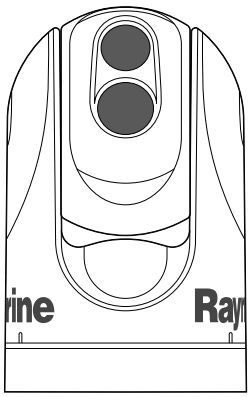
T-Series



Installation and operation instructions

English
Date: 01-2015
Document number: 81338-4
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Export control

T303, T403, T453, T463, T470SC and T473SC thermal cameras are controlled by US export laws.

There are special versions of the system that are approved for international distribution and travel. Please contact Raymarine customer support if you have any questions.

Contact details can be found on the Raymarine website, www.raymarine.com.

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Software updates

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

Product handbooks

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

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Chapter 1: Important information

Warning: Product installation and operation

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

Warning: Corrosion

To avoid accelerated galvanic corrosion of the product, ensure that a non-metallic isolation mount is used when fitting the product directly to large stainless steel platforms/mounts, or directly to steel construction vessels.

Warning: Potential ignition source

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

Warning: Product grounding

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

Warning: 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: Entrapment hazard

This product features moving parts that provide a potential entrapment hazard. Keep clear of moving parts at all times.

Warning: Ensure safe navigation

This product is intended only as an aid to navigation and must never be used in preference to sound navigational judgment. Only official government charts and notices to mariners contain all the current information needed for safe navigation, and the captain is responsible for their prudent use. It is the user's responsibility to use official government charts, notices to mariners, caution and proper navigational skill when operating this or any other Raymarine product.

Warning: Maintain a permanent watch

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

Caution: Do not open the unit

The unit is factory sealed to protect against atmospheric humidity, suspended particulates and other contaminates. It is important that you do not open the unit or remove the casing for any reason. Opening the unit will:

- compromise the seal with possible damage to the unit, and
- void the manufacturer's warranty.

Caution: Power supply protection

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

Caution: 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.

Caution: Sun covers

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

Location requirement

When planning the installation location, consider the following points:

- The camera is waterproof, and appropriate for above decks mounting.
- When mounting the camera in a ball-down position, ensure that the camera is installed with adequate drainage so that standing water does not collect above the cable glands. Standing water will eventually seep past the cable gland seals and compromise the internal electronics.
- If the base of the T-Series camera must be left exposed, the exit holes must be sealed with a marine-grade adhesive such as 3M 5200 or

equivalent. Use a sufficient amount of sealant to prevent pooling of water above the glands. Failure to properly install or seal these glands could void the camera warranty.

- Ensure the camera is installed in a location that will allow it to be accessed for regular periodic cleaning (fresh-water rinse), inspection of mounting point integrity and mechanical soundness, and preventative maintenance.
- The underside (inside) of the compartment or deck on to which the camera is mounted must be weather-tight. You must ensure protection from water ingress to cables and connections.
- The mounting surface must be horizontal.
- If you cannot access both sides of the mounting surface, then you will need to mount the camera “top down” using the optional top-down riser / galvanic isolation kit (A80334).
- If the mounting surface is metallic (for example, steel), then you will need to mount the camera “top down” using the optional top-down riser / galvanic isolation kit (A80334). The riser provides galvanic isolation and protection from galvanic corrosion.
- Fixings are supplied for a mounting surface of up to 41 mm (1.6 in) thick. A thicker surface will require the installer to provide alternative fixings.
- The camera mounting surface must be at least as large as the footprint of the camera itself to ensure an adequate seal with the O-ring.
- The camera should be mounted as high as practical, but without interfering with any radar, navigational or communications electronics.
- Choose a location that will provide the most unobstructed view in all directions.
- Choose a location as close to the vessel’s center line as possible. This provides a symmetrical view when looking forward or aft.
- Select a location for the camera that is at least 7 cm (2.75 in.) from any magnetic compass.
- Select a location that is at least 1 m (3 ft) from devices that may cause interference, such as motors, generators and radio transmitters / receivers.
- If installing an optional JCU, select a location for the JCU that is at least 11 cm (4.33 in.) from any magnetic compass.

Cleaning the thermal camera

The camera housing and lens will require occasional cleaning. Raymarine suggests that you clean the lens when image quality degradation is noticed or excessive contaminant buildup is seen. Clean the interface between the yoke and base often to prevent accumulation of debris or salt deposits.

When cleaning this product:

- Do NOT wipe the lens window with a dry cloth, or with abrasive materials such as paper or scrub brushes, as this could scratch the coating.
- Do NOT use acid or ammonia based products.
- Do NOT pressure wash.

Particular care should be taken when cleaning the lens window, this has a protective anti-reflective coating which may be damaged by improper cleaning.

1. Switch off the power to the unit.
2. Clean the camera body with a clean, soft cotton cloth. You can moisten the cloth and use a mild detergent if required.
3. Clean the camera lens.
   - Rinse the lens with fresh water to remove all dirt particles and salt deposits, and allow to dry naturally.
   - If any spots or smears remain, very gently wipe the lens window with a clean microfibre cloth or soft cotton cloth.
   - If necessary, use isopropyl alcohol (IPA) or a mild detergent to remove any remaining spots or marks.

Inspecting the thermal camera

Routinely inspect the camera and its mounting surface to ensure that it is installed securely, that the coated surfaces are intact, and that there are no signs of corrosion.

When the camera is powered off, grasp it firmly at the base and confirm it is rigid and secure. Then hold the camera above the base and confirm it will rotate freely and without noticeable wobble or looseness around the pan bearing.

Water ingress

Water ingress disclaimer

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

Disclaimers

This product (including the electronic charts) is intended to be used only as an aid to navigation. It is designed to facilitate use of official government charts, not replace them. Only official government charts and notices to mariners contain all the current information needed for safe navigation, and the

captain is responsible for their prudent use. It is the user's responsibility to use official government charts, notices to mariners, caution and proper navigational skill when operating this or any other Raymarine product. This product supports electronic charts provided by third party data suppliers which may be embedded or stored on memory card. Use of such charts is subject to the supplier's End-User Licence Agreement included in the documentation for this product or supplied with the memory card (as applicable).

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

This product uses digital chart data, and electronic information from the Global Positioning System (GPS) which may contain errors. Raymarine does not warrant the accuracy of such information and you are advised that errors in such information may cause the product to malfunction. Raymarine is not responsible for damages or injuries caused by your use or inability to use the product, by the interaction of the product with products manufactured by others, or by errors in chart data or information utilized by the product and supplied by third parties.

EMC installation guidelines

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

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

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

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

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

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

Suppression ferrites

Raymarine cables may be fitted with suppression ferrites. These are important for correct EMC performance. If a ferrite has to be removed for any purpose (e.g. installation or maintenance), it must be replaced in the original position before the product is used.

Use only ferrites of the correct type, supplied by Raymarine authorized dealers.

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

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

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

Product disposal

Dispose of this product in accordance with the WEEE Directive.



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

Warranty registration

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

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

IMO and SOLAS

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

Technical accuracy

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

Chapter 2: Handbook information

Chapter contents

- 2.1 Handbook information on page 12
- 2.2 T-Series thermal imaging cameras on page 12

2.1 Handbook information

This handbook describes the installation and operation of Raymarine T-Series thermal cameras as part of a marine electronics system. It provides an overview of features available and examples of the controls used.

This handbook covers models: T300, T303, T350, T353, T400, T403, T450, T453, T460, T463, T470SC and T473SC. It includes information to help you:

- plan your thermal imaging system and ensure you have all the necessary equipment,
- install and connect the thermal camera as a part of your system of Raymarine electronics,
- operate the thermal camera system,
- set up the thermal camera system using the on-screen menus,
- obtain support if required.

The handbook is for use with the following products:

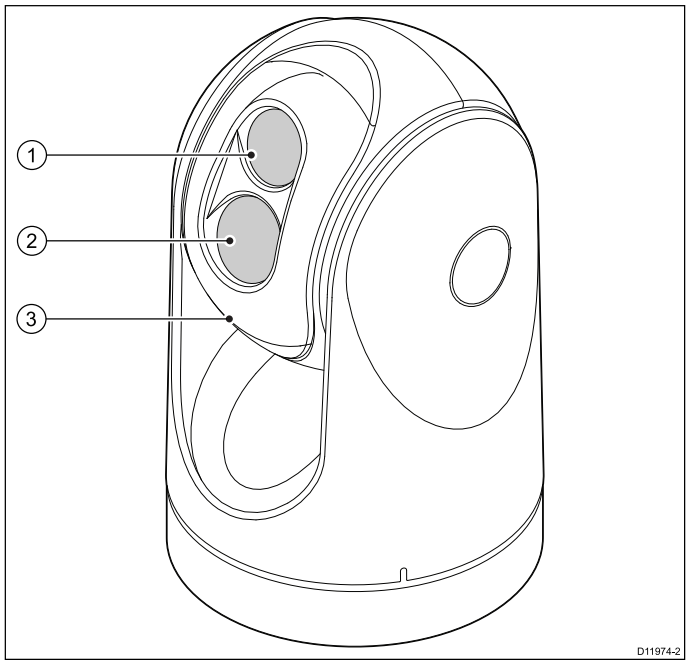
- T300 – QVGA Thermal camera
- T303 – QVGA Thermal camera (30 Hz)
- T350 – VGA Thermal camera
- T353 – VGA Thermal camera (30 Hz)
- T400 – QVGA dual payload camera
- T403 – QVGA dual payload camera (30 Hz)
- T450 – VGA dual payload camera
- T453 – VGA dual payload camera (30 Hz)
- T460 – VGA dual payload camera
- T463 – VGA dual payload camera (30 Hz)
- T470SC — VGA dual payload stabilized color camera
- T473SC — VGA dual payload stabilized color camera (30 Hz)

Thermal camera handbooks

Description	Part number
T-Series thermal cameras installation and operation handbook Installation, commissioning and operation instructions for T-Series thermal camera systems.	81338

2.2 T-Series thermal imaging cameras

T-Series is a maritime thermal imaging system for use on nearly any kind of vessel. It provides a clear image in low-light and no-light conditions. For example, a thermal camera can help you navigate at night or identify obstacles in areas of low visibility or even total darkness.



1. Thermal camera lens window
2. Visible light camera lens window
3. Gimbal assembly

The T-Series system has the following key functions and features:

- Pan, tilt and zoom operations.
- Automatic camera adjustment to suit changing conditions.
- Preset modes (Scenes) optimized for prevailing conditions.
- Automatic window heaters to de-ice the lens window in cold weather.
- Single and dual payload configurations. (T400, T403, T450, T453, T460 and T463 are dual payload models with both thermal and visible light (greyscale) capability to enhance low light performance.)
- The T470SC and T473SC models includes a mechanical stabilization feature which improves image stability by compensating for vessel motion and both thermal and continuous zoom color visible light camera.

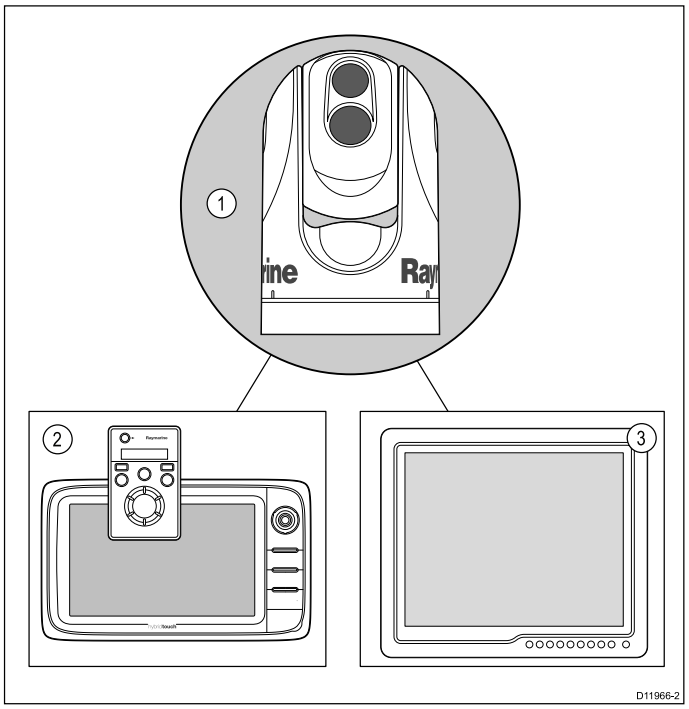
Chapter 3: Planning the installation

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- 3.1 Thermal camera system on page 14
- 3.2 Installation checklist on page 15
- 3.3 Typical systems with thermal cameras on page 16
- 3.4 Thermal camera parts supplied on page 18
- 3.5 JCU — Parts supplied on page 18
- 3.6 Tools required on page 19

3.1 Thermal camera system

A typical thermal camera system comprises the items shown below:



1. **Thermal camera**
2. **Controller** – This provides the controls to operate and configure the camera.
3. **Display** – This displays the thermal video image as well as status information and on-screen menus provided by the camera.

Note: The controller and display may be the same device. Some Raymarine multifunction displays provide a thermal camera application which has a set of integral camera controls.

Additional controllers and equipment

You may have additional equipment as part of your thermal camera system:

- Multiple controllers and displays, for example a camera serving multiple display / control stations.
- SeaTalk^{hs} network switch – Used to create a network of compatible Raymarine equipment.
- GVM video module – Used to distribute the video signal around a Raymarine G-Series system.

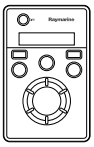
Compatible displays and controllers

The following Raymarine displays and systems are compatible with the T-Series range of thermal cameras.

Multifunction display system	Direct video	Network video	Camera control via display's physical keys	Camera control via display's touchscreen
LightHouse a Series — a95, a97, a98, a125, a127, a128	●		● (via optional RMK-9 remote keypad — A80217)	●
LightHouse c Series — c95, c97, c125, c127	●		●	
LightHouse e Series — e7, e7D, e95, e97, e125, e127, e165	●		●	●
LightHouse gS Series — gS95, gS125, gS165, gS195	●		● (via optional RMK-9 remote keypad — A80217)	●
G-Series system (GPM400)	● (direct to G-Series monitor)	● (using GVM400 video module)	● (via G-Series Command Center keyboard)	
E-Series Widescreen — E90W, E120W, E140W	●		●	●
C-Series Widescreen — C90W, C120W, C140W	●			
E-Series Classic — E80, E120	●			

Note: E80, E120, C90W, C120W, C140W displays require a separate JCU (Joystick Control Unit) for camera control.

Dedicated camera controllers

Controller		Description
Joystick control unit (JCU) — E32130		Dedicated thermal camera controller, featuring 3-axis puck control, function keys and an LCD display.

3.2 Installation checklist

Installation includes the following activities:

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

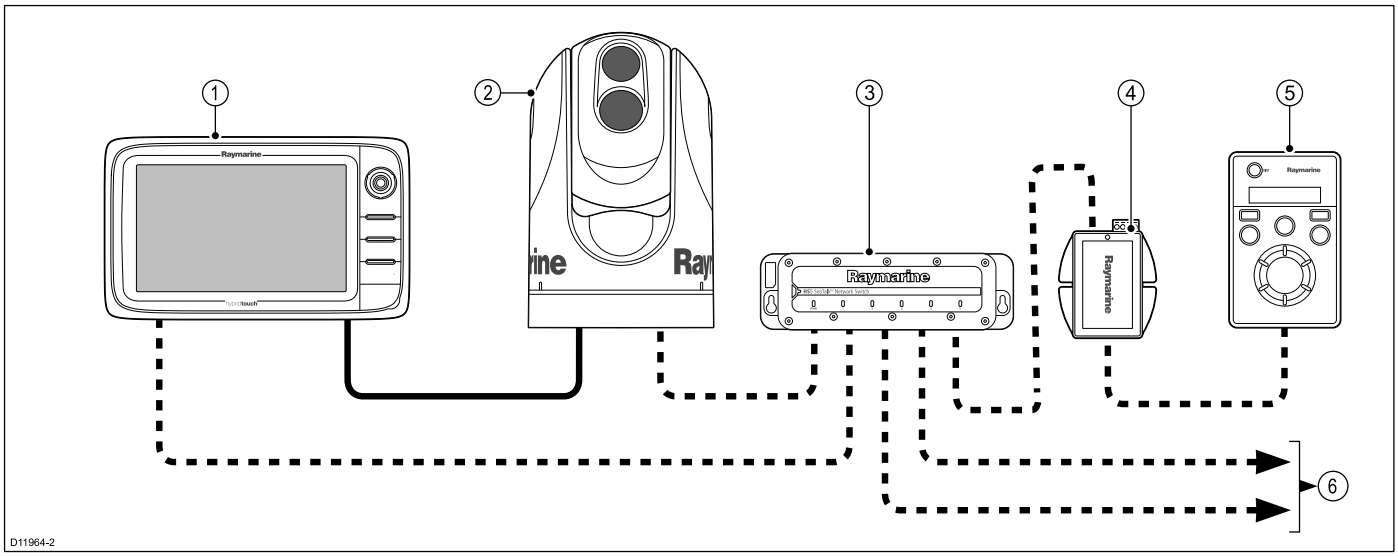
Schematic diagram

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

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

3.3 Typical systems with thermal cameras

Example system with fully integrated display

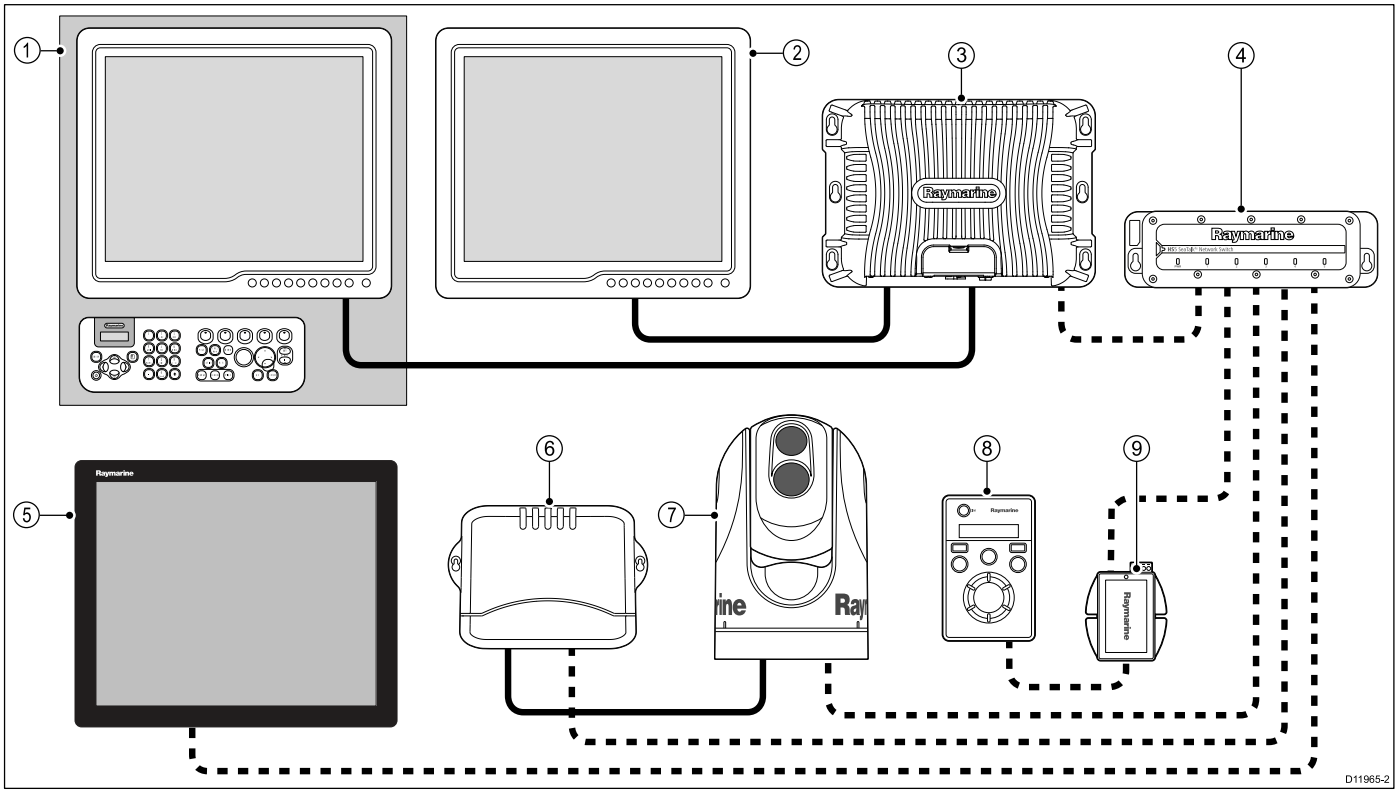


Video cable – Carries the thermal / visible light video image.

SeaTalk^{hs} – Includes the camera control communications.

1	e/c-series display	4	PoE injector (Required if JCU is included in the system.)
2	Thermal camera	5	JCU (optional)
3	Raymarine network switch	6	SeaTalk^{hs} to other digital devices: Additional displays / controllers, Radar, etc.

G-Series system



Video cable

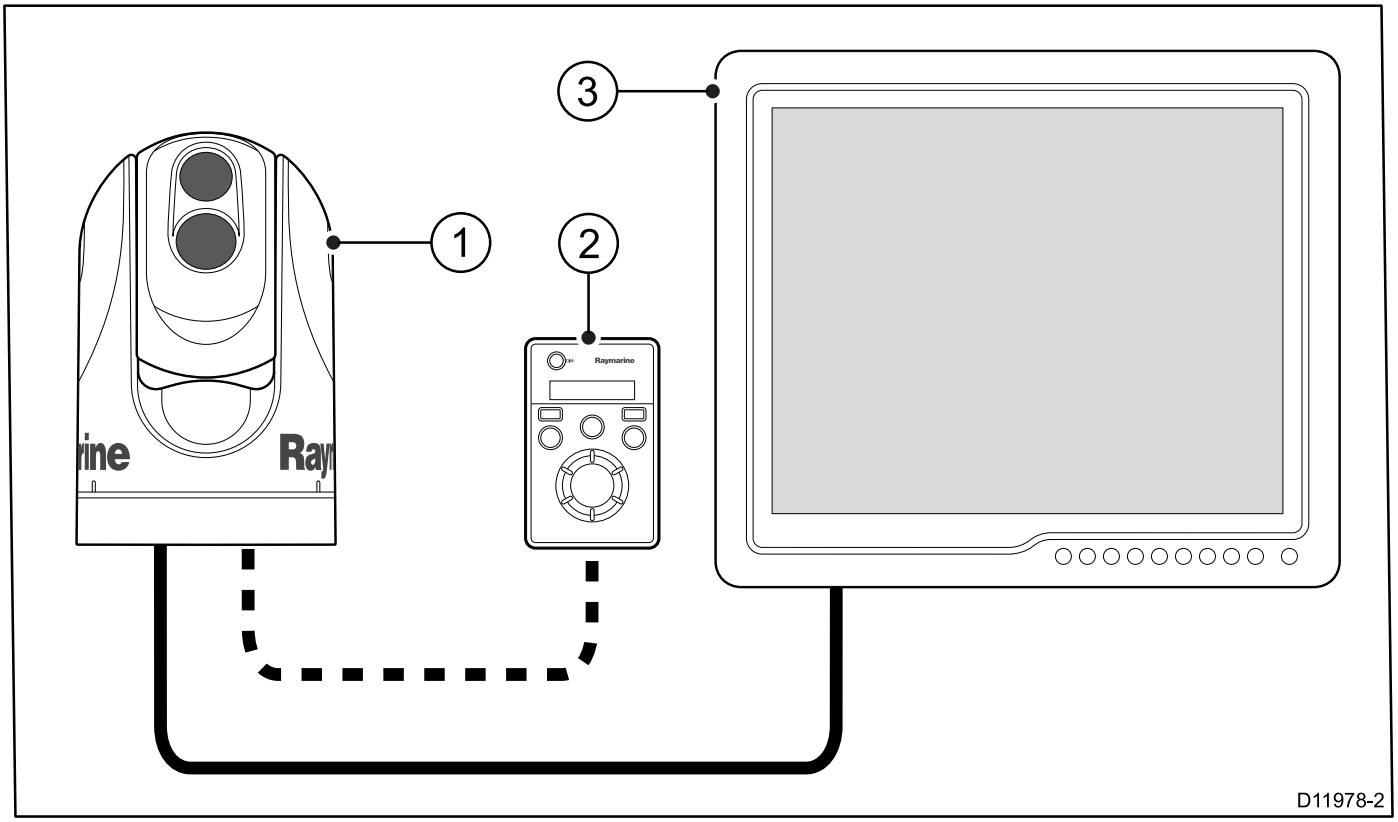
SeaTalk^{hs} – Includes the camera control communications (and video signal on G-Series system).

1	G-Series Nav station	6	G-Series GVM400 video module
2	Repeat monitor	7	Thermal camera
3	G-Series GPM400	8	JCU (optional)

4	Raymarine network switch	9	PoE injector (Required if JCU is included in the system.)
5	Glass bridge monitor		

System with basic / classic display(s)

This arrangement is applicable for displays which do not have the thermal camera application and integrated camera controls.



———	Video cable – Carries the thermal / visible light video image.
- - - - -	Ethernet – Includes the camera control

1	Thermal camera
2	JCU (required)
3	Monitor / Display

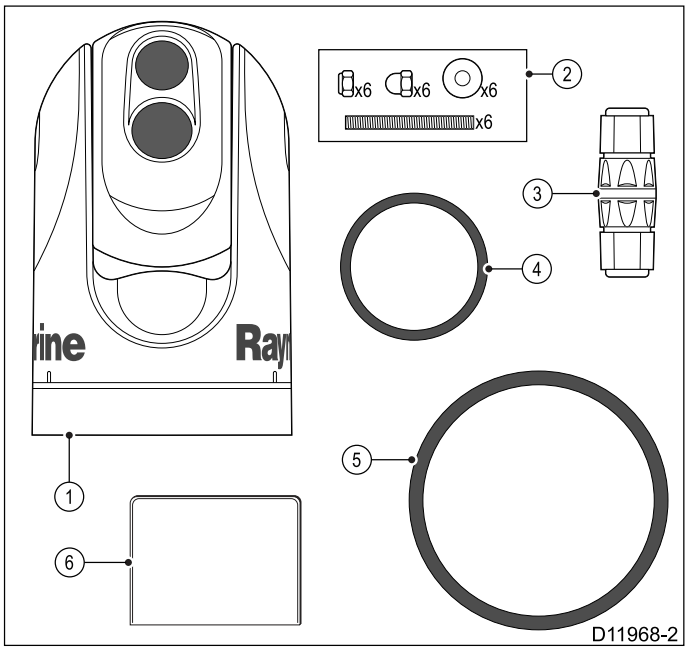
SeaTalk^{hs}

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

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

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

3.4 Thermal camera parts supplied



1. T-Series thermal camera
2. Mounting fasteners
3. Ethernet waterproof coupler
4. Small O-ring
5. Large O-ring
6. Documentation pack (containing: camera mounting template, warranty policy and documentation CD.)

Unpack the camera unit carefully to prevent damage. Save the carton and packing in case the unit has to be returned for service.

Additional items required

To complete the installation you will also need to obtain the following items:

- Compatible display / control hardware.
- Cables for power, ground, video and network connection.
- Thread locking compound (for example Loctite 242 or equivalent), required for all metal-to-metal threaded connections.

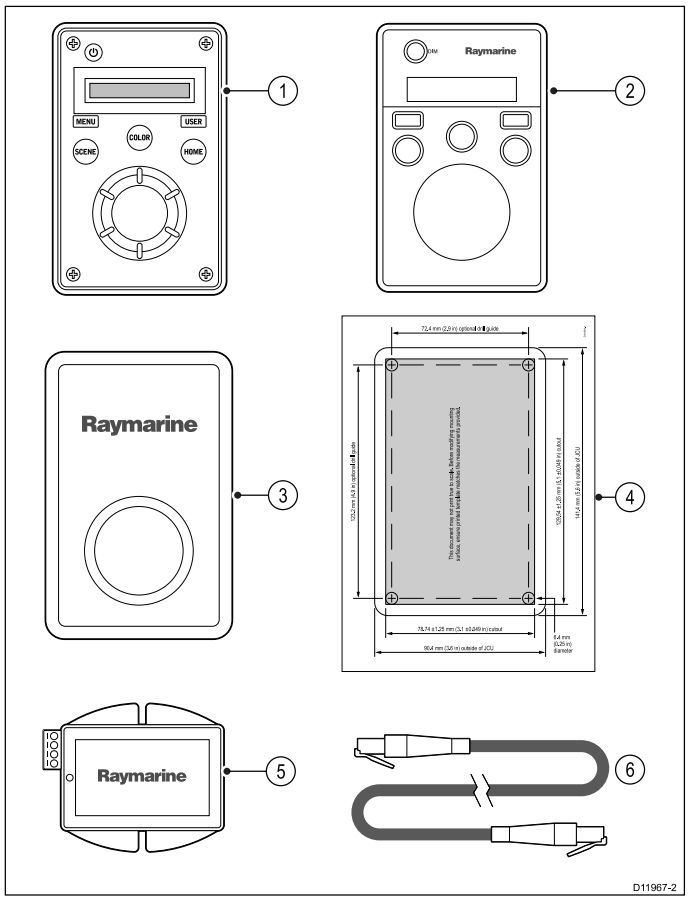
Optional accessories

You may also require the following items:

- Optional top-down riser / galvanic isolation kit (A80334). The kit comprises a riser, gasket, and additional mounting fasteners, and is required if either of the following conditions apply:
  - the camera is to be mounted on a surface with restricted access to the underside.
  - the camera is to be mounted on a metallic surface (for example, steel), which could otherwise cause galvanic corrosion between the camera base and the mounting point.

3.5 JCU — Parts supplied

T-Series thermal cameras with JCU included are supplied with the following additional parts:

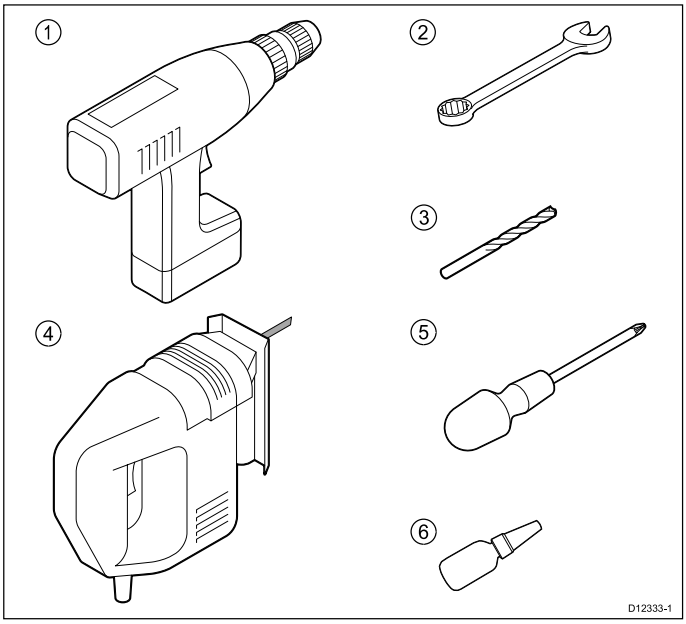


1. Joystick Control Unit (JCU).
2. Bezel.
3. Sun cover.
4. Mounting template
5. Power over Ethernet (PoE) injector.
6. PoE cable 1.5 m (5 ft).

Note: The JCU part number E32130 can also be ordered separately.

3.6 Tools required

The following tools are required for installation.



Item	Description
1.	Drill
2.	6mm spanner
3.	6.4mm drill bit
4.	Jigsaw (only required for JCU installation)
5.	Pozi-drive screwdriver (only required for JCU installation)
6.	Thread-lock

Chapter 4: Cables and connections

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- 4.1 General cabling guidance on page 22
- 4.2 Connection overview on page 23
- 4.3 Power connection on page 26
- 4.4 JCU Connection on page 27

4.1 General cabling guidance

Cable types and length

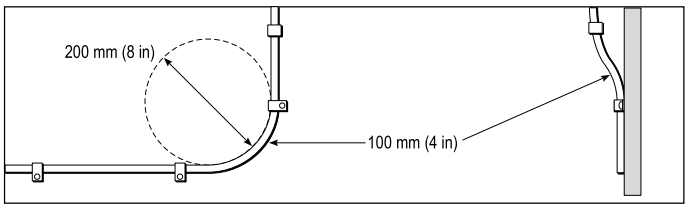
It is important to use cables of the appropriate type and length

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

Routing cables

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

- Do NOT bend cables excessively. Wherever possible, ensure a minimum bend diameter of 200 mm (8 in) / minimum bend radius of 100 mm (4 in).



- Protect all cables from physical damage and exposure to heat. Use trunking or conduit where possible. Do NOT run cables through bilges or doorways, or close to moving or hot objects.
- Secure cables in place using tie-wraps or lacing twine. Coil any extra cable and tie it out of the way.
- Where a cable passes through an exposed bulkhead or deckhead, use a suitable watertight feed-through.
- Do NOT run cables near to engines or fluorescent lights.

Always route data cables as far away as possible from:

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

Strain relief

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

Circuit isolation

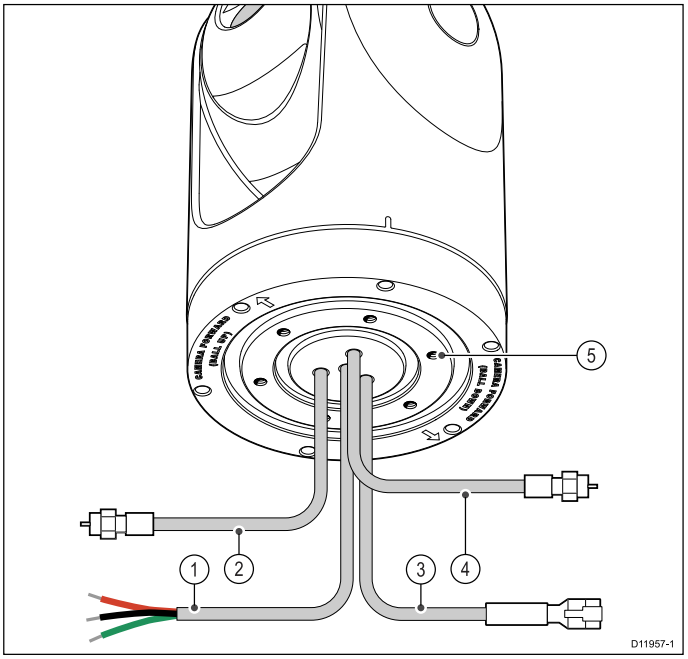
Appropriate circuit isolation is required for installations using both AC and DC current:

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

Cable shielding

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

4.2 Connection overview



1. Power and drain
2. IR out – Thermal camera video
3. SeaTalk^{hs} – To Raymarine network switch or JCU
4. VIS / IR out – Visible light and thermal video. (Dual payload only, VIS / IR are switched using camera controls.)
5. Low impedance ground connection

Connection care points:

- You must provide a low impedance chassis to ground connection, this is made to any one of the chassis threaded fixing points and is in addition to the drain-to-ground connection.
- The 450 mm (18in) cable tails should be routed to a dry area of the vessel for connection. Alternatively you must ensure that all connections are made water tight.
- Ensure that the VIS/IR feed is connected on dual payload models. Without this connection the user will not be able to use the camera controllers to switch between the thermal and low light (visible) camera images.

Thermal camera cables

Cabling requirements for thermal cameras.

Camera to network switch

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

Joystick Control Unit (JCU)

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

Power over Ethernet (PoE) injector to network switch

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

Video cables

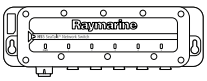
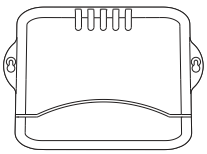
Video cables are not supplied with the product. Please contact your dealer for suitable cables and adaptors.

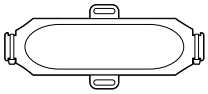
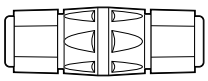
Raymarine recommends the use of a BNC terminated RG59 75ohm (or better) coaxial cable.

SeaTalk^{hs} patch cables

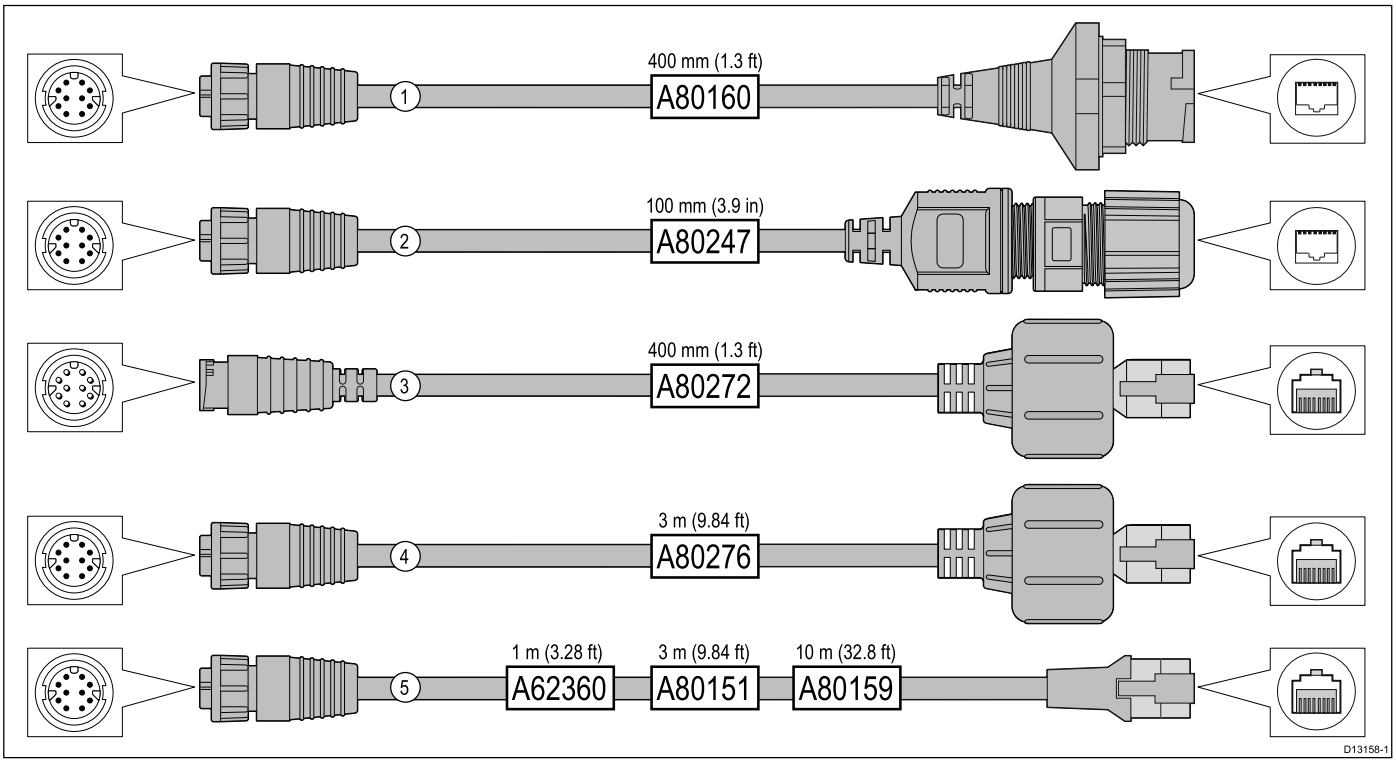
Cable	Part number
1.5 m (4.9 ft) SeaTalk^{hs} patch cable	E06054
5 m (16.4 ft) SeaTalk^{hs} patch cable	E06055
10 m (32.8 ft) SeaTalk^{hs} patch cable	E06056
15 m (49.2 ft) SeaTalk^{hs} patch cable	A62136
20 m (65.6 ft) SeaTalk^{hs} patch cable	E06057

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.

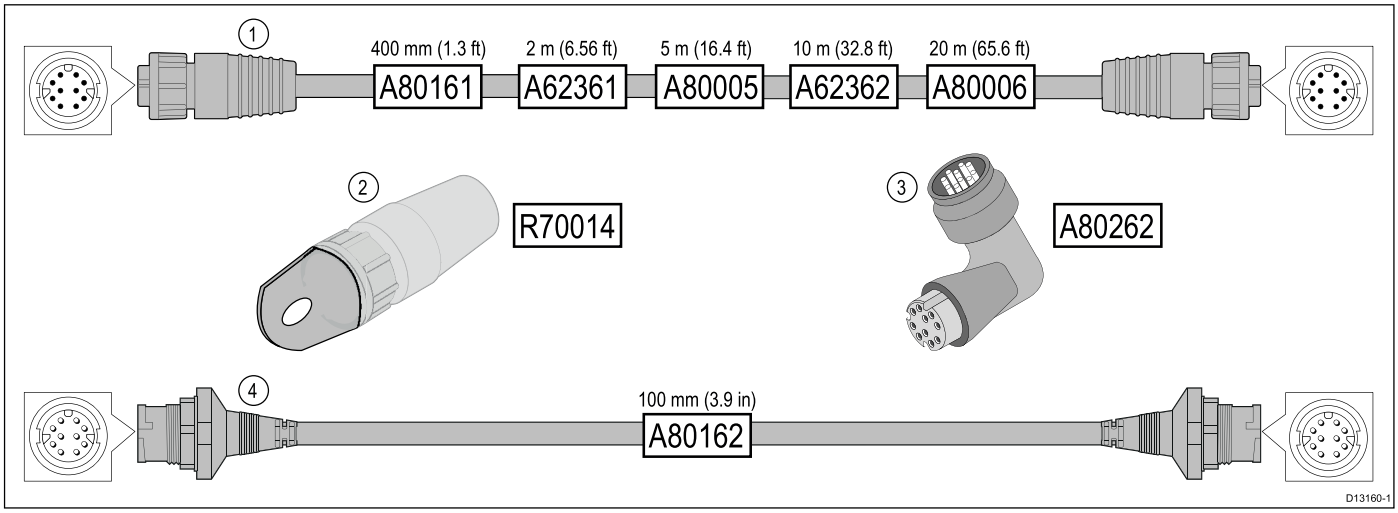
Item	Part num-ber	Notes
RJ45 SeaTalk^{hs} crossover coupler 	E55060	• Enables direct connection of RJ45 SeaTalk^{hs} devices to smaller systems where a switch is not required. • Enables the connection of RJ45 SeaTalk^{hs} devices to a HS5 RayNet network switch (in conjunction with suitable adapter cables). • 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.

RayNet to RJ45 adapter cables



	Description	Typical use	Quantity
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 SeaTalk^{hs}** waterproof **locking** (male) plug: • **A62245** (1.5 m). • **A62246** (15 m).	A typical use for this adapter cable is to connect a **DSM300** sonar module to a **LightHouse** MFD, using all-waterproof cable connections. This adapter cable will also accept the following **RJ45 SeaTalk^{hs}** cables, although the **RJ45** plug that connects at the equipment end (e.g. **DSM300**) will NOT be waterproof: • **E55049** (1.5 m). • **E55050** (5 m). • **E55051** (10 m). • **A62135** (15 m). • **E55052** (20 m).	1
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.	Directly connect a Raymarine radar scanner with an **RJ45 SeaTalk^{hs}** (male) cable to a **RayNet** network switch (e.g. **HS5**) or **LightHouse** MFD.	1
3	Adapter cable with a **RayNet** (male) plug on one end, and an **RJ45 SeaTalk^{hs}** waterproof (male) plug on the other end.	Connect a legacy **G-Series GPM-400**, **C-Series** Widescreen or **E-Series** Widescreen MFD to a Raymarine radar scanner supplied with a **RayNet** power / data cable.	1
4	Adapter cable with a **RayNet** (female) socket on one end, and an **RJ45 SeaTalk^{hs}** waterproof (male) plug on the other end.	Connect a legacy **G-Series GPM-400**, **C-Series** Widescreen or **E-Series** Widescreen MFD to a **RayNet** network switch (e.g. the **HS5**).	1
5	Adapter cable with a **RayNet** (female) socket on one end, and an **RJ45 SeaTalk^{hs}** (female) socket on the other end.	Connect a **LightHouse** MFD to a legacy **SR6** switch / weather receiver or a legacy 8–port **SeaTalk^{hs}** network switch. Another common use for the cable is in conjunction with a crossover coupler (**E55060** or **R32142**) to connect Raymarine products with an **RJ45** connection (e.g. radar scanner, thermal camera or **DSM300**) to a **LightHouse** MFD or **RayNet** network switch (e.g. the **HS5**).	1

RayNet to RayNet cables and connectors



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

4.3 Power connection

Power must be supplied to the camera from an appropriate power source.

Power connection requirements

- 12 or 24 Vdc nominal supply voltage
- Isolated power supply
- Connected via an appropriately rated thermal breaker or fused switch.

Power connection colors

Color	Description
Red	Power in +ve (12 / 24 V)
Black	Power in -ve (0 V)
Green	Drain / Ground

Power cable

The power connection is made to a 450 mm (18 in) tail out of the camera base. Extend this tail with appropriate cable as per the table below.

Total length (max)	Supply voltage	Cable size
0–8 m (25 ft)	12 V	1.5 mm^2 (16 AWG)
	24 V	0.8 mm^2 (18 AWG)
8–16 m (50 ft)	12 V	2.0 mm^2 (14 AWG)
	24 V	0.8 mm^2 (18 AWG)
16–24 m (75 ft)	12 V	3.5 mm^2 (12 AWG)
	24 V	0.8 mm^2 (18 AWG)
24–32 m (100 ft)	12 V	5.5 mm^2 (10 AWG)
	24 V	0.8 mm^2 (18 AWG)

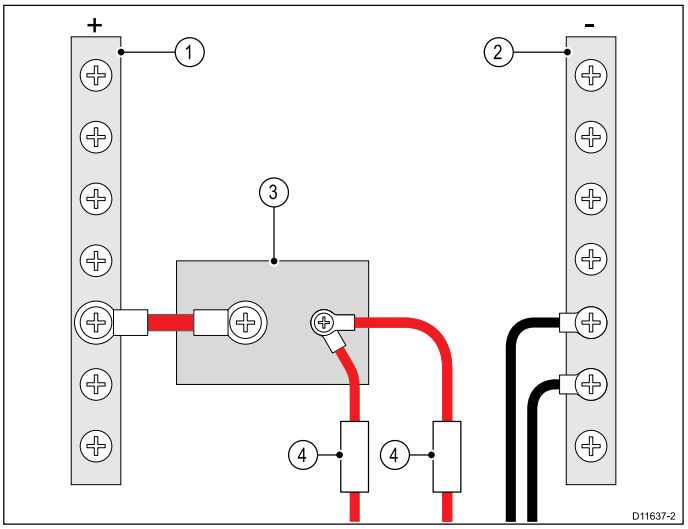
Breakers, fuses and circuit protection (12 / 24 V systems)

Raymarine recommends that you fit a thermal breaker or fuse for the camera at the distribution panel.

Power supply voltage	Camera	Recommended fuse
12 / 24 V	All models	5 A.

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.

Grounding — Dedicated drain wire

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

It is important that an effective RF ground is connected to the system. A single ground point should be used for all equipment. The unit can be grounded by connecting the shield (drain) wire of the power cable to the vessel's RF ground point. On vessels without an RF ground system the shield (drain) wire should be connected directly to the negative battery terminal.

The dc power system should be either:

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

Warning: Positive ground systems

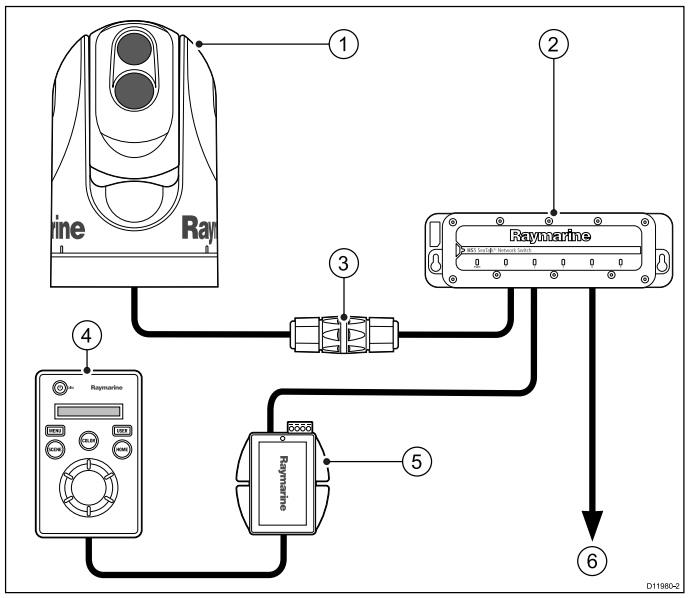
Do not connect this unit to a system which has positive grounding.

4.4 JCU Connection

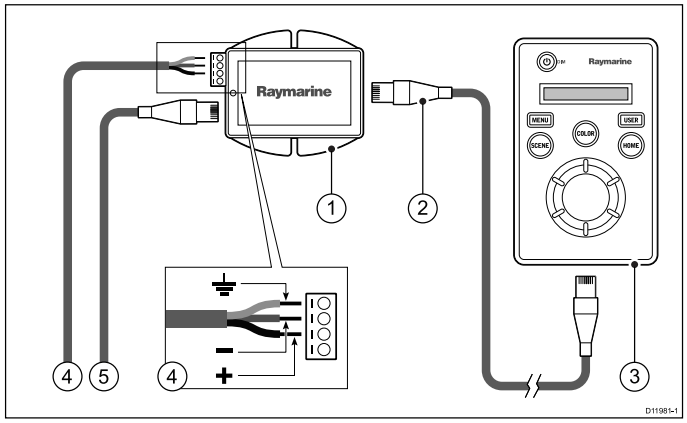
The JCU (Joystick Control Unit) can be connected as part of the SeaTalk^{hs} network. Alternatively it can be connected directly to the thermal camera provided that there are no other camera controllers on the system.

Connection to the SeaTalk^{hs} network

The JCU is connected to the SeaTalk^{hs} network via the PoE (power over Ethernet) injector supplied with the JCU.



1. Thermal camera
2. Raymarine network switch
3. Ethernet coupler
4. JCU
5. PoE injector
6. SeaTalk^{hs} to other devices (e.g. multifunction display, digital radar...).



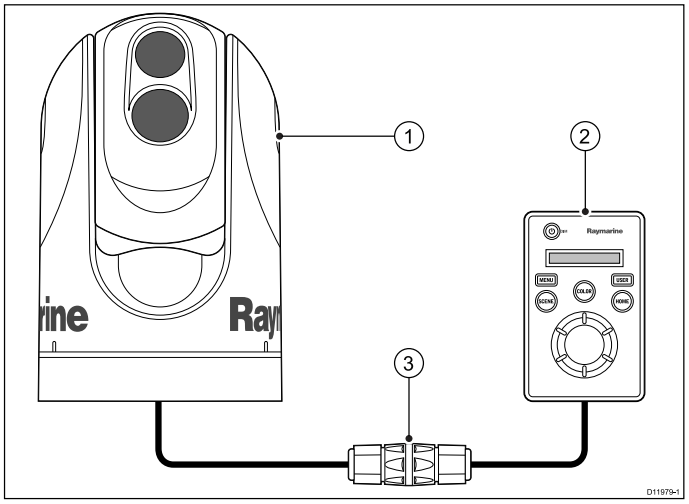
1. PoE injector
2. PoE cable.
3. JCU
4. Power to PoE injector
5. SeaTalk^{hs} connection (to SeaTalk^{hs} switch)

Cables

SeaTalk^{hs} connection	Use a SeaTalk^{hs} patch cable. These are available in various lengths from your dealer.
JCU to PoE injector	Use the 1.5 m (5 ft) PoE cable supplied with the JCU for this connection, if you require a different length contact your dealer for suitable cables.

Connection direct to camera

Direct connection is only valid if the JCU is the only controller and there are no displays with the thermal camera application.



1. Thermal camera
2. JCU
3. Ethernet coupler, supplied with camera

Cables

Camera to Ethernet coupler	Use the 450 mm (18 ”) tail hard wired from the camera. Should you need to extend this use an Ethernet (with power) cable and additional coupler available from your dealer.
JCU to Ethernet coupler	Use the 1.5 m (5 ft) PoE cable supplied with the JCU for this connection, if you require a different length contact your dealer for suitable cables.

Chapter 5: Installation

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- 5.1 Camera mounting on page 30
- 5.2 JCU Mounting on page 32

5.1 Camera mounting

Location requirement

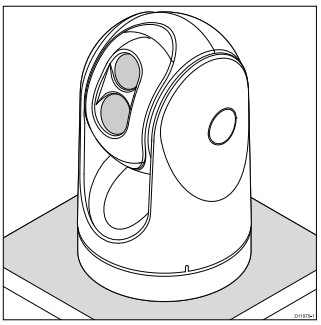
When planning the installation location, consider the following points:

- The camera is waterproof, and appropriate for above decks mounting.
- When mounting the camera in a ball-down position, ensure that the camera is installed with adequate drainage so that standing water does not collect above the cable glands. Standing water will eventually seep past the cable gland seals and compromise the internal electronics.
- If the base of the T-Series camera must be left exposed, the exit holes must be sealed with a marine-grade adhesive such as 3M 5200 or equivalent. Use a sufficient amount of sealant to prevent pooling of water above the glands. Failure to properly install or seal these glands could void the camera warranty.
- Ensure the camera is installed in a location that will allow it to be accessed for regular periodic cleaning (fresh-water rinse), inspection of mounting point integrity and mechanical soundness, and preventative maintenance.
- The underside (inside) of the compartment or deck on to which the camera is mounted must be weather-tight. You must ensure protection from water ingress to cables and connections.
- The mounting surface must be horizontal.
- If you cannot access both sides of the mounting surface, then you will need to mount the camera “top down” using the optional top-down riser / galvanic isolation kit (A80334).
- If the mounting surface is metallic (for example, steel), then you will need to mount the camera “top down” using the optional top-down riser / galvanic isolation kit (A80334). The riser provides galvanic isolation and protection from galvanic corrosion.
- Fixings are supplied for a mounting surface of up to 41 mm (1.6 in) thick. A thicker surface will require the installer to provide alternative fixings.
- The camera mounting surface must be at least as large as the footprint of the camera itself to ensure an adequate seal with the O-ring.
- The camera should be mounted as high as practical, but without interfering with any radar, navigational or communications electronics.
- Choose a location that will provide the most unobstructed view in all directions.
- Choose a location as close to the vessel’s center line as possible. This provides a symmetrical view when looking forward or aft.
- Select a location for the camera that is at least 7 cm (2.75 in.) from any magnetic compass.
- Select a location that is at least 1 m (3 ft) from devices that may cause interference, such as motors, generators and radio transmitters / receivers.
- If installing an optional JCU, select a location for the JCU that is at least 11 cm (4.33 in.) from any magnetic compass.

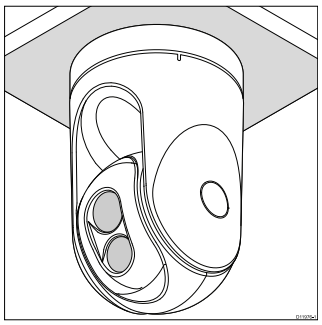
Camera orientation

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

Note: The stabilized variants of the T-Series thermal cameras MUST be mounted in the ball up configuration.



Ball up: The camera is mounted on top of the mounting surface.

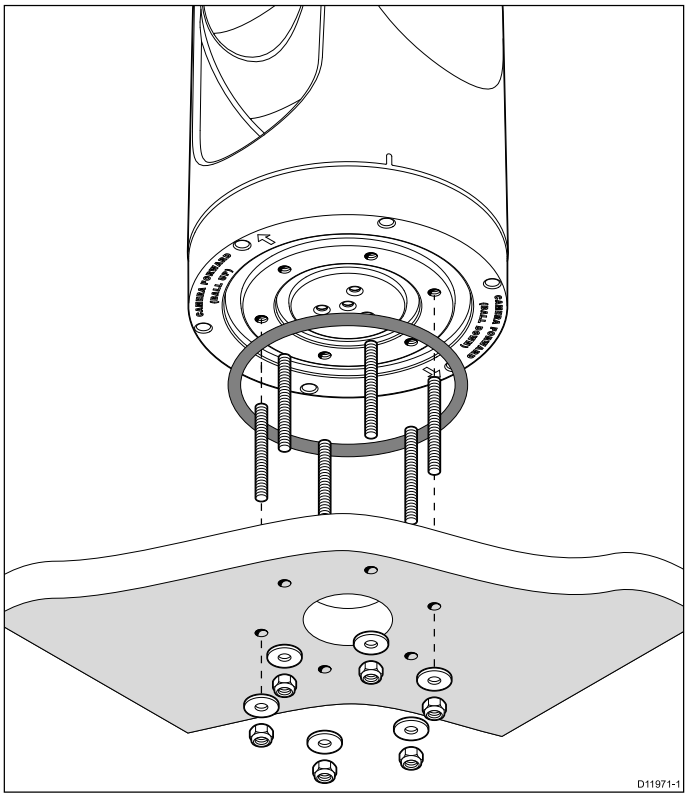


Ball down: The camera is suspended upside down, below the mounting surface.

Note: For ball down mounting you must set the ball down option in the camera system setup menu appropriately.

Mounting the camera

Use these instructions to mount the camera unit in position.



1. Using the template supplied, mark and drill the holes for mounting the camera.

   Mounting holes care points:

   - Check the dimensions of any printed template (to ensure that the template is printed to the correct scale) prior to drilling any holes.

- Note the camera forward markings on the camera base, and make sure the template is oriented properly relative to the bow of the vessel. This is affected by whether the camera is to be mounted ball-up or ball-down.

2. Install the 6x threaded studs into the base of the camera with thread-locking compound. If required, you can use studs of a different length to suit your installation.

   Tighten the studs to a torque of 9.5 Nm (7 lb-ft).
3. Install the rubber O-ring in the base of the camera.
4. Thread the power supply, video, and network cables from the camera through the center hole, and then place the camera on the mounting surface so the threaded studs extend through the drilled holes.
5. Make the required cable connections to the camera tails.
6. Secure the camera body to the mounting surface with the supplied nuts and washers.

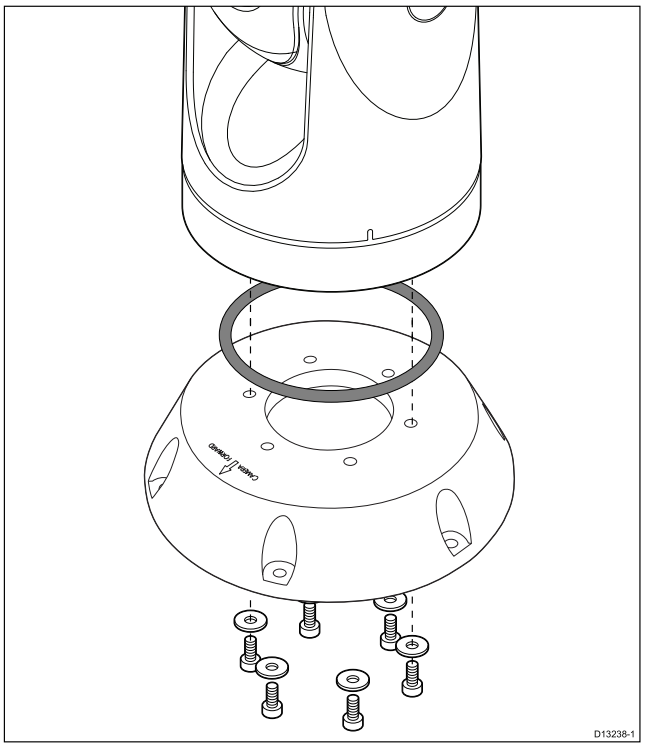
   Dome capped nuts are provided for a neater solution where the mounting is exposed to view.

   You must ensure a watertight seal. You may use a marine-grade sealant as an alternative to the mounting O-ring.

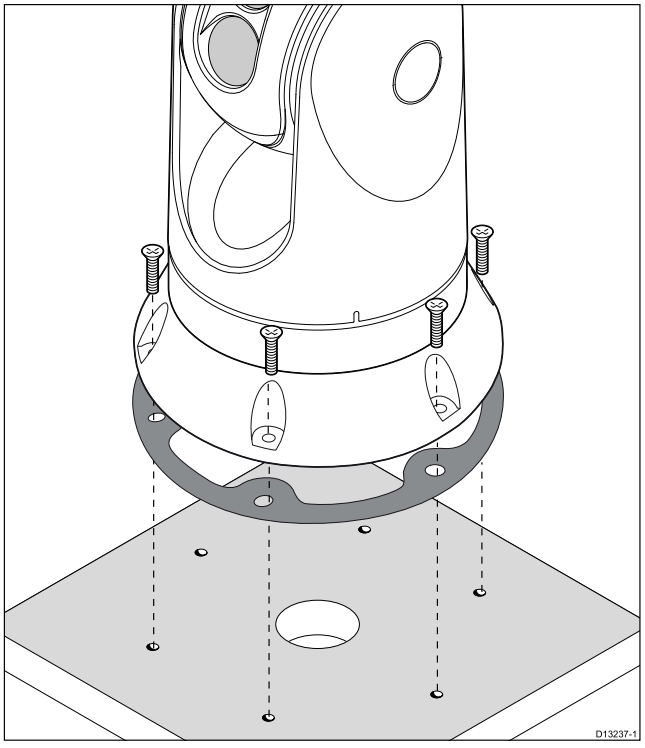
Mounting the camera with the optional top-down riser / galvanic isolation kit (A80334)

The optional top-down riser / galvanic isolation kit (A80334) is used when access to the underside of the mounting surface is restricted, or if galvanic isolation is required when mounting to a metallic surface. Use the instructions below to mount the camera unit using the optional top-down riser / galvanic isolation kit (A80334).

1. Use the riser as a template to mark and drill the holes for mounting the camera.
   - Note the camera forward marking on the top surface of the riser. You must ensure that the riser is mounted so that the camera is oriented properly relative to the bow of the vessel.
2. Fasten the camera unit to the riser using the 6x threaded bolts and a suitable thread-locking compound.



   - Note the camera forward markings on the camera base and on the top surface of the riser. You must ensure that the camera is facing the correct way depending upon whether the camera is to be mounted ball-up or ball-down.
   - Ensure the rubber O-ring is positioned correctly in the base of the camera.
3. Make the required cable connections to the camera tails.
4. Fasten the camera-riser assembly to the mounting surface using fasteners appropriate for the surface's thickness and material.



   You must ensure a watertight seal. You may use a marine-grade sealant as an alternative to the supplied mounting gasket.

5.2 JCU Mounting

Location requirements

When planning the installation location, consider the following points:

- Select a position on your vessel that is close to the monitor that displays the T-Series camera video output.
- Ensure the JCU is mounted at least 55 cm (21.7") away from any equipment fitted with a magnetic compass.
- The JCU can be mounted to a dash or other surface in any orientation.
- Consider cable lengths and cable routing.

Flush mounting

The standard method for mounting the JCU is a flush or panel mounting arrangement.

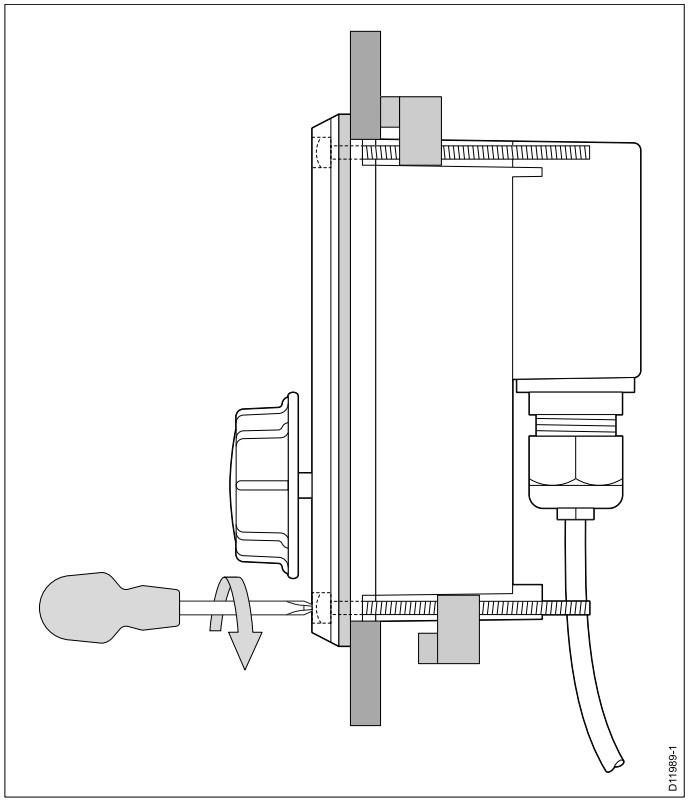
Before mounting the unit, ensure that you have:

- Selected a suitable location. A clear, flat area with suitable clearance behind the panel is required.
- Identified the cable connection required and the route that the cable will take.
- Detached the front bezel to reveal the mounting screws.

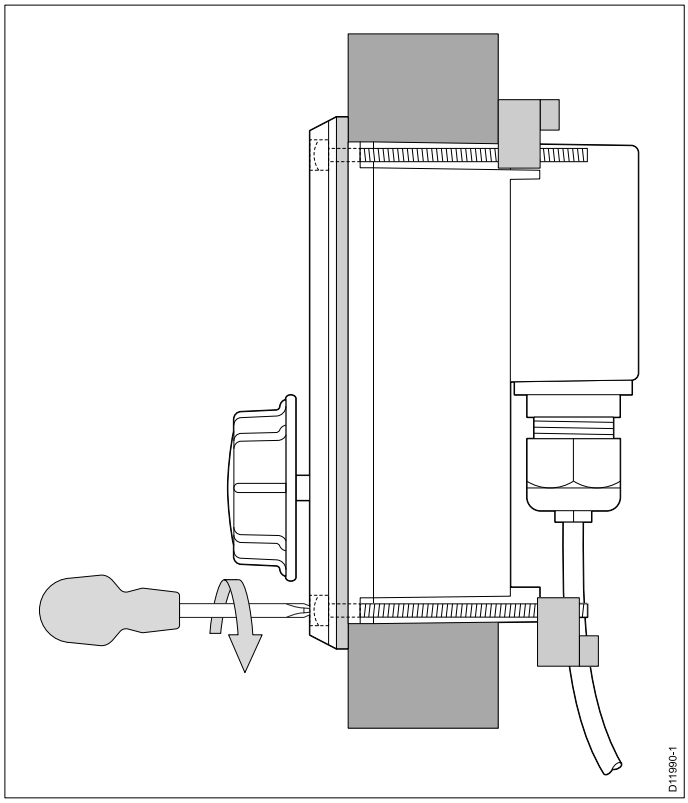
Mounting the JCU

1. Cut the mounting hole according to the dimensions specified in the mounting template included in this document.
2. Ensure that the unit fits into the removed area and then file around the cut edge until smooth.
3. Drill four 6.4 mm (0.25 in) holes as indicated on the template to accept the mounting screws.
4. Before mounting the JCU, insert the supplied ethernet cable through the mounting hole and into the JCU ethernet port. Ensure the cable gland sealing nut is tightened correctly.
5. Remove the 4 panel mounting clamps and insert the JCU in place. Affix the mounting clamps to the screws on the other side of the mounting surface, ensuring that the mounting clamps are rotated outward from the JCU housing. Tighten the screws to draw the mounting clamps up against the mounting surface and then tighten another 1/4 to 1/2 turn. Do not overtighten the screws.
   i. As shipped from the factory, the JCU can be mounted to a panel thickness ranging from 0.79 to 4.45 cm (0.31 to 1.750 in). The clamps are set with the small “foot” on the clamp facing towards the mounting surface, away from the front of the JCU, as shown in the "Thick panel mounting" diagram in this document.
   ii. To mount the JCU to a panel thickness of 0.79 cm (0.31 in) or less, remove the clamps from the mounting screws, turn them around and thread them back onto each of the four screws. In this configuration, the clamp “foot” faces away from the mounting surface and allows the clamp to contact thinner panel surfaces while still allowing for proper compression of the JCU mounting gasket to form a watertight seal. This mounting configuration is shown in the "Thin panel mounting" diagram in this document.
6. Once you have secured the JCU in place, replace the bezel.

Thin panel mounting



Thick panel mounting



Chapter 6: System operation and setup

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- 6.1 Thermal camera image on page 34
- 6.2 Operation and features overview on page 35
- 6.3 Power up and standby on page 36
- 6.4 Camera control on page 37
- 6.5 Image adjustments on page 39
- 6.6 System reset on page 40
- 6.7 Setup menus on page 41

6.1 Thermal camera image

The thermal camera provides a video image which is shown on your display.



The video feed provides:

- Thermal image.
- Status icons / system information.

You should take time to familiarize yourself with the thermal image. This will help you to make the most of your system:

- Consider every object you view in terms of how it will look “thermally” as opposed to how it looks to your eye. For example look for changes caused by the heating effect of the sun. These are particularly evident right after sunset.
- Experiment with white-hot and black-hot (reverse video) modes.
- Experiment by looking for hot objects (such as people) compared to the colder surroundings.
- Experiment with the camera for daytime viewing. The camera can provide improved daytime viewing in environments where traditional video camera performance suffers, such as in shadows or backlit scenes.

Thermal camera status icons

The thermal camera image includes icons to show the current status of the camera.

Icon	Description
	Camera direction indicator.
	Camera home position.
	Camera paused.
	Scene preset mode for night conditions.
	Scene preset mode for daytime conditions.
	Scene preset mode for night docking.
	Scene preset mode for identifying people or objects in the water.
	Rear-view mode — image is flipped horizontally.
	Zoom setting: 2x zoom.
	Zoom setting: 4x zoom.
	Single active controller on network.
	Multiple active controllers on network.
	PC / laptop detected on network.
	Point mode enabled.
	Point mode disabled.
	Stabilization Off.
	Stabilization On.

FFC (Flat Field Correction)

Periodically the camera will perform a Flat Field Correction (FFC). This will fine tune the thermal image to suit the current ambient temperature.

The FFC operation is indicated by a momentary pause and a green rectangle displayed in the upper left of the thermal video image.

6.2 Operation and features overview

The camera features can be accessed using the thermal camera application of a compatible Raymarine multifunction display, or from a dedicated JCU (Joystick control unit).

This handbook covers methods using the JCU, for details on how to operate this product using a compatible Raymarine multifunction display please refer to the thermal camera application section of the manual supplied with your multifunction display.

The main Thermal camera operations are outlined below:

Control the camera:

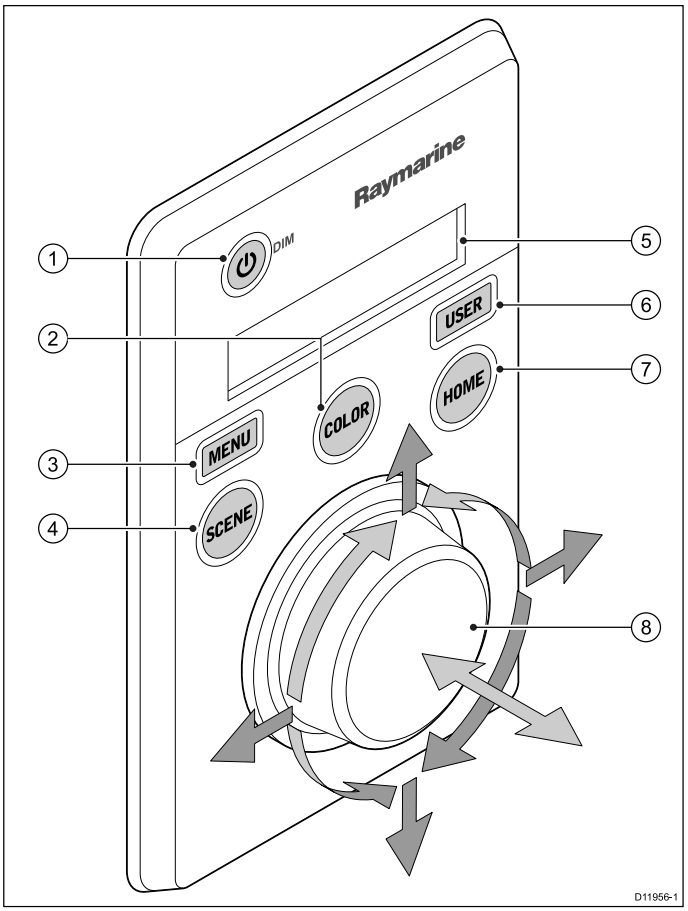
- Switch the camera between operational and standby modes.
- Pan and tilt
- Zoom
- Home position
- Pause the camera image
- Switch between visible light and thermal camera lenses. (Dual payload only)
- Surveillance mode

Adjust the camera image:

- Color palette
- Scene presets
- Reverse video (white hot / black hot)

In addition to the above, the camera also provides setup menus to configure the system to your requirements.

JCU controls overview



1	**STANDBY / DIM** • Press and hold – "Wake" the camera from standby mode or access the power menu. • Momentary press – Change JCU display brightness (3 different levels).
2	**COLOR** The factory default is for a red color image to suite night navigation. You may change this using the setup menus. • Momentary press – Cycle through the available color settings. (Greyscale, Red, Sepia, Rainbow and Fusion.) • Press and hold – Perform FFC (Flat Field Correction) operation. This performs a correction for the current ambient temperature.
3	**MENU** – Access the camera setup menus. • Press once – display on–screen setup menu. • Press again – exit setup menu.
4	**SCENE** • Short press – Select between the available scene presets. • Long press (dual payload only) – switch between the thermal and visible-light image.
5	**Display** – Provides information regarding the JCU and camera status.
6	**USER** – A programmable button for accessing a favorite setting or function not provided on the other keys. The default operation is the Reverse Video function (white-hot / black-hot). • Short press – Perform the programmed action. • Press and hold – Program the **USER** button with another function. The **USER** button can be programmed for the following functions: • **Search Settings** • **Switch Thermal / VIS Video** • **Hide / Show All Icons** • **Reverse Video** • **Rearview Mode** • **Surveillance Mode** • **Point Mode**

7	**HOME** • Momentary press – Return camera to home position. • Press and hold – Set current position as camera home. • 4 x press – Reset the camera (realign home and stow positions).
8	**PUCK** – Use the puck to control the camera and navigate the setup menus. Control camera: • Move up, down left right – Pan / Tilt camera. • Press down (and hold) – Zoom thermal image in . • Lift up – Zoom thermal image out. • Double-click (2 quick presses) – Pause thermal image. (Move puck in any direction to unfreeze.) Navigate setup menus: • Move up, down – Scroll through menu options. • Press down – Select highlighted menu option.

6.3 Power up and standby

When the breaker connecting power to the camera is switched on, the camera will run a boot up sequence lasting for about 1 minute, after which the camera will be in **Standby** mode.

In order for the camera to operate, you must bring the camera out of standby mode using the camera controls.

Thermal camera standby

Standby mode can be used to temporarily suspend the thermal camera's functions when the camera is not needed for a prolonged period.

When in standby mode the camera:

- Does NOT provide a live video image.
- Moves the camera into its “stowed” (parked) position (lens facing down into the camera base) to protect the camera optics.
- Engages its pan / tilt motors to hold the camera in place in rough seas.

Note: The “stowed” (parked) position can be configured using the camera's setup menu.

Power menu

Menu item / Description	Settings / Operation
Assign JCU	Assigns the JCU to the camera.
JCU Stndby?	This option places the JCU in standby. The camera and other controllers on the system are unaffected.
Camera Stndby?	With this option the camera moves to its stow position and enters standby mode. The JCU remains on and available to “wake” the camera.
System Off	This option places both the JCU and camera into Standby mode.
Calibrate JCU	Use the “Calibrate JCU” function to calibrate the JCU puck. Follow the on screen instructions to calibrate the puck: • **Rotate CCW / CW** – requires you to rotate the puck fully clockwise, then counter-clockwise. then press the puck to continue.
Cancel	Exit the Power Menu.

Accessing the power menu

The power menu can be accessed by following the steps below.

Using the JCU

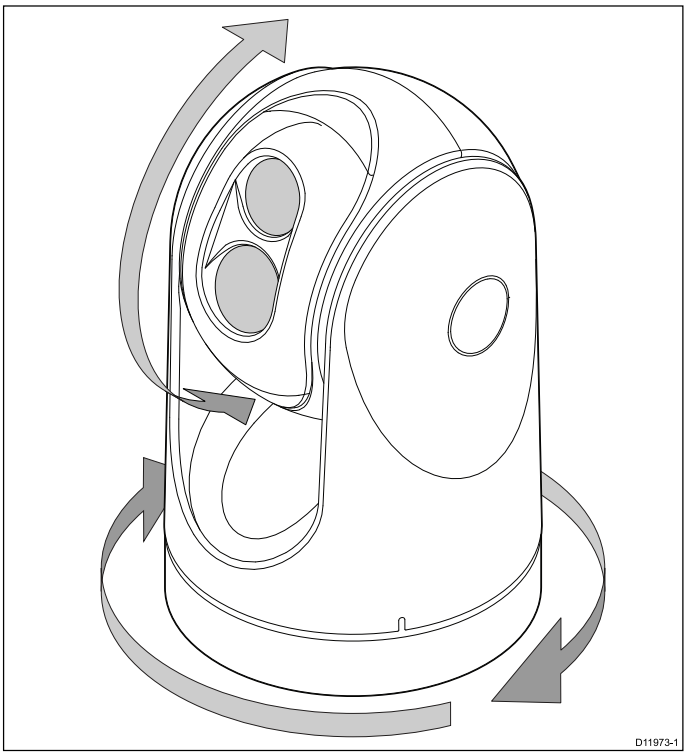
1. Press and hold the **Power** button on the JCU.
   The JCU LCD will countdown from 3 to 0, after which the power menu is displayed.
2. Use the JCU **Puck** to select the relevant power option.
3. Select **Cancel** to cancel the power menu.

Note: The power menu is only displayed on the JCU's LCD display.

6.4 Camera control

Pan, tilt and zoom

The camera controls allow for pan and tilt (elevation) of the camera, as well as zoom (magnification) of the thermal image.



- Pan continuously through 360º.
- Tilt (elevate) to ±90º relative to the horizon.
- Zoom (magnify) the thermal camera image.

Note: Stabilized variants of the T-Series thermal cameras include a continuous zoom function, non-stabilized variants can switch between x2 and x4 magnification.

Zooming the camera using the JCU

The JCU puck is used to control the zoom function of the thermal camera, an icon will be displayed on-screen to indicate the current zoom level.

With no zoom level selected:

1. Push the **Puck** in and hold for 1 second to turn on 2X zoom.
2. Push the **Puck** in and hold for 2 seconds to turn on 4X zoom.
3. Pull the **Puck** out to return to the previous zoom level.

Continuous zoom

The T470SC and T473SC have a continuous zoom color visible light camera. The visible light camera will zoom to the same magnification as the thermal camera. However, when the visible light color camera is viewed the zoom can continue to a preset limit.

Thermal camera home position

The home position is a preset position for the camera.

The home position usually defines a useful reference point — for example, straight ahead and level with the horizon. You can set the home position as required and to return the camera to the home position at any time.

	The home icon appears on-screen momentarily when the camera returns to the home position. The icon flashes when a new home position is set.

Thermal camera surveillance mode

In surveillance mode the camera pans left and right continuously.

The camera continues to pan until surveillance mode is disabled, or the JCU (Joystick Control Unit) is used to move the camera. When this occurs the camera does not automatically resume surveillance mode and the mode must be enabled again if required.

To enable surveillance mode using only the JCU you must set the **User** programmable button to Surveillance mode.

Thermal camera stabilization

The Raymarine T470SC and T473SC thermal cameras includes a mechanical stabilization feature.

The mechanical stabilization feature improves image stability by compensating for vessel motion and keeping the camera aimed at the point of interest. Mechanical stabilization has two aspects: horizontal (azimuth) and vertical (elevation). By default, mechanical stabilization is set to on, which provides the best on-the-water performance particularly when the vessel is underway and traveling on rough water or in swell conditions. You can disable or enable stabilization whenever you want. When you enable full stabilization (horizontal and vertical), the Stabilization On (no wave) icon flashes. It does not display continually, since this is the normal mode of operation. If you disable stabilization, the Stabilization Off (wave) icon remains on the screen to make you aware that the motion of the vessel can affect the camera performance. This is not a normal mode of operation. Stabilization is automatically turned off when the camera is stowed, but the system restores your setting when the camera is powered on. You can turn off the horizontal (pan) stabilization while retaining the tilt stabilization by enabling point mode.

Enabling / Disabling stabilization

Stabilization is enabled by default. You can enable or disable stabilization at any time by following the steps below.

Using the JCU:

1. Press **MENU**.
2. Select **System Setup**.
3. Select **Enable Stabilization** to turn on mechanical stabilization, or
4. Select **Disable Stabilization** to turn off mechanical stabilization.
5. Press **MENU** to cancel the on-screen menu.

Thermal camera point mode

Point mode is only applicable to thermal cameras which have mechanical stabilization.

Enabling point mode only has significance when stabilization is enabled. Enabling point mode turns off the horizontal (pan) stabilization while retaining the vertical (tilt) stabilization. This can be helpful when you want to use the thermal camera as an aide to navigation and keep the camera pointing in the same position relative to the vessel as it turns. For example, you may have stabilization enabled and have set the camera to point straight ahead relative to the front of the vessel. If the vessel is turned at a sharp angle under these conditions, the camera sensor will not follow the direction of the vessel. Enabling point mode keeps the camera in sync with the vessel direction while maintaining a stable elevation position. When point mode is enabled, a lock icon displays. The camera's azimuth position is now locked to the base. When you disable point mode, the unlock icon displays momentarily. The camera always starts up with point mode disabled.

Enabling / Disabling point mode

Point mode is disabled by default. With Stabilization enabled you can also enable point mode at any time by following the steps below.

Using the JCU:

1. Press **MENU**.
2. Select **Enable Point Mode** to turn on point mode, or if already enabled
3. Select **Disable Point Mode** to turn off point mode.
4. Press **MENU** to cancel the on-screen menu.

6.5 Image adjustments

Thermal camera scene presets

Scene presets enable you to quickly select the best image setting for the current environmental conditions.

During normal operation the thermal camera automatically adjusts itself to provide a high-contrast image optimized for most conditions. The Scene presets provide 4 additional settings that may provide better imagery in certain conditions. The 4 modes are:

	**Night Running** — scene preset mode for night conditions.
	**Day Running** — scene preset mode for daytime conditions.
	**Night Docking** — scene preset mode for night docking.
	**Search** — scene preset mode for identifying people or objects in the water.

Although the preset names indicate their intended use, varying environmental conditions might make another setting more preferable. For example, the night running scene preset might also be useful while in a harbor. You may find it beneficial to experiment with the different scene presets to discover the best preset to use for different conditions.

Thermal camera color modes

A range of color modes are available to help you distinguish objects on-screen in different conditions.

Changing the color mode switches the thermal camera image between a greyscale mode and 1 or more color modes. There are 5 color modes available.

The factory default color mode is white, which may improve your night vision. This default mode can be changed if required using the camera's on-screen **Video Setup** menu.

Note: If you have the Disable Color Thermal Video option selected in the camera's on-screen **Video Setup** menu, only 2 color modes are available — greyscale and red.

Thermal camera reverse video

You can reverse the polarity of the video image to change the appearance of objects on-screen.

The reverse video option (video polarity) switches the thermal image from white-hot (or red-hot if the color mode setting is active) to black-hot. The difference between white-hot and black-hot is shown below:

	White-hot thermal image.
	Black-hot thermal image.

You may find it useful to experiment with this option to find the best setting to suit your needs.

Reversing the video polarity

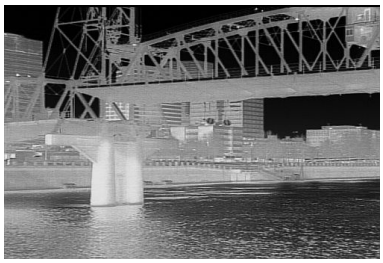
To reverse the polarity of the video image follow the steps below.

Using the JCU:

1. Press **MENU**.
2. Select **Video Setup**.
3. Select **Set Reverse Video** or **Invert Video Polarity**.
4. Select **MENU** to cancel the on-screen menu.

Thermal and visible-light operation

“Dual payload” thermal cameras are equipped with 2 cameras — a thermal imaging (infrared) camera and a visible-light camera.



Thermal camera — provides night-time imagery, based on temperature differences between objects. Thermal imaging produces a clear image even in total darkness.



Visible-light camera — provides black and white (or greyscale) imagery during the day and in low-light conditions. Helps to improve navigational abilities in low-light conditions; for example during twilight hours when operating along intercoastal waterways and near harbor entrances.

Note: The T470SC and T473SC have a color camera and continuous zoom lens.

Thermal camera rear view mode

The rear view mode flips the video image horizontally, providing a “mirror image”.

This is useful for example in instances where the camera is rear-facing and you are viewing the image on a forward-facing monitor.

Switching the camera to rearview mode

To switch the camera to rear view mode follow the steps below.

Using the JCU

1. Press **MENU**.
2. Select **System Setup**.
3. Select **Enable Rearview Mode**.

   When enabled the option is changed to **Disable Rearview Mode**, selecting this will revert back to normal view.
4. Press **MENU** to cancel the on-screen menu.

6.6 System reset

Resetting the JCU

Occasionally it may be necessary to reset the JCU, to do this you can either power cycle the JCU or follow the steps below:

1. Press and hold the **SCENE**, **COLOR** and **HOME** buttons for 1 second.

Resetting the thermal camera

Use this procedure to reset the thermal camera. This will realign the home and stow positions, for example if they become misaligned due to heavy weather.

1. Press the **HOME** button 4 times successively to reset the camera.

Restoring factory defaults

Use this procedure to reset the camera to its factory default settings.

With the camera setup menu displayed:

1. Select the **About / Help** menu.
2. Select **Restore Factory Defaults** from the available options.

6.7 Setup menus

The setup menus provide a range of tools and settings to configure the thermal camera.

The menus can be accessed from any controller on the system. The menus are overlaid onto the video image.

Note: The on-screen menus only appear on the thermal camera image. They are not available when viewing the visible light image (on dual payload models).

Menus available

Enable Point Mode / **Disable Point Mode**	Selecting Enable Point mode will turn point mode on, selecting disable point mode will turn point mode off. Only applies to models with mechanical stabilization.
Video Setup	This menu is used to set the video configuration options.
Set Symbology	Settings associated with the status icons.
User Programmable Button	Configure the **USER** button on the JCU.
System Setup	Settings to optimize operation for this particular system / installation.
About / Help	Helpful information and restore to factory defaults setting.
Exit	Cancels on-screen menu.

Video setup menu

Menu item / Description	**Settings / Operation**
Set Thermal Color Default	This saves the current color setting as the default value.
Set Reverse Video or **Set Video Polarity**	This toggles the infrared image between white-hot (or red-hot if viewing a color image) and black-hot.
Enable / Disable Color Thermal Video	Enable or disable the thermal color palettes: • Enabled – Greyscale, Red, Sepia, Rainbow and Fusion palettes are available. • Disabled – Only Greyscale and Red palettes are available.
Display Test Pattern	Use the display test pattern when setting up the color / contrast settings for your particular display or monitor. You can switch through the 4 test patterns available.
Exit	

Set symbology menu

Menu item / Description	**Settings / Operation**
Enable / Disable PC Icon	• Enabled – The PC icon is displayed whenever a PC is detected on the network. • Disabled – The PC icon is not displayed.
Enable / Disable JCU Icon	• Enabled – The JCU icon is displayed whenever a JCU is detected on the network. • Disabled – The JCU icon is not displayed.
Display All Icons	Selecting this menu item enables all available icons.
Display Minimal Icons	Selecting this menu item reduces the icon activity: • Position, Zoom, Rearview, Pause, Stabilization disabled and Point Mode enabled icons are unaffected. • Home and Scene icons are displayed only momentarily. • Other icons are not shown.
Hide All Icons	Selecting this option hides all icons except for: • Position indicator • Rearview mode enabled • Stabilization disabled • Point mode enabled
Exit	Returns to the main menu.

User Programmable Button menu

Use this menu to set up the **USER** button on the JCU.

Menu item / Description	**USER button operation**
Search settings	The **USER** button will set the camera scene to Search mode.
Switch Thermal / VIS Video (Dual payload models only)	The **USER** button will switch between Thermal and Low Light camera images.
Hide / Show All Icons	The **USER** button will toggle between Show and Hide icon settings.
Reverse Video	The **USER** button will toggle between the White-hot and Black-hot (reverse) thermal image.
Rearview Mode	The **USER** button will toggle Rearview mode on and off.
Surveillance Mode	The **USER** button will toggle Surveillance mode on and off.

Menu item / Description	USER button operation
Point Mode	The **USER** button will toggle Point Mode on and off.
Exit	Returns to the main menu.

System Setup menu

Menu item / Description	Settings / Operation
Enable / Disable Ball-Down Installation	This menu option should be enabled when the camera is mounted upside down in the “ball-down” configuration.
Enable / Disable Twist-to-Pan mode	This menu option changes the JCU controls pan and zoom functions as follows: **Enabled** — Pan the camera by rotating the **Puck** clockwise or counterclockwise, zoom in and out by pushing the puck in and pulling it out. (This is default operation of the JCU). **Disabled** — Pan the camera by moving the **Puck** left or right, zoom in and out by rotating the **Puck** clockwise and counterclockwise.
Enable / Disable High Power Standby	This option controls the amount of power used to hold the camera in position while it is in Standby mode. The enabled setting will consume more power, but will help ensure that the camera is held in place in rough seas. **Note:** If the camera moves when in standby (due to shock or vibration), then the Position indicator or Home setting may need realigning (reset the camera to realign).
Enable / Disable High Motor Torque	This option controls the amount of power used to hold the camera steady when in use. The enabled setting will consume more power, but help ensure that the camera is held in place in rough seas. The High Motor Torque mode may be useful for power boats that operate at higher speeds and experience high impact environments, and can accept higher power consumption. **Note:** If the camera moves due to shock or vibration, then the Position indicator or Home setting may need realigning (reset the camera to realign).
Enable / Disable Rearview Mode	When this option is enabled the camera image is reversed and you will see a mirror image on the display.
Enable / Disable Stabilization	When this option is enabled horizontal and vertical stabilization is turned on. Only applies to T470SC and T473SC.

Menu item / Description	Settings / Operation
Set Stow Position	This option sets the current position as the Stow position. The camera moves to the stow position whenever it is turned off or put into Standby mode.
Name Camera	Use this option to name the camera.
Surveillance mode	This options enables you to set the scan width and speed when in surveillance mode.
Exit	Exit to main menu.

High power / High torque power use

Camera State	Camera setting	Dual payload	Single payload
Standby	• High Power Mode ON • High Torque Mode ON	22 W	17.4 W
Standby	• High Power Mode OFF • High Torque Mode ON	8 W	7.4 W
Standby	• High Power Mode ON • High Torque Mode OFF	13 W	13 W
Awake	• High Power Mode OFF • High Torque Mode OFF	8 W	7.4 W
Awake	• High Power Mode ON or OFF • High Torque Mode ON	30 W	19.4 W
Awake	• High Power Mode ON or OFF • High Torque Mode OFF	20 W	16.5 W

Surveillance mode menu

Menu item / Description	Settings / Operation
Scan Width	This setting determines the distance that the camera pans left and right when in surveillance mode. Select from: • Narrow — The camera will scan approximately 20º left and right of the center (40º total). • Medium — The camera will scan approximately 40º left and right of the center (80º total). Or, • Wide The camera will scan approximately 80º left and right of the center (160º total).
Scan Speed	This option determines the speed at which the camera pans left and right when in surveillance mode. Select between: • Slow • Medium • Fast
Exit	

About / Help menu

Menu item / Description	Settings / Operation
Video Icon Help Screens	This option displays an explanation of the purpose of each of the screen icons. Use the direction controls to cycle through the pages.
Product Information	This option displays information about the camera: • Name, • Serial number, • MAC address, and • Software information.
Contact Raymarine	This option displays Raymarine contact details.
Restore Factory Defaults	Use this option to restore the camera settings to their factory default value.
Exit	

Chapter 7: Troubleshooting and support

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- 7.2 Raymarine customer support on page 48

7.1 Thermal camera troubleshooting

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

Problem	Possible causes	Possible solutions
Video not displayed.	Camera is in Standby mode.	The camera will not display video if it is in Standby mode. Use the camera controls (either the thermal camera application or JCU) to “wake” the camera from standby.
	Problem with the thermal camera video connections.	• Check thermal camera video cables are sound and properly connected. • Ensure that the video is connected into video input 1 at the multifunction display or GVM. • Ensure that the correct video input is selected at the display.
	Problem with power supply to the camera or JCU (if used as the primary controller)	• Check the power connections to the camera and JCU / PoE injector (if used). • Ensure that the power switch / breaker is on. • Check the fuse / breaker state.
Cannot control thermal camera from Raymarine display or keyboard.	Thermal camera application is not running.	Ensure the thermal camera application is running on the multifunction display (as oppose to the video application which does not have camera controls).
Erratic or unresponsive controls.	Network problem.	Check that the controller and thermal camera are correctly connected to the network. (Note: This may be a direct connection or via a Raymarine network switch.)
		Check the status of the Raymarine network switch.
		Check that SeaTalk^{hs} / RayNet cables are free from damage.
	Control conflict, e.g. caused by multiple users at different stations.	Ensure that no other controllers are in use at the same time.
	Problem with the controller.	Check power / network cabling to the controller and PoE injector (PoE only used with optional Joystick Control Unit).
		Check other controllers if available. If other controllers are operating this will eliminate the possibility of a more fundamental camera fault.
Cannot switch between thermal and visible (VIS / IR) video image .	Camera is not a dual payload model.	Only “dual payload” (dual lens) thermal cameras support VIS / IR switching.
	VIS / IR cable not connected.	Ensure that the VIS / IR cable is connected from the camera to the Raymarine system. (The IR-only cable does not support switching).
Noisy image.	Poor quality or faulty video cable.	Ensure that the video cable is no longer than necessary. The longer the cable is (or the smaller the wire gauge / thickness), the more severe the losses become. Use only high quality shielded cable suitable for a marine environment.
	Cable is picking up electromagnetic interference (EMI) from another device.	• Ensure you are using a high quality shielded cable. • Ensure proper cable separation, for example do not run data and power cables in close proximity with each other.

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

7.2 Raymarine customer support

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

Web support

Please visit the customer support area of our website at:

www.raymarine.com

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

Telephone and e-mail support

In the USA:

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

In the UK, Europe, and the Middle East:

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

In Southeast Asia and Australia:

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

Product information

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

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

You can obtain this product information using the menus within your product.

Chapter 8: Technical specification

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8.1 Technical specification

Nominal supply voltage	12 or 24 V dc
Operating voltage range	-10% to +30% of nominal supply range
Current	• Peak 3.8 A @ 12 V • Peak 1.9 A @24 V
Power consumption	25 W typical, 50 W Max
Environmental	**Installation environment** • Operating temperature: -25 ºC to +55 ºC (-13 ºF to 131 ºF) • Storage temperature: -40 ºC to +85 ºC (-40 ºF to 185 ºF) • Relative humidity: max 95% • Waterproof to IPX6 • Wind: 100 knot (115.2 mph) • Vibration: IEC 60945; MIL-STD-810E • Sand/dust: MIL-STD-810E • Salt Mist: IEC60945
Electromagnetic compliance	EMI: IEC 60945
Dimensions	• Base diameter: 178 mm (7 in.) • Height: 279.4 mm (11 in.) **Note:** T470SC and T473SC height is 292 mm (11.5 in.)
Weight	<5.26 kg (<11.6 lb) – depending on the camera model
Pan / tilt	• 360° continuous pan • +/-90° tilt
Video out	NTSC

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