M-Series

Operator's Manual

The M-Series thermal imaging system is controlled by US export laws. There are special versions of this system that are approved for international distribution and travel. Please contact FLIR Systems if you have any questions.

Document Number: 432-0003-00-10, Revision 150

Document History

Revision	Date	Comment
100	June 2009	Initial release
110	February 2010	Release of M-320L and M-324XP and minor changes
120	March 2010	Minor corrections and clarifications
130	December 2010	Release of M-625XP, M-324L, and M-625L Replacement of M-320L and M-626L
140	January 2011	Minor corrections
150	January 2012	Release of M-618CS Minor corrections and style changes

Contents

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M-Series Overview

This manual describes the operation of the M-Series camera. If you need help or have additional questions, please call to speak with our support experts; see the phone numbers listed on the back cover of this manual.

This manual includes information about the following topics:

- System description
- Using the joystick control unit (JCU)
- System startup and shutdown
- Configuring your M-Series camera
- Setting up the interface between your camera and a PC
- Helpful reference information such as acronyms, parts lists, and a table of icons, and a comparison of model features

Additional References

Your M-Series camera comes with a complete documentation set on a CD (FLIR Doc. # 432-0003-00-16) that includes this manual as well as others. All documents are in PDF format and can be viewed with Adobe Acrobat Reader:

• *M-Series Installation Guide* (FLIR Doc. # 432-0003-00-12) contains information about how to install the camera.

• *M-Series Quick Start Guide* (FLIR Doc. # 432-0003-00-11) is a double-sided card that shows the functions executed by the various JCU buttons.

• *M-Series Interface Control Document (ICD)* (FLIR Doc. # 432-0003-00) is an extensive set of CAD drawings with detailed component dimensions, wiring schemes, mounting dimensions, and several possible system configurations using more than one JCU.

You may also refer to the Resources Web page for up-to-date documentation:

http://www.flir.com/cvs/americas/en/maritime/resources/

Documentation Conventions

For safety, and to achieve the highest levels of performance from the M-Series system, always follow the warnings and cautions in this manual when handling and operating the M-Series camera system.

Warning: Warning notices are used to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury or death exist with this equipment, or may be associated with its use.

Caution: Caution notices are used where equipment might be damaged if care is not taken or an operation might have an unexpected outcome.

Note: Notes call attention to information that is especially significant to understanding and operating the equipment.

Warnings and Cautions

Warning: Do not use the M-Series imaging system as the primary navigation system. Use it in conjunction with other navigation aids and a primary manual navigation system.

Warning: Use of insufficient wire gauge can result in fire.

Caution: Do not open the M-Series camera unit for any reason. Disassembly of the camera (including removal of the cover) can cause permanent damage and will void the warranty.

Caution: Be careful not to leave fingerprints on the M-Series camera optics.

Caution: The M-Series requires a power supply of 12 – 24V DC nominal, 5 Amp maximum. Absolute voltage range: 10 – 32V DC. Operating the camera outside of the specified input voltage range or the specified operating temperature range can cause permanent damage.

Proper Disposal of Electrical and Electronic Equipment (EEE): The European Union (EU) has enacted Waste Electrical and Electronic Equipment Directive 2002/96/EC (WEEE), which aims to prevent EEE waste from arising, to encourage reuse, recycling, and recovery of EEE waste, and to promote environmental responsibility.

In accordance with these regulations, all EEE products labeled with the "crossed out wheeled bin" either on the product itself or in the product literature must not be disposed of in regular rubbish bins, mixed with regular household or other commercial waste, or by other regular municipal waste collection means. Instead, and in order to prevent possible harm to the environment or human health, all EEE products (including any cables that came with the product) should be responsibly discarded or recycled.

To identify a responsible disposal method where you live, please contact your local waste collection or recycling service, your original place of purchase or product supplier, or the responsible government authority in your area. Business users should contact their supplier or refer to their purchase contract.

System Description

Thermal Image at Night

M-Series is a maritime thermal imaging system for use on most types of vessels. The system is available in two configurations:

- The single payload models have a single thermal imaging camera.
- The dual payload models are equipped with both a thermal imaging camera and a visible-light (DLTV) camera, either low-light or color.

The infrared (IR) thermal camera provides night-time imagery, even in total darkness, based on temperature differences. The thermal camera provides a clear video image even under completely dark conditions because it is sensitive to thermal infrared energy. The infrared camera supports either 2X or both 2X and 4X zoom, depending on the model.

On dual payload models, the two integrated DLTV camera options provide either black and white imagery in low-light conditions or color imagery. The DLTV cameras provide enhanced navigational abilities in a variety of conditions, for example, during twilight hours or when operating along intercoastal waterways and near harbor entrances. The color camera dual payload model supports continuous zoom.

One M-Series model (indicated by an S suffix) includes a mechanical stabilization feature that improves image stability. The stabilization feature compensates for the motion of the vessel and improves the utility of the camera video output when operating in rough seas or swell conditions.

For a complete list of models and a comparison of key features, see "Feature Comparison of M-Series Models" on page 68. The differences in camera operation are noted in relevant locations in the manual.

The M-Series consists of two main components:

• The gimbal assembly, also known as the pan/tilt camera unit. A gimbal is a pivoted support that allows the rotation of an object such as a ship's compass about a single axis.

• The joystick control unit (JCU).

In this manual, the term *camera* may refer to the entire camera unit/gimbal assembly, or it may refer specifically to either the thermal camera or the visible camera, depending on the context in which it is used.

The M-Series gimbal and JCU are network devices. In some installations, additional cameras and JCUs will also be used, and networking equipment such as Power over Ethernet (PoE) switches may be used to interconnect these components.

M-Series Gimbal Assembly

The gimbal assembly has a pan/tilt mechanism that allows the camera to rotate continuously 360° in azimuth, and to tilt plus or minus 90° in elevation. The M-Series imaging sensors are contained in the ball of the gimbal assembly.

The thermal infrared camera uses an uncooled vanadium oxide (VOx) detector sensitive to long-wave infrared (LWIR) thermal energy. The camera is sensitive to the thermal energy that comes from the movement of atoms and molecules that make up whatever the camera is pointed at. All objects emit (or radiate) thermal energy, even cold objects like icebergs.

Video Options

The M-Series gimbal assembly has either one or two video cables:

• The cable labeled IR is for the composite—also known as analog—video signal from the thermal (infrared) camera. This is the only cable on single payload cameras.

• On dual payload models, the cable labeled VIS/IR is for video from either the thermal camera or the visible camera. You use the JCU to determine which output displays.

The video from dual payload models can be output on one or two video displays. If only a single display with a single video input is available, connect the cable labeled VIS/IR to the display. If the display has more than one video input, both

Ball

Side Cover

Bezel

Yoke

Base
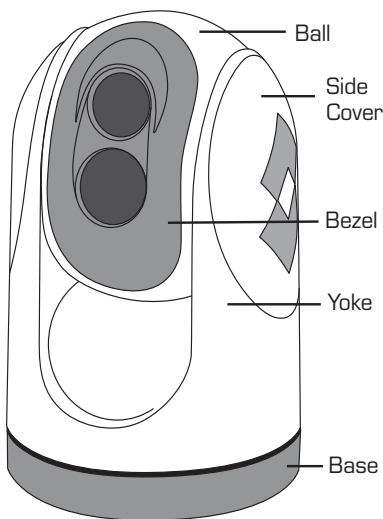
Gimbal Assembly
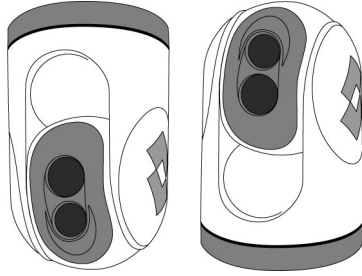
Upside down
(ball down)

Upright
(ball up)

video cables can be connected to the same display. In this type of installation, switching between the thermal and visible video channels is performed with the display controls, rather than the JCU.

Ball-Up and Ball-Down Installation

In most installations, the M-Series is mounted upright on top of a mounting surface, with the pan/tilt base below the camera; this is known as the ball-up orientation. Optionally, the unit can be hung upside down or ball down. When installed ball down, you must configure the camera in the ball-down mode, so the video is properly displayed and the pan/tilt controls operate as expected (see page 38 for details on configuring this setting).

Unless otherwise noted, this manual assumes an upright installation.

Warning: The M-618CS model, which is a mechanically stabilized system, must be installed in the ball-up orientation.

Joystick Control Unit (JCU)

The JCU is your primary method of controlling the camera. The JCU is used to power up the camera or put it in a standby state, to operate the pan (rotation) and tilt movement of the camera, to zoom the IR camera (and on the M-618CS model, the color visible camera), and to configure the camera settings by means of on-screen menus. The JCU connects to the camera using an Ethernet network connection, and that same connection provides power to the JCU.

The JCU has various buttons, an LCD display, and a joystick puck that is used to control the pan/tilt movement and to navigate through the on-screen menus. The puck can be rotated in either direction, moved left and right or forward and back, and pushed in (like a button) and pulled up. Chapter 2, "M-Series Joystick Control Unit," on page 15 describes the features of the JCU in detail.

Joystick Control Unit

The M-Series uses on-screen symbols to indicate the camera position (azimuth) and various system settings that have been enabled. These symbols are introduced in "Video Display" on page 10 and are further explained throughout this manual in the discussion of related functions.

Multiple Cameras, JCUs, and Other Devices

In some installations, the system may include additional components, such as additional cameras or JCUs, video equipment, or network equipment. More than one JCU can be used to control the camera, and more than one display can be used to view the video. If you have a PC on the same network as the camera and JCU, you can use the PC to control and configure the system, the same as you would with the JCU. Using PCs is described in Chapter 5, "M-Series IP Interface and PC Operations," on page 51.

Also a single JCU can be used to control more than one camera. In this case, you select which camera to control through a menu on the JCU. In the LCD display of the JCU, the name of the currently selected camera is displayed. When more than

one JCU is installed in the system, a camera can respond to commands from any JCU that is in the system.

Typically, the JCU and the video monitor are mounted in close physical proximity, as a pair, so you can immediately see the changes on the video screen when you use the JCU to change the camera position (pan or tilt).

In a simple installation, the JCU can be directly connected to the camera with the supplied double-shielded Ethernet cable. In this case, the JCU draws its power from the camera. In more complex installations, the camera and JCU can be interconnected using a network switch. If the network switch does not have Power over Ethernet (PoE) capability, a PoE injector can be used to provide power to the JCU. FLIR PoE injectors are available from your FLIR authorized dealer or integrator.

Contact FLIR for more information regarding available accessories including JCUs, PoE equipment, video distribution amplifiers, cables, connectors, mounting hardware, and so on. Contact information is listed on the back of this manual.

Video Display

The M-Series thermal imager does not produce images from visible light like an ordinary camera does or like the human eye does. Rather, it uses energy contained in the infrared band to produce images by sensing subtle differences in temperature and generating images based on those differences.

Thermal Imaging

The thermal imaging camera relies on the fact that all objects, even very cold objects like ice, emit thermal energy in the portion of the infrared spectrum that this camera can see, the long wave infrared (LWIR). Therefore, unlike an illuminated infrared camera, the thermal imaging camera does not need an additional active illumination source and images are based on directly radiated rather than reflected energy.
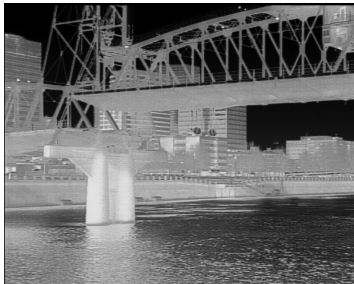
When the thermal camera is in white-hot mode, the warm objects in the scene display as white, or lighter shades of gray, and cold objects display as black or darker shades of gray. When you switch the video polarity, this is reversed.

This is why you will see hot objects such as parts on an outboard motor that appear white (or black, or red depending on the video image mode selected), while the puddles of water and other cold objects appear dark (or cool). Scenes with familiar objects will be easy to interpret with some experience. The camera automatically optimizes the image to provide you with the best contrast in most conditions.

FLIR Systems, Inc. offers a comprehensive selection of training courses to help you to get the best performance and value from your thermal imaging camera. You can find out more at the FLIR training Web page:

http://www.flir.com/training

Video Screen Icons

Depending on the camera settings and the JCU buttons that have been pressed, various symbols display on the screen. Some of these icons always display on the screen, and some appear momentarily or only when certain functions are enabled or executed.

Note: The icons and on-screen menus only display on the thermal image. Also some icons only display on the model that has the stabilization feature.

The display of icons can be modified using several configuration settings. See "Set Symbology" on page 35 for a description of menu options relation to symbol display.

The following image of a screen illustrates some of the possible icons displayed by the system, as well as an example of the on-screen menu that displays when you press the MENU button. Using the menus is described in Chapter 4, "M-Series System Configuration," on page 31.

If you are using the camera model that supports mechanical stabilization, your screen will look a little different. See "Video Screen Icons with Mechanical Stabilization" on page 45 for details.

A complete list of all of the icons used in the system and a brief description of how they are used can be found in "List of Icons" on page 65.
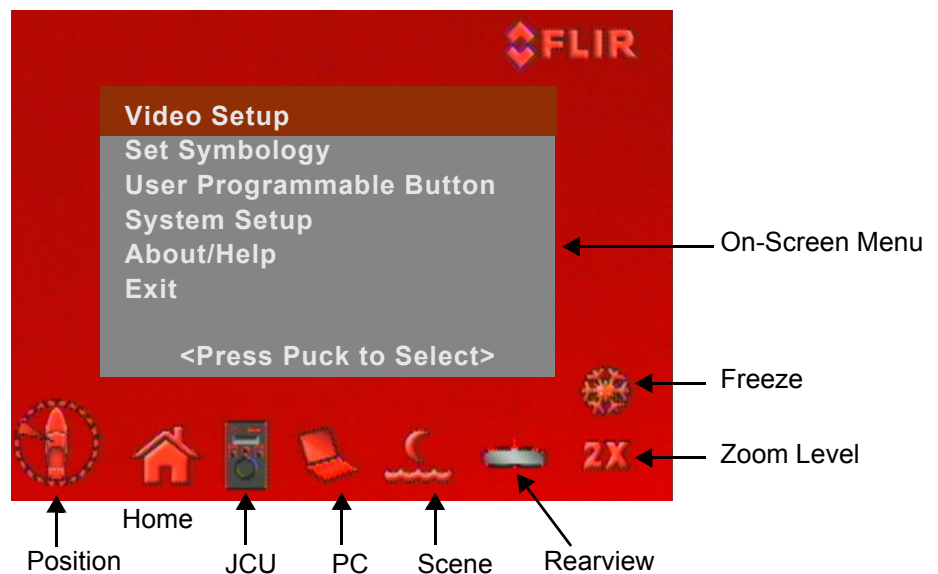
On-Screen Menu

The on-screen menu appears when the MENU button is pressed. Menu entries are selected using the joystick puck. Pressing the MENU button again removes the menu from the screen.

Position Icon

The position indication shows the azimuth (direction) of the camera relative to the vessel. The shaded triangle shows the approximate camera field of view (FOV).

JCU Icon

A single JCU icon indicates only one JCU is connected to the camera unit. If more than one JCU is discovered, the multiple JCU icon appears.

PC Icon

The PC icon indicates that a PC on the network has a connection with the camera. When you have integrated a PC into your network, you can manage the camera settings from a page that displays in a Web browser, rather than using the JCU. In some situations, this may be a more convenient way of controlling the camera. Using this page is described in Chapter 5, "M-Series IP Interface and PC Operations," on page 51.

SCENE Icons

Pressing the SCENE button cycles through four preset automatic gain control (AGC) settings, which change the image gain and level settings. Regardless of the scene setting, the thermal camera automatically adjusts to the scene to provide a balanced, high-quality image. However, you may prefer an image that has more or less contrast than the default one provided, and the SCENE button provides that type of fine adjustment.

Night Running   Night Docking

Day Running   Man Overboard

Which setting you use depends on personal preference and environmental conditions; you may like the way the Man Overboard setting looks, even though you are running on open water during the daytime.

Rearview Icon

The rearview icon indicates the rearview mode option has been selected in the System Settings menu. The rearview setting flips the video image horizontally left to right. The image on the display provides the same perspective as a rear view mirror in a vehicle; objects off the stern on the starboard side of the vessel are displayed on the right hand side of the video. See page 40 for details on configuring this setting.

Home Icon

The home icon appears momentarily to indicate the camera is in the home position. The icon flashes when a new home position is set.

2X   4X

Zoom (2X or 4X)

Pressing and holding the puck causes the thermal camera to digitally zoom in to 2X magnification. On the M-6x models, pressing and holding again causes the thermal camera to digitally zoom in to 4x magnification (the M-3x models do not support this). Pull and hold the puck to zoom out the thermal camera.

On the M-618CS model only, the color daylight camera zooms correspondingly with the changes to the thermal camera.

Image Frozen

The image frozen icon appears when the puck has been double clicked (pressed two times in quick succession), which momentarily stops the video. Pressing any button or moving the puck switches back to live video.

This feature is available on the thermal camera in all models, and is available on the DLTV camera in the M-618CS model. It is not available on the DLTV camera in other models.

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M-Series Joystick Control Unit
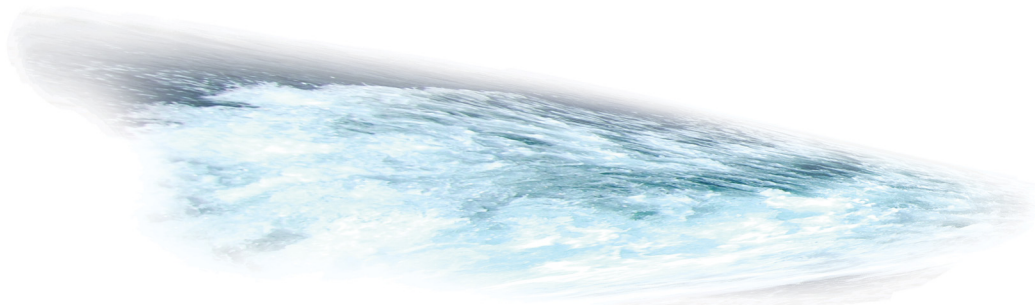
JCU Introduction

The JCU is the primary method of controlling the M-Series camera. You use it to move the camera (pan or tilt), electronically zoom the camera, switch between infrared and visible-light cameras, adjust the image settings, and access the on-screen menus.

This chapter describes how to use the JCU buttons to operate the camera features. Some of these features vary depending on the specific way your system has been configured. The various configuration settings and how they affect operation are all discussed in Chapter 4, "M-Series System Configuration," on page 31. When specific settings affect a particular button, you can refer to that chapter for additional details.

JCU Buttons

All of the buttons on the JCU perform multiple functions. In most cases, each performs one function when it is pressed briefly (short press) and a different function when it is pressed and held (long press). This flexibility enables a simple device to support a set of complex, rich features.

In the following discussion, the short press action is described first, followed by the long press. In addition, enabling some system features can affect how the buttons work. Table 2.1 on page 19 summarizes the two actions for each button.

Power/DIM Button

Short Press

A short press of the Power/DIM button cycles through the four levels of brightness for the JCU display. The JCU controls are backlit to make them easier to see at night. Use this button to adjust the brightness of the JCU backlighting for your comfort.

Long Press

Pressing and holding the Power/DIM button is used to "wake up" the camera, causing it to go from standby mode to powered on. It is also used to put the camera back in standby mode as well as complete other system functions such as calibrating the JCU and associating the JCU with a camera. These functions are described in more detail on page 23.

MENU Button

In many cases, you will not need to modify the factory default configuration settings of your system. However, the system gives you many options that you may want to tailor to your own needs. These settings are available through on-screen menus. Use the MENU button to turn these menus on or off.

Note: The MENU button does not have a press and hold action.

When the on-screen menu is displayed, use the joystick puck to navigate through the menus and select various menu entries. Each menu item is discussed in detail in Chapter 4, "M-Series System Configuration," on page 31, which explains how to navigate using the menus in more detail.

USER Button

The USER button is a programmable one-touch button that lets you quickly access the most common or favorite settings or functions. You configure the short-press action of this button from the User Programmable Button menu entry (see page 36).

Short Press

A short press of the USER button is initially configured to invert the video polarity setting from white-hot to black-hot. You can choose from a number of other options.

Long Press

Pressing and holding the USER button displays the on-screen menu for programming the button. The menu can also be accessed by pressing the MENU button and then scrolling down to the User Programmable Button entry.

SCENE Button

Short Press

A short press of the SCENE button cycles through four preset automatic gain control (AGC) settings, which change the image gain and level settings:

• Night Running

• Night Docking

• Day Running

• Man Overboard

Night Running   Night Docking

Day Running   Man Overboard

The M-Series automatically adjusts to changing scene conditions to provide a high-contrast image that is optimized for most conditions. The preset AGC settings for each scene have been optimized to offer the most balance and high quality image for specific conditions. Which setting to use depends on personal preference and environmental conditions.

You may like the way the Night Docking setting looks, even though you are running on open water during the daytime. Experiment with the different settings, and find out for yourself which settings works best in different conditions.

Long Press

On dual payload models, pressing and holding the SCENE button switches between the thermal and visible-light cameras for the video signal on the VIS/IR cable.

COLOR Button

Short Press

Pressing the COLOR button switches the thermal camera video display. The way the button works depends on the setting of Enable (Disable) Color Thermal Video (see page 34).

- When Color Thermal Video is disabled, pressing the COLOR button lets you choose between white/black or red/black display options.

- When Color Thermal Video is enabled, pressing the COLOR button cycles through five preset color palettes.

The default color scheme is red/black since the equipment is often used at night in the darkness and the red-hot image can help preserve the user's night vision. Based on personal preferences, one of the other color settings (or color palettes) may be chosen as a default.

Note: The USER button is configured to invert the video polarity setting by default, so it changes the infrared imagery from white-hot (red-hot) to black-hot.

Long Press

Press and hold the COLOR button to calibrate the thermal cameras, also called flat field correction. This process can improve the quality of the thermal image by recalibrating a more uniform output.

HOME Button

Short Press

A short press of the HOME button moves the camera to its home position. The home position is a programmable preset position—by default, straight ahead and level with the horizon—that operators can use as a reference. Home is the position the camera will most likely be in when it is in use.

Long Press

Pressing and holding the HOME button sets the home position. First use the puck to point the camera's line of sight to the position you want to set as home. Press and hold the HOME button for 3 seconds; the home symbol will flash on the screen when the new home position is set. When you want to move the camera to this position, press and release the HOME button. When you press the HOME button, the home icon appears on the screen briefly.

The home position is not the same as the stow position. The home position is the position the camera will most likely be in when it is in use. The stow position is the preferred position when the camera is not in use, for protecting the camera optics. Both positions are programmable by the use—the home position through the HOME button and the stow position using the on-screen menus.

Special Button Functions

You can use combinations of buttons to perform a few additional less common functions.

JCU Reset

Occasionally it may be necessary to reset the JCU. Simultaneously pressing and holding the MENU and USER buttons causes the JCU to reset. Unplugging and plugging the Ethernet cable will also cause the JCU to lose power temporarily and reset. When it resets, it will reacquire a network IP address and display connection progress messages on the display.

Camera Reset

Severe vibrations or shock may cause the camera gimbal assembly to rotate or tilt and cause the pan position indicator to be inaccurate. To reset the camera and cause the gimbal assembly to go through its initial pan/tilt cycle, repeatedly press the HOME button 4 times.

Note: The High Power Standby and High Motor Torque settings can be enabled to provide the camera with a better ability to withstand shock and vibration at high rates of speed or in high seas (see page 39 for details).

Global Standby

When the system is put into global standby, all cameras and JCUs found on the network are placed in standby mode at the same time. This function is used to properly shut down all cameras (return to stow position) and JCUs prior to removing power with the system breaker.

While this option can be selected from the JCU Power Menu, you can also achieve global standby by pressing and holding the SCENE, COLOR, and HOME buttons in unison.

Note: The JCU does not go into a countdown mode or display the Power Menu. The system immediately goes into global standby mode.

Display JCU IP Address

If you press the COLOR button while pushing the puck, the IP address of the JCU displays on the JCU screen.

Button Summary

Table 2.1 summarizes the action of each button on the JCU.

TABLE 2.1 **Summary of Button Actions**

Button	Action
COLOR Short	Cycle through thermal color options
COLOR Long	Calibrate thermal camera

TABLE 2.1 **Summary of Button Actions**

Button	Action
DIM Short	Change JCU illumination level
DIM Long	Display JCU Power Menu
HOME Short	Return to Home position
HOME Long	Set Home value
MENU Short	Display or exit menus
MENU Long	No Effect
SCENE Short	Cycle through four preset scenes
SCENE Long	Alternate visible and thermal camera output (dual payload only)
USER Short	Invert Video Polarity (can be reprogrammed)
USER Long	Display User Programmable Button menu entry
MENU + USER	Reset the JCU
HOME 4X	Reset the camera
SCENE + COLOR + HOME	Initiate global standby
COLOR + Puck	Display JCU IP address

JCU Puck

The JCU puck functions like a joystick and can be moved left or right, forward and back, and rotated in either direction. It can also be pushed in (like a mouse click) or pulled out. The puck movement is translated to control the pan/tilt position of the camera, zoom in and out, and freeze the video.

In addition to controlling the camera, you use the puck to navigate through the on-screen menus and select the options you want. Push the puck forward and back to move up and down in the menus and push the puck in (click) to select a menu item.

You can configure how you interact with the puck using two settings that affect how the system interprets puck movement. Many operators will prefer the way the system initially works, but you should be aware that the behavior of the puck can be modified through the system settings, letting you choose the mode that feels most natural to you. See "Enable (Disable) Aircraft Joystick Mode" on page 38 and "Enable (Disable) Twist-to-Pan Mode" on page 38 for details about these settings.

Note: The puck implements proportional control; therefore, the farther you rotate it or direct it from center, the faster the camera will move.

Tilting the Camera

You can use the puck to tilt the camera up and down by moving the puck forward and backward. By default, moving the puck forward causes the camera to tilt up. Moving the puck back causes the camera to tilt down. This is similar to the way the joystick for video games works.

You can change this so that the puck functions like the joystick used in an aircraft. In this case, the opposite happens: moving the joystick forward causes the camera to tilt down. Moving the puck back causes the camera to tilt up.

Panning the Camera

You also use the puck to pan the camera to the left and right. By default, turn the puck clockwise and the gimbal will pivot to the right. Rotate (twist) the puck counterclockwise and the M-Series will pivot left.

You can change this so that panning is done by moving the puck sideways left (pan left) or right (pan right).

Zooming the Camera

2X   4X

By default, push the puck in and hold it 1 second to turn on 2X electronic zoom on the IR camera. Push and hold for 2 seconds for 4X zoom (M-6x models only). Pull up on the puck to return to 2X zoom and pull again to return to no zoom. The screen icon changes to indicate the settings.

You can change this so that you zoom in by twisting the puck clockwise (zoom in) or counterclockwise (zoom out).

Zoom applies only to the thermal camera in all M-Series models except the M-618CS model, which has a continuous zoom visible color camera. The visible camera will zoom to the same magnification as the IR camera.However, when you are viewing visible output, you can continue to zoom to a preset limit.
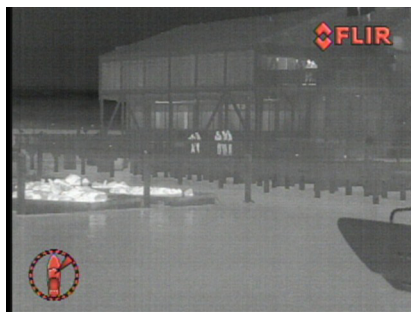
Normal View	2X Zoom	4X Zoom

Freezing an Image

To momentarily pause the IR video and freeze the current image on the screen, double-click the puck (press it in twice quickly). The freeze icon displays. Any other action with the JCU (moving the puck or pushing a button) will unfreeze the image.

This feature is also available on the DLTV camera in the M-618CS model. It is not available on the DLTV camera in other models.

JCU Display

The JCU display area generally shows the ID of the camera that the JCU is connected to. It also shows various JCU status messages, and it shows the countdown (`3, 2, 1, 0`) to access the Power Menu when the power button is pressed and held. The Power Menu displays on the LCD so you can choose various standby modes.

See "JCU Power Menu" on page 26 for details about using this menu.
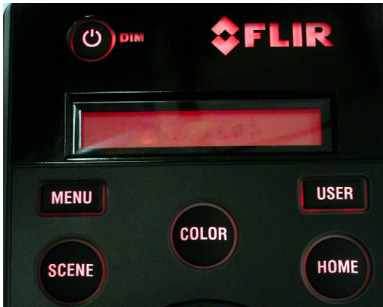
JCU powered on with backlit display and buttons

CHAPTER 3 # M-Series System Startup
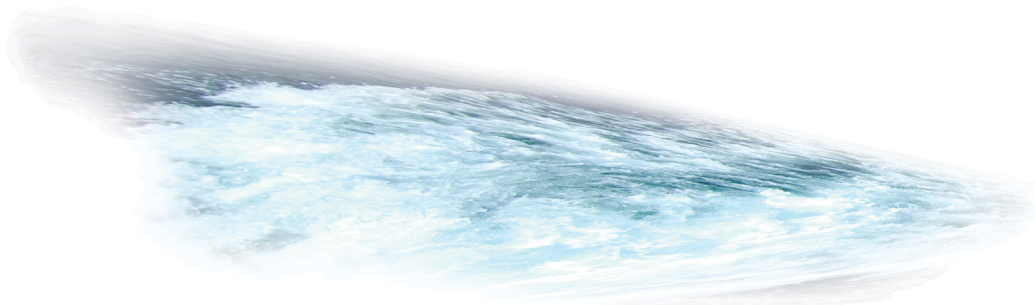
System Startup and Shutdown

The M-Series camera does not have an on/off switch. Instead, its power state is controlled by the JCU (or a PC, if you choose to set up that interface). Generally, the camera is never completely off but in a standby state waiting for a "wake" command from the JCU.

Typically, the M-Series system is connected to its power source through a circuit breaker, which functions as the primary on/off switch for the system. Should it be necessary for some reason to completely shut down the system, the circuit breaker is used. In normal operation, however, the camera will have power and will be in one of three states or modes:

• Bootup, or powering on

• Powered on, or fully functional

• Standby, a low-power state waiting for a wake command

The Bootup Process

The bootup process is slightly different depending on whether the system had been completely turned off or is being wakened from a standby state. Most of what happens, however, is the same.

If you are starting from a full shutdown, make sure your monitor is turned on. Then power on the system. When power from the circuit breaker is initially applied to the system, the camera will perform a short pan/tilt initialization by rotating back and forth and tilting up and down and then begin a bootup sequence.

When the JCU receives power, an amber light on the Power/DIM button will come on. When the Power/DIM button is pressed, the JCU will search for M-Series cameras on the network.

Troubleshooting Tip: If the JCU does not have power, it may be connected to a Power over Ethernet (PoE) switch that has not been powered on, or it may be connected to a network switch that does not provide PoE power.

During bootup, a series of screens displays as various components are activated. How the screen looks will vary depending on the particular configuration settings of your installation. In general, the following sequence occurs:

1. Two FLIR splash screens display.

   Initially the screen at the left appears. Then another splash screen with two important notices appears.

2. The screen then clears and a message displays:

   Loading, please wait

3. The screen clears and displays live video using default colors and icons. A dual payload model initially displays the IR video on both channels. Then the IR/VIS video channel switches to the visible camera if the visible camera was active when the camera was last powered down or placed in standby mode.

4. If a JCU or PC is not connected to the camera, it will immediately go into standby mode and the camera assembly will move to the stowed position.

Pressing and holding the JCU Power/DIM button or clicking and holding the Active link on the PC Web control page will activate the camera.

Starting, then Searching.. displays on the JCU LCD screen. When the last-used camera is found, the message changes to Connecting..., which continues to flash until the connection process completes.

⚠️ **Important**: Fully establishing a connection may take up to a minute. Please be patient while the system verifies each component.

If this is the very first time the JCU has been used to connect to the camera, you must first associate the JCU with the camera. See "Assign JCU" on page 27 for how to do this. You can also use the Assign function to choose a different camera when using a single JCU to control multiple cameras. By default the JCU always connects to the last-used camera.

Troubleshooting Tip: if the JCU does not discover a camera, check to make sure the JCU and the camera are connected to each other over the network or directly with a single cable.

When the camera is fully connected, the `Connecting...` message on the JCU display is replaced by the camera name such as `M-618L A01234`. This information blinks briefly to indicate the connection is final, and then remains on the screen to indicate an active camera/JCU connection. The camera will now respond to the JCU buttons and puck movements.

The camera initially boots up in red-hot mode by default, unless you have changed the color default using the system settings (see page 33). This is because many users activate the system when little or no light is available, and the red-hot mode helps to preserve night vision. If the white-hot display mode is preferred, simply press the COLOR button on the JCU.
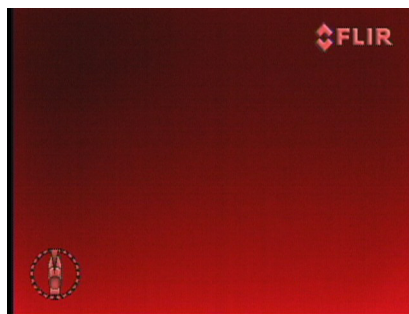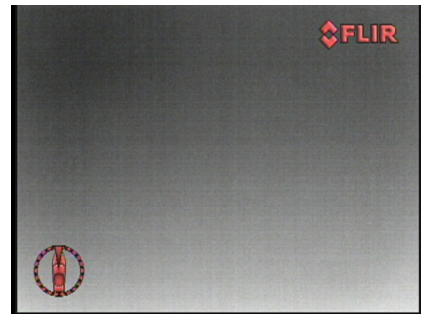
Red-Hot Mode   White-Hot Mode

Standby Mode

After the bootup sequence, the camera is ready to use. When you are done with the camera or want to conserve energy, you can put the camera in standby mode. You can optionally put only the camera in standby, put only the JCU in standby, or put the entire system in standby.

When the camera is in standby mode, the pan/tilt motors can be configured to remain engaged to hold the camera in place in rough seas. An alternative low-power configuration can disable the pan/tilt motors, further lowering the low-

power mode power consumption. In either case, the camera does not generate a live video signal. The camera will only respond to a wake command when you press and hold the Power/DIM button on the JCU or, if you are using a PC to control the camera, when you click the Active link.

While in standby mode, the camera is in the stowed position—by default, pointing straight down—to protect the camera optics. The stow position can be configured with the on-screen configuration menus (see page 40).

To initiate standby, press and hold the Power/DIM button. A brief countdown (`3, 2, 1, 0`) displays on the JCU screen and then `Power Menu` displays. The various options on the menu are described in more detail in the following section. When `Camera`, `System`, or `Global Stndby` is selected, the LCD displays `Goodbye`, the camera moves to the stowed position, and goes into standby state.

You can also press and hold SCENE, COLOR, and HOME buttons at the same time to go directly to global standby. In this case, you are not prompted to choose from the Power Menu before the camera enters standby.

If the camera will not be used for an extended period of time and you want to conserve power, first power down the camera from the JCU as described here so that the camera is in the stowed position. Then switch the system circuit breaker to the off position. When the circuit breaker is switched on, the camera will go through the bootup sequence again, as described previously.

JCU Power Menu

The JCU is more sophisticated than many joystick devices; in fact it has its own microprocessor and is capable of communicating with other IP devices on a network. To aid in the control of the system, the JCU has an LCD display that shows JCU messages, menu options, and general status information. The various JCU functions are accessed from a set of menus, with each menu entry selectable in the JCU display.

When the camera is powered on, pressing and holding the Power/DIM button causes the JCU to display the Power Menu. Use the JCU puck to scroll up and down within the menus (push forward and back or twist), and select an entry by pushing in (clicking) the puck or pushing it to the right or left. When the JCU is in the Power Menu mode, the other JCU buttons such as HOME, COLOR, SCENE, and USER are disabled.

In the JCU display, a down arrow (v) indicates you can access additional menu choices by moving the puck down or by rotating the puck clockwise. An up arrow (^) indicates the last menu entry is displayed, and the other choices must be accessed by moving the puck up or by rotating the puck counterclockwise. A double arrow indicates you can move up or down in the menu.

The Power Menu displays the following menu options:

```
Power Menu
Assign JCU
JCU Stndby?
Camera Stndby?
System Stndby?
Global Stndby?
Calibrate JCU
Cancel
```

Power Menu

`Power Menu` displays when you enter the menu. Use the puck to scroll down through the other menu options. To exit the Power Menu, scroll down to the Cancel entry and push the puck.

Assign JCU

Use the `Assign JCU` function to assign a JCU to a camera. When the Assign JCU entry is selected, the display prompts the user with `v Select Camera`. This indicates you can scroll down with the puck to select a camera to control. When the ID of the camera you want to use displays, press the puck to select it. The camera ID will blink momentarily to indicate it has been selected.

JCU Stndby?

When the `JCU Stndby?` option is selected, the display momentarily shows `Goodbye` and then the backlit controls and the display are turned off. The JCU buttons and puck will no longer control the camera. The Power/DIM button remains backlit as long as power is supplied to the JCU. To power up the JCU again, press and hold the Power/DIM button.

Camera Stndby?

When the `Camera Stndby?` option is selected, the camera will move to the stow position and go into the standby state. By default, the stow position is head rotated down but this can be configured with the menus (see page 40).

The JCU display will prompt the user to select a camera to control, in case you want to switch to a different camera. If you select the same camera, it will return to the powered on mode.

System Stndby?

When the `System Stndby?` option is selected, both the JCU and camera associated with it placed in standby mode.

Global Stndby?

When `Global Stndby?` is selected, all discovered cameras and JCUs found on the network are placed in standby mode. This function is used to properly shut down all cameras (return to stow position) and JCUs prior to removing power with the system breaker.

Note: `Global Stndby?` displays as an option only when multiple JCUs or cameras are found on the system.

Global standby can also be achieved by pressing and holding the SCENE, COLOR, and HOME buttons in unison.

Calibrate JCU

`Calibrate JCU` is used to standardize the movements of the JCU puck. This function might be used, for example, if the camera responds at a different rate when the puck is pushed left rather than right, or when the puck is twisted in one direction compared to the other. The JCU display directs the user to move and twist the puck in certain ways so the device can be calibrated.

After entering calibration mode, you will be instructed to move the puck to the maximum extent possible in each direction separately. After that has been done, pressing the puck moves to the next step. For example, `Rotate CW/CCW` requires rotating the puck clockwise to the full extent possible, and then rotating counter clockwise to the full extent possible. When both directions are completed, press the puck to continue.

Cancel

The `Cancel` option causes the JCU to exit the Power Menu and return to its normal state.

Factory Default Settings

Table 3.1 shows the factory default settings for the M-Series configuration options and the JCU buttons. Chapter 4, "M-Series System Configuration," on page 31 describes how to modify and update settings.

TABLE 3.1 Factory Default Settings

Option	Factory Default Setting
Aircraft Joystick	Disabled
Ball-Down Installation	Disabled (not available on M-618CS model cameras)
Camera Name	Model number followed by serial number (for example, M-618CS JD-0123)
Color Thermal Video	Enabled

TABLE 3.1 Factory Default Settings

Option	Factory Default Setting
High Motor Torque	Enabled
High Power Standby	Enabled
Home Position	0° azimuth, 0° elevation
Icon Display Mode	Display Minimal
Network Configuration	Dynamic
Point Mode*	Disabled
Rearview Mode	Disabled
Scan Width	Wide
Scan Speed	Slow
SCENE Button	Night Running
Stabilization Mode*	Enabled
Stow Position	0° azimuth, -90° elevation
Thermal Color Default	Red
Twist-to-Pan Mode	Enabled
USER button (short press)	Invert Video Polarity
Video Polarity	Red Hot, Black Cold
VIS/IR video signal (dual payload models only)	IR (Thermal)

* Point Mode and Stabilization Mode apply only to the model that supports the stabilization feature.

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M-Series System Configuration
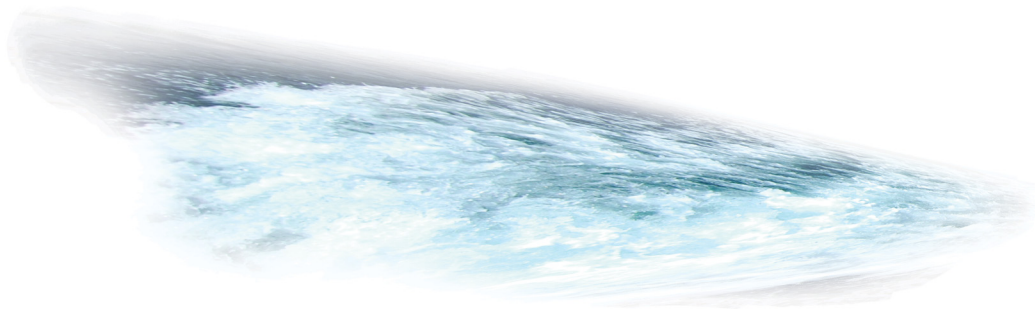
Overview

This chapter describes how to configure the system options using on-screen menus. To operate the M-Series camera does not require modifying any of the factory configuration settings. However, the on-screen menus let you:

- Choose configuration options that match your personal preferences or provide optimal performance under varying conditions, such as a default color scheme.

- Enable or disable specialized features such as using the camera in surveillance mode.

Some settings can be saved and, therefore, are preserved in the case of loss of power, and some settings will be configured as needed.

Some configuration settings are changed directly by pressing a button on the JCU. These are described in "JCU Buttons" on page 15. The way some of the buttons work can be modified using on-screen menus, described in this chapter.

The on-screen menus only appear on the thermal camera video. They do not appear on the video from the visible camera. If the display is currently visible and you press the MENU button, the camera switches to IR so the menu can display.

One of the specialized features that can be enabled or disabled with the on-screen menus is mechanical stabilization. This feature is only supported on one model (M-618CS). The menus for these options are described in "Mechanical Stabilization Feature" on page 45.

Main Menu

MENU

Use the MENU button to turn the on-screen menu on or off. When the on-screen menu is displayed, the joystick puck can be used to navigate through the menus and select various menu entries.

When the MENU button is pushed, the main menu displays. (This menu is slightly different when you are using a camera with stabilization; see page 46.)
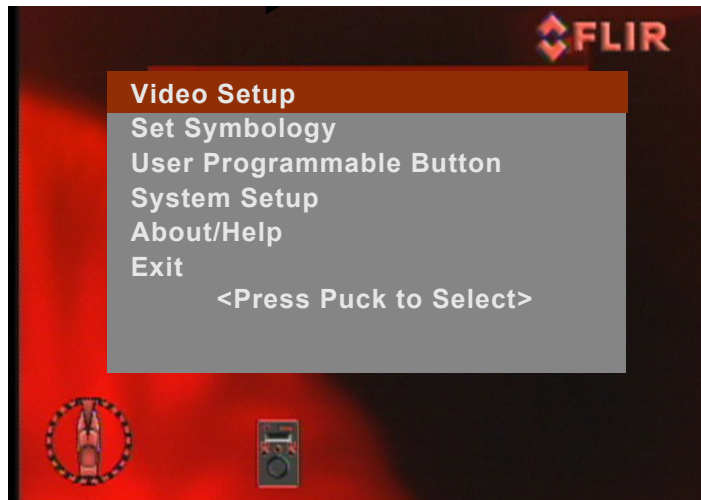
The current menu selection is indicated by the dark red bar. If a default choice is available, it displays in boldface type.

If a menu entry begins with the word Enable—for example Enable Point Mode—then that option is currently disabled. When it is selected, the option becomes enabled and the word Enable changes to Disable. Similarly, if an option begins with Disable, selecting that menu entry will disable the option and change the menu entry back to Enable.

To navigate the menus, use the puck to move the cursor up and down from one selection to the next (the puck can be moved forward and back, or it can be rotated). To make a selection, push the puck in (like a mouse click) or move the puck to the right or left. Once you are satisfied with your changes, press the MENU button to exit the menus.

Video Setup

When you select Video Setup from the main menu, the following on-screen menu displays.

> **Set Thermal Color Default**
> **Set Video Polarity**
> **Disable Color Thermal Video**
> **Display Test Pattern**
> **Exit**
>   **<Press Puck to Select>**
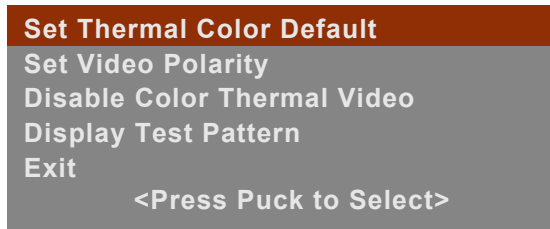
Set Thermal Color Default

Set Thermal Color Default saves the current color and polarity settings as the default value used when the system is booted up. When this menu entry is selected, the menu entry changes to "Thermal Color Default Saved" until Exit is selected.

Set Video Polarity

Selecting this item switches the colors representing hot and cold in the infrared imagery. Unless you set the thermal color default, this setting reverts to the factory default when the system is rebooted.

- Black-Hot polarity: darker colors represent hotter objects (the factory default).

- White-Hot polarity: lighter colors represent hotter objects.

The difference between white-hot and black-hot is shown below using a grayscale color palette; white-hot is on the left and black-hot on the right. The use of white-hot or black-hot display mode is strictly a personal preference; experiment with the different settings in different conditions and see which is preferred.
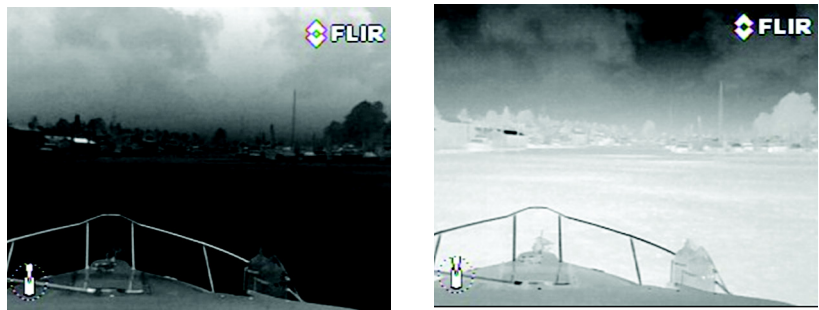
If Color Thermal Video is enabled, you have additional color choices. Inverting the polarity reverses the color map of the thermal output.

Note: By default, the USER button is configured to invert the video polarity. However, the function of the USER button can be changed from the factory default setting to do other functions. Refer to "User Programmable Button" on page 36 for more information about how to program the USER button.

Enable (Disable) Color Thermal Video

Many people prefer to look at thermal images in color instead of grayscale. When this menu item is enabled, the camera can use one of five color palettes, instead of just two settings. The palette to use can be changed by pressing the JCU COLOR button. See "COLOR Button" on page 18 for details.

Disable Color Thermal Video: Day and night (white/black or red/black) display as you press the JCU COLOR button. This is the factory default setting.

Enable Color Thermal Video: Five palettes display as you repeatedly press the JCU COLOR button: grayscale, red, glowbow, rainbow, and fusion.

You can set your own default with the Set Thermal Color Default option for the system to use the next time it is started.

This setting is used in combination with the Video Polarity setting. Inverting the color palettes doubles the possible ways of showing the same image on the display.

Display Test Pattern

Quite often the video from the M-Series camera can be optimized by adjusting the monitor that is being used to show the video. The Display Test Pattern function is useful for setting up the monitor to give the best detail and contrast.

When you select the Display Test Pattern entry, the Toggle Test Pattern menu displays, and you are prompted to press the puck to select a test pattern. Pressing the puck repeatedly cycles through the four test patterns.

When a test pattern is displayed, the monitor brightness and contrast can be adjusted to give the best image
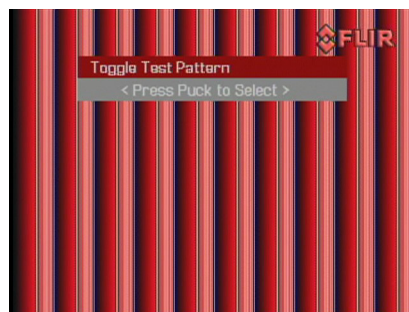
Set Symbology

When you select Set Symbology from the main menu, the following on-screen menu displays.

```
Disable PC Icon
Disable JCU Icon
Display All Icons
Display Minimal Icons
Hide All Icons
Exit
          <Press Puck to Select>
```

Disable (Enable) PC Icon and JCU Icon

The display of the PC icon and the JCU icons can be enabled or disabled using the first two menu entries. The other icons on the screen are controlled by selecting one of the three settings shown on the menu: Display All Icons, Display Minimal Icons, and Hide All Icons. The default setting is Display Minimal Icons.

The JCU Icon setting affects both the single JCU and multiple JCU icons that display based on the number of JCUs connected to the camera.

The PC icon only appears if the system has discovered a PC on the network.This happens only when you have completed the setup described in Chapter 5, "M-Series IP Interface and PC Operations," on page 51.
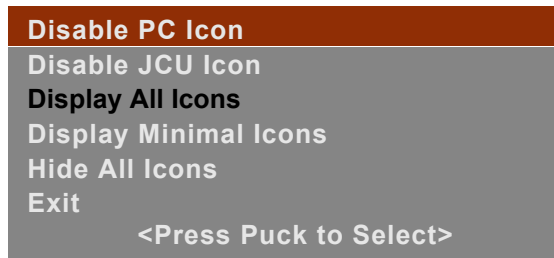
Display All Icons

Selecting this option maximizes the display of the on-screen icons. Some icons such as home are only displayed momentarily.

If you choose to display all icons, you can still turn off the display of the JCU and PC icons by disabling their individual settings.

Display Minimal Icons

Selecting this option turns off most of the on-screen icons except when their corresponding controls are actively in use. For example, the zoom (2X and 4X), rearview, and image freeze icons display when they are active. The pan position (azimuth) icon and the FLIR logo are always displayed. If stabilization has been disabled, an icon always displays since this is an atypical setting. When point mode is enabled, the lock icon is also persistent.

Other icons such as home and scene display on the screen only momentarily when they are changed.

Note: The PC and JCU icons do not display in minimal mode even when their icon settings are enabled.

Hide All Icons

None of the icons display permanently, except for the FLIR logo, the azimuth (pan position) icon, and icons for the following special modes:

• Rearview mode enabled

• Freeze video

• Stabilization disabled

• Point enabled

Transitory icons display when selected functions are used, such as pressing the HOME button.

User Programmable Button

When you select User Programmable Button from the main menu, the following on-screen menu displays. (An additional option is available when you are using a camera with stabilization; see page 48.)

Note: It is also possible to enter this menu by pressing and holding the USER button for 3 seconds.
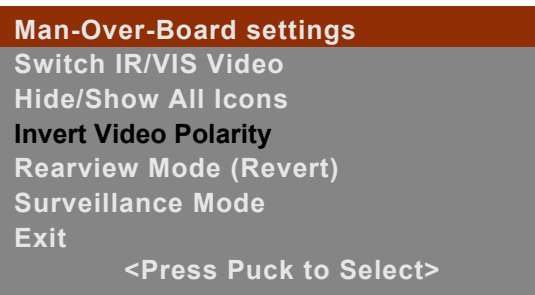
> **Man-Over-Board settings**
> Switch IR/VIS Video
> Hide/Show All Icons
> **Invert Video Polarity**
> Rearview Mode (Revert)
> Surveillance Mode
> Exit
>   <Press Puck to Select>

The USER button is a programmable one-touch button that lets you quickly access the most common or favorite settings or functions. You use this menu to select a function to associate with the USER button by selecting one of the six choices; Invert Video Polarity is the default selection. The active choice is shown in black type.

> **Man-Over-Board settings.** A short press of the USER button causes the thermal camera to use the Man Overboard AGC setting. This is one of the settings available from the SCENE button (see page 17).

Switch IR/VIS Video. A short press of the USER button causes the video signal to switch between the thermal camera and the visible-light camera. This option is only available on dual payload models.

Troubleshooting Tip: If pressing the USER button does not cause the display to switch from the thermal camera to the visible-light camera, be sure the proper input channel is selected on the display, and be sure the cable labeled VIS/IR is connected to the display.

Hide/Show All Icons. A short press of the USER button switches between the Hide All Icons setting and Display All Icons (refer to "Set Symbology" on page 35 for more information).

Invert Video Polarity. A short press of the USER button inverts the colors currently being used to indicate hot and cold in the infrared imagery. For example, if the current display is white-hot, it is inverted to black-hot (see "Set Video Polarity" on page 33). This is the factory default setting for the USER button.

Rearview Mode (Revert). A short press of the USER button enables or disables the Rearview Mode, which causes the video image to be flipped horizontally (revert). If Rearview Mode is enabled, the rearview mirror icon is displayed on the screen. See "Enable (Disable) Rearview Mode" on page 40 for details.

Surveillance Mode. A short press of the USER button enables or disables surveillance mode. See "Surveillance Mode" on page 41 for more information about this mode of operation.

System Setup Menu

When you select System Setup from the main menu, the following on-screen menu displays. (This menu is slightly different when you are using a camera with stabilization; see page 48.)

> **Enable Ball-Down Installation**
> **Enable Aircraft Joystick Mode**
> **Disable Twist-to-Pan Mode**
> **Disable High Power Standby**
> **Disable High Motor Torque**
> **Enable Rearview Mode**
> **Set Stow Position**
> **Name Camera**
> **Surveillance Mode**
> **Exit**
> **<Press Puck to Select>**

Enable (Disable) Ball-Down Installation

This menu option should be enabled when the camera is mounted upside down in the "ball-down" configuration. If it is not enabled, the video signal will be upside down on the monitor. When ball-down mode is first enabled, the camera rotates 180 degrees and the camera ball flips over. This option is disabled by default.

Warning: The M-618CS model, which is a mechanically stabilized system, can *only* be installed in the ball-up orientation.

Note: This option does not display on the M-618CS model, which is a mechanically stabilized system. This model must be installed in the ball-up orientation.

Enable (Disable) Aircraft Joystick Mode

In managing the elevation (tilt) of the camera, the joystick can be used in one of two modes.

Gaming Mode. Moving the joystick forward causes the camera to tilt up. Moving the puck back causes the camera to tilt down. This is the factory default mode.

Aircraft Mode. Moving the puck forward causes the camera to tilt down. Moving the puck back causes the camera to tilt up.

The choice of mode to use is a matter of personal preference. One mode may feel more natural than the other.

Enable (Disable) Twist-to-Pan Mode

This menu entry enables or disables the Twist-To-Pan Mode. This setting has a significant effect on how the puck is used (summarized in Table 4.1).

Enabled. Pan the camera by rotating (twisting) the puck to the left or right. Zoom in and out by pushing the puck in and pulling it out. This is the factory default mode.

Disabled. Pan the camera by moving the puck to the left or right, rather than rotating (twisting) it. Zoom the IR camera in and out by twisting the puck right or left.

On the M-618CS model only, the color daylight camera zooms correspondingly with the changes to the thermal camera. While viewing the color daylight output, you can also zoom by rotating or twisting the puck.

TABLE 4.1 Effect of Twist-to-Pan on Puck Movement

Puck Movement	Twist-to-Pan Enabled	Twist-to-Pan Disabled
Push Puck Left	N/A	Pan Counter Clockwise
Push Puck Right	N/A	Pan Clockwise
Twist Counter Clockwise	Pan Counter Clockwise	Zoom Out

TABLE 4.1 **Effect of Twist-to-Pan on Puck Movement**

Puck Movement	Twist-to-Pan Enabled	Twist-to-Pan Disabled
Twist Clockwise	Pan Clockwise	Zoom In
Push Puck In	Zoom In	N/A
Pull Puck Out	Zoom Out	N/A

Enable (Disable) High Power Standby and High Motor Torque

These two closely related settings help you to manage power consumption:

High Power Standby controls whether power is supplied to the pan/tilt motors while the camera is in the standby mode.

High Motor Torque controls the amount of power that is supplied to the pan/tilt motors while the camera is in the powered on state.

Choosing the amount of power to use involves a trade-off between power consumption and the ability of the gimbal assembly to hold the camera in place in rough seas. If the gimbal moves due to shock or vibration, the camera may not be in line with the position indicator or may lose precision regarding the home position. If this happens, you can reset the camera by pressing the HOME button 4 times in succession.

Disabling High Power Standby may also affect camera readiness in a cold environment. When High Power Standby is enabled and the motors are active, the unit stays closer to operating temperature.

High power standby mode may be useful for power boats that operate at higher speeds and experience high impact environments and can support higher power consumption.

Note: High power standby and high motor torque are enabled by default; for vessels such as sailboats with a limited power budget, it may be wise to disable the high power modes. See Table 4.2 below for power consumption.

When you select to enable or disable this setting, a prompts displays for you to confirm or cancel the change.

TABLE 4.2 **Power Consumption**

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	14.5 W	13 W

TABLE 4.2 Power Consumption

Camera State	Camera Setting	Dual Payload	Single Payload
Standby	High Power Mode OFF High Torque Mode OFF	8 W	7.4 W
Awake	High Power Mode ON High Torque Mode ON	30 W	19.4 W
Awake	High Power Mode OFF High Torque Mode ON	30 W	19.4 W
Awake	High Power Mode ON High Torque Mode OFF	21 W	16.5 W
Awake	High Power Mode OFF High Torque Mode OFF	21 W	16.5 W

These power numbers assume a single JCU is plugged into the camera and window heaters are not active. When heaters are active, additional power is consumed based on single or dual payload:

• For dual payload models, an additional 16 W is consumed for a maximum power consumption of under 46 W.

• For single payload models, an additional 6.5 W is consumed for a maximum power consumption of under 26 W.

Note: Window heaters are never active when the camera is in standby and high power mode is disabled.

Enable (Disable) Rearview Mode

This menu entry enables or disables the rearview mode, which causes the video image to be flipped horizontally (revert). The image on the display provides the same perspective as a rear view mirror in a vehicle; objects off the stern on the starboard side of the vessel are displayed on the right-hand side of the video. When rearview mode is enabled, the rearview mirror icon is displayed on the screen. You can configure the USER button to enable or disable Rearview Mode.
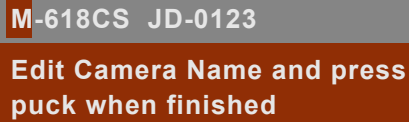
Set Stow Position

When Set Stow Position is selected, the camera stores the current position (camera azimuth and elevation) as the stow position. The camera moves to the stow position when it is turned off (put into standby mode). See "Standby Mode" on page 25 for additional information about standby mode.

The stow position is not necessarily the same as the home position. The home position is typically the position the camera will most likely be in when the camera is in use, or a preferred reference position for the camera. The stow position is the preferred position when the camera is not in use, for protecting the camera optics. Both positions are programmable by the user.
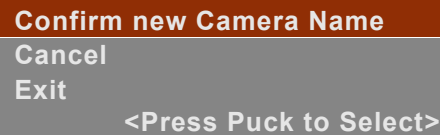
Name Camera

Use this option to give the camera a new name. When you select the menu entry, the current camera name is displayed on the screen, and the first character of the name is blinking. Move the puck forward and back or twist it to change the character. The next character can be selected by moving the puck to the right.

M-618CS JD-0123

Edit Camera Name and press
puck when finished

The possible characters that can be used include the letters of the alphabet (upper or lower case), the numbers 0-9, and the hyphen (-). When you finish entering the name, push the puck to exit.
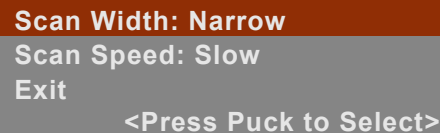
Confirm new Camera Name
Cancel
Exit
        <Press Puck to Select>

Then confirm the new camera name or cancel and continue making changes. When you are finished, select Exit.

Surveillance Mode

When you select Surveillance Mode from System Setup, the following on-screen menu displays.

Scan Width: Narrow
Scan Speed: Slow
Exit
        <Press Puck to Select>

The User Programmable Button can be programmed to enable or disable surveillance mode (see page 36).

When the camera is in surveillance mode, it pans continuously left and right, either until it is taken out of surveillance mode or until the JCU is used to move the camera. The camera does not automatically resume panning; you must enable surveillance again by pressing the USER button (if it is programmed to enable this mode) or selecting the menu option.

Scan Width

In surveillance mode, the Scan Width determines the range of horizontal azimuth (pan) covered by each scan. The choices are:

Narrow. The camera scans from approximately 20° left and right of center (40° total).

Medium. The camera scans from approximately 40° left and right of center (80° total).

Wide. The camera scan covers 80° to the left and right of center (160° total). The default scan width is wide.
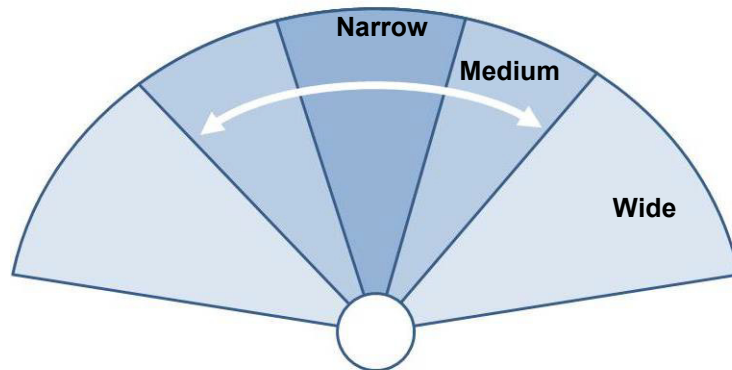
Note: The center of the scan pattern is determined by the direction the camera is pointing when surveillance is enabled. The scan pattern is not centered about the home position, unless the camera is in the home position when surveillance is enabled.
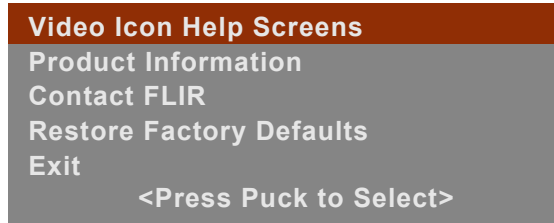
Scan Speed

In surveillance mode, the scan speed determines how quickly the camera scans back and forth. The choices are fast, medium, and slow.

The scan speed is affected by the zoom state (if the camera is zoomed in, it scans at a slower rate). The default scan speed is slow; try all three settings to determine which is best for your installation.

About/Help

When you select About/Help from the main menu, the following on-screen menu displays.

> **Video Icon Help Screens**
> **Product Information**
> **Contact FLIR**
> **Restore Factory Defaults**
> **Exit**
> **<Press Puck to Select>**

Video Icon Help Screens

The Video Icon Help Screens provide an on-screen explanation of the meaning of each of the screen icons. The icons are shown on two screens; press the JCU puck to cycle through the help screens.
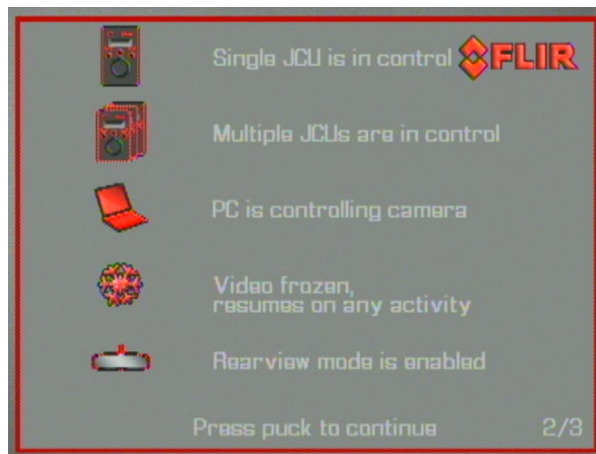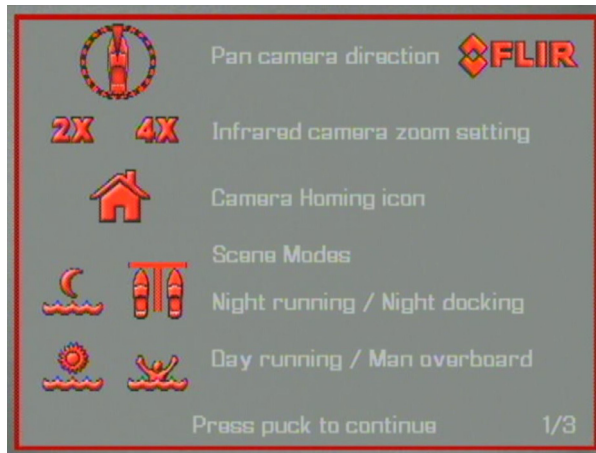
Product Information

Selecting Product Information displays product information for the M-Series camera you are using, such as the camera model, serial number, and software release information. If you are having any problems with the camera, have this information available when contacting FLIR technical support. An example of the display is shown below.

```
Name: M-618CS JD-0123
S/N: JD-0123
MAC 00:40:7f:40:1c:82
v2.5.7.1 Built 27-Oct-2011
MCU ver:4.0.34
Exit
```
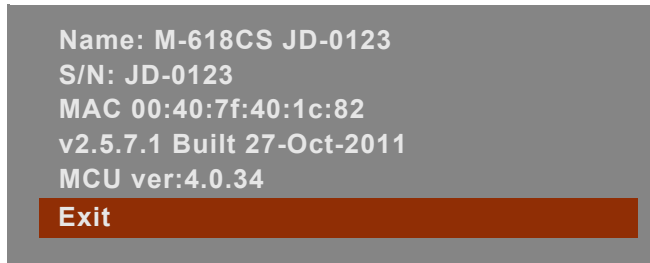
Contact FLIR

Selecting Contact FLIR displays the FLIR contact information on the screen. Additional contact information is included at the back of this manual. When contacting FLIR, please have the product information available.

```
FLIR CVS - Maritime
70 Castilian Drive
Goleta, CA 93117
1-877-773-3547
www.FLIR.com/cvs/maritime
```

Restore Factory Defaults

Select Restore Factory Defaults to restore the M-Series to its factory default settings. The camera will prompt you to confirm before continuing.

```
Confirm
Exit
        <Press Puck to Select>
```
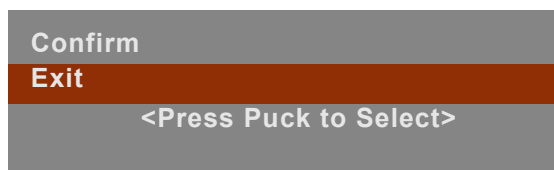
Refer to Table 3.1 on page 28 for a list of the factory default settings.

Mechanical Stabilization Feature

One of the specialized features that can be enabled or disabled with the on-screen menus is mechanical stabilization. This feature is only supported on one model (M-618CS). The on-screen menus look slightly different for this model. This section describes the additional features available with stabilization.

The features affected by mechanical stabilization include:

• Addition of several new video icons, which are affected by the Set Symbology options (see "Set Symbology" on page 35)

• Addition of Enable Point Mode on the main menu

• Addition of Point Mode on the User Programmable Button menu

• Addition of Enable (Disable) Stabilization on the System Setup menu

• Removal of Enable Ball-Down Installation from the System Setup menu; this feature is not supported on the stabilized camera

• A new Video Icon Help Screen for stabilization icons

Video Screen Icons with Mechanical Stabilization

Mechanical stabilization adds four additional icons that can display on the screen based on options selected. Otherwise, the screen icons and behavior are the same as described on page 11.

The following image of a screen illustrates the icons displayed by the system, as well as main menu on a camera that supports mechanical stabilization.
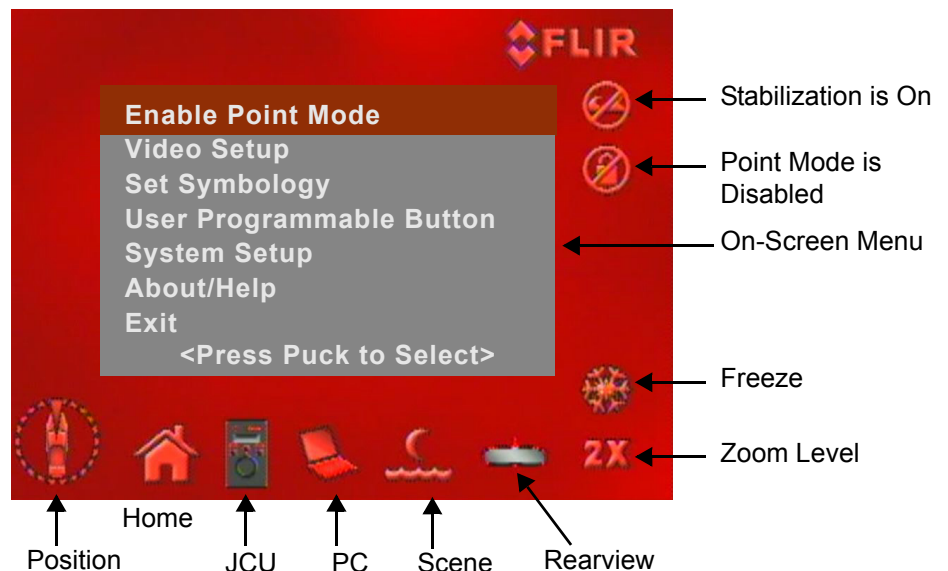
Mechanical stabilization improves image stability by compensating for vessel motion and keeping the camera aimed at the point of interest.

By default, mechanical stabilization is 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.

Mechanical stabilization has two aspects: horizontal (azimuth) and vertical (elevation).

When you enable full stabilization (horizontal and vertical), the icon on the far left (no wave) flashes. It does not display continually, since this is the normal mode of operation. If you disable stabilization, the wave icon remains on the screen to make you aware that 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. This can be helpful when you want to use the camera as an aide to navigation and keep it pointing in the same position relative to the vessel as it turns.

For example, you may have set the camera to point straight ahead relative to the front of the vessel and enabled stabilization. If the vessel is turned at a sharp angle under these conditions, the camera sensor will not follow the direction of the boat. Enabling point mode keeps the camera in sync with the boat 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.

Main Menu: Enable Point Mode

The main menu on the model with stabilization includes the Enable Point Mode option. All of the other options are identical to the description of this menu starting on page 32.
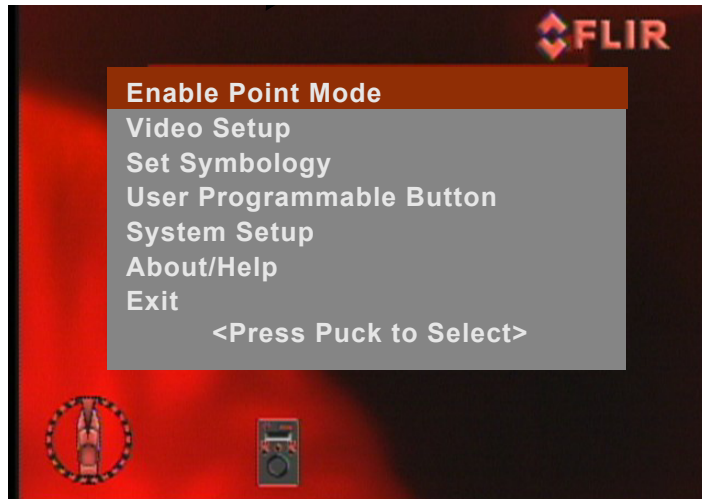
Point Mode only has significance when stabilization is also enabled (see page 48). The mechanical stabilization has two aspect: horizontal (azimuth) and vertical (elevation). Enabling point mode turns off the horizontal (pan) stabilization while retaining the tilt stabilization.

This can be helpful when you want to use M-Series 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 will attempt to maintain previous pointing direction. Enabling point mode keeps the camera in sync with the boat 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.

User Programmable Button: Point Mode

The User Programmable Button menu has an additional option on cameras supporting the stabilization feature. All of the other options are identical to the menu description starting on page 36.

Man-Over-Board settings
Switch IR/VIS Video
Hide/Show All Icons
Invert Video Polarity
Rearview Mode (Revert)
Surveillance Mode
Point Mode
Exit
<Press Puck to Select>
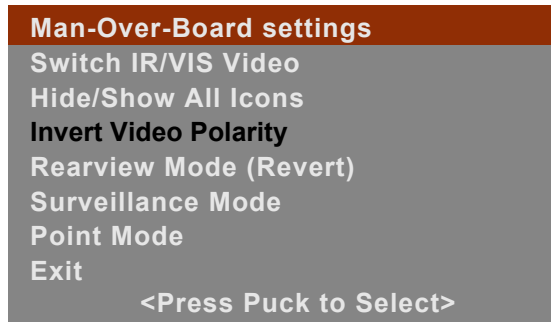
Point Mode. A short press of the USER button enables or disables point mode.

System Setup Menu

This menu has two differences on the model that includes stabilization:

•   The Enable Ball-Down Installation option is removed. The camera must be installed in the upright position.

•   The Enable (Disable) Stabilization option is added.

All of the other options are identical to the menu description starting on page 37.

Enable Aircraft Joystick Mode
Disable Twist-to-Pan Mode
Disable High Power Standby
Disable High Motor Torque
Enable Rearview Mode
Disable Stabilization
Set Stow Position
Name Camera
Surveillance Mode
Exit
<Press Puck to Select>

Enable (Disable) Stabilization

The System Setup menu on the model with stabilization includes the Enable (Disable) Stabilization option.Select this option to enable or disable the two-axis mechanical gyro-stabilization, which prevents camera images from being affected by mechanical vibrations caused by waves and ship motion. This setting is enabled by default and should not be changed under normal operation. The

icon to the left flashes when you enable this setting but does not display continually since this is the normal mode of operation.

If you disable stabilization, the wave icon on the left remains on the screen to make you aware that it is disabled. 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.

The Stabilization setting is affected by the setting of point mode. Mechanical stabilization has two aspect: horizontal (azimuth) and vertical (elevation). Enabling point mode turns off the horizontal (pan) stabilization while retaining the tilt stabilization.

An unlock icon may also display momentarily when you modify the stabilization setting when point mode is disabled. When point mode is enabled, the lock icon displays and remains on the screen indicating that the camera movement is constrained.

The camera retains your settings when it starts up; if stabilization was off when the camera was stowed, it will remain off.

### Video Icon Help Screen

For cameras with the stabilization feature, a third video icon help screen provides an on-screen explanation of the meaning of each of the stabilization screen icons. The first two help screens are the same as the ones described beginning on page 43.

The third screen displays by pressing the JCU puck to cycle through the help screens.
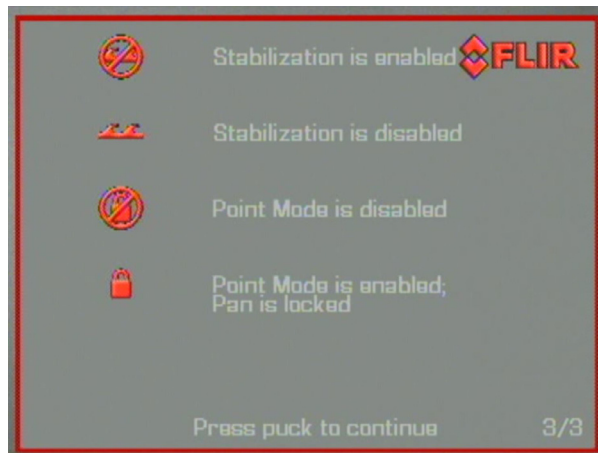
This page is intentionally blank.

M-Series IP Interface and PC Operations
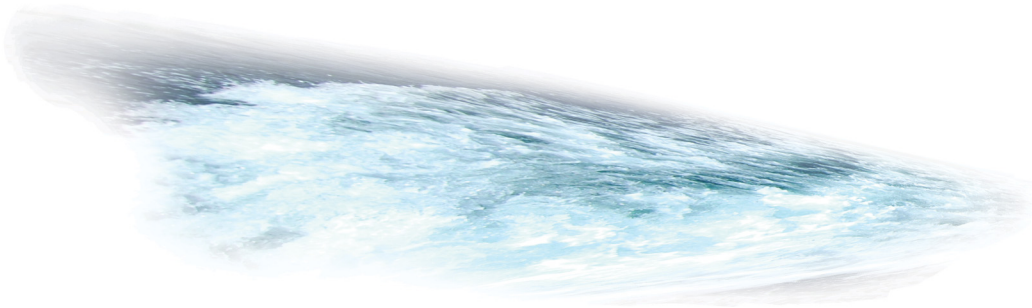
The M-Series cameras and JCUs are network devices that communicate over an Ethernet network using Internet Protocol (IP). In addition to using a JCU to control and configure a camera, a user or installer can also complete similar operations and even more advanced configurations using a Web browser when a PC or a laptop is connected to the network. This IP interface also allows marine electronics integrators with software development capabilities to design customized applications that integrate the camera and JCU capabilities with other types of marine electronics.

Supported Web browsers include Microsoft Internet Explorer version 7 or 8 on PC platforms running Microsoft Windows. Internet Explorer 8 may have to be configured to run in compatibility mode.

This chapter describes how to use a Web browser to communicate with and configure the M-Series cameras and JCUs. Integrators are encouraged to contact FLIR directly to obtain more detailed information about the Nexus Software Developer's Kit (SDK) and the communication protocols supported on the M-Series cameras and JCUs.

In most M-Series camera installations, a PC may not be needed or used. One or more JCUs will allow complete control and configuration of all the cameras on the network.The M-Series Web interface may be useful for more complex installations that have other devices on the network or a need for customization.

M-Series Web Control

If you have a PC on the same network as the camera and JCU, you can use the PC to control and configure the system, the same as you would with the JCU. The

cameras, JCUs and PCs are able to communicate with each other via HTTP protocol.

The same controls and functions that are available from the JCU are also available through the Web interface. As shown in the figure below, most JCU functions and menu options described in previous chapters are represented as links in blue boxes that are arranged in several groups. A link becomes highlighted when you mouse over it—the text changes from white to gray.

Note: Those options that are not available directly as a link, such as enabling and disabling stabilization on the model that supports mechanical stabilization, can be accessed by clicking the Menu link to access the camera's on-screen menus.
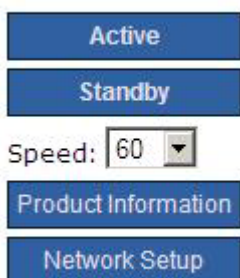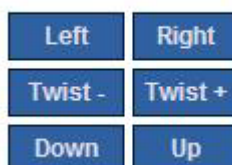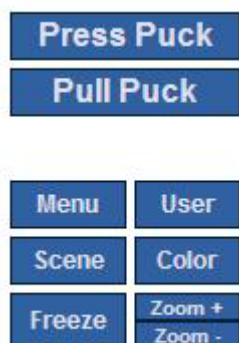

Web Control Functions

Each link on the Web control page corresponds to an equivalent operation on the JCU or with the on-screen menus, as Table 5.1 indicates. The table assumes the factory default settings are being used. For a more detailed description of each function, refer to the appropriate section in the previous chapters of this manual.
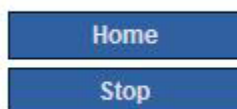
TABLE 5.1 Web Links and Equivalent JCU/Button Actions

Web Control	Equivalent Operation	Comment
Pan and Tilt		
Home	JCU: Press HOME button	Click and hold to set the home position.
Stop	No equivalent	Stops all movement of the camera, including surveillance mode. No equivalent JCU function.
Camera Controls		
Active	JCU: Press Power/DIM button	Wakes the camera from a standby mode.
Standby	JCU: Press and hold Power/DIM button	Executes the System Standby option on the JCU Power Menu.
Speed (pull-down)	JCU implements proportional speed control based on puck displacement	Controls the speed of pan and tilt operations; Possible selections: 40, 60, 80, 100.
Product Information	MENU: About/Help > Product Information	
Network Setup	No equivalent	Refer to "Network Settings" on page 58.
Joystick Control		
Left	JCU: Push Puck left	With Twist-to-Pan mode enabled (default), pressing the puck left/right does nothing.
Right	JCU: Push Puck right	With Twist-to-Pan mode disabled, clicking on Left or Right causes the camera to pan left or right.
Twist -	JCU: Twist Puck counterclockwise	With Twist-to-Pan mode enabled (default), twisting the puck causes the camera to pan left or right.
Twist +	JCU: Twist Puck clockwise	When Twist-to-Pan is disabled, twisting the puck will cause the IR camera to zoom in/out.
Down	JCU: Pull Puck backward (toward user)	Controls camera tilt (direction depends on Aircraft Joystick Mode); used to navigate menu in both modes.
Up	JCU: Push Puck forward (away from user)	Controls camera tilt (direction depends on Aircraft Joystick Mode); used to navigate menu in both modes.

TABLE 5.1 **Web Links and Equivalent JCU/Button Actions**

Web Control	Equivalent Operation	Comment
Press Puck	JCU: Press Puck into JCU	With Twist-to-Pan mode enabled (default), pressing the puck in causes the active camera to zoom in. In a dual payload model, the switch IR/VIS option determines which camera is active. For some models, only the thermal camera can zoom. Also functions as a click or Enter key when using menu functions.
Pull Puck	JCU: Pull Puck out from JCU	With Twist-to-Pan mode enabled (default), pulling the puck causes the active camera to zoom out. In a dual payload model, the switch IR/VIS option determines which camera is active. For some models, only the thermal camera can zoom.
Menu	JCU: Press MENU button	Opens or closes the on-screen menu.
User	JCU: Press USER button	Operation depends on the User Programmable Button setting; Invert Video Polarity is the default.
Scene	JCU: Press SCENE button	Cycles through the various scene settings. On a dual payload model, click and hold to switch VIS/IR video between IR and visible camera.
Color	JCU: Press COLOR button	Cycles through the various color settings. Clicking and holding forces a flat-field correction (FFC), which can improve thermal video quality by removing some artifacts. An FFC occurs normally at regular intervals to continually manage video quality.
Freeze	JCU: Double-click Puck (push in twice quickly)	To unfreeze, click any link on the page (except Product Information or Network Setup). On the JCU, press any button or move the joystick to unfreeze.
Zoom +	JCU: Push Puck in for 1 second to turn on 2X electronic zoom for the IR camera. Push and hold to zoom 4X (M-6x models only).	Push and hold for continuous color zoom of the DLTV camera (M-618CS model only).
Zoom -	JCU: Pull up on the Puck	

Menu Options

Display Minimal Icons

Display All Icons

Hide All Icons

Enable High Power

Enable High Torque

Set Stow Position

Switch IR/VIS

Set Default Color

Switch Video Polarity

Start Surveillance Scan

Switch Rearview Mode

TABLE 5.1 **Web Links and Equivalent JCU/Button Actions**

Web Control	Equivalent Operation	Comment
Menu Options		
Display Minimal Icons	MENU: Set Symbology > Display Minimal Icons	
Display All Icons	MENU: Set Symbology > Display All Icons	
Hide All Icons	MENU: Set Symbology > Hide All Icons	
Enable High Power	MENU: System Setup > Enable High Power Standby	
Enable High Torque	MENU: System Setup > Enable High Motor Torque	
Set Stow Position	MENU: System Setup > Set Stow Position	
Switch IR/VIS	JCU: Press and hold the SCENE button	On dual payload models, if the User Programmable Button is set to Switch IR/VIS Video, then the USER button can also be used to switch channels.
Set Default Color	MENU: Video Setup > Set Thermal Color Default	
Switch Video Polarity	MENU: Video Setup > Set Video Polarity	
Start Surveillance Scan	JCU: Press USER button	The User Programmable Button must be set to Surveillance Mode. To stop the scan, click Stop, Home, or any of the JCU links that control camera movement.
Switch Rearview Mode	MENU: System Setup > Enable (Disable) Rearview Mode	
Text Fields (Display Only)		
Camera Name	MENU: System Setup > Name Camera	The Web page displays the camera name. You can only change it from the menu.

TABLE 5.1 **Web Links and Equivalent JCU/Button Actions**

Web Control	Equivalent Operation	Comment
TX		Read-only field displaying commands sent to camera using FLIR network application programming Interface (API) protocol.
RX		Read-only field displaying camera acknowledgement of the received command.

Enabling Universal Plug and Play (UPnP)

In order to use the Web interface, the PC may need to be set up to use Universal Plug and Play (UPnP), which may not be active on your PC.

UPnP is typically not active on older computers using Windows XP but can be activated by following the steps outlined here.

Note: The JCU and camera will display on the PC network only when the PC is on the same network as the camera. If the PC is not configured with a static IP address, the UPnP icons will not display.

UPnP Overview

UPnP is a set of networking protocols that allows devices on a network to connect automatically, without the need for configuration by a network expert, thus simplifying the implementation of networks and the installation of computer components. A UPnP compatible device from any vendor can dynamically join a network, obtain an IP address, announce its name, convey its capabilities upon request, and learn about the presence and capabilities of other devices.

UPnP devices are plug-and-play in that when connected to a network they automatically announce information about themselves and supported device and services types, enabling clients that recognize those types to immediately begin using the device.

M-Series cameras and JCUs are UPnP devices so they broadcast their presence on the network. A PC configured to accept UPnP broadcasts will show all UPnP devices discovered under My Network Places.

## Enabling the UPnP User Interface

In some cases, Windows will discover UPnP devices and provide its own user interface to control them. Windows Vista and Windows 7 automatically detect network devices in the Network page. If UPnP devices are hidden, a prompt at the top of the screen will ask if you would like to display hidden devices.

With Windows XP, you can install the optional user interface (UI) component using the steps below. This UI component displays a balloon tip for newly discovered devices and places an icon for each device in the My Network Places folder. To enable the UPnP UI, follow these steps:

1. Click Start, click Control Panel, and then click Add or Remove Programs.

2. In the Add or Remove Programs dialog box, click Add/Remove Windows Components on the left side.

3. In the Windows Components Wizard, click Networking Services and then click Details.

4. Select the Universal Plug and Play check box.
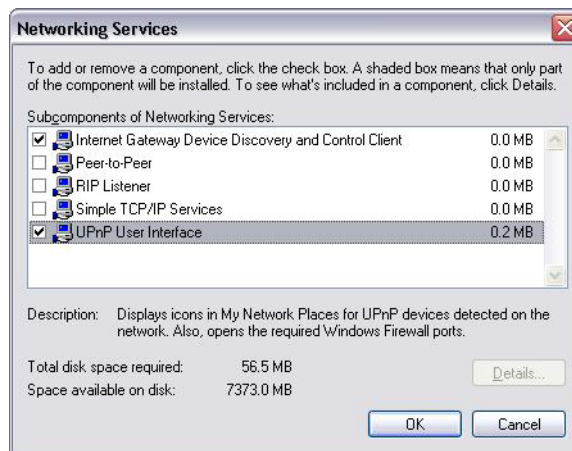
5. Click OK, and then click Next in the Windows Components Wizard. You may need to provide your Windows XP installation CD

You can now see if any UPnP-enabled devices exist on your network by opening My Network Places. If there are UPnP devices on your local network, they will

appear here with a generic icon based on the device type. In the future when a UPnP device is installed on the network, a notifying icon will appear briefly in the System Tray. When you see this icon, go to My Network Places to view the new device. Double-click on the icon to bring up the Web page.

Network Settings

By default, the camera and JCU device are configured to automatically determine IP addresses dynamically through UPnP. It is also possible to configure static IP addresses to coincide with addresses on an existing network.

Changing the IP Address of the Camera

You cannot display the camera's IP address on the JCU display. Instead, you do it from the control page. Clicking the Network Settings link displays the camera IP address, mask, and gateway, as show in the figure below. The Dynamic option is selected by default.

To enter a static IP address, select the Static option rather than Dynamic. The screen will refresh, and the IP, mask, and gateway fields will change from gray to white, indicating they can accept user entries. Enter the appropriate information, then click the Save link.

The system displays a warning as it restarts the network:

When the IP address is changed, the browser window opened under the old IP address is no longer valid. Type the new static IP address into the browser address field, or return to Network (Win 7/Vista) or My Network Places (Win XP) to find the camera. UPnP broadcast is never disabled for M-Series cameras, even when using a static IP address.

When the camera is in static mode, clicking on the Factory IP Defaults link results in the following warning.

Changing the IP Address of the JCU

The JCU communicates through the Ethernet IP protocol just like the M-Series camera does. Each JCU is configured by default to obtain an IP address dynamically from the system.

On the JCU, the IP address is displayed by pressing the COLOR button and puck at the same time. The IP is displayed for 3 seconds and then the display returns to the camera name or other the state it was in before the IP request was made.

On networks with specific requirements, you may need to assign the JCU a static IP address.You do this using steps similar to the way you changed the camera IP address:

1. Determine the JCU IP address by pressing the COLOR button and puck at the same time. The IP address displays on the JCU screen.

2. Type the JCU IP address into the address bar of the browser.

   The JCU control page displays, with a picture of the JCU.

3. For Network Addressing, select Static.

4. Enter the new value you want to use in the IP field. The Network Mask should fill in automatically (255.255.255.0).

5. Click Save to save your changes and exit the control page.

When software updates become available, you can use the Firmware Update field to load the update to the camera. Contact the FLIR dealer where you purchased the camera for additional information, or contact FLIR directly.

Custom Network Applications

Programmers/Integrators

In more advanced/sophisticated installations where other devices such as radars are present on the network, the use of a PC allows more complicated configuration, flexibility and customization. This interface is primarily intended to give installers, dealers or even system integrators direct access to low-level configuration options and to the actual network commands as they are being processed.

For specialized applications, FLIR offers the Nexus Software Developers Kit (SDK) that lets a marine electronics integrator write custom software programs based on the Nexus communication protocol. The SDK is a tool that helps integrators deploy FLIR M-Series thermal imaging cameras and other marine electronics such as radar in advanced networks. The SDK accelerates any application programming with FLIR Systems thermal imaging cameras and lets integrators combine camera functionality with other sensors and detection devices to take full advantage of this advanced technology.

Nexus implements a text-based common gateway interface (CGI) using a simple grammar to format commands going from a client to a camera sensor system, which may include multiple devices such as IR/DLTV cameras, GPS, or radar.

Responses from the sensor to a client are formatted in Java Script Object Notation (JSON). A subset of Nexus CGI commands have been tested and validated on the M-Series product. A listing of validated commands for use with M-Series is provided in FLIR document number 432-0003-00-70.

The SDK is available for download at no charge from the FLIR Network Systems Web site. The SDK helps software developers create SDK-based applications that make use of the rich features in the Nexus application. It provides a step-by-step guide for the creation of applications to control the pan/tilt motion of cameras, individual camera settings such as zoom and gain control, and many other powerful features that allow integration of Nexus-enabled cameras into on-board control systems.

You can find the SDK for download on the FLIR Developers Network tab:

http://ns.flir.com/

If you are a new user, you must register as a developer before you can download the SDK. Register and create an account on the FLIR Web site before downloading any files. You can purchase optional software support packages at the same location. Contact your FLIR dealer where you purchased the camera for additional information, or contact FLIR directly using the contact information printed on the back of this manual.

Command Strings

For programmers and integrators, the actual command strings that are sent back and forth with the camera are displayed in the Command Strings fields at the bottom of the M-Series control page. The transmitted commands are displayed in the TX field and the received commands are displayed in the RX field.

The commands sent back and forth are part of a communication protocol known as the FLIR Network Application Programming Interface (API). For custom network applications, this protocol can be used by software developers to integrate a FLIR camera with other marine electronic devices and other software applications.

Resources Available

If you would like more information about thermal imaging cameras and about integrating FLIR products with other marine electronics, please visit our Web site or call to speak with an Applications expert, using the contact information available on the back cover of this document.
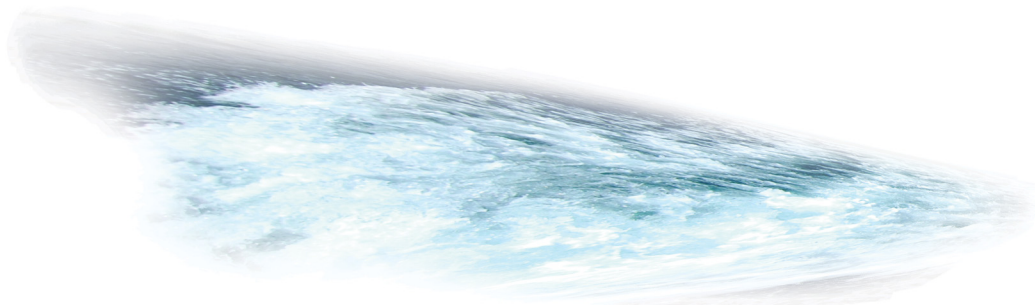
Training

If you are interested in learning about thermal imaging cameras FLIR offers complimentary training courses at the Infrared Training Center:

http://www.flir.com/training

M-Series Reference Information

Introduction

This chapter includes a glossary of acronyms, a list of symbols used in on-screen display, and a number of lists and tables that summarize system information and show how features vary by camera model.

It also includes a set of tips for troubleshooting issues.

Acronyms

Table 6.1 lists each acronym that is used in this manual and its meaning.

TABLE 6.1 **Acronyms**

Acronym/Term	Definition
AGC	Automatic Gain Control
ANSI	American National Standards Institute
API	Application Programming Interface
DLTV	Daylight TV, used to reference visible-band cameras
EAR	Export Administration Regulations
EMI	Electromagnetic Interference
FFC	Flat Field Correction
FLIR	Forward Looking Infrared
FoV	Field of View
FPS	Frames per Second (refresh rate)

TABLE 6.1 **Acronyms**

Acronym/Term	Definition
HFoV	Horizontal Field of View
ICD	Interface Control Document
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IR	Infrared or thermal
JCU	Joystick Control Unit
LCD	Liquid Crystal Display
MFD	Multifunction display
NMEA	National Marine Electronics Association
NTSC	National Television System Committee
PAL	Phase Alternating Line
P/T	Pan/Tilt
PoE	Power over Ethernet
SCTE	Society of Cable Telecommunications Engineers
SDK	Software Developer's Kit
UPnP	Universal Plug and Play
VDC	Volts, Direct Current
VIS	Visible (visible band camera reference)

List of Icons

Table 6.2 lists every icon that may display on the screen during various operations, with a brief description of its meaning. Some icons display permanently and some only display briefly. The display of some icons is affected by settings on the Symbology Menu (see page 35). The last four icons in this table display only on the camera model with stabilization.

TABLE 6.2 Video Display Icons

Icon	Name	Description
	Azimuth (Position)	Shows the azimuth (or direction) of the camera relative to the vessel. The shaded triangle shows the approximate camera field of view (FOV).
	Freeze	The IR video has been momentarily paused. Move the puck to resume the display. On the M-618CS model, the DLTV video will also freeze.
	Home	Indicates the camera is in the home position; the icon flashes when a new home position is set.
	JCU	Indicates a single JCU is connected to the camera.
	Multiple JCUs	Indicates more than one JCU is connected to the camera.
	PC	Indicates a PC on the network has a connection with the camera. You can use the PC to control the camera.
	Rearview Mode	Indicates camera is in rearview mode so that images are flipped horizontally.
	Scene: Night Running	One of four preset automatic gain control settings optimized for use on the open water at night.
	Scene: Night Docking	One of four preset automatic gain control settings optimized for use when the boat is docking at night.
	Scene: Day Running	One of four preset automatic gain control settings optimized for use on the open water during the day.
	Scene: Man Overboard	One of four preset automatic gain control settings optimized for providing visibility to small moving objects.

TABLE 6.2 Video Display Icons

Icon	Name	Description
Icons Used with Mechanical Stabilization		
🔒	Lock	Indicates that Point Mode is enabled and pan motion is not stabilized.
🚫	Lock Off	Indicates that Point Mode is disabled and pan motion is stabilized.
〰	Stabilization Off	Indicates the stabilization setting, which improves camera image stability, has been disabled. This icon remains on the screen.
🚫	Stabilization On	Indicates the stabilization setting, which improves camera image stability, has been enabled. This icon flashes momentarily on the screen.

System Specifications

Table 6.3 lists details about physical characteristics, power usage, and environmental features of your M-Series camera.

TABLE 6.3 **Specifications**

Physical Characteristics	
Camera Size	17.8 cm (7 in) diameter by under 29.2 cm (11.5 in) tall
Camera Weight	Under 5.4 kg (12 lb), depending on the camera model
Joystick Size	9.1 X 14.2 X 8.13 cm (3.6 X 5.6 X 3.2 in) 3.17 cm (1.25 in) above platform including joystick
Joystick Weight	.45 kg (1 lb)
Power	
Camera Input Power	12 – 24 V DC nominal, 5 A Max Absolute range 10 – 32V DC (–10%/+30% per IEC 60945)
Camera Output Power (to JCU)	Power Over Ethernet (PoE) per IEEE 802.3af 48V mode B PoE, RJ45
JCU Input Power	Power over Ethernet (PoE) per IEEE 802.3af
Consumption	25W Nominal 42W Max (dual payload)
Environmental	
Operating temperature range	–25° C to +55° C (–11° F to +131° F)
Storage temperature range	–40º C to +85º C (–38º F to +185º F)
Automatic Window defrost	Standard (automatic at unit power-up)
Sand/dust	Mil-Std-810E
Automatic Window de-icing	Standard (automatic at unit power-up)
Water Ingress	IPX 6
Shock	15 g vertical, 9 g horizontal
Vibration	IEC 60945; MIL-STD-810E
Lightening Protection	Standard
Salt Mist	IEC 60945
Wind	100 knot (115.2 mph)
EMI	IEC 60945

Feature Comparison of M-Series Models

The following table lists each M-Series model and its supported features. Each model is available in four variations, identified by a unique part number:

• <9 hz thermal frame refresh rate (FPS), NTSC video format

• 30 hz thermal frame refresh rate (FPS), NTSC video format

• <9 hz thermal frame refresh rate (FPS), PAL video format

• 25 hz thermal frame refresh rate (FPS), PAL video format

Note: Different frame formats and rates are used in the US (NTSC, 320 x 240 @ 30 FPS) and other parts of the world, such as Europe and China (PAL, 320 x 256 @ 25 FPS).

Model	Part Numbers	Camera Payload	Video Format	Thermal Video	Low-Light Video (DLTV)	Color Video (DLTV)	Thermal Video Resolution	Thermal Frame Refresh Rate	Mech Image Stabilization	HFoV	IR Digital Zoom
M-324XP	432-0003-05-00S	Single	NTSC	Yes	No	No	320 x 240	<9 Hz	No	24°	2x
	432-0003-05-00	Single	NTSC	Yes	No	No	320 x 240	30 Hz	No	24°	2x
	432-0003-06-00S	Single	PAL	Yes	No	No	320 x 256	<9 Hz	No	24°	2x
	432-0003-06-00	Single	PAL	Yes	No	No	320 x 256	25 Hz	No	24°	2x
M-625XP	432-0003-09-00S	Single	NTSC	Yes	No	No	640 x 480	<9 Hz	No	25°	2x and 4x
	432-0003-09-00	Single	NTSC	Yes	No	No	640 x 480	30 Hz	No	25°	2x and 4x
	432-0003-10-00S	Single	PAL	Yes	No	No	640 x 512	<9 Hz	No	25°	2x and 4x
	432-0003-10-00	Single	PAL	Yes	No	No	640 x 512	25 Hz	No	25°	2x and 4x
M-324L	432-0003-11-00S	Dual	NTSC	Yes	Yes	No	320 x 240	<9 Hz	No	24°	2x
	432-0003-11-00	Dual	NTSC	Yes	Yes	No	320 x 240	30 Hz	No	24°	2x
	432-0003-12-00S	Dual	PAL	Yes	Yes	No	320 x 256	<9 Hz	No	24°	2x
	432-0003-12-00	Dual	PAL	Yes	Yes	No	320 x 256	25 Hz	No	24°	2x
M-625L	432-0003-13-00S	Dual	NTSC	Yes	Yes	No	640 x 480	<9 Hz	No	25°	2x and 4x
	432-0003-13-00	Dual	NTSC	Yes	Yes	No	640 x 480	30 Hz	No	25°	2x and 4x
	432-0003-14-00S	Dual	PAL	Yes	Yes	No	640 x 512	<9 Hz	No	25°	2x and 4x
	432-0003-14-00	Dual	PAL	Yes	Yes	No	640 x 512	25 Hz	No	25°	2x and 4x
M-612L	432-0003-23-00S	Dual	NTSC	Yes	Yes	No	640 x 480	<9 Hz	No	12°	2x and 4x
	432-0003-23-00	Dual	NTSC	Yes	Yes	No	640 x 480	30 Hz	No	12°	2x and 4x
	432-0003-24-00S	Dual	PAL	Yes	Yes	No	640 x 512	<9 Hz	No	12°	2x and 4x
	432-0003-24-00	Dual	PAL	Yes	Yes	No	640 x 512	25 Hz	No	12°	2x and 4x
M-618CS	432-0003-31-00S	Dual	NTSC	Yes	No	Yes	640 x 480	<9 Hz	Yes	18°	2x and 4x
	432-0003-31-00	Dual	NTSC	Yes	No	Yes	640 x 480	30 Hz	Yes	18°	2x and 4x
	432-0003-32-00S	Dual	PAL	Yes	No	Yes	640 x 512	<9 Hz	Yes	18°	2x and 4x
	432-0003-32-00	Dual	PAL	Yes	No	Yes	640 x 512	25 Hz	Yes	18°	2x and 4x

Troubleshooting Tips

This section includes information that may help you with common issues that may arise during operation of the M-Series system.

Video not displayed on monitor

The camera will not display video if it is in standby mode. Power cycle the camera and allow the system to complete the boot cycle prior to JCU connection. Ensure the JCU is assigned to the camera, the camera ID appears in the JCU display, and the camera responds to JCU input (for example, pan/tilt movements).

If the camera will not produce an image, check the video connection at the camera and at your display. If the connectors appear to be properly connected but the camera still does not produce an image, ensure that power has been properly applied to the camera and circuit breaker is set properly. If a fuse was used, be sure the fuse is not blown.

Check the wiring at both the electrical panel and at the termination to the JCU. Ensure that the contacts are clean, dry and free from corrosion. If maintenance on the wiring connection is required, have an authorized service representative make the appropriate repairs.

If the camera still does not produce an image, contact the FLIR dealer or reseller who provided the camera, or contact FLIR directly (contact information is provided on the rear cover of this manual).

Cleaning

If the camera lens has become smudged or dirty, clean it with low-pressure fresh water and a soft cloth. Improper care of the camera window can cause damage to its anti-reflective coating, degrade the camera's performance, and void the camera warranty.

The camera housing has a durable marine coating. Rinse the camera housing with very low-pressure fresh water to keep it clean. If the front window of the camera gets water spots, wipe it with a clean lens cloth folded in fourths and dampened with fresh water.

Video not switching between thermal and visible (dual payload models)

On dual payload models, the display can be switched between the thermal camera and the visible camera either by pressing and holding the SCENE button, or, if the User Programmable Button is set to Switch IR/VIS Video, pressing the USER button. If neither of these operations causes the display to switch from the thermal camera to the visible-light camera, be sure the proper input channel is selected on the display, and be sure the cable labeled VIS/IR is connected to the display.

Noisy image

A noisy image is usually attributed to a cable problem—too long or inferior quality—or the cable is picking up electromagnetic interference (EMI) from another device. Although coax cable has built-in losses, the longer the cable is or the smaller the wire gauge/thickness, the more severe the losses become; and the higher the signal frequency, the more pronounced the losses. Unfortunately this is one of the most common and unnecessary problems that plagues video systems in general.

Cable characteristics are determined by a number of factors such as core material, dielectric material and shield construction, among others and must be carefully matched to the specific application. Moreover, the transmission characteristics of the cable will be influenced by the physical environment through which the cable is run and the method of installation. Use only high quality cable and ensure the cable is suitable to the marine environment.

Check cable connector terminations. Inferior quality connections may use multiple adapters that can cause unacceptable noise.

Image too dark or too light

By default, the M-Series thermal camera uses an automatic gain control (AGC) setting that has proven to be superior for most applications. However, a specific environment may benefit from a different AGC setting. For example, a very cold background (such as the sky) could cause the camera to use a wider temperature range than appropriate. You should keep the ocean, and not the sky or the boat, as the predominant object in the image. Refer to "SCENE Button" on page 17 for information about how to make adjustments to the image.

Performance varies with time of day

You may observe differences in the way the camera performs at different times of the day, due to the diurnal cycle of the sun. Recall that the camera produces an image based on temperature differences.

At certain times of the day, such as just before dawn, the objects in the image scene may all be roughly the same temperature, compared to other times of the day. Compare this to imagery right after sunset, when objects in the image may be radiating heat energy that has been absorbed during the day due to solar loading. Greater temperature differences in the scene generally will allow the camera to produce high-contrast imagery.

Performance may also be affected when objects in the scene are wet rather than dry, such as on a foggy day or in the early morning when everything may be coated with dew. Under these conditions, it may be difficult for the camera to show the temperature the object itself, rather than of the water coating.

Eastern or Western exposure

While a boat is under way, the camera may inevitably end up pointing directly east or west, and this may cause the sun to be in the field of view during certain

portions of the day. We do not recommend intentionally viewing the sun, but looking at the sun will not permanently damage the sensor. In fact the thermal imaging camera often provides a considerable advantage over a conventional camera in this type of back-lit situation.

However, the sun may introduce image artifacts that will eventually correct out and it may take some time for the camera to recover. The amount of time needed for recovery will depend on how long the camera was exposed to the sun. The longer the exposure, the longer the recovery time needed.

Image freezes momentarily

The camera has a feature that lets the user momentarily freeze the image. Double-click (press the puck in quickly two times) the JCU puck to freeze the image. The snowflake image icon appears on the screen. Any any other action with the JCU (moving the puck or pushing a button) will unfreeze the image.

By design, the camera image will freeze momentarily on a periodic basis during the flat field correction (FFC) cycle. A shutter activates inside the camera and provides a target of uniform temperature, allowing the camera to correct for ambient temperature changes and provide the best possible image. Just prior to the FFC, a small green square will appear in the upper left corner of the screen.

Note: Pressing and holding the COLOR button causes the thermal camera to do an FFC operation.

Multiple Cameras and/or JCUs on a single network

You can configure your system with multiple cameras and multiple JCUs on the same network. More than one JCU can be used to control a given camera. The camera will respond to commands from both JCU's in the order the commands are received across the network. Unpredictable behavior may result from users sending conflicting commands from separate JCU's (for example, one user pans left and the other user pans right). In general, the camera will respond to the last command received and there is no way to set priority, given that IP networks use a "best effort" delivery protocol.

On Screen Messages

In some circumstances, a status or alert message may appear on the video screen. This section describes the messages and the appropriate actions that may be necessary.

```
Loading, please wait…
```

Indicates the camera has power and is booting up. No action is needed; the message will be removed when camera is ready for operation. Refer to Chapter 3, "M-Series System Startup," on page 23 for more information.

```
Reconnect network, now...
```

Indicates the camera has detected a loopback termination on the Ethernet RJ45 connector and has reverted to the Factory Default network settings. Remove the Ethernet RJ45 loopback termination adapter. The camera will then continue the startup process under the Factory Default network configuration (with DHCP dynamic IP addressing).

```
Warming, please wait…
```

Indicates the camera has detected a low temperature condition and does not allow pan/tilt motion until it is sufficiently warm. Wait for the camera to self-heat to an operational temperature (the amount of time varies depending on the outside temperature). The message is removed when camera is ready to operate.

```
High Temperature - Motor Halted
```

Indicates the camera has detected an over-temperature condition and has disabled the internal pan/tilt motor power. Confirm the temperature of the camera is within the allowed operational temperature range. Allow the camera to cool down to a temperature within the operating range.

```
High Temp. - Shutdown System #
```

Indicates the camera has detected an over-temperature condition and must be shutdown. The # character displays a 5 second countdown. The user should confirm the temperature of the camera is within the allowed operational temperature range. Turn off the power to the camera and allow it to cool down to a temperature within the operating range. If the problem continues, contact FLIR.
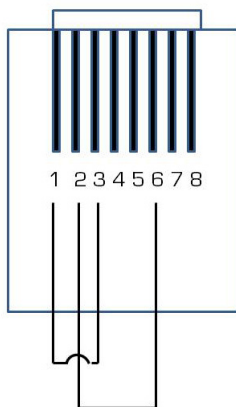
Restoring the Factory Network Settings

In some cases, it may be necessary to restore the network settings of the camera to the original factory settings. At each power up, the system transmits a packet and then checks to determine if that same packet has been received. Detection of the received packet indicates the camera has a custom loopback connector installed on its Ethernet interface. The detection of the loopback packet cues the camera to restore factory defaults and to revert to the same configuration and behavior as when the camera left the factory.

The following table describes the loopback connector.

Pin #	Signal	Tied to pin #
1	Transmit +	3
2	Transmit -	6
3	Receive +	1
4	Unused	N/A

Pin #	Signal	Tied to pin #
5	Unused	N/A
6	Receive -	2
7	Unused	N/A
8	Unused	N/A

The RJ45 loopback termination ties pin 1 to pin 3, and pin 2 to pin 6. The other pins are not connected.

NOTES

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