



a / c / e SERIES

INSTALLATION INSTRUCTIONS

English

Date: 08-2015

Document number: 87247-2-EN

© 2015 Raymarine UK Limited



Raymarine®
BY **FLIR**

Trademark and patents notice

Raymarine, Tacktick, Clear Pulse, Truzoom, HSB, SeaTalk, SeaTalk^{hs}, SeaTalk^{ng}, Micronet, Raytech, Gear Up, Marine Shield, Seahawk, Autohelm, Automagic, and Visionality are registered or claimed trademarks of Raymarine Belgium.

FLIR, DownVision, SideVision, Dragonfly, Instalert, Infrared Everywhere, and The World's Sixth Sense are registered or claimed trademarks of FLIR Systems, Inc.

All other trademarks, trade names, or company names referenced herein are used for identification only and are the property of their respective owners.

This product is protected by patents, design patents, patents pending, or design patents pending.

Fair Use Statement

You may print no more than three copies of this manual for your own use. You may not make any further copies or distribute or use the manual in any other way including without limitation exploiting the manual commercially or giving or selling copies to third parties.

Software updates

Important: Check the Raymarine website for the latest software releases for your product.

www.raymarine.com/software

Product handbooks

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

Copyright ©2015 Raymarine UK Ltd. All rights reserved.

Contents

Chapter 1 Important information.....	7	4.10 a6x and a7x to NMEA 0183 DSC VHF radio connection	44
Certified Installation	7	4.11 Sonar module and transducer connection	45
TFT Displays	8	4.12 Radar network connection	46
Water ingress	8	4.13 GA150 connection.....	49
Disclaimers	8	4.14 GNSS / GPS connection.....	49
RF exposure	8	4.15 AIS connection.....	50
FCC.....	9	4.16 Fastheading connection.....	50
Compliance Statement (Part 15.19)	9	4.17 Keypad network connection	51
FCC Interference Statement (Part 15.105 (b))	9	4.18 Weather receiver connection.....	51
Industry Canada	9	4.19 Video connection — composite	52
Industry Canada (Français)	9	4.20 Video in-out connection	52
Japanese approvals.....	9	4.21 IP Camera connection	53
Declaration of conformity.....	9	4.22 Thermal camera connection.....	54
Product disposal	9	4.23 Fusion network connection	56
Pixel defect policy	10	4.24 Fusion NMEA 2000 connection	56
Warranty registration.....	10	4.25 Media player connection	57
IMO and SOLAS.....	10	4.26 Raymarine mobile app connection.....	57
Technical accuracy	10	4.27 Bluetooth remote control connection.....	58
Chapter 2 Document and product information.....	11	Chapter 5 Mounting.....	59
2.1 Document information	12	5.1 Mounting - a Series	60
2.2 Product documentation.....	12	5.2 Mounting - c Series and e Series.....	62
2.3 Document illustrations	13	Chapter 6 Maintaining your display.....	65
2.4 Product overview	13	6.1 Service and maintenance	66
2.5 LightHouse MFD Operation instructions.....	16	6.2 Product cleaning	66
Chapter 3 Planning the installation	17	Chapter 7 Troubleshooting.....	67
3.1 System integration	18	7.1 Troubleshooting	68
3.2 Installation checklist	24	7.2 Power up troubleshooting	69
3.3 Multiple data sources (MDS) overview.....	24	7.3 Radar troubleshooting	70
3.4 Identifying your display variant	25	7.4 GPS troubleshooting	71
3.5 Networking constraints	25	7.5 Sonar troubleshooting	72
3.6 System protocols	26	7.6 Sonar crosstalk interference	75
3.7 Data master.....	27	7.7 Thermal camera troubleshooting.....	77
3.8 a6x and a7x parts supplied	28	7.8 System data troubleshooting.....	79
3.9 a9x and a12x parts supplied	28	7.9 Video troubleshooting.....	80
3.10 e7 / e7D Parts supplied	29	7.10 Wi-Fi troubleshooting.....	81
3.11 c Series and e Series parts supplied.....	29	7.11 Bluetooth troubleshooting.....	82
3.12 Tools required for installation.....	30	7.12 Touchscreen troubleshooting	83
3.13 Selecting a location	30	7.13 Touchscreen alignment.....	84
Chapter 4 Cables and connections.....	35	7.14 Miscellaneous troubleshooting	85
4.1 General cabling guidance	36	Chapter 8 Technical specification.....	87
4.2 Connections overview	37	8.1 a Series.....	88
4.3 a9x and a12x connections overview	38	8.2 c and e Series.....	92
4.4 3–pin power connection.....	38	Chapter 9 Technical support	97
4.5 Power and data (combined) connection	39	9.1 Raymarine product support and servicing	98
4.6 SeaTalk^{ng} connections	41	9.2 Learning resources	99
4.7 NMEA 2000 connection	42	9.3 Third-party support.....	99
4.8 SeaTalk connection.....	43	Chapter 10 Spares and accessories	101
4.9 NMEA 0183 connection — Power/NMEA/Video cable.....	43		

10.1 a Series spares	102
10.2 c Series and e Series spares	102
10.3 Digital ClearPulse Transducers and accessories	103
10.4 DownVision™ transducers and accessories	104
10.5 Network hardware	105
10.6 RayNet to RayNet cables and connectors	106
10.7 Network cable types	109
10.8 SeaTalk ^{ng} cabling components	109

Chapter 1: Important information

Certified Installation

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



Warning: Product installation and operation

- This product must be installed and operated in accordance with the instructions provided. Failure to do so could result in personal injury, damage to your vessel and/or poor product performance.
- Raymarine recommends certified installation by a Raymarine approved installer. A certified installation qualifies for enhanced product warranty benefits. Contact your Raymarine dealer for further details, and refer to the separate warranty document packed with your product.



Warning: Power supply voltage

The MFDs listed below are 12 V dc only products:

- **a6x / a7x**
- **e7 / e7D**

Do NOT connect these products to a 24 V power supply.



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: High voltages

This product may contain high voltages. Do NOT remove any covers or otherwise attempt to access internal components, unless specifically instructed in the documentation provided.



Warning: Product grounding

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



Warning: 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: FCC Warning (Part 15.21)

Changes or modifications to this equipment not expressly approved in writing by Raymarine Incorporated could violate compliance with FCC rules and void the user's authority to operate the equipment.



Warning: Radar transmission safety

The radar scanner transmits electromagnetic energy. Ensure all personnel are clear of the scanner when the radar is transmitting.



Warning: Sonar operation

- NEVER operate the sonar with the vessel out of the water.
- NEVER touch the transducer face when the sonar is powered on.
- SWITCH OFF the sonar if divers are likely to be within 7.6 m (25 ft) of the transducer.



Warning: Touchscreen display temperature

If the display is mounted where it will be exposed to prolonged periods of direct sunlight, the touchscreen may get very hot due to the absorbed solar energy.

In such conditions Raymarine highly recommends that you avoid using the touchscreen:

- For HybridTouch displays, use the integrated keypad to operate the display.
- For touch-only systems it is recommended that an external keypad is fitted to the system (for example, the RMK-9 accessory).



Warning: Touchscreen display

Exposure to prolonged rain may cause erroneous touch performance, in these situations keep touch activity to a minimum and wipe the screen with a dry non-abrasive cloth before using the touchscreen.

Caution: Transducer cable

- Do NOT cut, shorten, or splice the transducer cable.
- Do NOT remove the connector.

If the cable is cut, it cannot be repaired. Cutting the cable will also void the warranty.

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: Care of chart and memory cards

To avoid irreparable damage to and / or loss of data from chart and memory cards:

- DO NOT save data or files to a card containing cartography as the charts may be overwritten.
- Ensure that chart and memory cards are fitted the correct way around. DO NOT try to force a card into position.
- DO NOT use a metallic instrument such as a screwdriver or pliers to insert or remove a chart or memory card.

Caution: Ensure card reader door is securely closed

To prevent water ingress and consequent damage to the product, ensure that the card reader door is firmly closed.

Caution: Sun covers

- If your product is supplied with a sun cover, to protect against the damaging effects of ultraviolet (UV) light, always fit the sun cover when the product is not in use.
- Sun covers must be removed when travelling at high speed, whether in water or when the vessel is being towed.

Caution: Product cleaning

When cleaning products:

- If your product includes a display screen, do NOT wipe the screen with a dry cloth, as this could scratch the screen coating.
- Do NOT use abrasive, or acid or ammonia based products.
- Do NOT use a jet wash.

TFT Displays

The colors of the display may seem to vary when viewed against a colored background or in colored light. This is a perfectly normal effect that can be seen with all color Thin Film Transistor (TFT) displays.

Water ingress

Water ingress disclaimer

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

Disclaimers

This product (including the electronic charts) is intended to be used only as an aid to navigation. It is designed to facilitate use of official government charts, not replace them. 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. This product supports electronic charts provided by third party data suppliers which may be embedded or stored on memory card. Use of such charts is subject to the supplier's End-User Licence Agreement included in the documentation for this product or supplied with the memory card (as applicable).

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.

This product uses digital chart data, and electronic information from the Global Positioning System (GPS) which may contain errors. Raymarine does not warrant the accuracy of such information and you are advised that errors in such information may cause the product to malfunction. 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 chart data or information utilized by the product and supplied by third parties.

RF exposure

This equipment complies with FCC / IC RF exposure limits for general population / uncontrolled exposure. The wireless LAN / Bluetooth antenna is mounted behind the front fascia of the display. This equipment should be installed and operated with a minimum distance of 1 cm (0.39 in) between the device and the body. This transmitter must not be co-located

or operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures.

FCC

Compliance Statement (Part 15.19)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

FCC Interference Statement (Part 15.105 (b))

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio / TV technician for help.

Industry Canada

This device complies with Industry Canada License-exempt RSS standard(s).

Operation is subject to the following two conditions:

1. This device may not cause interference; and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

This Class B digital apparatus complies with Canadian ICES-003.

Industry Canada (Français)

Cet appareil est conforme aux normes d'exemption de licence RSS d'Industry Canada.

Son fonctionnement est soumis aux deux conditions suivantes:

1. cet appareil ne doit pas causer d'interférence, et
2. cet appareil doit accepter toute interférence, notamment les interférences qui peuvent affecter son fonctionnement.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Japanese approvals

In the frequency band used for this device, campus radio stations (radio stations that require a license) and specified low power radio stations (radio stations that do not require license) for mobile identification and amateur radio stations (radio stations that require license) used in industries such as microwave ovens, scientific, medical equipment devices and production line of other factories are also being operated.

1. Before using this device, please make sure that campus radio stations and specified low power radio stations for mobile identification and amateur radio stations are not being operated nearby.
2. In case there is any case of harmful interference to campus radio stations for mobile identification caused by this device, please immediately change the frequency used or stop the transmission of radio waves and then consult about the measures to avoid interference (for example, the installation of partitions) through the contact information below.
3. Besides, when in trouble, such as when there is any case of harmful interference to specified low power radio stations for mobile identification or amateur radio stations caused by this device, please consult through the following contact information.

Contact information: Please contact your local authorized Raymarine dealer.

Declaration of conformity

Raymarine UK Ltd. declares that this product is compliant with the essential requirements of R&TTE directive 1999/5/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.

Pixel defect policy

In common with all TFT units, the screen may exhibit a few wrongly-illuminated (“dead”) pixels. These may appear as black pixels in a light area of the screen or as colored pixels in black areas.

If your display exhibits MORE than the number of wrongly-illuminated pixels allowed (refer to the product *technical specification* for details), please contact your local Raymarine service center for further advice.

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 and product information

Chapter contents

- [2.1 Document information on page 12](#)
- [2.2 Product documentation on page 12](#)
- [2.3 Document illustrations on page 13](#)
- [2.4 Product overview on page 13](#)
- [2.5 LightHouse MFD Operation instructions on page 16](#)

2.1 Document information

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

The document includes information to help you:

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

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

User manuals Print Shop

Raymarine provides a Print Shop service, enabling you to purchase a high-quality, professionally-printed manual for your Raymarine product.

Printed manuals are ideal for keeping onboard your vessel, as a useful source of reference whenever you need assistance with your Raymarine product.

Visit <http://www.raymarine.co.uk/view/?id=5175> to order a printed manual, delivered directly to your door.

For further information about the Print Shop, please visit the Print Shop FAQ pages: <http://www.raymarine.co.uk/view/?id=5751>.

Note:

- Accepted methods of payment for printed manuals are credit cards and PayPal.
- Printed manuals can be shipped worldwide.
- Further manuals will be added to the Print Shop over the coming months for both new and legacy products.
- Raymarine user manuals are also available to download free-of-charge from the Raymarine website, in the popular PDF format. These PDF files can be viewed on a PC / laptop, tablet, smartphone, or on the latest generation of Raymarine multifunction displays.

2.2 Product documentation

The following documentation is applicable to your product:

All documents are available to download as PDFs from www.raymarine.com

Documentation

Description	Part number
a Series / c Series / e Series Installation instructions	87247
LightHouse™ multifunction display operation instructions	81360
a6x Mounting template	87165
a7x Mounting template	87191
a9x Mounting template	87205
a12x Mounting template	87217
e95 / e97 / c95 / c97 Mounting template	87144
e125 / e127 / c125 / c127 Mounting template	87145
e7 / e7D Mounting template	87137
e165 Mounting template	87166

Additional documentation

Description	Part number
SeaTalk ^{ng} reference manual	81300
RMK-9 Installation and operations instructions	81351

2.3 Document illustrations

Products may differ slightly from those shown in the illustrations in this document, depending on product variant and date of manufacture.

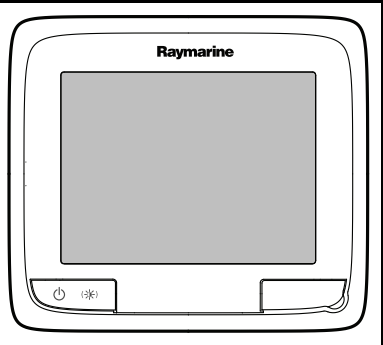

The illustration shown below is used throughout this document to represent **LightHouse™** powered **MFDs** and unless otherwise stated applies to all multifunction display variants.



2.4 Product overview

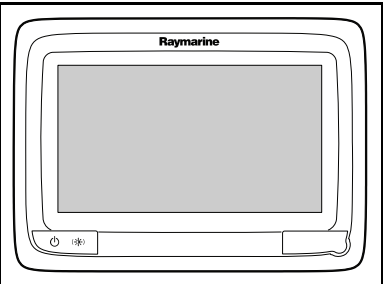
a6x Display variants


a6x multifunction displays are available in the following variants:


	
Non-sonar variant	a65 (E70162)
Sonar variant	a67 (E70163)
DownVision variant	a68 (E70201) — display only (E70207) — (with CPT-100 transducer)
Features	<ul style="list-style-type: none"> • Bluetooth • Internal GPS • Wi-Fi
Controls	 Multi-Touch touchscreen (HybridTouch when paired with a remote keypad.)

a7x Display variants

a7x multifunction displays are available in the following variants:

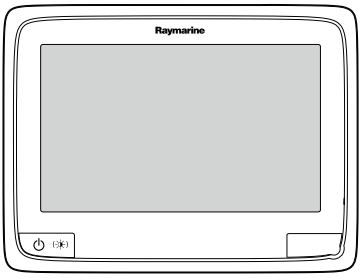

	
Non-sonar variant	a75 (E70166)
Sonar variant	a77 (E70167)
DownVision variant	a78 (E70203) — display only (E70209) — (with CPT-100 transducer)

Features	<ul style="list-style-type: none"> • Bluetooth • Internal GPS • Wi-Fi
Controls	 Multi-Touch touchscreen (HybridTouch when paired with a remote keypad.)

Features	<ul style="list-style-type: none"> • NMEA 0183 • Bluetooth • Wi-Fi • Internal GNSS (GPS / GLONASS) receiver • GA150 external antenna connection
Controls	 Multi-Touch touchscreen (HybridTouch when paired with a remote keypad.)

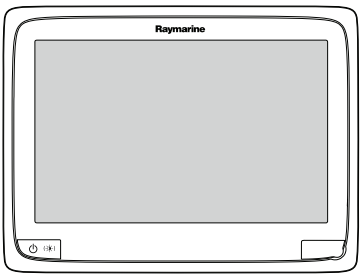
a9x Display variants

a9x multifunction displays (MFDs) are available in the following variants:

	
Non-sonar variant	a95 — (E70232)
Sonar variant	a97 — (E70233)
DownVision variant	a98 — (E70234)
Features	<ul style="list-style-type: none"> • NMEA 0183 • Bluetooth • Wi-Fi • Internal GNSS (GPS / GLONASS) receiver • GA150 external antenna connection
Controls	 Multi-Touch touchscreen (HybridTouch when paired with a remote keypad.)

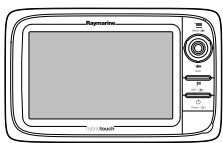

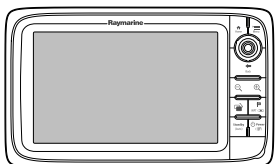

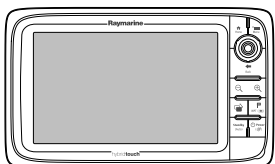

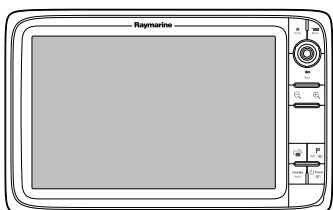

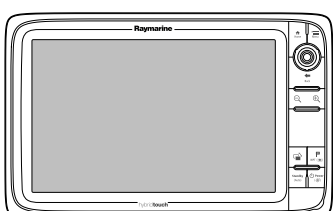

a12x Display variants

a12x multifunction displays (MFDs) are available in the following variants:

	
Non-sonar variant	a125 — (E70235)
Sonar variant	a127 — (E70236)
DownVision variant	a128 — (E70237)

c Series and e Series display variants

The following c Series and e Series multifunction display variants are available

	Non-sonar	Sonar	Series	Controls	Features
	e7 (E62354)	e7D (E62355)	e Series	 HybridTouch (Touchscreen and physical buttons)	<ul style="list-style-type: none"> • Bluetooth. • Wi-Fi • NMEA 0183 • NMEA 2000 (via SeaTalk^{ng}) • Internal GPS. • Video input.
	c95 (E70011)	c97 (E70012)	c Series	 Physical buttons only	<ul style="list-style-type: none"> • Bluetooth. • Wi-Fi • NMEA 0183 • NMEA 2000 (via SeaTalk^{ng}) • Internal GPS. • Video input.
	e95 (E70021)	e97 (E70022)	e Series	 HybridTouch (Touchscreen and physical buttons)	<ul style="list-style-type: none"> • Bluetooth. • Wi-Fi • NMEA 0183 • NMEA 2000 (via SeaTalk^{ng}) • Internal GPS. • Video input x2. • Video output.
	c125 (E70013)	c127 (E70014)	c Series	 Physical buttons only	<ul style="list-style-type: none"> • Bluetooth. • Wi-Fi • NMEA 0183 • NMEA 2000 (via SeaTalk^{ng}) • Internal GPS. • Video input.
	e125 (E70023)	e127 (E70024)	e Series	 HybridTouch (Touchscreen and physical buttons)	<ul style="list-style-type: none"> • Bluetooth. • Wi-Fi • NMEA 0183 • NMEA 2000 (via SeaTalk^{ng}) • Internal GPS. • Video input x2.

	Non-sonar	Sonar	Series	Controls	Features
					<ul style="list-style-type: none"> • Video output.
	e165 (E70025)	n/a	e Series	 HybridTouch (Touchscreen and physical buttons)	<ul style="list-style-type: none"> • Bluetooth. • Wi-Fi • NMEA 0183 • NMEA 2000 (via SeaTalk^{ng}) • Video input x2. • Video output.

HybridTouch overview

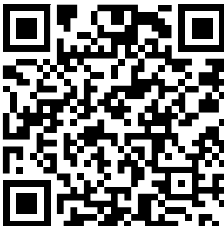
If your multifunction display features HybridTouch, this enables you to operate the unit using the touchscreen and the physical buttons.

A HybridTouch display has physical buttons which can be used in addition to the touchscreen. Touchscreen only multifunction displays (which do not have physical buttons) can be connected to a remote keypad which allows HybridTouch functionality.

All functions can be accessed using the touchscreen. However, there may be situations (such as rough sea conditions) when it is not appropriate to use the touchscreen. In these situations, Raymarine strongly recommends that you activate the touch lock and use the physical buttons to operate your multifunction display.

2.5 LightHouse MFD Operation instructions

For operation instructions for your MFD, including 'Getting Started' and 'System Checks' information please use the User Manual icon on the Homescreen.

	<p>the LightHouse Operation Instructions (81360) can also be downloaded from the Raymarine website: www.raymarine.com/manuals</p>
---	--

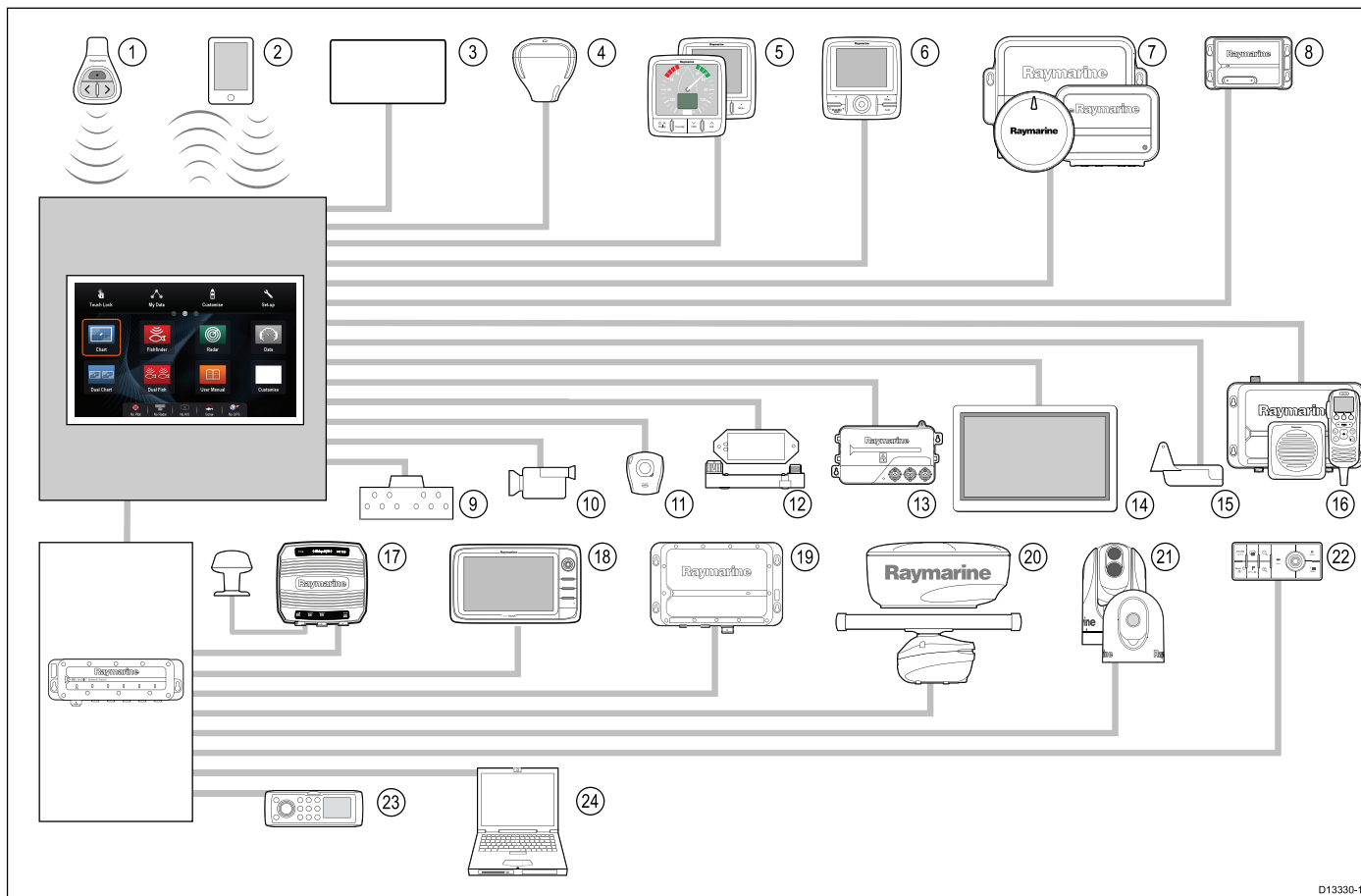
Chapter 3: Planning the installation

Chapter contents

- 3.1 System integration on page 18
- 3.2 Installation checklist on page 24
- 3.3 Multiple data sources (MDS) overview on page 24
- 3.4 Identifying your display variant on page 25
- 3.5 Networking constraints on page 25
- 3.6 System protocols on page 26
- 3.7 Data master on page 27
- 3.8 a6x and a7x parts supplied on page 28
- 3.9 a9x and a12x parts supplied on page 28
- 3.10 e7 / e7D Parts supplied on page 29
- 3.11 **c Series** and **e Series** parts supplied on page 29
- 3.12 Tools required for installation on page 30
- 3.13 Selecting a location on page 30

3.1 System integration

Raymarine® multifunction displays (MFDs) are compatible with a wide range of marine electronics devices.



D13330-1

MFDs use various protocols to transfer data between devices in your system. The table below details which devices may be connected to your **MFD**, and the type of connections (in terms of protocols and physical interfaces):

Item	Device Type	Maximum quantity	Suitable Devices	Connections
1	Remote control	1 per MFD	Raymarine® RCU-3	Bluetooth
2	Mobile device (Smartphone / Tablet)	1 per multifunction display.	<p>For Raymarine® wireless video streaming and remote control apps:</p> <ul style="list-style-type: none"> • Apple iPhone 4 (or later) or iPad 2 (or later) • Android device with minimum 1GHz processor and running android 2.2.2 (or later) • Amazon Kindle Fire <p>For chartplotter sync with Navionics Marine app:</p> <ul style="list-style-type: none"> • Apple iPhone or iPad • Android-compatible smartphone or tablet <p>For media player control (Touchscreen MFDs only):</p> <ul style="list-style-type: none"> • Any Bluetooth-enabled device that supports Bluetooth 2.1+ EDR power class 1.5 (supported profile: AVRCP 1.0) 	<ul style="list-style-type: none"> • Chartplotter sync with Navionics Marine app: Wi-Fi • Video streaming and remote control: Wi-Fi • Media player control: Bluetooth 2.1+ EDR power class 1.5 (supported profile: AVRCP 1.0) or later

Item	Device Type	Maximum quantity	Suitable Devices	Connections
3	Vessel tank sensors — third-party	<ul style="list-style-type: none"> • Up to 5 x fuel. • 1 x fresh water. • 1 x waste water. • 1 x sewage. • 1 x bait / fish. 	Third-party NMEA 2000 interfaces	NMEA 2000 (via optional DeviceNet adaptor cables)
4	GNSS Receiver (external) — Raymarine®	1	Any combination of the following: <ul style="list-style-type: none"> • RS130 GPS • Raystar125 GPS • Raystar125+GPS (via optional SeaTalk to SeaTalkng® converter) 	SeaTalk , SeaTalkng® , or NMEA 0183
5	Instruments — Raymarine®	As determined by SeaTalkng® bus bandwidth and power loading.	SeaTalkng® : <ul style="list-style-type: none"> • i50 Depth, Speed, or Tridata • i60 Wind, CH Wind • i70 • ST70+ • ST70 SeaTalk (via optional SeaTalk to SeaTalkng® converter): <ul style="list-style-type: none"> • i40 Wind, Speed, Depth, or Bidata • ST60+ Wind, Speed, Depth, Rudder, or Compass • ST40 Wind, Speed, Depth, Rudder, or Compass 	SeaTalk , SeaTalkng®
6	Pilot control heads — Raymarine®	As determined by SeaTalk or SeaTalkng® bus bandwidth and power loading, as appropriate.	SeaTalkng® : <ul style="list-style-type: none"> • p70 • p70R • ST70 (SeaTalkng® course computer only.) • ST70+ (SeaTalkng® course computer only.) SeaTalk (via optional SeaTalk to SeaTalkng® converter): <ul style="list-style-type: none"> • ST6002 • ST7002 • ST8002 	SeaTalk , SeaTalkng®
7	Autopilots — Raymarine®	1	SeaTalkng® : <ul style="list-style-type: none"> • Evolution autopilots • All SPX course computers SeaTalk (via optional SeaTalk to SeaTalkng® converter): <ul style="list-style-type: none"> • ST1000 • ST2000 • S1000 • S1 	SeaTalk , SeaTalkng® , or NMEA 0183

Item	Device Type	Maximum quantity	Suitable Devices	Connections
			<ul style="list-style-type: none"> • S2 • S3 	
8	AIS — Raymarine®	1	<ul style="list-style-type: none"> • AIS350 • AIS650 • AIS950 	SeaTalk ^{ng} ®, or NMEA 0183
8	AIS — third-party	1	Third-party NMEA 0183-compatible AIS Class A or Class B receiver / transceiver	NMEA 0183
9	Vessel trim tabs — third-party	1 pair	Third-party NMEA 2000 interfaces	NMEA 2000 (via optional DeviceNet adaptor cables)
10	Analog video / camera	a6x / a7x = 0 a9x / a12x / e7 / e7D = 1 c Series = 1 e9x / e12x / e165 = 2 eS Series = 1 gS Series = 2	Composite PAL or NTSC video source	BNC connectors
10	IP camera	Multiple	<ul style="list-style-type: none"> • CAM200IP <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note: Whilst third-party ONVIF compatible IP cameras may work, Raymarine® cannot guarantee their compatibility.</p> </div>	Via SeaTalk ^{hs} network
11	Lifetag (Man overboard alert)	1 basestation	All Raymarine® Lifetag basestations	SeaTalk (via optional SeaTalk to SeaTalk ^{ng} ® converter)
12	Engine interface — Raymarine®	1 unit for each engine CAN bus	<ul style="list-style-type: none"> • ECI-100 	SeaTalk ^{ng} ®
12	Engine interface — third-party	1	Third-party NMEA 2000 interfaces	NMEA 2000 (via optional DeviceNet adaptor cables)
13	Transducers and sensors — Raymarine®	1	Analog transducers: <ul style="list-style-type: none"> • Wind • Speed • Depth • Rudder reference • Fluxgate compass 	SeaTalk ^{ng} ® (via optional iTC-5 converter)
13	Transducers and sensors — Airmar	1	<ul style="list-style-type: none"> • DT800 Smart Sensor • DST800 Smart Sensor • PB200 weather station 	SeaTalk ^{ng} ® (via optional iTC-5 converter)
14	External display	a6x / a7x = 0 a9x / a12x = 1 c Series = 0 e7 / e7D = 0 e9x / e12x / e165 = 1 eS7x = 0 eS9x / eS12x = 1 gS Series = 1	e.g. HDTV	a9x / a12x = 15 pin D-Type connector (VGA Style) e9x / e12x / e165 = 15 pin D-Type connector (VGA Style) eS9x / eS12x = HDMI gS Series = HDMI

Item	Device Type	Maximum quantity	Suitable Devices	Connections
15	Sonar transducer	1	<ul style="list-style-type: none"> • P48 • P58 • P74 • B60 20° • B60 12° • B744V ; OR: <ul style="list-style-type: none"> • Any 600 watt / 1Kw compatible transducer (via optional E66066 adaptor cable) ; OR: <ul style="list-style-type: none"> • Any Minn Kota transducer (via optional A62363 adaptor cable) Connection via external Raymarine® Sonar Module: <ul style="list-style-type: none"> • Any sonar module-compatible transducer 	Direct connection to 600 W internal sonar variant displays.
15	DownVision™ transducers	1	Direct connection to internal CHIRP DownVision™ variant displays <ul style="list-style-type: none"> • CPT-100 — Transom mount • CPT-110 — Thru-hull plastic • CPT-120 — Thru-hull bronze 	Direct connection to CHIRP DownVision™ variant displays.
16	DSC VHF radio — Raymarine®	1	SeaTalk^{ng}® : <ul style="list-style-type: none"> • Ray50 • Ray60 • Ray70 • Ray260 • Ray260 AIS NMEA 0183 : <ul style="list-style-type: none"> • Ray50 • Ray60 • Ray70 • Ray49 • Ray55 • Ray218 • Ray240 	NMEA 0183 or SeaTalk^{ng}®
17	Raymarine® Sirius marine weather / satellite radio receiver (North America only)	1	SeaTalk^{hs} : <ul style="list-style-type: none"> • SR150 • SR100 • SR6 SeaTalk^{ng}® : <ul style="list-style-type: none"> • SR50 	SeaTalk^{hs} , SeaTalk^{ng}®

Item	Device Type	Maximum quantity	Suitable Devices	Connections
18	Additional multifunction display(s) — Raymarine®	9	<p>3rd generation Raymarine® multifunction displays SeaTalk^{hs} (recommended):</p> <ul style="list-style-type: none"> • a Series • c Series • e Series • gS Series • eS Series <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note: You can connect Raymarine® multifunction displays using NMEA 0183 or SeaTalk^{ng}® but not all functions are supported.</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note: Visit www.raymarine.com to download the latest software version for your display.</p> </div>	SeaTalk^{hs}
18	Additional multifunction display(s) — third-party	<ul style="list-style-type: none"> • Connections to multifunction display NMEA outputs: 4 • Connections to multifunction display NMEA inputs: 2 	NMEA 0183 –compatible chartplotters and multifunction displays	NMEA 0183
19	Sonar Modules (Fishfinder) — Raymarine®	Multiple	<ul style="list-style-type: none"> • CP100 — DownVision™ • CP200 — SideVision™ • CP300 / CP370— Traditional sonar • CP450C / CP470 — CHIRP sonar • CP570 CHIRP professional sonar • 600 W Sonar and CHIRP DownVision™ variant displays. 	SeaTalk^{hs}
20	Radar — Raymarine®	2	<p>All Raymarine® Non-HD Digital Radomes and HD or SuperHD radar scanners.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note: Please ensure your radar scanner is using the latest software version.</p> </div>	SeaTalk^{hs}
21	Thermal camera — Raymarine®	1	<ul style="list-style-type: none"> • T200 Series • T300 Series • T400 Series • T800 Series • T900 Series 	SeaTalk^{hs} (for control), BNC connector (for video)
22	Remote keypad	Multiple	<ul style="list-style-type: none"> • RMK-9 	SeaTalk^{hs}

Item	Device Type	Maximum quantity	Suitable Devices	Connections
23	Fusion entertainment systems	Multiple	Fusion 700 series entertainment systems: <ul style="list-style-type: none"> • MS-IP700 • MS-AV700 	SeaTalk^{hs}
24	PC / laptop	1	Windows-compatible PC or laptop running Raymarine[®] Voyage Planner software.	SeaTalk^{hs}

Note: Raymarine[®] cannot guarantee the compatibility of any third-party devices listed above.

3.2 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.

3.3 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.

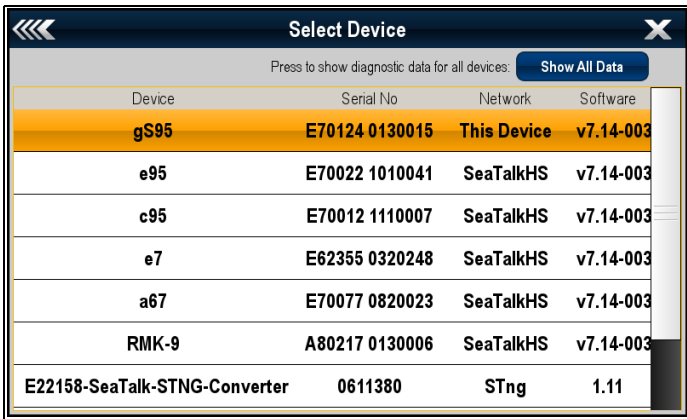
Typically this exercise is completed as part of the initial installation, or when new equipment is added.

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.

3.4 Identifying your display variant

To discover which model display you have follow the steps below:



The screenshot shows a 'Select Device' screen with a table of networked displays. The table has four columns: Device, Serial No, Network, and Software. The first row is highlighted in orange and shows 'gS95' with serial number 'E70124 0130015', network 'This Device', and software 'v7.14-003'. Other rows include 'e95', 'c95', 'e7', 'a67', 'RMK-9', and 'E22158-SeaTalk-STNG-Converter'.

Device	Serial No	Network	Software
gS95	E70124 0130015	This Device	v7.14-003
e95	E70022 1010041	SeaTalkHS	v7.14-003
c95	E70012 1110007	SeaTalkHS	v7.14-003
e7	E62355 0320248	SeaTalkHS	v7.14-003
a67	E70077 0820023	SeaTalkHS	v7.14-003
RMK-9	A80217 0130006	SeaTalkHS	v7.14-003
E22158-SeaTalk-STNG-Converter	0611380	STng	1.11

From the homescreen:

1. Select **Set-up**.
2. Select **Maintenance**.
3. Select **Diagnostics**.
4. Select **Select Device**.
5. Search the Network column for the **'This Device'** entry.
6. The Device column for this record will list the model of your display.

3.5 Networking constraints

Up to 10 **LightHouse** powered **MFDs** can be connected together using **SeaTalk^{hs}**. It is recommended that all networked displays contain the same software version.

Software versions

- All networked **aa Series**, **c Series** and **e Series** displays must contain **LightHouse** software release V4.32 or later.
- All networked **gS Series** displays must contain **LightHouse** software release V7.43 or later.
- All networked **eS Series** displays must contain **LightHouse** software release V14.xx or later.

Master / repeater operation

- Any network featuring more than 1 **MFD** must have 1 of the displays designated as the Data Master.
- The Data Master display will receive data through **NMEA 0183** and / or **SeaTalk^{ng}**, and bridge the data over **SeaTalk^{hs}** to other networked displays.

Homescreen sharing

- When networked, **MFDs** can share the Data Master's Homescreen.

Cartography sharing

- The cartography contained on chart cards is always used in preference to embedded world base maps.
- Chart card cartography can be shared between networked **MFDs**.

Radar operation

- **MFDs** support the use of up to 2 Radar scanners simultaneously.
- The data supplied by a connected Radar scanner(s) is repeated to networked displays.

Note: All **MFDs** must have **LightHouse II** Release V12.26 software or later to enable multiple radar support.

Sonar / DownVision™ / SideVision™ operation

- You can connect an external sonar modules to the **MFD** via the **SeaTalk^{hs}** network.
- 600 W sonar and **CHIRP DownVision™** variant displays include an internal sonar module which enables direct connection of a compatible transducer.
- You can have multiple active sonar modules (internal and external) on a network.
- The data supplied by the sonar module is repeated to networked displays.

Note:

- All **MFDs** must have **LightHouse II** Release V10.41 software or later to enable multiple sonar support.
- Sonar modules should be updated to the latest available software version to ensure compatibility.

3.6 System protocols

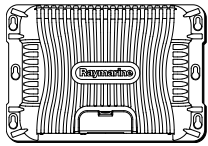
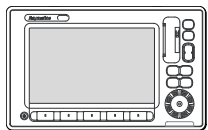
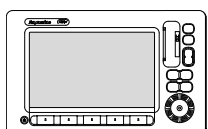
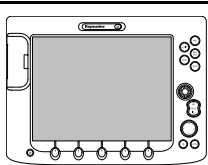
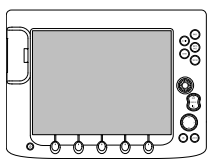
Your Multifunction Display can connect to various instruments and displays to share information and so improve the functionality of the system. These connections may be made using a number of different protocols. Fast and accurate data collection and transfer is achieved by using a combination of the following data protocols:

- SeaTalk^{hs}
- SeaTalk^{ng}
- NMEA 2000
- SeaTalk
- NMEA 0183

Incompatible displays

If you connect a multifunction display to your system that is not compatible, a warning message will be displayed until you disconnect the incompatible device from your network.

Your **MFD** is not compatible with the following Raymarine displays:

Product Image	Multifunction display	Generation
	G-Series	2 nd generation
	E-Series Widescreen	2 nd generation
	C-Series Widescreen	2 nd generation
	E-Series Classic	1 st generation
	C-Series Classic	1 st generation

Note: You may find that your system does not use all of the connection types or instrumentation described in this section.

SeaTalk^{hs}

SeaTalk^{hs} is an ethernet based marine network. This high speed protocol allows compatible equipment to communicate rapidly and share large amounts of data.

Information shared using the SeaTalk^{hs} network includes:

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

Seataalk^{ng}

SeaTalk^{ng} (Next Generation) is an enhanced protocol for connection of compatible marine instruments and equipment. It replaces the older SeaTalk and SeaTalk² protocols.

SeaTalk^{ng} 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.

SeaTalk^{ng} 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.

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.

SeaTalk

SeaTalk is a protocol which enables compatible instruments to connect to each other and share data.

The SeaTalk cable system is used to connect compatible instruments and equipment. The cable carries power and data and enables connection without the need for a central processor.

Additional instruments and functions can be added to a SeaTalk system, simply by plugging them into the network. SeaTalk equipment can also communicate with other non-SeaTalk equipment via the NMEA 0183 standard, provided a suitable interface is used.

NMEA 0183

The NMEA 0183 Data Interface Standard was developed by the National Marine Electronics Association of America. It is an international standard to enable equipment from many different manufacturers to be connected together and share information.

The NMEA 0183 standard carries similar information to SeaTalk. However it has the important difference that one cable will only carry information in one direction. For this reason NMEA 0183 is generally used to connect a data receiver and a transmitter together, e.g. a compass sensor transmitting heading to a radar display. This information is passed in 'sentences', each of which has a three letter sentence identifier. It is therefore important when checking compatibility between items that the same sentence identifiers are used some examples of which are:

- VTG - carries Course and Speed Over Ground data.
- GLL - carries latitude and longitude.
- DBT - carries water depth.
- MWV - carries relative wind angle and wind speed data.

NMEA Baud rates

The NMEA 0183 standard operates at a number of different speeds, depending upon the particular requirement or equipment capabilities. Typical examples are:

- 4800 baud rate. Used for general purpose communications, including FastHeading data.
- 38400 baud rate. Used for AIS and other high speed applications.

3.7 Data master

Any system containing more than one networked multifunction display must have a designated data master.

The data master is the display which serves as a primary source of data for all displays, it also handles all external sources of information. For example the displays may require heading information from the autopilot and GPS systems, usually received through a SeaTalk^{ng} or NMEA connection. The data master is the display to which the SeaTalk, NMEA and any other data connections are made, it then bridges the data to the SeaTalk^{hs} network and any compatible repeat displays. Information shared by the data master includes:

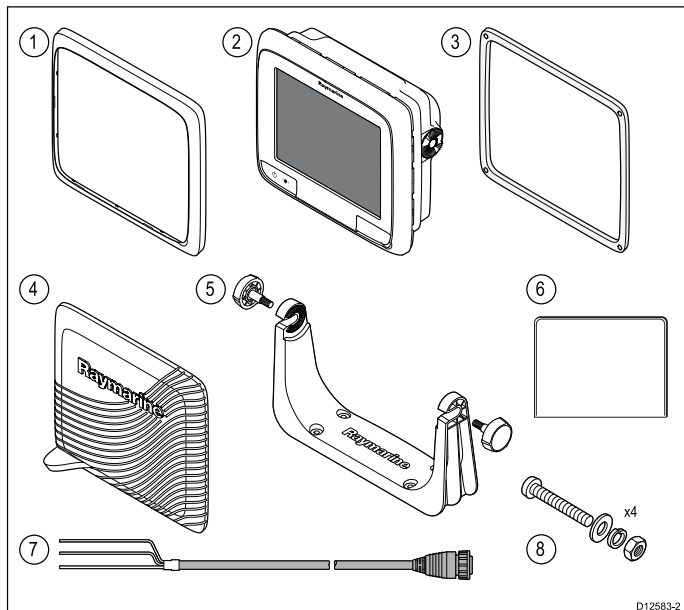
- Cartography
- Routes and waypoints
- Radar
- Sonar
- Data received from the autopilot, instruments, the engine and other external sources.

Your system may be wired for redundancy with data connections made to repeat displays. However these connections will only become active in the event of a fault and/or reassignment of the data master.

In an autopilot system which does not contain a dedicated pilot control head the Data master also acts as the control for the autopilot.

3.8 a6x and a7x parts supplied

The following items are supplied with your a6x and a7x variant MFD.

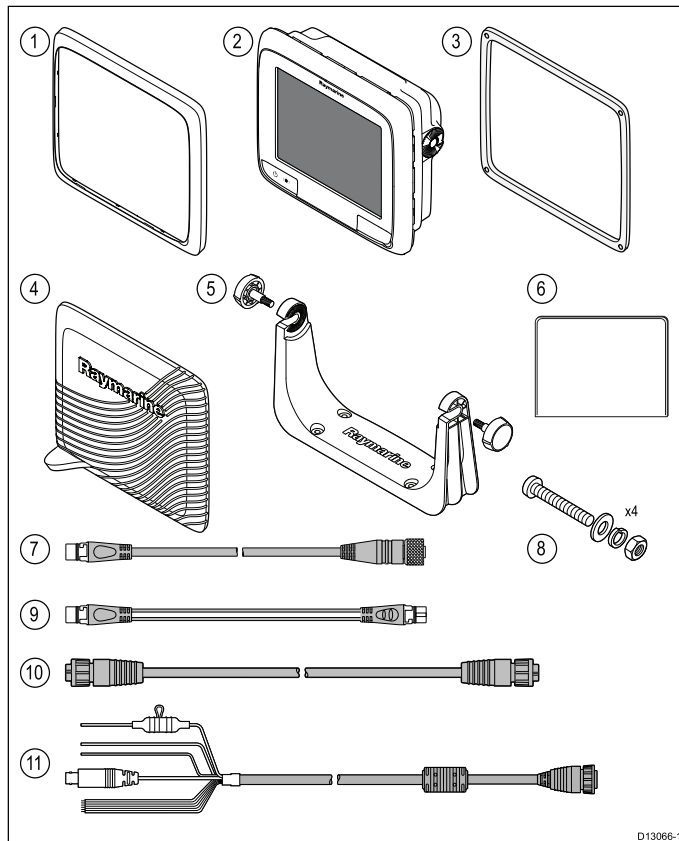


D12583-2

1	Front bezel
2	Multifunction display
3	Mounting gasket
4	Sun cover
5	Trunion bracket kit
6	Documentation pack
7	Power cable
8	4x Nuts, bolts, spring washers and washers (can be used for either surface or bracket mounting.)

3.9 a9x and a12x parts supplied

The following items are supplied with your a9x and a12x variant MFD.

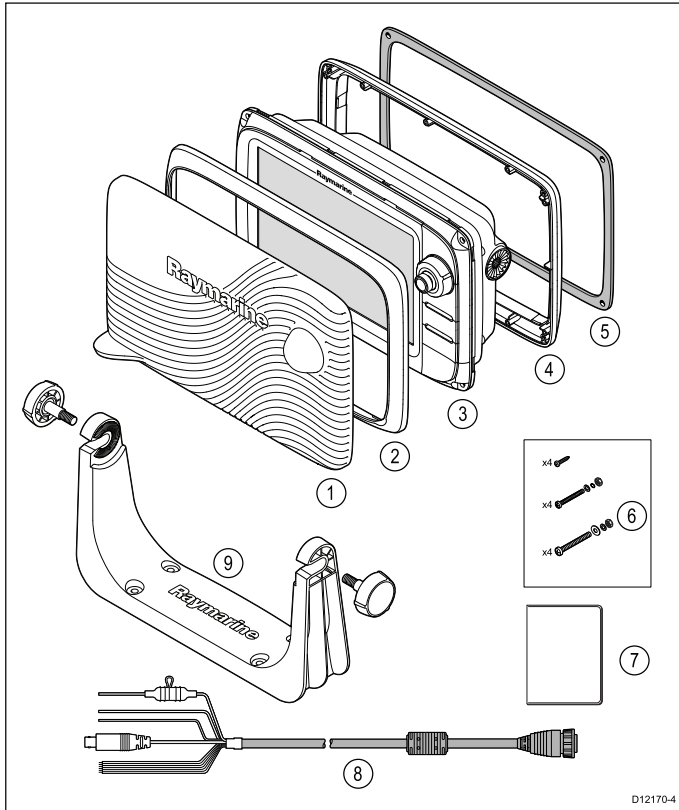


D13066-1

1	Front bezel
2	Multifunction display (MFD)
3	Mounting gasket
4	Sun cover
5	Trunion bracket kit
6	Documentation
7	SeaTalk^{ng} to DeviceNet adaptor cable
8	4x Nuts, bolts, spring washers and washers (can be used for either surface or bracket mounting.)
9	1 m (3.3 ft.) SeaTalk^{ng} spur cable
10	2 m (6.6 ft.) RayNet cable
11	1.5 m (4.9 ft.) Power and data cable (Power/NMEA/Video)

3.10 e7 / e7D Parts supplied

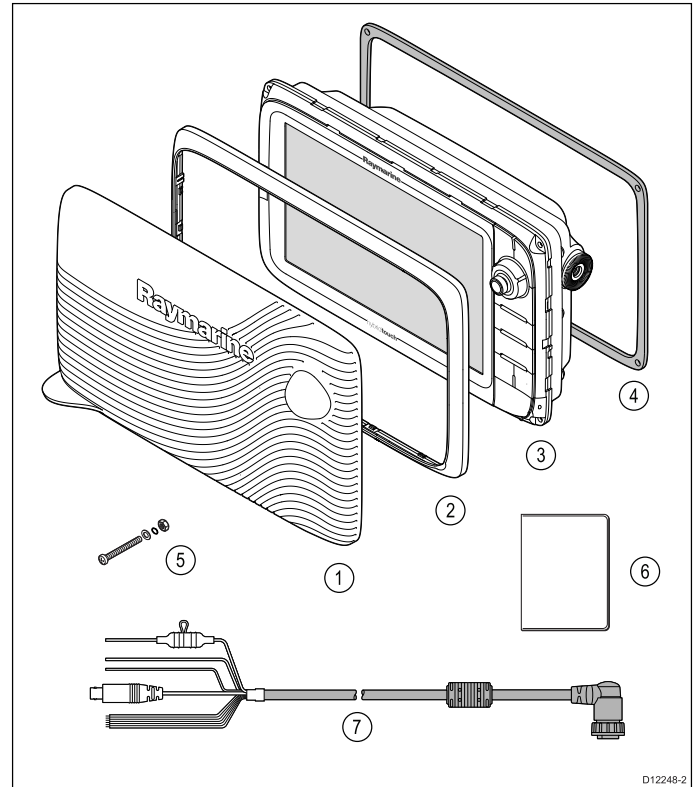
The parts shown below are supplied with the e7 / e7D multifunction display.



1. Sun cover.
2. Front bezel.
3. Multifunction display.
4. Rear bezel (required for trunnion bracket mounting).
5. Gasket (required for flush mounting).
6. Screw pack, includes:
 - 4 x rear bezel fixing screws.
 - 4 x sets of fixings (for surface mounting).
 - 4 x sets of fixings (for trunnion bracket mounting).
7. Documentation pack, includes:
 - Multilingual CD.
 - Mounting and getting started multilingual guide
 - Mounting template.
 - Warranty policy
8. Power and data cable.
9. Trunnion bracket kit.

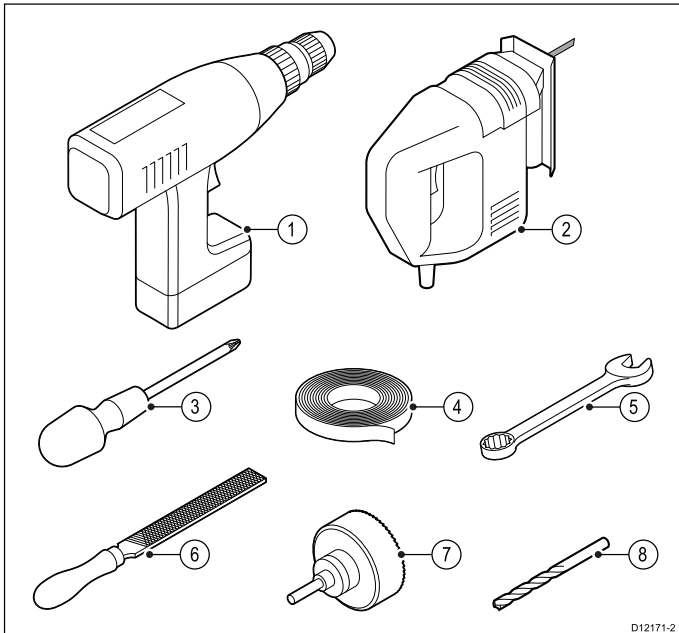
3.11 c Series and e Series parts supplied

The parts shown below are supplied with the c Series and e Series (Excluding e7 and e7D) multifunction displays.



1. Sun cover
2. Front bezel
3. Multifunction display (MFD)
4. Gasket (required for surface mounting)
5. 4 x sets of fixings (for surface mounting)
6. Documentation pack, includes:
 - Multilingual CD
 - Mounting and getting started multilingual guide
 - Mounting template
 - Warranty policy
7. Power and data cable

3.12 Tools required for installation



1. Power drill.
2. Jigsaw.
3. Pozidrive screwdriver.
4. Adhesive tape.
5. Spanner for surface mounting or bracket mounting fixings.
6. File.
7. Hole saw for flush mounting (For hole saw size refer to your product's mounting template).
8. Drill bit for surface mounting or bracket mounting.

3.13 Selecting a location



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).

General location requirements

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

Key factors which can affect product performance are:

• **Ventilation**

To ensure adequate airflow:

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

Any specific requirements for each system component are provided later in this chapter.

• **Mounting surface**

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

• **Cabling**

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

- Minimum bend radius of 100 mm (3.94 in) unless otherwise stated.
- Use cable clips to prevent stress on connectors.
- If your installation requires multiple ferrites to be added to a cable then additional cable clips should be used to ensure the extra weight of the cable is supported.

• **Water ingress**

The product is suitable for mounting both above and below decks. Although the unit is waterproof, it is good practice to locate it in a protected area away from prolonged and direct exposure to rain and salt spray.

• **Electrical interference**

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

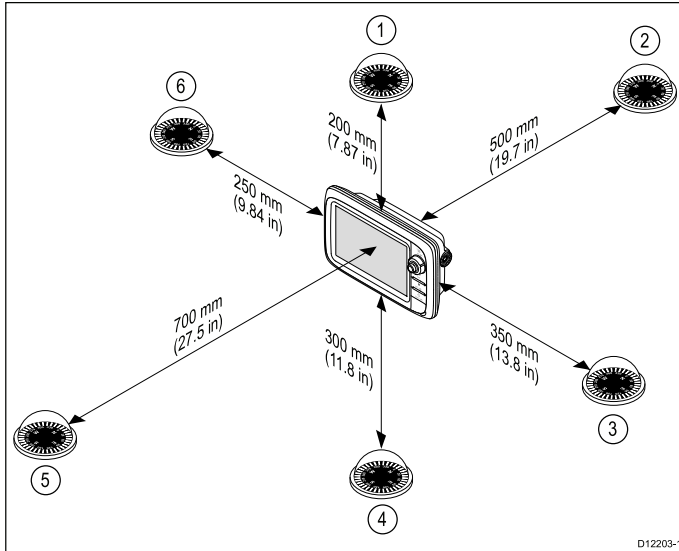
• **Power supply**

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

Compass safe distance

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

When choosing a suitable location for the multifunction display you should aim to maintain the maximum possible distance between the display and any compasses. Typically this distance should be at least 1 m (3 ft) in all directions. However for some smaller vessels it may not be possible to locate the display this far away from a compass. In this situation, the following figures provide the minimum safe distance that should be maintained between the display and any compasses.



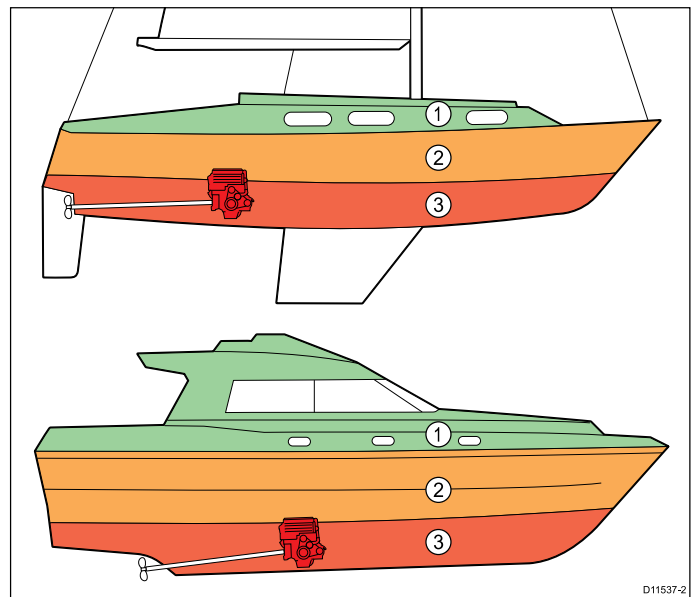
Item	Compass position in relation to display	Minimum safe distance from display
1	Top	200 mm (7.87 in.)
2	Rear	500 mm (19.7 in.)
3	Right-hand side	350 mm (13.8 in.)
4	Underside	300 mm (11.8 in.)
5	Front	700 mm (27.5 in.)
6	Left-hand side	250 mm (9.84 in.)

GPS location requirements

In addition to general guidelines concerning the location of marine electronics, there are a number of environmental factors to consider when installing equipment with an internal GPS antenna.

Mounting location

- **Above Decks mounting:**
Provides optimal GPS performance. (For equipment with appropriate waterproof rating.)
- **Below Decks mounting:**
GPS performance may be less effective and may require an external GPS antenna mounted above decks.



1.	■	This location provides optimal GPS performance (above decks).
2.	■	In this location, GPS performance may be less effective.
3.	■	This location is NOT recommended for GPS antenna.

Vessel construction

The construction of your vessel can have an impact on GPS performance. For example, the proximity of heavy structure such as a structural bulkhead, or the interior of larger vessels may result in a reduced GPS signal. Before locating equipment with an internal GPS antenna below decks, seek professional assistance and consider use of an external GPS antenna mounted above decks.

Prevailing conditions

The weather and location of the vessel can affect the GPS performance. Typically calm clear conditions provide for a more accurate GPS fix. Vessels at extreme northerly or southerly latitudes may also receive a weaker GPS signal. GPS antenna mounted below decks will be more susceptible to performance issues related to the prevailing conditions.

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:

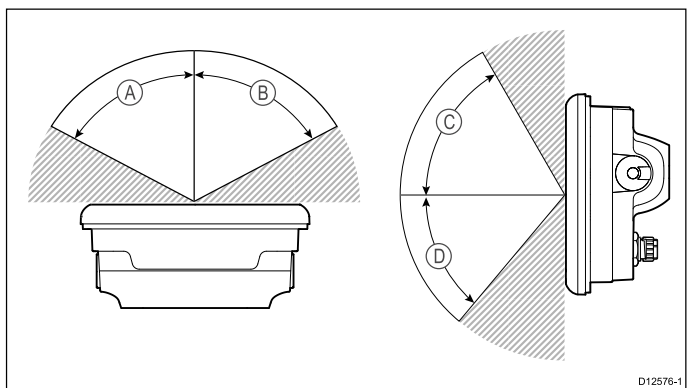
- Raymarine equipment and cables connected to it are:
 - At least 1 m (3 ft) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 7 ft (2 m).
 - More than 2 m (7 ft) from the path of a radar 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

Viewing angle considerations

As display contrast, color and night mode performance are all affected by the viewing angle, Raymarine recommends you temporarily power up the display when planning the installation, to enable you to best judge which location gives the optimum viewing angle.

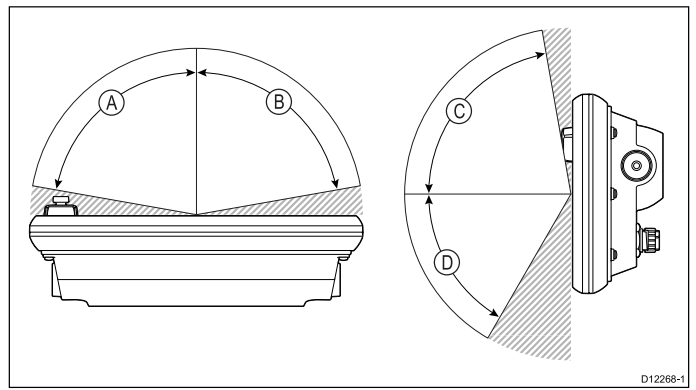
Viewing angle



	a6x	a7x	a9x	a12x
A (Right)	60°	75°	80°	80°
B (Left)	60°	75°	80°	80°
C (Up)	60°	70°	80°	80°
D (Down)	50°	75°	80°	80°

Note: The viewing angles stated above were taken using internationally agreed standards and should be used for comparison purposes only. Do NOT install the product before testing its viewability in the desired location.

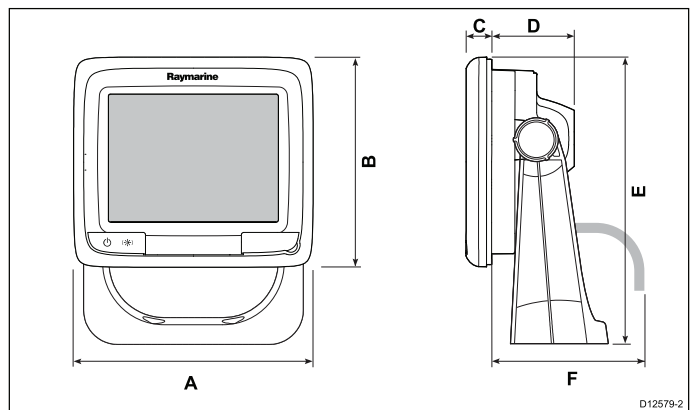
Viewing angle



	e7 / e7D	e95 / e97 / c95 / c97	e125 / e127 / c125 / c127	e165
A	70°	80°	80°	80°
B	70°	80°	80°	80°
C	70°	80°	80°	70°
D	50°	60°	60°	70°

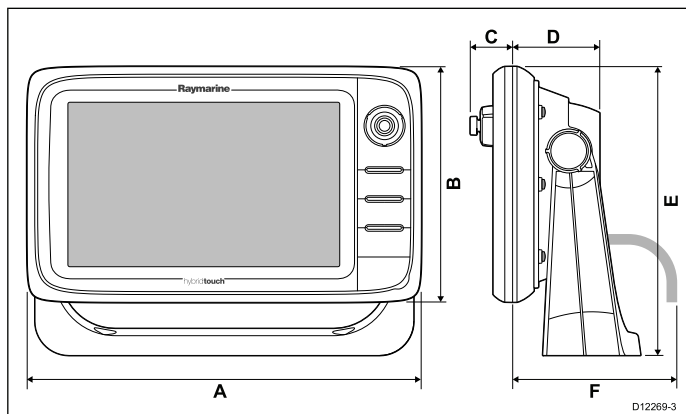
Note: The viewing angles stated above were taken using internationally agreed standards and should be used for comparison purposes only. Do NOT install the product before testing the viewability in the desired location.

a Series product dimensions



	a6x	a7x	a9x	a12x
A	163.6 mm (6.4 in.)	205.1 mm (8 in.)	250.1 mm (9.8 in.)	318 mm (12.5 in.)
B	143.5 mm (5.6 in.)	147.1 mm (5.8 in.)	189.5 mm (7.5 in.)	238.3 mm (9.4 in.)
C	17.5 mm (0.7 in.)	14.5 mm (0.57 in.)	14.5 mm (0.57 in.)	14.5 mm (0.57 in.)
D	56.6 mm (2.2 in.)	59.1 mm (2.3 in.)	68.1 mm (2.7 in.)	69.6 mm (2.7 in.)
E	162.4 mm (6.4 in.)	163.3 mm (6.4 in.)	198.26 mm (7.8 in.)	248.14 mm (9.8 in.)
F	150 mm (5.9 in.)	150 mm (5.9 in.)	150 mm (5.9 in.)	150 mm (5.9 in.)

c Series and e Series product dimensions



	e7 / e7D	e95 / e97 / c95 / c97	e125 / e127 / c125 / c127	e165
A	233 mm (9.17 in.)	289.6 mm (11.4 in.)	353.6 mm (13.92 in.)	426 mm (16.8 in.)
B	144 mm (5.67 in.)	173.1 mm (6.81 in.)	222 mm (8.74 in.)	281.4 mm (11.1 in.)
C	30 mm 1.18 in.)	31.4 mm (1.24 in.)	31.9 mm (1.26 in.)	31.4 mm (1.24 in.)
D	63.5 mm (2.5 in.)	63.9 mm (2.5 in.)	68.9 mm (2.71 in.)	69.8 mm (2.75 in.)
E	177 mm (6.97 in.)	212 mm (8.35 in.)	256.5 mm (10.1 in.)	292 mm (11.5 in.)
F	160 mm (6.29 in.)	160 mm (6.29 in.)	160 mm (6.29 in.)	160 mm (6.29 in.)

Chapter 4: Cables and connections

Chapter contents

- 4.1 General cabling guidance on page 36
- 4.2 Connections overview on page 37
- 4.3 a9x and a12x connections overview on page 38
- 4.4 3-pin power connection on page 38
- 4.5 Power and data (combined) connection on page 39
- 4.6 **SeaTalk^{ng}**® connections on page 41
- 4.7 NMEA 2000 connection on page 42
- 4.8 **SeaTalk** connection on page 43
- 4.9 NMEA 0183 connection — Power/NMEA/Video cable on page 43
- 4.10 a6x and a7x to NMEA 0183 DSC VHF radio connection on page 44
- 4.11 Sonar module and transducer connection on page 45
- 4.12 Radar network connection on page 46
- 4.13 GA150 connection on page 49
- 4.14 GNSS / GPS connection on page 49
- 4.15 AIS connection on page 50
- 4.16 Fastheading connection on page 50
- 4.17 Keypad network connection on page 51
- 4.18 Weather receiver connection on page 51
- 4.19 Video connection — composite on page 52
- 4.20 Video in-out connection on page 52
- 4.21 IP Camera connection on page 53
- 4.22 Thermal camera connection on page 54
- 4.23 Fusion network connection on page 56
- 4.24 Fusion **NMEA 2000** connection on page 56
- 4.25 Media player connection on page 57
- 4.26 Raymarine mobile app connection on page 57
- 4.27 Bluetooth remote control connection on page 58

4.1 General cabling guidance

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.

Cable types and length

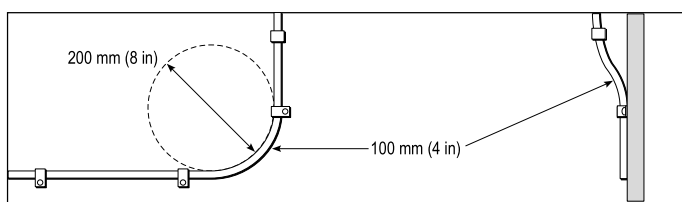
It is important to use cables of the appropriate type and length

- 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:

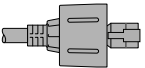
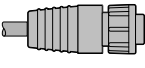
- Always use isolating transformers or a separate power-inverter to run PC's, processors, displays and other sensitive electronic instruments or devices.
- Always use an isolating transformer with Weather FAX audio cables.
- Always use an isolated power supply when using a 3rd party audio amplifier.
- 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).

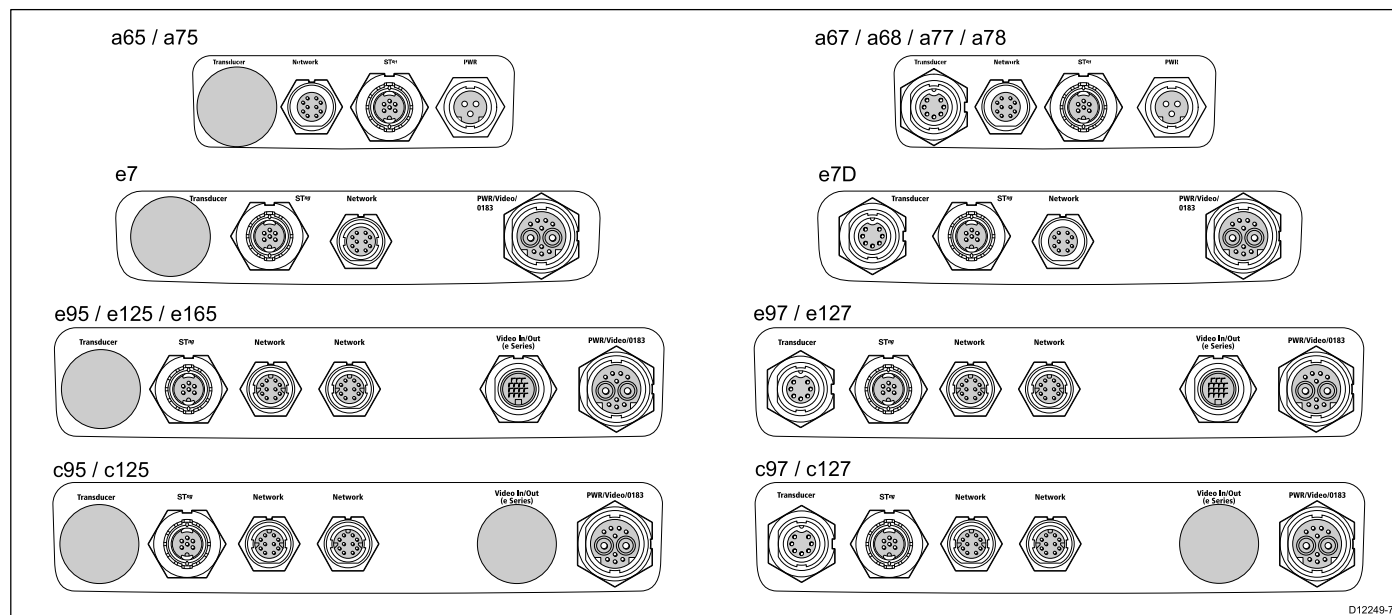
Network cable connector types

There are 2 types of network cable connector — SeaTalk^{hs} and RayNet.

	SeaTalk^{hs} connector — used for connecting SeaTalk ^{hs} devices to a Raymarine network switch via SeaTalk ^{hs} cables.
	RayNet connector — used for connecting Raymarine network switches and SeaTalk ^{hs} devices to the multifunction display via RayNet cables. Also required for connecting a crossover coupler if only one device is being connected to the display's Network connector.

4.2 Connections overview

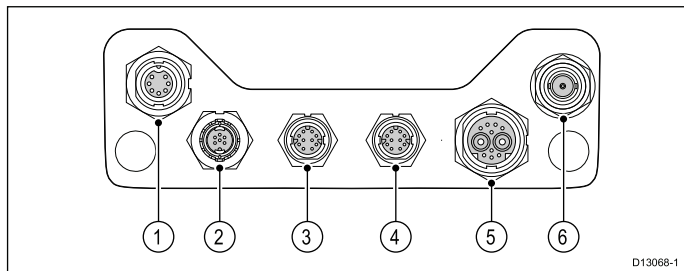
Details of the connections available on Raymarine multifunction displays are shown below.



	Transducer	DownVision transducer	SeaTalk ^{ng}	SeaTalk ^{hs} / RayNet Network 1	SeaTalk ^{hs} / RayNet Network 2	Video in / out	Power / Data	
							Power	Video / NMEA 0183
a65 a65 Wi-Fi	✗	✗	✓	✓	✗	✗	✓	✗
a67 a67 Wi-Fi	✓	✗	✓	✓	✗	✗	✓	✗
a68 a68 Wi-Fi	✗	✓	✓	✓	✗	✗	✓	✗
a75 a75 Wi-Fi	✗	✗	✓	✓	✗	✗	✓	✗
a77 a77 Wi-Fi	✓	✗	✓	✓	✗	✗	✓	✗
a78 a78 Wi-Fi	✗	✓	✓	✓	✗	✗	✓	✗
e7	✗	✗	✓	✓	✗	✗	✓	✓
e7D	✓	✗	✓	✓	✗	✗	✓	✓
e95	✗	✗	✓	✓	✓	✓	✓	✓
e97	✓	✗	✓	✓	✓	✓	✓	✓
e125	✗	✗	✓	✓	✓	✓	✓	✓
e127	✓	✗	✓	✓	✓	✓	✓	✓
e165	✗	✗	✓	✓	✓	✓	✓	✓
c95	✗	✗	✓	✓	✓	✗	✓	✓
c97	✓	✗	✓	✓	✓	✗	✓	✓
c125	✗	✗	✓	✓	✓	✗	✓	✓
c127	✓	✗	✓	✓	✓	✗	✓	✓

4.3 a9x and a12x connections overview

The a9x and a12x variant MFDs include the following connections.



1. Sonar transducer (a97 and a127) / DownVision™ transducer (a98 and a128)
2. SeaTalk^{ng}
3. Network 1 (RayNet)
4. Network 2 (RayNet)
5. Power and data
6. GA150 antenna

Connector and cable protective caps

Unused connectors and disconnected cables should be adequately protected against damage.

Important:

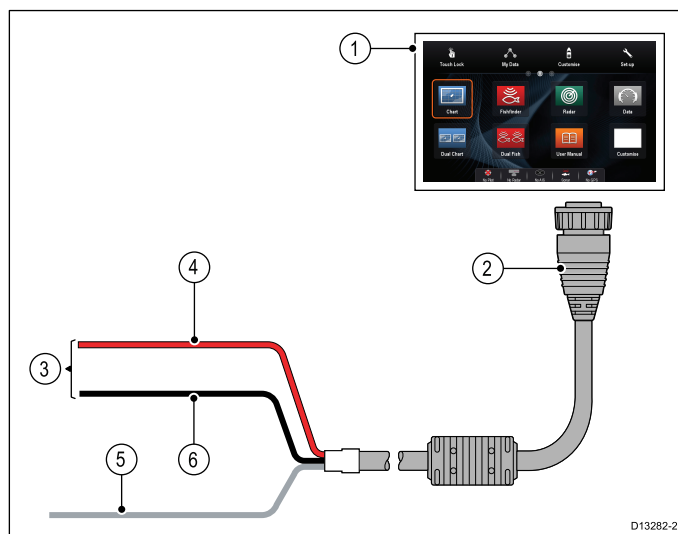
The rear connectors on your product are fitted with protective caps which should be securely fitted over any connectors that are not going to be used / connected.

If any cables are to be left disconnected then, if available use the cables protective cap or insulation tape to protect the cable connector.

4.4 3-pin power connection

The details below apply to **MFDs** that have a 3-pin power cable.

Refer to the *Connections Overview* section to establish the power connection for your **MFD**.



1. MFD
2. 3-pin power cable
3. Connection to power supply
4. Red cable (positive)
5. Ground (drain) wire
6. Black cable (negative)



Warning: Power supply voltage

The MFDs listed below are 12 V dc only products:

- a6x / a7x
- e7 / e7D

Do NOT connect these products to a 24 V power supply.

In-line fuse and thermal breaker ratings

The following in-line fuse and thermal breaker ratings apply to your product:

In-line fuse rating	Thermal breaker rating
5 A	3 A (if only connecting one device)

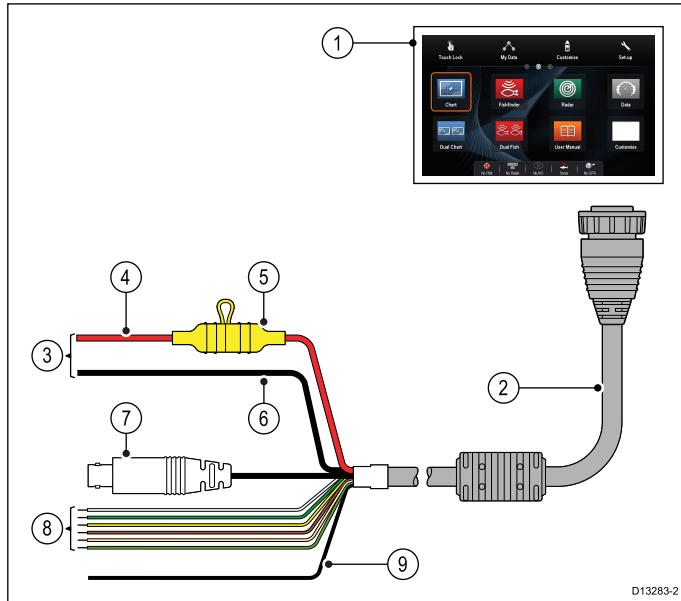
Note:

- The suitable fuse rating for the thermal breaker is dependent on the number of devices you are connecting. If in doubt consult an authorized Raymarine dealer.
- Your product's power cable may have a fitted in-line fuse, if not then you must add an in-line fuse / breaker to the positive wire of your products power connection.

4.5 Power and data (combined) connection

The details below apply to **MFDs** that have a combined power/NMEA/video cable.

Refer to the *Connections Overview* section to establish the power connection for your **MFD**.



1. **MFD**
2. Combined Power and data cable
3. Connection to vessel's 12 V / 24 V dc power supply
4. Red cable (positive)
5. Fuse
6. Black cable (negative)
7. Video input cable
8. NMEA 0183 data cables
9. Ground (drain) wire



Warning: Power supply voltage

The MFDs listed below are 12 V dc only products:

- **a6x / a7x**
- **e7 / e7D**

Do NOT connect these products to a 24 V power supply.

In-line fuse and thermal breaker ratings

The following in-line fuse and thermal breaker ratings apply to your product:

In-line fuse rating	Thermal breaker rating
15 A	15 A (if only connecting one device)

Note:

- The suitable fuse rating for the thermal breaker is dependent on the number of devices you are connecting. If in doubt consult an authorized Raymarine dealer.
- Your product's power cable may have fitted in-line fuse, if not then you can add an in-line fuse to the positive wire of your products power connection.

Power distribution

Recommendations and best practice.

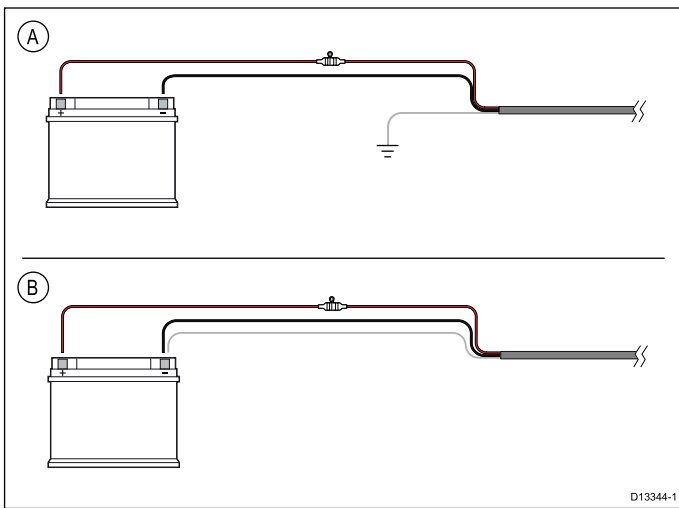
- The product is supplied with a power cable. Only use the power cable supplied with the product. Do NOT use a power cable designed for, or supplied with, a different product.
- Refer to the *Power connection* section for more information on how to identify the wires in your product's power cable, and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

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

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.

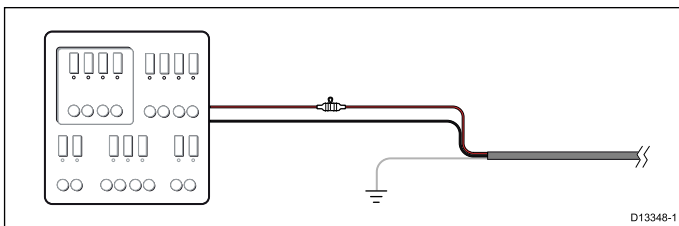
Implementation — direct connection to battery

- The power cable supplied with your product may be connected directly to the vessel's battery, via a suitably rated fuse or breaker.
- The power cable supplied with your product may NOT include a separate drain wire. If this is the case, only the power cable's red and black wires need to be connected.
- If the supplied power cable is NOT fitted with an inline fuse, you MUST fit a suitably rated fuse or breaker between the red wire and the battery's positive terminal.
- Refer to the inline fuse ratings provided in the product's documentation.
- If you need to extend the length of the power cable supplied with your product, ensure you observe the dedicated *Power cable extensions* advice provided in the product's documentation.



A	Battery connection scenario A: suitable for a vessel with a common RF ground point. In this scenario, if your product's power cable is supplied with a separate drain wire 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's power cable is supplied with a separate drain wire then it should be connected directly to the battery's negative terminal.

Implementation — connection to distribution panel



- Alternatively, the supplied power cable may be connected to a suitable breaker or switch on the vessel's distribution panel or factory-fitted power distribution point.
- The distribution point should be fed from the vessel's primary power source by 8 AWG (8.36 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.
- In all cases, observe the recommended breaker / fuse ratings provided in the product's documentation.
- If you need to extend the length of the power cable supplied with your product, ensure you observe the dedicated *Power cable extensions* advice provided in the product's documentation.

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 separate grounding advice provided in the product's documentation.

More information

Raymarine recommends 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

Power cable extension

The product is supplied with a power cable, which can be extended if required.

- The power cable for each unit in your system should be run as a separate, single length of 2-wire cable from the unit to the vessel's battery or distribution panel.
- Raymarine recommends a **minimum** wire gauge of 18AWG (0.82 mm²) for any length of cable extension.
- For all lengths of extension to the power cable, ensure there is a continuous **minimum** voltage at the product's power connector of 10.8 V with a fully flat battery at 11 V.

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.

Grounding — Dedicated drain wire

The power cable supplied with this product includes a dedicated shield (drain) wire for connection to a vessel's RF ground point.

It is important that an effective RF ground is connected to the system. A single ground point should be used for all equipment. The unit can be grounded by connecting the shield (drain) wire of the power cable to the vessel's RF ground point. On vessels without an RF ground system the shield (drain) wire 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.
- Floating, with neither battery terminal connected to the vessel's ground



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.

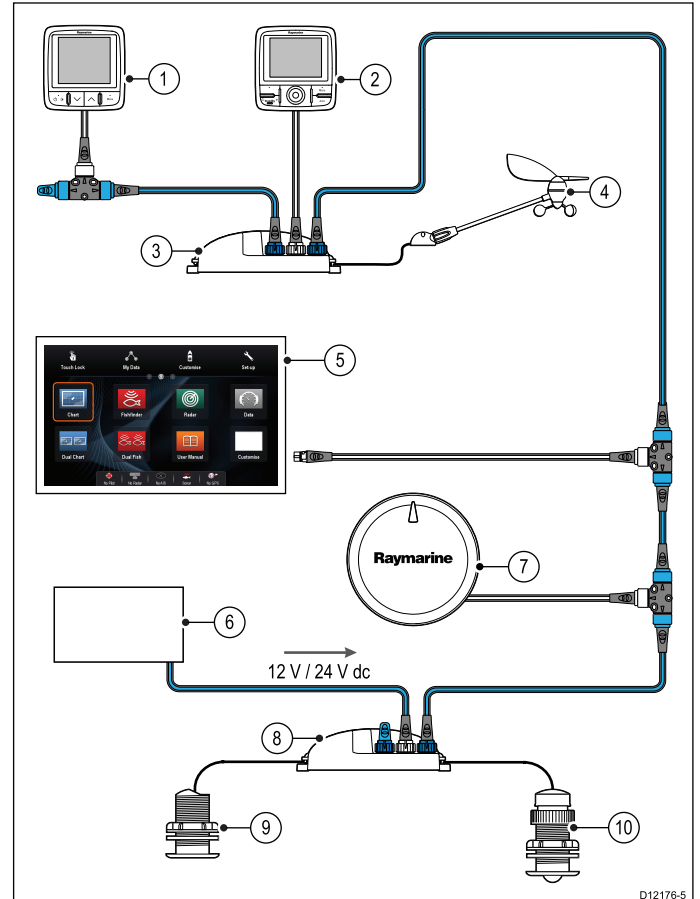
4.6 SeaTalk^{ng}® connections

The **MFD** can connect to a **SeaTalk^{ng}®** backbone.

SeaTalk^{ng}® can be used to communicate with:

- **SeaTalk^{ng}®** instruments
- SeaTalk**SeaTalk^{ng}®** autopilots
- **SeaTalk** equipment via the optional **SeaTalk** to **SeaTalk^{ng}®** converter
- **NMEA 2000** equipment via optional **DeviceNet** adaptor cables

Typical SeaTalk^{ng}® system



1. **SeaTalk^{ng}®** instrument
2. **SeaTalk^{ng}®** pilot control head
3. iTC-5 converter
4. Wind transducer
5. **MFD**
6. Power supply
7. **SeaTalk^{ng}®** autopilot
8. iTC-5 converter
9. Depth transducer
10. Speed transducer

For details of SeaTalk^{ng} cabling please refer to [Chapter 10 Spares and accessories](#).

SeaTalk^{ng} power requirements

The SeaTalk^{ng} bus requires a 12 V power supply.

Power may be provided from:

- Raymarine equipment with a regulated 12 V power supply (for example, a SmartPilot SPX course computer); or:

- Other suitable 12 V power supply.

Note: SeaTalk^{ng} does NOT supply power to multifunction displays and other equipment with a dedicated power supply input.

4.7 NMEA 2000 connection

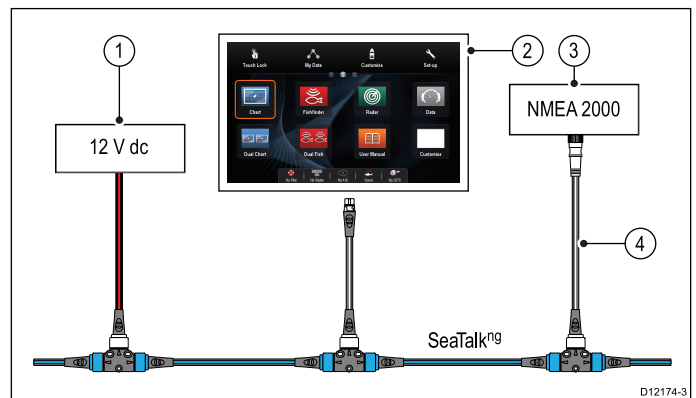
The display can receive data from **NMEA 2000** devices (e.g. data from compatible engines). The **NMEA 2000** connection is made using **SeaTalk^{ng}**® and appropriate adaptor cables.

You can EITHER:

- Use your **SeaTalk^{ng}**® backbone and connect each **NMEA 2000** device on a spur, OR
- connect the display on a spur into an existing **NMEA 2000** backbone.

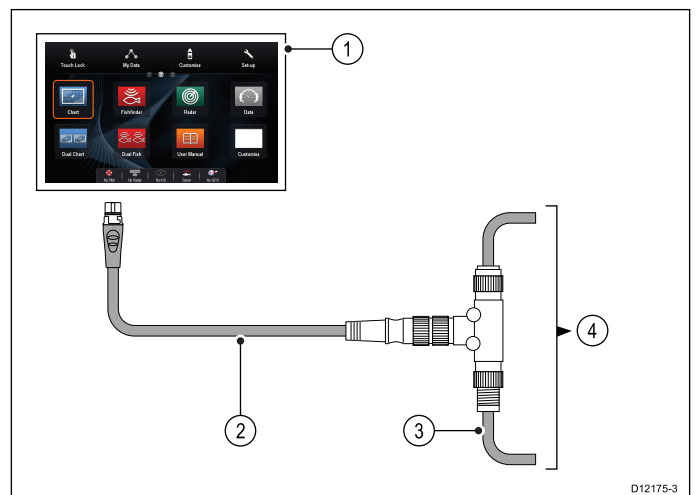
Important: You cannot have 2 backbones connected together.

Connecting NMEA 2000 equipment to the SeaTalk^{ng}® backbone



1. 12 V supply into backbone
2. MFD
3. NMEA 2000 device
4. SeaTalk^{ng}® to DeviceNet adaptor cable

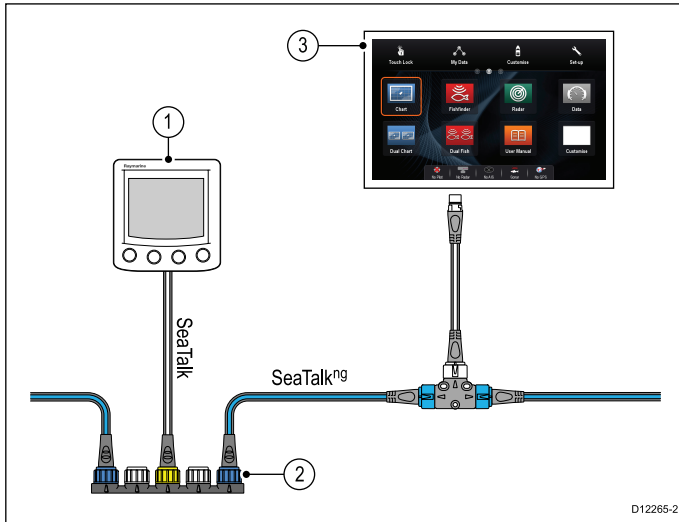
Connecting the display to an existing NMEA 2000 (DeviceNet) backbone



1. MFD
2. SeaTalk^{ng}® to DeviceNet adaptor cable
3. DeviceNet backbone
4. NMEA 2000 equipment

4.8 SeaTalk connection

You can connect **SeaTalk** devices to your MFD using the optional **SeaTalk to SeaTalk^{ng}** converter.

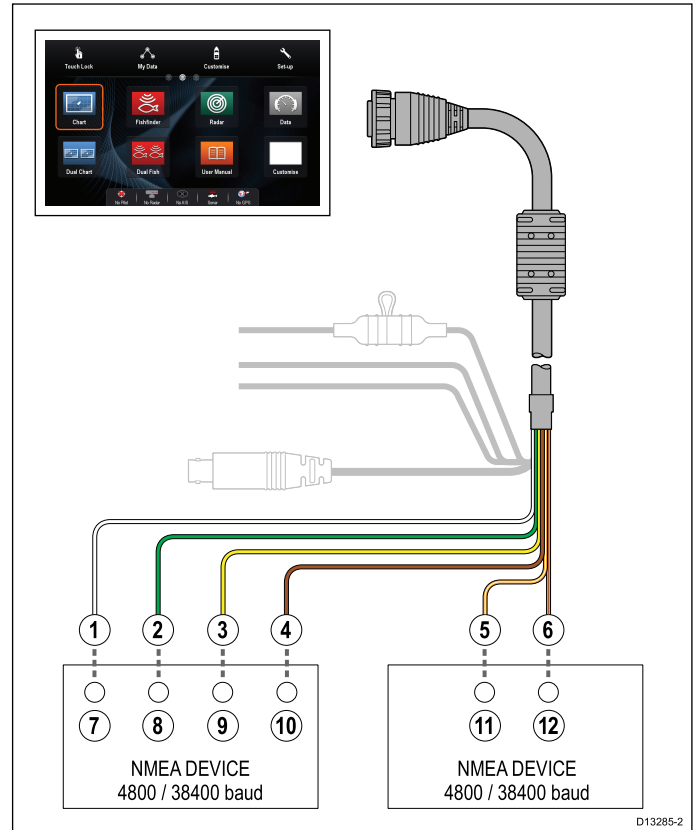


1. **SeaTalk** device
2. **SeaTalk to SeaTalk^{ng}** converter
3. **MFD**

4.9 NMEA 0183 connection — Power/NMEA/Video cable

NMEA 0183 devices can be connected directly to **MFDs** with a combined **Power/NMEA/Video** cable.

Refer to the *Connection Overview* section to establish the **NMEA 0183** connection method for your **MFD**.



2 **NMEA 0183** ports are available:

- **Port 1:** Input and output, 4800 or 38400 baud rate.
- **Port 2:** Input only, 4800 or 38400 baud rate.

The baud rate for each input port must be specified in the **System Settings** menu (**Homescreen > Set-up > System Settings > NMEA Set-up > NMEA Input Port**).

Note: For Port 1, both the input and output communicate at the same baud rate. For example, if you have one **NMEA 0183** device connected to Port 1 INPUT, and another **NMEA 0183** device connected to Port 1 OUTPUT, both NMEA devices must use the same baud rate.

You can connect up to 4 devices to the display's output port and 2 devices to the display's input ports.

Item	Device	Cable color	Port	Input / output	Positive (+) / negative (-)
1	Multifunction display	White	1	Input	Positive
2		Green	1	Input	Negative
3		Yellow	1	Output	Positive
4		Brown	1	Output	Negative

Item	Device	Cable color	Port	Input / output	Positive (+) / negative (-)
5		Orange / white	2	Input	Positive
6		Orange / green	2	Input	Negative
7	NMEA device	*	*	Output	Positive
8		*	*	Output	Negative
9		*	*	Input	Positive
10		*	*	Input	Negative
11	NMEA device	*	*	Output	Positive
12		*	*	Output	Negative

Note: * Refer to instructions provided with the NMEA 0183 device.

NMEA 0183 cable

You can extend the NMEA 0183 wires within the supplied power and data cable.

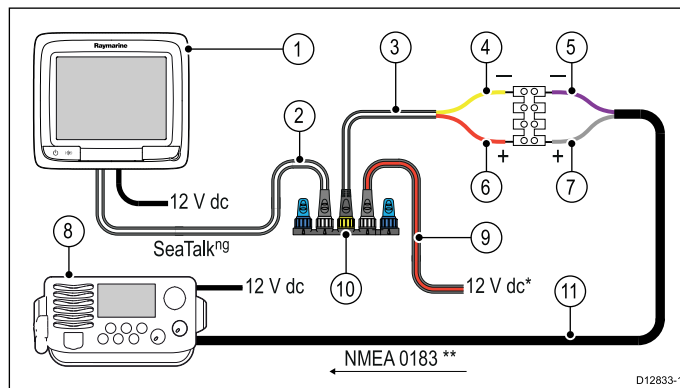
Data cable extension

Total length (max)	Cable
Up to 5 m	High quality data cable: <ul style="list-style-type: none"> • 2 x twisted pair with overall shield. • 50 to 75 pF/m capacitance core to core.

4.10 a6x and a7x to NMEA 0183 DSC VHF radio connection

To connect an a6x and a7x variant MFDs to an NMEA 0183 DSC radio a **SeaTalk^{ng}** to NMEA 0183 converter must be used to convert the **SeaTalk^{ng}** messages to NMEA 0183 messages.

The MFD and converter must be connected to the same **SeaTalk^{ng}** backbone.



1	a6x / a7x MFD
2	SeaTalk^{ng} spur cable
3	SeaTalk^{ng} to NMEA 0183 bare wires spur cable
4	Converter NMEA 0183 negative connection (yellow wire)
5	NMEA 0183 device input negative connection (purple wire)
6	Converter NMEA 0183 positive connection (red wire)
7	NMEA 0183 device input positive connection (grey wire)
8	NMEA 0183 DSC VHF Radio
9	SeaTalk^{ng} power cable (only required if not connecting to an existing powered SeaTalk^{ng} backbone).
10	Converter
11	NMEA 0183 connection (use cable supplied with VHF radio)

Note: The connection at the VHF radio must be to the NMEA 0183 input only. It is a uni-directional (one-way) connection.

4.11 Sonar module and transducer connection

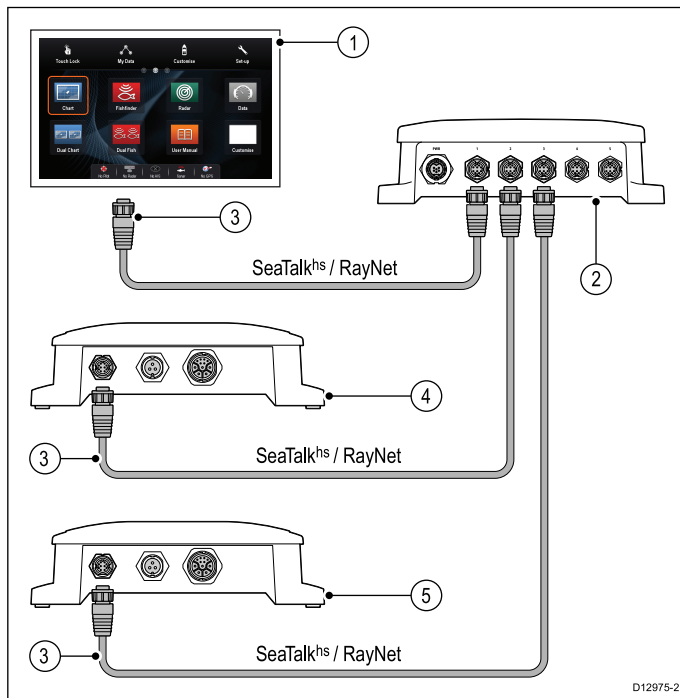
External sonar modules can be connected directly to the display's network connection or can be connected to the **SeaTalk^{hs}** network, via a **Raymarine[®]** network switch.

2 connections are required:

- **Network connection** — transmits the sonar data to a compatible **Raymarine[®]** MFD.
- **Transducer connection** — Internal and external sonar modules require connection to a compatible transducer. Internal 600 W and internal **CHIRP DownVision™** sonar variant displays feature a built-in module, enabling a compatible transducer to be connected directly to the display.

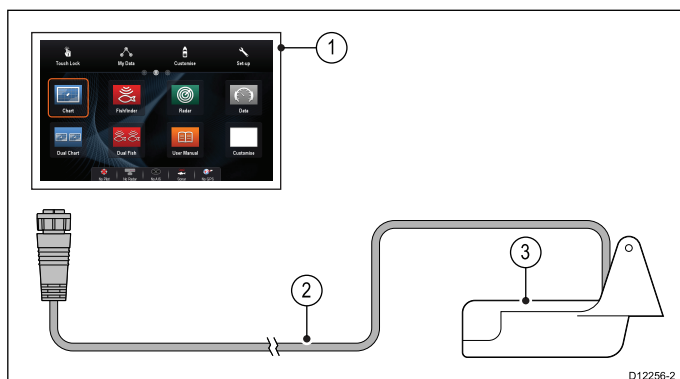
Network connection

Multiple sonar modules can be connected to the same network.



1. MFD
2. **Raymarine[®]** network switch
3. **RayNet** network cables
4. Sonar module 1 (e.g. **CHIRP** sonar module)
5. Sonar module 2 (e.g. **CHIRP DownVision™** sonar module)

Transducer connection — Internal 600 W MFD direct connection

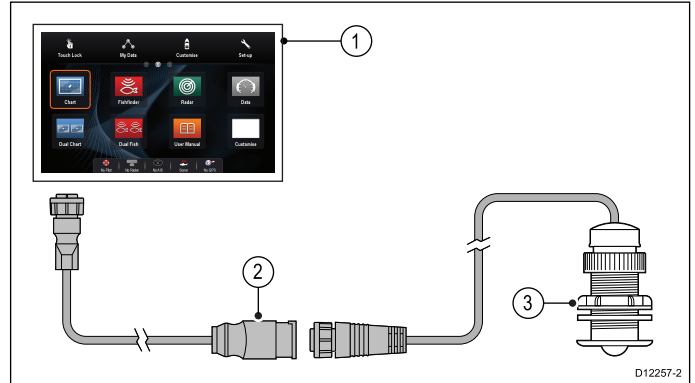


1. 600 W sonar variant MFD
2. 600 W MFD transducer

Refer to [10.3 Digital ClearPulse Transducers and accessories](#) for a list of transducer that can be connected directly to 600 W internal sonar variant MFDs.

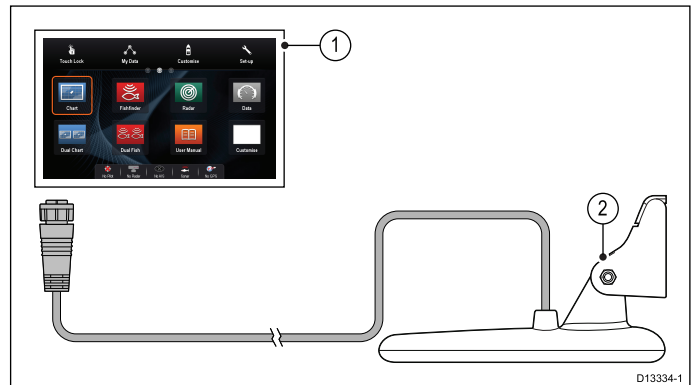
Transducer connection – Internal 600 W MFD connection via optional adaptor cable

An optional adaptor cable is available to allow connection of external sonar module transducers to internal 600 W variant MFDs.



1. 600 W sonar variant MFD
2. Adaptor cable (E66066)
3. 600 W external sonar module transducer.

Transducer connection — CHIRP DownVision™ MFD direct connection

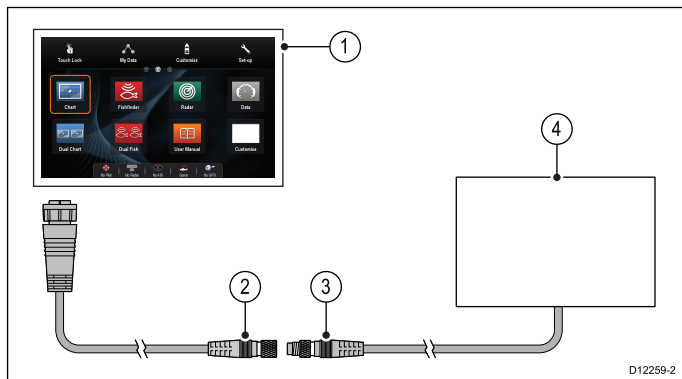


1. **CHIRP DownVision™** sonar variant MFD
2. **CHIRP DownVision™** Transducer

Refer to [10.4 DownVision™ transducers and accessories](#) for a list of transducer that can be connected directly to **CHIRP DownVision™** sonar variant MFDs.

Note: The **CPT200 SideVision™** transducer cannot be connected directly to a **DownVision™** variant MFD.

Transducer connection — Minn Kota transducer



1. 600 W sonar variant **MFD**
2. Minn Kota transducer adaptor cable (A62363)
3. Minn Kota transducer cable
4. Minn Kota transducer

For further information regarding sonar module installation (including power connection and mounting), refer to the installation instructions supplied with the sonar module.

Sonar variant multifunction displays

600 W sonar variants	CHIRP DownVision™ variants
a67	a68
a77	a78
a97	a98
a127	a128
c97	eS78
c127	eS98
e7D	eS128
e97	
e127	
eS77	
eS97	
eS127	

Important software requirements for multiple sonar systems

If your system includes more than one source of sonar data you must ensure that any CP300 or CP450C sonar modules are running software version **v4.04** or later.

This applies to systems which include:

- Any number of MFD(s) with an internal sonar module plus a CP300 and / or CP450C sonar module; or
- No MFD(s) with an internal sonar module, but more than one CP300 or CP450C sonar module.

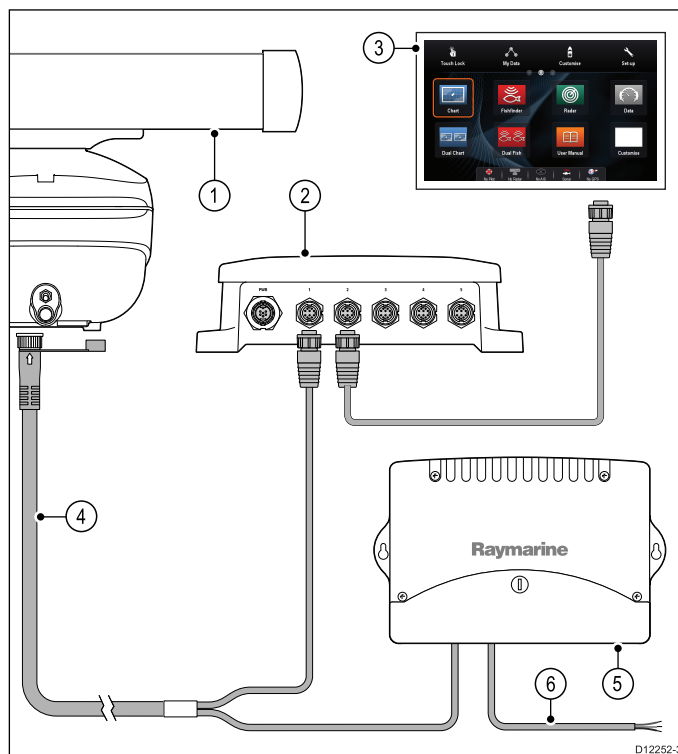
This does NOT apply to any systems that do NOT include a CP300 or CP450C sonar module.

Note: For software downloads and instructions on how to update the software for your product(s), visit www.raymarine.com/software.

4.12 Radar network connection

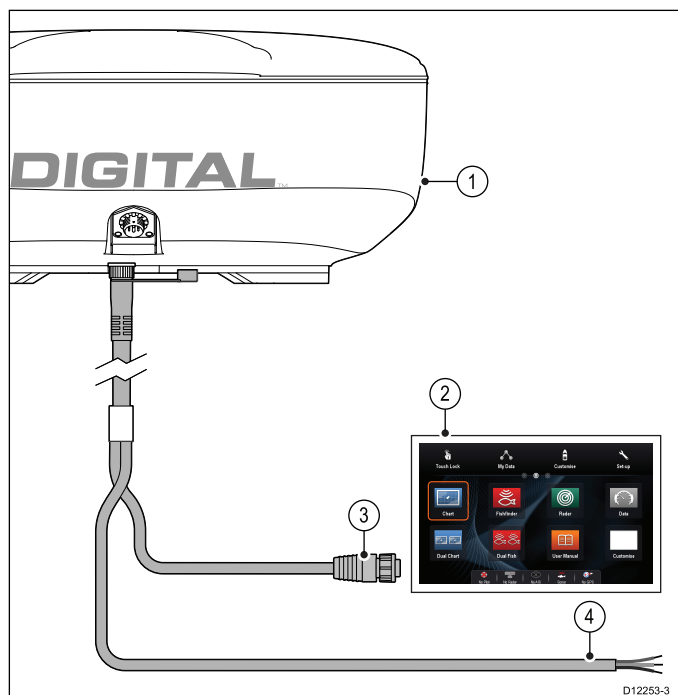
Radar units are connected to the **SeaTalk^{hs}** network, usually via a **Raymarine®** network switch. On smaller systems the Radar may be connected directly to the display's network connection.

Radar connected via network switch



1. Radar scanner
2. **Raymarine®** network switch
3. **MFD**
4. **RayNet** Radar cable
5. VCM (Voltage Converter Module) — (required for Open Arrays)
6. Power connection

Radar connected directly to the display



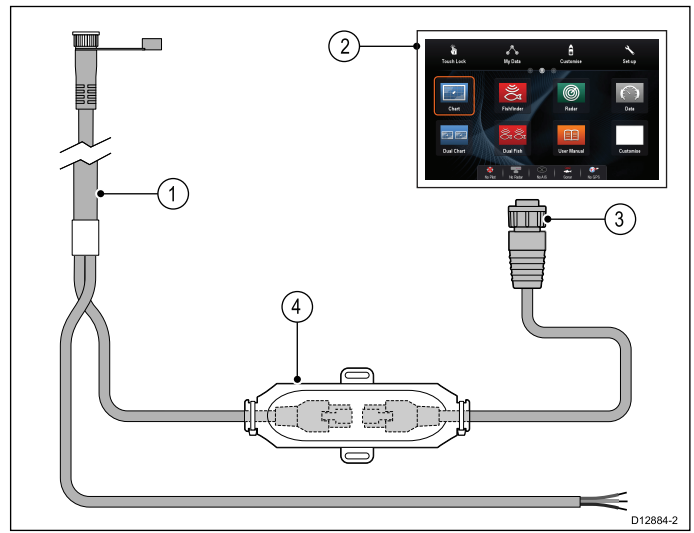
1. Radar scanner

2. **MFD**
3. Network connection to **MFD (RayNet Radar cable)**
4. Power connection

Note: Open array scanners require a VCM.

RJ45 SeaTalk^{hs} Radar cable connection

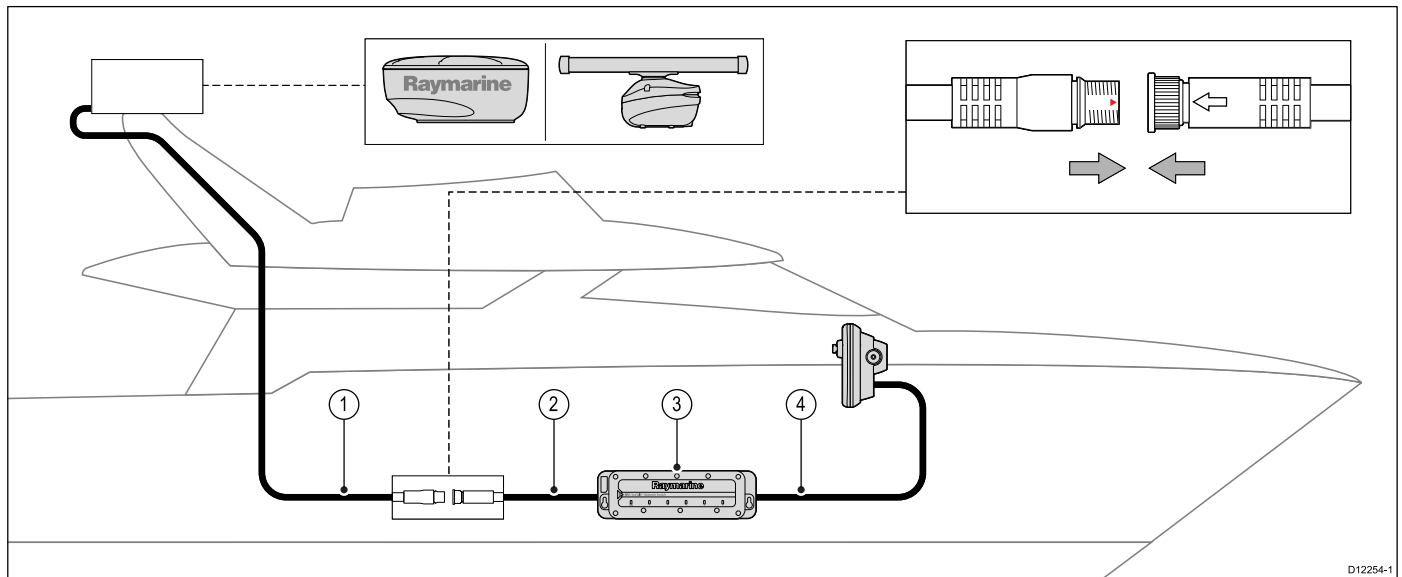
To connect a Radar using an RJ45 SeaTalk^{hs} Radar cable additional accessories are required.



1. RJ45 **SeaTalk^{hs}** Radar cable
2. **MFD**
3. Network connection to **MFD (RayNet to RJ45 SeaTalk^{hs} adaptor cable)**
4. **SeaTalk^{hs}** crossover coupler

Radar cable extension

For longer cable runs a Radar power and data digital cable extension is required.



1. Radar extension cable.
2. Radar power and data digital cable.
3. **Raymarine®** network switch (or crossover coupler if connecting Radar directly to display).
4. **RayNet** cable (or **RayNet to SeaTalk^{hs}** cable, if connecting via a crossover coupler)

Note: The power connection is NOT shown in the diagram. If using an Open Array scanner a VCM (Voltage Converter Module) must be connected between the scanner and the power supply.

For further information regarding Radar installation (including power connections and mounting), refer to the installation instructions supplied with the Radar.

Digital radar cables

You will need a dedicated radar power and data digital cable and appropriate network cables to connect your scanner to your system.

Connection	Required cable
Radar scanner to power supply and Raymarine network switch.	Power and data digital cable. For longer cable runs, extensions are available in a variety of lengths.
Raymarine network switch to multifunction display.	Network cables, available in a variety of cable lengths.

SeaTalk^{hs} Radar power and data digital cables

These cables contain the wires for a scanner's power and data connections.

Cable	Part number
RJ45 SeaTalk ^{hs} 5 m (16.4 ft) Power and data digital cable	A55076D
RJ45 SeaTalk ^{hs} 10 m (32.8 ft) Power and data digital cable	A55077D
RJ45 SeaTalk ^{hs} 15 m (49.2 ft) Power and data digital cable	A55078D
RJ45 SeaTalk ^{hs} 25 m (82.0 ft) Power and data digital cable	A55079D

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

RayNet Radar power and data digital cables

These cables contain the wires for a scanner's power and data connections.

Cable	Part number
RayNet 5 m (16.4 ft) Power and data digital cable	A80227
RayNet 10 m (32.8 ft) Power and data digital cable	A80228
RayNet 15 m (49.2 ft) Power and data digital cable	A80229
RayNet 25 m (82.0 ft) Power and data digital cable	A80230

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

Radar power and data digital extension cables

These cables extend the power and data digital cables for a scanner's power and data connections.

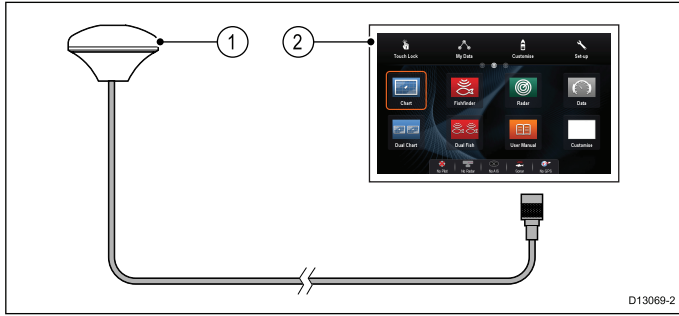
Cable	Part number
2.5 m (8.2 ft) Power and data digital cable	A92141D
5 m (16.4 ft) Power and data digital cable	A55080D
10 m (32.8 ft) Power and data digital cable	A55081D

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

4.13 GA150 connection

If your **MFD** has a **GA150** connection, the external antenna can be connected to help improve the GNSS (GPS / GLONASS) receiver's reception.

Refer to the *Connection Overview* section to establish if your **MFD** can be connected to a **GA150**.



1. GA150 external antenna
2. **MFD**

For installation details for your external antenna, refer to the documentation that accompanied the antenna.

Antenna cable length

The GA150 is supplied with a fitted 10 m (33 ft.) cable. The length of the antenna cable can be extended if required.

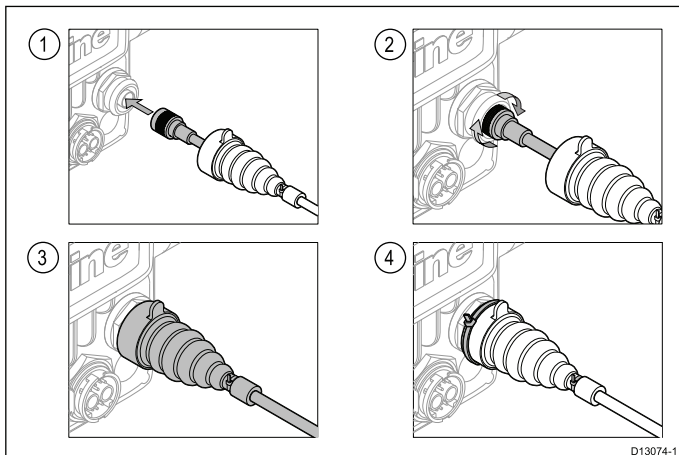
The antenna cable length can be extended by up to 10 m (33 ft.) giving a total maximum cable length of 20 m (66 ft.)

50 ohm coaxial cable and reliable connectors (offering protection against water ingress) must be used when extending the antenna cable.

Note: Extending the cable length by more than the recommended maximum length will result in signal degradation.

Connecting an external antenna

Follow the steps below to connect the GA150 external antenna.

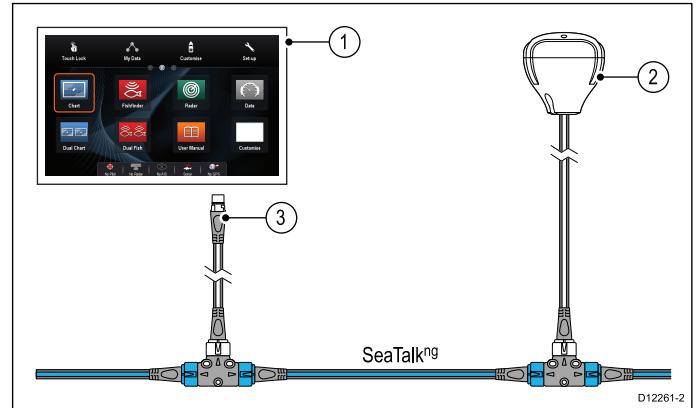


1. Fully insert the antenna's cable connector into the GA150 connector on the rear of your display.
2. Turn the locking collar clockwise until **TIGHT**.
3. Push to protective boot over the connection on the back of the display.
4. Use the supplied cable tie to secure the protective boot over the connection.

4.14 GNSS / GPS connection

Depending on display variant, your multifunction display may include an internal GNSS or GPS receiver. If required the multifunction display can also be connected to an external GNSS / GPS receiver, using **SeaTalk^{ng}** or **NMEA 0183**.

GNSS / GPS connection — SeaTalk^{ng}



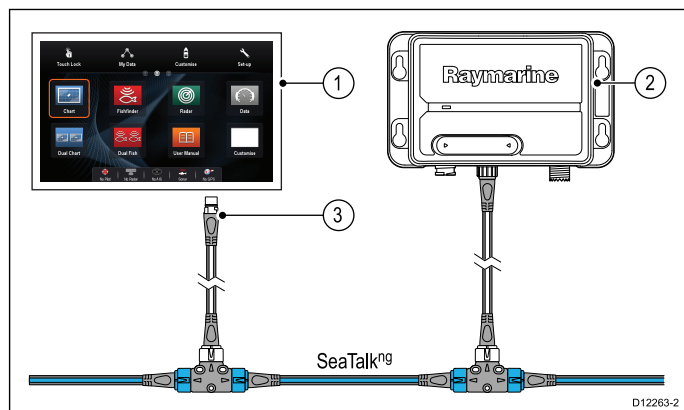
1. **MFD**
2. **SeaTalk^{ng}** connection to **MFD**.
3. **SeaTalk^{ng}** GNSS / GPS receiver.

An **NMEA 0183** GNSS / GPS receiver can be connected to the **MFD** by following the details provided in section [4.9 NMEA 0183 connection — Power/NMEA/Video cable](#) and the installation instructions provided with the unit.

4.15 AIS connection

A compatible AIS unit can be connected using **SeaTalk^{ng}**® or **NMEA 0183**.

Connection using SeaTalk^{ng}



1. **MFD**
2. **SeaTalk^{ng}**® connection to **MFD**.
3. **SeaTalk^{ng}** AIS receiver / transceiver.

An AIS unit can be connected to the **MFD** by following the details provided in section [4.9 NMEA 0183 connection — Power/NMEA/Video cable](#) and the installation instructions provided with the unit.

4.16 Fastheading connection

If you wish to use MARPA (radar target acquisition) functions on your multifunction display you need either:

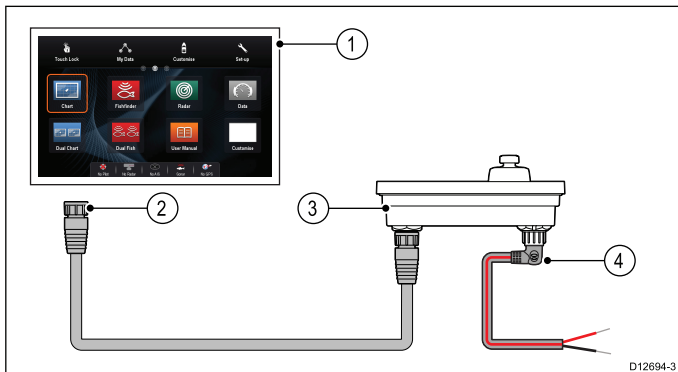
- An autopilot connected to the multifunction display via SeaTalk^{ng} or NMEA 0183. The compass is connected to the course computer and calibrated via the pilot control head; or:
- A Raymarine or third-party fastheading sensor connected to the multifunction display via NMEA 0183.

Note: Please contact your dealer or Raymarine technical support for more information.

4.17 Keypad network connection

Raymarine® remote keypads (e.g. the **RMK-9**) can be connected directly to the display's network connection or can be connected to the **SeaTalk^{hs}** network, via a **Raymarine®** network switch.

Multiple keypads can be connected to a system, with each keypad capable of controlling up to 4 **MFDs**.



1. **MFD**
2. Network connection to **MFD** or **Raymarine®** network switch (**RayNet** cable)
3. **RMK-9** Keypad
4. Alternate power connection (Right angled power cable)

Note:

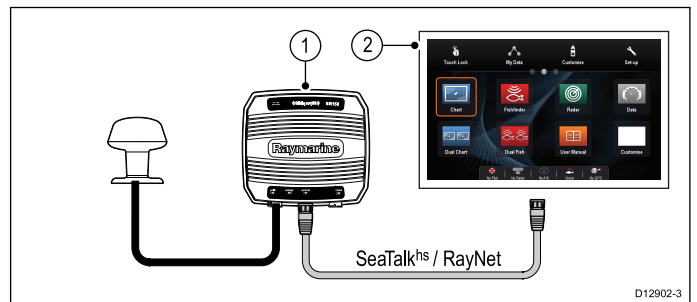
- a. When connecting the keypad directly to the **MFD**, unless the **MFD** is capable of providing power over ethernet the keypad must be powered separately, using the alternate power connection.
- b. When connecting the keypad via a network switch the keypad must be powered separately, using the alternate power connection.

For further information regarding keypad installation (including power connection and mounting), refer to the installation instructions supplied with the keypad.

Once connected the keypad must be paired with the each **MFD** you want it to control.

4.18 Weather receiver connection

A Sirius XM weather receiver can be connected directly to the display's network connection or can be connected to the **SeaTalk^{hs}** network, via a **Raymarine®** network switch.



1. Raymarine weather receiver
2. **MFD**

For information on connecting an SR50 using SeaTalk^{ng} please refer to 82257 – *SR50 operation* which can be downloaded from the Raymarine website: www.raymarine.com.

For further information regarding weather receiver installation (including power connection and mounting), refer to the installation instructions supplied with the weather receiver.

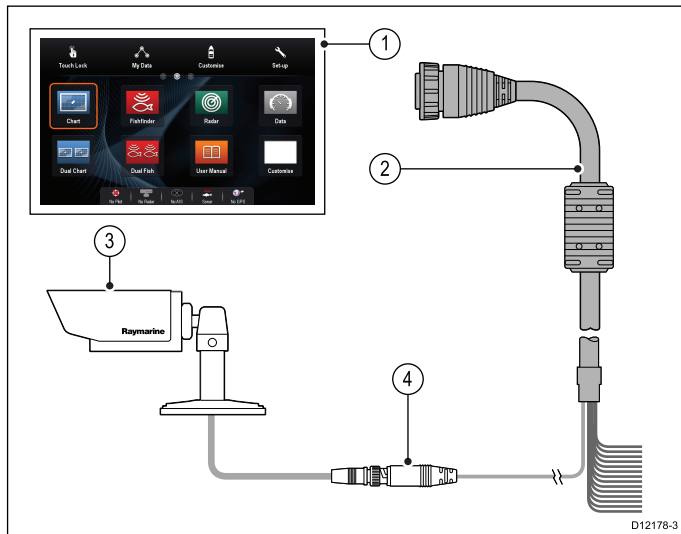
Note: You must select your Raymarine Weather receiver in the **Weather Set-up** menu: (**Homescreen > Set-up > System Settings > External Devices > Weather Set-up**).

4.19 Video connection — composite

Analog cameras can be connected directly to **MFDs** that have a composite video input connection.

Refer to the *Connection Overview* section to establish if your **MFD** has a composite video input.

MFDs that do not have a composite video input connection can only be connected to IP cameras.



1. **MFD**
2. Connection to **MFD** (Power/NMEA/Video cable)
3. BNC video connector
4. Camera (video source)

Examples of other video sources that you can connect to the video in put connection:

- Thermal camera
- DVD player
- Portable media player

Note: To listen to audio, any connected player will require external speakers to be connected to the player's audio output.

4.20 Video in-out connection

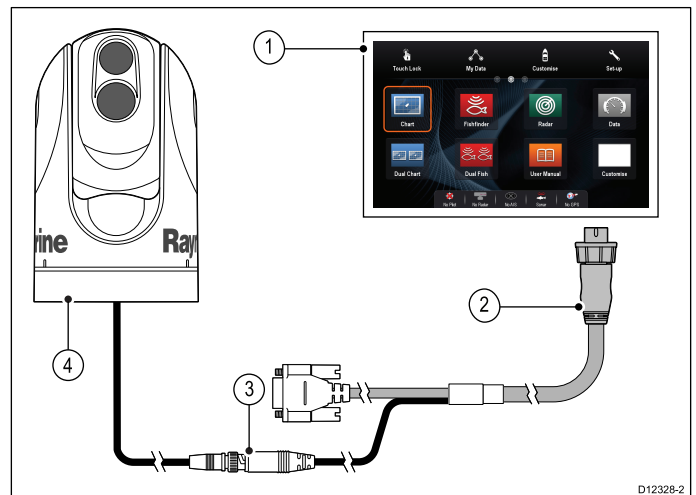
A camera / video device or external display can be connected to **MFDs** that have a dedicated video in/out connection.

Refer to the *Connections overview* section to establish if your **MFD** has the Video in/out connector.

Video In

Examples of video input sources that you can connect to the display include:

- Video camera
- Thermal camera
- DVD player
- Portable digital video player



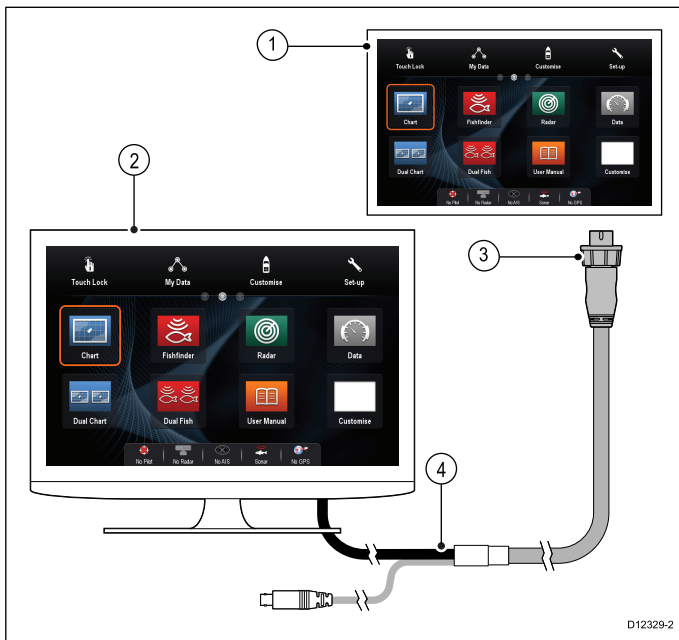
1. **MFD**
2. Video accessory cable
3. BNC video connector
4. Video source (e.g. Thermal camera)

Note: To listen to a movie's audio track, any connected DVD or digital video player will require speakers to be connected to the players audio output.

Video out

Examples of video output devices that you can connect to the display include:

- HDTV with VGA input
- VGA monitor



1. MFD
2. Video accessory cable
3. VGA cable to external display
4. External display (e.g. HDTV)

Video specification

Signal type	Composite
Format	PAL or NTSC
Connector type	BNC (female)
Output resolution	720p

e9 and e12 Video cables

The following video cable is required for the video in / out connector on the e95 / e97 / e125 / e127 variant multifunction displays.

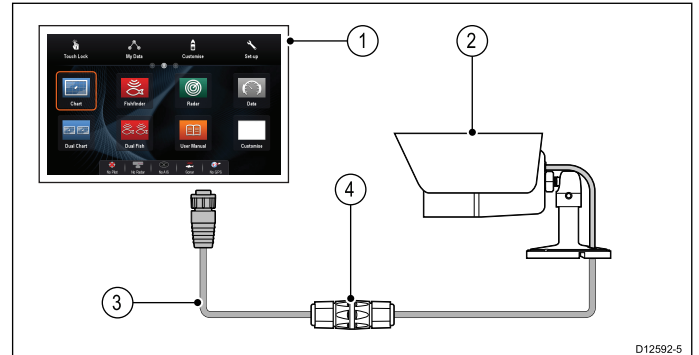
Part number	Description	Notes
R70003	5 m (16.4 ft.) Video cable for e9 and e12 (1 x video in and 1 x video out VGA)	

4.21 IP Camera connection

Raymarine® IP cameras can be connected directly to the display's network connection or can be connected to the **SeaTalk^{hs}** network, via a **Raymarine®** network switch.

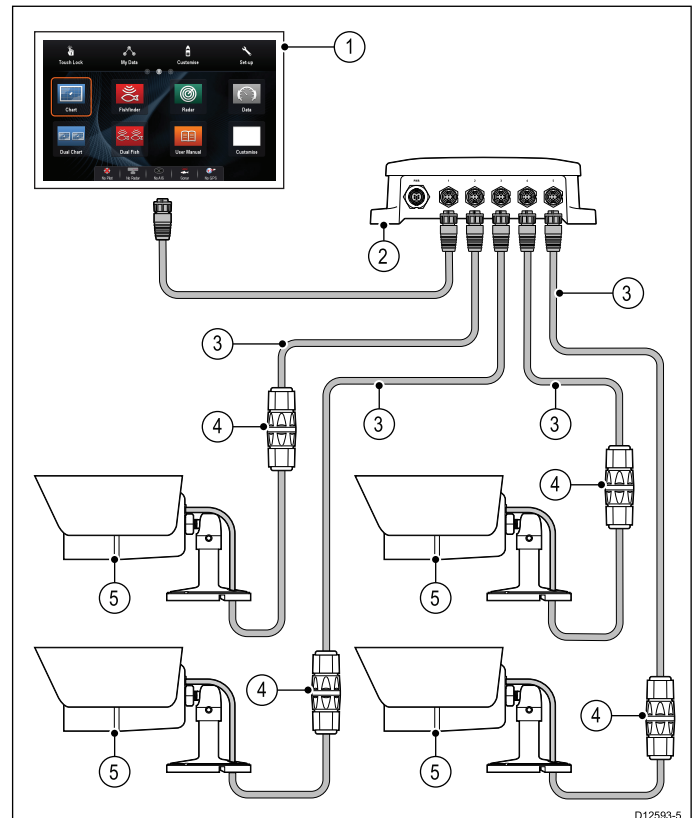
The network connection transmits the video signal to a compatible **Raymarine®** MFD.

IP camera direct connection



1. MFD
2. CAM200IP
3. RayNet to RJ45 SeaTalk^{hs} adaptor cable
4. Ethernet coupler (R32142)

IP camera network connection



1. MFD
2. Raymarine® network switch
3. RayNet to RJ45 SeaTalk^{hs} adaptor cable
4. Ethernet coupler (R32142)
5. CAM200IP

Important: If your IP camera(s) are not detected by your multifunction display, try power cycling the IP camera(s) whilst leaving your multifunction display powered up.

For further information regarding camera installation (including power connection and mounting), refer to the installation instructions supplied with the camera.

IP camera guidance

Raymarine® MFDs are capable of displaying IP camera feeds. Whilst third-party IP cameras may work, Raymarine® highly recommends only using Raymarine® IP cameras such as the CAM200IP.

As guidance any third-party IP camera must conform to the following:

- The camera must support H.264 compression and RTSP (Real time Streaming Protocol).
- The camera must be ONVIF compliant
- The camera must be capable of and be setup to allow unauthenticated anonymous access
- The camera must be capable of and be setup to assign an IP address automatically via DHCP
- The camera resolution must be set to no higher than 720p

The camera settings must be checked and if necessary adjusted using a PC and the software supplied with the camera, prior to adding the camera to the SeaTalk^{hs} network.

Important: Raymarine® does not guarantee compatibility with third-party IP cameras.

4.22 Thermal camera connection

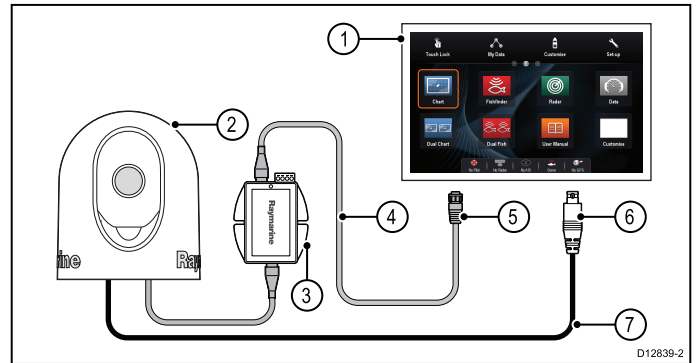
Thermal cameras can be connected directly to the display's network connection or can be connected to the SeaTalk^{hs} network, via a Raymarine® network switch.

2 connections are required:

- **Network connection** — required to control the thermal camera via a compatible Raymarine® MFD or optional Joystick Control Unit (JCU).
- **Video connection** — transmits the composite video signal to a compatible Raymarine® MFD.

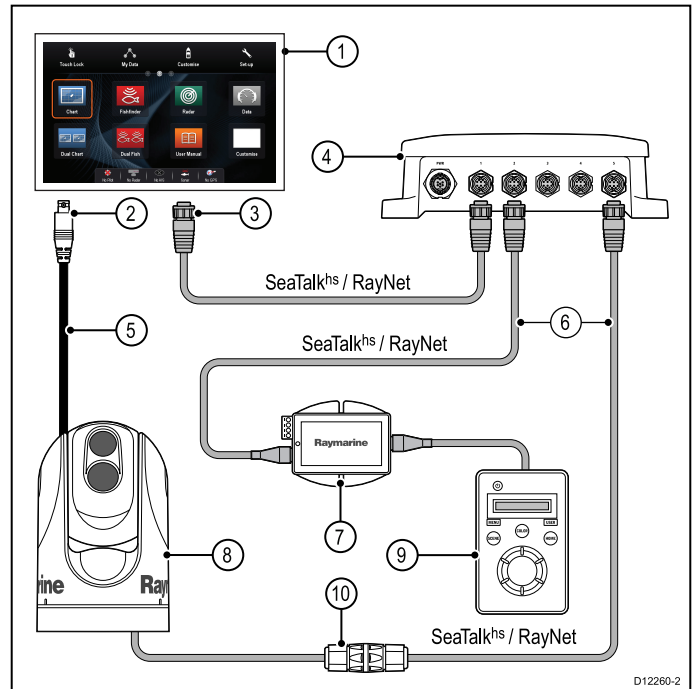
Note: The Thermal camera can only be connected to MFDs with a Video input connection.

T200 Series connection



1. MFD
2. Thermal camera
3. Power over Ethernet (PoE) Injector
4. RayNet to RJ45 SeaTalk^{hs} adaptor cable
5. Network connection to MFD (RayNet)
6. Video connection to MFD (composite video)
7. Video cable

T300 / T400 Series connection.



1. MFD
2. Video connection to MFD (composite video)
3. Network connection to MFD (RayNet cable)

4. **Raymarine®** network switch
5. Video cable
6. **RayNet** to RJ45 **SeaTalk^{hs}** adaptor cables
7. PoE (Power over Ethernet) injector (only required if using the optional JCU)
8. Thermal camera
9. Joystick Control Unit (JCU), optional
10. Ethernet coupler (R32142)

Raymarine recommends the use of a BNC terminated RG59 75ohm (or better) coaxial cable.

Important:

- You can only view the thermal camera image on the multifunction display to which the camera is physically connected. If you want to view the thermal camera image on more than 1 display you must obtain a suitable third-party video distribution unit.
- You can control the thermal camera using any multifunctional display connected to the same network. The Joystick Control Unit (JCU) is optional, but can be used in conjunction with multifunctional displays to control the thermal camera if required.
- “Dual payload” thermal cameras include 2 independent lenses; 1 for thermal (infrared) and 1 for visible light. If you only have 1 display you should only connect the video cable labelled “VIS / IR” (visible light / infrared) to the display. If you have 2 or more displays you should connect 1 cable to each display.

For further information regarding thermal camera installation (including power connection and mounting), refer to the installation instructions supplied with the camera.

Thermal camera cables

Cabling requirements for thermal cameras.

Camera to network switch

A network patch cable is required to connect the camera to the network switch. The connection is made between the camera cable tail and the network switch via the coupler (supplied with the camera). Network patch cables are available in a variety of lengths.

Joystick Control Unit (JCU)

An Ethernet (with power) cable is used to connect the JCU. The JCU is supplied with a 1.5 m (5 ft) Ethernet cable for this connection. If you require a different length contact your dealer for suitable cables.

Power over Ethernet (PoE) injector to network switch

A network patch cable is required for connecting the PoE injector to the network switch. Network patch cables are available in a variety of lengths.

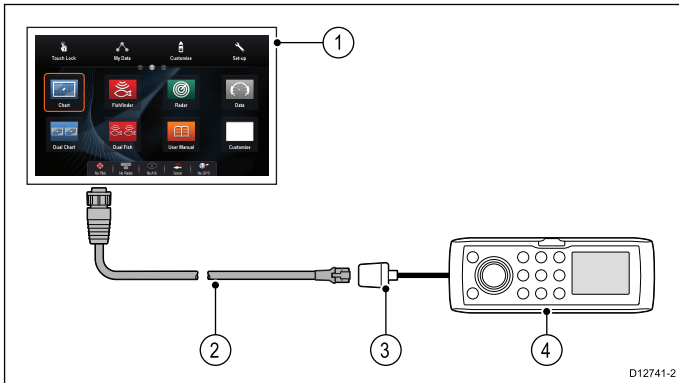
Video cables

Video cables are not supplied with the product. Please contact your dealer for suitable cables and adaptors.

4.23 Fusion network connection

Fusion 700 and 750 Series marine entertainment systems can be connected directly to the display's network connection or can be connected to the **SeaTalk^{hs}** network, via a **Raymarine®** network switch. The Fusion entertainment system can be controlled by any MFD connected to the same network.

Multiple Fusion units can be connected to the same network.



1. MFD
2. Network connection to MFD (RayNet to RJ45 SeaTalk^{hs} adaptor cable)
3. Fusion ethernet connection
4. Fusion unit

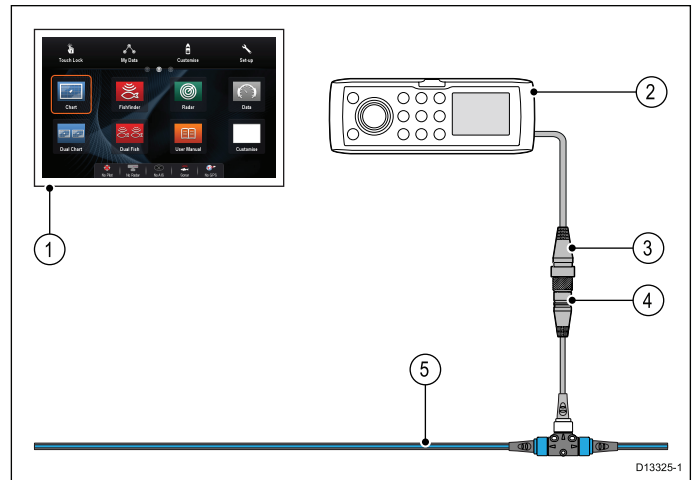
Note: The MFD should always be powered from a separate breaker and be powered on before any other connected devices.

For further installation information, refer to the installation instructions supplied with the unit.

4.24 Fusion NMEA 2000 connection

Compatible Fusion NMEA 2000 marine entertainment systems can be connected to the **SeaTalk^{ng}®** backbone. The Fusion entertainment system can be controlled by any compatible MFD connected to the same backbone.

Multiple Fusion units can be connected to the same backbone.



1. MFD
2. NMEA 2000 Fusion unit
3. Fusion NMEA 2000 connection
4. SeaTalk^{ng}® to DeviceNet female adaptor cable (A06045)
5. SeaTalk^{ng}® backbone

Note: The MFD should always be powered from a separate breaker and be powered on before any other connected devices.

For further installation information, refer to the installation instructions supplied with the unit.

Compatible Fusion units

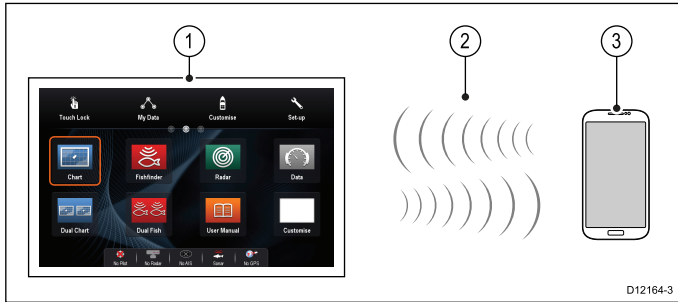
The table below details the Fusion entertainment systems that are compatible with **Raymarine® LightHouse™** powered MFDs.

Fusion unit	NMEA 2000 connection	SeaTalk ^{hs} connection
650 Series	✓	✗
700 Series	✓	✓
750 Series	✓	✓
RA205 Series	✓	✗

4.25 Media player connection

You can use your **MFD** to control a Bluetooth media player (such as a smartphone).

The media player must be compatible with the Bluetooth 2.1+ EDR power class 1.5 (supported profile: AVRCP 1.0) or higher.



1. **MFD**
2. Bluetooth connection
3. Bluetooth media player

To use this feature you must first:

- Enable Bluetooth in the **System Settings** on the **MFD**.
- Enable Bluetooth on the media player device.
- Pair the media player device with the **MFD**.
- Enable **Audio Control** in the System Settings on the **MFD**.
- Connect an **RCU-3** remote and assign the shortcut key to Start/Stop audio playback (Only required on MFD that do not have a touchscreen).

Note: If your media player does not include built-in speakers it may be necessary to connect the media player's audio output to an external audio system or a pair of headphones. For more information refer to the instructions that accompany the media player device.

4.26 Raymarine mobile app connection

You can use compatible tablet and smartphone devices as a wireless repeat display or remote control for your multifunction display.

Raymarine apps allow you to stream and / or control, remotely what you see on your multifunction display to a compatible device, using a Wi-Fi connection.

To use this feature you must first:

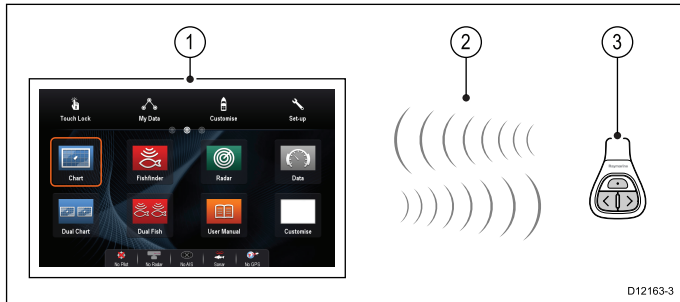
- Ensure your device is compatible with the app you wish to use.
- Download and install the relevant Raymarine app, available from the relevant market store.
- Enable Wi-Fi in the System Settings on the multifunction display.
- Enable Wi-Fi on your compatible device.
- Select the Raymarine Wi-Fi connection from the list of available Wi-Fi networks on your compatible device.
- Enable the relevant Mobile app in the System Settings menu on the multifunction display.

Note: The multifunction display acts as a Wi-Fi access point. If your device already connects to an access point for e-mail and internet you must revert your access point back to regain access to e-mails and internet.

4.27 Bluetooth remote control connection

You can control the multifunction display wirelessly using a Raymarine remote control unit.

The remote control uses a Bluetooth wireless connection.



1. Multifunction display
2. Bluetooth connection
3. Raymarine Bluetooth remote control (for example, RCU-3)

To use the remote control you must first:

- Enable Bluetooth in the System Settings on the multifunction display
- Pair the remote control unit with the multifunction display

Chapter 5: Mounting

Chapter contents

- [5.1 Mounting - a Series on page 60](#)
- [5.2 Mounting - c Series and e Series on page 62](#)

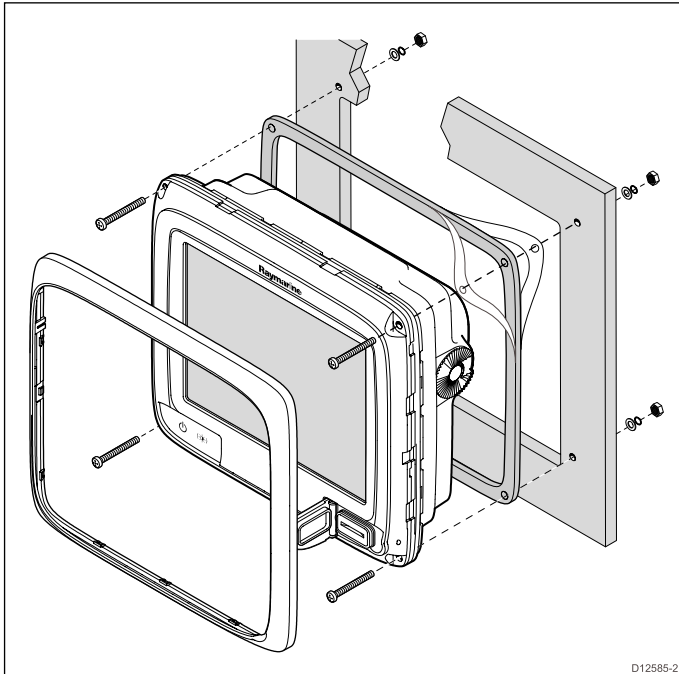
5.1 Mounting - a Series

Mounting

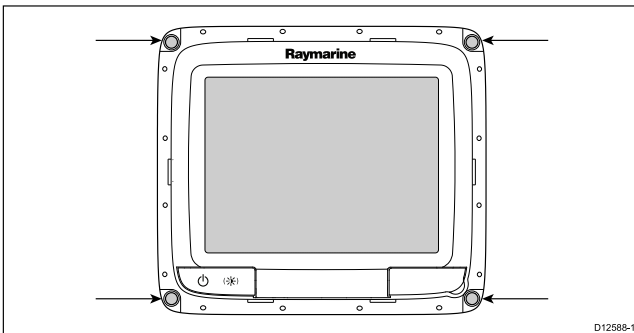
the display can be surface mounted.

Before mounting the unit, ensure that you have:

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



1. Check the selected location for the unit. A clear, flat area with suitable clearance behind the panel is required.
2. Drill or knock out the 4 mounting holes on the unit



3. Fix the appropriate cutting template supplied with the product, to the selected location, using masking or self-adhesive tape.
4. Using a suitable hole saw (the size is indicated on the template), make a hole in each corner of the cut-out area.
5. Using a suitable saw, cut along the inside edge of the cut-out line.
6. Ensure that the unit fits into the removed area and then file around the rough edge until smooth.
7. Drill 4 holes as indicated on the template to accept the securing screws.
8. Place the gasket onto the display unit and press firmly onto the flange.
9. Connect the power, data and other cables to the unit.

10. Slide the unit into place and secure using the provided fixings.

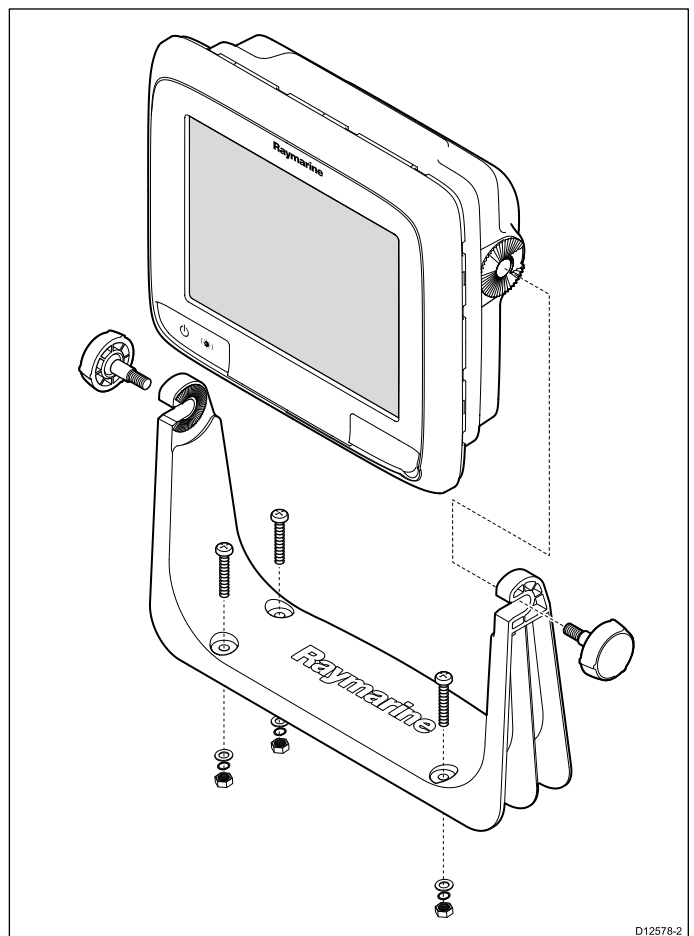
Note: The supplied gasket provides a seal between the unit and a suitably flat and stiff mounting surface or binnacle. The gasket should be used in all installations. It may also be necessary to use a marine-grade sealant if the mounting surface or binnacle is not entirely flat and stiff or has a rough surface finish.

Bracket (trunnion) mounting

The display can be mounted on a trunnion bracket.

Before mounting the unit ensure that you have:

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



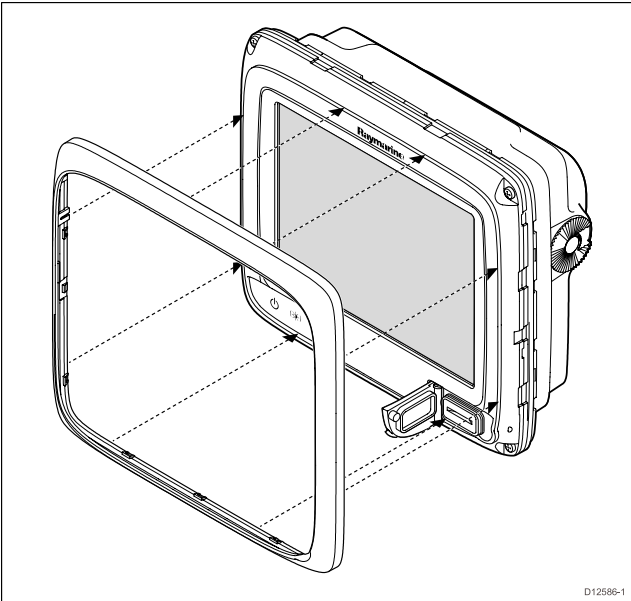
1. Mark the location of the mounting bracket screw holes on the chosen mounting surface.
2. Drill holes for the screws using a suitable drill, ensuring there is nothing behind the surface that may be damaged.
3. Use the fixings supplied with the mounting bracket to attach securely.
4. Attach the display to the mounting bracket.

Attaching the front bezel

The following procedure assumes that the unit has already been mounted in position.

1. Carefully lift one edge of the screen protection film, so that it is accessible for removing when unit installation is complete.

2. Ensure the memory card slot door is in the open position.
3. Orientate the bottom-right side of the bezel under the lip of the chart card door and place the bezel over the front of the display, ensuring that the clips along the bottom edge of the bezel latch into position.



4. Ensure the bezel is correctly aligned with the display, as shown.
5. Apply firm but even pressure to the bezel along the:
 - i. Outer edges - work from the sides upwards and then along the top edge, to ensure that it clips securely into position.
 - ii. Inner edges - particularly along the chart card door edge, to ensure that the bezel sits flat.
6. Check that the **Power** button and chart card door are free to operate.

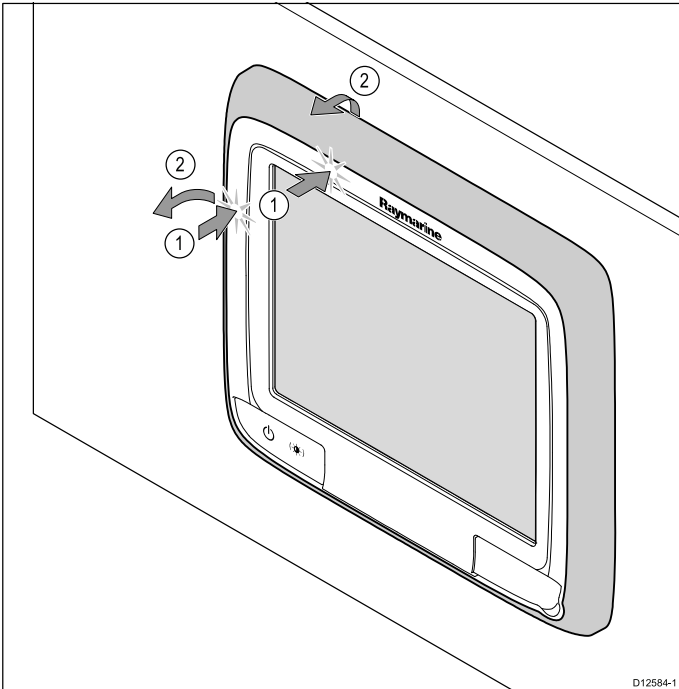
Important: Use care when removing the bezel. Do not use any tools to lever the bezel; doing so may cause damage.

1. Place both your thumbs on the upper left edge of the display, at the positions indicated in the diagram above.
2. Place your fingers underneath the bezel, at the positions indicated in the diagram above.
3. In a single firm motion, apply pressure to the outer edge of the display with your thumbs and pull the bezel towards you using your fingers.

The bezel should now come away from the display easily.

Removing the front bezel

Before proceeding ensure the memory card slot door is open.



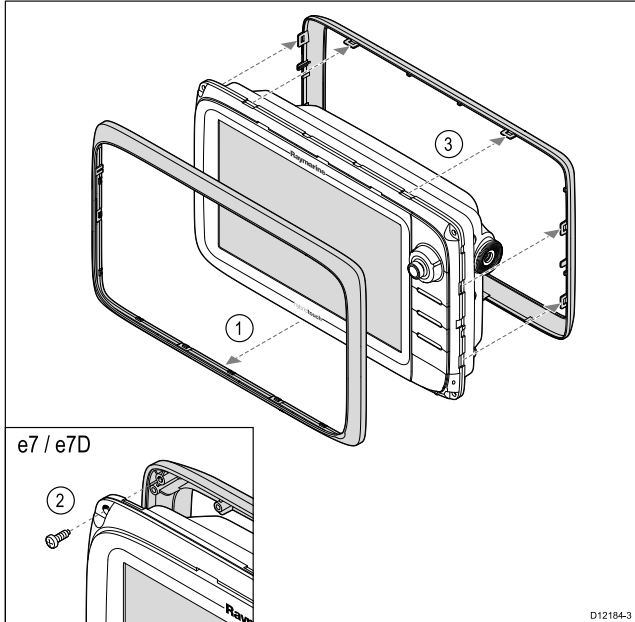
5.2 Mounting - c Series and e Series

Removing the rear bezel

You must remove the rear bezel before surface mounting the display.

Note: These steps do not apply to the e165 as it does not require a rear bezel.

1. Remove the front bezel. Refer to the separate instructions provided for that procedure.



2. Remove the screws that secure the bezel to the display (only required for e7 and e7D).
3. Carefully remove the bezel from the rear of the display, pulling the bezel gently along the:
 - i. Outer edges - work from the sides upwards and then along the top edge, ensuring that the clips are fully released from the display.
 - ii. Inner edges - ensure that the bezel is completely removed from the display.

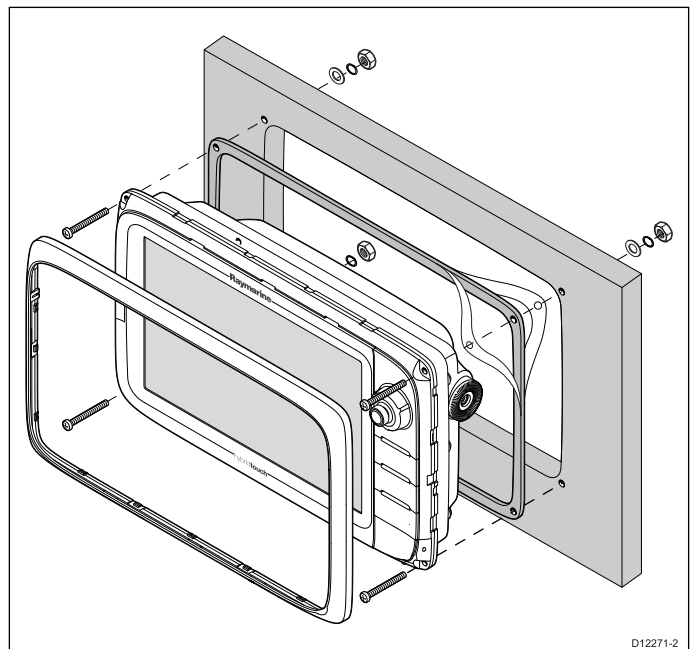
Note: Only the e7 and e7D have fixing screws for the rear bezel, other multifunction display variants have clips which hold the rear bezel in place.

Surface mounting

The display can be surface mounted.

Before mounting the unit, ensure that you have:

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



1. Check the selected location for the unit. A clear, flat area with suitable clearance behind the panel is required.
2. Fix the appropriate cutting template supplied with the product, to the selected location, using masking or self-adhesive tape.
3. Using a suitable hole saw (the size is indicated on the template), make a hole in each corner of the cut-out area.
4. Using a suitable saw, cut along the inside edge of the cut-out line.
5. Ensure that the unit fits into the removed area and then file around the rough edge until smooth.
6. Drill 4 holes as indicated on the template to accept the fixings.
7. Place the gasket onto the display unit and press firmly onto the flange.
8. Connect the power, data and other cables to the unit.
9. Slide the unit into place and secure using the fixings provided.

Note: The supplied gasket provides a seal between the unit and a suitably flat and stiff mounting surface or binnacle. The gasket should be used in all installations. It may also be necessary to use a marine-grade sealant if the mounting surface or binnacle is not entirely flat and stiff or has a rough surface finish.

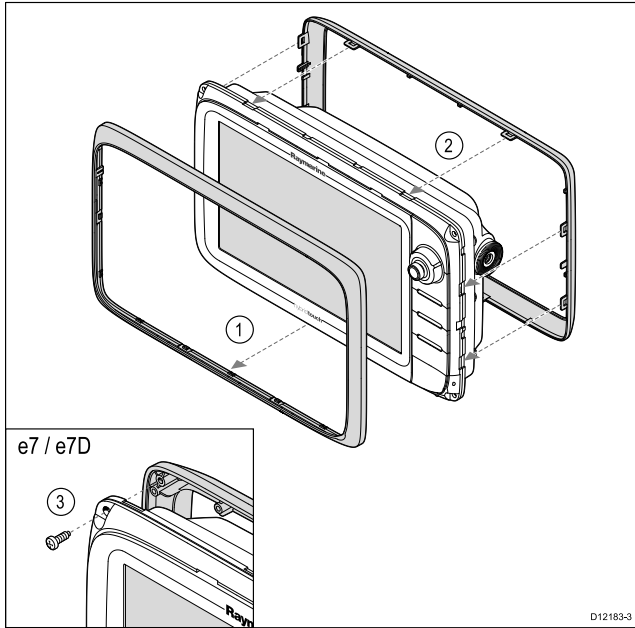
Attaching the rear bezel

The rear bezel must be fitted if you wish to use a mounting bracket to mount the unit.

Note: These steps do not apply to the e165 as it does not require a rear bezel.

1. Remove the front bezel. Refer to the separate instructions provided for that procedure.
2. Place the bezel over the rear of the display, ensuring that it is correctly aligned with the display. Apply firm but even pressure to the bezel along the:

- i. Outer edges - work from the sides upwards and then along the top edge, to ensure that it clips securely into position.
- ii. Inner edges - ensure that the bezel sits flat against the unit.



3. Use the supplied screws to secure the bezel to the display (e7 and e7D only).

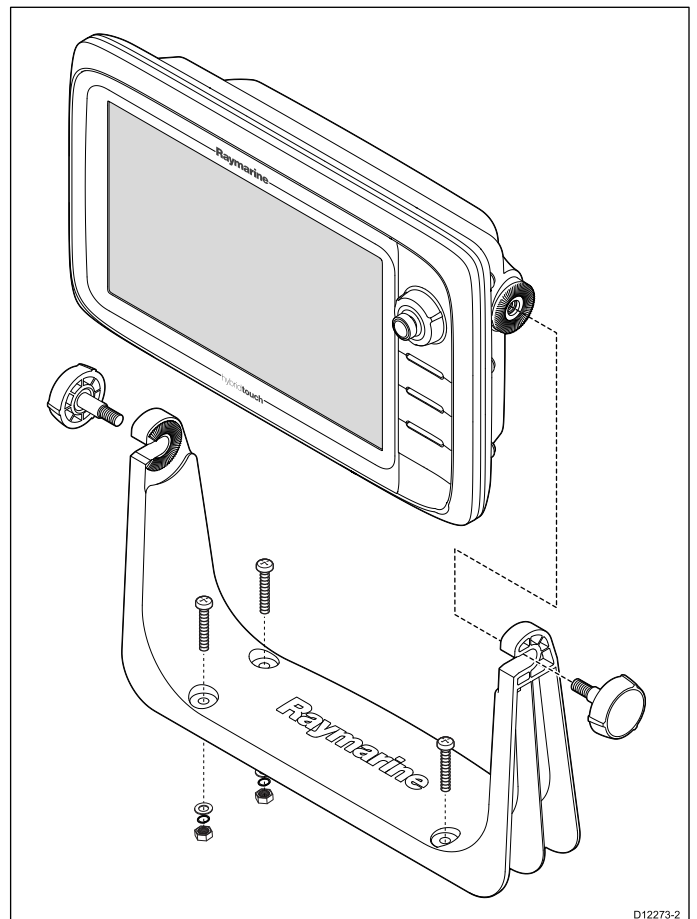
Bracket (trunnion) mounting

The display can be mounted on a trunnion bracket.

Note: The mounting bracket is supplied with the e7 and e7D display variants, for all other display variants the mounting bracket is an optional accessory. See the *Spares and Accessories* section of this manual for details.

Before mounting the unit ensure that you have:

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

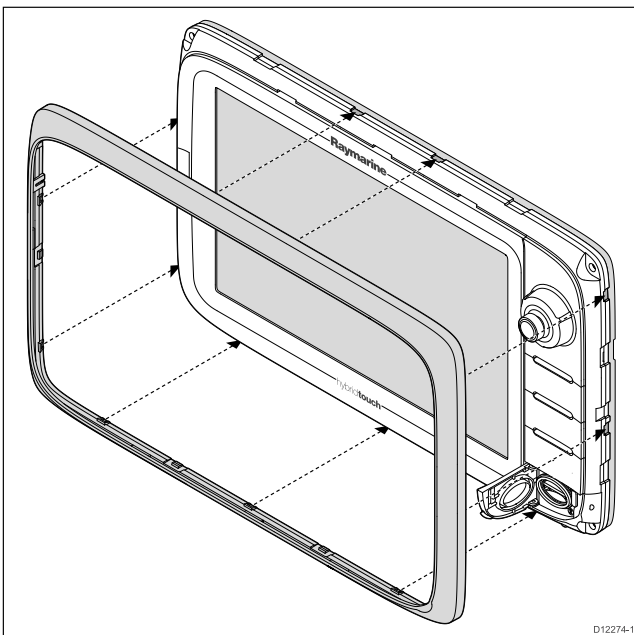


1. Mark the location of the mounting bracket screw holes on the chosen mounting surface.
2. Drill holes for the fixings using a suitable drill, ensuring there is nothing behind the surface that may be damaged.
3. Use the fixings supplied with the mounting bracket to attach securely.
4. Attach the display unit to the mounting bracket.

Attaching the front bezel

The following procedure assumes that the unit has already been mounted in position.

1. Carefully lift one edge of the screen protection film, so that it is accessible for removing when unit installation is complete.
2. Ensure the memory card slot door is in the open position.
3. Orientate the bottom-right side of the bezel under the lip of the chart card door and place the bezel over the front of the display, ensuring that the clips along the bottom edge of the bezel latch into position.



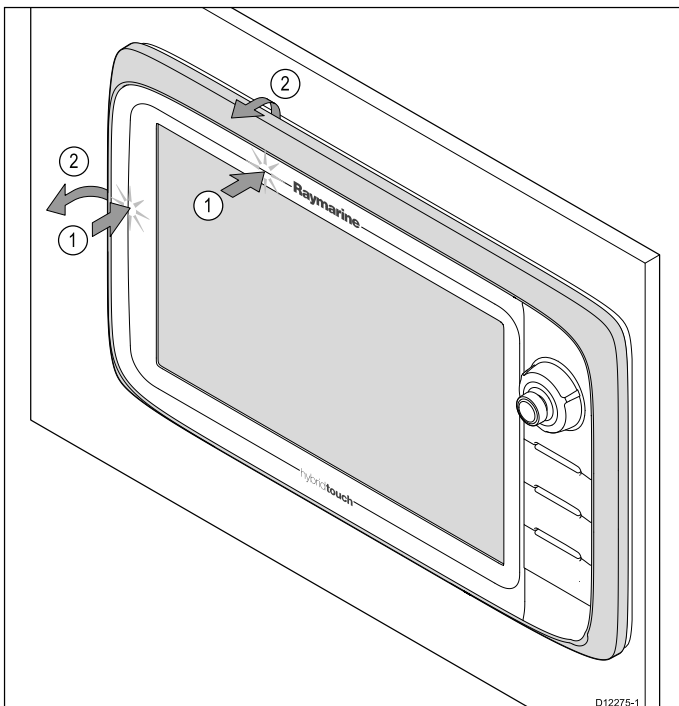
2. Place your fingers underneath the bezel, at the positions indicated in the diagram above.
3. In a single firm motion, apply pressure to the outer edge of the display with your thumbs and pull the bezel towards you using your fingers.

The bezel should now come away from the display easily.

4. Ensure the bezel is correctly aligned with the display, as shown.
5. Apply firm but even pressure to the bezel along the:
 - i. Outer edges - work from the sides upwards and then along the top edge, to ensure that it clips securely into position.
 - ii. Inner edges - particularly along the chart card door edge, to ensure that the bezel sits flat.
6. Check that all control buttons are free to operate.

Removing the front bezel

Before proceeding ensure the memory card slot door is open.



Important: Use care when removing the bezel. Do not use any tools to lever the bezel; doing so may cause damage.

1. Place both your thumbs on the upper left edge of the display, at the positions indicated in the diagram above.

Chapter 6: Maintaining your display

Chapter contents

- [6.1 Service and maintenance on page 66](#)
- [6.2 Product cleaning on page 66](#)

6.1 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.

Routine equipment checks

Raymarine strongly recommends that you complete a number of routine checks to ensure the correct and reliable operation of your equipment.

Complete the following checks on a regular basis:

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

6.2 Product cleaning

Best cleaning practices.

When cleaning products:

- If your product includes a display screen, do NOT wipe the screen with a dry cloth, as this could scratch the screen coating.
- Do NOT use abrasive, or acid or ammonia based products.
- Do NOT use a jet wash.

Cleaning the display case

The display unit is a sealed unit and does not require regular cleaning. If it is necessary to clean the unit, follow this basic procedure:

1. Switch off the power to the display.
2. Wipe the display with a clean, soft cloth (a microfibre cloth is ideal).
3. If necessary, use a mild detergent to remove grease marks.

Note: Do NOT use solvents or detergents on the screen itself.

Note: In certain conditions, condensation may appear inside the display screen. This will not harm the unit, and can be cleared by powering on the display for a short time.

Cleaning the display screen

A coating is applied to the display screen. This makes it water repellent, and prevents glare. To avoid damaging this coating, follow this procedure:

1. Switch off the power to the display.
2. Rinse the screen with fresh water to remove all dirt particles and salt deposits.
3. Allow the screen to dry naturally.
4. If any smears remain, very gently wipe the screen with a clean microfibre cleaning cloth (available from an opticians).

Cleaning the sun cover

The supplied sun cover features an adhesive surface. In certain conditions unwanted contaminants may stick to this surface. To avoid damaging the monitor display, clean the sun cover regularly following this procedure:

1. Carefully remove the sun cover from the display.
2. Rinse the sun cover with fresh water to remove all dirt particles and salt deposits.
3. Allow the sun cover to dry naturally.

Chapter 7: Troubleshooting

Chapter contents

- [7.1 Troubleshooting on page 68](#)
- [7.2 Power up troubleshooting on page 69](#)
- [7.3 Radar troubleshooting on page 70](#)
- [7.4 GPS troubleshooting on page 71](#)
- [7.5 Sonar troubleshooting on page 72](#)
- [7.6 Sonar crosstalk interference on page 75](#)
- [7.7 Thermal camera troubleshooting on page 77](#)
- [7.8 System data troubleshooting on page 79](#)
- [7.9 Video troubleshooting on page 80](#)
- [7.10 Wi-Fi troubleshooting on page 81](#)
- [7.11 Bluetooth troubleshooting on page 82](#)
- [7.12 Touchscreen troubleshooting on page 83](#)
- [7.13 Touchscreen alignment on page 84](#)
- [7.14 Miscellaneous troubleshooting on page 85](#)

7.1 Troubleshooting

The troubleshooting information provides possible causes and corrective action required for common problems associated with marine electronics installations.

All Raymarine products are, prior to packing and shipping, subjected to comprehensive test and quality assurance programs. However, if you experience problems with the operation of your product this section will help you to diagnose and correct problems in order to restore normal operation.

If after referring to this section you are still having problems with your unit, please contact Raymarine Technical Support for further advice.

7.2 Power up troubleshooting

Problems at power up and their possible causes and solutions are described here.

Product does not turn on or keeps turning off

Possible causes	Possible solutions
Blown fuse / tripped breaker	<ol style="list-style-type: none"> 1. Check condition of relevant fuses and breakers and connections, replace if necessary (Refer to the <i>Technical Specification</i> section of your product's installation instructions for fuse ratings.) 2. If fuse keeps blowing check for cable damage, broken connector pins or incorrect wiring.
Poor / damaged / insecure power supply cable / connections	<ol style="list-style-type: none"> 1. Check that the power cable connector is fully inserted into the unit and locked in position. 2. Check the power supply cable and connectors for signs of damage or corrosion, replace if necessary. 3. With the unit turned on, try flexing the power cable near to the display connector to see if this causes the unit to re-boot/loose power, replace if necessary. 4. Check the vessel's battery voltage, the condition of the battery terminals and power supply cables, ensuring connections are secure, clean and free from corrosion, replace if necessary. 5. With the product under load, using a multi-meter, check for high voltage drop across all connectors/fuses etc, replace if necessary.
Incorrect power connection	The power supply may be wired incorrectly, ensure the installation instructions have been followed.
Power source insufficient	With the product under load, using a multi-meter, check the power supply voltage as close to the unit as possible to establish actual voltage when the current is flowing. (Refer to the <i>Technical Specification</i> section of your product's installation instructions for power supply requirements.)

Product will not boot up (re-boot loop)

Possible causes	Possible solutions
Power supply and connection	See possible solutions from 'Products does not turn on or keeps turning off' above.
Software corruption	<ol style="list-style-type: none"> 1. In the unlikely event that the products software has become corrupted please try re-flashing the latest software from the Raymarine website. 2. On display products, as a last resort, you can try to perform a 'Power on Reset', however this will delete all settings/presets and user data (such as waypoints and tracks) and revert the unit back to factory defaults.

Performing a Power on Reset

Performing a 'Power on Reset' will delete all settings/presets and user data (such as waypoints and tracks) and revert the unit back to factory defaults.

1. Power the unit off.
2. Power the unit back on.
3. When the **LightHouse** logo appears Press and hold the **Power** button.
The Raymarine Initialization screen is displayed.
4. **Touch only displays:**
 - i. Press the **Power** button again to select '1 – Reset to factory defaults'.
A 7 second countdown will begin. When the countdown reaches zero the unit will be reset to factory default settings.

- ii. You can stop the reset process by pressing the **Power** button again before the countdown timer reaches zero.

This will select the second option: '2– Exit and start the application' and begin a new countdown timer.

5. Non-Touch and HybridTouch displays:

- i. Press the **WPT/MOB** button.
The unit will be reset to factory default settings.

7.3 Radar troubleshooting

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

Problem	Possible causes	Possible solutions
No Data or No scanner message	Radar scanner power supply	Check that the scanner power supply cable is sound and that all connections are tight and free from corrosion.
		Check relevant fuses and breakers.
		Check power source is of the correct voltage and sufficient current (using voltage booster if appropriate).
	SeaTalk ^{hs} / RayNet network problem	Check that the Scanner is correctly connected to a Raymarine network switch or SeaTalk ^{hs} crossover coupler (as applicable).
		Check the status of the Raymarine network switch.
		Check that SeaTalk ^{hs} / RayNet cables are free from damage.
	Software mismatch between equipment may prevent communication.	Contact Raymarine technical support.
Switch at scanner pedestal in OFF position	Ensure scanner pedestal switch is in ON position.	
Radar will not initialize (Voltage control module (VCM) stuck in "sleep mode")	Intermittent or poor power connection	Check power connection at VCM. (Voltage at input = 12 / 24 V, Voltage at output = 40 V)
The bearing of a target on the radar screen is incorrect.	The radar bearing alignment requires correcting.	Check and adjust radar bearing alignment.

7.4 GPS troubleshooting

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

Problem	Possible causes	Possible solutions
"No Fix" GPS status icon is displayed.	Geographic location or prevailing conditions preventing satellite fix.	Check periodically to see if a fix is obtained in better conditions or another geographic location.
	GPS connection fault.	Ensure that external GPS connections and cabling are correct and fault free.
	External GPS antenna in poor position. For example: <ul style="list-style-type: none">• Below decks.• Close proximity to transmitting equipment such as VHF radio.	Ensure GPS antenna has a clear view of the sky.
	GPS installation problem.	Refer to the installation instructions.

Note: A GPS Status screen is available within the display. This provides satellite signal strength and other relevant information.

7.5 Sonar troubleshooting

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

Scrolling image is not being displayed

Possible causes	Possible solutions
Sonar disabled	Select Ping Enable from the Sounder Set-up menu.
Incorrect transducer selected	Check that the correct transducer is selected in the Transducer Set-up menu.
Damaged cables	<ol style="list-style-type: none"> 1. Check that the transducer cable connector is fully inserted and locked in position. 2. Check the power supply cable and connectors for signs of damage or corrosion, replace if necessary. 3. With the unit turned on, try flexing the cable near to the display connector to see if this causes the unit to re-boot/loose power, replace if necessary. 4. Check the vessel's battery voltage, the condition of the battery terminals and power supply cables, ensuring connections are secure, clean and free from corrosion, replace if necessary. 5. With the product under load, using a multi-meter, check for high voltage drop across all connectors/fuses etc (this can cause the Fishfinder applications to stop scrolling or the unit to reset/turn off), replace if necessary.
Damaged or fouled transducer	Check the condition of the transducer ensuring it is not damaged and is free from debris/fouling, clean or replace as necessary.
Wrong transducer fitted	Ensure the transducer is compatible with your system.
SeaTalk ^{hs} / RayNet network problem.	<ul style="list-style-type: none"> • Check that the unit is correctly connected to the multifunction display or Raymarine network switch. If a crossover coupler or other coupler cable / adapter is used, check all connections ensuring connections are secure, clean and free from corrosion, replace if necessary.
Software mismatch between equipment may prevent communication.	Ensure all Raymarine products contain the latest available software, check the Raymarine website: www.raymarine.com/software for software compatibility.

No depth reading / lost bottom lock

Possible causes	Possible solutions
Transducer location	Check that the transducer has been installed in accordance with the instructions provided with the transducer.
Transducer angle	If the transducer angle is too great the beam can miss the bottom, adjust transducer angle and recheck.
Transducer kicked-up	If the transducer has a kick-up mechanism, check that it has not kicked up due to hitting an object.
Power source insufficient	With the product under load, using a multi-meter, check the power supply voltage as close to the unit as possible to establish actual voltage when the current is flowing. (Check your product's Technical specification for power supply requirements.)
Damaged or fouled transducer	Check the condition of the transducer ensuring it is not damaged and is free from debris / fouling.
Damaged cables	<ol style="list-style-type: none"> 1. Check the unit's connector for broken or bent pins. 2. Check that the cable connector is fully inserted into the unit and that the locking collar is in the locked position. 3. Check the cable and connectors for signs of damage or corrosion, replace if necessary. 4. With the unit turned on, try flexing the power cable near to the display connector to see if this causes the unit to re-boot/loose power, replace if necessary. 5. Check the vessel's battery voltage, the condition of the battery terminals and power supply cables, ensuring connections are secure, clean and free from corrosion, replace if necessary.

Possible causes	Possible solutions
	6. With the product under load, using a multi-meter, check for high voltage drop across all connectors/fuses etc (this can cause the Fishfinder applications to stop scrolling or the unit to reset/turn off), replace if necessary.
Vessel speed too high	Slow vessel speed and recheck.
Bottom too shallow or too deep	The bottom depth may be outside of the transducers depth range, move vessel to shallower or deeper waters as relevant and recheck.

Poor / problematic image

Possible causes	Possible solutions
Vessel stationary	Fish arches are not displayed if the vessel is stationary; fish will appear on the display as straight lines.
Scrolling paused or speed set too low	Unpause or increase sonar scrolling speed.
Sensitivity settings may be inappropriate for present conditions.	Check and adjust sensitivity settings or perform a Sonar reset.
Damaged cables	<ol style="list-style-type: none"> 1. Check the unit's connector for broken or bent pins. 2. Check that the cable connector is fully inserted into the unit and that the locking collar is in the locked position. 3. Check the cable and connectors for signs of damage or corrosion, replace if necessary. 4. With the unit turned on, try flexing the power cable near to the display connector to see if this causes the unit to re-boot/loose power, replace if necessary. 5. Check the vessel's battery voltage, the condition of the battery terminals and power supply cables, ensuring connections are secure, clean and free from corrosion, replace if necessary. 6. With the product under load, using a multi-meter, check for high voltage drop across all connectors/fuses etc (this can cause the Fishfinder applications to stop scrolling or the unit to reset/turn off), replace if necessary.
Transducer location	<p>Check that the transducer has been installed in accordance with the instructions provided with the transducer.</p> <p>If a transom mount transducer is mounted too high on the transom it may be lifting out of the water, check that the transducer face is fully submerged when planing and turning.</p>
Transducer kicked-up	If the transducer has a kick-up mechanism, check that it has not kicked up due to hitting an object.
Damaged or fouled transducer	Check the condition of the transducer ensuring it is not damaged and is free from debris / fouling.
Damaged transducer cable	Check that the transducer cable and connection is free from damage and that the connections are secure and free from corrosion.
Turbulence around the transducer at higher speeds may affect transducer performance	Slow vessel speed and recheck.
Interference from another transducer	<ol style="list-style-type: none"> 1. Turn off the transducer causing the interference. 2. Reposition the transducers so they are further apart.
Unit power supply fault	Check the voltage from the power supply, if this is too low it can affect the transmitting power of the unit.

Incorrect speed reading (from DST transducer)

Possible causes	Possible solutions
Paddle wheel fault	Check that the paddle wheel is clean.
No speed offset set	Add speed offset.
Incorrect calibration	Re-calibrate equipment


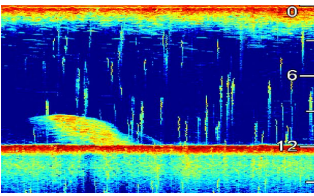
Possible causes	Possible solutions
Transducer does not have a speed element	Install transducer with speed element to enable speed readings.
Incorrect transducer selected (no speed displayed)	Select a transducer that supports speed measurement from the Transducer Set-Up menu.

7.6 Sonar crosstalk interference

There are 2 types of potential sonar crosstalk interference in a Raymarine sonar system:

1. **SideVision** sonar crosstalk interference
2. Multiple sonar crosstalk interference

The types of crosstalk interference that you may experience in your system depend on the combination and type of sonar equipment installed, and the way in which the equipment has been installed.

SideVision sonar crosstalk interference	Multiple sonar crosstalk interference
	
<p>Due to the high sensitivity of SideVision transducers, you may experience some minor crosstalk interference between the left and right receiving channels in areas of strong target returns. Examples of strong target returns include solid objects such as underwater bridge structure. This interference shows up in the Fishfinder application as subtle reflections from the right sonar image displayed in the left sonar image, or vice versa.</p>	<p>When using multiple sonar modules and transducers operating in overlapping frequency ranges, you may experience some crosstalk interference between the ranges. This interference is displayed in the Fishfinder application as vertical “rain drops” throughout the water column. These vertical “rain drops” indicate that 2 sonar modules are operating in close frequency proximity to one another.</p>

SideVision sonar crosstalk interference

Crosstalk interference is expected behavior in a high sensitivity device such as a **SideVision** transducer, and is not indicative of a fault with your transducer or sonar module.

Reducing multiple sonar crosstalk interference

Crosstalk interference in systems with multiple sonar modules and transducers is the result of a number of factors, including installation, operation, and environment.

- **Choose an equipment combination that minimizes overlapping frequencies.** Wherever possible, choose to use sonar modules and transducers that operate in different frequency ranges (“Channels”), for example CP100 and CP300 sonar modules and CPT-100 and B744V transducers. This will help to ensure that each component is operating in a distinct relative frequency range – for example, a “high” frequency range for the CP100 and a “low” frequency range for the CP300.
- **Only use the sonar channels that you really need.** Although it is possible to run multiple sonar

modules simultaneously in a Raymarine system, it may not always be necessary to do so. If you are in a scenario that requires only one sonar module to be active at a time, disable any other sonar modules by changing the Fishfinder application pane to a single one which only displays the output from one sonar module. Alternatively, disable the ping for any unused sonar modules by selecting **MENU > Channel > Ping > OFF** in the Fishfinder application.

- **Identify the sonar module and transducer that is causing the interference.** To do this, disable the ping or remove the power for one of the sonar modules in your system. If the interference in the Fishfinder application disappears immediately, you now know which device is causing the interference. If the interference doesn’t disappear, repeat the exercise again with the other sonar module(s) in your system, one at a time. Once you know which device is causing the interference, proceed with the following methods to reduce the interference from the relevant device.
- **Adjust the Interference Rejection Filter.** The default setting for all Raymarine MFDs is “Auto”. Changing this setting to “High” might help to reduce interference (**MENU > Setup > Sounder Setup > Interference Rejection**). Note that the Interference Rejection Filter setting is not available for all sonar modules.
- **Decrease the power output of the interfering transducer.** Adjusting the “Power Mode” in the Sensitivity Settings in the MFD’s Fishfinder application can help to minimize the presence of crosstalk interference (**MENU > Sensitivity Settings > Power Mode**). Note that the Power Mode setting is not available for all transducers.
- **Ensure that you have a common RF ground point for all electrical equipment on your vessel.** On vessels without an RF ground system, ensure all product drain wires (where available) are connected directly to the negative battery terminal. Ineffective RF grounding can cause electrical interference which may in turn result in sonar crosstalk interference.
- **Increase the physical distance between your sonar modules.** Electrical interference may be occurring between a cable on one sonar module, and a cable on a different sonar module. Ensure that your sonar modules are physically located as far away from each other as possible.
- **Increase the physical distance between your sonar transducers.** Electrical and / or acoustic interference may be occurring between the different transducers in your system. Ensure that your transducers are physically located as far away from each other as possible.

Note: Given the effort and potential difficulties involved in relocating sonar equipment, it should only be considered as a last resort when you judge the interference to be a significant problem which cannot be resolved using the methods described above.

Note: Due to physical size and other constraints that vary from vessel to vessel, it may not be possible to completely eliminate crosstalk interference from your system. However, this will not impede your ability to benefit from the full capabilities of your sonar system. Being able to easily identify the way in which interference is displayed in the Fishfinder application can sometimes be the best and easiest route to dealing with it.

7.7 Thermal camera troubleshooting

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

Problem	Possible causes	Possible solutions
Video not displayed.	Camera is in Standby mode.	The camera will not display video if it is in Standby mode. Use the camera controls (either the thermal camera application or JCU) to “wake” the camera from standby.
	Problem with the thermal camera video connections.	<ul style="list-style-type: none"> • Check thermal camera video cables are sound and properly connected. • Ensure that the video is connected into video input 1 at the multifunction display or GVM. • Ensure that the correct video input is selected at the display.
	Problem with power supply to the camera or JCU (if used as the primary controller)	<ul style="list-style-type: none"> • Check the power connections to the camera and JCU / PoE injector (if used). • Ensure that the power switch / breaker is on. • Check the fuse / breaker state.
Cannot control thermal camera from Raymarine display or keyboard.	Thermal camera application is not running.	Ensure the thermal camera application is running on the multifunction display (as oppose to the video application which does not have camera controls).
Erratic or unresponsive controls.	Network problem.	Check that the controller and thermal camera are correctly connected to the network. (Note: This may be a direct connection or via a Raymarine network switch.)
		Check the status of the Raymarine network switch.
		Check that SeaTalk ^{hs} / RayNet cables are free from damage.
	Control conflict, e.g. caused by multiple users at different stations.	Ensure that no other controllers are in use at the same time.
Problem with the controller.	Check power / network cabling to the controller and PoE injector (PoE only used with optional Joystick Control Unit).	
	Check other controllers if available. If other controllers are operating this will eliminate the possibility of a more fundamental camera fault.	
Cannot switch between thermal and visible (VIS / IR) video image .	Camera is not a dual payload model.	Only “dual payload” (dual lens) thermal cameras support VIS / IR switching.
	VIS / IR cable not connected.	Ensure that the VIS / IR cable is connected from the camera to the Raymarine system. (The IR-only cable does not support switching).
Noisy image.	Poor quality or faulty video cable.	Ensure that the video cable is no longer than necessary. The longer the cable is (or the smaller the wire gauge / thickness), the more severe the losses become. Use only high quality shielded cable suitable for a marine environment.
	Cable is picking up electromagnetic interference (EMI) from another device.	<ul style="list-style-type: none"> • Ensure you are using a high quality shielded cable. • Ensure proper cable separation, for example do not run data and power cables in close proximity with each other.

Problem	Possible causes	Possible solutions
Image too dark or too light.	Display brightness is set too low.	Use the brightness controls at the display to adjust accordingly.
	The contrast or brightness settings in the thermal camera application are set too low.	Use the appropriate menu in the thermal camera application to adjust the contrast and brightness of the image.
	The Scene Mode is not appropriate for the current conditions.	A particular environment may benefit from a different Scene Mode setting. For example, a very cold background (such as the sky) could cause the camera to use a wider temperature range than appropriate. Use the SCENE button.
Image freezes momentarily.	FFC (Flat Field Correction).	The image will pause momentarily on a periodic basis during the Flat Field Correction (FFC) cycle. Just prior to the FFC, a small green square will appear in the upper left corner of the screen.
Image is inverted (upside down).	Camera “Ball down” setting is incorrect.	Ensure that the Ball down setting within the thermal camera system setup menu is set correctly.

7.8 System data troubleshooting

Aspects of the installation can cause problems with the data shared between connected equipment. Such problems, their possible causes and solutions are described here.

Problem	Possible causes	Possible solutions
Instrument, engine or other system data is unavailable at all displays.	Data is not being received at the display.	Check the data bus (e.g. SeaTalk^{ng}) wiring and connections.
		Check the overall integrity of the data bus (e.g. SeaTalk^{ng}) wiring.
		If available refer to the reference guide for the data bus (e.g. SeaTalk^{ng} reference manual).
	Data source (e.g. instrument display or engine interface) is not operating.	Check the source of the missing data (e.g. instrument display or engine interface).
		Check the power to the SeaTalk bus.
		Refer to the manufacturer's handbook for the equipment in question.
Software mismatch between equipment may prevent communication.	Contact Raymarine technical support.	
Instrument or other system data is missing from some but not all displays.	Network problem.	Check that all required equipment is connected to the network.
		Check the status of the Raymarine network Switch.
		Check that SeaTalk^{hs} / RayNet cables are free from damage.
	Software mismatch between equipment may prevent communication.	Contact Raymarine technical support.
Position data is not displayed on VHF radio	VHF radio NMEA 0183 input not isolated / incorrect polarity	<ul style="list-style-type: none"> • Check that the radio has an Isolated NMEA 0183 input. • Check polarity of NMEA 0183 wires.

7.9 Video troubleshooting

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

Problem	Possible causes	Possible solutions
No signal message on screen (video image not displayed)	Cable or connection fault	Check that the connections are sound and free from corrosion.

7.10 Wi-Fi troubleshooting

Aspects of the installation can cause problems with the data shared between wireless devices. Such problems, their possible causes and solutions are described here.

Problem	Possible causes	Possible solutions
No wireless connection.	Tablet / smartphone does not have a wireless connection established with the multifunction display.	Ensure that Wi-Fi is enabled on the MFD.
		Ensure that the "Wi-Fi" option is enabled on the Smart Device (available from the phone's Settings menu).
		Ensure that the Raymarine connection is selected as the Wi-Fi network. If a passcode has been specified for the multifunction display's Wi-Fi connection ensure that the same passcode is entered into the Smart Device when prompted.
No Raymarine app on device.	Tablet / smartphone does not have Raymarine app installed and running.	Download the required Raymarine app from the relevant application store. Start the Raymarine app on your device.
	Mobile applications are NOT enabled on the multifunction display.	Enable "Viewing only" or "Remote Control" as required in the Mobile Apps setting.
Raymarine app runs slowly or not at all.	Device not compatible with Raymarine app.	Recommended device requirements: <ul style="list-style-type: none"> • iOS Devices = Best performance achieved on iPhone 4 or later and iPad 2 or later. • Android/Kindle Fire = Best performance achieved with 1GHz processor and better and running 2.2.2. or later.
	MFD software incompatible with mobile application.	Ensure your MFD contains software application version 3.15 or later.
No waypoint / routes synchronization with Navionics Marine app.	Smartphone / tablet does not have "Navionics Marine" app installed and running.	Download the "Navionics Marine" app from the relevant app store. Start the "Navionics Marine" app on the device.
	Chart application is not running on the multifunction display.	Start the chart application on the multifunction display.
Weak or intermittent Wi-Fi signal.	Interference from other wireless devices in the vicinity.	Multiple wireless devices running simultaneously (such as laptops, phones, and other wireless devices) can sometimes cause wireless signal conflicts. Temporarily disable each wireless device in turn until you have identified the device causing the interference.
Smartphone / tablet can no longer connect to the internet or receive e-mails after using a Raymarine mobile app.	Device still connected to the multifunction display.	Ensure the access point on your Smart Device is switched back to your previous access point (e.g. the marina Wi-Fi).

7.11 Bluetooth troubleshooting

Aspects of the installation can cause problems with the data shared between wireless devices. Such problems, their possible causes and solutions are described here.

Problem	Possible causes	Possible solutions
No wireless connection.	Smart Device does not have a Bluetooth connection established with the multifunction display.	Ensure that Bluetooth is enabled on the MFD.
		Ensure that the "Bluetooth" option is enabled on the Smart Device (available from the phone's Settings / General menu).
		Ensure that the Bluetooth device is paired with the MFD that you want to use it with.
No media player control.	Media player device is not compatible with the Bluetooth 2.1+ EDR power class 1.5 (supported profile: AVRCP 1.0) or higher.	Check the Bluetooth compatibility with the device manufacturer. If the device is not Bluetooth 2.1+ EDR power class 1.5 (supported profile: AVRCP 1.0) compatible then it is not suitable for wireless use with the multifunction display.
	"Audio Control" is NOT enabled on the multifunction display.	Enable "Audio Control".
Weak or intermittent Bluetooth signal.	Interference from other wireless devices in the vicinity.	Multiple wireless devices running simultaneously (such as laptops, phones, and other wireless devices) can sometimes cause wireless signal conflicts. Temporarily disable each wireless device in turn until you have identified the device causing the interference.

7.12 Touchscreen troubleshooting

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

Problem	Possible causes	Possible solutions
Touchscreen does not operate as expected.	Touch lock is enabled.	Use the Joystick to turn off the touch lock on the home screen.
	Screen is not being operated with bare fingers, for example gloves are being worn.	Bare fingers must make contact with the screen for correct operation. Alternatively you may use conductive gloves.
	Touchscreen requires calibration.	Use the setup menus to calibrate the touchscreen.
	Saltwater deposits on the screen.	Carefully clean and dry the screen in accordance with the instructions provided.

7.13 Touchscreen alignment

If the touchscreen is misaligned to your touch, you can realign it to improve the accuracy.

Realignment involves a simple exercise to align an on-screen object with your touch. For best results, perform this exercise when your vessel is anchored or moored.

Note: This only applies to touchscreen multifunction displays.

Aligning the touchscreen

With the homescreen displayed:

1. Select **Set-up**.
2. Select **Maintenance**.
3. Select **Touchscreen Alignment**.
4. Place your finger over the on-screen object momentarily, then remove it.
5. Repeat the action a further 3 times.
6. If the operation was successful, an "Alignment Completed" message is displayed.
7. Select **Exit** to return to the Maintenance menu.
8. If the operation was unsuccessful at any point during the alignment exercise, an "Incorrect touch detected" message is displayed, the alignment exercise is repeated.
9. After 2 failed alignment exercises you may be asked to perform a precision alignment exercise.

7.14 Miscellaneous troubleshooting

Miscellaneous problems and their possible causes and solutions are described here.

Problem	Possible causes	Possible solutions
Display behaves erratically: <ul style="list-style-type: none"> • Frequent unexpected resets. • System crashes or other erratic behavior. 	Intermittent problem with power to the display.	Check relevant fuses and breakers.
		Check that the power supply cable is sound and that all connections are tight and free from corrosion.
		Check that the power source is of the correct voltage and sufficient current.
	Software mismatch on system (upgrade required).	Go to www.raymarine.com and click on support for the latest software downloads.
	Corrupt data / other unknown issue.	Perform a factory reset. <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p>Important: This will result in the loss of any settings and data (such as waypoints) stored on the product. Save any important data to a memory card before resetting.</p> </div>

Chapter 8: Technical specification

Chapter contents

- [8.1 a Series on page 88](#)
- [8.2 c and e Series on page 92](#)

8.1 a Series

a6x Physical specifications

Dimensions	<ul style="list-style-type: none"> • Width: 163.57 mm (6.44 in) • Height (NOT including bracket): 143.47 mm (5.65 in) • Height (including bracket): 162.72 mm (6.41 in) • Depth (NOT including cables): 74.1 mm • Depth (including cables): 167.5 mm (6.6 in)
Weight (bare unit)	0.715 kg (1.58 lbs)

a7x Physical specifications

Dimensions	<ul style="list-style-type: none"> • Width: 205.1 mm (8 in) • Height (NOT including bracket): 147.1 mm (5.8 in) • Height (including bracket): 163.3 mm (6.4 in) • Depth (NOT including cables): 73.6 mm (2.9 in) • Depth (including cables): 164.5 mm (6.48 in)
Weight (bare unit)	0.715 kg (1.58 lbs)

a9x Physical specifications

Dimensions	<ul style="list-style-type: none"> • Width: 250.1 mm (9.8 in.) • Height (NOT including bracket): 189.5 mm (7.5 in.) • Height (including bracket): 198.26 mm (7.8 in.) • Depth (NOT including cables): 82.6 mm (3.3 in.) • Depth (including cables): 164.5 mm (6.5 in.)
Weight (bare unit)	2.31 kg (5 lbs)

a12x Physical specifications

Dimensions	<ul style="list-style-type: none"> • Width: 318 mm (12.5 in.) • Height (NOT including bracket): 238.3 mm (9.4 in.) • Height (including bracket): 248.14 mm (9.8 in.) • Depth (NOT including cables): 84.1 mm (3.3 in.) • Depth (including cables): 164.5 mm (6.5 in.)
Weight (bare unit)	3.68 kg (8.1 lbs)

a6x Power specification

Nominal supply voltage	12 V dc
Operating voltage range	10.8 V dc to 15.6 V dc
Fuse / Breakers	It is recommended that you fit a thermal breaker or fuse at the distribution panel. The suitable fuse rating for the thermal breaker is dependent on the number of devices you are connecting. If in doubt consult an authorized Raymarine dealer
Power consumption	<p>Full brightness:</p> <ul style="list-style-type: none"> • a65 — 8.6 W Max • a67 — 12.2 W Max • a68 — 8.5 W Max <p>PowerSave mode:</p> <ul style="list-style-type: none"> • a65 — 3.8 W Max • a67 — 7.4 W Max • a68 — 4.9 W Max <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note: Power consumption figures represent a loaded system; for sonar variants this includes an active 600 W transducer and DownVision™ variants includes an active CPT-100 transducer.</p> </div>
LEN (Refer to Seatalk ^{ng} reference manual for further information).	1

a7x Power specification

Nominal supply voltage	12 V dc
Operating voltage range	10.8 V dc to 15.6 V dc

Fuse / Breakers	It is recommended that you fit a thermal breaker or fuse at the distribution panel. The suitable fuse rating for the thermal breaker is dependent on the number of devices you are connecting. If in doubt consult an authorized Raymarine dealer
Power consumption	<p>Full brightness:</p> <ul style="list-style-type: none"> • a75 — 7.7 W Max • a77 — 13.2 W Max • a78 — 9.9 W Max <p>PowerSave mode:</p> <ul style="list-style-type: none"> • a75 — 3.1 W Max • a77 — 8.2 W Max • a78 — 5.2 W Max
LEN (Refer to Seataalk ^{ng} reference manual for further information).	1

Note: Power consumption figures represent a loaded system; for sonar variants this includes an active 600 W transducer and **DownVision™** variants includes an active **CPT-100** transducer.

a9x Power specification

Nominal supply voltage	12 V / 24 V dc
Operating voltage range	10.8 V dc to 31.2 V dc
In-line Fuse	• 15 A (Standard 20 mm glass fuse)
Power consumption	<p>Full brightness:</p> <ul style="list-style-type: none"> • a95 — 13.8 W Max • a97 — 15.1 W Max • a98 — 15 W Max <p>PowerSave mode:</p> <ul style="list-style-type: none"> • a95 — 5.0 W Max • a97 — 7.3 W Max • a98 — 5.7 W Max
LEN (Refer to Seataalk ^{ng} reference manual for further information).	1

Note: Power consumption figures represent a loaded system; for sonar variants this includes an active 600 W transducer and **DownVision™** variants includes an active **CPT-100** transducer.

a12x Power specification

Nominal supply voltage	12 V / 24 V dc
Operating voltage range	10.8 V dc to 31.2 V dc
In-line Fuse	• 15 A (Standard 20 mm glass fuse)
Power consumption	<p>Full brightness:</p> <ul style="list-style-type: none"> • a125 — 23 W Max • a127 — 23.9 W Max • a128 — 24.3 W Max <p>PowerSave mode:</p> <ul style="list-style-type: none"> • a125 — 5.2 W Max • a127 — 7.4 W Max • a128 — 6.7 W Max
LEN (Refer to Seataalk ^{ng} reference manual for further information).	1

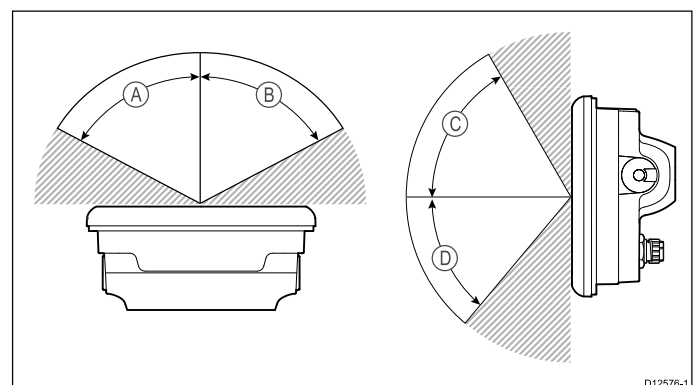
Note: Power consumption figures represent a loaded system; for sonar variants this includes an active 600 W transducer and **DownVision™** variants includes an active **CPT-100** transducer.

Environmental specification

Environmental specifications below apply to all display variants

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	Maximum 75%
Waterproof rating	<ul style="list-style-type: none"> • IPX6 and IPX7 • IPX6 (e165 only)

Viewing angle



	a6x	a7x	a9x	a12x
A (Right)	60°	75°	80°	80°
B (Left)	60°	75°	80°	80°
C (Up)	60°	70°	80°	80°
D (Down)	50°	75°	80°	80°

Note: The viewing angles stated above were taken using internationally agreed standards and should be used for comparison purposes only. Do NOT install the product before testing its viewability in the desired location.

Wireless connections

Wi-Fi	802.11 b / g
Bluetooth	Bluetooth 2.1 + EDR power class 1.5 (supported profile: AVRCP 1.0)

a Series Display specification

	a6x	a7x	a9x	a12x
Size	5.7 in	7 in	9.0 in	12.1 in
Type	TFT backlit LED	TFT backlit LED	TFT backlit LED	TFT backlit LED
Color depth	24-bit	24-bit	24-bit	24-bit
Resolution	640 x 480 VGA	800 x 480 WVGA	800 x 480 WVGA	1280 x 800 WXGA
Aspect	4:3	16:9	16:9	16:9
Maximum allowable wrongly illuminated pixels	5	6	6	6

Internal GPS specification

The Internal GPS specification applies to the following MFDs a Series (excluding a9x and a12x), c Series and e Series (excluding the e165).

Channels	50
Cold start	<2 minutes
Refresh rate	5 Hz
Receiver IC Sensitivity	163 dBm Tracking
Satellite Based Aiding System (SBAS)	WAAS + EGNOS + MSAS
Special features	Active Jamming Reduction
Operating frequency	1575.42MHz
Signal Acquisition	Automatic
Almanac Update	Automatic
Geodetic Datum	WGS-84, alternatives available through Raymarine displays.
Update Rate	1 second
Antenna	Ceramic chip
Accuracy	<ul style="list-style-type: none"> Without SBAS: <= 15 metres 95% of the time With SBAS: <= 5 metres 95% of the time

a6x and a7x Data connections

Wired connections

NMEA 2000	1 x SeaTalk ^{ng} ® connection
Network (SeaTalk ^{hs})	1 x RayNet type SeaTalk ^{hs} port. 10/100 Mbits/s

Wireless connections

Wi-Fi	802.11 b / g <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> Note: Wi-Fi connection only applies to Wi-Fi variant displays. </div>
Bluetooth	Bluetooth 2.1 + EDR power class 1.5 (supported profile: AVRCP 1.0)

a9x and a12x Data connections

Wired connections

NMEA 0183	<ul style="list-style-type: none"> NMEA port 1: Input and output, 4800 / 38400 baud rates NMEA port 2: Input only, 4800 / 38400 baud rates
NMEA 2000	1 x SeaTalk ^{ng} ® connection
Network (SeaTalk ^{hs})	2 x RayNet type SeaTalk ^{hs} port. 10/100 Mbits/s
GA150	1 x TNC type external GPS / GLONASS antenna connection
Video input	1 x BNC type video input connection

Internal GNSS (GPS / GLONASS) receiver specification

Channels	72
Cold start	<2 minutes
Receiver IC Sensitivity	-167 dBm (Tracking) / -148 dBm (Acquisition)
GNSS compatibility	<ul style="list-style-type: none"> GPS GLONASS * Beidou
SBAS compatibility	<ul style="list-style-type: none"> WAAS EGNOS MSAS
Special features	Active Jamming and Interference Reduction
Operating frequency	<ul style="list-style-type: none"> GPS L1 C/A GLONASS L10F Beidou B1
Signal Acquisition	Automatic
Almanac Update	Automatic

Geodetic Datum	WGS-84 (alternatives available through Raymarine MFD)
Refresh Rate	10 Hz (10 times per second Concurrent GNSS)
Antenna	<ul style="list-style-type: none"> • Internal — Ceramic chip mounted near top of unit • External — GA150 external antenna may be used
Position Accuracy	<ul style="list-style-type: none"> • Without SBAS: <= 15 metres 95% of the time • With SBAS: <= 5 metres 95% of the time

Note: * Supported but not currently available. A software update will be required to add support for this GNSS when it becomes available. A GA150 must be connected to receive Beidou. Please check with your Raymarine dealer for further details.

Internal 600 W sonar specification

The following specification only applies to multifunction displays that include a built-in 600 W sonar module.

Operating frequencies	50 / 83 / 200 KHz
Transmit power	Up to 600 W RMS, depending on transducer
Depth range	Up to 3000 ft, depending on transducer

Sonar / DownVision™ specification

The following specification only applies to **DownVision™** products.

Channels	2 x CHIRP (1 x traditional sonar and 1 x DownVision™)
Beam coverage	<ul style="list-style-type: none"> • Sonar — conical beam. • DownVision™ — Wide (port / starboard) and thin (fore / aft) fan beam.
Depth range	0.6 M (2 ft) to 183 m (600 ft). Depending on water conditions, the Sonar channel maybe able to achieve increased depth range over the DownVision™ channel.

Note: The **DV** and **Wi-Fish™** variants are single channel **DownVision™** only products.

a9x and a12x Video specification

Signal type	Composite
Format	PAL or NTSC
Connector type	BNC (female)
Output resolution	720p

Internal storage

Multifunction displays (**MFDs**) include internal storage that can be used to store recorded video and photos taken using the Camera application. The table below shows the approximate available internal storage space for **LightHouse™** powered **MFDs**.

MFD variant	Approximate available internal storage	Approximate record time (CAM200IP)
a Series	2 GB	88.8 minutes
c Series	2 GB	88.8 minutes
e Series (excluding e165)	2 GB	88.8 minutes
e165	6 GB	266.6 minutes
gS Series	14 GB	622.2 minutes
eS Series	6 GB	266.6 minutes

Note:

- The available internal storage stated above is based on **MFD** manufactured after May 2014. Available storage on displays manufactured prior to this date may vary.
- Available internal storage space is subject to change without prior notice.
- The approximate record times stated above were taken using a **CAM200IP** set to its default resolution of 720p. Increasing image resolution and other factors such as lighting conditions may affect the resulting filesize and therefore reduce the available record time.

Electronic chart specification

Embedded electronic charts	<ul style="list-style-type: none"> • LightHouse Charts world base map. • Navionics world base map. • Jeppesen world base map
Compatible LightHouse cartography	<ul style="list-style-type: none"> • Vector — LightHouse charts • Raster — LightHouse charts
Compatible Navionics cartography	<ul style="list-style-type: none"> • Navionics Ready to Navigate • Navionics Silver • Navionics Gold • Navionics Gold+ • Navionics Platinum • Navionics Platinum+ • Navionics Fish'N Chip • Navionics Hotmaps
Compatible Jeppesen cartography	<ul style="list-style-type: none"> • C-MAP Essentials • C-MAP 4D MAX • C-MAP 4D MAX+

Note:

Refer to the Raymarine website (www.raymarine.com) for the latest list of supported charts.

Conformance specification

Conformance certification applies to all display variants

Conformance	<ul style="list-style-type: none"> • NMEA 2000 certification • WiFi Alliance certification • Bluetooth certification • Europe: 1999/5/EC • Australia and New Zealand: C-Tick, Compliance Level 2 • FCC 47CFR part 15 • Industry Canada RSS210
--------------------	--

8.2 c and e Series**e7 / e7D Physical specifications**

Dimensions	<ul style="list-style-type: none"> • Width: 233 mm (9.17 in.) • Height (NOT including bracket): 145 mm (5.71 in.) • Height (including bracket): 180 mm (7.09 in.) • Depth (NOT including cables): 64 mm (2.52 in.) • Depth (including cables): 160 mm (6.29 in.)
Weight (bare unit)	<p>e7</p> <ul style="list-style-type: none"> • 1.465 kg (3.23 lb.) <p>e7D</p> <ul style="list-style-type: none"> • 1.550 kg (3.42 lb.)
Weight (boxed unit)	<p>e7</p> <ul style="list-style-type: none"> • 2.385 kg (5.26 lb.) <p>e7D</p> <ul style="list-style-type: none"> • 2.423 kg (5.34 lb.)

e95 / e97 / c95 / c97 Physical specifications

Dimensions	<ul style="list-style-type: none"> • Width: 290 mm (11.42 in.) • Height (NOT including bracket): 173 mm (6.81 in.) • Height (including bracket): 212 mm (8.35 in.) • Depth (NOT including cables): 64 mm (2.52 in.) • Depth (including cables): 160 mm (6.29 in.)
Weight (bare unit)	<p>e95 / c95</p> <ul style="list-style-type: none"> • 2.165 kg (4.77 lb.) <p>e97 / c97</p> <ul style="list-style-type: none"> • 2.265 kg (4.99 lb.)
Weight (boxed unit)	<p>e95 / c95</p> <ul style="list-style-type: none"> • 3.540 kg (7.8 lb.) <p>e97 / c97</p> <ul style="list-style-type: none"> • 3.635 kg (8 lb.)

e125 / e127 / c125 / c127 Physical specifications

Dimensions	<ul style="list-style-type: none"> • Width: 354 mm (13.94 in.) • Height (NOT including bracket): 222 mm (8.74 in.) • Height (including bracket): 256 mm (10.08 in.) • Depth (NOT including cables): 69 mm (2.72 in.) • Depth (including cables): 160 mm (6.29 in.)
Weight (bare unit)	e125 / c125 <ul style="list-style-type: none"> • 3.320 kg (7.32 lb.) e127 / c127 <ul style="list-style-type: none"> • 3.450 kg (7.6 lb.)
Weight (boxed unit)	e125 / c125 <ul style="list-style-type: none"> • 4.955 kg (10.9 lb.) e127 / c127 <ul style="list-style-type: none"> • 5.070 kg (11.18 lb.)

e165 Physical specifications

Dimensions	<ul style="list-style-type: none"> • Width: 426 mm (16.8 in) • Height (NOT including bracket): 281.4 mm (11.1 in) • Height (including bracket): 295 mm (11.6 in) • Depth (NOT including cables): 68.4 mm (2.7 in) • Depth (including cables): 176.6 mm (7 in)
Weight (bare unit)	5.6 kg (12.3lb)

e7 / e7D Power specification

Nominal supply voltage	12 V dc
Operating voltage range	10.8 V dc to 15.6 V dc
Fuse / Breakers	In-line fuse (fitted within power cable) <ul style="list-style-type: none"> • 15 A (Standard 20 mm glass fuse)

Power consumption	Full brightness: <ul style="list-style-type: none"> • e7 — 10 W • e7D — 13.8 W PowerSave mode: <ul style="list-style-type: none"> • e7 — 4.3 W • e7D — 10.3 W <div style="border: 1px solid black; padding: 5px;"> <p>Note: Power consumption figures represent a loaded system and for sonar variants include an active 600 W transducer.</p> </div>
LEN (Refer to Seataalk ^{ng} reference manual for further information).	1

c95 / c97 / e95 / e97 power specification

Nominal supply voltage	12/24 V dc
Operating voltage range	10.8 V dc to 31.2 V dc
Fuse / Breakers	In-line fuse (fitted within power cable) <ul style="list-style-type: none"> • 15 A (Standard 20 mm glass fuse)
Power consumption	Full brightness: <ul style="list-style-type: none"> • c95 — 13.1 W • c97 — 16.7 W • e95 — 18 W • e97 — 22.1 W PowerSave mode: <ul style="list-style-type: none"> • c95 — 5.9 W • c97 — 9.7 W • e95 — 11.2 W • e97 — 14.9 W <div style="border: 1px solid black; padding: 5px;"> <p>Note: Power consumption figures represent a loaded system and for sonar variants include an active 600 W transducer.</p> </div>
LEN (Refer to Seataalk ^{ng} reference manual for further information).	1

c125 / c127 / e125 / e127 power specification

Nominal supply voltage	12/24 V dc
Operating voltage range	10.8 V dc to 31.2 V dc

Fuse / Breakers	In-line fuse (fitted within power cable) <ul style="list-style-type: none"> • 15 A (Standard 20 mm glass fuse)
Power consumption	Full brightness: <ul style="list-style-type: none"> • c125 — 16.3 W • c127 — 20.8 W • e125 — 27.6 W • e127 — 33.5 W PowerSave mode: <ul style="list-style-type: none"> • c125 — 6.1 W • c127 — 14.6 W • e125 — 10.9 W • e127 — 17 W <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note: Power consumption figures represent a loaded system and for sonar variants include an active 600 W transducer.</p> </div>
LEN (Refer to Seatalk ^{ng} reference manual for further information).	1

e165 power specification

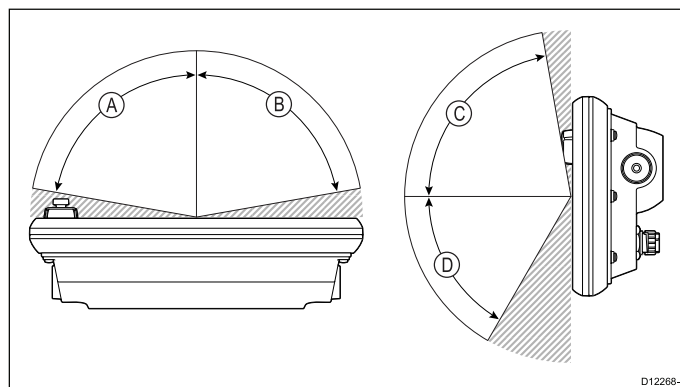
Nominal supply voltage	12/24 V dc
Operating voltage range	10.8 V dc to 31.2 V dc
Fuse / Breakers	In-line fuse (fitted within power cable) <ul style="list-style-type: none"> • 15 A (Standard 20 mm glass fuse)
Power consumption	Full brightness: <ul style="list-style-type: none"> • e165 — 59.5 W PowerSave mode: <ul style="list-style-type: none"> • e165 — 10.9 W <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note: Power consumption figures represent a loaded system and for sonar variants include an active 600 W transducer.</p> </div>
LEN (Refer to Seatalk ^{ng} reference manual for further information).	1

Environmental specification

Environmental specifications below apply to all display variants

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	Maximum 75%
Waterproof rating	<ul style="list-style-type: none"> • IPX6 and IPX7 • IPX6 (e165 only)

Viewing angle



	e7 / e7D	e95 / e97 / c95 / c97	e125 / e127 / c125 / c127	e165
A	70°	80°	80°	80°
B	70°	80°	80°	80°
C	70°	80°	80°	70°
D	50°	60°	60°	70°

Note: The viewing angles stated above were taken using internationally agreed standards and should be used for comparison purposes only. Do NOT install the product before testing the viewability in the desired location.

e7 / e7D Display specification

Size	7 in.
Type	TFT backlit LED
Color depth	24-bit
Resolution	800 x 480 pixels (WVGA)
Maximum allowable wrongly illuminated pixels	7

e95 / e97 / c95 / c97 Display specification

Size	9 in.
Type	TFT backlit LED
Color depth	24-bit
Resolution	800 x 480 pixels (WVGA)
Maximum allowable wrongly illuminated pixels	8

e125 / e127 / c125 / c127 Display specification

Size	12 in.
Type	TFT backlit LED
Color depth	24-bit
Resolution	1280 x 800 pixels (WXGA)
Maximum allowable wrongly illuminated pixels	8

e165 Display specification

Size	15.4 in.
Type	TFT backlit LED
Color depth	24-bit
Resolution	1280 x 800 pixels (WXGA)
Aspect ratio	16:9
Maximum allowable wrongly illuminated pixels	8

c Series and e Series data connections

Wired connections

NMEA 0183	2x NMEA 0183 ports: <ul style="list-style-type: none"> NMEA port 1: Input and output, 4800 / 38400 baud NMEA port 2: Input only, 4800 / 38400 baud
NMEA 2000	1 x SeaTalk ^{ng} connection
Network (SeaTalk ^{hs})	<ul style="list-style-type: none"> e7 and e7D = 1 x RayNet type SeaTalk^{hs} port. 10/100 Mbits/s c Series and e Series (excluding e7 and e7D) = 2x RayNet type SeaTalk^{hs} port. 10/100 Mbits/s

Wireless connections

Wi-Fi	802.11 b / g
Bluetooth	Bluetooth 2.1+ EDR power class 1.5 (supported profile: AVRCP 1.0)

Internal GPS specification

The Internal GPS specification applies to the following MFDs a Series (excluding a9x and a12x), c Series and e Series (excluding the e165).

Channels	50
Cold start	<2 minutes
Refresh rate	5 Hz
Receiver IC Sensitivity	163 dBm Tracking
Satellite Based Aiding System (SBAS)	WAAS + EGNOS + MSAS
Special features	Active Jamming Reduction
Operating frequency	1575.42MHz
Signal Acquisition	Automatic

Almanac Update	Automatic
Geodetic Datum	WGS-84, alternatives available through Raymarine displays.
Update Rate	1 second
Antenna	Ceramic chip
Accuracy	<ul style="list-style-type: none"> Without SBAS: <= 15 metres 95% of the time With SBAS: <= 5 metres 95% of the time

Internal 600 W sonar specification

The following specification only applies to multifunction displays that include a built-in 600 W sonar module.

Operating frequencies	50 / 83 / 200 KHz
Transmit power	Up to 600 W RMS, depending on transducer
Depth range	Up to 3000 ft, depending on transducer

Video specification

Signal type	Composite
Format	PAL or NTSC
Connector type	BNC (female)
Output resolution	720p

Internal storage

Multifunction displays (MFDs) include internal storage that can be used to store recorded video and photos taken using the Camera application. The table below shows the approximate available internal storage space for LightHouseTM powered MFDs.

MFD variant	Approximate available internal storage	Approximate record time (CAM200IP)
a Series	2 GB	88.8 minutes
c Series	2 GB	88.8 minutes
e Series (excluding e165)	2 GB	88.8 minutes
e165	6 GB	266.6 minutes
gS Series	14 GB	622.2 minutes
eS Series	6 GB	266.6 minutes

Note:

- The available internal storage stated above is based on **MFD** manufactured after May 2014. Available storage on displays manufactured prior to this date may vary.
- Available internal storage space is subject to change without prior notice.
- The approximate record times stated above were taken using a **CAM200IP** set to its default resolution of 720p. Increasing image resolution and other factors such as lighting conditions may affect the resulting filesize and therefore reduce the available record time.

Electronic chart specification

Embedded electronic charts	<ul style="list-style-type: none"> • LightHouse Charts world base map. • Navionics world base map. • Jeppesen world base map
Compatible LightHouse cartography	<ul style="list-style-type: none"> • Vector — LightHouse charts • Raster — LightHouse charts
Compatible Navionics cartography	<ul style="list-style-type: none"> • Navionics Ready to Navigate • Navionics Silver • Navionics Gold • Navionics Gold+ • Navionics Platinum • Navionics Platinum+ • Navionics Fish'N Chip • Navionics Hotmaps
Compatible Jeppesen cartography	<ul style="list-style-type: none"> • C-MAP Essentials • C-MAP 4D MAX • C-MAP 4D MAX+

Note:

Refer to the Raymarine website (www.raymarine.com) for the latest list of supported charts.

Conformance specification

Conformance certification applies to all display variants

Conformance	<ul style="list-style-type: none"> • NMEA 2000 certification • WiFi Alliance certification • Bluetooth certification • Europe: 1999/5/EC • Australia and New Zealand: C-Tick, Compliance Level 2 • FCC 47CFR part 15 • Industry Canada RSS210
--------------------	--

Chapter 9: Technical support

Chapter contents

- [9.1 Raymarine product support and servicing on page 98](#)
- [9.2 Learning resources on page 99](#)
- [9.3 Third-party support on page 99](#)

9.1 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 the menus within your product.

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>.

Region	Tele- phone	E-mail
United Kingdom (UK), EMEA, and Asia Pacific	+44 (0)1329 246 932	emea.service@raymarine.com
United States (US)	+1 (603) 324 7900	rm-usrepair@flir.com

Web support

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

- **Manuals and Documents** — <http://www.raymarine.co.uk/display/?id=10125>
- **FAQ / Knowledgebase** — <http://www.raymarine.co.uk/knowledgebase/>
- **Technical support forum** — <http://raymarine.ning.com/>
- **Software updates** — <http://www.raymarine.com/software>

Telephone and e-mail support

Region	Tele- phone	E-mail
United Kingdom (UK), EMEA, and Asia Pacific	+44 (0)1329 246 777	support.uk@raymarine.com
United States (US)	+1 (603) 324 7900 (Toll-free: +800 539 5539)	support@raymarine.com

Region	Tele- phone	E-mail
Australia and New Zealand	+61 2 8977 0300	aus.support@raymarine.com (Raymarine subsidiary)
France	+33 (0)1 46 49 72 30	support.fr@raymarine.com (Raymarine subsidiary)
Germany	+49 (0)40 237 808 0	support.de@raymarine.com (Raymarine subsidiary)
Italy	+39 02 9945 1001	support.it@raymarine.com (Raymarine subsidiary)
Spain	+34 96 2965 102	sat@azimut.es (Authorized Raymarine distributor)
Netherlands	+31 (0)26 3614 905	support.nl@raymarine.com (Raymarine subsidiary)
Sweden	+46 (0)317 633 670	support.se@raymarine.com (Raymarine subsidiary)
Finland	+358 (0)207 619 937	support.fi@raymarine.com (Raymarine subsidiary)
Norway	+47 692 64 600	support.no@raymarine.com (Raymarine subsidiary)
Denmark	+45 437 164 64	support.dk@raymarine.com (Raymarine subsidiary)
Russia	+7 495 788 0508	info@mikstmarine.ru (Authorized Raymarine distributor)

Viewing product information

With the homescreen displayed:

1. Select **Set-up**.
2. Select **Maintenance**.
3. Select **Diagnostics**.
4. Select **Select Device**.
5. Select the relevant product from the list.
6. Select **Show All Data**.

9.2 Learning resources

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

Video tutorials

	<p>Raymarine official channel on YouTube:</p> <ul style="list-style-type: none">• http://www.youtube.com/user/RaymarineInc
	<p>Video Gallery:</p> <ul style="list-style-type: none">• http://www.raymarine.co.uk/view/?id=2679
	<p>Product Support videos:</p> <ul style="list-style-type: none">• http://www.raymarine.co.uk/view/?id=4952

Note:

- Viewing the videos requires a device with an Internet connection.
- Some videos are only available in English.

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>

FAQs and Knowledge Base

Raymarine has produced an extensive set of FAQs and a Knowledge Base to help you find more information and troubleshoot any issues.

- <http://www.raymarine.co.uk/knowledgebase/>

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:

- <http://raymarine.ning.com/>

9.3 Third-party support

Contact and support details for third-party suppliers can be found on the appropriate websites.

Fusion

www.fusionelectronics.com

Navionics

www.navionics.com

Sirius

www.sirius.com

Chapter 10: Spares and accessories

Chapter contents

- 10.1 a Series spares on page 102
- 10.2 c Series and e Series spares on page 102
- 10.3 Digital ClearPulse Transducers and accessories on page 103
- 10.4 **DownVision™** transducers and accessories on page 104
- 10.5 Network hardware on page 105
- 10.6 **RayNet** to **RayNet** cables and connectors on page 106
- 10.7 Network cable types on page 109
- 10.8 SeaTalk^{ng} cabling components on page 109

10.1 a Series spares

Item	Part numbers			
	a6x	a7x	a9x	a12x
Trunnion (bracket)	R70147	R70158	R70305	R70309
Front kit bezel (Gun-metal)	R70148	R70156	R70304	R70308
Front bezel (Black)	R70359	R70360	R70357	R70358
Suncover	R70149	R70155	R70303	R70307
Power cable Straight 1.5 m (4.9 ft)	R70159	R70159	R62379	R62379
Power cable – right-angled 1.5 m (4.9 ft)	A80221	A80221	R70029	R70029
Mounting screw kit	R70197	R70230		

10.2 c Series and e Series spares

Item	Part numbers			
	e7 / e7D	e9x / c9x	e12x / c12x	e165
Trunnion (bracket) mount kit	A62358	R70001	R70002	A80176
Front bezel (Gun-metal)	R62377	R70004	R70006	R70126
Rear bezel (Gun-metal)	N/A	R70027	R70028	N/A
Front bezel (Black)	R70361	R70362	R70363	R70364
Suncover	R62365	R70005	R70007	R70127
Power and data cable – Straight 1.5 m (4.9 ft)	R62379	R62379	R62379	R62379
Power and data cable – Right-angled 1.5 m (4.9 ft)	R70029	R70029	R70029	R70029
Mounting adaptor kit (Wide-screen MFDs)	N/A	R70008	R70009	N/A
Mounting adaptor kit (Classic MFDs)	N/A	R70010	R70011	N/A
Mounting screw kit	R62369	N/A	N/A	N/A
Flush mount panel kit	R62376	R70079	R70080	R70125

e9 and e12 Video cables

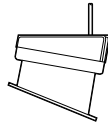
The following video cable is required for the video in / out connector on the e95 / e97 / e125 / e127 variant multifunction displays.

Part number	Description	Notes
R70003	5 m (16.4 ft.) Video cable for e9 and e12 (1 x video in and 1 x video out VGA)	

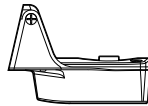
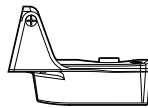
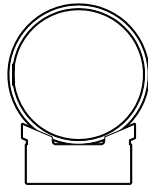
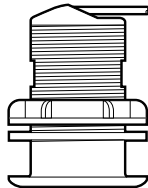
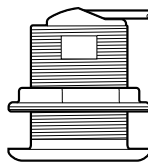
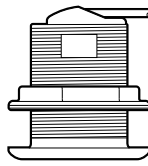
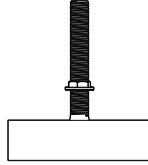
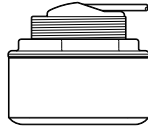
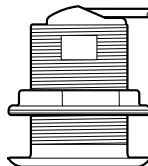
10.3 Digital ClearPulse Transducers and accessories

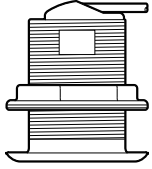
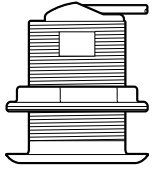
The transducers listed below can be connected directly to sonar variant MFDs.

Depth transducers

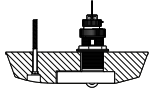
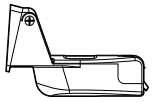
Part number	Image	Mounting	Housing
A80170		In-Hull	P79

Depth and Temperature transducers

Part number	Image	Mounting	Housing
A80150		Transom	P48
A102140		Transom	P48 (widebeam)
E66073		In-hull / Trolling	P74
A80171		Thru-hull — Low profile	P319
E66087		Thru-hull	B60 (20° angle)
E66088		Thru-hull	B60 (12° angle)
A80172		Thru-hull	B258
A80173		Thru-hull — Low profile	B164
A80214		Thru-hull	SS60 (600W, 0° angle)

Part number	Image	Mounting	Housing
A80215		Thru-hull	SS60 (600W, 12° angle)
A80216		Thru-hull	SS60 (600W, 20° angle)

Depth, Speed and Temperature (DST) transducers

Part number	Image	Mounting	Housing
A66090		Thru-hull	B744V (including fairing block)
A102138		Transom	P58

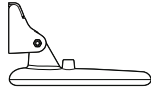
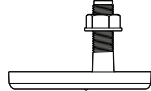
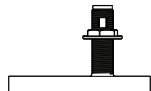
Accessories

Part number	Item	Notes
A62363	1 m (3.28 ft) Minn Kota transducer adaptor cable	Only for direct connection to sonar variant multifunction display.
E66066	0.5 m (1.64 ft) transducer adaptor cable for DSM transducers	For connecting any 600 watt sonar module-compatible sonar transducer directly to a sonar variant multifunction display.
E66074	3 m (9.84 ft.) transducer extension cable	

10.4 DownVision™ transducers and accessories

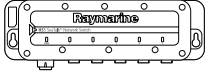
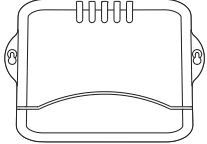
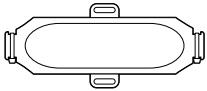
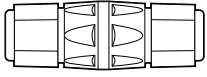
The transducers listed below can be connected directly to **DownVision™** variant MFDs.

Depth and temperature transducers

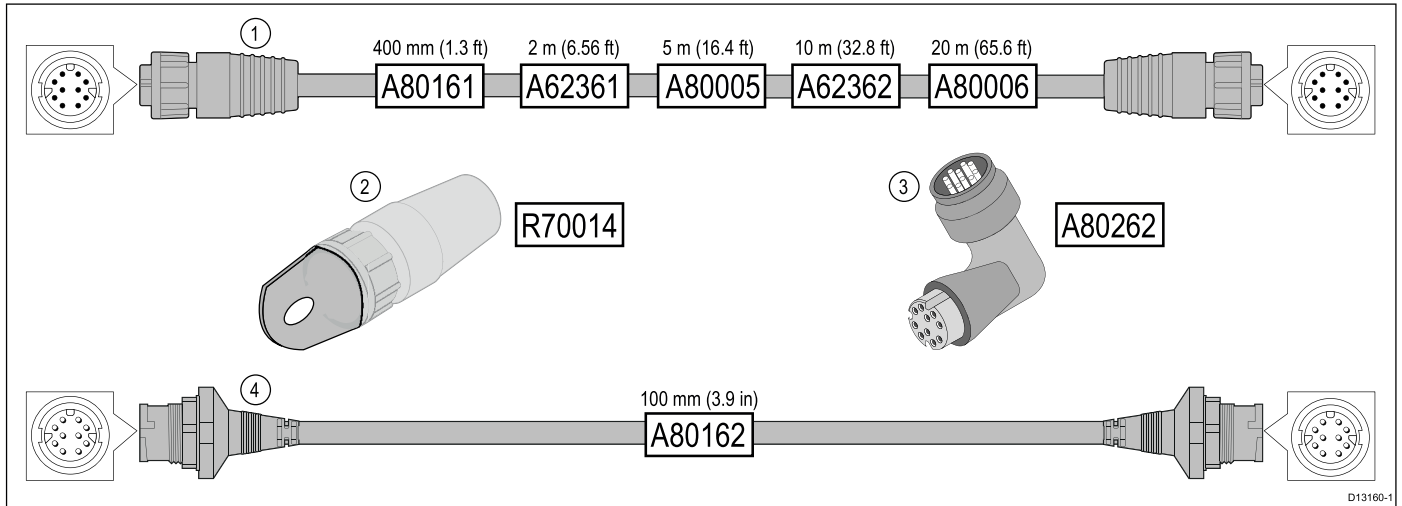
Part number	Image	Mounting	Housing
A80270		Transom	CPT-100 plastic
A80277		Thru-hull	CPT-110 plastic
A80271		Thru-hull	CPT-120 bronze

Part number	Description	Notes
A80207	Transom transducer shield for vessels with a trolling motor	
A80273	4 m (13.12 ft) transducer extension cable for CPT-100, CPT-110 and CPT-120 transducers	

10.5 Network hardware

Item	Part number	Notes
HS5 RayNet network switch 	A80007	5–port switch for network connection of multiple devices featuring RayNet connectors. Equipment with RJ45 SeaTalk ^{hs} connectors can also be connected using suitable adapter cables.
RJ45 SeaTalk ^{hs} network switch 	E55058	8–port switch for network connection of multiple SeaTalk ^{hs} devices featuring RJ45 connectors.
RJ45 SeaTalk ^{hs} crossover coupler 	E55060	<ul style="list-style-type: none"> • Enables direct connection of RJ45 SeaTalk^{hs} devices to smaller systems where a switch is not required. • Enables the connection of RJ45 SeaTalk^{hs} devices to a HS5 RayNet network switch (in conjunction with suitable adapter cables). • Enables 2 RJ45 SeaTalk^{hs} cables to be connected together to extend the length of the cabling. <p>Recommended for internal installations.</p> <div style="border: 1px solid black; padding: 5px;"> <p>Important: Do NOT use crossover devices for POE (Power Over Ethernet) connections.</p> </div>
Ethernet RJ45 coupler 	R32142	<ul style="list-style-type: none"> • Enables direct connection of RJ45 SeaTalk^{hs} devices to smaller systems where a switch is not required. • Enables the connection of RJ45 SeaTalk^{hs} devices to a HS5 RayNet network switch (in conjunction with suitable adapter cables). • Enables 2 RJ45 SeaTalk^{hs} cables to be connected together to extend the length of the cabling. <p>Recommended for external installations.</p>

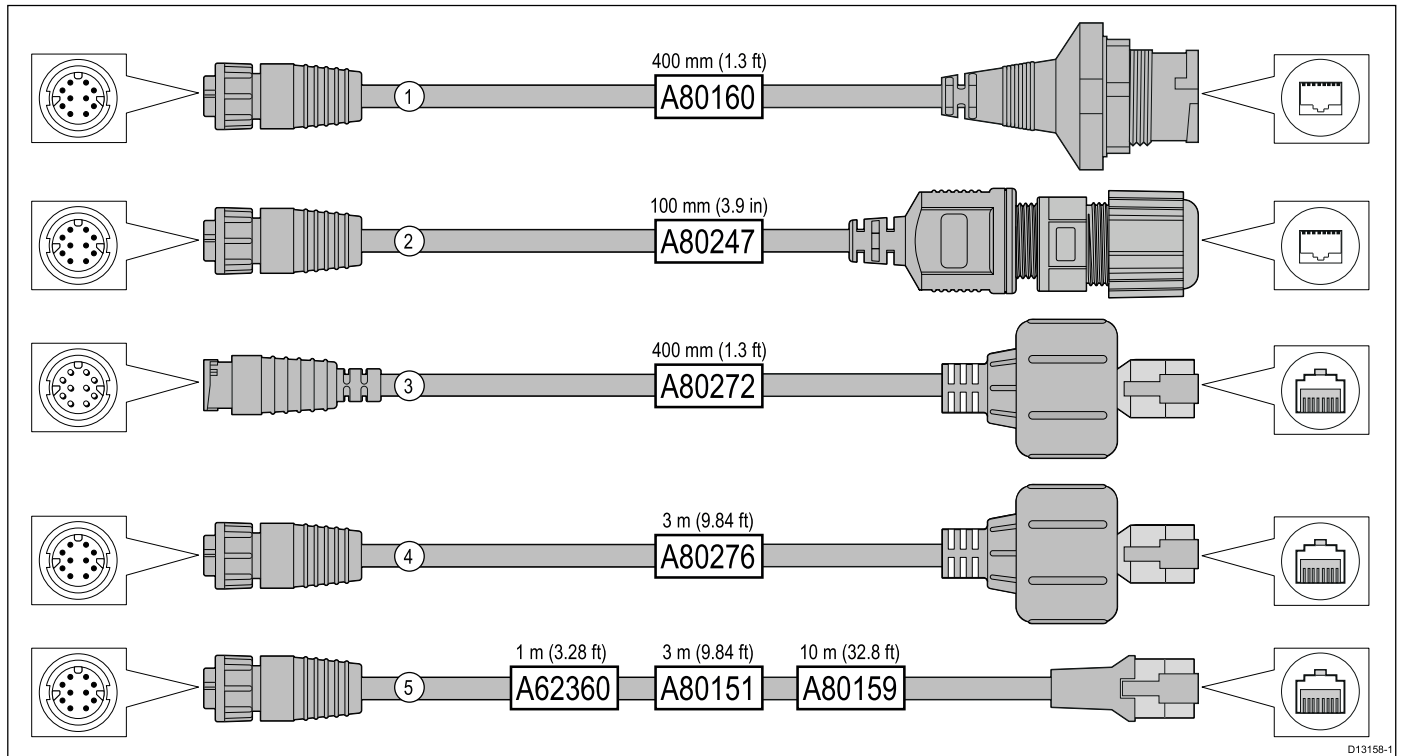
10.6 RayNet to RayNet cables and connectors



D13160-1

	Description	Typical use	Quantity
1	Standard RayNet connection cable with a RayNet (female) socket on both ends.	Suitable for connecting all RayNet equipment directly to LightHouse multifunction displays featuring a RayNet connector. Can also be used to connect RayNet equipment via a RayNet network switch (e.g. HS5).	1
2	RayNet cable puller (5 pack).	These “handles” securely attach to the twist-lock on RayNet cables, enabling you to pull the cables through conduits and other obstacles.	5
3	RayNet to RayNet right-angle coupler / adapter.	Suitable for connecting RayNet cables at 90° (right angle) to devices, for installations where space is limited. For example, use this adapter to connect a RayNet cable to a multifunction display when there is not enough space behind the display for the usual cable bend radius required by a standard RayNet cable. This adapter features a RayNet (female) socket at one end, and a RayNet (male) plug at the other end.	1
4	Adapter cable with a RayNet (male) plug on both ends.	Suitable for joining (female) RayNet cables together for longer cable runs.	1

RayNet to RJ45 adapter cables

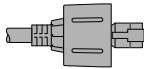
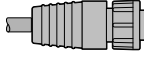


D13158-1

	Description	Typical use	Quantity
1	<p>Adapter cable with a RayNet (female) socket on one end, and a waterproof (female) socket on the other end accepting the following cables with an RJ45 SeaTalk^{hs} waterproof locking (male) plug:</p> <ul style="list-style-type: none"> • A62245 (1.5 m). • A62246 (15 m). 	<p>A typical use for this adapter cable is to connect a DSM300 sonar module to a LightHouse MFD, using all-waterproof cable connections. This adapter cable will also accept the following RJ45 SeaTalk^{hs} cables, although the RJ45 plug that connects at the equipment end (e.g. DSM300) will NOT be waterproof:</p> <ul style="list-style-type: none"> • E55049 (1.5 m). • E55050 (5 m). • E55051 (10 m). • A62135 (15 m). • E55052 (20 m). 	1
2	<p>Adapter cable with a RayNet (female) socket on one end, and a waterproof (female) RJ45 socket on the other end, along with a locking gland for a watertight fit.</p>	<p>Directly connect a Raymarine radar scanner with an RJ45 SeaTalk^{hs} (male) cable to a RayNet network switch (e.g. HS5) or LightHouse MFD.</p>	1
3	<p>Adapter cable with a RayNet (male) plug on one end, and an RJ45 SeaTalk^{hs} waterproof (male) plug on the other end.</p>	<p>Connect a legacy G-Series GPM-400, C-Series Widescreen or E-Series Widescreen MFD to a Raymarine radar scanner supplied with a RayNet power / data cable.</p>	1
4	<p>Adapter cable with a RayNet (female) socket on one end, and an RJ45 SeaTalk^{hs} waterproof (male) plug on the other end.</p>	<p>Connect a legacy G-Series GPM-400, C-Series Widescreen or E-Series Widescreen MFD to a RayNet network switch (e.g. the HS5).</p>	1
5	<p>Adapter cable with a RayNet (female) socket on one end, and an RJ45 SeaTalk^{hs} (female) socket on the other end.</p>	<p>Connect a LightHouse MFD to a legacy SR6 switch / weather receiver or a legacy 8–port SeaTalk^{hs} network switch. Another common use for the cable is in conjunction with a crossover coupler (E55060 or R32142) to connect Raymarine products with an RJ45 connection (e.g. radar scanner, thermal camera or DSM300) to a LightHouse MFD or RayNet network switch (e.g. the HS5).</p>	1

Network cable connector types

There are 2 types of network cable connector — SeaTalk^{hs} and RayNet.

	<p>SeaTalk^{hs} connector — used for connecting SeaTalk^{hs} devices to a Raymarine network switch via SeaTalk^{hs} cables.</p>
	<p>RayNet connector — used for connecting Raymarine network switches and SeaTalk^{hs} devices to the multifunction display via RayNet cables. Also required for connecting a crossover coupler if only one device is being connected to the display's Network connector.</p>

10.7 Network cable types

There are 2 types of **SeaTalk^{hs}** network cable — “patch” and “network”.

- **Patch** — for connecting the following devices to a Raymarine network switch:
 - Thermal camera via PoE injector.
 - Additional Raymarine network switch.
 - PC or laptop using **Voyage Planner** software.
- **Network** — for connecting the following devices to a Raymarine network switch:
 - Sonar Module.
 - SR100 Sirius weather receiver.
 - Additional compatible Raymarine multifunction displays.

SeaTalk^{hs} network cables

Cable	Part number
1.5 m (4.9 ft) SeaTalk ^{hs} network cable	E55049
5 m (16.4 ft) SeaTalk ^{hs} network cable	E55050
10 m (32.8 ft) SeaTalk ^{hs} network cable	E55051
20 m (65.6 ft) SeaTalk ^{hs} network cable	E55052

SeaTalk^{hs} patch cables

Cable	Part number
1.5 m (4.9 ft) SeaTalk ^{hs} patch cable	E06054
5 m (16.4 ft) SeaTalk ^{hs} patch cable	E06055
10 m (32.8 ft) SeaTalk ^{hs} patch cable	E06056
15 m (49.2 ft) SeaTalk ^{hs} patch cable	A62136
20 m (65.6 ft) SeaTalk ^{hs} patch cable	E06057

10.8 SeaTalk^{ng} cabling components

SeaTalk^{ng} cabling components and their purposes.

Connection / Cable	Notes
Backbone cable (various lengths)	The main cable carrying data. Spurs from the backbone are used to connect SeaTalk ^{ng} devices.
T-piece connector	Used to make junctions in the backbone to which devices can then be connected.
Terminator	Required at either end of the backbone.
Inline terminator	Used to connect a spur cable directly to the end of a backbone; useful for longer cable runs.
Spur cable	Used to connect devices to the backbone. Devices may be daisy chained or connected directly to the T-pieces.
SeaTalk ^{ng} 5-way connector	Used to branch, split, or make additional connections in SeaTalk or SeaTalk ^{ng} networks.
Blanking plug	Inserted into unused spur connector positions in a 5-way connector or T-piece.

SeaTalk^{ng} cables and accessories

SeaTalk^{ng} cables and accessories for use with compatible products.

Description	Part No	Notes
SeaTalk ^{ng} starter kit	T70134	Includes: <ul style="list-style-type: none"> • 1 x 5 Way connector (A06064) • 2 x Backbone terminator (A06031) • 1 x 3 m (9.8 ft) spur cable (A06040) • 1 x Power cable (A06049)
SeaTalk ^{ng} Backbone Kit	A25062	Includes: <ul style="list-style-type: none"> • 2 x 5 m (16.4 ft) Backbone cable (A06036) • 1 x 20 m (65.6 ft) Backbone cable (A06037) • 4 x T-piece (A06028) • 2 x Backbone terminator (A06031) • 1 x Power cable (A06049)

Description	Part No	Notes
SeaTalk ^{ng} 0.4 m (1.3 ft) spur	A06038	
SeaTalk ^{ng} 1 m (3.3 ft) spur	A06039	
SeaTalk ^{ng} 3 m (9.8 ft) spur	A06040	
SeaTalk ^{ng} 5 m (16.4 ft) spur	A06041	
SeaTalk ^{ng} 0.4 m (1.3 ft) elbow spur	A06042	
SeaTalk ^{ng} 0.4 m (1.3 ft) backbone	A06033	
SeaTalk ^{ng} 1 m (3.3 ft) backbone	A06034	
SeaTalk ^{ng} 3 m (9.8 ft) backbone	A06035	
SeaTalk ^{ng} 5 m (16.4 ft) backbone	A06036	
SeaTalk ^{ng} 9 m (29.5 ft) backbone	A06068	
SeaTalk ^{ng} 20 m (65.6 ft) backbone	A06037	
SeaTalk ^{ng} to bare ends 1 m (3.3 ft) spur	A06043	
SeaTalk ^{ng} to bare ends 3 m (9.8 ft) spur	A06044	
SeaTalk ^{ng} Power cable	A06049	
SeaTalk ^{ng} Terminator	A06031	
SeaTalk ^{ng} T-piece	A06028	Provides 1 x spur connection
SeaTalk ^{ng} 5-way connector	A06064	Provides 3 x spur connections
SeaTalk ^{ng} backbone extender	A06030	
SeaTalk to SeaTalk ^{ng} converter kit	E22158	Allows the connection of SeaTalk devices to a SeaTalk ^{ng} system.
SeaTalk ^{ng} Inline terminator	A80001	Provides direct connection of a spur cable to the end of a backbone cable. No T-piece required.
SeaTalk ^{ng} Blanking plug	A06032	
ACU / SPX SeaTalk ^{ng} spur cable 0.3 m (1.0 ft)	R12112	Connects an SPX course computer or an ACU to a SeaTalk ^{ng} backbone.
SeaTalk (3 pin) to SeaTalk ^{ng} adaptor cable 0.4 m (1.3 ft)	A06047	

Description	Part No	Notes
SeaTalk to SeaTalk ^{ng} spur 1 m (3.3 ft) spur	A22164	
SeaTalk2 (5 pin) to SeaTalk ^{ng} adaptor cable 0.4 m (1.3 ft)	A06048	
DeviceNet adaptor cable (Female)	A06045	Allows the connection of NMEA 2000 devices to a SeaTalk ^{ng} system.
DeviceNet adaptor cable (Male)	A06046	Allows the connection of NMEA 2000 devices to a SeaTalk ^{ng} system.
DeviceNet adaptor cable (Female) to bare ends.	E05026	Allows the connection of NMEA 2000 devices to a SeaTalk ^{ng} system.
DeviceNet adaptor cable (Male) to bare ends.	E05027	Allows the connection of NMEA 2000 devices to a SeaTalk ^{ng} system.

Raymarine[®]
BY  **FLIR**[®]



www.raymarine.com

CE 0168 