CALUMINO
intelligent thermal sensing

Enhancing Asset Management and Safety with Affordable CTM

Unplanned downtime and general shutdown costs for critical equipment due to industrial electrical malfunctions can result in significant financial losses for businesses.

To reduce the frequency and cost of such incidents, organizations have traditionally used thermal handheld cameras to manually monitor the temperature of components. But thermal imaging inspections can be expensive, and if not conducted at the right time, serious issues may go undetected.

For these reasons, organizations are turning to continuous thermal monitoring (CTM). This technology provides a continuous stream of data about the heat of your electrical components, enabling you to predict when an electrical failure is approaching and take corrective action—all without the high costs associated with traditional thermal imaging.

> ***Continuous thermal monitoring (CTM)***
> *provides a continuous stream of data about the heat temperature and temperature cycles of your electrical components, enabling you to predict when an electrical failure is approaching and take corrective action.*

WHY PERIODIC THERMAL INSPECTIONS ARE INSUFFICIENT

Even though using traditional infrared (IR) technology to check the temperature of components is a common practice, it often does a poor job of reducing risk. Additionally, certain components, like mechanical and electrical interlocks, cannot be surveyed using portable thermal imaging, leaving potential blind spots in your inspection process.

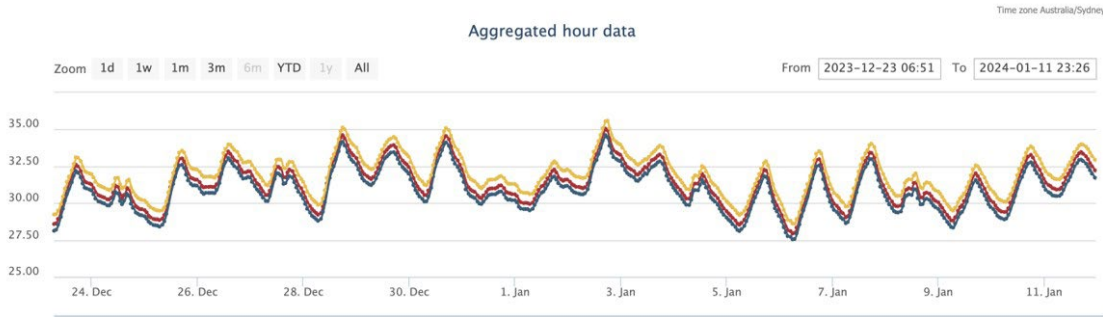
Time Gaps Between Checks

When using thermal cameras to inspect your infrastructure, you only receive risk data at the end of each inspection. You then have to wait until the next inspection for an update. Between inspections, however, an electrical issue can arise and quickly escalate into a fire.

Here's how this dangerous sequence of events unfolds—electrical contact resistance causes a thermal runway, leading to a connection failure and, eventually, fire—step by step:

1. **Increased resistance:** Improper installation, misalignment, or surface deterioration increases resistance at electrical contacts.
2. **Temperature rise:** The increased resistance causes the temperature at the contact point to rise.
3. **Accelerated deterioration:** Higher temperatures accelerate the deterioration process.
4. **Compounding resistance:** Further deterioration leads to even more resistance at the point of contact.
5. **Connection failure:** The heat and deterioration create a vicious cycle, ultimately causing the connection to fail.
6. **Consequences:** The escalating heat can result in fire or flashover, leading to explosions, component destruction, and/or injury.

However, with continuous thermal monitoring, you can detect overheating components long before they trigger a thermal runway, preventing damage or injury. Continuous monitoring also alerts you to emerging issues that could indicate other problems, making it easier to proactively identify—and prevent—serious complications.



THE TRANSITION TO CONTINUOUS THERMAL MONITORING

Historically, the market has relied on manual surveillance for thermal monitoring due to the absence of sensors that strike the right balance between cost and performance.

Traditional methods like thermal cameras and bolometers have been used, but they come with drawbacks—bolometers, for example, are expensive and often suffer from temperature drifts. While single-point sensors are more affordable, they don't provide the in-depth information needed for effective monitoring.

The ideal solution lies in using sensors that combine affordability with high performance. For example, using 600 affordable but high-performing pixels can enable continuous monitoring across multiple zones. This approach shifts from manual snapshots to comprehensive, real-time monitoring, making it a more suitable IoT solution for businesses aiming to enhance thermal surveillance.

Key Benefits of CTM

With affordable, high-performing sensors now available, businesses can take a more proactive approach to equipment maintenance. When you use always-on sensors, you gain access to real-time data.

This information lets you establish a condition-based maintenance program, which can:

- Enable early detection of potential problems by identifying symptoms right away
- Leverage pattern recognition and anomaly detection to improve your maintenance strategies
- Prevent costly breakdowns
- Improve safety by reducing the need for personnel to interact with live equipment
- Boost operational efficiency by identifying and addressing excess electrical usage early
- Provide data-driven insights to optimize system performance

To illustrate, suppose you're monitoring a component, and a neighboring unit with a capacitor experiences a short circuit. This could allow excess current to flow directly into the component you're monitoring. With continuous thermal monitoring, you can detect the temperature rise and identify the problem as soon as it occurs. You can then shut down the system, inspect the capacitor, and replace it at a minimal cost.

Without continuous thermal monitoring, the issue may escalate, potentially destroying valuable equipment or resulting in a much more expensive repair.

THE CALUMINO ADVANTAGE

Calumino's proprietary thermal technology, based on Micro-Optical Mechanical Systems (MOMs), enables a stable, accurate, and cost-effective solution for CTM. This technology delivers real-time thermal data, allowing you to make time-sensitive decisions that can extend the life, functionality, and safety of your equipment.

Offering a similar signal-to-noise ratio compared to traditional infrared sensors at an affordable price point, Calumino's CTM technology provides a real-time, continuous and scalable asset management solution. It also offers:

- Scalability, allowing you to add sensors wherever and whenever needed
- A radiometrically stable system that provides accurate temperature readings

Calumino offers a breakthrough price / performance proposition and opens up permanent installation of thermal sensors as part of a comprehensive IoT strategy for asset monitoring.

Use Cases for Calumino's Thermal Sensors

Calumino's thermal sensors are a reliable solution for a number of applications, such as:

- **Electrical switchboards:** Monitoring these is crucial, as they distribute power to downstream electrical components. Early detection of issues can prevent failures and minimize downtime.
- **Data centers:** Keeping an eye on the temperature of computing components can provide early warnings of potential failures or disruptions, ensuring continuous operation.
- **Manufacturing companies:** Continuous monitoring of equipment and machinery temperatures helps detect issues like poor electrical connections or excess friction resulting from faulty bearings, weakened bushings, or worn components.
- **Utilities:** Continuous monitoring of electrical components ensures reliable power delivery. For example, monitoring transformers can detect overloading or failing insulation. Similarly, monitoring cables and conductors can help identify excessive load or insulation issues, allowing you to prevent short circuits or failure.
- **Batteries:** Monitoring the temperature of electric vehicle and home batteries can detect internal faults. Identifying temperature anomalies early helps address critical issues before they escalate.

IMPROVE YOUR ASSET MANAGEMENT WITH CONTINUOUS THERMAL MONITORING

While periodic thermal inspections with cameras can help prevent some issues, they leave dangerous gaps in your monitoring strategy. To catch problems early, you need a system that's always on. Continuous thermal monitoring provides real-time data, giving you the visibility needed to identify and address potential issues before they become more serious problems.

As a result, continuous monitoring helps prevent costly breakdowns, improves safety, offers data-driven insights, and enhances operational efficiency. With Calumino, you gain all these advantages at a lower cost, making it an ideal solution for budget-conscious organizations that prioritize asset health.

*To learn more about how Calumino can enhance your asset management system, **get in touch with us** today.*