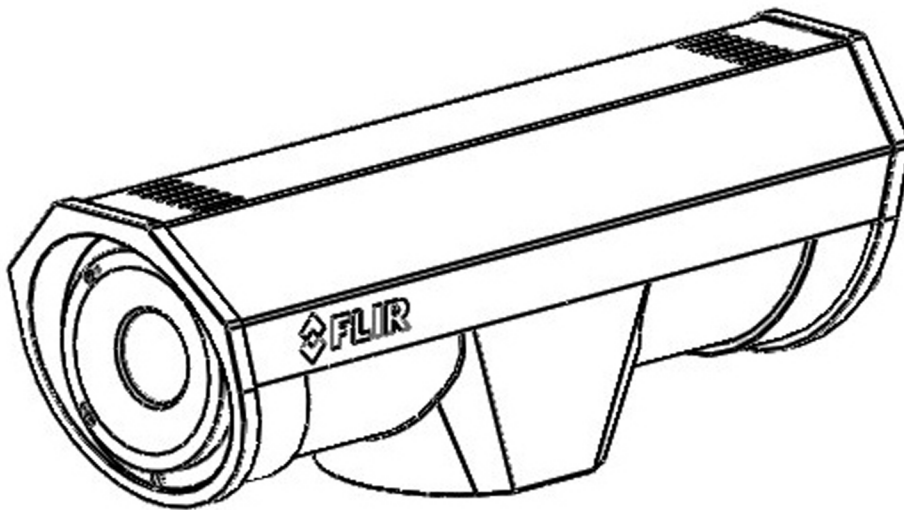




Installation Manual

F-Series



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FLIR Systems, Inc.

6769 Hollister Avenue

Goleta, CA 93117

Support: <https://www.flir.com/support-center/support-hq/>

Important Instructions and Notices to the User:

Modification of this device without the express authorization of FLIR Systems, Inc., may void the user's authority under the FCC Rules to operate this device.

Note 1: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Shielded cables must be used to connect this device to other devices.

Note 2: If ferrites are supplied with this equipment, the equipment was tested for compliance with the FCC limits for a Class A digital device using power cables with the ferrites installed. When connecting one or two power cables to the equipment, the supplied ferrites must be used with this equipment.

Industry Canada Notice:

This Class A digital apparatus complies with Canadian ICES-003.

Avis d'Industrie Canada:

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

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 nearby, please contact a local waste collection or recycling service, the original place of purchase or product supplier, or the responsible government authority in the area. Business users should contact their supplier or refer to their purchase contract.

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This manual describes the installation of the F-Series cameras. If you need help during the installation process, please call to speak with our support experts. All installers and integrators are encouraged to take advantage of the training offered by FLIR; visit <https://www.flir.com/support-center/training/> for more information.

This manual includes the following topics:

- Installation overview
- Mounting the camera and its components
- Connecting the electronics
- Bench testing the camera
- Basic configuration and operation of the camera
- Camera Specifications

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

1.1 Warnings and Cautions

Warning!



If mounting the F-Series camera on a pole, tower or any elevated location, use industry standard safe practices to avoid injuries.

Caution!

Except as described in this manual, do not open the F-Series camera for any reason. Disassembly of the camera can cause permanent damage and will void the warranty.

Be careful not to leave fingerprints on the F-Series camera's infrared optics.

The F-Series camera requires a power supply of 24 V. Operating the camera outside of the specified input voltage range or the specified operating temperature range can cause permanent damage.

1.2 References

F-SERIES Camera Mechanical Interface Control Document (ICD) (FLIR Doc # 427-0030-00-19)—available from the FLIR website, provides further details regarding mechanical dimensions and mounting for the F-Series camera.

1.3 Camera Overview

The F-Series camera is both an analog and an IP camera. The video from the camera can be viewed over a traditional analog video network or it can be viewed by streaming it over an IP network using MPEG-4, M-JPEG, and H.264 encoding. Analog video will require a connection to a video monitor or an analog matrix/switch. The IP video will require a connection to an Ethernet network switch and a computer with the appropriate software for viewing the video stream.

1.4 Installation Overview

The F-Series Camera is an infrared thermal imaging camera intended for outdoor applications, and can be installed in a fixed location or on a pan/tilt mechanism.



Figure 1-1: F-Series Camera

The F-Series camera is intended to be mounted on a medium-duty fixed pedestal mount or wall mount commonly used in the CCTV industry. Cables will exit from the back of the camera housing. The mount must support up to 30 lbs. (15 KG).

1.4.1 Camera Connection Options

Camera connections are made through water-tight cable gland seals on the rear of the camera. Refer to [Cable Gland Sealing, pg. 7](#) to ensure the glands are used correctly and the connections are properly sealed.

The camera can be powered with a conventional power supply using 21 - 30 VAC or 21 - 30 VDC.

The F-Series Camera can produce analog or digital (IP) video output (or both). Analog video will require a connection to a video monitor or an analog video matrix switch.

An Ethernet connection is provided for IP video streaming and for command and control communications. A web browser can be used for camera configuration and maintenance (software/firmware updates). On some models, a web browser can also be used for IP video streaming and for command and control.

For analog installations that are not using Ethernet/IP, a serial cable (RS232 or RS422) can optionally be connected and used for command and control communications, supporting either Pelco D or Bosch protocols. In installations using analog video and serial communications, it is recommended an Ethernet cable should also be installed for camera configuration, operation, and troubleshooting.

For installations where the camera is mounted on a tower or pole or other location that may be difficult to access, it is recommended the Ethernet connection should be installed from the camera down to ground level at a minimum, to allow easier access.

1.4.2 Supplied Components

The F-Series camera includes these standard components:

- Fixed Camera Unit
- Cable Glands and Spare Parts kit

1.4.3 Required Components

The installer will need to supply the following items, which are specific to the installation.

- 24 V Power supply
- Electrical wire, for system power; up to 100' (3-conductor, shielded, gauge determined by cable length and supply voltage. Refer to [Camera Connections, pg. 9](#).
- Camera grounding strap
- Coaxial RG59U video cables (BNC connector at the camera end) for analog video
- Shielded Category 6 Ethernet cable for control, streaming video, and for software upgrades.
- Optional serial cable for serial communications
- Miscellaneous electrical hardware, camera mount, connectors, and tools

1.5 Location Considerations

The camera will require connections for power, communications (IP Ethernet, and/or serial communications), and video.

Important Note

Install cameras with an easily accessible Ethernet connection to support future software updates.

Ensure that cable distances do not exceed the specifications and that cables adhere to all local and Industry Standards, Codes, and Best Practices.

Important Note

If the camera is to be mounted on a pole, tower, or other hard-to-reach location, connect and operate the camera as a bench test prior to mounting the camera in its final location.

1.5.1 Bench Testing

Connect the power, video, serial, and Ethernet connections and confirm that the video is displayed on a monitor when the power is turned on. For configuration and basic setup information using the onboard web server, refer to [Camera Bench Test, pg. 16](#).

1.5.2 Prior to Cutting/Drilling Holes

When selecting a mounting location for the F-Series camera, consider cable lengths and cable routing. Ensure the cables are long enough, given the proposed mounting locations and cable routing requirements, and route the cables before you install the components.

Use cables that have sufficient dimensions to ensure safety (for power cables) and adequate signal strength (for video and communications).

1.5.3 Camera Mounting

F-Series cameras must be mounted upright on top of the mounting surface, with the base below the camera. The unit should not be hung upside down.

The F-Series camera can be secured to the mount with three to five 1/4-20 threaded fasteners as shown below.

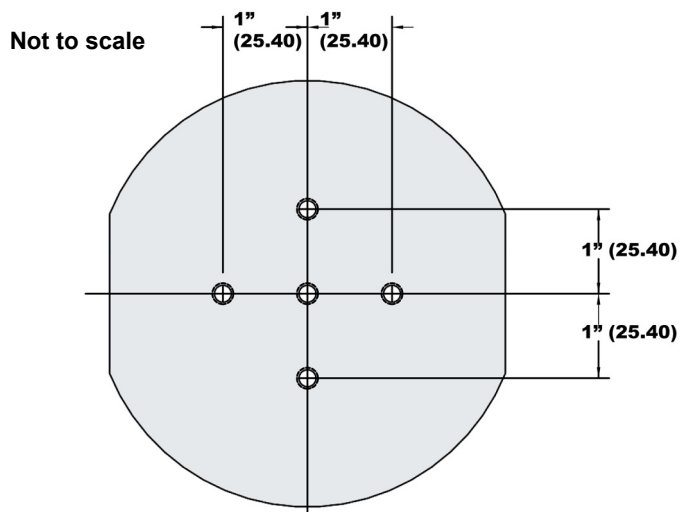


Figure 1-2: F-Series Camera Mounting Holes

Once the mounting location has been selected, verify both sides of the mounting surface are accessible.

Use a thread locking compound such as Loctite 242 or equivalent with all metal to metal threaded connections.

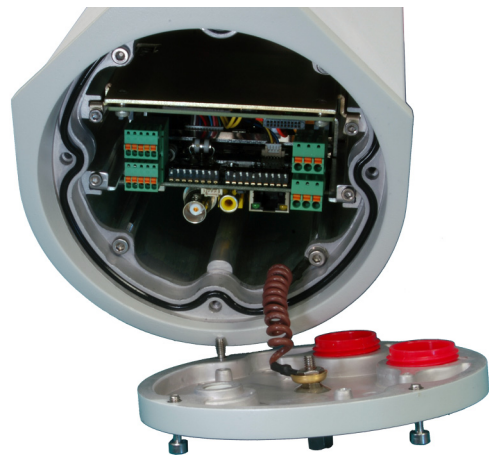
Once the holes are drilled in the mounting surface, install three (3) to five (5) 1/4-20 threaded fasteners into the base of the camera with thread-locking compound.

1.5.4 Removing the Back Cover

Use a 3 mm hex key to loosen the four captive screws, exposing the connections at the back of the camera enclosure. There is a grounding wire connected between the case and the back cover as shown. If the grounding wire is temporarily disconnected during the installation, it must be reconnected to ensure proper grounding of the camera.

1.5.5 Cable Gland Sealing

Proper installation of cable sealing glands and use of appropriate elastomer inserts is critical to long term reliability. Cables enter the camera mount enclosure through liquid-tight compression glands. Be sure to insert the cables through the cable glands on the enclosure



before terminating and connecting them (the connectors will not fit through the cable gland). Leave the gland nuts loosened until all cable installation has been completed. Inspect and install gland fittings in the back cover with suitable leak sealant and tighten to ensure water tight fittings. Teflon tape or pipe sealant (i.e. DuPont RectorSeal T™) are suitable for this purpose.

1.5.6 Cable Glands and Spare Parts Kit

The kit contains the two 3/4" cable glands and gland seal plugs required for non-conduit installations.

The remaining parts included in the kit are:

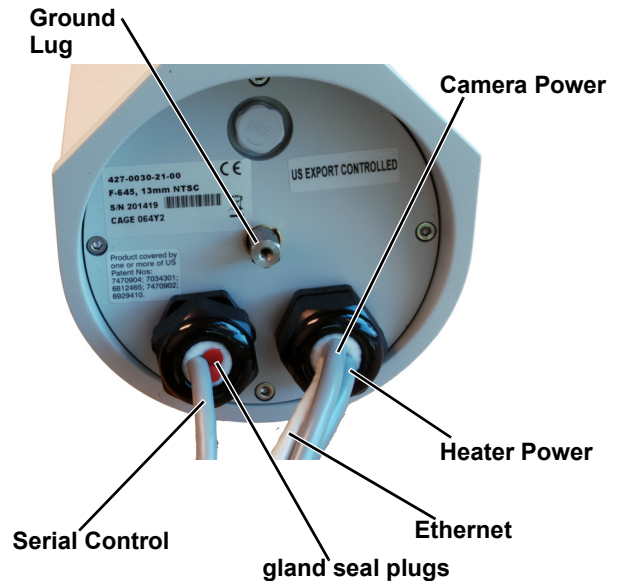
- a spare ground wire
- a spare ground nut and lock washer
- two spare power terminal block plugs
- two spare serial port terminal block plugs
- four spare F-Series back cover screws
- four spare PT-Series back cover screws



1.5.7 Cable Gland Seal Inserts

The F-Series camera comes with two 3/4" NPT cable glands, each with a three hole gland seal insert. Cables may be between 0.23" to 0.29" OD. Typically up to five cables may be needed. Plugs are required for any insert hole(s) not being used. The photograph at the right shows two power cables, an Ethernet cable, a serial control cable (no analog video is installed), and two gland seal plugs.

If non-standard cable diameters are used, you may need to locate or fabricate the appropriate insert to fit the desired cable. FLIR Systems, Inc. does not provide cable gland inserts other than the inserts supplied with the system.



Note

Insert the cables through the cable glands on the enclosure before terminating and connecting them. In general, the terminated connectors will not fit through the cable gland. If a terminated cable is required, you can make a clean and singular cut in the gland seal to install the cable into the gland seal.

1.6 Camera Connections

Connections for Serial, Video, Ethernet, and Power

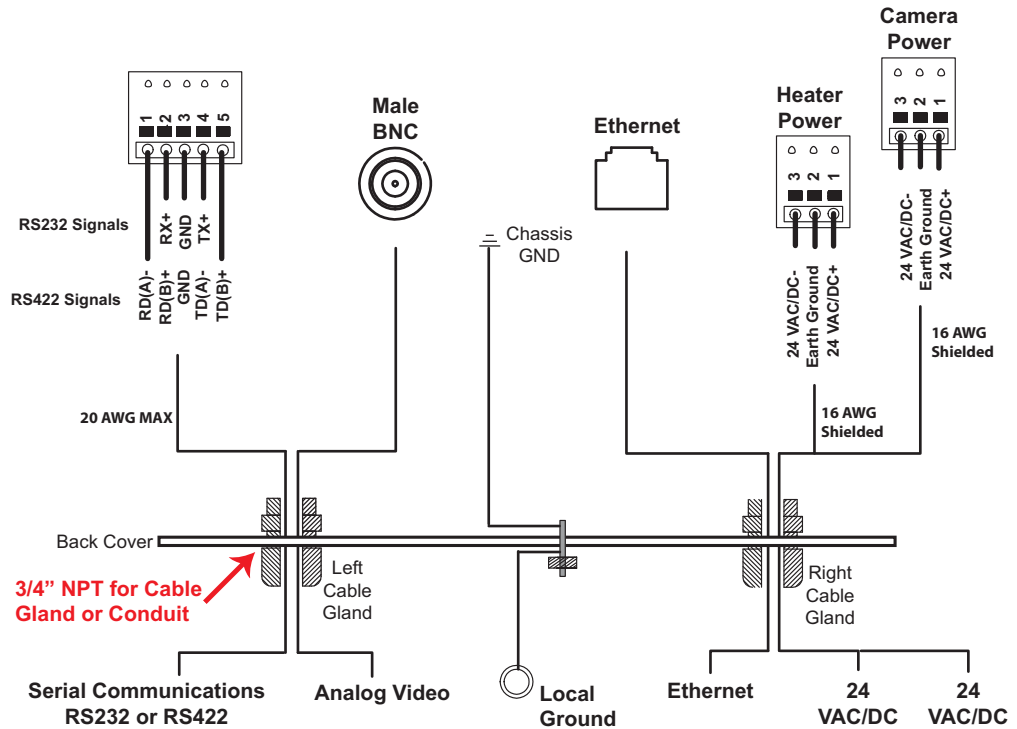


Figure 1-3: Camera Connections

1.6.1 Connecting power

The camera itself does not have an on/off switch. Generally the F-Series camera will be connected to a circuit breaker and the circuit breaker will be used to apply or remove power to the camera. If power is supplied to it, the camera will be in one of two modes: Booting Up or Powered On.

The power cable supplied by the installer must use wires that are sufficient size gauge (16 AWG recommended) for the supply voltage and length of the cable run, to ensure adequate current carrying capacity. Always follow local building codes.

Ensure the camera is properly grounded. Typical to good grounding practices, the camera chassis ground should be connected to the lowest resistance path possible. FLIR requires a grounding strap anchored to the grounding lug on the back plate of the camera housing and connected to the nearest earth-grounding point.

Note

The terminal blocks for power connections will accept a maximum 16 AWG wire size.

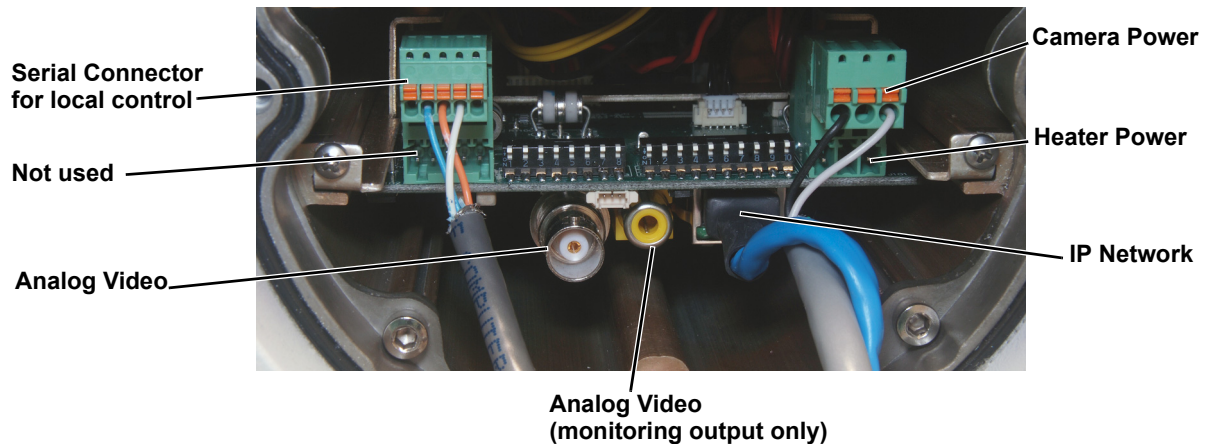


Figure 1-4: Connector and DIP Switch locations

1.6.2 Video Connection

The analog video connection on the back of the camera is a BNC connector. The camera also provides an RCA video connector that can be used to temporarily monitor the video output, without disconnecting the BNC connection.

The video cable used should be rated as RG59U or better to ensure a quality video signal.

1.6.3 Ethernet Connection

The cable gland seal is designed for use with Shielded Category 6 Ethernet cable.

1.6.4 Serial Connection

For serial communications, it is necessary to set the parameters such as the signaling standard (RS-232 or RS-422), baud rate, number of stop bits, parity and so on. It is also necessary to select the communication protocol used (either Pelco D or Bosch) and the camera address. By default, the serial interface uses Pelco D, RS-422 standard, 9600 baud rate, 8/1/none, and address 1.

Note

Typical Bosch systems operate using a biphasic connection and the FLIR cameras do not accept biphasic signals directly. It may be necessary to install a biphasic converter in order to use the Bosch protocol.

Connect the wires of the serial cable as show in Figure 1-3. When using the RS-422 standard, ensure the transmit pair of the camera goes to the receive pair of the other device, and vice versa.

Note

The terminal blocks for serial connections will accept a maximum 20 AWG wire size.

1.7 Serial Communications Overview

The installer must decide if the serial communications settings will be configured via hardware (DIP switch settings) or software. If the camera has an Ethernet connection, then generally it will be easier (and more convenient in the long run) to make configuration settings via software. Then configuration changes can be made over the network without physically accessing the camera. Also the settings can be saved to a file and backed up or restored as needed.

If the camera is configured via hardware, then configuration changes in the future may require accessing the camera on a tower or pole, dismounting it, and removing the back and so on. If the camera does not have an Ethernet connection, the DIP switches must be used to set the serial communication options.

Note

The serial communications parameters for the F-Series camera are set or modified either via hardware DIP switch settings or via software, through a web browser interface. A single DIP switch (SW102-9), Software Override determines whether the configuration comes from the hardware DIP switches or the software settings.

Note

The DIP switches are only used to control serial communications parameters. Other settings, related to IP camera functions and so on, must be modified via software (using a web browser).

1.7.1 Serial Communications Settings - Hardware DIP Switches

The camera has two blocks of DIP switches that are used to configure the serial communications settings. One block of switches has 8 switches and is used to set the serial address (or ID) of the camera. The other block of switches has 10 switches and is used to set baud rate, hardware protocol (RS-232 or RS-422), serial protocol (Pelco D or Bosch), and Software Override.

The figure below shows the locations of dip switches SW101 and SW102.

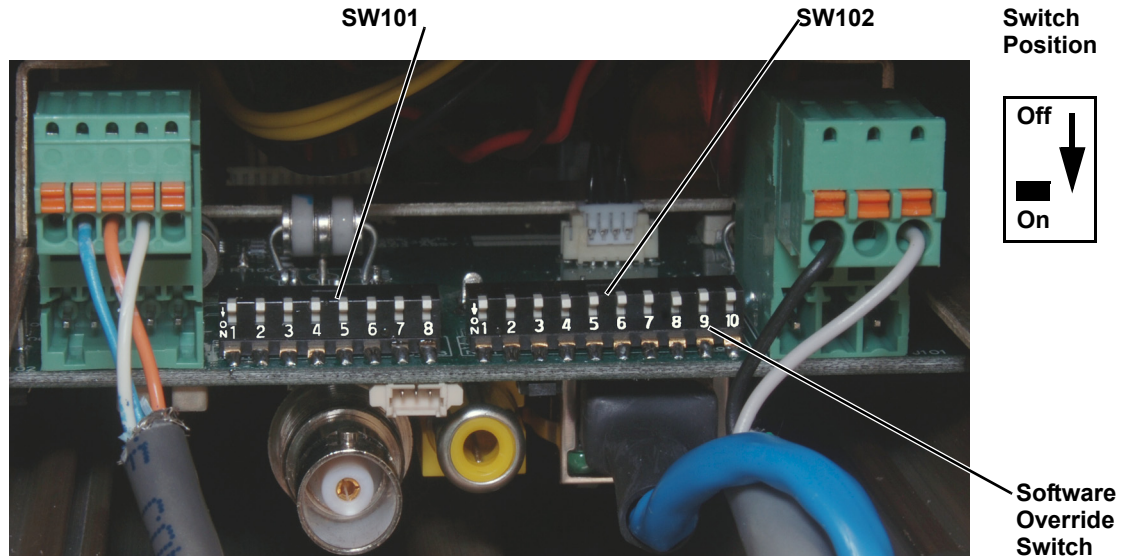
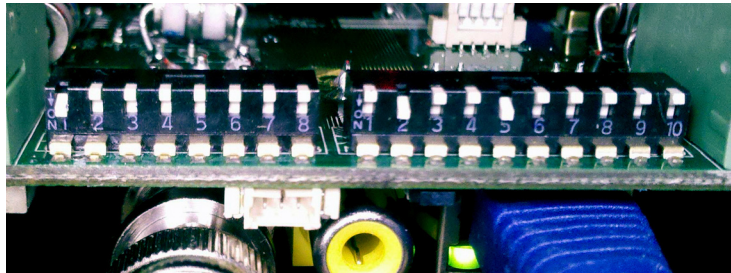


Figure 1-5: F-Series Camera Configuration

If the Software Override DIP switch is set to the software position (as it is by default), all of the other DIP switches will be ignored, and configuration changes must be made through software. If the switch is set to the hardware position, all configuration settings related to serial communications are made with the DIP switches, and changes that are made via software (with a web browser) will be ignored.

The following image shows the factory default settings, with address 1, 9600 baud, Pelco D, RS-422, Software Override set to software:



Serial Address: Use the block of switches on the left (SW101) to set the serial address of the camera. The available range of values is from decimal 1 to 255. The dip switches are interpreted as a binary number, with switch 1 representing the least significant bit (the switches are in the reverse order of the bits). For convenience, a table of serial addresses and their binary equivalents is included at the end of the manual. Refer to [Serial Address: Decimal To Binary Conversion](#), pg. 37.

Table 1-1: Dip Switch Address/ID Settings—SW101

ID	Sw 1 LSB	Sw 2	Sw 3	Sw 4	Sw 5	Sw 6	Sw 7	Sw 8 MSB
1	On	Off	Off	Off	Off	Off	Off	Off
2	Off	On	Off	Off	Off	Off	Off	Off
3	On	On	Off	Off	Off	Off	Off	Off
...
255	On	On	On	On	On	On	On	On

Other Serial Communication Parameters: The tables below defines the switch locations, bit numbering and on/off settings used in controlling the other serial communication parameters.

Table 1-2: Dip Switch Settings—SW102

	Settings		Description
	Bit 1	Bit 2	
Baud Rate: This is the baud rate of the system user serial port. The available values are 2400, 4800, 9600, 19200 kbaud.	Off	Off	2400
	On	Off	4800
	Off	On	9600
	On	On	19200

Table 1-2: Dip Switch Settings—SW102

	Settings		Description
	Bit 3	Bit 4	
Camera Control Protocol: This is the communication protocol selected for the system when operating over the serial port. The available protocols are Pelco-D and Bosch.	Off	Off	Pelco-D
	On	Off	NA
	Off	On	Bosch
	On	On	NA
Serial Communication Standard: This determines the electrical interface selected for the user serial port. The available settings are RS422 and RS232.	Bit 5	Bit 6	
	Off	Off	NA
	On	Off	RS422
	Off	On	RS232
	On	On	NA
Not Used	Bit 7	Bit 8	
	X	X	
	X	X	
	X	X	
	X	X	
Software Override DIP Switch: This setting determines whether the system will use software settings for configuration or if the dip switch settings will override the software settings. Default is Off.	Bit 9		
	Off		Software select
	On		Hardware select
Not Used	Bit 10		
	X		

1.8 F-Series Camera Specifications

Thermal Camera Specifications	Array Format (NTSC)	320 × 240		640 × 480			
	Detector Type	Long-Life, Uncooled VOx Microbolometer					
	Effective Resolution	76,800		307,200			
	Pixel Pitch	25 μm		17 μm			
	Thermal Frame Rate	NTSC: 30 Hz or 7.5 Hz or PAL: 25 Hz or 8.33 Hz					
Optical Characteristics	Model	FOV	Focal Length	Model	FOV	Focal Length	
	F-348	48° × 39°	9 mm	F-645	45° × 37°	13 mm	
	F-334	34° × 28°	13 mm	F-625	25° × 20°	25 mm	
	F-324	24° × 19°	19 mm	F-618	18° × 14°	35 mm	
	F-313	13° × 10°	35 mm	F-612	12° × 10°	50 mm	
	F-307	7° × 5°	65 mm	F-610	10° × 8°	65 mm	
	F-304	4.6° × 3.7°	100 mm	F-606	6.2° × 5°	100 mm	
	Zoom 2x & 4x E-zoom (continuous E-zoom available on specific F-6xxE models)						
	Spectral Range 7.5 μm to 13.5 μm						
	Focus Range Athermalized, Focus-Free						
Video	Composite Video	NTSC or PAL Standard					
	Video Compression	Two independent channels of streaming MPEG-4, H.264, or M-JPEG; multiple streams per channel.					
	Streaming Resolution	<p>NTSC: D1 (720 × 480), 4SIF (704 × 480), VGA (640 × 480), SIF (352 × 240), QVGA (320 × 240)</p> <p>PAL: D1 (720 × 576), 4CIF (704 × 576), VGA (640 × 480), CIF (352 × 288), QVGA (320 × 240)</p>					
	Thermal AGC Modes	Preset AGC modes and manual Brightness (ITT Mean), Contrast (Max Gain), Sharpness (DDE Gain), and AGC Filter controls.					
	Thermal AGC Region of Interest (ROI)	Default, Presets and User definable to insure optimal image quality for subjects of interest					
	Image Uniformity Optimization	Automatic Flat Field Correction (FFC) - Thermal and Temporal Triggers					
	System Integration	Ethernet	Yes				
Serial Control Interfaces		RS-232/-422; Pelco D, Bosch					
External Analytics Compatible		Yes					

General	Weight	~10.2 lb (4.8 kg); Configuration Dependent
	Dimensions (L, W, H)	18.1" x 5.5" x 6.3" (460 x 140 x 160 mm)
	Input Voltage	24 Vac (21-30 Vac) 24 Vdc (21-30 Vdc)
	Power Consumption	24 Vdc = 10 W (max no heater); 46 W (max w/ heaters) 24 Vac = 15 VA (max no heater); 51 VA (max w/ heaters)
	Inrush Current	< 5 A for DC supply with slew rate > 10 ms < 19 A for AC power supply with slew rate > 4.17 ms
Environmental	IP Rating (dust & water ingress)	IP66
	Operating Temperature Range	-50°C to 70°C continuous operation -40°C to 70°C cold start
	Storage Temperature Range	-55°C to 85°C
	Humidity	0-95% relative
	Shock	MIL-STD-810F Transportation
	Vibe	IEC 60068-2-27
	De-Icing / Anti-Icing	MIL-STD-810F, Method 521.1

Note:

Power consumption is independent of the input voltage when the heater is off. The power drawn by the heaters increases with the input voltage to a maximum at 30 Volts.

Compliance & Certifications	EN 61000-6-4: 2007 Class A/CISPR 22: 2005 Class A
	EN 61000-3-3: 1995+A1:2001+A2:2005
	EN 61000-3-2: 2006
	EN 50130-4: 1996+A1:1998+A2:2003
	FCC Part 15, Subpart B, Class A
	IP 66 (IEC 60529)
	IEC 60068-2-27)

2 Basic Operation and Configuration

This chapter provides basic information on how to operate the F-Series camera. A bench test can be used to verify camera operation before the camera is configured for the local network. This chapter also provides general configuration information.

2.1 IP Camera, ONVIF Profile S Compliant

When the camera is connected to the network it functions as a server; it provides services such as camera control, video streaming, network communications, and geo-referencing capabilities. The communications protocol used is an open, standards-based protocol that allows the server to communicate with a video management client, such as FLIR Latitude™ or with a third-party VMS client, including systems that are compatible with ONVIF Profile S. These clients can be used to control the camera and stream video during day-to-day operations. Refer to the individual product web page at <https://www.flir.com/browse/security/thermal-security-cameras/> for a listing of supported VMS clients

2.1.1 Serial and/or IP Communications

For a camera that is installed in a legacy-type CCTV network using analog video, the camera may commonly be controlled with serial communications. The serial cable from the camera will be connected to a keyboard/joystick device, or to a video switch, encoder, or DVR that has a serial communication port. In this case the installer may want to configure parameters such as the address of the camera, the baud rate, and so on. These parameters can be set through software using a web browser. The parameters can also be set using DIP switches when IP communications are not used.

2.1.2 Server Configuration

It may be necessary for the installer to make a limited number of configuration changes to the camera server, such as setting the IP communication parameters, setting new login passwords, as well as some scene specific parameters. For example, each camera comes from the factory with the same default IP address, so adding more than one camera to an IP network requires each camera to be configured with a different IP address. On the other hand, many of the configuration parameters will remain unchanged from the factory default settings.

2.2 Camera Bench Test

Since the camera offers both analog video and IP video, it is recommended that the installer test the camera using the same type of connections as the final installation. If using analog video and serial communications in the final installation, also test the IP communications when performing the bench test. If any image adjustments are necessary, they can be done using a web browser over the IP connection, and saved as power-on default settings.

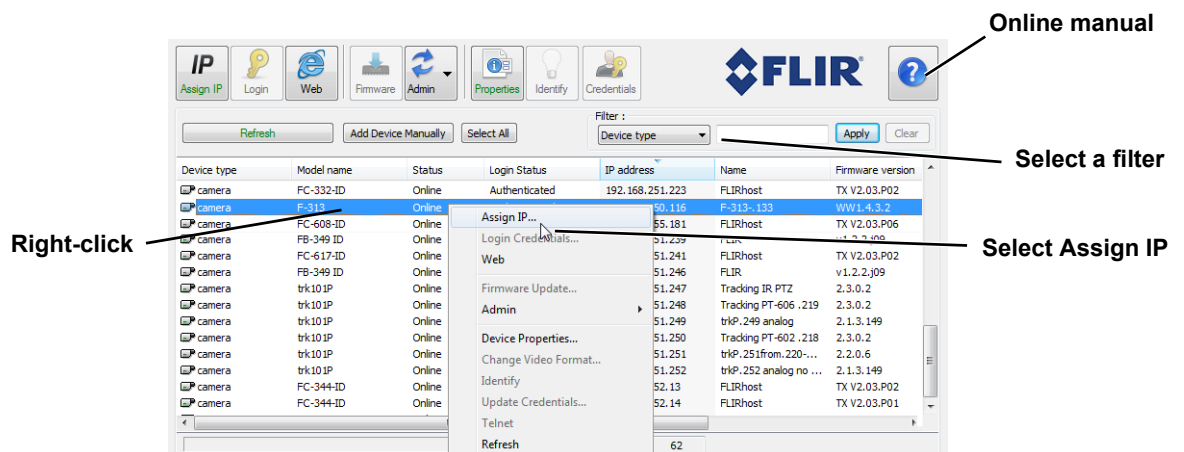
Test serial communications by connecting a serial device such as a keyboard and confirm the camera is responding to serial commands. It may be necessary to configure the serial device interface to operate with the camera.

Once the camera is connected to a network and powered on, set camera network parameters using the FLIR Discovery Network Assistant (DNA) software, perform a bench test by using a web browser to view the video and control the camera, or view video in the local Network Video Management System (for example, FLIR Latitude). The FLIR Discovery Network Assistant (DNA) software does not require a license to use and is a free download from the individual product web page at: <https://www.flir.com/browse/security/thermal-security-cameras/>.

2.2.1 Set IP Address using the FLIR Discovery Network Assistant (DNA)

The F-Series camera is shipped with a static IP address: 192.168.250.116. Configuring the camera for IP communications generally involves the following steps:

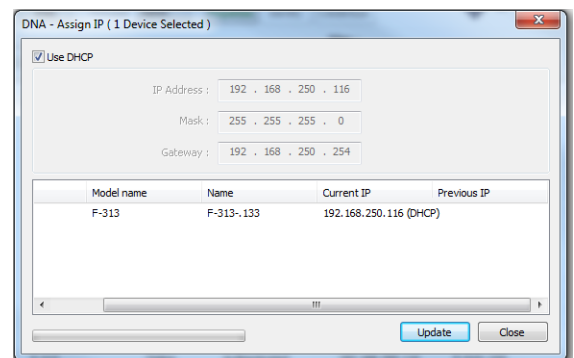
- Step 1 Connect the Ethernet port of the camera to the existing IP camera network.
- Step 2 Connect a PC or laptop to the same network.
- Step 3 From the PC connected to the camera network, use the DNA utility to discover and display the camera's current IP address.
 - a Download the DNA utility.
 - b Unzip the utility, then double-click to run the executable file (**DNA.exe**). All the units on the VLAN are discovered.
 - c For additional instructions on using DNA, refer to the DNA User's Manual available in the Help (?) link while the software is running.



- Step 4 Right-click on the camera, select **Assign IP** to change the IP address or select between static IP or DHCP addressing.

- Step 5 Double-click the camera in DNA's **Discovery List** to open the camera's web server **Login** page in Internet Explorer or point your web browser to the camera's IP address.

- Step 6 Using a web browser, configure the camera settings, such as camera date/time, and other parameters, so the camera is compatible with the existing network.



2.2.2 Log into the Camera Web Page

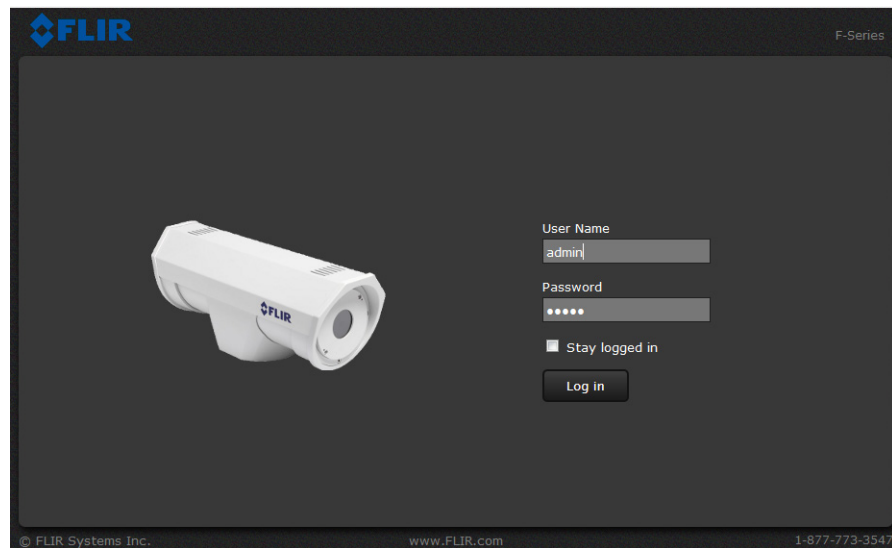
Use a web browser to connect to the camera's web server using one of three User Names: **user**, **expert**, or **admin** (the default passwords are **user**, **expert**, and **admin** respectively). The **user** login can be used to do the initial bench test of the camera. The **expert** login may be used to make configuration changes such as setting the IP address and other server settings. The **admin** login has access to all configuration, setup, and maintenance settings. The login passwords should be changed (**admin** login required) to prevent unauthorized access. Two web sessions can be active at once. An inactive session will be logged out after 20 minutes.

For information on how to change the passwords, refer to [Server > Security Options, pg. 27](#).

Note

A VMS Remote to the camera, ONVIF or Nexus CGI, uses the same password as the web interface. Refer to [Sensor > Communications > VMS Remote, pg. 29](#).

Open a web browser and enter the camera IP address. The login screen with a picture of the camera will appear. Enter **user** for the User Name and **user** for the Password, and click Log in.



2.2.3 Live Video Page

The **Live Video** page displays a live image from the camera on the left part of the screen. Along the top of the screen are some menu choices, including **Live Video** (the red text indicates it is selected), **Help** and **Log out**.

On the right side are some control buttons.



Figure 2-1: Live Video Web Page – user login

In the lower right corner of the web 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 controls the frame rate of the user's own web browser only, and does not affect the video streams to other users or to an NVR. If the live video is not displayed, refer to [Troubleshooting Tips, pg. 35](#).

Help

The **Help** menu displays software version information. If it is necessary to contact FLIR Technical Support for assistance, it will be helpful to have the information from this page on hand. For information about the camera including hardware part numbers and serial numbers refer to the Maintenance > Product Info > Identification web page (requires Admin login).

Log out

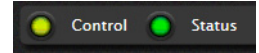
Use this button to disconnect from the camera and stop the display of the video stream. If a web session is inactive for 20 minutes, it will be stopped and it will be necessary to log in again.

Toggle PC/Camera time

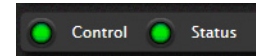
Use this button to display either the PC time or the camera time.

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 immediately. 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.



A user is able to request control of the camera by clicking on the yellow or black light, or simply by sending a command to the camera. After a short pause, the Control light should turn green. Be patient, there may be a slight delay between each command while the browser waits for a response from the camera.



If a command is sent to the camera when the user does not have control, the command will not be executed, and it is necessary to send the command again once the light is green.

Web Control Panel

The control buttons on the right side of the page can control the camera. When the mouse cursor is positioned over a button, a tool tip is displayed which explains the function of the button.

When the mouse is positioned over the video window, a snapshot button is shown in the upper right corner of the video image. The snapshot button will save an image as a .jpg file to the selected destination folder or as determined by the web browser.

Save snapshot



The functions of the buttons appearing for the F-Series cameras are described below:



Zoom In/Zoom Out

The camera has both 2x and 4x E-Zoom which extends the ability to zoom in, but at the expense of resolution.



Toggle Polarity

This button changes the way various objects are displayed in the image, for example, with hot objects displayed as white and cold objects as black, or vice versa.



Toggle Palette

This button causes the IR camera to cycle through different color palettes. Each of the palettes presents the IR image using a different color scheme. Use the Toggle Polarity button to invert the palette, for example, between white hot and black hot.



Perform IR NUC Calibration

This button causes the camera to do a manual Non-Uniformity Correction (NUC) operation. The F-Series camera, by default, does an automatic NUC calibration as required based on changes in temperature.




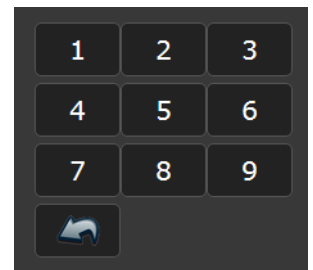
Toggle Scene Preset

This button causes the IR camera to cycle through different image settings. 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.



Function

When the Function button is selected, the keypad changes to a numeric keypad. A tool tip can be shown when a function has been assigned to a number. Use the back () arrow to return to the Control Panel.



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.



Freeze Video

This button stops the video on a single frame. Click again to start the video.

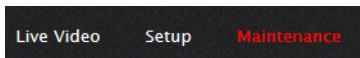
2.3 Basic Camera Configuration

The following procedures describe how to do the most common basic camera configuration steps, such as setting the camera IP address and hostname and changing the user passwords.

Note

In most installations, the only camera settings needed are available from the Live Video page (using Scene Presets or Polarity). Use caution when modifying the camera settings described in this section. Some settings may adversely affect the thermal image over time or may completely disable the camera or the network interface.

2.3.1 Expert and Admin Accounts



When a user logs in as **expert** or **admin**, additional menus, **Setup** and **Maintenance** are available. The **Setup** menu is used to make advanced adjustments to the thermal camera.

The basic camera configuration steps are accessed through the **Maintenance > Server** menu, using the menus on the left side of the page. The **LAN Settings**, **Services**, and **Security Options** selections are described below ([Maintenance Menu, pg. 24](#)). The **expert** login has access to the **Server** pages. The **admin** login provides access to all configuration options. The login passwords should be changed (**admin** login required) to prevent unauthorized access.

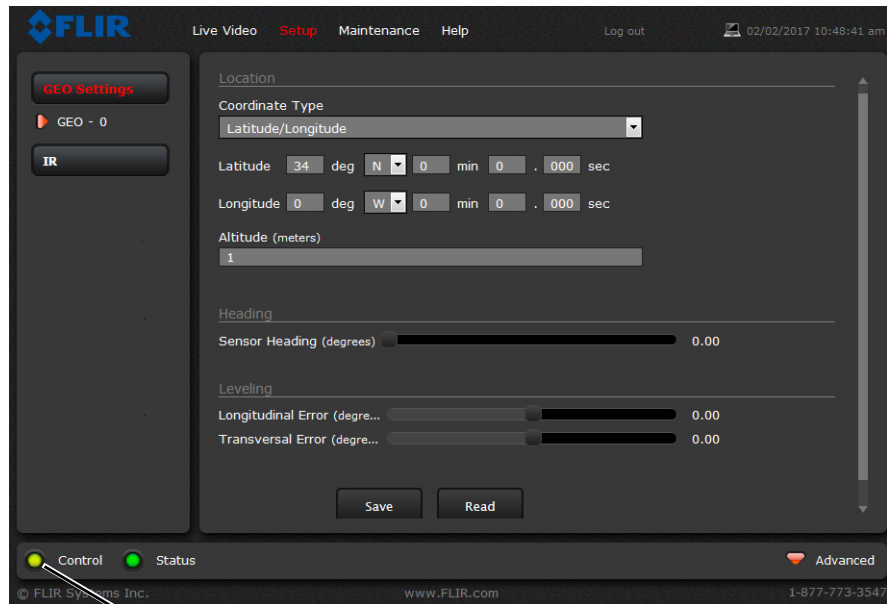
2.3.2 Setup Menu

The **Setup** menu is used for GEO Settings, camera setup, and defining parameters for surveillance zones.

When configuration changes are made with the web browser, the settings are saved to a configuration file. It is a good idea to make a backup of the existing configuration file prior to making changes, and another backup once the changes are finalized. If necessary the camera can be restored to its original factory configuration or one of the saved configurations (refer to [Sensor > Communications > Serial Remote](#), pg. 28).

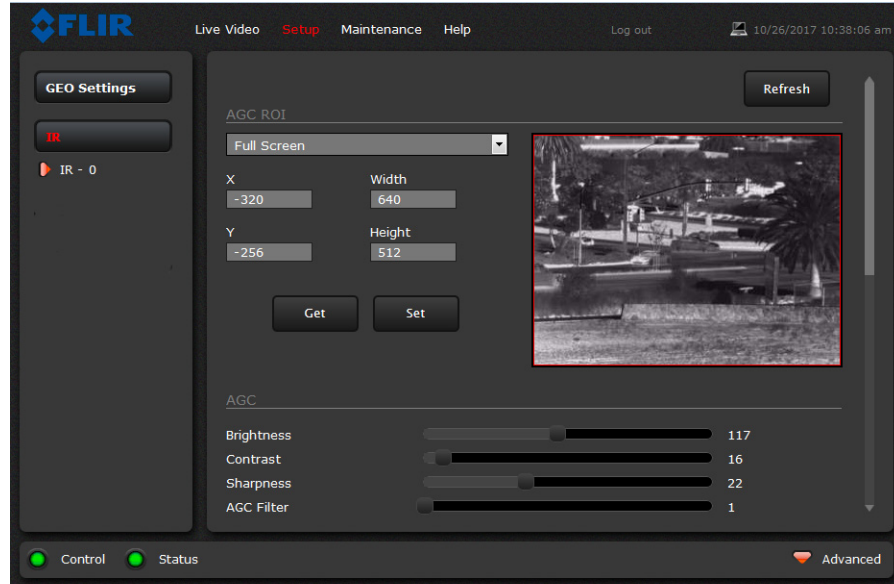
It is necessary to have control of the camera to make Setup changes. Changes made through the **Setup** menu have an immediate effect (it is not necessary to stop and restart the server). To use these settings at power up, it is necessary to save the changes.

Adjustments to the IR settings should only be made by someone who has expertise with thermal cameras and a thorough understanding of how the various settings affect the image. In most installations, the only camera settings needed are available from the Web Control panel on the Live Video page (Scene Presets, Polarity, Palettes, and AGC). Haphazard changes can lead to image problems including a complete loss of video.



Camera Control

IR > AGC ROI



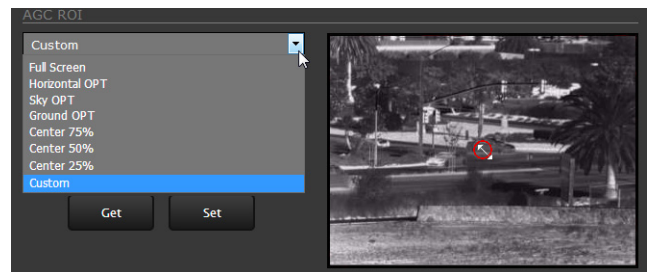
The IR camera adjustments to the region of interest (ROI) determine what portion of the image is used by the Automatic Gain Control (AGC) algorithm. By default all of the pixels in the image are considered; in some cases it may provide an improved image if a portion of the image is excluded. For example, 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.

When Custom is selected, a handle is shown in the center of the screen.

Drag the handle to set the size of the ROI box.



Drag the ROI box over the portion of the scene that will control the AGC.



IR > AGC

The AGC parameters affect how the overall IR video image appears. Using the AGC button on the Live Video page (refer to [Toggle Automatic Gain Control \(AGC\), pg. 21](#)), toggle through five AGC algorithms. The default algorithms are suitable for most installations, but each selection allows a combination of further adjustments that may provide a more appealing image, depending on personal preferences. Be aware that 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.

Experiment with different AGC parameters to find the settings that work best for the particular installation. 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.

- **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.

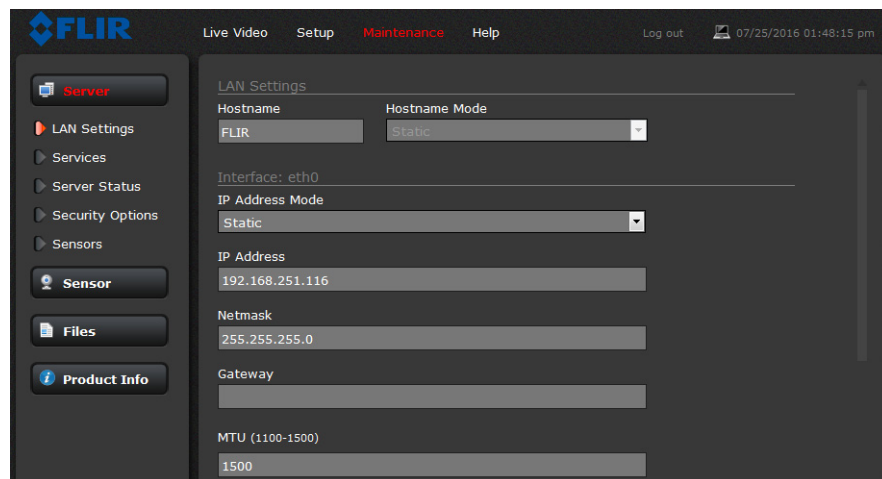
- **Contrast** (Max Gain) can be used to increase contrast, especially for scenes with little temperature variation (it may also increase noise due to increased gain).
- **Sharpness** (DDE Gain) is used to enhance image details and/or suppress fixed pattern noise. Positive values increase Sharpness, while negative values soften the image and filter fixed pattern noise. A setting of 0 is neutral and will not have any effect.
- **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.

2.3.3 Maintenance Menu

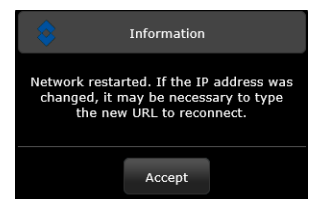
When a user logs in as **admin**, a complete **Maintenance** menu is available. The basic camera configuration steps are accessed through the **Maintenance** menu, using the **Server** submenu on the left side of the page. The **LAN Settings**, **Date and Time**, **Server Status**, and **Security Options** selections are described below. Generally with these settings it is necessary to save the changes to make them effective, but it is not necessary to stop and restart the server.

Server > LAN Settings

If the IP address of the camera is changed, the PC may no longer be on the same network and therefore may not be able to access the camera until the IP address on the PC is changed also. For that reason, it may be preferable to change the IP address after making other configuration changes.

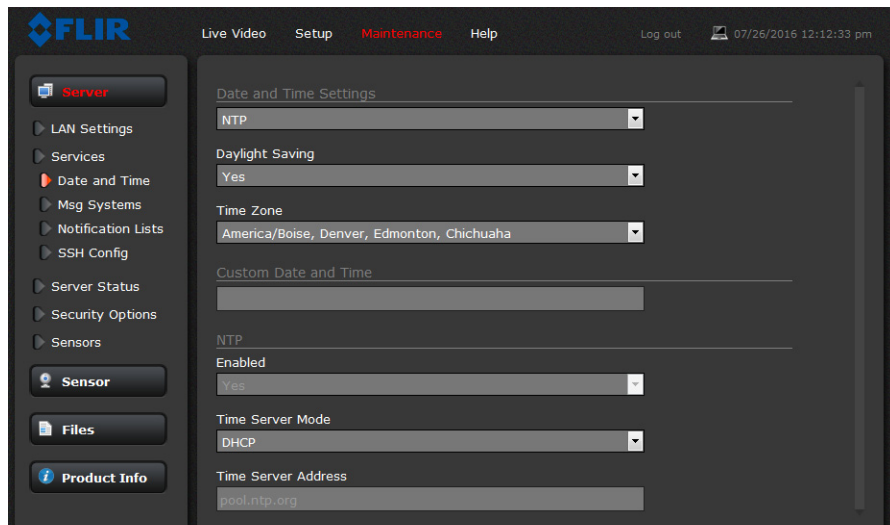


When the LAN settings are changed and the Save button is clicked, a pop-up message will appear to indicate the network interface should be restarted. Once all the changes have been made and saved, click on the **Restart Network** button at the bottom of the page.



Server > Services > Date and Time

The date, time, and time zone can be obtained from an NTP server, or can be entered manually. If the NTP mode is selected, the NTP server information can be entered. The NTP server address can be entered as a static address or can be obtained via DHCP.

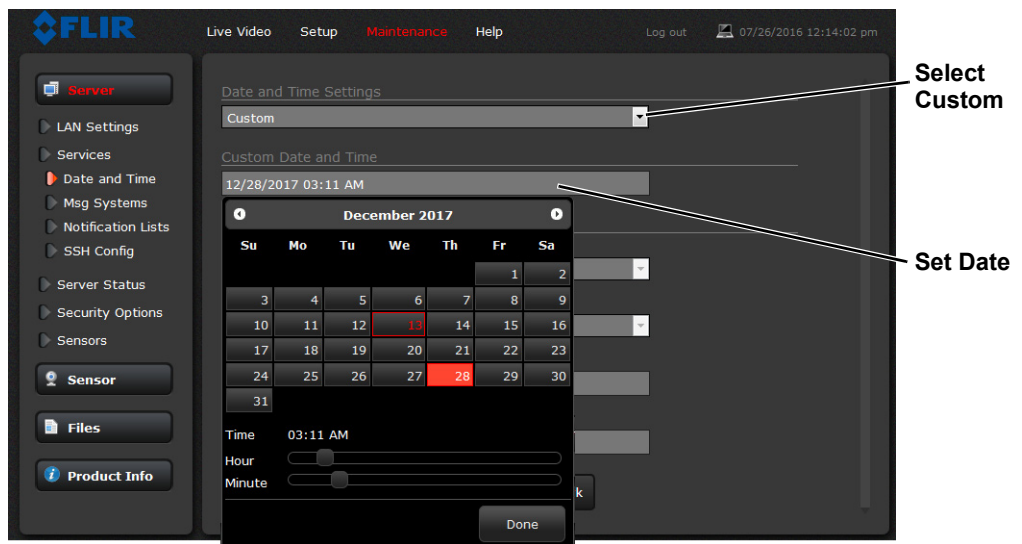


Note

The server must be stopped before date and time settings can be changed.

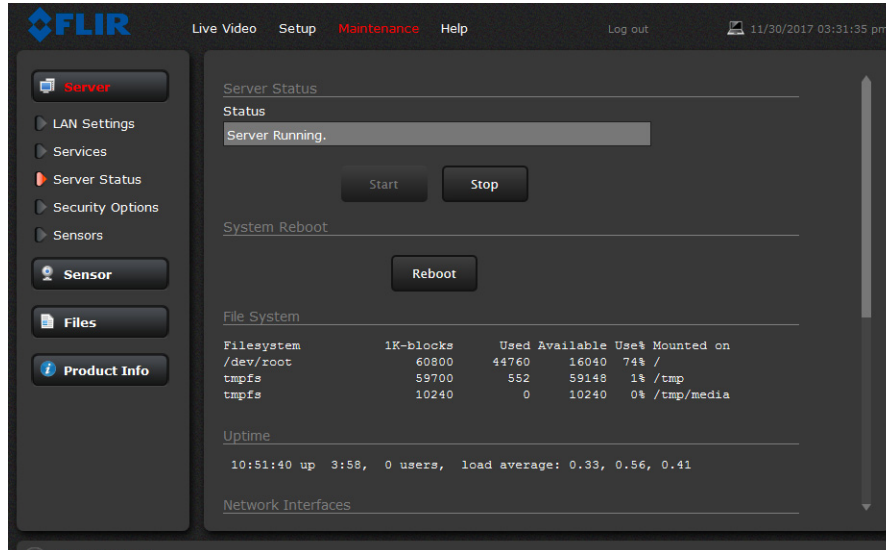
Set the date and time parameters, then select the Save button at the bottom. After saving the settings, reboot the system. Refer to [Server > Server Status](#), pg. 26.

If the Custom mode is selected, a pop-up window allows the information to be entered manually.



Server > Server Status

The **Server Status** page provides an indication of the current server status (either running or stopped) and buttons for starting or stopping the server and for rebooting the system. The **Uptime** section of the **Server Status** page shows how long the camera has been running, number of users, and the load on the camera processor. All values are updated only when the Server Status page is first accessed.



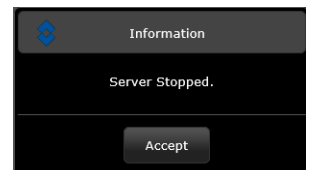
After making configuration changes, it is necessary to save the changes to the server (there is a **Save** button at the bottom of each configuration page). The configuration changes do not take effect immediately. Generally, it is also necessary to stop and restart the server for the changes to become effective. The server has a configuration that is active and running, and another configuration that is saved (and possibly different than the running configuration).

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.

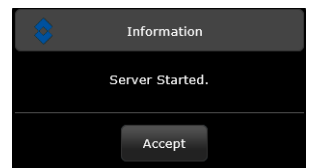
You must restart the server for the changes to be effective.

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

When the server is stopped and the page is refreshed, the status will show Server Stopped and the Start button will be enabled.

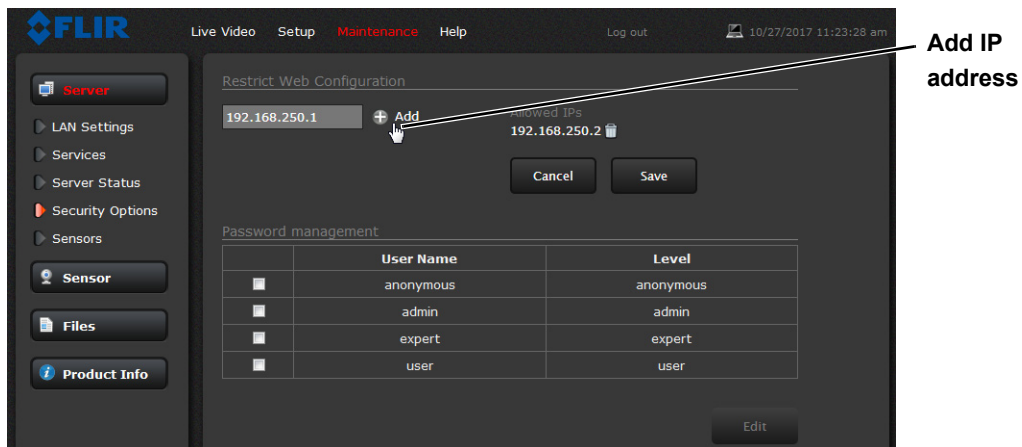


Click on the Start button to restart the server, and when the page refreshes, the status will again show Server Running. The Start button will be replaced by a Stop button when the startup procedure has completed.



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 can change or set any password. The **expert** login can only configure the **expert** login password.



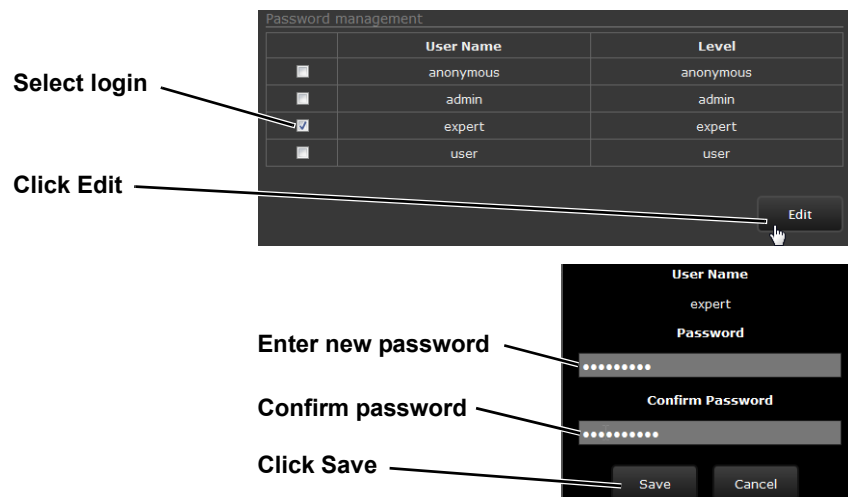
As an additional security measure, limit which computers have access to the web browser interface. Simply add a computer's IP address and click Add. After all the allowed IP addresses are entered, select the **Save** button to save the changes.

Note

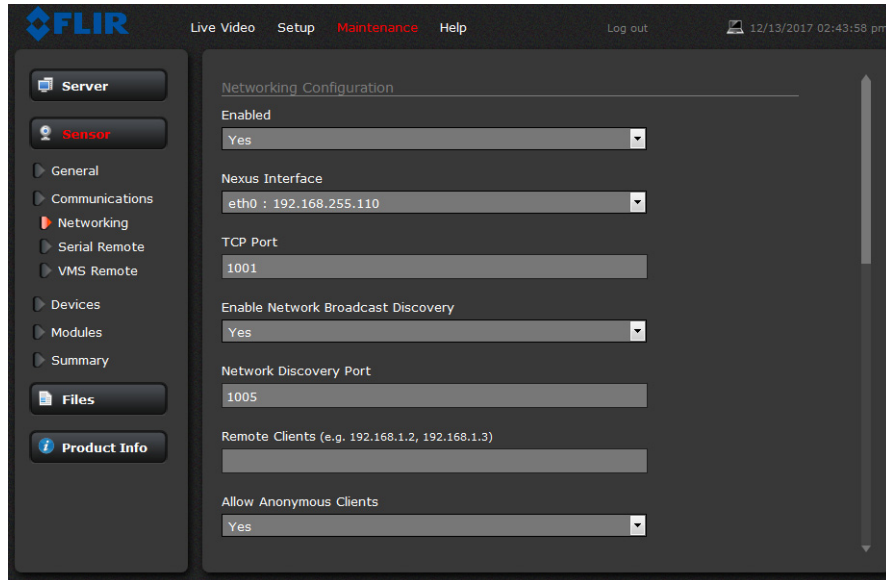
A VMS Remote to the camera, ONVIF or Nexus CGI, uses the same password as the web interface. Refer to [Sensor > Communications > VMS Remote](#), pg. 29.

To maintain security of the system set new passwords for each of the three login accounts.

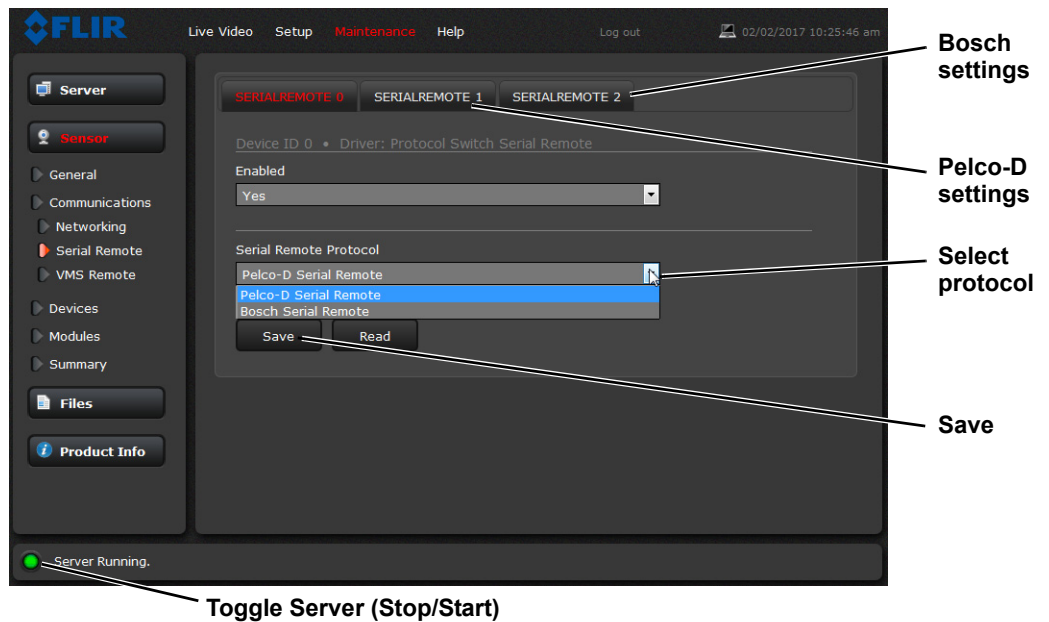
- **user**—The user account can only use the **Live Video** page and controls.
- **expert**—The expert account can use the **Live Video** page, the camera **Setup** page, the Server pages on the **Maintenance** menu, and set the password for the expert login.
- **admin**—The admin account can use all pages and set passwords.



Sensor > Communications > Networking

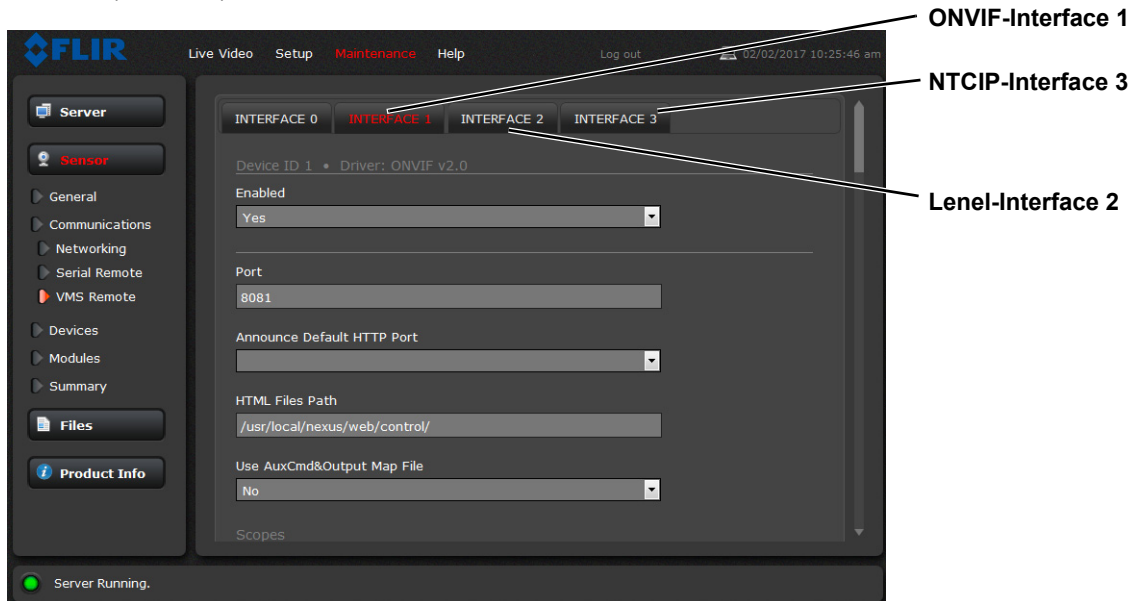


Sensor > Communications > Serial Remote



Sensor > Communications > VMS Remote

If the camera is used with a VMS that is compliant with ONVIF, the parameters can be adjusted (if needed) to work with the VMS. Refer to the VMS documentation to determine what parameter values are needed. By default, the camera is configured with a VMS Remote interface with ONVIF 2.0 parameters (Profile S).



Interface 0 is the Nexus CGI interface used by the camera server. Select INTERFACE 0 and scroll down to enable password authentication.

Authentication when enabled uses the same passwords set from the **Server Security Options** page. Refer to [Server > Security Options, pg. 27](#). Several types of third-party Video Management Systems (VMS) are supported by FLIR IP cameras. Because these systems tend to evolve and change over time, contact the local FLIR representative or FLIR Technical Support to resolve any difficulties or questions about using this feature.

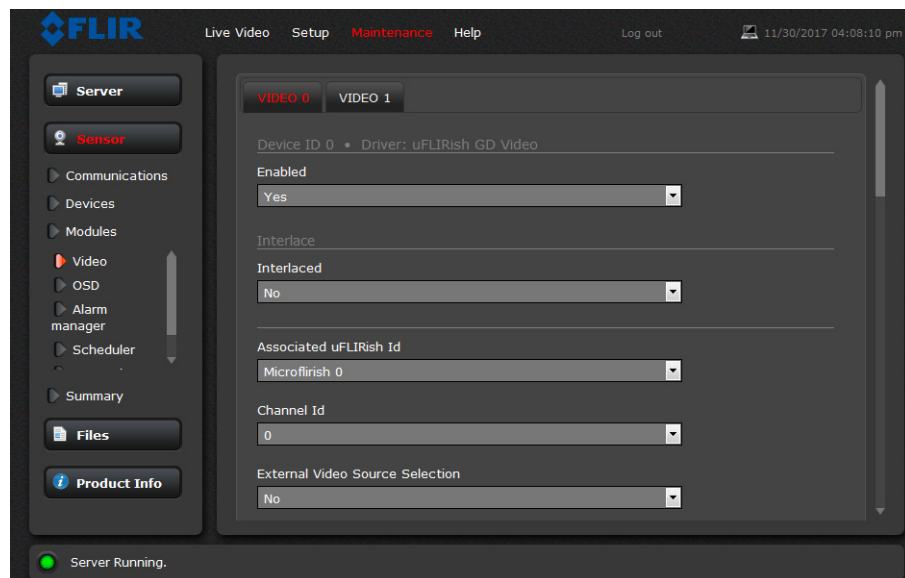
Sensor > Modules > Video

By default, two video streams are enabled for the camera: Video 0 and Video 1. The streams are available for viewing from a client program such as FLIR Latitude, a stand-alone video player, or a third-party VMS including ONVIF systems.

Caution!

Adjustments to these settings should only be made by someone trained with thermal cameras and a thorough understanding of how the various settings affect the image. Haphazard changes can lead to image problems including a complete loss of video.

To modify parameters that affect a particular IP Video stream from the camera, select the appropriate link at the top of the page (for example, **Video 0**).



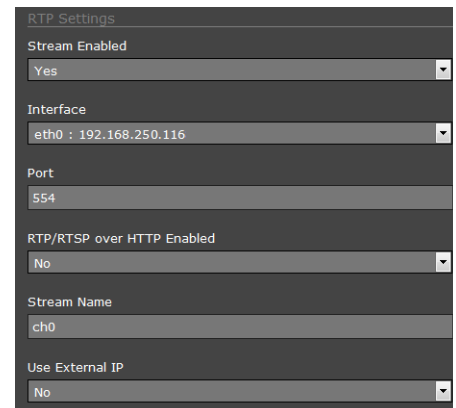
The default RTP Settings for connecting to an IP video stream from the F-Series are shown in the illustration. The RTP Port and the Stream Name are used when establishing a session from a client.

Given the camera IP address of 192.168.250.116, the complete connection string for each of the video stream is as follows:

VIDEO 0 - rtsp://192.168.250.116:554/ch0

VIDEO 1 - rtsp://192.168.250.116:554/ch1

In some networks, the RTP/RTSP traffic is carried (tunneled) over Hypertext Transfer Protocol (HTTP) as that may allow the traffic to cross network boundaries and firewalls. While this method involves more overhead due to encapsulation, it may be necessary for clients to access the video streams when HTTP proxies are used.



By default, the video streams from the camera are sent using unicast packets. With Multicast enabled, video packets are shared by streaming clients, so additional clients do not cause bandwidth to increase as dramatically.

If more than one camera is providing multicast streams on the network, be sure to configure each stream with a unique multicast Destination Network IP address and Destination Port combination.

The time-to-live field controls the ability of IP packets to traverse network boundaries. A value of 1 restricts the stream to the same subnet. Greater values allow increasing access between networks.

The video streaming is done using a protocol generally referred to as Real-time Transport Protocol (RTP), but there are actually many protocols involved, including Real-Time Transport Control Protocol (RTCP) and Real Time Streaming Protocol (RTSP). In the background, a “negotiation” takes place to establish a session between the client (such as FLIR Latitude, a third party VMS, or video player) and the camera. The ports which form a session are negotiated using a protocol such as RTSP. A client typically requests a video stream using its preferred settings, and the camera can respond with its preferred settings. As a result, many of the details are established dynamically, which may run contrary to network security requirements.

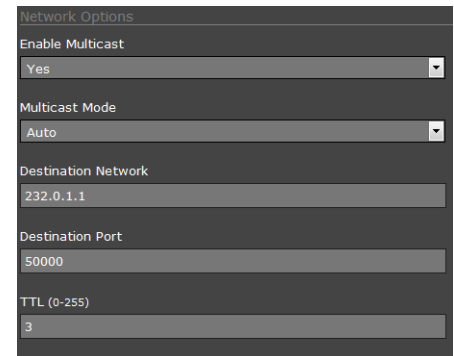
The parameters in the Stream Settings section will have a significant impact on the quality and bandwidth requirements of the video stream. In general it is recommended that the default values be used initially, and then individual parameters can be modified and tested incrementally to determine if the bandwidth and quality requirements are met.

For video streams, the Codec options are H.264 and MJPEG.

The Bit Rate parameter is used with the CBR (Constant Bit Rate) setting to attempt to keep the resulting bit rate of the video at or near the target bit rate.

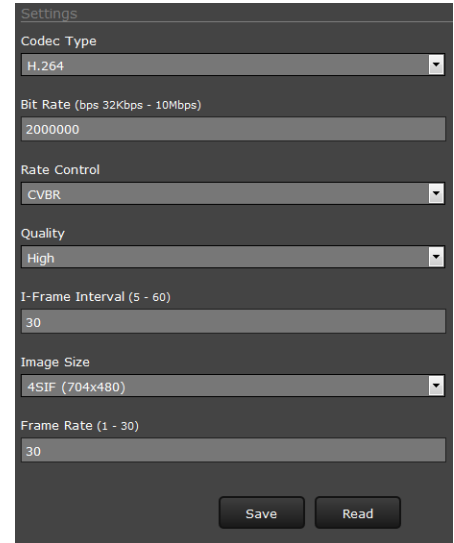
When the Rate Control parameter is set to CVBR (Constrained Variable Bit Rate), the Bit Rate parameter is used as an upper limit bit rate and the system keeps the stream at or under the target bit rate.

The I-Frame Interval parameter controls the number of P-frames used between I-frames. I-frames are full frames of video and the P-frames contain the changes that occurred since the last I-frame. A smaller I-Frame Interval results in higher bandwidth (more full frames sent) and better video quality. A higher I-Frame Interval number means fewer I-frames are sent and therefore results in lower bandwidth and possibly lower quality.



Network Options

Enable Multicast	Yes
Multicast Mode	Auto
Destination Network	232.0.1.1
Destination Port	50000
TTL (0-255)	3



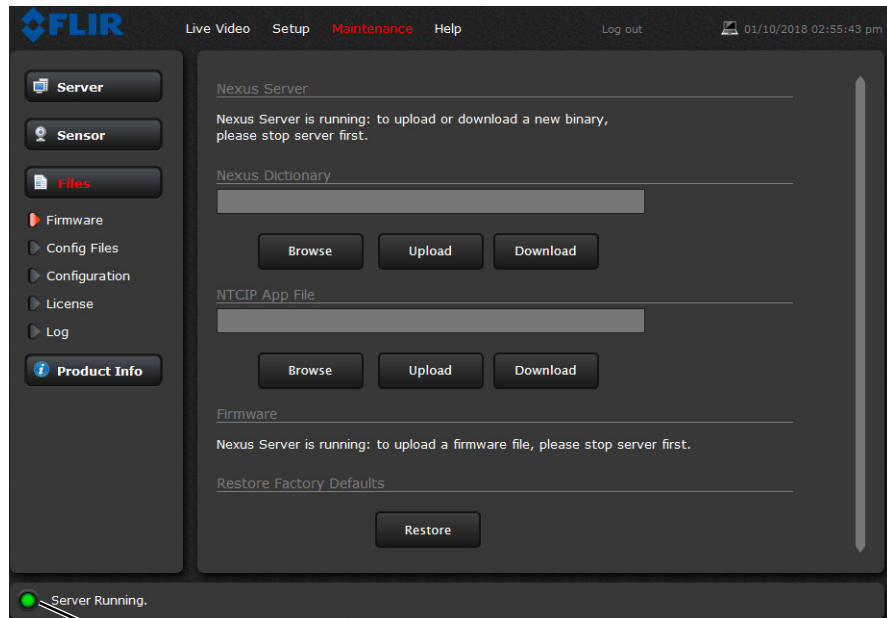
Settings

Codec Type	H.264
Bit Rate (bps 32Kbps - 10Mbps)	2000000
Rate Control	CVBR
Quality	High
I-Frame Interval (5 - 60)	30
Image Size	4SIF (704x480)
Frame Rate (1 - 30)	30

Save Read

Files > Firmware

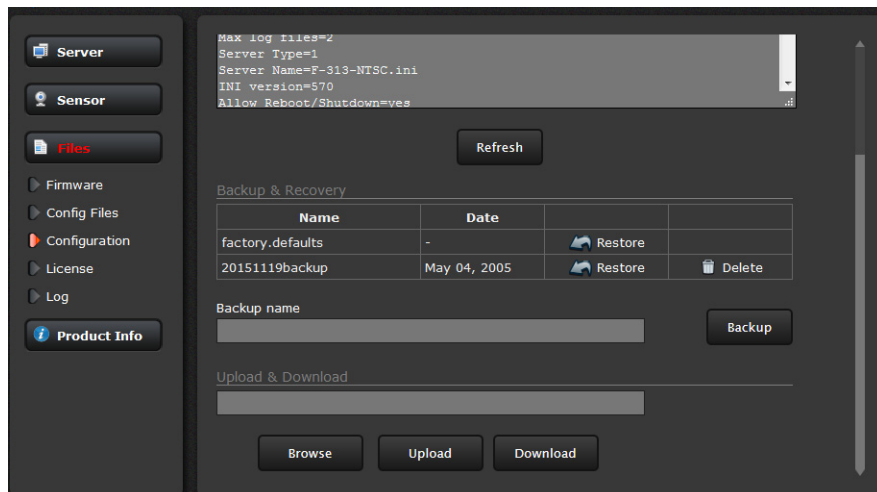
For camera firmware updates, manually install a firmware update file by first stopping the camera server, browsing to select the update file on your computer, and selecting Upload. The firmware files will be uploaded and installed.



Stop server

Files > Configuration

The **Configuration** page allows the Nexus Server configuration to be displayed or backed up locally (on the camera). The configuration file can also be downloaded to another computer for backup, or a new configuration file can be uploaded from a computer to the camera. Shown at the top of the screen is the configuration script file in a scrollable window. This can be useful if you ever need help from a support engineer.



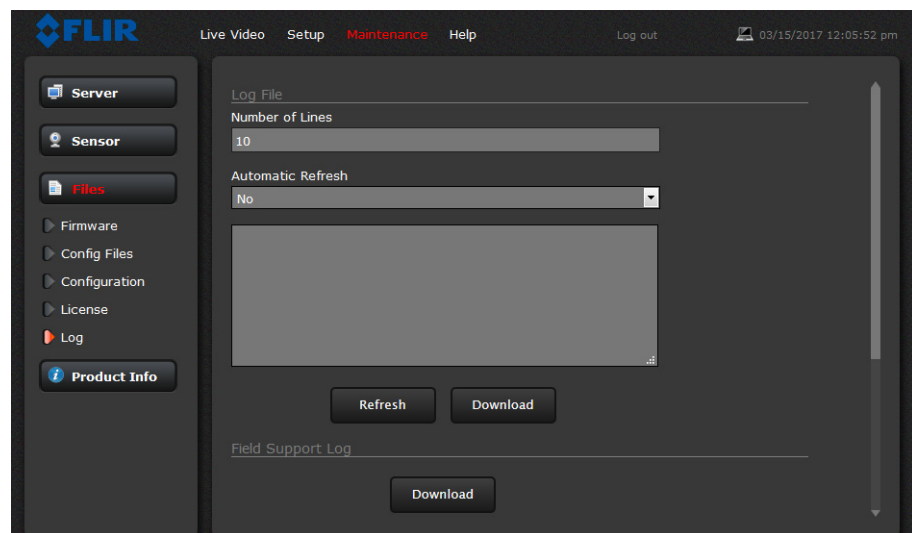
In the Backup & Recovery section, click the factory.defaults Restore link to restore the camera to its factory settings. This file can not be modified or deleted, so it is always available.

Use the Backup button to make a backup of your final settings. This will make a backup copy of the configuration file and store it locally on the camera. In the Upload & Download section, the Download to save a copy to a PC for safe keeping. A pop-up window will ask for a file name.

To Upload a configuration file from a PC to the camera, use the Browse button to select a configuration file on the PC then select upload.

Files > Log > Field Support Log

Scroll down and select the **Download** button under Field Support Log to download a zip file to the computer for field service evaluation.



2.4 Thermal Imaging Overview

The thermal camera makes an image based on temperature differences. In the thermal image, by default the hottest item in the scene appears as white and the coldest item is black, and all other items are represented as a gray scale value between white and black.

It takes some time getting used to the thermal imagery from the camera, especially for someone who only has experience with normal daylight cameras. An understanding of the differences between thermal and daylight cameras can help with getting the best performance from the thermal camera.

Both thermal and daylight cameras have detectors (pixels) that detect energy. One difference between thermal and daylight cameras has to do with where the energy comes from to create an image. When viewing an image with an daylight camera, there has to be a source of visible light (such as the sun or lights) that reflects off the objects in the scene to the camera. The same is true with human eyesight; the vast majority of what people see is based on **reflected** light energy.

On the other hand, the thermal camera detects energy that is directly **radiated** from objects in the scene. Most objects in typical surroundings are not hot enough to radiate visible light, but they easily radiate the type of infrared energy that the thermal camera can detect. Even very cold objects, like ice and snow, radiate this type of energy.

The camera is capable of sensing very small temperature differences, and produces a video image that typically has dramatic contrast in comparison to daylight cameras. This high contrast level from the thermal video enables intelligent video analytic software to perform more reliably.



The performance of the camera varies throughout the day. Right after sunset, objects warmed by the sun will appear warmest. Early in the morning, many of these objects will appear cooler than their surroundings, so be sure to look for subtle differences in the scene, as opposed to just hot targets.

While the imagery on the monitor may at first look similar to ordinary black and white daylight video, experience with the camera in varying conditions and seasons will lead to an appreciation of the characteristics that make thermal imaging distinct. A few tips on how to interpret some of the imagery may help to make the most of the system.

The camera senses small differences in apparent radiation from the objects in view, and displays them as either white (or lighter shades of gray) for warmer objects, and black (or darker shades of gray) for colder objects. This is why hot objects such as parts on an engines and exhaust pipes appear white, while the sky, puddles of water and other cold objects appear dark (or cool). Scenes with familiar objects will be easy to interpret with some experience. The camera automatically optimizes the image to provide the best contrast in most conditions.

2.5 Troubleshooting Tips

If help is needed during the installation process, contact a local FLIR representative. FLIR Systems, Inc. offers a selection of training courses to help get the best performance and value from the thermal imaging camera.

Find out more at the FLIR training web page: <https://www.flir.com/support-center/training/>

No video: 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 the circuit breaker is set properly. If a fuse was used, be sure the fuse is not blown. If the video cabling is suspected as a possible source of the problem, plug a monitor into the RCA connection inside the camera and determine if it produces an image.

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).

Performance varies with time of day: It may be possible to 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 higher-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.

Unable To Communicate Over Ethernet: First check to ensure the physical connections are intact and that the camera is powered on and providing analog video to the monitor. Confirm that the IP address for the PC is on the same network as the camera.

By default the camera will broadcast a discovery packet two times per second. Use the FLIR Discovery Network Assistant (DNA) or a packet sniffer utility such as Wireshark and confirm the packets are being received by the PC from the camera.

Determine if Windows Personal Firewall is blocking the packets. Turn off the firewall or add an exception for the client program. Typically when a program runs for the first time, a pop-up notification may ask for permission to communicate on the network. Select the check boxes (domain/private/public) that are appropriate for the network.

Image too dark or too light: By default the F-Series thermal camera uses an Automatic Gain Control (AGC) setting that has proven to be superior for most applications, and the camera will respond to varying conditions automatically. The installer should keep in mind that the sky is quite cold and can strongly affect the overall image. It may be possible to avoid a problem by slightly moving the camera up or down to include (or exclude) items with hot or cold temperatures that influence the overall image. For example, a very cold background (such as the sky) could cause the camera to use a wider temperature range than appropriate.

Unable to View Video Stream: If the video stream from the camera is not displayed in a client program, it could be that the packets are blocked by the firewall, or there could be a conflict with video codecs that are installed for other video programs.

When displaying video with FLIR Latitude or a VMS for the first time, the Windows Personal Firewall may ask for permission to allow the video player to communicate on the network. Select the check boxes (domain/private/public) that are appropriate for the network.

If necessary, test to make sure the video from the camera can be viewed by a generic video player such as VLC media player (<http://www.videolan.org/vlc/>). To view the video stream, specify RTSP port 554 and the appropriate stream name.

For example: `rtsp://192.168.250.116:554/ch0`.

Refer to [Sensor > Modules > Video, pg. 30](#)).

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, or the smaller the wire gauge, the more severe the losses become; and the higher the signal frequency, the more pronounced the losses. Unfortunately this is one of the most common and unnecessary problems that plagues video systems in general.

Cable characteristics are determined by a number of factors (core material, dielectric material and shield construction, among others) and must be carefully matched to the specific application. Moreover, the transmission characteristics of the cable will be influenced by the physical environment through which the cable is run and the method of installation.

Check cable connector terminations. Inferior quality connections may use multiple adapters which can cause unacceptable noise. Use a high-quality video distribution amplifier when splitting the signal to multiple monitors.

Eastern or Western Exposure: Once installed, the camera may point 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. The thermal imaging camera often provides a considerable advantage over a visible camera in a back-lit situation. However, the sun may introduce image artifacts that eventually will be corrected but it may take some time to recover. The amount of time needed will depend on how long the camera was exposed to the sun. The longer the exposure, the longer the recovery time needed.



visible camera



thermal camera

Figure 2-2: Images facing sun

3

Serial Address: Decimal To Binary Conversion

Note, the order of the switches 1-8 is the reverse of the binary digits. For example, for address 1 the binary equivalent is 00000001 and the left-most switch (switch1) is on.

3.1 Address Conversion Table

Address	Sw1	Sw 2	Sw 3	Sw4	Sw 5	Sw 6	Sw 7	Sw 8
1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
...
255	ON	ON	ON	ON	ON	ON	ON	ON

The following table shows the binary equivalent for each decimal address between 1 and 255.

Decimal	Binary	Decimal	Binary	Decimal	Binary	Decimal	Binary
1	00000001	65	01000001	129	10000001	193	11000001
2	00000010	66	01000010	130	10000010	194	11000010
3	00000011	67	01000011	131	10000011	195	11000011
4	00000100	68	01000100	132	10000100	196	11000100
5	00000101	69	01000101	133	10000101	197	11000101
6	00000110	70	01000110	134	10000110	198	11000110
7	00000111	71	01000111	135	10000111	199	11000111
8	00001000	72	01001000	136	10001000	200	11001000
9	00001001	73	01001001	137	10001001	201	11001001
10	00001010	74	01001010	138	10001010	202	11001010
11	00001011	75	01001011	139	10001011	203	11001011
12	00001100	76	01001100	140	10001100	204	11001100
13	00001101	77	01001101	141	10001101	205	11001101
14	00001110	78	01001110	142	10001110	206	11001110
15	00001111	79	01001111	143	10001111	207	11001111
16	00010000	80	01010000	144	10010000	208	11010000
17	00010001	81	01010001	145	10010001	209	11010001
18	00010010	82	01010010	146	10010010	210	11010010
19	00010011	83	01010011	147	10010011	211	11010011
20	00010100	84	01010100	148	10010100	212	11010100
21	00010101	85	01010101	149	10010101	213	11010101
22	00010110	86	01010110	150	10010110	214	11010110
23	00010111	87	01010111	151	10010111	215	11010111
24	00011000	88	01011000	152	10011000	216	11011000
25	00011001	89	01011001	153	10011001	217	11011001
26	00011010	90	01011010	154	10011010	218	11011010

27	00011011	91	01011011	155	10011011	219	11011011
28	00011100	92	01011100	156	10011100	220	11011100
29	00011101	93	01011101	157	10011101	221	11011101
30	00011110	94	01011110	158	10011110	222	11011110
31	00011111	95	01011111	159	10011111	223	11011111
32	00100000	96	01100000	160	10100000	224	11100000
33	00100001	97	01100001	161	10100001	225	11100001
34	00100010	98	01100010	162	10100010	226	11100010
35	00100011	99	01100011	163	10100011	227	11100011
36	00100100	100	01100100	164	10100100	228	11100100
37	00100101	101	01100101	165	10100101	229	11100101
38	00100110	102	01100110	166	10100110	230	11100110
39	00100111	103	01100111	167	10100111	231	11100111
40	00101000	104	01101000	168	10101000	232	11101000
41	00101001	105	01101001	169	10101001	233	11101001
42	00101010	106	01101010	170	10101010	234	11101010
43	00101011	107	01101011	171	10101011	235	11101011
44	00101100	108	01101100	172	10101100	236	11101100
45	00101101	109	01101101	173	10101101	237	11101101
46	00101110	110	01101110	174	10101110	238	11101110
47	00101111	111	01101111	175	10101111	239	11101111
48	00110000	112	01110000	176	10110000	240	11110000
49	00110001	113	01110001	177	10110001	241	11110001
50	00110010	114	01110010	178	10110010	242	11110010
51	00110011	115	01110011	179	10110011	243	11110011
52	00110100	116	01110100	180	10110100	244	11110100
53	00110101	117	01110101	181	10110101	245	11110101
54	00110110	118	01110110	182	10110110	246	11110110
55	00110111	119	01110111	183	10110111	247	11110111
56	00111000	120	01111000	184	10111000	248	11111000
57	00111001	121	01111001	185	10111001	249	11111001
58	00111010	122	01111010	186	10111010	250	11111010
59	00111011	123	01111011	187	10111011	251	11111011
60	00111100	124	01111100	188	10111100	252	11111100
61	00111101	125	01111101	189	10111101	253	11111101
62	00111110	126	01111110	190	10111110	254	11111110
63	00111111	127	01111111	191	10111111	255	11111111
64	01000000	128	10000000	192	11000000		



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