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# BUYER'S GUIDE

## CONTINUOUS CONDITION MONITORING

# CONTENT

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# WELCOME TO THIS GUIDE

The rapid development of the industrial internet of things, artificial intelligence, and sensing technologies make continuous condition monitoring (CM) systems more capable than ever. Implementing a continuous CM program can seem daunting, with so many options for sensing, connecting, and communicating. To help you sort everything out, we created this guide to educate and summarize the critical considerations for continuous CM. In this guide, we break things down into the following categories:

- Sensors
- Security
- Connectivity
- Expandability and Scalability
- System upgrades and updates
- Integrator Expertise and Support

While we tried to make this a comprehensive guide, we understand you may still have questions. As such, we are always available by email, text, or phone to help in any way we can. So please don't hesitate to reach out. It is our pleasure to assist!

- The MoviTHERM Team

# ABOUT US

**MOViTHERM**
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# OVER 20 YEARS OF EXPERIENCE

MoviTHERM has over 20 years of experience in engineering solutions that leverage the sensing advantages of thermal imaging. Our strategic partnerships with key suppliers provide access to the latest and greatest sensing technology. Our experience, combined with the newest tech, produces "a generation ahead" smart IR solutions for early fire detection, condition monitoring, automated quality inspection, and infrared non-destructive testing.

Our vision is to make hindsight irrelevant for our customers by eliminating surprises and guesswork. Our solutions provide the foresight needed to take best-informed actions before failures occur. We turn efforts from reactive to proactive, thus avoiding the pain of making mistakes.

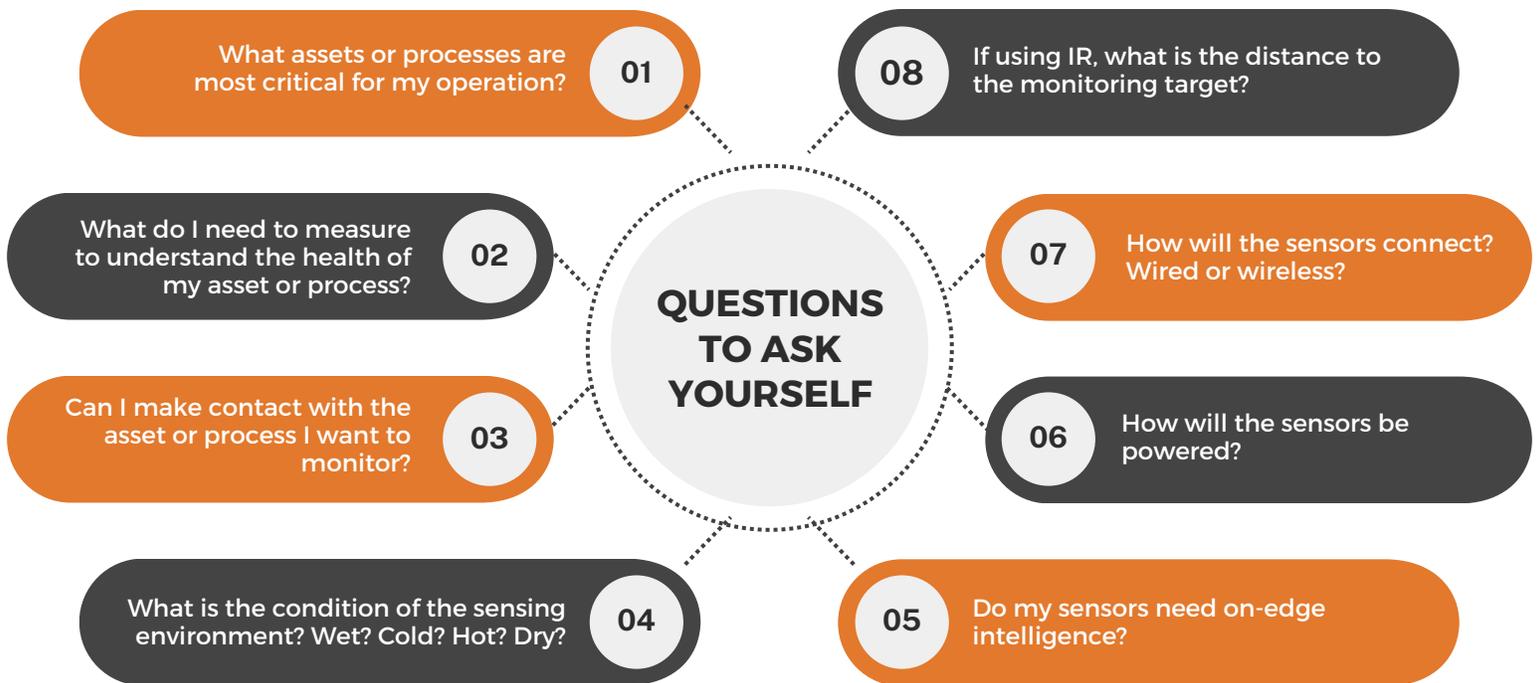# HOW TO CONTACT US

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# CHOOSING THE RIGHT SENSORS

## "WHAT SENSORS SHOULD I USE?"

Several sensor technologies are available today for assessing the health condition of electrical, mechanical, steam, and hydraulic systems. Choosing the correct sensors is critical to ensure an asset or process's complete condition health assessment. Below, we listed 8 questions you should ask yourself while selecting a sensor for your continuous CM application.

**QUESTIONS TO ASK YOURSELF**

**01** What assets or processes are most critical for my operation?

**08** If using IR, what is the distance to the monitoring target?

**02** What do I need to measure to understand the health of my asset or process?

**07** How will the sensors connect? Wired or wireless?

**03** Can I make contact with the asset or process I want to monitor?

**06** How will the sensors be powered?

**04** What is the condition of the sensing environment? Wet? Cold? Hot? Dry?

**05** Do my sensors need on-edge intelligence?

# ACCURATE MEASUREMENT

In some cases, having input from multiple sensor types is essential for accurate condition valuation.  For example, when using infrared thermography to assess a fuse bank, it is also critical to know the electrical load on the system. Collecting amperage and voltage data is just as crucial as the IR Camera temperature data to assess the fuse panel's health accurately. Not having the complete picture, one could erroneously diagnose a faulty fuse as healthy if it is under a no-load condition and shows low temperatures.

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# COMMONLY USED SENSORS

A multi-sensor approach to countinuous CM increases the chances of discovering multiple failure modes and detecting them early enough to make the necessary repairs before they become catastrophic.

| Infrared Camera | Spot Pyrometer | Ultrasound | Vibration | Humidity | Voltage & Amperage |
|---|---|---|---|---|---|

# WIRELESS SENSORS

How the sensors connect is also a critical selection criterion. Sensors that require wired connections for power and communications add to the infrastructure and installation costs. In contrast, wireless sensors that connect via standard protocols, like LoRa, are easy to install and configure.

**LoRa®**

# INFRARED CAMERAS

Infrared (IR) cameras operate on the heat transfer principle of radiation. The infrared camera has a focal plane array of detector elements that sense infrared light from object surfaces and displays it as a viewable image. Calibrated IR cameras can report temperature measurements from specific spots, lines, and areas on live or recorded images.

Infrared thermography uses an infrared camera to assess the condition of an asset or process. Infrared thermography is an effective non-contact health assessment tool for electrical, mechanical, steam, hydraulic, and steam systems.

Faults in electrical and mechanical systems are usually indicated by an increase in temperature. For example, with increased electrical resistance, there is a corresponding increase in heat. The increased electrical resistance could result from a loose connection, corrosion, or component failure. Regardless of the cause, increases in resistance produce heat that can be seen and measured with an infrared camera.

In mechanical systems, friction increases will cause an increase in heat. Mechanical friction could result from bearing wear, poor lubrication, or misalignment. Regardless of the cause, the increase in mechanical system temperature can be monitored with an infrared camera.

# SPOT PYROMETER

Spot pyrometers function on the same physics as IR cameras, with the key difference of making a single-point measurement versus an array of measurements from a thermal image. Spot pyrometers provide a wide choice of temperature and spectral ranges, covering multiple industrial applications. They are relatively inexpensive and are effective in providing non-contact temperature measurement in harsh environments.

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# VIBRATION

A vibration sensor is a contact device that measures the amount and frequency of vibration in a mechanical system or piece of equipment. One can detect mechanical imbalance, misalignment, looseness, and late-stage bearing wear by sampling and analyzing the vibration measurements. Early fault detection and correction with vibration analysis can prevent impending and potentially costly failures.

Types of vibration sensors include displacement sensors, velocity sensors, and accelerometers. Accelerometers are the best choice for most machine monitoring because they are versatile, reliable, simple, and easy to apply.

# ULTRASOUND

Ultrasonic sensors detect airborne and structure-borne ultrasounds inaudible to the human ear and convert them into audible and viewable signals. Ultrasound is a proven technology that detects specific mechanical, electrical, and other faults much sooner than other technologies. For instance, ultrasound monitoring can detect the most subtle ultrasonic noise from the friction of poorly lubricated or failing bearings before producing measurable heat. Additional applications for ultrasound sensing include the detection of leaks, blockage, stuck valves, and failed traps in steam systems. Or identifying anomalies like corona, arcing, and tracking in electrical systems.

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# NETWORK SECURITY

## STAYING SAFE FROM HACKERS

It seems like we hear more and more about networks being hacked or companies being held hostage by hackers who have overtaken systems until ransoms are paid. As we become a more connected world with the proliferation of the internet of things and cloud-connected devices, the need for network security is ever-increasing. Especially for systems that monitor critical processes like continuous CM, the need to keep networks hack-free and safe must be considered. As it applies to installing and running a continuous CM system, the following are key security areas.

# ON NETWORK VS OFF NETWORK SYSTEMS

Companies today have two options for a network-based continuous CM system. They can choose to have the system reside on the company's network. The same network that supports its infrastructure, processes, and operations. Or they can decide to run the system separate from the company network, or in other words, "off-network." The advantage of operating a continuous CM system independent of the company network is that there is zero chance the company network can ever be hacked via the monitoring system. When operating a cloud-based platform, it is important to understand what cloud server will be used and what encryption is provided. For example, the Amazon Web Services platform uses 2048-bit encryption to ensure system security.

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# CELLULAR CONNECTIVITY

## CONNECTING TO THE CLOUD

Cellular connectivity is one "off-network" option that can be used to connect a continuous CM system to the cloud.

Advantages to this approach include:

- Off-network connectivity with zero IT burden
- Reduced cabling simplifying the installation
- Cybersecure with modem firewalls and VPN
- Multi-carrier options with robust fail-safe switching
- Simplified remote support
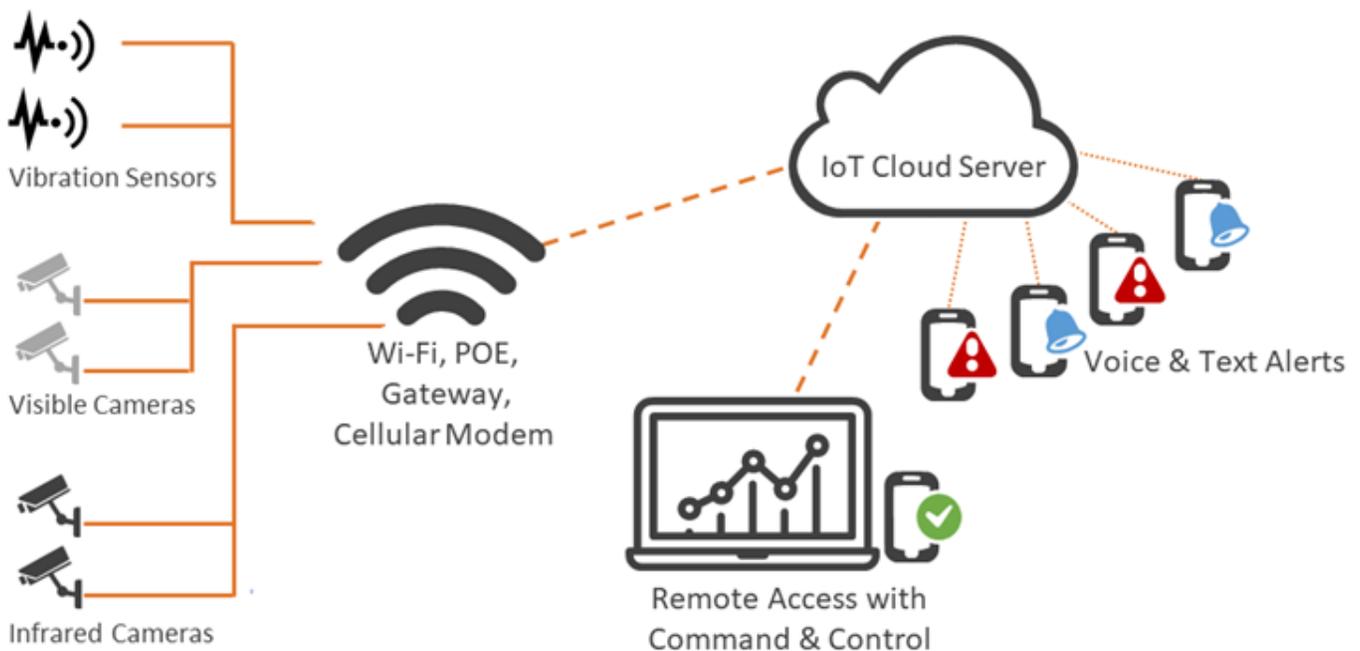


The figure above illustrates a continuous CM system that utilizes cellular for cloud connectivity.

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# CONNECTIVITY & REPORTING

The next area to discuss is system reporting and connectivity. This includes not only how you access the system, but how the system accesses you. Just as important to know if an alarm has been triggered is the need to know that the system is operating correctly. An important aspect of system connectivity is how information and content are presented. Below are some questions you should be considering when evaluating a continuous CM system.

**01**     Does the system generate reports?

**02**     Does the system alert of potential failures?

**03**     How does the system notify of a problem with sensor health?

**04**     Can sensor measurement trends be easily viewed?

**05**     Can the sensor connection status be easily accessed?

**06**     Does the system automatically save historical data?

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MoviTHERM's iCM Application

# SYSTEM ACCESS
## CONNECTING TO THE USER

A simple and easy connection to the continuous CM system while maintaining security is a critical consideration when selecting a platform. Just as critical, is how the system will connect with users when there is an alarm or system health issue. Local network systems typically require the same security protocols the in-house IT organization sets. While these protocols may ensure system security, they may also add complexity to accessing the system. For example, a localized system may only allow system access with company IT-approved hardware limiting accessibility and sharing of dashboard views (more on this later).

Cloud-based off-network systems are accessed via any internet-connected device with the appropriate credentials. This means the necessary individuals can access the system anytime from anywhere. This also means the necessary individuals can be notified of an alarm or system health issue anytime or anywhere. Additionally, with the appropriate credentials, system configuration settings can be made remotely without the need to be on-site. This is a powerful feature for system managers and the system integrator, who can log into the system for diagnostics, updates, and firmware upgrades.

# CONFIGURING ALARMS & ALERTS
## EASY-TO-USE INTERFACE

Adding alarms and configuring alerts should not require a programmer or system integrator.  Modern condition monitoring platforms will deploy easy-to-use graphical interfaces with logical workflows to add sensors, set threshold alarms, and notification alerts. Additionally, the system should be able to set and deliver tiered notifications via text, email, or phone call.
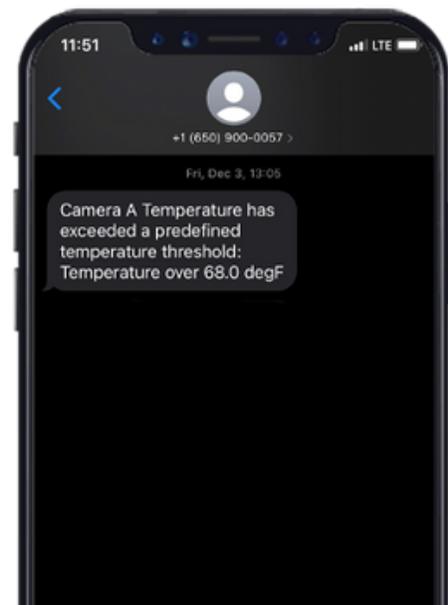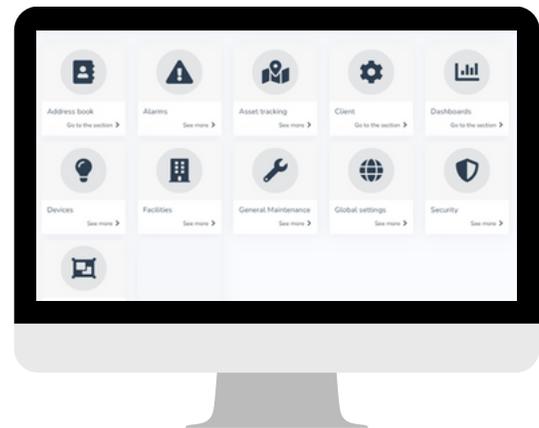
# DASHBOARDS & REPORTS

## CUSTOMIZE TO YOUR NEEDS

Dashboards are visual displays that distill key system and sensor information into an easily consumable format.

**Essential features to consider include:**

- **Customizable Layout**
  - Does the system support the easy creation of custom displays?
  - Does it include dashboard templates to work with as a starting point?

- **Facility Selector**
  - Does the system support sharing multiple facility systems with the ability to "drill into" a single facility view?

- **Alarm Status**
  - Does the dashboard have a flexible way to show alarm status?
  - Can the sensor status be overlaid on a facility map or schematic view?

- **Sensor Trending**
  - Can the system show measurement trends from the various sensor types?
  - Can sensor raw data be accessed?

- **Thermal Imagery**
  - Do the dashboards show infrared camera output along with the region of interest temperature measurement?

- **Visible Imagery**
  - Can the dashboard show visible camera imagery?

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# AUTOMATED REPORTING

Another connectivity area for consideration is the system's ability to automatically generate and distribute condition reports. Tracking equipment conditions through reporting is valuable for communicating facility maintenance needs to managers, maintenance, and production staff.



# SHARING VIEWS

### SHARE DASHBOARDS & MAPS

Freely sharing dashboards and views can be valuable when performing equipment repairs. For example, a live map view could be automatically shared with a maintenance technician via a URL link if an alarm threshold is met.

**The map view could include the following:**

- Measurement trend history of the sensor in alarm.

- Map view with sensor locations and alarm status.

- Current thermal and visible camera views.

Maintenance technicians can use this map view to effectively assess condition history before arriving on-site to repair equipment.

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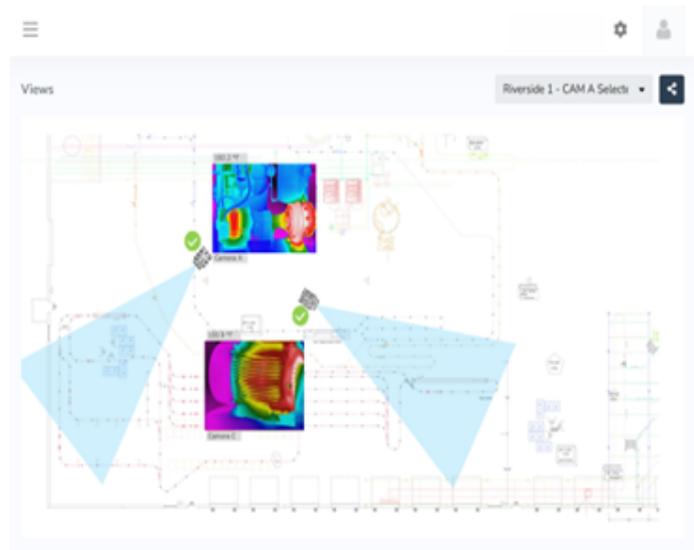
# EXPANDABILITY & SCALABILITY

Expandability is the ability to add sensors, features, and users, while scalability is the ability to add additional sites/facilities to the monitoring system. The ability to do both with low effort and cost is essential to a continuous CM system.

## EXPANDABILITY

Cloud-based systems are the easiest to expand and grow. Once the application foundation is in place, additional sensors and cameras can be added and configured with just a few clicks. This capability allows easy entry into continuous CM as systems can be built up over time. The initial investment is small compared to traditional condition monitoring systems and can be started with a single camera or sensor.
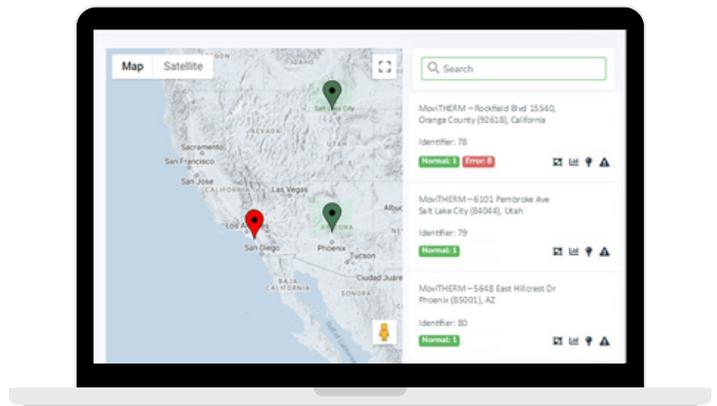


## SCALABILITY

This is another area where cloud-based monitoring systems shine. Adding sites and facilities to global dashboards take just a few clicks in the application software. Once added, global-level managers, can readily see all facilities' health and safety status. These global-level managers have access to all the connectivity functionality available locally, including dashboard views, alarm and health notifications, and automated reporting. Connection only requires an internet-connected device with the appropriate credentials.

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# SYSTEM UPGRADES & UPDATES

## CLOUD-BASED VS TRADITIONAL SYSTEMS

Cloud-based continuous CM systems are less expensive to maintain than traditional CM systems. Because the cloud-based system software resides in the cloud, there is no need to maintain a dedicated facility computer server and be concerned with software updates. This eliminates any potential for operating system software conflicts, as access to the application only requires an internet connection. When application updates and new features are released, they are readily available to system users without the hassle of installing updates.

In addition to software updates, firmware updates to cameras and sensors are done automatically and remotely via cloud connectivity. This is another critical advantage of cloud-based systems over traditional localized monitoring systems.

## MOVITHERM'S iCM

✔ **IR Cameras**
- Receive expert guidance from our team of engineers on what camera best fits your needs.

✔ **Mass Alerting**
- Customize and set alerts to be sent via voice call, text, or email, depending on the severity of the alarm.

✔ **Easily Scalable**

✔ **Personalized Dashboard**
- Access to all connected sensors.
- Access your facility's layout.
- Access alarm history reports.

✔ **URL MapVIEWS**
- Updates in real-time to keep all first responders aware of the quickly evolving situation.

✔ **Automated Reporting**
- Schedule history reports to be delivered to your inbox.

✔ **Upgrades & Updates**
- The application resides in the cloud, which means automatic software & firmware installs.

## TRADITIONAL SYSTEMS

✔ **IR Cameras**
- Receive suggestions on what type of camera will fit your needs.

✔ **Mass Alerting**
- Alerts will typically require an autodialer and are not customizable.

✘ **Easily Scalable**
- Expandability is possible, but not achieved easily on systems that do not reside in the cloud.

✘ **Personalized Dashboard**
- Traditional systems don't come with a user-friendly application.

✘ **URL MapVIEWS**
- MapVIEWS are not available in traditional systems.

✘ **Automated Reporting**
- Automated reporting can only be achieved on cloud-based systems.

✘ **Upgrades & Updates**
- Traditional systems require manual upgrades, plus PC and hardware maintenance and/or replacement.

# INTEGRATOR EXPERTISE & SUPPORT

## GO WITH THE EXPERTS

Not to be overlooked is the reputation of the system integration and the support you will receive, not only during the installation but during the operation of the system as well. You will want to be sure they have experience with successful installations. Additionally, if your system is going to incorporate thermal imaging technology, you will want to make sure the integrator understands the physics of infrared imaging and has access to reliable and proven IR camera technology.



iCM

**TELEDYNE FLIR | PREMIUM PARTNER**

# OUR SOLUTION

MoviTHERM iCM is an intelligent condition monitoring solution that uses thermal imaging and other sensing technology to provide a holistic understanding of asset health. Leveraging IIoT connectivity with cloud computing, iCM more efficiently detects and alerts of potential equipment failure with low installation and maintenance costs. Our system can scale to connect and monitor multiple sites from a central location anywhere in the world.

Learn more about MoviTHERM iCM

## CONTACT US

If you have any questions regarding condition monitoring, please don't hesitate to reach out. It is our pleasure to assist!

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