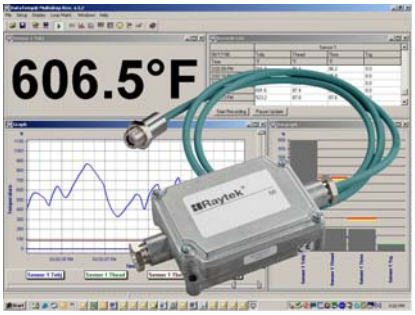
Continuous Thermal Monitoring: Key to True Predictive Maintenance

Maintenance professionals are increasingly turning to continuous, online temperature monitoring as a way to make more informed decisions about equipment health.

Thermal monitoring using non-contact infrared (IR) sensors provides 24/7/365 monitoring and alarms, and collects and stores data for temperature trend analysis, allowing condition-based predictive maintenance without touching the equipment.

Increasingly, maintenance professionals are turning to continuous, online temperature monitoring as a way to make more informed decisions about equipment health. Thermal monitoring employing noncontact infrared (IR) sensors not only provides 24/7/365 monitoring and alarms, but also collects and stores data for temperature trend analysis—enabling true, condition-based predictive maintenance, without touching the equipment.

Although traditional equipment maintenance scheduling based on lifetime data and replacement-upon-failure may be suitable for some users, in the case of high reliability/availability-oriented industries, this type of reactive approach is usually inadequate.



Preventive maintenance is better than "breakdown" maintenance, but it is not cost-effective in many cases. Nor can preventive maintenance be used to optimize operations. Frequently, service is performed as a precautionary measure—regardless of whether it is really needed—and often results in unnecessary expenses.

Predictive maintenance evolved as a way to assess the condition of equipment on a continual basis, and be proactive instead of reactive. Equipment status is evaluated by processing information gathered from monitors placed at different points in the system. Maintenance is performed only as the malfunction or failure dictates.

Facilities face asset management issues

Rising energy costs have caused many plants and factories to take a hard look at the performance and efficiency of their power distribution system. Inefficiency can be caused by overloading, phase imbalance, poor connections, inductive loading and harmonics.

Safety is of utmost concern to all facility operators, but has added importance at sites like petrochemical complexes where high temperatures in electrical equipment can create the threat of explosion.

There are also strong economic reasons for prolonging equipment life. “Run-to-failure” no longer makes sense for facilities seeking lower operating and maintenance costs. That is why companies are implementing enterprise-wide asset management programs leveraging the data provided by intelligent equipment monitoring solutions.

Thermal monitoring achieves higher performance

Since heat is the enemy of most machinery, thermal monitoring is at the forefront of information-driven asset and lifecycle management. Consider the effects of temperature on an industrial motor: Any time there is a 10° C rise in temperature over and above the manufacturer’s specification, the result may be up to a 30-50% reduction in the life expectancy of the motor.

Traditionally, maintenance departments monitored power system voltage, current and temperature, and performed surface inspection and material quality tests, at regularly scheduled intervals. In the case of electrical switchgear, many companies opened their cabinets and performed routine maintenance once a year—just in case.

With the introduction of digital, “smart” monitors capable of logging equipment-operating data at microsecond intervals, and the development of advanced signal processing tools for extracting features from collected data, a new level of maintenance performance has been achieved.

Thermal monitoring systems employing advanced IR sensors can measure temperature just about anywhere on the factory floor. These versatile devices measure and accumulate real-time data, and are well suited for environments with moving targets, inaccessible objects and high temperatures. An IR thermometer has no energy interference (thus, no energy is lost from the target), and no risk of contamination and mechanical effect on the target.

IR sensors incorporating a miniature sensing head and separate electronics can be located in confined spaces close to hazardous process areas. They are able to withstand ambient temperatures as high as 180° C without any cooling, and cover measurement ranges from approximately - 40 to 600° C.

Unlike standard thermocouples, IR sensors do not require any type of electrical isolation. The sensors can provide up to 20:1 optical resolution (a 1 in. diameter target can be measured from a 20 in. distance), avoiding the danger of accidental contact with high voltage equipment.

IR sensor electronics also have sophisticated signal processing capabilities, including emissivity, sample and hold, peak hold, valley hold, and averaging functions, all of which are adjustable from a remote user interface.

IR sensors solve a wide range of applications

Infrared technology has been utilized successfully in industrial plant settings for decades. Now, thanks to new innovations that reduce costs and increase reliability, it is the answer to a wide range of noncontact temperature measurement applications. For example, IR sensors allow maintenance staff to check for heat created by loose electrical connectors or corrosion buildup; locate problems in battery banks and power panel terminations, ballasts, switch gear and fuse connections; and

identify hot spots. Heat is generated by increased resistance and indicates a loss in electrical energy.

In a typical plant application, maintenance workers might use an IR-based thermometer to monitor the performance of a motor driving an air conditioning unit. The installation of a permanent sensor makes it easier to detect overheated bearings or other hot spots, and implement true predictive maintenance procedures.

IR sensors can also be used to keep track of electrical phase temperatures affecting motors, pumps, belt drivers and other machinery. By continually monitoring phase temperatures, technicians can detect overload conditions on one or more legs of the phase, as well as identify phase distortion or imbalance.

Temperature data improves maintenance decisions

As power demand rises in data centers and manufacturing plants, their electrical switchgear and distribution components need to handle the increased load. Currently, many companies perform annual thermography scans for predictive maintenance. But at some point between normal maintenance intervals, system components may reach a premature limit.

Continuous thermal monitoring solutions with trending and graphing capabilities enable technicians to review temperature data and make decisions based on the information collected. From there, they can decide how well equipment is performing and look for problems occurring under specific operating conditions or during certain production periods.

Real-time temperature trend data shows how a facility's electrical system is handling load growth, allowing for a more precise estimate of the expected capacity and life span of vital components—and optimizing the original investment of the equipment in place.

In addition, plant personnel can chart ongoing temperature changes in a piece of equipment and actually predict when it will require service. This allows maintenance work to be scheduled during periods of normal factory downtime, as opposed to having an emergency shutdown for needed repairs.

For example, if bus bars are monitored 24/7/365, the data can be reviewed and if no increase in temperature is seen, that maintenance cycle can be extended.

Non-intrusive inspection reduces safety risks

Continuous thermal monitoring provides a safer, non-intrusive alternative for equipment inspection. With traditional physical maintenance, there is always a chance of an accident causing failure of the equipment or putting personnel in harms way. There is also an issue of the system not coming back online in a timely manner. In the worst-case scenario, a technician can be killed from an accident or arc flash.

In addition, non-contact thermal monitoring eliminates concerns about electrical isolation, insulation and EMI flashover associated with contact probes. IR sensors can accurately measure temperature without contacting the surface of the target.

In the case of electrical switchgear, thermal measurements are sometimes limited to snapshot scans through a glass observation window—a safety interlock will disable the unit if its enclosure door is opened. Use of an IR sensor allows precise temperature readings to be taken without the need to access the equipment and under full load conditions.

Thermal monitoring systems can even provide alarms alerting operators when maximum temperature levels have been reached on a particular piece of equipment, or at a critical electrical connection. Review of these alarms and/or trend data can highlight a problem before it grows into an expensive failure or catastrophic event.

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