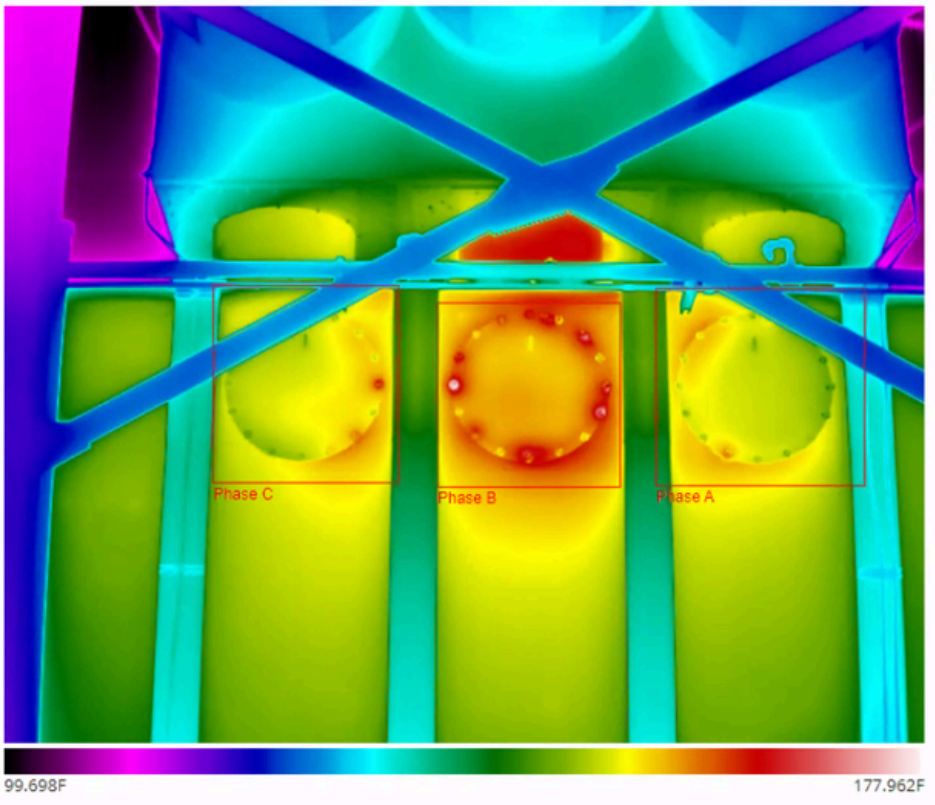
CUTSFORTH

Operations Manual
EZDP-2160 Rev –
Infrared Thermography



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Please send patent information requests to patents@cutsforth.com.

Safety Information

Safety Information [English]

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Safety Conventions

NOTE:

Additional information.

ELECTRICAL DANGER

Indicates an action or specific equipment area that can result in personal injury or death from an electrical hazard if proper precautions are not taken.

CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury or equipment damage.

WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

ROTATING PART CAUTION

Indicates possible injury from rotating parts.

DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

General Safety Instructions

ELECTRICAL DANGER

Only qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid injury should work with Cutsforth products. Among the many considerations are the following:

- Avoid contact with energized circuits.
- Avoid contact with rotating parts.
- Never install any component that appears not to be functioning in a normal manner.

ROTATING PART CAUTION

High-voltage and rotating parts can cause serious or fatal injury. Installation, operation, and maintenance of this product must be performed only by qualified personnel, in accordance with all applicable safety regulations and guidelines.

Consignes de Sécurité [Français]

Les informations qui suivent sont essentielles afin d'assurer la sécurité de l'utilisateur lors de l'installation et de l'opération de l'équipement. Assurez-vous de bien lire et de comprendre tous les avertissements et mises en garde qui suivent.

Conventions de Sécurité

NOTE:

Informations supplémentaires.

RISQUES DE CHOC ÉLECTRIQUE

Indique que l'action ou la partie de l'équipement concernée peut mener à des blessures par électrisation ou à la mort par électrocution si les précautions adéquates ne sont pas prises.

MISE EN GARDE

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures mineures à modérées ou à des dommages matériels.

AVERTISSEMENT

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures sévères ou à la mort.

MISE EN GARDE : PIÈCE ROTATIVE

Indique la présence de pièces d'équipement rotatives pouvant causer des blessures.

DANGER

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures sévères ou à la mort.

Consignes de Sécurité Générales

RISQUES DE CHOC ÉLECTRIQUE

L'utilisation des produits Cutsforth n'est recommandée qu'aux professionnels qualifiés qui savent comment reconnaître la présence de risques de choc électrique ainsi que les consignes de sécurité à suivre pour éviter les blessures liées à ces risques. Lesdites consignes de sécurité incluent, sans s'y limiter :

- Éviter tout contact avec des circuits alimentés;
- Éviter tout contact avec des pièces d'équipement rotatives;
- Ne jamais installer de composante ne paraissant pas fonctionner normalement;

MISE EN GARDE : PIÈCE ROTATIVE

Les pièces d'équipement rotatives et sous haute tension peuvent causer des blessures sévères ou fatales. L'installation, l'opération et la manutention de ce produit ne doivent être faites que par des professionnels qualifiés et en respectant toutes les règles et consignes de sécurité applicables.

1. The Cutsforth Infrared (IR) Thermography System

The Cutsforth Infrared (IR) Thermography system provides continuous, non-contact thermal assessment of critical electrical and mechanical equipment. By visualizing and trending heat patterns in real time, the system enables early detection of developing issues such as loose electrical connections, overloaded circuits, insulation breakdown, improper lubrication, and mechanical friction points. This proactive insight helps prevent unplanned outages, extend asset life, and improve operational reliability.

Designed for both periodic and always-on monitoring, IR thermography supports safe condition assessment in areas where manual inspection is hazardous or impractical. The system is ideal for generators, motors, transformers, pumps, turbomachinery, and breakers/panels, providing visibility into failure modes long before they escalate into critical faults.

At the core of the monitoring system is InsightCM™, Cutsforth's unified condition monitoring software. InsightCM integrates thermal imaging with other sensor data to generate automated temperature trends, correlate heat signatures with electrical and vibration indicators, and issue early alarms based on user-defined Regions of Interest (ROIs). Operators can monitor minimum, maximum, average, and differential temperatures across multiple ROIs, enabling precise detection of abnormal conditions.

The standard system utilizes the Optris Xi410 camera device and scalable multi-camera installations. With the ability to configure extensive ROIs and temperature deltas, facilities can tailor monitoring to specific assets and expand coverage across transformers, switchgear, and other high-value infrastructure.

1.1. Assets Monitored and Failure Modes Detected

Some of the common assets monitored with IR thermography:

- Generators
- Motors
- Transformers
- Pumps
- Turbomachinery
- Breakers/Panels

Some of the common failure modes managed with IR thermography:

- Loose or corroded electrical connections
- Overloaded or imbalanced circuits or phases
- Insulation breakdown and hot spots

- Improper lubrication
- Misalignment
- Mechanical friction points
- Cooling system inefficiencies

1.2. InsightCM Features

InsightCM can extract a multitude of features from hardware installed in the field. The calculated feature data from InsightCM can be transmitted to plant historians for integration into advanced pattern recognition (APR) models or other advanced machine learning platforms. For more information on InsightCM features, visit the InsightCM user manual on the Cutsforth Support webpage at support.cutsforth.com.

1.3. Part Number Reference

This manual applies to the EIRA product family. The following part numbers are available at the time of this document's publication; additional part numbers may be introduced in the future.

Part Number	Description
EIRA-001	Infrared (IR) Thermography Monitoring System (non-PoE), complete system
EIRA-002	Infrared (IR) Thermography Camera with Climate Controlled Enclosure
EIRA-002-PoE	PoE-Powered Infrared (IR) Thermography Camera with Climate Controlled Enclosure
EIRA-003	Infrared (IR) Thermography Monitoring System (PoE), complete system
EIRA-004	Infrared (IR) Thermography Camera with Enclosure (non-climate-controlled)

EIRA-001 and EIRA-003 are complete monitoring system orders (camera, cRIO, and both enclosures) that differ by power scheme. EIRA-002, EIRA-002-PoE, and EIRA-004 are camera-and-enclosure components, typically ordered as spares or to expand an existing system with additional cameras.

1.4. Key Specifications

1.4.1. Camera Specifications (Optris Xi410)

Specification	Value
Measurement Range	-20°C to 1500°C (-4°F to 2732°F)
Resolution	384 x 240 pixels
Frame Rate	25 Hz
Interface	Ethernet
Focus	Motorized focus

1.5. Technical Specifications

1.5.1. System Components and Architecture

The Cutsforth IR Thermography System consists of the following components:

Component	Description
cRIO-9055 Controller	Ingests data from the connected camera(s) via Ethernet, then sends that data to InsightCM via Ethernet or fiber.
cRIO Enclosure (NEMA 4X)	Houses the cRIO controller, power supply, and network switch.
Optris Xi410 Camera	Captures thermal images and sends them to the cRIO-9055 via Ethernet cable.
Camera Enclosure, Climate Controlled (NEMA 4X)	Houses the camera and active climate-control equipment. Used on EIRA-002 and EIRA-002-PoE.
Camera Enclosure, Non-Climate-Controlled	Houses the camera with heating and air circulation only, no active cooling. Used on EIRA-004.
InsightCM	Ingests data from the cRIO-9055 and allows the user to analyze and trend the data.

Data flows as follows: each camera sends thermal image data to the cRIO via Ethernet; the cRIO forwards that data to the InsightCM server over Ethernet or fiber, where it becomes available for analysis, trending, and alarming.

1.5.2. IR Thermography cRIO Enclosure

Catalog Number	Dimensions (in. (mm))
SNB-3736	15.75 (400) x 11.81 (300) x 7.87 (200)

Specifications:

- UL 508A Listed Type 1, 2, 4, 4X, 12, and 13
- IP Rating: IP65 and IP66
- RoHS Compliant
- Powder Coated Steel

1.5.3. Camera Enclosure, Climate Controlled (EIRA-002 / EIRA-002-PoE)

Catalog Number	Dimensions (in. (mm))
ST-CD-HBX-24V-SS	20.9 (531) x 7.5 (191) x 6.7 (170)

Specifications:

- Active cooling (400 BTU) and heating (65 Watts), both thermostatically controlled
- 25 CFM fan (always on)

- UV-resistant polycarbonate body
- Stainless steel mounting arm
- IP Rating: IP66
- IK Rating: IK10

1.5.4. Camera Enclosure, Non-Climate-Controlled (EIRA-004)

EIRA-004 uses the Optris outdoor protective housing (Optris part number ACXIOPH24). Unlike the climate-controlled enclosure used on EIRA-002 and EIRA-002-PoE, this enclosure provides heating and air circulation only; it does not include active cooling.

Catalog Number	Dimensions (in. (mm))
ACXIOPH24	19.1 (485) x 5.5 (140) x 4.7 (120)

Specifications:

- Environmental Rating: IP66
- IK Rating: Not specified
- Thermal Management: PTC heater (auto-starts below 15°C / 59°F) and fan for even heat distribution; no active cooling
- Air Purge Collar: Integrated
- Material: Aluminum
- Weight: 4.4 lb (2.0 kg); 5.5 lb (2.5 kg) with wall mount bracket
- Max Field of View: 90° (HFOV)
- Mounting: Wall mount bracket (mandatory for this enclosure)

Product certifications in Product Certifications (page 12) were tested against the standard (climate-controlled) system configuration. Certification status for the EIRA-004 non-climate-controlled enclosure should be verified separately if required for a specific installation.

1.5.5. AC Power Supply Requirements

1.5.5.1. cRIO Enclosure

Parameter	Value
Plant-supplied power source	120 V, 60 Hz or 240 V, 50 Hz
Circuit breaker	Internal 120 V, 5 A
Maximum power consumption	72 W
Input Voltage Range	100 to 240 VAC
Input Frequency Range	50 to 60 Hz
Input Power Rating	150 W
Overvoltage Category	II; according to EN62368, EN61558, EN50178, EN60664-1, EN62477-1
Input Wire Connection Type	DIN, screw-down terminal block
Input Wire Size	26 to 10 AWG

1.5.5.2. Camera Enclosure, Climate Controlled (EIRA-002 / EIRA-002-PoE)

Parameter	Value
Plant-supplied power source	120 V, 60 Hz or 240 V, 50 Hz
Circuit breaker	N/A
Maximum power consumption	165 W
Input Voltage Range	90 to 305 VAC
Input Frequency Range	47 to 63 Hz
Input Power Rating	240 W
Input Wire Connection Type	Butt splice, wire nut
Input Wire Size	22 to 14 AWG

1.5.5.3. Camera Enclosure, Non-Climate-Controlled (EIRA-004)

Parameter	Value
Plant-supplied power source	24 VDC or PoE (PoE does not power the heater or fan)
Circuit breaker	N/A
Maximum power consumption	70 W
Current Draw	3 A (6 A short-term)
Input Wire Connection Type	Spring cage

1.5.6. Approved Manufacturing Location

Cutsforth LLC

5160 Industrial Place #101

Ferndale, WA 98248

Customer Support: support.cutsforth.com

Website: Cutsforth.com

1.5.7. Product Certifications

The following certifications apply to the standard system configuration (cRIO enclosure and climate-controlled camera enclosure).

Table 1. North America

Category	Details
Safety	Conforms to UL 508A and CSA C22.2 No. 286

1.5.7.1. WEEE Directive Statement

In accordance with Article 14 of Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), the following marking requirements apply:

- The directive applies to electrical and electronic equipment falling under Annex I, Category 9 of Directive 2012/19/EU.
- Products must include markings that clearly identify the producer and indicate that the equipment was placed on the market after 13 August 2005.
- The crossed-out wheeled bin symbol signifies that the equipment must not be disposed of with unsorted municipal waste. End users are required to follow applicable local recycling and disposal procedures for electrical and electronic equipment.
- The marking affixed to the product confirms that it falls within the scope of this directive.

1.5.8. Environmental Requirements

1.5.8.1. cRIO Enclosure

Parameter	Value
Storage Temperature	-40°C to 85°C (-40°F to 185°F)
Operating Temperature	-20°C to 65°C (-4°F to 149°F)
Storage Humidity	5% RH to 95% RH, non-condensing
Operating Humidity	10% RH to 90% RH, non-condensing
Maximum Altitude	2,000 m (6,500 ft)
Pollution Degree	2
Weight	11.34 kg (25 lbs.)
Indoor / Outdoor Use	Both

1.5.8.2. Camera Enclosure, Climate Controlled (EIRA-002 / EIRA-002-PoE)

Parameter	Value
Storage Temperature	-40°C to 70°C (-40°F to 158°F)
Operating Temperature	-25°C to 65°C (-13°F to 149°F)
Storage Humidity	10% RH to 95% RH, non-condensing
Operating Humidity	10% RH to 95% RH, non-condensing

1.5.8.3. Camera Enclosure, Non-Climate-Controlled (EIRA-004)

Parameter	Value
Operating Temperature	-40°C to 50°C (-40°F to 122°F)

2. IT System Requirements

2.1. Overall Architecture

The IR Thermography System follows Cutsforth's standard InsightCM reference architecture: field devices (cameras and the cRIO controller) connect to an on-premise or cloud-hosted server running the InsightCM server application, which in turn makes data available to a web interface, a plant historian, and other connected business systems. For a detailed architecture diagram, refer to the Infrared Thermography Installation Planning Guide (EZDP-2152).

2.2. Server Hardware Requirements

The following sections describe the recommended specifications for the InsightCM Server. InsightCM and SystemLink are incompatible and should be installed on separate servers.

Cutsforth recommends using solid state drives to improve disk throughput.

Systems with fewer than 10 Monitoring Devices	Systems with fewer than 50 Monitoring Devices	Systems with more than 50 Monitoring Devices

▪ Windows 10 or Windows 11, 64-bit Professional
▪ 2.2 GHz, 4-core processor
▪ 16 GB RAM
▪ One physical hard drive for OS, program installation, and storing data files—At least 500 GB disk space
	▪ Windows Server 2016, 2019, or 2022
	▪ 2.2 GHz, 8-core processor
	▪ 16 GB RAM
	▪ Two physical hard drives:
	  ▪ **For OS and program installation**—At least 250 GB disk space
	  ▪ **For storing data files**—At least 1 TB disk space
		▪ Windows Server 2016, 2019, or 2022
		▪ 3 GHz, 16-core processor
		▪ 32 GB RAM
		▪ Two physical hard drives:
		  ▪ **For OS and program installation**—At least 250 GB disk space
		  ▪ **For storing data files**—At least 2 TB disk space

2.3. Networking Requirements

A fast or gigabit Ethernet (100 Mbps or 1000 Mbps) local area network or business network connection is required between a PC/server running InsightCM and the data acquisition devices. It is also preferable for this PC/server to be connected through the network to the site data historian for ease of gathering process data.

3. Installation

3.1. Equipment List

To install the IR Thermography System, you need the equipment listed below. Some items are provided by Cutsforth, and some are provided by the electrical contractor.

Equipment	Supplied by Cutsforth	Supplied by Electrical Contractor
Infrared camera	✓	
Controller (cRIO-9055 4-slot controller)	✓	
NEMA 4X rated enclosures (camera enclosure, cRIO enclosure)	✓	
Conduit		✓
Ethernet cable for data run from camera to cRIO		✓
Ethernet cable for connection to server		✓
600-volt-rated power cable		✓

3.2. Installation Overview

This section provides step by step instructions for installing the IR Thermography System.

1. Mount the IR cRIO enclosure at the planned location.
2. Mount the IR camera enclosure(s) at the planned location(s).
3. Install the conduit and run cable between the IR cRIO enclosure and the camera enclosure(s).
4. Install the conduits and run cables for AC power inputs to the cRIO enclosure and camera enclosure(s). Minimum circuit size: 20A circuit free of non-linear loads. Consider a circuit with isolated ground.
5. Install the conduit and run cable for data connection to the cRIO enclosure. Cutsforth recommends Cat6a or fiber connection (media converter required if using fiber).
6. Connect protective earth conductor per local electrical codes.
7. Install wire for 120 to 240 VAC supply per local electrical codes.
8. If required by local electrical codes, install an external switch or circuit breaker near the equipment. Ensure equipment is positioned so that it will not be difficult to operate the external disconnecting device.

Up to seven cameras can be connected to each cRIO, provided that cable lengths stay within the specified limitations.

3.3. Mounting and Placement Requirements

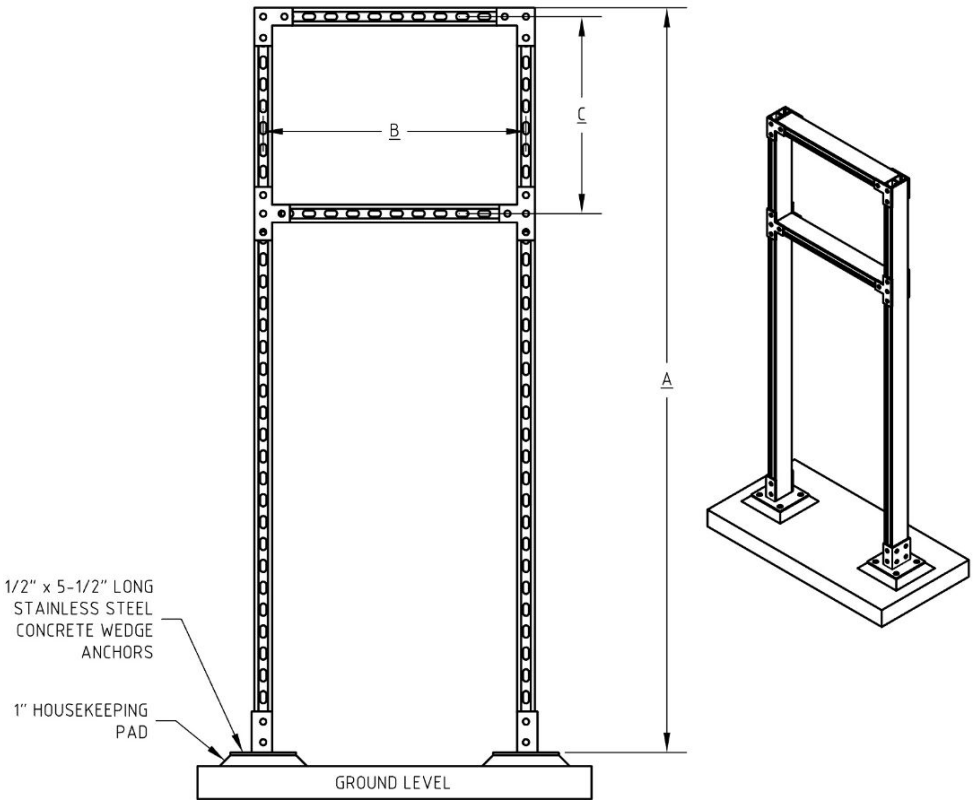
- Cameras should be installed in a location with a direct line of sight to the equipment being measured.
- The cRIO enclosure should be mounted in a location that accommodates the desired camera installation locations without exceeding the specified maximum cable run lengths.
- Avoid mounting the cRIO enclosure in an area that experiences excessive direct sunlight, to avoid overheating.
- The camera enclosure ships with both wall and pole mounting hardware options.

Mount the camera so its line of sight is not obstructed by any material that is not IR-transparent. Materials such as glass, water, and most plastics pass visible light but block or distort infrared energy, and will produce inaccurate temperature readings even though they appear transparent to the eye.

3.4. Conduit and Strut Channel Recommendations

Component	Standard Recommendation	Recommendation for High-Corrosion Environments
Conduit type	Galvanized rigid metal conduit (RMC)	Rigid Aluminum Conduit (RAC)
Conduit fittings type	Malleable, NEMA 4X rated or greater	Aluminum
Strut channel type	Hot dipped galvanized, back-to-back	316 Stainless steel
Mounting hardware	316 Stainless steel	316 Stainless steel
Liquid flexible metallic conduit	Type HCX	Type HCX

3.4.1. Recommended Strut Rack Design for cRIO Enclosure



A in. (mm)	B in. (mm)	C in. (mm)
68 (1730)	24 (610)	Refer to enclosure mounting feet dimensions

3.5. Cabling Requirements

The following table describes the conduit runs required between the plant power source, the camera enclosure(s), the cRIO enclosure, and the InsightCM Server.

Conduit Run	Conduit Trade Size	Wire Description	Purpose	Max Cable Length
Plant power to IR Camera Enclosure(s)	3/4 in (2 cm)	120 VAC power (20A dedicated circuit, preferably with isolated ground)	Power for the camera enclosure	N/A
IR Camera Enclosure to cRIO Enclosure	3/4 in (2 cm)	Cat6a	Data from camera to cRIO	100 ft
IR cRIO Enclosure to InsightCM Server	3/4 in (2 cm)	Cat6a or Fiber	Data to InsightCM Server	330 ft (100 m)
Plant power to IR cRIO Enclosure	3/4 in (2 cm)	120 VAC power (20A dedicated circuit, preferably with isolated ground)	Power for the cRIO enclosure	N/A

cRIO enclosures do not come with conduit holes pre-drilled. Conduit sizing and hole placement is customizable. All conduit runs listed above are the responsibility of the plant electrical contractor.

3.6. Running Plant Power and Data Connections

The Ethernet cables from the camera(s) should be plugged into the Ethernet switch inside the cRIO enclosure. The Ethernet cable from the InsightCM server should be plugged into Port 0 on the cRIO.

Connect protective earth conductor per local electrical codes, and confirm the AC power circuit supplying each enclosure is sized per the Installation Overview before energizing the system.

4. System Configuration

4.1. Hardware Configuration

The Ethernet cables from the cameras should be plugged into the Ethernet switch inside the cRIO enclosure. The Ethernet cable from the InsightCM server should be plugged into Port 0 on the cRIO.

4.2. Thermal Imaging Device Types

Using thermal cameras, monitor thermal data in a large area without extensive wiring to thermocouples.

Device Type	Compatible Camera	Sensor Asset Type	Description
IR-9055	Xi410	Delta, ROI	Supports up to ten thermal cameras. Connects to the device through a Power over Ethernet (PoE) adapter, not by channels on a module. See the cRIO-9055 help for more information.

4.3. Adding a Thermal Imaging Device

Add a thermal imaging device to collect temperature data from thermal cameras.

1. Click Configuration and select Devices.
2. In the Devices tab, click Add.
3. Select Connect to an online device and enter the IP address in the textbox. If you do not know the device IP address, click Browse to see a list of devices on the same subnet as the server machine.
4. Click the Connect button. The Test Connection dialog box prompts you if the device fails to connect to the server machine and come online. Resolve all failures before continuing.
5. Click Next.
6. If the device passes all connection tests, the web application detects and displays the controller. Click Next.
7. Enter the two types of names for the device: Device Name (the name that will appear throughout the web application; assign an easily identifiable name, such as one that includes the device location) and Hardware Name (the hostname of the device, in the format NI-IC-ModelNumber-SerialNumber by default; if the device is online, the server automatically populates this name, otherwise the two values are printed on a label on the back of the device).
8. Click Finish.
9. When the web application prompts you to send the connection information to the device web server, click Yes.

After completing these steps, discover your Optris cameras as described in Discovering Optris Cameras (page 21).

4.4. Preparing Optris Cameras for Discovery

Set up the Xi410 Optris cameras you will use to monitor your equipment's thermal data before you add and configure them on InsightCM. Before you begin, ensure the computer you use for the initial camera setup is compatible with PIX Connect software and you can change the network settings securely.

1. Install and launch the latest version of PIX Connect software as an administrator.
2. Connect the Xi410 camera to the computer using the provided USB cable. Cutsforth recommends setting up one camera at a time.
3. Click Devices and verify that PIX Connect recognizes the camera.
4. Click Help then About and verify that the Imager Firmware version on the camera is at least 3814 or newer. If the firmware version is older than 3814, click Tools, then Extended, then Update Firmware; deploy the latest firmware to the camera from PIX Connect; click Help then About to confirm the firmware update; then click Close. If the firmware version is 3814 or newer, click Close.
5. Click Devices, then Ethernet Settings.
6. Set Device Address to 192.168.0.101. If multiple Optris cameras will be connected to the same thermal imaging device, increment the last digit of the IP address for each successive camera.
7. Set Send to address to 192.168.0.100.
8. Set Subnet Mask to 255.255.255.0.
9. Set Port to 50000. If multiple Optris cameras will be connected to the same thermal imaging device, increment the final digit of the port number for each successive camera.
10. Disable the Auto assign port number checkbox to better track what data is coming from which camera.
11. Set Listen on port number to 50000 (or, if another camera, to the same port number you assigned to this camera).
12. Click OK.
13. Click Tools, then Configuration.
14. On the Device tab, input a Temperature Range.
15. On the External Communication tab, select the Enable checkbox under Direct temperature mode. Temperature values will not be correct unless you enable this checkbox.
16. Click OK.
17. Click Devices, then Set configuration to device, to push your configuration settings to the camera. Once the progress bar at the bottom of the window is complete, you have successfully configured your Optris camera.
18. Disconnect and set aside the USB cable.
19. Connect the camera to the Power over Ethernet (PoE) adapter.
20. Using an Ethernet cable, connect the PoE adapter to the PoE Switch.
21. Using another Ethernet cable, connect the PoE Switch to the computer.
22. On the computer, navigate to View network computers and devices in File Explorer.
23. Select Network and Sharing Center.

24. Click Change adapter options.
25. Set up your Ethernet port for a connection test with the Optris camera: select the Ethernet port connected to your Optris camera and click Change settings of this connection, then Properties; select Internet Protocol Version 4 (TCP/IPv4), then Properties; select Use the following IP address; set IP address to 192.168.0.100 and Subnet mask to 255.255.255.0. After you successfully test the camera Ethernet connection, revert this setting so that your Ethernet port resumes obtaining IP addresses automatically.
26. Test the Ethernet connection to the Optris camera: launch PIX Connect; click Devices and select the Optris camera you want to test; select the Connect checkbox and verify that the UDP Port number is 50000 (if you change the port number between when you configured it during initial camera setup, you have to re-enter the correct port number each time you launch the software); your operating system firewall may request permission to communicate, in which case select Private networks and Public networks and click Allow access (if you are unable to see an image from the camera, you may need to temporarily disable the Windows Firewall to complete this test, and ensure your computer is not connected to an open network while the firewall is disabled).
27. Confirm that the direct temperature mode checkbox is enabled.
28. Click Tools, then Configuration, then External Communication.
29. Confirm that a live image from the camera shows on the computer and that the Connected to IP address matches the one you set for the Optris camera during setup. The corners of the live image should say Temperature Mode.
30. Close PIX Connect and disconnect the PoE Switch from the computer.
31. Using an Ethernet cable, connect the PoE Switch to the secondary Ethernet port on the IR-9055.

Configure your thermal imaging device (Adding a Thermal Imaging Device (page 19)) and sensors (Discovering Optris Cameras (page 21)) in InsightCM.

4.5. Discovering Optris Cameras

Discover and configure the Xi410 Optris cameras on InsightCM. Before you begin, complete the setup process in Preparing Optris Cameras for Discovery (page 20) and add a thermal imaging device as described in Adding a Thermal Imaging Device (page 19). Have your camera IP address(es) and port number(s) ready.

1. Click Configuration and select Devices.
2. On the Devices tab, double-click the device to which the camera(s) connect. The camera's device connection both powers the device and carries the signal.
3. On the Cameras tab, click Add.
4. In the Add Cameras dialog box, click Discover; the IP addresses and port numbers of all valid cameras connected to the device appear in the table.
5. Select the cameras you want to add and click Apply.
6. When prompted, enter a descriptive name for each camera and click OK. Allow several minutes after you add a thermal imaging device before attempting to discover cameras.

Continue to Adding and Mapping Regions of Interest (page 22) to add regions of interest, and Configuring Temperature Deltas (page 22) to configure temperature deltas.

4.6. Adding and Mapping Regions of Interest

Define the section of a camera image that you want to monitor for thermal data. Complete the following steps to define a Region of Interest (ROI) to monitor using your thermal imaging camera and device.

1. Click the Configuration pull-down and select Devices.
2. In the list of devices on the Devices tab, double-click the device connected to the camera for which you want to define an ROI.
3. On the Cameras tab, select the camera that monitors the equipment for thermal data and click Manage ROIs.
4. In the [Camera Name] ROIs dialog box, click Add.
5. In the New ROI dialog box, select the piece of equipment the camera is monitoring.
6. In the box at the bottom of the New ROI dialog box, enter a descriptive name for the ROI and click OK.
7. In the ROIs dialog box, click the Capture Image button. If you added your camera as an offline device, but captured an image that you took from the device prior to connecting it to InsightCM, you may upload it as a JSON file and identify ROIs using the uploaded image.
8. Use the Rectangle ROI or Polygon ROI button to draw an ROI on the captured image. You can use the arrow buttons along the side of the image to nudge the ROI if the position of the camera shifts.
9. Without capturing a new image each time, repeat steps 2 through 7 until you have added all your ROIs.
10. Click Close when you are finished adding ROIs.

4.7. Configuring Temperature Deltas

Deltas measure the difference between two ROIs that have the largest temperature difference in a group of two or more ROIs. The delta is calculated by subtracting the lowest maximum temperature from the highest maximum temperature of a set of ROIs selected. You can set alarm conditions on deltas to monitor when the difference between ROI temperatures exceeds the value you specify. Complete the following steps to configure an ROI Delta.

1. Click the Configuration button and ensure that you are on the Asset Configuration page.
2. In the asset tree, select the piece of equipment that contains the ROIs for which you want to configure a delta.
3. Click Add and select Sensors, then Thermal Imaging, then Delta in the New Asset dialog box.
4. Enter a descriptive name for the delta and click OK.
5. On the Properties tab for the new ROI delta, click the Edit button next to the Camera field.
6. In the Camera dialog box, select the camera containing the ROIs you want to configure a delta for, and click OK; a new row for ROIs should appear.
7. Click the pull-down next to the ROIs field and select the ROIs you want the delta to compare. Your changes will be saved automatically.

You can monitor delta values using the thermal imaging viewer on the Data Viewer page after you send the connection information to the device.

5. System Operation

5.1. User Interface

There is no local user interface on the IR Thermography System hardware. The user interacts with the system entirely through InsightCM. Refer to the InsightCM user manual for the InsightCM version your facility is running.

5.2. Typical Daily Use

Users check InsightCM dashboards, review thermal images captured by the IR Thermography System, and review trend data for anomalies or alarm threshold crossings. Interaction is required any time an alarm condition is triggered, or as noted by the plant's preventive maintenance schedule.

5.3. Interpreting Thermal Data by Asset Type

What counts as a normal reading, and what should raise concern, varies significantly by the type of asset being monitored. The following guidance is organized by common asset type. Readings should always be compared against a known baseline for the specific asset and load condition wherever possible.

5.3.1. Generators

Normal reading: Stator, exciter, and connection-point temperatures typically stay within a few degrees of comparable connections under matched load. Some warming above ambient is expected and should scale with load current; symmetric components (for example, the three phases) should track closely to one another.

Reason for concern: A delta of roughly 4 to 15°C (7 to 27°F) above a comparable connection at similar load suggests a probable deficiency worth scheduling for repair; 15 to 40°C (27 to 72°F) indicates a serious problem needing prompt correction; anything above approximately 40°C (72°F) is typically treated as a critical, address-immediately finding. Any single connection running notably hotter than its symmetric counterparts is worth investigating regardless of the absolute number.

Degradation trend: A connection that shows a steady, repeatable rise across successive scans at similar load and ambient conditions, even while each individual reading is still within a normal band, is often the earliest sign of a loosening or corroding connection, since contact resistance and resulting heating tend to escalate as a connection degrades.

Relevant failure modes: Loose or corroded electrical connections, Overloaded or imbalanced circuits or phases, Insulation breakdown and hot spots.

5.3.2. Motors

Normal reading: Bearing housings and terminal box connections typically run within a few degrees of sister motors of the same type and duty. Overall casing temperature should scale predictably with load and ambient conditions.

Reason for concern: A bearing housing running meaningfully hotter than comparable motors, especially with no corresponding difference in load, suggests a lubrication or bearing wear issue. Hot spots concentrated at terminal lugs point toward loose or corroded electrical connections rather than a mechanical problem.

Degradation trend: A gradual, sustained rise in bearing temperature over successive weeks or months, independent of load and ambient swings, often precedes a bearing or lubrication failure, frequently well before it would show up in vibration data.

Relevant failure modes: Loose or corroded electrical connections, Improper lubrication, Mechanical friction points, Cooling system inefficiencies.

5.3.3. Transformers

Normal reading: Bushings and connections at equivalent phases should track closely to one another under matched load. Radiator and cooling fin banks should show a fairly even, predictable temperature gradient consistent with normal convective oil flow.

Reason for concern: A single bushing or connection running hotter than its phase-mates by more than the severity thresholds described above suggests a developing electrical issue. A radiator fin or section that is cooler than its neighbors, rather than hotter, can indicate blocked or restricted oil flow rather than an overload condition.

Degradation trend: A specific bushing or connection creeping upward relative to its phase-mates across successive scans at comparable load, or a cool region in a radiator bank that grows over time as flow blockage worsens.

Relevant failure modes: Loose or corroded electrical connections, Overloaded or imbalanced circuits or phases, Insulation breakdown and hot spots, Cooling system inefficiencies.

5.3.4. Pumps

Normal reading: Bearing, seal, and coupling housing temperatures typically run within an expected band tied to the pump's duty point, and should correlate predictably with flow and load.

Reason for concern: A seal or bearing running notably above its own historical baseline, or hotter than an equivalent pump running the same duty, suggests a lubrication or wear issue. Asymmetric heating across the two halves of a coupling can indicate misalignment.

Degradation trend: A slow, steady increase in bearing or seal temperature across successive readings, especially when it is not explained by a process or load change, is a classic early precursor to lubrication breakdown or bearing failure.

Relevant failure modes: Improper lubrication, Misalignment, Mechanical friction points.

5.3.5. Turbomachinery

Normal reading: Casing and bearing temperatures should track predictably with load and process conditions (steam or gas temperature, flow), and should be broadly symmetric front to back and side to side unless the design has a known asymmetric feature.

Reason for concern: A localized hot spot, particularly one that reappears in the same location on repeated scans, can indicate internal rubbing or a developing misalignment. Bearing temperatures outside the OEM-specified normal band are also worth flagging even without an obvious hot spot.

Degradation trend: A hot spot that reappears in the same location and grows in size or intensity across successive scans is a strong indicator of a worsening mechanical condition, such as progressive rubbing or misalignment.

Relevant failure modes: Misalignment, Mechanical friction points, Cooling system inefficiencies.

5.3.6. Breakers/Panels

Normal reading: The temperature rise across a breaker or bus connection relative to ambient should stay within a modest, predictable range at typical load, and should be comparable across similar breakers and connections within the same panel.

Reason for concern: Any single connection point running meaningfully hotter than adjacent, similarly loaded connections is a concern; the same generic severity bands described under Generators apply here (mild, serious, or critical based on delta-T above a comparable connection).

Degradation trend: A connection trending hotter across successive PM cycles at comparable load, even while still in a mild band, indicates progressive loosening or corrosion and is worth tightening or inspecting before it reaches a serious or critical threshold.

Relevant failure modes: Loose or corroded electrical connections, Overloaded or imbalanced circuits or phases, Insulation breakdown and hot spots.

6. Troubleshooting

The following table lists common fault scenarios for the IR Thermography System hardware and configuration. This is not a comprehensive list of every possible issue; contact Cutsforth Support if an issue is not resolved using the guidance below.

Symptom / Condition	Probable Cause	How to Troubleshoot / Fix
Camera does not appear during the Discover step in InsightCM	Direct Temperature Mode not enabled in PIX Connect, or the camera's Ethernet settings do not match the subnet and port configured on the device	Reconnect the camera via USB and confirm the Enable checkbox under Direct Temperature Mode (External Communication tab) is checked. Verify Device Address, Send-to address, and Port match the values set during Ethernet Settings configuration. Confirm the camera has power. Allow several minutes after adding the device before retrying discovery.
ROI temperature reading does not match a handheld thermal gun or known reference	Incorrect emissivity setting for the target surface, camera out of focus, or reflected heat from a nearby source	Verify and adjust the emissivity setting for the target's actual surface material and finish. Use a reference material with known emissivity, such as black electrical tape, as a calibration check. Refocus the lens and re-aim to avoid glare or reflection from adjacent heat sources.
Live camera image is blurry or soft	Motorized focus has drifted, or the lens is dirty or smudged	Inspect the lens and clean it per the preventive maintenance guidance in Calibration and Preventive Maintenance (page 28) (soft, lint-free cloth only; never touch with bare fingers). Command a re-focus through PIX Connect or InsightCM. Confirm camera-to-target distance has not changed since installation.
Camera enclosure interior shows condensation or fogging	Compromised door seal or gasket, or, on the non-climate-controlled EIRA-004 enclosure, ambient conditions dropping below the dew point without adequate internal air circulation	Inspect the door seal and latch for damage or improper closure. Confirm the heater and fan (or active cooling, on the EIRA-002 / EIRA-002-PoE climate-controlled enclosure) is functioning. Verify the enclosure door is fully latched.
cRIO does not come online, or InsightCM server cannot connect to it	Network cabling issue, IP address conflict on the plant network, or a power fault at the cRIO enclosure	Verify the Ethernet or fiber connection from the cRIO to the plant network. Check the cRIO's internal breaker and power supply. Look for IP address conflicts. Confirm plant firewall and VLAN settings allow communication with the InsightCM server.
Intermittent temperature spikes or dropouts in an otherwise stable ROI	Loose Ethernet connection between camera and cRIO, or electrical noise along a cable run routed too close to AC power	Reseat or replace the Ethernet connectors at both ends. Confirm the data cable run maintains the separation from AC power conduit recommended in Installation (page 15). Consider shielded cable if not already in use.

7. Calibration and Preventive Maintenance

ELECTRICAL DANGER

Follow all plant safety and lockout/tagout requirements before accessing the equipment referenced in these procedures.

7.1. Clean the Camera Lens

Preventive Maintenance Need: Advised

Frequency: As needed

Action: Clean the camera lens using a soft, lint-free, scratch-free cloth.

CAUTION

The camera lens is a precision optical component. Do not touch the lens with bare fingers, and avoid scratching the lens surface. Keep the lens cap in place whenever the camera is not in active service.

7.2. Clean the Outside of Enclosures

Preventive Maintenance Need: Advised

Frequency: As needed

Action: Clean the exterior of the enclosure(s), as needed, to remove excess buildup of dust, debris, or other contamination and to prevent overheating. Ensure the enclosure door is shut while cleaning to prevent contact with internal components. Use a non-conductive, non-residue cleaner (a 70% isopropyl alcohol and 30% water mixture) and a soft, lint-free, scratch-free cloth that will not scratch the enclosure surface.

7.3. Clean Enclosures' Internal Electrical Components

Preventive Maintenance Need: Advised

Frequency: As needed

Action: Using a compressed-air duster approved for electronics, blow all dust and debris off the electrical components inside the enclosure(s).

7.4. Calibration

No Cutsforth-specific calibration procedure has been established for this product at the time of this document's publication. If camera performance or reading accuracy is in question, contact Cutsforth Support.

8. Reference Information

8.1. Understanding Emissivity and Thermal Readings

IR thermography measures emissivity, not actual surface temperature, and those two are often conflated. This means two objects with different surface finishes or materials, but the same actual temperature, will measure as different temperatures in the thermal image. It is important to keep this difference in mind when reviewing thermal imagery. A piece of reference material with a known emissivity, such as black electrical tape, can be used as a temperature calibration reference.

8.2. Related Documents

Document Name	Document Number
Infrared Thermography Installation Planning Guide	EZDP-2152
Wiring diagram associated with your hardware part number	Refer to product part number (e.g., EIRA-001)
InsightCM User Manual	Refer to the InsightCM version your facility is running

9. Glossary

AC (Alternating Current)	An electrical power supply in which current periodically reverses direction. Required for powering the cRIO and camera enclosures.
APR (Advanced Pattern Recognition)	A machine-learning or statistical modeling method that uses historical sensor data to detect abnormal asset behavior and predict developing failures. InsightCM can send feature data to plant historians for use in APR models.
asset tree	A hierarchical representation of plant equipment inside InsightCM. Used for organizing devices, configuring monitoring, and associating data with specific assets.
cRIO	NI Compact Reconfigurable I/O Controller.
delta (temperature delta)	The difference between the highest and lowest maximum temperatures among a group of two or more selected Regions of Interest (ROIs).
emissivity	A measure of a material's efficiency in emitting infrared energy, relative to a perfect emitter. Because emissivity varies by surface material and finish, two objects at the same actual temperature can display different temperatures in a thermal image if their emissivity differs.
heat signature	A visible thermal pattern captured by the IR camera, representing temperature distribution on a surface.
IK rating	A rating that indicates an enclosure's resistance to mechanical impact.
IP rating (ingress protection)	A standardized classification that describes an enclosure's resistance to dust and water.
InsightCM™ (ICM)	InsightCM™ is application software for condition monitoring with full access to waveforms, multiple sensor technology inputs, enterprise software connectivity, and analytics packages.
I/O	input/output
infrared (IR)	A wavelength of light not visible to the human eye but detectable with specialized cameras to measure surface temperatures.
NEMA rating	A North American standard classifying enclosure protection levels against environmental conditions.

regions of interest (ROIs)	User-defined rectangular or polygonal areas within a thermal image. InsightCM trends minimum, maximum, average, and delta temperatures for each ROI.
trending	The process of recording and analyzing temperature changes over time to detect abnormal patterns or emerging failures.