

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:

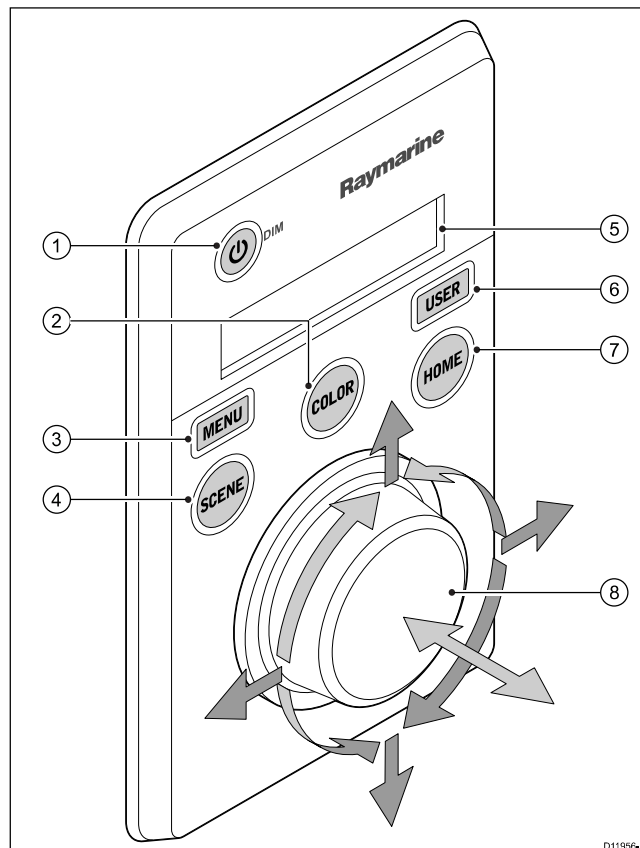
- Switch the camera between operational and standby modes.
- Pan and tilt
- Zoom
- Home position
- Pause the camera image
- Switch between visible light and thermal camera lenses. (Dual payload only)
- Surveillance mode

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 <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • Press once – display on–screen setup menu. • Press again – exit setup menu.
4	SCENE <ul style="list-style-type: none"> • 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). <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • Search Settings • Switch Thermal / VIS Video • Hide / Show All Icons • Reverse Video • Rearview Mode • Surveillance Mode • Point Mode

7	<p>HOME</p> <ul style="list-style-type: none"> • 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	<p>PUCK – Use the puck to control the camera and navigate the setup menus.</p> <p>Control camera:</p> <ul style="list-style-type: none"> • 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.) <p>Navigate setup menus:</p> <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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

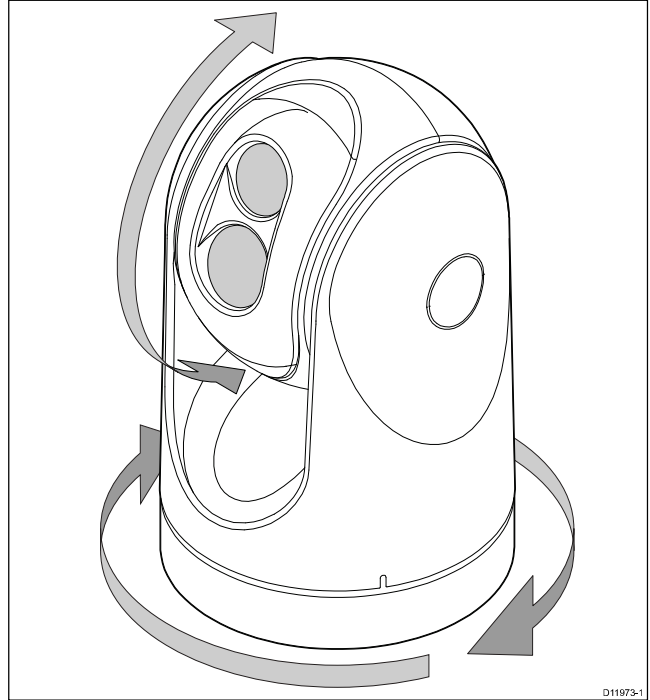
1. Press and hold the **Power** button on the JCU. The JCU LCD will countdown from 3 to 0, after which the power menu is displayed.
2. Use the JCU **Puck** to select the relevant power option.
3. Select **Cancel** to cancel the power menu.

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 360°.
- Tilt (elevate) to $\pm 90^\circ$ 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.

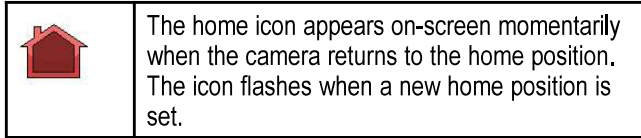
Continuous zoom

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.



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.

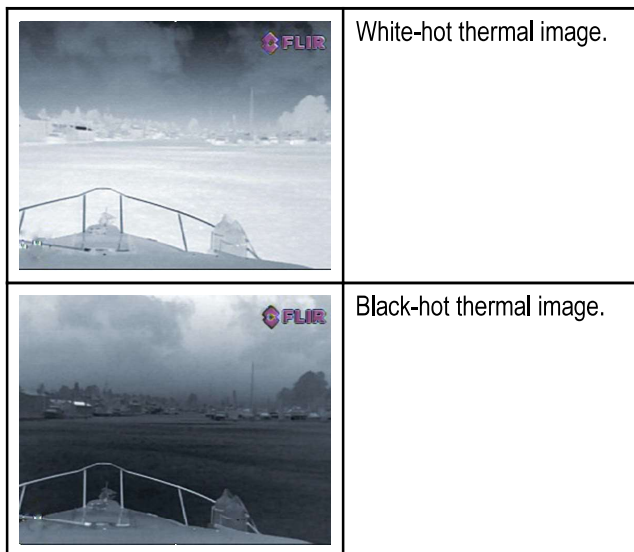
The factory default color mode is white, which may improve your night vision. This default mode can be changed if required using the camera's on-screen **Video Setup** menu.

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:



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

Reversing the video polarity

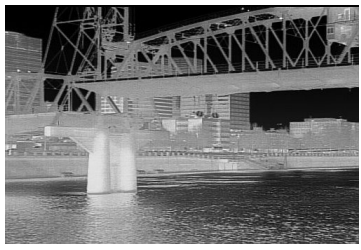

To reverse the polarity of the video image follow the steps below.

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.

	<p>Thermal camera — provides night-time imagery, based on temperature differences between objects. Thermal imaging produces a clear image even in total darkness.</p>
	<p>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.</p> <div style="border: 1px solid black; padding: 5px;"><p>Note: The T470SC and T473SC have a color camera and continuous zoom lens.</p></div>

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	Cancel 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: <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> 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). </div>
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. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> 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). </div>
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	<ul style="list-style-type: none"> High Power Mode ON High Torque Mode ON 	22 W	17.4 W
Standby	<ul style="list-style-type: none"> High Power Mode OFF High Torque Mode ON 	8 W	7.4 W
Standby	<ul style="list-style-type: none"> High Power Mode ON High Torque Mode OFF 	13 W	13 W
Awake	<ul style="list-style-type: none"> High Power Mode OFF High Torque Mode OFF 	8 W	7.4 W
Awake	<ul style="list-style-type: none"> High Power Mode ON or OFF High Torque Mode ON 	30 W	19.4 W
Awake	<ul style="list-style-type: none"> 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: <ul style="list-style-type: none">• Narrow — The camera will scan approximately 20° left and right of the center (40° total).• Medium — The camera will scan approximately 40° left and right of the center (80° total). Or,• Wide The camera will scan approximately 80° left and right of the center (160° total).
Scan Speed	This option determines the speed at which the camera pans left and right when in surveillance mode. Select between: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• 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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7.1 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.	<ul style="list-style-type: none"> • Check thermal camera video cables are sound and properly connected. • Ensure that the video is connected into video input 1 at the multifunction display or GVM. • Ensure that the correct video input is selected at the display.
	Problem with power supply to the camera or JCU (if used as the primary controller)	<ul style="list-style-type: none"> • Check the power connections to the camera and JCU / PoE injector (if used). • Ensure that the power switch / breaker is on. • Check the fuse / breaker state.
Cannot control thermal camera from Raymarine display or keyboard.	Thermal camera application is not running.	Ensure the thermal camera application is running on the multifunction display (as oppose to the video application which does not have camera controls).
Erratic or unresponsive controls.	Network problem.	Check that the controller and thermal camera are correctly connected to the network. (Note: This may be a direct connection or via a Raymarine network switch.)
		Check the status of the Raymarine network switch.
		Check that SeaTalk ^{hs} / RayNet cables are free from damage.
	Control conflict, e.g. caused by multiple users at different stations.	Ensure that no other controllers are in use at the same time.
Problem with the controller.	Check power / network cabling to the controller and PoE injector (PoE only used with optional Joystick Control Unit).	
	Check other controllers if available. If other controllers are operating this will eliminate the possibility of a more fundamental camera fault.	
Cannot switch between thermal and visible (VIS / IR) video image .	Camera is not a dual payload model.	Only “dual payload” (dual lens) thermal cameras support VIS / IR switching.
	VIS / IR cable not connected.	Ensure that the VIS / IR cable is connected from the camera to the Raymarine system. (The IR-only cable does not support switching).
Noisy image.	Poor quality or faulty video cable.	Ensure that the video cable is no longer than necessary. The longer the cable is (or the smaller the wire gauge / thickness), the more severe the losses become. Use only high quality shielded cable suitable for a marine environment.
	Cable is picking up electromagnetic interference (EMI) from another device.	<ul style="list-style-type: none"> • Ensure you are using a high quality shielded cable. • Ensure proper cable separation, for example do not run data and power cables in close proximity with each other.

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