# Evolution EV-2


## Installation instructions

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**ENGLISH**
Document number: 87181-1
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# Contents

# Chapter 1: Important information

## Safety notices

### Warning: Autopilot system Installation

As correct performance of the vessel's steering is critical for safety, we 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 this product.

### Warning: Product installation and operation

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

### 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: 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: Product grounding

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

### Warning: Positive ground systems

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

### Caution: Power supply protection

When installing this product ensure the power source is adequately protected by means of a suitably-rated fuse or automatic circuit breaker.

### 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.

## General Information

### EMC installation guidelines

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

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

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

- Raymarine equipment and cables connected to it are:
  - At least 1 m (3 ft) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 7 ft (2 m).
  - More than 2 m (7 ft) from the path of a radar beam. A radar beam can normally be assumed to spread 20 degrees above and below the radiating element.
- The product is supplied from a separate battery from that used for engine start. This is important to prevent erratic behavior and data loss which can occur if the engine start does not have a separate battery.
- Raymarine specified cables are used.
- Cables are not cut or extended, unless doing so is detailed in the installation manual.

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

#### Water ingress — EV-1 and EV-2

Water ingress disclaimer.

Although the waterproof rating capacity of these products meets the IPX6 standard, water intrusion and subsequent equipment failure may occur if the products are subjected to commercial high-pressure washing. Raymarine will not warrant products subjected to high-pressure washing.

#### Suppression ferrites

Raymarine cables may be fitted with suppression ferrites. These are important for correct EMC performance. 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 authorized dealers.

#### 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

Raymarine UK Ltd. declares that this product is compliant with the essential requirements of EMC directive 2004/108/EC.

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

## Product disposal

Dispose of this product in accordance with the WEEE Directive.

The Waste Electrical and Electronic Equipment (WEEE) Directive requires the recycling of waste electrical and electronic equipment. Whilst the WEEE Directive does not apply to some Raymarine products, we support its policy and ask you to be aware of how to dispose of this product.

## 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: Planning the installation

## Chapter contents

# 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-2 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.

## Related products

This document covers the following product:

| Part number | Name | Description |
|---|---|---|
| E70097 | EV-2 | Attitude Heading Reference Sensor (AHRS) — primary heading sensor and course computer. |

## Evolution handbooks

The following documentation is available for 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 DBW autopilot system Installation instructions** Plan and install a Drive-By-Wire (DBW) autopilot system including an EV-2 Attitude Heading Reference Sensor (AHRS). | 87181 |

## p70 / p70R Handbooks

| Description | Part number |
|---|---|
| p70 / p70R Installation and commissioning instructions | 87132 |
| p70 / p70R Quick reference guide | 86142 |
| p70 / p70R User reference handbook | 81331 |

## SeaTalkng handbooks

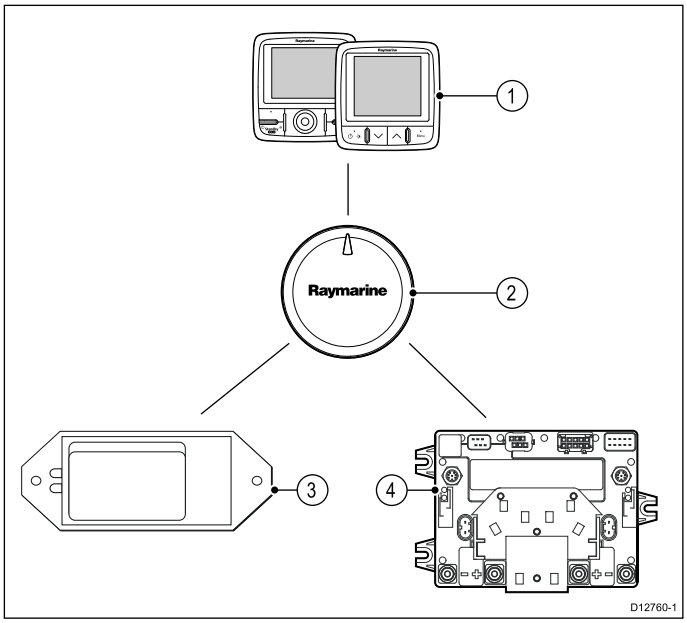
| Description | Part number |
|---|---|
| **SeaTalkng reference manual** Planning and connection of systems based around the SeaTalkng network. | 81300 |
| **SeaTalk – SeaTalkng converter handbook** Installation and connection of the SeaTalk - SeaTalkng converter. | 87121 |

## Product overview

The Evolution EV-2 is a primary heading sensor and course computer, providing autopilot control for vessels fitted with a Drive-By-Wire (DBW) steering system.

In conjunction with a separately supplied drive interface unit and a compatible autopilot control head, the EV-2 enables 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 consists of the following components:




| Item | Component | Purpose |
|---|---|---|
| 1 | SeaTalkng autopilot control head. | A graphical display and interface enabling you to issue navigation and other operational commands to the autopilot system. |
| 2 | EV-2 autopilot with Attitude Heading Reference Sensor (AHRS). | The primary heading sensor and course computer, incorporating an attitude 9-axis sensor. This sensor also replaces the fluxgate compass typical in existing autopilot systems. |
| 3 | Drive interface unit for Volvo Penta EVC systems (as supplied separately by Raymarine). | Houses the main power and drive electronics for direct connection to a Volvo Penta Drive-By-Wire system. |
| 4 | Third-party drive interface unit for Teleflex Optimus systems (as supplied separately by Teleflex). | Houses the main power and drive electronics for direct connection to a Teleflex Optimus Drive-By-Wire system. |

**Note:** Your drive system will include either one of these interface units, NOT both.

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

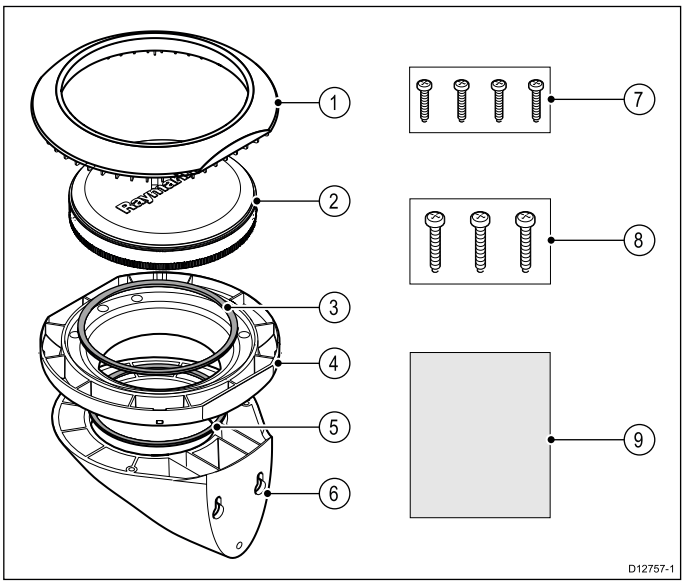
- **Flexible mounting options** — The EV-2 unit can be mounted flat on a deck or alternatively on a bracket, for direct mounting to a mast, wall or other surface.

**Note:** The arrow on the front of the unit must be in alignment with the vessel's head (parallel to the longitudinal axis of the vessel).

- **Simple connections** — all Evolution system components are easily and simply connected using SeaTalkng and DeviceNet connections.
- **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.

## Parts supplied — EV-1 and EV-2



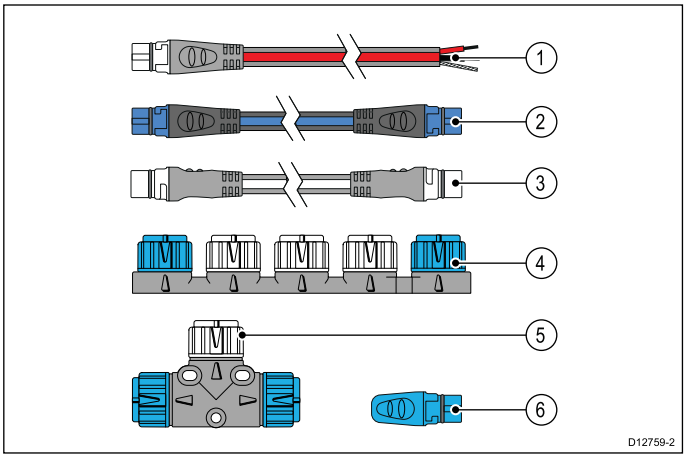

| Item | Description | Quantity |
|---|---|---|
| 1 | Mounting trim. | 1 |
| 2 | EV-1 / EV-2. | 1 |
| 3 | Sealing ring. | 1 |
| 4 | Mounting tray. | 1 |
| 5 | Sealing ring. | 1 |
| 6 | Wall mounting bracket. | 1 |
| 7 | Screws for deck or bracket mounting. | 4 |
| 8 | Screws for wall bracket. | 3 |
| 9 | Documentation pack. | 1 |

## Evolution SeaTalkng cable kit

A SeaTalkng cable kit is available for Evolution components.

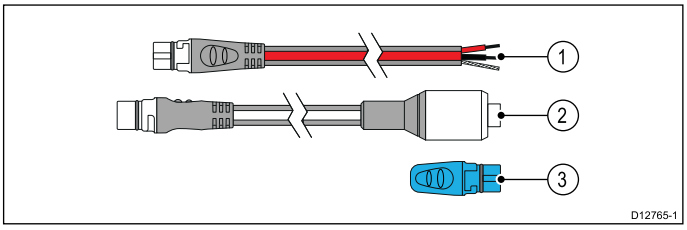
This cable kit provides the cables required to make all the SeaTalkng connections for some typical Evolution systems. The kit is supplied with certain Evolution systems. The kit is also available as an optional accessory, part number **R70160**. If you require additional SeaTalkng cables or accessories to complete your installation, refer to 3.8 SeaTalkng cables and accessories for a list of part numbers.

### Cable kit contents




| Item | Description | Quantity | Length |
|---|---|---|---|
| 1 | SeaTalkng power cable. | 1 | 0.4 m (1.3 ft) |
| 2 | SeaTalkng backbone cable | 1 | 5 m (16.4 ft) |
| 3 | SeaTalkng spur cable. | 1 | 0.4 m (1.3 ft) |
| 4 | SeaTalkng 5-way connector block. | 1 | — |
| 5 | SeaTalkng T-piece. | 2 | — |
| 6 | SeaTalkng terminator. | 2 | — |

## Parts supplied — DeviceNet cable kit




| Item | Description | Quantity |
|---|---|---|
| 1 | SeaTalkng power cable 0.4 m (1.3 ft). | 1 |
| 2 | DeviceNet / SeaTalkng adaptor cable (Female). | 2 |
| 3 | SeaTalkng terminator. | 2 |

## 2.2 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.

### Software requirements

Correct operation of this product requires software version 2.0 or later for p70 and p70R pilot control heads.

### 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 control head.
- Teleflex Optimus or Volvo Penta EVC Drive interface unit (as appropriate for your vessel's drive system).
- Power cables.

**Recommended:**

- Compatible speed data source. The autopilot uses speed data when making calculations relating to navigation. As a minimum, this information must come from a 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 SeaTalk$^{ng}$ bus.
- Rudder angle sensor. To ensure optimum autopilot performance, Raymarine highly recommends that a rudder reference unit is used.

**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 GPS receiver on the SeaTalk$^{ng}$ bus.

### Multiple data sources (MDS) overview

Installations that include multiple instances of data sources can cause data conflicts. An example is an installation featuring more than one source of GPS data.

MDS enables you to manage conflicts involving the following types of data:

- GPS Position.
- Heading.
- Depth.
- Speed.
- Wind.

Typically this exercise is completed as part of the initial installation, or when new equipment is added.

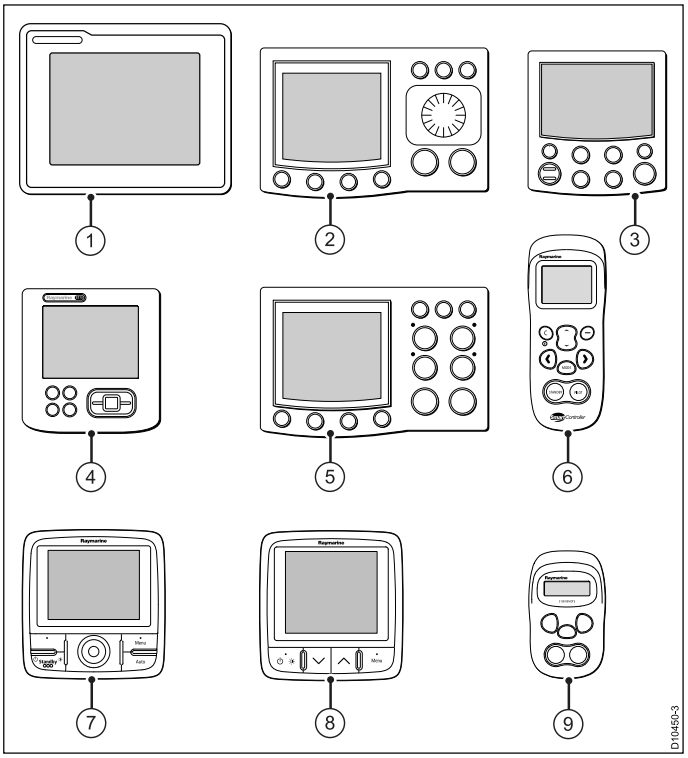
If this exercise is NOT completed the system will automatically attempt to resolve data conflicts. However, this may result in the system choosing a source of data that you do not want to use.

If MDS is available the system can list the available data sources and allow you to select your preferred data source. For MDS to be available all products in the system that use the data sources listed above must be MDS-compliant. The system can list any products that are NOT compliant. It may be necessary 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 and you do NOT want the system to automatically attempt to resolve data conflicts, any non-compliant product(s) can be removed or replaced to ensure the entire system is MDS-compliant.

# 2.3 Autopilot controllers

The Evolution system is designed for use with the p70 and p70R autopilot control heads.

It can also be used with a number of other SeaTalk$^{ng}$ and SeaTalk autopilot control heads, but with limited functionality.

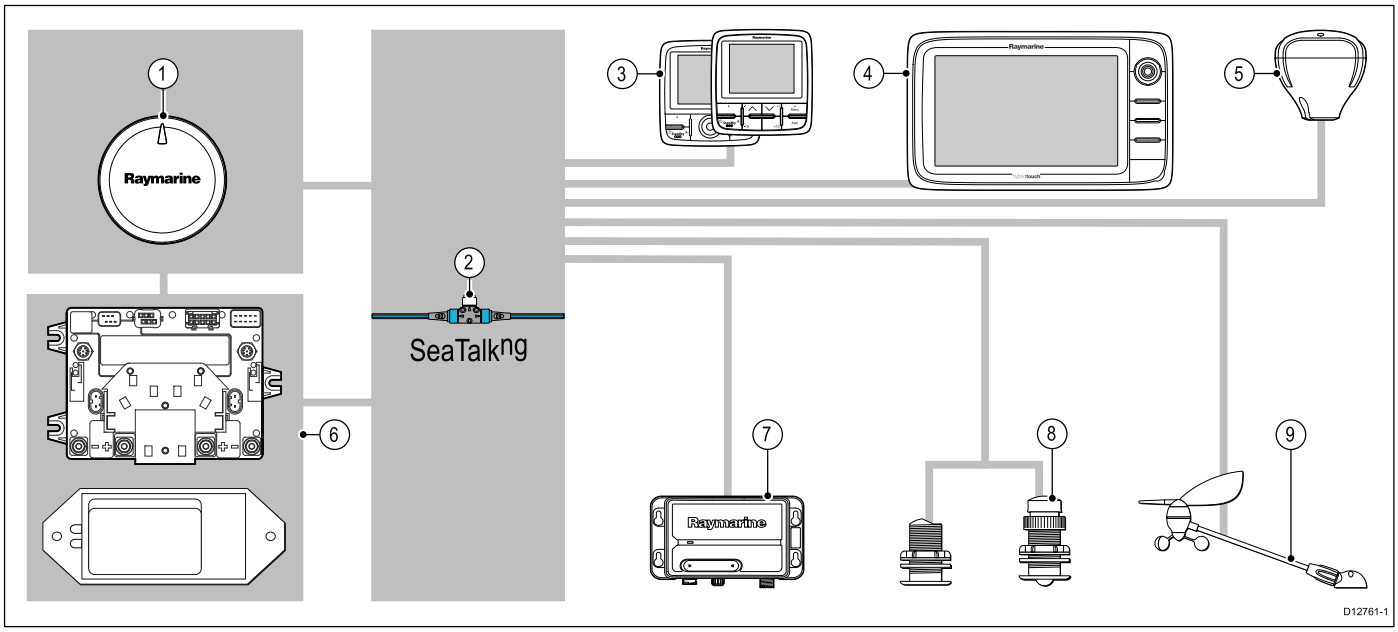



| | Pilot controller | SeaTalk$^{ng}$ | SeaTalk (via optional SeaTalk to SeaTalk$^{ng}$ converter) |
|---|---|---|---|
| 1* | ST70+ | ● | |
| 2* | ST8002 | | ● |
| 3* | ST6002 | | ● |
| 4* | ST70 | ● | |
| 5* | ST7002 | | ● |
| 6* | Smart controller | | ● (repeat controller only) |
| 7 | p70R | ● | ● |
| 8 | p70 | ● | ● |
| 9* | S100 remote | | ● (repeat controller only) |

**Note:** * Items marked with an asterisk (*) have limited functionality with the Evolution system. Refer to the SeaTalk to SeaTalk$^{ng}$ converter handbook (87121) for more information on these limitations, and how to connect a SeaTalk autopilot control head to an Evolution system.

# 2.4 System integration

The Evolution components are compatible with a wide range of marine electronics devices.

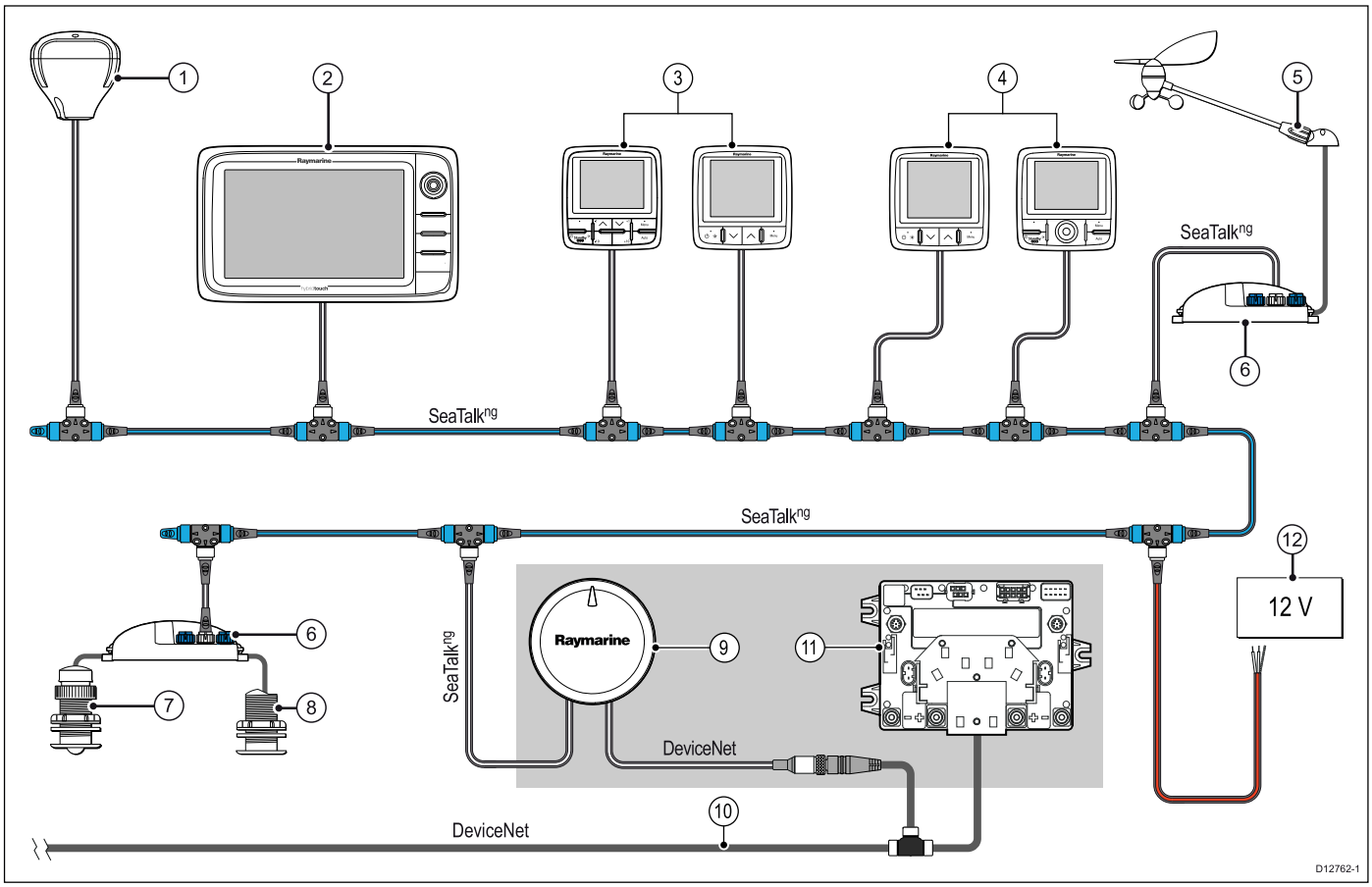



**Note:** To prevent potential data bandwidth issues, do NOT connect an SR50 weather receiver to a system that includes Evolution autopilot components. The SR50 should be connected to a dedicated system bus which is isolated from the SeaTalkng bus that hosts the Evolution components.

| Item | Device type | Maximum Quantity | Suitable Devices | Connections |
|---|---|---|---|---|
| 1 | Heading sensor and course computer. | 1 | EV-2 | • SeaTalkng |
| 2 | SeaTalkng backbone | 1 | • SeaTalkng<br>• SeaTalk via the optional SeaTalk to SeaTalkng converter. | • SeaTalkng<br>• SeaTalk via the optional SeaTalk to SeaTalkng converter. |
| 3 | Autopilot control head.<br>**Note:** All SeaTalk control heads have limited functionality with the Evolution system. Refer to the SeaTalk to SeaTalkng converter handbook (87121) for more information on these limitations, and how to connect a SeaTalk autopilot control head to an Evolution system. | As determined by the SeaTalkng bus bandwidth and power loading. | • p70.<br>• p70R.<br>• ST70 / ST70+ (limited functionality)<br>• ST6002<br>• ST7002.<br>• ST8002<br>• S100 remote (repeat controller only).<br>• Smart controller (repeat controller only). | • SeaTalkng<br>• SeaTalk via the optional SeaTalk to SeaTalkng converter. |
| 4 | SeaTalkng multifunction displays.<br>**Note:** The Evolution EV-1 provides heading data to multifunction displays, for use in chart and radar functions such as radar overlay and MARPA. | 6 | • New a, c, e Series: a65 / a67 / e7 / e7D / c95 / c97 / c125 / c127 / e95 / e97 / e125 / e127 / e165.<br>• C90W / C120W / C140W.<br>• E90W / E120W / E140W. | • SeaTalkng |

| Item | Device type | Maximum Quantity | Suitable Devices | Connections |
|---|---|---|---|---|
| 5 | GPS receiver. | As determined by the SeaTalkng bus bandwidth and power loading. | GPS position data is usually received from a SeaTalkng multifunction display. If your system does NOT include a multifunction display, or your multifunction display does NOT include an internal GPS receiver, an external SeaTalkng GPS receiver will be required.<br>• SeaTalkng multifunction display with internal GPS receiver.<br>• RS125 GPS (via optional SeaTalk1 to SeaTalkng converter.<br>• RS130 GPS. | • SeaTalkng |
| 6 | Drive interface unit | 1 | • Teleflex Optimus (as supplied separately by Teleflex).<br>• Volvo Penta EVC (as supplied separately by Raymarine).<br>**Note:** Your drive system will include either one of these interface units, NOT both. | • SeaTalkng |
| 7 | AIS receiver / transceiver<br>**Note:** The Evolution system can provide magnetic heading information to an AIS unit. Transmission of heading information is optional for AIS transceivers, and they only transmit true heading information, NOT magnetic. | 1 | • AIS 350.<br>• AIS 650. | • SeaTalkng |
| 8 | Speed / Depth transducer | As determined by the SeaTalkng bus bandwidth and power loading. | Any transducer compatible with the iTC-5 converter or ST70 transducer pod. | • Analog transducer connections via iTC-5 converter or ST70 transducer pod.<br>• Other transducer connections via compatible Sonar Module. |
| 9 | Raymarine Wind transducer | As determined by the SeaTalkng bus bandwidth and power loading. | • Short arm wind vane transducer.<br>• Long arm wind vane transducer.<br>• Short arm masthead wind transducer.<br>• Long arm masthead wind transducer. | Analog transducer connections via iTC-5 converter or ST70 transducer pod. |

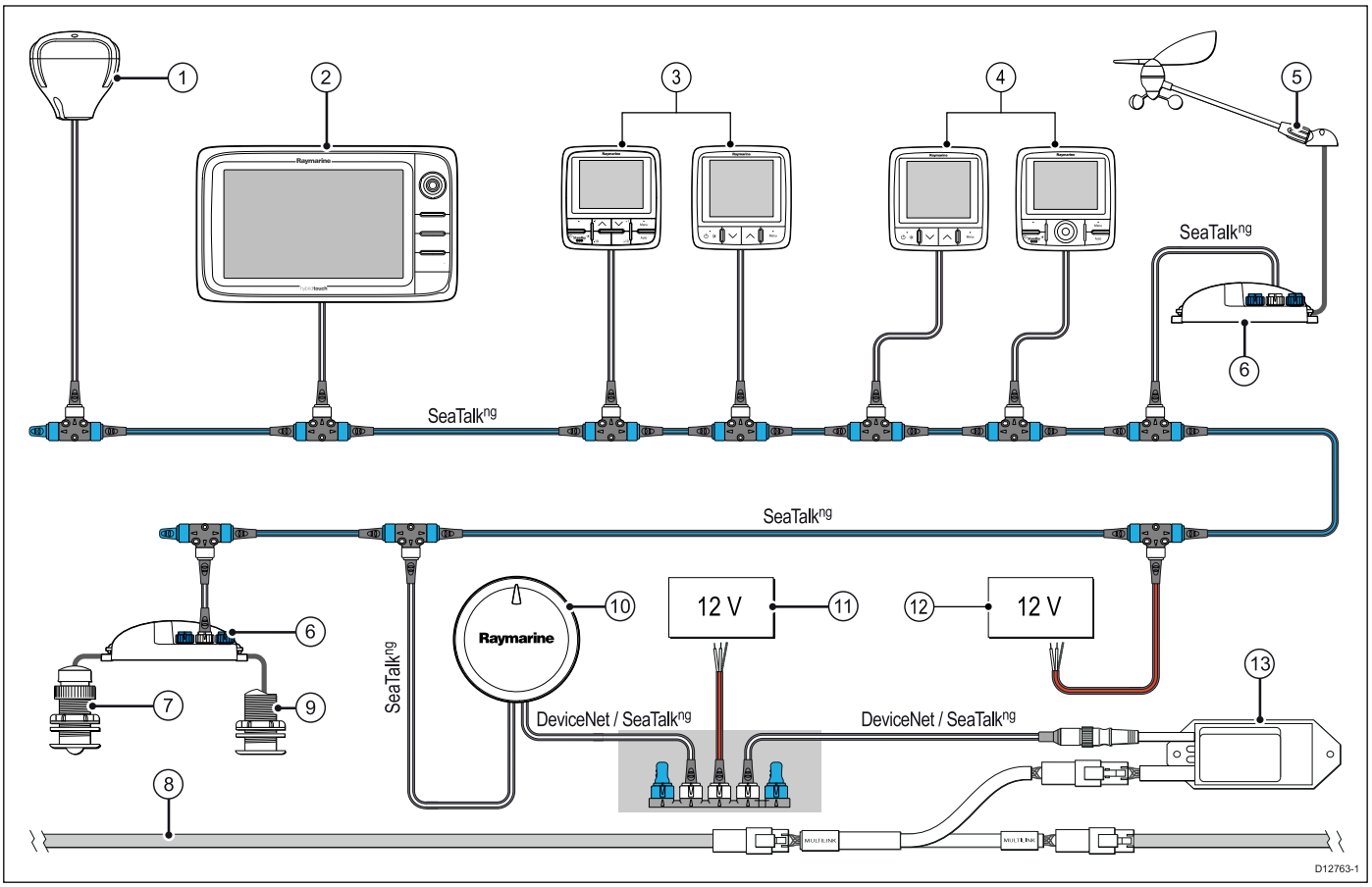
## 2.5 Example: typical system — Teleflex Optimus




1. GPS receiver.
2. Multifunction display.
3. Autopilot controller and instruments (e.g. helm 1).
4. Autopilot controller and instruments (e.g. helm 2).
5. Wind transducer.
6. iTC-5 converter.
7. Speed transducer.
8. Depth transducer.
9. EV-2.
10. DeviceNet bus.
11. Teleflex Optimus drive interface unit.
12. Power supply for SeaTalkng bus.

**Note:** The multifunction display and Teleflex drive interface units require separate, dedicated power connections. These units cannot take power from the SeaTalkng bus.

## 2.6 Example: typical system — Volvo Penta EVC




1. GPS receiver.
2. Multifunction display.
3. Autopilot controller and instruments (e.g. helm 1).
4. Autopilot controller and instruments (e.g. helm 2).
5. Wind transducer.
6. iTC-5 converter.
7. Speed transducer.
8. Engine CAN bus.
9. Depth transducer.
10. EV-2.
11. Power supply for Volvo Penta EVC drive interface unit.
12. Power supply for SeaTalkng backbone.
13. Volvo Penta EVC drive interface unit.

**Note:** The multifunction display requires a separate power connection. It cannot take its power from the SeaTalkng bus.

## 2.7 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 to which compatible instruments connect 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 / SeaTalk2 devices can also be connected using the appropriate interfaces or adaptor cables as required.

## 2.8 NMEA 2000

NMEA 2000 offers significant improvements over NMEA 0183, most notably in speed and connectivity. Up to 50 units can simultaneously transmit and receive on a single physical bus at any one time, with each node being physically addressable. The standard was specifically intended to allow for a whole network of marine electronics from any manufacturer to communicate on a common bus via standardized message types and formats.

# Chapter 3: Cables and connections

## Chapter contents

# 3.1 General cabling guidance

## Cable types and length

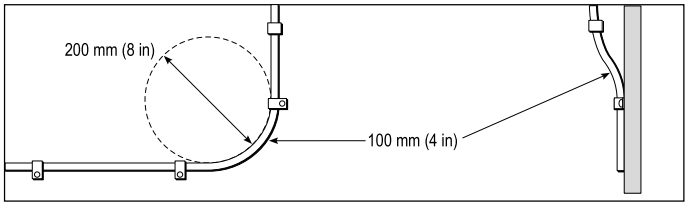
It is important to use cables of the appropriate type and length

- Unless otherwise stated use only standard cables of the correct type, supplied by Raymarine.
- Ensure that any non-Raymarine cables are of the correct quality and gauge. For example, longer power cable runs may require larger wire gauges to minimize voltage drop along the run.

## Routing cables

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

- Do NOT bend cables excessively. Wherever possible, ensure a minimum bend diameter of 200 mm (8 in) / minimum bend radius of 100 mm (4 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 tie-wraps or lacing twine. Coil any extra cable and tie it out of the way.
- Where a cable passes through an exposed bulkhead or deckhead, use a suitable watertight feed-through.
- Do NOT run cables near to engines or fluorescent lights.

Always route data cables as far away as possible from:

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

## Strain relief

Ensure adequate strain relief is provided. Protect connectors from strain and ensure they will not pull out under extreme sea conditions.

## Circuit isolation

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

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

## Cable shielding

Ensure that all data cables are properly shielded that the cable shielding is intact (e.g. hasn't been scraped off by being squeezed through a tight area).

# 3.2 Power connection — EV-2

The power for the EV-2 unit is provided by the SeaTalk$^{ng}$ system.

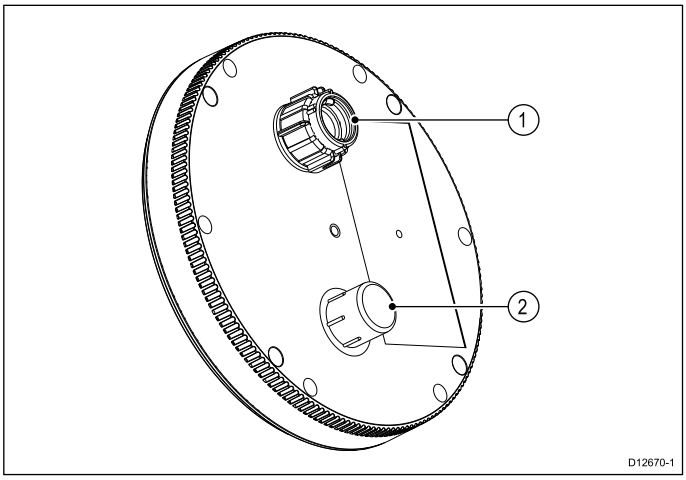
- The EV-2 unit must be connected to a SeaTalk$^{ng}$ backbone. This is typically achieved using a SeaTalk$^{ng}$ 5-way connector block or T-piece connector.
- The SeaTalk$^{ng}$ system requires only ONE 12 V power source. This can be provided by a battery. If your vessel has a 24 V supply a suitable voltage convertor is required.
- The power source must be protected by a 5 A fuse or a circuit breaker providing equivalent protection.
- SeaTalk$^{ng}$ cables carry both data and power signals. The power is supplied to the EV-2 via a SeaTalk$^{ng}$ spur cable.
- Refer to the SeaTalk$^{ng}$ reference manual for more information on general SeaTalk$^{ng}$ power requirements.

## Power connection — Volvo Penta EVC interface

The EVC interface unit requires a 12 V power source, which must be provided to the EVC unit via a battery.

- If your vessel has a 24 V supply a suitable voltage convertor is required.
- The power source must be protected by a 5 A fuse or a circuit breaker providing equivalent protection.
- The EVC interface unit must be connected to the 12 V power source via a SeaTalk$^{ng}$ 5-way connector block.
- A SeaTalk$^{ng}$ to bare ends power cable must be used to connect the SeaTalk$^{ng}$ 5-way connector block to the 12 V power source.
- The supplied DeviceNet to SeaTalk$^{ng}$ adaptor cable must be used to connect the EVC interface unit to the SeaTalk$^{ng}$ 5-way connector block. This cable carries both data and power signals to the EVC unit.

## 3.3 Connections overview — EV-1 and EV-2

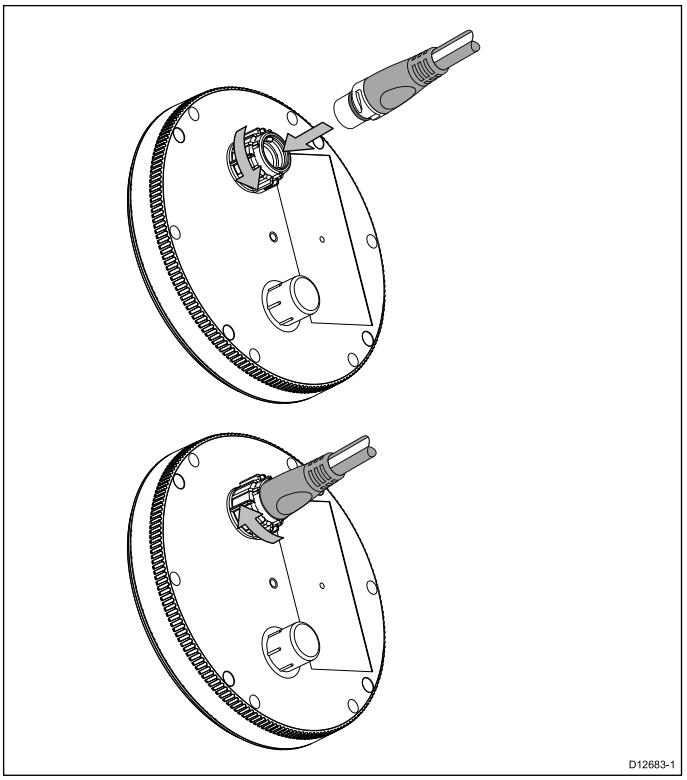



1. SeaTalkng.
2. DeviceNet.

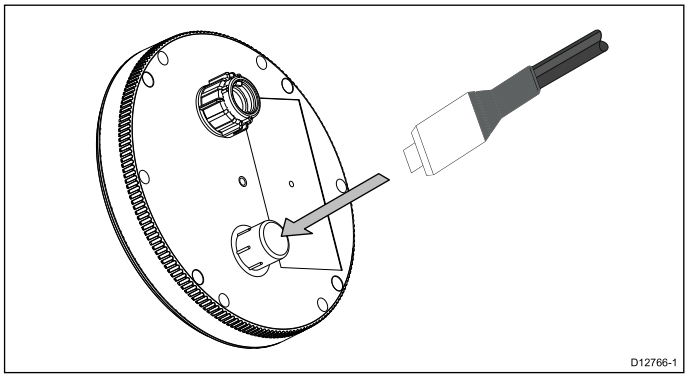
**Important:** The DeviceNet port is for use with the EV-2 only. Do NOT connect this port on the EV-1 unit.

## 3.4 SeaTalkng connection — EV-1 and EV-2

The EV unit is connected to the autopilot system using SeaTalkng.



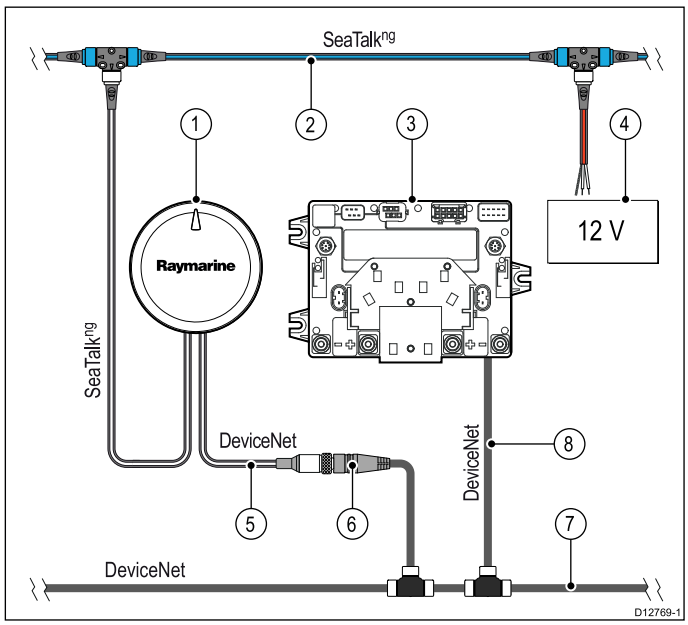
## 3.5 DeviceNet connection — EV-2




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

## 3.6 Drive interface unit connection — Teleflex Optimus

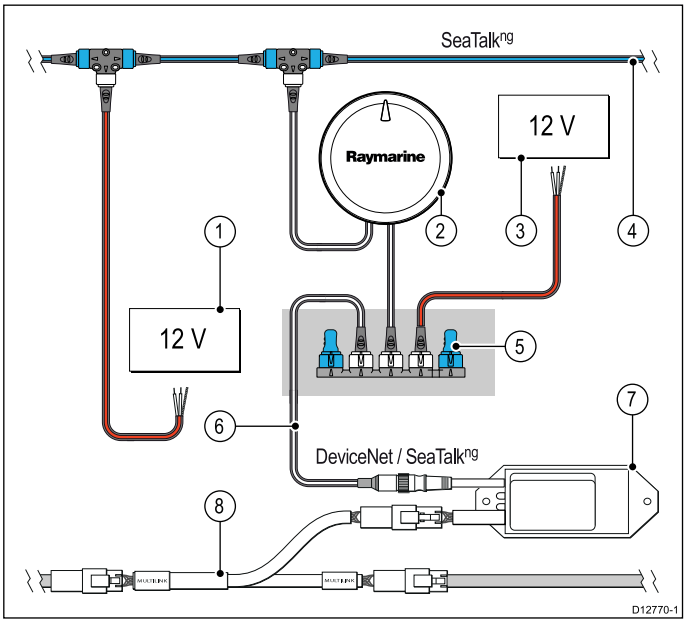
The EV-2 connects to a Teleflex Optimus drive interface unit via DeviceNet connections.




1. EV-2.
2. SeaTalkng backbone.
3. Teleflex Optimus drive interface unit (as supplied by Teleflex or dealer).
4. Power supply for SeaTalkng backbone.
5. DeviceNet cable (female) (as supplied by Teleflex or dealer).
6. DeviceNet spur cable (as supplied by Teleflex or dealer).
7. DeviceNet bus.
8. DeviceNet spur cable (as supplied by Teleflex or dealer).

## 3.7 Drive interface unit connection — Volvo Penta EVC

The EV-2 connects to a Teleflex Optimus drive interface unit via DeviceNet connections.




1. Power supply for SeaTalkng backbone.
2. EV-2.
3. Power supply for Volvo Penta EVC interface unit.
4. SeaTalkng backbone.
5. Terminator.
6. DeviceNet adaptor cable (female) (as supplied with Raymarine DeviceNet cable kit).
7. Volvo Penta EVC drive interface unit (available separately from Raymarine).
8. Engine CAN bus.

## 3.8 SeaTalkng cables and accessories

SeaTalkng cables and accessories for use with compatible products.

| Description | Part No | Notes |
|---|---|---|
| SeaTalkng starter kit | T70134 | Includes:<br>• 1 x 5 Way connector (A06064)<br>• 2 x Backbone terminator (A06031)<br>• 1 x 3 m (9.8 ft) spur cable (A06040)<br>• 1 x Power cable (A06049) |
| SeaTalkng Backbone Kit | A25062 | Includes:<br>• 2 x 5 m (16.4 ft) Backbone cable (A06036)<br>• 1 x 20 m (65.6 ft) Backbone cable (A06037)<br>• 4 x T-piece (A06028)<br>• 2 x Backbone terminator (A06031)<br>• 1 x Power cable (A06049) |
| SeaTalkng 0.4 m (1.3 ft) spur | A06038 | |
| SeaTalkng 1 m (3.3 ft) spur | A06039 | |
| SeaTalkng 3 m (9.8 ft) spur | A06040 | |
| SeaTalkng 5 m (16.4 ft) spur | A06041 | |
| SeaTalkng 0.4 m (1.3 ft) elbow spur | A06042 | |
| SeaTalkng 0.4 m (1.3 ft) backbone | A06033 | |
| SeaTalkng 1 m (3.3 ft) backbone | A06034 | |
| SeaTalkng 3 m (9.8 ft) backbone | A06035 | |
| SeaTalkng 5 m (16.4 ft) backbone | A06036 | |
| SeaTalkng 9 m (29.5 ft) backbone | A06068 | |
| SeaTalkng 20 m (65.6 ft) backbone | A06037 | |
| SeaTalkng to bare ends 1 m (3.3 ft) spur | A06043 | |
| SeaTalkng to bare ends 3 m (9.8 ft) spur | A06044 | |
| SeaTalkng Power cable | A06049 | |
| SeaTalkng Terminator | A06031 | |
| SeaTalkng T-piece | A06028 | Provides 1 x spur connection |
| SeaTalkng 5–way connector | A06064 | Provides 3 x spur connections |
| SeaTalkng backbone extender | A06030 | |
| SeaTalk to SeaTalkng converter kit | E22158 | Allows the connection of SeaTalk devices to a SeaTalkng system. |

| Description | Part No | Notes |
|---|---|---|
| SeaTalkng Inline terminator | A80001 | Provides direct connection of a spur cable to the end of a backbone cable. No T-piece required. |
| SeaTalkng Blanking plug | A06032 | |
| ACU / SPX SeaTalkng spur cable 0.3 m (1.0 ft) | R12112 | Connects an SPX course computer or an ACU to a SeaTalkng backbone. |
| SeaTalk (3 pin) to SeaTalkng adaptor cable 0.4 m (1.3 ft) | A06047 | |
| SeaTalk to SeaTalkng spur 1 m (3.3 ft) spur | A22164 | |
| SeaTalk2 (5 pin) to SeaTalkng adaptor cable 0.4 m (1.3 ft) | A06048 | |
| DeviceNet adaptor cable (Female) | A06045 | Allows the connection of NMEA 2000 devices to a SeaTalkng system. |
| DeviceNet adaptor cable (Male) | A06046 | Allows the connection of NMEA 2000 devices to a SeaTalkng system. |
| DeviceNet adaptor cable (Female) to bare ends. | E05026 | Allows the connection of NMEA 2000 devices to a SeaTalkng system. |
| DeviceNet adaptor cable (Male) to bare ends. | E05027 | Allows the connection of NMEA 2000 devices to a SeaTalkng system. |

# Chapter 4: Installation

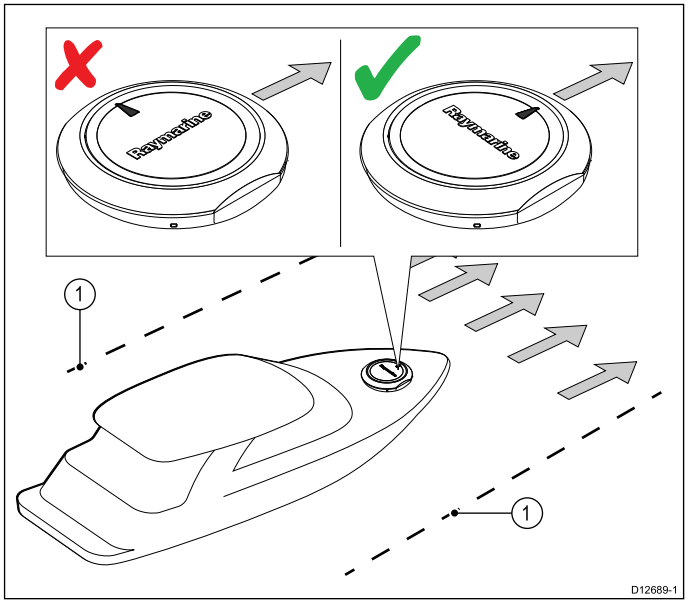
## Chapter contents

# 4.1 EV-2 Installation

## Location requirements — EV–1 and EV–2

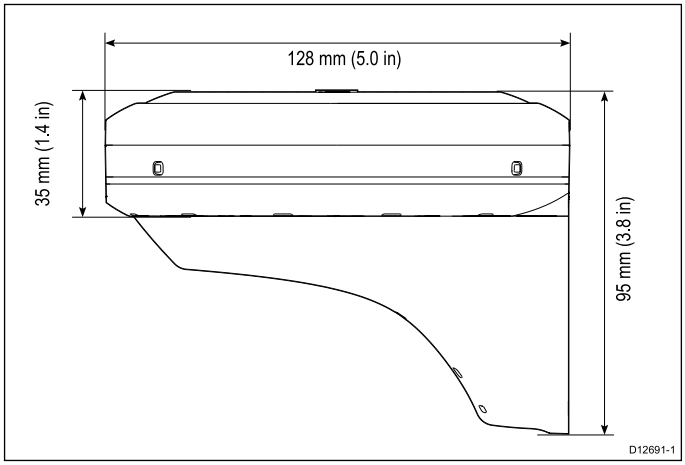
The installation location must take into account the following requirements:

- Install above or below decks.
- Mount on a horizontal and level surface. The unit may be mounted upright or upside-down, but the back and front of the unit must be level within 5º of pitch and 5º of roll (compared with the vessel's neutral position when at rest and normally loaded).
- Install flat on a deck, or mounted to a bulkhead, mast or other vertical surface, using the supplied bracket to fit and orient the unit horizontally.
- Location must be at least 1 m (3 ft.) away from any source of magnetic interference, such as compasses and electrical cables.
- Safe from physical damage and excessive vibration.
- Away from any source of heat.
- Away from any potential flammable hazard, such as fuel vapors.
- Must be mounted with the arrow on the top of the unit in parallel alignment with the vessel's longitudinal axis. Position the arrow on the unit facing forward in the direction of the arrows shown in the following illustration:



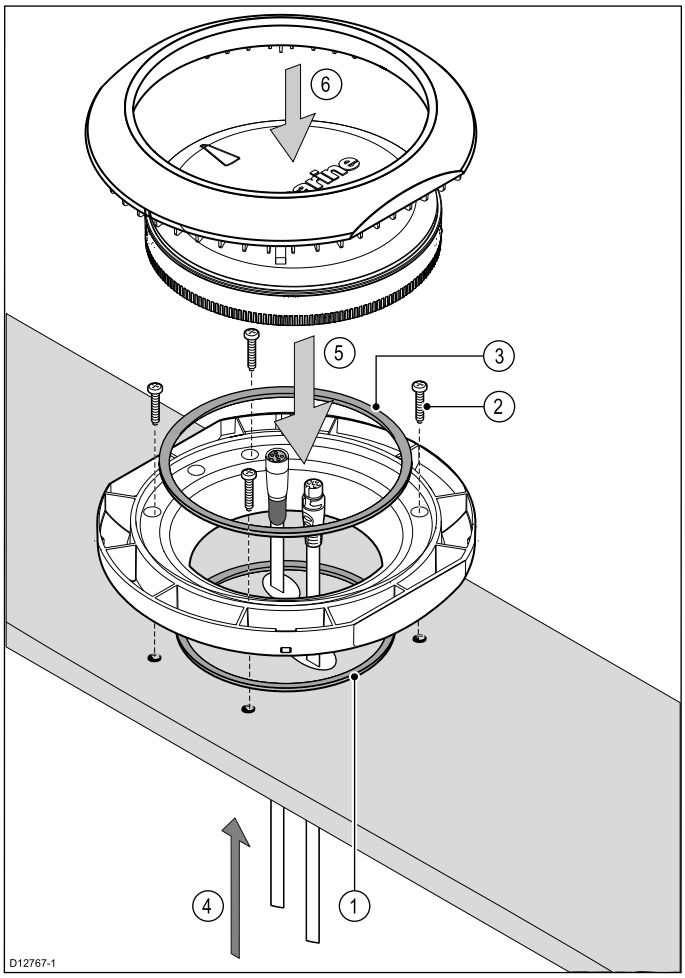

1. Vessel's longitudinal axis.

## Dimensions — EV–1 and EV–2




## Deck mounting the EV-2

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



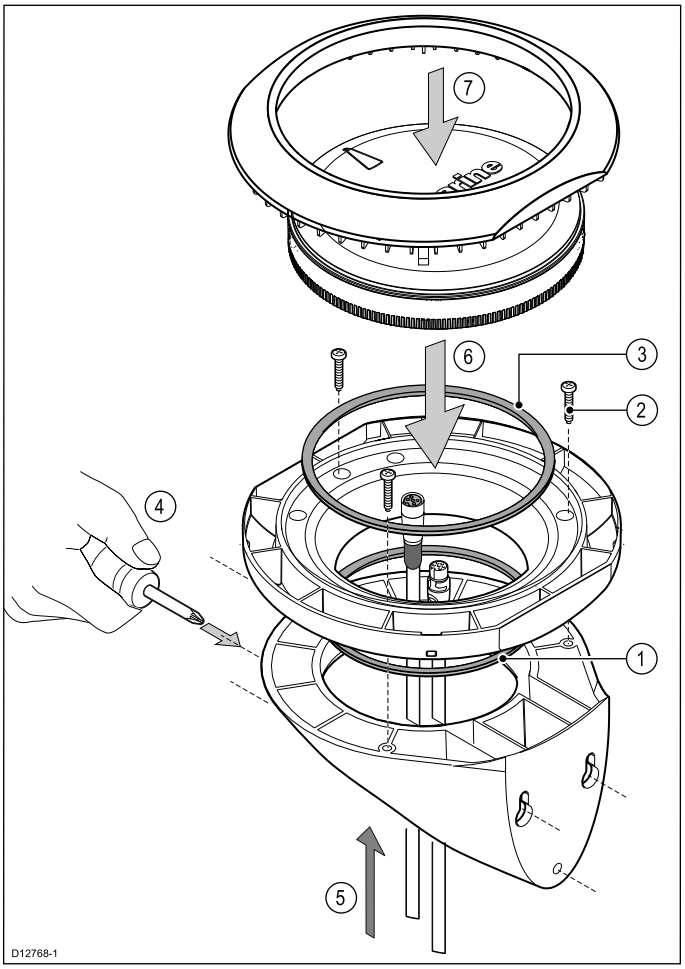

1. Use the supplied deck mounting template to drill 4 holes in the mounting surface, plus holes of a suitable size for each of the SeaTalkng and DeviceNet cables. Affix the small sealing ring to the groove located on the bottom of the mounting tray.
2. Affix the tray to the mounting surface and secure using the supplied screws in the 4 positions indicated in the above illustration.
3. Affix the large sealing ring into the groove on the upper side of the mounting tray.
4. Pull the SeaTalkng and DeviceNet cables through the mounting surface hole and the mounting tray. Insert the plugs into the EV-2 unit.
5. Secure the EV-2 unit to the mounting tray by positioning and inserting carefully in alignment with the grooves in the mounting tray.

**Important:** The EV-2 unit must be mounted with the arrow on the top of the unit in parallel alignment with the vessel's longitudinal axis.

6. Place the EV-2 mounting trim over the EV-2 unit and push the trim together with the mounting tray until the 2 items click into position.

## Bracket mounting the EV-2

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



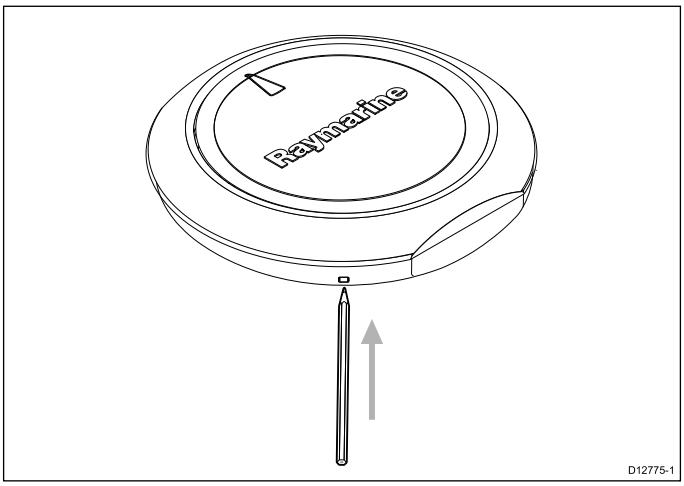

1. Affix the small sealing ring to the groove located on the bottom of the mounting bracket.
2. Affix the tray to the mounting bracket and secure using the supplied screws in the 3 positions indicated in the above illustration.
3. Affix the large sealing ring into the groove on the upper side of the mounting tray.
4. Affix the bracket to the mounting surface using the supplied mounting template. Secure the bracket using the supplied screws in the 3 positions indicated in the illustration above.
5. Pull the SeaTalk$^{ng}$ and DeviceNet cables through the mounting bracket hole and the mounting tray. Insert the plugs into the EV-2 unit.
6. Secure the EV-2 unit to the mounting tray by positioning and inserting carefully in alignment with the grooves in the mounting tray.

**Important:** The EV-2 unit must be mounted with the arrow on the top of the unit in parallel alignment with the vessel's longitudinal axis.

7. Place the EV-2 mounting trim over the EV-2 unit and push the trim together with the mounting tray until the 2 items click into position.

## Dismantling the EV-1 and EV-2 enclosure

Once the mounting trim and mounting bracket are clicked into position with the EV-1 or EV-2 unit inside, you must release the clips if you need to subsequently remove the unit from the enclosure.




1. Push the end point of a pencil or similar tool into one of the clips located around the outside edge of the EV-1 or EV-2 enclosure.

   The mounting trim will be released from the mounting bracket.
2. If necessary, repeat for all 4 clips located around the EV-1 or EV-2 enclosure, until the mounting trim is completely released.

**Note:** To avoid potential damage or permanent markings to the clips, only use a non-abrasive and non-permanent marking tool to perform the above procedure.

## 4.2 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 control head.
   - SeaTalk$^{ng}$ data bus (if this has its own power supply).
2. Check that the autopilot control head powers up. If the display is blank press and hold the **Power** key for 2 seconds.
3. Check the display for error messages that could indicate a problem with the installation.

   For assistance with diagnosing faults:
   - Refer to the troubleshooting information supplied with the product, or
   - contact Raymarine customer support.

## 4.3 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 the 81331 p70 / p70R User reference handbook for detailed instructions on how to setup the Evolution autopilot system.

## 4.4 LED indications — EV-2

| LED color | LED code | | Status | Action required |
|---|---|---|---|---|
|  |  | Solid green | Normal operation. | • 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. | • None (normal power up takes <1 minute.) |
|  |  | Long flash green on (x2), long flash off. Cycle repeats after 8 seconds. | No DeviceNet connection. | • Ensure network is powered.<br>• Ensure network cable and connections are secure and free from damage.<br>• If problem persists contact Raymarine technical support. |
|  |  | Short flash green on (x7), long flash off. Cycle repeats after 9 seconds. | DeviceNet connected but not receiving data. | • If problem persists contact Raymarine technical support. |
|  |  | Short flash red on (x2), long flash off. Cycle repeats after 4 seconds. | No SeaTalkng connection. | • Ensure network is powered.<br>• Ensure network cable and connections are secure and free from damage.<br>• 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. | • If problem persists contact Raymarine technical support. |

# 4.5 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 control heads and multifunction displays, 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 control head or multifunction display. 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 control head or multifunction display.

| 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. | • Check the physical cables and connections between the autopilot control head and the SeaTalkng system. Also between the EV-1 / EV-2 and the SeaTalkng system.<br>• If the autopilot control head is connected via a SeaTalk to SeaTalkng converter, check the converter is using the latest software version. |
| AUTO RELEASE | Possible fault with rudder reference unit. 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. | • Check rudder reference unit connections.<br>• For systems using the Volvo Penta EVC drive interface unit, check the unit is operating correctly. |
| WAYPOINT ADVANCE | The autopilot has steered the vessel to the current waypoint. | Acknowledge the turn to the next waypoint. |
| DRIVE STOPPED | • Motor / steering has not moved within 20 seconds of a course change command.<br>• The autopilot is unable to turn the rudder (either because the weather load on the helm is too high, or if the rudder position sensor has passed beyond the preset rudder limits or rudder end-stops.<br>• Autopilot resets due to an external event (such as use of the sleep switch, or faulty wiring causing the autopilot components to power cycle).<br>• Autopilot resets due to software error. | • Check the rudder reference unit has been installed correctly to reflect the limits and end-stops of the vessel's rudder system.<br>• For EV-1 systems, check ACU drive output voltage and drive and clutch voltage output (if applicable).<br>• For EV-1 systems, check all connections to ACU.<br>• Check all connections to drive unit.<br>• Check that the drive unit operates and is not stalled.<br>• Check steering system is secure. |
| NO RUDDER REFERENCE | No rudder reference unit is detected, or the rudder reference unit has turned outside its operational range (50 degrees). | If a rudder reference unit 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. | • Check that the drive unit operates and is not stalled.<br>• 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. |
| 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. |
| ROUTE COMPLETE | Your vessel has arrived at the end of the current route. | No action required. |

| Alarm Message | Possible causes | Solution |
|---|---|---|
| NO DATA | • The autopilot is in Wind Vane mode and has not received wind angle data for 32 seconds.<br>• The autopilot is in Track mode and is not receiving navigation data, or the rudder position sensor is receiving a low-strength signal. This will clear when the signal improves. | Check the connections to the wind transducer, multifunction display, and autopilot control head (as appropriate). |
| PILOT STARTUP | Autopilot components are initializing. | Some components may take a moment to startup. |
| 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. | • Check the connections to the EV-1 / EV-2.<br>• 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. |
| 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) | • 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. |

# Chapter 5: Maintenance and support

## Chapter contents

## 5.1 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.

## 5.2 Cleaning

1. Switch off the power to the unit.
2. Wipe the unit with a clean, damp cloth.
3. If necessary, use isopropyl alcohol (IPA) or a mild detergent to remove grease marks.

**Note:** Do NOT use abrasive, or acid or ammonia based products.

## 5.3 Raymarine customer support

Raymarine provides a comprehensive customer support service. You can contact customer support through the Raymarine website, telephone and e-mail. If you are unable to resolve a problem, please use any of these facilities to obtain additional help.

### Web support

Please visit the customer support area of our website at:

www.raymarine.com

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

### Telephone and e-mail support

**In the USA:**

- **Tel:** +1 603 324 7900
- **Toll Free:** +1 800 539 5539
- **E-mail:** support@raymarine.com

**In the UK, Europe, and the Middle East:**

- **Tel:** +44 (0)13 2924 6777
- **E-mail:** ukproduct.support@raymarine.com

**In Southeast Asia and Australia:**

- **Tel:** +61 (0)29479 4800
- **E-mail:** aus.support@raymarine.com

### Product information

If you need to request service, 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 the menus within your product.

# Appendix A Spare parts

| Item | Part number | Notes |
|---|---|---|
| SeaTalkng cable kit | R70160 | Consists of:<br>• SeaTalkng power cable 0.4 m (1.3 ft) (quantity: 1).<br>• SeaTalkng backbone cable 5 m (16.4 ft) (quantity: 1).<br>• SeaTalkng spur cable 0.4 m (1.3 ft) (quantity: 1).<br>• SeaTalkng 5–way connector block (quantity: 1).<br>• SeaTalkng T-piece connector (quantity: 2).<br>• SeaTalkng terminator (quantity: 2). |
| DeviceNet cable kit | R70192 | Consists of:<br>• DeviceNet adaptor cable (female) (quantity: 2).<br>• SeaTalkng power cable (quantity: 1).<br>• SeaTalkng terminator (quantity: 2). |
| Sealing ring pack | R70161 | |
| EV-1 / EV-2 wall bracket | R70162 | |

# Appendix B 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** | • 3-axis digital accelerometer.<br>• 3-axis digital compass.<br>• 3-axis gyro digital angular rate sensor. |
| **Data Connections** | • SeaTalkng.<br>• NMEA 2000 DeviceNet (EV-2 only; port not used on EV-1 unit). |
| **Environmental** | **Installation environment**<br>• Operating temperature: -20 °C to +55 °C (-4 °F to +131 °F).<br>• Storage temperature: -30 °C to +70 °C (-22°F to +158°F).<br>• Relative humidity: max 93%.<br>• Waterproof rating: IPX 6. |
| **Dimensions** | • Diameter: 140 mm (5.5 in).<br>• Depth (including mounting enclosure): 35 mm (1.4 in).<br>• Depth (including wall bracket): 95 mm (3.8 in). |
| **Weight** | 0.29 kg (0.64 lbs) |
| **EMC compliance** | • Europe: 2004/108/EC.<br>• Australia and New Zealand: C-Tick, Compliance Level 2. |

# Appendix C 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:<br>• NMEA 2000 Database Version<br>• NMEA Manufacturer's Product Code<br>• NMEA Manufacturer's Model ID<br>• Manufacturer's Software Version Code<br>• Manufacturer's Model Version<br>• Manufacturer's Model Serial Code<br>• NMEA 2000 Certification Level<br>• 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:<br>• Date<br>• Time<br>• Lattitude<br>• Longitude | | • |
| 129283 | Cross track error | | • |
| 129284 | Navigation data (for following routes):<br>• Active Leg Distance To Waypoint (DTW)<br>• Course / Bearing reference<br>• Perpendicular Crossed<br>• Arrival Circle Entered<br>• Calculation Type<br>• Estimated Time of Arrival (ETA)<br>• Estimated Date of Arrival<br>• Active Leg Bearing Origin to Destination (BOD)<br>• Active Leg Bearing To Waypoint (BTW)<br>• Active Leg Origin Waypoint ID<br>• Active Waypoint ID<br>• Destination Waypoint Latitude<br>• Destination Waypoint Longitude<br>• Waypoint closing velocity | | • |

| Message number | Message description | Transmit | Receive |
|---|---|---|---|
| 129285 | Active Waypoint data | | • |
| 130306 | Wind data | | • |

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