M-Series

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January 2011

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.

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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

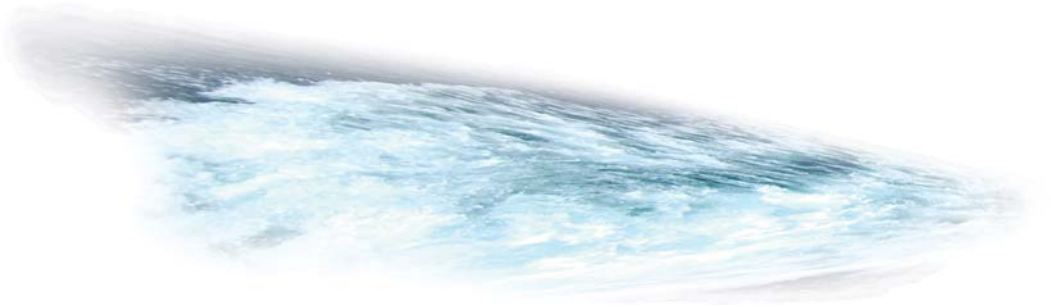
Contents

Glossary

Acronym/Term	Definition
AGC	Automatic Gain Control
ANSI	American National Standards Institute
API	Application Programming Interface
EAR	Export Administration Regulations
EMI	Electromagnetic Interference
FFC	Flat Field Correction
FLIR	Forward Looking Infrared
ICD	Interface Control Document
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IR	Infrared
JCU	Joystick Control Unit
NMEA	National Marine Electronics Association
P/T	Pan/Tilt
PoE	Power Over Ethernet
SCTE	Society of Cable Telecommunications Engineers
SDK	Software Developer's Kit
VDC	Volts, Direct Current
VIS	Visible

CHAPTER 1

M-Series System Description



Thank you for buying your new M-Series thermal imaging system. 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 (phone numbers listed on the back cover of this manual).

This manual includes information about the following topics:

- System Description
- System Startup
- Configuration Menus
- Operation Tips

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

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 in this publication 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.

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's 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.

Note: The M-Series IR Thermal Imaging System is an Export Controlled item. Authorization by the U.S. Government must be obtained prior to export outside the United States.

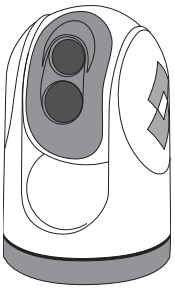
This equipment must be disposed of as electronic waste. Contact your nearest FLIR representative for instructions on how to return the product to FLIR for proper disposal.

System Description

M-Series is a maritime thermal imaging system for use on nearly any kind of vessel. The system is available in two configurations: the *single payload* model has a single thermal imaging camera, and the *dual payload* model is equipped with both a thermal imaging camera and a visible-light camera.

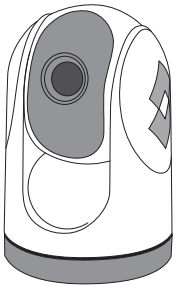
Thermal Image at night

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.



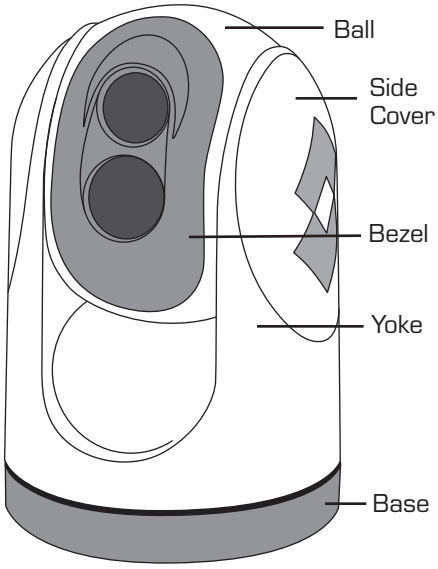
Dual Payload

On dual payload models, the integrated visible-light camera provides black and white (or greyscale) imagery during the day and in low-light conditions. It provides enhanced navigational abilities in lowlight conditions; for example, during twilight hours, when operating along intercoastal waterways, and near harbor entrances.



Single Payload

The M-Series consists of two main components: the Gimbal Assembly[1] (also known as the pan/tilt camera unit) and 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.



Gimbal Assembly

The M-Series gimbal and JCU are network devices and connect together with Ethernet. In some installations, additional cameras and JCUs will also be used, and networking equipment such as Power Over Ethernet 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) this thermal energy, even cold objects like icebergs.

1 A gimbal is a pivoted support that allows the rotation of an object (such as a ship's compass) about a single axis.

Joystick Control Unit

Joystick Control Unit (JCU)

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, and to configure the camera settings by means of on-screen menus. The JCU connects to the camera by way of an Ethernet network connection, and that same connection provides power to the JCU.

The JCU has various buttons, an LCD display, and it has a joystick "puck" which is used to control the pan/tilt movement and to navigate through the on-screen menus. The puck can be rotated in either direction and it can be moved left and right or forward and back, and it can be pushed down (like a button) and pulled up.

Other Components

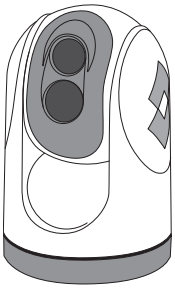
In some installations, the system will be comprised of additional components, including additional cameras or JCUs, video equipment, or network equipment. In a simple installation, the JCU will be directly connected to the camera with an Ethernet cable. In more complex installations, the camera and JCU will be interconnected by means of a network switch. If the network switch does not have Power over Ethernet (PoE) capability, a PoE injector may be used to provide power to the JCU. FLIR PoE injectors are available where you purchased your M-Series camera.

Contact FLIR (+1.888.747.3547 or +33 765794194) for more information regarding available accessories including JCUs, PoE equipment, video distribution amplifiers, cables, connectors, mounting hardware, and so on.

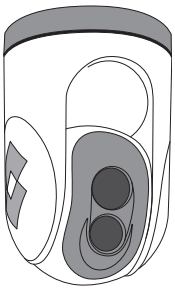
Camera Video Options

The M-Series camera provides a video cable (labeled "IR") for the composite (also known as analog) video signal from the thermal (infrared) camera. On dual payload models, another video cable (labeled "VIS/IR") is for video from either the thermal camera or the lowlight (visible) camera; it is switchable from the JCU.

The video from the dual payload M-Series camera can therefore be displayed on one or two video displays. If only a single display with a single video input is available, the cable labeled "VIS/IR" is connected to the display. If the display has more than one video input, both 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.



Upright installation
(ball up)



Upside down
(ball down)

Ball Up / Ball Down

In most installations, the M-Series will be 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 may be hung upside down ("ball down"). When installed ball down, it is necessary to configure the camera in the ball down mode, so the video is properly displayed and the pan/tilt controls operate as expected (information about how to configure the camera is available in the System Operation and Configuration section).

Unless otherwise noted, the information in this manual generally assumes an upright installation; refer to the Configuration Menus section for information about ball down configurations.

Multiple Camera and JCU Options

More than one JCU can be used to control the camera, and more than one display can be used to view the video. Also a single JCU can be used to control more than one camera.

Most often, the JCU and the video monitor are mounted close together, as a pair, so the video can be viewed when the camera position (pan or tilt) is changed with the JCU.

The JCU can be connected to the camera directly with the supplied double-shielded Ethernet cable. In this case, the JCU draws its power from the camera. Alternatively, the camera and the JCU can be connected together via an Ethernet switch; this type of configuration allows more than one camera and/or JCU to be used. The JCU draws its power over the Ethernet, so a PoE injector or PoE switch is required.

If a single JCU is used to control more than one camera, the user can select which camera is to be controlled 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.

Joystick Control Unit

JCU Introduction

The JCU is the primary method of control for the M-Series camera. It can be used to move the camera (pan or tilt), electronically zoom the cameras in and out, switch between infrared and visible-light cameras, adjust the image quality, and access the on-screen menus.

This section contains a brief description of the buttons and other features on the JCU. More detailed descriptions of the buttons and their functions are provided in the subsequent sections of this manual.

Power/DIM

The Power 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. The Power button is described in more detail in the System Startup section.

The Power button is also used to select various levels of brightness of the JCU display. The JCU controls are backlit to make them easier to see at night. This button controls the brightness of the JCU backlighting, so you can adjust it for your comfort. Press this button to cycle through the four different settings or levels of brightness.

MENU

The MENU button is used to turn on or off the on-screen menu. When the on-screen menu is displayed, the joystick puck can be used to navigate through the menus and select various menu entries. The on-screen menus are described in the Configuration Menus section.

USER

The USER button is a programmable one-touch button. It is intended to allow the user to quickly access the most common or favorite settings or functions. It is configured with the Invert Video Polarity setting by default.

SCENE

The SCENE button allows the user to toggle through a set of preconfigured image settings, in order to select the best setting for the given conditions. Refer to the Operation/Configuration Using JCU Buttons section for more details about how to use the SCENE button to optimize the video.

COLOR

The COLOR button switches the thermal camera video between a greyscale mode and a color mode. When viewed at night in the darkness, the factory default mode uses a red-colored video image that may preserve the user's night vision better. The default color setting is selectable by the user.

HOME

The HOME button is used to move the camera to its home position, or it is used to select a given position as the home position. The Home position is a

programmable preset position - usually straight ahead and level with the horizon – which operators can use as a reference.

JCU Puck

The JCU Puck functions like a joystick - it can be moved left or right, or fore and aft, and it can be rotated in either direction. It can also be pushed down (like a mouse click) or pulled up. It is used to move the pan/tilt position of the camera and it is used to navigate through the on-screen menus.

Use the Puck to pivot the M-Series camera left and right and tilt it up and down.

Pan - Rotate (twist) the puck counterclockwise and the M-Series will pivot left. Rotate the Puck clockwise and the M-Series will pivot to the right.

Tilt - Push the Puck forward (toward the bow) and the camera will tilt down; pull it back (toward aft) and the camera will tilt up.

Zoom - Push down for 1 second to turn on 2X electronic zoom on the IR camera. Push and hold for 2 seconds for 4x zoom (M-6xx models only). Pull up on the Puck to return to 2X zoom and pull again to return to no zoom. The lowlight visible camera does not have a zoom feature.

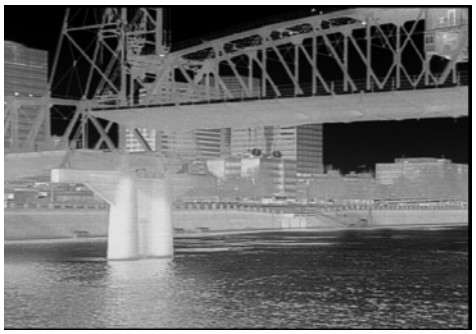
JCU powered on with backlit display and buttons

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

The Puck implements proportional control; therefore the father you rotate it or direct it from center; the faster the camera will move.

JCU Display

The JCU Display generally shows the name 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.



Video Display

The M-Series thermal imager does not produce an image from visible light like an ordinary camera does; rather, it uses thermal infrared energy to produce an image. It senses subtle differences in temperature and makes images based on those differences.

When the thermal camera is in white-hot mode, the warm things in the scene will display as white, or lighter shades of grey, and cold objects will

display as black or darker shades of gray. (When you switch the video polarity, this will be reversed.)

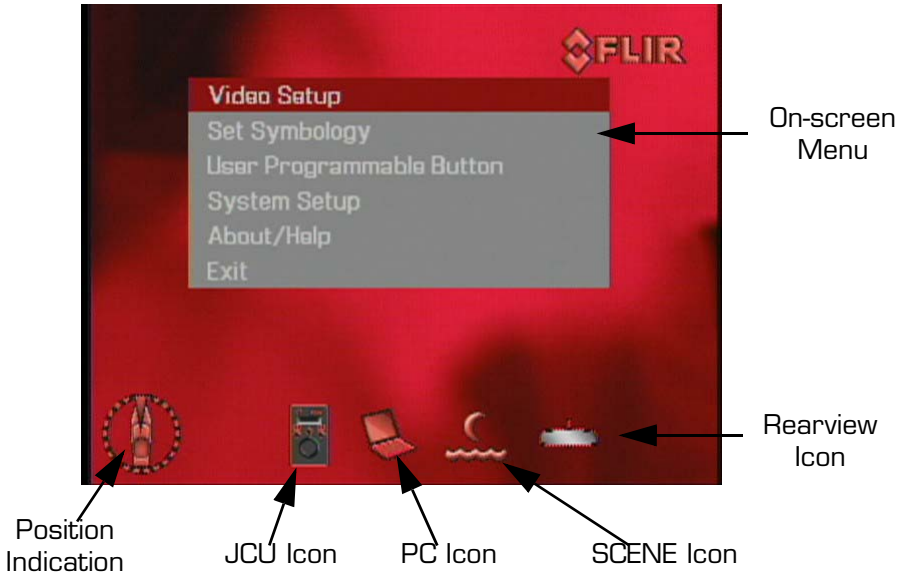
Video Screen Icons

The following section provides a brief description of the symbols that may appear on the screen, depending on the camera settings and the JCU buttons that have been pushed.

Note: Symbology and menu functions are only available in the thermal image.

Some icons are on the screen all the time, and some icons appear momentarily or only when certain functions are enabled. Several configuration settings are available to control which icons appear or do not appear. Refer to the System Operation and Configuration section for a detailed description of each setting and the on-screen menus.

The figure below shows an example of a screen with some of the possible icons displayed, as well as the on-screen menu.



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 Indication

The Azimuth Indication shows the azimuth (or 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 currently connected to the camera unit. If more than one JCU is discovered, the multiple JCU icon will appear on screen.

PC Icon

The PC Icon indicates there is a PC on the network that has a connection with the camera. FLIR offers a Software Developer's Kit (SDK) that allows marine electronics integrators to develop custom software applications for networking the M-Series thermal camera and other marine electronics. Contact your FLIR dealer where you purchased the camera for additional information, or contact FLIR directly: +1.888.747.3547 or +33 765794194.

SCENE Icons

Day Running

Night Running

Man Overboard

Night Docking

Pressing the SCENE button toggles between four preset Automatic Gain Control (AGC) settings. Toggling between the four presets will 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.

Which setting to use comes down to 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

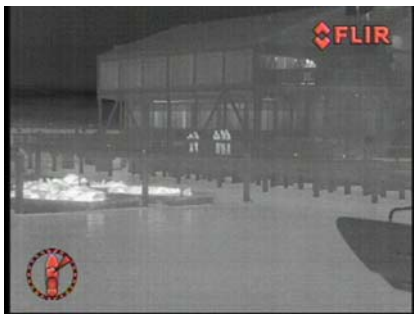
The Rearview Icon indicates the Rearview Mode option has been selected in the System Settings menu. The Rearview setting flips the video image horizontally left to right. The image on the display provides the same perspective as a rear view mirror in a vehicle - objects off the stern on the starboard side of the vessel are displayed on the right hand side of the video.

Home Icon

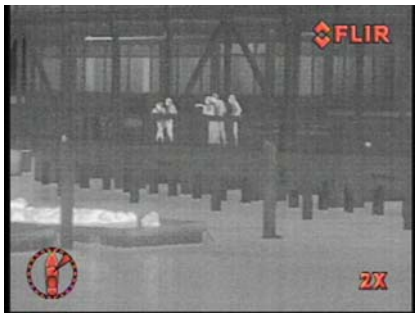
The Home icon appears momentarily to indicate the camera is in the Home position. The icon flashes when a new home position is set.

Zoom (2X or 4X[2])

Pressing and holding the Puck will cause the thermal camera to digitally zoom in to 2X magnification. Pressing and holding again will cause the thermal camera to digitally zoom in to 4x magnification (M-6xx models only). Pull and hold the puck to zoom out the thermal camera.



Normal (no zoom)



2X zoom

4X zoom

Image Frozen

The Image Frozen image appears when the Puck has been double clicked (pressed two times in quick succession) and the video has been momentarily stopped. Pressing any button or moving the Puck will switch back to live video. This feature is only available on the thermal camera.

2 Note, 4X Zoom not available on all models.

CHAPTER 2 M-Series System Startup

System Startup

In order for the M-Series camera to operate, it will need to receive a "wake" command from another device on the LAN network. This section describes the system startup process and various camera modes.

To begin, turn on the video monitor/display and select the M-Series thermal camera as the video source for the display. Most multi-function displays (MFDs) allow the user to select from a number of available inputs.

Generally the M-Series system will be connected to its power source through a circuit breaker, which will function as the primary “on/off” switch for the system. There is no on/off switch on the camera itself, but the JCU has an power switch, and it is used to control the state of the camera.

If the camera has power, it will be in one of three states or modes: Bootup, Standby, and Powered On. The camera is never off unless the circuit breaker is off. When the JCU power button is used to “turn off” the system, the camera goes into a low-power standby mode waiting for a wake command.

The Bootup Process

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 the camera will 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 which has not been powered on, or it may be connected to a network switch that does not provide PoE power.

Bootup Mode

The following section describes what happens when the circuit breaker is energized and power is applied to the camera. The camera will stay in the Bootup state for approximately 55 seconds. During the bootup process, the bootup screen and messages are displayed on the monitor, followed by live video, which is displayed only momentarily, until the camera goes into standyby mode..

Initially the FLIR splash screen will appear, as shown to the left. Then another splash screen with two important notices will appear:

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

Note: The M-Series IR Thermal Imaging System is an Export Controlled item. Authorization by the U.S. Government must be obtained prior to export outside the United States.

After the splash screens are displayed, the video screen will show a message that says "`Loading, please wait...`"[1] When the bootup is complete, the monitor will briefly show live video, and then the display will be blank, to indicate the camera is in Standby mode. The gimbal assembly

moves to the Stow position in order to provide additional protection for the camera optics.

Camera Discovery

If the Power/Dim button is pressed after the system bootup is complete, the JCU will automatically detect all available cameras on the network. The first time a camera is started, the installer must associate the JCU with the camera. The display on the JCU will indicate "`Select Camera`" the first time a JCU connects to a camera. Scroll down to the available camera and press (or "click") the puck to accept the camera shown in the JCU Display. The JCU will automatically connect to the last camera it was linked to after the initial startup.

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

If the Power/Dim button is pressed while the camera is booting up, the JCU LCD display will say "Searching…" until the JCU discovers cameras on the network. If there are multiple cameras in the network, the JCU will discover them and the user must select one. The user can move the puck fore and aft to scroll through the list of discovered cameras. Once a camera has been selected, the next time the user powers the JCU, the JCU will default to the last camera it was connected to.

Note: In the JCU Display, a down arrow (V) indicates additional menu choices can be accessed by moving the puck down (aft), or by rotating the puck clockwise. An up arrow (^) indicates the last menu entry is shown in the display, and the other choices must be accessed by moving the puck up (fore) or by rotating the puck counterclockwise. A double arrow indicates the user can move up or down in the menu.

Standby Mode

After the bootup sequence, the camera will switch from the Bootup mode to the Standby mode. In the Standby mode the pan/tilt motors are engaged in high-power mode, to hold the camera in place in rough seas. In the Standby mode, the cameras will not supply a live video signal via the video cables. The gimbal assembly does not respond to any commands or buttons from the JCU (with the exception of the Power/DIM button). The camera ball will be pointing straight down, to protect the camera optics.

Note: When a dual payload camera powers up, it will display the IR video on both channels initially. Then the IR/VIS video channel will switch to the visible camera if the visible camera was selected when the camera was last powered down.

1 Refer to the Troubleshooting Tips section in the System Operation and Configuration chapter for more information about messages that appear on the video screen.

Powering Up

To power up the camera, press and hold the Power/DIM button on the JCU for 3 seconds. The camera will switch from the Standby state to the Powered On state. Once the M-Series gimbal assembly is in the Powered On mode, the cameras will display the two splash screens and then supply live video to the monitor. The camera will rotate to the home position and the ball will tilt up to its home position and the JCU icon will appear on the screen momentarily. On the JCU display, the camera name will blink momentarily to indicate the camera is selected. The camera will now respond to the JCU buttons and joystick puck movements.

Powering Down

When the camera is in the Powered On mode, pressing the Power/Dim button continuously for 2 seconds will cause the display to start a brief countdown (`3, 2, 1, 0`). After the countdown the JCU will enter the JCU Power Menu[2], and the display will show "`v Power Menu`". The JCU puck can be used to select from the following menu options:

```
Power Menu
Assign JCU
JCU Stndby?
Camera Stndby?
System Stndby?
Global Stndby?[3]
Calibrate JCU
Cancel
```

Each of these menu items are described in more detail in the JCU Power Menu section below.

If the "`Camera Stndby?`", "`System Stndby?`" or "`Global Stndby?`" option is selected, the camera will move to the stowed (parked) position and the camera will go into the Standby state. Generally the stowed position is with the ball rotated down so the camera lenses are in a protected position. The Stow position can be configured with the on-screen configuration menus.

Note: Selecting "`Camera Stndby?`", "`System Stndby?`" or "`Global Stndby?`" on the JCU will not shut down the camera entirely. The camera will go into the Standby mode, with the motors engaged, waiting for a "wake" command from the JCU.

If the camera will not be used for an extended period of time and it is preferable to conserve power, it is recommended that you first power down the camera from the JCU as described above. Powering the camera down from the JCU will put the camera in the Stow position. Then switch the system circuit breaker to the off position. When the circuit breaker is switched on again, the camera will go through its bootup sequence again.

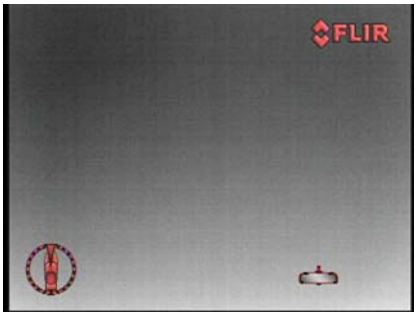
2 Refer to the JCU Power Menu section for a detailed description of the JCU Power Menu.

3 Global Stndby will only be shown when multiple JCU's have been detected.

M-Series Video

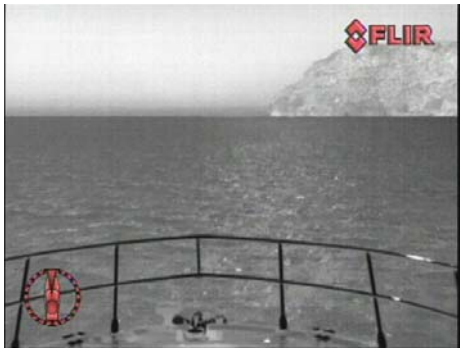
The M-Series thermal camera starts up in “red-hot” mode by default. Many users will be turning the system on when there is little or no light available, and the red-hot mode will help preserve the operator’s night vision. If the white-hot display mode is preferred, simply press the COLOR button on the JCU. Through the configuration menus, it is also possible to save a default color setting to be used each time the system is powered on.

Red-hot Mode



White-hot Mode

Now that the system has started up, hopefully you will be able to put it to use right away. It is recommended that you become familiar with the system, especially the JCU buttons and operation of the puck, while the vessel is stationary. You should begin using the SCENE, COLOR, and USER buttons and get familiar with how they affect the displayed video.



JCU Power Menu

The JCU is a bit more sophisticated than most 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 can be accessed via a set of menus, with each menu entry selectable in the JCU display.

The JCU puck is used to scroll up and down within the menus, and a menu entry can be selected by pressing down (clicking) the puck. When the JCU is in the Power Menu mode, the other JCU buttons such as HOME, COLOR, SCENE, and USER are disabled.

Accessing the Power Menu

When the camera is in the Powered On mode, pressing and holding the Power/DIM will cause the JCU to enter the JCU Power Menu and the display will show "v `Power Menu`".

The JCU puck can be used to select from the following menu options:

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

Each of these options is described below.

Note: In the JCU Display, a down arrow (v) indicates additional menu choices can be accessed by moving the puck down (aft). An up arrow (^) indicates the last menu entry is shown in the display, and the other choices must be accessed by moving the puck up (fore). A double arrow indicates the user can move up or down in the menu.

Power Menu

When "`Power Menu`" is shown in the display, it indicates the user has entered the Power Menu. Use the puck to scroll down through the other menu options. To exit the Power Menu, scroll down to the Cancel entry.

Assign JCU

The Assign JCU function is used 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 the user can scroll down with the puck to select a camera to control. When the desired camera name is shown in the display, press the puck to select that camera. The camera name will blink momentarily to indicate the camera 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 stowed (parked) position and the camera will go into the Standby state. Generally the stowed position is with the ball rotated down so the camera optics are in a protected position. The Stow position can be configured with the on-screen configuration menus.

The JCU display will prompt the user to select a camera to control. If the same camera is selected, the camera will return to the Powered On mode.

System Stndby?

If the "System Stndby?" option is selected, both the JCU and camera are powered off, as described above.

Global Stndby?

Global standby is a command sent by a JCU that will power down all discovered cameras and JCUs. This function is used to properly shutdown all cameras (return to stow position) and JCUs prior to removing power with the system breaker. Selecting "Global Stndby?" directs the JCU to command all JCUs and cameras found on the network to go to standby mode. Global standby can also be achieved by pressing the SCENE, COLOR, and HOME buttons in unison for three seconds.

Calibrate JCU

The "Calibrate JCU" function is used to calibrate 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.

When calibrating, 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 CW to the full extent possible, and then rotating

CCW to the full extent possible, and when both directions are completed, pressing 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

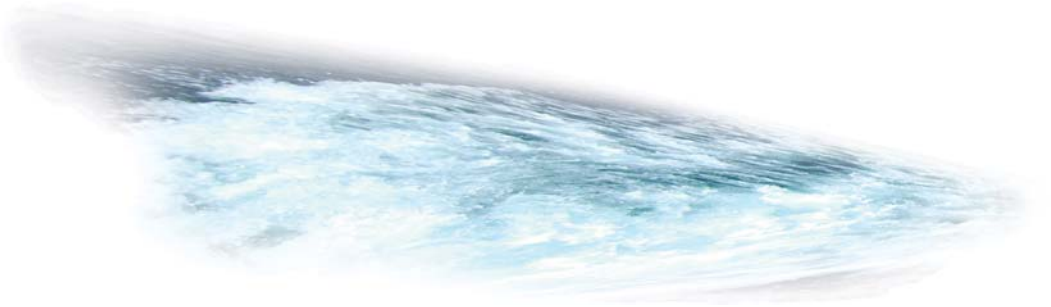
The following table shows the factory default settings for the M-Series configuration options.

TABLE 1.

Option	Factory Default	Comment
Home Position	0^0 azimuth, 0^0 elevation	
Stow Position	0^0 azimuth, -90^0 elev.	
Scene	Night Running	
Thermal Color Default	Red	
Polarity	Red hot, black cold	
USER button	Invert Video Polarity	
Color Thermal Video	Enabled	
Symbology	Display Minimal Icons	
Ball Down Installation	Disabled	
Aircraft Joystick	Disabled	
Twist To Pan	Enabled	
High Power Standby	Enabled	
High Motor Torque	Enabled	
Rearview Mode	Disabled	
Camera Name	Model number followed by serial number (variable)	Example: `M-625XP A01234`
VIS/IR video signal (dual payload models only)	IR (thermal)	
Network Configuration	Dynamic	

CHAPTER 3

System Operation and Configuration



System Operation and Configuration

This section provides additional information about operating the camera system and describes how to configure the system options. To operate the M-Series camera, it is not necessary to modify any of the factory configuration settings. However, you may choose to configure the camera with settings that match your personal preferences or provide optimal performance under varying conditions. In this section the various JCU and Menu settings are described.

Some configuration settings are changed directly by pressing a button on the JCU. Other configuration settings must be changed by accessing the on-screen configuration menus. Some camera functions or settings are dependent on the on-screen menu settings as well as how the JCU buttons are used.

In particular, note that the USER button on the JCU is programmable, and can be used to quickly access your favorite feature or function. Refer to the User Programmable Button section for more details on how to make the best use of this button.

Operation/Configuration Using JCU Buttons

Ensure the JCU you are using is communicating with the camera to be operated/configured. If necessary, use the Assign JCU function in the JCU Power Menu to connect the JCU to the appropriate camera.

The following camera settings are controlled with the buttons on the JCU.

COLOR

The COLOR button switches the thermal camera video between a greyscale mode and one or more color modes. When viewed at night in the darkness, the default color mode uses a red-colored video image that may help preserve the user's night vision. Based on personal preferences, one of the other color settings (or color palettes) may be desirable.

Press the COLOR button to cycle through the different color settings. The function of the COLOR button is dependent on the on-screen menu settings in the Video Menu. If the COLOR button only allows access to two settings (toggles between white-hot and red-hot, or black-hot and red-cold) then it is likely the Disable Color Thermal Video menu entry has been selected. Refer to the Configuration Menus section for additional information.

Note: The USER button is configured with the Invert Video Polarity setting by default, so it will toggle the infrared imagery from white-hot (or red-hot, if the COLOR setting is active) to black-hot.

HOME

The HOME button is used to move the camera to its home position, or it is used to select a given position as the home position. The Home position is a programmable preset position - usually straight ahead and level with the horizon – which operators can use as a reference.

To set the Home position, 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 Home position, press and release the HOME button. When you push the HOME button, this icon will appear on the screen briefly.

Note: 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 the camera 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 user; refer to the Configuration Menus section for additional information regarding the Stow position.

SCENE


Day Running


Night Running


Man Overboard


Night Docking

The SCENE button allows the user to toggle through a set of preconfigured image settings, in order to select the best setting for the given conditions.

The M-Series automatically adjusts to changing scene conditions to provide a high-contrast image that is optimized for most conditions. The camera contains four preset SCENE settings that might provide better imagery in certain conditions: Night Running, Day Running, Man Overboard, and Night Docking.

While these names indicate their intended use, varying environmental conditions might make one setting preferable over another; night running while in a harbor, for instance. Experiment with the different settings, and find out for yourself which settings works best in different conditions.

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

USER

The USER button is a programmable one-touch button. It is intended to allow the user to quickly access the most common or favorite settings or functions.

Pressing and holding the USER button will automatically take the user to the on-screen menu that is used to program the button. The menu can also be accessed by pressing the MENU button and then scrolling down to the User Programmable Button entry.

Note: The USER button is configured with the Invert Video Polarity setting by default, so it will toggle the infrared imagery from white-hot (or red-hot, if the COLOR setting is active) to black-hot.

Refer to the User Programmable Button section below for more information about programming the USER button.

Configuration Menus

In most installations, it will not be necessary to modify the factory default configuration settings. If the user has a set of preferred settings, it may be desirable to modify some of the configuration settings with the on-screen menu. Some settings can be saved and therefore are preserved (in the case of loss of power), and some settings will be configured as needed.

MENU

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

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 fore and aft, or it can be rotated). To make a selection, press the puck (like a mouse click) or move the puck to the right. Once you are satisfied with your changes, press the MENU button to exit the menus.

Note: The on-screen menus only appear on the thermal camera video. They do not appear on the video from the visible camera.

When the Menu button is pushed, the following on-screen menu is displayed on the thermal video:

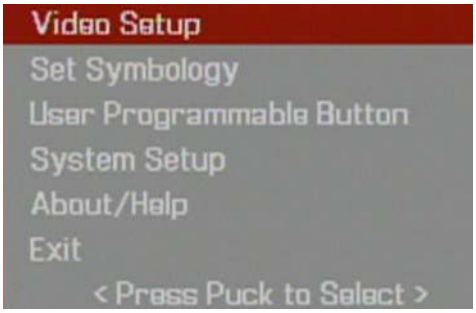
When the MENU button is pressed while viewing the Visible Low-Light Camera, the video will switch back to Thermal Video to allow the MENU to be displayed.

The current menu selection is indicated by the dark red bar.

If a menu entry begins with the word “Enable” (for example “Enable Color Thermal Video”), then that option is currently disabled. When it is selected, the option becomes enabled and the word “Enable” toggles to “Disable”. Similarly, if an option begins with “Disable…”, selecting that menu entry will disable the option and toggle the menu entry back to “Enable…”.

Video Setup Menu

From the main menu (shown at the left), the Video Setup entry will lead to the following menu.



Main On-Screen Menu

This menu is used to set the video configuration options.

Set Thermal Color Default

The Set Thermal Color Default saves the current Color setting as the default value. This setting will be 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 will toggle the infrared imagery from white-hot (or red-hot, if the COLOR setting is active) to black-hot. The difference between white-hot and black-hot is shown below; 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.

Note: By default, the USER button is configured with the Invert Video Polarity setting, so it can be used to toggle the video polarity. However, the function of the USER button can be changed from the factory default setting to do other functions. Refer to the User Programmable Button section for more information about how to program the USER button.

Enable (Disable) Color Thermal Video

Many people prefer to look at the thermal images in color instead of grayscale. When this menu item is enabled, the camera uses all five color palettes available. The JCU COLOR button will cycle through all five settings: greyscale, red, glowbow, rainbow and fusion, instead of just two settings. When it is disabled, the three color palettes (rainbow, sepia and fusion) are not available. This option is enabled by default.

Display Test Pattern

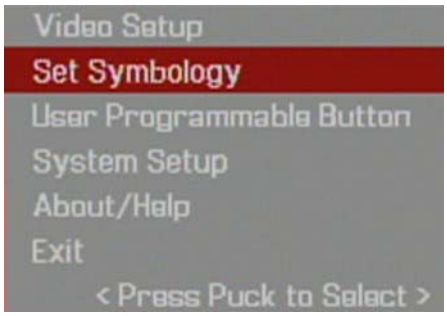
Quite often the video from the M-Series camera can be optimized by adjusting the monitor that is being used to show the video. The Display Test Pattern function is useful for setting up the monitor to give the best detail and contrast.

When the Display Test Pattern entry is selected, the Toggle Test Pattern menu is displayed, and the user is prompted to press the puck to select a test pattern. Pressing the puck repeatedly will cycle through the four test patterns.

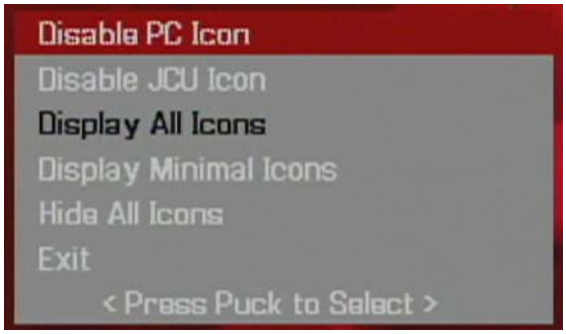
When a test pattern is displayed, the monitor brightness and contrast, can be adjusted to give the best image.

Set Symbology

From the main menu (shown at the left), the Set Symbology entry will lead to the following menu:



Main On-Screen Menu



Icon Display

The PC Icon and the JCU Icon can be enabled or disabled using the first two menu entries.

Note: The PC Icon will only appear if the system has discovered a PC on the network.

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.

Display All Icons

Selecting this menu item will turn on all the on-screen icons at all times. Some icons are only displayed momentarily (for example, the Home Icon).

Display Minimal Icons

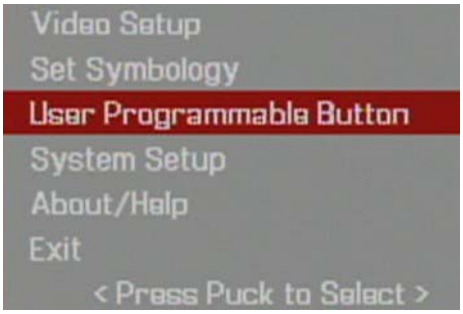
When the Minimal Icon mode is selected, the Position Indicator is displayed continuously on screen. The Home and Scene icons will display on screen for 3 seconds only before disappearing. The Zoom (2X and 4X[1]), Rearview, and Image Freeze icons are displayed whenever those functions are active.

Hide All Icons

Selecting this menu item will turn off most of the on-screen icons except when their corresponding controls are actively in use. The Position Indicator and the FLIR logo are always displayed.

1 Note, 4X Zoom not available on all models.

User Programmable Button



Main On-Screen Menu

From the main menu (shown at the left), the User Programmable Button entry will lead to the following menu:

Note: It is also possible to enter this menu by pressing and holding the USER button for 3 seconds.

The USER button is a programmable one-touch button. It is intended to allow the user to quickly access the most common or favorite settings or functions. This menu allows the user to select how the USER button will function. The user can select one of the five choices; the Invert Video Polarity is the default selection. The active choice is shown in black type.

Man-Over-Board Settings - pressing the USER button causes the thermal camera to use the Man Overboard AGC setting.

Switch IR/VIS Video (this option is available on dual payload models only) - pressing the USER button causes the video signal on the cable labeled "VIS/IR" to toggle between the thermal camera and the visible-light camera.

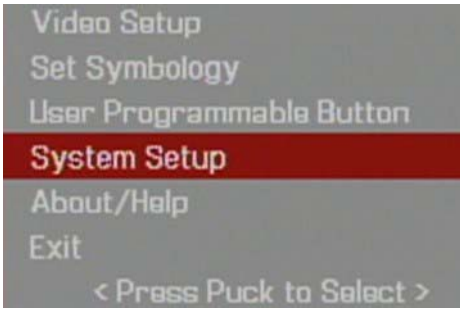
Troubleshooting Tip: If this mode is selected, but pressing the USER button does not cause the display to switch from the thermal camera to the visible-light camera, be sure the proper input channel is selected on the display, and be sure the cable labeled "VIS/IR" is connected to the display.

Hide/Show All Icons - pressing the USER button toggles between the Hide All Icons menu setting and the Show All Icons setting (refer to the Set Symbology section for more information).

Invert Video Polarity - pressing the USER button will toggle the infrared imagery between white-hot (or red-hot, if the COLOR setting is active) and black-hot.

Rearview Mode (Revert) - pressing 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 will be displayed on the screen.

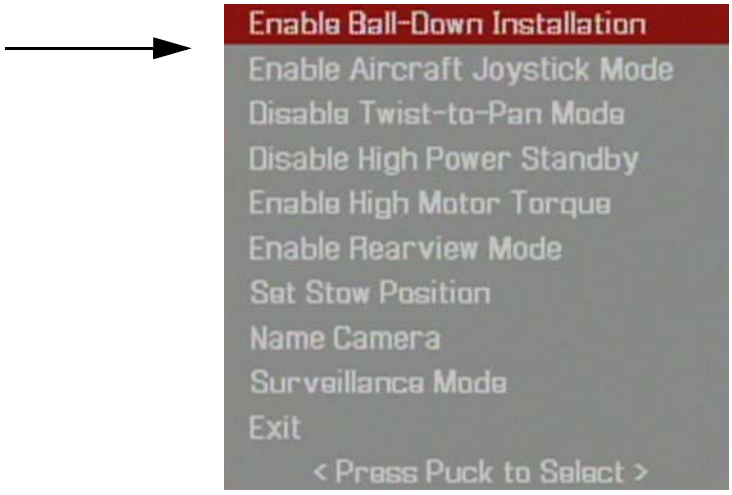
Surveillance Mode - pressing the USER button enables or disables the Surveillance Mode. Refer to the Surveillance Mode section below for more information about this mode of operation.



Main On-Screen Menu

System Setup

From the main menu (shown at the left), the System Setup entry will lead to the following menu:



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 the Ball-Down mode is first enabled, the camera to rotate 180 degrees and the camera ball will flip over. This option is disabled by default.

Enable (Disable) Aircraft Joystick Mode

The joystick can be used in either “aircraft” or “gaming” mode. The choice of which mode to use is a matter of personal preference. One mode may feel more natural than the other. When Aircraft Joystick Mode is enabled, moving the joystick forward causes the camera to tilt down. When disabled, moving the joystick forward causes the camera to tilt up. The default mode is disabled.

Enable (Disable) Twist-to-Pan Mode

This menu entry enables or disables the Twist-To-Pan mode. The default JCU setting for the Puck is "twist to pan"; alternatively, you can change the Puck setting so that the camera is panned by moving the Puck to the left or right, rather than rotating (twisting) it. The Zoom Function is also assigned to "twisting left/right" when "twist to pan is disabled.

Enable (Disable) High Power Standby

This menu entry controls the amount of power that is supplied to the pan/tilt motors while the camera is in the Standby mode. 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.

The High Power Standby mode may be useful for power boats that operate at higher speeds and experience high impact environments, and can accept higher power consumption.

Note: The High Power Standby mode is enabled by default; for vessels such as sailboats with a limited power budget, it may be wise to disable the High Power mode. Refer to the Power Consumption table below.

Note: If the gimbal moves due to shock or vibration rather than a command from the JCU, the camera can be reset by repeated pressing of the HOME button 4 times.

When the Enable or Disable selection is made, the camera prompts the user to confirm or cancel the selection.

Enable (Disable) High Motor Torque

This menu entry controls the amount of power that is supplied to the pan/tilt motors while the camera is in the Powered On mode. As with the High Power Standby mode option, choosing the amount of motor torque 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. Also a trade-off with camera readiness delay is possible in cold environments while the system reaches operational temperature.

The High Motor Torque mode may be useful for power boats that operate at higher speeds and experience high impact environments, and can accept higher power consumption.

Note: The High Motor Torque mode is enabled by default; for vessels such as sailboats with a limited power budget, it may be wise to disable the High Power mode. Refer to the Power Consumption table below.

Note: If the gimbal moves due to shock or vibration rather than a command from the JCU, the camera can be reset by repeated pressing of the HOME button 4 times.

When the Enable or Disable selection is made, the camera prompts the user to confirm or cancel the selection.

TABLE 1. Power Consumption

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

The above power numbers assume a single JCU is plugged into the camera and window heaters are not active. For a dual-payload camera, an additional 16W is consumed when window heaters are active for a maximum power consumption of under 46 W. For single payload, when heaters are active there is an additional 6.5W, for a maximum power consumption of under 26W.

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. If Rearview Mode is enabled, the Rearview mirror icon will be displayed on the screen. It is possible to configure the USER button to enable or disable the Rearview Mode.

Set Stow Position

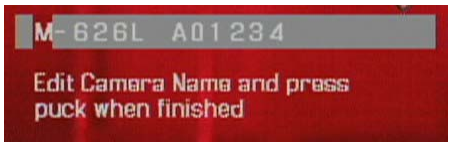
When Set Stow Position is selected, the camera stores the current position (camera azimuth and elevation) as the Stow position. The camera moves to

the Stow position when it is turned off (put into Standby mode). Refer to the System Startup section for additional information about the Standby mode.

Note: The Stow position is not the same as the Home position. The Home position is the position the camera will most likely be in when the camera 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 user; refer to the Operation/Configuration Using JCU Buttons section for additional information regarding the Home position.

Name Camera

The Name Camera can be used to give the camera a new name. When the Name Camera function is selected, the current name is displayed on the screen, and the first character of the name is blinking. The puck can be moved fore and aft (or twisted) to change the character. The next character can be selected by moving the puck to the right.



The possible characters that can be used include the letters of the alphabet (upper or lower case), the numbers `0-9`, and the hyphen symbol (`-`). When the name has been entered completely, push the puck to exit.

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

Surveillance Mode

The Surveillance Mode entry will lead to the following menu:

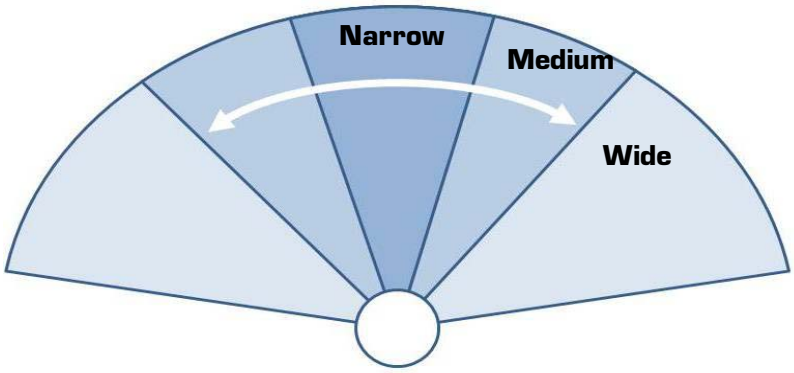
The User Programmable Button can be programmed to enable or disable Surveillance Mode (refer to the section above called User Programmable Button). When the USER button is configured with the Surveillance Mode setting, the Surveillance Mode will be enabled when the USER button is pressed. When the camera is in Surveillance Mode, it will cause the cam-

era to continuously pan left and right, until it is taken out of Surveillance Mode or until the JCU is used to move the camera. The camera will not resume Surveillance Mode automatically; it is necessary to enable Surveillance Mode again by pressing the USER button.

Scan Width

In Surveillance Mode, the Scan Width determines the range of horizontal azimuth (pan) covered by each scan. The choices are Narrow, Medium, and Wide. If the Scan Width is set to Narrow, the camera will scan from approximately 20° left of center to 20° right of center, with the center determined by which direction the camera is pointing when the USER button is pressed. The Medium scan width covers an area 40° to the left and right of center (80° total), and the Wide scan width covers 80° to the left and right of center (160° total).

Note: The center of the scan pattern is determined by the direction the camera is pointing when the USER button is pressed. The scan pattern is not centered about the Home position, unless the camera is in the Home position when the USER button is pressed.

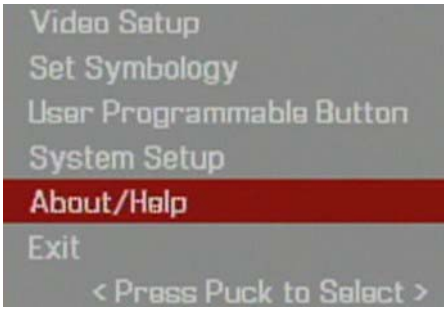


Scan Speed

In Surveillance Mode, the Scan Width determines how quickly the camera scans back and forth. The choices are Fast, Medium, and Slow.

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

About/Help



Main On-Screen Menu

From the main menu (shown at the left), the About/Help entry will lead to the following menu:

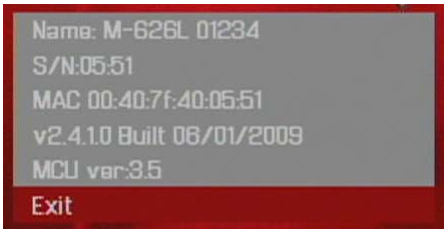
Video Icon Help Screens

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

About/Help Menu

Selecting the Product Information menu entry will display on the screen the product information, such as the camera model, serial number, and software release information. When contacting FLIR, please have this information available.



Contact FLIR

About/Help Menu

Selecting the Contact FLIR menu entry will cause the FLIR contact information to be displayed on the screen. Additional contact information is included at the back of this manual. When contacting FLIR, please have the product information available (see above).

About/Help Menu

Restore Factory Defaults

Select this item to restore the M-Series to its factory default settings. The camera will prompt the user to confirm if the camera is to be restored to the factory default settings.

Refer to Factory Default Settings table for a list of the factory default settings.

System Reset Functions

JCU Reset

Occasionally it may be necessary to reset the JCU. Simultaneously pressing the MENU and USER buttons for >3 seconds causes the JCU to reset. Unplugging and plugging the Ethernet will also cause the JCU to lose power temporarily and reset.

Camera Reset

Severe vibrations or shock may cause the camera gimbal assembly to rotate or tilt and cause the 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.

Operation Tips

As you experiment with the M-Series, you will see the world in a different light. Consider every object you view in terms of how it will look “thermally” as opposed to how it looks to your eye. Right after sunset, objects warmed by the sun will appear warmest. Early in the morning, many of these objects will appear cooler than their surroundings, so be sure to look for subtle ball-down differences in the scene, as opposed to just hot targets.

Originally developed for the military, thermal imaging cameras are now deployed in numerous commercial applications where it is impractical or too expensive to use active illumination (lights). They are perfect for a wide variety of applications in addition to maritime, including transportation, security, fire fighting, and medical applications. The cameras often provide improved daytime viewing in environments where traditional video camera performance suffers, such as in shadows or backlit scenes.

The M-Series camera is a state-of-the-art thermal imaging system that will provide you with excellent night visibility and situational awareness, without any form of natural or artificial illumination. The system is easy to use, but you should take a moment to understand how to interpret what you are seeing on your display and how to use the controls.

While the imagery you will see on the monitor may at first look similar to ordinary black and white daylight video, as you get familiar with the camera you will appreciate the characteristics that make thermal imaging distinct. A few tips on how to interpret some of the imagery will help you to make the most of your system.

The thermal imager inside the camera does not sense light like conventional cameras; it senses heat or temperature differences. As you experiment with the system during daylight and nighttime operation, you will notice differences in the picture quality; this is normal. The camera senses small "differences" in apparent radiation from the objects in view, and, in white hot mode, displays them as either white (or lighter shades of grey) for warmer objects, and black (or darker shades of grey) for colder objects.

Your 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, a thermal imaging camera does not need an additional active illumination source and images based on directly radiated rather than reflected energy.

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 experi-

ence. 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.

If you have any questions about the operation of the M-Series, or you would like to provide feedback on the product, please feel free to call us at 1.888.747.FLIR in the United States.

Troubleshooting Tips

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 boot cycle prior to JCU connection. Ensure the JCU is assigned to the camera, the camera name 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.

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).

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

On a dual payload model, 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 mode is set to Switch IR/VIS Video, pressing the USER button. If neither of these operations will 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.

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 (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 which can cause unacceptable noise. Use the FLIR Video Distribution Amp when splitting the signal to multiple monitors.

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, but a particular 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. The user should keep the ocean, and not the sky or the boat, as the predominant object in the image. Refer to the Video Setup Menu section for information about how to make adjustments to the image with the SCENE button.

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 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 allows the user to momentarily freeze the image. Double click (press down quickly two times) on the JCU puck to freeze the image. The snowflake Image Freeze icon will appear 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. Periodically the image will momentarily freeze for a fraction of a second while the camera performs a flat field correction. 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 will cause the thermal camera to do an FFC operation.

Multiple Cameras and/or JCUs on a single network

It is possible to have 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 JCUs in the order the commands are received across the network. Unpredictable behavior may result from users sending conflicting commands from separate JCUs (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 2 System Startup 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[2]. Remove the Ethernet RJ45 loopback termination adapter. The camera will then continue the start-up 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 will vary depending on the outside temperature). The message will be removed when camera is ready to operate.

`"High Temperature - Motor Halted"`

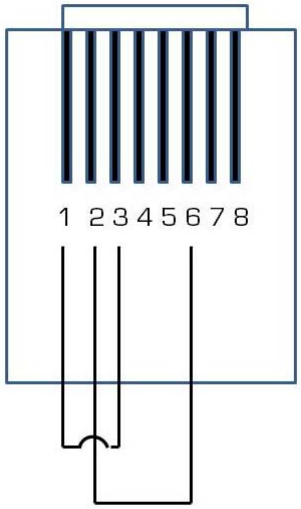
Indicates the camera has detected an over-temperature condition and has disabled the internal pan/tilt motor power. Confirm the temperature of the camera is within the allowed operational temperature range. Allow the camera to cool down to a temperature within the operating range.

`"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 onfirm 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.

2 Refer to the following section for more information about the RJ45 loopback connector and how to restore the network settings to factory defaults.

Restoring the Factory Network Settings



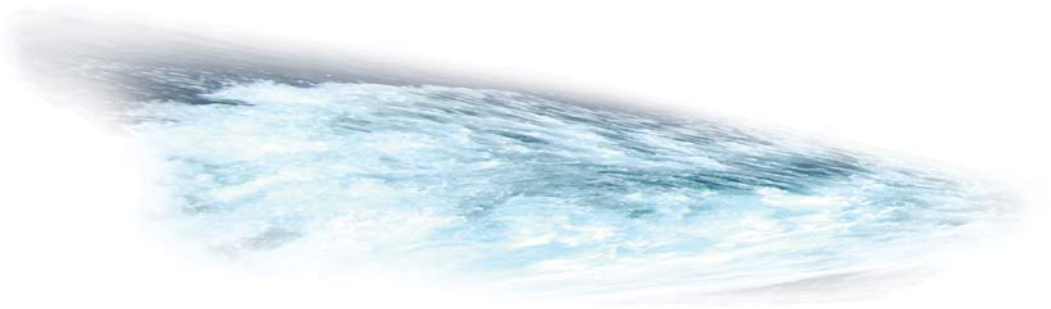
In some cases, it may be necessary to restore the network settings of the camera to the original factory settings. At each power-up, the system transmits a packet and then checks to determine if that same packet has been recieved. Detection of the received packet indicates the camera has a custom loopback 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 custom loopback connector is described below.

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

CHAPTER 4 M-Series IP Interface



M-Series IP Interface and PC Operations

The M-Series cameras and JCUs are network devices that communicate over an Ethernet network using the Internet Protocol (IP). In addition to using a JCU to control and configure a camera, a user or installer can also do similar operations (and even more advanced configurations) using a web browser[1] 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.

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: +1.888.747.3547.

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.

1 Supported web browsers: 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.

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 the HTTP protocol.

Generally the same controls and functions that are available from the JCU are also available through the web interface. As shown in the screen shot below, the JCU functions and menu options described in the previous chapters are represented as web 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 grey).

Web Control Functions

For the most part, each link on the Web Control page corresponds to an equivalent operation on the JCU or with the System Menu, as the table below 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.

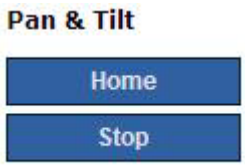


TABLE 1. Web links and the equivalent JCU/Menu operation

Web Control Link	Equivalent Operation	Comment
Pan and Tilt		
Home	JCU: Press HOME button	Click and hold to set the home position.
Stop		Stops all movement of the camera, including Surveillance Mode. No equivalent JCU function
Camera Controls		
Active	JCU: Press POWER/Dim button	
Standby	JCU: Press and hold POWER/ Dim button	
Speed (pull-down)		Controls the speed of pan and tilt operations; Possible selections: 40, 60, 80
Product Information	MENU: About/ Help > Product Information	See below for an example
Network Setup		Refer to the Network Setup section that follows
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.

TABLE 1. Web links and the equivalent JCU/Menu operation

Web Control Link	Equivalent Operation	Comment
Twist -	JCU: Twist Puck counterclock-wise	With Twist-to-Pan mode enabled (default), twisting the puck will cause 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 all modes.
Up	JCU: Push Puck forward (away from user)	Controls camera tilt (direction depends on Aircraft Joystick mode); used to navigate menu in all modes.
Press Puck	JCU: Press Puck into JCU	With Twist-to-Pan mode enabled (default), pressing the puck will cause the IR camera to zoom in. Also functions as "enter" when using Menu functions.
Pull Puck	JCU: Pull Puck out from JCU	With Twist-to-Pan mode enabled (default), pulling the puck will cause the IR camera to zoom out.
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
Color	JCU: Press COLOR button	Cycles through the various Color settings.
Scene	JCU: Press SCENE button	Cycles through the various Scene settings. On a dual payload camera, click and hold to toggle VIS/IR video between IR and Visible camera.
Freeze	JCU: Double click Puck (press down 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.

TABLE 1. Web links and the equivalent JCU/Menu operation

Web Control Link	Equivalent Operation	Comment
Zoom +	JCU: Push Puck down for 1 second to turn on 2X electronic zoom	
Zoom -	JCU: Pull up on the Puck	
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	This function is only valid for dual payload cameras. 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	

TABLE 1. Web links and the equivalent JCU/Menu operation

Web Control Link	Equivalent Operation	Comment
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 Joystick Control links that control camera movement.
Switch Rearview Mode	MENU: System Setup > Enable (Disable) Rearview Mode	
Text Fields		
Camera Name		This field displays the camera name. It is not possible to change the camera name with this field. Use MENU: System Setup > Name Camera function to set/change the name of the camera.
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

UPnP Configuration

In order to use the Web Interface, the PC may need to be setup to use Universal Plug and Play (UPnP), which is not normally active on most PCs.

Universal Plug and Play

UPnP is a set of networking protocols that allow devices on a network to connect automatically, without the need for configuration by a network expert. The intent of UPnP is to simplify 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, but by default PCs are not set up to accept UPnP broadcasts.

Users need to activate UPnP on their computers so that M-Series cameras or JCUs can be found. The JCU and camera use this same process to connect to one another.

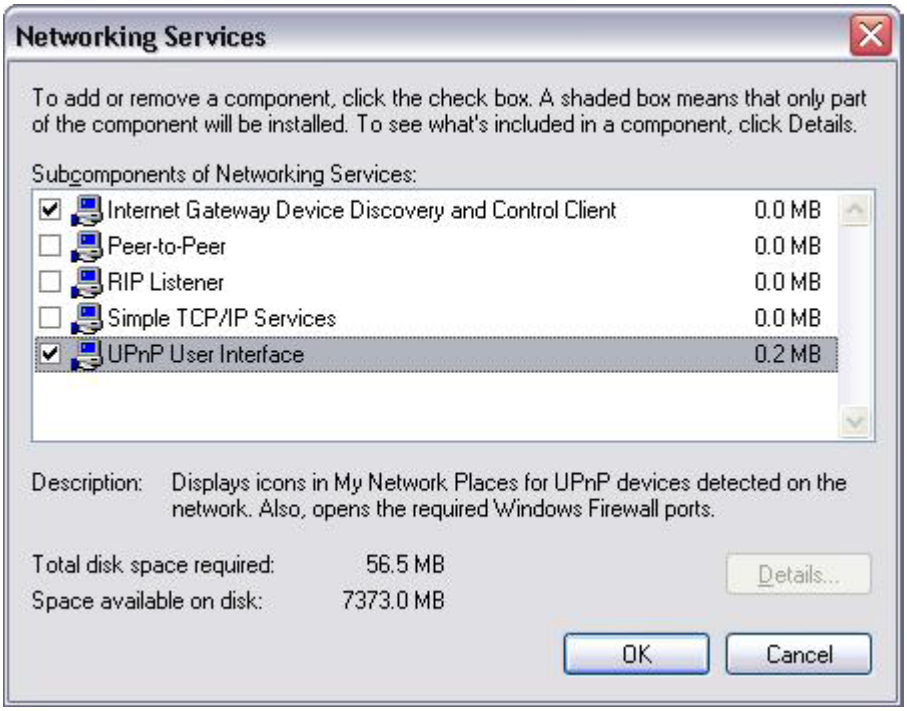
Enabling the UPnP User Interface

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

3. In the Windows Components Wizard, click Networking Services, click Details, and then select the Universal Plug and Play check box.



4. 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.

PC Icon

On the M-Series video output, the PC Icon indicates there is a PC on the network that has a connection with the camera.

JCU Icon

A single JCU Icon indicates only one JCU is currently connected to the camera unit. If more than one JCU is discovered, the multiple JCU icon will appear on screen.

Network Settings

IP Addresses

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.

Note: 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 returns to the Camera name it had prior or the state it was in before the IP request was made.

Note: it is not possible to display the camera's IP address on the JCU display.

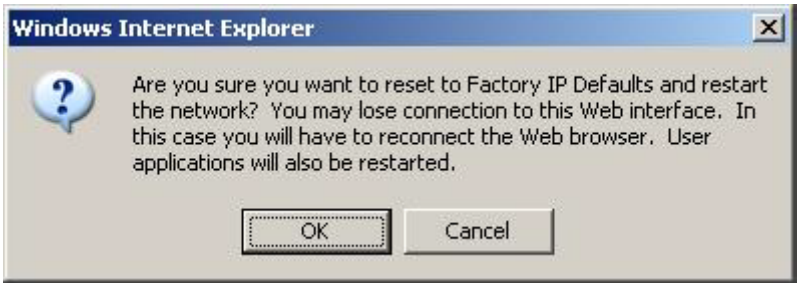
When the Network Settings link is selected, the camera IP address, Mask, and Gateway are displayed, as show in the screen shot below. The Dynamic option is selected by default.

Static IP Address

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 grey to white, indicating they can accept user entries. Once you have entered the appropriate information, click on the Save link.

As soon as you select Save, the system will give a warning as it restarts the Network stack:

When the camera is in Static mode, clicking on the “Factory IP Defaults” link will result in the following warning:



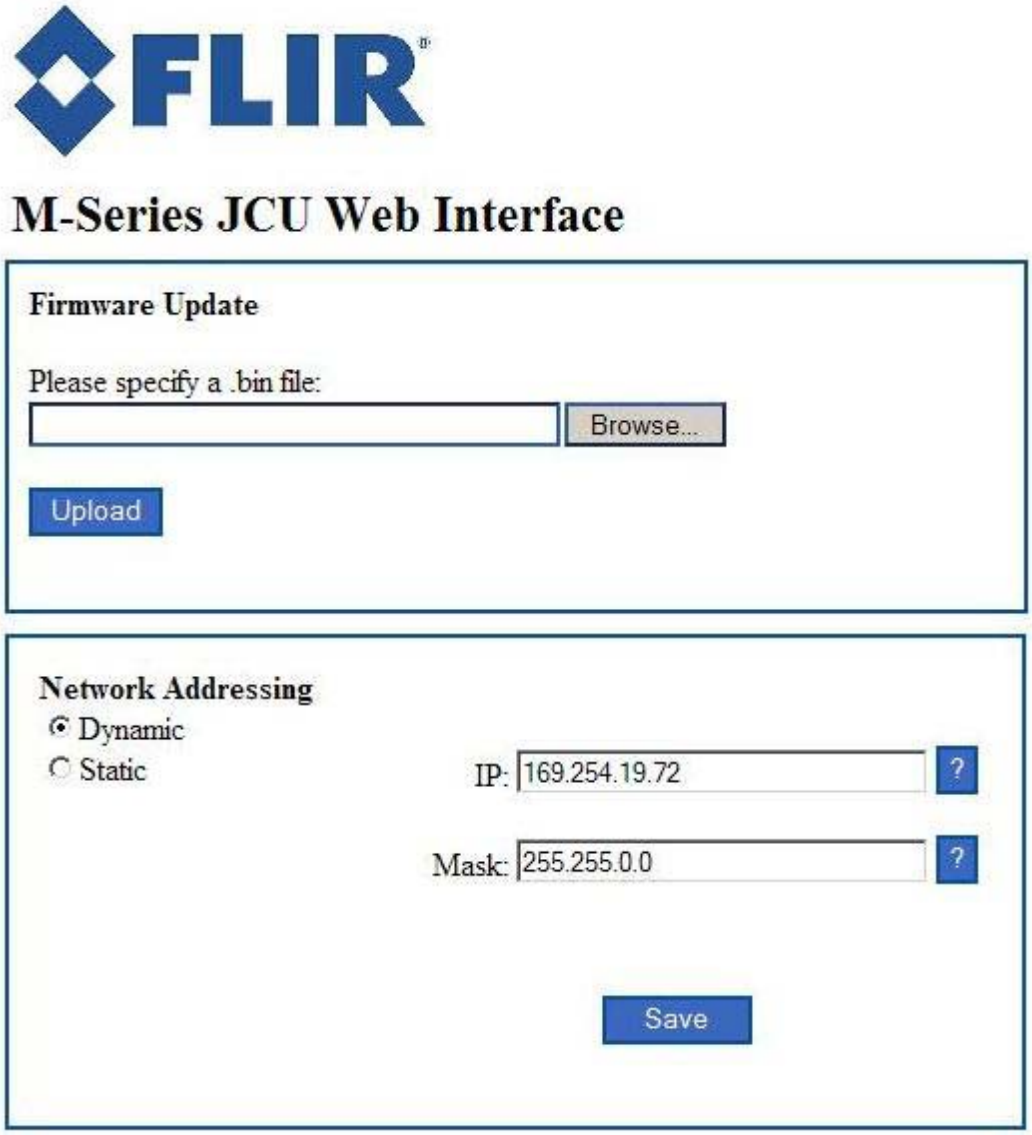
Note: When the IP address is changed, the browser window opened under the old IP address will no longer be valid.

Type the new static IP address into the browser, 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).

JCU Control

The JCU web page allows the user to select the dynamic or static IP address option for the JCU. It is similar to the IP Address option described above for the camera. Note that a PoE power injector is necessary to connect a JCU to a PC. It is not possible to configure a JCU if it is not powered..

Note: As software updates become available in the future, the Firmware Update function will be used to load the update to the camera. Contact the FLIR dealer where you purchased the camera for additional information, or contact FLIR directly: +1.888.747.3547.



Custom Network Applications

Programmers/Integrators

In more advanced/sophisticated installations, where other devices such as radars may be 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 allows a marine electronics integrator to 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 will accelerate any application programming with FLIR Systems thermal imaging cameras and will allow integrators to combine camera functionality with other sensors and detection devices to take full advantage of this advanced technology.

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

Interested parties may download the SDK at http://ns.flir.com/ under the FLIR Developers Network tab. A new user must register as a developer before access to the SDK is possible. The registration link is on the website and an account is required for downloading any files. Optional software support packages may be purchased at the same location. Contact your FLIR dealer where you purchased the camera for additional information, or contact FLIR directly: +1.888.747.3547.

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 Web Control web 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) protocol. 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.

In the future, the TX/RX fields on the Web Control web page will allow developers who are testing new applications the ability to edit/modify the commands on the fly to actually control the camera.

Resources Available

If you would like more information about thermal imaging cameras and about integrating FLIR products with other marine electronics, please visit our website 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 and how to become a FLIR Certified Maritime Integrator (FCSMI), FLIR offers complimentary training courses at the Infrared Training Center:

http://www.flir.com/training


FLIR
M-Series Quick Start Guide
Power Button
• Press and hold to power On/Off
• Press to dim
Menu Button
• Press to enable menu
• Press to exit menu
Scene Button
• Press to change scene settings
• Press and hold to switch between visible and thermal cameras
FLIR
M-Series
MENU
USER
COLOR
SCENE
HOME
Twist
Fore
Aft
LCD Display
• Displays Startup/Shutdown options
• Use puck to interact
User Programmable Button
• Press and hold to display options
• Press to apply
Home Button
• Press and hold until icon flashes to store home
• Press to return to home position
Color Button
• Press to change color pallet (thermal only)
Puck
• Twist to rotate camera
• Push fore/aft to tilt camera
To Zoom and Freeze Picture
• Press down and hold to zoom in
• Pull up and hold to zoom out
• Double click to freeze image
• Any action unfreezes image
To Navigate On-Screen Menus
• Push fore/aft or twist to scroll up/down
• Press down to accept menu item
To Navigate LCD Menu
• Push fore/aft to scroll up/down
• Press puck to accept menu item
432-0003-00-11 Rev 200


FLIR
M-Series Quick Start Guide
FLIR
2X
4X
Position Indicator
Controllers on Network
Scene Icons MOB, Night Running, Daytime Running, Night Docking
Rearview, Zoom, Image Frozen
Home Position
PC on Network
Permanent Icons: Displayed in "minimal" or "all" icon mode
Persistent Icons: Displayed persistently when enabled
Momentary Icons: Momentarily displayed in "minimal" or "all" icon mode
Selectable Icons: Displayed only in "all" icon mode

NOTES

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