![FLIR logo]

Operator's Manual
M500

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Proper Disposal of Electrical and Electronic Equipment (EEE)

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

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

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

Document History

Version	Date	Comment
100	December 2017	

Contents

M500 Overview

General Information

This manual describes the operation of the M500 cameras. If you need help or have additional questions, please call to speak with our support experts; refer to contact information listed on the back cover of this manual.

This manual includes information about the following topics:

*   System description

*   Using the Joystick Control Unit

*   System startup and shutdown

*   Using Video Tracking mode

*   Using the on-screen-display (OSD) menus for controlling the M500

*   Helpful reference information such as acronyms, parts lists, a table of icons, and a comparison of model features

Additional References

The M500 system comes with a complete documentation set, available on the FLIR website, that includes this manual as well as other information. All documents are in PDF format and can be viewed with Adobe Acrobat Reader:

*   *M500 Installation Guide* (FLIR Doc. # 432-0012-01-12) contains information about how to install the camera.

*   *M500 Quick Start Guide* (FLIR Doc. # 432-0012-01-11) is a double-sided card that shows the functions executed by the Joystick Control Unit.

Refer to the FLIR Resources Web page for up-to-date documentation:
http://www.flir.com/

Documentation Conventions

For safety, and to achieve the highest levels of performance from the M500 system, always follow the warnings and cautions in this manual when handling and operating the M500 system.

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

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

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

Warnings and Cautions

Warning: Do not use the M500 system as the primary navigation system. Use it in conjunction with other navigation aids and a primary manual navigation system.

Warning: Ensure power is removed before accessing power wires during installation or removal of system components. Damage to equipment or injury to personnel may result.

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

Warning: The M500 system is not designed to operate in an enclosed environment in the presence of flammable gases. Failure to follow this warning may result in explosion or fire.

Warning: The M500 camera body is a remotely and automatically controlled device. Ensure camera motion has been disabled before cleaning surfaces that can cause pinch hazards.

Caution: Do not open the M500 unit for any reason. Disassembly of the M500 (including removal of the cover) can cause permanent damage and will void the warranty.

Caution: Be careful not to leave fingerprints on the M500 optics.

Caution: The M500 requires a power supply of 12 Vdc to 24 Vdc nominal, 5.5 A maximum @ 24 Vdc, 11 A maximum @ 12 Vdc. Absolute voltage range: 12 Vdc to 32 Vdc. Operating the system outside of the specified input voltage range or the specified operating temperature range can cause permanent damage.

Operating temperature range	–20 °C to +55 °C (–4 °F to +131 °F) per IEC 60945
Storage temperature range	–50 °C to +80 °C (–58 °F to +176 °F)

System Description

The multi-sensor M500 is a stabilized maritime thermal and high definition (HD) visible-light camera system for use on most types of vessels. The mid-wave infrared (MWIR) thermal camera with 14X optical zoom provides excellent nighttime visibility and situational awareness, without any form of natural or artificial illumination. The HD visible-light camera with 30X optical zoom provides daytime viewing.

LED spotlight

HD visible-light camera

Thermal camera

Joystick Control Unit (JCU II)
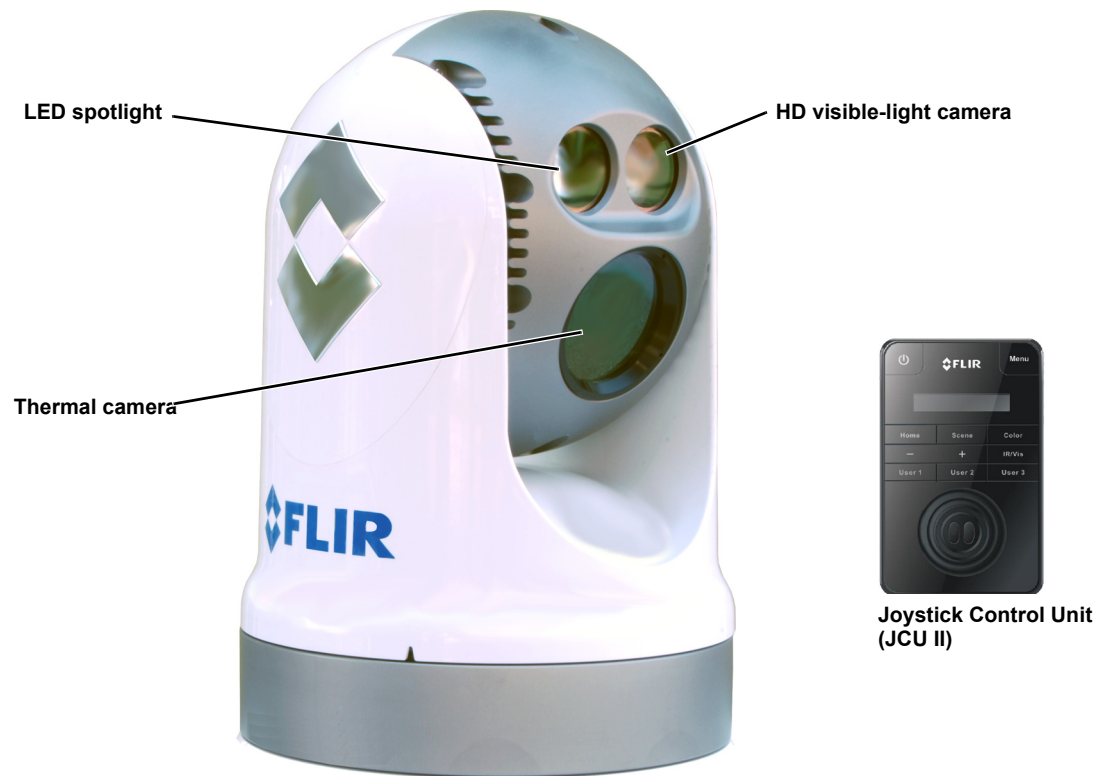
Figure 1-1: M500 Pan/Tilt Camera System

Standard Features

•   Cooled thermal camera, 14x continuous optical zoom

•   HD visible-light camera, 30x continuous optical zoom

•   High intensity LED spotlight

•   Active gyro-stabilization

•   Radar integration to follow specific radar targets (NMEA 0183 serial communications)

•   Dual, independent H.264 network video streams

•   HD-SDI (Serial data interface)

•   Analog video

The thermal camera, HD visible-light camera, and spotlight are aligned to view or illuminate a target for quick identification providing enhanced navigational abilities in a variety of conditions.

M500 Components:

- Main camera body, also known as the pan/tilt camera unit

- Joystick Control Unit (JCU II), compatible with the MU, MV, M400, and M500 camera systems

- Ethernet switch with power over Ethernet (PoE) to power the JCU II and network to the camera

- Analog and/or digital video monitors (customer supplied)

- Personal computer (PC) to control and configure the system (customer supplied)

The M500 camera body and JCU II are network devices. In some installations, additional M500 cameras and/or additional JCU II may also be used.

The camera body's pan/tilt mechanism allows the operator to rotate 360° in azimuth, tilt +/– 90° in elevation. The camera body houses the two cameras and the LED spotlight.

The JCU II is the primary control for the camera. The JCU II is used to wake the system or put it in standby, select the active camera, operate the pan and tilt movement of the camera, zoom the active camera, control the M500 modes and features, and configure the system settings by means of OSD menus.

The JCU II has various buttons, an LCD display, and the joystick. The joystick can be moved left and right or forward and back, and rotated in either direction. "M500 Joystick Control Unit" on page 16 describes the functions of the JCU II in detail.

The M500 uses on-screen icons to indicate the camera position (azimuth and elevation) and various system settings that have been enabled. These symbols are introduced in "Thermal Video Display" on page 11 and are further explained throughout this manual in the discussion of related functions.

Multiple Cameras, Joysticks, and Other Devices:

More than one JCU II can be used to control the camera, and more than one display can be used to view the video. A personal computer (PC) on the same network as the camera, can use a web browser to view video, control, and configure the system. The camera's web server uses password protected accounts to control access to camera functions. Using a PC is described in the *M500 Installation Guide*.

Also, a single JCU II can be used to select and control more than one camera. In this case, a menu on the JCU II lists available cameras. In the LCD display of the JCU II, the name of the currently selected camera is displayed. When more than one JCU II is installed in the network, a camera will respond to commands from any JCU II that has the camera selected.

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

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

Thermal Video Display

The infrared (IR) imaging thermal 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 the camera can see. Therefore, unlike an illuminated infrared camera, the thermal imaging camera does not need an additional active illumination source and images are based on directly radiated energy rather than reflected energy.

When the thermal camera is in white-hot mode, the warm objects in the scene are shown as white, or lighter shades of gray, and cold objects are shown as black or darker shades of gray. When the video polarity is switched, this is reversed.

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

Video Screen Icons

Depending on the system settings, various symbols are shown on the screen. Some of these icons are always shown on the screen, and some appear momentarily or only when certain functions are enabled or executed. The icons can be shown as white or red. See "Display icons:" on page 28 for a description of menu options and the displayed icons.

The following figures illustrate some of the icons displayed by the system, as well as an example of the OSD menu that is shown when the Menu button is pressed. Using the menus is described in "M500 System Configuration" on page 20.

A complete list of all of the icons used in the system and a brief description of how they are used can be found in "List of Icons" on page 58.
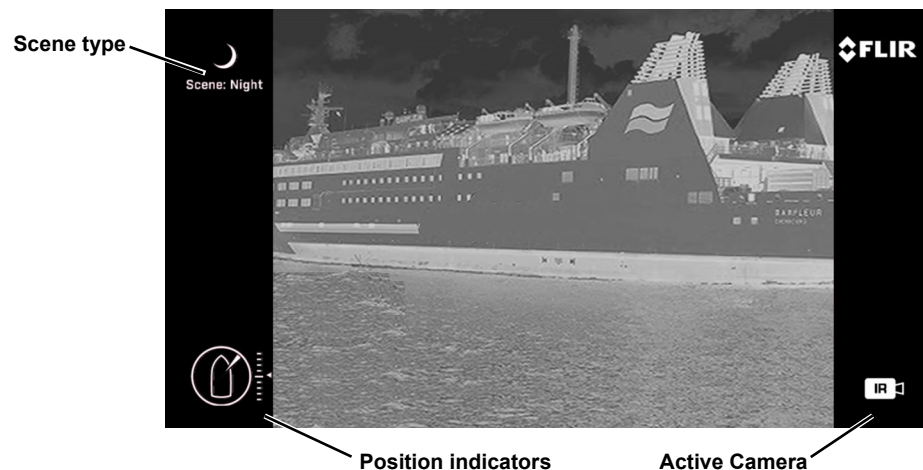
Figure 1-2: On-screen Icons

Position indicator icons

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

The elevation position indicator shows the vertical tilt of the camera above or below the horizontal plane of the vessel.

Azimuth   **Elevation**

Scene type icons

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

Night   Harbor

Day   Contrast

Active Camera Icons

At any given time, either the thermal camera (IR) or the HD visible-light camera is designated as the Active camera. The Active camera responds to commands such as zoom or focus that could apply to either camera. Pressing the CAMERA button on the JCU II toggles the active camera between the thermal camera and the HD visible-light camera.

Thermal   **Visible**

On-Screen-Display (OSD) Menu

The OSD menu appears when the Menu button on the JCU II is pressed. Menu entries are selected using the joystick and the joystick buttons. Pressing the Menu button again removes the menu from the screen.
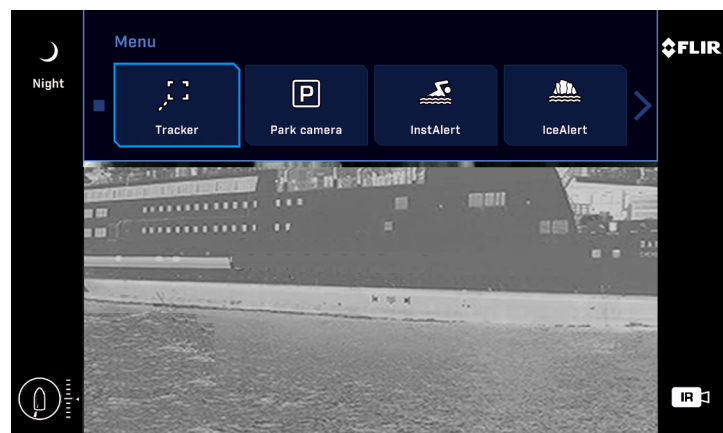
Figure 1-3: OSD Menu

M500 System Startup

System Startup and Shutdown

The M500 camera does not have an on/off switch. Instead, its power state is controlled by the JCU II. Generally, the camera is never completely off but in a Park mode or standby state waiting for a "wake" command from the JCU II.

Typically, the M500 system is connected to power through a circuit breaker, which functions as the primary on/off switch for the system. Should it be necessary for some reason to completely shut down the system, the circuit breaker is used. In normal operation, however, the camera will have power and will be in one of four states or modes:

• Bootup, or powering on

• Powered on and fully functional

• Park mode, powered on with video turned off

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

Park Mode

When the system is in Park mode, the camera does not generate a live video signal. After the bootup is complete or when done using the system, Park the camera from the OSD menu to keep the system ready to use at a moments notice.

The Bootup Process

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

Powering the Camera

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

1. If starting from a full shutdown, make sure the monitor is turned on, then power on the system.

2. The FLIR splash screen is shown, then live video with a counter showing boot progress.

3. When the bootup is complete (about 8 minutes), the monitor shows the welcome screen with icons, live video, and the OSD menus are enabled.

Important: Do not turn on the JCU II until the message "Welcome System is ready for use" is shown. Fully establishing a connection may take up to four minutes. Please be patient while the system verifies each component.

Powering the JCU II

When the JCU II is receiving power, the Power button will be lit amber. When the button is pressed for approximately three seconds, the JCU II will turn on and search for cameras on the network.

On the LCD screen, `Starting`, then `Searching…` is shown. When a camera is found, the message changes to `Connecting…`, which continues to flash until the connection process completes and is replaced by the camera ID, such as `M500`. When more than one camera is found on the network, the JCU II attempts to reconnect to the last camera it was connected to, or if it has not connected to a camera, it will prompt the user to select a camera.

Power

LCD screen

Scroll up or down

Select camera

JCU II Power Menu

The JCU II LCD screen generally shows the ID of the camera that is connected to the JCU II. The various functions are accessed from a set of menus, with each menu entry selectable in the JCU II display. When powered on and connected to a camera, pressing and holding the Power button causes the JCU II to enter the Power Menu.

Use the JCU II joystick to scroll up and down (push fore and aft), and select an entry by clicking the left joystick button. When the JCU II is in the Power Menu mode, the other JCU II buttons are disabled.

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

The Power Menu shows the following menu options:

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

Standby States

When finished with the camera, Park the camera from the OSD menu to keep the system ready to use at a moments notice on a command from the JCU II. When in Park mode, the system does not generate a live video signal.

To initiate other standby modes, press and hold the Power button. After a brief countdown, the Power Menu is shown. Scroll down with the joystick, press the left joystick button to select an option from the menu. The menu options available will reflect the available hardware on the camera network.

- JCU Stndby?—select to power down the JCU II.

- Camera Stndby?—select to power down the camera, leaving the JCU II powered to connect to a different camera.

- System Stndby?—select to power down the camera and the JCU II.

- Global Stndby?—select to power down all the cameras and all the JCU II present on the network.

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

Troubleshooting Tip: If this is the first time the JCU II has been used to connect to the camera, or if the camera was not powered before the JCU II, `v Select Camera` is shown on the LCD screen. Scroll down with the joystick to select a camera to control. When the ID of the camera appears, press the left joystick button to select it. The camera ID will blink momentarily to indicate it has been selected.

M500 Joystick Control Unit

Introduction

The Joystick Control Unit (JCU II) is the primary method of controlling the M500 camera. Use it to move the camera, zoom the camera, switch between infrared and visible-light cameras, adjust image settings, and access the on-screen menus.

This chapter describes how to use the JCU II buttons to operate the camera features. Some of these features vary depending on the specific way the system has been configured. Table 3.1 on page 19 summarizes the actions of each button.

Refer to the various configuration settings and how they affect operation in Chapter 4, "M500 System Configuration," on page 20.

JCU II Joystick

The JCU II joystick can be moved left or right, forward and back, and twisted in either direction. The joystick movement is translated to control the pan/tilt position of the camera and the zoom setting of the camera.

The right and left joystick buttons on the top of the joystick are used to select and navigate when in the on-screen-display menus and the JCU Power Menu.

Video Tracking—Use the right joystick button to enable and engage video tracking with the M500 system. Use the left joystick button to stop tracking.
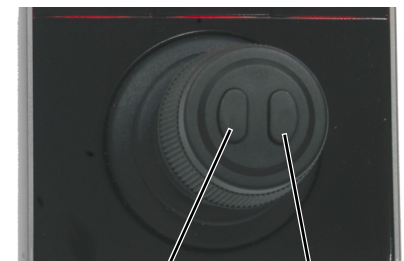
**Back   Enable/Engage
Video Tracking**

Tilting the Camera

The camera has two tilt modes: Gaming and Pilot. When in Gaming mode (the default), moving the joystick forward tilts the camera up; moving the joystick back tilts the camera down.

When in Pilot mode, moving the joystick forward causes the camera to tilt down; moving the joystick back causes the camera to tilt up.

See "User Interface Menu" on page 28 for details about this settings.

Rotating the Camera

Use the joystick to rotate the camera to the left and right. Push the joystick to the right and the camera will pivot to the right. Push the joystick to the left and the camera will pivot left.

Zooming the Camera

Twisting the joystick causes the camera to zoom in (clockwise) or zoom out (counterclockwise).

JCU II Buttons

All of the buttons on the JCU II perform multiple functions. In most cases, each performs one function when it is pressed briefly (short press) and a different function when it is pressed and held (long press). The descriptions of the buttons in this section assume that the JCU II is powered on (not in standby) and connected to an M500 camera system.

Power Button

Short Press—When the JCU II is powered on, a short press of the Power button cycles through the four levels of brightness (including off) for the JCU II display. The JCU II controls are back lit to make them easier to see at night. Use this button to adjust the brightness of the back lighting.

Long Press—When the JCU II is in standby, pressing and holding the Power button is used to "wake up" the camera. When the JCU II is powered on, it is used to access the JCU II Power Menu to perform functions such as selecting another camera or placing the system in standby. Refer to "JCU II Power Menu" on page 14.

Power button

Standby

Powered on
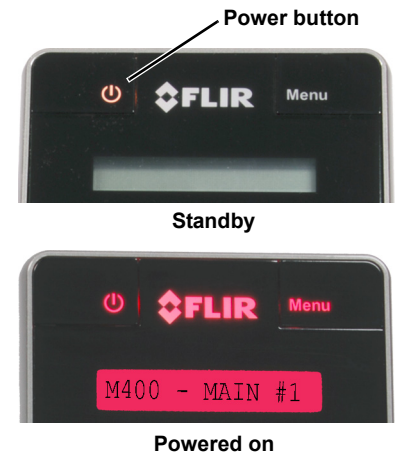
Menu Button

Press the Menu button to access the system on-screen-display (OSD) menus. In most cases, there is no need to modify the factory default configuration settings of the system. Refer to "M500 System Configuration" on page 20.

When the OSD menu is shown, use the joystick up, down, left, and right to navigate through the menu entries. The buttons on top of the joystick are used as select and back buttons.

Back   **Select**

- Joystick Up – move up in a vertical menu

- Joystick Down – move down in a vertical menu

- Joystick Right/Left – move to the next menu or menu choice

- Menu – Exit Menu

- Right joystick button – select a menu or menu choice

- Left joystick button – back to the last menu or exit OSD menu
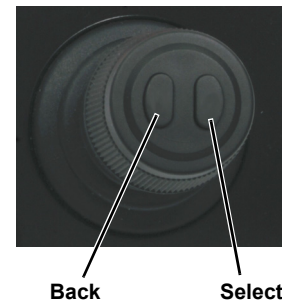
Home Button

Short Press—A short press of the Home button moves the camera to its home position. The home position is a programmable preset position that operators can use as a reference. When the Home button is pressed, the home icon appears briefly on the video monitor display.

Long Press—Pressing and holding the Home button sets the home position. First use the joystick to point the camera's line of sight to the a new home position. Press and hold the Home button until the home symbol flashes on the video monitor display; the new home position is set.

Scene Button—IR imaging only

The M500 thermal sensor automatically adjusts to changing conditions providing optimized high-contrast images. The preset automatic gain control (AGC) settings offer the most balance and image quality for specific conditions. Experiment with the different settings to find out which settings work best in different conditions. The Scene button only effects the IR camera.

Short Press—A short press of the Scene button cycles through the four preset AGC settings, which change the image gain and level settings. The icon for each scene preset is shown on the video monitor display.

Night	🌙	Harbor	
Day	☀	Contrast	

Color Button—IR Imaging only

Short Press—Pressing the Color button cycles through the preset color palettes of the active IR camera. See "Color:" on page 24 for these additional options.

Long Press—Press and hold the Color button to invert the thermal camera video polarity (for example, changing from black-hot to white-hot).

Focus Buttons

The M500 thermal camera can be focused either manually or automatically. The visible-light camera is always focused automatically.

The manual focus buttons are effective only when the IR camera is the Active Camera.

the **–** button will move the focus nearer
the **+** button will move the focus farther away

During the manual focus operation, the OSD focus bar will change accordingly.

Manual focus buttons

Camera Button

Switch the Active Camera shown on the main video output. The buttons on the JCU II are effective only on the Active Camera, except as noted.

User Buttons

The User buttons are programmable one-touch buttons to access the most often used functions. Configure the short-press action of this button from the User Programmable Button menu entry (see page 28).

Short Press—   **User 1** – Auto Focus
                      User 2 – Stabilization on/off
                      User 3 – Spotlight

Long Press—Press and hold a user button to open the OSD menu to reprogram a function.

Display Camera and JCU II IP Address

Press the Color button while pushing the joystick forward; the IP address of the JCU II and then the camera will display on the JCU II screen.

Button Summary

Table 3.1 summarizes the action of each button on the JCU II.

TABLE 3.1 **Summary of Button Actions**

Button	Action
Color Short	Cycle through the thermal palette options of the IR thermal imaging sensor.
Power Short	Change JCU II back light illumination level
Power Long	Display JCU II Power Menu
Home Short	Return to home position
Home Long	Set home to current position
Menu Short	Display or exit menus
Scene Short	Cycle through four preset scene settings
User 1	Auto Focus (can be reprogrammed)
User 2	Horizontal and Vertical Stabilization on/off (can be reprogrammed)
User 3	Spotlight on/off (can be reprogrammed)
Color + Joystick Forward	Display JCU II and camera system IP address
Right Joystick Button	When in OSD, select a menu or menu choice
	Enable video tracking, then again to select a target
Left Joystick Button	When in OSD, back to the last menu or exit OSD menu
	Stop tracking a target or disable video tracking

4 # M500 System Configuration

Overview

This chapter describes how to configure the system options using on-screen-display (OSD) menus. Operating the M500 camera does not require modifying any of the factory configuration settings. However, the OSD menus allow setting the following:

• Choose configuration options that match personal preferences such as Joystick Mode or the default color scheme.

• Enable or disable specialized modes such as Tracker, InstAlert, IceAlert, NMEA messaging, or operating the camera in Surveillance mode.

After making updates, most of the changes persist. However, a few settings revert to the factory default when the system is rebooted.

Not all options can be used at the same time. The way the various options interact is also described in the following sections.

Some configuration settings are changed directly by pressing a button on the JCU II. These are described in "JCU II Buttons" on page 17. The way some of the buttons work can be modified using OSD menus, described in this chapter.

Main Menu

Use the Menu button to turn the OSD menu on or off. When the OSD menu is shown, the joystick is used to navigate through the menus and select various menu entries.
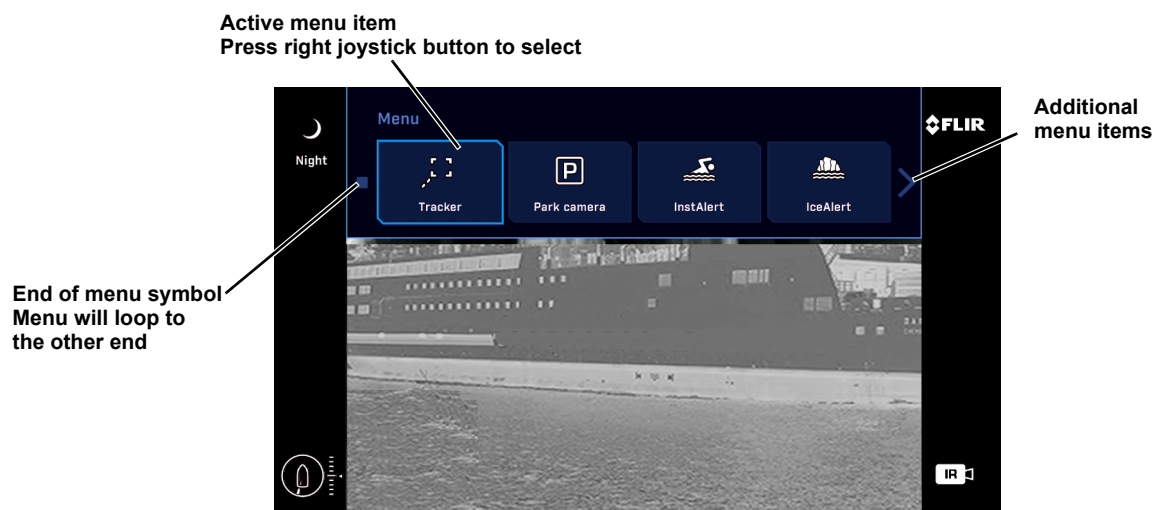

Figure 4-1: OSD Main Menu

Use the joystick to navigate through the menus and select options.

Press the Menu button to exit the menus.

Note: During navigation in the OSD menu, camera zoom is disabled, but manual focus/Auto focus is still enabled.

Some features are directly accessible from the main menu. Selecting a menu button below invokes the action immediately and closes the OSD menu.

Back   **Select**

Menu

| Tracker | Park camera | InstAlert | IceAlert | Surveillance | NMEA |
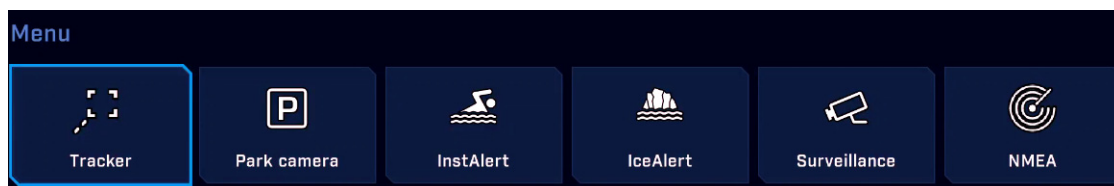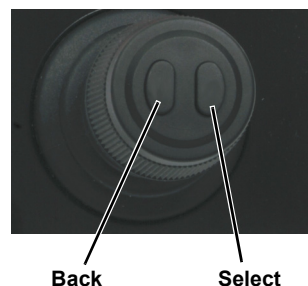
Tracker: When the Tracker is enabled pressing the Menu button will open the Tracker contextual menu. You can set the Tracking box to show or not show when the Tracker is engaged (actively tracking a target).

Tracker

Exit tracker | Tracking box Show | Main menu
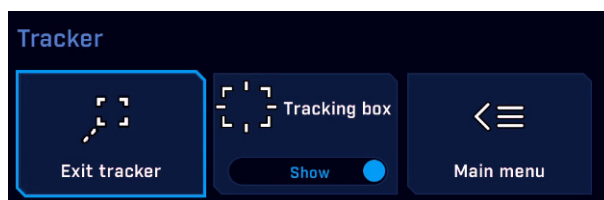
Park camera: the camera drives to its predefined Park position remaining fully active (no Stand-by) except that the video is turned off. To exit Park and return to normal operation, command a move with the joystick or press the Home button. The camera will return to Home position. The Park position can be reconfigured by an admin user through the web browser interface. See the *M500 Installation Guide*.

InstAlert/Exit InstAlert mode: When the camera is placed in InstAlert mode, a special search palette is invoked so that a set percentage of the hottest temperatures in the image are highlighted in Red-Orange shades, while colder temperatures are all in shades of gray. Especially useful for locating people or running boats in the dark. After invoking the mode, pressing the Menu button will show the InstAlert settings menu. The Highlight setting controls the percentage of the hottest temperatures to display in Red-Orange.

InstAlert

Exit InstAlert | Highlight setting 15 | Main menu
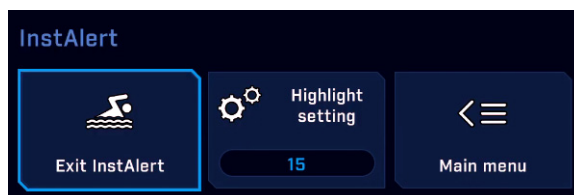
   IceAlert/Exit IceAlert mode: Conversely to InstAlert mode, when the camera is placed in IceAlert mode, a special search palette is invoked so that a set percentage of the coldest temperatures in the image are highlighted in Blue-Green shades, while warmer temperatures are all in shades of gray. Especially useful for locating ice in the dark. After invoking the mode, pressing the Menu button will show the IceAlert settings menu. The Highlight setting controls the percentage of the coldest temperatures to display in Blue-Green.
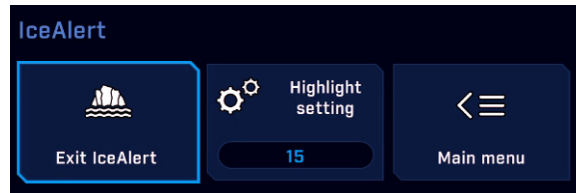
   Surveillance: When the camera is in surveillance mode, it pans continuously left and right, until it is taken out of surveillance mode or until the JCU II is used to move the camera. The camera does not automatically resume panning; enable surveillance again by pressing a User button (if it is programmed to enable this mode) or selecting it in the main menu.

   Surveillance… When Surveillance is selected from the Settings menu or the Menu button on the JCU II is pressed when in Surveillance mode, the following OSD menu is shown.
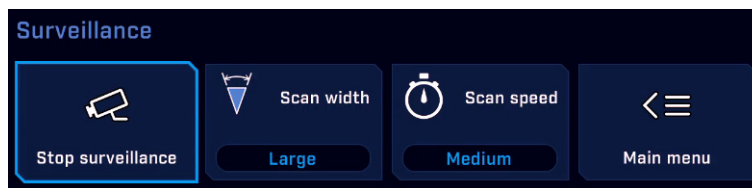
   Scan Width: In surveillance mode, the Scan Width determines the range of horizontal azimuth (pan) covered by each scan. The choices are:

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

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

   Large: The camera scan covers 80° to the left and right of center (160° total). The default scan width is wide.

Note: The center of the scan pattern is determined by the direction the camera is pointing when surveillance is enabled. The scan pattern is not centered about the home position, unless the camera is in the home position when surveillance is enabled.

   Scan Speed: In surveillance mode, the scan speed determines how quickly the camera scans back and forth. The choices are fast, medium, and slow. The scan speed is affected by the zoom state (scans at a slower rate when zoomed in).

   NMEA: Select this option to enable or disable the processing of messages using the NMEA interface. The factory default setting is disabled. All messages are ignored when NMEA Mode is disabled even if the specific message types are enabled. See "NMEA Settings" on page 30.

The following main menu buttons provide additional choices for system settings and information.

Menu

Spotlight
Image...
Settings...
Help...

Off ✓
On
Flash
SOS

End of menu symbol
Menu will loop to
the other end
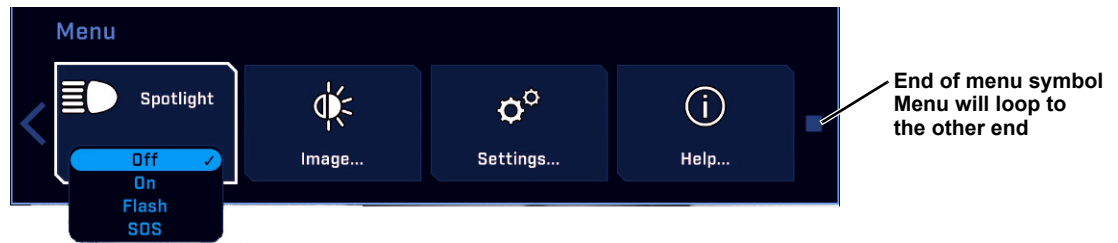
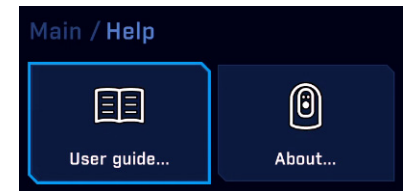**Spotlight:** Select this option and then select one of the active spotlight modes (On, Flash, SOS). The Spotlight turns on in the selected mode. A user programmable button (UPB) can be programmed as Spotlight on/off or as Signal Light to control the light. When set to Signal Light, the UPB will turn on the Spotlight when pressed and turn off the Spotlight when released.
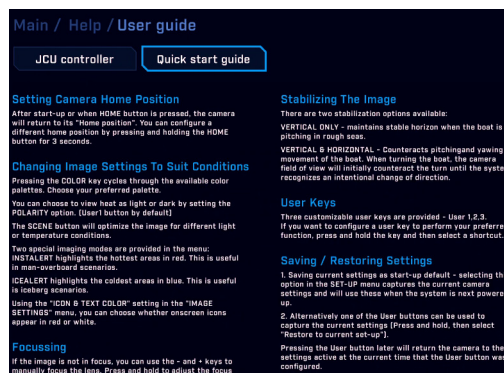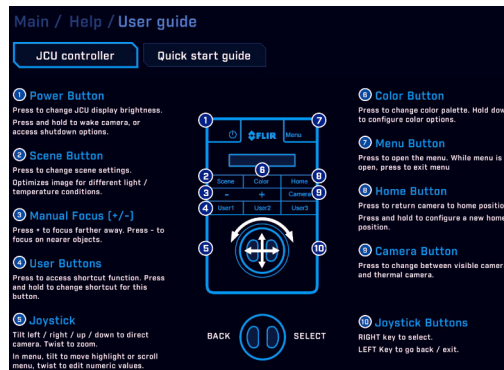
Image... See "Image Menu" on page 24.

Settings… See "Settings Menu" on page 25.

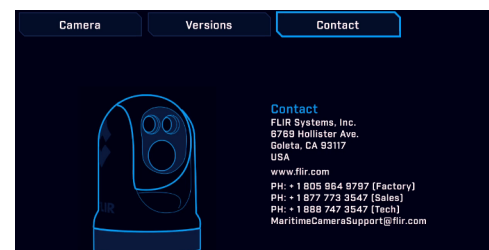**Help…** Refer to the help menus for camera operation and configuration information.

Main / Help

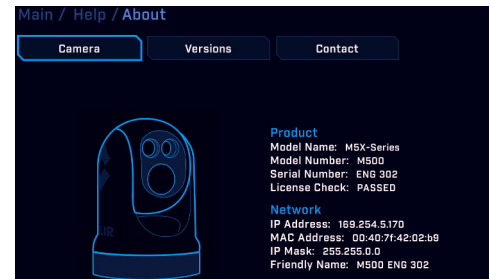User guide...
About...

User guide...
About...

Main / Help / User guide

JCU controller   Quick start guide

① **Power Button**
Press to change JCU display brightness.
Press and hold to wake camera, or access shutdown options.

② **Scene Button**
Press to change scene settings.
Optimizes image for different light / temperature conditions.

③ **Manual Focus (+/-)**
Press + to focus farther away. Press - to focus on nearer objects.

④ **User Buttons**
Press to access shortcut function. Press and hold to change shortcut for this button.

⑤ **Joystick**
Tilt left / right / up / down to direct camera. Twist to zoom.
In menu, tilt to move highlight or scroll menu, twist to edit numeric values.

⑥ **Color Button**
Press to change color palette. Hold down to configure color options.

⑦ **Menu Button**
Press to open the menu. While menu is open, press to exit menu

⑧ **Home Button**
Press to return camera to home position. Press and hold to configure a new home position.

⑨ **Camera Button**
Press to change between visible camera and thermal camera.

⑩ **Joystick Buttons**
RIGHT key to select.
LEFT Key to go back / exit.

Main / Help / About

Camera   Versions   Contact

Product
Model Name: M5X-Series
Model Number: M500
Serial Number: ENG 302
License Check: PASSED

Network
IP Address: 169.254.5.170
MAC Address: 00:40:7f:42:02:b9
IP Mask: 255.255.0.0
Friendly Name: M500 ENG 302

Camera   Versions   Contact

Versions
Product: M5X-Series
Software version: v2.1.0-rc1
FPGA version: v23.2.12.3
MCU: Marlin-MCU
MCU version: 5.0.10
Nexus version: v2.5.30.73
Host ID: IT177353557
Web version: 3.17.0.85
IR camera part#: 425-0027-00
Visible camera part#: FCB-EV7520 R0700

Main / Help / User guide

JCU controller   Quick start guide

Setting Camera Home Position
After start-up or when HOME button is pressed, the camera will return to its "Home position". You can configure a different home position by pressing and holding the HOME button for 3 seconds.

Changing Image Settings To Suit Conditions
Pressing the COLOR key cycles through the available color palettes. Choose your preferred palette.
You can choose to view heat as light or dark by setting the POLARITY option. (User1 button by default)
The SCENE button will optimize the image for different light or temperature conditions.
Two special imaging modes are provided in the menu:
INSTALERT highlights the hottest areas in red. This is useful in man-overboard scenarios.
ICEALERT highlights the coldest areas in blue. This is useful is iceberg scenarios.
Using the "ICON & TEXT COLOR" setting in the "IMAGE SETTINGS" menu, you can choose whether onscreen icons appear in red or white.

Focussing
If the image is not in focus, you can use the - and + keys to manually focus the lens. Press and hold to adjust the focus

Stabilizing The Image
There are two stabilization options available:
VERTICAL ONLY - maintains stable horizon when the boat is pitching in rough seas.
VERTICAL & HORIZONTAL - Counteracts pitchingand yawing movement of the boat. When turning the boat, the camera field of view will initially counteract the turn until the system recognizes an intentional change of direction.

User Keys
Three customizable user keys are provided - User 1,2,3. If you want to configure a user key to perform your preferred function, press and hold the key and then select a shortcut.

Saving / Restoring Settings
1. Saving current settings as start-up default - selecting this option in the SET-UP menu captures the current camera settings and will use these when the system is next powered up.
2. Alternatively one of the User buttons can be used to capture the current settings (Press and hold, then select "Restore to current set-up").
Pressing the User button later will return the camera to the settings active at the current time that the User button was configured.

Contact
FLIR Systems, Inc.
6769 Hollister Ave.
Goleta, CA 93117
USA
www.flir.com
PH: + 1 805 964 9797 (Factory)
PH: + 1 877 773 3547 (Sales)
PH: + 1 888 747 3547 (Tech)
MaritimeCameraSupport@flir.com

Camera   Versions   Contact
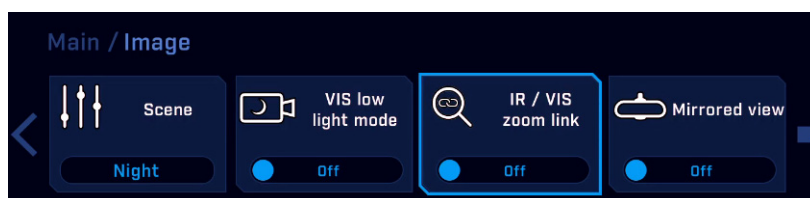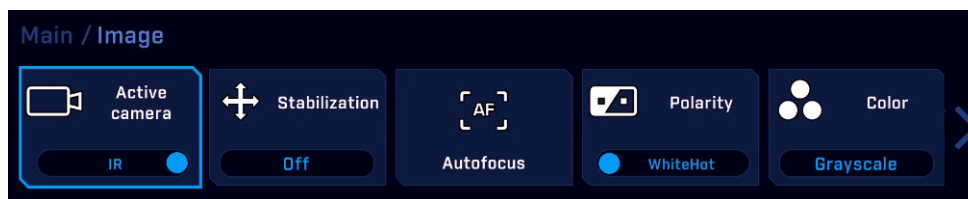
Image Menu

When Image is selected from the main menu, the following OSD menu items are shown.


Polarity—IR camera only: Inverts the colors representing hot and cold in the infrared imagery. When using the IR camera the color palettes described below are available. Inverting the polarity reverses the color map of the thermal image.

Color Palette	Polarity	Inverted
Grayscale	White-Hot	Black-Hot
Redscale	Red-Hot	Red-Cold
Fusion	Fusion	Fusion-Invert

Stabilization: Off, Vertical, Horiz & vertical

Select this option to enable or disable the two-axis mechanical gyro stabilization. Gyro Stabilization is automatically turned off when the camera in Park mode or in standby, but the system restores the setting when the camera is returned to service.
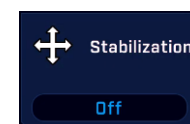
Autofocus
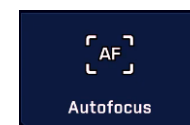
Color: Grayscale, Redscale, Fusion

Cycle through the available color palettes. Inverting the polarity reverses the color map of the thermal image.

Color Palette	Polarity	Inverted
Grayscale	White-Hot	Black-Hot
Redscale	Red-Hot	Red-Cold
Fusion	Fusion	Fusion-Invert

VIS low light mode: On/Off

Select this option to turn On/Off VIS low light mode. This function works in conjunction with the setting of the Advanced image low light mode (refer to "Advanced Image Menu" on page 27). If the advanced setting is Auto, this button will only change the state of the low light mode for about 5 seconds.
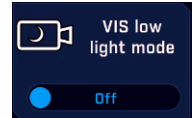
IR/Daylight zoom link: On/Off

When the zoom link is off, the active camera zoom setting will not affect the zoom setting of the secondary camera.
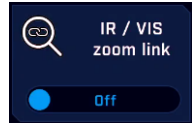
Mirrored view: On/Off

Select this option to revert the video image which makes the scene appear as if viewed in a mirror.
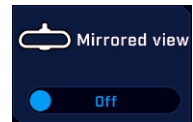
Settings Menu

When Setup is selected from the main menu, the following OSD menu is shown.

Save current settings as start-up defaults: Select this option to store the current camera settings described below for start-up or anytime **Restore settings from defaults** is selected.

Restore settings from defaults: Revert to the stored values of the following settings.

Active Camera	Scene	Color
Home position	Polarity	Stabilization
Icon display	Help text	Mirrored View
Joystick mode	UPB assignments	NMEA auto movement settings
InstAlert settings	IceAlert settings	

Advanced image... See "Advanced Image Menu" on page 27.

User interface… See "User Interface Menu" on page 28.

Surveillance… See "Surveillance…" on page 22.

NMEA… See "NMEA Settings" on page 30.

Calibration & diagnostics Menu
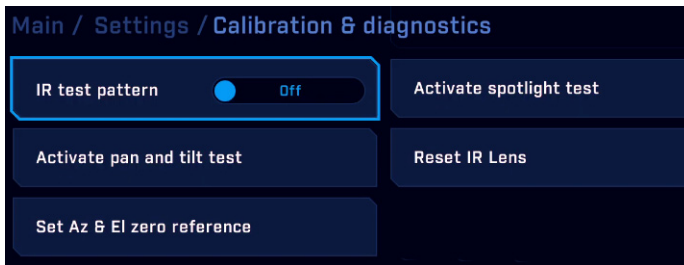
IR test pattern: (On/Off)

Activate spotlight test: Click to run.

Activate pan and tilt test: Click to run.

Reset IR Lens: Click to run.

Set Az & El zero reference: Icons on the video show the direction the camera is facing in relation to an outline of a ship. The M500 camera has a "forward" direction adjustment which has been set at the factory. After the camera is installed, both the azimuth and elevation should be set to account for variations required during installation so that the icons on the video show the expected angular position of the camera. The azimuth direction should be directly toward the front of the vessel; the elevation may be set to the horizon or another user preferred reference.

1. Using the JCU II, point the camera directly ahead and choose an elevation reference point. For example, place the horizon in the center of the video.

2. Press the Menu button to turn the OSD menu on.

3. Navigate to **Set-up Menu**, **Calibration & diagnostics…**, then select **Set Az & El zero reference**.

4. Select **Set origin** to set the azimuth and elevation offsets.

5. Verify that the icons on the video correspond to the direction the camera is pointing.
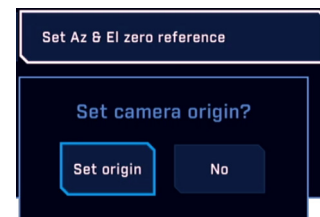
Advanced Image Menu
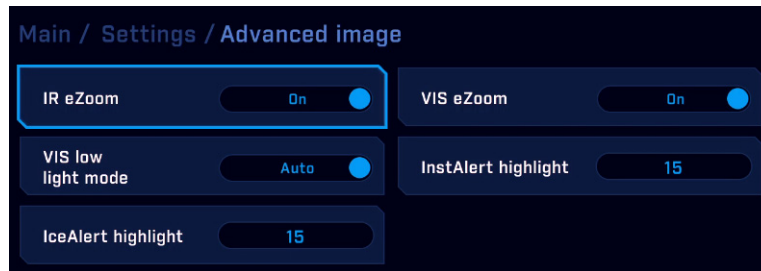
IR eZoom, VIS eZoom: (On/Off)

The IR camera will extend past the 14x optical zoom with an additional 8x eZoom (to 112x). After the lens reaches the maximum optical zoom, the zoom scale shown on the display changes as shown at the right. The scale will change back to 14x when the eZoom is decreased to zero.

The visible camera will extend past the 30x optical zoom with an additional 12x eZoom (to 360x). The VIS eZoom and scale when the visible camera is selected works in a similar manner as the IR camera.
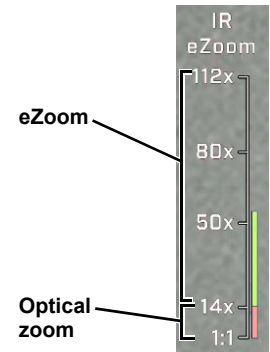
VIS low light mode: (Auto/Manual)

When set to manual, use the VIS low light mode button on the Main menu to turn low light mode On/Off. When set to Auto, this setting will override the Main menu button within about five seconds (refer to "VIS low light mode:" on page 25).

InstAlert highlight, IceAlert highlight (0 – 100)

The highlight settings control the range of temperatures to show colored. The hottest range of temperatures will be shown in red when in InstAlert mode (InstAlert highlight) and the coldest range of temperatures will be shown in blue when in IceAlert mode (IceAlert highlight). All other temperatures are shown in grayscale.

To change a numeric setting, using IceAlert for example:

1. Select **IceAlert highlight** with the right joystick button.

2. Twist or move the joystick left or right to change the value.

3. Set the value by clicking the right joystick button. Navigating away from the menu item before setting the value will reset it to the previous setting.
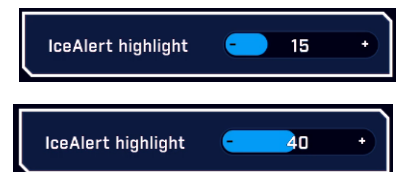
User Interface Menu
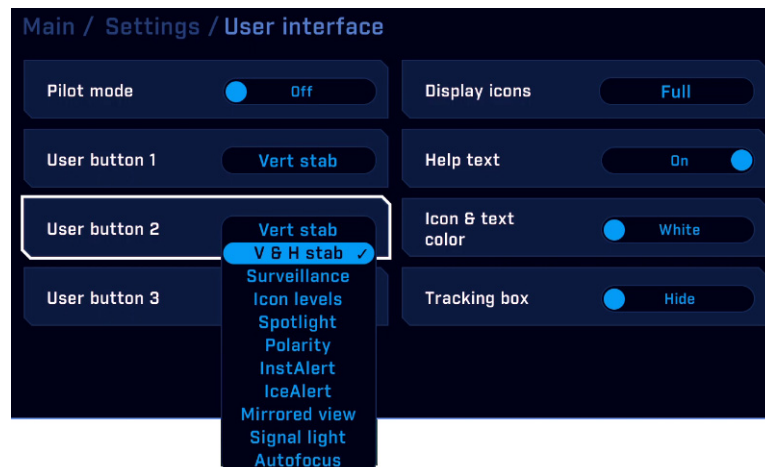
Joystick mode: (Gaming/Pilot) In managing the elevation (tilt) of the camera, the joystick can be used in one of two modes.

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

Pilot Mode: Moving the joystick forward causes the camera to tilt down. Moving the joystick back causes the camera to tilt up.

User button 1, User button 2, User button 3: The User buttons are programmable one-touch buttons on the JCU II that quickly access common settings or useful functions. Use this menu to select a function to associate with each User button from the following choices: Stabilization (vertical only, vertical and horizontal), Surveillance, Icon Levels, Spotlight, Polarity, InstAlert on/off, IceAlert on/off, Mirrored view on/off, Signal Light, Autofocus

Display icons: Minimal, Custom, Full

Selecting **Minimal** turns off most of the on-screen icons except when their corresponding controls are actively in use. The pan position (azimuth) icon, tilt (elevation) position icon, and the FLIR logo are always displayed. Other icons such as home and scene display on the screen only momentarily when they are changed. Selecting **Full** maximizes the display of the on-screen icons. Some icons such as home are only displayed momentarily. Refer to *M500 Installation Guide* for configuring which icons are selected in each setting.

Help text: (On/Off) Help text can be displayed to provide contextual information to the user. Unlike feedback or notification text which is always shown, the help text is controlled by this setting.

Icon & text color: (Red/White) Icons and text can be displayed either in white or in red.

Tracking box: (Show /Hide) Select whether to display the tracking box when video tracking is engaged.

NMEA Data

This section describes how to configure and use the set of NMEA interface functions supported by the M500. The NMEA interface allows the M500 to communicate with radar, GPS, or other devices using the National Marine Electronics Association (NMEA) 0183 protocol. NMEA 0183 (or NMEA for short) is a combined electrical and data specification for communication between marine electronic devices.

Additional information regarding the protocol can be found on the NMEA Web site: http://www.nmea.org/content/nmea_standards/nmea_standards.asp.

When NMEA is being used, the M500 acts as a listener and receives messages from the main control unit that is monitoring various sending devices in the system, such as radar, GPS, or independent input ports. The M500 connects to the other equipment through the M500 Connection box.

The NMEA protocol allows the camera to automatically point toward vessels and other objects that show up on the display and to track their movement. The M500 can receive three types of NMEA messages.

- Radar Cursor Tracking, which is implemented using the NMEA Radar System Data (RSD) sentence format

- Slew to Waypoint, which uses the NMEA Bearing and Distance to Waypoint, Great Circle (BWC) sentence format

- Radar Tracking, which uses the NMEA Tracked Target Message (TTM) sentence format

Even though you can only choose three types of messages to enable through the NMEA interface, the M500 uses additional messages to perform the calculations needed to respond to these three. If your system is not responding as expected, verify that the NMEA device sending messages is sending the following additional message types:

- HDT Heading, True

- GGA Global Positioning System Fix Data

- VHW Water Speed and Heading

- OSD Own Ship Data

- TLL Target Latitude and Longitude

Any combination or all three messages can be enabled; when more than one type is enabled, the system processes RSD first, then BWC, and finally TTM. For example, if the unit is listening to BWC or TTM messages and looking at a particular target and it receives an RSD message, it waits until the end of the dwell time and then move on to the RSD message, ignoring all other input.

Note: Using the joystick to pan or tilt the camera always takes priority over processing of an NMEA message.

Each message type has a unique icon associated with it. Depending on the Icon Display Mode, these icons either always display or display momentarily when a message is received. In both cases, they flash on and off when the message is received.

Additional settings such as target dwell time affect how the messages are processed. Dwell time determines how long the camera remains on a particular target. The ability of the M500 to accurately track a target depends on the quality of the data sent from the radar unit.

The ability of the radar to effectively track a target is influenced by several factors, such as the make and model of the radar unit, the radar update rate, the relative angular rate of the target, the angular rate of the boat heading and the velocity of the target being tracked.

Note: It is important to enter the accurate offset location of the camera above the water line to ensure the unit's pointing accuracy for close-in targets. Refer to the *M500 Installation Guide*.

While you can choose to track a large number of targets, in practical terms the number of targets is linked to the dwell time. Since the camera looks at each target for a minimum of 10 seconds before moving on to the next target, when the number of targets become too large, the system will take too long to cycle through them all for the information to be of any real use.

NMEA Settings

Configure how the NMEA interface works with settings on the NMEA Menu. Select NMEA Data from the Main Menu or when in NMEA mode, select Menu to see the following OSD menu.
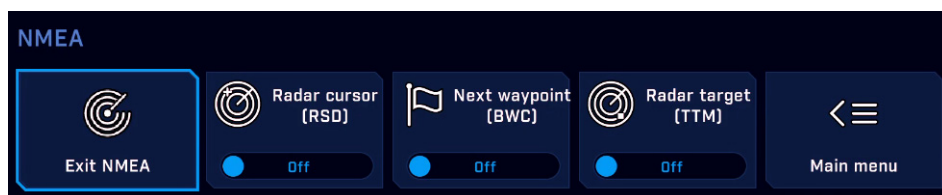
Radar cursor (RSD): When this option is enabled, you can control the camera by using the cursor on the radar display screen to highlight a target. The camera will track (point toward) whatever target is selected by the cursor. Moving the cursor to a different target will move the camera to the new target (see note below). The camera will continue to follow the cursor until this option is disabled from the main menu. This function is implemented with NMEA RSD messages.

When the camera is in this mode, an icon is either briefly or continuously displayed, depending on the setting of Icon Display Mode.

Note: The camera points toward the cursor position for the dwell time period (a minimum of 10 seconds). If the cursor is moved during that time, the camera will not move immediately to the new position. It will ignore all other RSD messages (produced when the cursor is moved to another position) until the dwell time expires. Then it will respond to the next RSD message received.

Next Waypoint (BWC): When this option is enabled, the camera will move to a preselected waypoint when that waypoint gets to within approximately 3 mile (5 km), based on waypoint location information from the NMEA BWC messages. When the camera is in this mode, an icon is either briefly or continuously displayed, depending on the setting of Icon Display Mode.

For example, while en route the operator could designate a buoy, an island or any other landmark as a navigation waypoint and the camera will point toward it automatically when in range. The camera will remain on the target for the specified dwell time. If an additional BWC message is received, the camera will point to the newer BWC heading for an additional dwell time period.

Radar target (TTM): When this option is enabled, the camera tracks selected radar targets using data from NMEA Target Tracking Messages (TTM) provided by the radar unit. When the camera is in this mode, an icon is either briefly or continuously displayed, depending on the settings of Icon Display Mode.

While it is possible to select up to 100 targets to be tracked by M500 (refer to the radar or GPS documentation on how to designate a target), typically the operator selects five or less. Once targets are selected, the camera will point toward each sequentially, and track it using position data sent from the radar unit.

The camera points at each target for a preset amount of dwell time (10 seconds by default) before moving on to the next target. The dwell time is determined by the setting of Radar Target Dwell.

Due to the way radar operates, it is possible to lose a target momentarily. To ensure that the tracking process continues after the momentary loss of a target, the TTM function maintains the last known position of the target in its queue for 60 seconds after receiving the last valid message. After the 60 seconds has lapsed, that target is removed from the queue.

Video Tracking Mode

Overview

To enable Video Tracking mode press the right joystick button; a tracking box is shown on the video. Manually center the target in the tracking box by pointing the camera using the joystick. Press the right joystick button again to engage the target and begin tracking. When a target is selected, the tracking box is no longer shown and the Tracking icon is shown on the display.

To show the tracking box after engaging a target, select show tracking box (refer to "Tracker:" on page 21). The tracking box can be resized (hold the right joystick button and twist the joystick).

Acquisition is easiest when the target has clear contrasts, rigid edges, and a predictable rate of motion. For example, it is easier for the system to track a boat in the open ocean than when the shoreline is in the background because the boat has a clearer contrast.

The tracker uses a gray scale frame from either the IR or the visible camera. The visible camera color frame is converted to a gray scale frame for the tracker. Because of this conversion, what is seen on the visible camera as very distinct, may sometimes appear less so to the tracker.

Once a target is being tracked by one of the cameras, that camera will continue to provide video to the tracker even if the active camera is changed. In other words, a target can be tracked using the IR camera while the visible camera video is being shown. If the target is lost (acquisition gate reappears), manually reacquiring the target will begin tracking using the current active camera.

Consider the following in order to maintain an active tracking session:

- Very fast turns by the target that change the aspect ratio of the target may cause confusion
- Very fast turns by the tracking vessel or heavy swells may challenge the ability of the camera to keep the target in view. Stabilization modes are recommended.

Acquisition state—Use the joystick to move the camera. Zoom in to more clearly focus on the target and initiate tracking by pressing the right joystick button.
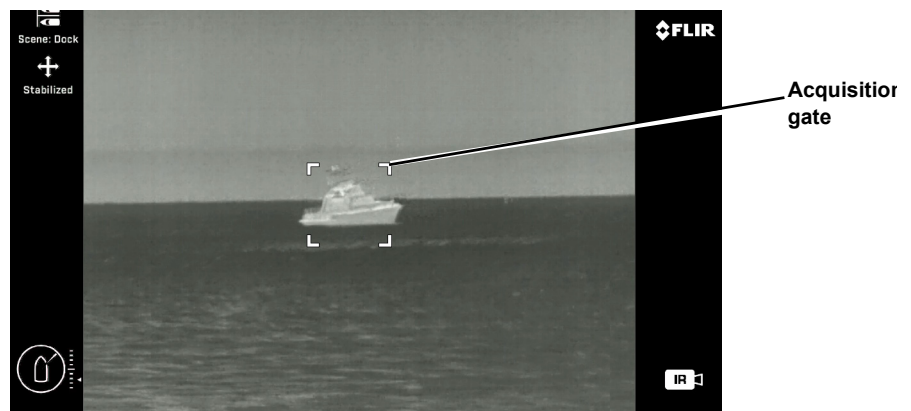
Joystick Buttons: Left - Exit Video Tracking mode
Right - Acquire target, engage tracking

Figure 5-1: Video Tracking Mode—Acquisition state

Tracking state—When the target is acquired, the acquisition gate disappears and the tracking icon is shown. To show the tracking box after engaging a target, select show tracking box (refer to "Tracker:" on page 21).
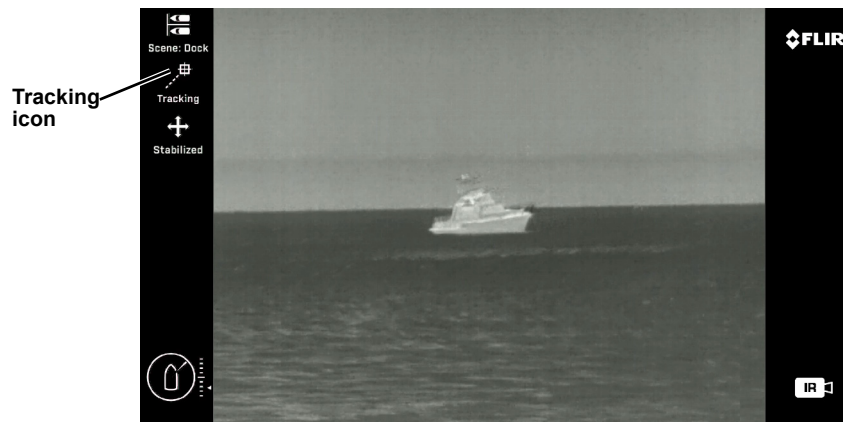
Joystick Buttons: Left - Cancel tracking

Figure 5-2: Video Tracking Mode—Tracking state

Seeking state—In the seeking state, orange cross-hairs will be shown within the acquisition gate and flash at 2 Hz, while trying to acquire the target. After the seek period times out, the system will return to the acquisition state and you will need to reacquire the target manually.
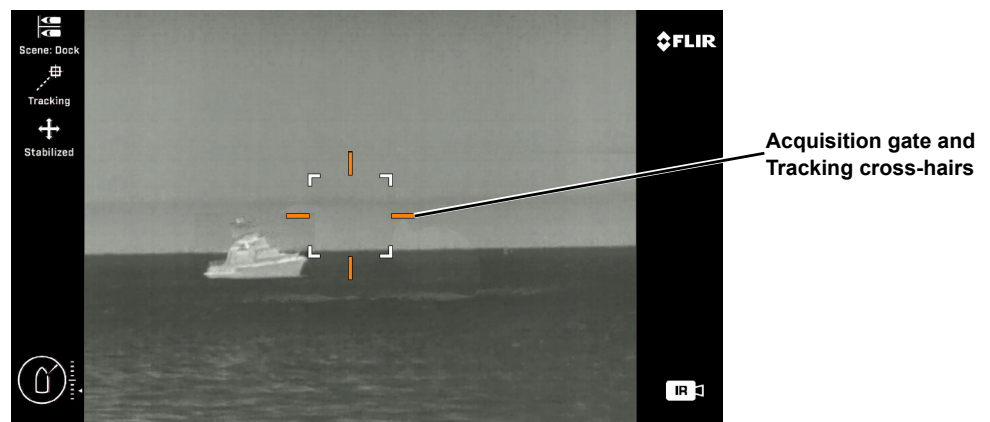
Joystick Buttons: Left - Cancel tracking to reacquire target
Right - Reacquire target

Figure 5-3: Video Tracking Mode—Seeking state

While a target is being tracked the system may lose and reacquire the target automatically. For example, if the target you are tracking is a small boat that is temporarily obscured by a large wave, the tracker will seek to predict where the target will be next based on its previous rate of change, and attempt to reacquire it.

Joystick Operation

When the Video Tracking mode is enabled by pressing the right joystick button, the behavior of the joystick changes so that tracker-specific features can be controlled.

When acquiring a target, use the JCU II to:

- Point the camera at the area containing a possible target
  (normal pan and tilt joystick operation).

- Begin tracking a target
  (press right joystick button again).

- Resize the acquisition gate
  (hold right joystick button and twist to resize gate).

Once you engage tracking, use the JCU II to:

- Resize the tracking gate
  (hold right joystick button and twist to resize gate).

- Disengage Video Tracking
  (press left joystick button).

- Re-acquire a target or acquire a new target
  (press right joystick button).

Exit Video Tracking   **Select target**

Video Tracker Errors

If the red cross hairs are seen it means one of two things:

Communications error with the imx6

- In the case of a Comms error, Nexus will reset the imx6 which may take 1-2 minutes, it will do this 5 times before giving up

- If the Tracker reconnects in any of the 5 times all operations will return to normal

- During the error period attempting to enter Track mode will show the box with red cross hairs
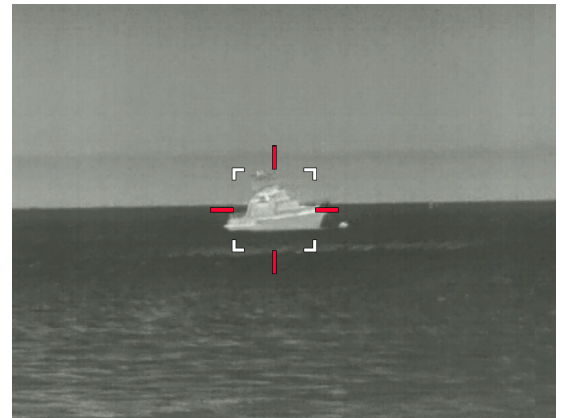
Tracker reports a problem capturing frames from one of the cameras

- Tracking on the other camera should behave as normal

- Attempting to Track on the camera that has an error will give the red box

IP Interface and PC Operations

The M500 cameras and JCU IIs are network devices that communicate over an Ethernet network using Internet Protocol (IP). In addition to using the JCU II to control and configure a camera, a user or installer can also complete similar operations and more advanced configurations using a Web browser[1] to view the video and control the camera.

Once the camera is connected to a network and powered on, a video management system (VMS) or a network video recorder (for example, FLIR DNR400 Series) can record video streams and provide other features such as cloud storage. Refer to the documentation of any VMS or video recorder for operation and setup details.

The M500 camera and JCU II are shipped with Dynamic Host Configuration Protocol (DHCP) enabled to assign IP addresses. During installation or at other times the system may have been set to Static addressing and these addresses may have been changed.

M500 Web Browser Interface

This chapter describes how to use a Web browser to communicate with and configure the M500 cameras and JCU IIs:

Caution: Changes to configuration settings should only be made by someone who has expertise with M500 cameras and a thorough understanding of how the settings affect the image. Haphazard changes can lead to image problems including a complete loss of video.

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1 The web interface is supported on Microsoft Internet Explorer version 9, as well as the latest versions of Google Chrome and Mozilla Firefox.

View Camera and JCU II IP Address

Connect the camera and JCU II together through the switch and power on both the camera and the switch. (The JCU II is a PoE device getting power from the switch.)

On the JCU II, press and hold the COLOR button while pushing the joystick forward. The IP address of the JCU II and then camera are shown for 3 seconds on the LCD display.

The PC or laptop must be on the same network as the camera and JCU II. For example: for a camera IP address of 192.168.250.116, set the network adapter to a compatible IP address such as 192.168.250.1 with a netmask of 255.255.255.0. See "Enabling Universal Plug and Play (UPnP)" on page 55 for another method of finding the camera on the network.

Camera Web Server Login Accounts

It is possible to log in to the camera using one of three User Names: **user**, **expert,** or **admin**. By default, the passwords are: **user**, **expert**, and **admin**, respectively. The **user** login can access the Live Video page and control the camera. The **expert** login can access the Setup menus and make configuration changes to the payloads and other components. The **admin** login can access the Maintenance menu and all the other menus as well as change the login passwords. The default login passwords should be changed to prevent unauthorized log in. Refer to "Maintenance->Server->Security Options" on page 47.

Note: Only two web sessions can be active at once.

Log in to the Camera Web Server

1. Open a web browser and enter the camera IP address.
    The login screen with a picture of the camera will appear.

2. Enter **admin** for User Name and **admin** for Password, then click Log in.
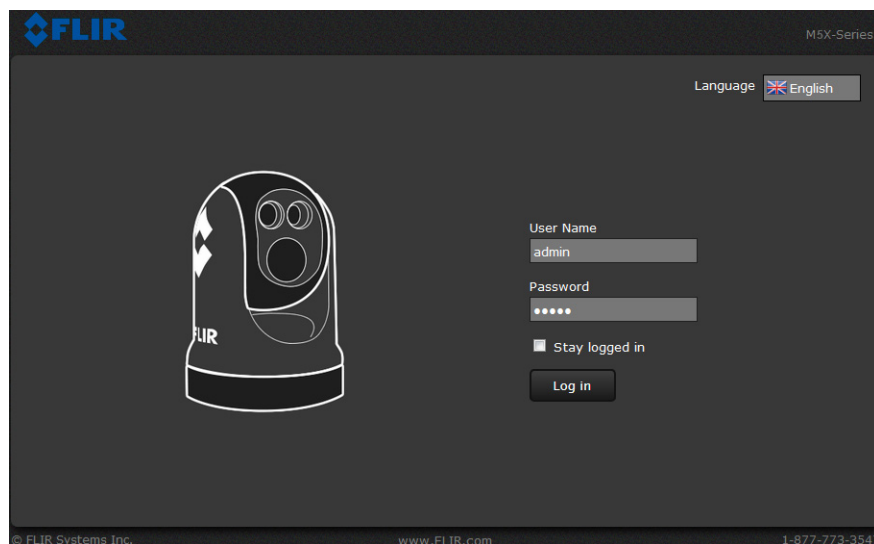
Live Video Page

The Live Video page will be displayed, with a live image from the camera on the left part of the page and a virtual joystick and function buttons on the right part of the page. Next to the FLIR logo along the top of the screen are some menu choices, including Live Video (the red text indicates it is selected), Setup, Maintenance, Help, and Log out.
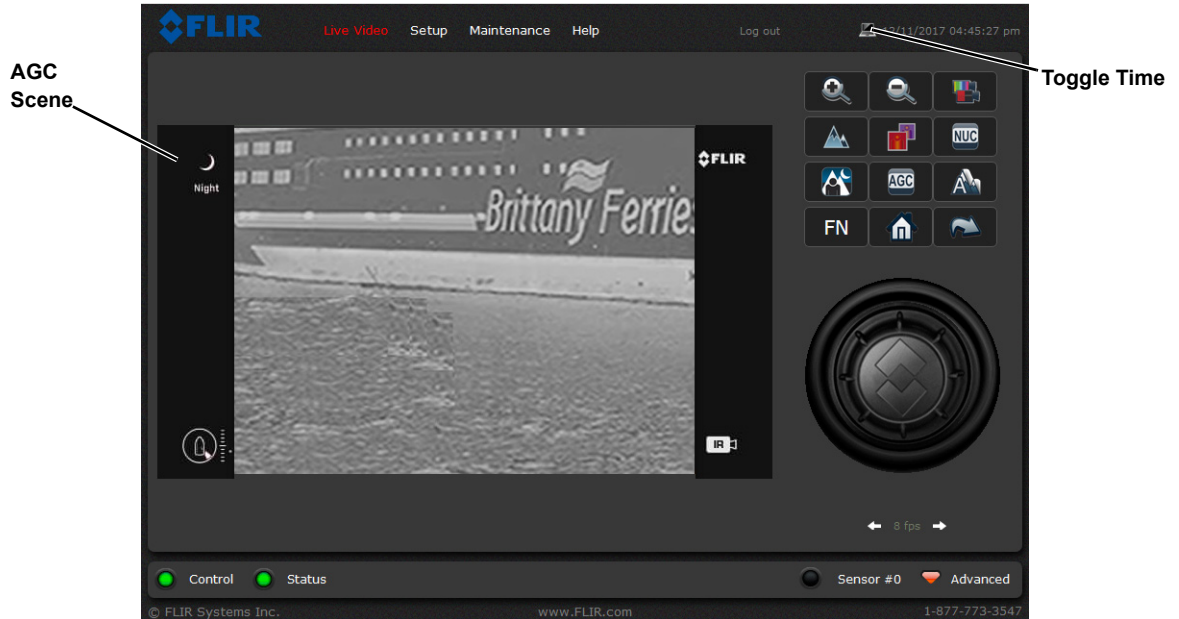
Figure 6-1: Live Video Page from admin or expert Log in

The **user** log in, shown below, can only use the Live Video page and controls and can only reset the user password if an admin or expert user has allowed the option for the user log in.
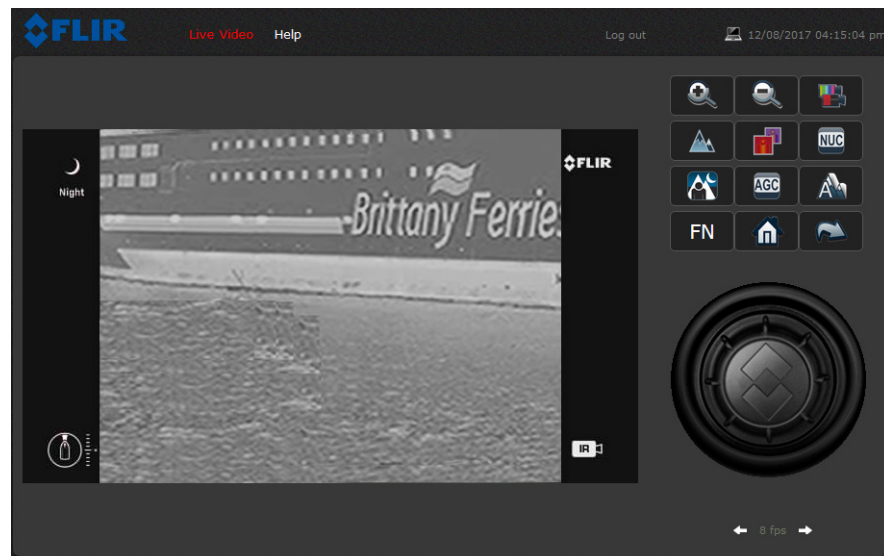
Figure 6-2: Live Video Page (user log in)

In the lower right of the page there is a frame rate selector. This selector allows the user to change the rate at which the frames are displayed in the browser from the default 8 fps up to 16 fps. This rate controls the user's own web browser only, and does not affect video streams to other users.

Help

At the top of the page, the **Help** menu shows software version information. This page has information about the camera software revision numbers. If it is necessary to contact FLIR Technical Support for assistance, it will be helpful to have the information from this page on hand.

Log out

Use this button to disconnect from the camera and stop the display of the video stream. If a web session is inactive for 20 minutes, it will be stopped.

Toggle Camera/PC time

Use this button to view either the PC time or the camera time.

Camera Control and Status

In the lower left of the screen are two indicator lights: Control and Status. Initially the Control light is off, as in the image above, indicating the user is not able to control the camera. When multiple users are connected to a camera, only one user at a time can issue commands to the camera. If another user has control of the camera, the Control light is yellow. Request control of the camera by clicking on the yellow or black light, or simply by sending a command to the camera. The Status light may turn off temporarily while waiting for the response from the camera. Be patient, there may be a slight delay between each command while the browser waits for a response from the camera.
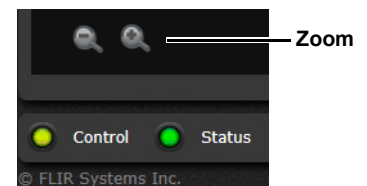
In addition, when the cursor is moved over the video, there are mouse-over pan, tilt, and zoom buttons and a mouse-over snapshot button. The zoom buttons appear in the lower left of the screen; the snapshot button appears in the upper right of the screen. After clicking the snapshot button, the video image is saved as a .jpg file and the browser will provide prompts depending on which browser is being used.

Web Control Panel

The control buttons on the right side of the page provide a way to control the camera in a limited number of ways. When the mouse cursor is positioned over a button, a tool tip is displayed.

This same web interface is used with various cameras. As a result, different buttons in the control panel will appear for different cameras.
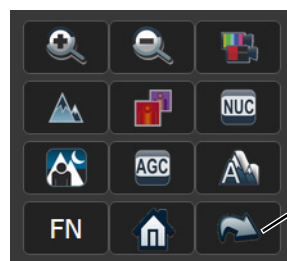
Go to Preset position.
See "Setup->Surveillance->Scan List" on page 43.
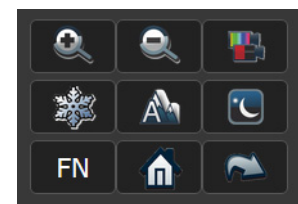
IR Control Keypad

Visible Control Keypad

The functions of the buttons appearing for the M500 cameras are described below:

Zoom In/Zoom Out

These buttons zoom the active camera (IR or daylight). Plus zooms the camera in; minus zooms the camera out.

Toggle Video Source

This button changes the source of the Live Video image between the IR camera and the daylight camera. When the daylight camera is selected, only buttons that have a function on the daylight camera are shown.

Freeze - Visible only

This button freezes the video on the current frame. Click again to return to live video. The IR video stream is not affected.

Toggle Polarity - IR only

This button changes the polarity of the assigned colors to the different temperatures in a scene. In the black and white palette for example, hot objects are displayed as white and cold objects as black, or vice versa.

Toggle Palette - IR only

This button causes the camera to cycle through six different look up table (LUT) color palettes. Depending on the subjects viewed, one color palette may be preferable to the others. The Toggle Polarity button allows access to six more palettes.

Perform IR NUC Calibration - IR only

This button causes the camera to perform a Non-Uniformity Correction operation.

Toggle Scene Preset

This button causes the camera to cycle through four different image settings: Night, Day, Dock, and High Contrast. The Scene Presets cause the image brightness and contrast to adjust. Depending on the time of day, weather, and other conditions, one Scene Preset may be preferable to the others.

Toggle Automatic Gain Control (AGC)

This button causes the camera to cycle through different AGC options that use a combination of settings to produce different configurations that could improve the video image for a given set of conditions.

AutoFocus

This button causes the camera to perform a focus function.

Toggle Low Light Mode - Visible only

This button causes the camera to enter or exit low light mode.

Home

Click moves the camera to the Home position; Click and Hold sets the current pan and tilt position of the camera as the Home position.

FN　**Function Keys**

When selected, the keypad changes to an OSD control panel. Select the back arrow to return to the main keypad.

Use the OSD menu keypad to navigate through the OSD menus and make selections.
Refer to the *M500 Camara Operator's Manual* for descriptions of the menu functions.
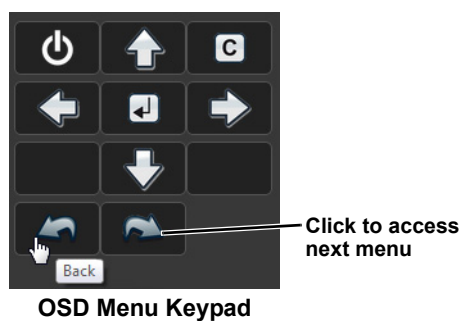
OSD Menu Keypad

OSD Menu Keypad	
⏻	Display OSD menu
⬆	Move up through OSD
C	Exit current OSD function
⬅	Move left through OSD
↵	Enter
➡	Move right through OSD
⬇	Move down through OSD

Use the shortcut keypad to access common modes. These modes are also available through the OSD, JCU II, or other web pages.
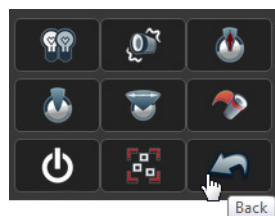
Shortcut Keypad

Shortcut Keypad	
🔦	Spotlight On/Off
	Stabilization On/Off
	Vertical Stabilization On/Off
	AutoScan On/Off
	AutoScan Width toggle
	AutoScan Speed toggle
⏻	Video Tracking On/Off (M500 Only)
	Video Tracking Engage/Disengage (M500 Only)
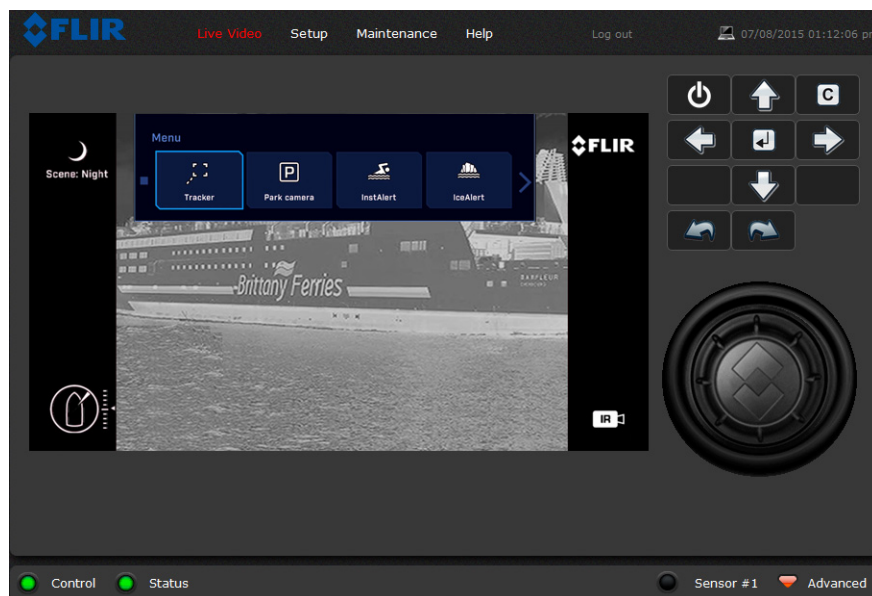
When using the OSD menu from the Web page, the virtual joystick is still enabled. Use the Web Control Panel, as shown above, to navigate through the OSD menu and make selections. Refer to the *M500 Camara Operator's Manual* for descriptions of the menu functions.

Setup and Configuration Menus

Additional configuration options are available that are not described in this manual. For more information on setting or changing these camera parameters refer to the *Nexus IP Camera Configuration Guide* (FLIR Doc #427-0030-00-28) or contact the local FLIR representative or FLIR Technical Support.

Setup->IR->ROI (region of interest)

The camera adjustments under the ROI heading allow the user to make changes to the Region Of Interest. The ROI determines what portion of the image is considered by the Automatic Gain Control (AGC) algorithm. By default all of the pixels in the image are considered; in some cases it may provide an improved image if a portion of the image is excluded. For example, the sky is generally very cold, so if the ROI excludes the sky it may add more contrast to the rest of the image. A pull-down list offers some convenient options.

Setup->IR->AGC Scene Presets

The AGC parameters affect how the overall IR video image appears. The default algorithm is suitable for most installations, but in some cases one of the other selections may provide a more appealing image, depending on personal preferences. Be aware the settings that are optimal at one time may be less optimal a short time later, since conditions such as weather and time of day affect the image and are constantly changing.

• **Brightness** (ITT Mean) setting determines the temperature that is at the middle of the 256 "shades of gray" produced by the AGC. Positive values allow more detail in hotter scenes, while negative values allow more detail in lower temperature scenes. Range is -4 to 4.

• **Contrast** (Max Gain) can be used to increase contrast, especially for scenes with little temperature variation (it may also increase noise due to increased gain). Range is 12 to 24.

• **Sharpness** (DDE Gain) is used to enhance image details and/or suppress fixed pattern noise. Positive values increase Sharpness, while negative values soften the image and filter fixed pattern noise. A setting of 0 is neutral and will not have any effect. Range is -10 to 40.

• **AGC Filter** determines how quickly a scene will adjust when a hot object appears (or disappears) within the AGC ROI. If set to a low value, when a hot object enters the ROI, the AGC will adjust more slowly to the hot object, resulting in a more gradual transition. Range is 1 to 32.

It may be best to start with the Scene Presets selections, but experiment with different AGC settings. Select **Save Settings** button at the bottom of the page to keep the settings after a power cycle or select the **Factory Defaults** button to return the settings to default values.

Each Scene Preset provides a combination of parameters that are preferred for certain types of conditions. Select a Scene Preset that provides an image that is optimal for the situation. Recall the Scene preset can also be toggled by selecting the Toggle Scene Preset button from the **Live Video** page control panel.

Setup->Pan and Tilt->Status
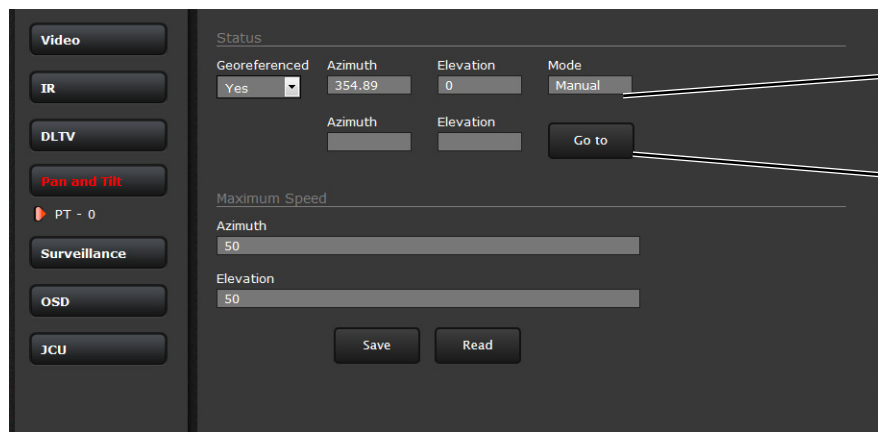
Reported direction coordinates, updated in real time.

To move the camera enter coordinates, click Go to.

Icons on the video show the direction the camera is facing in relation to an outline of a ship. The Pan and Tilt status shows the azimuth and elevation of the current direction of the camera.

The azimuth angle is measured from 0 to 360 starting to starboard from the bow of the ship outline icon on the video. The elevation angle is measured from horizontal; minus values are down. positive values are up. Both the reported angles and the **Go to** angles take into consideration the Offsets. See "Azimuth and Elevation Offsets" on page 49.

The Azimuth "0" direction should be directly toward the front of the vessel; the elevation may be set to the horizon or another preferred reference. The azimuth and elevation offsets can be set using the OSD menu. Refer to the *M500 Camara Operator's Manual*.

Setup->Surveillance->Scan List

To setup Presets:
position camera,
select Preset ID

Click Set,
then Save

Setup->Surveillance->Auto Scan

To start Auto Scan:
select width and speed,
then select Start

Set Autoscan at Startup:
select speed,
select limits,
click Save

The Relative Auto Scan (Surveillance mode) can be started and the settings changed from the OSD menu, JCU II (UPB), or the web page.

The Absolute Auto Scan can be started and the parameters set in the web page, but Absolute Auto Scan can also be started as an option in the Startup mode when the camera boots. Refer to "Startup Mode" on page 49.
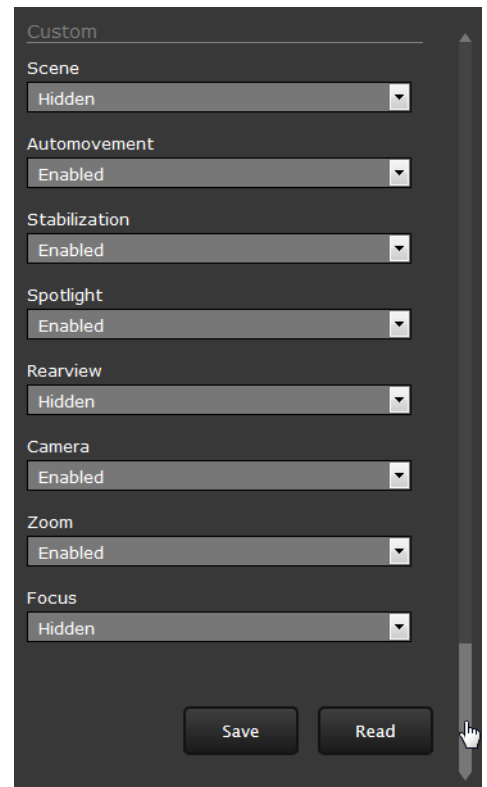
Setup->OSD

Make selections on the OSD Web page to set the content of each level of Display Icons.

Scroll down and select to enable or hide each icon for the **Full**, **Minimal**, and **Custom** icon sets.

Choose **Read** to display the current settings.

Choose **Save** to save the current selections.

Maintenance Menus

After making configuration changes, click the Save button at the bottom of the page. After saving, it is also necessary to stop and restart the server. The server has a configuration that is active and running, and another configuration that is saved.
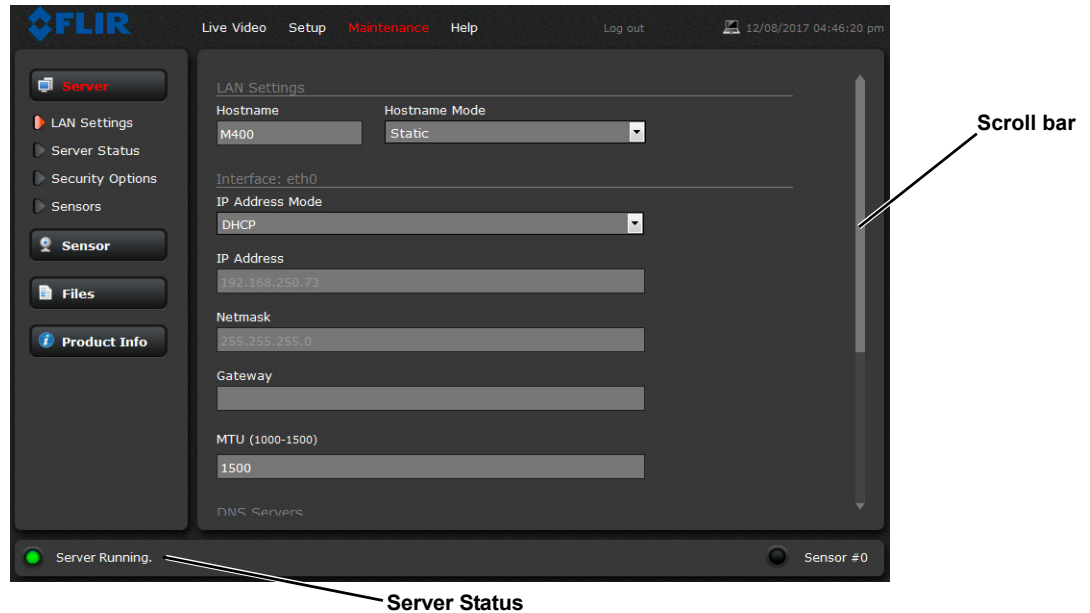
Figure 6-3: Maintenance Menu Pages

The message at the bottom of the page indicates the saved configuration is different than the active (running) configuration, and it is necessary to restart the server.

Restarting the Server

Click on the green light at the lower left next to "Server Running" to stop the server.

It may take up to 20 seconds for the server to stop, especially if multiple video streams are open. Be patient when stopping the server.

Once the server is stopped, an information message will pop up on the screen.

When the server is stopped and the page is refreshed, the status will show as "Server Stopped."

Click to restart the server. When the page refreshes, the status will again show as "Server Running…". The Start button will be replaced by a Stop button when the startup procedure has completed.
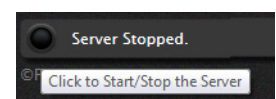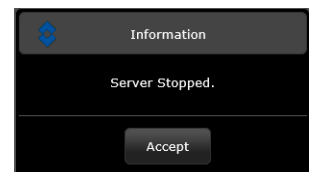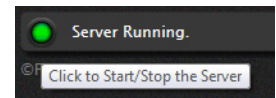
Maintenance->Server->Server Status

The page provides an indication of the current server status (either running or stopped) and buttons for starting or stopping the server or for rebooting the system. Scroll down to see additional status information which may be useful to FLIR technical support.
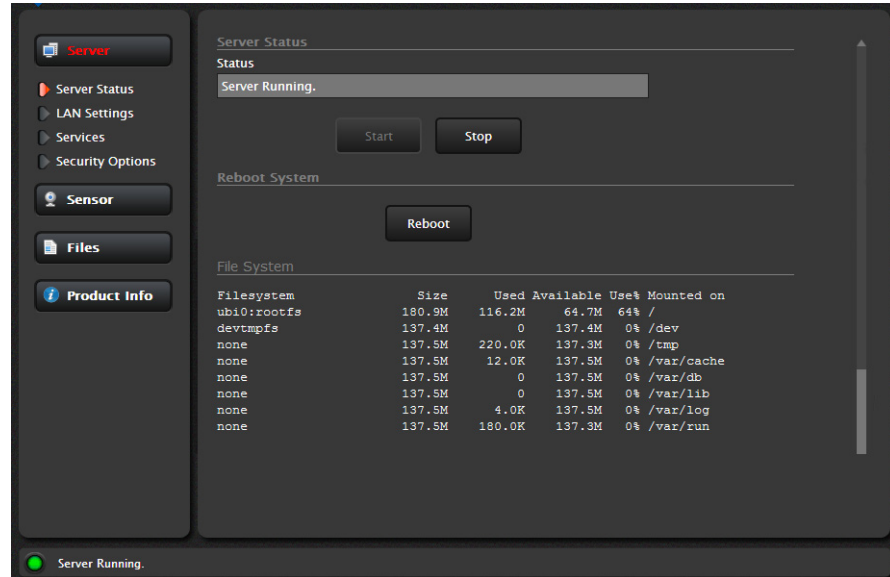
Changing the IP Address of the Camera

The admin and expert log in accounts can change LAN settings.

Maintenance->Server->LAN Settings

The M500 system is shipped with DHCP IP address mode enabled. Some networks may require that a static IP address is set. The camera IP address, mask, and gateway is shown in the figure below. A Static option is selected with an IP address of 192.168.250.116.
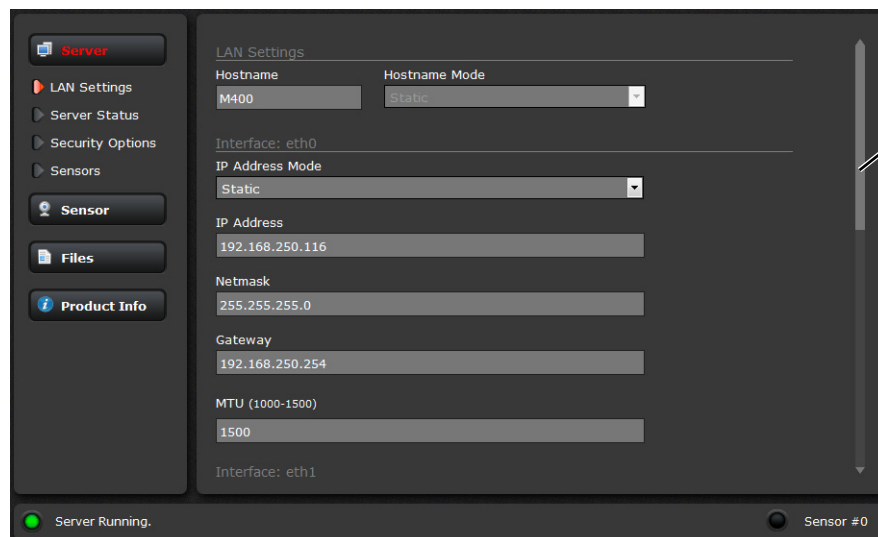
Select the Static or DHCP option. The screen will refresh, enter the appropriate information for the network, then scroll down to select the Save button at the bottom of the page.

Maintenance->Server->Security Options

Use the **Security Options** page to restrict access through the camera web server to specific IP addresses and to set or change passwords. The **admin** login is required to change or set any password.
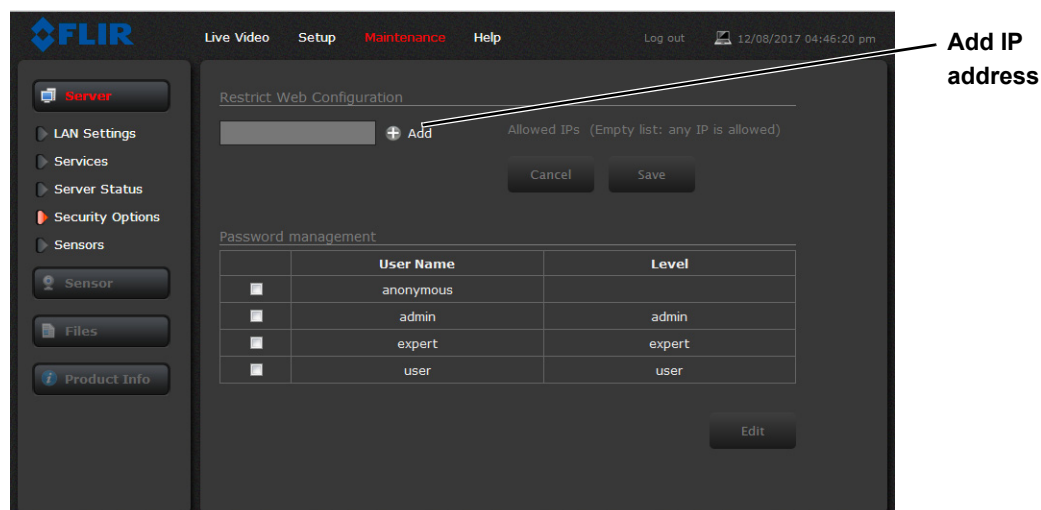
As an additional security measure, limit which computers have access to the web browser interface. Simply add a computer's IP address and click Add. After all the allowed IP addresses are entered, select the **Save** button to save the changes.

Note

A VMS Remote to the camera, ONVIF or Nexus CGI, uses the same password as the web interface.

To maintain security of the system set new passwords for each of the three login accounts (requires the **admin** login).

- **user**—The user account can only use the **Live Video** page and controls.
- **expert**—The expert account can use the **Live Video** page, the camera **Setup** page, and the Server pages on the **Maintenance** menu.
- **admin**—The admin account can use all pages.
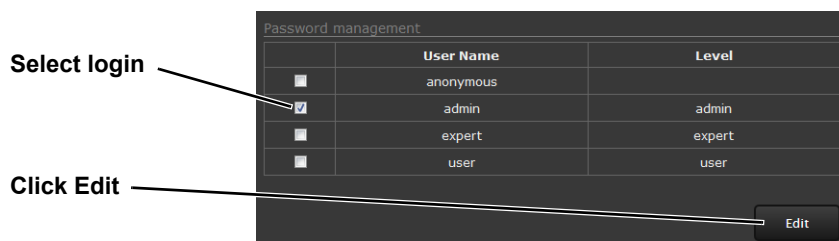
Maintenance->Sensor->Communications->VMS Remote

Enable ONVIF v2.0 Driver

Enable the ONVIF driver to connect the camera to a VMS or a network video recorder.

1. On the Maintenance->Sensor->Communications->VMS Remote page, select **INTERFACE 1**.

2. Select Yes to enable driver.

3. Scroll down and select **Save**.

4. Stop and start the server to make the change effective.
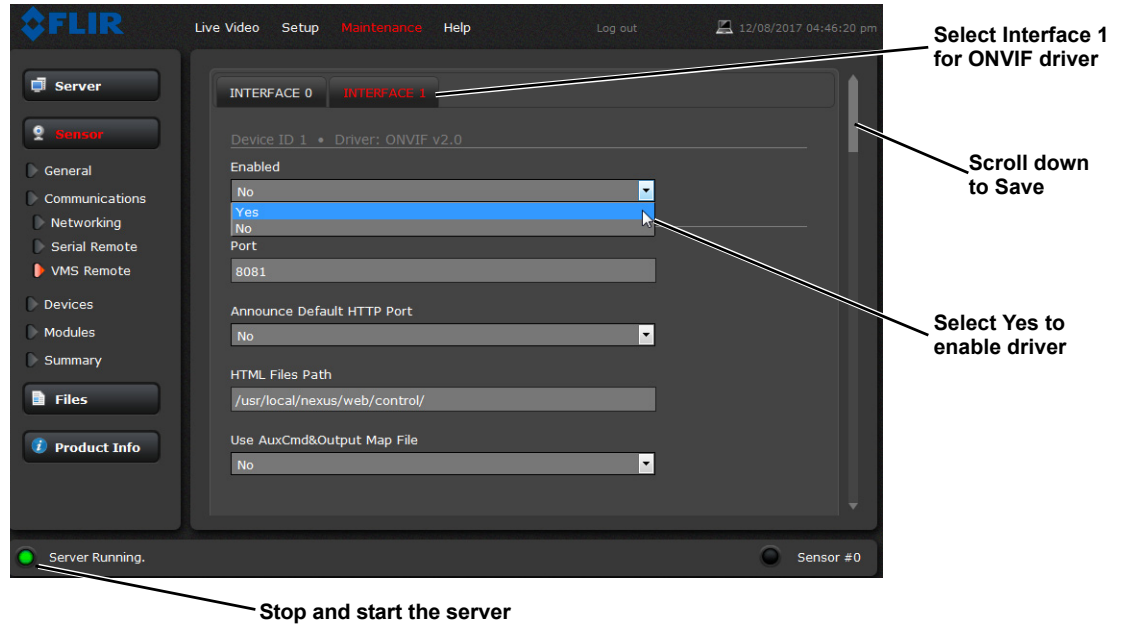
Maintenance->Sensor->Devices->Pan & Tilt

Startup Mode

Select an action the camera will perform at startup (power cycle or server reset).
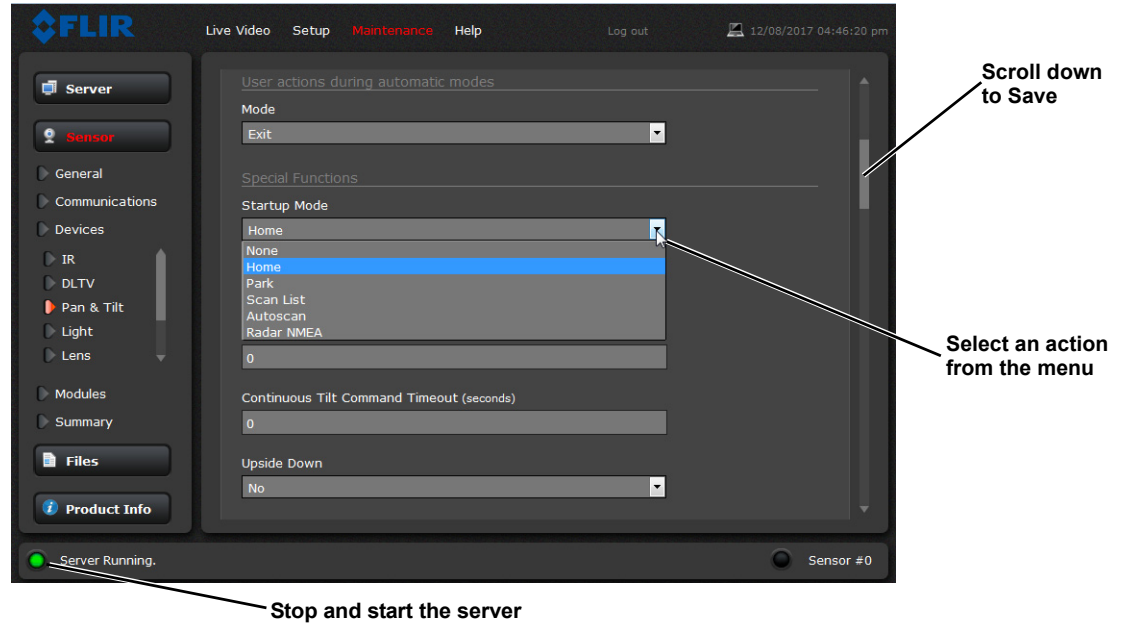
Azimuth and Elevation Offsets

After the camera is installed, the azimuth may be set to account for variations required during installation. The azimuth direction should be directly toward the front of the vessel; the Elevation Offset should be zero. The azimuth/elevation offset can be set using the OSD menu.
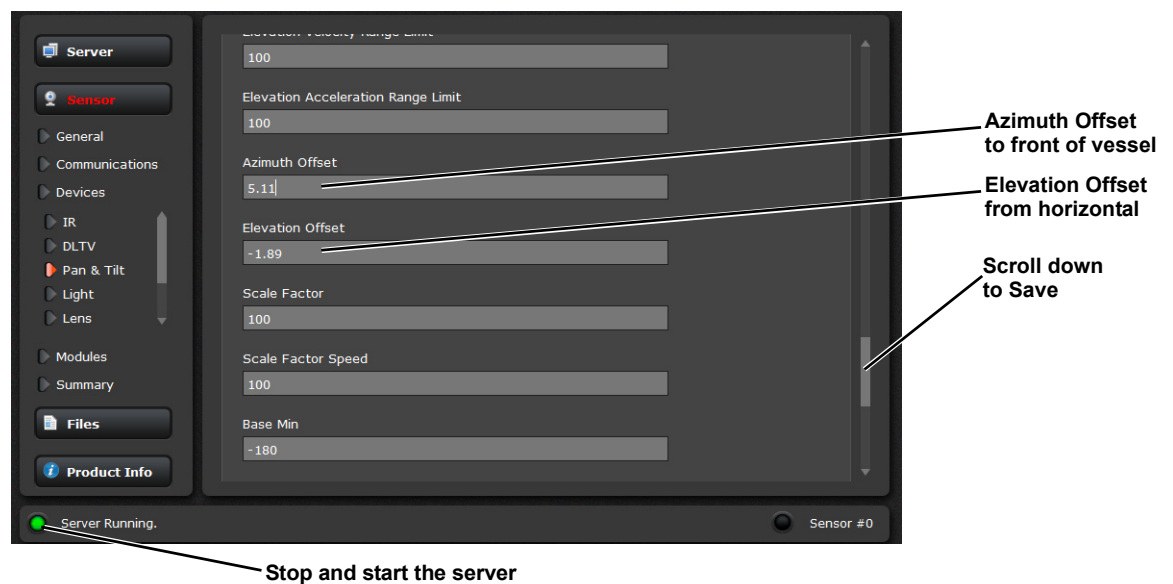
Setting Park Position

The default park position is defined as 0° azimuth and -90° elevation. If a a different park position is desired, adjust the Park position as follows:

1. On the Maintenance->Sensor->Devices->Pan & Tilt page, enter the value of the new Elevation Park Position, as shown below.
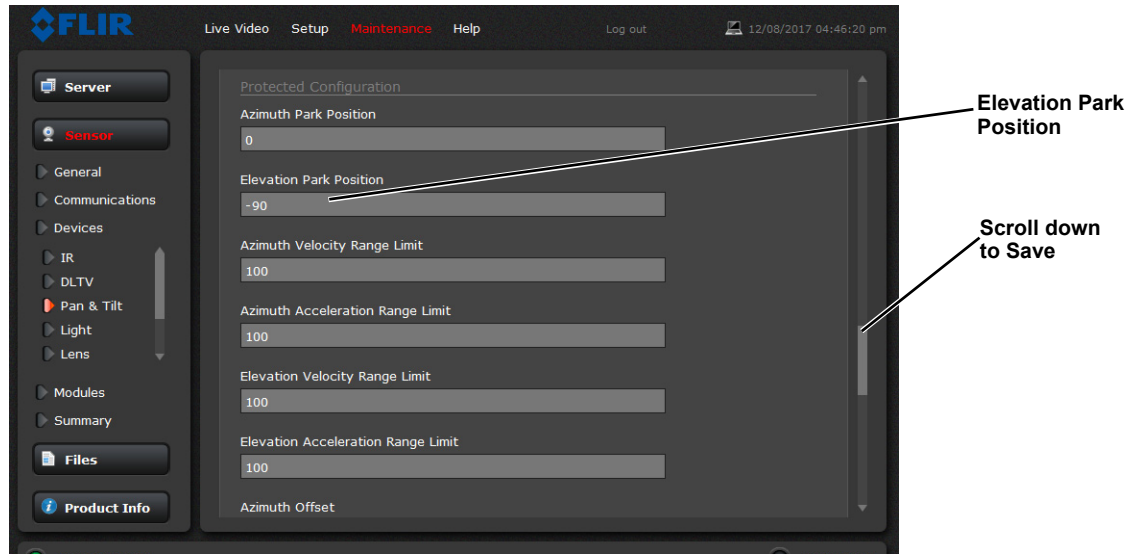
Changing Video Outputs

The M500 camera system has two cameras with different video streams which are then processed to provide multiple display formats and video resolutions. Use the following web pages to control these video streams and how they are affected by Active Camera selections from the JCU II.

Maintenance->Sensor->Devices

- **Sensor -> Devices->IR, Aspect Ratio**—select either 4:3 or 16:9 video

- **Sensor -> Devices->DLTV**—16:9 video

These video streams are provided unchanged as inputs to VIDMUX.

Maintenance->Sensor->Devices->Video Matrix
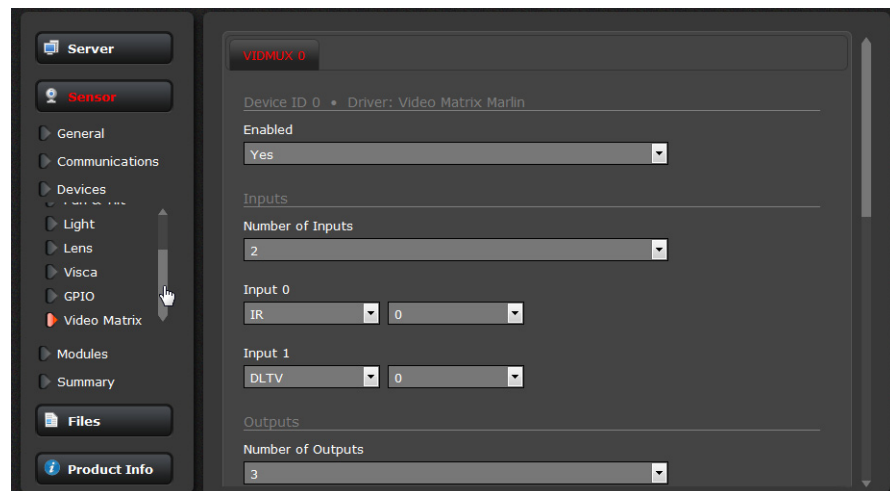
Scroll down to select how the Active Camera selection will affect each video Output (HDSDI, SD, or LiveView). Each video output stream can be set to the Active Camera, Secondary Camera, or to always display one or the other of the cameras.

Note: The IP video output streams can not be changed except by the initial selection above in Maintenance->Sensor->Devices->IR or DLTV.

Additional display resolution settings can be made for the standard video (SD) and the LiveView video streams.
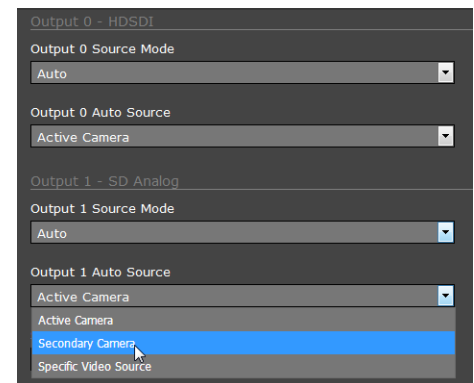
- **Sensor -> Devices->Video Matrix Output 0** - HDSDI is output unchanged.

- **Sensor -> Devices->Video Matrix Output 1** - SD Analog is processed as either NTSC Letter Box 720x360 (cropped top and bottom), NTSC Center Box 720x480 (full data), PAL Letter Box 720x432 (cropped top and bottom), or PAL Center Box 720x576 (full data).

- **Sensor -> Devices->Video Matrix Output 2** - LiveView (Live Video web page) is output unchanged.

Maintenance->Sensor->Modules->Video
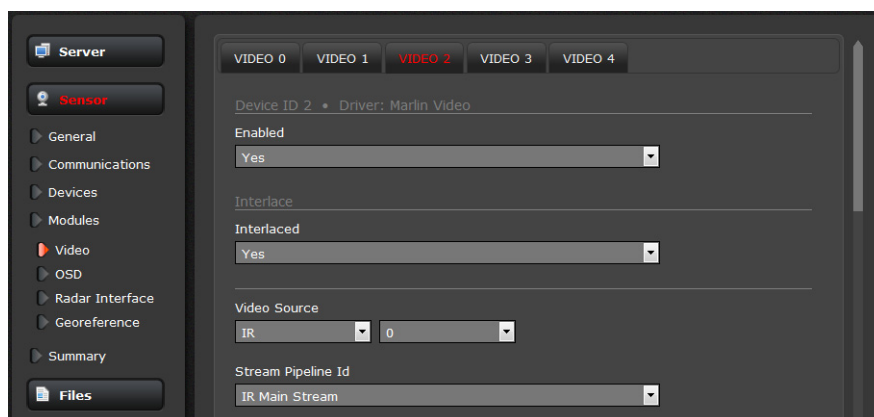
VIDEO 0 is the daylight camera (DLTV) video stream, VIDEO 2, shown above and at the right, is the infrared camera video stream, and VIDEO 4 is the video stream shown on the Live Video web page.

- VIDEO 0 and VIDEO 2 Video Settings Image Size
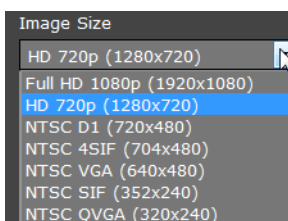
- VIDEO 4 Video Settings Image Size
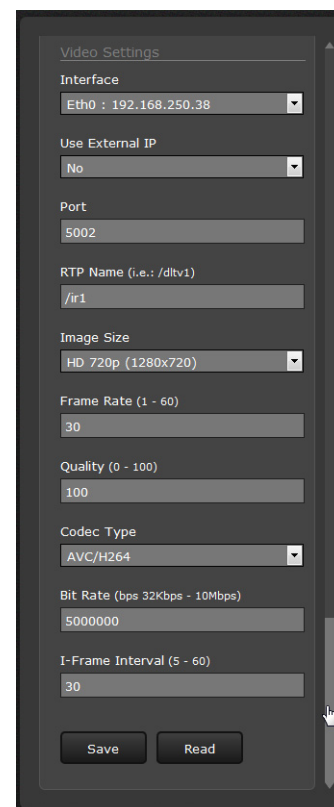
Maintenance->Sensor->Modules->Radar Interface

Geo-Referencing of the Sensors

The Camera Server and the Radar Server can each have a Georeference location. When the camera is installed on a vessel, the location information can come from a GPS and gyrocompass and the information is available as NMEA data directly from those devices or through the radar device.

Maintenance->Sensor->Modules->Georeference

The Camera Server can have a different Georeference location and heading than the Radar Server, but typically they are associated with each other, with an offset if they are in different locations on a larger ship. It is recommended that the Radar Server is configured to receive the live location information, and the Camera Server Georeference can be associated with the Radar Server Georeference.

Software Update

When software updates become available, use the Software Update field to load the update to the camera. The update typically comes with a pre-update file (update-prep.sh) and an update file (for example, marlin-v2.1.1.swu.sh). Contact the FLIR dealer where you purchased the camera for additional information, or contact FLIR directly.

Maintenance->Files->Firmware
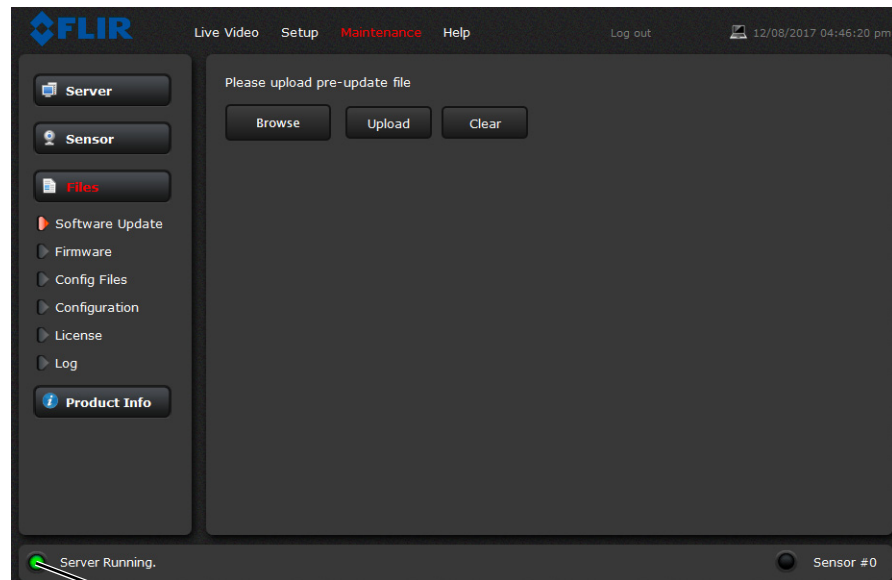
Click to stop server. The server must be stopped to upload or download any files.

Accessing the JCU II Web Interface

The JCU II communicates through the Ethernet IP protocol just like the M500 camera does.

Changing the IP Address of the JCU II

On the JCU II, the IP address is displayed by pressing the COLOR button and pushing the joystick forward at the same time. The IP addresses of the JCU II and the camera are displayed for 3 seconds and then the display returns to its state before the IP request was made.

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

1. Determine the JCU II IP address by pressing the COLOR button and pushing the joystick forward at the same time. The IP address is shown on the JCU II screen.

2. Type the JCU II IP address into the address bar of the browser adding /index.html.
   for example: http://192.168.250.110/index.html
   The JCU II Web page is shown, with a picture of the JCU II.

3. For Network Addressing, select Static.

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

5. Click Save to save the changes and exit the Web page.

Enabling Universal Plug and Play (UPnP)

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

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

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

UPnP Overview

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

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

M500 cameras and JCU IIs are UPnP devices so they broadcast their presence on the network. A PC configured to accept UPnP broadcasts will show all UPnP devices discovered under My Network Places.

Enabling the UPnP User Interface

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

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

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

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

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

4. Select the Universal Plug and Play check box.
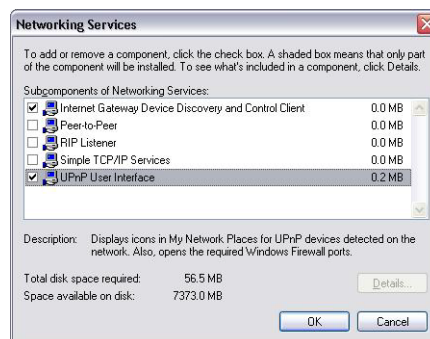
5. Click OK, and then click Next in the Windows Components Wizard. The Windows XP installation CD may be required.

See if any UPnP-enabled devices exist on your network by opening My Network Places. If there are UPnP devices on the 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.

M500 Reference Information

Introduction

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

It also includes a set of tips for troubleshooting issues.

Acronyms

Table 7.1 lists each acronym that is used in this manual and its meaning.

TABLE 7.1 Acronyms

Acronym/Term	Definition
AGC	Automatic Gain Control
ANSI	American National Standards Institute
API	Application Programming Interface
B/W	Black and White
DLTV	Daylight TV, used to reference visible-band cameras
EAR	Export Administration Regulations
EMI	Electromagnetic Interference
FFC	Flat Field Correction
FLIR	Forward Looking Infrared
FoV	Field of View
FPS	Frames per Second (refresh rate)
HFoV	Horizontal Field of View
ICD	Interface Control Document
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IR	Infrared or thermal
JCU	Joystick Control Unit
LCD	Liquid Crystal Display
LSZH	Low Smoke Zero Halogen
MFD	Multifunction display
MWIR	Mid-wave infrared
NMEA	National Marine Electronics Association

TABLE 7.1 **Acronyms**

Acronym/Term	Definition
NTSC	National Television System Committee
OSD	on-screen-display
P/T	Pan/Tilt
PAL	Phase Alternating Line
PoE	Power over Ethernet
SCTE	Society of Cable Telecommunications Engineers
SDK	Software Developer's Kit
UPnP	Universal Plug and Play
Vdc	Volts, Direct Current
VIS	Visible (visible-band camera reference)

List of Icons

Table 7.2 lists the icons that may be shown on the screen during various operations, with a brief description of their meaning. Some icons display permanently and some only display briefly. The display of some icons is affected by settings on the Display Icons menu (see page 28).

TABLE 7.2 **Video Display Icons**
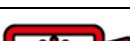
Icon	Name	Description
IR	Thermal camera	
	Daylight camera	
	Azimuth (Position)	Shows the azimuth (or direction) of the camera relative to the vessel. The shaded triangle shows the approximate camera field of view (FOV).

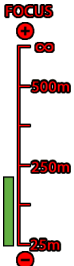**TABLE 7.2 Video Display Icons (Continued)**
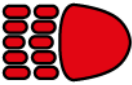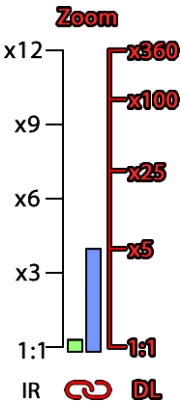
Icon	Name	Description
	Elevation (Tilt)	Shows the vertical tilt of the camera. The shaded triangle shows the approximate camera position.
	Focus Scale	Shown when autofocus is invoked to indicate the progress of the operation.
	Home	Indicates the camera is in the home position; the icon flashes when a new home position is set.
	Lock zoom	Lock the zoom of cameras to the active payload, whenever possible.
	Mirrored View	
	Polarity	
	Color Palette	
	Spotlight (continuous)	
	Spotlight (SOS)	
	Spotlight (Flash)	
	NMEA BWS Message	Receiving NMEA messages using Bearing and Distance to Waypoint, Great Circle (BWC) sentence format has been enabled; this is also known as slew to waypoint.
	NMEA RSD Message	Receiving NMEA messages using the Radar System Data (RSD) sentence format has been enabled; this is also known as radar cursor tracking.

TABLE 7.2 Video Display Icons (Continued)

Icon	Name	Description
	NMEA TTM Message	Receiving NMEA messages using the NMEA Tracked Target Message (TTM) sentence format has been enabled; this is also known as radar tracking
	Power down	The camera is shutting down.
	Scene: Night	One of four scene presets (automatic gain control settings) optimized for use on the open water at night.
	Scene: Docking	One of four scene presets (automatic gain control settings) optimized for use when the boat is docking at night.
	Scene: Day	One of four scene presets (automatic gain control settings) optimized for use on the open water during the day.
	Scene: Contrast	One of four scene presets (automatic gain control settings) optimized for providing visibility to small moving objects.
	Vertical Stabilization	Indicates the gyro stabilization setting is vertical only (point mode), which improves camera image stability while keeping the camera pointing in the same position relative to the vessel as it turns.
	Vertical and Horizontal Stabilization	Indicates the gyro stabilization setting, which improves camera image stability, while keeping the camera pointing in the same direction even as the vessel turns.
	Zoom scale	Shown to indicate the progress of the zoom position of the active camera.

System Specifications

Table 7.3 lists details about physical characteristics, power usage, and environmental features of the M500 camera.

TABLE 7.3 Specifications

Physical Characteristics	
Camera Size	32.4 cm (12.75 in) diameter by 46 cm (18.1 in) tall
Camera Weight	12.22 kg (27 lb), depending on the camera model
Joystick Size	9.1 X 14.2 X 8.13 cm (3.6 X 5.6 X 3.2 in) 7.4 cm (3 in) above platform including joystick
Joystick Weight	0.45 kg (1 lb)
Power	
Camera Input Power	24 Vdc, 2.5 A typical, 5.5 A max 12 Vdc, 5 A typical, 11 A max Absolute range 12 Vdc to 32 Vdc
JCU II Input Power	Power over Ethernet (PoE) per IEEE 802.3af
Consumption	50 W nominal, 132 W maximum
Environmental	
Operating temperature range	–20 °C to +55 °C (–4 °F to +131 °F) per IEC 60945
Storage temperature range	–50 °C to +80 °C (–58 °F to +176 °F)
Automatic Window defrost	Standard
Sand/dust	IEC 60945
Water Ingress	IP X6
Shock	15 g vertical, 9 g horizontal
Vibration	IEC 60945
Lightening Protection	IEC 60945
Salt Mist	IEC 60945
Wind	100 knot (115 mph)
EMI	IEC 60945

Troubleshooting Tips

This section includes information that may help with common issues that may arise during operation of the M500 system.

Video not displayed on monitor

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

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

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

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

Cleaning

Warning: The M500 camera body is a remotely and automatically controlled device. Ensure camera motion has been disabled before cleaning surfaces that can cause pinch hazards.

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

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

Video not switching between thermal and visible

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

Noisy image

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

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

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

Image too dark or too light

By default, the M500 thermal camera uses an automatic gain control (AGC) setting that has proven to be superior for most applications. However, a specific environment may benefit from a different AGC setting. For example, a very cold background (such as the sky) could cause the camera to use a wider temperature range than appropriate. Try to keep the ocean, and not the sky or the boat, as the predominant object in the image. Refer to "Home Button" on page 17 for information about how to make adjustments to the image.

Performance varies with time of day

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

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

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

Eastern or Western exposure

While a boat is under way, the camera may inevitably end up pointing directly east or west, and this may cause the sun to be in the field of view during certain portions of the day. We do not recommend intentionally viewing the sun, but looking at the sun will not permanently damage the sensor. In fact the thermal imaging camera often provides a considerable advantage over a conventional camera in this type of back-lit situation.

However, the sun may introduce image artifacts that will eventually correct out and it may take 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.

Multiple Cameras and/or JCU IIs on a single network

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

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