

Raymarine®

EVOLUTION AUTOPILOT



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

Installation instructions

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Product documentation



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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 RECOMMEND** that an Authorized Raymarine Service Representative fits this product. 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, ensure it has been correctly grounded, in accordance with the instructions provided.



Warning: Positive ground systems

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



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.

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.

Declaration of Conformity

FLIR Belgium BVBA declares that the following products are in compliance with the Radio Equipment Directive (RED) 2014/53/EU:

- Evolution EV-1, part number: E70096

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

Declaration of Conformity

FLIR Belgium BVBA declares that the following products are in compliance with the EMC Directive 2014/30/EU:

- Evolution ACU-100, part number: E70098

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

Declaration of Conformity

FLIR Belgium BVBA declares that the following products are in compliance with the EMC Directive 2014/30/EU:

- Evolution ACU-150, part number: E70374

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

Declaration of Conformity

FLIR Belgium BVBA declares that the following products are in compliance with the EMC Directive 2014/30/EU:

- Evolution ACU-200, part number: E70099

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

Declaration of Conformity

FLIR Belgium BVBA declares that the following products are in compliance with the EMC Directive 2014/30/EU:

- Evolution ACU-300, part number: E70139

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

Declaration of Conformity

FLIR Belgium BVBA declares that the following products are in compliance with the EMC Directive 2014/30/EU:

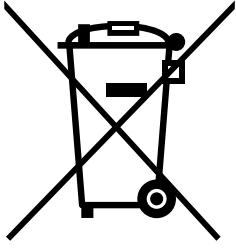
- Evolution ACU-400, part number: E70100

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

Product disposal

Dispose of this product in accordance with the WEEE Directive.

The Waste Electrical and Electronic Equipment (WEEE) Directive requires the recycling of waste electrical and electronic equipment which contains materials, components and substances that may be hazardous and present a risk to human health and the environment when WEEE is not handled correctly.



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



Warranty registration

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

It is important that you register your product to receive full warranty benefits. Your unit package includes a bar code label indicating the serial number of the unit. You will need this serial number when registering your product online. You should retain the label for future reference.

IMO and SOLAS

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

Technical accuracy

To the best of our knowledge, the information in this document was correct at the time it was produced. However, Raymarine cannot accept liability for any inaccuracies or omissions it may contain. In addition, our policy of continuous product improvement may change specifications without notice. As a result, Raymarine cannot accept liability for any differences between the product and this document. Please check the Raymarine website (www.raymarine.com) to ensure you have the most up-to-date version(s) of the documentation for your product.

Chapter 2: Document information

Chapter contents

- [2.1 Handbook information on page 14](#)

2.1 Handbook information

This handbook describes installation of the Evolution autopilot system.

The handbook includes information to help you:

- plan your autopilot system and ensure you have all the necessary equipment,
- install and connect the EV-1 and ACU (if applicable) as part of the autopilot system,
- obtain support if required.

This and other Raymarine product documentation is available to download in PDF format from www.raymarine.com.

Applicable products

Part number	Name	Description	Maximum continuous drive power output
E70096	EV-1	Attitude Heading Reference Sensor (AHRS)	Not applicable.
E70098	ACU-100	Actuator Control Unit (ACU)	7 A
E70374	ACU-150	Actuator Control Unit (ACU)	12 A
E70099	ACU-200	Actuator Control Unit (ACU)	15 A
E70139	ACU-300	Actuator Control Unit (ACU)	5 A
E70100	ACU-400	Actuator Control Unit (ACU)	30 A

Product documentation

The following documentation is applicable to your product:

Evolution documentation

Description	Part number
Evolution autopilot system Installation instructions Plan and install an autopilot system including an EV-1 Attitude Heading Reference Sensor (AHRS) and an Actuator Control Unit (ACU).	87180
Evolution Drive-By-Wire (DBW) autopilot system Installation instructions Plan and install a DBW autopilot system including an EV-2 AHRS.	87181
ACU-100 and ACU-150 Mounting template Template for surface mounting the ACU-100 or ACU-150.	87192
ACU-200, ACU-300 and ACU-400 Mounting template Template for surface mounting the ACU-200, ACU-300 or ACU-400.	87176
EV-1 and EV-2 mounting template Template for surface or wall mounting the EV-1/EV-2 sensor.	87170

Autopilot controller documentation

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

Description	Part number
p70/p70R installation and operation instructions Installation, commissioning and operation instructions including connection to a wider system of marine electronics.	81355
p70s/p70Rs installation and operation instructions Installation, commissioning and operation instructions including connection to a wider system of marine electronics.	81365
LightHouse™ 2 MFDs Operations and autopilot commissioning instructions for a LightHouse 2 Multifunction display, including connection to a wider system of marine electronics.	81360
LightHouse™ 3 MFDs Operation instructions for a LightHouse 3 Multifunction display, including connection to a wider system of marine electronics.	81370

All documents are available to download from the Raymarine website: www.raymarine.com/manuals

Autopilot drive unit documentation

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

Description	Part number
Tiller Drive Installation instructions Installation and commissioning instructions for the following Tiller Drive: Q047	87279
ST1000+ / ST2000+ Tiller Drive Owner handbook Installation and commissioning instructions for the following Tiller Drives: A12004, A12005	81130
Wheel Drive Installation instructions Installation and commissioning instructions for the following Wheel Drive: E12093	87287
Constant Running Hydraulic Pump Installation instructions Installation and commissioning instructions for the following Constant Running Hydraulic Pumps: E12171, E12172	87039
Hydraulic Linear Drive Installation instructions Installation and commissioning instructions for the following Hydraulic Linear Drives: E12207, E12208, M81202, M81203	81177
Hydraulic Pump Installation instructions Installation and commissioning instructions for the following Hydraulic Pumps: E12139, M81119, M81120, M81121, M81122, M81123, M81124	81178
Mechanical Linear Drive Installation instructions Installation and commissioning instructions for the following Mechanical Linear Drives: M81130, M81131, M81132, M81133, M81134	81175
Rotary Drive Installation instructions Installation and commissioning instructions for the following Rotary Drives: M81135, M81136, M81137	81174

Description	Part number
IO Stern Drive Installation instructions Installation and commissioning instructions for the following Stern Drives: M81138, E12019	81176
Universal IO Stern Drive Installation instructions Installation and commissioning instructions for the following Stern Drive: E12026	81180

All documents are available to download from the Raymarine website: www.raymarine.com/manuals

SeaTalkng® documentation

Description	Part number
SeaTalkng® reference manual Planning and connection of systems based around the SeaTalkng® network.	81300
SeaTalk — SeaTalkng® converter installation instructions Installation and connection of the SeaTalk — SeaTalkng® converter.	87121

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

Chapter contents

- [3.1 Product overview on page 18](#)

3.1 Product overview

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

- **Flexible mounting options** — The EV 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 sensor must be parallel with the centerline of the vessel and pointing towards the vessel's bow.

- **Simple connections** — all Evolution system components are connected to a single SeaTalkng[®] 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 system consists of the following components:

Component	Purpose
EV-1 unit 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.

Required additional components

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

Essential:

- Compatible autopilot controller — refer to: [p.26 — Compatible autopilot controllers](#)
- Drive unit appropriate for your vessel and Evolution EV and ACU units (See: [p.28 — Drive unit](#)).
- ACU power cable (not supplied).
- SeaTalkng[®] backbone.
- **Essential** for ACU-300: Rudder angle reference sensor / transducer (M81105).

Recommended:

- Rudder angle reference sensor / transducer (M81105). **Highly recommended** to ensure optimum autopilot performance.
- 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.
- 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 SeaTalkng[®] backbone.

Note: The system components listed above are “recommended” because 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:

- Position data source – The autopilot uses position data when following routes and calculating the optimum course to steer. This data is usually supplied by a GNSS receiver on the SeaTalkng[®] backbone.

SeaTalkng[®]

SeaTalkng[®] (Next Generation) is an enhanced protocol for connection of compatible marine instruments and equipment. It replaces the older SeaTalk and SeaTalk2 protocols.

SeaTalkng[®] 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 draw can be powered from the network, although high current equipment will need to have a separate power connection.

SeaTalkng[®] is a proprietary extension to NMEA 2000 and the proven CAN bus technology. Compatible NMEA 2000 and SeaTalk and SeaTalk2 devices can also be connected using the appropriate interfaces or adaptor cables as required.

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 GPS / GNSS 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 (www.raymarine.com) to obtain the latest software for your products.

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

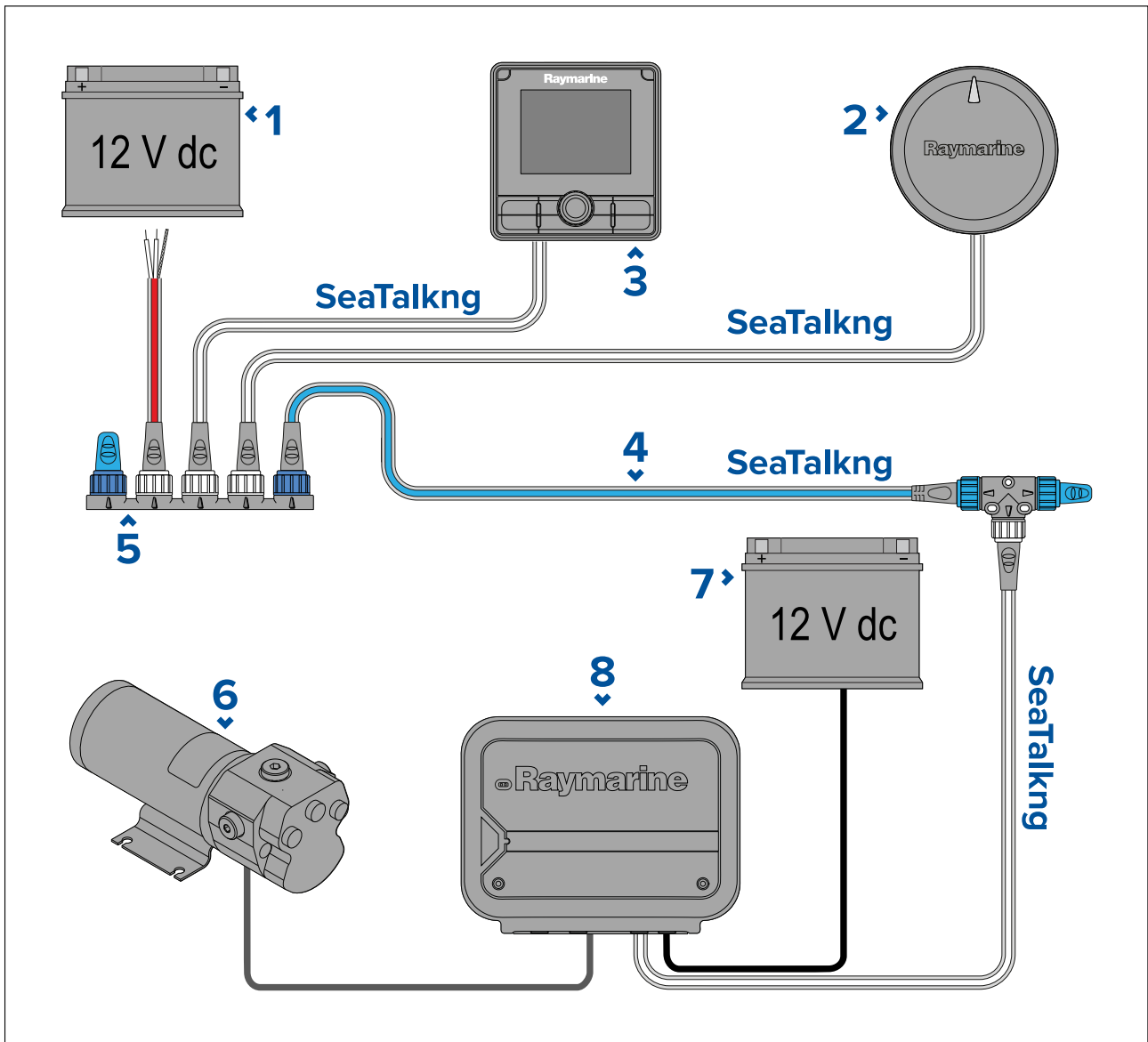
With the Evolution system, there are a number of important exceptions to the handling of multiple sources of certain types of data.

Specifically:

- **Heading data** — If a non-Evolution source of heading data is designated by the user, the Evolution 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 SeaTalkng[®] bus.
- **Rudder angle data** — Where there are multiple sources of rudder reference information, the Evolution system components will ignore rudder angle inputs from any rudder reference units that are NOT connected directly to the ACU.

System examples

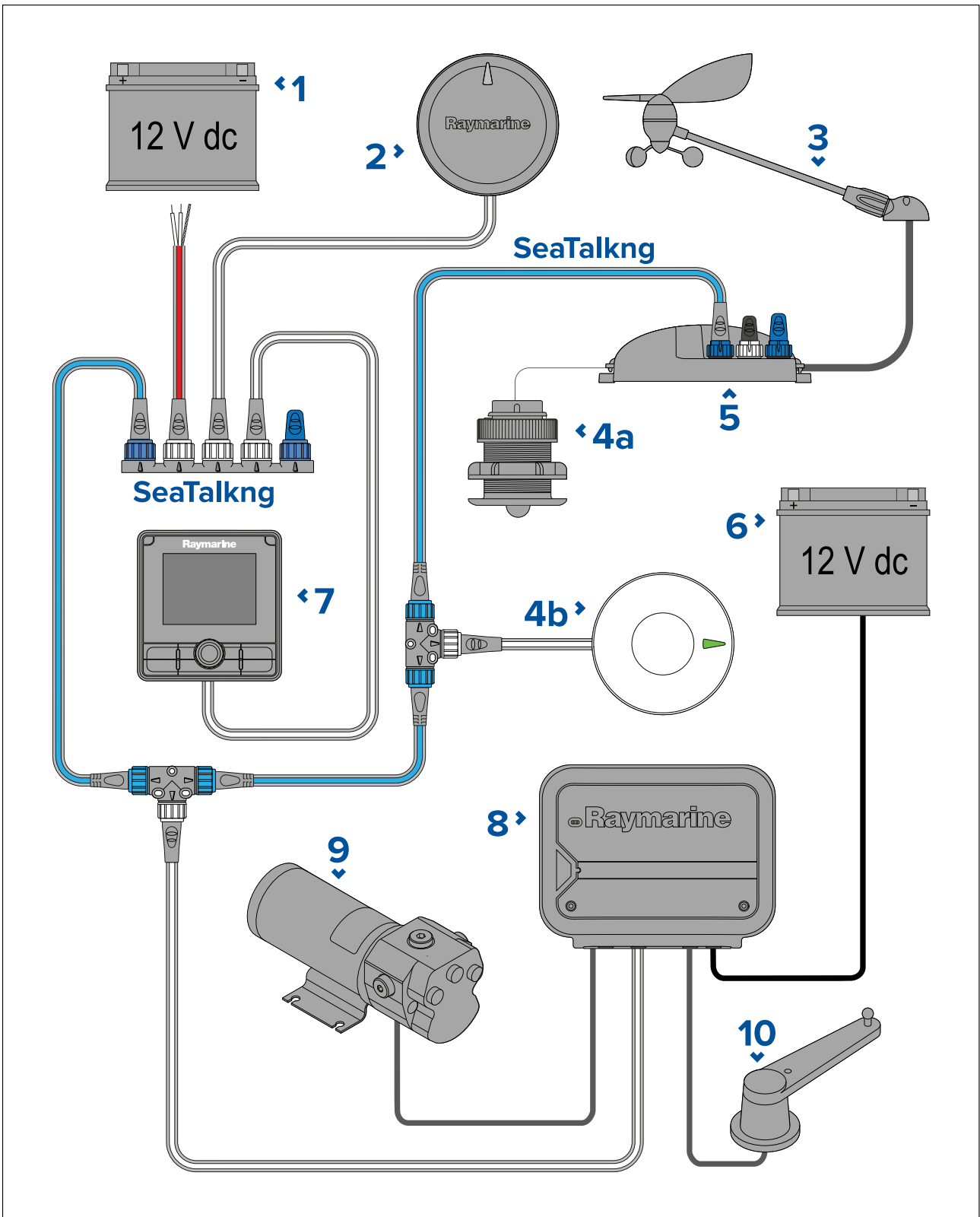
Example: Evolution minimum system ACU-100, ACU-150



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 SeaTalkng®)
2. EV-1 sensor
3. Autopilot controller
4. SeaTalkng® backbone
5. SeaTalkng® 5-way block
6. Drive unit (example)
7. 12 V dc power supply (providing power to the ACU)
8. ACU

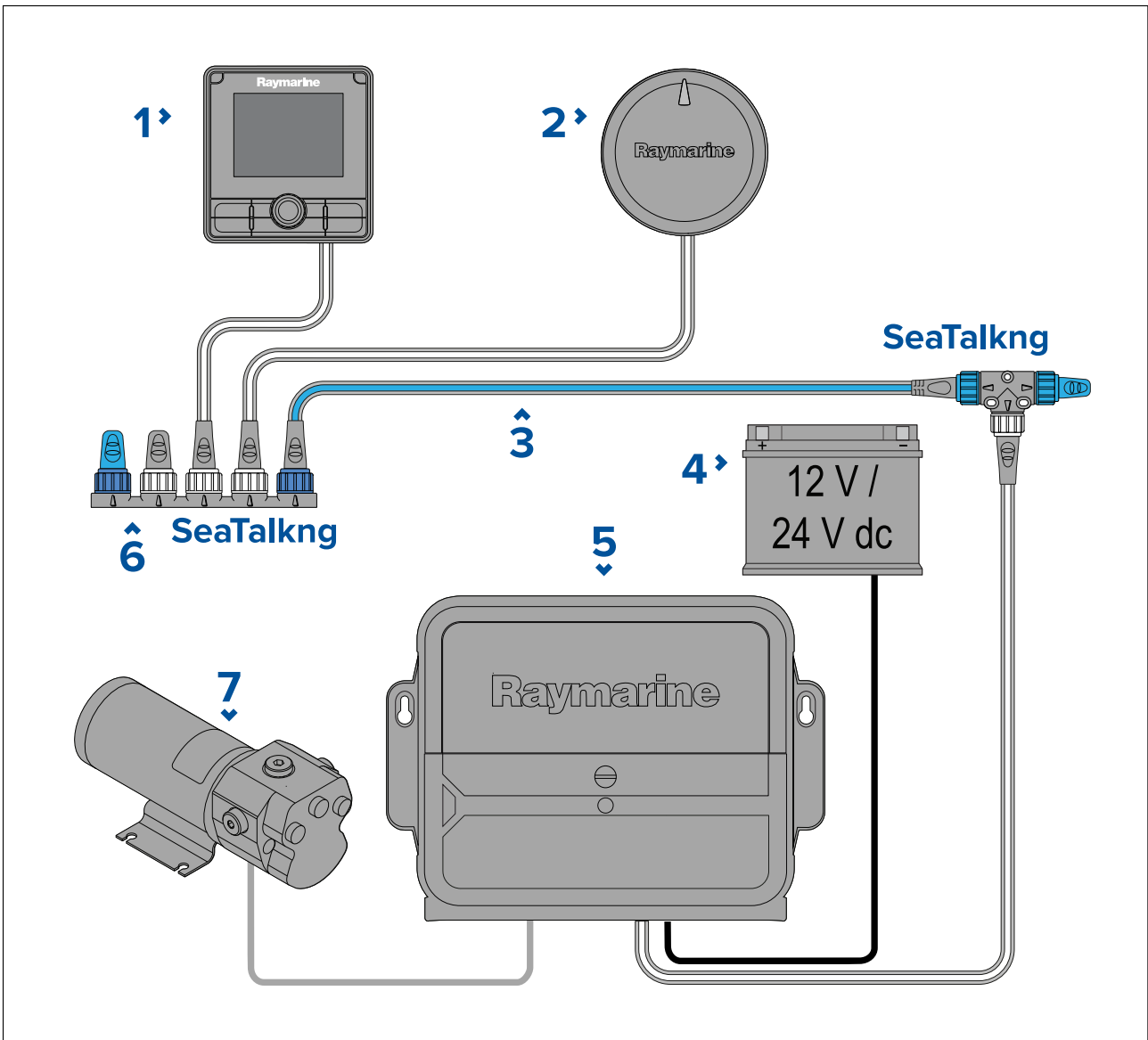
Example: Evolution recommended system ACU-100, ACU-150



1. 12 V dc power supply (providing power to SeaTalkng®)
2. EV-1
3. Wind transducer (only required for Sailing vessels)
4. Speed data source:
 - a. Speed transducer (STW), or
 - b. GNSS Receiver (SOG)
5. iTC-5
6. 12 V dc power supply (providing power to the ACU)

7. Autopilot controller
8. ACU
9. Drive unit (example)
10. Rudder angle reference sensor / transducer (M81105)

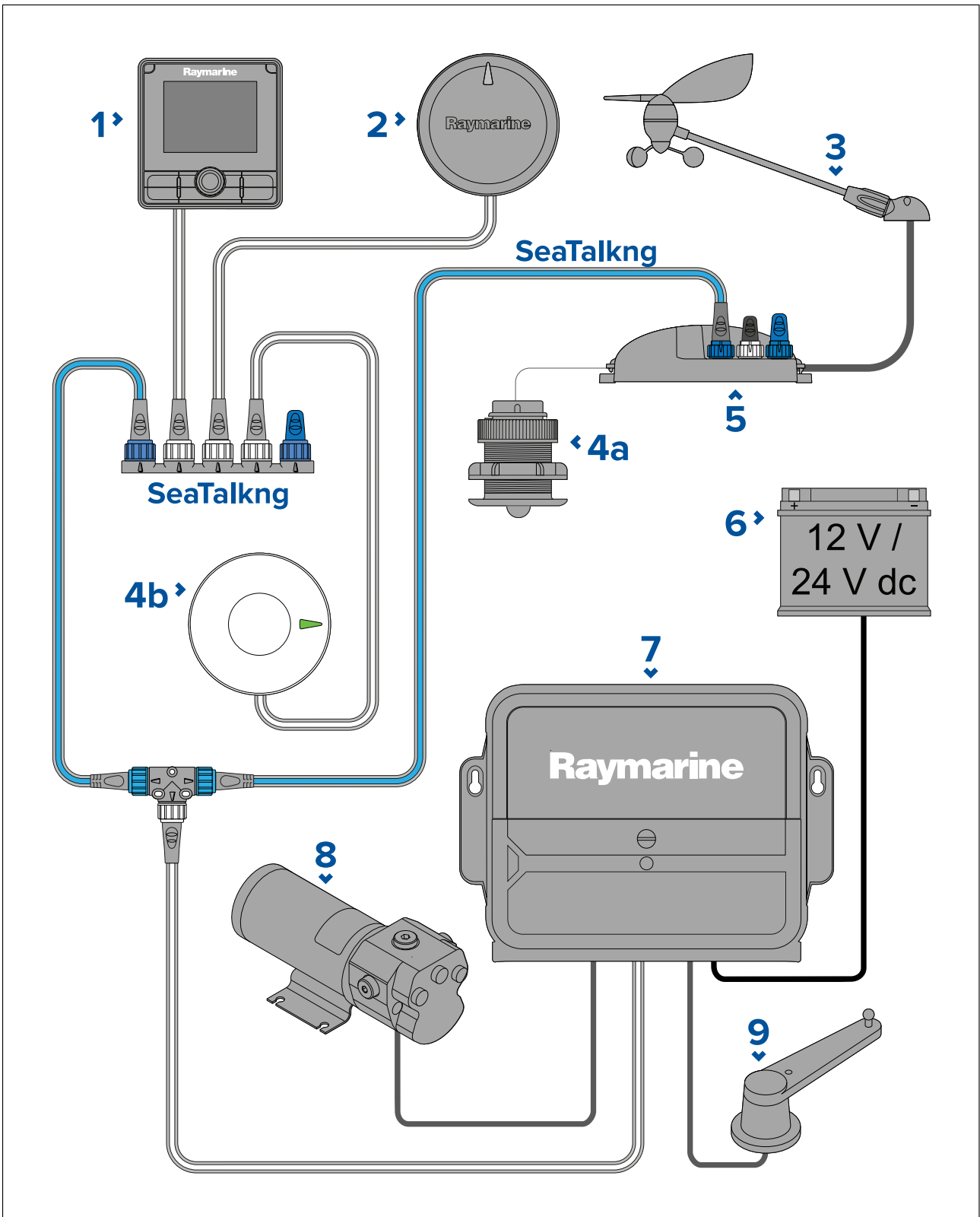
Example: Evolution minimum system ACU-200, ACU-400



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
2. EV-1 sensor
3. SeaTalkng® backbone
4. 12 V / 24 V dc power supply (providing power to the ACU and SeaTalkng® backbone)
5. ACU
6. SeaTalkng® 5-way block
7. Drive unit (example)

Example: Evolution recommended system ACU-200, ACU-300, ACU-400



1. Autopilot controller
2. EV-1
3. Wind transducer (only required for Sailing vessels)
4. Speed data source:
 - a. Speed transducer (STW), or
 - b. GNSS Receiver (SOG)
5. iTC-5
6. 12 V / 24 V dc power supply (providing power to the ACU and SeaTalkng® backbone)

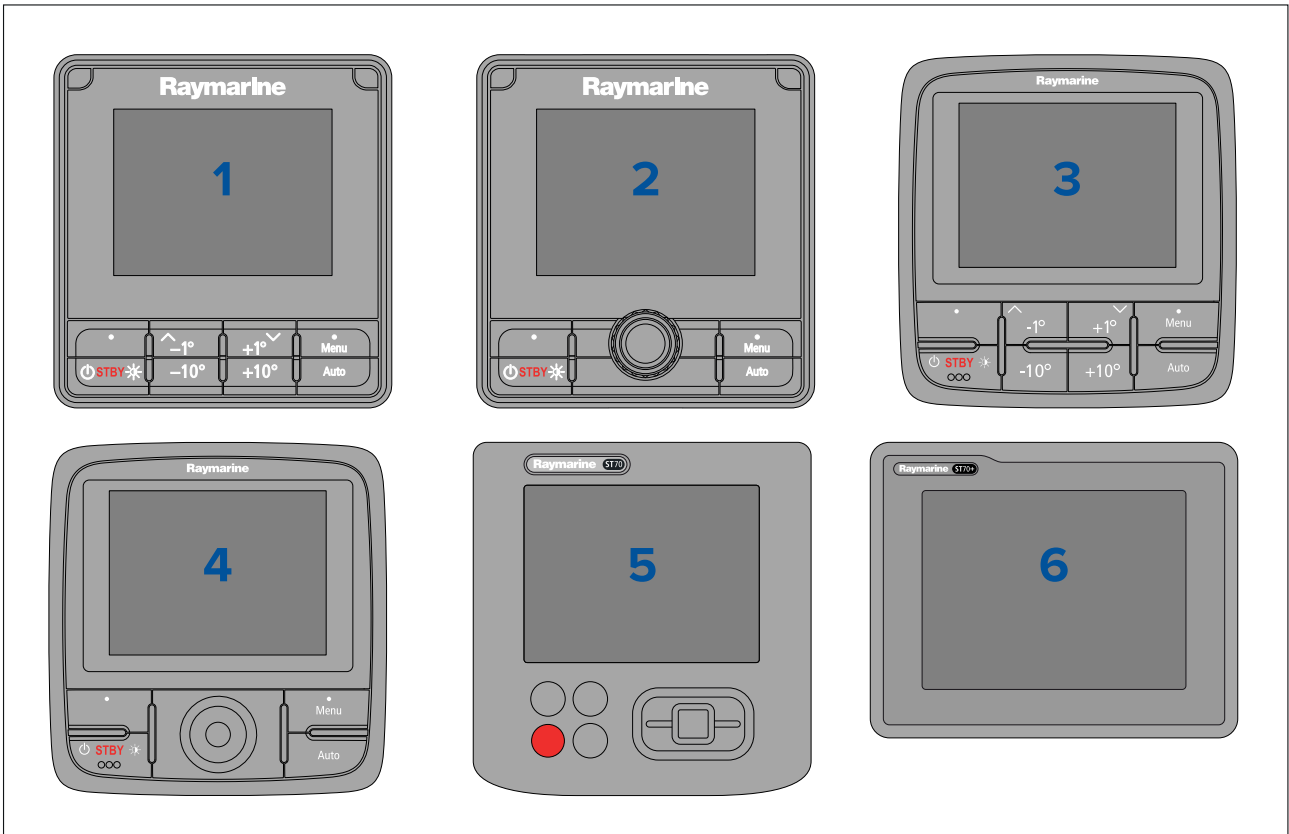
7. ACU
8. Drive unit (example)
9. Rudder angle reference sensor / transducer (M81105) — This is **essential for ACU-300** systems, and highly recommended for all other systems.

Compatible autopilot controllers

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

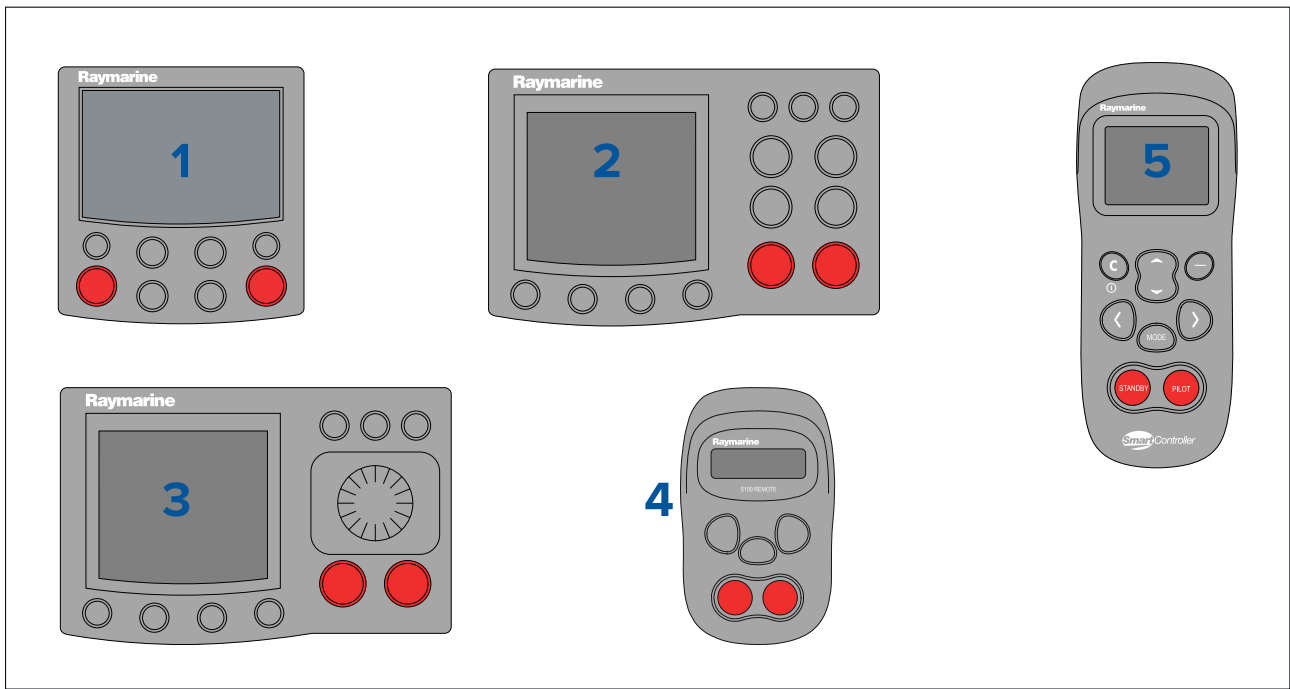
More than 1 autopilot controller can be used to control your autopilot system.

SeaTalkng[®] autopilot controllers



	Product details		Product details
1	p70s (E70328)	2	p70Rs (E70329)
3	p70 (E22166)	4	p70R (E22167)
5	ST70 (E22105)	6	ST70+ (E22115)

SeaTalk® autopilot controllers



	Product details		Product details
1	ST6002 (E12098-P / E12100-P)	2	ST7002 (E12099-P / E12182)
3	ST8002 (E12119-P / E12183)	4	S100 (repeat controller only) (E15024)
5	SmartController (repeat controller only) (E15023)		

Compatible autopilot controllers - MFDs

You can operate your autopilot system from a Raymarine MFD.

LightHouse 2 MFDs:

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

LightHouse 3 MFDs:

- Axiom
- Axiom+
- Axiom Pro
- Axiom XL

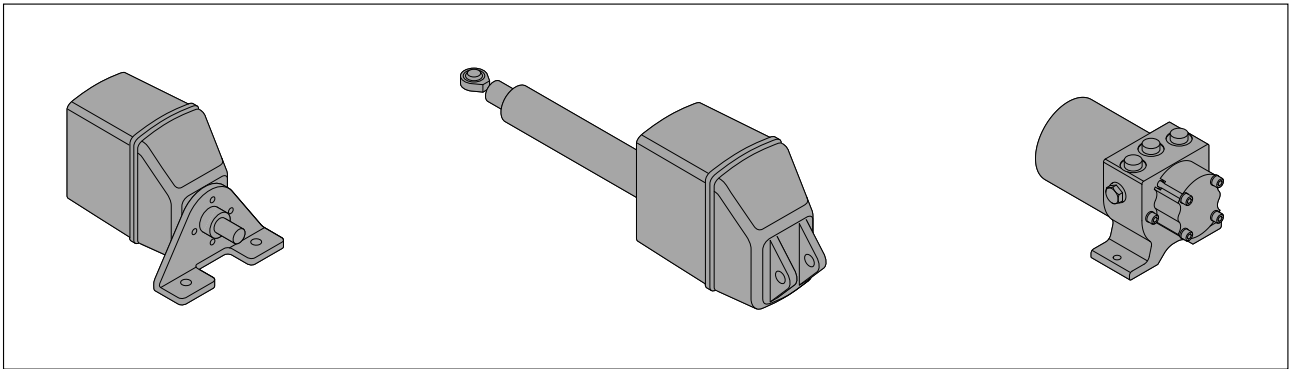
Compatible drive units

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.



Drive category	Available types	Suitable ACU	* Max output
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 .	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

Drive category	Available types	Suitable ACU	* Max output
<p>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.</p>	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
<p>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.</p>	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
<p>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.</p>	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
<p>Universal stern drive For use with inboard / outboard (I/O) vessels with cable power-assisted steering.</p>		ACU-200	15 A
<p>Wheel drive – Power (Sport Drive) Designed for smaller power vessels featuring a steering system that can be driven directly from the helm position.</p>	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

Drive category	Available types	Suitable ACU	* Max output
Wheel drive – Sail Designed for smaller sailing vessels featuring a steering system that can be driven directly from the helm position. <hr/> 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.	Sail (for vessels with a maximum displacement of 7,500 Kg)	ACU-100	7 A
Tiller drive Designed for smaller tiller-steered sailing vessels. <hr/> 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.	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.

Software updates

The software running on the product can be updated.

- Raymarine periodically releases software updates to improve product performance and add new features.
- The software on many products can be updated using a connected and compatible multifunction display (MFD).
- Refer to www.raymarine.com/software/ for the latest software updates and the software update procedure for your specific product.

Important:

- To prevent potential software-related issues with your product, always follow the relevant update instructions carefully and in the sequence provided.
- 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

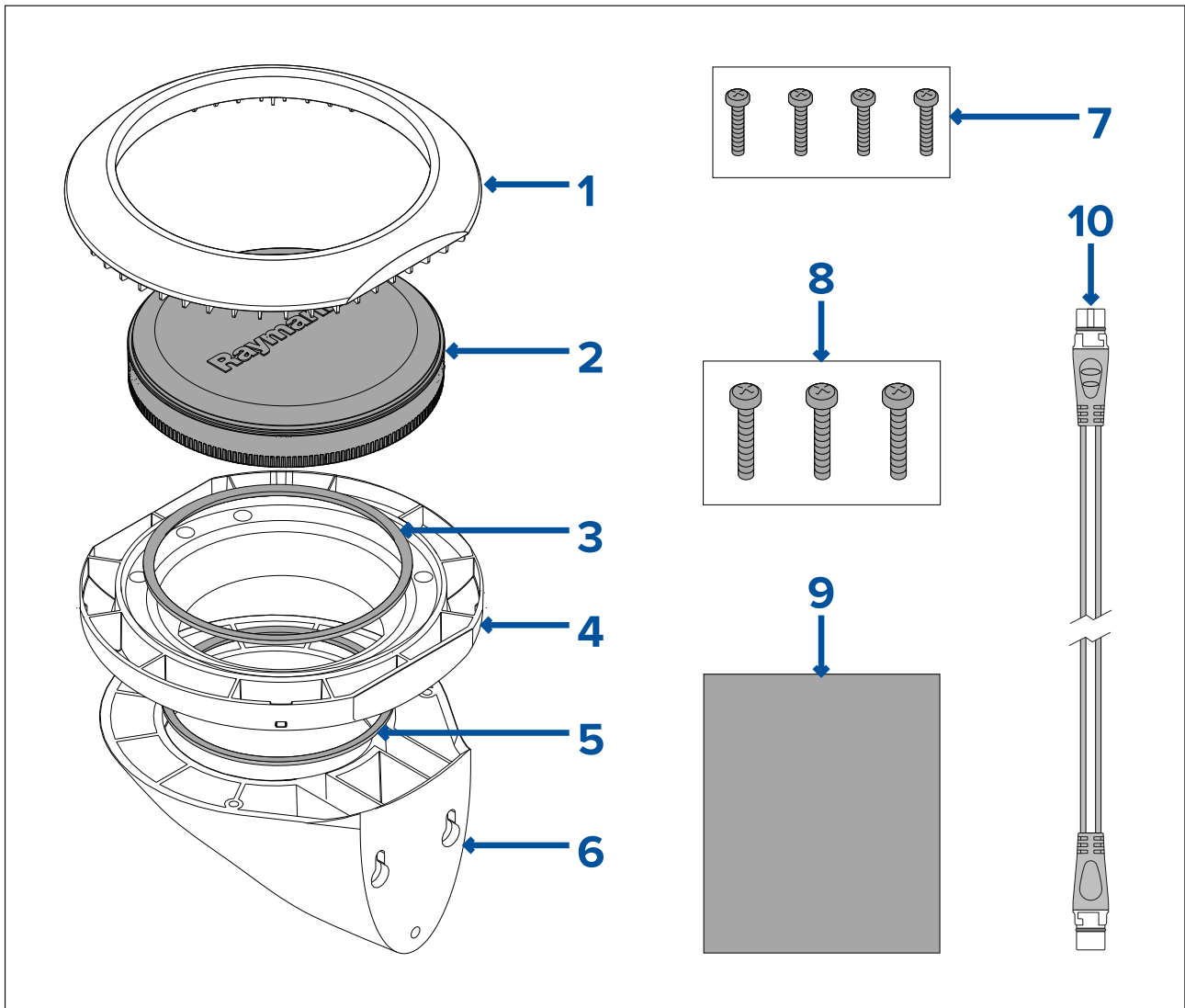
- The software update process is carried out at your own risk. Before initiating the update process ensure you have backed up any important files.
- Ensure that the unit has a reliable power supply and that the update process is not interrupted.
- Damage caused by an incomplete update is not covered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

Chapter 4: Parts supplied

Chapter contents

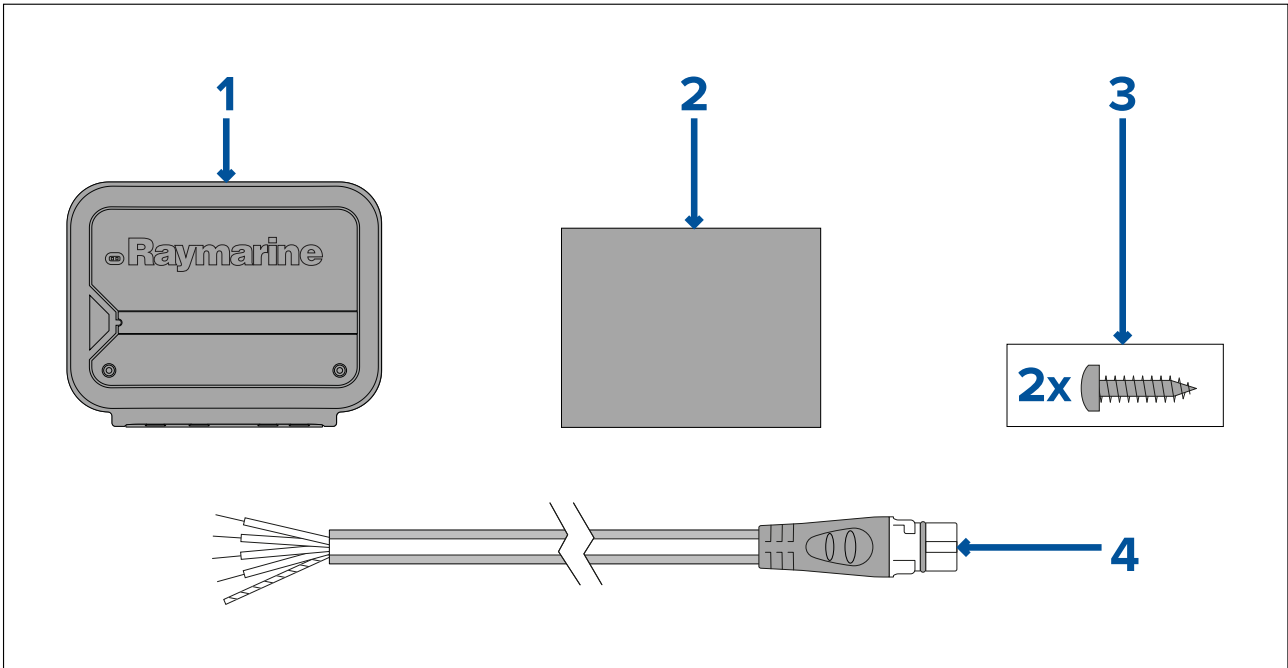
- 4.1 Parts supplied — EV-1 and EV-2 on page 32
- 4.2 Parts supplied — ACU-100, ACU-150 on page 33
- 4.3 Parts supplied — ACU-200, ACU-300, ACU-400 on page 33

4.1 Parts supplied — EV-1 and EV-2



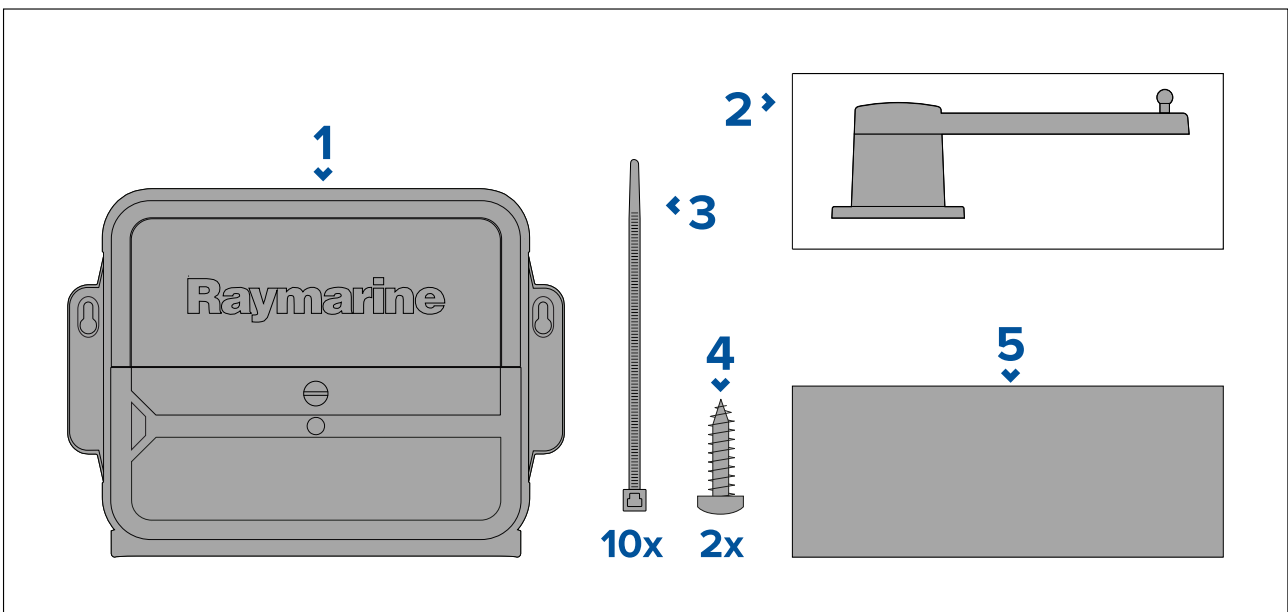
Item	Description	Quantity
1	Mounting trim.	1
2	EV-1 / EV-2.	1
3	Sealing ring.	1
4	Mounting tray.	1
5	Sealing ring.	1
6	Wall mounting bracket.	1
7	Screws for deck or bracket mounting.	4
8	Screws for wall bracket.	3
9	Document pack.	1
10	1 m (3.3 ft) SeaTalk ^{ng} spur cable.	1

4.2 Parts supplied — ACU-100, ACU-150



Item	Description	Quantity
1	ACU unit	1
2	Documentation pack	1
3	Screws (pan head type)	2
4	SeaTalkng® spur to bare wires cable 1 m (3.3 ft)	1

4.3 Parts supplied — ACU-200, ACU-300, ACU-400



Item	Description	Quantity
1	ACU unit.	1
2	Rudder angle reference sensor / transducer. Not supplied with all system packs — please check with your dealer. Also available separately as M81105.	1
3	Cable ties.	10

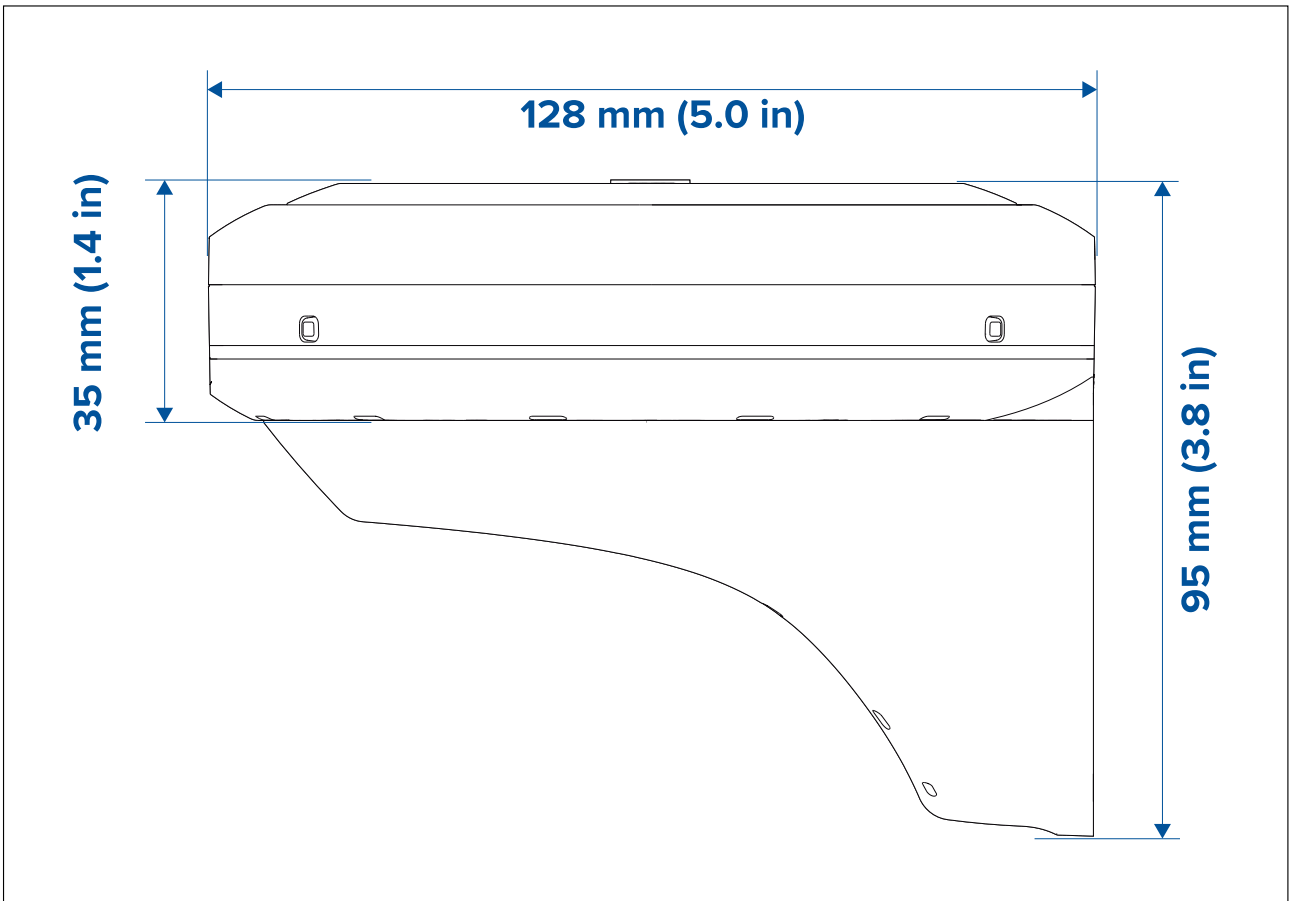
Item	Description	Quantity
4	Mounting screws	2
5	Document pack	1

Chapter 5: Product dimensions

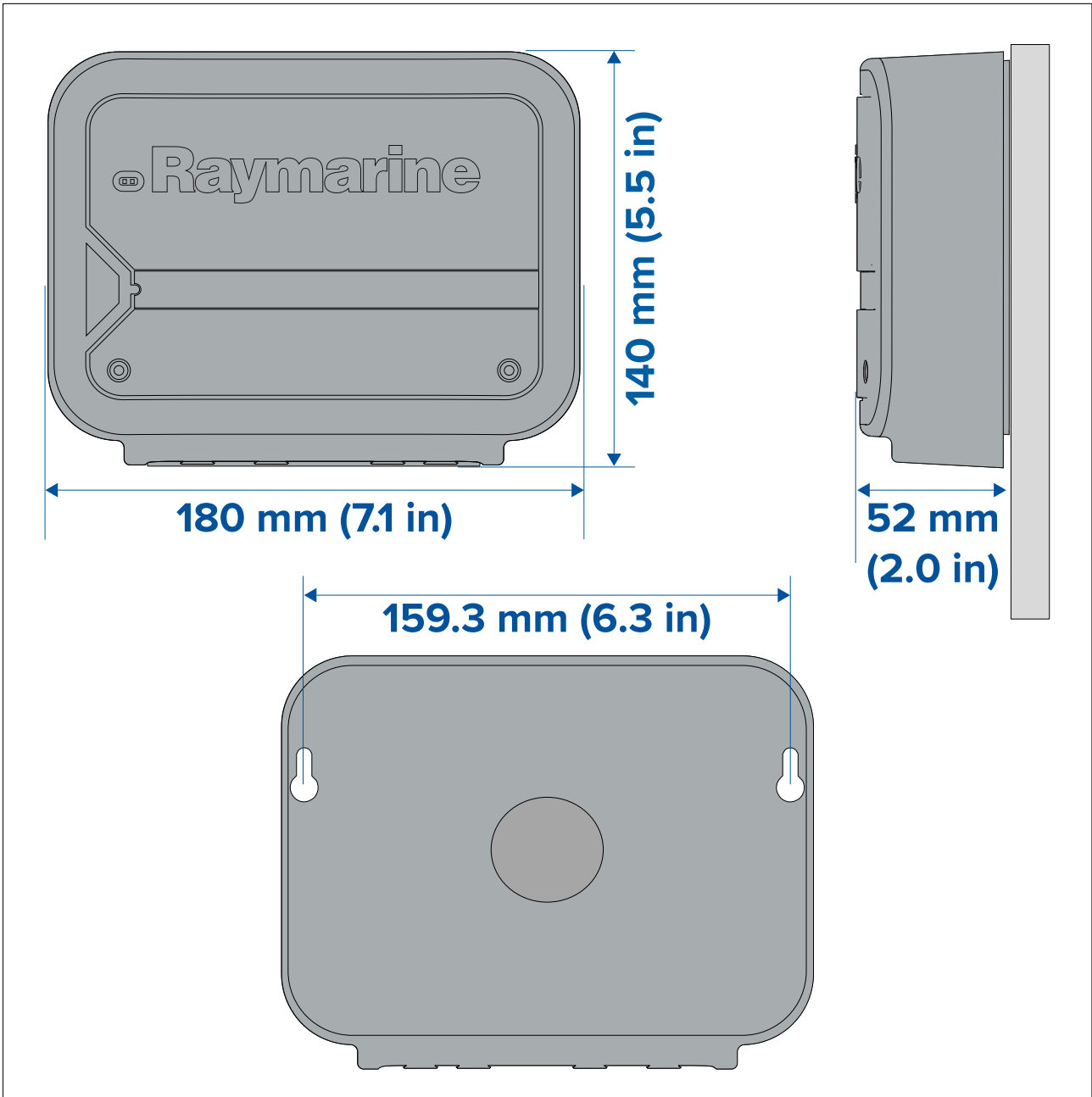
Chapter contents

- 5.1 Dimensions — EV-1 and EV-2 on page 36
- 5.2 Dimensions — ACU-100, ACU-150 on page 37
- 5.3 Dimensions — ACU-200, ACU-300, ACU-400 on page 38

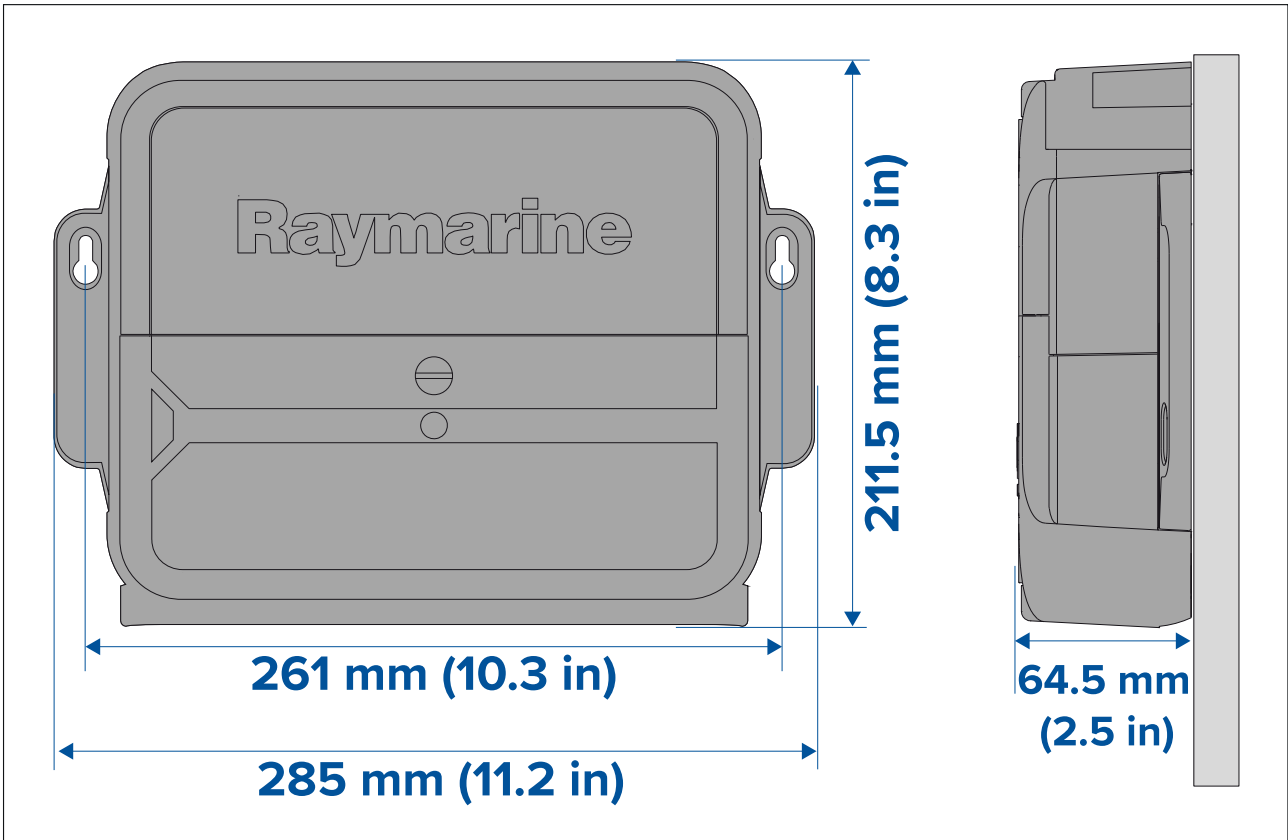
5.1 Dimensions — EV-1 and EV-2



5.2 Dimensions — ACU-100, ACU-150



5.3 Dimensions — ACU-200, ACU-300, ACU-400



Chapter 6: Installation sequence

Chapter contents

- [6.1 Installation checklist on page 40](#)

6.1 Installation checklist

Installation includes the following activities:

Installation Task

1. Plan your system.
2. Obtain all required equipment and tools.
3. Site all equipment.
4. Route all cables.
5. Drill cable and mounting holes.
6. Make all connections into equipment.
7. Secure all equipment in place.
8. Power on and test the system.

Schematic diagram

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

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

Chapter 7: Location requirements

Chapter contents

- 7.1 Warnings and cautions on page 42
- 7.2 Potential ignition source on page 42
- 7.3 Location requirements — EV-1 and EV-2 on page 42
- 7.4 Location requirements — ACU on page 43
- 7.5 Compass safe distance on page 44
- 7.6 EMC installation guidelines on page 44

7.1 Warnings and cautions

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

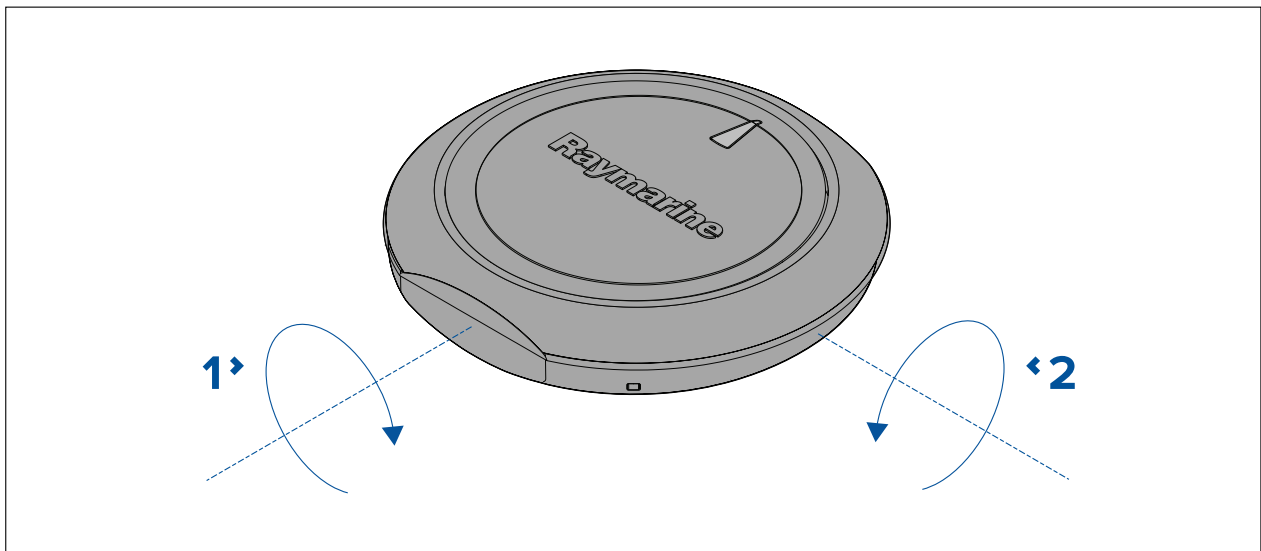
7.2 Potential ignition source

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

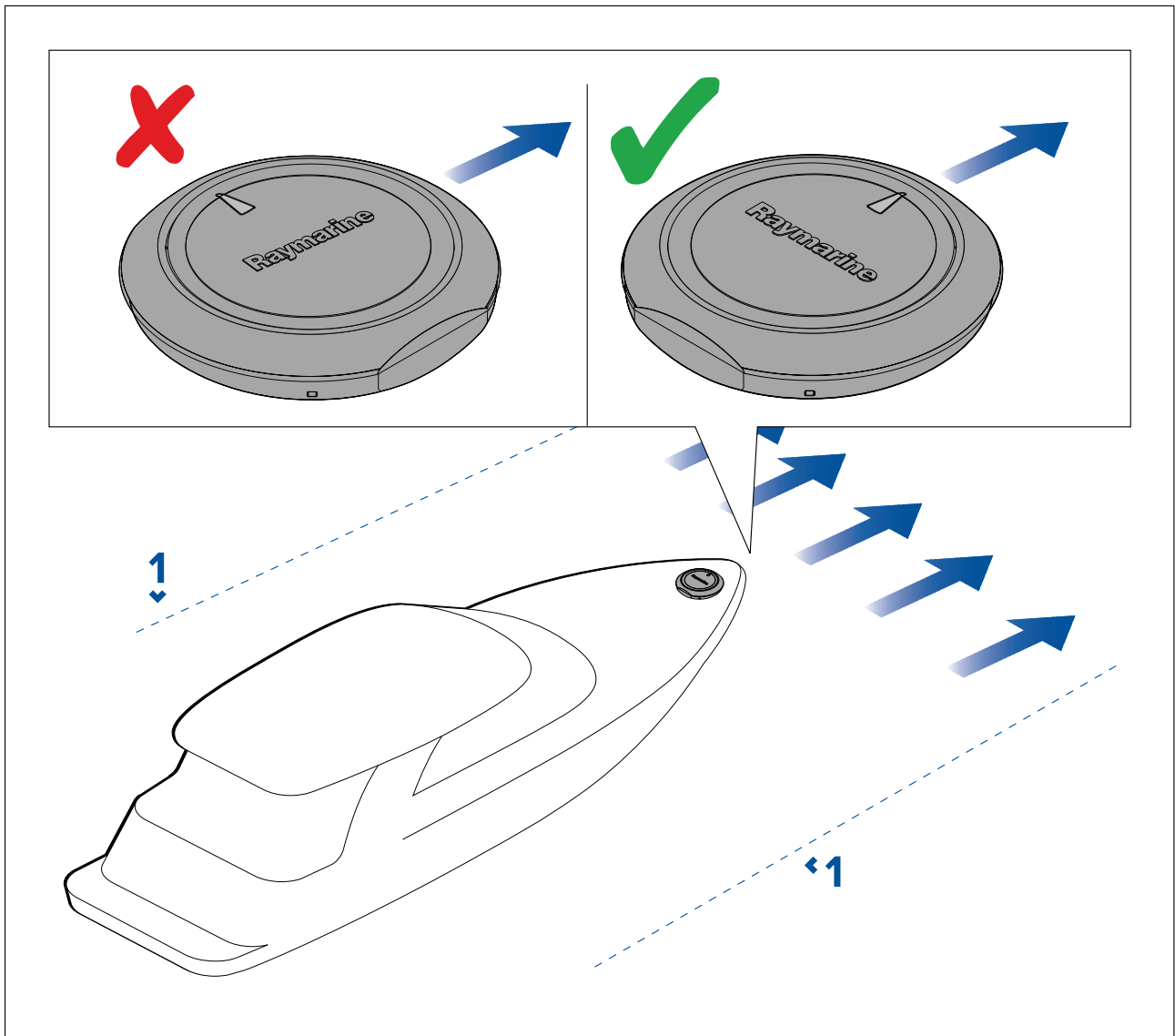
7.3 Location requirements — EV-1 and EV-2

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.

7.4 Location requirements – ACU

The installation location must take into account the following requirements:

- ACU-200, ACU-300, ACU-400 — install below decks in a dry area.
- ACU-100, ACU-150 — install above or below decks.
- The unit should be mounted on a vertical surface.
- 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.
- The unit should be mounted in a location where the diagnostics LED is viewable.

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

7.6 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 (3.3 ft) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 2 m (6.6 ft).
 - More than 2 m (6.6 ft) from the path of a radar beam. A radar beam can normally be assumed to spread 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 8: Installation

Chapter contents

- [8.1 EV-1 Installation on page 46](#)
- [8.2 ACU Installation on page 53](#)
- [8.3 Drive unit installation on page 57](#)

8.1 EV-1 Installation

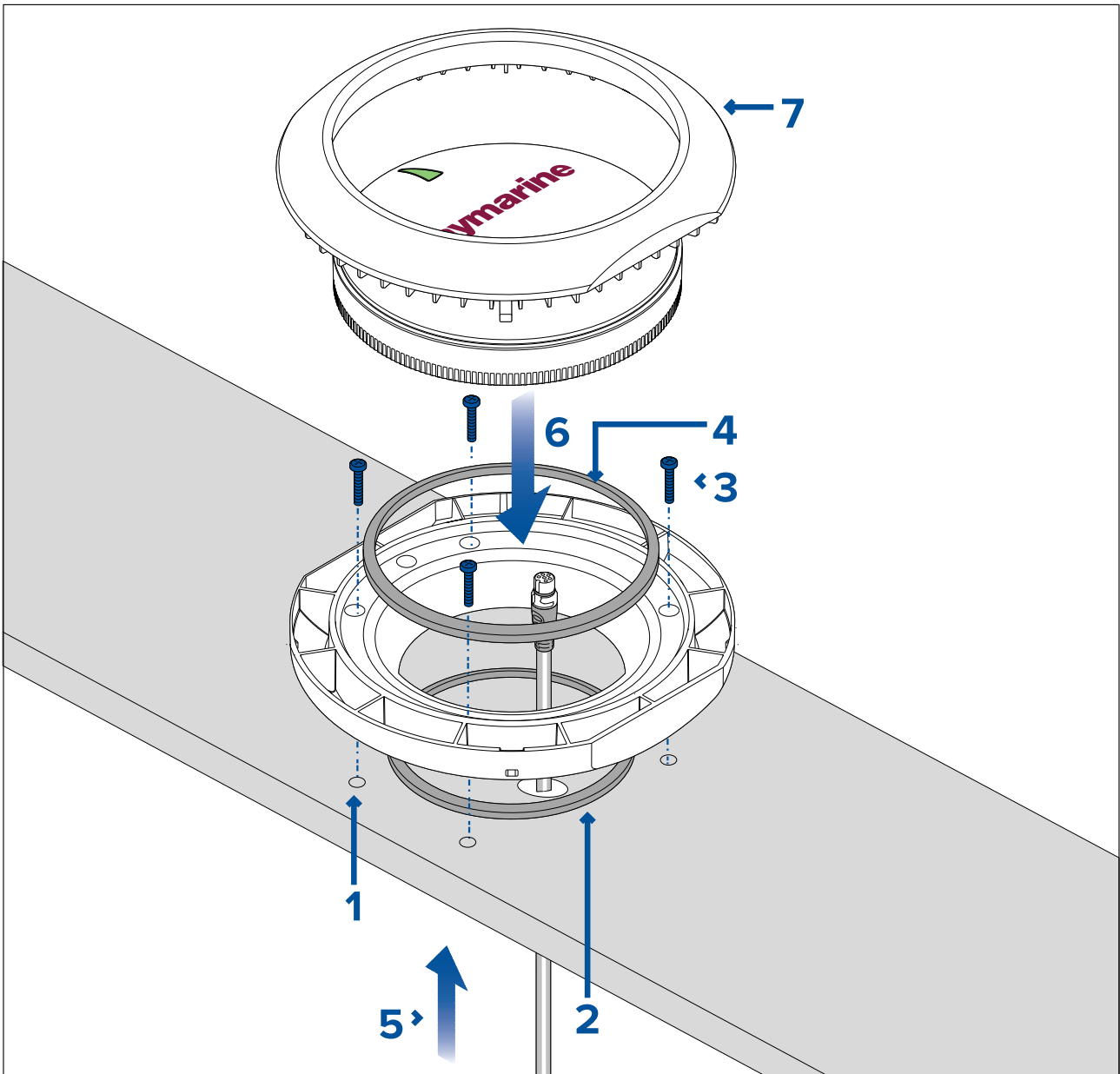
Surface mounting the EV-1

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

Ensure that the chosen location meets the product's location requirements; refer to: [p.42 – Location requirements – EV-1 and EV-2](#)

Important:

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

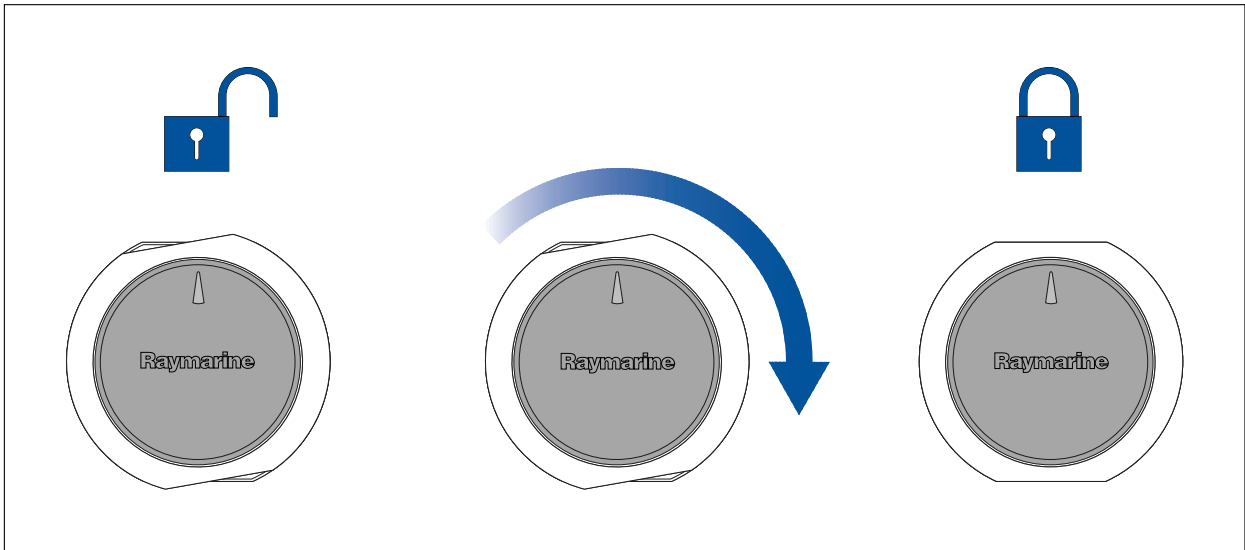


1. Using the Mounting tray template (87170), drill 4 holes in the mounting surface, plus a 22 mm (7/8 in) hole for the SeaTalkng[®] cable.
2. Place the small sealing ring in the groove located on the bottom of the Mounting tray.
3. Secure the tray to the mounting surface using the 4 x fixings, supplied.
4. Place the large sealing ring into the groove on the upper side of the Mounting tray.
5. Pull the SeaTalkng[®] cable 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.

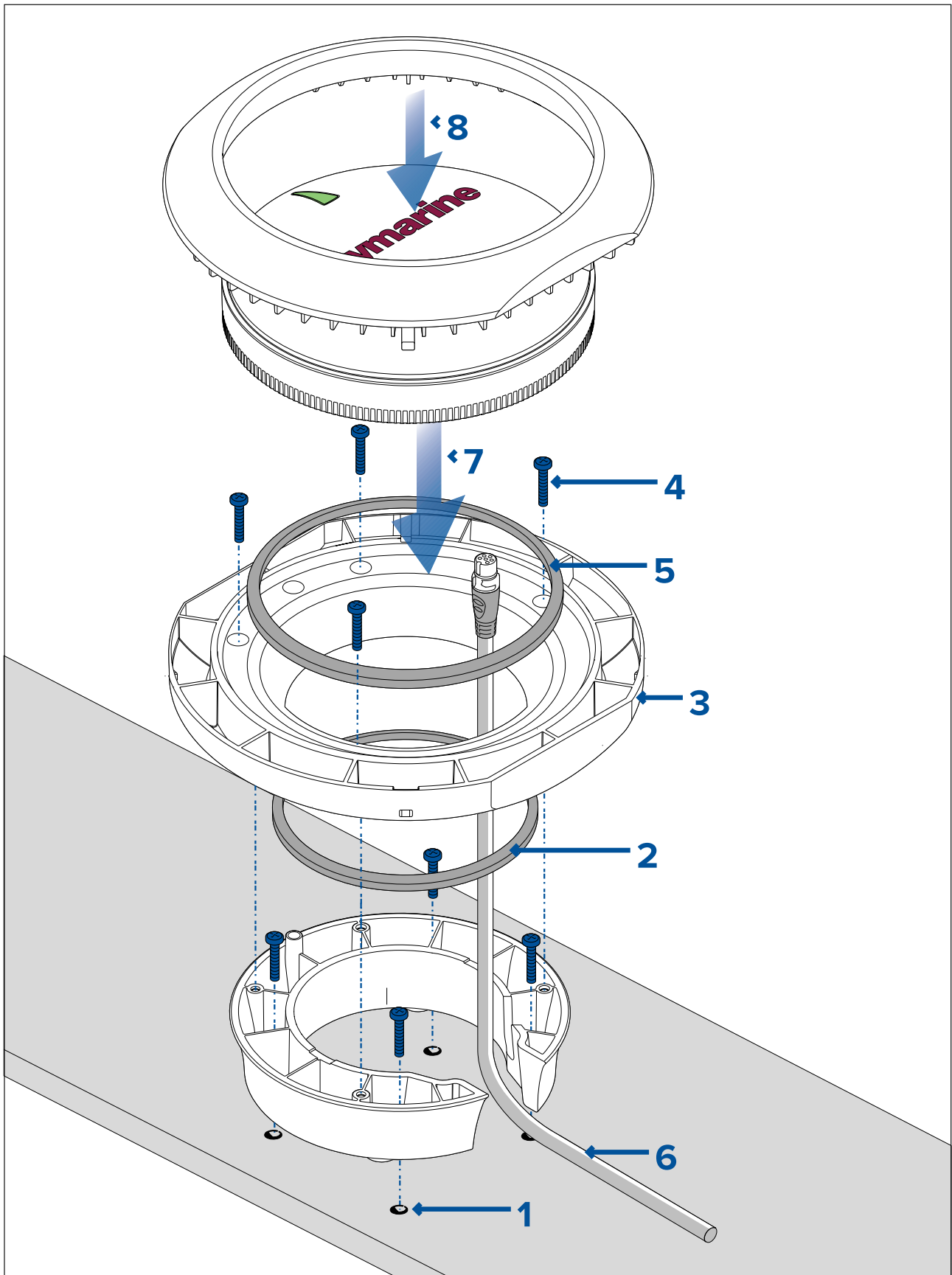
7. Place the Mounting trim over the unit slightly offset, and then twist the Mounting trim clockwise until it locks into position.



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 3x supplied fixings.
5. Place the large sealing ring into the groove on the upper side of the Mounting tray.
6. Pull the SeaTalkng[®] cable through the Riser and Mounting tray. Plug in the cable connector on the underside of the unit and secure by rotating the locking collar clockwise 2 clicks.

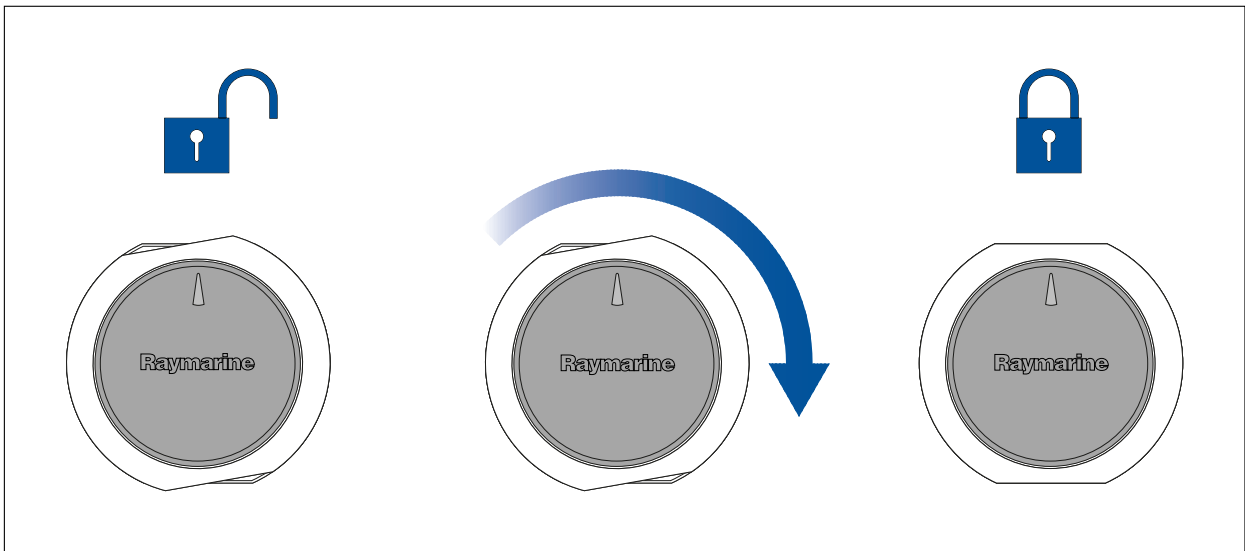
Note: If there is not enough space in the riser to accommodate the cable and to plug the SeaTalkng[®] spur cable into the unit, you may need to obtain a spur cable with a right-angled elbow connector (A06081), or a right-angled elbow adaptor (A06077).

7. Insert the 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.

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

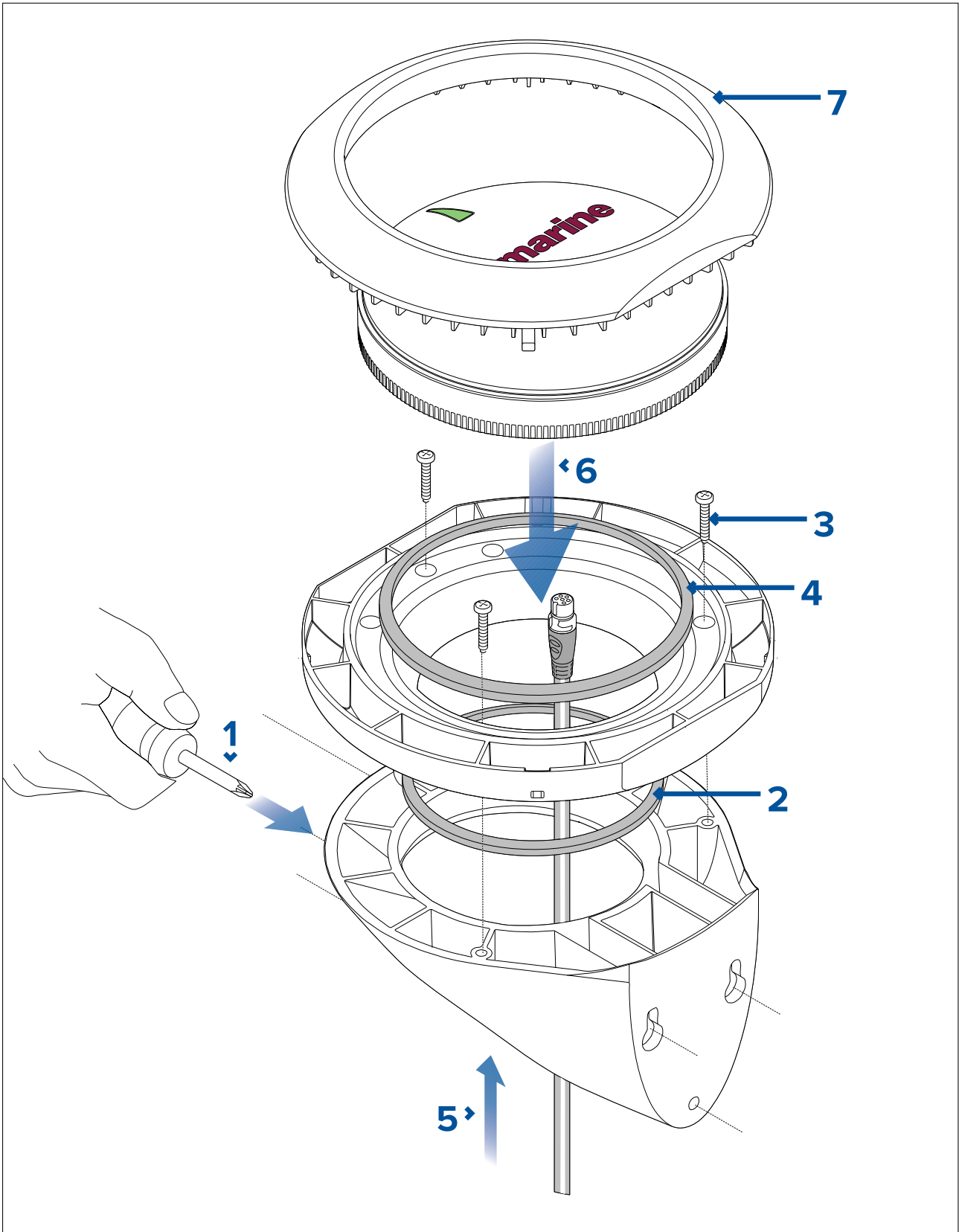


Bracket mounting the EV-1

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; refer to: [p.42 – Location requirements – EV-1 and EV-2](#)

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

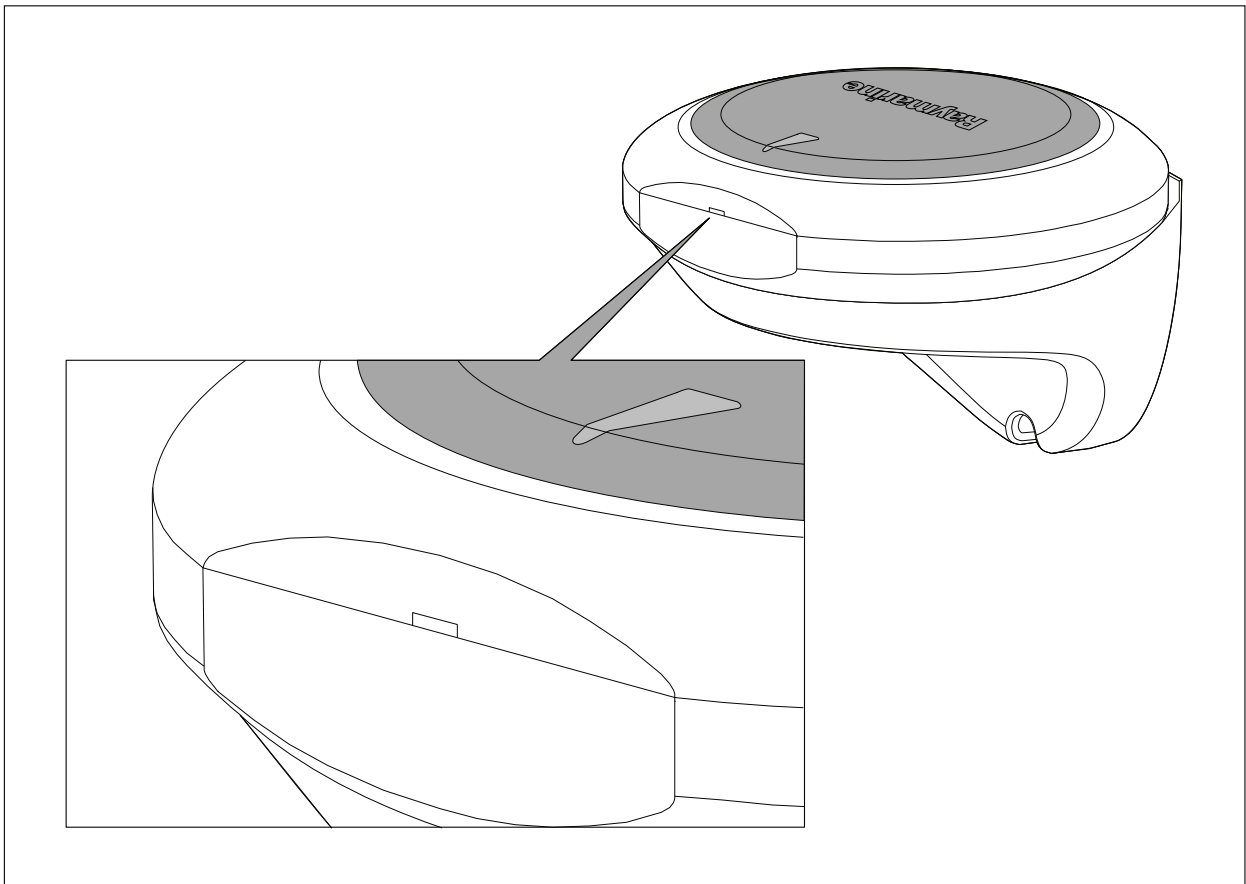


1. Use the Mounting bracket template (87170) to drill 3 pilot holes in the vertical mounting surface. Secure the mounting bracket to the surface using the supplied screws.
2. Place the small sealing ring in the groove located on the bottom of the Mounting tray.
3. Secure the tray to the bracket using 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 SeaTalkng[®] 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.

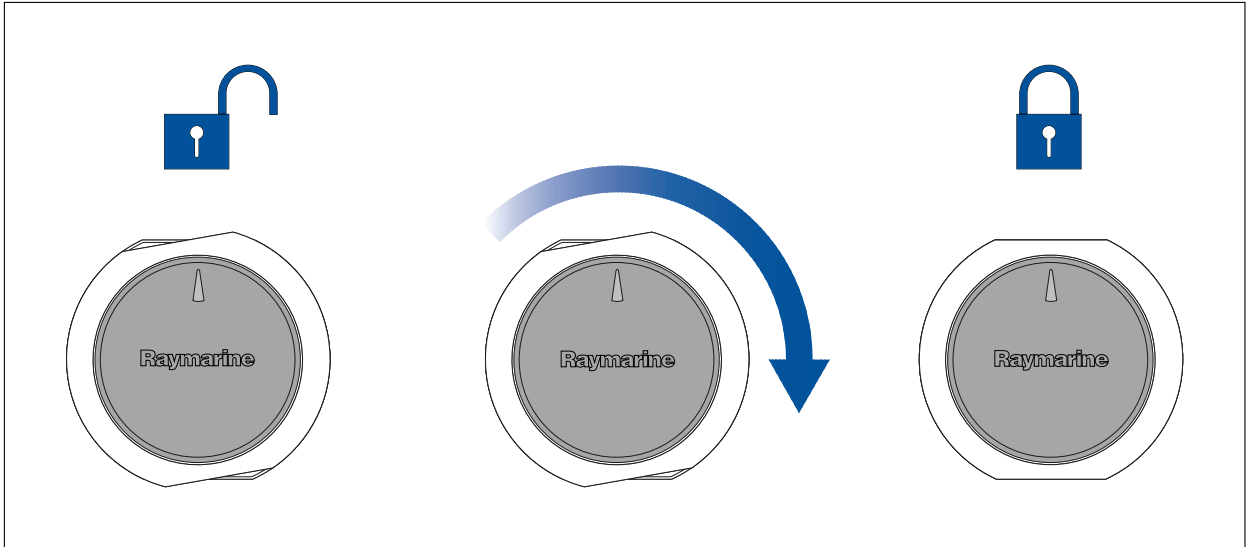
Important:

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.

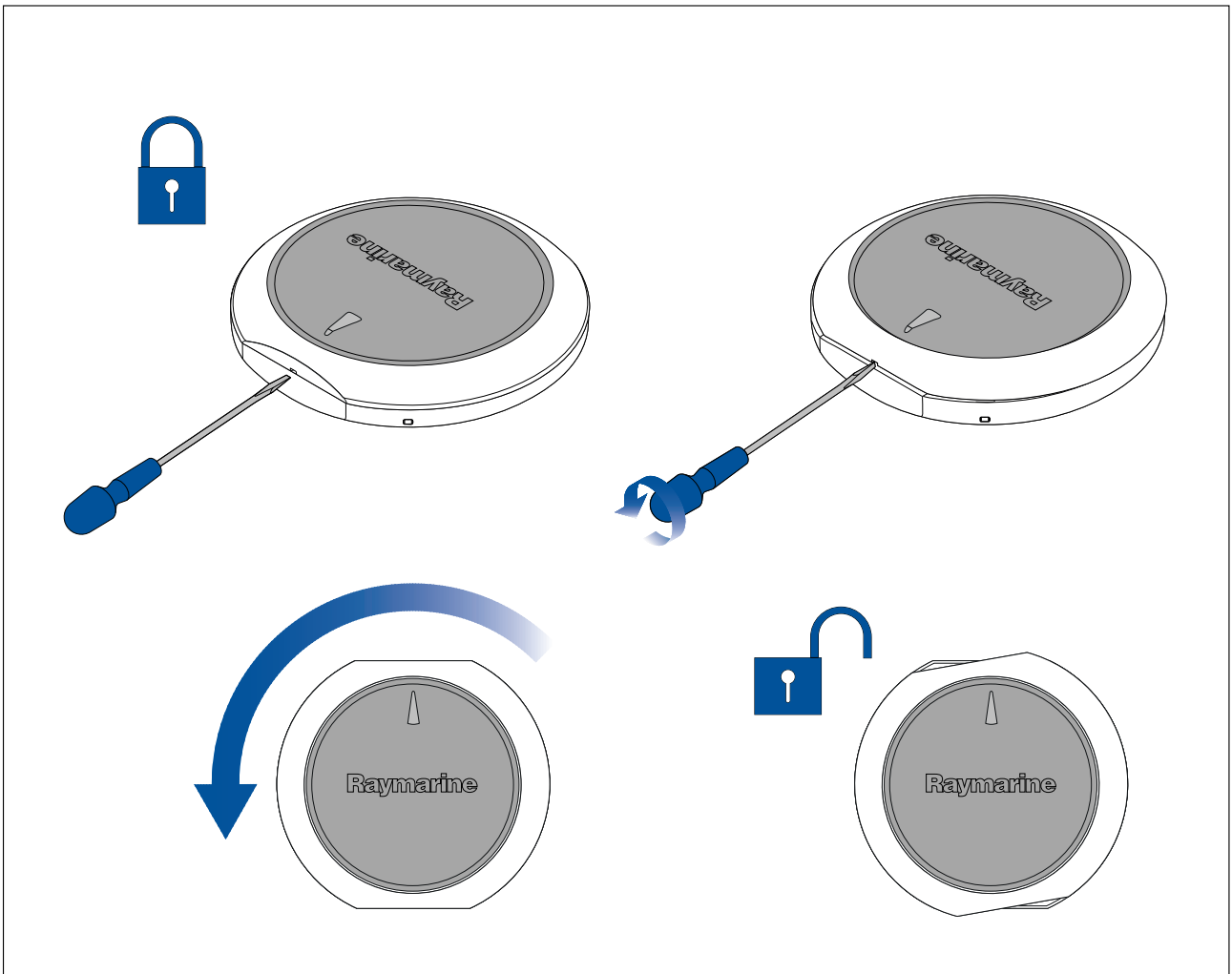


- Place the Mounting trim over the unit slightly offset, and then twist the Mounting trim clockwise until it locks into position.



Releasing the unit from the bracket

Follow the steps below to release the unit from the Mounting bracket.



- Insert the flat of a small flat blade screw driver, or similar tool into the release hole located on the flat edge of the mounting bracket and twist the screw driver 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 screw driver with a small piece of insulation tape.

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

8.2 ACU Installation

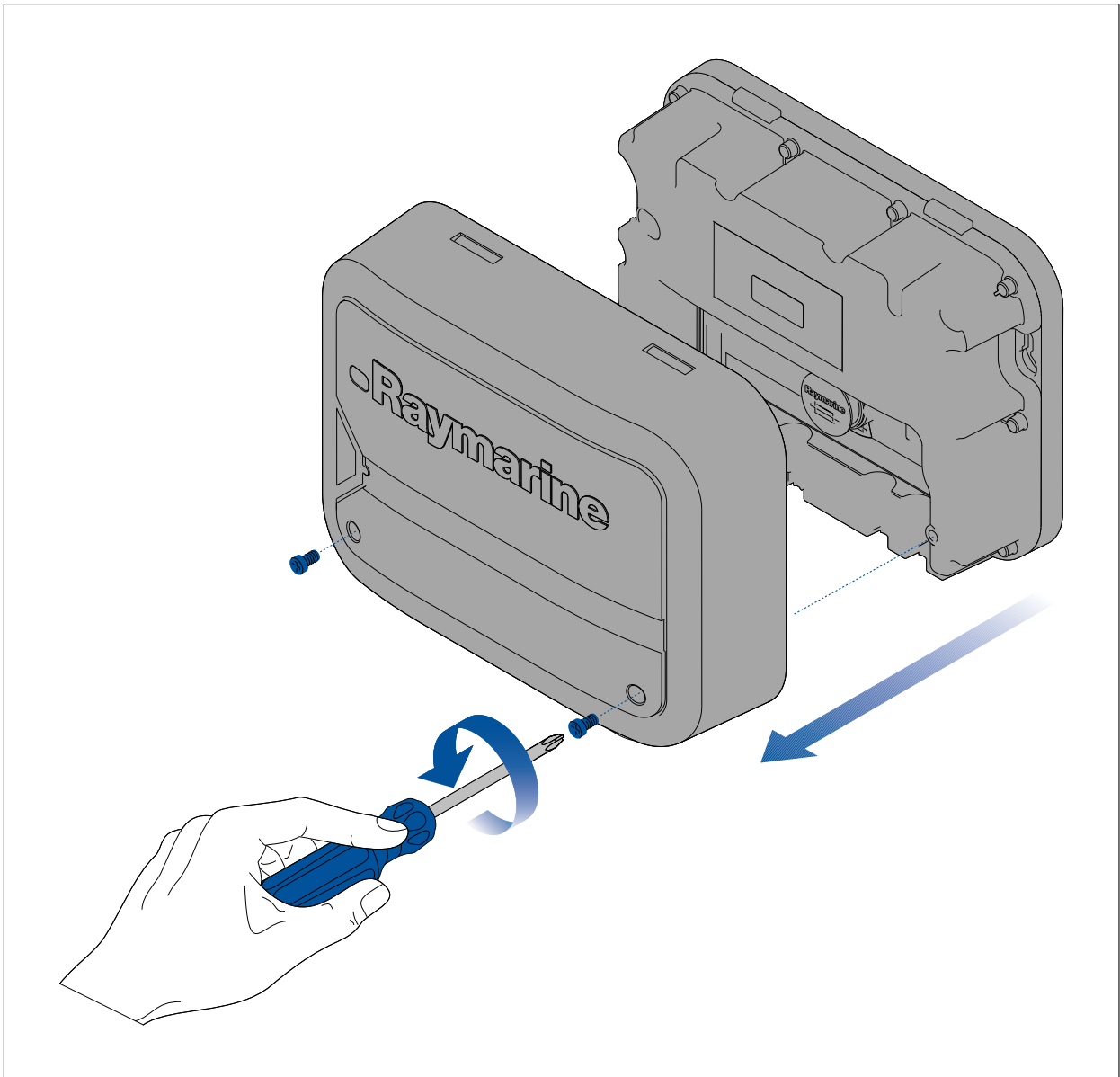
Mounting the ACU-100, ACU-150

Ensure that the chosen location meets the product's location requirements; refer to: [p.43 — Location requirements — ACU](#)

Important:

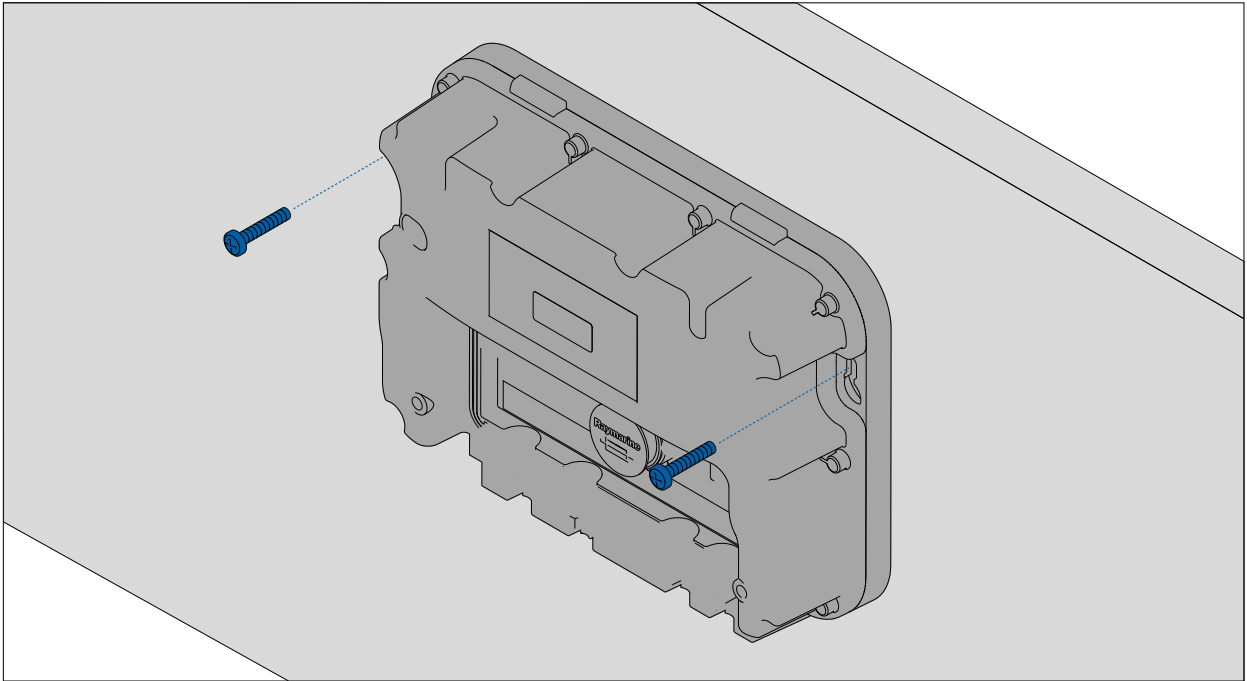
The installation must only be performed with the vessel either on a hard standing, or tied-up alongside a pontoon or berth.

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



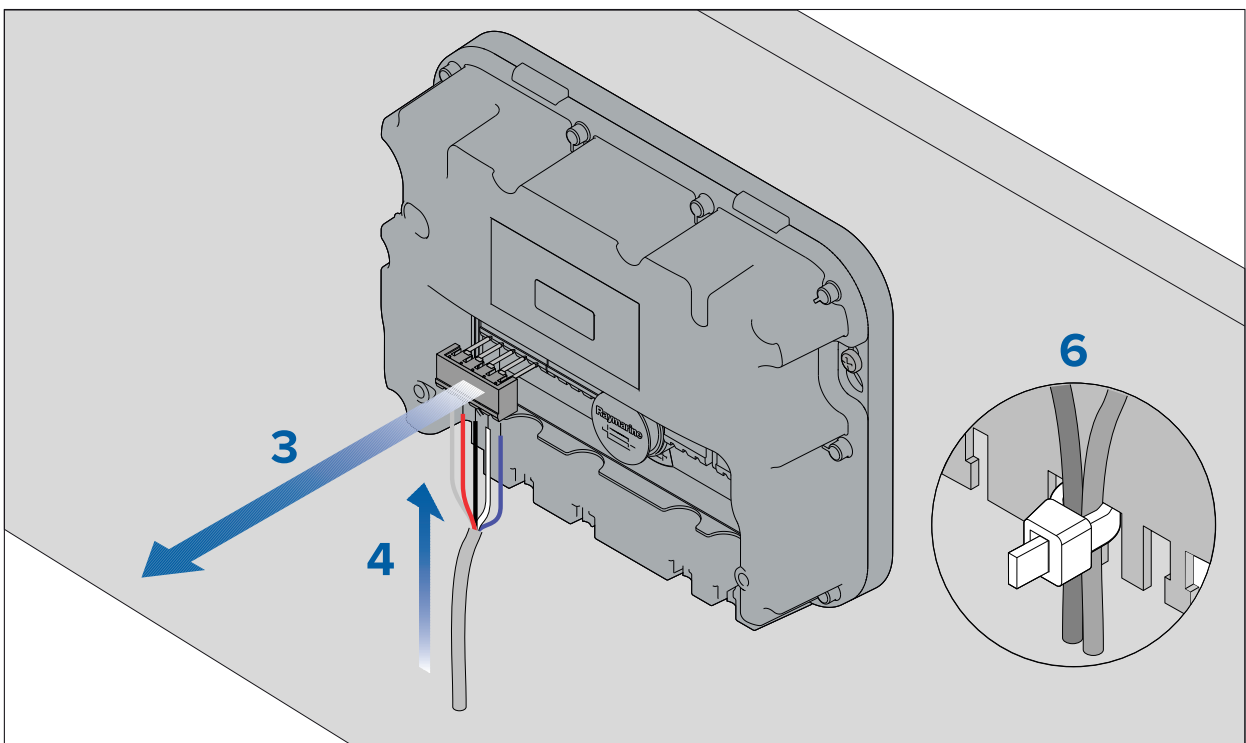
Once the cover is removed, the unit's mounting holes are accessible.

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

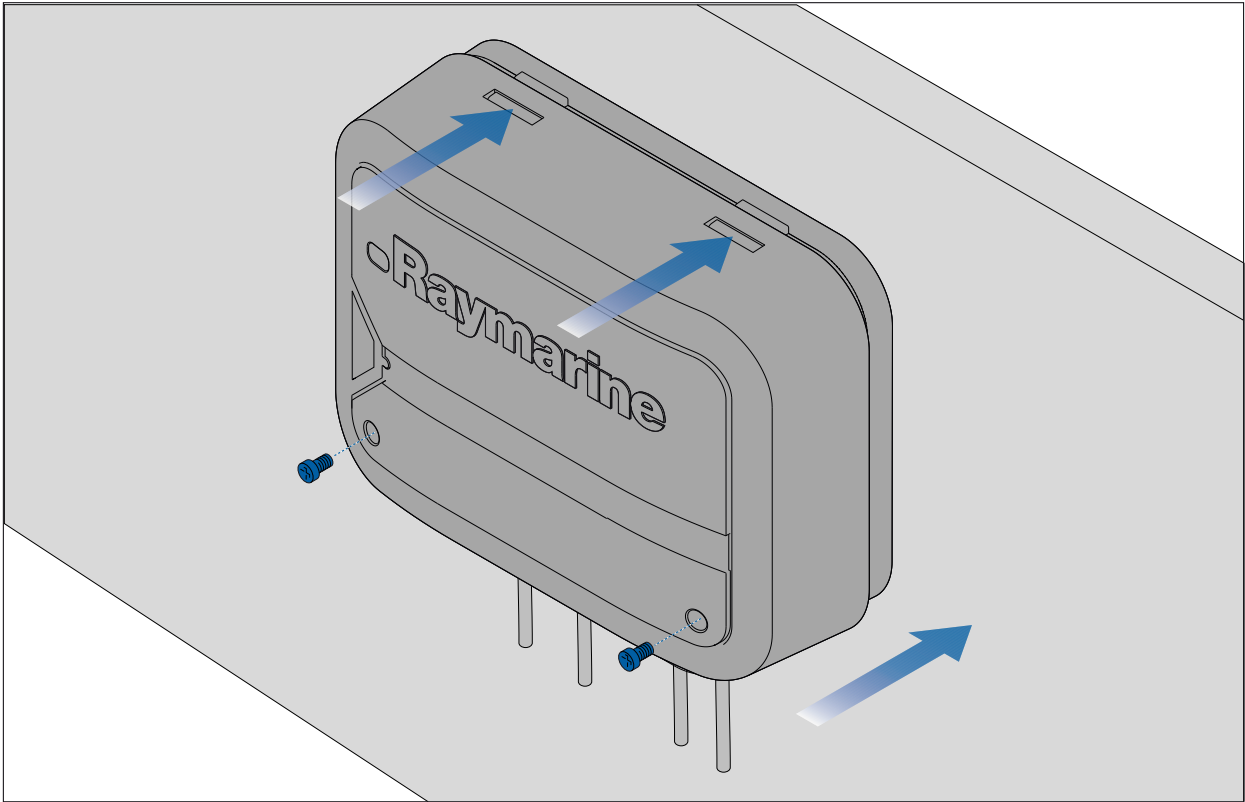


You should also mount the autopilot control head and rudder angle reference sensor / transducer (if appropriate) at this time.

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:



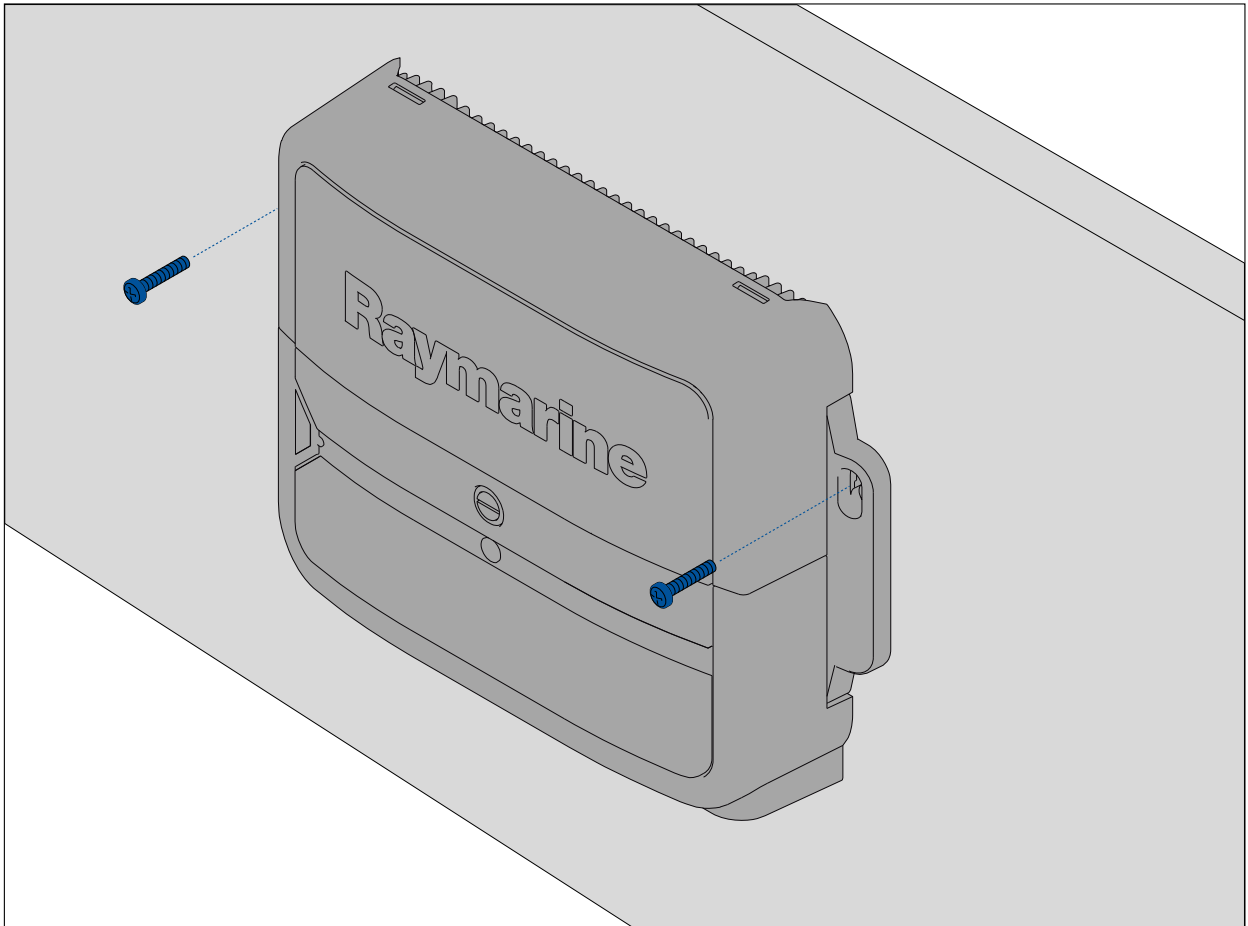
4. Insert the relevant wires from the SeaTalk^{ng} spur cable into the SeaTalk^{ng} screw terminals, as shown in the illustration above. Tighten the screws to secure the wires. Repeat for all required connections.
5. Push the screw terminals back into the connector panel, ensuring a tight connection.
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 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.

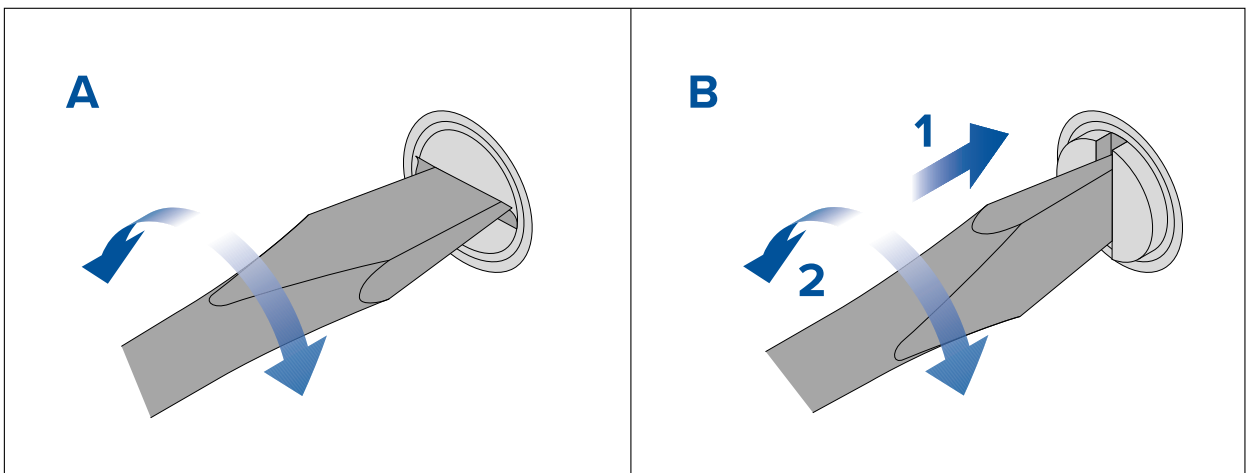
1. Mount the ACU in an appropriate location and secure with the screws supplied.



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

8.3 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: www.raymarine.com/manuals

Autopilot drive unit documentation

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

Description	Part number
Tiller Drive Installation instructions Installation and commissioning instructions for the following Tiller Drive: Q047	87279
ST1000+ / ST2000+ Tiller Drive Owner handbook Installation and commissioning instructions for the following Tiller Drives: A12004, A12005	81130
Wheel Drive Installation instructions Installation and commissioning instructions for the following Wheel Drive: E12093	87287
Constant Running Hydraulic Pump Installation instructions Installation and commissioning instructions for the following Constant Running Hydraulic Pumps: E12171, E12172	87039
Hydraulic Linear Drive Installation instructions Installation and commissioning instructions for the following Hydraulic Linear Drives: E12207, E12208, M81202, M81203	81177
Hydraulic Pump Installation instructions Installation and commissioning instructions for the following Hydraulic Pumps: E12139, M81119, M81120, M81121, M81122, M81123, M81124	81178
Mechanical Linear Drive Installation instructions Installation and commissioning instructions for the following Mechanical Linear Drives: M81130, M81131, M81132, M81133, M81134	81175
Rotary Drive Installation instructions Installation and commissioning instructions for the following Rotary Drives: M81135, M81136, M81137	81174
IO Stern Drive Installation instructions Installation and commissioning instructions for the following Stern Drives: M81138, E12019	81176
Universal IO Stern Drive Installation instructions Installation and commissioning instructions for the following Stern Drive: E12026	81180

All documents are available to download from the Raymarine website: www.raymarine.com/manuals

Chapter 9: EV-1 connections

Chapter contents

- 9.1 General cabling guidance on page 60
- 9.2 Connections overview — EV-1 and EV-2 on page 61
- 9.3 Connecting SeaTalkng[®] cables on page 61
- 9.4 Power connection — EV-1 on page 62
- 9.5 SeaTalkng[®] power connection point on page 62
- 9.6 Power distribution — SeaTalkng[®] on page 63

9.1 General cabling guidance

Cable types and length

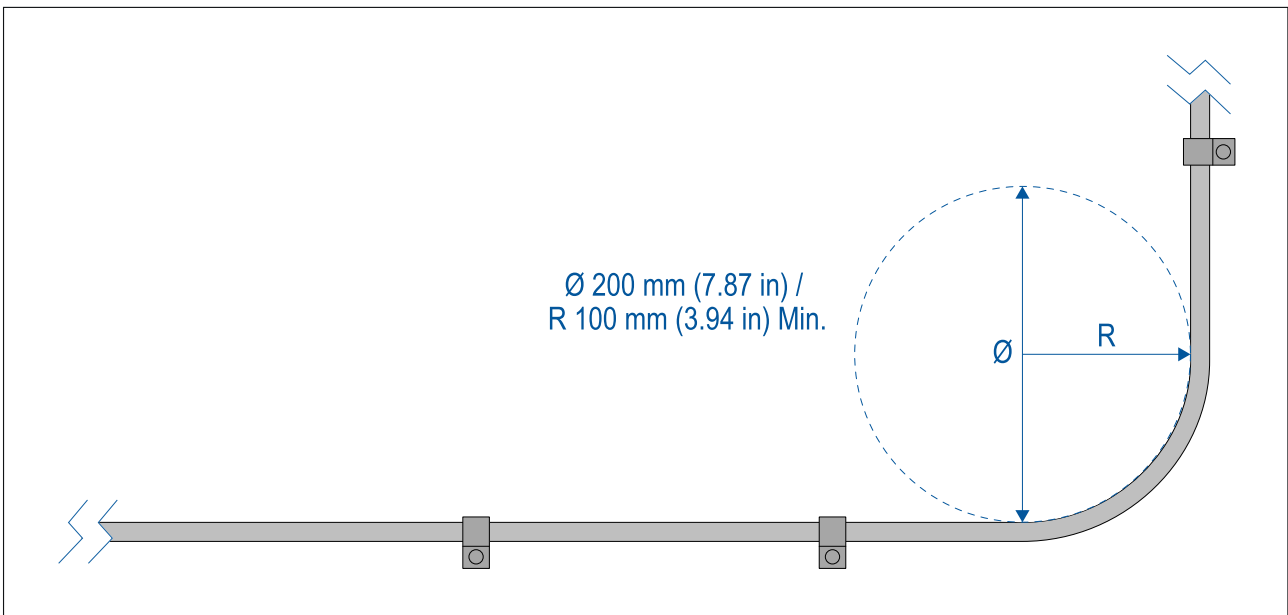
It is important to use cables of the appropriate type and length.

- 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.

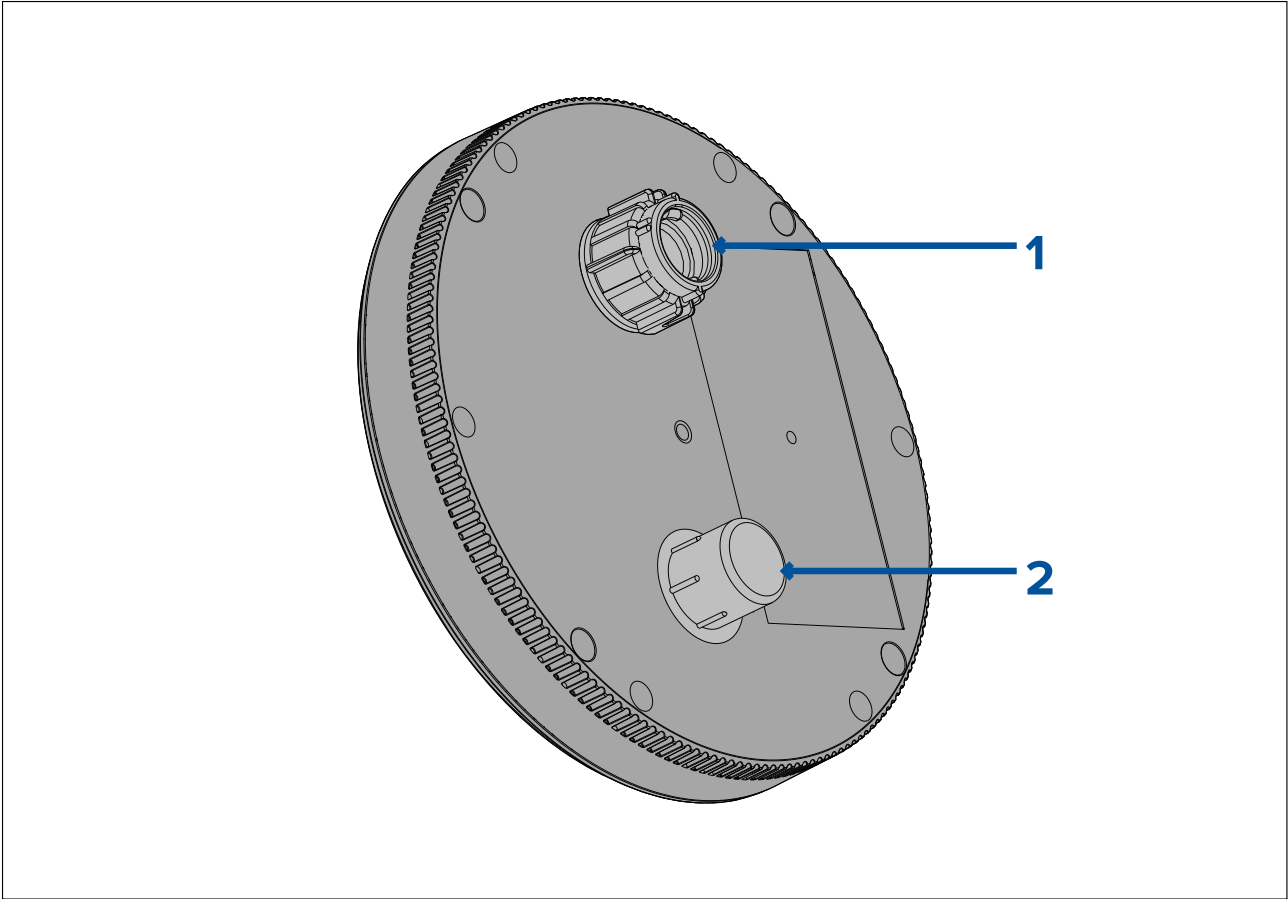
Strain relief

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.

9.2 Connections overview — EV-1 and EV-2

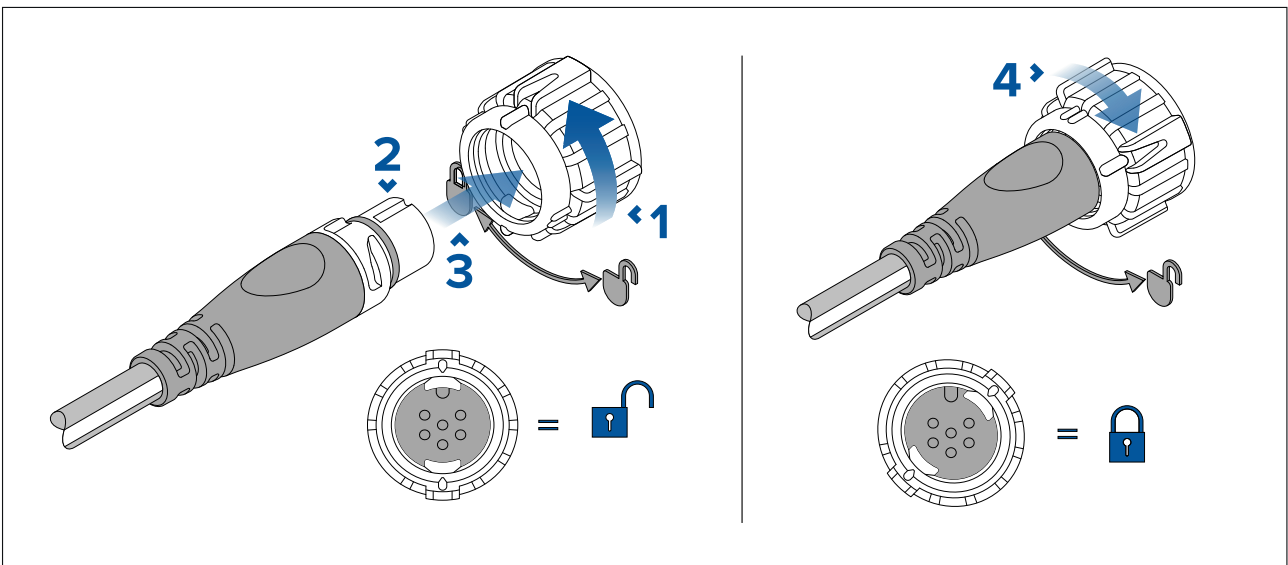


1. SeaTalkng®
2. DeviceNet

Important:

The DeviceNet port is for use with the EV-2 only. Do NOT connect this port on the EV-1 unit.

9.3 Connecting SeaTalkng® cables



1. Rotate your product's SeaTalkng® 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.

9.4 Power connection — EV-1

The power for the EV-1 unit is provided by the SeaTalkng® backbone.

- The EV-1 unit must be connected to a spur connection on the SeaTalkng® backbone.
- SeaTalkng® requires ONE 12 V dc power source. This can be provided by:
 - A battery
 - An Evolution ACU-200, ACU-300 or ACU-400 providing power to the same SeaTalkng® backbone.

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



Warning: Positive ground systems

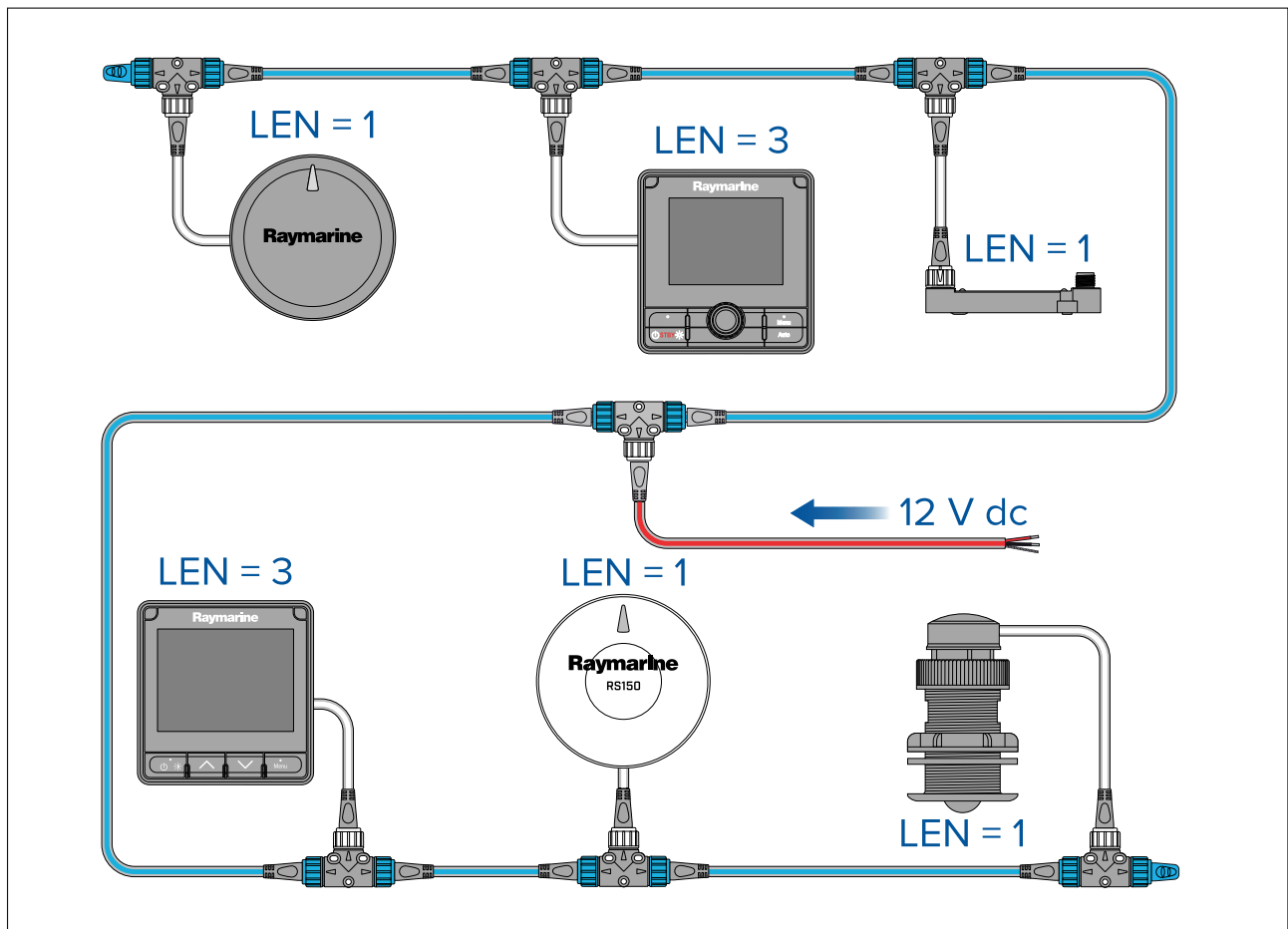
Do not connect this unit to a system which has positive grounding.

9.5 SeaTalkng® power connection point

The 12 V dc power supply is connected to a spur connection on the SeaTalkng® backbone.

Large systems

If the backbone length is greater than 60 m (197 ft), the power connection point 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 power connection point for the backbone.



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

Small systems

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

In-line fuse and thermal breaker ratings

The SeaTalkng[®] network's power supply requires an in-line fuse or thermal breaker to be fitted.

- In-line fuse rating: 5 A
- Thermal breaker rating : 3 A (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 SeaTalkng[®] network; and 2) How many devices are sharing the same thermal breaker that your SeaTalkng[®] network is connected to.

SeaTalkng[®] system loading

The maximum loading / LEN for a SeaTalkng[®] system depends on the length of the backbone.

Unbalanced system loading:

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

Balanced system loading:

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

9.6 Power distribution — SeaTalkng[®]

Recommendations and best practice.

- Only use approved SeaTalkng[®] 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.

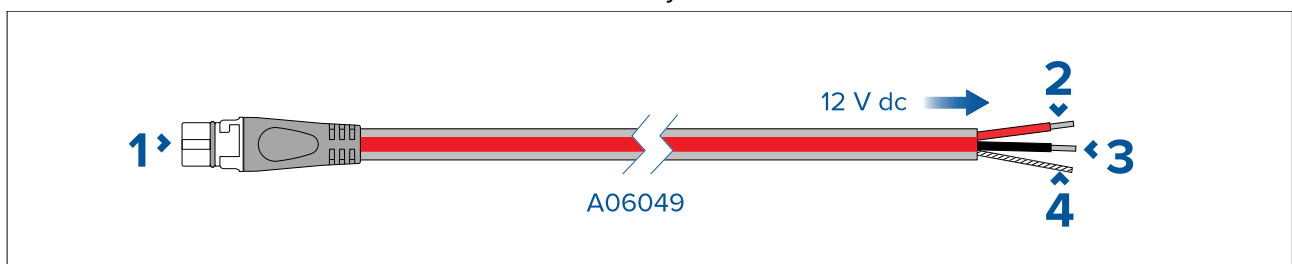
Important:

- 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.

SeaTalkng[®] power cable (A06049)

When powering the SeaTalkng[®] bus (backbone or 5-way connector) from a battery or distribution panel, the A06049 power cable must be used.

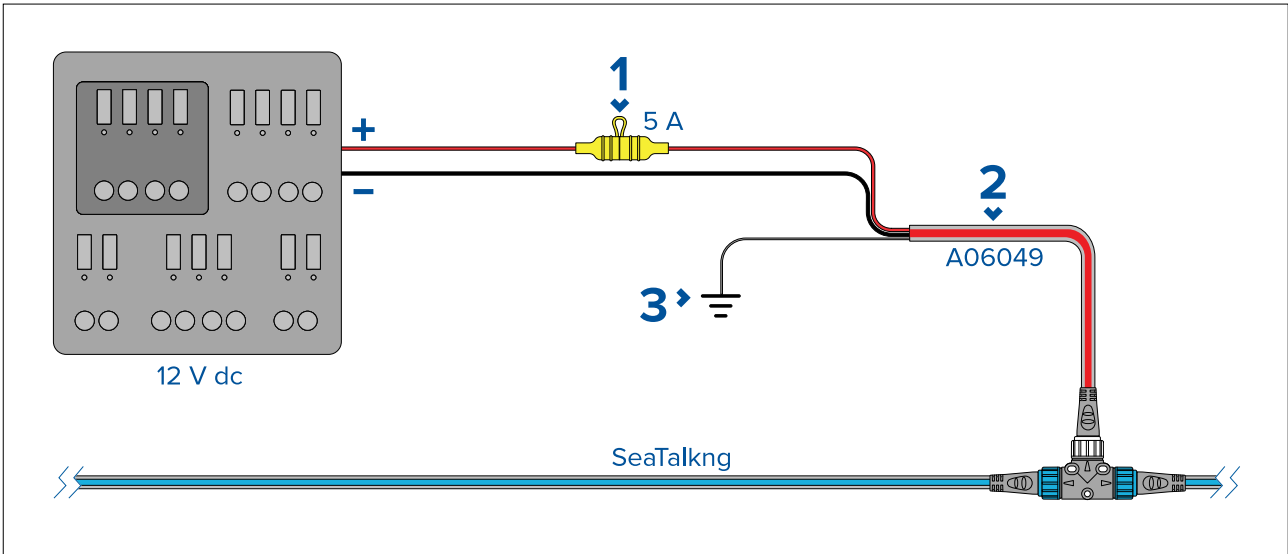
All 3 cores of the cable must be connected correctly:



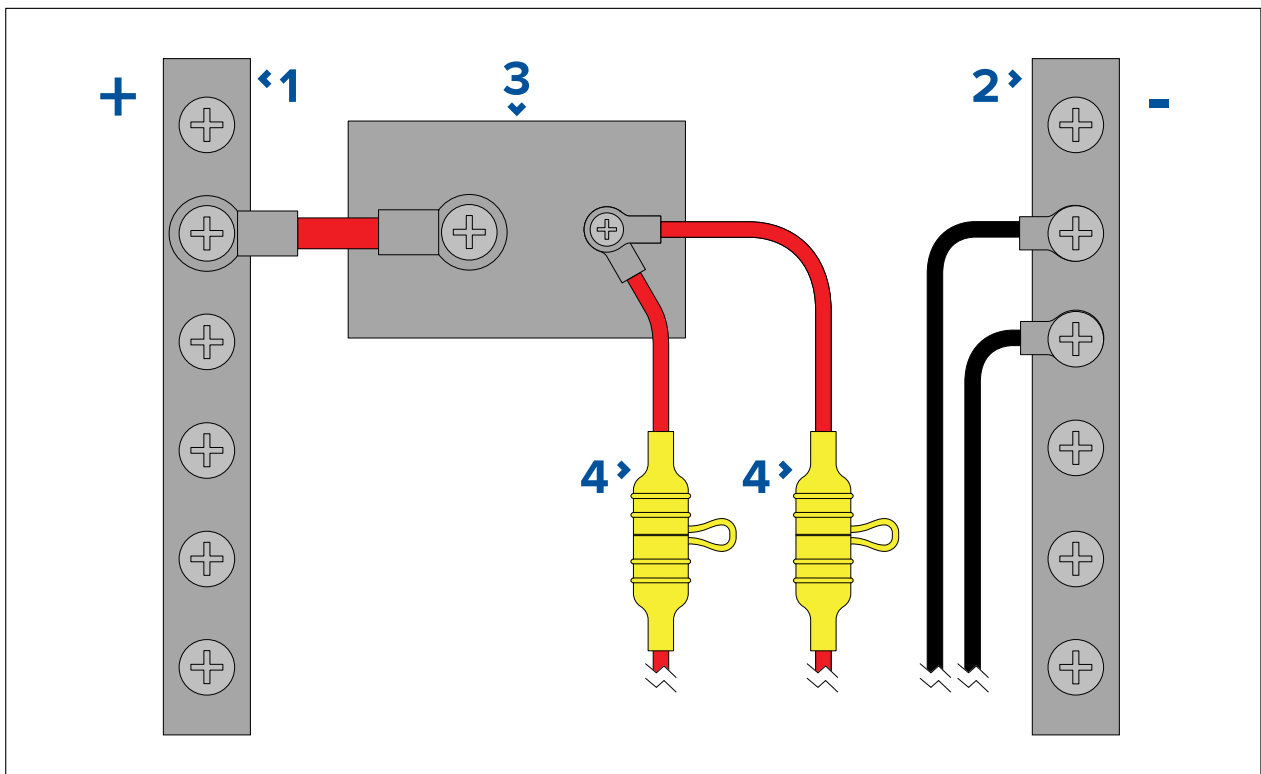
1. SeaTalkng[®] spur connector — connects to spur connection on the SeaTalkng[®] network.

2. + Red (positive) wire — connects to battery or distribution panel positive terminal.
3. – Black (negative) wire — connects to battery or distribution panel negative terminal.
4. Ground wire connects to RF ground point, if no ground point is available connect to the battery negative (-) terminal.

Implementation — connection to distribution panel



1. Waterproof fuse holder with 5 A inline fuse must be fitted (not supplied).
 2. SeaTalkng[®] power cable.
 3. RF Ground connection point for drain wire.
- Ideally, the SeaTalkng[®] 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 SeaTalkng[®] 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 1 item of equipment shares a breaker, use individual in-line fuses for each power circuit to provide the necessary protection.



1. Positive (+) bar

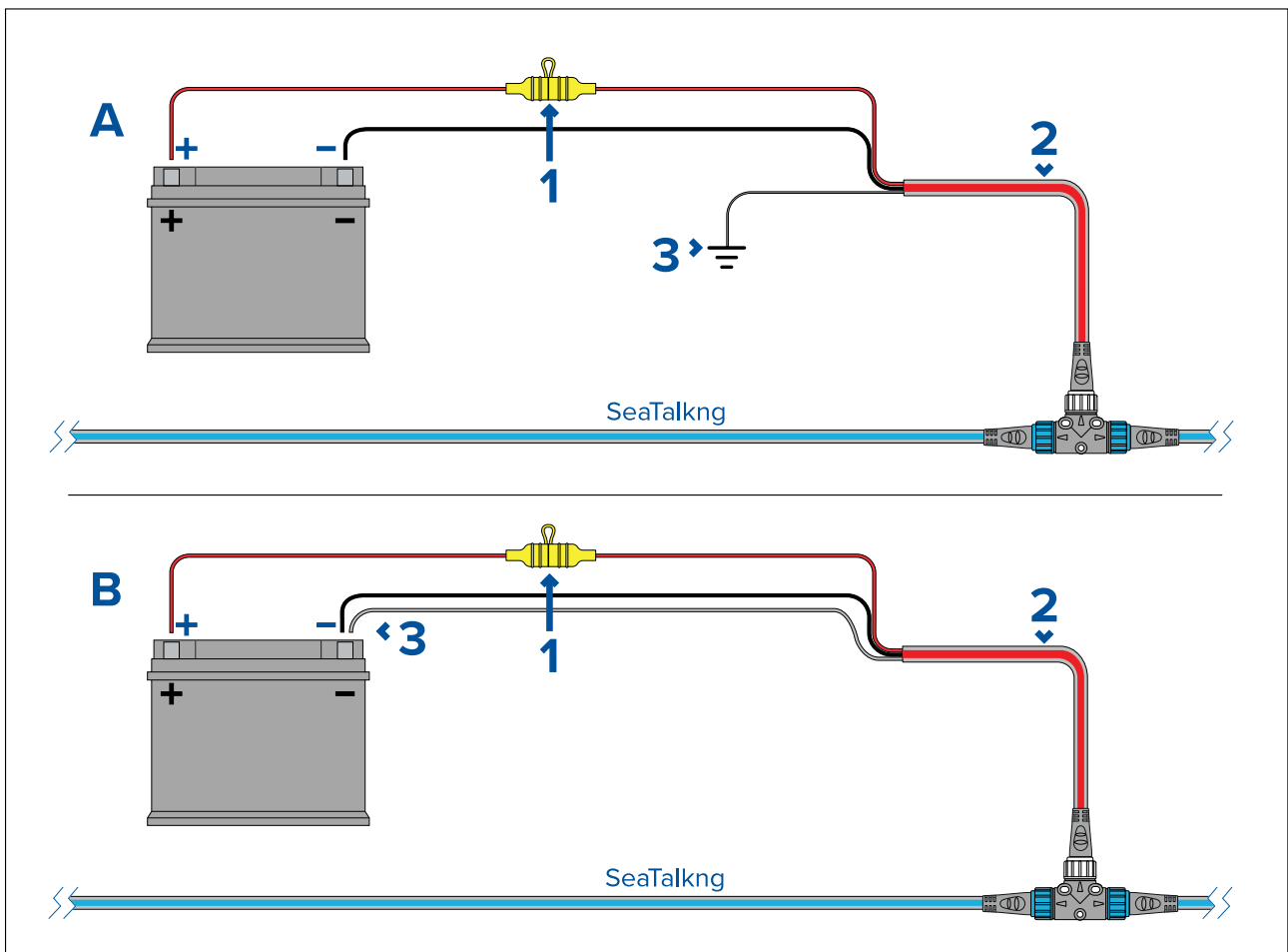
2. Negative (-) bar
3. Circuit breaker
4. Waterproof fuse holder with 5 A inline fuse must be fitted (not supplied).

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

- SeaTalkng® 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 suitably rated fuse or breaker between the red wire and the battery's positive terminal.
- Refer to the inline fuse ratings provided in the product's documentation.
- If you need to extend the length of the power cable, ensure you use suitably rated cable and that sufficient power (12 V dc) is available at the SeaTalkng® backbone's power connection.



1. Waterproof fuse holder with 5 A inline fuse must be fitted (not supplied).
2. SeaTalkng® power cable.
3. Drain wire connection point.

Battery connection scenario A:

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

SeaTalkng® Power cable extension

If you need to extend the length of the SeaTalkng® power cable, ensure you use suitably rated cable and that sufficient power is available at the SeaTalkng® 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 meters, you may need to consider a thicker wire gauge (e.g. 14 AWG (2.08 mm²), or 12 AWG (3.31 mm²)).
- An important requirement for all lengths of power cable (including any extension) is to ensure that there is a continuous **minimum** voltage at the product's power connector of 10.8 V dc, with a fully flat battery at 11 V dc.

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.

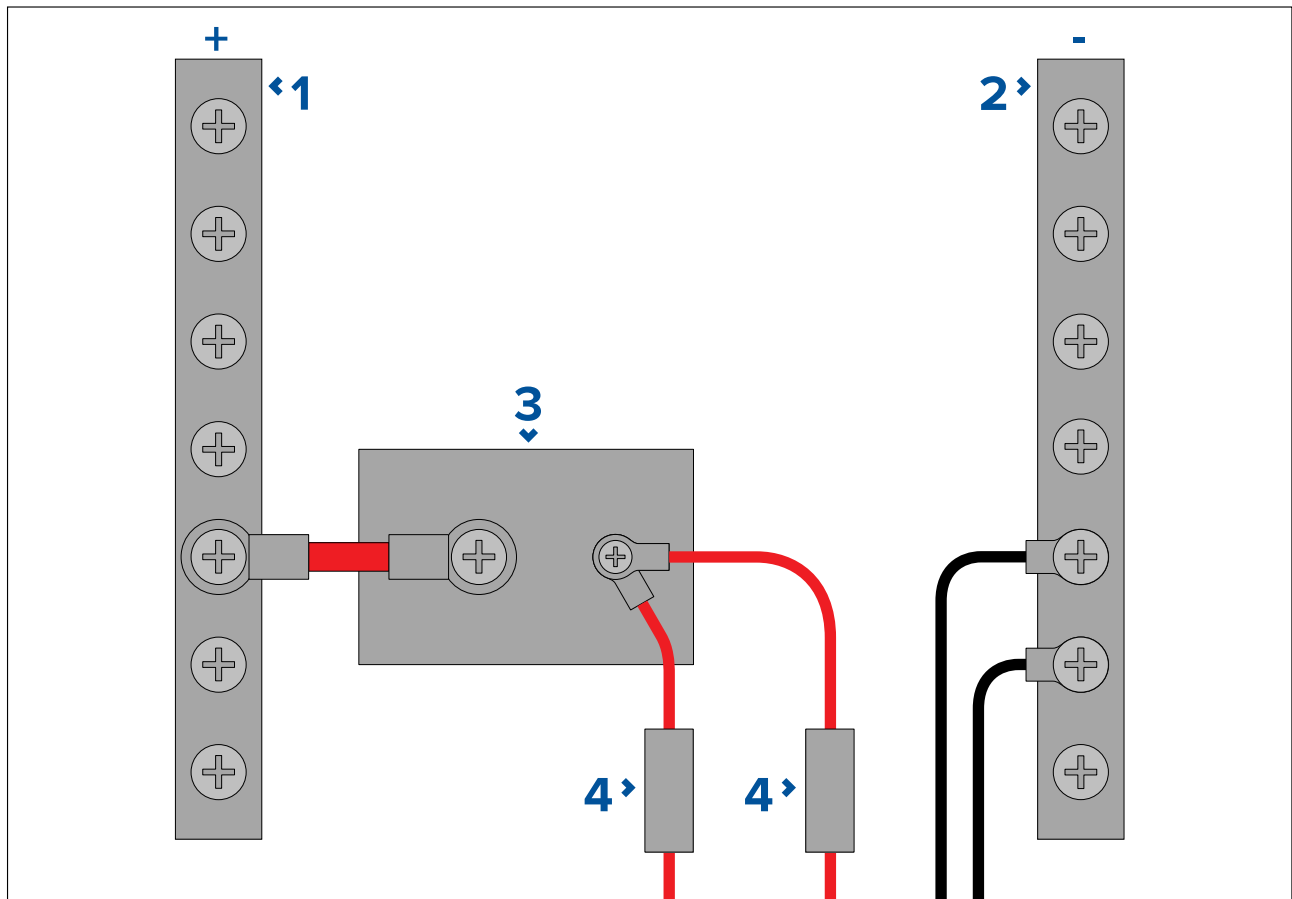
More information

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
- 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.



1	Positive (+) bar
2	Negative (-) bar

3	Circuit breaker
4	Fuse

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.

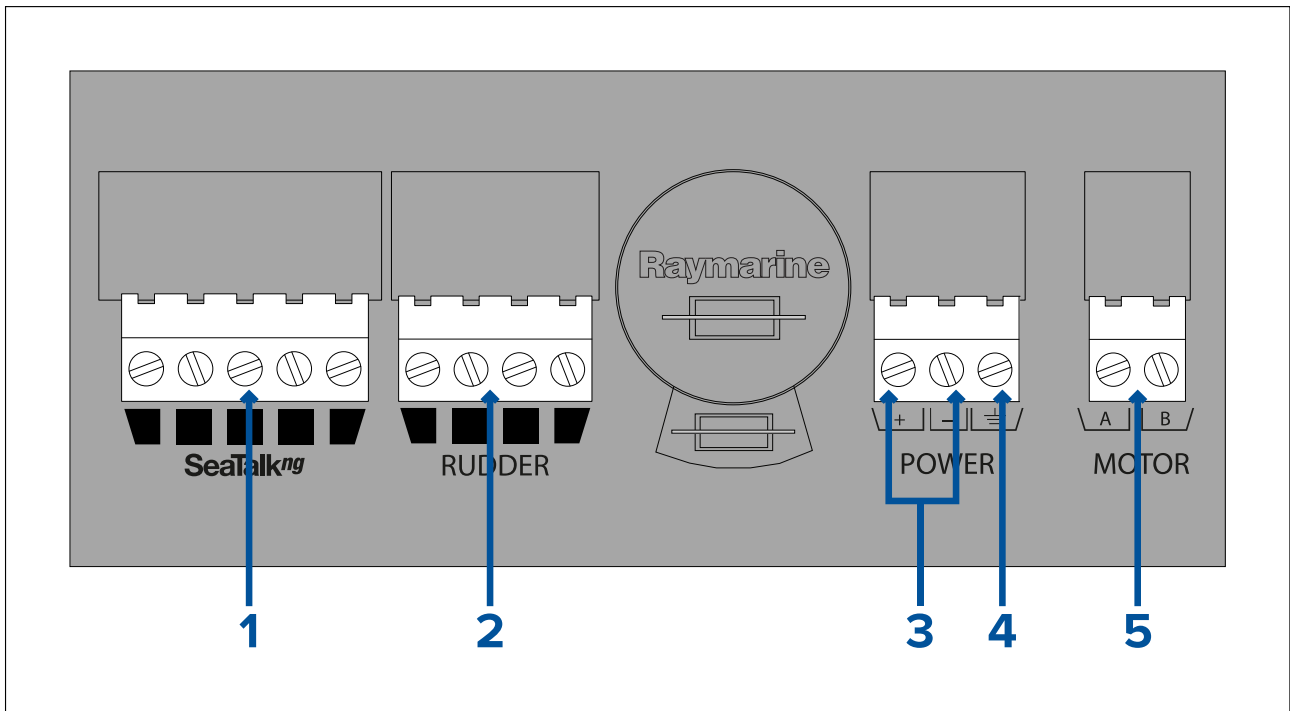
Chapter 10: ACU–100 / ACU–150 connections

Chapter contents

- [10.1 ACU-100, ACU-150 connections on page 70](#)

10.1 ACU-100, ACU-150 connections

Connections overview — ACU-100, ACU-150



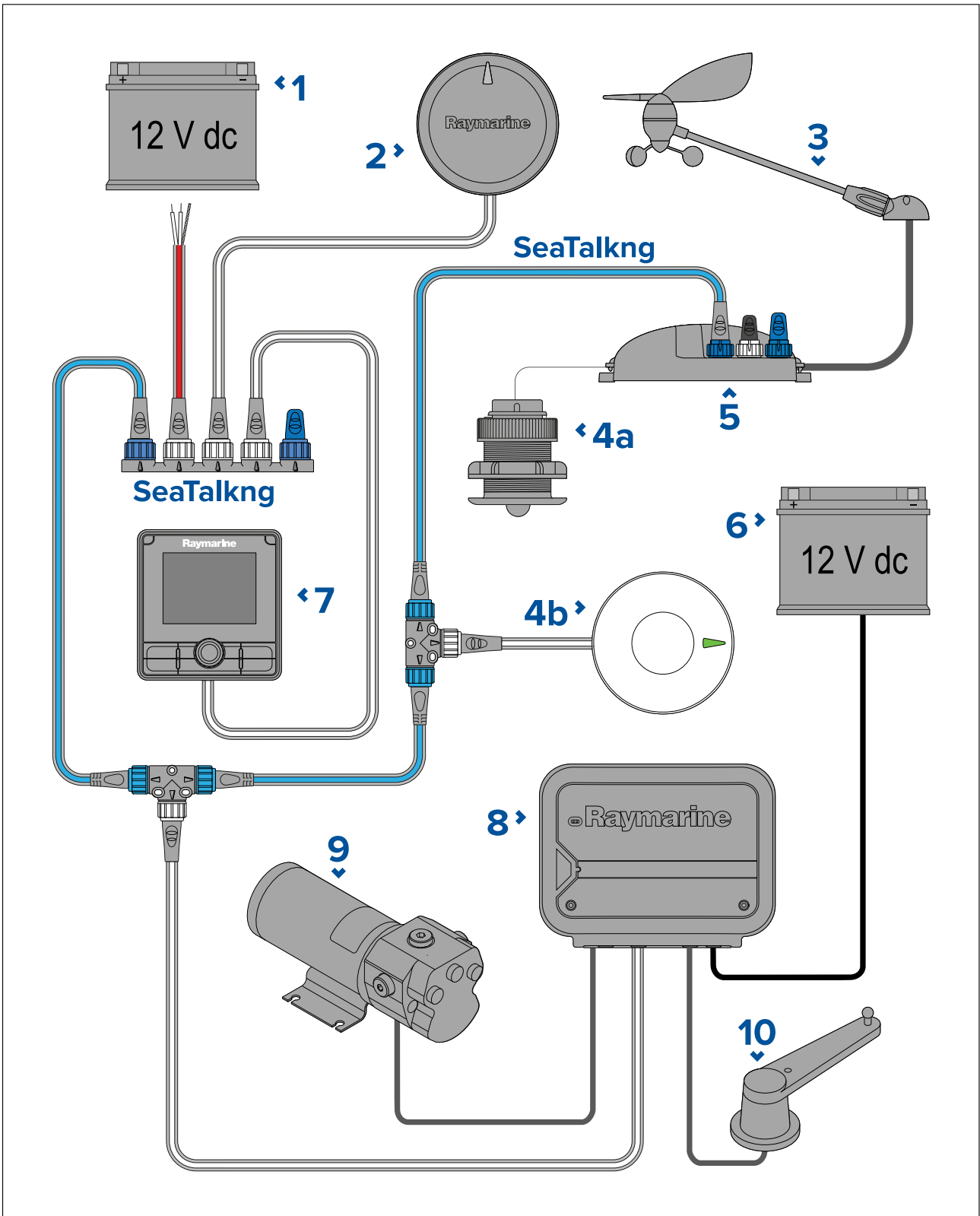
1. SeaTalkng® connection
2. Connection for rudder angle reference sensor / transducer (M81105)
3. Power connection
4. RF Ground connection (drain conductor)
5. Motor (drive) connection

Making connections

For information on how to connect the various components of the autopilot system, refer to the following sections:

- [p.46 — EV and ACU installation instructions](#)
- [p.120 — Pilot controller documents](#)
- [p.57 — Drive unit installation documents](#)

Example: Evolution recommended system ACU-100, ACU-150

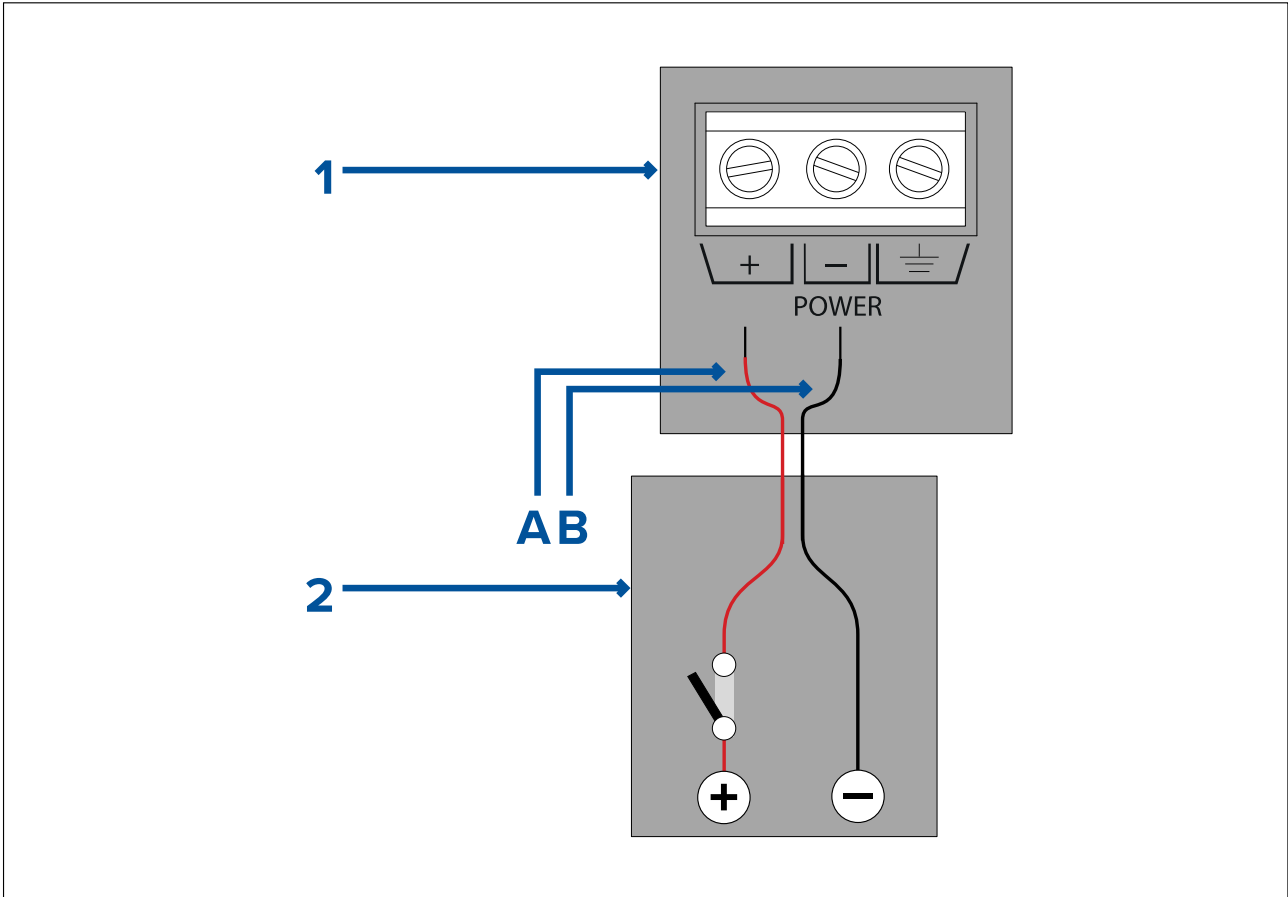


1. 12 V dc power supply (providing power to SeaTalkng[®])
2. EV-1
3. Wind transducer (only required for Sailing vessels)
4. Speed data source:
 - a. Speed transducer (STW), or
 - b. GNSS Receiver (SOG)
5. iTC-5
6. 12 V dc power supply (providing power to the ACU)

7. Autopilot controller
8. ACU
9. Drive unit (example)
10. Rudder angle reference sensor / transducer (M81105)

Power connection — ACU-100, ACU-150

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

Power connection colors

	Color	Description
A	Red	Power in Positive (+) 12 V dc
B	Black	Power in Negative (-) 0 V dc



Warning: Positive ground systems

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

Fuses and circuit protection

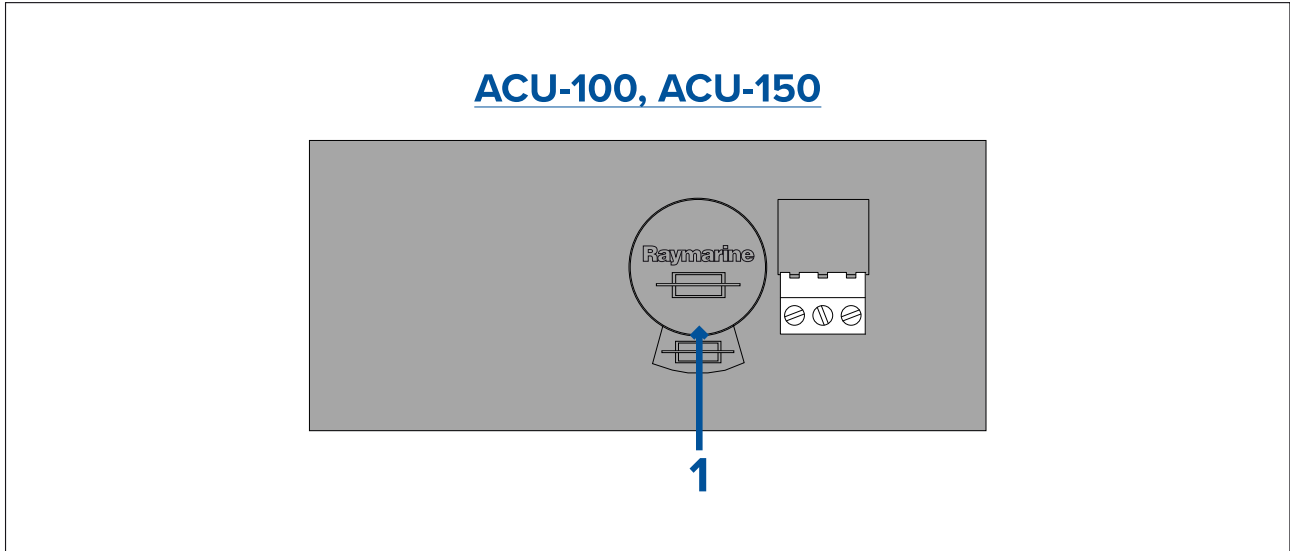
There are 3 levels of power protection in the autopilot system. The drive (motor) and associated cables are initially protected by the current sensing and stall condition detection within the ACU hardware and software. A second level of protection is provided to these parts and the ACU components by 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 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.

ACU internal fuses

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

ACU internal fuse ratings

ACU-100	10 A
ACU-150	15 A

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 may be 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

Power distribution — ACU

Recommendations and best practice.

- The product is NOT supplied with a power cable. Please refer to the [Power and drive cables](#) section for power cable requirements.
- Refer to the *Power connection* section for more information on how to identify the wires in your product's power cable, and where to connect them.
- See below for more information on implementation for some common power distribution scenarios.

Important:

When planning and wiring, take into consideration other products in your system, some of which (e.g. sonar modules) may place large power demand peaks on the vessel's electrical system.

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

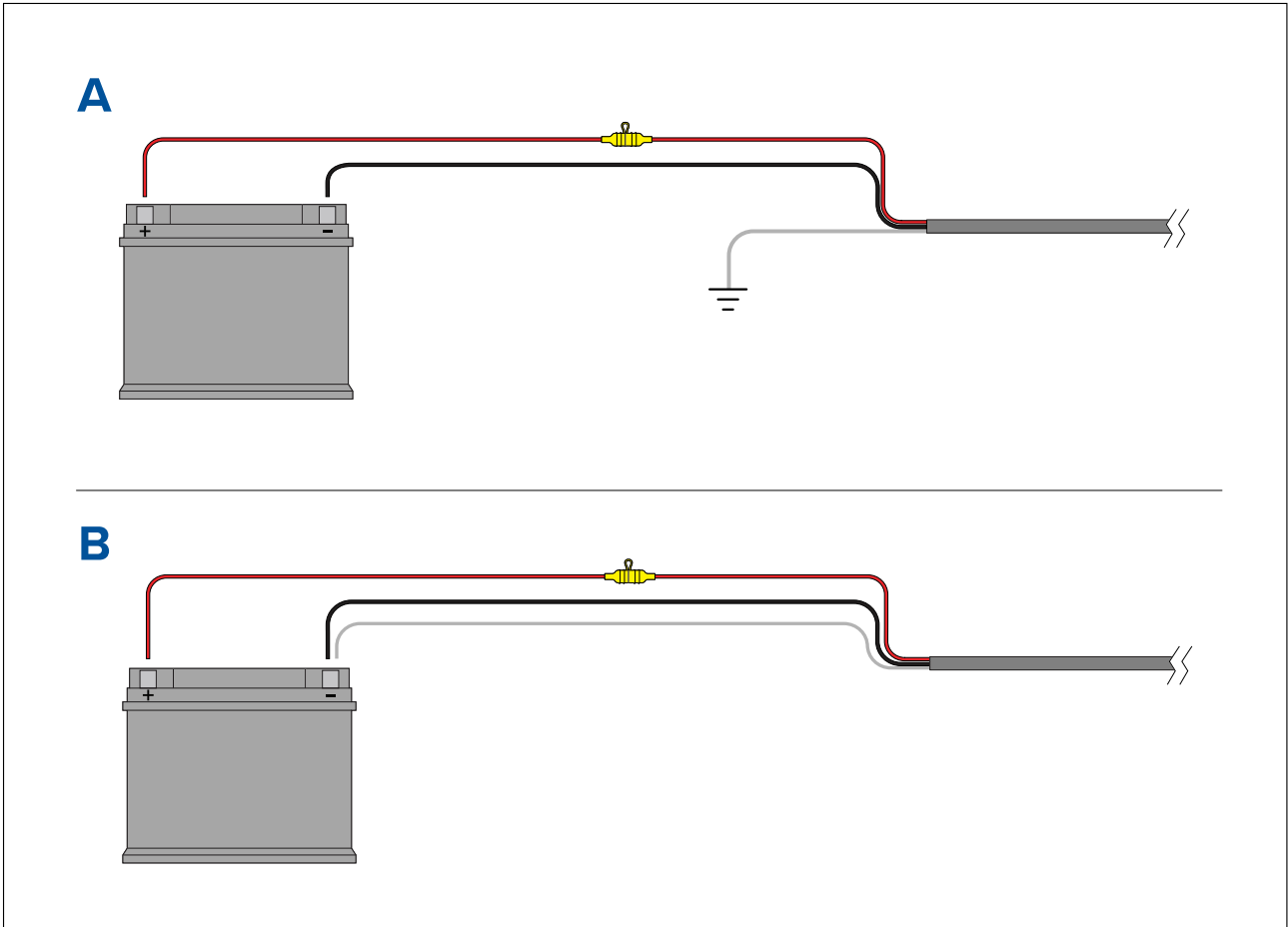
- The unit may be connected directly to the vessel's battery, via a suitably rated fuse or breaker.
- The unit also requires a separate RF Ground (drain) connection, refer to the following section: *Grounding — Dedicated drain wire required.*
- You **MUST** fit a suitably-rated fuse or breaker between 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	In-line fuse rating
ACU-100	10 A
ACU-150	15 A
ACU-200	20 A
ACU-300	15 A
ACU-400	40 A

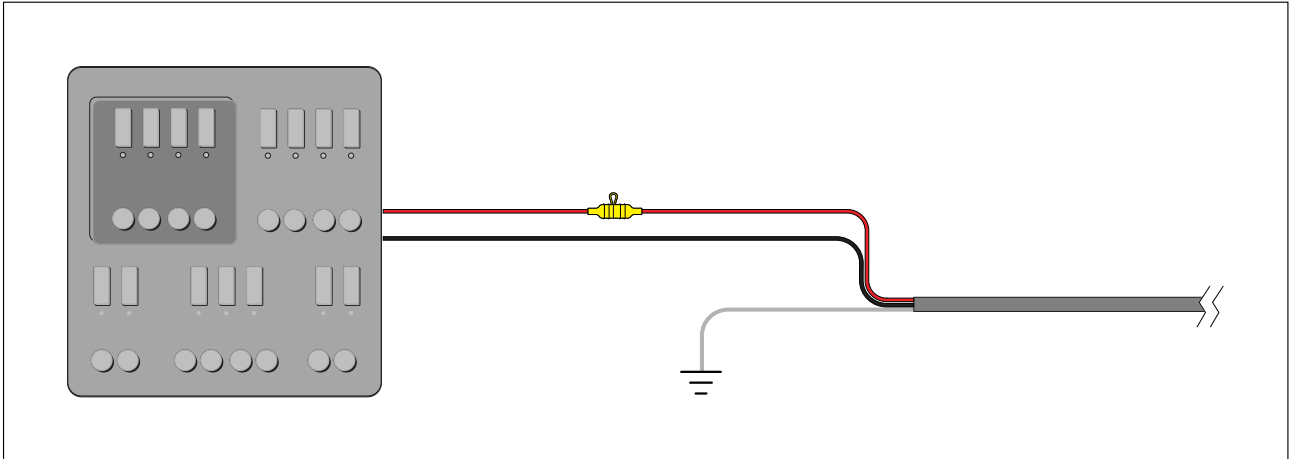
Important:

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



A	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	Battery connection scenario 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	Thermal breaker rating
ACU-100	10 A
ACU-150	15 A
ACU-200	20 A
ACU-300	15 A
ACU-400	40 A

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.

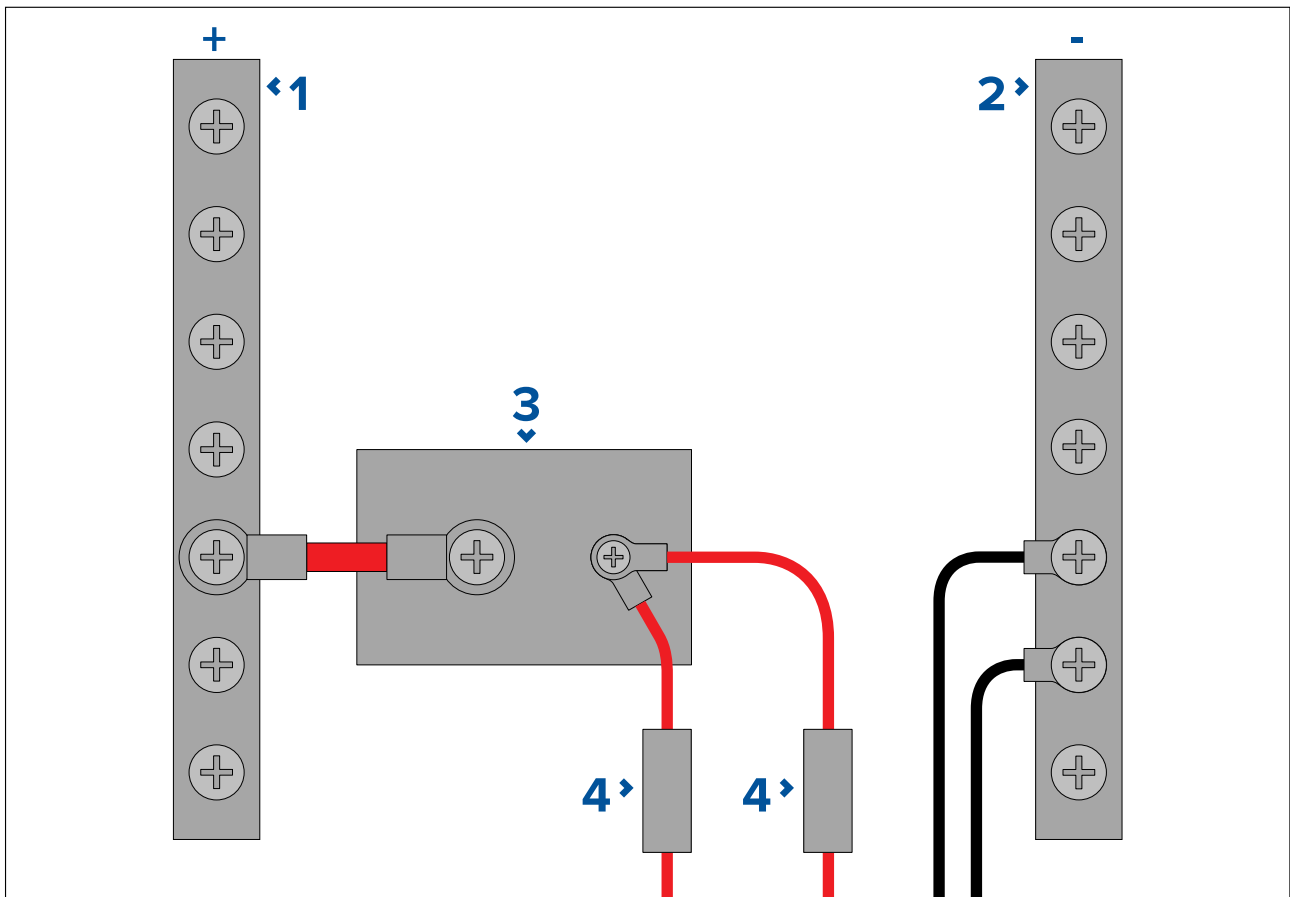
More information

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.



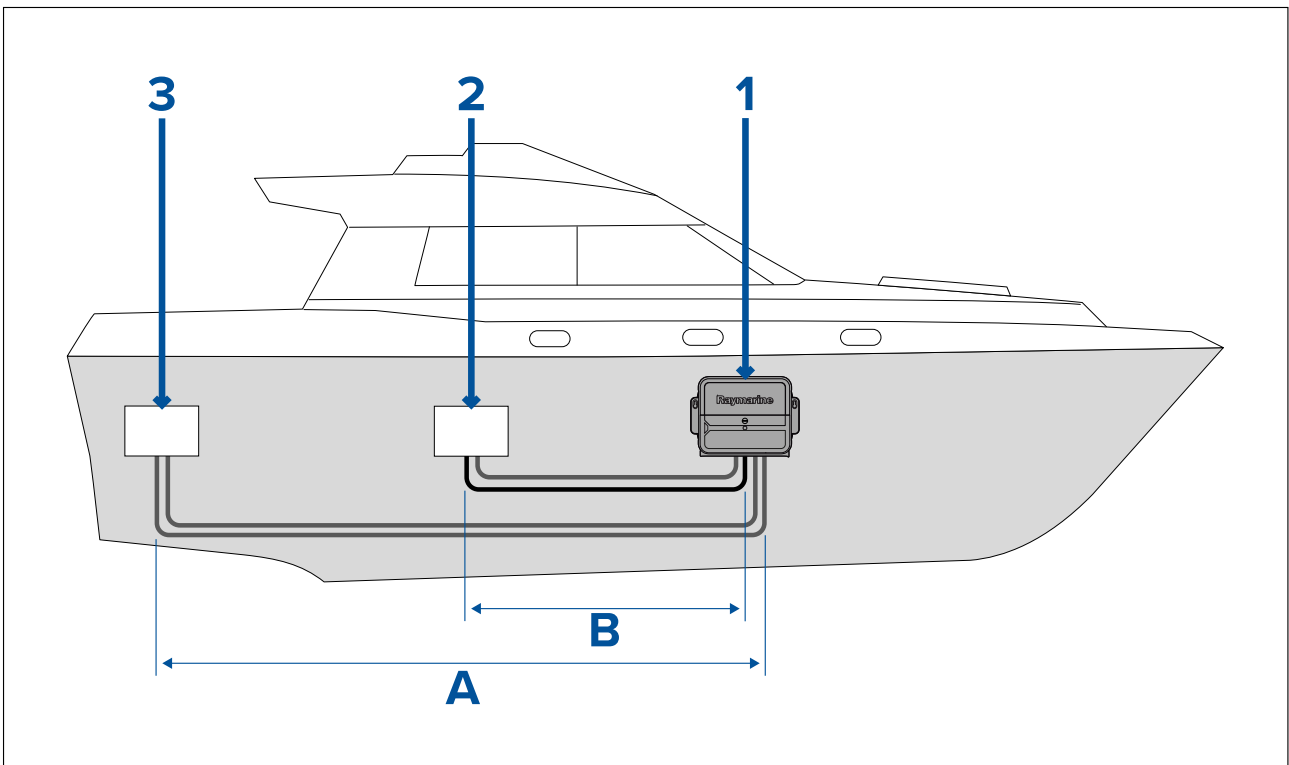
1	Positive (+) bar
2	Negative (-) bar
3	Circuit breaker
4	Fuse

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.

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

Power and drive cable selection

Drive	Supply voltage	Max. length (A+B)	Cable size
Type 0.5 hydraulic pump	12 V	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)
<ul style="list-style-type: none"> • Type 1 drive • CR pump (ACU-300 only) 	12 V	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)

Drive	Supply voltage	Max. length (A+B)	Cable size
Type 2 drive	12 V	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)
	24 V	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	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)
	24 V	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	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	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	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)

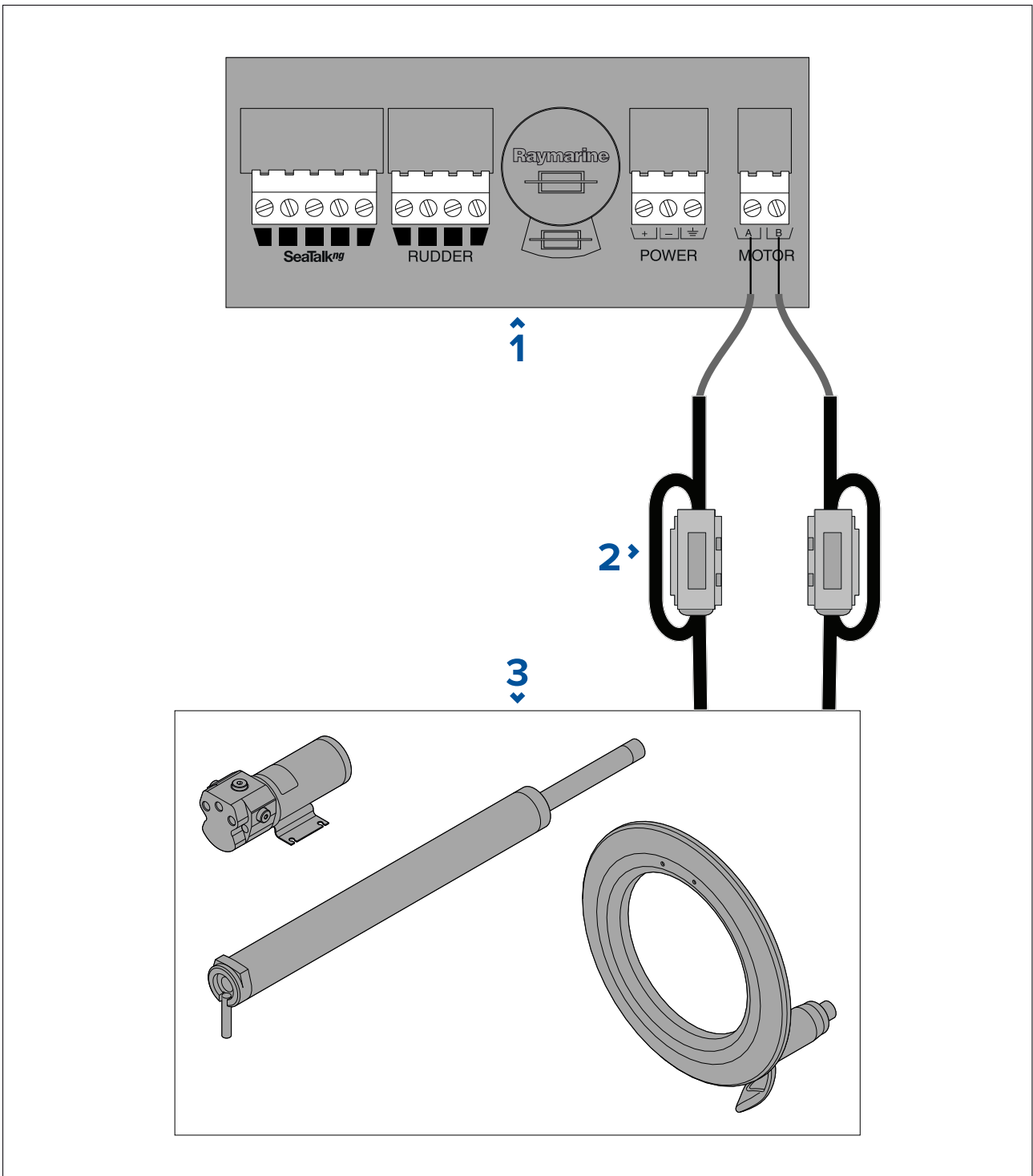
Important:

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.

Drive (motor) connection — ACU-100, ACU-150

Motor connection

The motor connects to the connection panel of the ACU.



1. ACU-100 / 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).

Important:

The connection colors for the motor cables may be different depending on the motor type; refer to the Installation instructions for the relevant drive unit.

Motor power output

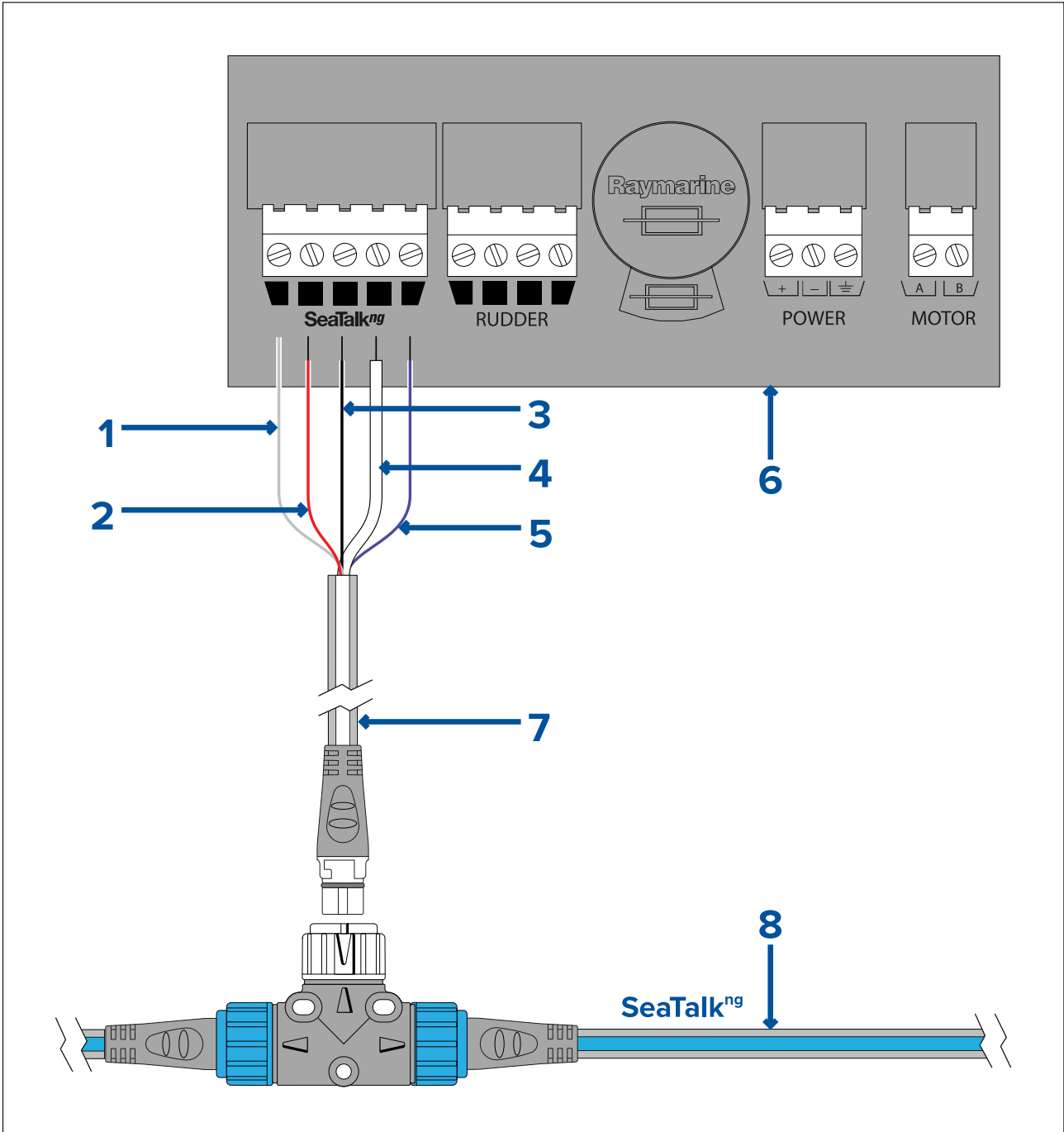
ACU-100	ACU-150
7 A (maximum continuous output)	12 A (maximum continuous output)

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.

SeaTalkng® connection — ACU-100, ACU-150

The ACU connects to the SeaTalkng® backbone using the supplied Spur cable.



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. SeaTalkng® spur cable (supplied)
8. SeaTalkng® backbone

Note:

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

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 as M81105.

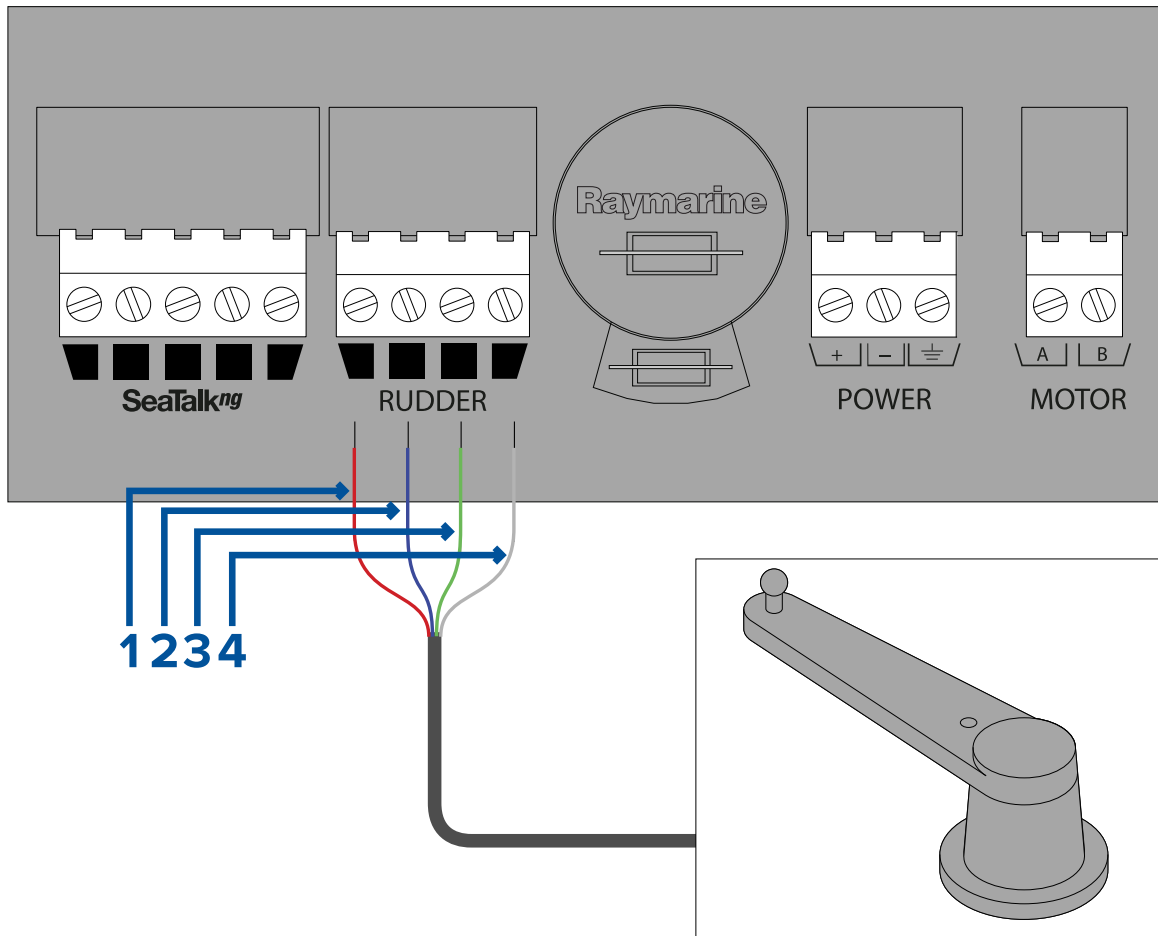
A rudder angle reference sensor / transducer converts its movement information to rudder angle in +/- degrees.

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.

ACU-100 / ACU-150



Item	Wire color – ACU-100, ACU-150
1	Red
2	Blue
3	Green
4	Gray (screen)

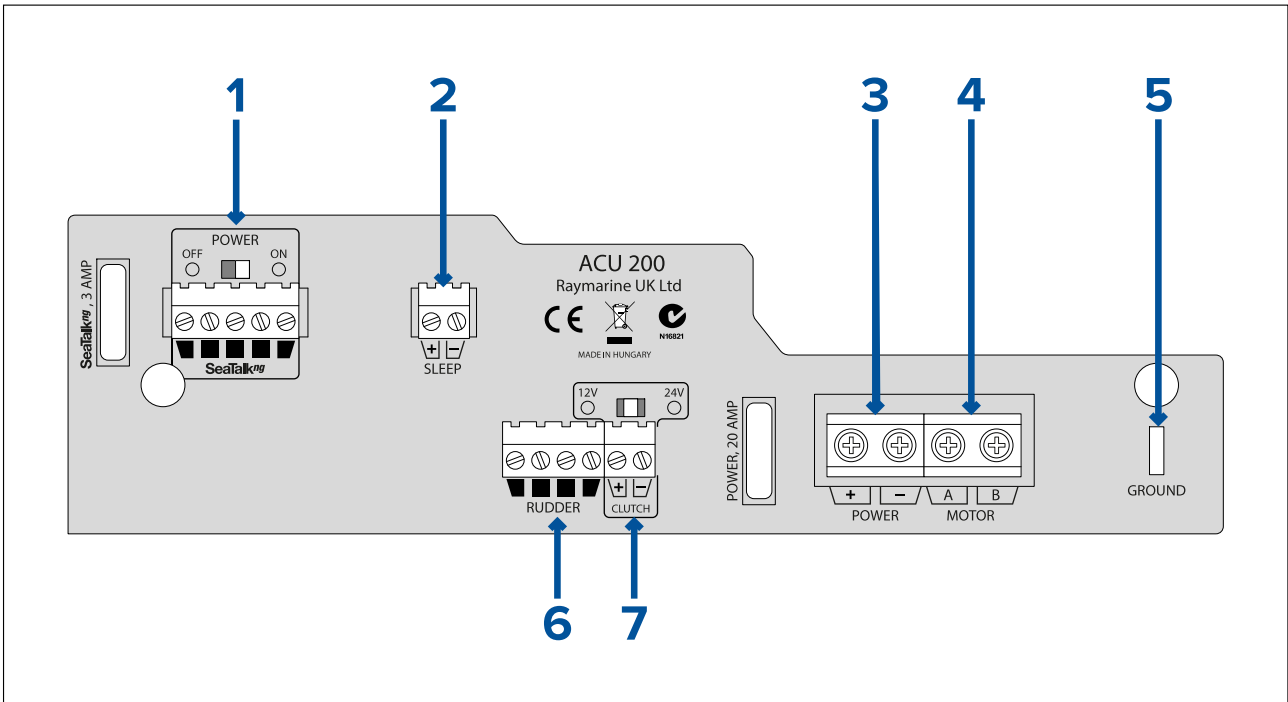
Chapter 11: ACU-200, ACU-300, ACU-400 connections

Chapter contents

- [11.1 ACU-200, ACU-300, ACU-400 connections on page 84](#)

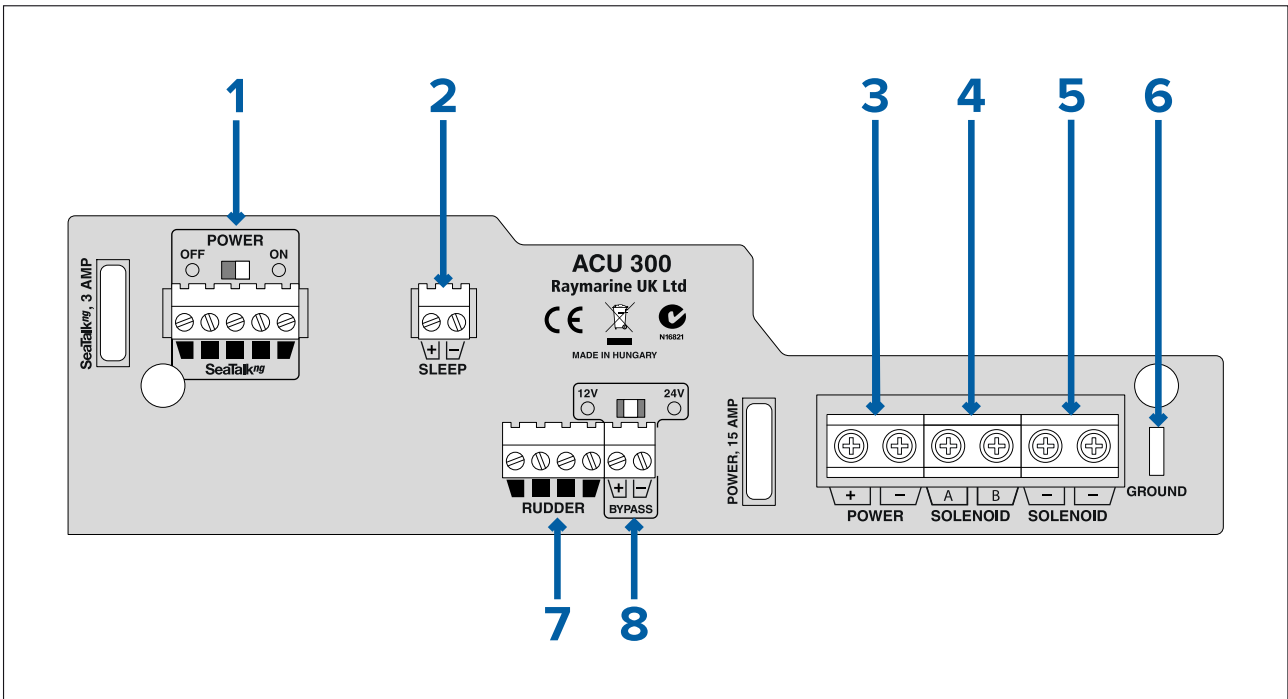
11.1 ACU-200, ACU-300, ACU-400 connections

Connections overview — ACU-200



1. SeaTalkng® 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

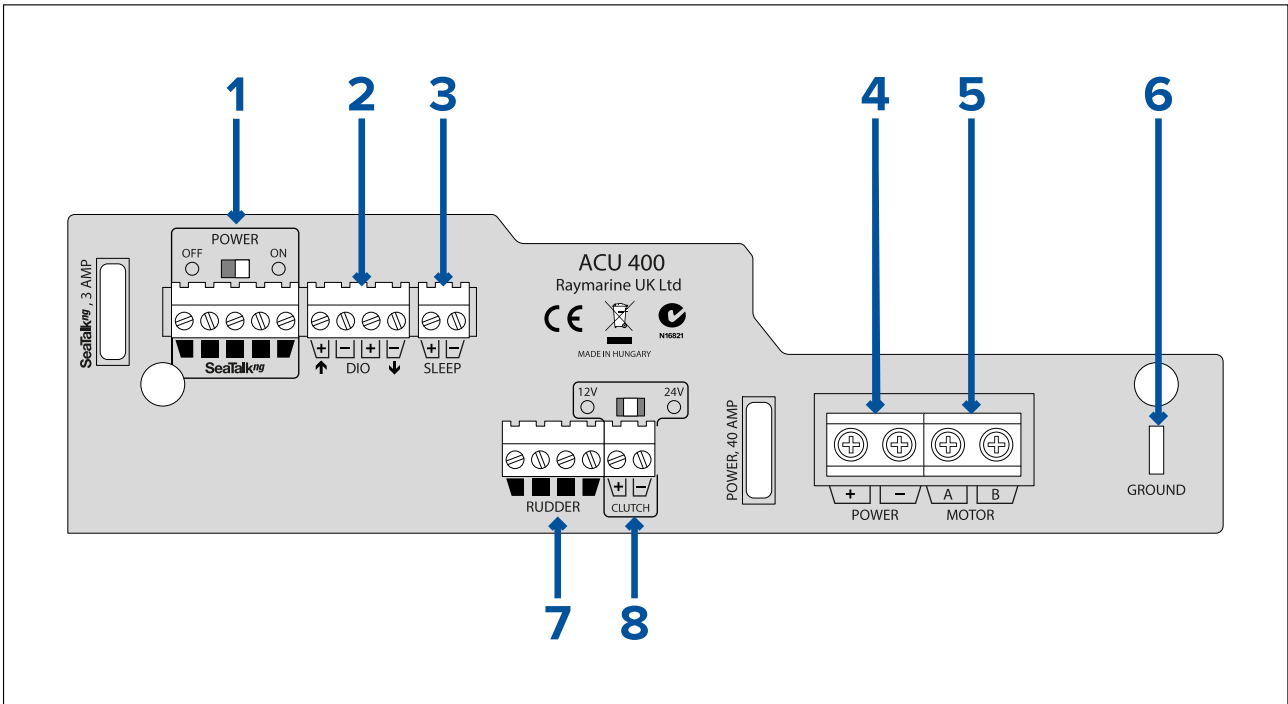
Connections overview — ACU-300



1. SeaTalkng® 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

Connections overview — ACU-400



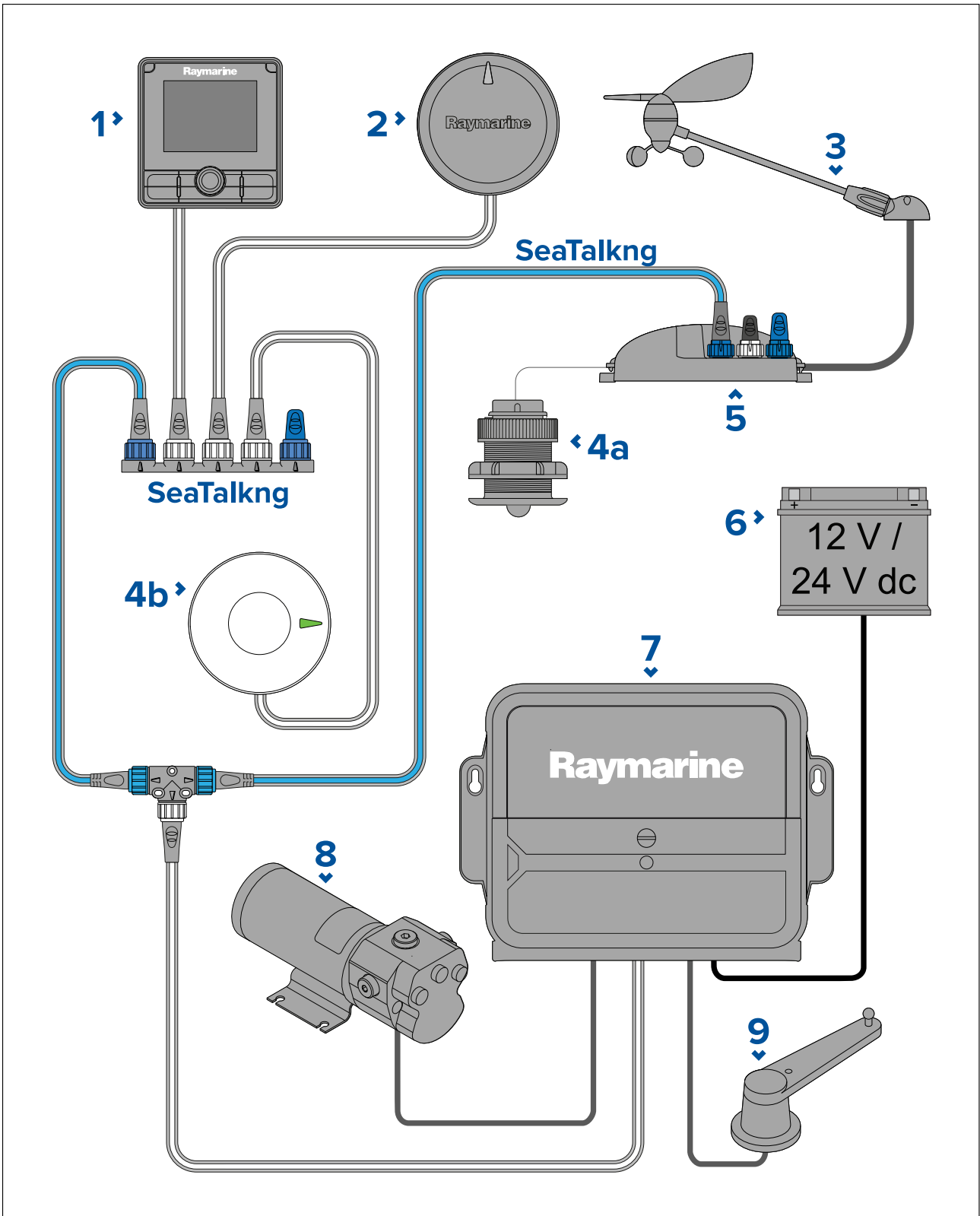
1. SeaTalkng® connection
2. Digital input / output connection
3. Sleep switch connection
4. Power connection
5. Motor (drive) connection
6. RF ground connection (drain conductor)
7. Connection for rudder angle reference sensor / transducer (M81105)
8. Clutch connection — selectable between 12 / 24 V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

Making connections

For information on how to connect the various components of the autopilot system, refer to the following sections:

- [p.46 — EV and ACU installation instructions](#)
- [p.120 — Pilot controller documents](#)
- [p.57 — Drive unit installation documents](#)

Example: Evolution recommended system ACU-200, ACU-300, ACU-400

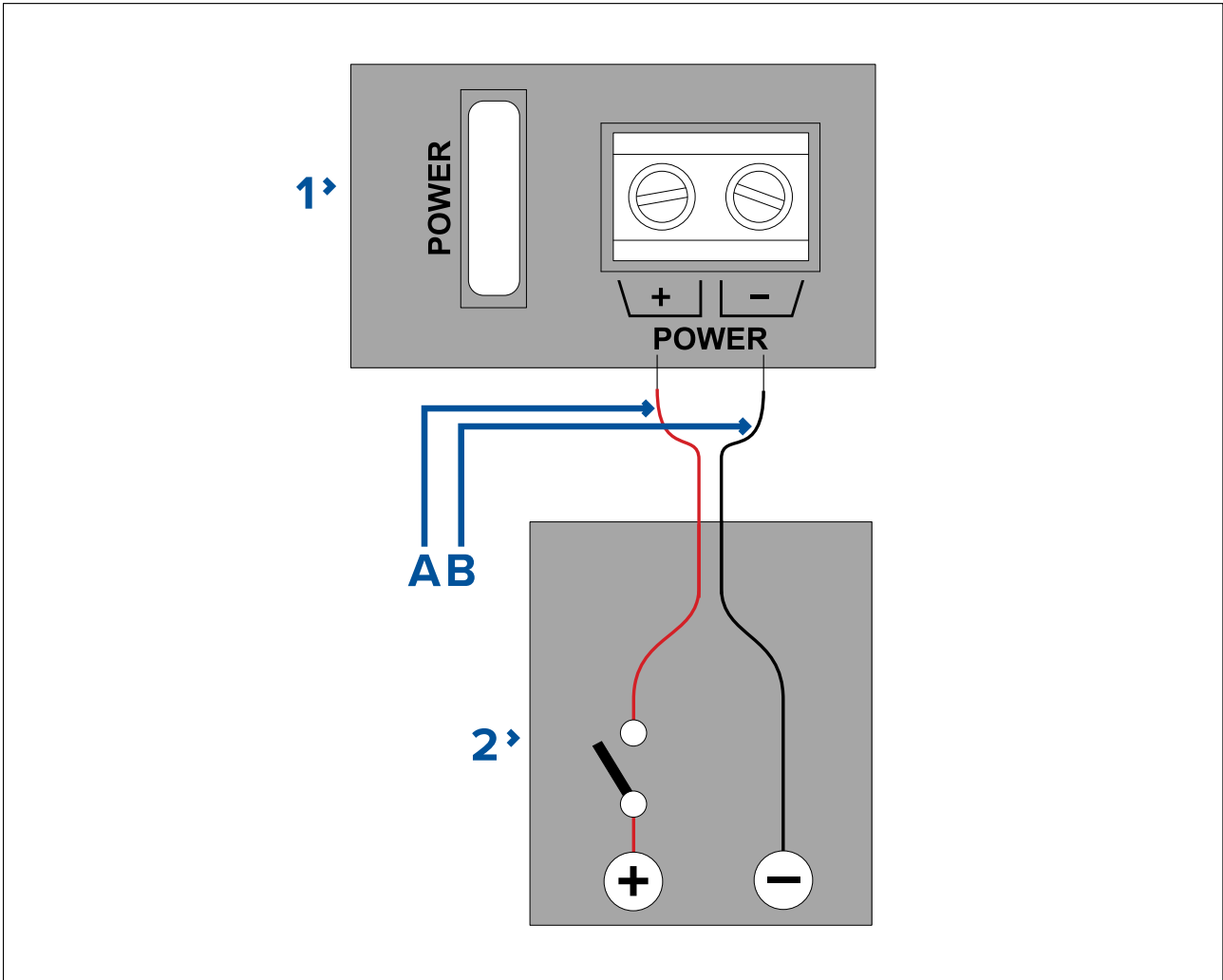


1. Autopilot controller
2. EV-1
3. Wind transducer (only required for Sailing vessels)
4. Speed data source:
 - a. Speed transducer (STW), or
 - b. GNSS Receiver (SOG)
5. iTC-5
6. 12 V / 24 V dc power supply (providing power to the ACU and SeaTalkng® backbone)

7. ACU
8. Drive unit (example)
9. Rudder angle reference sensor / transducer (M81105) — This is **essential for ACU-300** systems, and highly recommended for all other systems.

Power connection — ACU-200, ACU-300, ACU-400

Power to the ACU unit must be from an appropriately fused and rated supply.



1. ACU power connection panel
2. Vessel power distribution panel

Power connection colors

	Color	Description
A	Red	Power in Positive (+) 12 / 24 V dc
B	Black	Power in Negative (-) 0 V dc



Warning: Positive ground systems

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

Fuses and circuit protection

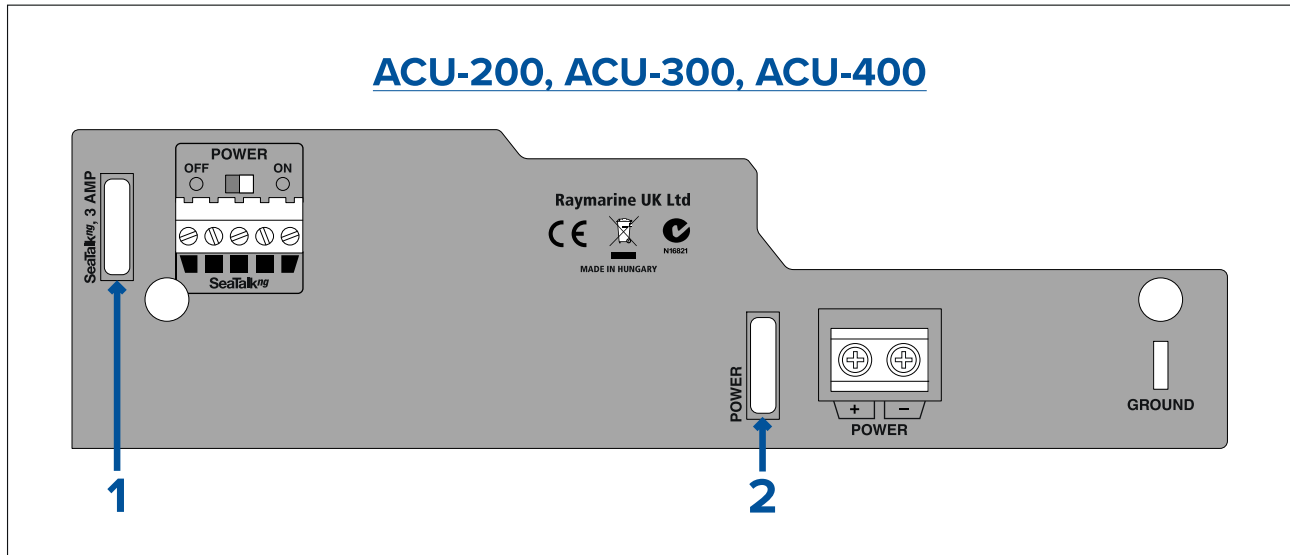
There are 3 levels of power protection in the autopilot system. The drive (motor) and associated cables are initially protected by the current sensing and stall condition detection within the ACU hardware and software. A second level of protection is provided to these parts and the ACU components by 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 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.

ACU internal fuses

The ACU 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. SeaTalkng[®] fuse (fuse power supply from ACU to SeaTalkng[®] backbone)
2. Internal power fuse (labelled with total power consumed by system)

ACU internal fuse ratings

SeaTalkng [®]	3 A
ACU-200	20 A
ACU-300	15 A
ACU-400	40 A

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

Power distribution — ACU

Recommendations and best practice.

- The product is NOT supplied with a power cable. Please refer to the [Power and drive cables](#) section for power cable requirements.
- Refer to the *Power connection* section for more information on how to identify the wires in your product's power cable, and where to connect them.
- See below for more information on implementation for some common power distribution scenarios.

Important:

When planning and wiring, take into consideration other products in your system, some of which (e.g. sonar modules) may place large power demand peaks on the vessel's electrical system.

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

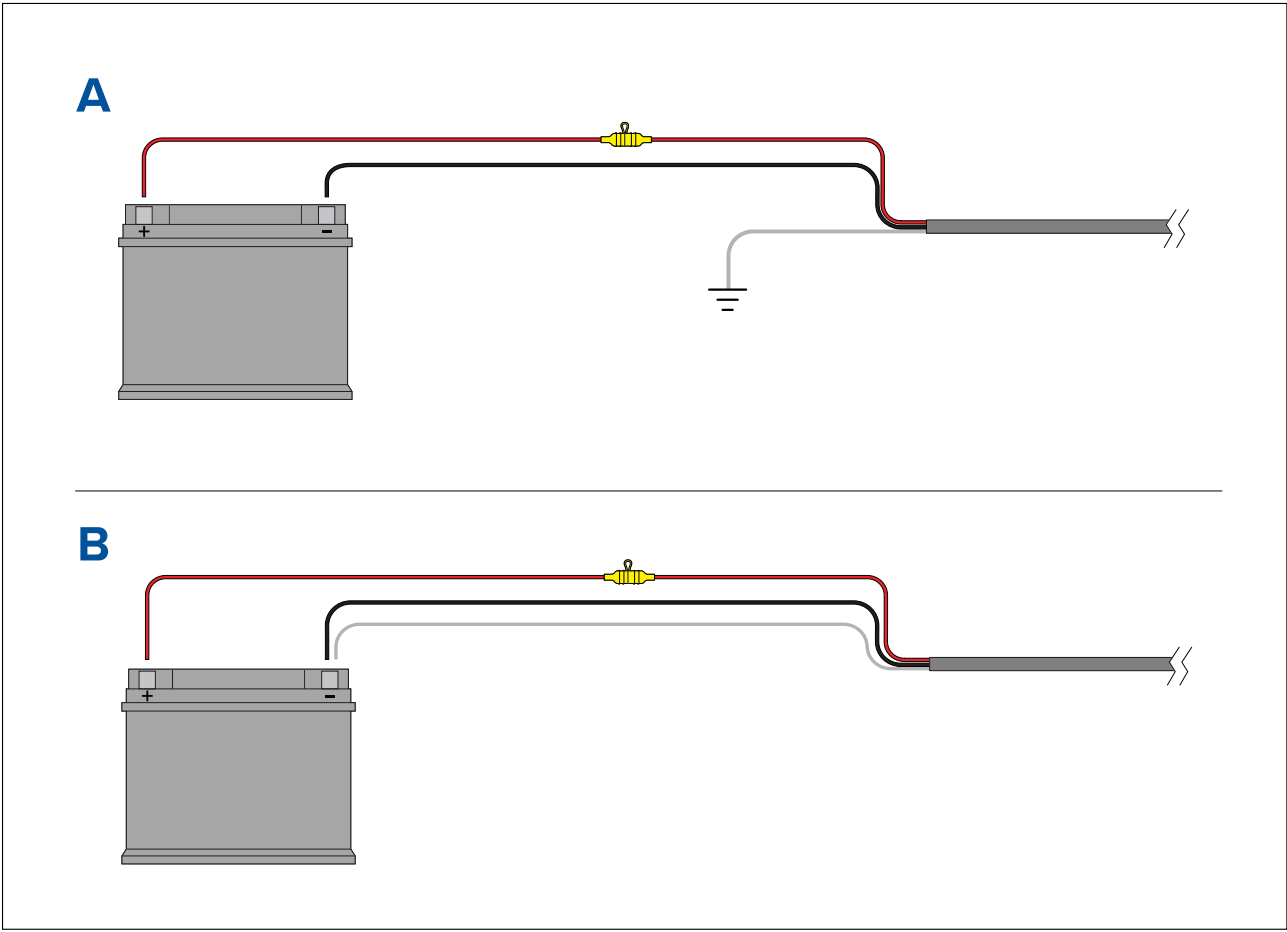
- The unit may be connected directly to the vessel's battery, via a suitably rated fuse or breaker.
- The unit also requires a separate RF Ground (drain) connection, refer to the following section: *Grounding — Dedicated drain wire required.*
- You **MUST** fit a suitably-rated fuse or breaker between 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	In-line fuse rating
ACU-100	10 A
ACU-150	15 A
ACU-200	20 A
ACU-300	15 A
ACU-400	40 A

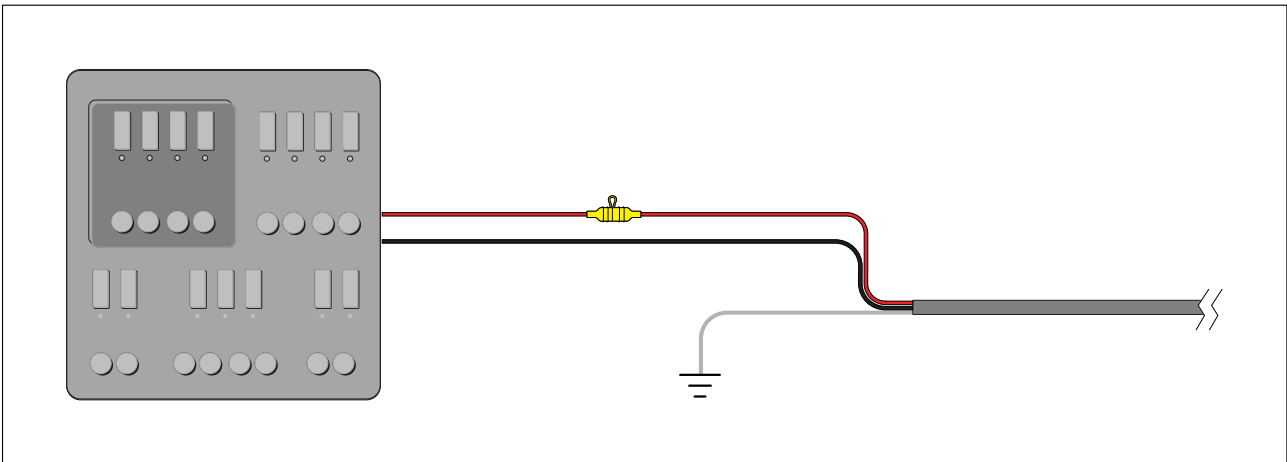
Important:

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



A	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	Battery connection scenario 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	Thermal breaker rating
ACU-100	10 A
ACU-150	15 A
ACU-200	20 A
ACU-300	15 A
ACU-400	40 A

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.

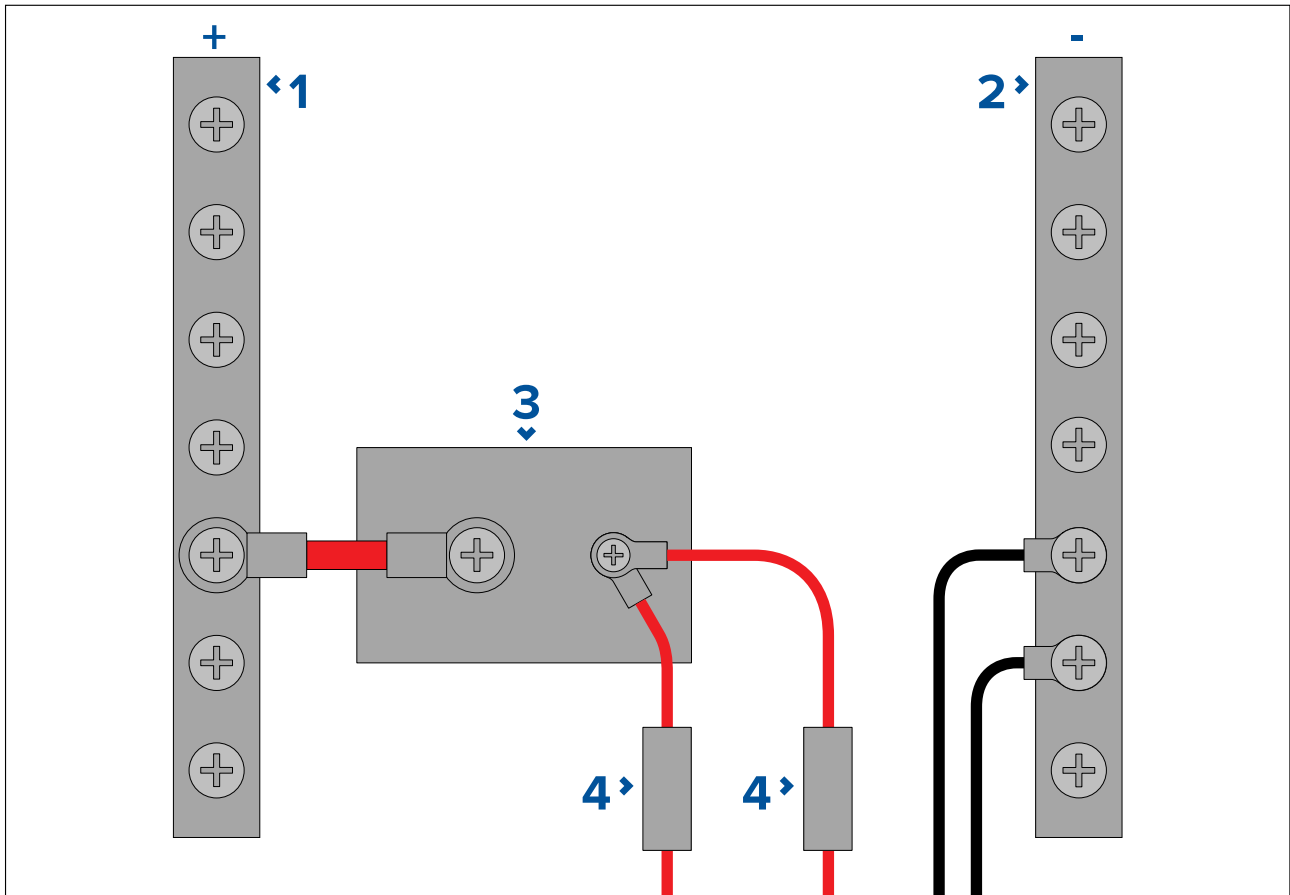
More information

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.



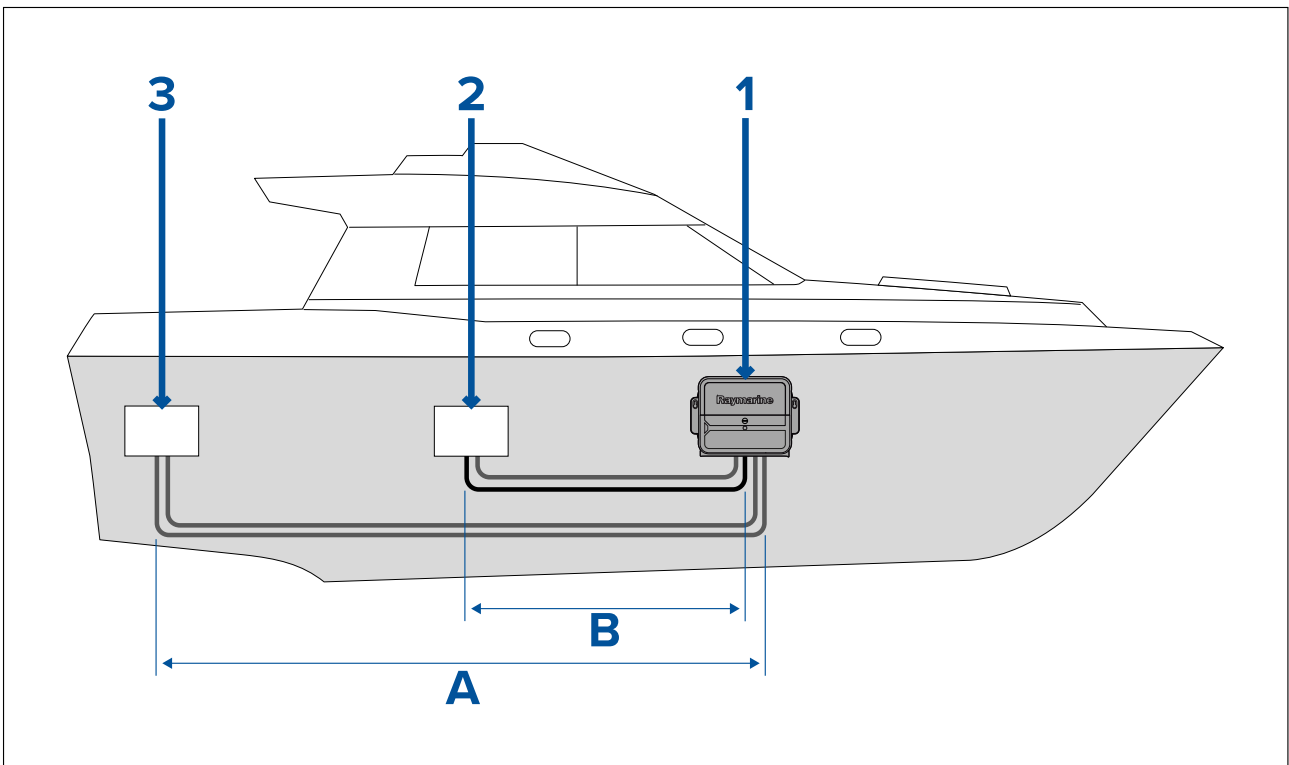
1	Positive (+) bar
2	Negative (-) bar
3	Circuit breaker
4	Fuse

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.

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

Power and drive cable selection

Drive	Supply voltage	Max. length (A+B)	Cable size
Type 0.5 hydraulic pump	12 V	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)
<ul style="list-style-type: none"> • Type 1 drive • CR pump (ACU-300 only) 	12 V	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)

Drive	Supply voltage	Max. length (A+B)	Cable size
Type 2 drive	12 V	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)
	24 V	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	Up to 5 m (16 ft)
Up to 7 m (23 ft)			16 mm ² (6 AWG)
Up to 16 m (52 ft)			25 mm ² (4 AWG)
24 V		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	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	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	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)

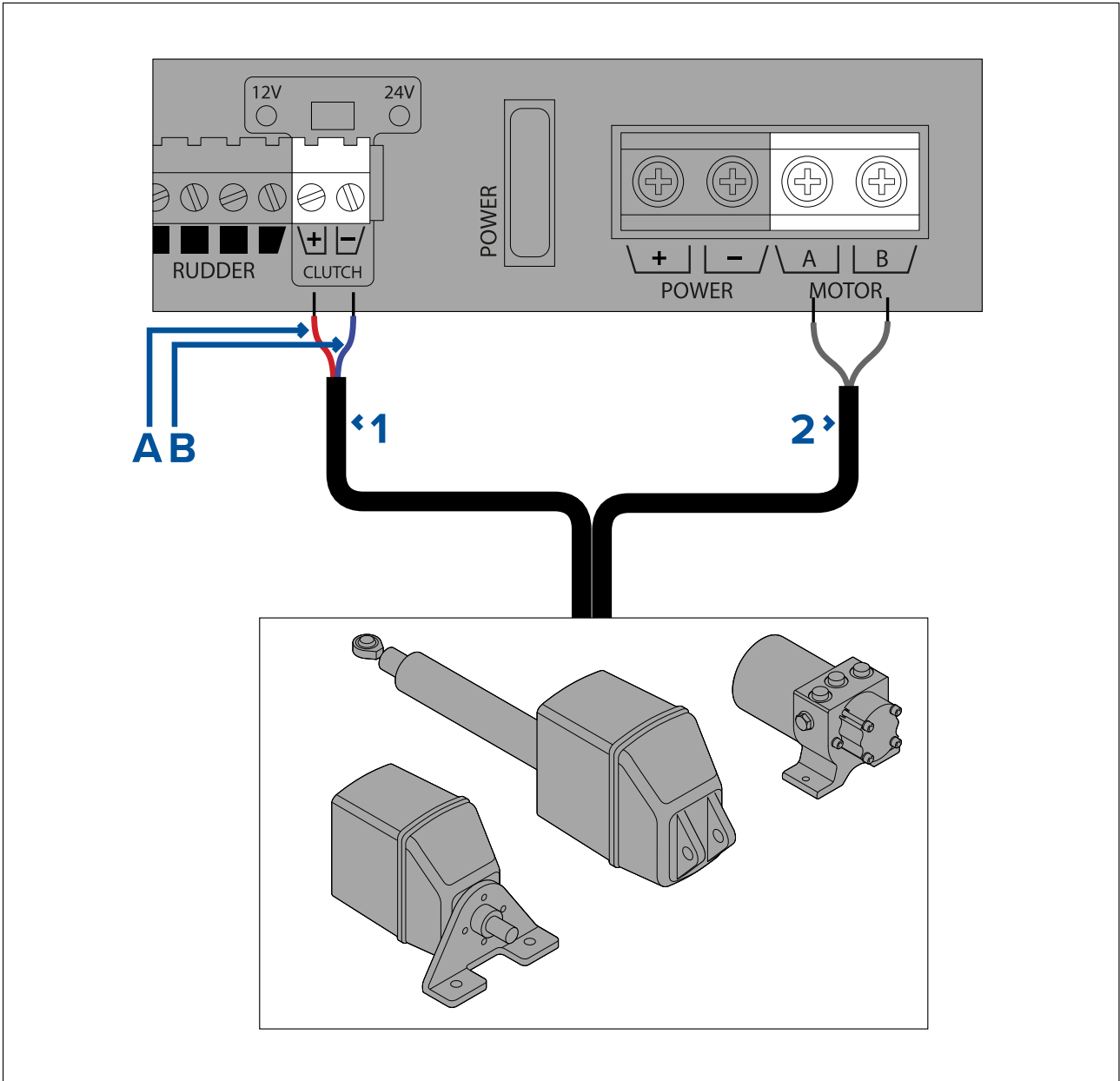
Important:

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.

Motor (drive) and clutch connection — ACU-200 and ACU-400

Motor connection

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
A	Red	Clutch Positive (+) connection
B	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.

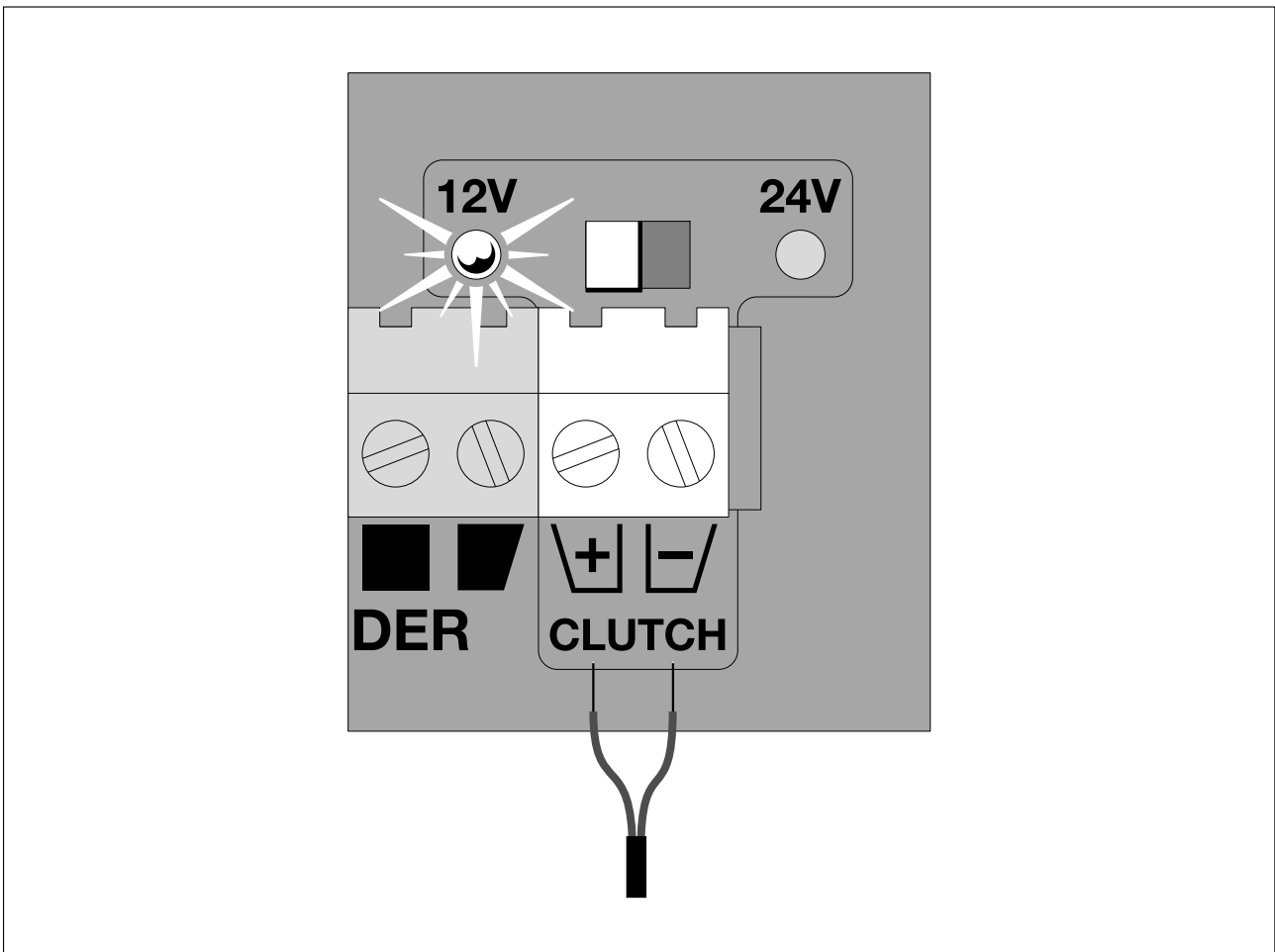
Note:

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

Note:

The clutch output on all ACU variants 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.

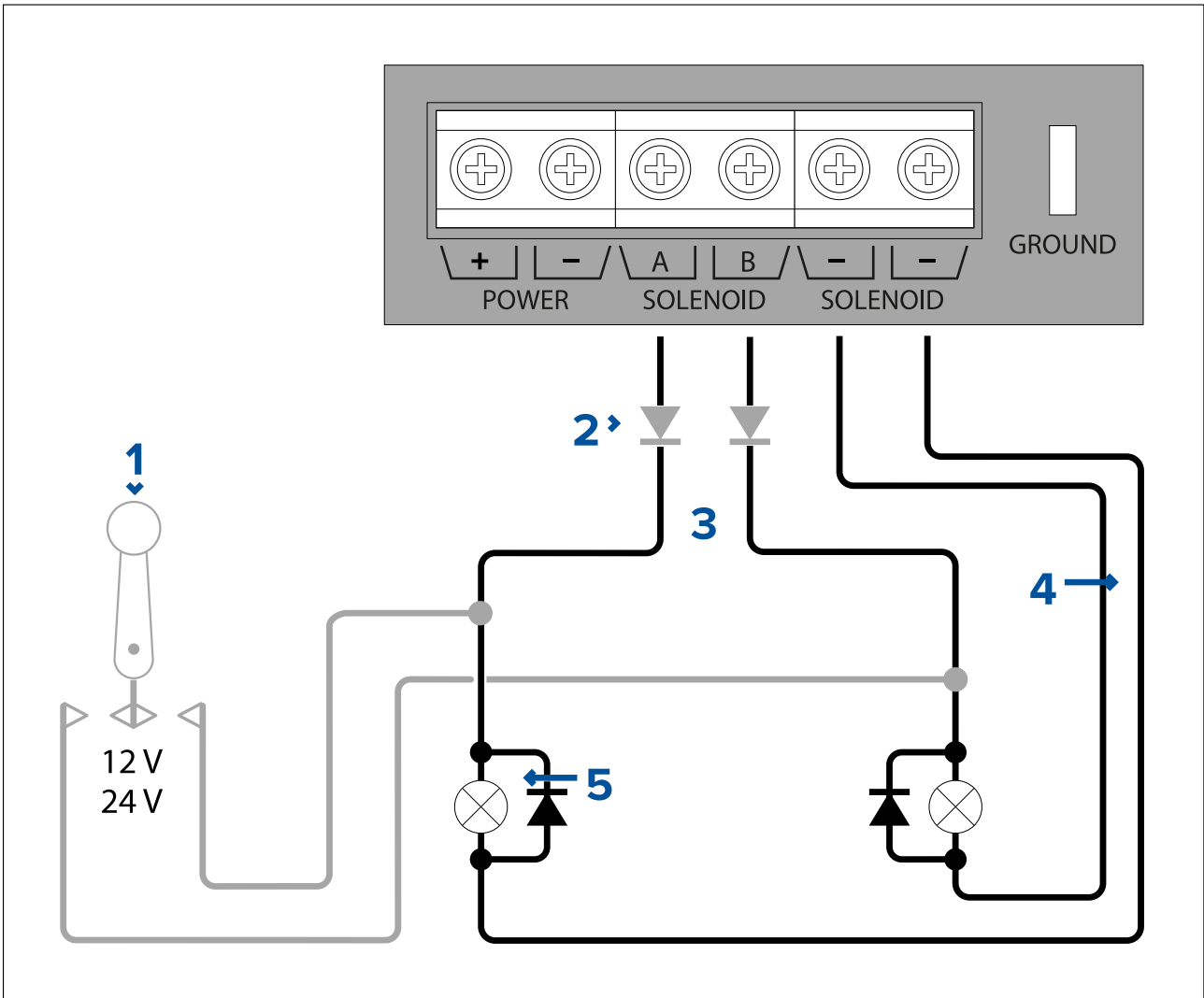
Important:

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.

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

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

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:

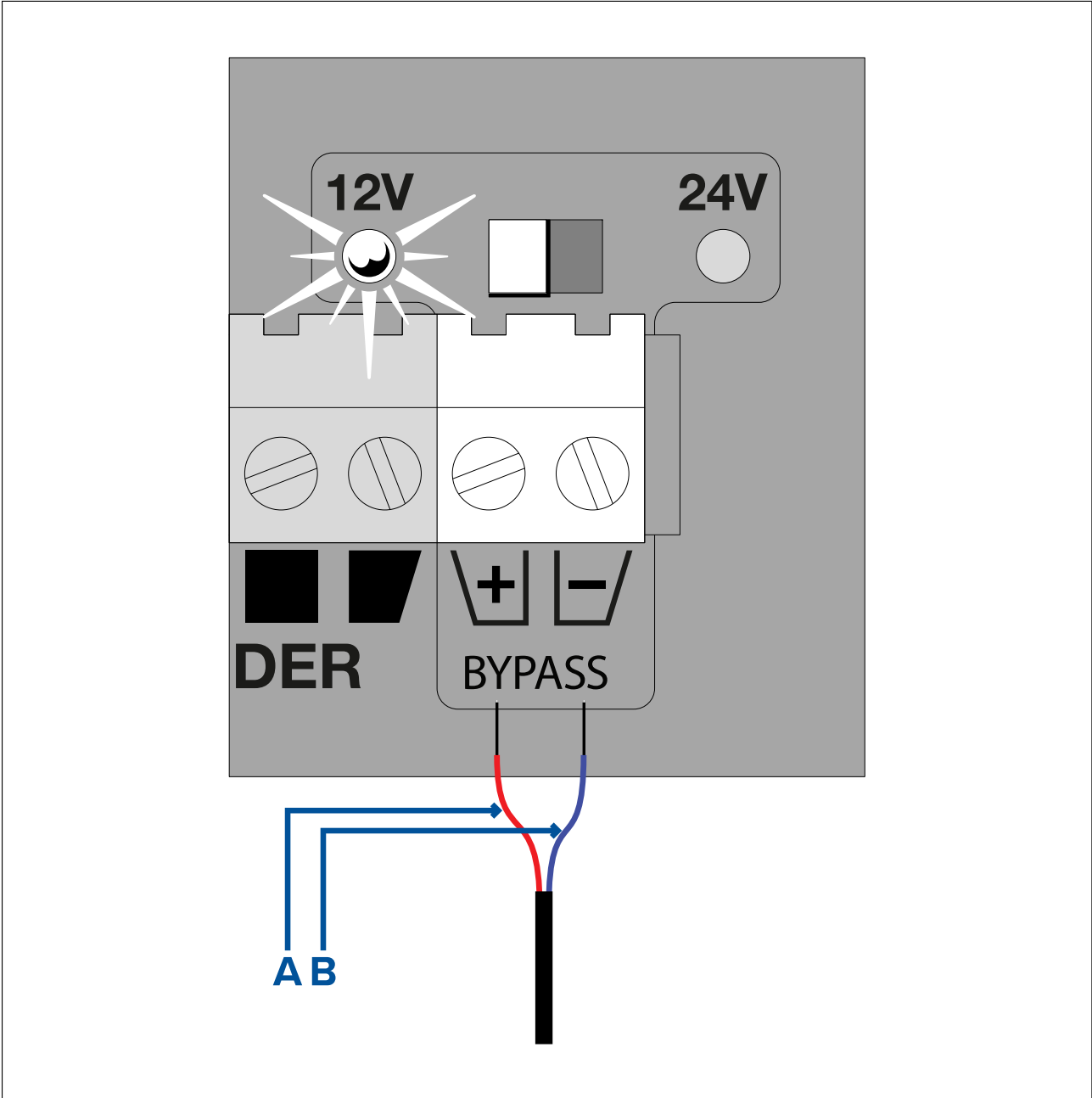
If an electronic steering or jog lever is used, fit diodes (suggested type: 1N4004) in-line with the solenoid outputs to prevent back-feeding the ACU.

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, 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.

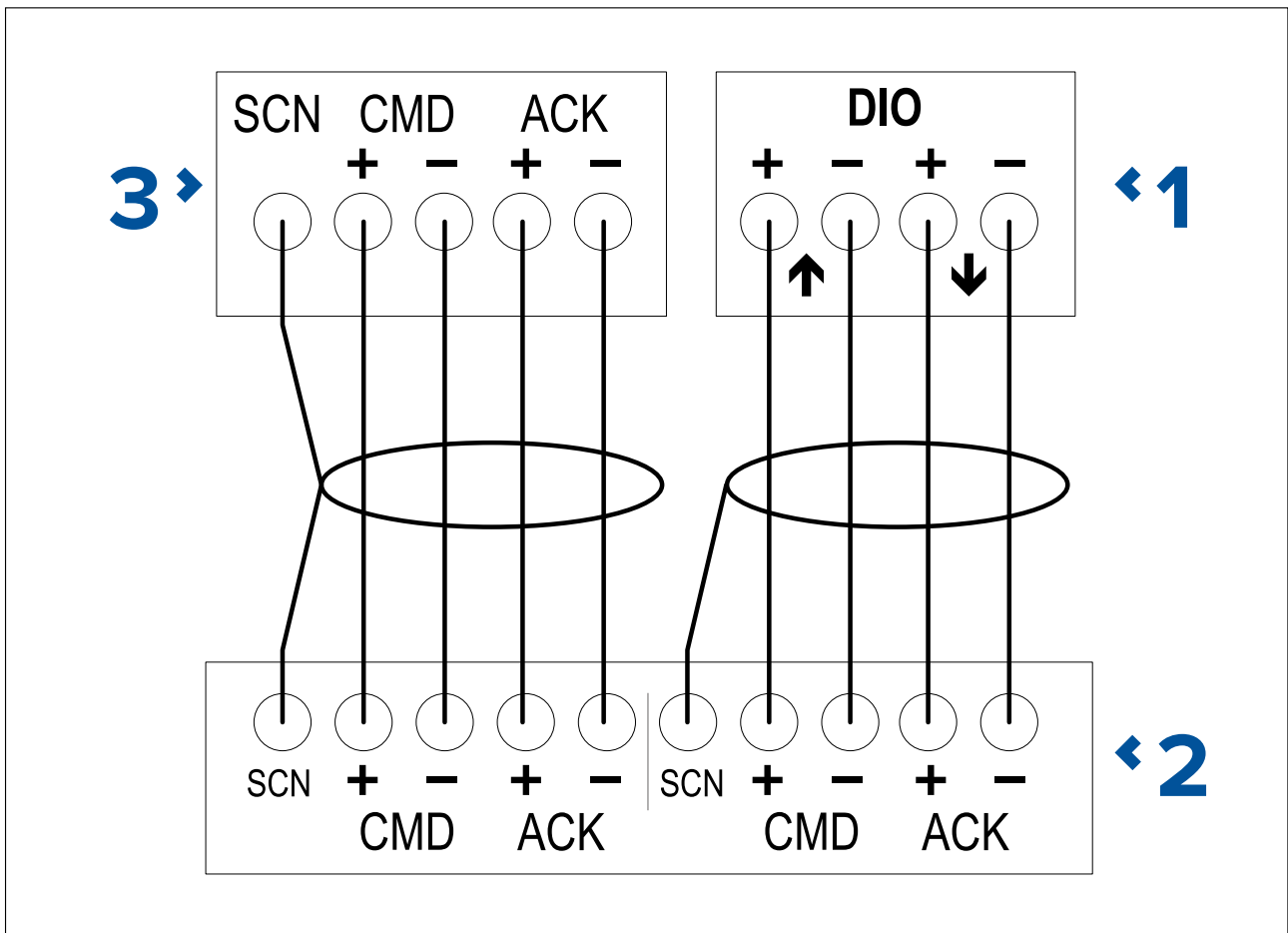
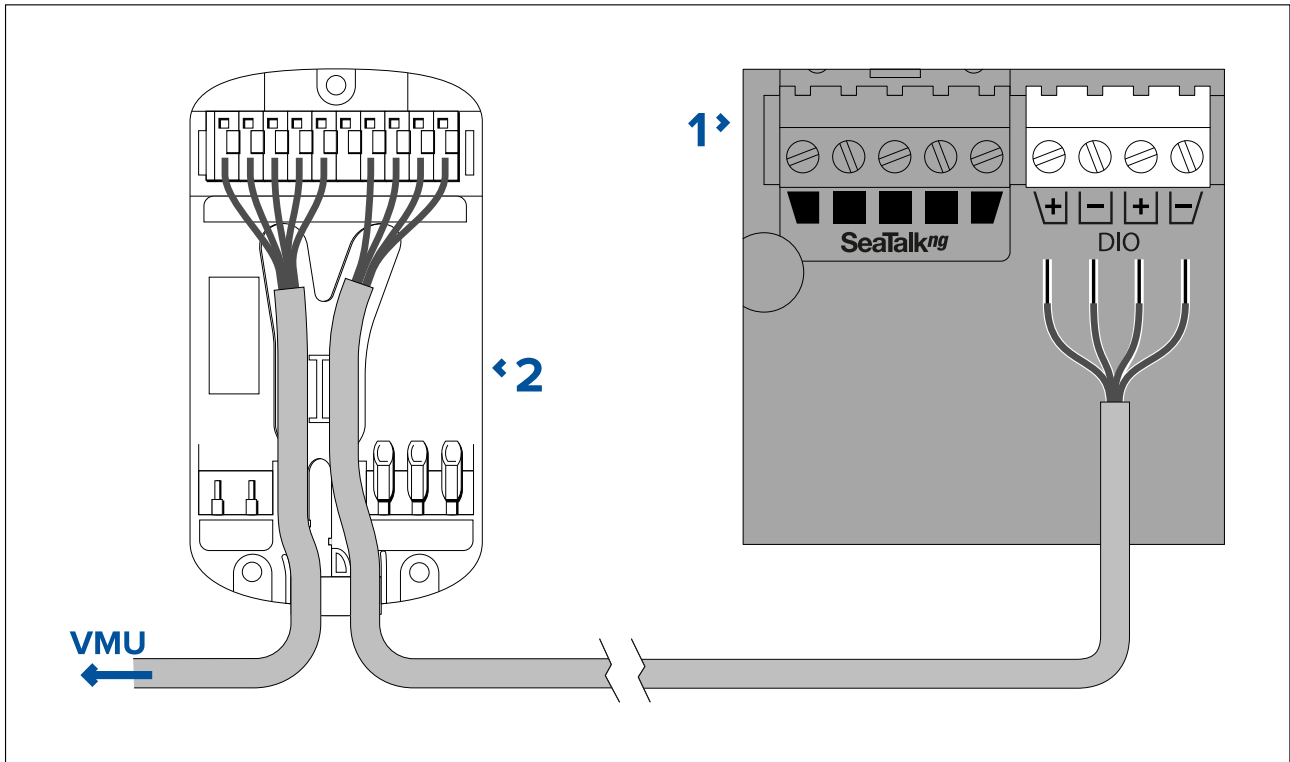


Bypass valve connection colors

	Color	Description
A	Red	Bypass valve Positive (+) connection
B	Blue	Bypass valve Negative (-) connection

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.



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.

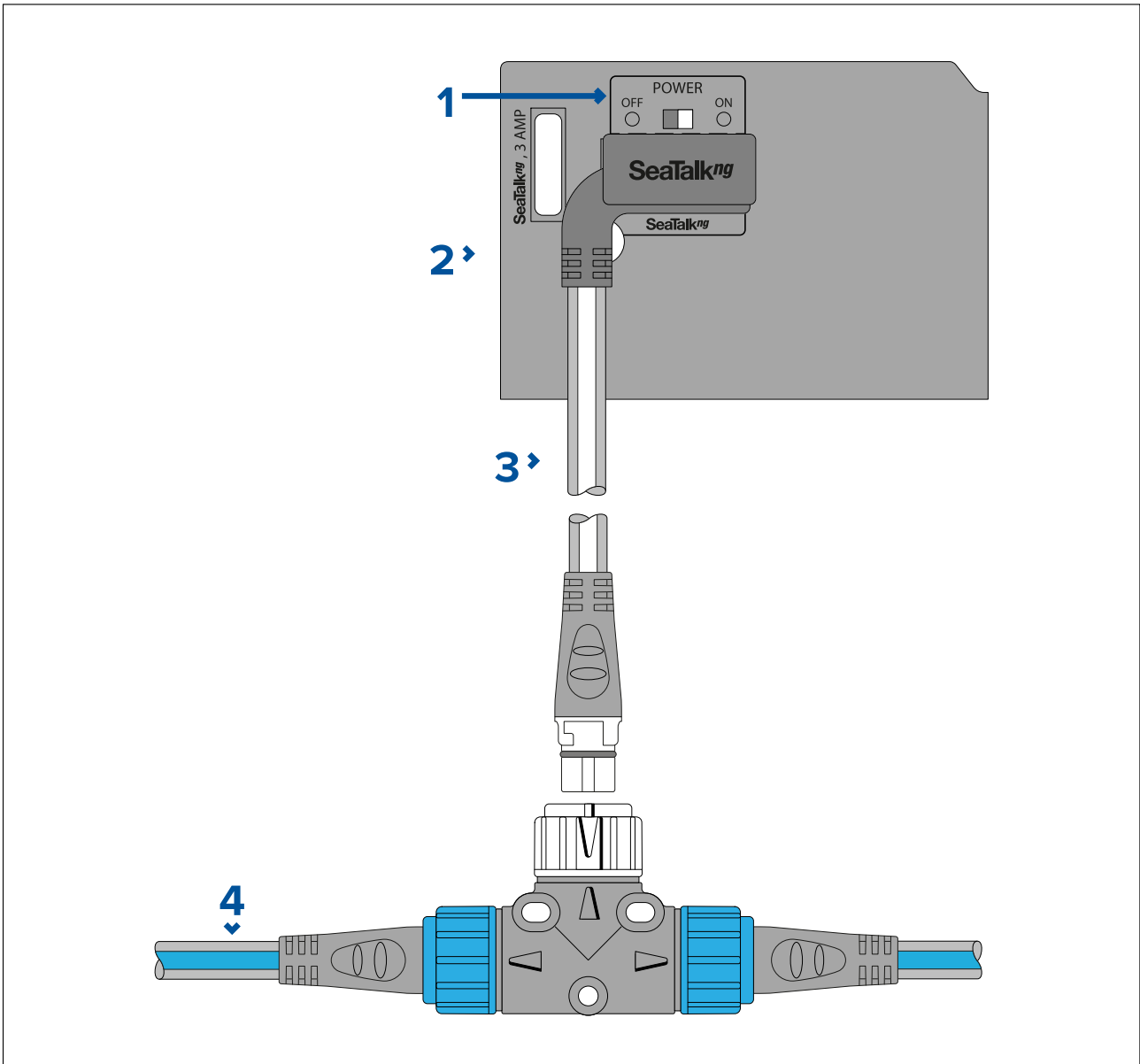
Raymarine recommends the following cable specification:

- 4-core (22 AWG) with overall screen

SeaTalkng® connection — ACU-200, ACU-300, ACU-400

The ACU-200, ACU-300, and ACU-400 are connected to a compatible autopilot controller using SeaTalkng®.

The ACU-200, ACU-300, and ACU-400 connect to the SeaTalkng® backbone using the supplied spur cable.



Note:

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

1. SeaTalkng® power switch
2. ACU connector panel
3. Evolution™ to SeaTalkng® spur cable
4. SeaTalkng® backbone

SeaTalkng® power switch (ACU-200, ACU-300, ACU-400 only)

The ACU-200, ACU-300, ACU-400 can provide power to the SeaTalkng® backbone. This will provide power to certain equipment connected to the backbone (e.g. SeaTalkng® autopilot control head and instrument displays).

Set the SeaTalkng® power switch on the connector panel to the appropriate position:

- **ON** — The ACU-200, ACU-300, ACU-400 will supply power to the SeaTalkng® backbone.

Important: Ensure that there are no other power feeds connected into the backbone.

Ensure that there are no other power feeds connected into the backbone.

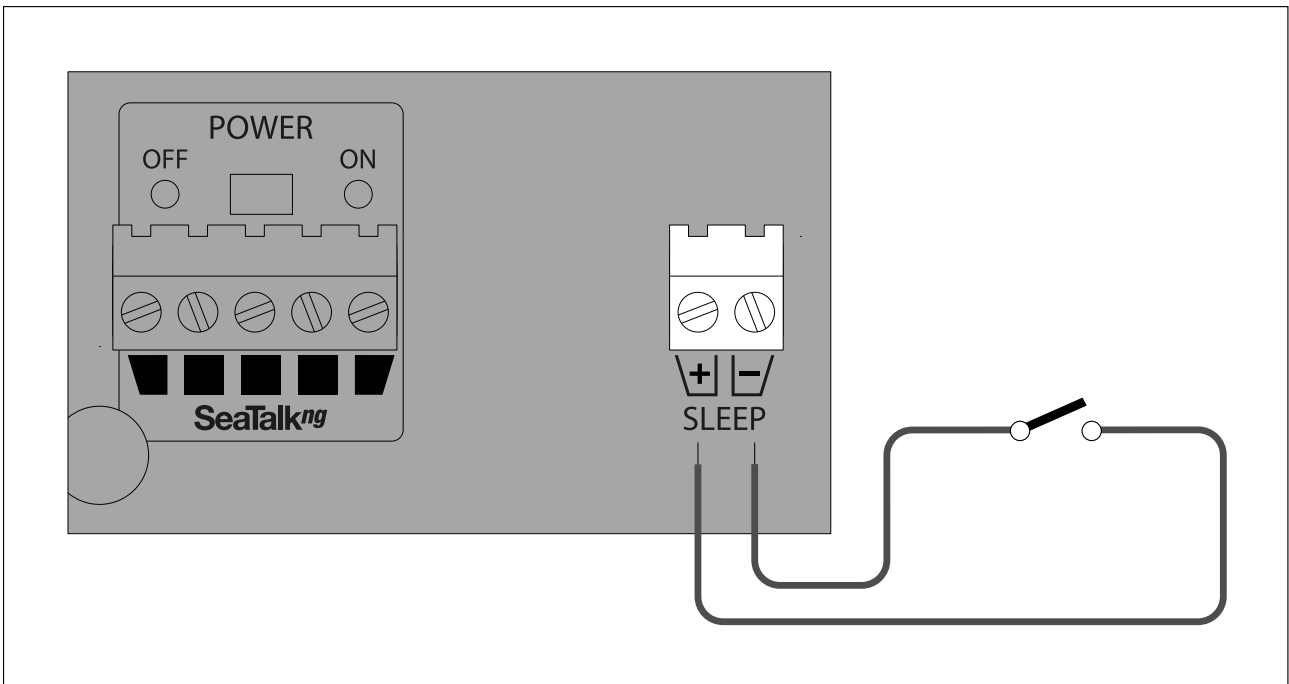
- **OFF** — The ACU-200, ACU-300, ACU-400 will NOT supply power to the SeaTalkng® backbone. Ensure that there is a separate power feed to the SeaTalkng® backbone.

Important:

Use correct fuse. The fuse supplying the SeaTalkng® system MUST be rated as per the value shown on the ACU connector panel.

Sleep switch connection — ACU-200, ACU-300, ACU-400

A Sleep switch disables the operation of the autopilot while retaining any power supplied to the SeaTalkng® backbone.



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

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.

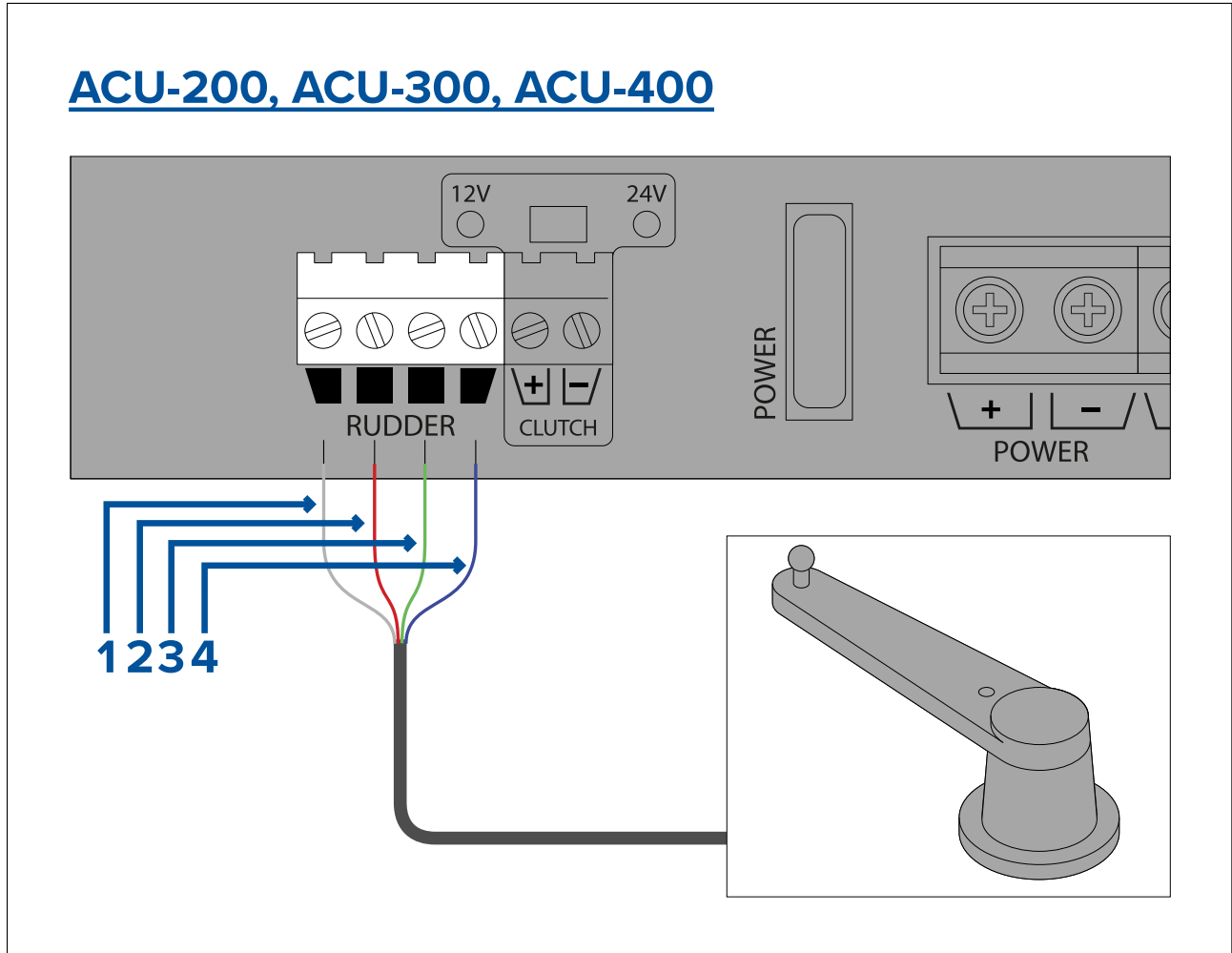
Note: The rudder angle reference sensor / transducer is not included with all autopilot products or system packs. Consult the Raymarine website or your local dealer for a full list of the components included with your autopilot system. The rudder angle reference sensor / transducer is also available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



Item	Wire color — ACU-200, ACU-300, ACU-400
1	Gray (screen)
2	Red
3	Green
4	Blue

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

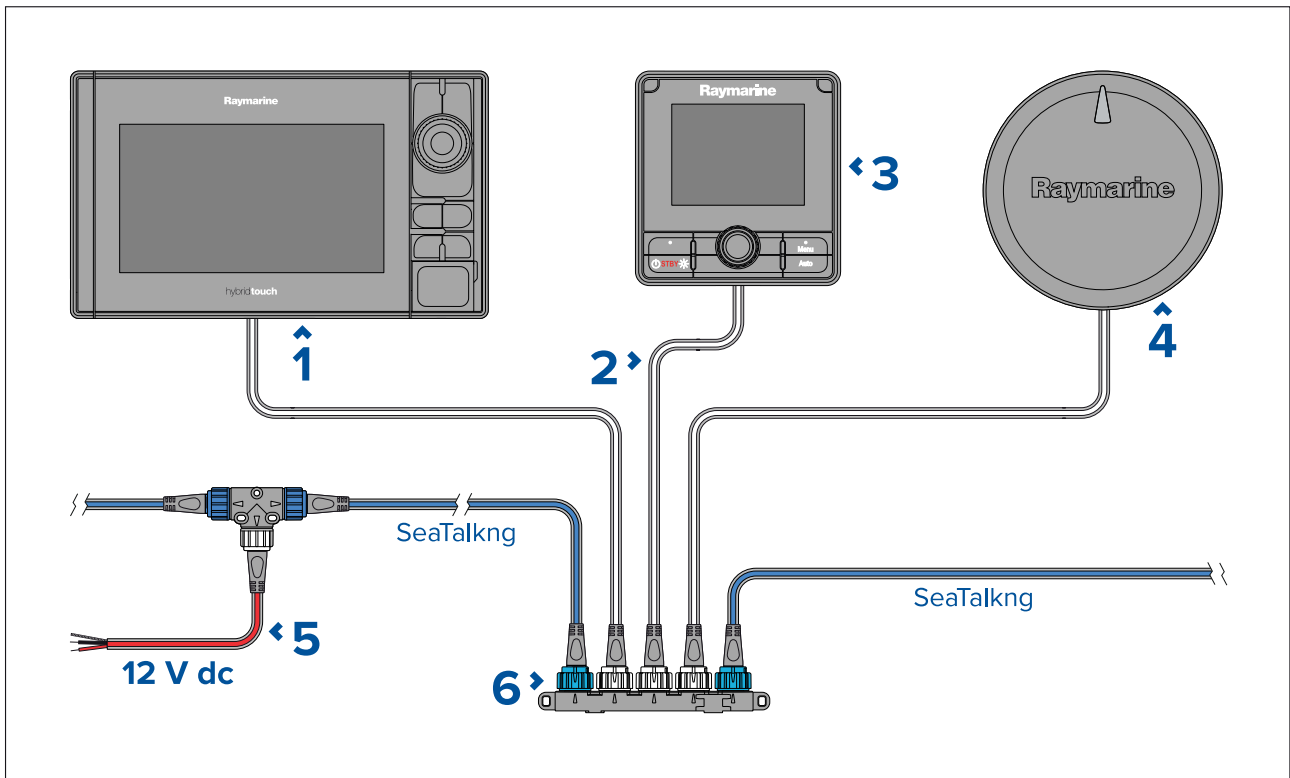
Chapter 12: Pilot controller connections

Chapter contents

- [12.1 SeaTalkng pilot controller connection on page 104](#)
- [12.2 SeaTalk® pilot controller connection on page 105](#)

12.1 SeaTalkng pilot controller connection

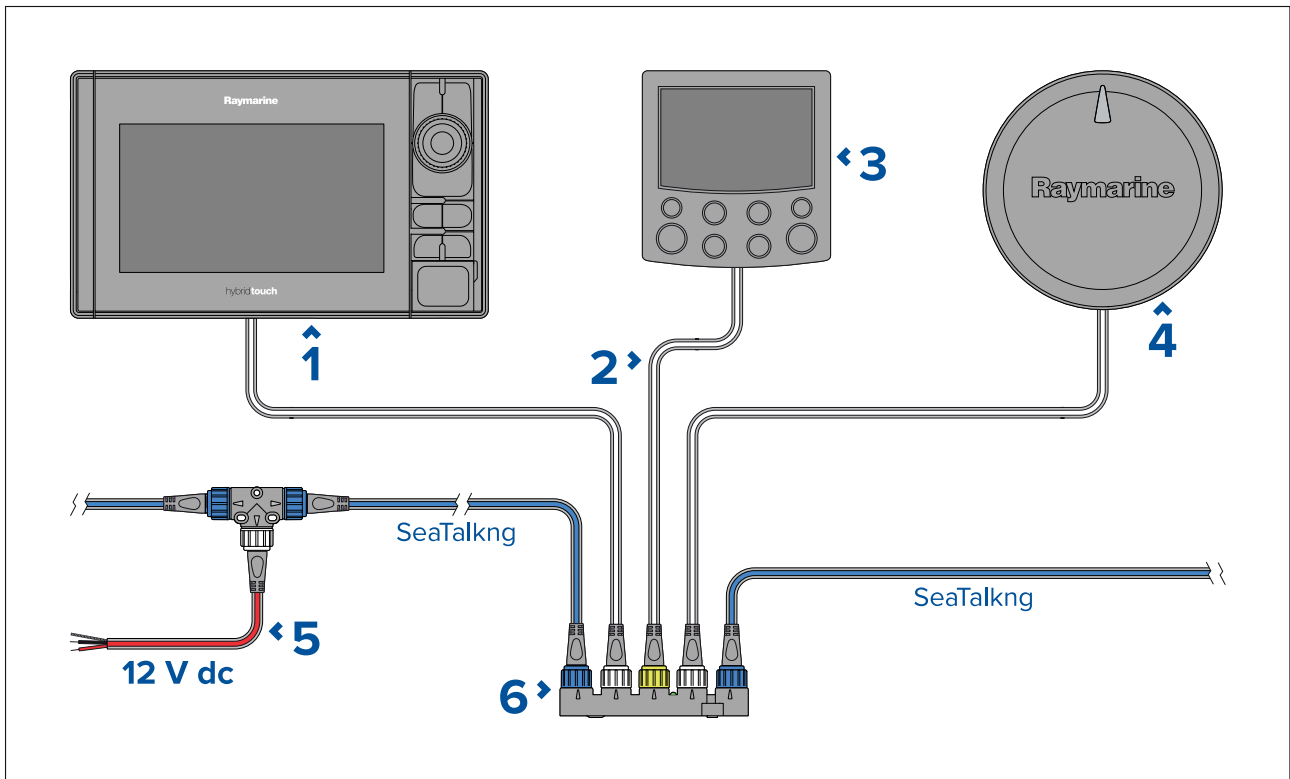
A SeaTalkng® pilot controller is connected directly into the same SeaTalkng® backbone as the EV autopilot.



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

12.2 SeaTalk® pilot controller connection

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



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

Chapter 13: System checks and troubleshooting

Chapter contents

- [13.1 Post-installation checks on page 108](#)
- [13.2 Error messages \(Troubleshooting\) on page 109](#)
- [13.3 Autopilot system setup on page 112](#)
- [13.4 Alarms on page 113](#)
- [13.5 LED indications — EV-1 on page 115](#)
- [13.6 LED indications — ACU on page 116](#)
- [13.7 Rudder damping levels and deadband angles on page 117](#)

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 associated equipment.
 - ACU (for EV-1 systems only)
 - Autopilot controller
 - SeaTalkng® backbone (if this has its own power supply)
2. Check that the autopilot controller powers up. If the display is blank press and hold the **Power** button for 2 seconds.
3. Check the EV-1, ACU and Pilot Controller display have the latest software. Visit www.raymarine.com/software to obtain the latest software, and then use your multifunction display to update the software on these autopilot system components. The web page also contains instructions on how to update your software.
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. Refer to:

[p.115 — LED indications — EV-1](#)

[p.116 — LED indications — ACU](#)

6. If the fault persists and cannot be rectified, **contact your dealer or Raymarine product support.**

13.2 Error messages (Troubleshooting)

The following 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	Solution
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. • For systems using the Volvo Penta EVC drive interface unit, check the unit is operating correctly.
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. • For EV-1 systems, check ACU drive output voltage and drive and clutch voltage output (if applicable). • For EV-1 systems, check all connections to ACU. • Check all connections to drive unit. • Check that the drive unit operates and is not stalled. • Check steering system is secure.
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	The clutch for the drive system is demanding a greater power output than is supported by the clutch power output of the Evolution components.	Refer to the clutch power output ratings provided in the Installation instructions for the relevant Evolution components, and ensure the clutch for the drive unit does not exceed this power output.

Alarm Message	Possible causes	Solution
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.
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 or EV-2 is not receiving heading data.	<ul style="list-style-type: none"> • Check the connections to the EV-1 / EV-2. • Power cycle the EV-1 / EV-2, by removing and then reconnecting the SeaTalkng[®] cable.
RATEGYRO FAIL	The internal rate gyro on the EV-1 or EV-2 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 Evolution 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 SeaTalkng [®] system.	Check connections to the GPS data source.
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.

Alarm Message	Possible causes	Solution
NO IPS (NO DRIVE DETECTED)	Loss of communications between the EV-1 and ACU, or EV-2 and drive interface unit.	Check all physical data connections between these devices, as appropriate.
PILOT RESET NORMAL (UNEXPECTED HARDWARE RESET)	<ul style="list-style-type: none"> 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 / EV-2 software has detected a fault it cannot recover from, and has reset the pilot.	Wait approximately 1 minute for the EV-1 / EV-2 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 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 components transmit alarm alerts on the SeaTalkng[®] network for display on autopilot controllers and MFDs, along with an audible alert. The Evolution 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	Solution
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.
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 SeaTalkng[®] system. Also between the EV-1 / EV-2 and the SeaTalk^{ng} system. • If the autopilot control head is connected via a SeaTalk[®] to SeaTalkng[®] 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.
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 	Check the connections to the wind transducer, multifunction display, and autopilot control head (as appropriate).

Alarm Message	Possible causes	Solution
	will clear when the signal improves.	
PILOT STARTUP	Autopilot components are initializing.	Some components may take a moment to startup.

13.5 LED indications — EV-1

LED color	LED code	Status	Action required	
		Solid green	Normal operation.	<ul style="list-style-type: none"> • None (normal power up takes <1 minute.)
		Long flash green on (x1), long flash off. Cycle repeats after 2 seconds.	Unit is initializing; no pilot or compass functions currently available.	<ul style="list-style-type: none"> • None (normal power up takes <1 minute.)
		Short flash red on (x2), long flash off. Cycle repeats after 4 seconds.	No SeaTalkng [®] connection.	<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.
		Short flash red on (x7), long flash off. Cycle repeats after 9 seconds.	SeaTalkng [®] connected but not receiving data.	<ul style="list-style-type: none"> • If problem persists contact Raymarine technical support.

13.6 LED indications – ACU

LED color	LED code	Status	Action required	
	* _____ o	Solid green	Normal operation.	<ul style="list-style-type: none"> • None (normal power up takes <1 minute.)
	*  o	Short flash red on (x2), long flash off. Cycle repeats after 4 seconds.	No SeaTalkng® connection.	<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.
	*  o	Short flash red on (x7), long flash off. Cycle repeats after 9 seconds.	SeaTalkng® connected but not receiving data.	<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 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 ACU 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 software:

Rudder damping level	Existing Deadband angle		New Deadband angle (ACU software version v3.11 onwards)
	ACU-100, 150, 200, 400	ACU-300	
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 2 MFD** — From the Pilot Set-up page: **Pilot Settings > Drive Settings > Rudder Damping**
- **LightHouse 3 MFD** — **Homescreen > Settings > Autopilot > Pilot control > Advanced settings > Rudder Damping.**

Chapter 14: Operation

Chapter contents

- [14.1 Evolution autopilot operation instructions on page 120](#)

14.1 Evolution 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).

Autopilot controller documentation

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

Description	Part number
p70/p70R installation and operation instructions Installation, commissioning and operation instructions including connection to a wider system of marine electronics.	81355
p70s/p70Rs installation and operation instructions Installation, commissioning and operation instructions including connection to a wider system of marine electronics.	81365
LightHouse™ 2 MFDs Operations and autopilot commissioning instructions for a LightHouse 2 Multifunction display, including connection to a wider system of marine electronics.	81360
LightHouse™ 3 MFDs Operation instructions for a LightHouse 3 Multifunction display, including connection to a wider system of marine electronics.	81370

All documents are available to download from the Raymarine website: www.raymarine.com/manuals

Chapter 15: Maintenance

Chapter contents

- [15.1 Service and maintenance on page 122](#)
- [15.2 Routine equipment checks on page 122](#)
- [15.3 Product cleaning on page 122](#)

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

Chapter contents

- [16.1 Raymarine product support and servicing on page 124](#)
- [16.2 Learning resources on page 125](#)

16.1 Raymarine product support and servicing

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

Product information

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

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

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

Servicing and warranty

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

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

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

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

United States (US):

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

Web support

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

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

Worldwide support

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

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

United States (US):

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

Australia and New Zealand (Raymarine subsidiary):

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

France (Raymarine subsidiary):

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

Germany (Raymarine subsidiary):

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

Italy (Raymarine subsidiary):

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

Spain (Authorized Raymarine distributor):

- E-Mail: sat@azimut.es

- Tel: +34 96 2965 102

Netherlands (Raymarine subsidiary):

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

Sweden (Raymarine subsidiary):

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

Finland (Raymarine subsidiary):

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

Norway (Raymarine subsidiary):

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

Denmark (Raymarine subsidiary):

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

Russia (Authorized Raymarine distributor):

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

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:

- [YouTube](#)

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

Chapter contents

- 17.1 Technical specification — EV-1 and EV-2 on page 128
- 17.2 Technical specification — ACU-100, ACU-150 on page 129
- 17.3 Technical specification — ACU-200, ACU-300, ACU-400 on page 130

17.1 Technical specification – EV-1 and EV-2

Nominal supply voltage	12 V (powered by SeaTalkng [®] system).
Operating voltage range	10.8 V to 15.6 V dc.
Power consumption (taken from SeaTalkng[®] system)	30 mA.
SeaTalkng[®] LEN (Load Equivalency Number)	1
Sensors	<ul style="list-style-type: none"> • 3-axis digital accelerometer. • 3-axis digital compass. • 3-axis gyro digital angular rate sensor.
Data Connections	<ul style="list-style-type: none"> • SeaTalkng[®]. • NMEA 2000 DeviceNet (EV-2 only; port not used on EV-1 unit).
Environmental	Installation environment <ul style="list-style-type: none"> • 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: IPX 6.
Dimensions	<ul style="list-style-type: none"> • 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)
EMC compliance	<ul style="list-style-type: none"> • Europe: 2004/108/EC. • Australia and New Zealand: C-Tick, Compliance Level 2.

17.2 Technical specification — ACU-100, ACU-150

	ACU-100	ACU-150
Drive current output	<ul style="list-style-type: none"> Maximum continuous 7 A at supply voltage. 	<ul style="list-style-type: none"> Maximum continuous 12 A at supply voltage.
Drive clutch output	No clutch connection.	No clutch connection.
Connections	<ul style="list-style-type: none"> Rudder angle reference sensor / transducer. Power. Drive motor. Ground. 	<ul style="list-style-type: none"> Rudder angle reference sensor / transducer. Power. Drive motor. Ground.
Nominal supply voltage	12 V	12 V
Operating voltage range	10.8 V to 15.6 V dc	10.8 V to 15.6 V dc
Power consumption (standby) — main power supply	300 mA (12 V)	300 mA (12 V)
Power consumption (standby) — SeaTalkng® power supply	No power supply to SeaTalkng®	No power supply to SeaTalkng®
SeaTalkng® LEN (Load Equivalency Number)	1	1
SeaTalkng® Power out	No power supply to SeaTalkng®	No power supply to SeaTalkng®
Data connections	SeaTalkng®	SeaTalkng®
Environmental	<p>Installation environment</p> <ul style="list-style-type: none"> 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: Connector panel: IPX2 Drive electronics: IPX6 	<p>Installation environment</p> <ul style="list-style-type: none"> 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: Connector panel: IPX2 Drive electronics: IPX6
Dimensions	<ul style="list-style-type: none"> Width: 180 mm (7.1 in). Height: 140 mm (5.5 in). Depth: 52 mm (2.0 in). 	<ul style="list-style-type: none"> Width: 180 mm (7.1 in). Height: 140 mm (5.5 in). Depth: 52 mm (2.0 in).
Weight	0.6 kg (1.32 lbs).	0.6 kg (1.32 lbs).
EMC compliance	<ul style="list-style-type: none"> Europe: 2004/108/EC. Australia and New Zealand: C-Tick, Compliance Level 2. 	

17.3 Technical specification — ACU-200, ACU-300, ACU-400

	ACU-200	ACU-300	ACU-400
Drive current output	<ul style="list-style-type: none"> Maximum continuous 15 A at supply voltage. 	<ul style="list-style-type: none"> Maximum continuous 5 A at supply voltage. 	<ul style="list-style-type: none"> Maximum continuous 30 A at supply voltage.
Drive clutch output	Up to 2.0 A continuous, selectable between 12 / 24 V	No clutch connection.	<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.
Connections	<ul style="list-style-type: none"> Rudder angle reference sensor / transducer. Sleep switch. Power. Drive motor. Drive clutch. Ground. 	<ul style="list-style-type: none"> Rudder angle reference sensor / transducer. Sleep switch. Power. Solenoid drive out / return. Ground. 	<ul style="list-style-type: none"> Rudder angle reference sensor / transducer. Sleep switch. Power. Drive motor. Drive clutch. Ground. Digital Input / Output (DIO).
Nominal supply voltage	12 V or 24 V		
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) — SeaTalkng® power supply	20 mA (12 V)		
SeaTalkng® LEN (Load Equivalency Number)	1		
SeaTalkng® Power out	3 A at 12 V (fuse protected at 3 A).		
Data connections	SeaTalkng®		
Environmental	Installation environment <ul style="list-style-type: none"> 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. 		
Dimensions	<ul style="list-style-type: none"> Width: 285 mm (11.2 in). Height: 211.5 mm (8.3 in). Depth: 64.5 mm (2.5 in). 		

	ACU-200	ACU-300	ACU-400
Weight	2.2 kg (4.84 lbs).		
EMC compliance	<ul style="list-style-type: none"> • Europe: 2004/108/EC. • Australia and New Zealand: C-Tick, Compliance Level 2. 		

Chapter 18: Spares and accessories

Chapter contents

- [18.1 Accessories and spare parts on page 134](#)
- [18.2 SeaTalkng[®] cables and accessories on page 135](#)

18.1 Accessories and spare parts

Item	Part number	Notes
Evolution SeaTalk ^{ng} cable kit	R70160	Consists of: <ul style="list-style-type: none"> • SeaTalk^{ng} power cable 0.4 m (1.3 ft) (quantity: 1). • SeaTalk^{ng} backbone cable 5 m (16.4 ft) (quantity: 1). • SeaTalk^{ng} spur cable 0.4 m (1.3 ft) (quantity: 1). • SeaTalk^{ng} 5-way connector block (quantity: 1). • SeaTalk^{ng} T-piece connector (quantity: 2). • SeaTalk^{ng} terminator (quantity: 2).
Evolution DeviceNet cable kit (for EV-2)	R70192	Consists of: <ul style="list-style-type: none"> • DeviceNet adaptor cable (female) (quantity: 2). • SeaTalk^{ng} power cable (quantity: 1). • SeaTalk^{ng} terminator (quantity: 2).
EV-1 / EV-2 Sealing ring pack	R70161	
EV-1 / EV-2 Wall bracket	R70162	
EV-1 / EV-2 Deck mounting kit	A80437	Consists of: <ul style="list-style-type: none"> • Mounting adaptor (clamshell) • Riser • Wall bracket • Sealing rings • Fixings

Note:

For accessories and spare parts for pilot controllers and drive units, refer to the Installation documents specific to those products.

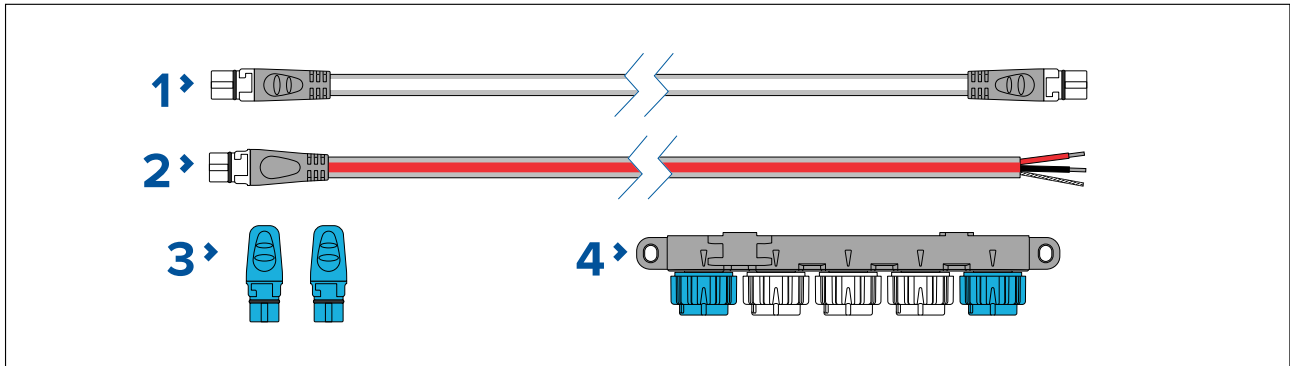
18.2 SeaTalkng[®] cables and accessories

SeaTalkng[®] cables and accessories for use with compatible products.

SeaTalkng[®] kits

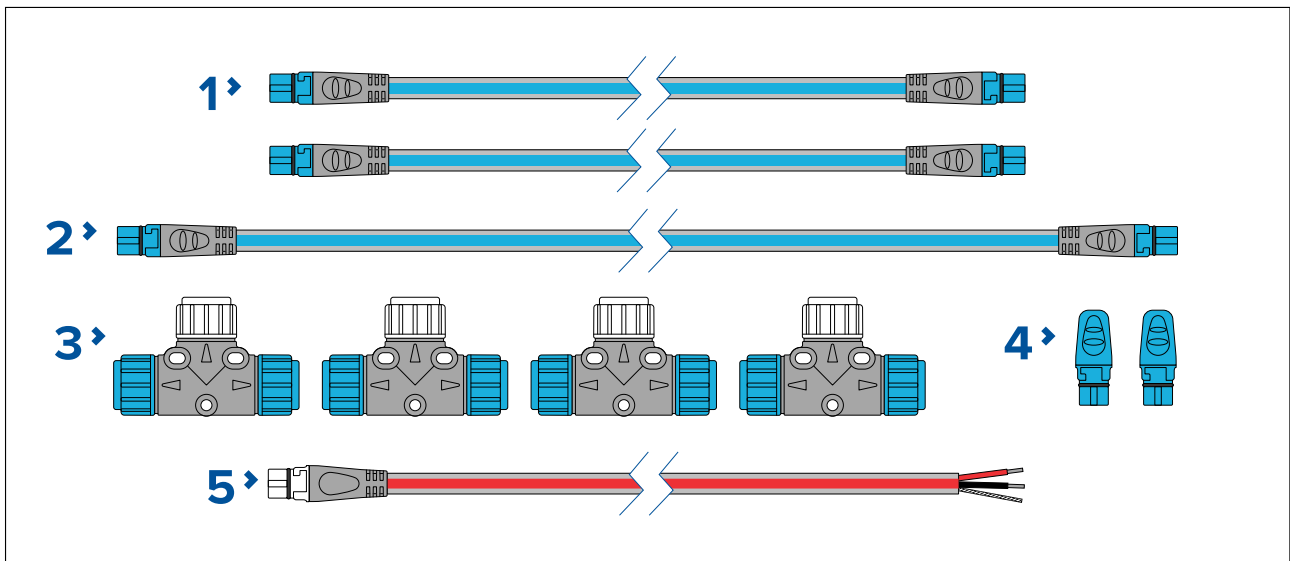
SeaTalkng kits enable you to create a simple SeaTalkng backbone.

Starter kit (T70134) consists of:



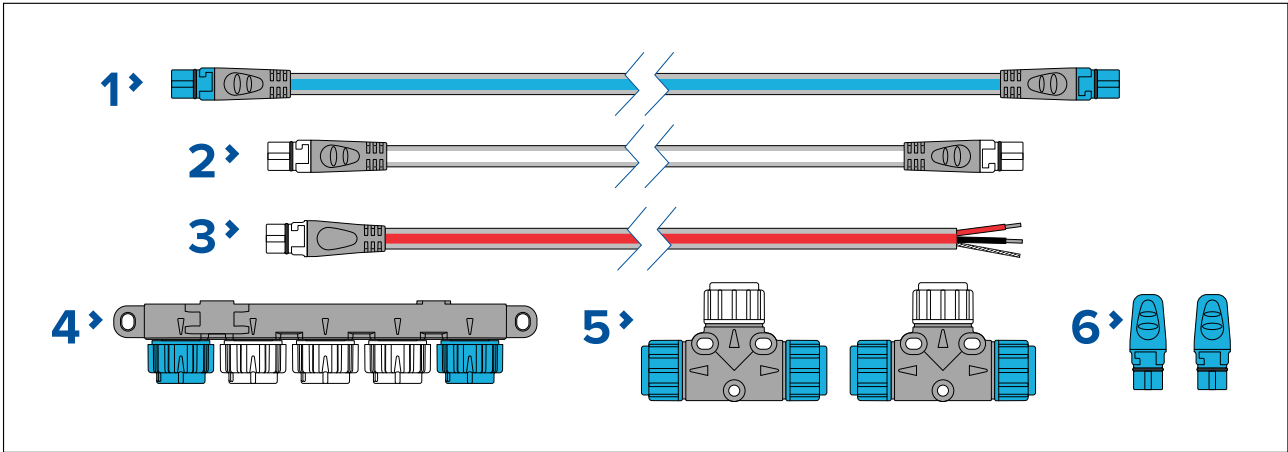
1. 1 x 3 m (9.8 ft) Spur cable (**A06040**). Used to connect device to the SeaTalkng backbone.
2. 1 x 2 m (6.6 ft) Power cable (**A06049**). Used to provide 12 V dc power to the SeaTalkng backbone.
3. 2 x Backbone terminators (**A06031**). Terminators must be fitted to both ends of the SeaTalkng backbone.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

Backbone kit (A25062) consists of:



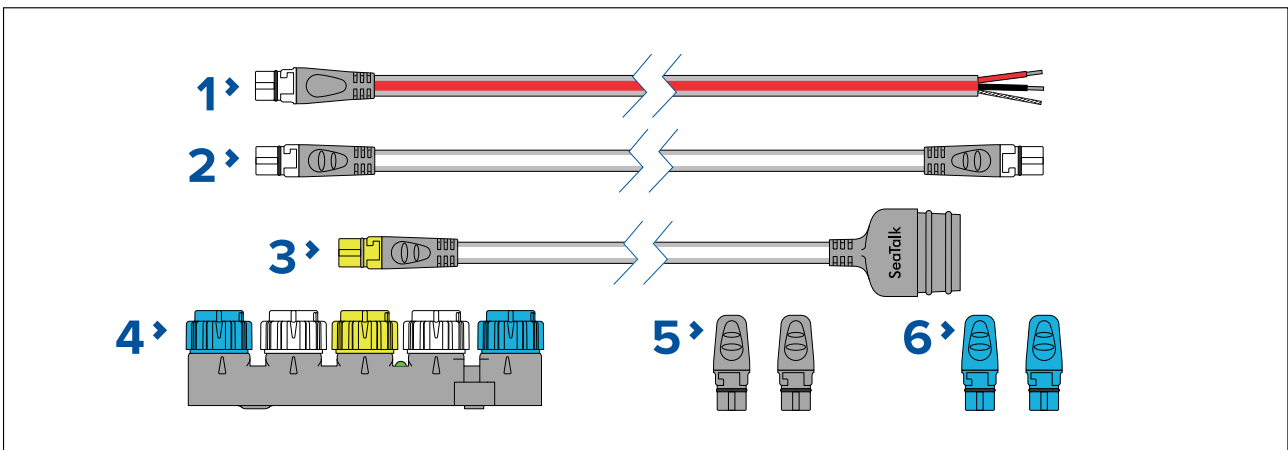
1. 2 x 5 m (16.4 ft) Backbone cables (**A06036**). Used to create and extend the SeaTalkng backbone.
2. 1 x 20 m (65.6 ft) Backbone cable (**A06037**). Used to create and extend the SeaTalkng backbone.
3. 4 x T-piece (**A06028**). Each T-piece allows connection of one SeaTalkng device. Multiple T-pieces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

Evolution autopilot cable kit (R70160) consists of:



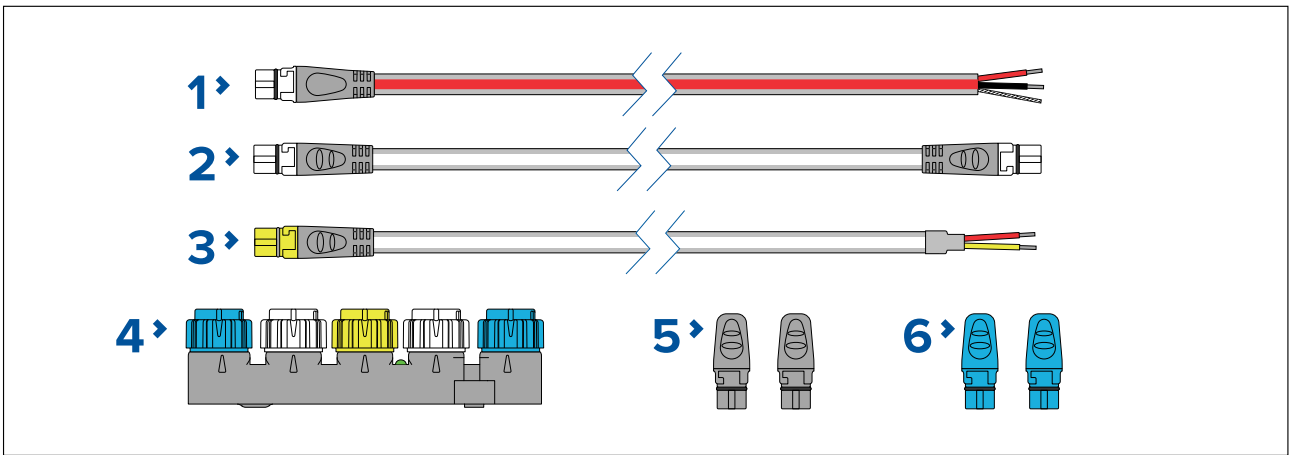
1. 1 x 5 m (16.4 ft) Backbone cable (**A06036**). Used to create and extend the SeaTalkng backbone.
2. 1 x 1 m (3.3 ft) Spur cable (**A06040**). Used to connect device to the SeaTalkng backbone.
3. 1 x 2 m (6.6 ft) Power cable (**A06049**). Used to provide 12 V dc power to the SeaTalkng backbone.
4.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

SeaTalk to SeaTalkng converter kit (E22158) consists of:



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

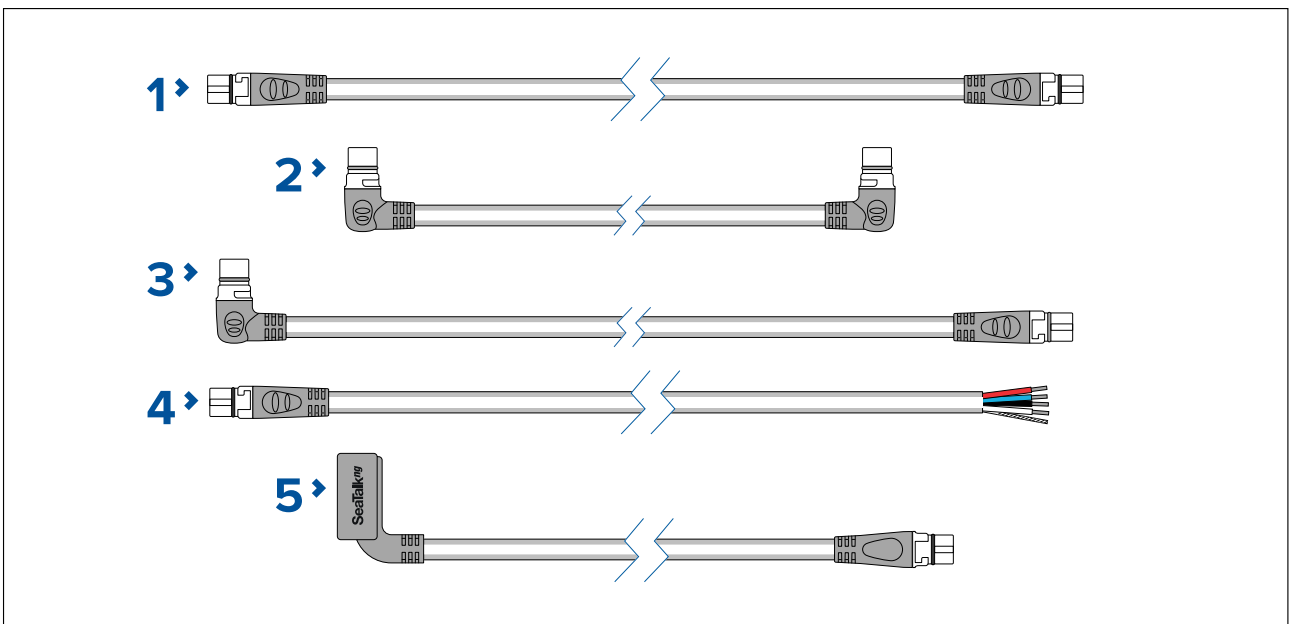
NMEA 0183 VHF 2 wire to SeaTalkng converter kit (E70196) consists of:



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

SeaTalkng[®] spur cables

SeaTalkng spur cables are required to connect devices to the SeaTalkng backbone.

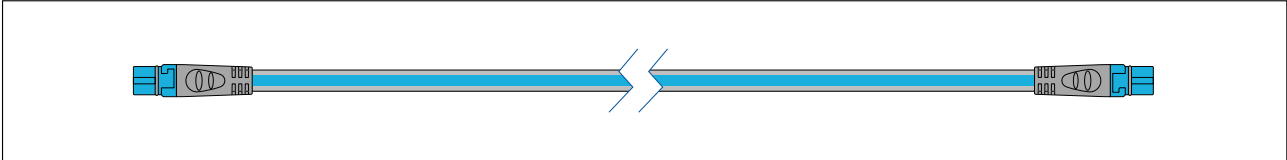


1. SeaTalkng spur cables:
 - 0.4 m (1.3 ft) Spur cable (**A06038**).
 - 1 m (3.3 ft) Spur cable (**A06039**).
 - 3 m (9.8 ft) Spur cable (**A06040**).
 - 5 m (16.4 ft) Spur cable (**A06041**).
2. 0.4 m (1.3 ft) Elbow (right angled) to elbow spur cable (**A06042**). Used in confined spaces where a straight spur cable will not fit.
3. 1 m (3.3 ft) Elbow (right angled) to straight spur cable (**A06081**). Used in confined spaces where a straight spur cable will not fit.

4. SeaTalkng to stripped-end spur cables (Connects compatible product that do not have a SeaTalkng connector such as transducer pods):
 - 1 m (3.3 ft) SeaTalkng to stripped-end spur cable — **A06043**
 - 3 m (9.8 ft) SeaTalkng to stripped-end spur cable — **A06044**
5. 0.3 m (1.0 ft) ACU / SPX autopilot to SeaTalkng spur cable (**R12112**). Connects the course computer to the SeaTalkng backbone. This connection can also be used to provide 12 V dc power to the SeaTalkng backbone.

SeaTalkng® backbone cables

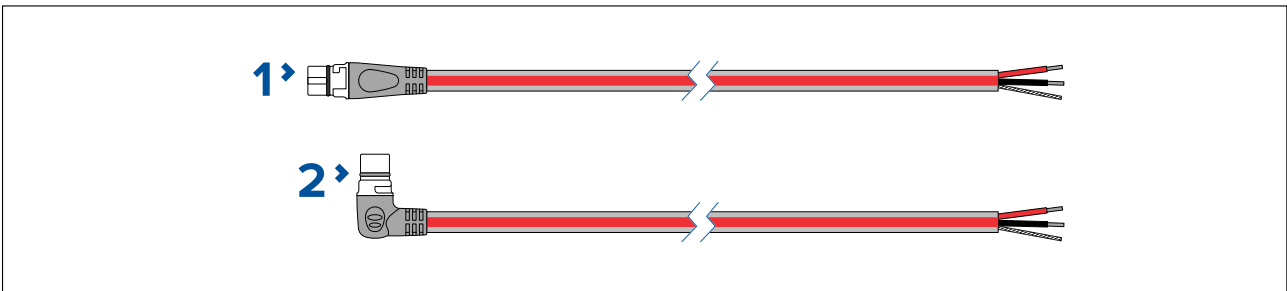
SeaTalkng backbone cables are used to create or extend a SeaTalkng backbone.



- 0.4 m (1.3 ft) Backbone cable (**A06033**).
- 1 m (3.3 ft) Backbone cable (**A06034**).
- 3 m (9.8 ft) Backbone cable (**A06035**).
- 5 m (16.4 ft) Backbone cable (**A06036**).
- 9 m (29.5 ft) Backbone cable (**A06068**).
- 20 m (65.6 ft) Backbone cable (**A06037**).

SeaTalkng® power cables

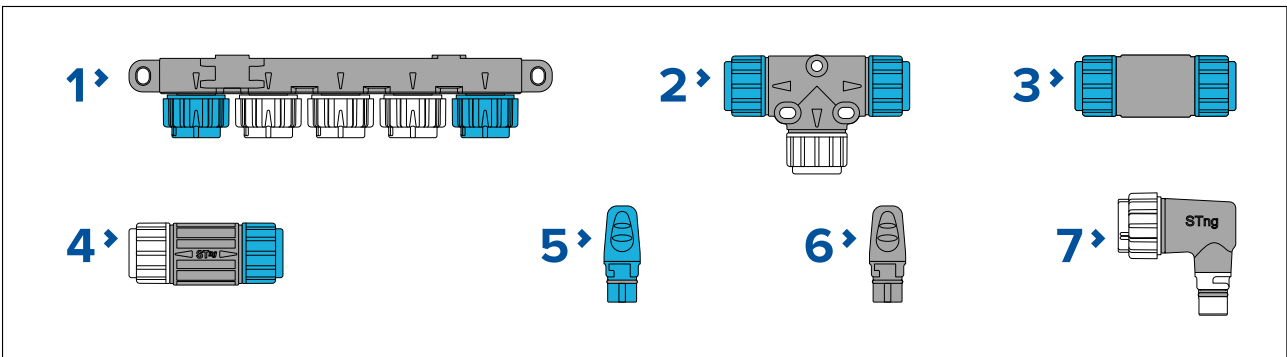
SeaTalkng power cables are used to provide the SeaTalkng backbone with a single 12 V dc power source. The power connection must include a 5 amp inline fuse (not supplied).



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

SeaTalkng® connectors

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

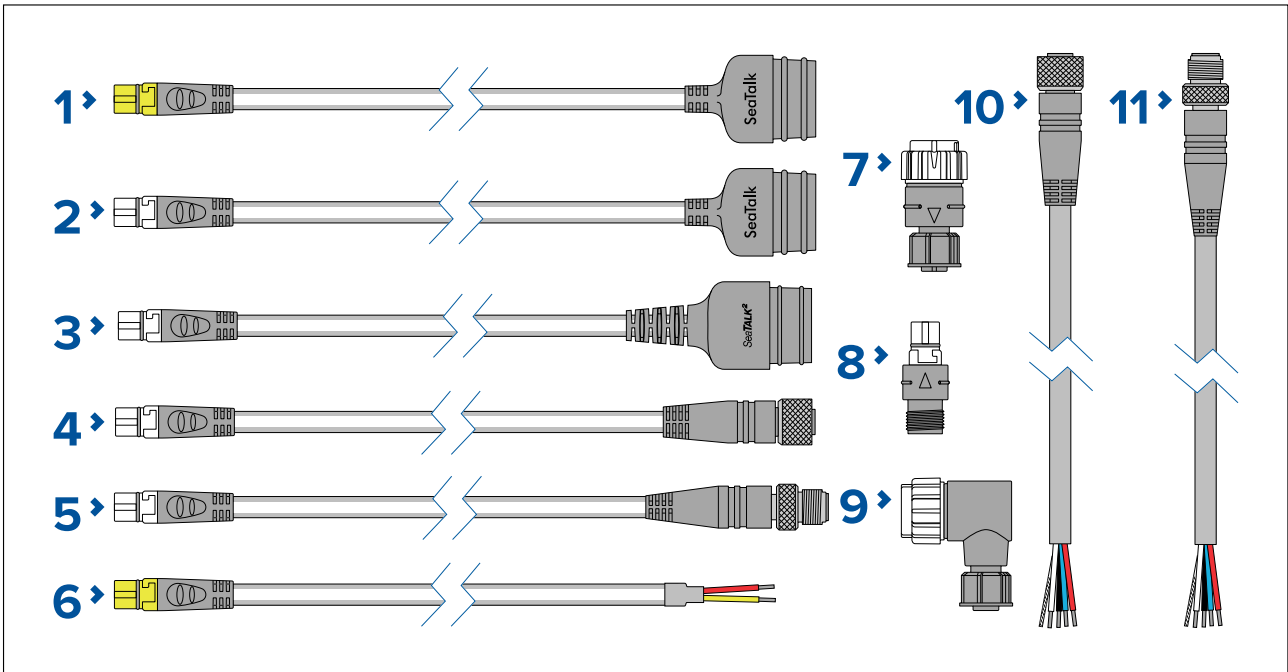


1. 5-Way connector (**A06064**). Each connector block allows connection of up to 3 SeaTalkng devices. Multiple connector blocks can be 'daisy chained' together.
2. T-piece (**A06028**). Each T-piece allows connection of one SeaTalkng device. Multiple T-pieces can be 'daisy chained' together.
3. Backbone extender (**A06030**). Used to connect 2 backbone cables together.
4. Inline terminator (**A80001**). Used to connect a spur cable and SeaTalkng device at the end of a backbone instead of a backbone terminator.

5. Backbone terminator (**A06031**). Terminators must be fitted to both ends of the SeaTalkng backbone.
6. Spur blanking plugs (**A06032**). Used to cover unused spur connections in 5-way blocks, T-piece connectors, or the SeaTalk to SeaTalkng converter.
7. Spur connector right angled elbow (**A06077**). Used in confined spaces where a straight spur cable will not fit.

SeaTalkng® adaptors and adaptor cables

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



1. 1 m (3.3 ft) SeaTalk (3 pin) to SeaTalkng converter cable (**A22164 / A06073**). Can be used to connect a SeaTalk device to a SeaTalkng backbone via the SeaTalk to SeaTalkng converter, or to connect a SeaTalkng product directly to a SeaTalk network.
2. 0.4 m (1.3 ft) SeaTalk (3 pin) to SeaTalkng adaptor cable (**A06047**). Can be used to connect a SeaTalk device to a SeaTalkng backbone via the SeaTalk to SeaTalkng converter, or to connect a SeaTalkng product directly to a SeaTalk network.
3. 0.4 m (1.3 ft) SeaTalk2 (5 pin) to SeaTalkng adaptor cable (**A06048**). Used to connect SeaTalk2 devices or networks to a SeaTalkng backbone.
4. SeaTalkng to DeviceNet (female) adaptor cables connect NMEA 2000 devices that use a DeviceNet connector to the SeaTalkng backbone, or connects SeaTalkng devices to an NMEA 2000 network. The following cables are available:
 - 0.4 m (1.3 ft) SeaTalkng to DeviceNet (female) adaptor cable (**A06045**).
 - 1 m (3.3 ft) SeaTalkng to DeviceNet (female) adaptor cable (**A06075**).
5. SeaTalkng to DeviceNet (male) adaptor cables. Connect NMEA 2000 devices that use a DeviceNet connector to the SeaTalkng backbone, or connect SeaTalkng devices to an NMEA 2000 network. The following cables are available:
 - 0.1 m (0.33 ft) SeaTalkng to DeviceNet (male) adaptor cable (**A06078**).
 - 0.4 m (1.3 ft) SeaTalkng to DeviceNet (male) adaptor cable (**A06074**).
 - 1 m (3.3 ft) SeaTalkng to DeviceNet (male) adaptor cable (**A06076**).
 - 1.5 m (4.92 ft) SeaTalkng to DeviceNet (male) adaptor cable (**A06046**).
6. 1 m (3.3 ft) NMEA 0183 VHF stripped-end (2 wire) to SeaTalkng adapter cable (**A06071**). Used to connect an NMEA 0183 VHF radio to the SeaTalkng backbone via the NMEA 0183 VHF to SeaTalkng converter.
7. SeaTalkng (male) to DeviceNet (female) adaptor (**A06082**).
8. SeaTalkng (female) to DeviceNet (male) adaptor (**A06083**).
9. SeaTalkng (male) to DeviceNet (female) elbow (right angled) adaptor (**A06084**).

10. (0.4 m (1.3 ft) DeviceNet (female) to stripped-end adaptor cable (**E05026**).
11. (0.4 m (1.3 ft) DeviceNet (male) to stripped-end adaptor cable (**E05027**).

Appendix A NMEA 2000 sentences (PGNs) – EV-1 and EV-2

EV-1 and EV-2 support the following NMEA 2000 sentences.

Message number	Message description	Transmit	Receive
59392	ISO Acknowledgment	●	
59904	ISO Request	●	●
60928	ISO Address Claim	●	●
65240	ISO Commanded address		●
126208	NMEA - Request group function	●	●
126208	NMEA - Command group function	●	●
126208	NMEA - 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		●
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 		●

Message number	Message description	Transmit	Receive
	<ul style="list-style-type: none"> • Destination Waypoint Latitude • Destination Waypoint Longitude • Waypoint closing velocity 		
129285	Active Waypoint data		●
130306	Wind data		●

Appendix B NMEA 2000 sentences (PGNs) – ACU

The ACU supports the following NMEA 2000 sentences.

Message number	Message description	Transmit	Receive
59392	ISO Acknowledgment	●	
59904	ISO Request	●	●
60928	ISO Address Claim	●	●
65240	ISO Commanded address		●
126208	NMEA - Request group function		●
126208	NMEA - Command group function		●
126208	NMEA - 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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