Raymarine®

CAM220IP

Digital IP Camera

Installation & operation instructions

English (en-US)
Date: 05-2022
Document number: 87268 (Rev 4)
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Software updates

Check the Raymarine website for the latest software releases for your product.
www.raymarine.com/software

Product documentation

The latest versions of all English and translated documents are available to download in PDF format from the website:
www.raymarine.com/manuals.
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English (en-US)
Document number: 87268 (Rev 4)
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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 highly recommends certified installation by a Raymarine approved installer. A certified installation qualifies for enhanced product warranty benefits. Register your warranty on the Raymarine website: www.raymarine.com/warranty

Warning: Positive ground systems

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

Warning: Power supply voltage

Connecting this product to a voltage supply greater than the specified maximum rating may cause permanent damage to the unit. Refer to the product's information label for the correct voltage.

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: Powering PoE devices

This device can be powered over its ethernet connection (PoE) OR via its dedicated power cable.

NEVER connect the device's dedicated power cable when the device is being supplied PoE.

Caution: Power supply protection

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

Warning: Ensure all equipment has isolated power supply

This product features an isolated power supply. To prevent potential damage to equipment, Raymarine recommends that any external equipment connected to this product also features an isolated power supply.

Power Over Ethernet (PoE)

PoE is a system which allows electrical power to be passed from a PSE (Power Sourcing Equipment) device along the ethernet connection to supply power to a PD (Powered Device). This allows a single cable to be used to provide both data connection and electrical power to compatible devices.

PoE Classifications

PSE devices detect the indicated power range / classification of connected PDs and allocate the necessary maximum power based on the PDs classification

The PoE classifications are as follows:

PoE Class	Current (mA)	Power range (Watt)	Class description
Class 0	0 to 4	0.44 W to 12.94 W	-
Class 1	9 to 12	0.44 W to 3.84 W	Very low power

PoE Class	Current (mA)	Power range (Watt)	Class description
Class 2	17 to 20	3.84 W to 6.49 W	Low power
Class 3	26 to 30	6.49 W to 12.95 W	Mid power
Class 4	36 to 44	12.95 W to 25.5 W	High power

The PSE will always allocate the maximum power based on the classification of the PD.

Caution: Service and maintenance

This product contains no user serviceable components. Please refer all maintenance and repair to authorized Raymarine dealers. Unauthorized repair may affect your warranty.

Water ingress

Water ingress disclaimer

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

Disclaimer

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

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

EMC installation guidelines

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

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

Note:

In areas of extreme EMC interference, some slight interference may be noticed on the product. Where this occurs the product and the source of the interference should be separated by a greater distance.

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

- Raymarine equipment and cables connected to it are:
  - At least 1 m (3.3 ft) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 2 m (6.6 ft).
  - More than 2 m (6.6 ft) from the path of a radar beam. A radar beam can normally be assumed to spread 20 degrees above and below the radiating element.
- The product is supplied from a separate battery from that used for engine start. This is important to prevent erratic behavior and data loss which can occur if the engine start does not have a separate battery.
- Raymarine specified cables are used.
- Cables are not cut or extended, unless doing so is detailed in the installation manual.

Note:

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

Suppression ferrites

- Raymarine cables may be pre-fitted or supplied with suppression ferrites. These are important for correct EMC performance. If ferrites are supplied

separately to the cables (i.e. not pre-fitted), you must fit the supplied ferrites, using the supplied instructions.

- If a ferrite has to be removed for any purpose (e.g. installation or maintenance), it must be replaced in the original position before the product is used.
- Use only ferrites of the correct type, supplied by Raymarine or its authorized dealers.
- Where an installation requires multiple ferrites to be added to a cable, additional cable clips should be used to prevent stress on the connectors due to the extra weight of the cable.

Connections to other equipment

Requirement for ferrites on non-Raymarine cables:

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

Declaration of conformity

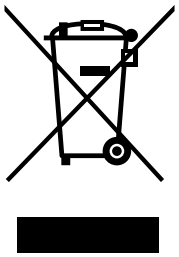
FLIR Belgium BVBA declares that this product is compliant with the essential requirements of EMC Directive 2014/30/EU.

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

Product disposal

Dispose of this product in accordance with the WEEE Directive.

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



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

Warranty registration

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

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

IMO and SOLAS

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

Technical accuracy

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

CHAPTER 2: DOCUMENT INFORMATION

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2.1 Document information

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

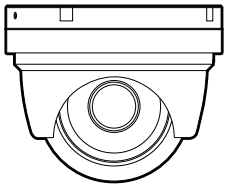
The document includes information to help you:

- 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/manuals.

2.2 Applicable products

This document is applicable to the following products:

	Part number	Name	Description
	E70347	CAM220IP	Eyeball IP camera

2.3 Document illustrations

Your product and if applicable, its user interface may differ slightly from that shown in the illustrations in this document, depending on product variant and date of manufacture.

All images are provided for illustration purposes only.

2.4 Product documentation

The following documentation is applicable to your product:

Description	Part number
CAM220IP Eyeball Camera Installation instructions (this document) Installation of a CAM220IP and connection to a wider system of marine electronics.	87268
CAM220IP surface mounting template Mounting diagram for mounting a CAM220IP.	87269
Lighthouse 2 MFD Operation Instructions Details the operation of the Camera application for multifunction displays running the LightHouse 2 software.	81360
Lighthouse 3 MFD Operation Instructions Details the operation of the Camera application for multifunction displays running the LightHouse 3 software.	81370
Lighthouse 4 MFD Operation Instructions Details the operation of the Camera application for multifunction displays running the LightHouse 4 software.	81406
gS Series Installation and operation instructions Includes details for operation of the Camera application on a gS Series MFD.	81344

2.5 Operation instructions

For detailed operation instructions for your product, refer to the documentation that accompanies your display.

All product documentation is available to download from the Raymarine website: www.raymarine.com/manuals.

CHAPTER 3: PRODUCT AND SYSTEM OVERVIEW

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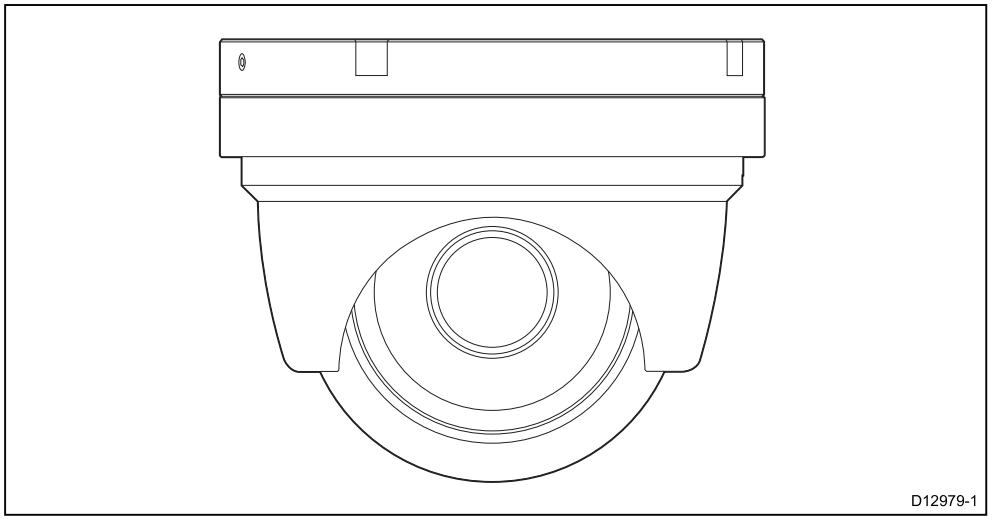
3.1 Product Overview

The CAM220IP is an Infrared illuminated (I^2) eyeball IP camera with both day and night vision. In conjunction with a compatible multifunction display (MFD), the camera provides a high-definition image which can be viewed or recorded for later playback.



The camera has the following features:

- 2 mega pixel 1/2.8" SONY progressive scan CMOS image sensor (Exmor) for excellent image quality
- 3.6mm wide-angle megapixel board lens
- 20 m I^2 beam distance
- Field of View (Horizontal = 51.0° / Vertical = 93.0° ±3°)
- Multi-streaming of H.264 and MJPEG
- Full HD (supports image resolutions up to 1920 x 1080 (1080p), at 30 fps)
- 12 V dc power
- Class 2 PoE device (IEEE802.3af)

The camera can also be connected to a PC which enables use of the built-in web interface to access additional features. These additional features can only be configured or used via a connected PC.

Approximate record times

The approximate record times are dependant on IP camera resolution and settings, lighting conditions and available storage space.

A **Raymarine® CAM220IP**, set to factory default settings can record at an approximate rate of 22.5 MB per minute; allowing up to 44 minutes of record time per 1 GB of available storage space.

3.2 Compatible multifunction displays

This product is compatible with the following LightHouse powered Raymarine multifunction displays.

- Axiom, Axiom+, Axiom Pro, Axiom XL.
- a Series, c Series, e Series.
- gS Series.

Lighthouse MFD software requirements

To use this product with a Raymarine LightHouse™ MFD, ensure that your MFD is running the required version of the software.

MFD software	Required version
LightHouse™ 2	R12 or later
LightHouse™ 3	3.0 or later
LightHouse™ 4	4.0 or later

Note:

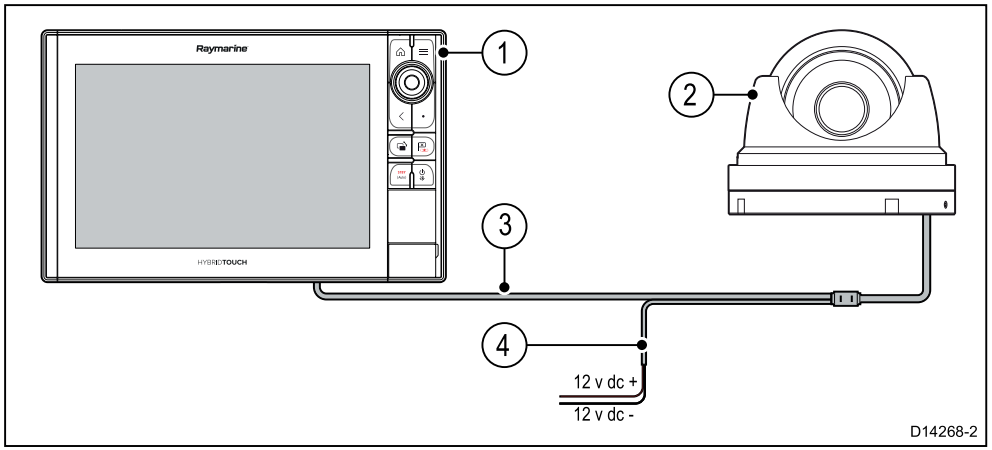
The latest MFD software can be obtained by visiting www.raymarine.com/software

3.3 Typical systems

Note: The illustrations below show products that can be connected in a typical system. For information on how to connect the products, refer to the Chapter 8 **Cables and connections** section. For information on available cables and accessories, refer to the Chapter 15 **Spares and accessories** section.

Example: Basic MFD system

When connecting the product to a non-PoE multifunction display (MFD), the camera requires a separate power source.

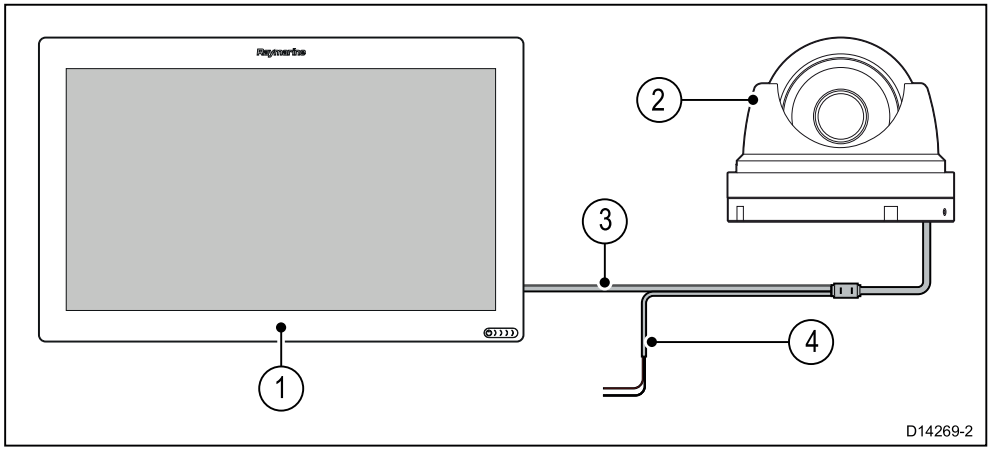


Item	Description
1	MFD
2	IP camera
3	Camera's ethernet cable
4	* Camera's power cable

Note: * The IP camera requires a separate power connection when not connected to a device that is providing Power over Ethernet (PoE). Alternatively a PoE injector can be used to power the camera.

Example: Basic PoE MFD system

When connecting the camera directly to a gS Series or Axiom XL multifunction display, the camera can be supplied Power over Ethernet (PoE), providing that the display has the necessary remaining PoE allocation. Refer to the MFD's installation instructions for details on PoE allocation.

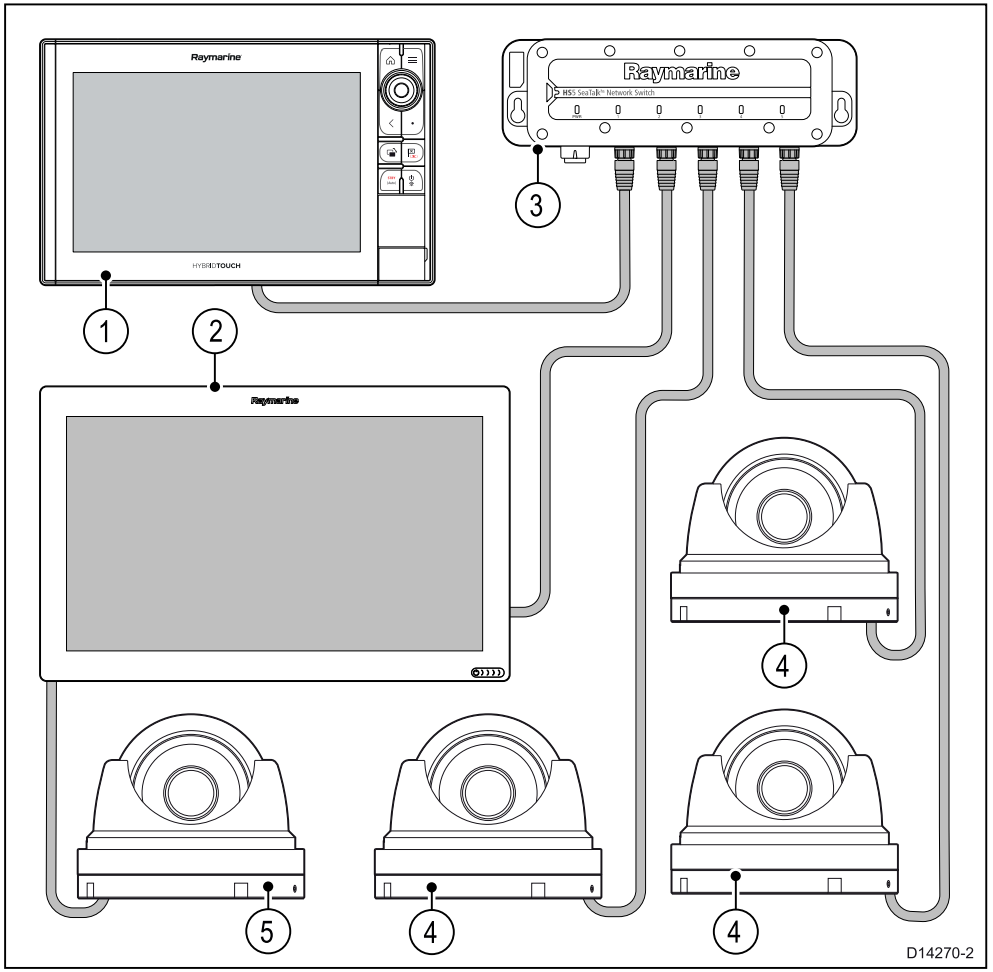


Item	Description
1	MFD with PoE (providing PoE to the camera)
2	IP camera
3	Camera's PoE / ethernet cable
4	** Camera's power cable (connection not required as camera is powered by PoE)

Important:

** A separate power supply is not required when the camera is being supplied PoE. NEVER connect the camera to a separate power supply when it is being provided power via PoE.

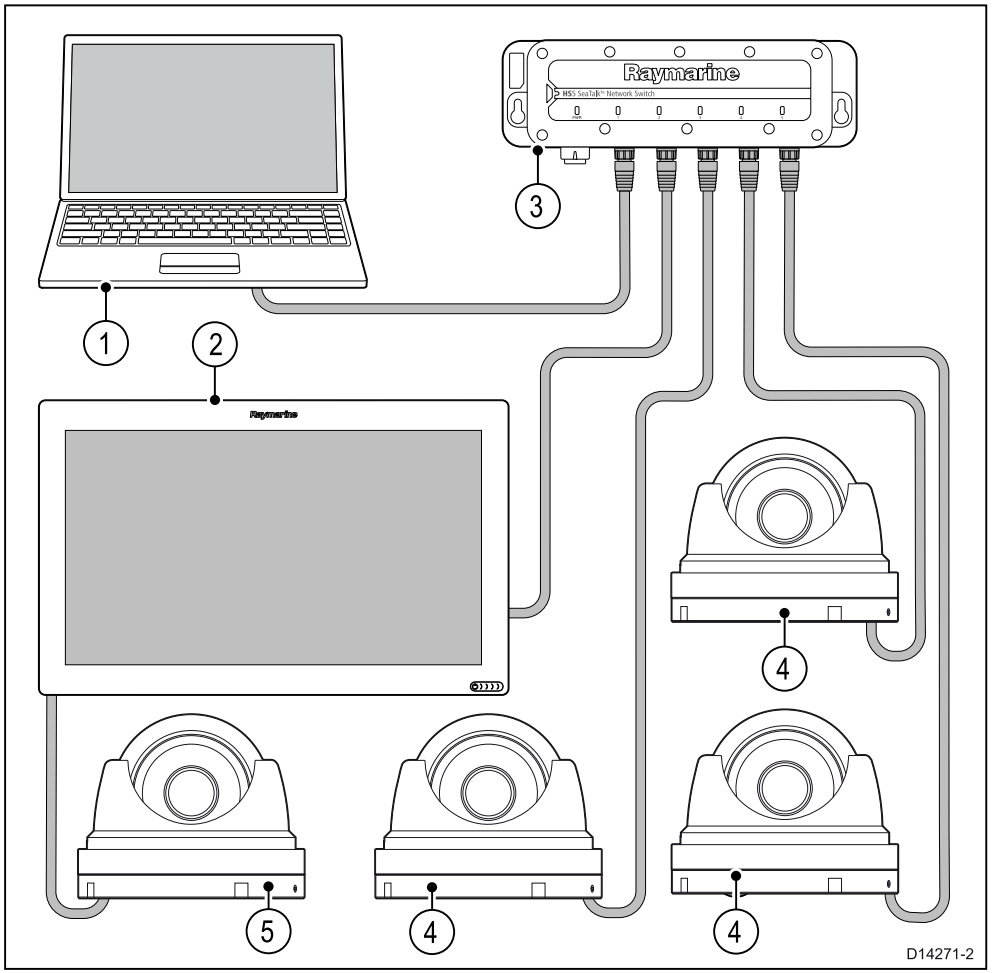
Example: Multiple camera system



Item	Description
1	MFD (no PoE)
2	MFD (with PoE)
3	Raymarine network switch
4	IP cameras (When connected to a network switch a separate power supply for each camera is required, unless the switch is capable of providing PoE.)
5	IP camera (When connected to a gS Series or Axiom XL MFD, the camera can be supplied PoE by the display.)

Example: System with Laptop

If there is a PC connected to your system you can access the product's built–in web interface.

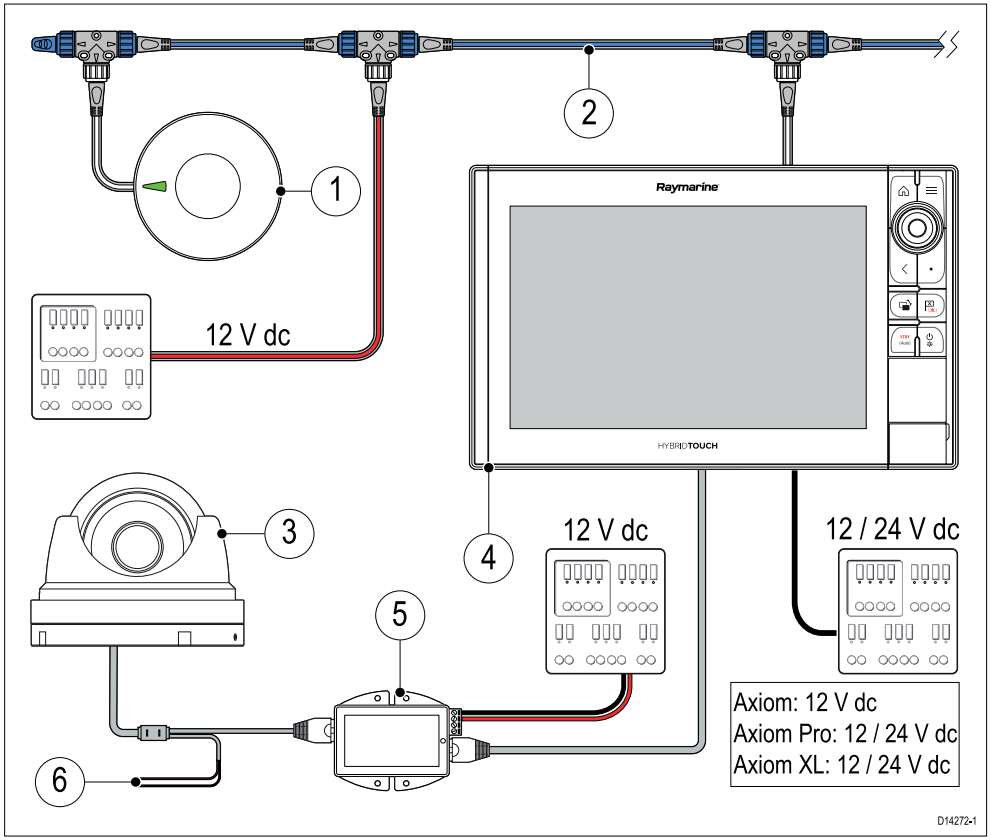


Item	Description
1	Laptop computer
2	Raymarine network switch
3	MFD (with PoE)

Item	Description
4	IP cameras (When connected to a network switch a separate power supply for each camera is required, unless the switch is capable of providing PoE.)
5	IP camera (When connected to a gS Series or Axiom XL MFD, the camera can be supplied PoE by the MFD.)

3.4 Augmented reality

CAM220IP can be used with a Raymarine AR200 to enable ClearCruise™ Augmented Reality features. Below is a typical system example showing the components and connections required to enable ClearCruise™ Augmented Reality on your system.



1. AR200.
2. SeaTalkng ® backbone (providing 12 V dc power to the AR200).
3. CAM220IP (CAM210IP is also compatible).
4. Axiom LightHouse™ 3 or LightHouse™ 4 MFD (running LH3 version 3.7 or above, or LH4 version 4.0 or above).
5. Optional PoE injector (providing power to the camera).
6. Alternate power connection for camera (connection required when not using PoE to power the camera).

Note:

- ClearCruise™ Augmented Reality is not available via CAM220's Web Browser Interface.
- For more information on ClearCruise™ Augmented Reality, please refer to the appropriate multifunction display Operation instructions: **81370 — Lighthouse 3 Advanced operations instructions.**, or **81406 — Lighthouse 4 Advanced operations instructions.**

CHAPTER 4: PARTS SUPPLIED

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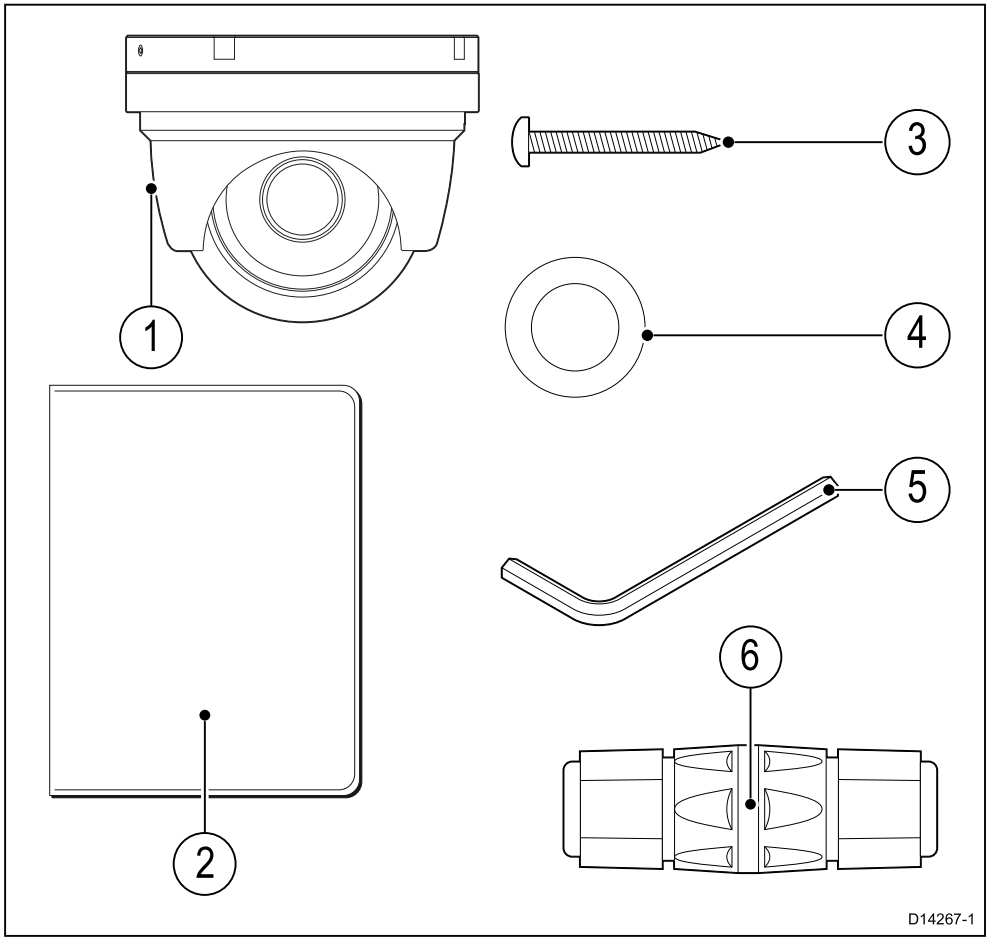
4.1 Parts supplied

The following items are supplied with your product.



1. 220IP camera (Includes a 1 m (39.4 in) ethernet and power pigtail cable) x1
2. Documentation and software pack x1
3. Mounting screws x4
4. Nylon washers x4
5. Hex wrench (Allen key) x1
6. Waterproof RJ45 coupler x1

Note: To connect the camera to a compatible MFD, a RayNet to SeaTalk hs (male) adaptor cable is also required. Refer to *Spares and accessories* section.

CHAPTER 5: PRODUCT DIMENSIONS

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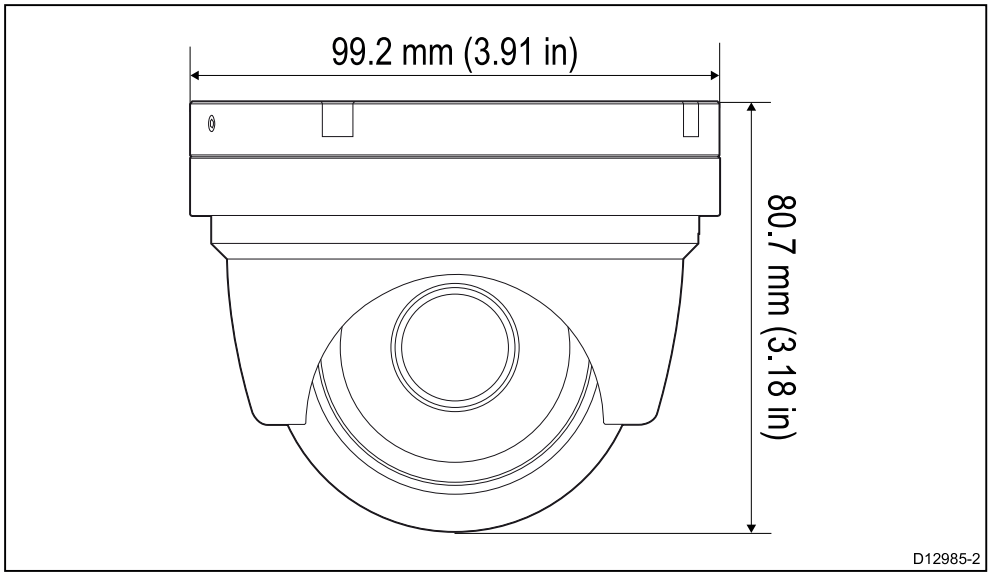
5.1 Product dimensions



CHAPTER 6: LOCATION REQUIREMENTS

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6.1 General location requirements

Important considerations when choosing a suitable location for your product.

This product is suitable for mounting below decks.

The product should be mounted where it will be:

- protected from physical damage and excessive vibration.
- well ventilated and away from heat sources.

When choosing a location for the product, consider the following points to ensure reliable and trouble-free operation:

- **Access** — there must be sufficient space to enable cable connections to the product, avoiding tight bends in the cable.
- **Diagnostics** — the product must be mounted in a location where the diagnostics LED is easily visible.

Note: Not all products include a diagnostics LED. Refer to the Chapter 12 **System checks and troubleshooting** for more information.

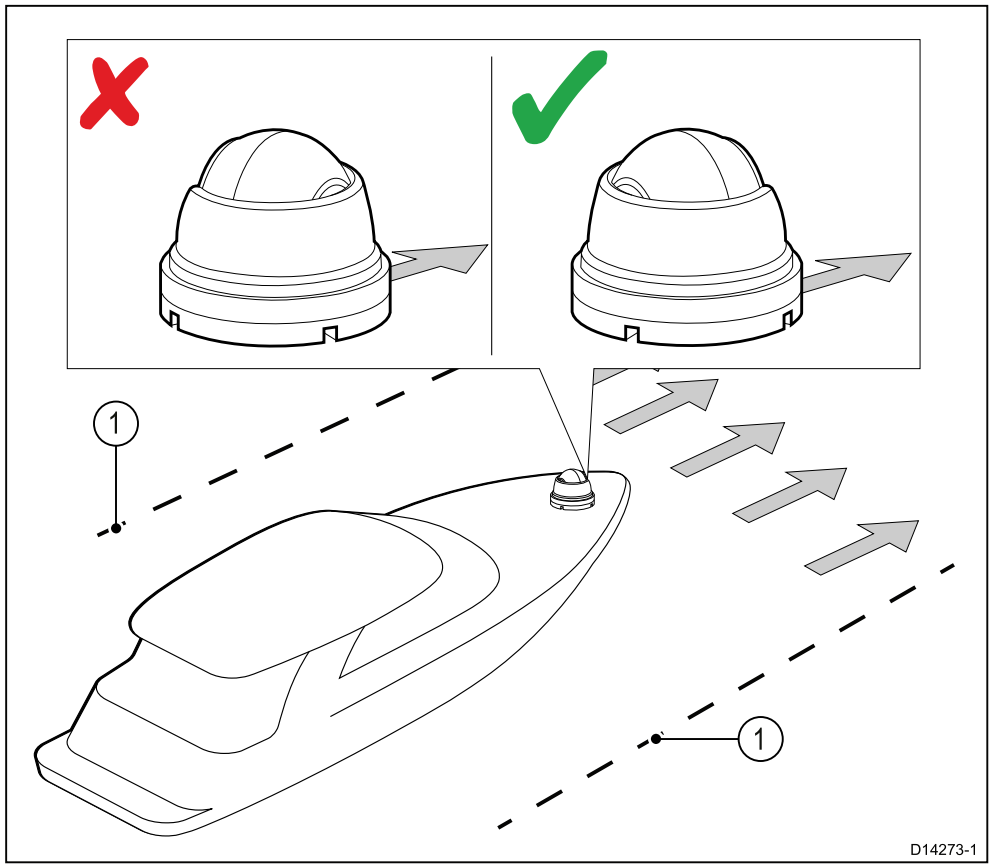
- **Electrical interference** — the product should be mounted far enough away from any equipment that may cause interference such as motors, generators and radio transmitters / receivers.
- **Magnetic compass** — refer to the *Compass safe distance* section in this document for advice on maintaining a suitable distance between this product and any compasses on your vessel.
- **Power** — to keep cable runs to a minimum, the product must be located as close as possible to the vessel's dc power supply.
- **Mounting surface** — ensure the product is adequately supported on a secure surface. Refer to the weight information provided in the *Technical specification* for this product and ensure that the intended mounting surface is suitable for bearing the product weight. Do NOT mount units or cut holes in places which may damage the structure of the vessel.

Augmented reality

If your product is being used for Augmented Reality it is important to consider its position and directional view for operation.

In addition to the 6.1 **General location requirements**, please consider the following recommendations to ensure reliable and trouble free operation:

- **Direction** — the product should be pointing towards the vessel's bow and must be in parallel alignment with the longitudinal axis (centerline) of the vessel.
- **Tilt angle** — the product should be tilted so the water and horizon are clearly visible at all times.



1. Vessel's longitudinal axis.

Note:

- The product must be calibrated with your MFD system in the **Camera Installation** page before Augmented Reality features can be used. Please refer to your MFD operation instructions manual for more information.

Compass safe distance

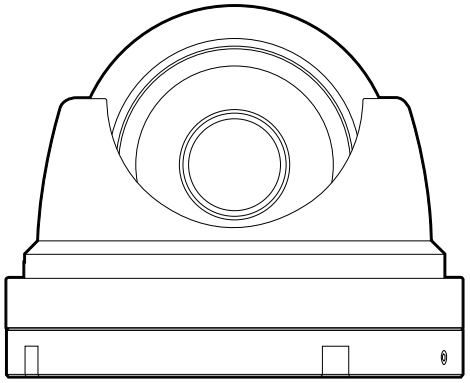
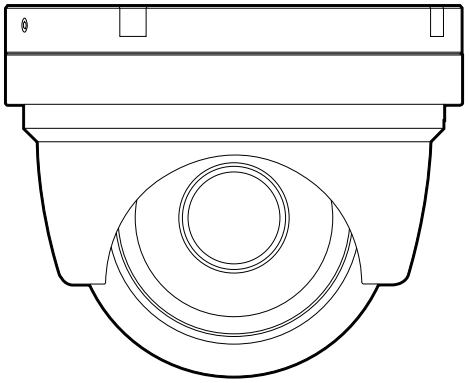
To prevent potential interference with the vessel's magnetic compasses, ensure an adequate distance is maintained from the product.

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

6.2 Camera orientation

The camera can be mounted in 2 orientations referred to as “Ball up” and “Ball down”.

The default image orientation is for the ball-down configuration, if the camera is to be mounted in the ball-up configuration then the video image must be flipped.

	
Ball-up: The camera is mounted on top of the mounting surface.	Ball-down: The camera is suspended upside down, below the mounting surface.

The image orientation must be changed using the built-in web interface accessible when connected to a PC.

CHAPTER 7: INSTALLATION

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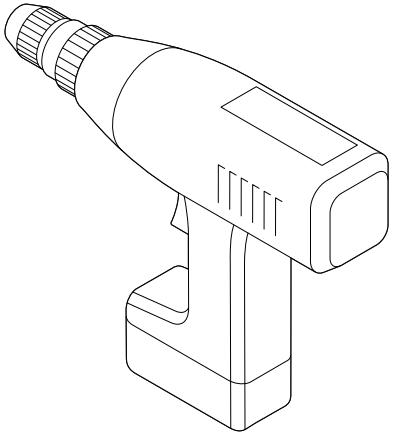
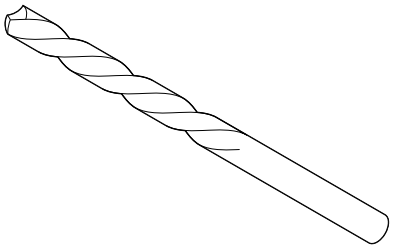
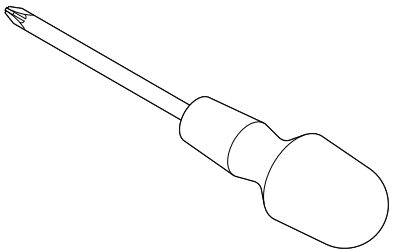
7.1 Tools required

Product installation requires the following tools:

Item	Description
	Power drill
	Drill bit of appropriate size*
	Pozi drive screwdriver

Note: * The appropriate drill bit size is dependent on the thickness and material of the mounting surface.

7.2 Mounting the unit

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

Ensure the power supply is switched off and that the necessary cables have been fed to the mounting location.

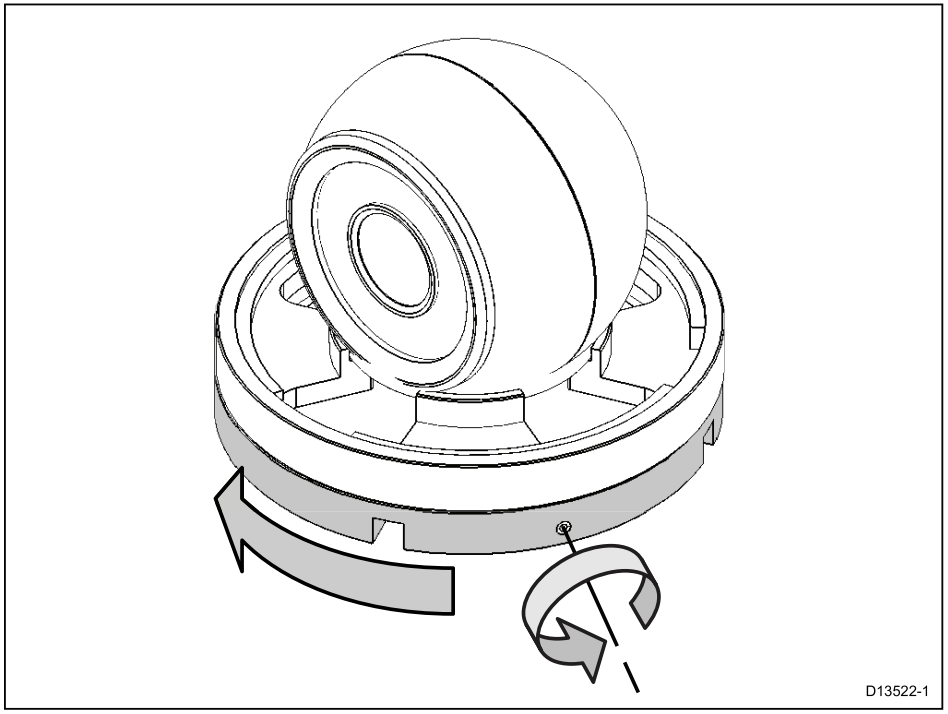
Note: The camera is supplied partly assembled. The external plastic collar (packed separately in the box) protects the camera ball when the camera is in use. You must attach the collar to the camera base after mounting the camera.

1. Remove all components from the box.

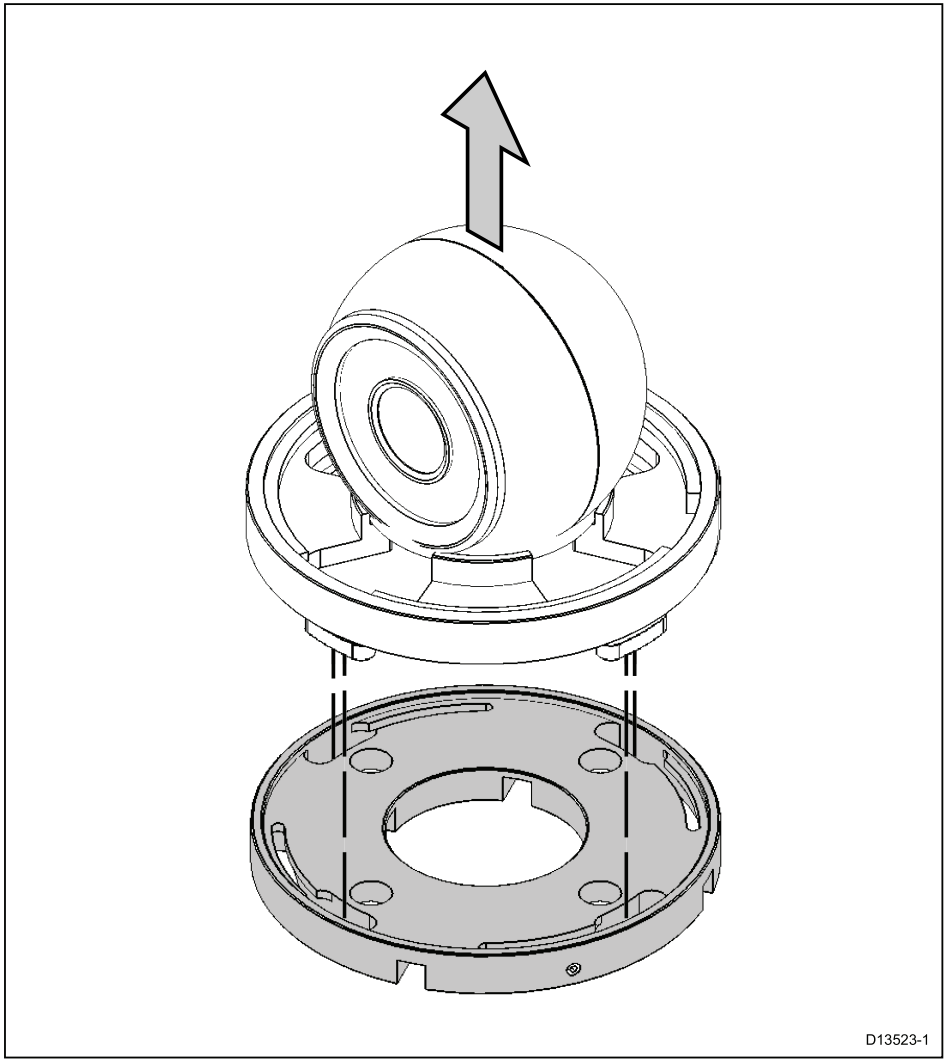
   Ensure that you retain the external plastic collar, as you must attach this to the camera base at the end of this procedure.

2. Check the selected location for the unit. A clear, flat area is required, which is safe to have screws fitted to.
3. Use the supplied mounting template to mark out the location of the mounting holes, and if required the cable feed hole.
4. Drill the mounting holes, and if required the cable feed hole at the marked locations.

5. Loosen the screw in the side of the camera's base using the supplied hex wrench (Allen key).

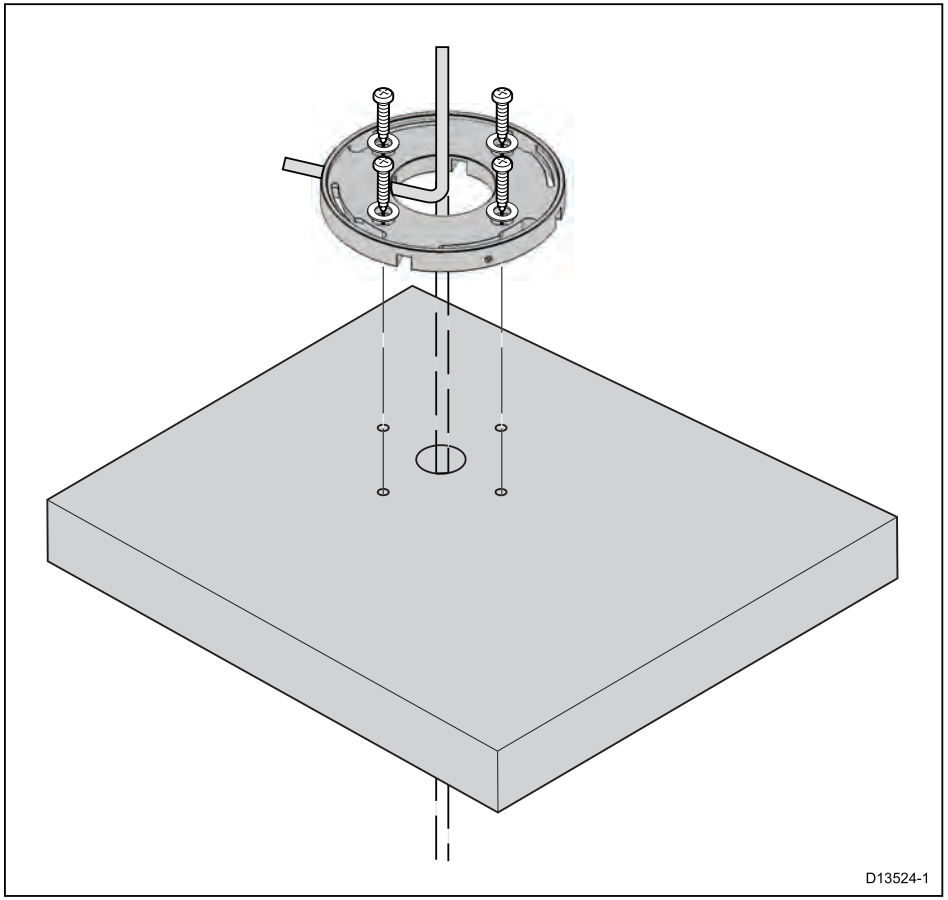


6. Disconnect the camera's base from the body of the camera: with the base facing you, grip the camera's body and twist the base counter-clockwise, then pull the base away from the camera body.



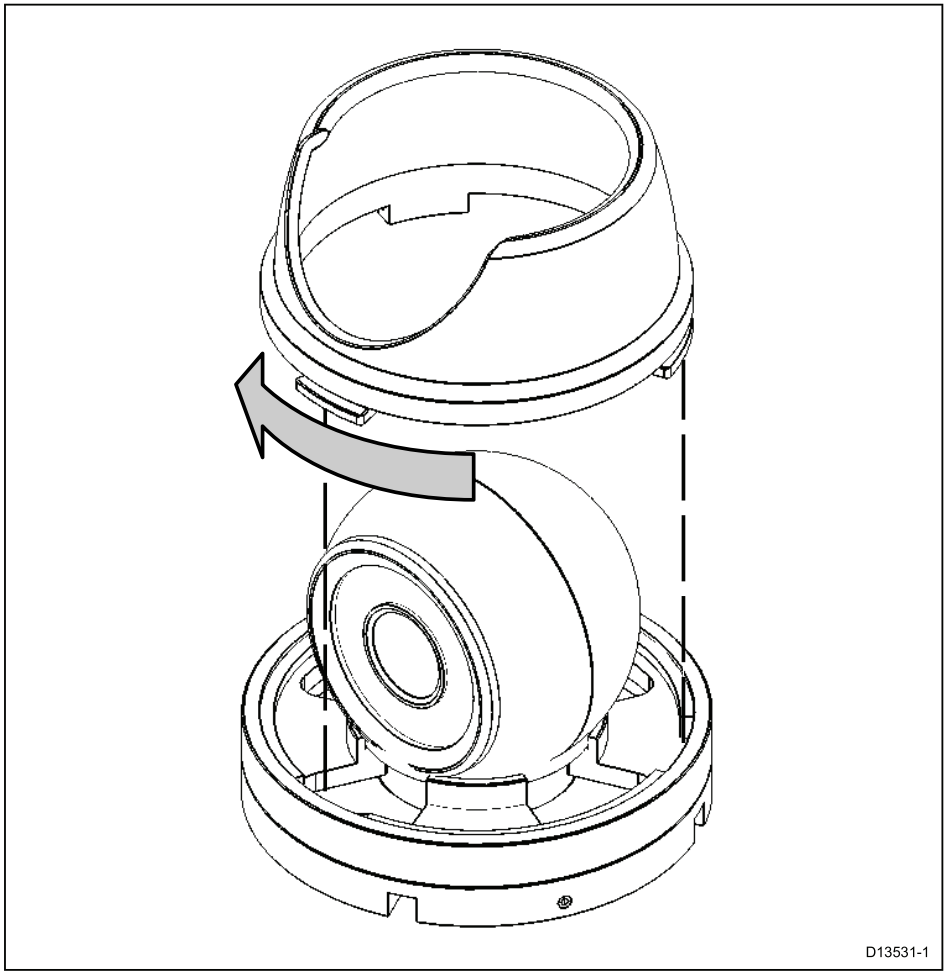
7. Feed the camera's cables through the hole in the camera's base, or through one of the provided cable channels.

8. Place the camera's base into position, lining up the holes in the base with the drilled holes in the mounting surface.



9. Secure the base in position using the screws and nylon washers provided, ensuring that the camera's cables sit in the camera base's cable channels, or feed through the cable-feed hole drilled in the mounting surface.
10. Re-attach the camera to its base and tighten the locking screw in the side of the base using the supplied hex wrench (Allen key).
11. Connect the camera's cables to the relevant cable feeds.
12. Power up the system and check the camera's feed on your display.
13. Adjust the position of the ball by hand, to obtain the best picture.

14. To attach the external plastic collar to the camera base, align the three lugs with the slots in the base, then turn the collar clockwise to lock it into position around the ball.



Note: If the collar is blocking the camera's field of view, remove it, and reposition the ball as required. The collar can be re-attached in one of three different positions, and adjusted to align the cut-out with the camera lens.

CHAPTER 8: CABLES AND CONNECTIONS

CHAPTER CONTENTS

8.1 General cabling guidance

Cable types and length

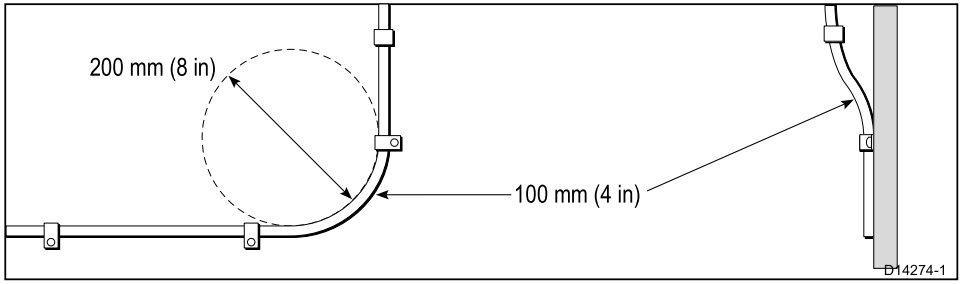
It is important to use cables of the appropriate type and length.

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

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

Use adequate strain relief for cabling to ensure that connectors are protected from strain and will not pull out under extreme sea conditions.

Circuit isolation

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

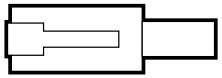
- Always use isolating transformers or a separate power-inverter to run PC's, processors, displays and other sensitive electronic instruments or devices.
- Always use an isolating transformer with Weather FAX audio cables.
- Always use an isolated power supply when using a 3rd party audio amplifier.
- 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 cable shielding is not damaged during installation and that all cables are properly shielded.

8.2 Connections overview

Use the following information to help you identify the connections on your product.

Connector	Type	Connects to:	Suitable cables
	RJ45	• RayNet network • Multifunction display • PC	A Network coupler and / or RayNet to SeaTalk hs adaptor cable is required. Refer to Chapter 15 **Spares and accessories**.
	Power	12 V dc power supply **Note:** The terminator should be removed to enable connection to a power supply.	18AWG minimum thickness for power cable extensions.

Connecting cables

Follow the steps below to connect the cable(s) to your product.

1. Ensure that the vessel's power supply is switched off.
2. Ensure that the device being connected has been installed in accordance with the installation instructions supplied with that device.
3. Ensuring correct orientation, push cable connectors fully onto the corresponding connectors.
4. Engage any locking mechanism to ensure a secure connection (e.g.: turn locking collars clockwise until tight, or in the locked position).
5. Ensure any bare ended wire connections are suitably insulated to prevent shorting and corrosion due to water ingress.

8.3 Power options

This product must be powered using ONE of the following methods:

1. **PoE (Power over Ethernet).**Either:
   - Direct connection to a Raymarine gS Series or Axiom XL MFD (only one cable is required to carry both data and power signals); or:
   - Connection to a suitably-powered Raymarine or FLIR PoE injector. Only one cable is required to carry both data and power signals between the camera and the PoE injector. However, the PoE itself will require its own power source, and a separate ethernet data cable to a laptop, Raymarine MFD, or Raymarine network switch.

   This method is useful if the camera is located a long distance from a power source; you will only need a single ethernet data cable to the camera itself, and the PoE injector can be located close to the power source.
2. **Self-powered.**Direct connection to a vessel's power supply using the supplied power cable. With this method, a separate ethernet data cable is required to a laptop, Raymarine MFD, or Raymarine network switch.

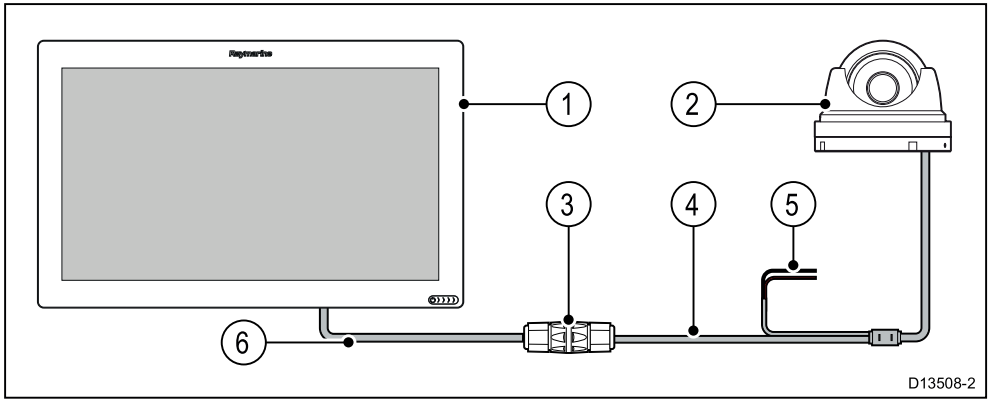
Refer to the *Power connection* section for connection details.

8.4 Power connection - PoE

Connection via PoE-capable MFD

The camera is a Class 2 PoE device. When the camera is connected directly to a gS Series or Axiom XL multifunction display (MFD), the unit can be powered from the display's network connection.

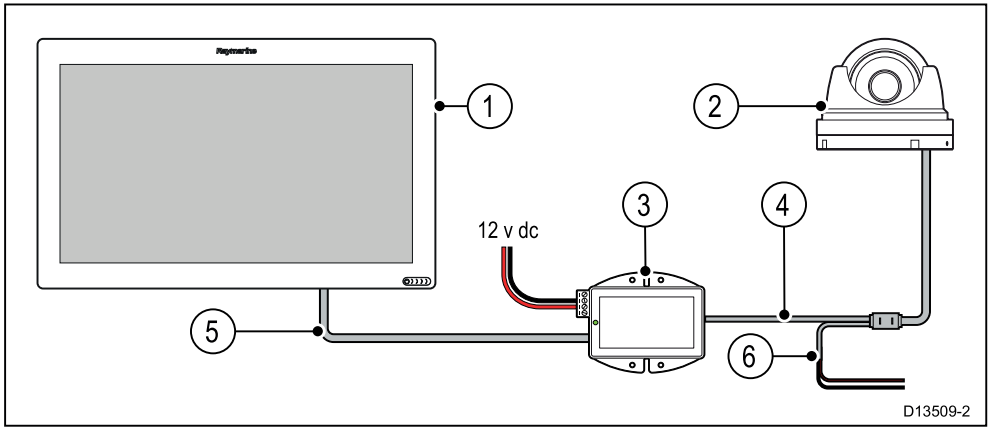
NEVER connect the camera's power supply connection when the unit is being supplied PoE.



1	MFD (providing PoE to the camera)
2	IP camera
3	Waterproof RJ45 ethernet coupler (R32142) (supplied)
4	Camera's ethernet connection
5	Camera's power cable (connection not required as camera is being supplied PoE by the MFD.)
6	RayNet to SeaTalk hs adaptor cable (not supplied)

Connection via PoE injector

The camera can also be powered using a PoE injector.



1	MFD
2	IP camera
3	PoE injector (R32141) (not supplied)
4	Camera's ethernet connection
5	RayNet to SeaTalk hs adaptor cable (not supplied)
6	Camera's power cable (Connection not required as camera is being supplied PoE by the injector.)

Important:

All connections should be made in a dry area and be suitably insulated to prevent corrosion and possible product damage due to water ingress.

Warning: Powering PoE devices

This device can be powered over its ethernet connection (PoE) OR via its dedicated power cable.

NEVER connect the device's dedicated power cable when the device is being supplied PoE.

Power Over Ethernet (PoE)

PoE is a system which allows electrical power to be passed from a PSE (Power Sourcing Equipment) device along the ethernet connection to supply power to a PD (Powered Device). This allows a single cable to be used to provide both data connection and electrical power to compatible devices.

PoE Classifications

PSE devices detect the indicated power range / classification of connected PDs and allocate the necessary maximum power based on the PDs classification

The PoE classifications are as follows:

PoE Class	Current (mA)	Power range (Watt)	Class description
Class 0	0 to 4	0.44 W to 12.94 W	-
Class 1	9 to 12	0.44 W to 3.84 W	Very low power
Class 2	17 to 20	3.84 W to 6.49 W	Low power

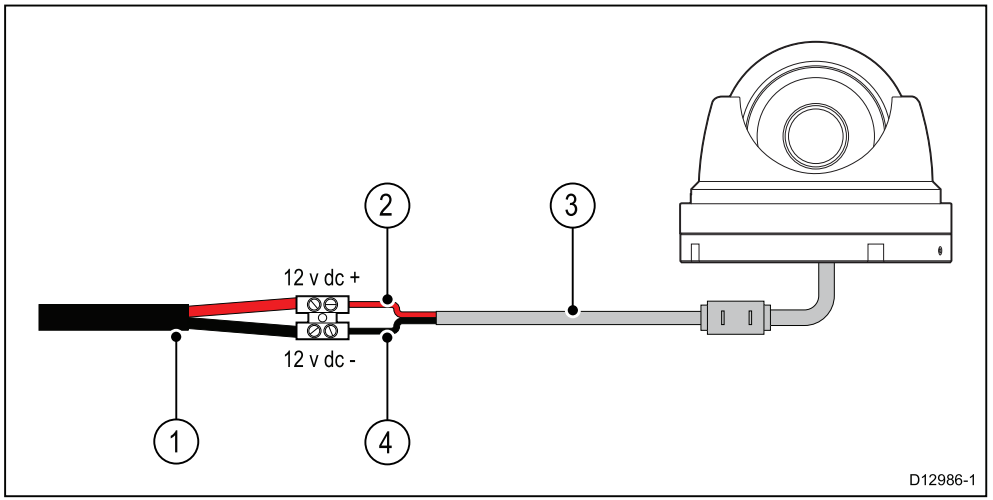
PoE Class	Current (mA)	Power range (Watt)	Class description
Class 3	26 to 30	6.49 W to 12.95 W	Mid power
Class 4	36 to 44	12.95 W to 25.5 W	High power

The PSE will always allocate the maximum power based on the classification of the PD.

8.5 Power connection — self-powered

The unit can be powered from a **12 volt dc** power supply using its dedicated power cable.

Note: The power cable is supplied with a terminator fitted; this must be removed if the device is to be self-powered.



Item	Description	Connects to:
1	Vessel's 12 V dc power supply	Product's power cable
2	Positive terminal	Power supply — positive terminal
3	Product's power cable	Vessel's 12 V dc power supply
4	Negative terminal	Power supply — negative terminal

In-line fuse and thermal breaker ratings

If powering the camera separately (e.g. NOT via PoE), you must fit an inline fuse to the power cable, and also an appropriately-rated thermal fuse if powering the camera from a distribution panel.

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

In-line fuse rating	Thermal breaker rating
2 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.

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 mm^2) 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.

Power distribution

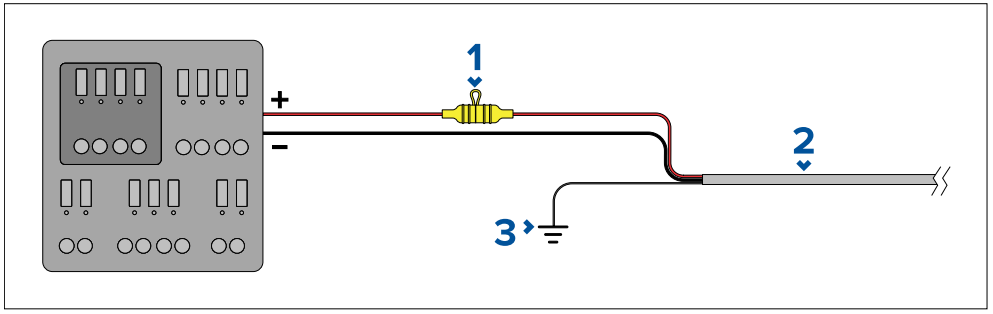
Recommendations and best practice.

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

Important:

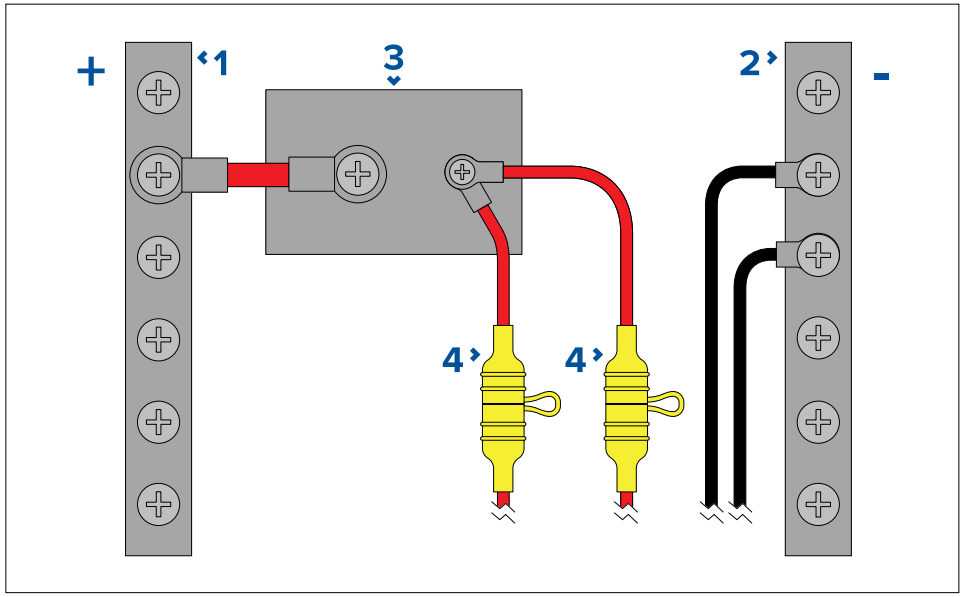
- When planning and wiring, take into consideration other products in your system, some of which (e.g. sonar modules) may place large power demand peaks on the vessel's electrical system, which may impact the voltage available to other products during the peaks.
- The information provided below is for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

Implementation — connection to distribution panel (Recommended)



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

- It is recommended that the supplied power cable is connected to a suitable breaker or switch on the vessel's distribution panel or factory-fitted power distribution point.
- The distribution point should be fed from the vessel's primary power source by 8 AWG (8.36 mm²) cable.
- Ideally, all equipment should be wired to individual suitably-rated thermal breakers or fuses, with appropriate circuit protection. Where this is not possible and more than 1 item of equipment shares a breaker, use individual in-line fuses for each power circuit to provide the necessary protection.



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

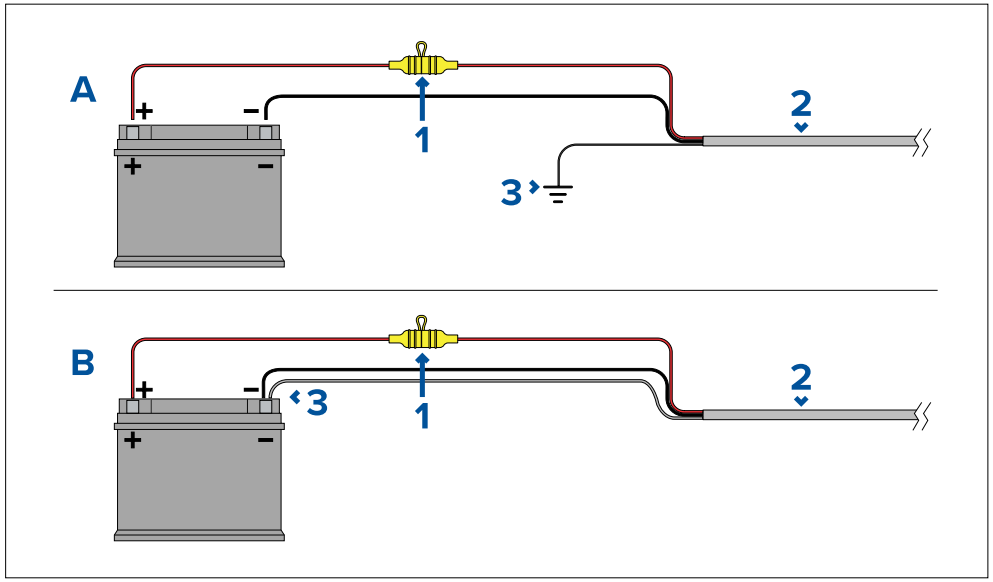
3	Circuit breaker
4	Waterproof fuse holder containing a suitably-rated inline fuse must be fitted. For suitable fuse rating, refer to: *In-line fuse and thermal breaker ratings*.

Important:

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

Implementation — direct connection to battery

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



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

Battery connection scenario A:

Suitable for a vessel with a common RF ground point. In this scenario, 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.

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.

Power cable extension

If you need to extend the length of the power cable supplied with your product, ensure you observe the following advice:

- 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.

- Ensure that the extension cable is of a sufficient gauge for the supply voltage and the total load of the device and the length of the cable run. Refer to the following table for typical **minimum** power cable wire gauges.

Cable length in meters (feet)	Wire gauge in AWG (mm^2) for 12 V supply	Wire gauge in AWG (mm^2) for 24 V supply
<8 (<25)	16 (1.31 mm^2)	18 (0.82 mm^2)
16 (50)	14 (2.08 mm^2)	18 (0.82 mm^2)
24 (75)	12 (3.31 mm^2)	16 (1.31 mm^2)
>32 (>100)	10 (5.26 mm^2)	16 (1.31 mm^2)

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.

Important: To ensure power cables (including any extension) are of a sufficient gauge, ensure that there is a continuous **minimum** voltage of **10.8 V dc** at the end of the cable where it enters the product's power connector, even with a fully flat battery at 11 V dc. (Do not assume that a flat battery is at 0 V dc. Due to the discharge profile and internal chemistry of batteries, the current drops much faster than the voltage. A "fully flat" battery still shows a positive voltage, even if it doesn't have enough current to power your device.)

Grounding

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

More information

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

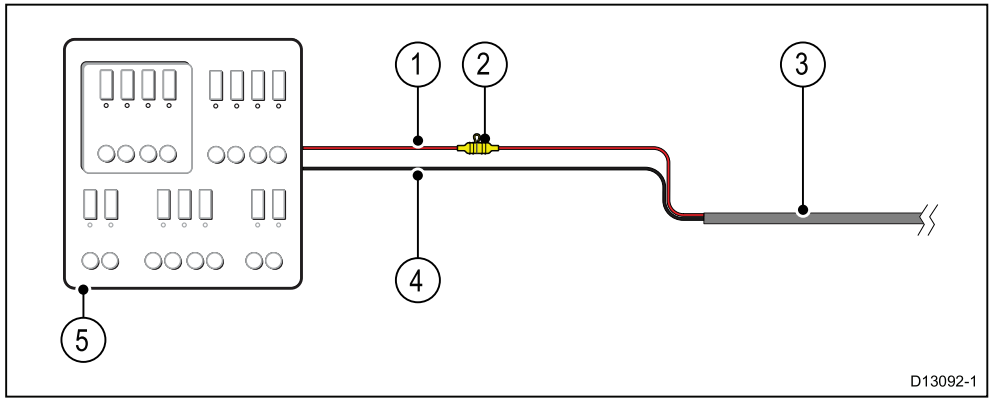
- BMEA Code of Practice for Electrical and Electronic Installations in Boats
- NMEA 0400 Installation Standard
- ABYC E-11 AC & DC Electrical Systems on Boats
- ABYC A-31 Battery chargers and Inverters
- ABYC TE-4 Lightning Protection

Breakers, fuses and circuit protection

The information below is provided as guidance to help protect your product. The example illustrations provided are for common vessel power arrangements, if you are unsure how to provide the correct level of protection then please consult a Raymarine authorized dealer for support.

Distribution panel connection

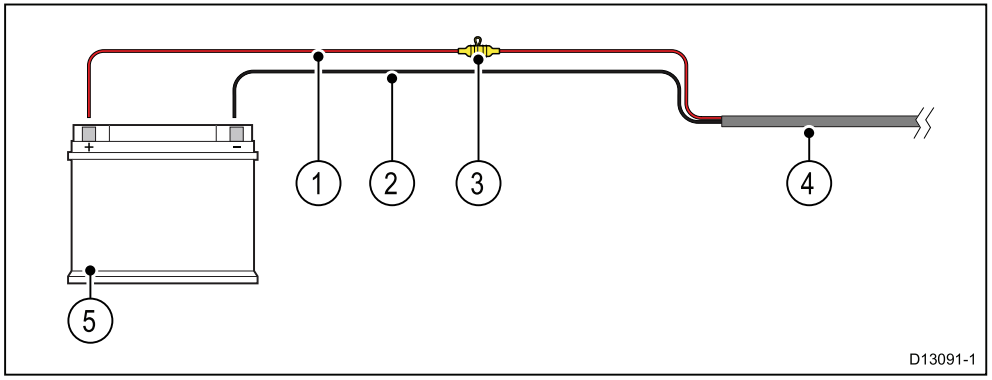
It is recommended that your product is wired through your vessel's distribution panel via a thermal breaker or fuse.



1. Vessel power supply positive (+)
2. In-line fuse. (If your product's power cable does not have an in-line fuse then one should be fitted.)
3. Product power cable
4. Vessel power supply negative (-)
5. Vessel distribution panel

Battery connection

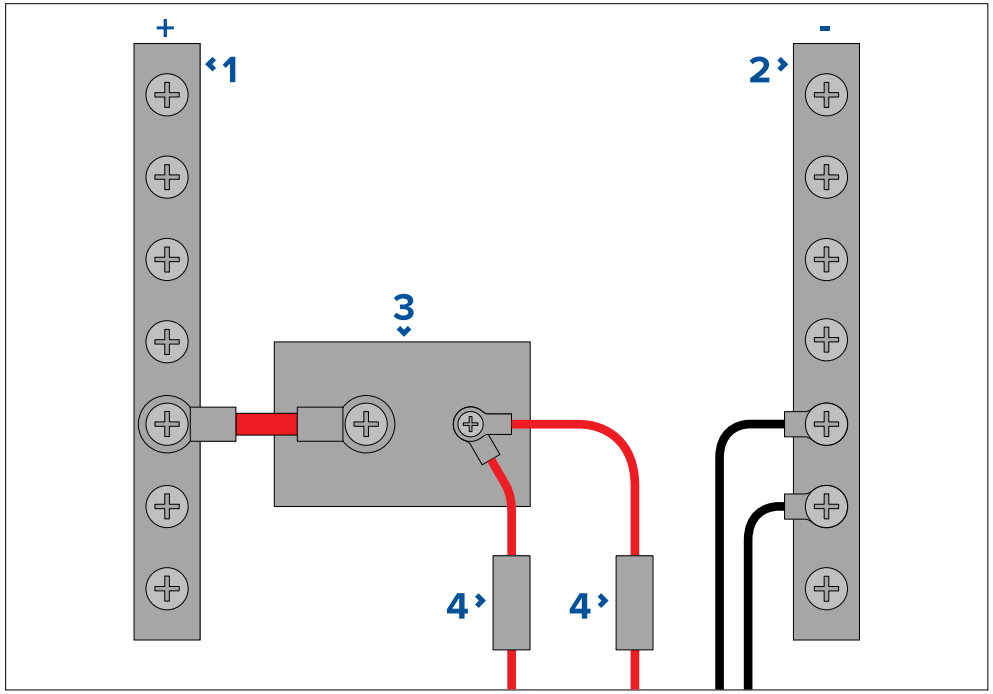
Your product may be wired directly to the battery using an in-line fuse.



1. Vessel power supply positive (+)
2. Vessel power supply negative (-)
3. In-line fuse. (If your product's power cable does not have an in-line fuse then one should be fitted.)
4. Product power cable
5. Vessel battery

Sharing a breaker

Where more than 1 piece of equipment shares a breaker you must provide protection for the individual circuits. E.g. by connecting an in-line fuse for each power circuit.



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

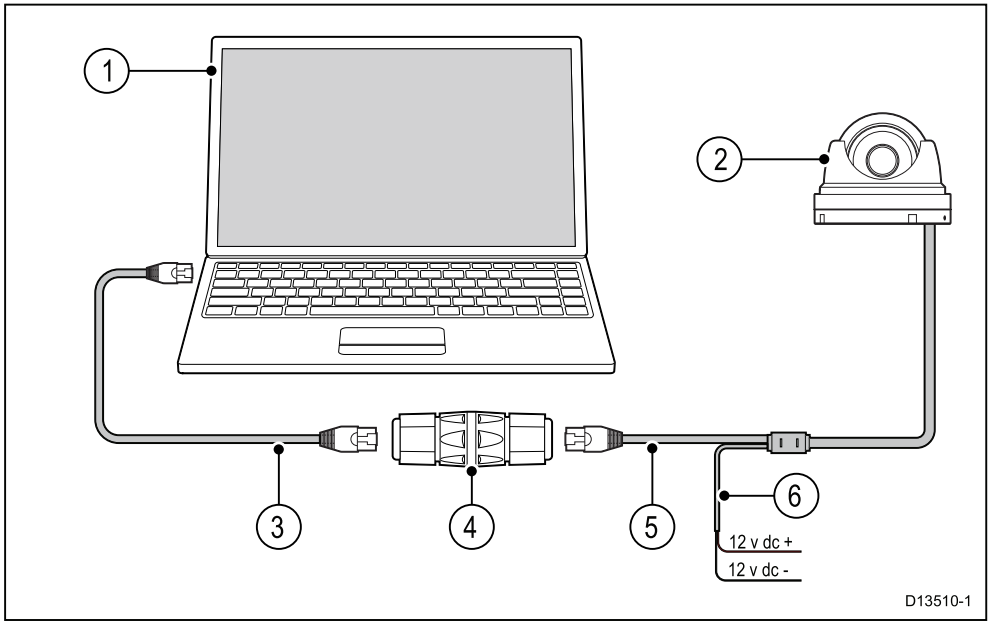
Where possible, connect individual items of equipment to individual circuit breakers. Where this is not possible, use individual in-line fuses to provide the necessary protection.

8.6 Network connection

The unit must be connected to a compatible MFD or PC to enable the video feed to be viewed.

PC connection

When connecting the camera directly to a PC the camera requires a separate power supply connection. Alternatively a PoE injector could be used to power the camera.

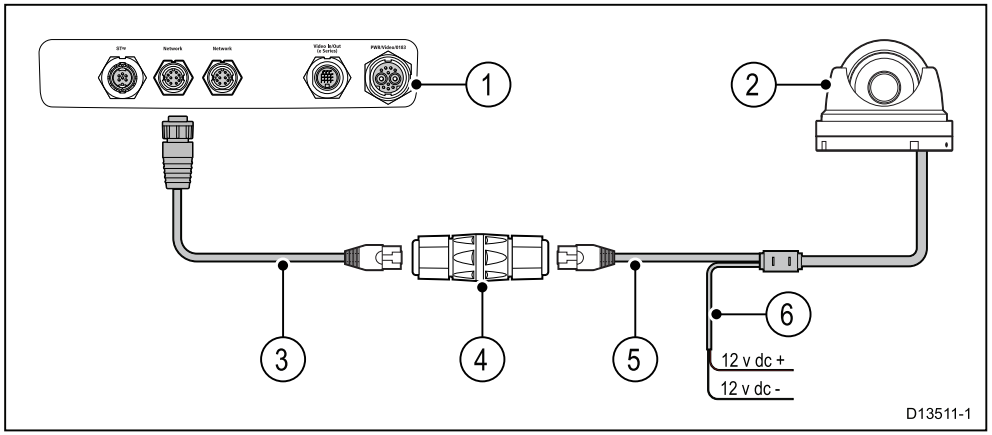


Item	Description
1	PC
2	IP camera
3	RJ45 ethernet cable
4	Waterproof RJ45 ethernet coupler (R32142) (supplied)
5	Camera's ethernet cable
6	Camera's power cable

For details on available network hardware and cables refer to Chapter 15 **Spares and accessories**.

Multifunction display connection

The unit can connect directly to a multifunction display. If the multifunction display provides Power over Ethernet (PoE) then a separate power supply may not be required.



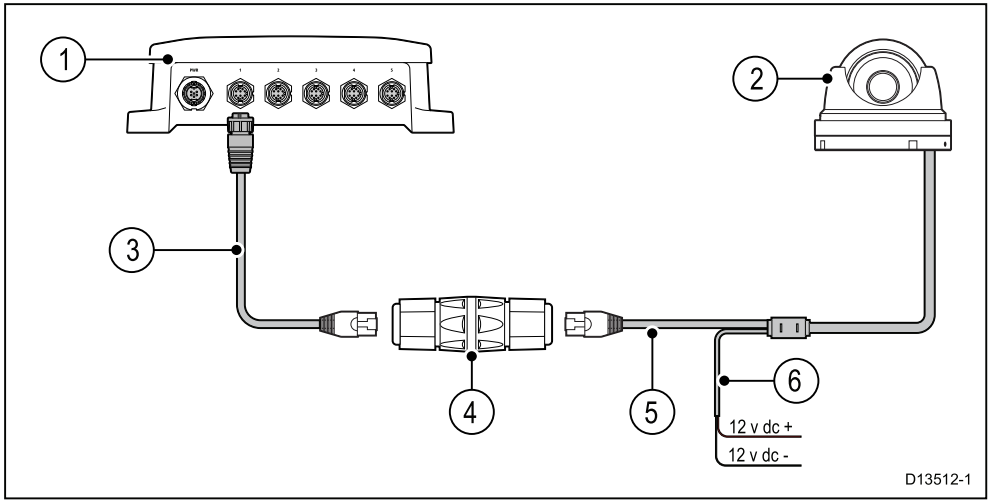
Item	Description
1	MFD rear connector panel
2	IP camera
3	RayNet to SeaTalk hs (male) adaptor cable
4	Waterproof RJ45 ethernet coupler (R32142) (supplied)
5	Camera's ethernet cable
6	Camera's power cable (Connection not required if the camera is being supplied PoE by the MFD.)

Note: The connection panel on your product may look slightly different to that shown, depending on variant. The network connection method remains the same for all products featuring RayNet connectors.

For details on available network hardware and cables refer to Chapter 15 **Spares and accessories**.

Network switch connection

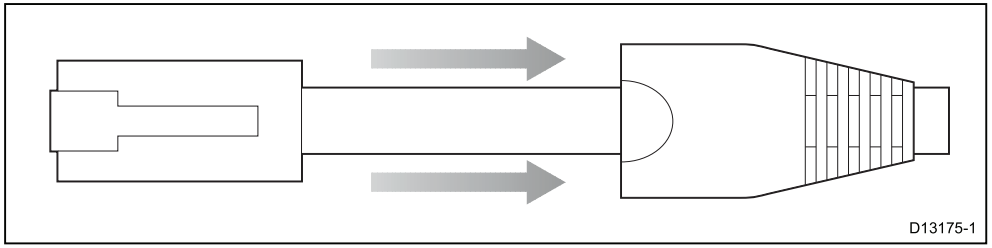
Multiple camera's can be networked together using an network switch or router.



Item	Description
1	Raymarine network switch
2	IP camera
3	RayNet to SeaTalk hs adaptor cable (not supplied)
4	Waterproof RJ45 ethernet coupler (R32142) (supplied)
5	Camera's ethernet cable
6	Camera's power cable

RJ45 adaptor cable sleeve

The sleeve surrounding the RJ45 connector on the RJ45 to RayNet adaptor cables can be pulled back away from the connector to allow for connection to an ethernet coupler.



CHAPTER 9: OPERATION

CHAPTER CONTENTS

9.1 Operation instructions

For detailed operation instructions for your product, refer to the documentation that accompanies your display.

All product documentation is available to download from the Raymarine website: www.raymarine.com/manuals.

9.2 Web browser interface

Network setup and operation

Default username, password and ports

Username	admin
Password	1234
Ports	• 80 (HTTP) • 554 (RTSP) • 2700 (AV streaming) • 2300 (Event trigger)
IP address	DHCP enabled by default (IP address is assigned automatically.)

Camera IP address

By default the camera's IP address is assigned automatically.

You can find out what IP address your camera has been assigned using:

- IP scanner software (supplied)
- UPnP

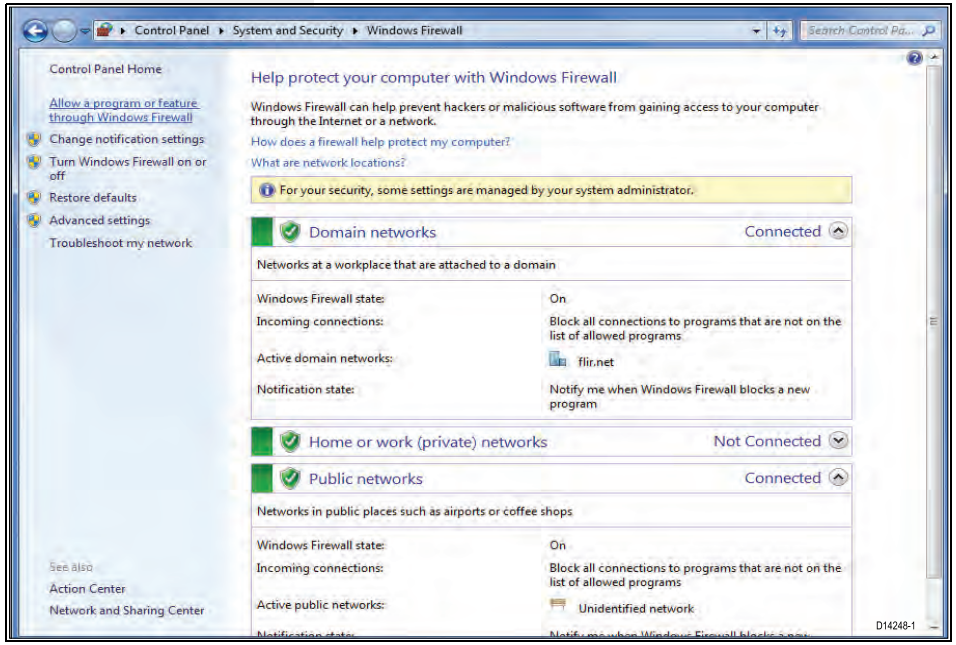
Note: * You may need to change your network settings to connect to a PC running Windows 7.

Changing network settings - Windows 7

To configure the necessary network settings on a Windows 7 PC follow the steps below

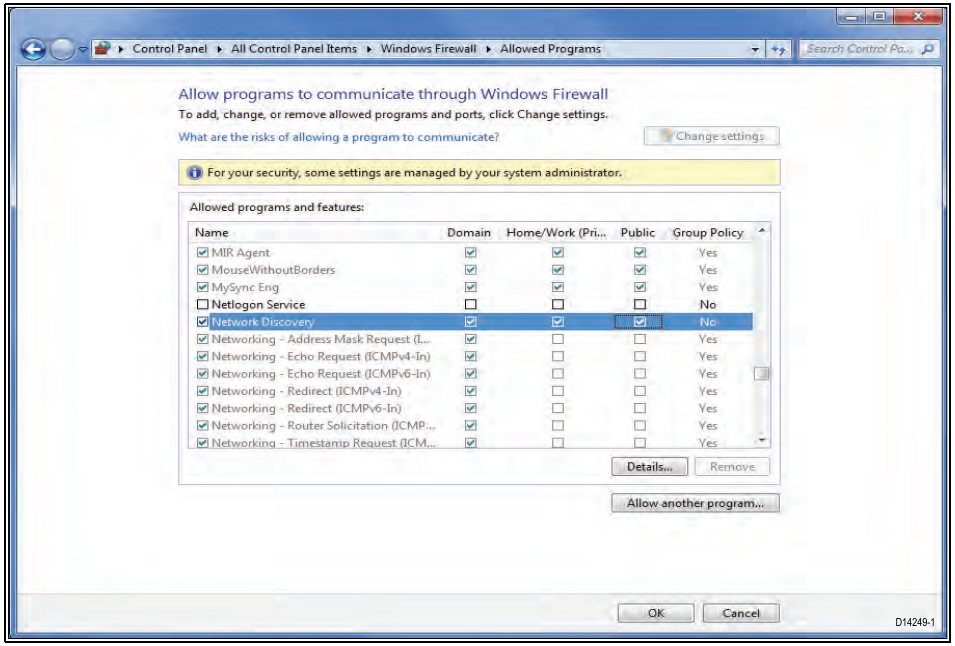
With the camera networked to the PC (refer to Chapter 8 **Cables and connections** for details.

1. Click **Start**.
2. Click **Control Panel**.
3. Click **System and Security**.
4. Click **Windows Firewall**.

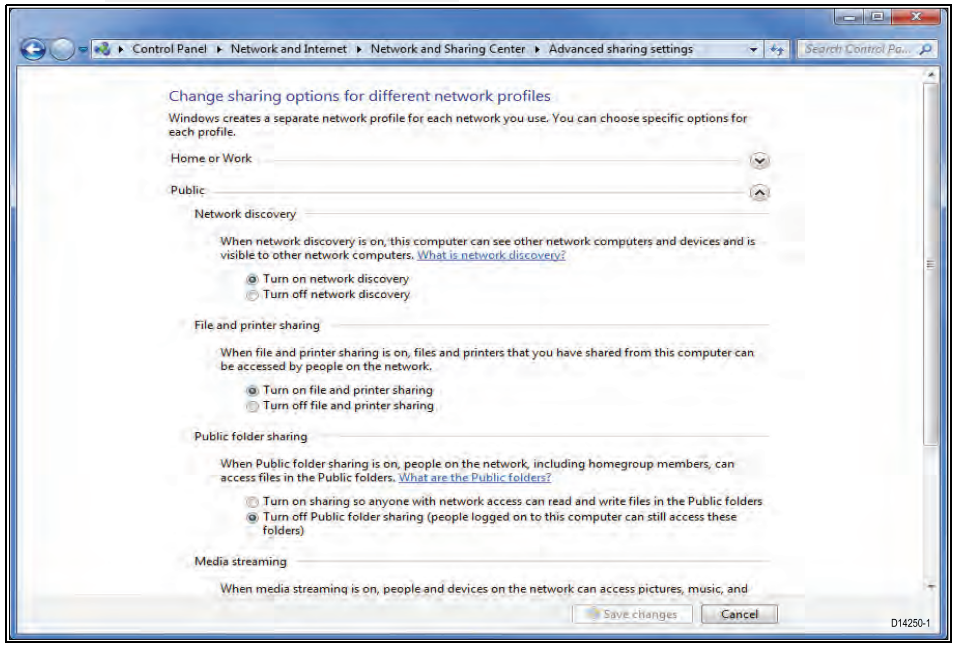


5. Click **Allow a program or feature through Windows Firewall**.
6. Scroll down the list to **Network Discovery**.

7. Place a tick in the box for the type of network that the camera is on (this is usually Public).



8. Click **OK**.
9. From the Control Panel click **Network and Internet**.
10. Click **Network and Sharing Center**.
11. Click **Change advanced sharing settings**.
12. Click on the relevant network type (e.g. Public).
13. Ensure **Turn on network discovery** is selected.



14. Click **Save changes** if you switched on network discovery, or
15. Click **Cancel** if network discovery was already turned on.

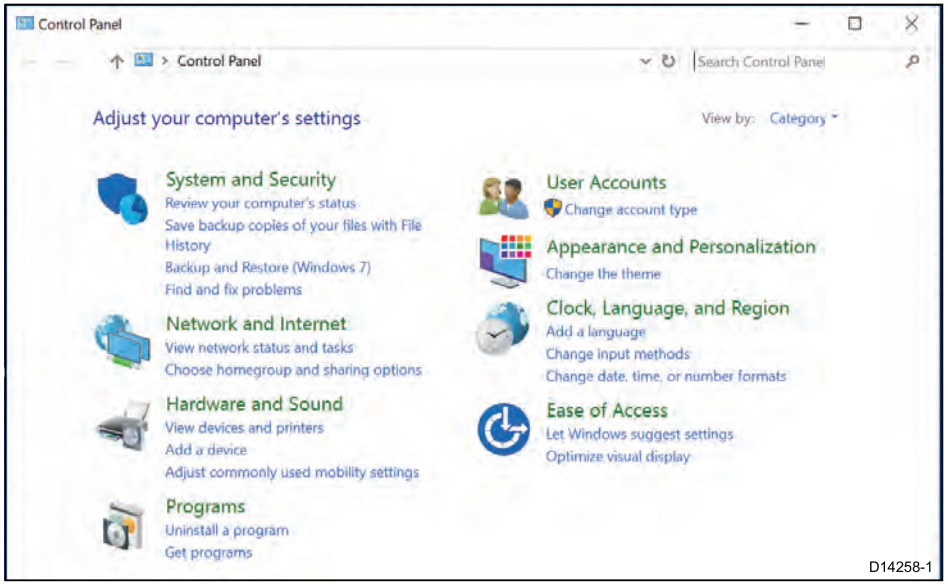
Changing network settings - Windows 10

To configure the necessary network settings on a Windows 10 PC follow the steps below

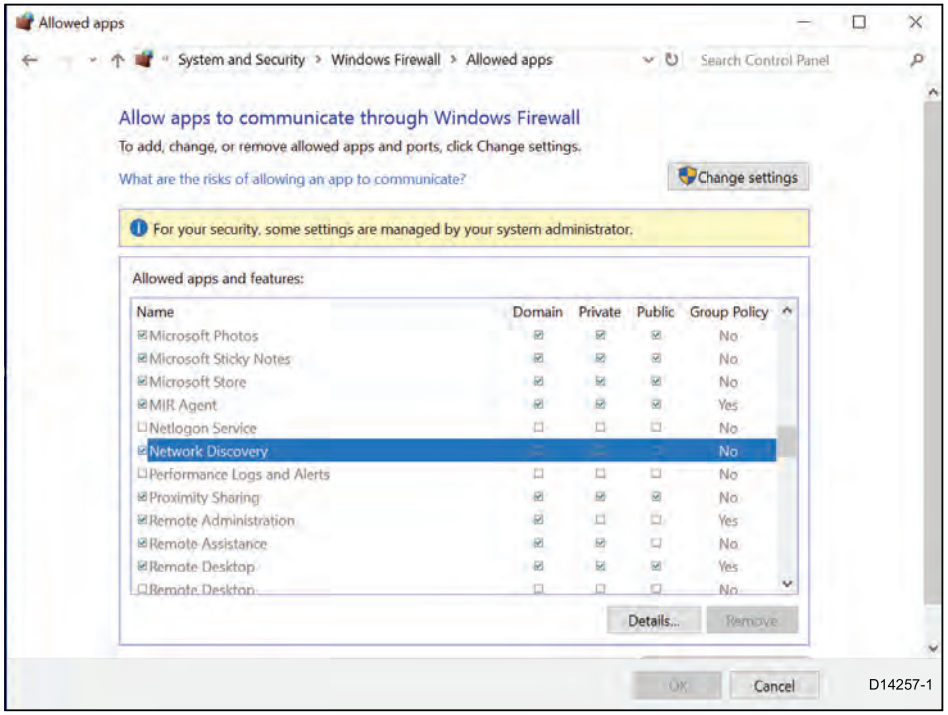
With the camera networked to the PC (refer to Chapter 8 **Cables and connections** for details.

1. Click **Control Panel**.

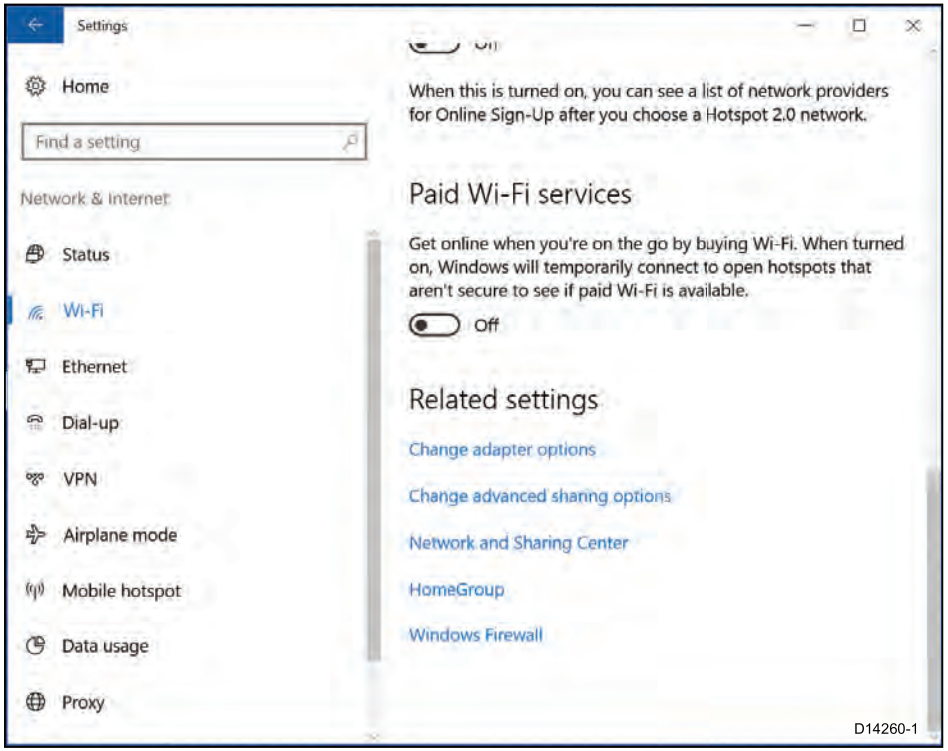
2. Click **System and Security**.



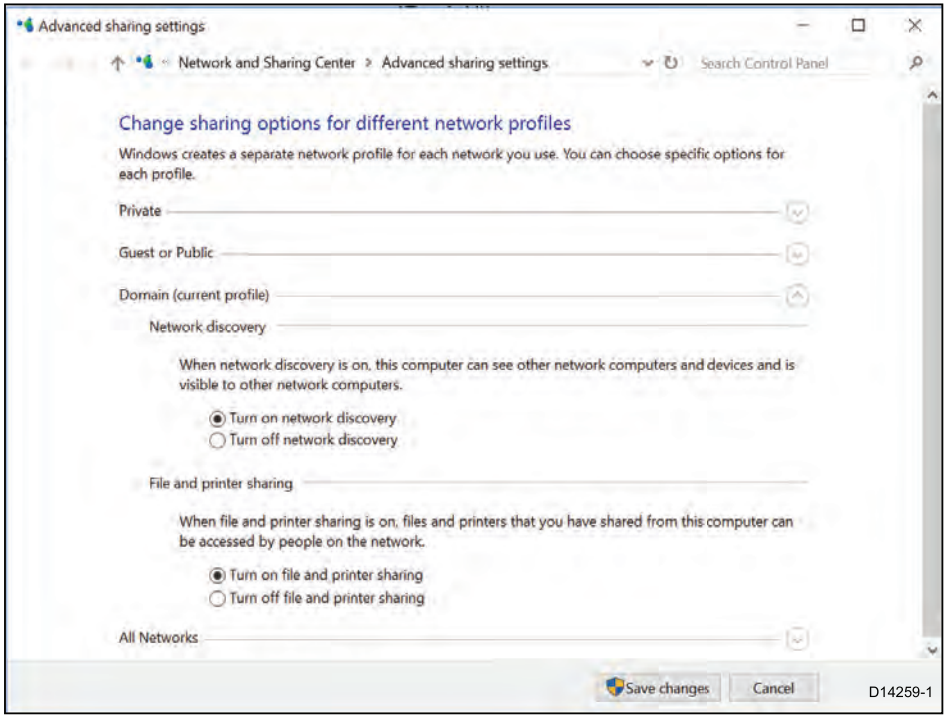
3. Under Windows Defender Firewall, click **Allow an app through Windows Firewall**.
4. Scroll down the list to **Network Discovery**.
5. Place a tick in the box for the type of network that the camera is on (this is usually Public).



6. Click **OK**.
7. From the Settings menu click **Network & Internet**.
8. From the left hand panel select the network your PC and the camera are connected to.
9. Scroll down to **Change advanced sharing options**.



10. Ensure **Turn on network discovery** is selected.



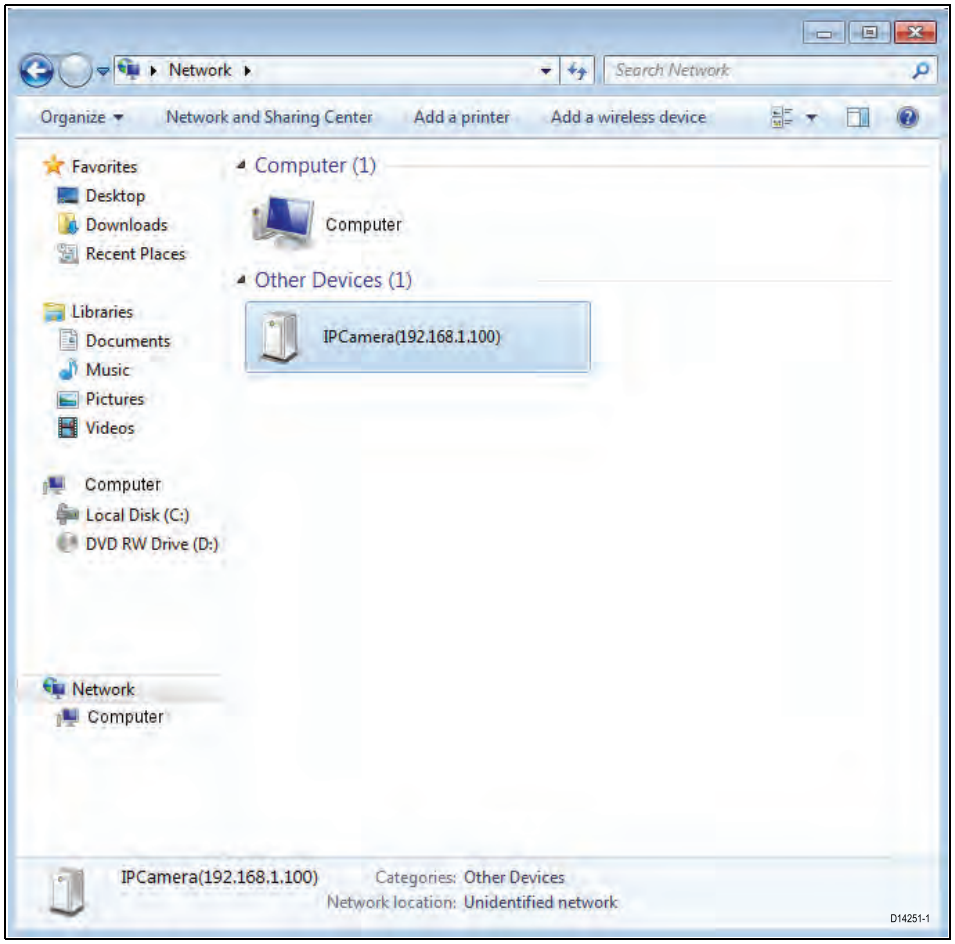
11. Click **Save changes** if you switched on network discovery, or
12. Click **Cancel** if network discovery was already turned on.

Finding the camera's IP address using Windows 7 UPnP

To use this method, your PC, and router (if used) must support UPnP (UPnP is enabled in the camera by default). The camera and the PC must be on the same network.

Ensure the camera is connected to your PC as described in Chapter 8 **Cables and connections**.

1. Click **Start > Computer > Network**.
   The camera appears under Network Infrastructure.



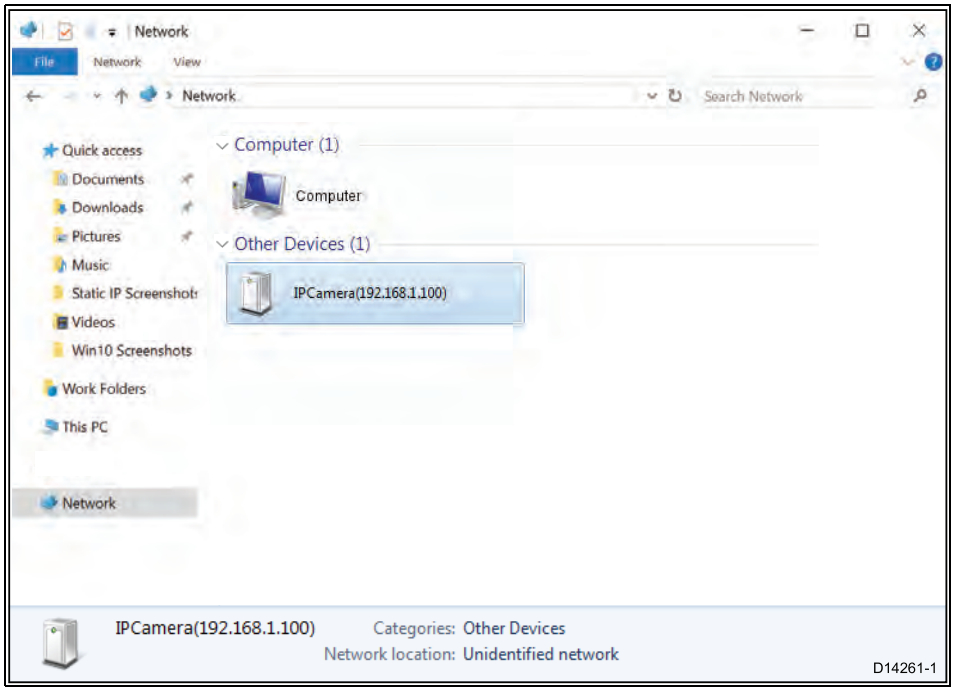
2. Double-click a camera icon to open the web interface in your default browser.
3. Enter the username and password for the camera and click **Login**.

Finding the camera's IP address using Windows 10 UPnP

To use this method, your PC, and router (if used) must support UPnP (UPnP is enabled in the camera by default). The product and the PC must be on the same network.

Ensure the product is connected to your PC as described in Chapter 8 **Cables and connections**.

1. Click **Start** > **This PC** > **Network**.
   The product appears under Network Infrastructure.



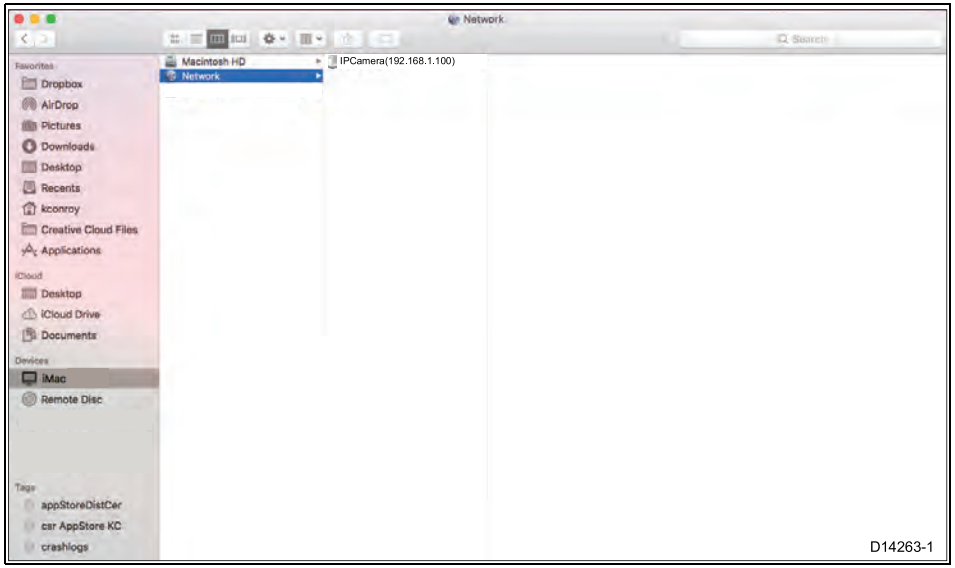
2. Double-click the product icon to open the web interface in your default browser.
3. Enter the username and password for the camera and click **Login**.

Finding the camera's IP address using Mac UPnP

To use this method, your Mac, and router (if used) must support UPnP (UPnP is enabled in the product by default). The product and the Mac must be on the same network.

Ensure the product is connected to your Mac as described in Chapter 8 **Cables and connections**.

1. Click **Finder** > **Devices** > **Mac**.
   The product appears under Network.



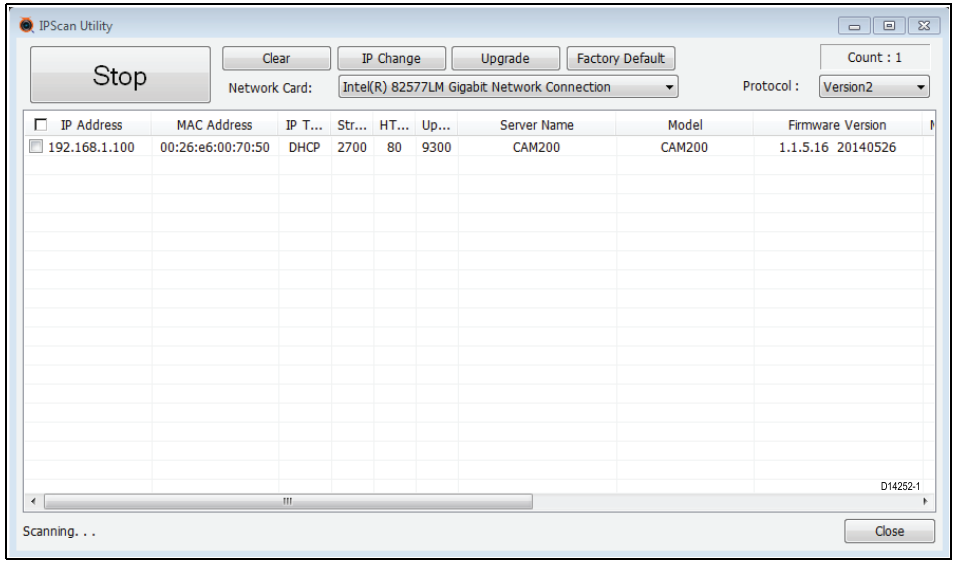
2. Double-click the product icon to open the web interface in your default browser.
3. Enter the username and password for the camera and click **Login**.

Finding the camera's IP address using IP Scanner software

To use this method, your PC, and router (if used) must support UPnP (UPnP is enabled in the camera by default). The camera and the PC must be on the same network.

Ensure the camera is connected to your PC as described in Chapter 8 **Cables and connections**.

1. Insert the CD that was supplied with the camera into the CD/DVD drive of your PC.
2. Navigate to the **SOFTWARE** folder.
3. Double click the IP Scanner executable file (e.g. IPScan Utility.exe).
4. Click the **SCAN** button.
   Details for any connected IP devices will be displayed.



5. Double-click the relevant camera entry to open the web interface using your default web browser.
6. Enter the username and password for the camera and click **Login**.

Static IP

In some cases the IP addresses of your computer and product do not match, meaning you are unable to connect to the product. This issue can be resolved by assigning your computer a static IP address to match your products.

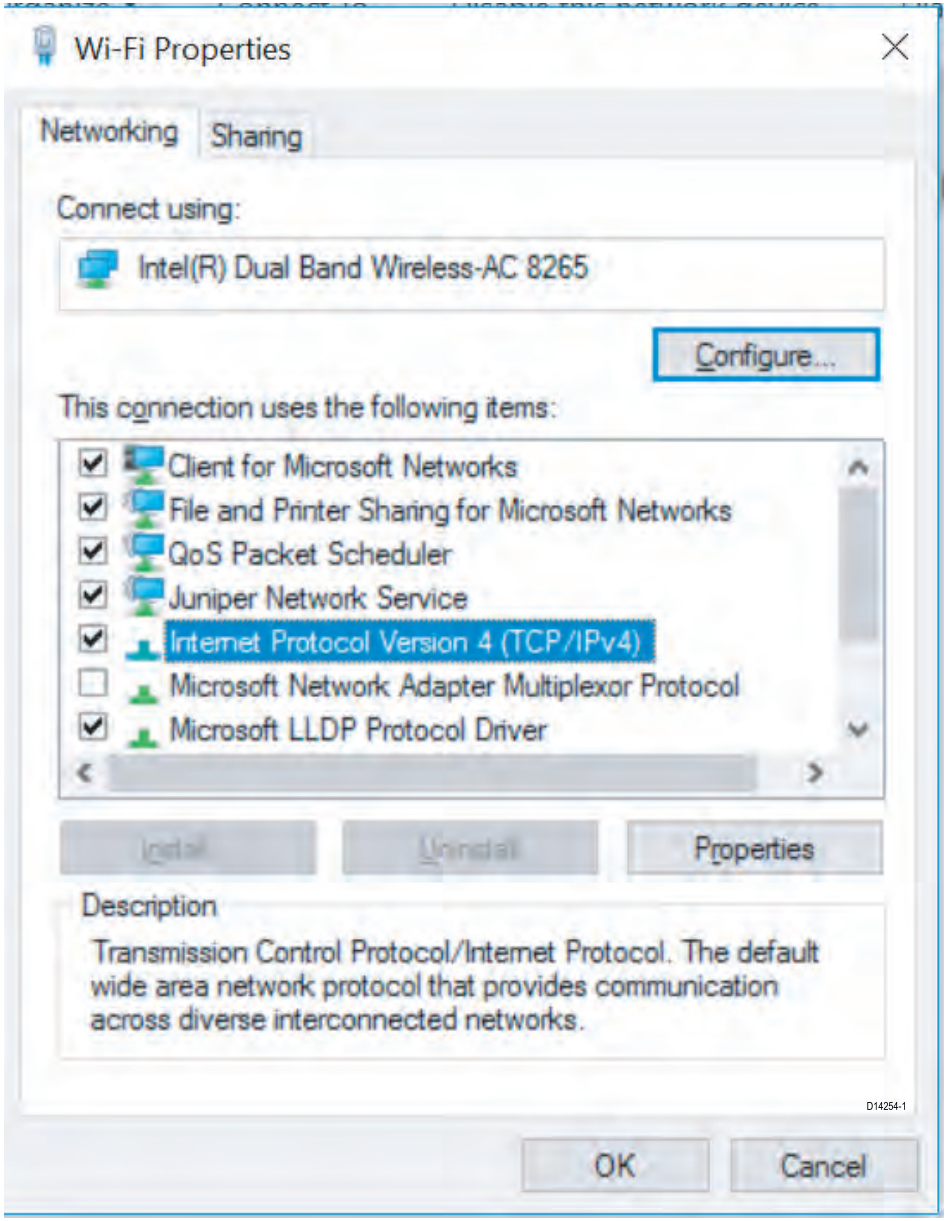
Assigning a static IP address using Windows 7

To configure the necessary IP address settings on a Windows 7 PC follow the steps below:

Note: You need to know the IP address of your product for **step 10**. This can be found by referring to **Finding the camera's IP address using IP Scanner software**.

1. Click **Start**
2. Click **Control Panel**
3. Click **Network and Sharing Center**
4. Click **Change adapter settings**
5. Select and Right click the **network** the product is communicating on
6. Click **Properties**
7. Scroll to **Internet Protocol Version 4 (TCP/IPv4)** and select it

8. Click **Properties**



9. Click **Use the following IP address**
10. Enter the **IP address** so it matches the IP address of your product (default: 192.168.1.100)
11. Change the **last three digits** of the IP address to a number between **1–225** (these digits must not match the IP address of the product or any other device on the network).
12. Enter the **Subnet mask** 255.255.255.0
13. Click **OK**

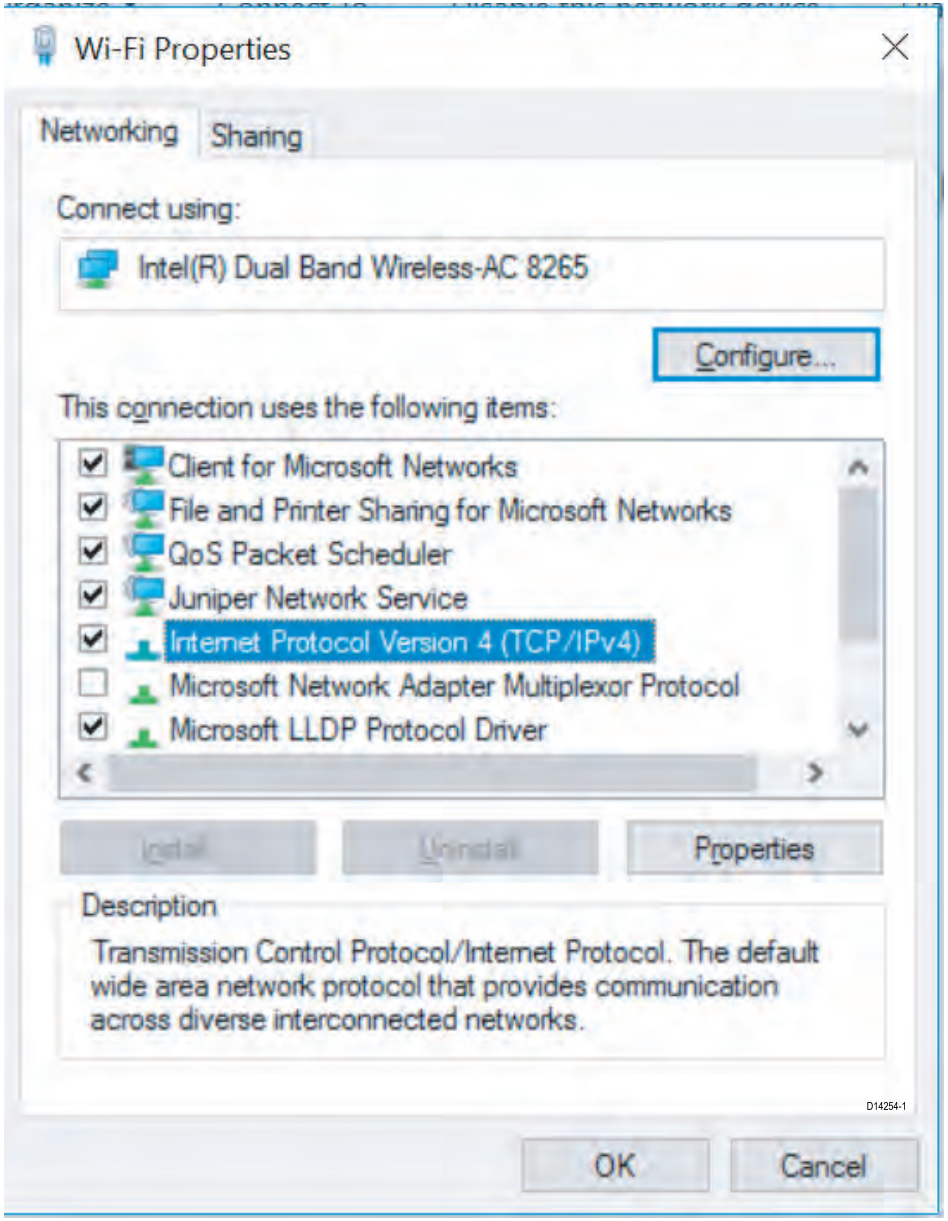
14. You can now access the product by typing its IP address into your default browser.

Assigning a static IP address using Windows 10

To configure the necessary IP address settings on a Windows 7 PC follow the steps below:

Note: You need to know the IP address of your product for **step 10**. This can be found by referring to **Finding the camera's IP address using IP Scanner software**.

1. Click **Start**
2. Click **Settings**
3. Click **Network and Internet**
4. Click **Change adapter options**
5. Select and Right click the **network** the product is communicating on
6. Click **Properties**
7. Scroll to **Internet Protocol Version 4 (TCP/IPv4)** and select it
8. Click **Properties**



9. Click **Use the following IP address**
10. Enter the **IP address** so it matches the IP address of your product (default: 192.168.1.100)

11. Change the **last three digits** of the IP address to a number between **1–225** (these digits must not match the IP address of the product or any other device on the network).
12. Enter the **Subnet mask** 255.255.255.0
13. Click **OK**

14. You can now access the product by typing its IP address into your default browser.

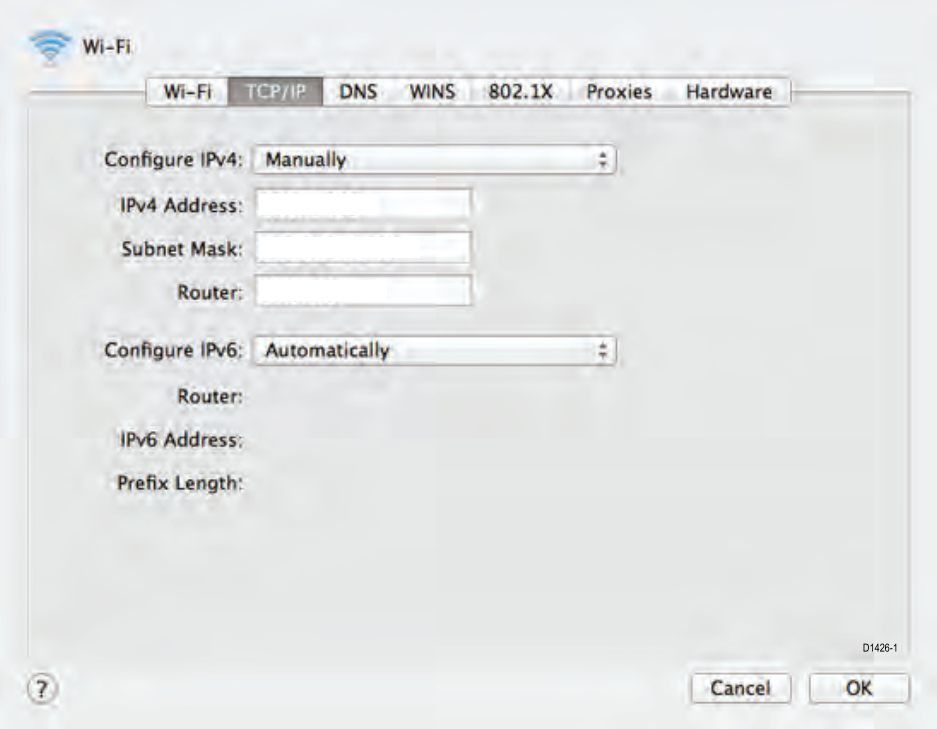
Assigning a static IP address using Mac

To configure the necessary IP address settings on a Mac computer follow the steps below:

Note: You need to know the IP address of your product for **step 8**. This can be found by referring to **Finding the camera's IP address using IP Scanner software**.

1. Click the **Apple menu**
2. Click **System Preferences**
3. Click **Network**
4. Select the **network** the product is communicating on from the sidebar
5. Click **Advanced**
6. Click **TCP/IP**
7. From the **Configure IPv4** menu, select **Manually**
8. Enter the **IP address** so it matches the IP address of your product (default: 192.168.1.100)
9. Change the **last three digits** of the IP address to a number between **1–225** (these digits must not match the IP address of the product or any other device on the network).
10. Enter the **Subnet mask** 255.255.255.0

11. Click **OK**



12. You can now access the product by typing its IP address into your default browser.

Supported browsers

The camera includes a built-in web interface that can be accessed using a web browser.

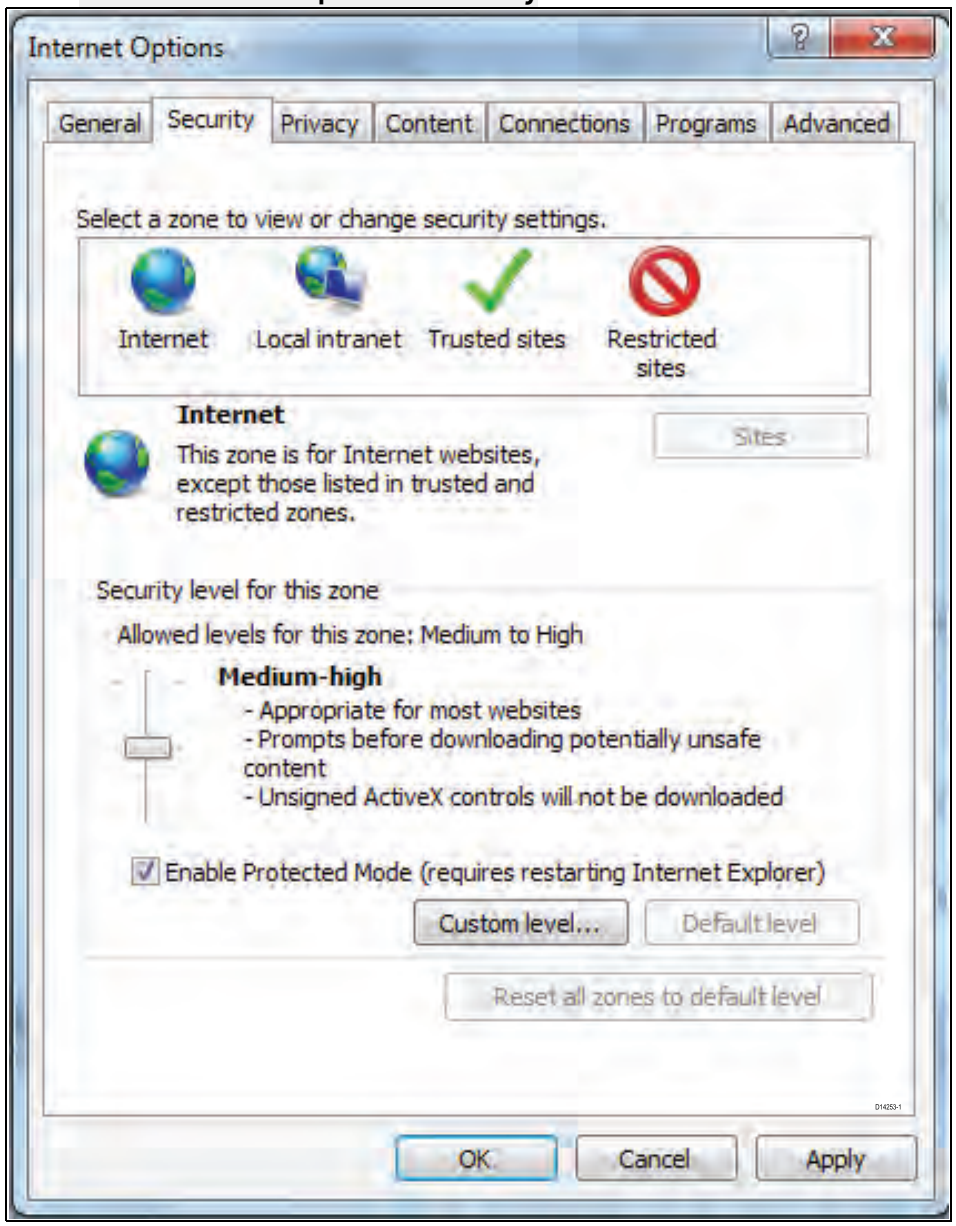
The following browsers are supported:

- Google Chrome (using Adobe Flash Player)
- Mozilla Firefox (using Adobe Flash Player)
- Apple Safari (using Adobe Flash Player)
- Microsoft Internet Explorer 7.0 or later, 32–bit version (using ActiveX or Adobe Flash Player)

Setting up Internet Explorer

If you are using Microsoft Internet Explorer then you may need to change the internet settings.

1. Click **Tools** > **Internet Options** > **Security**.



2. Click **Custom Level**.
3. Under **Download unsigned ActiveX controls**, click **Prompt** (recommended) or **Enable**.
4. Click **OK** and then click **OK** again.

Accessing using a web browser

1. Open your web browser from a web-enabled device connected to the same network as the IP camera.
2. Enter your camera's IP address in the browser's address bar in the following format: **http://192.168.1.100:80** and press **Return**.
3. Enter the username and password for the camera and click **Login**.

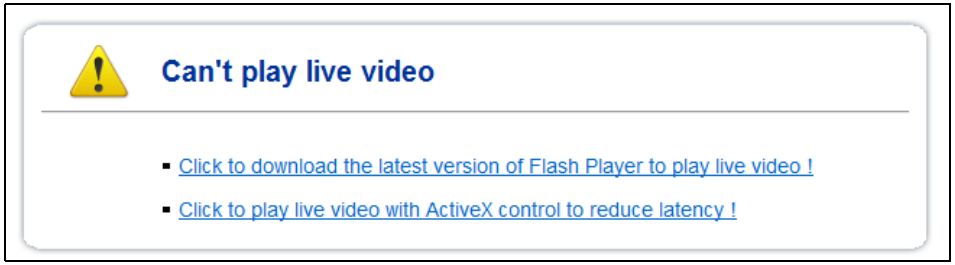
The main screen for the camera web interface is displayed. From here you can configure and view the camera feed.

Note: If you do not see the camera feed, make sure your computer has the latest version of Adobe Flash Player (Chrome, Firefox Internet Explorer and Safari) or ActiveX (Internet Explorer only) installed. After installing restart your browser and reconnect to the camera.

Internet Explorer - ActiveX and Flash Player

The ActiveX plug-in may provide smoother video performance than Flash Player.

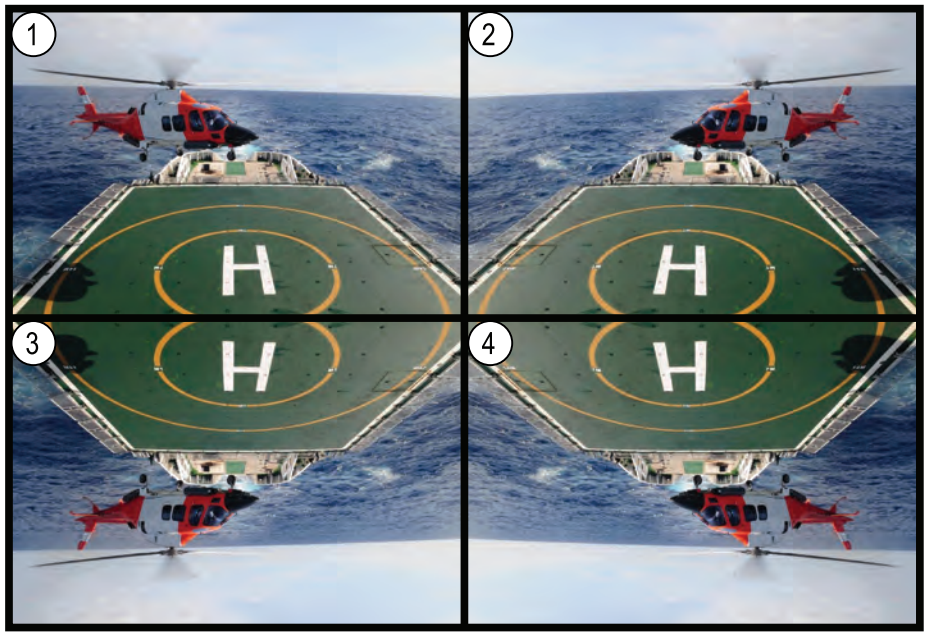
1. If your computer has Flash Player installed:
   i. Open the web interface.
   ii. Click the message above the video window.
   iii. Click inside the video area and select **Install this Add-on for all users on this computer**.
   iv. Follow the onscreen prompts.
2. If your computer does not have Flash Player installed you will be prompted to select if you would like to use ActiveX or Flash Player:



- **Click to play live video with ActiveX control to reduce latency (Recommended)** — Uses the ActiveX plug-in to connect to the camera. To install the plug-in, click on the video area, and select **Install this add-on for all users on this computer**.
- **Click to download the latest version of Flash Player to play live video** — Opens a link to download Flash Player from Adobe's website. After completing the installation, restart your browser and open the web interface.

9.3 Reverse video and video flip

The video feed can be reversed (mirror image), flipped upside down or reversed and flipped depending on your installation.



1. **Normal view** — For forward facing cameras.
2. **Mirror / reverse view** — For cameras facing aft.
3. **Image flip view** — For forward facing cameras, where the camera image appears upside down.

4. **Image flip and mirror / reverse view** — For cameras facing aft, where the camera image appears upside down.

Reversing and flipping the video

In order to reverse the video image or flip the image follow the steps below.

From the camera's Web-interface:

1. Click the **Camera** icon on the left hand side of the page.
2. Click **Camera Setup** from the quick links.
3. Select the relevant option from the **Mirror** drop down box.
   The options available are:
   - **Off** — For forward facing cameras.
   - **Mirror** — For cameras facing aft.
   - **Flip** — For forward facing cameras, where the camera image appears upside down.
   - **Rotate** — For cameras facing aft, where the camera image appears upside down.

Augmented reality

If your system is setup for displaying Augmented Reality content, please note that mirroring or vertically flipping the camera will result in an inaccurate display of Augmented Reality content.

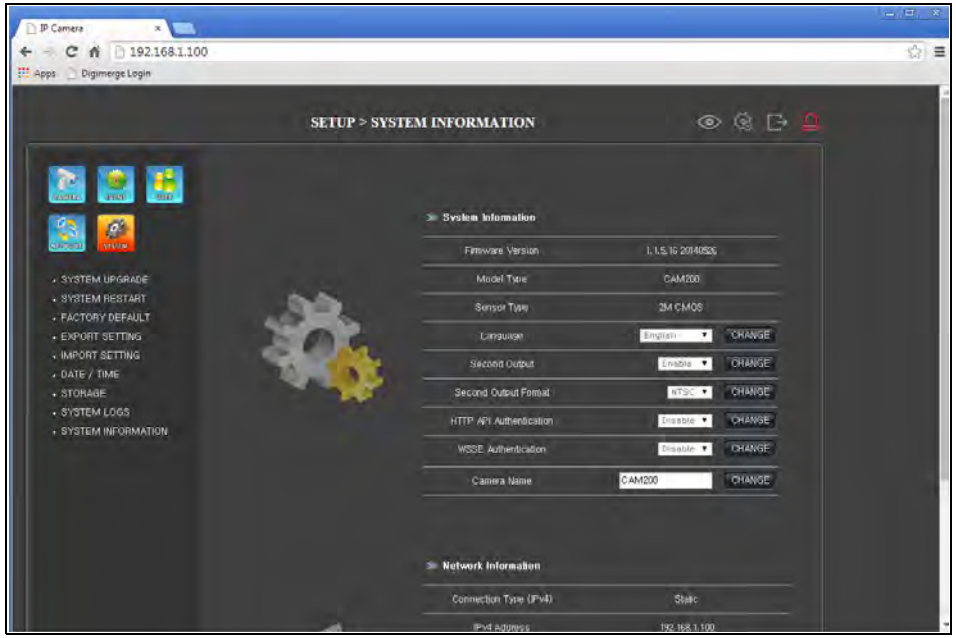
9.4 Resetting the camera to factory defaults

Follow the steps below to reset your camera's settings to their factory default values.

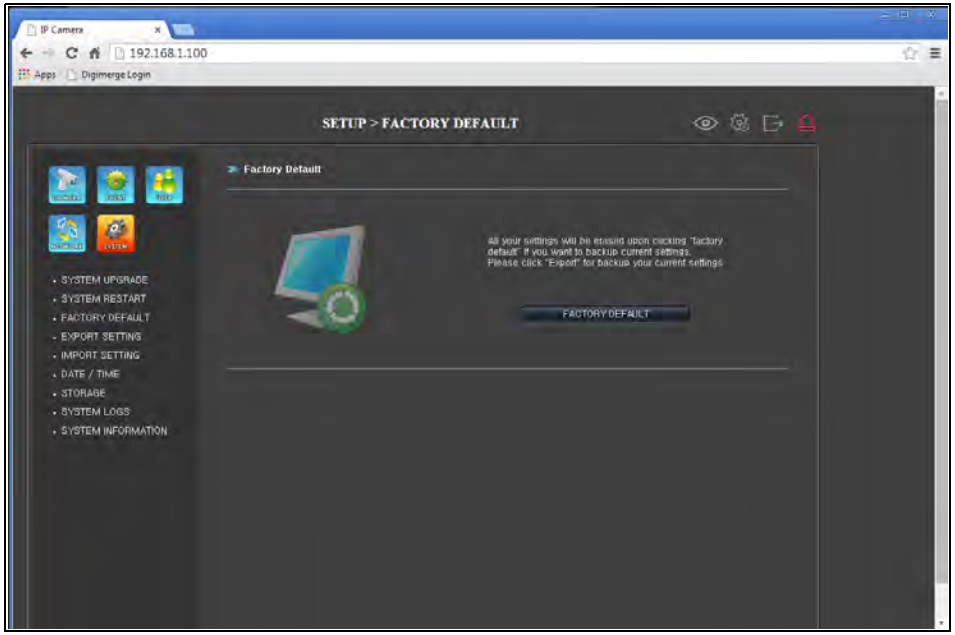
- Ensure that the camera and IP camera are connected to the same network as described in the Network connection section.
- Ensure that your PC settings have been changed to allow access to the web interface as described in the Network setup and operation section.

1. Login to the camera's web interface.

2. Click on the Settings icon  , located in the top right hand corner of the page.
   The System Information page is displayed.



3. Click **FACTORY DEFAULT** from the quick links, located on the left hand side of the page.



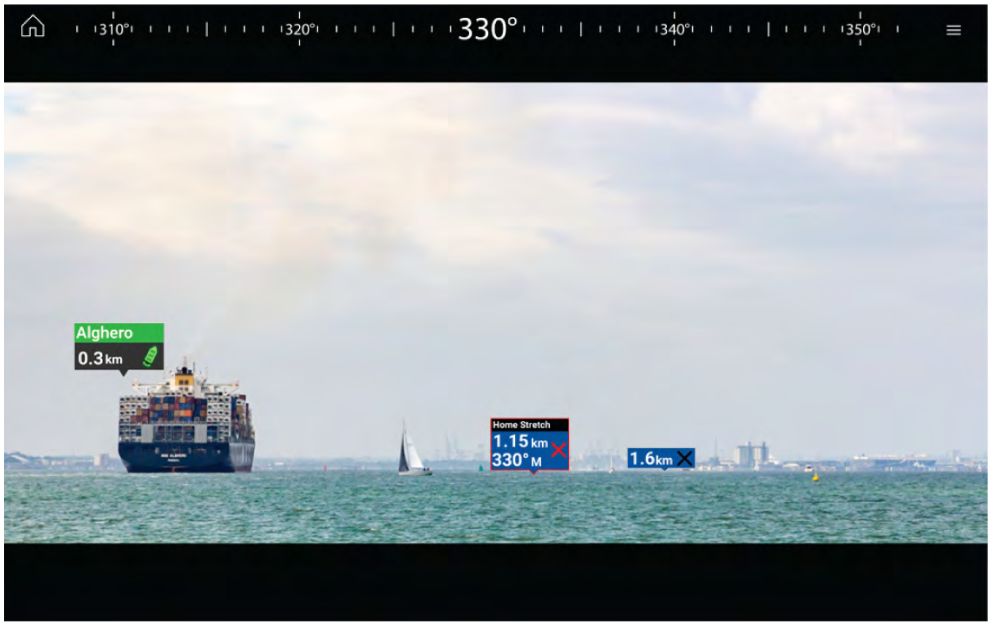
4. Click **FACTORY DEFAULTS**, located near the center of the page.
   The camera will now reset itself to factory default settings.

CHAPTER 10: AUGMENTED REALITY

CHAPTER CONTENTS

10.1 Augmented Reality (AR) overview

ClearCruise™ Augmented Reality uses data from the MFD's Chart app and displays this data in realtime as an overlay in the Video app.



The **Augmented Reality** feature places layers of digital information directly over the top of the Video app's video feed. Data from the Chart app is used to generate informative text and images (flags) on the Video app. When calibrated correctly, ClearCruise™ Augmented Reality accurately overlays automatically-updating flags on the Video app so they overlap real-life objects.

The Augmented Reality feature requires an Axiom, Axiom+, Axiom Pro or Axiom XL MFD, an AR200 sensor, and a compatible camera.

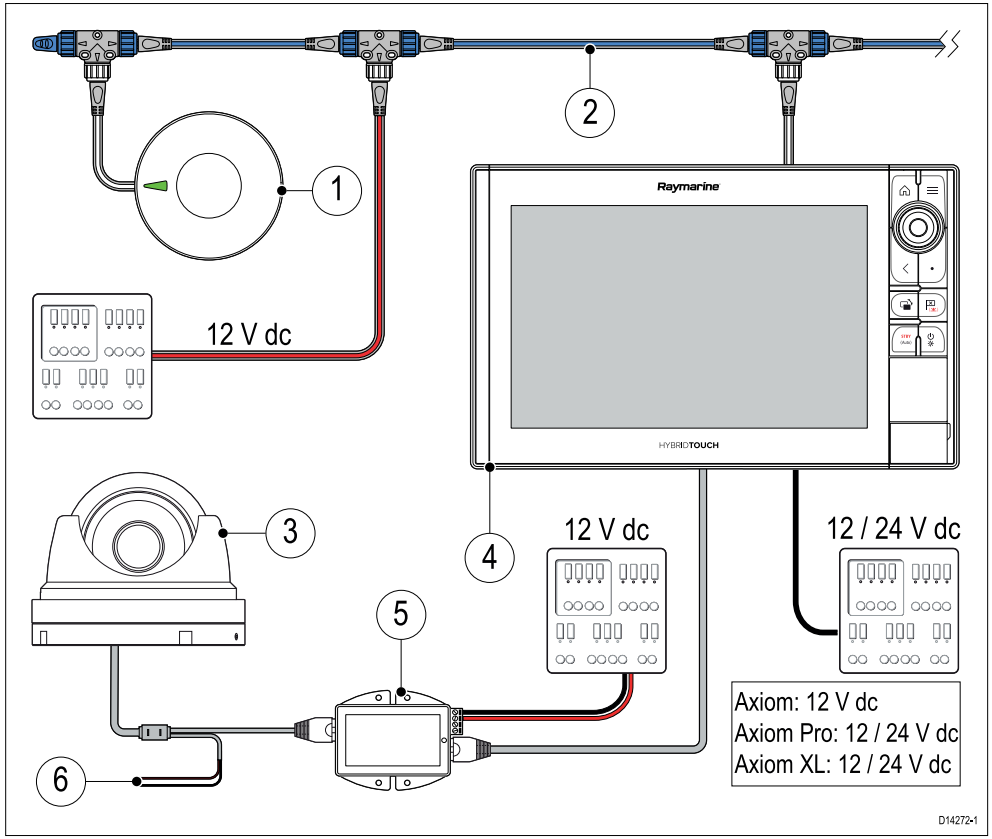
Note:

- The Augmented Reality feature requires correct camera calibration for accurate image overlay.
- The Augmented Reality feature serves as an aid to navigation and situational awareness only, and should not be solely relied on for precise navigation. **Always maintain a visual watch.**

Important: Rear-facing cameras with a flipped or mirrored image may not place Augmented Reality content as accurately as a forward-facing camera.

10.2 Augmented reality

CAM220IP can be used with a Raymarine AR200 to enable ClearCruise™ Augmented Reality features. Below is a typical system example showing the components and connections required to enable ClearCruise™ Augmented Reality on your system.



1. AR200.
2. SeaTalkng ® backbone (providing 12 V dc power to the AR200).
3. CAM220IP (CAM210IP is also compatible).
4. Axiom LightHouse™ 3 or LightHouse™ 4 MFD (running LH3 version 3.7 or above, or LH4 version 4.0 or above).

5. Optional PoE injector (providing power to the camera).
6. Alternate power connection for camera (connection required when not using PoE to power the camera).

Note:

- ClearCruise™ Augmented Reality is not available via CAM220's Web Browser Interface.
- For more information on ClearCruise™ Augmented Reality, please refer to the appropriate multifunction display Operation instructions: **81370 — Lighthouse 3 Advanced operations instructions.**, or **81406 — Lighthouse 4 Advanced operations instructions.**

10.3 Camera setup

Before using the Augmented Reality features, it's important to correctly install and setup your compatible camera.

Refer to your camera's installation manual to determine the correct physical installation and connections for using the camera as part of an Augmented Reality system.

A number of additional camera-related settings and calibrations must be completed in the Video app before Augmented Reality features can be used:

- Camera height above the waterline.
- Camera direction.
- Camera horizontal field of view [not required for cameras which auto assign their field of view].
- Horizon calibration.

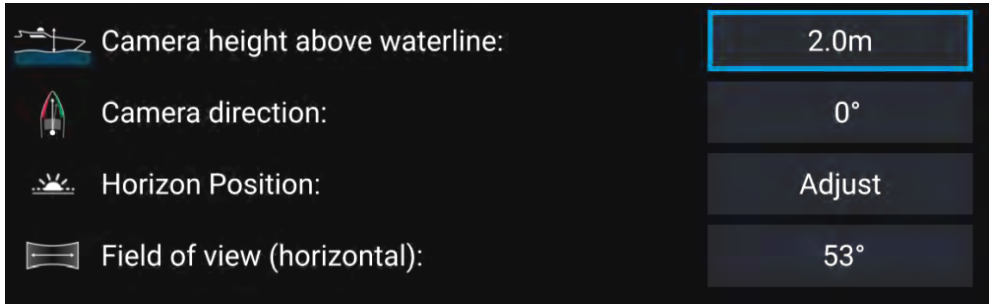
Note:

- The camera's height above the waterline and camera's view direction need to be physically measured for accurate camera installation.
- The camera's horizontal field of view can be found in your camera's installation manual specification.

Fixed camera calibration

Fixed mount cameras require calibration for Augmented Reality to function correctly.

1. For first time setup, either:
   i. Select the **Enter Details** prompt in the Video app.
   ii. Select the **ClearCruise** tab in the Video app's Settings, **Video app > Settings > ClearCruise.** There will be a prompt to **Enter Details** using the **Camera Installation** page.
2. Go directly to the **Camera Installation** page in the Video app (**Settings > Camera Setup > Camera Installation**).
3. The **Camera Installation** page will offer a series of camera installation options which all need to be completed correctly.



Note:

Incorrect physical camera installation and incorrect settings provided in the camera setup page could result in an inaccurate Augmented Reality overlay.

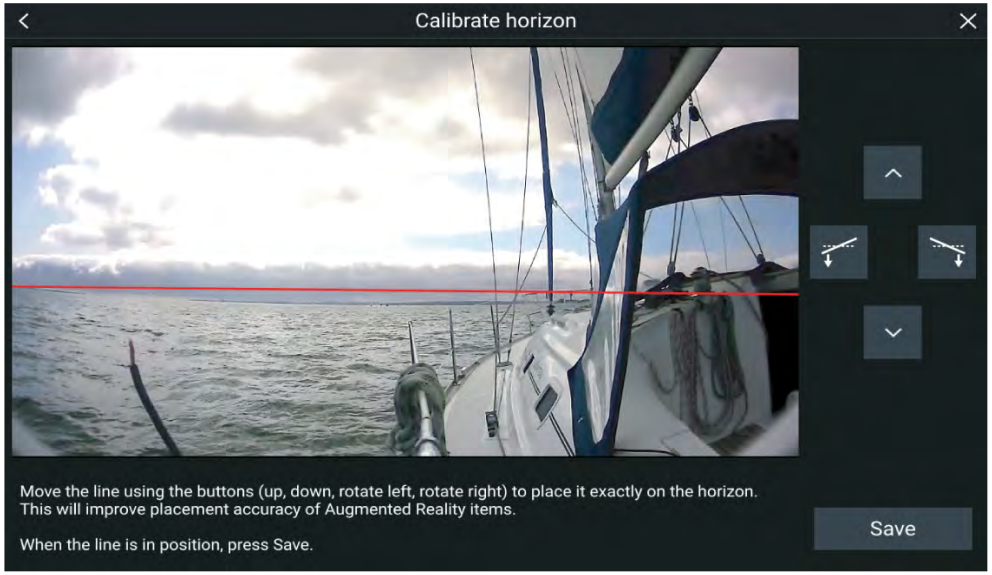
- To adjust the values of **Camera height above waterline**, **Camera direction** and **Field of view**, select the value boxes of each option and adjust using the arrows.

Menu item	Options
Camera height above waterline	• 0m to 50m • 0ft to 165ft
Camera direction	• 0° (Forward) (default) • 0° to 180°p (Port) • 0° to 180°s (Starboard)
Field of view	• 30° to 120° • [CAM210IP – 53°] • [CAM220IP – 93°]

- To Calibrate horizon, use the **up**, **down**, **rotate left** and **rotate right** arrow keys until the red line is placed on the horizon. When the line is in position, select **Save**.

Important:

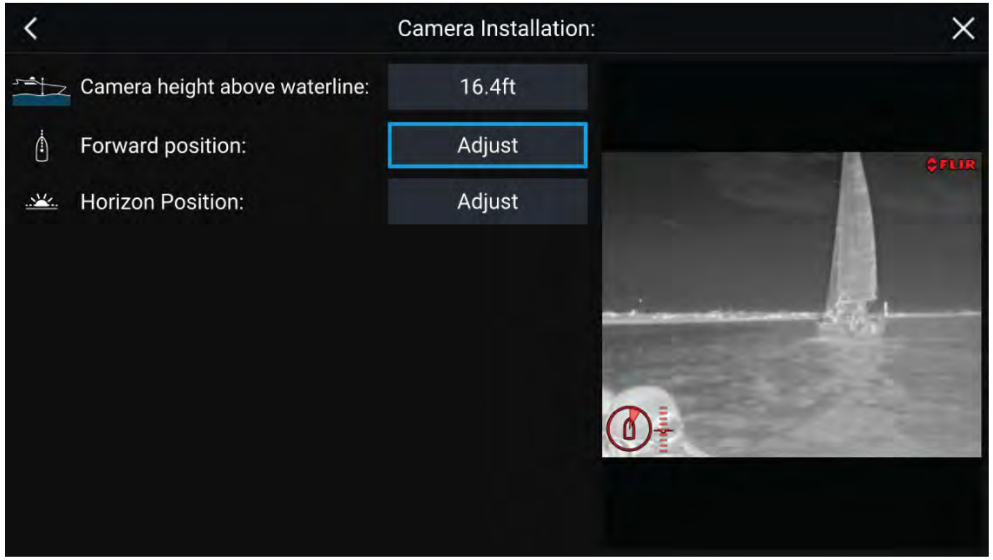
Calibrating the horizon correctly is essential for accurate Augmented Reality overlay. Calibrating on calm water and in clear sight of the horizon is recommended.



Pan and Tilt camera calibration

Pan and Tilt cameras require calibration for Augmented Reality to function correctly.

1. For first time setup, either:
   i. Select the **Enter Details** prompt in the Video app.
   ii. Select the **ClearCruise** tab in the Video app's Settings, **Video app > Settings > ClearCruise.** There will be a prompt to **Enter Details** using the **Camera Installation** page.
2. Go directly to the **Camera Installation** page in the Video app (**Settings > Camera Setup > Camera Installation**).
3. The **Camera Installation** page will offer a series of camera installation options which all need to be completed correctly.



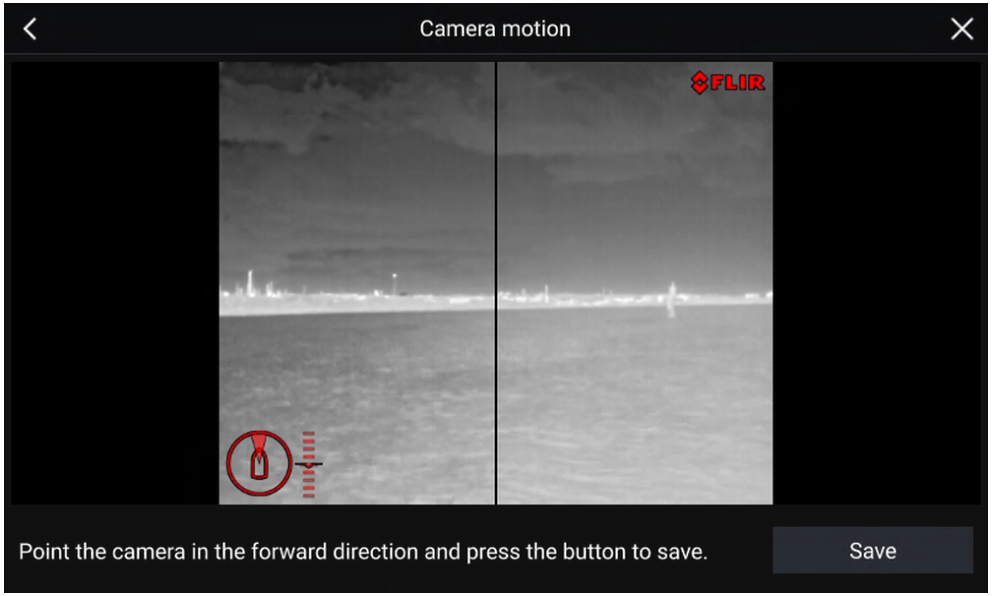
Note:

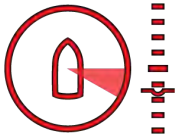
Incorrect physical camera installation and incorrect settings provided in the camera setup page could result in an inaccurate Augmented Reality overlay.

- To adjust the values of **Camera height above waterline** select the value box and adjust using the arrows.

Menu item	Options
Camera height above waterline	• 0m to 50m • 0ft to 165ft

- To Calibrate the camera's **Forward Position** adjust the camera direction so the vertical black line is positioned directly forward, parallel to your vessels forward position.

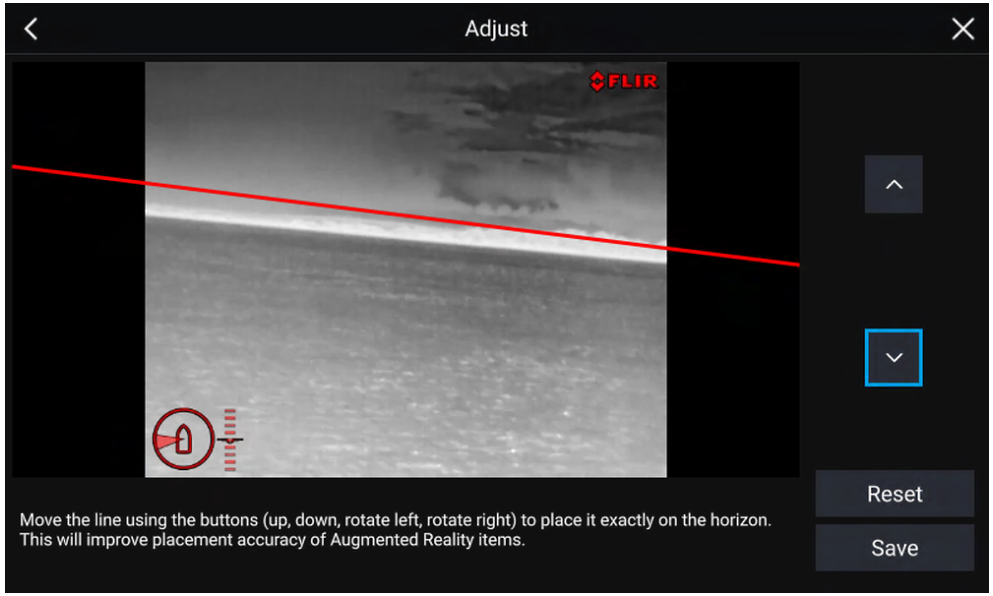




Important:

- Calibrating the cameras forward position is essential for accurate Augmented Reality overlay when the camera pans and tilts. Calibrating on calm water and with a clear view of the front of your vessel is recommended.
- Certain cameras display a camera direction indicator which can help identify when the camera is facing directly forward.

- To Calibrate the camera's **Horizon position** use the arrow keys to align the horizontal red line so it is level with the horizon.
- Pan and tilt the camera 360° during calibration to ensure the horizon line has been positioned correctly.



Important:

Calibrating the horizon correctly is essential for accurate Augmented Reality overlay. Calibrating on calm water and in clear sight of the horizon is recommended.

10.4 AR200 setup for Augmented Reality

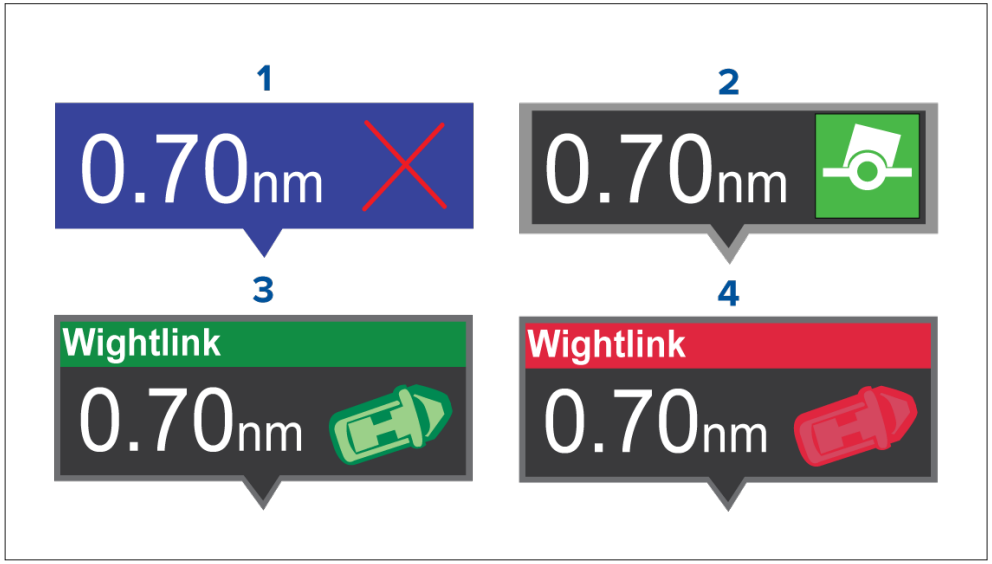
Before using the Augmented Reality features, it's important to correctly install and setup the AR200 Augmented Reality sensor.

Refer to the AR200 Installation manual (87372) to determine the correct physical installation and connections for using the AR200 as part of an Augmented Reality system.

10.5 Augmented Reality flags

ClearCruise™ Augmented Reality displays AIS Targets, Waypoints and Chart Objects as individual Augmented Reality **Flags** in the Video app.

All flags display an icon and your vessel's distance from the target's location.



1	Waypoint flag
2	Chart Object flag (buoy)
3	AIS Target flag (passenger ferry; icon points in the direction of travel relative to the camera feed)
4	Dangerous AIS Target flag (passenger ferry; icon points in the direction of travel, relative to the camera feed)

Note: AIS flags update periodically; however, accurate placement is not guaranteed.

- AIS Targets, Waypoints and Chart Object flags can be quickly enabled / disabled via buttons in the Video app.
- The maximum range within which flags are automatically shown can also be adjusted in the Video app.
- For more information on adjusting flag settings.

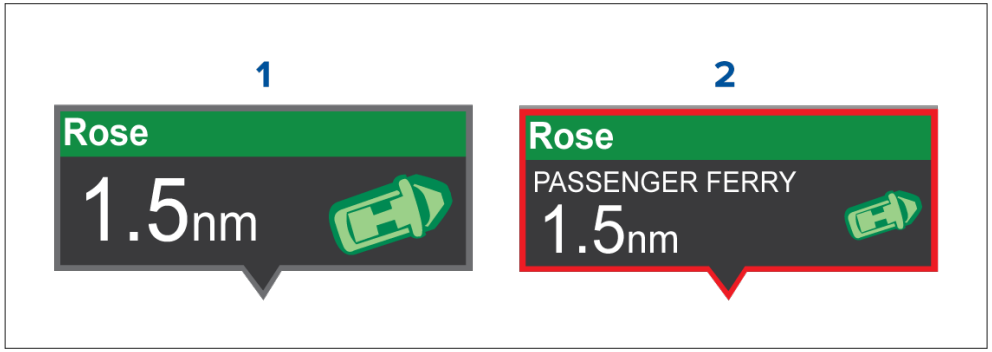
Selected flags

Augmented Reality flags in the Video app can be selected (highlighted), providing access to more information about the object and additional features.

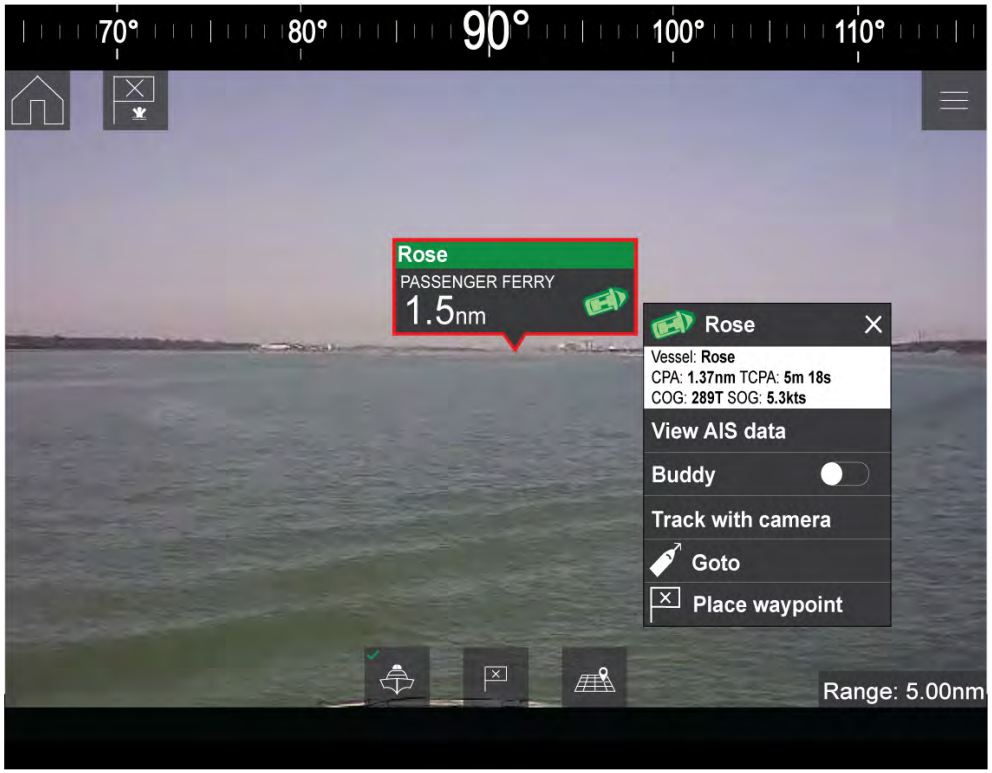
A flag is an onscreen visual overlay element displayed in the Video app when the Augmented Reality features are enabled. A flag represents an object from the Chart application: e.g. AIS target, Waypoint, or other chart object.

When a flag is selected, the corresponding object is also highlighted in the Chart app. Conversely, selecting an object in the Chart app highlights the corresponding flag in the Video app.

Only one flag may be selected at a time.



1	AIS Flag
2	Selected AIS Flag



Selecting a flag highlights it in red and provides additional information about the object in a context menu. The menu also provides additional features. The range of features available in the context menu depends on the type of object selected:

AIS Target Flag

Option	Description
AIS Target name	The name of the target vessel.
Target data	Vessel (name), CPA, TCPA, COG, SOG.
View AIS data	Displays the AIS data transmitted by the target vessel.
Buddy (toggle ON/OFF)	Add the vessel to your “Buddy List”, with the option to rename it. The Buddy feature enables you to add AIS-equipped friends and regular contacts to a “Buddy List” on your MFD. As soon as a vessel on your Buddy List comes within range of your AIS receiver, the onscreen vessel icon changes to indicate this.
Goto	The Chart app will plot a direct route to the last known location of the target.
Place waypoint	The Chart app will place a waypoint at the last known location of the target.

Waypoint Flag

Option	Description
Waypoint name	The name of the waypoint.
Target data	Lat, Lon, Rng, Brg.
Goto	The Chart app will plot a direct route to the last known location of the target.
Delete	Delete the waypoint.
Edit	Edit the waypoint’s Name, Symbol, Group, Position, and add a Comment.

Chart Object Flag

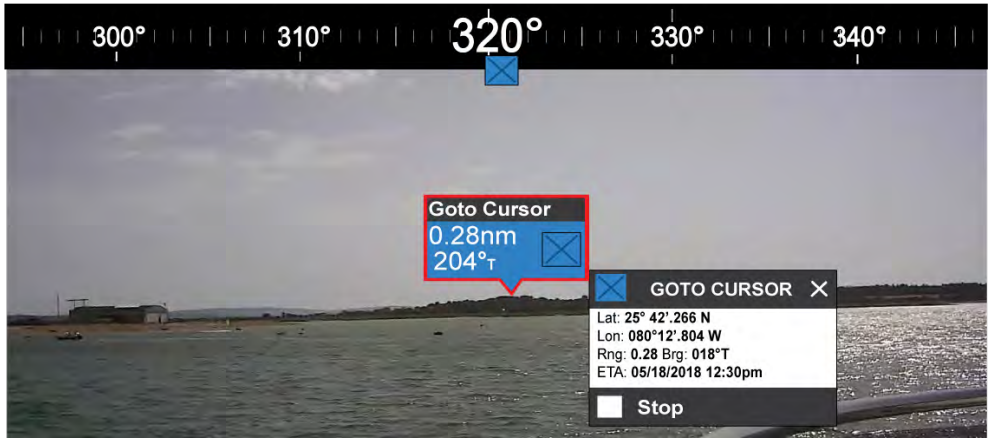
Option	Description
Chart Object name	The name of the chart object.
Target data	Lat, Lon, Rng, Brg.
Goto	The Chart app will plot a direct route to the last known location of the target.

Goto flag

Selecting **Goto** on a selected Augmented Reality flag will plot a direct course to the flag's last known location.

A **Goto** flag will appear in the last known location of the selected flag in both the Video and Chart apps, and in the Video app's **Compass bar**. The flag is displayed with a Goto icon, as a blue copy of the original flag.

Selecting the **Goto** flag makes it a selected flag, and also displays a context menu providing more information about the location of the flag, and the option to stop a goto action.

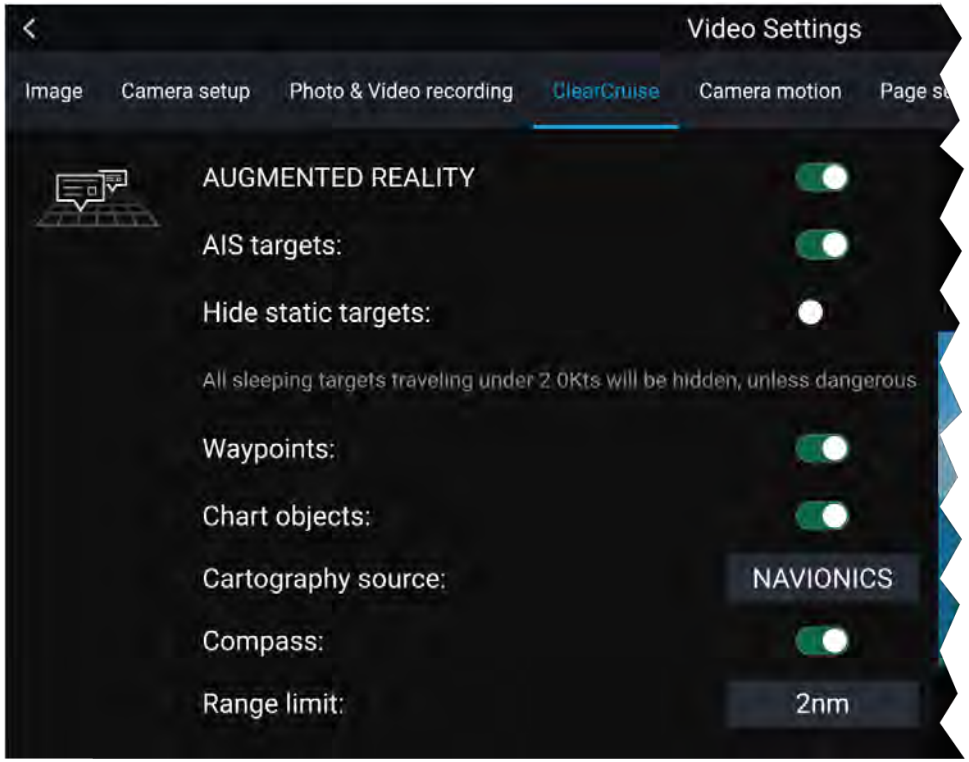


- Selecting **Stop** removes the Goto flag from the Video app and Chart app.
- If the camera loses sight of the **Goto** flag, it will display red and green navigational arrows on the **Compass bar**, indicating whether you need to turn port or starboard to regain sight of the flag. However, this only works if the camera is forward-facing.

10.6 ClearCruise settings (Augmented Reality)

Augmented Reality settings can be edited in the **ClearCruise** tab in the Video app.

Setting	Description
AIS labels	Enables/disables the display of other vessels as Augmented Reality flags (requires AIS).
Hide static targets	Enables/disables the display of AIS targets travelling under 2 knots (requires AIS).
Waypoints	Enables/disables the display of Waypoint Augmented Reality flags.
Chart objects	Enables/disables the display of Chart objects (requires compatible charts).
Cartography source	Select the cartography source that the ClearCruise™ features will use for the display of chart objects in the Video app Augmented Reality features. (Requires compatible charts).
Compass	Enables/disables the display of the Compass bar in the Video app.
Range limit	Sets the maximum range at which the camera will detect and display Augmented Reality flags. This range is displayed visually in the Chart app with the "FOV cone". Refer to: Field of View. For the maximum range supported by your camera, refer to: Range limit



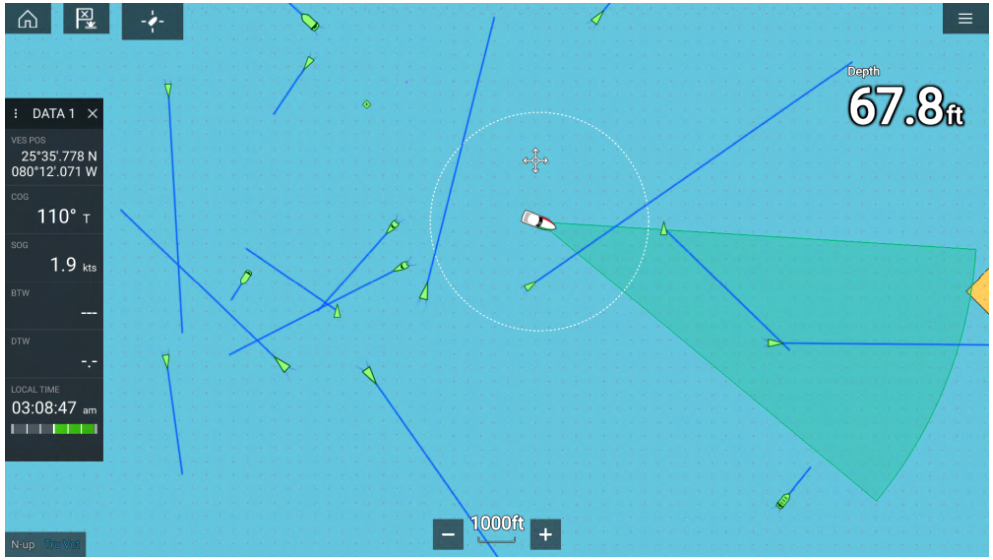
Note:

The variety of chart objects is dependent on the selected cartography source. For more information on different cartography sources, refer to: Find nearest

Range limit

The Range Limit is the maximum range at which ClearCruise™ can display AIS targets, Waypoints and Chart Object flags in the Video app.

The range limit can be checked using the Field of View (FOV) cone in the Chart app. All AIS targets, Waypoints and Chart Objects within the area of coverage of the FOV cone can be displayed as Augmented Reality flags in the Video app. For more information, refer to: Field of View



Note:

Some chart objects just outside of the FOV cone might still display in the Video app as flags.

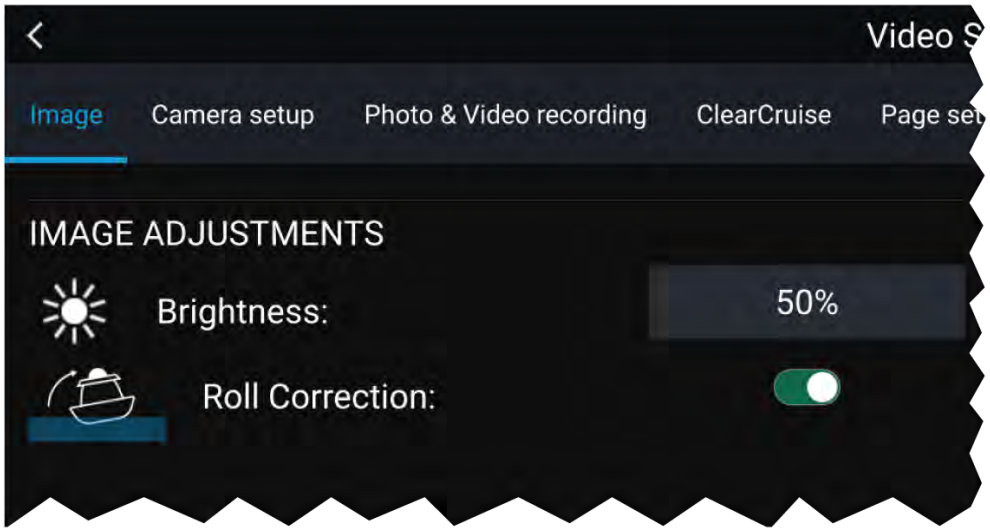
You can specify this range limit manually in the Video app: **Video Settings > ClearCruise tab**. Any adjustments you make will be reflected in the FOV cone display in the Chart app.

10.7 Roll correction

Roll Correction automatically adjusts the Video app image when the vessel tilts (rolls) to port or starboard.

Note: Roll correction is only available with IP cameras.

Roll Correction can be enabled/disabled in the Video app: **Settings > Image**.



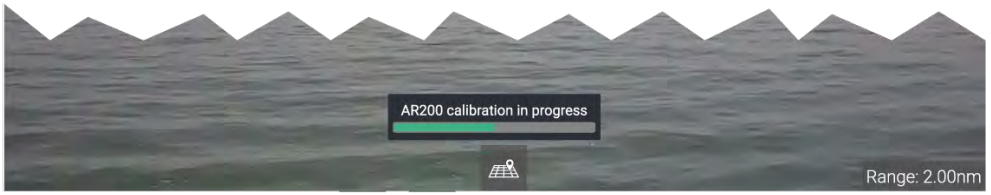
When enabled, the Roll Correction feature accounts for the boat tilting and stabilizes the video feed accordingly. This means that the video feed's horizon will be parallel with the actual horizon. When disabled, the video feed will tilt with the boat and the MFD screen.

1	Roll correction disabled
2	Roll correction enabled

10.8 AR200 Calibration (Linearization)

To enable accurate placement of Augmented Reality (AR) flags on the camera's video feed, the AR200's AHRS sensors need to compensate for local magnetic fields, as well as the Earth's magnetic fields.

Calibration is achieved using an automatic linearization process. The linearization process starts automatically after your vessel has turned approximately 100°, when travelling at a speed of between 3 to 15 knots. The linearization process requires no user input, however at least a 270° turn is required before linearization can be completed. The duration of the linearization process can be decreased by completing a full 360° turn, when travelling at a speed of between 3 to 15 knots. The linearization process can also be restarted at anytime.



In the Video app the Linearization progress bar is displayed when linearization is in progress. The bar is filled to indicate completeness, and will turn Red if the process is paused or otherwise interrupted.

The time taken to complete the linearization process will vary according to the characteristics of the vessel, the AR200's installation location, and the levels of magnetic interference present at the time linearization is performed.

Magnetic interference can be caused by objects onboard your vessel, such as:

- Speakers
- Electronic equipment
- Electrical cabling
- Metal bulkhead or hull

Magnetic interference can also be caused by external objects in close proximately to your vessel, such as:

- Metal hulled vessels
- Underwater electrical cables
- Marine pontoons

Magnetic deviation

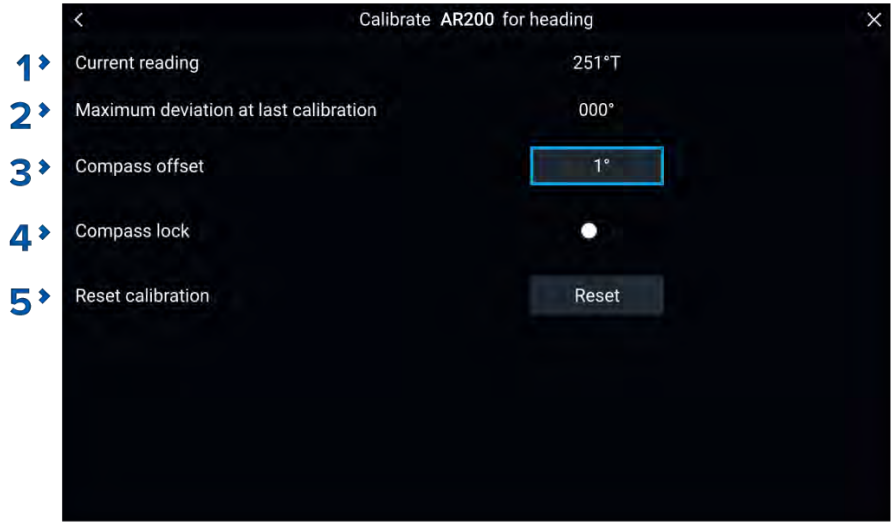
Magnetic deviation is the error induced in a compass caused by interference from local magnetic fields.

The automatic linearization process results in a deviation value being set for your AR200. If Augmented Reality flags in the Video app are not aligned with their onscreen objects, or the compass is out of alignment, you should check the AR200's current calibration settings. For instructions on how to do this, refer to: **AR200 calibration settings**

AR200 calibration settings

The calibration settings page provides access to the AR200's compass calibration options.

The AR200 calibration page can be accessed using your Data master MFD; from the Homescreen select: **Settings > Network > Data sources > Heading > AR200 > Calibrate**.



1	**Current reading:** The current heading reported by the AR200.
2	**Maximum deviation at last calibration:** The maximum deviation reported during the last linearization process. **Important:** • If the **Maximum deviation at last calibration** is 45° or above, it is recommended that the AR200 unit is moved and re-installed in a location which is subject to less magnetic interference. **Calibration in progress:** While linearization is in progress the progress percentage is displayed.
3	**Compass offset** Once the linearization process has completed, it is possible that the heading value may be slightly out of alignment. This is common where installation space is limited and the AR200 is not properly aligned with your vessel's longitudinal axis. In this case, it is possible to manually adjust the Compass offset.
4	**Compass lock** When enabled, the Compass lock prevents the continual monitoring and adaptation of the compass linearization process. For more information, refer to: **Compass lock**.
5	**Reset calibration** You can reset your AR200's current linearization settings by selecting **Reset calibration**

Continual monitoring and adaptation

To ensure optimum performance, after the initial linearization process is complete the unit continues to monitor and adapt the compass linearization to suit current conditions.

If the conditions for linearization are less than ideal, the automatic linearization process temporarily pauses until conditions improve again. The following conditions can cause the linearization process to temporarily pause:

- significant magnetic interference is present
- vessel speed too slow or too fast
- rate-of-turn too slow or too fast

Compass lock

Once you are satisfied with the compass accuracy, you can lock the setting to prevent the system from completing a further automatic linearization in the future.

This feature is particularly useful for vessels in environments that are exposed to strong magnetic disturbances on a regular basis (such as offshore wind farms or very busy rivers, for example). In these situations it may be desirable to use the Compass lock feature to disable the continuous linearization process, as the magnetic interference may build a heading error over time.

Note: The compass lock may be released at any time, to allow the compass continual monitoring and adaptation to re-commence. This is particularly useful if planning a long voyage. The earth's magnetic field will change significantly from one geographical location to another, and the compass can continually compensate for the changes, ensuring you maintain accurate heading data throughout the voyage.

CHAPTER 11: MAINTENANCE

CHAPTER CONTENTS

11.1 Routine checks

The following periodic checks should be made:

- Examine cables for signs of damage, such as chafing, cuts or nicks.
- Check that the cable connectors are firmly attached and that their locking mechanisms are properly engaged.

Note:

Cable checks should be carried out with the power supply switched off.

Warning: High voltage

This product contains high voltage. Adjustments require specialized service procedures and tools only available to qualified service technicians. There are no user serviceable parts or adjustments. The operator should never remove the cover or attempt to service the product.

11.2 Unit cleaning instructions

The unit does not require regular cleaning. However, if you find it necessary to clean the unit, please follow the steps below:

1. Ensure power is switched off.
2. Wipe unit clean with a damp cloth.
3. If necessary, use a mild detergent solution to remove grease marks.

CHAPTER 12: SYSTEM CHECKS AND TROUBLESHOOTING

CHAPTER CONTENTS

12.1 Troubleshooting

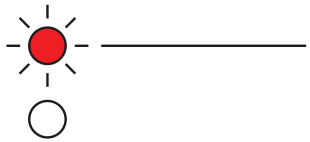
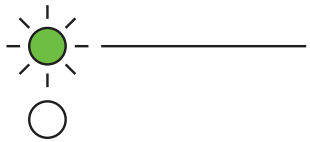
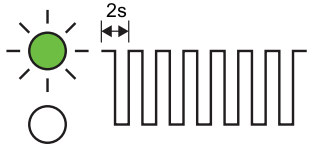
The troubleshooting information provides possible causes and the corrective action required for common problems that are associated with the installation and operation of your product.

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

If after referring to this section you are still having problems with your product, please refer to the Technical support section of this manual for useful links and Raymarine Product Support contact details.

12.2 LED status

The unit has an LED status indicator to help determine the camera's state.

LED sequence	LED color	State
	Solid Red	Power On
	Solid Green	Network connected and transmitting
	Blinking green	Motion detection

12.3 IP camera troubleshooting

Problem	Possible Solutions
Camera does not power on.	**Power over Ethernet (PoE) connection** • Ensure that the ethernet cable is connected correctly and that connections are secure. • Ensure you are not using a **crossover** coupler or cable as they are not appropriate for PoE applications. • Ensure that the Power Sourcing Equipment (PSE) device is switched on and has sufficient remaining power allocation to power the camera. **Dedicated power cable connection** • Ensure that the power supply meets the camera's power requirements. • Ensure that the power supply is switched on. • Ensure power cables are correctly connected and that connections are secure. **Note:** Refer to the Chapter 14 **Technical specification** for camera power requirements.
PSE is allocating PoE to the camera even though it is powered using a separate power supply.	• PoE allocation always takes priority over the dedicated power supply. If connecting the camera to a PSE ensure that the camera's dedicated power cable is not connected. • Alternatively re-configure the network so the camera is plugged into a non-PoE ethernet connection.
No image on multifunction display	• Using the Camera application on the MFD, Cycle through the available camera feeds to see if the IP camera image is displayed • Ensure that the camera is connected to the multifunction display in accordance with the supplied instructions. • Ensure that the camera is correctly powered on. • Ensure that the MFD and camera are physically connected to the same network. • Ensure that the MFD is running the latest version of LightHouse software. • Try power cycling the IP camera whilst leaving your MFD powered up.

Video performs poorly	• Insufficient bandwidth available for high quality stream. Using a connected PC, select an alternative, lower resolution stream to conserve bandwidth and improve performance on low bandwidth connections. • If using a PC and Microsoft Internet Explorer, click the message above the video area to use the ActiveX plug-in instead of Flash Player. ActiveX may provide smoother video performance.
Can't find the camera's IP address (PC connections).	By default, the camera is set to obtain an IP address by DHCP, which means it will automatically obtain an IP address from the network. • Ensure that the PC and camera are configured for the same IP address range and subnet mask (IPv4). • Try to Ping the camera's IP address. On you PC go to: **Start > Programs > Accessories > Command Prompt** and type **ping** then the **camera's local IP address** and press **Enter**. If you get a 'request timed out' message the PC and camera are not on the same network or the camera is not connected. The camera is connected if you get replies. • Ensure any VPN software installed on the PC is disabled. • With UPnP enabled go to: **My Computer > Network** and check under network infrastructure. • Ensure your PC's network settings are configured correctly. • Use the supplied IP Scanner software to find out the camera's IP address. **Note:** Refer to **Network setup and operation** for details on network settings.

12.4 Resetting the camera

When connected to an MFD it should not be necessary to perform a factory reset. However in the event that a factory reset is required the camera's built-in web interface must be used. The camera's web interface can be accessed when connected to a web-enabled device such as a PC.

Please refer to 9.4 Resetting the camera to factory defaults for details.

12.5 Augmented Reality (AR) Troubleshooting

AR options not available in Video app

Possible causes	Possible solutions
Wrong camera selected.	Ensure that the correct AR-compatible camera has been selected in the Video app menu.
Compatible camera not detected.	1. Ensure your camera is AR compatible. 2. Ensure your camera is correctly installed and networked to your MFD.
AR200 not detected.	1. Ensure your AR200 is correctly installed and on the same network as the MFD from which you are using the AR features.
Incorrect LightHouse™ software version.	Ensure that your MFD is running LightHouse™ 3 version 3.7 or above or .LightHouse™ 4
AR options turned off.	The Compass bar, AIS, Waypoint and Chart object flags can be enabled and disabled from the **ClearCruise** settings page (**Video app > Menu > Settings > ClearCruise**). Ensure relevant options are enabled. **Note:** For AIS flags to be displayed, compatible AIS hardware must be operational and connected to the same network as your MFD.

AR flags do not appear directly above on-screen target

Possible causes	Possible solutions
AIS update rate	Depending on the classification of the target's AIS hardware, transmitted position updates may be sent up to 3 minutes apart and therefore the flag may appear up to 3 minutes behind the actual onscreen target.
Camera Field of View (FOV) set incorrectly.	Ensure that the FOV setting reflects your camera's horizontal FOV. Check your camera's documentation for FOV specifications.
AR200 interference	If your AR200 is installed in a location which includes a source of magnetic interference large enough to affect AR flag placement, you may need to re-install the AR200 in a different location.
Deviation too high	1. Reset the AR200 calibration by selecting **Reset** from the AR200 calibration page: **Homescreen > Settings > Network > Data sources > Heading > Raymarine AR200 Attitude > Calibrate**. 2. If the problem persists, you may need to move your AR200 to a location with less magnetic interference.

CHAPTER 13: TECHNICAL SUPPORT

CHAPTER CONTENTS

13.1 Raymarine product support and servicing

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

Product information

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

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

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

Servicing and warranty

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

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

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

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

United States (US):

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

Web support

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

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

Worldwide support

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

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

United States (US):

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

Australia and New Zealand (Raymarine subsidiary):

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

France (Raymarine subsidiary):

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

Germany (Raymarine subsidiary):

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

Italy (Raymarine subsidiary):

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

Spain (Authorized Raymarine distributor):

- E-Mail: sat@azimut.es
- Tel: +34 96 2965 102

Netherlands (Raymarine subsidiary):

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

Sweden (Raymarine subsidiary):

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

Finland (Raymarine subsidiary):

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

Norway (Raymarine subsidiary):

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

Denmark (Raymarine subsidiary):

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

Russia (Authorized Raymarine distributor):

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

CHAPTER 14: TECHNICAL SPECIFICATION

CHAPTER CONTENTS

14.1 Technical specification

Physical specification

Dimensions	• **Base diameter**: 99.2 mm (3.9 in) • **Overall Height**: 80.7 mm (3.2 in)
Weight	• **Boxed**: 0.65 kg (1.4 lbs) • **Unboxed**: 0.55 kg (1.2 lbs)

Power specification

Nominal supply voltage	12 V dc
Operating voltage range	10.8 V to 13.2 V dc
Power consumption	5.4 W Maximum (IR LEDs On)
Current	1.5 A
Power over Ethernet	PoE Class 2 (6.49 W Max) device (802.3af)

Environmental specification

Operating temperature	–10°C to 50°C (14°F to 122°F)
Storage temperature	–20°C to 60°C (–4°F to 140°F)
Relative humidity	95%
Weatherproof rating	IPX6 & IPX7

Camera specification

Sensor / DSP	2.0 Megapixel 1/2.8” Sony CMOS image sensor (Exmor)
Scanning system	Progressive scan
Day / Night	True Day / Night with ICR filter changer
Total pixels	1952(H) x 1116(V) 2.18 Megapixel
Effect pixels	1944(H) x 1104(V) 2.14 Megapixel
Minimum illumination	0 Lux (IR LEDs On)
I² Distance	20 m (65.6 ft.) (4 LEDs)
Lens	3.6 mm Megapixel board lens
Field of View	Horizontal = 51.0 deg +/- 3 deg Vertical = 93.0 deg +/- 3 deg

Video specification

Compression	H.264 High Profile @ level 4.0, Motion JPEG
Resolutions	1280 x 720 default (supporting up to 1920 x 1080 (FHD)
Video streaming	Supports multi streaming with H.264, MJPEG
Frame Rate	• H.264: 30fps @ 1920 x 1080p • MJPEG: 30fps @ VGA resolution
Bit Rate Control	• Dual stream: H.264, MJPEG • H.264: CBR / CVBR

Conformance specification

Conformance	• EN 60945:2002 • EMC Directive 2004/108/EC • Australia and New Zealand: C-Tick, Compliance Level 2

CHAPTER 15: SPARES AND ACCESSORIES

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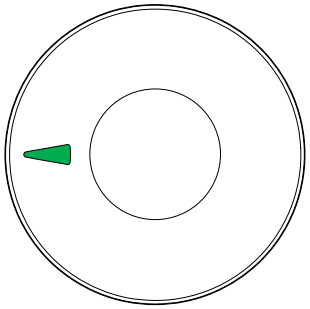
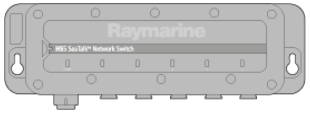
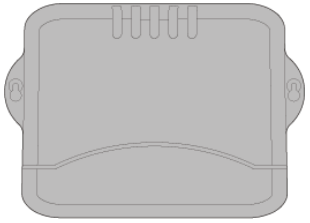
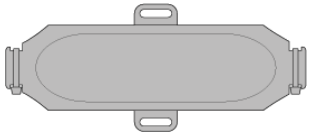
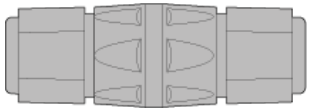
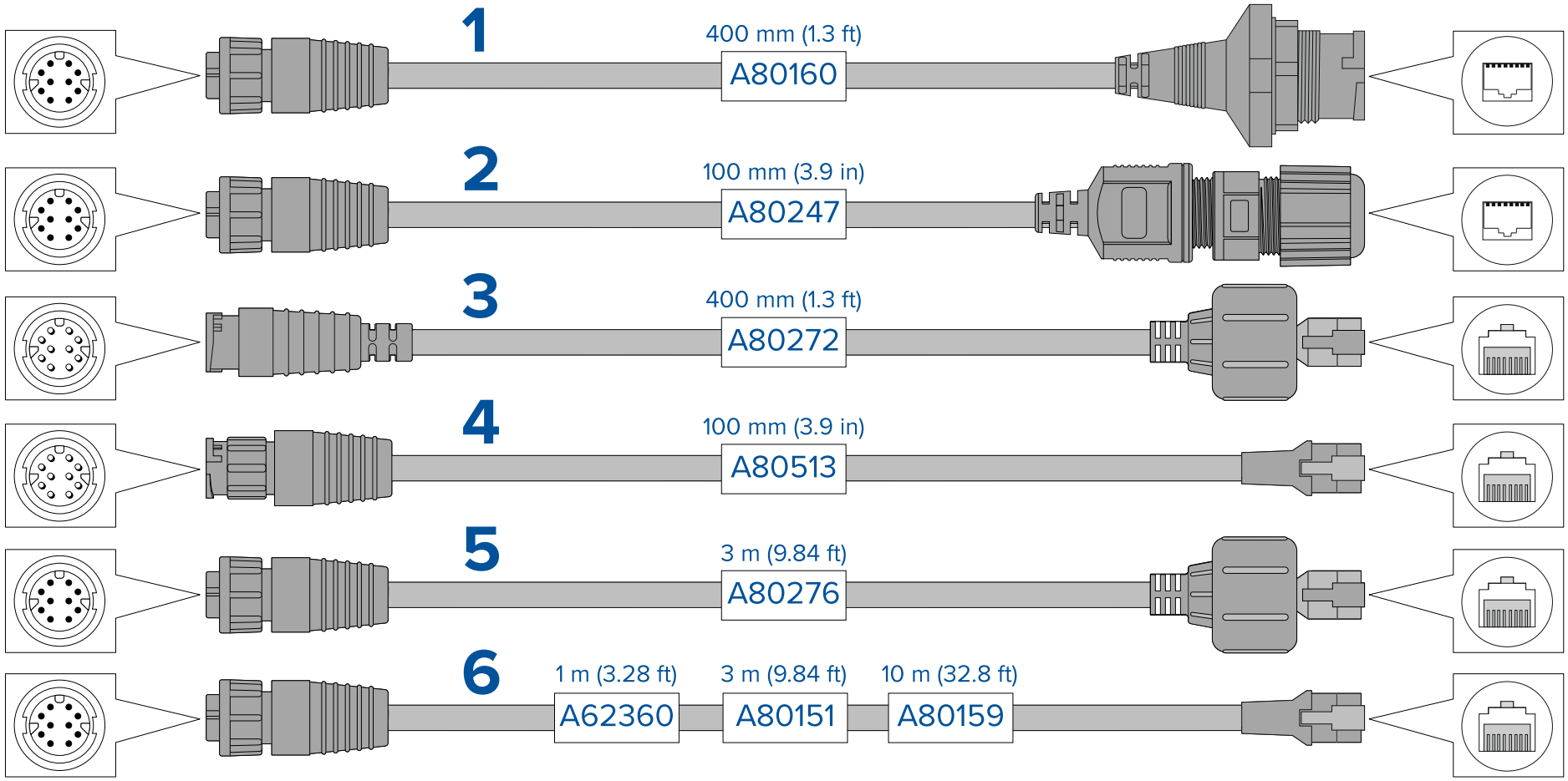
15.1 Spares and accessories

Item	Part number	Notes
AR200 	E70537	SeaTalkng ® Augmented Reality Sensor

15.2 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	• 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. Recommended for internal installations. **Important:** Do NOT use crossover devices for POE (Power Over Ethernet) connections.
Ethernet RJ45 coupler 	R32142	• 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. Recommended for external installations.

15.3 RayNet to RJ45 adapter cables

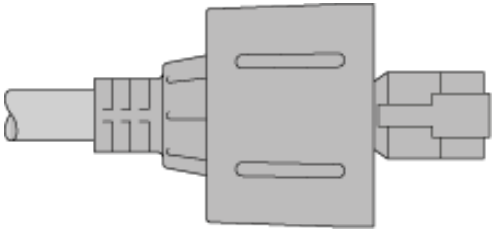
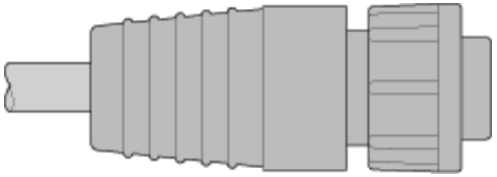


1. Adapter cable with a RayNet (female) socket on one end, and a waterproof (female) socket on the other end accepting the following cables with an RJ45 SeaTalkhs ® waterproof locking (male) plug:
   - A62245 (1.5 m).
   - A62246 (15 m).

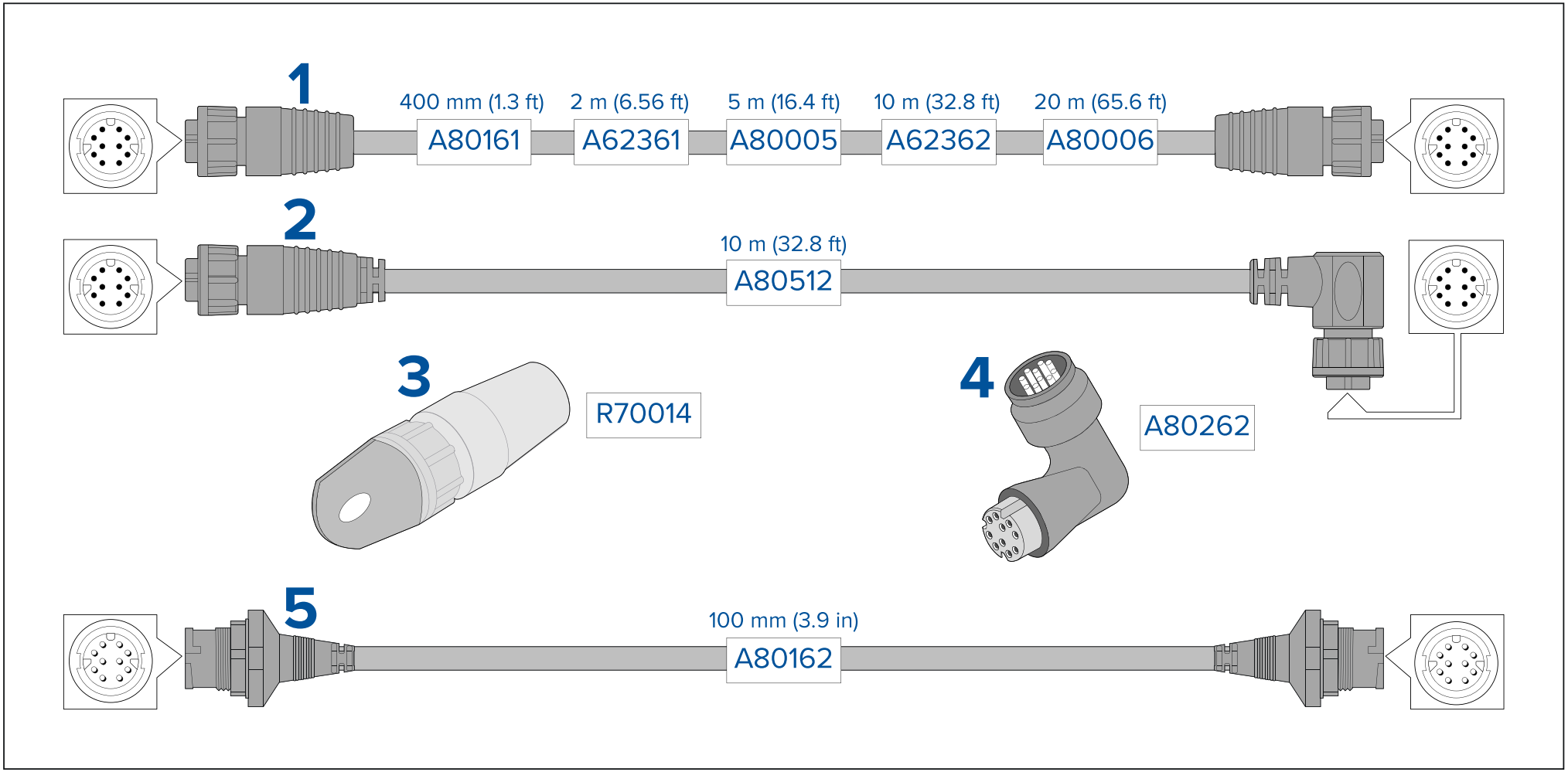
2. Adapter cable with a RayNet (female) socket on one end, and a waterproof (female) RJ45 socket on the other end, along with a locking gland for a watertight fit.
3. Adapter cable with a RayNet (male) plug on one end, and an RJ45 SeaTalkhs ® waterproof (male) plug on the other end.
4. Adapter cable with a RayNet (male) plug on one end, and an RJ45 SeaTalkhs ® (male) plug on the other end.
5. Adapter cable with a RayNet (female) socket on one end, and an RJ45 SeaTalkhs ® waterproof (male) plug on the other end.
6. Adapter cable with a RayNet (female) socket on one end, and an RJ45 SeaTalkhs ® (male) socket on the other end.

15.4 Network cable connector types

There are 2 types of network cable connector — RayNet, and RJ45 SeaTalk hs.

	RJ45 SeaTalk hs connector.
	RayNet connector.

15.5 RayNet to RayNet cables and connectors



1. Standard RayNet connection cable with a RayNet (female) socket on both ends.
2. Right-angle RayNet connection cable with a straight RayNet (female) socket on one end, and a right-angle RayNet (female) socket on the other end. Suitable for connecting at 90° (right angle) to a device, for installations where space is limited.
3. RayNet cable puller (5 pack).
4. RayNet to RayNet right-angle coupler / adapter. Suitable for connecting RayNet cables at 90° (right angle) to devices, for installations where space is limited.
5. Adapter cable with a RayNet (male) plug on both ends. Suitable for joining (female) RayNet cables together for longer cable runs.

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