Application Note

FC-Series

Radiometric, Video Analytic and General Purpose Input Output (GPIO) Alarms

FLIR Commercial Systems, Inc.

70 Castilian Drive

Goleta, CA 93117

Phone: +1.888.747.FLIR (+1.888.747.3547)

Document History

Revision	Date	Comment
100	Aug 2014	Software Release BU 1.2.1
110	May 2015	Additional information regarding GPIO

References

- FLIR Support web site: http://support.flir.com/
- Security Resources web site: http://www.flir.com/cvs/americas/en/security/view/?id = 44516
- 427-0073-12-12 FC-Series Camera Installation Manual
- 427-0030-00-28 Nexus IP Camera Configuration Guide

Table of Contents

Introduction

The FC-Series camera has features that allow alarms to be generated based on a variety of features, including radiometric (temperature) conditions and/or video analytics (intelligent motion detection). In addition, the firmware implements input and output capabilities through the General Purpose Input Output (GPIO) connector. This document describes how to configure and use these features.

To a large extent, this document describes the **Alarm Manager** feature that is available in the FC-Series as well as all other FLIR IP cameras, such as F-Series, PT-Series, and D-Series Security cameras. The Alarm Manager is available with any Nexus Server, so that also includes the Maritime IP cameras and PC-based Nexus Server (for example, Radar Server, IO Server, and so on).

In general, the Alarm Manager allows one sensor, such as a camera, to listen for alarms that are from another sensor on the network, such as an IO server, and to process the alarm with the appropriate response action. In some cases, such as with the FC-Series, the Alarm Manager may process alarms that are from the sensor itself, rather than from another sensor on the network.

With the latest version of firmware, the FC-Series camera can send alarms to other devices or third party software in the following ways:

- Send email
- Send an XML Message (to an application listening on a remote IP Address/TCP Port)
- Trigger a GPIO
- ONVIF VMD Events (for VMS packages that support it)
- Send Milestone Generic Event Notification
- Send Lenel Notification
- Custom application developed using Nexus SDK or cgi interface

All installers and integrators are encouraged to take advantage of the training offered by FLIR; visit http://www.flir.com/training for more information.

Using a thermal camera to obtain accurate temperature measurements requires a level of training and expertise that is far beyond the scope of this document. Users who are interested in using the radiometric features of the camera are encouraged to learn about the science of thermography through one of the training courses that are offered in the industry. The Infrared Training Center offers instructor led courses as well as online training in a variety of thermography disciplines: http://www.infraredtraining.com/.

Refer to the *427-0073-12-12 FC-Series Camera Installation Manual* for specific information about using the web interface to configure and operate the camera and for a description of the GPIO connector wiring. For the purposes of this document, it is assumed the reader is already familiar with using the web interface to make configuration changes to a camera and with starting and stopping the server.

Setup

Pre-requisites:

- FC-Series camera with BU 1.2.1 firmware or later
- PC with a web browser (Microsoft IE 9, Firefox or Google Chrome) and a network connection to the camera
- FLIR Sensors Manager (FSM) software, version 4.0 or later (optional but recommended)
- Output device (if using the output contact) and power supply [1]
- Input device (if using the input contact) - for testing purposes, a simple push button switch can be used

If necessary, it is possible to log into the camera with a web browser and view the information from the Help web page to determine the current version. The FLIR Firmware Update Tool (FFUT) will also display the current firmware version once it has discovered the camera.

The FSM software and the FFUT tool can be downloaded from the FLIR Support web site: http://support.flir.com/. It is necessary to register for a login to download the software or manuals.

While this application note was written specifically for the FC-Series cameras, many of the concepts relating to the Alarm Manager and alarms in general can also be applied to the other Nexus cameras including:

- F-Series
- PT-Series
- D-Series
- A310pt & A310f [2]

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[1] For testing purposes, a simple light or buzzer and a 5 volt power supply can be used; in most actual installations, a powered relay would be used to control a device such as a light or alarm bell that operates on a higher voltage.

[2] The Alarm Manager information does not apply to A310f cameras that not are running Nexus Server software.

Alarms Overview

The FC-Series can automatically generate an alarm based on temperature conditions (Radiometry) or motion detection (Analytics). The camera can also generate an alarm when it receives an Input signal via the GPIO connector. These are just three types of alarms that are possible with FLIR IP cameras, based on a communication architecture called Nexus.

An alarm can be characterized by the alarm **source** (what causes the alarm), and the alarm **action** (what should happen as a result of the alarm). In the FC-Series, the configuration of alarms is managed through the **Alarm Manager** web page. The Alarm Manager allows the user to create a **Rule** that associates an alarm source to a corresponding alarm action. One or more Rules can be created for each alarm source.

The source of an alarm can be the camera itself (for example, if the camera detects a temperature alarm or an analytics alarm), or the alarm could come from another device on the network (for example, another camera, or another sensor such as a radar, I/O device, or a fence system).

Just as there can be many sources of alarms, there are also a variety of responses or actions to these alarms. For the FC-Series, typically a rule will be configured to Send a Notification (such as an email), Capture an Image, or generate an Output on the GPIO device.

When configuring the alarm actions, some of the choices for alarm actions that are available are intended for pan/tilt cameras and will not be used with the FC-Series cameras. The following Actions would only be used with a pan/tilt camera and are not used with the FC-Series fixed camera:

- Point
- Load ScanList
- Go To Preset
- Engage Radar Track

If it is necessary to have more than one action for an alarm (for example, generate an output as well as capture an image) then it is necessary to add more than one rule with the Alarm Manager.

Web Configuration Steps

The majority of the configuration and testing of alarms can be done with a web browser. The FSM software provides a convenient way to view alarms and to check the status of the GPIO input and to turn on or off the GPIO output device.

When using the web browser, log in with username "admin", as it is required for some of the configuration steps. Initially the **Setup** pages for **Analytics** and **Radiometry** will be used to set up the temperature and motion detection areas and alarm criteria.
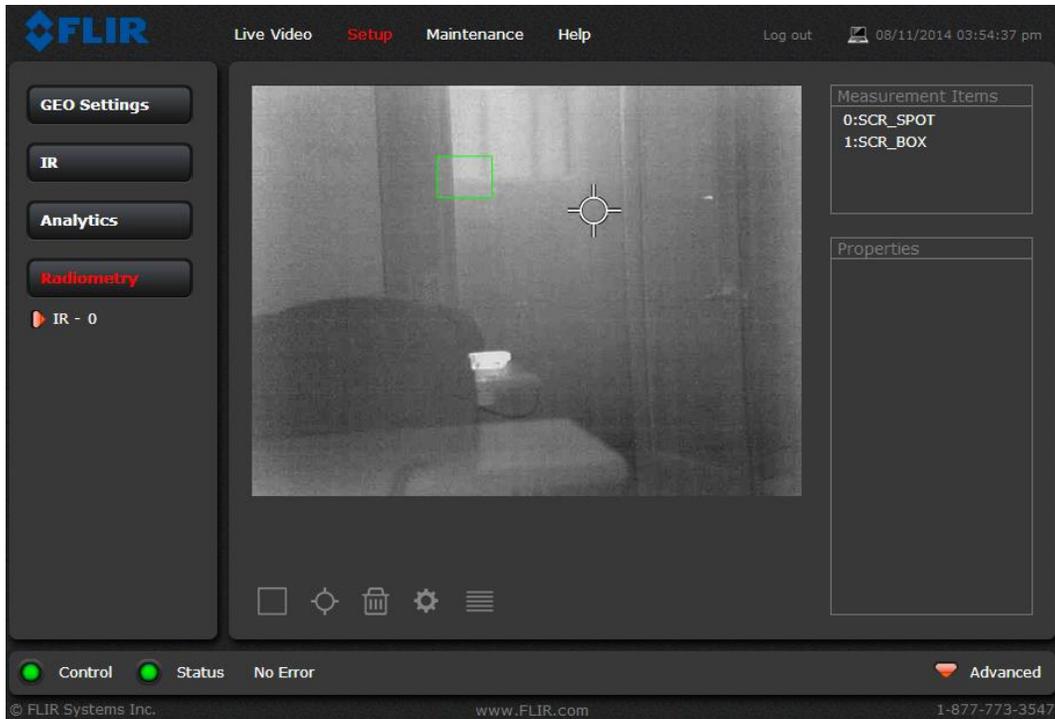
Then the **Maintenance** web pages will be used to set up the GPIO devices and to create the **Alarm Manager** Rules for responding to alarms.

In order to show how the alarms are configured, the following examples will be provided:

1. Temperature alarm which results in a captured image file (snapshot)
2. Analytics alarm which results in a GPIO output
3. GPIO input alarm which results in sending an email

It is necessary to have control of the camera to set up the Analytics and Radiometry or to send commands from the **Live Video** page, as indicated in the lower left of the screen. [Control] If the control icon is black or yellow rather than green, click on the icon to request control of the camera.

Note: As a convention in this document, rather than indicating each of the individual web links that are needed (for example, click on Maintenance, then click on Sensor, then click on Modules) a shorthand notation will be used to indicate the required web page: Maintenance > Sensor > Modules.

Example 1: Temperature Alarm with Captured Image

The following steps are required for this example:

1. Set up the temperature measurement items (spot or box)
2. Configure the Alarm Manager Rule to connect the alarm source (Radiometric IR) with the alarm action (capture an image)
3. Use the Media Browser to view and download the captured image

Set Up the Temperature Measurements

Refer to the "Temperature Monitoring Setup" section of the Installation Manual for details about how to add a radiometric item (either Spot or Box) using the Setup > Radiometry page. If necessary, change the temperature unit of measure for the camera (Celsius or Fahrenheit) using the Maintenance > Sensor > Device > IR web page. Configure the item(s) and the alarm parameters according to the particular circumstances of the installation.

If necessary, on the Setup > Radiometry page select the Show Global Setting gear icon ⚙ and set the Global Settings according to the environment. Recognize that these settings, and the conditions they represent, can have a large impact on how the camera calculates temperatures. It is also possible to use Local Parameters (emissivity, distance, and reflected temperature) for each spot or box.

Note that each measurement item has a unique identifying number (for example, 1: SCR_SPOT). This number will be used later when the Alarm Manager is configured.

For this example, a Spot will be set up and it will be configured to alarm when the temperature value is above 90 degrees Fahrenheit. That way it will be easy to generate an alarm by moving a hand in front of the camera.

When adding a spot or box on the FC-Series fixed camera, select the type "Screen". While it is possible to set the type of spot or box to "Geo", that type is only used with pan/tilt cameras.

Alarm Manager Rule

Select Maintenance > Sensor > Modules > Alarm Manager to configure the alarm rule. Initially there may already be an Alarm Manager entry (Alarm Manager 0) by default that has not yet been enabled and configured fully.
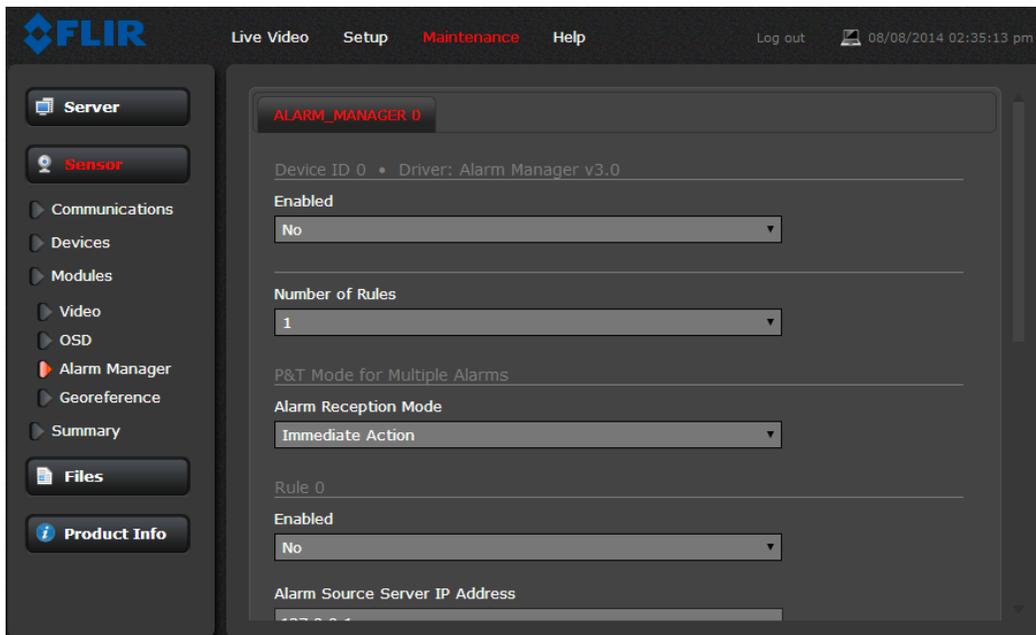
Set the Alarm Manager parameters as follows:

- Enabled = Yes
- Number of Rules = 1
- P&T Mode for Multiple Alarms
    - Alarm Reception Mode = Immediate Action
- Rule 0
    - Enabled = Yes
    - Alarm Source Server IP Address = 127.0.0.1
    - Alarm Source Server TCP Port = 1001
    - Alarm Source Device Type = Radiometric IR
    - Alarm Source Device Id = 0
    - Alarm Id = 0   Note: this corresponds to the number of the sport or box measurement item that was configured above; set the Alarm ID to a range (such as "0-3") if the rule applies to more than one item
    - Action = Capture Image File
    - Snapshot Type = All Non Radiometric (the FC-Series is not capable of capturing a radiometric image, so no image will be saved if the "Radiometric Only" option is selected.

Once the parameters are entered, click the Save button at the bottom of the screen and restart the server.

Media Browser

Test the temperature measurement by having a person hold up a hand in the field of view of the camera in the same area as the temperature measurement. If FSM is running and connected to the camera, it is easy to determine if an alarm occurs. In the bottom part of the screen, an alarm indication will appear.

Select Maintenance > Files > Media Browser to determine if the image was successfully captured.
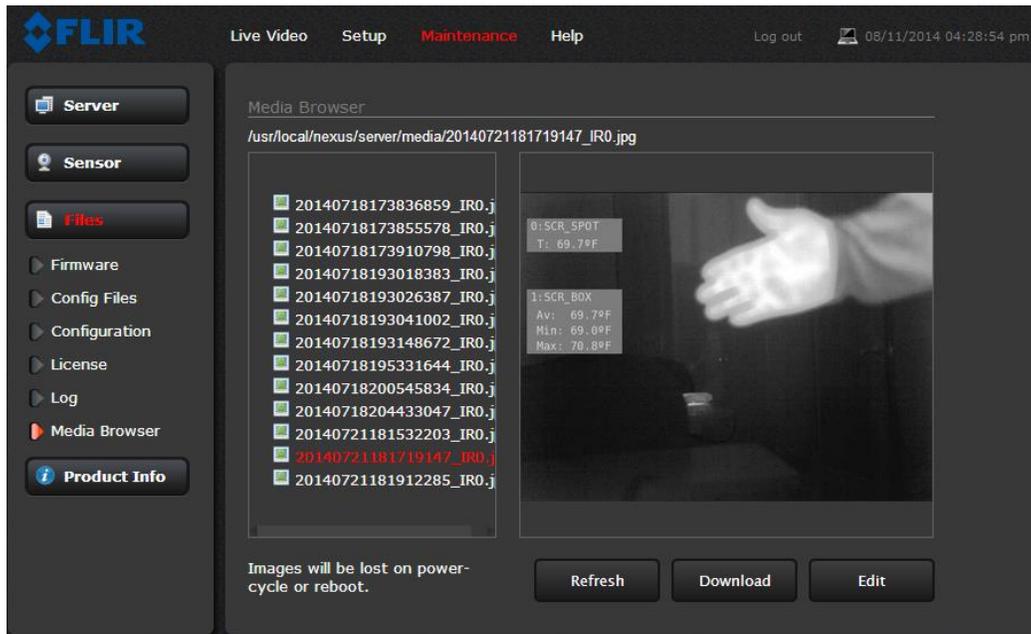
Select an image from the list to view the image or to download the .jpg file.

Example 2: Analytics Alarm with GPIO output

In this example, a temperature alarm will result in sending an output signal through the GPIO port. In this context, "sending" an output signal simply means the output is set to "on"; that is, the circuit closes and there aren't actually any communications sent over the wire.

The following steps are required for this example:

1. Set up the analytics area(s) and near/far alarm criteria
2. Configure the GPIO device
3. Configure the Alarm Manager Rule to connect the alarm source (Analytics) with the alarm action (Output)
4. Use FSM to confirm the output signal is set to On and the alarm is detected

Set Up the Analytics Areas

Refer to the "Video Analytics Setup" section of the Installation Manual for details about how to add Video Analytics (VA) areas using the Setup > Analytics page. Configure the area(s) according to the particular circumstances of the installation, setting the Human Size and Vehicle Size parameters as appropriate.
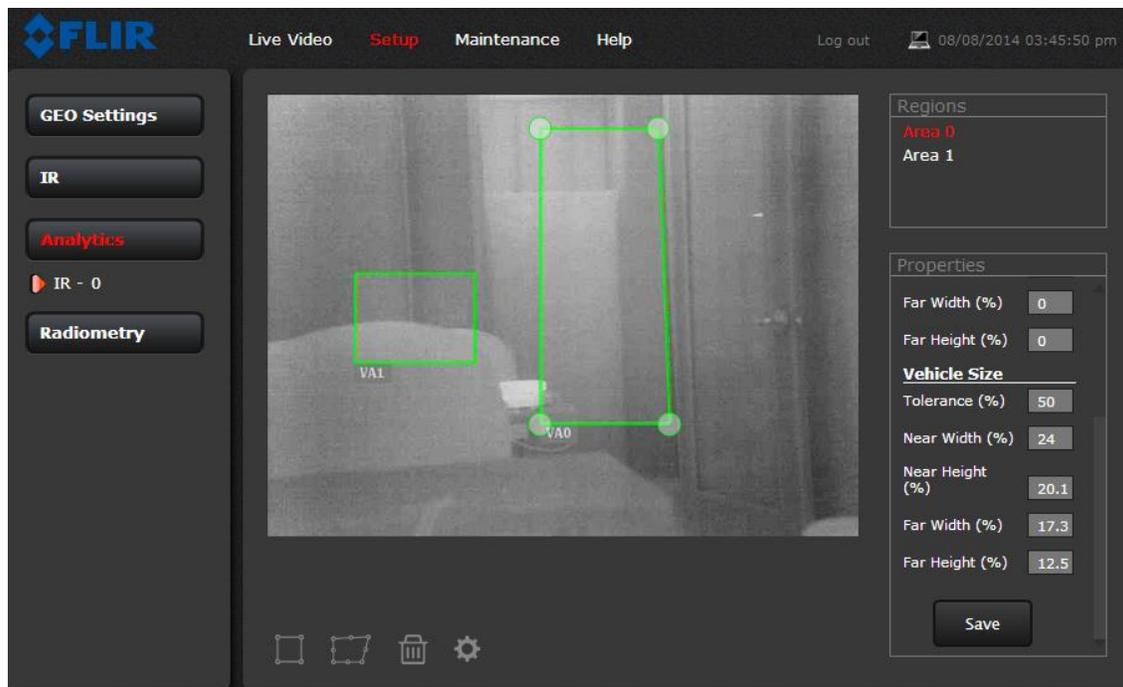

Note that each detection area has a unique designation (for example "Area 1"), and therefore each one can have a unique response. The area designation is used in the Alarm Manager when selecting one or more values for the Alarm ID parameter.

FC-Series GPIO Wiring Example

In the image below, the GPIO output is wired to a Crouzet DR-ODC5 relay and a 6VDC power supply. The relay has an LED at the top that lights up when the camera sends an output. The output of the relay would normally be connected to alarm device such as a light or a siren (this particular relay can control a circuit up to 60VDC and 3 AMP). For this example, the light on the relay is used to confirm the output.

For the GPIO input, two wires are connected to the input pins (5=red, 4=yellow). When the input circuit is closed by touching the other ends of the wire together, an alarm is generated on the camera.
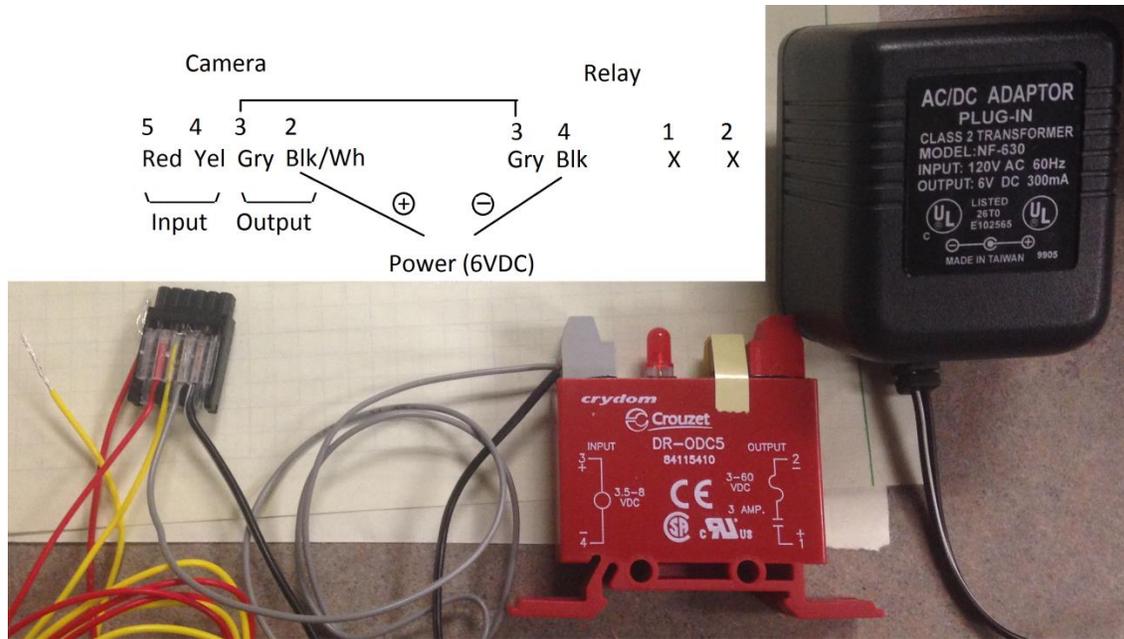
To test the GPIO, connect to the camera with FSM and view the Advanced Sensor Control for the GPIO. Make sure the camera is Active and you have control of the camera. Use the check box next to the output (IO 1) to manually turn on the Output channel, and confirm the LED on the relay turns on. To test the Input channel, touch the red and yellow wire together and confirm the check box next to the input (IO 0) is checked.
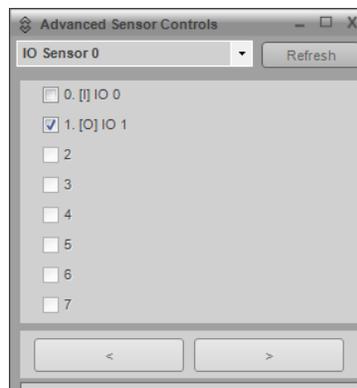
GPIO Device

Since there will be several configuration changes that are needed, it may be useful to stop the server prior to making the changes. Once all the configuration changes are made, the server can be restarted.

Select Maintenance > Sensor > Devices > GPIO to view the input/output device. It may not be necessary to modify the settings. For testing purposes, or even in normal operation, it may be useful to set the "Output Reset Interval (0-600 secs.)" parameter to a non-zero value. This will allow the output to be cleared (reset) automatically after some period of time.

Also it is useful to modify the labels of the two input/outputs to indicate which one is input and which is output (for example, "IO 1 Output"). The index of the output (1) will be used when setting up the Alarm Manager rule. Do not modify the "GPIO Name" or "Type" parameters for the input or the output.

Once the parameters are entered, click the Save button at the bottom of the screen (the server can be restarted after the Alarm Manager changes are made).
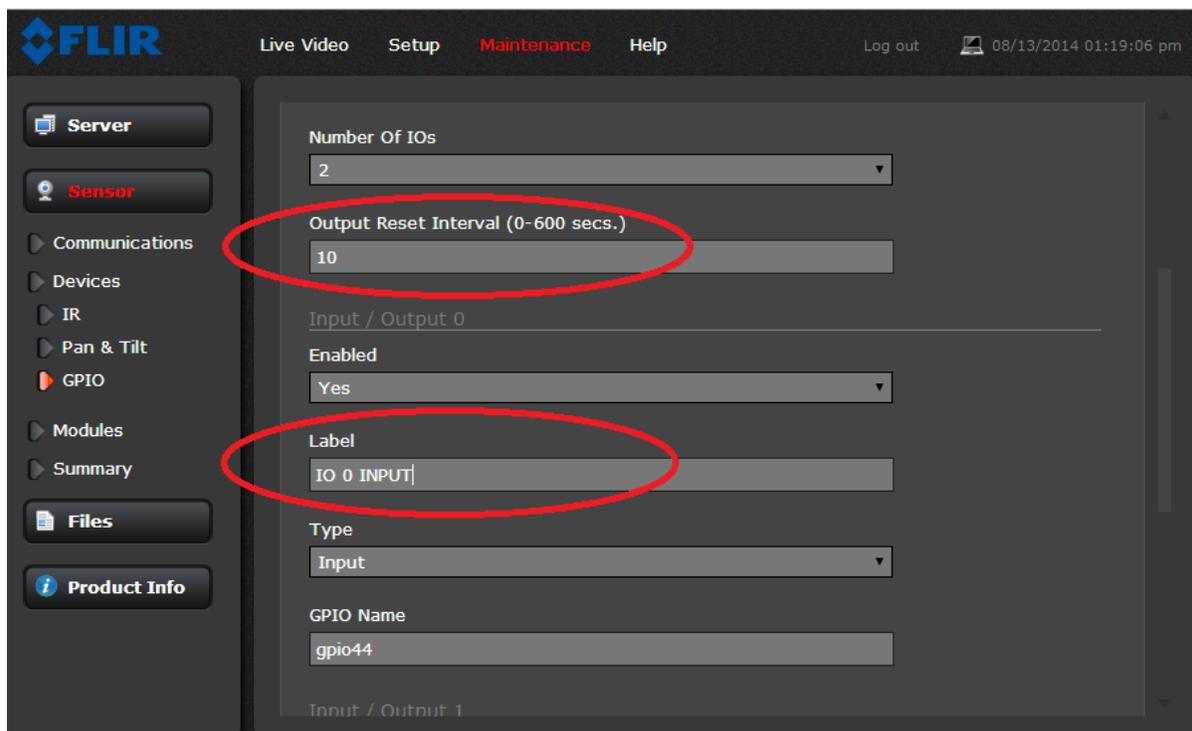
It is not possible to turn on the output or view the status of the input or output using the web browser interface, so FSM will be used for that.

Alarm Manager Rule

Select Maintenance > Sensor > Modules > Alarm Manager to configure the alarm rule. It is possible to change the existing Alarm Manager rule (Rule 0) that was used in the first example, or to add another rule by changing the "Number of Rules" parameter (in this example we have chosen to add another rule). Note below the difference between the I/O Port and the I/O Index.

Set the parameters for Rule 1 as follows:

- Number of Rules = 2
- Rule 1
    - Enabled = Yes
    - Alarm Source Server IP Address = 127.0.0.1
    - Alarm Source Server TCP Port = 1001
    - Alarm Source Device Type = Video Analytics
    - Alarm Source Device Id = 0
    - Alarm Id = 0 (This corresponds to the number of the measurement item that was configured above; if this rule applies to more than one item, use a range, such as "0-3")
    - Action = Output
    - Associated I/O Device Id = 0
    - Associated I/O Port = 0 (Although it may be tempting to select 1 from the pull-down to correspond to the Output port, leave this parameter set to 0)
    - Associated I/O Index (Example 0-5,7,9) = 1   This parameter is set to 1 to correspond to the Output port
   - Output State Mode = Unbound

If the Output State mode is set to Bound the output follows the state of the alarm. For example, when a VA region or Radiometry spot/box goes red, the GPIO output will close/connect. When the region/spot/box has no alarm (green for VA, gray for Radiometry), the GPIO output will open (high impedance – greater than 100 K ohms).

If Unbound is selected, when an alarm occurs the GPIO output will close and remain closed until it is reset through FSM, or until the Output Reset Interval expires, if the interval is set to a number of seconds greater than 0.

Once the parameters are entered, click the Save button at the bottom of the screen and restart the server.
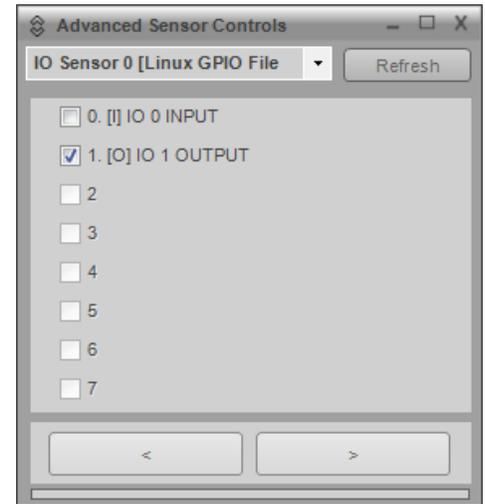
Confirm the Analytics Alarm

Run FSM and use Setup > Discovery to add the sensor to the Sensors List. Make sure FSM is connected to the camera and the user has control of the camera (green joystick icon in the upper left). Since there isn't a way to check the state of the input/output from the web browser, FSM can be used instead.
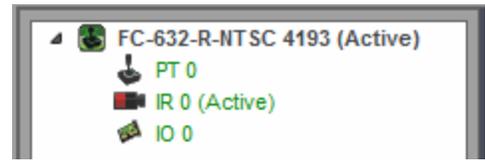
Double click on the IO 0 icon (🔩 IO 0) to open up the Advanced Sensor Controls for the IO device. If the names of the input and output were modified above, the new names will appear next to the check boxes. To test the output, click on the check box next to the output to turn it on. Confirm that the output is sent to whatever device is connected. For example, if a light is connected, it should turn on. Also in FSM there should be an indication of an alarm at the bottom of the window.

Clear the alarm indication by clicking on the alarm icon. Uncheck the IO 1 Output check box.

Once the output is confirmed to be working properly, generate an analytics alarm by having a person or vehicle enter the field of view of the camera where the analytics area was configured. There should be another alarm indication at the bottom of the screen, and the output should turn on.

In FSM, the Alarms Monitor can also be used to view alarm information and confirm the alarm areas are working properly. From the menu at the top of the FSM window, select View > Alarms Monitor.
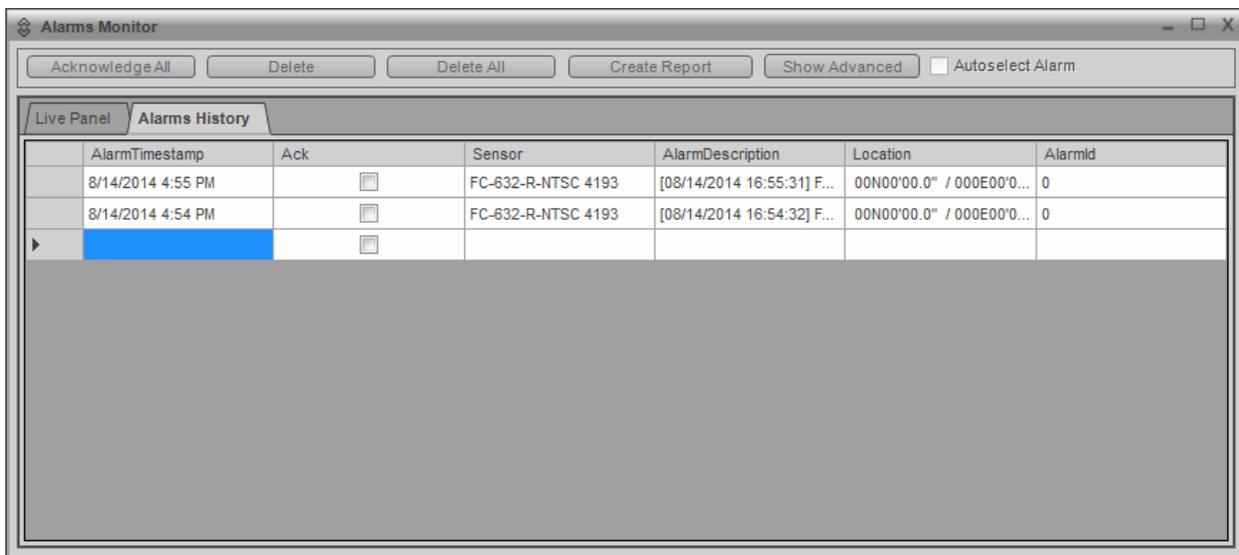
To clear the alarm, uncheck the output check box in the Advanced Sensors Panel. If the Output Reset Interval was set to a non-zero number, the output will be reset automatically after that amount of time.

Example 3: GPIO Input With Email

The following steps are required for this example:

1. Confirm the GPIO Device is set up properly
2. Confirm the LAN Settings including the default gateway and DNS servers are configured properly
3. Set up the Messaging Services (email) and Notification Lists
4. Configure the Alarm Manager Rule to connect the alarm source (GPIO Input) with the alarm action (send notification)
5. Use FSM to confirm the input causes an alarm. Check the email system to confirm the message was received.

GPIO Device

Since there will be several configuration changes that are needed, it may be useful to stop the server prior to making the changes. Once all the configuration changes are made, the server can be restarted.

Select Maintenance > Sensor > Devices > GPIO to view the input/output device. It may not be necessary to modify the settings, especially if the device was set up for Example 2.

In a real world scenario, the Input to the FC-Series would be connected to some other security sensor which is capable of generating an output (such as a fence system or access control system). For demonstration purposes, a simple device such as a push button can be used (or simply touch together two wires from pins 4 & 5 from the GPIO connector).

To test the input, run FSM and open the Advanced Sensor Controls. Then generate an input and confirm the input is received (observe checkbox next to "0. [I] IO 0") and it causes an alarm.

Confirm the LAN Settings

For the camera to send a notification email, the camera must be able to communicate over the network with the email server (typically an SMTP server). Often the server is on a different network than the camera, so the camera must be configured with a default gateway so that IP packets can be routed to other networks.

In most cases the name of the server is known (for example, smtp.live.com) but the particular IP address is not. If the camera is configured with one or more DNS servers, then the name can be resolved to an IP address and that will allow the camera to send the notification to the server.

The Default Gateway and DNS Servers settings are available from the Maintenance > Server > LAN Settings configuration page. If changes are made, click on the Save button at the bottom of the page, and then click on the Restart Network button.

To confirm if the default gateway is configured properly, test if it is possible to connect to the camera remotely with a web browser (from a different network).

Messaging Services (email) and Notification Lists

To configure the camera to send email, select Maintenance > Server > Services > Msg Systems. The camera supports three types of messages: email, XML messages, and Milestone event notifications. In this example the email services will be configured. If necessary, consult with your network/IT administrator to determine the IP Address/name of the server, the appropriate port (typically port 25 for SMTP) and authentication settings.

It is possible to test the email settings by using a free email from one of the common email providers, such as Gmail, Hotmail, or Yahoo. The settings for the mail server of course depend on the specific server used. As an example, the following settings were tested with a Gmail account (with the username, password and "From Address" replaced appropriately):

- Server IP Address = smtp.gmail.com
- Server SMTP Port = 587
- Authentication = Yes
- TLS Authentication = Yes
- User Name = username@gmail.com
- Password = *******
- From Address = username@gmail.com

When a message it sent, it can be sent to one of three different email lists: Default Notification List, Notification List 1, and Notification List 2. Separate the email addresses by commas or semicolons. This allows the system to be configured to send certain alarm notifications to one group and other alarm notifications to a different group. The appropriate notification list is specified when setting up the Alarm Manager rule.

For this example, the Default Notification List is used. Add the appropriate email address to the list and click Save at the bottom of the screen.

To test the email settings, it is possible to manually have the camera send an email. From the **Live Video** page, ensure the user has control of the camera. Select the FN button, and then select function 9 (click the 9 button). This automatically causes a test email to be sent to the Default Notification List.
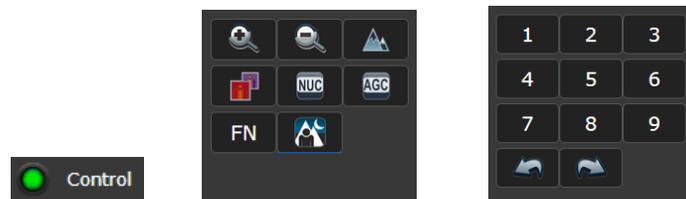
If there are problems with sending the email, it may be useful to turn on the message logging capability. Under Maintenance > Files > Log, set the Log max size parameter to a non-zero value (3 MB suggested). Then view the most recent messages by clicking Refresh, or download the log messages to a text file that can be viewed with WordPad or a similar application.

Configure the Alarm Manager Rule

Select Maintenance > Sensor > Modules > Alarm Manager to configure the alarm rule. Add a new rule by increasing the "Number of Rules" parameter, then fill in the rule parameters as follows.

Set the parameters for Rule 2 as follows:

- Number of Rules = 3
- Rule 2
  - Enabled = Yes
  - Alarm Source Server IP Address = 127.0.0.1
  - Alarm Source Server TCP Port = 1001
  - Alarm Source Device Type = GPIO
  - Alarm Source Device Id = 0
  - Input Id = 0 (This corresponds to the input device IO 0)
  - Action = Send Notification
  - Notification List = Default List
  - Subject = Input Alarm!
  - Attach Image File = All Non Radiometric (optional; this will attach a normal JPEG image)
  - Send Activity Report – Every 6h (optional – this will email a report every 6 hours indicating if any alarms have occurred)

Once the parameters are entered, click the Save button at the bottom of the screen and restart the server.

Confirm the Alarm and Check for Email

Generate an input to the camera, depending on what device is connected to the Input to the camera. To determine if the input is received and it causes an alarm in FSM, confirm there is an alarm indication and in the Advanced Sensor Controls there is a check mark next to the Input.
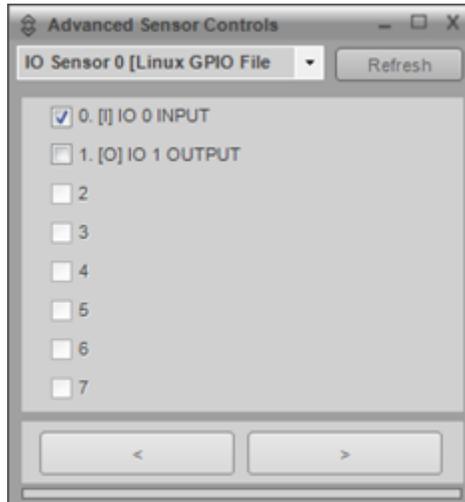
Confirm that the email message was received and that it includes a snapshot image as an attachment.

The size and quality of the image snapshot can be changed by modifying the video settings under Maintenance->Sensor->Modules->Video. The VIDEO 2 device uses the Bullet Video Snap driver and creates the snapshot images. It is possible to increase the image size and/or quality of snapshots by changing qFactor and/or Image Size.

FLIR Commercial Systems, Inc.
70 Castilian Drive
Goleta, CA 93117
Phone: 888.747.FLIR (888.747.3547)
International: +1.805.964.9797
www.flir.com