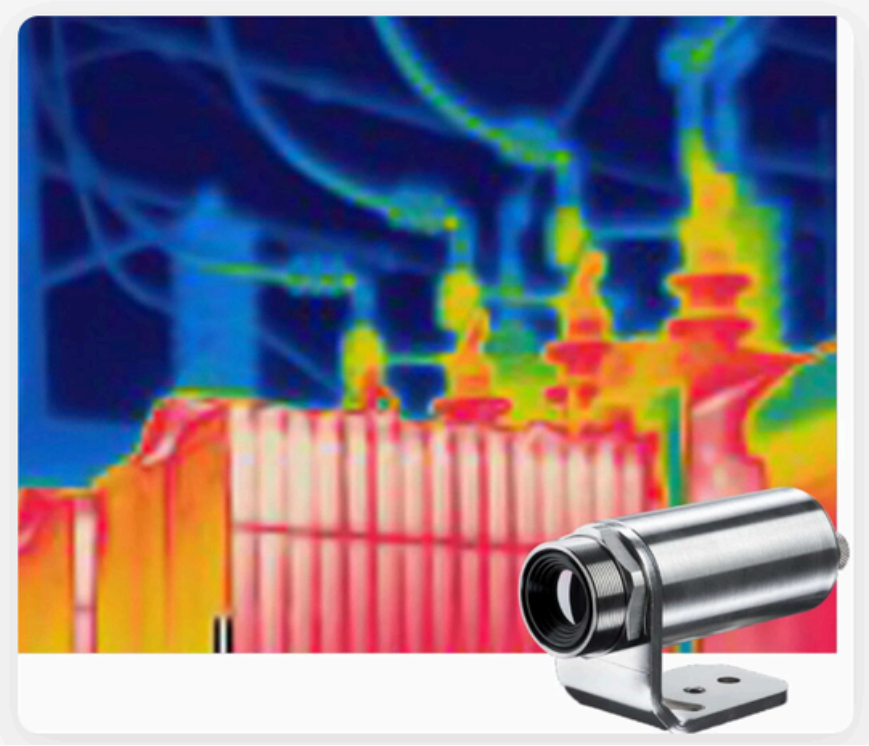
CUTSFORTH

Installation Planning Guide EZDP-2152 Rev B

Infrared Thermography



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1. About Cutsforth

Cutsforth specializes in developing innovative new technologies and services to support the power generation industry. Cutsforth's patented EASYchange® brush holder design, online truing service, InsightCM™ condition monitoring software, and patented shaft grounding and monitoring systems have been installed across the globe in generators of all sizes and in nearly every industry application, including nuclear, natural gas, coal, wind, and hydroelectric.

Cutsforth's knowledge and commitment to excellence drives our innovative solutions for the changing needs of the power industry. Whether it is a quick response to a critical situation or a new way of solving an old problem, our commitment to quality ensures that our customers receive best-in-class products and services—Cutsforth is the Power of Innovation.

Cutsforth started back in 1991 as a small company focused primarily on making replacement brush holders for generators and exciters. Today, after 30+ years in business, Cutsforth's experience and innovative designs have brought its best-in-class excitation brush holder and shaft grounding replacements and collector ring services to some of the world's largest power companies.

1.1. Cutsforth Products

- EASYchange® Removable Brush Holders
- EASYchange® Brush Condition Monitoring
- Cutsforth Shaft Grounding Systems
- Rotor Flux Monitoring
- Electro-Magnetic Interference Monitoring
- InsightCM™ Condition Monitoring Software

1.2. Cutsforth Field Services

Cutsforth provides comprehensive product installations for all product offerings as well as on-site training after the installation. We work efficiently during your outage to ensure a smooth upgrade to our innovative solutions such as Product Installations, Online Collector Ring and Commutator Truing, Spiral Groove Restoration, and Consulting and Emergency Services.

1.3. Cutsforth Automation and Control Services

Cutsforth provides comprehensive Automation and Control services which include data historian integration, InsightCM™ integration, DCS logic, engineered drawings and much more. This further complements our turnkey monitoring system installations.

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1.4. Approved Manufacturing Location

CUTSFORTH

Cutsforth LLC

5160 Industrial Place #101

Ferndale, WA 98248

Customer Support: support.cutsforth.com

Website: Cutsforth.com

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For a period of ninety (90) days from the date of invoice, Cutsforth warrants that (i) its software products will perform substantially in accordance with the applicable documentation provided with the software, and (ii) the software media will be free from defects in materials and workmanship. If Cutsforth receives notice of a defect or non-conformance during the applicable warranty period, Cutsforth will, in its discretion: (i) repair or replace the affected product, or (ii) refund the fees paid for the affected product. Repaired or replaced hardware will be warranted for the remainder of the original warranty period or ninety (90) days, whichever is longer. If Cutsforth elects to repair or replace the product, Cutsforth may use new or refurbished parts or products that are equivalent to new in performance and reliability and are at least functionally equivalent to the original part or product. You must obtain an RMA number from Cutsforth before returning any product to Cutsforth. Cutsforth reserves the right to charge a fee for examining and testing hardware not covered by the Limited Warranty.

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2.3. Patents

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3. Safety Information

3.1. 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.

Please note that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

3.1.1. 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.

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3.1.2. 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.
- Always ensure proper installation of the holder assembly and shaft grounding rope.

ELECTRICAL DANGER

Before working on the generator, de-energize, lock out, and tag out all power sources to the generator, shaft, and accessory devices. Electric shock and death may result due to failure to heed this warning.

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.

3.2. 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.

Veuillez noter que si l'équipement est utilisé d'une manière non spécifiée par le fabricant, la protection assurée par l'équipement peut être compromise.

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3.2.1. 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.

3.2.2. 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;
- Toujours s'assurer que la structure de soutien et le câble de terre de l'arbre de la génératrice sont correctement installés.

RISQUES DE CHOC ÉLECTRIQUE

Avant de travailler sur la génératrice, désalimentez, cadenassez et étiquetez toutes les sources d'énergies liées à la génératrice, à l'arbre et aux appareils accessoires. L'opérateur s'expose à des risques de chocs électriques pouvant causer la mort s'il ne tient pas compte de cet avertissment.

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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.

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4. System Overview

This manual is a guide for planning the installation of the Infrared Thermography system.

This manual does not cover all details or variations in equipment, nor does it consider every possible contingency for installation, operation, or maintenance. If you have questions or concerns that are not addressed in this manual, contact Cutsforth Engineering Support.

4.1. Infrared Thermography System Overview

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 high-resolution 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.

Cutsforth's IR Thermography system delivers powerful, real-time thermal intelligence that strengthens predictive maintenance programs, reduces operational risk, and enhances both safety and equipment performance.

Some of the common assets monitored with IR:

- Generators
- Motors
- Transformers
- Pumps

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- Turbomachinery
- Breakers/Panels

Some of the common failure modes managed with IR:

- 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

4.2. 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 https://support.cutsforth.com.

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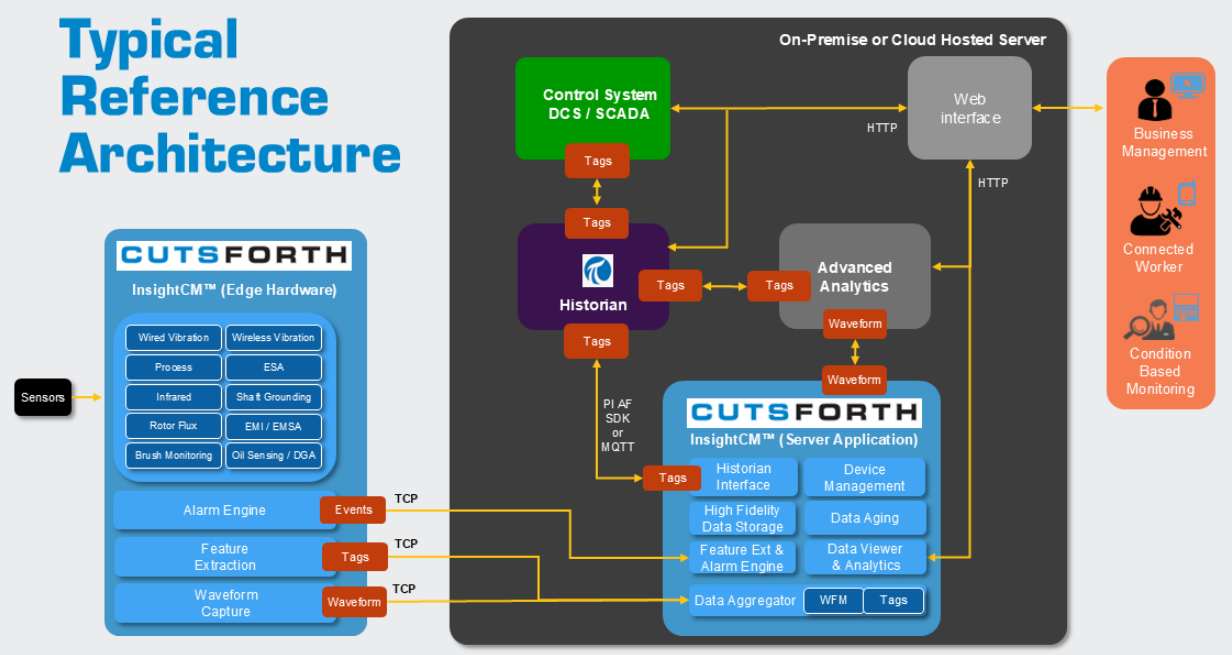
5. IT System Requirements

5.1. Overall Architecture



5.2. 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.

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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

5.3. 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.

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6. Physical Installation Overview

6.1. Equipment List

To install the IR Thermography system, you need the equipment listed below. Some 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		✓

6.2. Installation

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 – 240VAC 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.

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6.2.1. Conduit Layout

Color on Diagram	Conduit Run Description	Conduit Trade Size*	Wire Description	Purpose	Max. Cable Length	Wire Supplied By
Purple	Plant power to IR Camera Enclosure(s)	¾ in (2 cm)	120VAC Power (20A dedicated circuit – preferably with isolated ground)	Power for the camera enclosure	N/A	Plant Electrical Contractor
Yellow	IR Camera Enclosure to cRIO Enclosure	¾ in (2 cm)	Cat6a	Data from camera to cRIO	100 ft	Plant Electrical Contractor
Blue	IR cRIO Enclosure to InsightCM Server	¾ in (2 cm)	Cat6a or Fiber	Data to InsightCM Server	330 ft (100 m)	Plant Electrical Contractor
Red	Plant power to IR cRIO Enclosure	¾ in (2 cm)	120VAC Power (20A dedicated circuit – preferably with isolated ground)	Power for the cRIO enclosure	N/A	Plant Electrical Contractor

*cRIO Enclosures do not come with conduit holes pre-drilled. Conduit sizing and hole placement is customizable.

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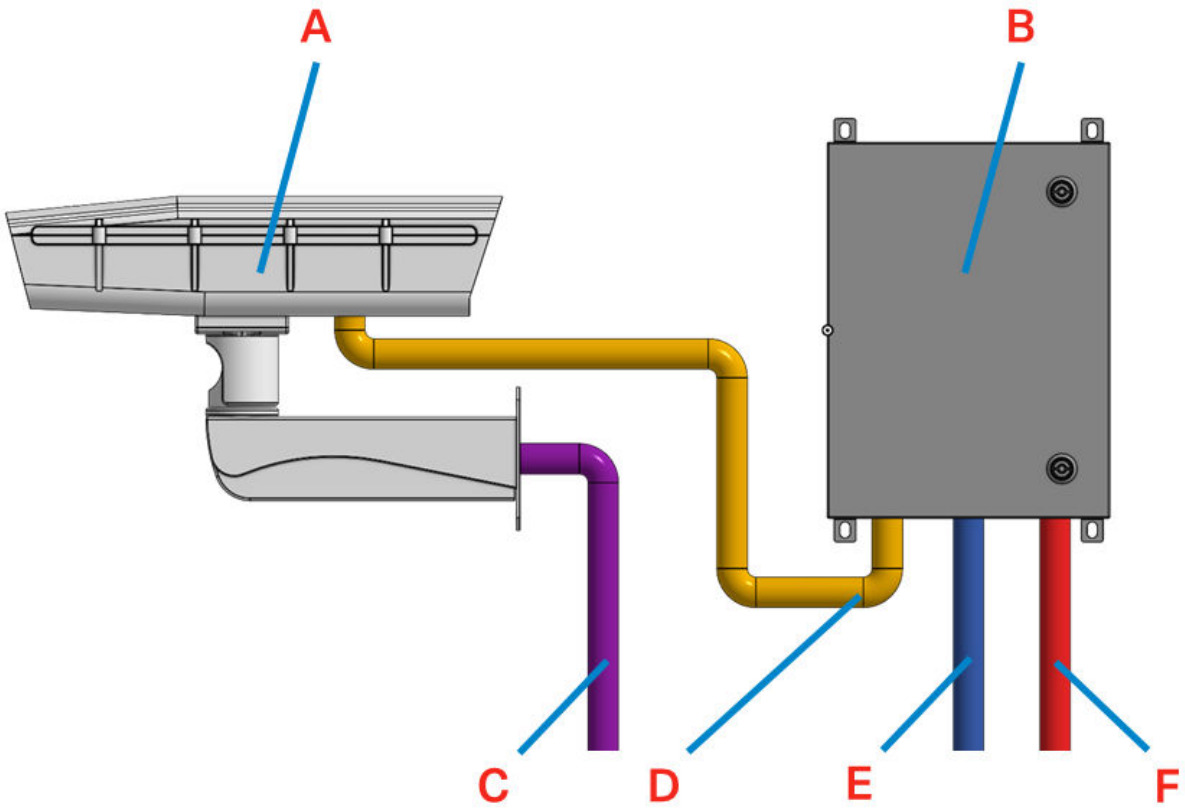

Up to seven (7) cameras can be connected to each cRIO, provided that cable lengths stay within the specified limitations.

Part	Name
A	Cutsforth IR Thermography Camera Enclosure
B	Cutsforth IR Thermography cRIO Enclosure
C	Purple: Plant Power Input to Camera Enclosure
D	Yellow: Data from Camera to cRIO
E	Blue: Data Output to InsightCM Network
F	Red: Plant Power Input to cRIO Enclosure

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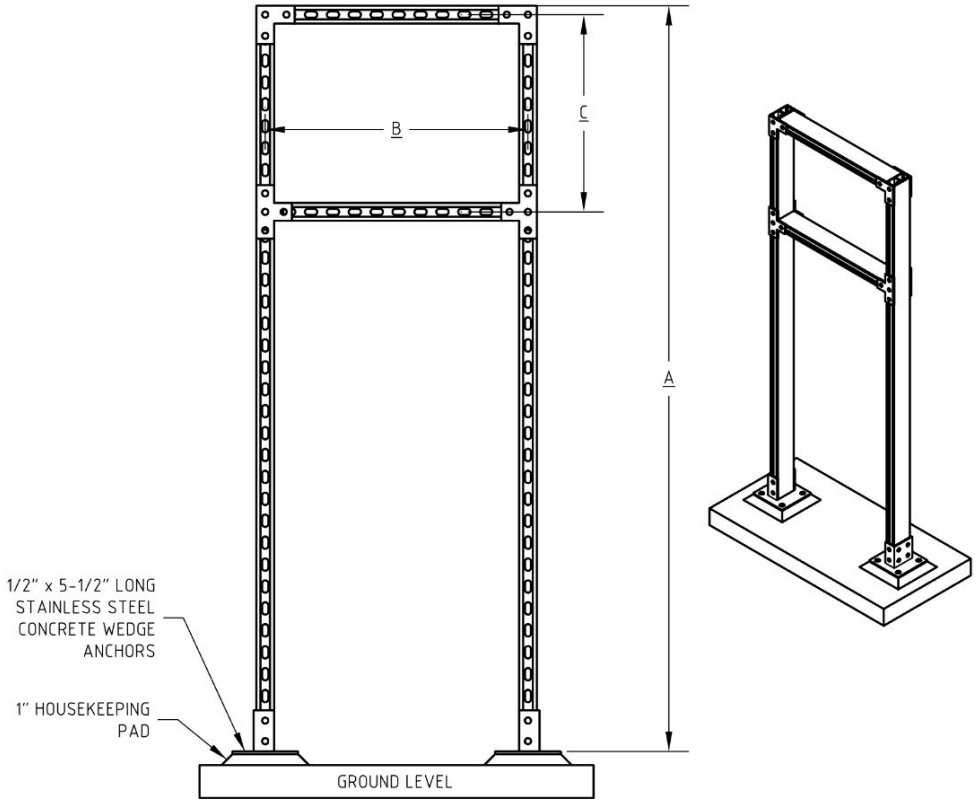
6.2.2. Conduit and Strut Channel Recommendations

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

6.2.2.1. 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

6.2.3. Enclosure Specifications

6.2.3.1. IR Thermography cRIO Enclosure

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

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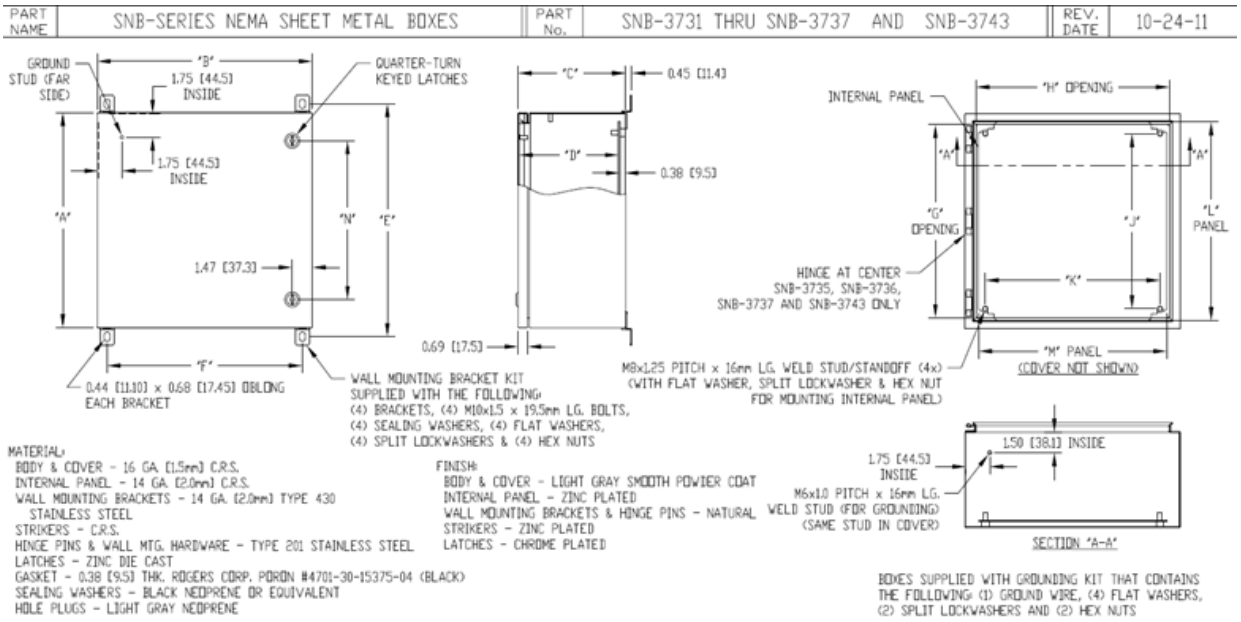

Specifications:

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

6.2.3.2. IR Thermography Camera Enclosure

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

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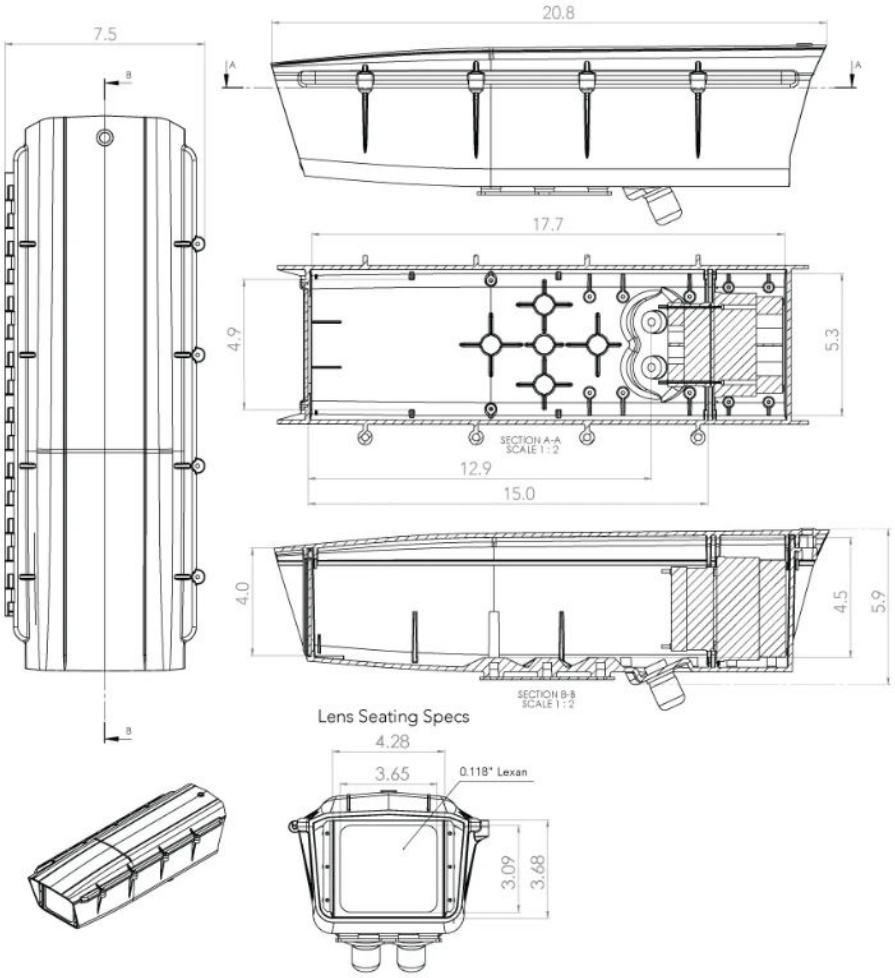

Specifications:

- 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

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6.2.3.3. Enclosure Cleaning

CLEANING THE ENCLOSURE

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

6.3. Power Requirements

6.3.1. AC Power Supply Requirements

6.3.1.1. cRIO Enclosure

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

6.3.1.2. Camera Enclosure

Plant-supplied power source	120 V, 60 Hz or 240 V, 50 HZ
Circuit breaker	N/A
Maximum power consumption	165 W

6.3.2. AC Power Specifications

6.3.2.1. cRIO Enclosure

Input Voltage Range	100 – 240 VAC
Input Frequency Range	50 – 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 – 10 AWG

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6.3.2.2. Camera Enclosure

Input Voltage Range	90 – 305 VAC
Input Frequency Range	47 – 63 Hz
Input Power Rating	240 W
Input Wire Connection Type	Butt splice, Wire nut
Input Wire Size	22 – 14 AWG

6.4. Environmental Specifications

6.4.1. cRIO Enclosure

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

6.4.2. Camera Enclosure

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

6.5. Product Certifications

Table 1. North America

Electromagnetic Compatibility (EMC)	Conforms to FCC 15.107 2026, Class A FCC 15.109 2026, Class A Certified to ICES-003 Issue 7 2020, Class A
Safety	Conforms to UL 508A and CSA C22.2 No. 286

Table 2. EU Directive Information – CE Compliance

Electromagnetic Compatibility (EMC) Directive 2014/30/EU	Tested to EN IEC 61326-1 2021, Class A

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Table 3. UKCA

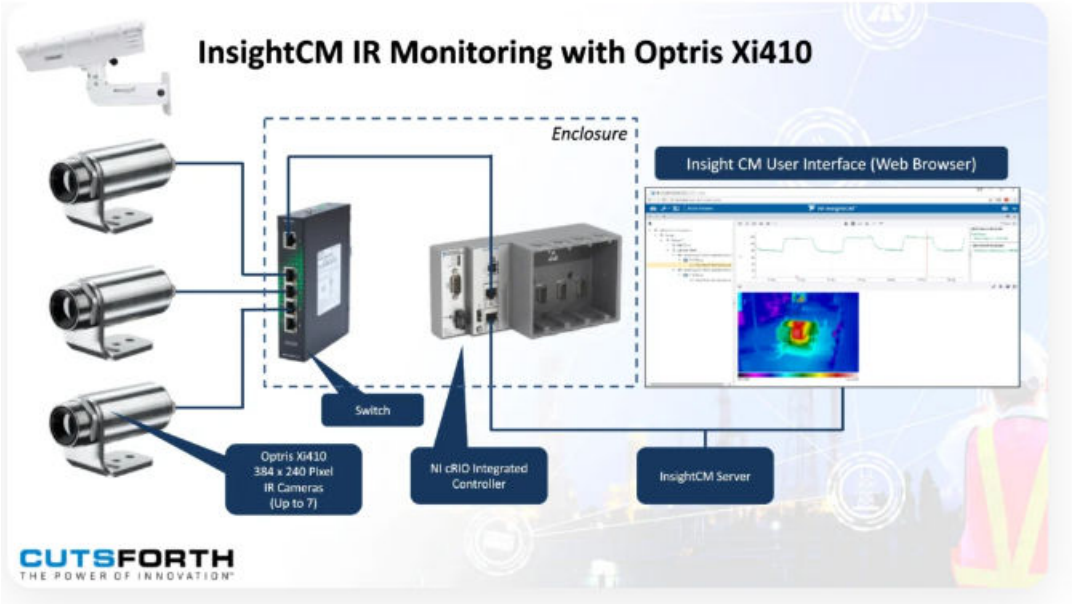
Electromagnetic Compatibility (EMC) 2016	Tested to EN 61326-1 2021, Class A

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.

6.6. Instrumentation



6.7. Integration and Infrastructure

The Cutsforth ESA Monitoring System is designed to be integrated into InsightCM™ software. For more information on InsightCM™, including specific server requirements, visit the InsightCM™ README on the Cutsforth Support webpage at https://support.cutsforth.com.

The plant must provide a PC or Server for InsightCM™ meeting the requirements listed at the above link. Cutsforth is not responsible for the configuration of server-side deployment. Ensure the plant's

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InsightCM™ server is set up and ready for communication to field equipment in advance of system commissioning by Cutsforth.

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7. Configuring InsightCM for IR Assets

7.1. Thermal Imaging Device Types

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

Device Type	Compatible Camera(s)	Sensor Asset Type	Description
IR-3120[1]	FLIR A35, FLIR A65	Delta, ROI	Supports up to two thermal cameras. See the IC-3120 help for more information.
IR-9055[2]	Xi410	Delta, ROI	Supports up to ten thermal cameras. See the cRIO-9055 help for more information.

[1]Connects directly to the device controller by ethernet connection, not by channels on a module.

[2]Connects to the device through a Power over Ethernet (PoE) adapter, not by channels on a module.

7.1.1. 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.
   a. **Device Name**—The name that will appear throughout the web application.

      Assign your device an easily identifiable name, such as one that includes the device location.

   b. **Hardware Name**—The hostname of the device, which is in the format of `NI-IC-ModelNumber-SerialNumber` by default. If the device is online, the server automatically populates this name. Otherwise, you can find the two values printed on a label on the back of the device.

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8. Click **Finish**.
9. When the web application prompts you to send the connection information to the device web server, click **Yes**.

Discover your FLIR (page 26) or Optris (page 29) cameras.

7.1.2. Discovering FLIR Cameras

Discover and add the FLIR A35 and/or FLIR A65 cameras you will use to monitor your equipment's thermal data.

Ensure that you have completed the steps in Adding a Thermal Imaging Device (page 25) and that you have the serial number for each camera you intend to add.

1. Click **Configuration** ( ) and select **Devices**.
2. On the **Devices** tab, double-click the device to which the camera(s) connect.

   Cameras are connected and also powered through their connection to the device.

3. On the **Cameras** tab, click **Add**.
4. In the **Add Cameras** dialog box, click **Discover** and the serial 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.

Add regions of interest (page 29) and configure temperature deltas (page 30).

7.1.3. 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.

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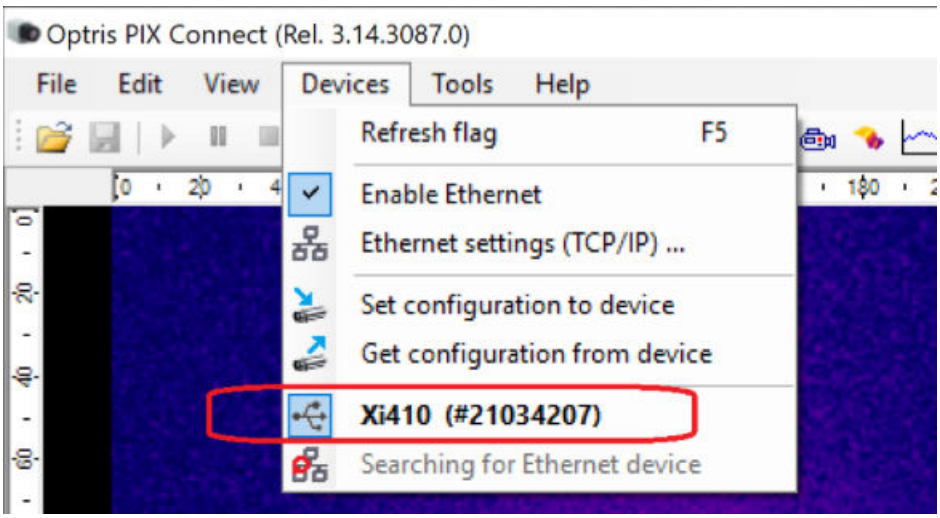
3. Click **Devices** and verify that PIX Connect recognizes the camera.



4. Click **Help > About** and verify that the Imager Firmware version on the camera is at least 3814 or newer.

Imager Firmware version is older than 3814	1. Click Tools → Extended → Update Firmware. 2. Deploy the latest firmware to the camera from PIX Connect. 3. Click Help → About to confirm the firmware update. 4. Click **Close**.
Imager Firmware version is 3814 or newer	Click **Close**.

5. Click **Devices > 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 > Configuration**.
14. On the **Device** tab, input a Temperature Range.

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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 > 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 adaptor options**.
25. Set up your ethernet port for a connection test with the Optris camera.
    a. Select the Ethernet port that is connected to your Optris camera and click **Change settings of this connection > Properties**.
    b. Select **Internet Protocol Version 4 (TCP/IPv4) > Properties**.
    c. Select **Use the following IP address**.

       After you successfully test the camera ethernet connection, revert this setting so that your ethernet port resumes obtaining IP addresses automatically.

    d. Set **IP address** to **192.168.0.100**.
    e. Set **Subnet mask** to **255.255.255.0**.
26. Test the ethernet connection to the Optris camera.
    a. Launch PIX Connect.
    b. Click **Devices** and select the Optris camera you want to test.
    c. 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.

       As a result, your operating system firewall may request permission to communicate.

    d. 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 disable the Windows Firewall until you complete this test. If you disable the Windows Firewall, ensure that your computer is not connected to an open network while the firewall is disabled.

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e. Confirm that the **direct temperature mode** checkbox is enabled.

f. Click **Tools > Configuration > External Communication**.

g. 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.

27. Close PIX Connect and disconnect the PoE switch from the computer.
28. Using an ethernet cable, connect the PoE Switch to the secondary ethernet port on the IR-9055.

Configure your thermal imaging device (page 25) and sensors (page 29) in InsightCM.

7.1.4. Discovering Optris Cameras

Discover and configure the Xi410 Optris cameras on InsightCM.

Before you begin, complete the set-up process (page 26) for the Optris cameras and add a thermal imaging device (page 25). 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** and 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.

Add regions of interest (page 29) configure temperature deltas (page 30)

7.1.5. 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.

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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 2–7 until you have added all your ROIs.
10. Click **Close** when you are finished adding ROIs.

7.1.6. 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** » **Thermal Imaging** » **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, click **OK** and 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.

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

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8. 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.
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™	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.

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