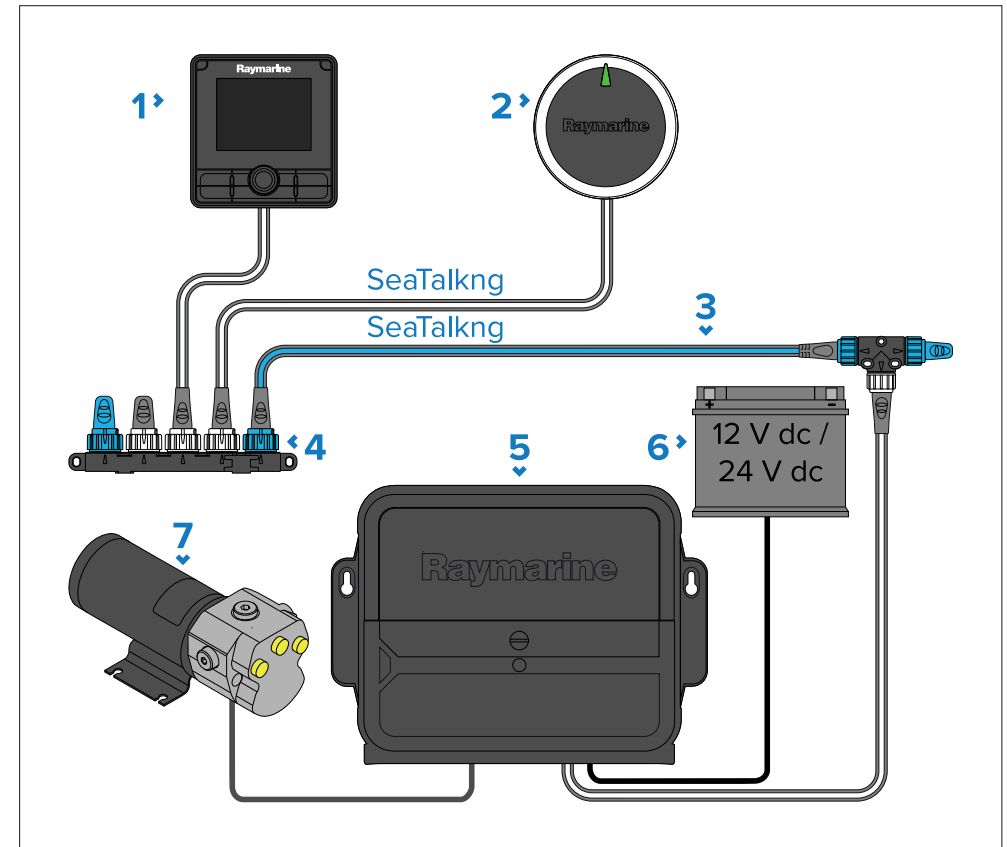
The ACU-400 includes the following connections:



1. SeaTalk NG connection.
2. Digital input / output connection.
3. Sleep switch connection.
4. Power connection.
5. Motor (drive) connection.
6. RF ground connection (drain conductor).
7. Connection for rudder angle reference sensor / transducer (M81105).
8. Clutch connection — selectable between 12 / 24 V dc to suit connected device.

11.4 Evolution-Series minimum system example (ACU-200 / ACU-400)

The following example provides an overview of an Evolution-Series *minimum system*, including the available connections and types of devices that **must** be connected to your Evolution-Series system when an ACU-200 or ACU-400 is present.



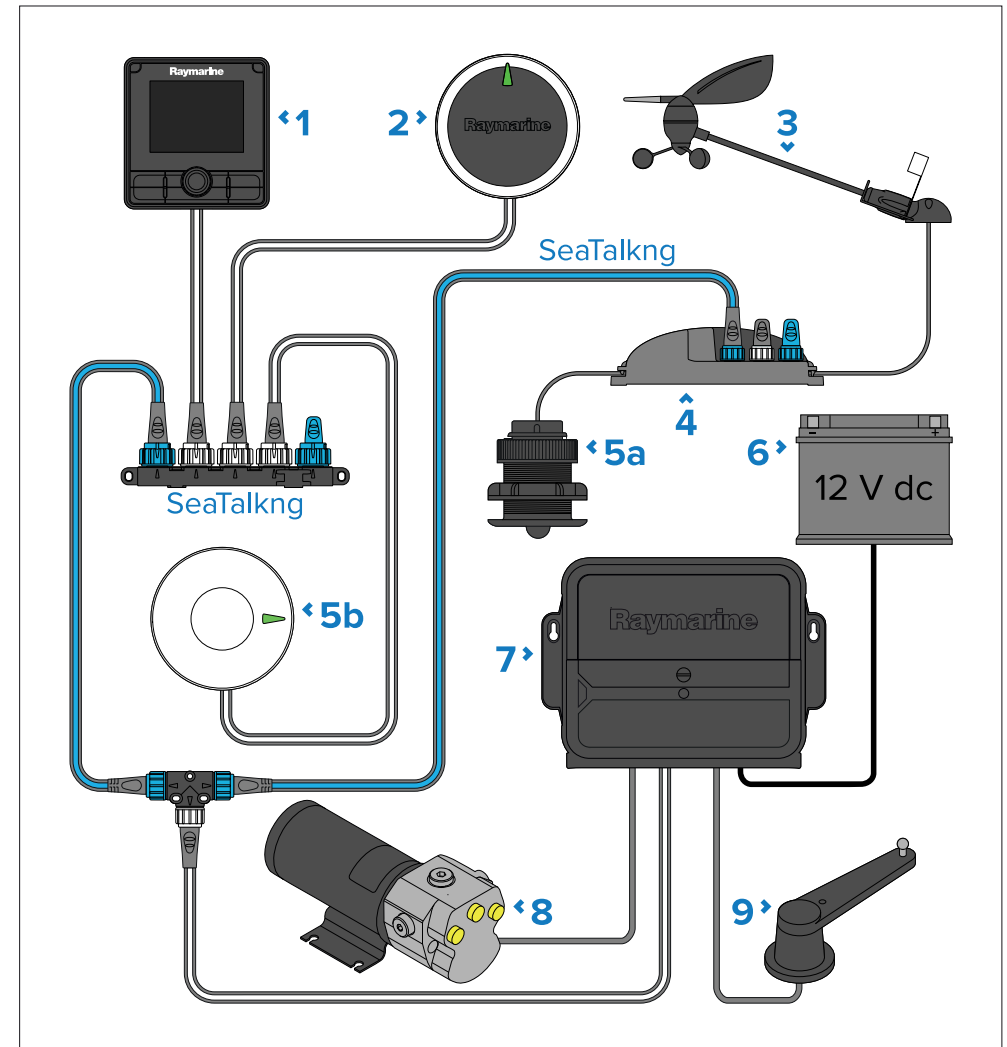
Note:

A rudder angle reference sensor / transducer is a highly recommended system component (not shown in the drawing above, but available separately as M81105).

1. Autopilot controller (e.g. P70Rs).
2. EV-1 sensor.
3. SeaTalk NG backbone.
4. SeaTalk NG 5-way block.
5. ACU-200 / ACU-400.
6. 12 V / 24 V dc power supply (providing power to the ACU-200 / ACU-400 and SeaTalk NG backbone).
7. Drive unit (e.g. hydraulic pump).

11.5 Evolution-Series recommended system example (ACU-200 / ACU-300 / ACU-400)

The following example provides an overview of an Evolution-Series *recommended system*, including the available connections and types of devices that can be connected to your autopilot system when an ACU-200 or ACU-400 is present, which **must** be connected to your Evolution-Series system when an ACU-300 is present.

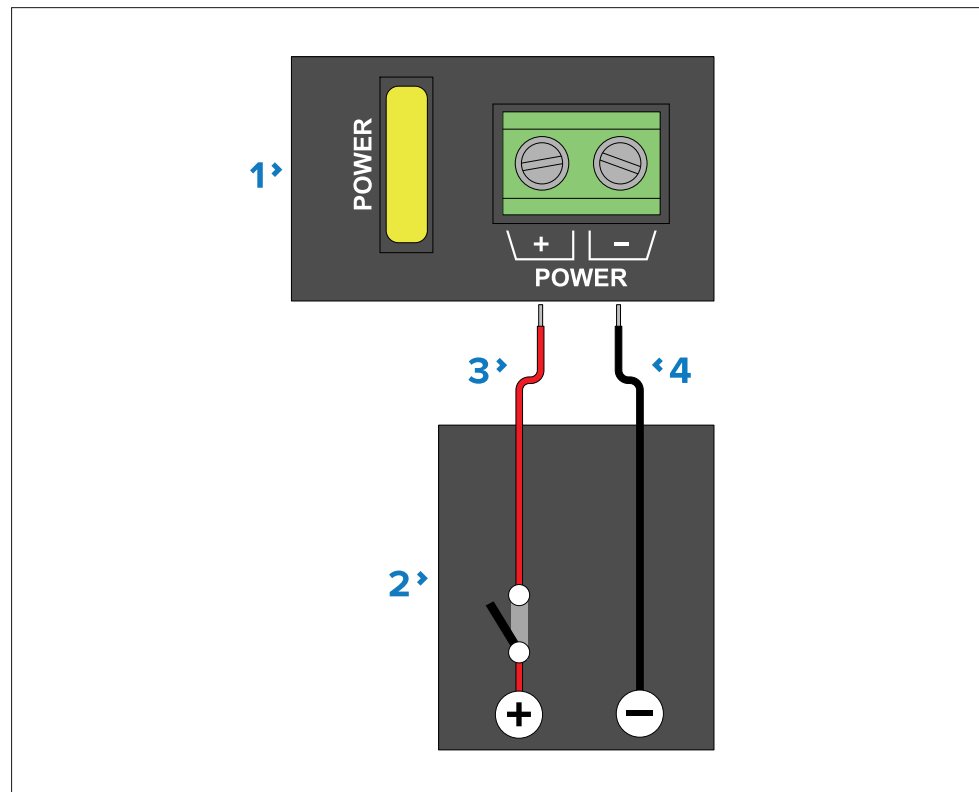


1. Autopilot controller (e.g. P70Rs).
2. EV-1 sensor.
3. Wind transducer (only required for Sailing vessels).
4. iTC-5 converter.
5. Speed data source:
 - a. Speed transducer (providing STW data), or

- b. GNSS (GPS) Receiver (providing SOG data).
6. 12 V / 24 V dc power supply (providing power to the ACU and SeaTalk NG backbone).
7. ACU-200 / ACU-300 / ACU-400.
8. Drive unit (e.g. hydraulic pump).
9. Rudder angle reference sensor / transducer (M81105) — This is **essential for ACU-300** systems, and highly recommended for all other systems.

11.6 Power connection

Power to the ACU-200 / ACU-300 / ACU-400 must be from an appropriately fused and rated supply.



1. ACU-200 / ACU-300 / ACU-400 power connection panel.

2. Vessel power distribution panel.
3. Red wire (positive) — connects to the power supply's positive terminal.
4. Black wire (negative) — connects to the power supply's negative terminal.



Warning: Positive ground systems

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

Fuses and circuit protection

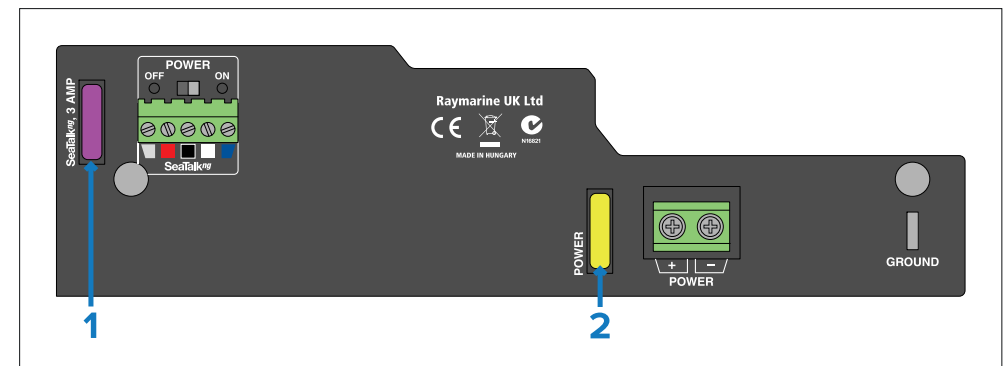
There are 3 levels of power protection in the autopilot system. The drive (motor) and associated cables are initially protected by the current sensing and stall condition detection within the ACU-Series unit's hardware and software. A second level of protection is provided to these parts and the ACU components by the ACU's internal power fuse. Protection for the entire autopilot system and its wiring back to the main power distribution panel is provided by your vessel's circuit breaker / fuse.

Power supply circuit protection

Protect the power supply for the Evolution-Series system at the distribution board with a fuse or circuit breaker that is suitable for the ACU. For guidance, refer to main power fuse rating stated on the ACU connector panel. If in doubt, consult your local dealer.

Internal fuses

The ACU-200 / ACU-300 / ACU-400 uses standard automotive blade fuses. Spare fuses are located on the underside of the removable cover.



Note:

For clarity, only the power and fuse-related connections are shown in the illustration above.

1. SeaTalk NG fuse (fuse power supply from the ACU-200 / ACU-300 / ACU-400 to the SeaTalk NG backbone).
2. Internal power fuse (labelled with total power consumed by system).

Internal fuse ratings:

Internal fuse	Internal fuse rating
SeaTalk NG	3A
ACU-200	20A
ACU-300	15A
ACU-400	40A

11.7 Grounding — Dedicated drain wire required

This product includes a dedicated drain conductor (screen) for connection to a vessel's RF ground point.

It is important that an effective RF ground is connected to the unit. The unit can be grounded by connecting the drain conductor (screen) to the vessel's RF ground point. On vessels without an RF ground system the drain conductor (screen) should be connected directly to the negative battery terminal.

The dc power system should be either:

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

If several items require grounding, they may first be connected to a single local point (e.g. within a switch panel), with this point connected via a single, appropriately-rated conductor, to the vessel's common RF ground point.

Implementation

The preferred minimum requirement for the path to ground is via a flat tinned copper braid, with a 30 A rating (1/4 inch) or greater. If this is not possible, an equivalent stranded wire conductor maybe used, rated as follows:

- For runs of <1 m (3 ft), use 6 mm² (#10 AWG) or greater.
- For runs of >1 m (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.

References

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

11.8 Power distribution

Recommendations and best practice.

- The product is NOT supplied with a power cable. For more information on the power cable requirement, refer to the following section: [p.76 — Power and drive cables](#)
- For more information on how to identify the wires in your product's power cable and where to connect them, refer to the *Power connection* section.
- For more information on the implementation of common power distribution scenarios, see below.

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.

Note:

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 — direct connection to battery

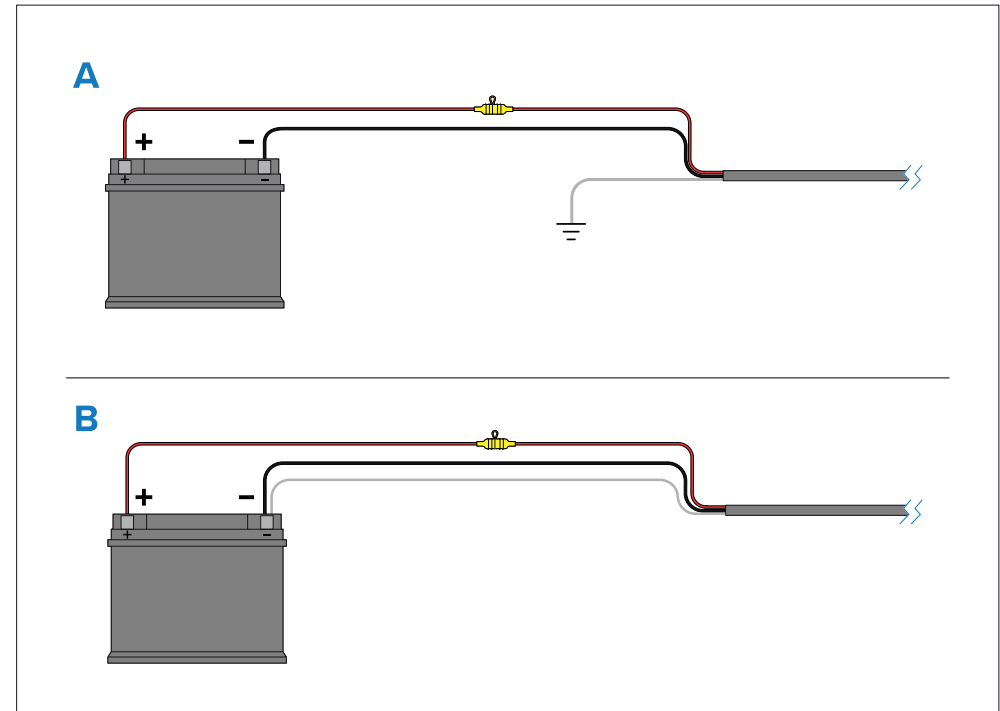
- The unit may be connected directly to the vessel's battery, via a suitably rated fuse or breaker.
- The unit also requires a separate RF Ground (drain) connection, refer to the following section: *Grounding — Dedicated drain wire required.*
- You **MUST** fit a suitably-rated fuse or breaker between the red wire and the battery's positive terminal. **This is required in addition to the internal fuse fitted to the ACU.**
- Refer to the table below for suitable fuse ratings.

Fuse ratings — battery connection via inline fuse

ACU-Series	Inline fuse rating
ACU-100	10A
ACU-150	15A
ACU-200	20A
ACU-300	15A
ACU-400	40A

Important:

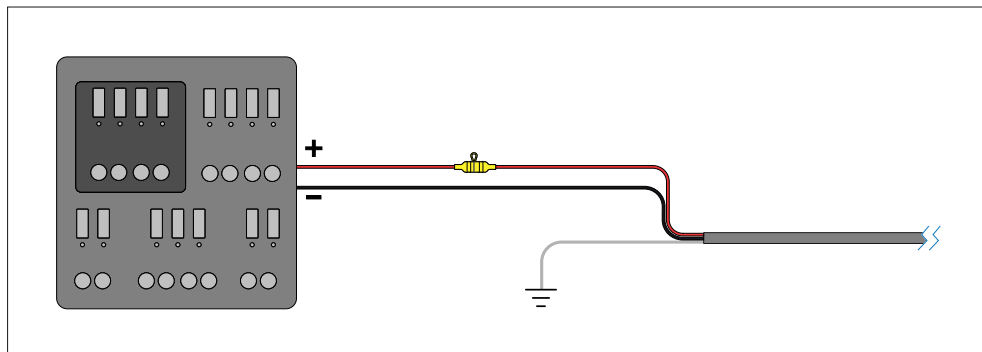
Be aware that the suitable fuse rating is dependent on the number of devices you are connecting.



Battery connection scenario

- A** Suitable for a vessel with a common RF ground point. In this scenario, if your product requires a separate RF Ground (drain) connection then it should be connected to the vessel's common ground point.
- B** Suitable for a vessel without a common grounding point. In this case, if your product requires a separate RF Ground (drain) connection then it should be connected directly to the battery's negative terminal.

Implementation — connection to distribution panel



- Alternatively, the unit's power connection may be connected to a suitable breaker or switch on the vessel's power distribution panel, or factory-fitted power distribution point.
- The distribution point should be fed from the vessel's primary power source by 8AWG (8.36mm²) cable.
- The unit also requires a separate RF Ground (drain) connection, refer to the following section: *Grounding — Dedicated drain wire required.*
- 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 in-line fuses for each power circuit to provide the necessary protection.
- In all cases, observe the recommended breaker ratings provided in the following table.

Thermal breaker ratings — connection via distribution panel

ACU-Series	Thermal breaker rating
ACU-100	10A
ACU-150	15A
ACU-200	20A
ACU-300	15A
ACU-400	40A

Important:

Be aware that the suitable fuse rating for the thermal breaker or fuse is dependent on the number of devices you are connecting.

Grounding

Ensure that you observe the dedicated grounding advice provided.

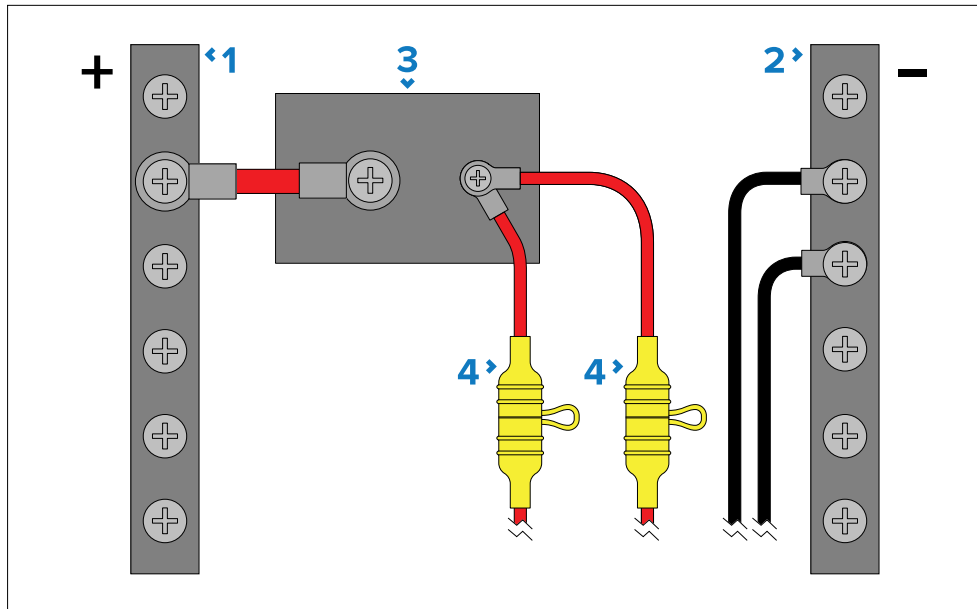
More information

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
- 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

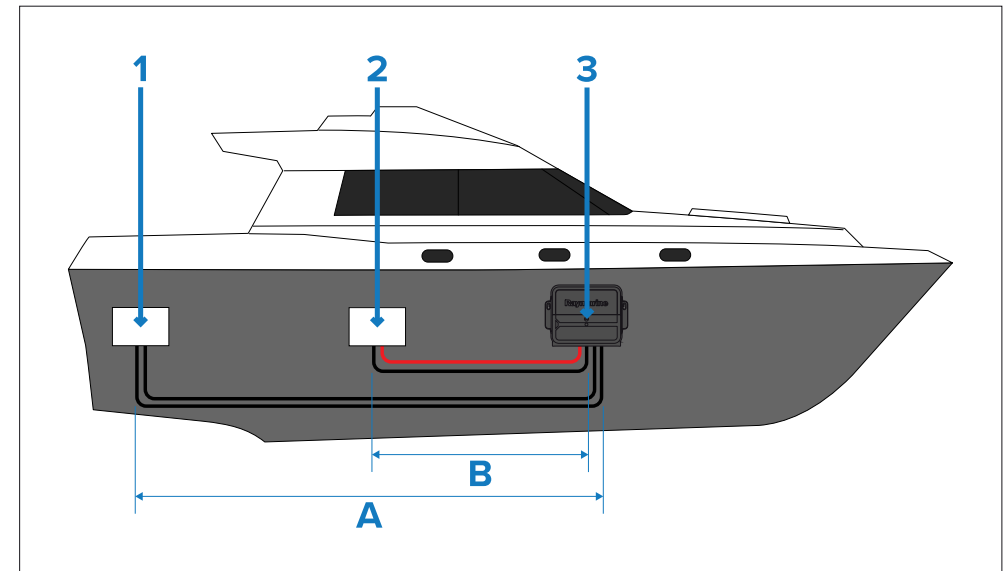
- 1 Positive (+) bar
- 2 Negative (-) bar
- 3 Circuit breaker
- 4 Waterproof fuse holder containing a suitably-rated inline fuse must be fitted. For suitable fuse rating, refer to: *Inline fuse and thermal breaker ratings*.

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.

11.9 Power and drive cables

Important electrical considerations when planning cable runs and equipment location.

The amount of electrical current available to the autopilot system components will be impacted by the length and gauge of the cables used to connect all the components. When determining the cable required for the power and drive connections it is necessary to consider the **combined** cable length of both connections.



1. Drive unit.
2. Power supply / distribution panel.
3. ACU (Actuator Control Unit).

Power and drive cable selection:

Type 0.5 hydraulic pump – (12 V):

Max. length (A+B)	Cable size
Up to 3 m (10 ft)	2.5 mm ² (14 AWG)
Up to 5 m (16 ft)	4 mm ² (12 AWG)
Up to 7 m (23 ft)	6 mm ² (10 AWG)

Max. length (A+B)	Cable size
Up to 10 m (32 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Type 1 drive / CR pump (ACU-300 only) — (12 V):

Max. length (A+B)	Cable size
Up to 3 m (10 ft)	2.5 mm ² (14 AWG)
Up to 5 m (16 ft)	4 mm ² (12 AWG)
Up to 7 m (23 ft)	6 mm ² (10 AWG)
Up to 10 m (32 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Type 2 drive — (12 V):

Max. length (A+B)	Cable size
Up to 5 m (16 ft)	6 mm ² (10 AWG)
Up to 7 m (23 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Type 2 drive — (24 V):

Max. length (A+B)	Cable size
Up to 3 m (10 ft)	4 mm ² (12 AWG)
Up to 5 m (16 ft)	6 mm ² (10 AWG)
Up to 10 m (32 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Type 3 drive — (12 V):

Max. length (A+B)	Cable size
Up to 5 m (16 ft)	10 mm ² (8 AWG)
Up to 7 m (23 ft)	16 mm ² (6 AWG)
Up to 16 m (52 ft)	25 mm ² (4 AWG)

Type 3 drive — (24 V):

ACU-200, ACU-300, ACU-400 connections

Max. length (A+B)	Cable size
Up to 5 m (16 ft)	6 mm ² (10 AWG)
Up to 7 m (23 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Wheel drive; Sail — (12 V):

Max. length (A+B)	Cable size
Up to 3 m (10 ft)	2.5 mm ² (14 AWG)
Up to 5 m (16 ft)	4 mm ² (12 AWG)
Up to 7 m (23 ft)	6 mm ² (10 AWG)
Up to 10 m (32 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Wheel drive; Power (Sport Drive) — (12 V):

Max. length (A+B)	Cable size
Up to 3 m (10 ft)	2.5 mm ² (14 AWG)
Up to 5 m (16 ft)	4 mm ² (12 AWG)
Up to 7 m (23 ft)	6 mm ² (10 AWG)
Up to 10 m (32 ft)	10 mm ² (8 AWG)
Up to 16 m (52 ft)	16 mm ² (6 AWG)

Tiller drive — (12 V):

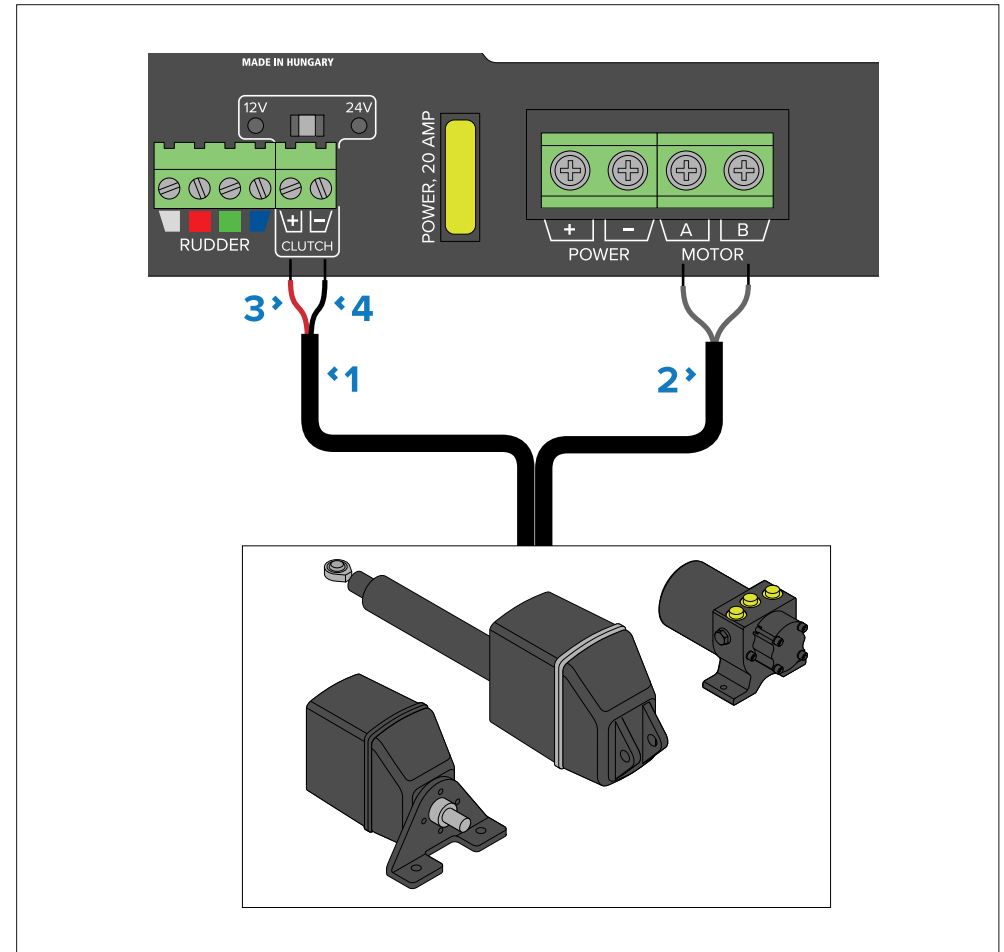
Max. length (A+B)	Cable size
Up to 2.5 m (8 ft)	1.0 mm ² (18 AWG)
Up to 4 m (13 ft)	1.5 mm ² (16 AWG)
Up to 6 m (22 ft)	2.5 mm ² (14 AWG)

Important:

Use of an incorrect power cable size will reduce the power supplied to the drive unit and could cause your autopilot to malfunction. If in doubt, use a heavier gauge cable. Keep cable runs to a minimum where possible, and also observe the guidance provided in the location requirements section of this document.

11.10 Motor (drive) and clutch connection (ACU-200 / ACU-400)

The motor connects to the connection panel of the ACU.



1. Clutch (not all motors have this connection).
2. Motor (not all compatible variants are shown in the illustration above).

Clutch connection colors:

	Color	Description
3	Red	Clutch Positive (+) connection
4	Blue	Clutch Negative (-) connection

Motor power output

ACU-200	ACU-400
15 A (maximum continuous output)	30 A (maximum continuous output)

Note:

The motor output has full short-circuit and over-current protection. Should either of the motor output connections be shorted to ground, there should be no permanent damage to the autopilot.

Clutch power output

ACU-200	ACU-400
Up to 2 A continuous at 12 V on 12 V and 24 V systems.	<ul style="list-style-type: none"> Up to 4 A continuous at 12 V on 12 V systems. Up to 4 A continuous at 24 V on 24 V systems. Up to 4 A continuous at 12 V on 24 V systems.

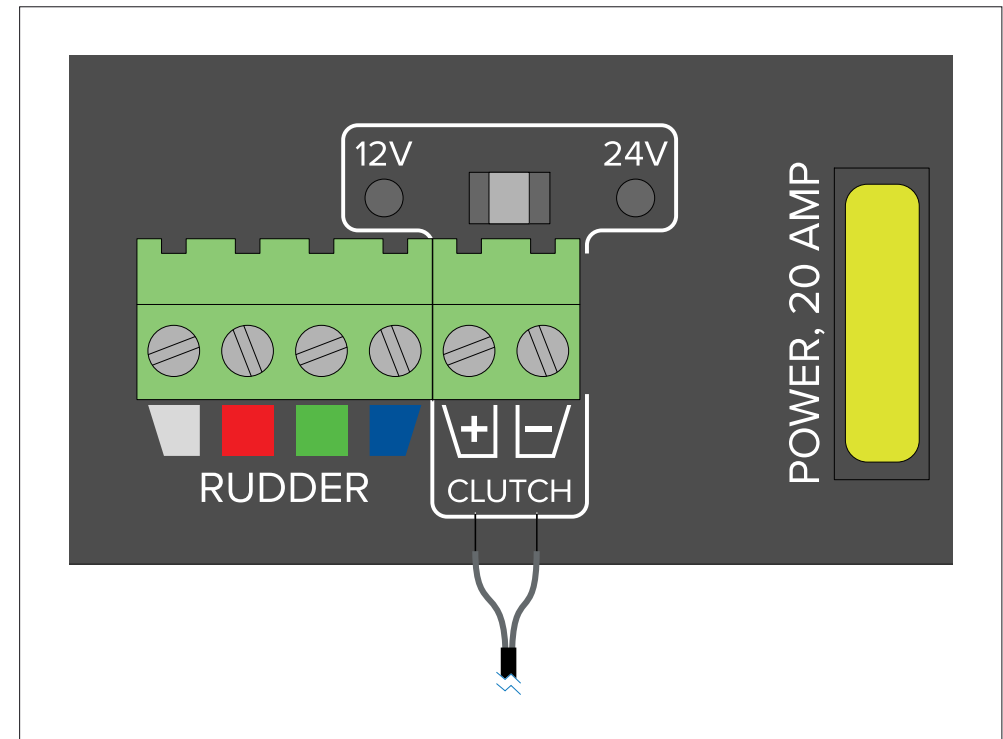
Note:

The use of a clutch drive will have an impact on the amount of electrical current available to the SeaTalk NG backbone. On 24 V systems, there is an 8 A / 12 V maximum supply for the SeaTalk NG backbone and clutch drive **combined**. For example, if the clutch requires 4 A, the SeaTalk NG supply can only deliver 4 A to the rest of the backbone.

Note:

The clutch output has full short-circuit and over-current protection. Should either of the clutch output connections be shorted to ground, there should be no permanent damage to the autopilot.

Clutch voltage switch



If the drive has a separate clutch connection, you must ensure that the clutch voltage switch on the ACU is set correctly to suit the connected drive.

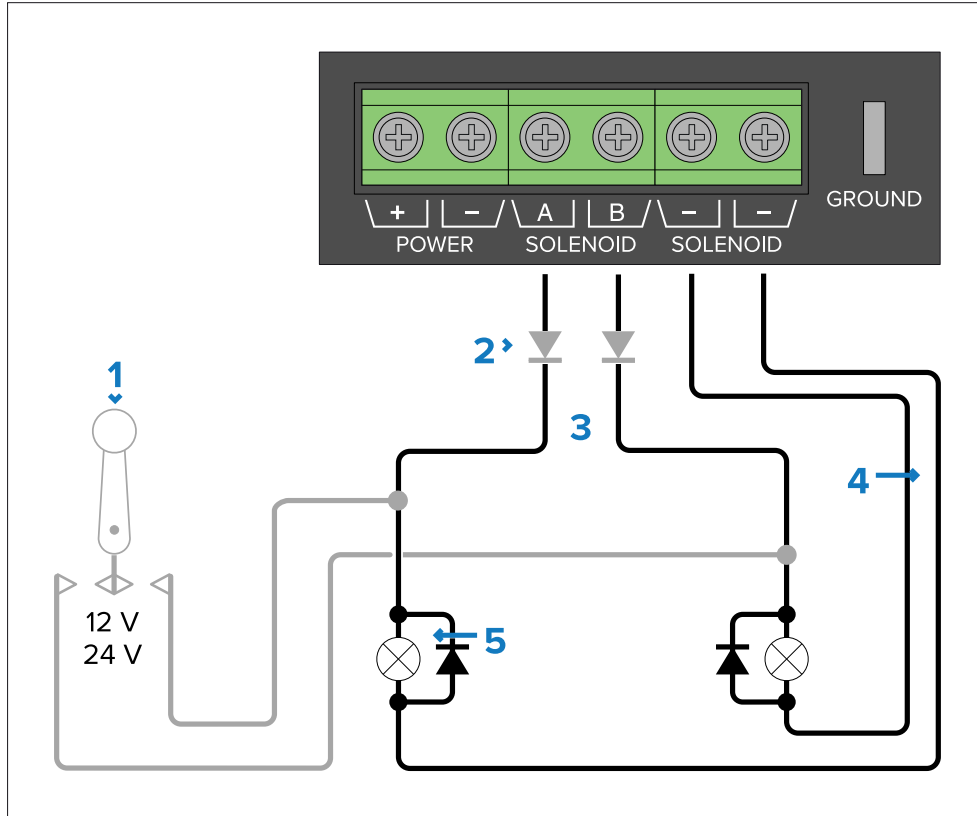
Important:

To avoid potential damage to equipment, ensure voltage selector switch is set to the correct setting. The clutch voltage may be different from that of the drive itself, for example the range of both 12 V and 24 V Raymarine drives all have a 12 V clutch. If in doubt, consult your local dealer.

11.11 Solenoid (drive) and bypass valve connection (ACU-300)

Constant Running Pump (solenoid) drives connect to the connection panel of the ACU-300 as follows:

Solenoid drive connection



1. Electronic steering / jog lever (if required).
2. Back-feed protection diodes (if using an electronic steering or jog lever).
3. Solenoid out.
4. Solenoid return.
5. Solenoid valves (with diodes across spool valves).

Note:

If an electronic steering or jog lever is used, fit diodes (suggested type: 1N4004) in-line with the solenoid outputs to prevent back-feeding the ACU-300.

Bypass valve connection and voltage switch

Some drives feature an electrically-operated bypass valve to minimize the effect on the steering when the autopilot is in standby.

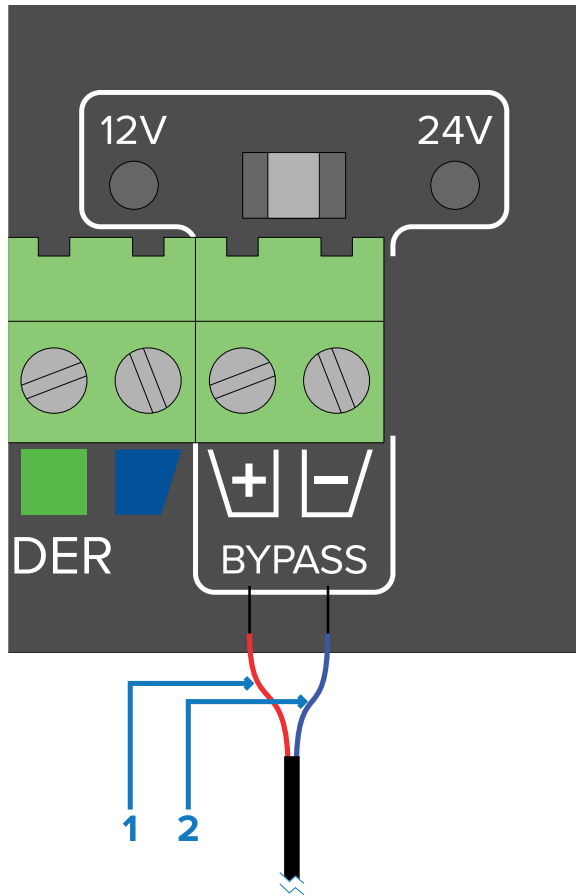
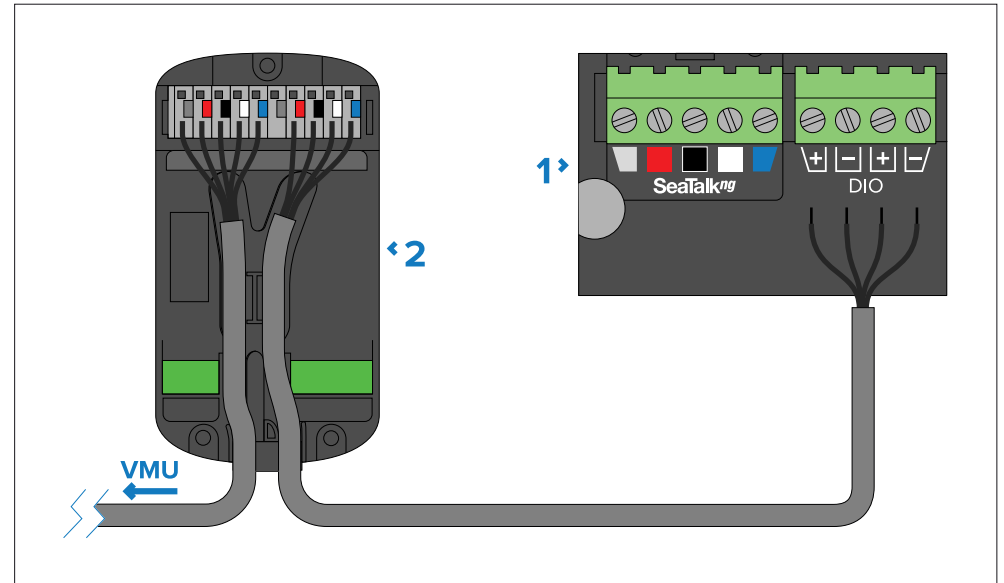
If the drive has a separate bypass valve, connect it to the Bypass connection on the ACU-300, ensuring that the voltage selection switch is set correctly to 12 V / 24 V as appropriate.

Important:

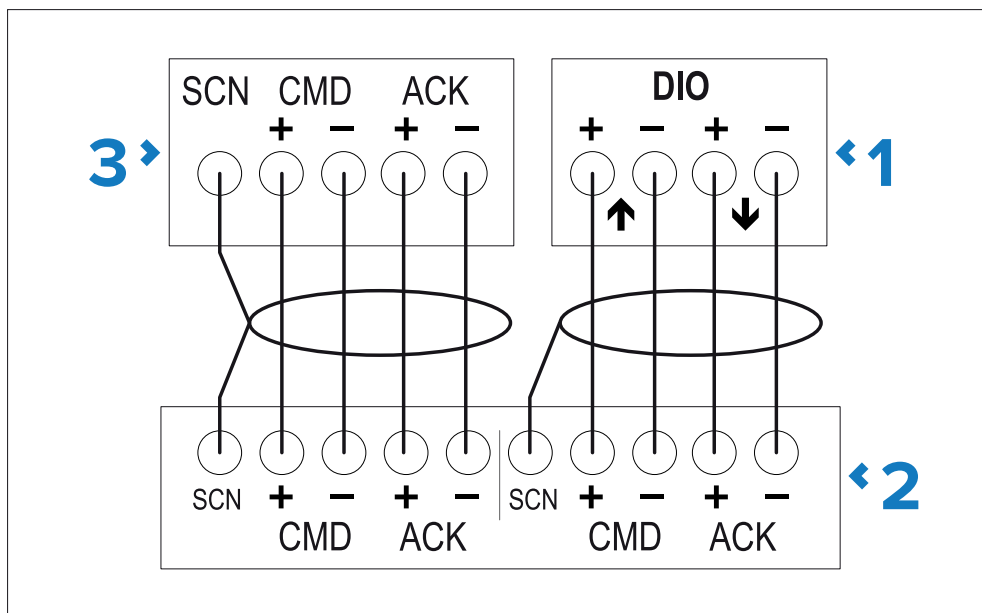
To avoid potential damage to equipment, ensure voltage selector switch is set to the correct setting. The bypass valve voltage may be different from that of the drive itself. If in doubt, consult the manufacturer of the drive unit.

11.12 VMU adapter connection (ACU-400)

The ACU-400 interfaces to the ZF-Marine VMU (sail pod drive) using the VMU adapter. The VMU adapter connects to the ACU-400 as shown below.



	Color	Description
1	Red	Bypass valve Positive (+) connection
2	Blue	Bypass valve Negative (-) connection



1. ACU-400.
2. VMU adapter.
3. ZF-Marine VMU (connection to sail pod drive).

Note:

The screen wire is terminated at the ZF-Marine VMU and VMU adaptor. It is NOT connected at the ACU-400.

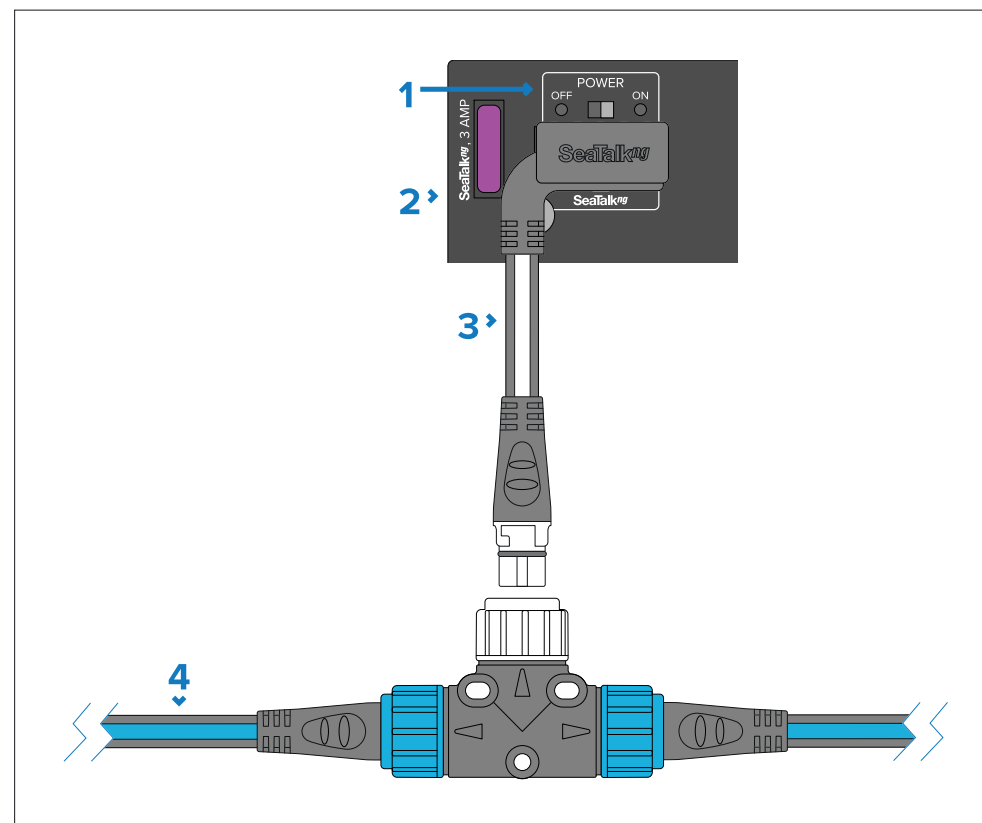
Note:

Raymarine recommends the following cable specification:

- 4-core (22 AWG) with overall screen.

11.13 SeaTalk NG connection

The ACU is connected to a compatible autopilot controller using SeaTalk NG. The ACU connects to the SeaTalk NG backbone using the separately available spur cable.



1. SeaTalk NG power switch.
2. ACU connector panel.
3. Evolution-Series to SeaTalk NG spur cable.
4. SeaTalk NG backbone.

Note:

For clarity, only the power-related Evolution-Series connections are shown in the illustration above.

11.14 SeaTalk NG power switch

The ACU can provide power to the SeaTalk NG backbone. This will provide power to equipment connected to the backbone (e.g. SeaTalk NG autopilot control head and instrument displays).

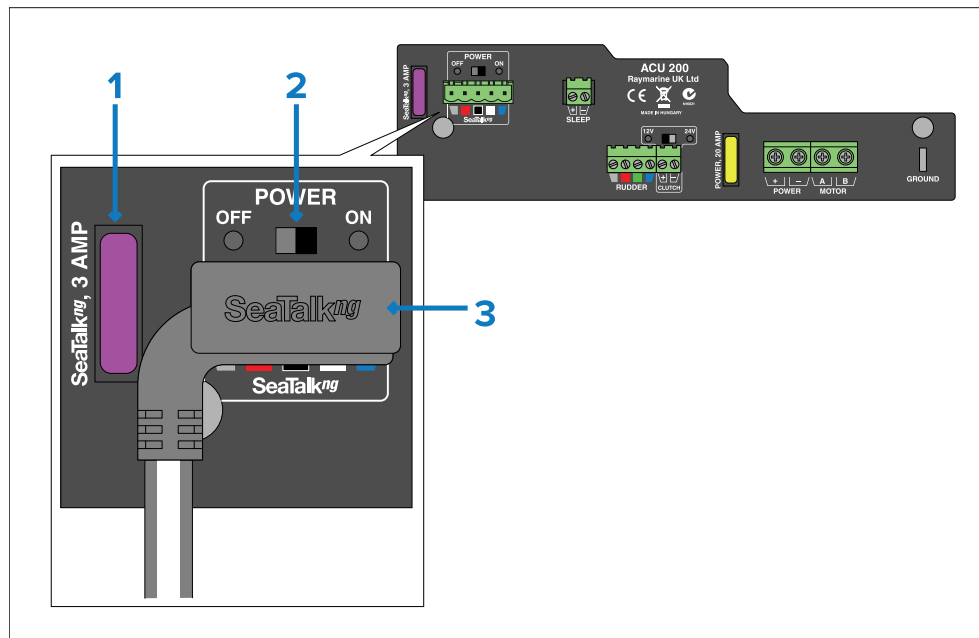
Important:

- The SeaTalk NG backbone must have a single power supply connection, if your SeaTalk NG backbone is supplied power directly then you must ensure that the SeaTalk NG power switch on your ACU is switched Off.
- The SeaTalk NG power supply fuse MUST be rated as per the value shown on the ACU connector panel.

Note:

The ACU-100, ACU-150 and SPX-5 autopilot control units cannot supply power to the SeaTalk NG backbone.

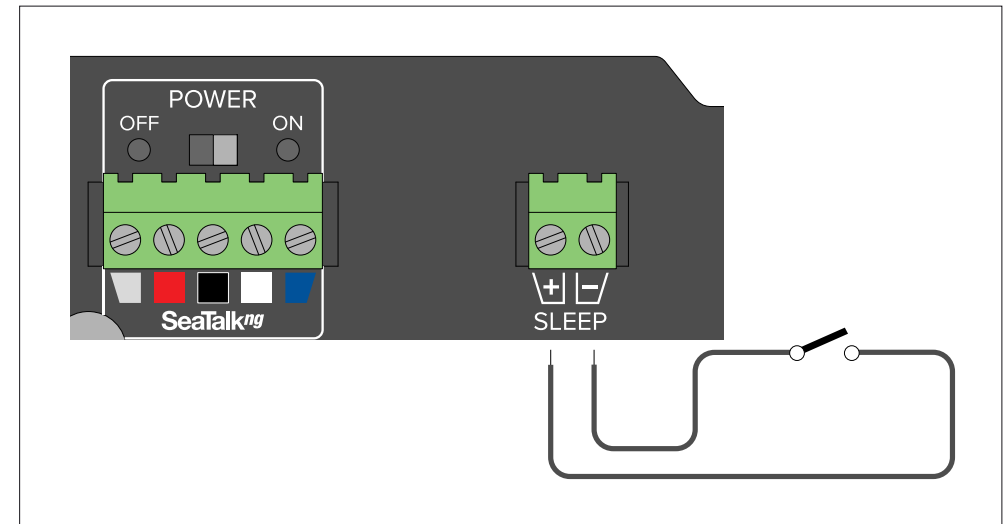
Example: ACU-200 power switch



1. Fuse for SeaTalk NG power supply.
2. Power switch for SeaTalk NG power supply. The power switch must be switched *[ON]* in order to provide power to the SeaTalk NG backbone. If the power switch is switched *[OFF]*, ensure that there is a separate power feed to the SeaTalk NG backbone.
3. ACU / SPX-Series autopilot to SeaTalk NG spur cable (part number: R12112).

11.15 Sleep switch connection

A sleep switch disables the operation of the autopilot while retaining any power supplied to the SeaTalk NG backbone.



The switch and associated cable are not supplied with the Evolution-Series system. Contact your dealer or drive manufacturer for more information.

11.16 Rudder angle reference sensor connection

A rudder angle reference sensor / transducer can be connected to the ACU to provide rudder angle information to the autopilot system.

The connection of a rudder angle reference sensor / transducer is highly recommended for all systems, to help ensure optimum autopilot performance.

For ACU-300 systems, the rudder angle reference sensor / transducer (M81105) is an essential component. For these systems, it is also important to ensure that the ACU-300 is running software version v3.13 or later.

Note:

The rudder angle reference sensor / transducer is not included with all autopilot products or system packs. Consult the Raymarine website or your local dealer for a full list of the components included with your autopilot system. The rudder angle reference sensor / transducer is also available separately as M81105.

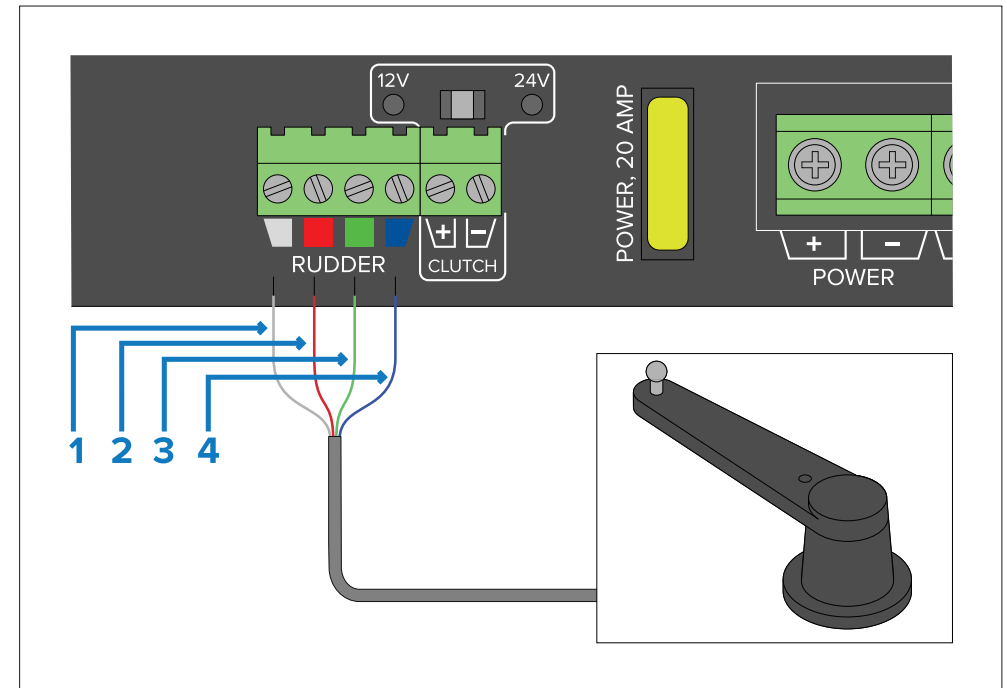
A rudder angle reference sensor / transducer converts its movement information to rudder angle in +/- degrees.

Certain environmental conditions such as cross-current can cause the autopilot system to steer persistently to port or starboard, even when the rudder is centered. With a rudder angle reference sensor / transducer connected to your autopilot system, you can use an autopilot control head to specify an offset angle in +/- degrees to compensate for inaccurate rudder angle information caused by such conditions.

The more accurate the rudder angle information, the more accurately the autopilot system can keep to a correct course.

The rudder angle reference sensor / transducer connection to the ACU connection panel is shown below.

Example: ACU-200 rudder reference sensor connection



1. Gray (screen).
2. Red.
3. Green.
4. Blue.

Note:

Where there are multiple sources of rudder reference information, the Evolution-Series system components will ignore rudder inputs from any rudder reference units that are NOT connected directly to an ACU.

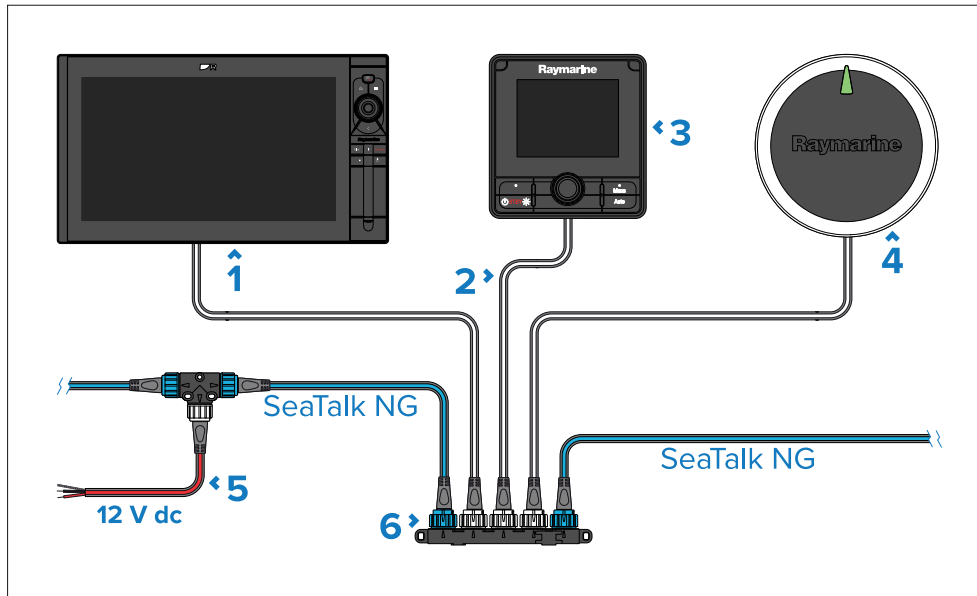
CHAPTER 12: PILOT CONTROLLER CONNECTIONS

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- 12.1 SeaTalk NG pilot controller connection — page 86
- 12.2 SeaTalk 1 pilot controller connection — page 86

12.1 SeaTalk NG pilot controller connection

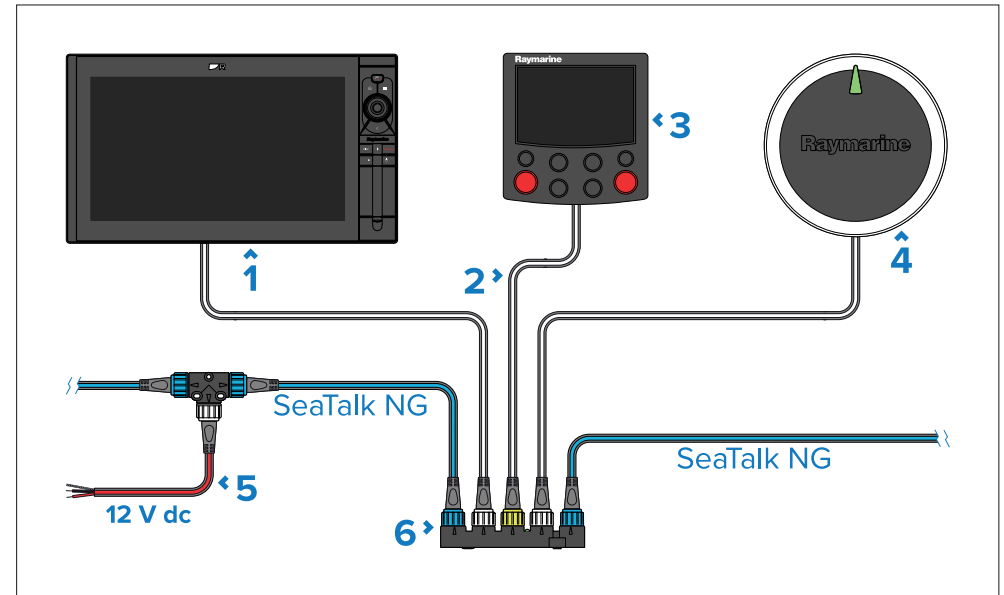
A SeaTalk NG pilot controller is connected directly into the same SeaTalk NG backbone as the Evolution-Series autopilot.



1. SeaTalk NG MFD (MFDs require a separate power supply).
2. SeaTalk NG spur cable.
3. SeaTalk NG pilot controller (powered from the SeaTalk NG backbone).
4. SeaTalk NG autopilot.
5. SeaTalk NG 12 V dc power supply connection.
6. SeaTalk NG 5-way block.

12.2 SeaTalk 1 pilot controller connection

The SeaTalk 1 to SeaTalk NG converter can be used to enable control of SeaTalk NG autopilots using legacy SeaTalk 1 pilot controllers. Other SeaTalk 1 devices can be connected to the SeaTalk NG backbone in the same way.



1. SeaTalk NG MFD (MFDs require a separate power supply).
2. SeaTalk 1 to SeaTalk NG adaptor cable (A22164).
3. SeaTalk 1 pilot controller (powered from the SeaTalk NG backbone).
4. SeaTalk NG autopilot.
5. SeaTalk NG 12 V dc power supply connection.
6. SeaTalk 1 to SeaTalk NG converter (E22158).

CHAPTER 13: SYSTEM CHECKS AND TROUBLESHOOTING

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- 13.1 Post-installation checks — page 88
- 13.2 Error message troubleshooting — page 88
- 13.3 Autopilot system setup — page 90
- 13.4 Alarms — page 91
- 13.5 LED indications (EV-1) — page 93
- 13.6 LED indications (ACU-100 / ACU-150) — page 94
- 13.7 Rudder damping levels and deadband angles — page 94
- 13.8 Performing a factory reset of a SeaTalk NG device — page 95

13.1 Post-installation checks

These checks should be carried out after installation, and prior to the commissioning of the autopilot system.

1. Switch on power to the autopilot system and any associated equipment.
 - *ACU-Series.*
 - *Autopilot controller.*
 - *SeaTalk NG backbone (if this has its own power supply).*
2. Check to ensure that the autopilot controller powers up. If the display is blank, press and hold the *[Power]* button for 2 seconds.
3. Check to ensure that the EV-1, ACU-Series unit and autopilot controller have the latest software installed. For more information, visit: <https://bit.ly/rym-docs>
4. Check the display for error messages that could indicate a problem with the installation.
5. Check the LED status indications for both the EV-1 and ACU-Series unit. For more information, refer to:
 - i. **p.93 – LED indications (EV-1)**
 - ii. **p.94 – LED indications (ACU-100 / ACU-150)**
6. If the fault persists and cannot be rectified, **contact your dealer or Raymarine product support.**

13.2 Error message troubleshooting

The following alarm messages are displayed on the Autopilot controller display when there is an error with the autopilot system requiring your attention. Use the information provided here to troubleshoot your autopilot.

Alarm Message	Possible causes	Possible solutions
AUTO RELEASE	Possible fault with rudder angle reference sensor. Alternatively, if your autopilot system includes a stern I/O drive, you have taken manual control of the steering while the pilot is in Auto mode.	<ul style="list-style-type: none"> • Check rudder angle reference sensor connections.
DRIVE STOPPED	<ul style="list-style-type: none"> • Motor / steering has not moved within 20 seconds of a course change command. • The autopilot is unable to turn the rudder (either because the weather load on the helm is too high, or if the rudder angle sensor has passed beyond the preset rudder limits or rudder end-stops. • Autopilot resets due to an external event (such as use of the sleep switch, or faulty wiring causing the autopilot components to power cycle). • Autopilot resets due to software error. 	<ul style="list-style-type: none"> • Check the rudder angle reference sensor has been installed correctly to reflect the limits and end-stops of the vessel's rudder system. • Check ACU drive output voltage and drive and clutch voltage output (if applicable). • Check all connections to ACU. • Check all connections to drive unit. • Check that the drive unit operates and has not stalled. • Check steering system is secure.

Alarm Message	Possible causes	Possible solutions
NO RUDDER REFERENCE	No rudder angle reference sensor is detected, or the rudder angle reference sensor has turned outside its operational range (50 degrees).	If a rudder angle reference sensor is installed, check the wiring. Inspect the unit for possible damage.
STALL DETECTED	Motor speed dropped too low for given course change or motor stalling. This can be caused by a faulty drive unit or steering fault. Alternatively, the steering hard-over time may be too slow.	<ul style="list-style-type: none"> • Check that the drive unit operates and is not stalled. • Check the steering hard-over time.
CLUTCH OVERLOAD	Serious drive failure; the drive is demanding too much electrical current due to short-circuit or jamming. Caused by a faulty drive unit or motor, or wiring short-circuit. Alternatively, a fault in the steering system may be causing the drive unit to lock-up.	Refer to the clutch power output ratings provided in the Installation Instructions for the relevant Evolution-Series components, and ensure the clutch for the drive unit does not exceed this power output.

Alarm Message	Possible causes	Possible solutions
CURRENT OVERLOAD	Serious drive failure; the drive is demanding too much electrical current due to short-circuit or jamming. Caused by a faulty drive unit or motor, or wiring short-circuit. Alternatively, a fault in the steering system may be causing the drive unit to lock-up.	Check the drive unit.
NO DATA	<ul style="list-style-type: none"> • The autopilot is in Wind Vane mode and has not received wind angle data for 32 seconds. • The autopilot is in Track mode and is not receiving navigation data, or the rudder angle sensor is receiving a low-strength signal. This will clear when the signal improves. 	Check the connections to the wind transducer, multifunction display, and autopilot control head (as appropriate).
NO WIND DATA	The autopilot is in Wind Vane mode and has not received wind angle data for 32 seconds.	Check the connections to the wind transducer.

Alarm Message	Possible causes	Possible solutions
NO SPEED DATA	The autopilot has not received speed (STW or SOG) data for 10 seconds, while in Auto mode.	Check the connections to the speed transducer. Pilot does not require speed data in order to operate. However, it does enhance the overall performance when in Auto mode.
NO COMPASS	The EV-1 is not receiving heading data.	<ul style="list-style-type: none"> • Check the connections to the EV-1. • Power cycle the EV-1 by removing and then reconnecting the SeaTalk NG cable.
RATEGYRO FAIL	The internal rate gyro on the EV-1 unit has developed a fault. This will be evident as a compass issue and could cause the compass heading to deviate or lock-up.	If the problem persists, contact your local Raymarine service center.
MOTOR POWER SWAPPED	On the ACU unit, the motor cables are connected to the power terminals, and vice versa.	Switch off the power to the unit and reconnect correctly.
NO GPS DATA	A source of GPS data is not connected to the SeaTalk NG system.	Check connections to the GPS data source.

Alarm Message	Possible causes	Possible solutions
JOYSTICK FAULT	A fault has occurred with the joystick. This alarm applies only to autopilot systems that include a joystick controller.	Check the connections to, and operation of the joystick.
NO IPS (NO DRIVE DETECTED)	Loss of communications between the EV-1 and ACU.	Check all physical data connections between these devices, as appropriate.
PILOT RESET NORMAL (UNEXPECTED HARDWARE RESET)	Autopilot resets due to an external event (such as use of the sleep switch, or faulty wiring causing the autopilot components to power cycle).	Check all system wiring, especially power-related wiring.
PILOT RESET EXCEPTION (UNEXPECTED SOFTWARE RESET)	The EV-1 software has detected a fault it cannot recover from, and has reset the pilot.	Wait approximately 1 minute for the EV-1 to reset and re-initialize.

13.3 Autopilot system setup

Important:

Before using the autopilot system it is essential that it is properly commissioned in accordance with the setup instructions.

1. Perform an initial power-on test to ensure all components are working correctly.
2. Refer to the latest version of your compatible Autopilot Controller's user documentation for detailed instructions on how to commission your Evolution-Series autopilot system.

13.4 Alarms

Alarms are raised by the autopilot system to alert you to mechanical and electrical conditions requiring your attention.

The Evolution-Series components transmit alarm alerts on the SeaTalk NG network for display on autopilot controllers and MFDs, along with an audible alert. The Evolution-Series components stop raising an alarm when the alarm condition ceases or the alarm is acknowledged on the autopilot controller or MFD. If the alarm is safety-critical it will be raised again after a timed delay.





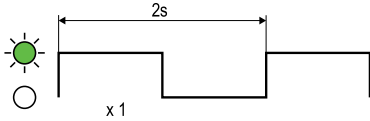
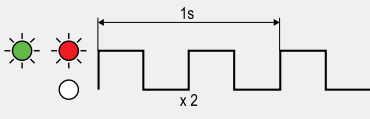
Unless otherwise stated in the table below, you should respond to alarms by selecting *[OK]* or *[Acknowledge]* on your autopilot controller or MFD.

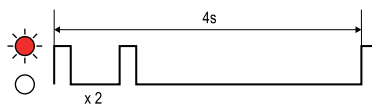
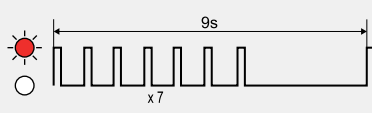
Alarm message	Possible causes	Possible solutions
OFF COURSE	Autopilot has deviated from planned course.	Check your vessel position and if necessary take manual control to steer the vessel back on course.
WIND SHIFT	Autopilot is unable to maintain navigation to the current wind angle.	
LOW BATTERY	Power supply voltage has dropped below acceptable limits. Caused by low battery voltage or voltage drop at the ACU unit (EV-1 systems only), due to poor connections or inadequate wiring.	Acknowledge the alarm and then start the engine to recharge the battery. If problem persists, check wiring connections and that the quality and gauge of wiring is adequate for the current draw of the drive unit.
LARGE XTE	Large cross-track error. The autopilot has deviated more than expected from a planned course.	Check your vessel position and if necessary take manual control to steer the vessel back on course.

Alarm message	Possible causes	Possible solutions
CU DISCONNECTED	The autopilot control head has been disconnected.	<ul style="list-style-type: none"> Check the physical cables and connections between the autopilot control head and the SeaTalk NG system. Also between the EV-1 and the SeaTalk NG system. If the autopilot control head is connected via a SeaTalk 1 to SeaTalk NG converter, check the converter is using the latest software version.
WAYPOINT ADVANCE	The autopilot has steered the vessel to the current waypoint.	Acknowledge the turn to the next waypoint.
ROUTE COMPLETE	Your vessel has arrived at the end of the current route.	No action required.

Alarm message	Possible causes	Possible solutions
NO DATA	<ul style="list-style-type: none"> The autopilot is in Wind Vane mode and has not received wind angle data for 32 seconds. The autopilot is in Track mode and is not receiving navigation data, or the rudder angle sensor is receiving a low-strength signal. This will clear when the signal improves. 	Check the connections to the wind transducer, multifunction display, and autopilot control head (as appropriate).
PILOT STARTUP	Autopilot components are initializing.	Some components may take a moment to startup.

13.5 LED indications (EV-1)

LED Indication	LED Status and required action
 	<p><u>(No color) LED has been disabled</u></p> <ul style="list-style-type: none"> Ensure that the <i>[Always off]</i> multifunction display / chartplotter LED setting (requires LightHouse 4 software version v4.6.74 or later) has not been enabled. For more information, refer to: p.93 – Switching off sensor LEDs
 	<p><u>(Solid green) LED Normal operation</u></p> <ul style="list-style-type: none"> None (normal power up takes <1 minute).
	<p><u>(Green) Unit is initializing; no pilot or compass functions currently available.</u></p> <ul style="list-style-type: none"> None (normal power up takes <1 minute).
	<p><u>(Green and Red) LED has been triggered manually</u></p> <ul style="list-style-type: none"> Ensure that the <i>[Find me]</i> multifunction display / chartplotter LED setting (requires LightHouse 4 software version v4.6.74 or later) has not been enabled. Once enabled, the LED indicator shown will appear for a 5 minute duration. For more information, refer to: p.93 – Switching off sensor LEDs

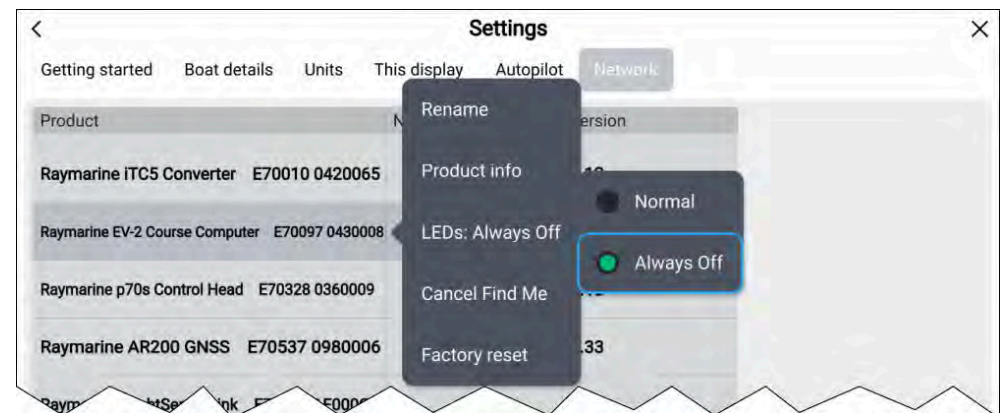
LED Indication	LED Status and required action
	<p><u>(Red) No SeaTalk NG connection.</u></p> <ul style="list-style-type: none"> Ensure network is powered. Ensure network cable and connections are secure and free from damage. If problem persists contact Raymarine technical support.
	<p><u>(Red) SeaTalk NG connected but not receiving data.</u></p> <ul style="list-style-type: none"> If problem persists contact Raymarine technical support.

Switching off sensor LEDs

To assist users who wish their vessel to “go dark” (i.e. not emit any visible light), the LED indicators present on SeaTalk NG position sensors can be switched off. Supported devices: RS150, EV-1, EV-2 and AR200).

Note:

The *[Always Off]* feature may not be available for devices running older software versions. Ensure that you obtain the latest available software for your position sensors.



1. Open the *[Network]* settings menu: *[Homescreen > Settings > Network]*.
2. Select the relevant sensor from the network list.

3. Select *[LEDs:]*.
4. Select *[Always Off]*.

The status LED on the selected device will now be switched off, and will remain off until this setting is reverted to *[Normal]*, or the *[Find Me]* feature is enabled.

Find me

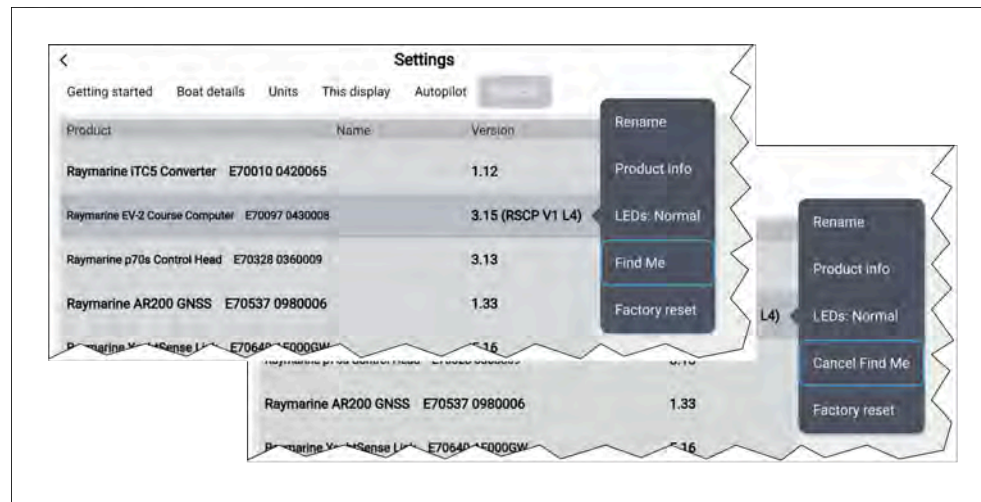
The *[Find me]* feature assists you in finding the physical installation location of a specific Raymarine SeaTalk NG position sensor (i.e.: RS150, EV-1, EV-2, or AR200).

The *[Find me]* feature works by making the selected device's status LED flash continuously for 5 minutes, giving you time to search the vessel to determine the device's physical location. The feature works even if the device's LEDs have been switched to *[Always off]*.

The *[Find Me]* flash sequence will be visibly different than normal LED status sequences in that both the red and green LEDs will flash on and off at the same time, twice every second for 5 minutes.

Note:

The *[Find me]* feature may not be available on devices running older software versions. Ensure that you obtain the latest available software for your position sensors.


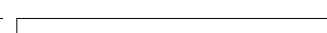

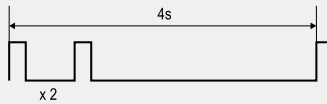

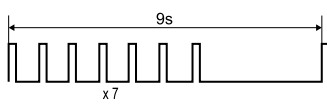


To initiate the *[Find Me]* feature for a specific SeaTalk NG device, locate the device name in the *[Network]* settings menu, and then select *[Find Me]* from the device's pop-over menu.

Once *[Find Me]* has been activated, its menu option will change to *[Cancel Find Me]* until 5 minutes has elapsed.

Selecting *[Cancel Find Me]* at any time within the 5 minute timeframe will stop the LED flashing and return the device to its previous LED state.

13.6 LED indications (ACU-100 / ACU-150)

LED Indication	LED Status and required action
 	<u>(Solid green) Normal operation</u> <ul style="list-style-type: none"> • None (normal power up takes <1 minute).
 	<u>(Red) No SeaTalk NG connection.</u> <ul style="list-style-type: none"> • Ensure network is powered. • Ensure network cable and connections are secure and free from damage. • If problem persists contact Raymarine technical support.
 	<u>(Red) SeaTalk NG connected but not receiving data.</u> <ul style="list-style-type: none"> • If problem persists contact Raymarine technical support.

13.7 Rudder damping levels and deadband angles

For autopilot systems which include a rudder angle reference sensor / transducer, rudder damping is used to prevent Evolution-Series autopilot system over-activity, characterized by "hunting" maneuvers. A number of rudder damping levels are available to address this behavior. Rudder

damping levels relate to “deadband angles”, and can be configured using your autopilot control head (e.g. p70s/p70Rs or MFD). A higher damping level is intended to eliminate pilot and helm over-activity.

Typically, the appropriate rudder damping level is the lowest acceptable value. However, it is important to be aware that the rudder damping scaling has been changed in recent versions of the ACU-Series units, which include newer processor and software versions (these units can be identified with an “A” appended to their SKU).

Important:

The rudder damping levels can have a significant impact on your autopilot performance. If you are unsure as to how to adjust these settings to best suit your autopilot system, please refer to your dealer or Raymarine product support.

The following table lists the rudder damping levels and deadband angles that are available with both old and new versions of the ACU-Series software:

Rudder damping level	Existing Deadband angle (ACU-100, ACU-150, ACU-200, ACU-400)	Existing Deadband angle (ACU-300)	New Deadband angle (ACU-Series software version v3.11 or later)
1	0.1°	0.15°	0.1°
2	0.2°	0.30°	0.2°
3	0.3°	0.45°	0.3°
4	0.4°	0.60°	0.4°
5	0.5°	0.75°	0.7°
6	0.6°	0.9°	0.9°
7	0.7°	1.05°	1.1°
8	0.8°	1.20°	1.6°
9	0.9°	1.35°	2.2°

It’s important to check the rudder damping level currently configured on your autopilot control head, to ensure it matches your needs. The rudder damping value should be increased one level at a time until the autopilot stops hunting.

Rudder Damping level adjustments

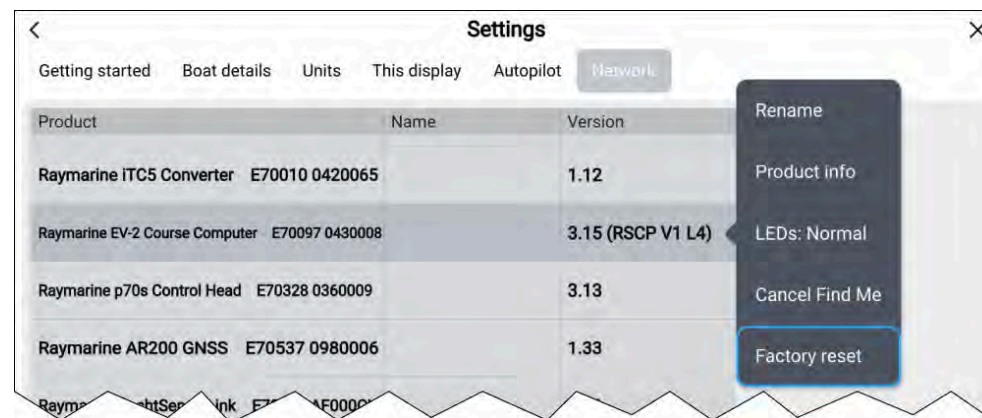
You can adjust the Rudder Damping levels using your pilot control head.

The menu item for adjusting the Rudder Damping level depends on which pilot controller you are using:

- **p70 / p70s / p70R / p70Rs** — *[Menu > Set-up > Autopilot Calibration > Drive Settings > Rudder Damping].*
- **LightHouse 3 MFD** — *[Homescreen > Settings > Autopilot > Pilot control > Advanced settings > Rudder Damping].*
- **LightHouse 2 MFD** — From the Pilot Set-up page: *[Pilot Settings > Drive Settings > Rudder Damping]*

13.8 Performing a factory reset of a SeaTalk NG device

Raymarine SeaTalk NG devices can be factory reset from the *[Network]* settings menu.



1. Open the *[Network]* settings menu: *[Homescreen > Settings > Network].*
2. Select the relevant SeaTalk NG from the network list.
3. Select *[Factory reset].*

The product will perform a factory reset and may reboot, no confirmation will be given.

CHAPTER 14: OPERATION

CHAPTER CONTENTS

- 14.1 Evolution-Series autopilot operation instructions — page 97

14.1 Evolution-Series autopilot operation instructions

For detailed instructions on how to operate your autopilot system, please refer to the documentation for your autopilot control unit (e.g. p70s / p70Rs pilot control head, or a LightHouse multifunction display / chartplotter).

Autopilot controller documentation

Installation, commissioning and operation instructions for your autopilot controller are listed below. Please select the appropriate document for your autopilot controller:

Document	Description
81355	p70 /p70R Installation and Operation Instructions
81365	p70s /p70Rs Installation and Operation Instructions
81406	LightHouse 4 Advanced Operation Instructions
81370	LightHouse 3 Advanced Operation Instructions
81360	LightHouse 2 Operation Instructions

All documents are available to download from the Raymarine website:
<https://bit.ly/rym-docs>

CHAPTER 15: MAINTENANCE

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- 15.1 Service and maintenance — page 99
- 15.2 Routine equipment checks — page 99
- 15.3 Product cleaning — page 99

15.1 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.

15.2 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.

15.3 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.

CHAPTER 16: TECHNICAL SUPPORT

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- 16.1 Raymarine technical support and servicing — page 101
- 16.2 Learning resources — page 102

16.1 Raymarine technical 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

[Technical 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

Viewing product information

With your MFD Homescreen displayed:

1. Select *[Set-up]*.
2. Select *[Maintenance]*.
3. Select *[Diagnostics]*.
4. Select *[Select Device]*.
5. Select the relevant product from the list.

The Diagnostics page is displayed.

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>

CHAPTER 17: TECHNICAL SPECIFICATION (EV-1)

CHAPTER CONTENTS

- 17.1 Physical specification — page 104
- 17.2 Power specification — page 104
- 17.3 Network specification — page 104
- 17.4 Sensor specification — page 104
- 17.5 Environmental specification — page 104
- 17.6 Conformance specification — page 104

17.1 Physical specification

Specification

Diameter:	140 mm (5.5 in).
Depth (including mounting enclosure):	35 mm (1.4 in).
Depth (including wall bracket):	95 mm (3.8 in).
Weight:	0.29 kg (0.64 lbs)

17.2 Power specification

Specification

Nominal supply voltage:	12 V (powered by SeaTalk NG system).
Operating voltage range:	10.8 V to 15.6 V dc.
Power consumption (taken from SeaTalk NG system):	30 mA.
SeaTalk NG LEN (Load Equivalency Number):	1

17.3 Network specification

Specification

Data connections:	<ul style="list-style-type: none">• SeaTalk NG• DeviceNet⁽¹⁾
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Important:

(1) The DeviceNet connection is not currently supported.

17.4 Sensor specification

Specification

Sensors:	<ul style="list-style-type: none">• 3-axis digital accelerometer.• 3-axis digital compass.• 3-axis gyro digital angular rate sensor.
-----------------	--

17.5 Environmental specification

Specification

Operating temperature:	-25 °C to +55 °C (-13 °F to +131 °F).
Storage temperature:	-30 °C to +70 °C (-22°F to +158°F).
Relative humidity:	max 93%.
Waterproof rating:	IPx6.

17.6 Conformance specification

Specification

EMC compliance:	<ul style="list-style-type: none">• Europe: 2004/108/EC.• Australia and New Zealand: C-Tick, Compliance Level 2.
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CHAPTER 18: TECHNICAL SPECIFICATION (ACU-100)

CHAPTER CONTENTS

- 18.1 Physical specification — page 106
- 18.2 Power specification — page 106
- 18.3 Network specification — page 106
- 18.4 Environmental specification — page 106
- 18.5 Conformance specification — page 106

18.1 Physical specification

Specification	
Height:	140.00 mm (5.5 in)
Width:	180.00 mm (7.1 in)
Depth:	52.00 mm (2.0 in)
Weight:	0.6 kg (1.32 lbs)

18.2 Power specification

Specification	
Nominal supply voltage:	12 V dc
Operating voltage range:	10.8 V to 15.6 V dc
Power consumption (standby) — main power supply:	300 mA (12 V)
Power consumption (standby) — SeaTalk NG power supply:	No power supply to SeaTalk NG
SeaTalk NG LEN (Load Equivalency Number):	1
SeaTalk NG Power out:	No power supply to SeaTalk NG
Drive current output:	<ul style="list-style-type: none">• Maximum continuous 7 A at supply voltage.
Drive clutch output:	No clutch connection.

18.3 Network specification

Specification	
Connections:	<ul style="list-style-type: none">• Rudder angle reference sensor / transducer.• Power.• Drive motor.• Ground.
Data connections:	SeaTalk NG

18.4 Environmental specification

Specification	
Operating temperature:	-20 °C to +55 °C (-4 °F to +131 °F).
Storage temperature:	-30 °C to +70 °C (-22°F to +158°F).
Relative humidity:	Max 93%
Waterproof rating:	<ul style="list-style-type: none">• Connector panel: IPx2• Drive electronics: IPx6

18.5 Conformance specification

Specification	
EMC compliance:	<ul style="list-style-type: none">• Europe: 2004/108/EC.• Australia and New Zealand: C-Tick, Compliance Level 2.

CHAPTER 19: TECHNICAL SPECIFICATION (ACU-150)

CHAPTER CONTENTS

- 19.1 Physical specification — page 108
- 19.2 Power specification — page 108
- 19.3 Network specification — page 108
- 19.4 Environmental specification — page 108
- 19.5 Conformance specification — page 108

19.1 Physical specification

Specification	
Height:	140.00 mm (5.5 in)
Width:	180.00 mm (7.1 in)
Depth:	52.00 mm (2.0 in)
Weight:	0.6 kg (1.32 lbs)

19.2 Power specification

Specification	
Nominal supply voltage:	12 V dc
Operating voltage range:	10.8 V to 15.6 V dc
Power consumption (standby) — main power supply:	300 mA (12 V)
Power consumption (standby) — SeaTalk NG power supply:	No power supply to SeaTalk NG
SeaTalk NG LEN (Load Equivalency Number):	1
SeaTalk NG Power out:	No power supply to SeaTalk NG
Drive current output:	<ul style="list-style-type: none">• Maximum continuous 12 A at supply voltage.
Drive clutch output:	No clutch connection.

19.3 Network specification

Specification	
Connections:	<ul style="list-style-type: none">• Rudder angle reference sensor / transducer.• Power.• Drive motor.• Ground.
Data connections:	SeaTalk NG

19.4 Environmental specification

Specification	
Operating temperature:	-20 °C to +55 °C (-4 °F to +131 °F).
Storage temperature:	-30 °C to +70 °C (-22°F to +158°F).
Relative humidity:	Max 93%
Waterproof rating:	<ul style="list-style-type: none">• Connector panel: IPx2• Drive electronics: IPx6

19.5 Conformance specification

Specification	
EMC compliance:	<ul style="list-style-type: none">• Europe: 2004/108/EC.• Australia and New Zealand: C-Tick, Compliance Level 2.

CHAPTER 20: TECHNICAL SPECIFICATION (ACU-200)

CHAPTER CONTENTS

- 20.1 Physical specification — page 110
- 20.2 Power specification — page 110
- 20.3 Network specification — page 110
- 20.4 Environmental specification — page 110
- 20.5 Conformance specification — page 110

20.1 Physical specification

Specification	
Height:	211.50 mm (8.3 in)
Width:	285.00 mm (11.2 in)
Depth:	64.50 mm (2.5 in)
Weight:	2.2 kg (4.84 lbs)

20.2 Power specification

Specification	
Nominal supply voltage:	12 / 24 V dc
Operating voltage range:	10.8 V to 31.2 V dc
Power consumption (standby) — main power supply:	300 mA (12 / 24 V)
Power consumption (standby) — SeaTalk NG power supply:	20 mA (12 V)
SeaTalk NG LEN (Load Equivalency Number):	1
SeaTalk NG Power out:	3 A at 12 V (fuse protected at 3 A).
Drive current output:	<ul style="list-style-type: none">• Maximum continuous 15 A at supply voltage.
Drive clutch output:	Up to 2 A continuous, selectable between 12 / 24 V

20.3 Network specification

Specification	
Connections:	<ul style="list-style-type: none">• Rudder angle reference sensor / transducer.• Sleep switch.• Power.• Drive motor.• Drive clutch.• Ground.
Data connections:	SeaTalk NG

20.4 Environmental specification

Specification	
Operating temperature:	-20 °C to +55 °C (-4 °F to +131 °F).
Storage temperature:	-30 °C to +70 °C (-22°F to +158°F).
Relative humidity:	Max 93%
Waterproof rating:	Drip resistant.

20.5 Conformance specification

Specification	
EMC compliance:	<ul style="list-style-type: none">• Europe: 2004/108/EC.• Australia and New Zealand: C-Tick, Compliance Level 2.

CHAPTER 21: TECHNICAL SPECIFICATION (ACU-300)

CHAPTER CONTENTS

- 21.1 Physical specification — page 112
- 21.2 Power specification — page 112
- 21.3 Network specification — page 112
- 21.4 Environmental specification — page 112
- 21.5 Conformance specification — page 112

21.1 Physical specification

Specification	
Height:	211.50 mm (8.3 in)
Width:	285.00 mm (11.2 in)
Depth:	64.50 mm (2.5 in)
Weight:	2.2 kg (4.84 lbs)

21.2 Power specification

Specification	
Nominal supply voltage:	12 / 24 V dc
Operating voltage range:	10.8 V to 31.2 V dc
Power consumption (standby) — main power supply:	300 mA (12 / 24 V)
Power consumption (standby) — SeaTalk NG power supply:	20 mA (12 V)
SeaTalk NG LEN (Load Equivalency Number):	1
SeaTalk NG Power out:	3 A at 12 V (fuse protected at 3 A).
Drive current output:	<ul style="list-style-type: none">• Maximum continuous 5 A at supply voltage.
Drive clutch output:	No clutch connection.

21.3 Network specification

Specification	
Connections:	<ul style="list-style-type: none">• Rudder angle reference sensor / transducer.• Sleep switch.• Power.• Solenoid drive out / return.• Ground.
Data connections:	SeaTalk NG

21.4 Environmental specification

Specification	
Operating temperature:	-20 °C to +55 °C (-4 °F to +131 °F).
Storage temperature:	-30 °C to +70 °C (-22°F to +158°F).
Relative humidity:	Max 93%
Waterproof rating:	Drip resistant.

21.5 Conformance specification

Specification	
EMC compliance:	<ul style="list-style-type: none">• Europe: 2004/108/EC.• Australia and New Zealand: C-Tick, Compliance Level 2.

CHAPTER 22: TECHNICAL SPECIFICATION (ACU-400)

CHAPTER CONTENTS

- 22.1 Physical specification — page 114
- 22.2 Power specification — page 114
- 22.3 Network specification — page 114
- 22.4 Environmental specification — page 114
- 22.5 Conformance specification — page 114

22.1 Physical specification

Specification	
Height:	211.50 mm (8.3 in)
Width:	285.00 mm (11.2 in)
Depth:	64.50 mm (2.5 in)
Weight:	2.2 kg (4.84 lbs)

22.2 Power specification

Specification	
Nominal supply voltage:	12 / 24 V dc
Operating voltage range:	10.8 V to 31.2 V dc
Power consumption (standby) — main power supply:	300 mA (12 / 24 V)
Power consumption (standby) — SeaTalk NG power supply:	20 mA (12 V)
SeaTalk NG LEN (Load Equivalency Number):	1
SeaTalk NG Power out:	3 A at 12 V (fuse protected at 3 A).
Drive current output:	Maximum continuous 30 A at supply voltage.
Drive clutch output:	<ul style="list-style-type: none">• Up to 4 A continuous at 12 V on 12 V systems.• Up to 4 A continuous at 24 V on 24 V systems.• Up to 4 A continuous at 12 V on 24 V systems.

22.3 Network specification

Specification	
Connections:	<ul style="list-style-type: none">• Rudder angle reference sensor / transducer.• Sleep switch.• Power.• Drive motor.• Drive clutch.• Ground.• Digital Input / Output (DIO).
Data connections:	SeaTalk NG

22.4 Environmental specification

Specification	
Operating temperature:	-20 °C to +55 °C (-4 °F to +131 °F).
Storage temperature:	-30 °C to +70 °C (-22°F to +158°F).
Relative humidity:	Max 93%
Waterproof rating:	Drip resistant.

22.5 Conformance specification

Specification	
EMC compliance:	<ul style="list-style-type: none">• Europe: 2004/108/EC.• Australia and New Zealand: C-Tick, Compliance Level 2.

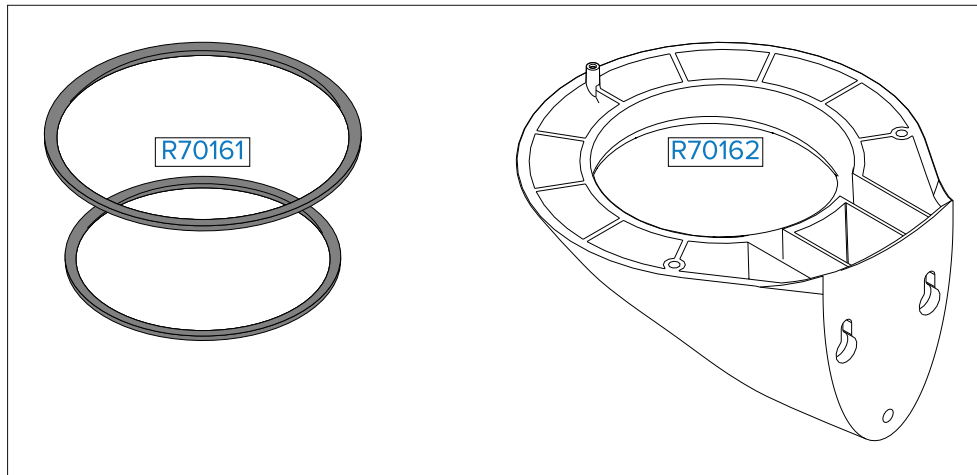
CHAPTER 23: SPARES AND ACCESSORIES

CHAPTER CONTENTS

- 23.1 Spares — page 116
- 23.2 Accessories — page 116
- 23.3 SeaTalk NG cables and accessories — page 117

23.1 Spares

The following spares are available for your product:



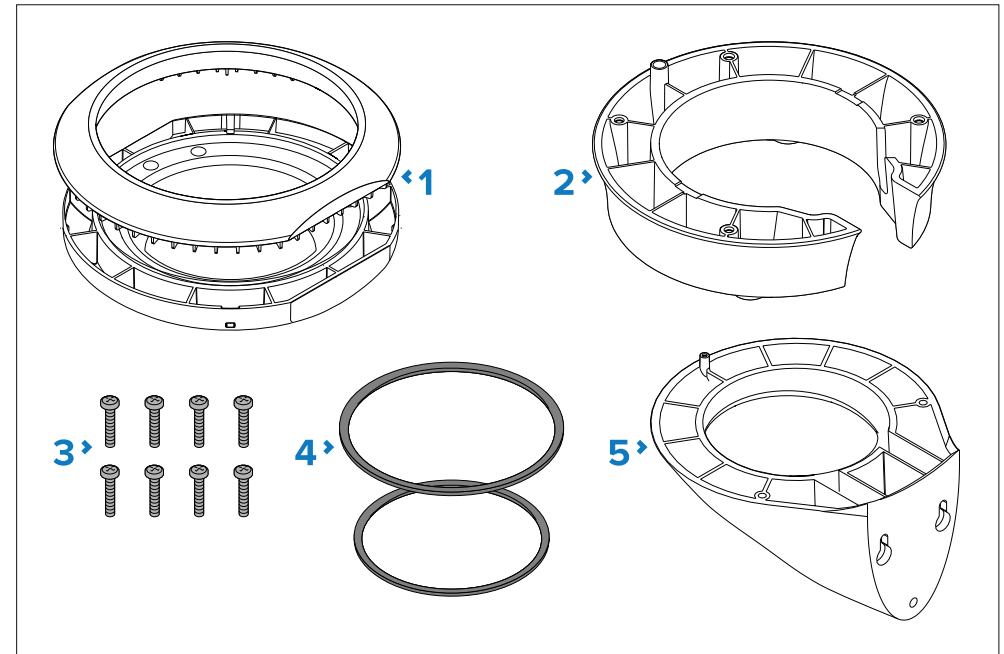
Part #	Description
R70161	EV-1 / EV-2 Sealing ring pack.
R70162	EV-1 / EV-2 Wall bracket.

23.2 Accessories

The following accessories are available for your product:

Note:

For pilot controller and drive interface unit spares and accessories, refer to the Installation Instruction documentation specific to those products.



Part #	Description
A80437	EV-1 / EV-2 Deck mounting kit, consisting of: <ol style="list-style-type: none"> 1. Mounting adaptor (clamshell). 2. Riser. 3. Fixings. 4. Sealing rings. 5. Wall bracket.

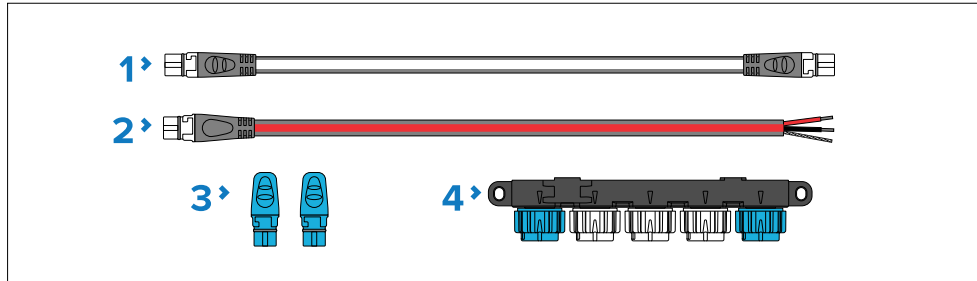
23.3 SeaTalk NG cables and accessories

SeaTalk NG cables and accessories for use with compatible products.

SeaTalk NG kits

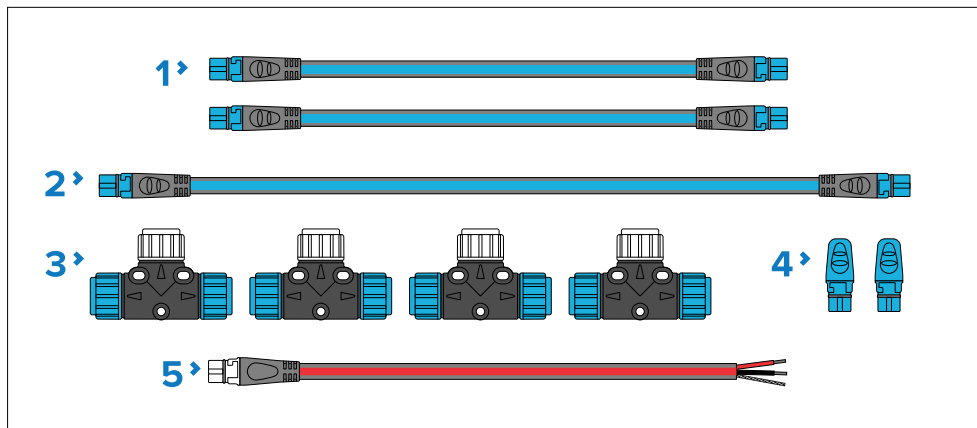
SeaTalk NG kits enable you to create a simple SeaTalk NG backbone.

Starter kit (part number: T70134) consists of:



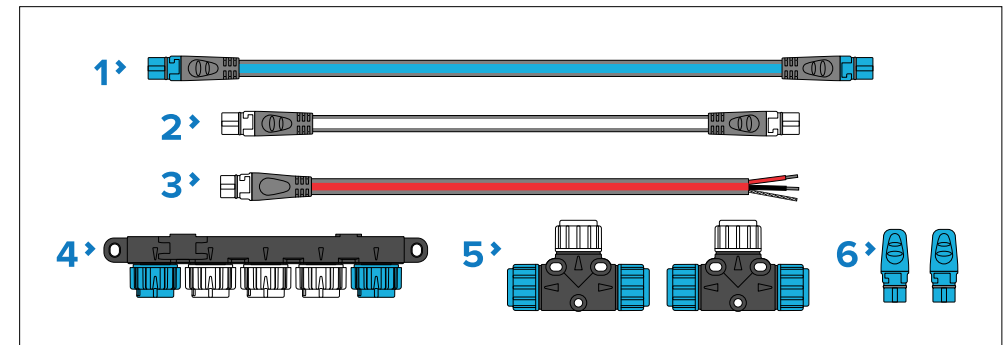
- 1 x Spur cable 3 m (9.8 ft) (part number: **A06040**). Used to connect device to the SeaTalk NG backbone.
- 1 x Power cable 2 m (6.6 ft) (part number: **A06049**). Used to provide 12 V dc power to the SeaTalk NG backbone.
- 2 x Backbone terminators (part number: **A06031**). Terminators must be fitted to both ends of the SeaTalk NG backbone.
- 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:



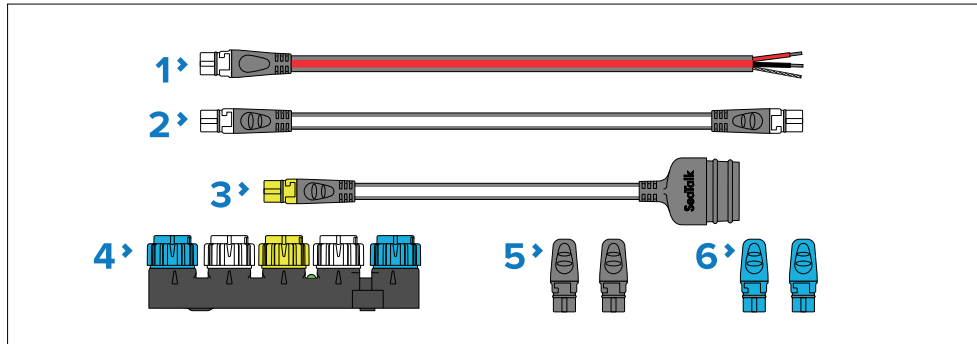
- 2 x Backbone cables 5 m (16.4 ft) (part number: **A06036**). Used to create and extend the SeaTalk NG backbone.
- 1 x Backbone cable 20 m (65.6 ft) (part number: **A06037**). Used to create and extend the SeaTalk NG backbone.
- 4 x T-piece (part number: **A06028**). Each T-piece allows connection of one SeaTalk NG device. Multiple T-pieces can be 'daisy chained' together.
- 2 x Backbone terminators (part number: **A06031**). Terminators must be fitted to both ends of the SeaTalk NG backbone.
- 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-Series autopilot cable kit (part number: R70160) consists of:



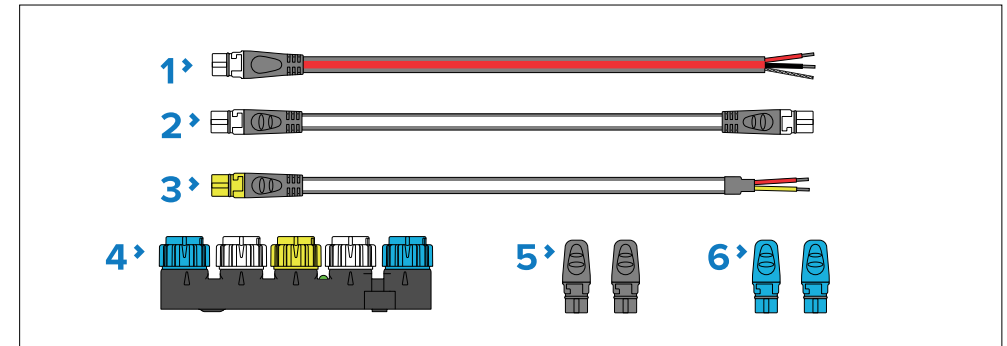
- 1 x Backbone cable 5 m (16.4 ft) (part number: **A06036**). Used to create and extend the SeaTalk NG backbone.
- 1 x Spur cable 1 m (3.3 ft) (part number: **A06040**). Used to connect device to the SeaTalk NG backbone.
- 1 x Power cable 2 m (6.6 ft) (part number: **A06049**). Used to provide 12 V dc power to the SeaTalk NG backbone.
- 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.
- 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.
- 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.

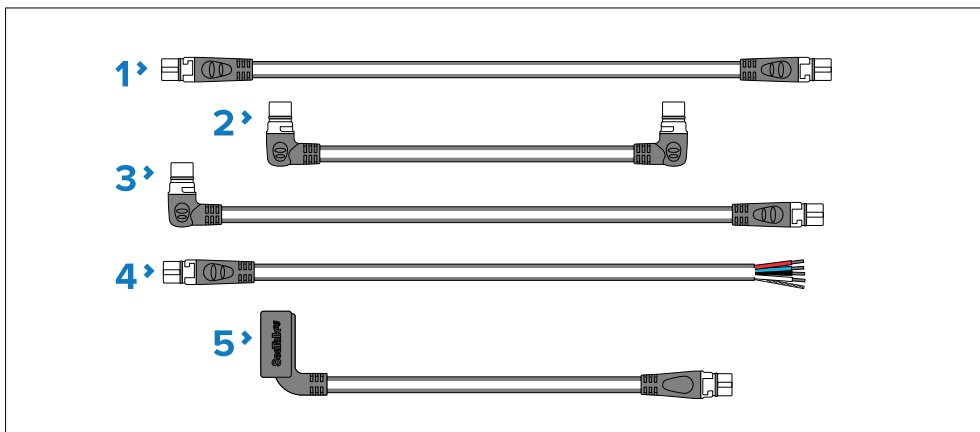
NMEA 0183 VHF 2-wire to SeaTalk NG converter kit (part number: E70196) consists of:



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

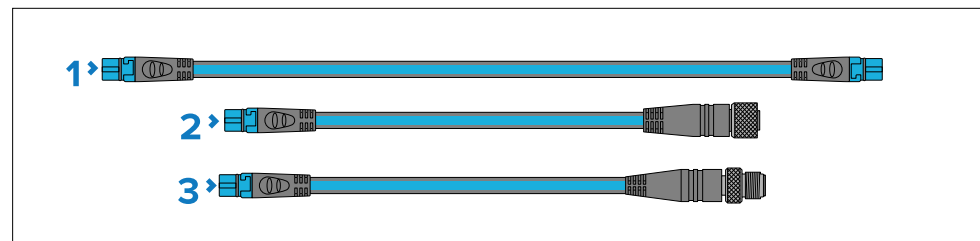
SeaTalk NG spur cables are required to connect devices to the SeaTalk NG backbone.



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-Series / SPX-Series 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

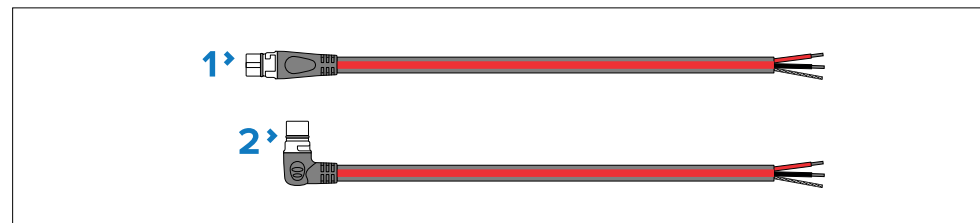
SeaTalk NG backbone cables are used to create or extend a SeaTalk NG backbone.



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

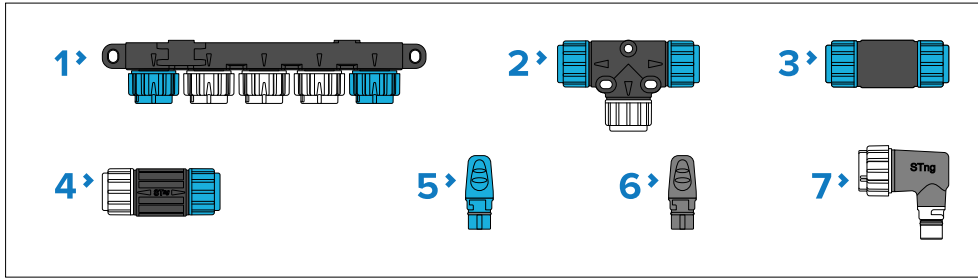
SeaTalk NG power cables are used to provide the SeaTalk NG backbone with a single 12 V dc power source. The power connection must include a 5 amp inline fuse (not supplied).



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

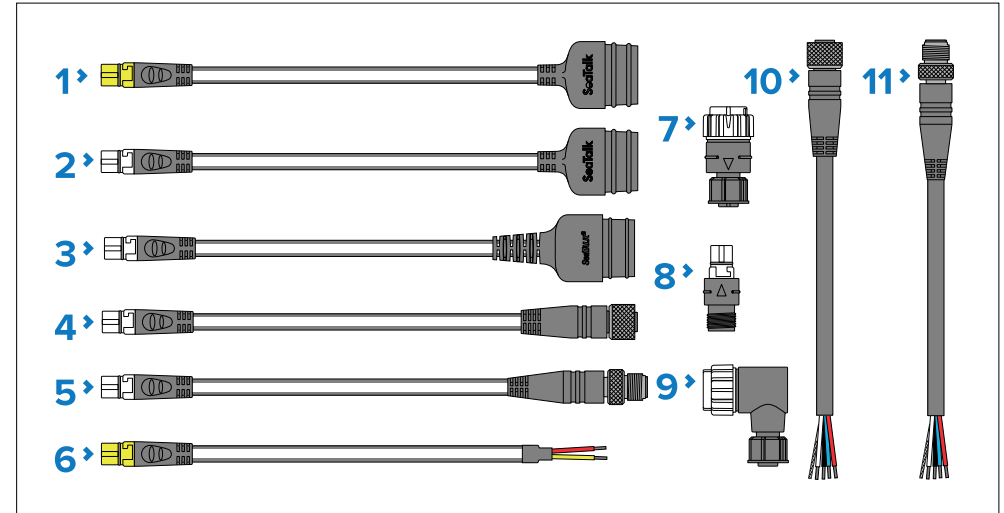
SeaTalk NG connectors are used to connect SeaTalk NG devices to the SeaTalk NG backbone and to create and extend the backbone.



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**).

Important:

* Do NOT connect the A06082, A06083, or A06084 adaptors directly to a backbone. Only connect as part of a **spur** connection between backbone and device.

Appendix A NMEA 2000 PGNs (EV-1 / EV-2)

The EV-1 and EV-2 support the following NMEA 2000 PGNs.

Message number	Message description	Transmit	Receive
59392	ISO Acknowledgment	●	
59904	ISO Request	●	●
60928	ISO Address Claim	●	●
65240	ISO Commanded address		●
126208	Request group function	●	●
126208	Command group function	●	●
126208	Acknowledge group function	●	●
126464	PGN List	●	●
126996	Product information: <ul style="list-style-type: none"> • NMEA 2000 Database Version • NMEA® Manufacturer's Product Code • NMEA® Manufacturer's Model ID • Manufacturer's Software Version Code • Manufacturer's Model Version • Manufacturer's Model Serial Code • NMEA 2000 Certification Level • Load Equivalency 	●	
127245	Rudder angle	●	●
127250	Vessel heading	●	●
127258	Magnetic Variation		●
128259	Speed Through Water (STW) (Referenced)		●
129026	Course Over Ground (COG) and Speed Over Ground (SOG) rapid update		●

Message number	Message description	Transmit	Receive
129029	GNSS position data: <ul style="list-style-type: none"> • Date • Time • Latitude • Longitude 		●
129283	Cross track error		●
129284	Navigation data (for following routes): <ul style="list-style-type: none"> • Active Leg Distance To Waypoint (DTW) • Course / Bearing reference • Perpendicular Crossed • Arrival Circle Entered • Calculation Type • Estimated Time of Arrival (ETA) • Estimated Date of Arrival • Active Leg Bearing Origin to Destination (BOD) • Active Leg Bearing To Waypoint (BTW) • Active Leg Origin Waypoint ID • Active Waypoint ID • Destination Waypoint Latitude • Destination Waypoint Longitude • Waypoint closing velocity 		●
129285	Active Waypoint data		●
130306	Wind data		●

Appendix B NMEA 2000 PGNs (ACU)

The ACU-Series supports the following NMEA 2000 PGNs.

Message number	Message description	Transmit	Receive
59392	ISO Acknowledgment	●	
59904	ISO Request	●	●
60928	ISO Address Claim	●	●
65240	ISO Commanded address		●
126208	Request group function		●
126208	Command group function		●
126208	Acknowledge group function	●	●
126464	PGN List	●	●
126996	Product information: <ul style="list-style-type: none"> • NMEA 2000 Database Version • NMEA® Manufacturer's Product Code • NMEA® Manufacturer's Model ID • Manufacturer's Software Version Code • Manufacturer's Model Version • Manufacturer's Model Serial Code • NMEA 2000 Certification Level • Load Equivalency 	●	
127245	Rudder angle	●	●

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