APPLICATION NOTE

Hot or not?
Spot issues before failure with thermal monitoring using infrared sensors

Most maintenance managers are well acquainted with the panic of handling a critical equipment issue and investigating potential causes after the fact. In many cases, the damage requires major repairs or re-purchasing expensive equipment. Thermal monitoring with an infrared sensor allows you to have a proactive rather than reactive response to potential breakdowns, problems that could lead to failures in other equipment down the line. Thermal monitoring with infrared sensors enable you to compare images of a process throughout its duty cycle.

The Fluke 3550 FC Thermal Imaging Sensor has a monitoring cycle that is shorter than normal thermal inspection intervals (about one week), yet long enough to make holding a handheld imager to take sequential images impossible (longer than 1 hour). You can see issues as they develop and assess how quickly you need to take action, as opposed to spending much of your day determining if you can delay repairs until a slow production period (or after hours).

What to look for
First, using thermal monitoring with an infrared camera involves basic identification of infrared images indicating hot and cold spots. Next, it involves paying special attention to differences in temperature between similar units operating under similar conditions. When it comes to motors, fans, pumps, and conveyers, performing thermal inspections of bearings, shafts, casings, belts, gearboxes and other components that emit heat can be used as indicators of

Four key advantages of the Fluke 3550 FC:

1. **Troubleshooting**: The thermal imaging sensor helps spot abnormalities that develop over a period of time by automatically capturing a series of thermal images.

2. **Versatility**: The sensors come with a bracket with 360 degree gimbal—that can be mounted with a magnet, screws, or adhesive tape—making them easily fixed and easily moveable.

3. **Data correlation**: Fluke Connect® software enables your team to receive alarms based on thresholds you set, remotely monitor multiple assets, and produce multiple graphs per asset correlating current, voltage, temperature, and power monitoring. Adding thermal images from the 3550 FC helps correlate visual inspection to the data.

4. **Mobility**: The sensors can operate on battery power—10 hours under performance mode, three days under energy saving mode, indefinite if connected to wall wart. All of this allows you to move the sensors around a facility and re-position no matter how awkward the angle or line of sight. This also keeps technicians out of harm’s way when taking thermal readings.
equipment condition to prevent unexpected equipment breakdowns. Comparatively, cold spots often point to blown fuses or failed capacitors.

In specific processes, thermal monitoring with an infrared camera is ideal for spotting a lack of uniformity in equipment. For example, a thermal condition monitoring sensor can help facility managers spot temperate inconsistencies, like winding insulation failure, in a single motor. You use the software to build heat profiles (via heat mapping) of a motor by capturing infrared images while the motors are fully operational under standard conditions.

**How does it work?**

Portable thermal imaging sensors, such as the Fluke 3550 FC, can be installed virtually on any surface. The thermal sensors take sequential infrared images, thermal patterns of the surface temperature of equipment, and transmit those images to the cloud. Since heat often is an early indicator of degradation, identifying abnormal thermal patterns before failure helps extend the life of equipment and builds you condition-based or proactive maintenance capabilities.

These sensors are helpful in spotting abnormal thermal patterns—high-resistance contact surface, load imbalances, and failed components—at any time of day and can auto-capture and save infrared and visible light images for comparison in real time or whenever convenient. Because the images are taken at regular intervals from the exact same location, comparison is simple. This is different from a handheld thermal imaging, which by its very nature of usage means that you cannot be certain that the angle and distance are identical. Subsequently, images extracted from the handheld method can be difficult to compare. Troubleshooting intermittent problems requires you to be in the right place at the right time, which is not always possible. The Fluke 3550 FC solves these limitations of a fixed cameras, as the sensors are movable and do not need to run on cable.

Managers can compare and contrast multiple motors, so hot and cold spots stand out. The Fluke 3550 FC comes with an adjustable bracket that can be positioned at numerous angles and just about anywhere in a facility. A center target allows you to capture temperature data of a key component with suspected stability issues. Adding Fluke Connect software allows you to see that center point.

Fluke Connect is browser-based software with Fluke Connect Cloud data storage, a mobile app for onsite use, and connectivity to radio-enabled test tools. The system transfers measurement data from test tools to the smartphone app, using point-to-point Bluetooth or Wi-Fi and no interaction with the local network. The smartphone app uses a cellular signal or Wi-Fi connection to transfer the data using a secure connection to the Fluke Connect Cloud data storage. Your team can collaborate more efficiently with ShareLive, the software’s video call and email component. With AutoRecord (automated routine data collection and report generation), TrendIt graphs, and the capability to save measurements directly to work orders, Fluke Connect establishes a reliable, traceable asset history. When paired with thermal monitoring, you can now accompany asset data with visual inspection images.
Fluke Condition Monitoring software now includes thermal monitoring sensors. The thermal monitoring sensor is always on and the images can be viewed from anywhere at anytime. The 3550 FC sensor is very movable because it is wireless and can run on battery. The battery life of the sensor ranges from 10 hours (Performance Mode) to 72 hours (Energy Saving Mode), and longer with the extended battery or the AC power option. You can start with frequent images, identify how quickly a problem is developing, then adjust the frequency to suit your needs. For example, if the surface temperature is changing very slowly, you can change the frequency from one image per minute to one image per 30 minutes. When plugged in, the sensor can take measurements indefinitely.

The device’s battery life and bracket—which allows the sensor to rotate 360 degrees—highlight the importance of flexibility. If a maintenance manager cannot safely access a power source, the 3550 FC can run uninterrupted for almost a full day. It should be mounted at a distance of 4 to 20 feet for the best accuracy. The sensor is securable using magnets or adhesive discs. All of these features provide mobility and utility.

**Common issues solved by thermal monitoring**

No matter the industry or facility, faster response time to sudden mishaps avoids catastrophic failure and curtails damage costs. With thermal monitoring, workers can check for hot and cold spots more regularly, averting downtime. Temperature thresholds can also be determined and in the software set to send an alert to your phone if thresholds are exceeded.

**Here are common problems maintenance managers face that can be helped by thermal monitoring:**

1. **Smaller teams:** Many maintenance managers in mid-sized facilities with smaller teams find it difficult to perform regular equipment check-ups with a thermal imager, so they often outsource to consultants. This tool is so simple to use that you can begin to take routine thermal images without third-party intervention. You can replace some thermal inspection rounds with automated sequential images.

2. **Reactive mindset:** As facilities are comprised of seemingly countless components, from compressors to small transformers, chasing problems as they surface strains even the most capable of maintenance managers.

3. **Poor response time:** If you’re spread thin and are constantly hustling around to handle the latest equipment failure, your response time can suffer.

Thermal monitoring with an infrared sensors aim to alleviate these all-too-common headaches. The sensors keep “eyes” on equipment, no matter the time of day.
Six benefits of infrared monitoring

There are several ways thermal monitoring with the 3550 FC can positively impact your preventative maintenance (PM) program:

1. **Proactive maintenance:**
   Most equipment’s failure mechanisms involve a significant rise or drop in operating temperature before catastrophic failure occurs. Issues that seem insignificant at first can lead to downtime if they go unchecked, which can impact your bottom line. Thermal imaging sensors let you catch measurement variations, and prioritize situations that demand urgent response.

2. **No shutdowns, less downtime:**
   The thermal imaging sensor is non-invasive and can be installed on some equipment while it is operational. Your team develops a better idea of the overall health of your facility’s equipment, and faces less unexpected downtime.

3. **Safer employees:**
   Thermal images are taken automatically keeping technicians away from operating equipment. Minimal safety risk (except for live voltage—that still requires full electrical safety precautions).

4. **Labor impact:**
   Thermal inspections with a sensor can cover more ground and find problems in areas that would typically be ignored because they are difficult for a person to access. When you position and secure (via magnet, bracket, or authorized adhesives) a thermal imaging sensor, a team can monitor more equipment with more precision.

5. **Accessibility:**
   Thermal images can keep an eye on hard to reach components and assets running throughout the night not otherwise measurable. Also, thermal sensors help detect imminent failures in nearly all types of automated equipment—from electrical to mechanical, process, electronic, and so on—in an enclosure or hard to reach place.

6. **Improve ROI:**
   Having sequential thermal images stored on the cloud and accessible on your mobile device or computer creates equipment histories. Having this knowledge on hand saves time from having to search for baseline measurements, as it lets maintenance managers conduct smarter evaluations.

These payoffs work in concert with The Fluke Connect Monitoring system, which supplies more indicator data versatility.
Five applications—
for thermal monitoring with infrared sensors

Thermal monitoring with infrared camera sensors, when combined with voltage, current, power quality, and temperature sensors, have a wealth of applications for equipment common to a large variety of facilities. Here are a few examples:

1. **Motors, drives, and compressors**: Thermal imaging is especially useful for monitoring rotating equipment, since many impending failures are accompanied by overheating. You can use the sensor to quickly compare the surface temperatures of multiple motors in a row. This predictive technique uses a thermal imaging sensor to capture two-dimensional images representing the apparent surface temperatures of equipment.

2. **Process instrumentation**: Pipes, hoses and valves are crucial to delivering fluids to processes at precise moments. Thermal image sensors can indicate leaks, stiction, or excess friction in valves and tubes, and can be mounted near machinery inside enclosures. Proactive thermal monitoring in pipes can help spot obstructions before an entire loop fails. Apart from knowing insulation specifications and the material the tank is constructed of, thermal monitoring lets technicians monitor liquid levels and rough checks of dry bulk material levels.

3. **HVAC systems and condensers**: In data centers, where cooling is important to keep servers from overheating, uncharacteristically cool surfaces might also indicate a problem, perhaps an imbalance in the HVAC system. Thermal imaging sensors can monitor server racks or used in HVAC systems to monitor valves and condensers.

4. **Small transformers**: Thermal monitoring helps to quickly identify bad electrical connections, imbalances, overloads, harmonics, and other impending electrical equipment failures. You can spot uneven or inadequate power supply, then take corrective action on the power supply and prevent downtime. This also applies to electrical systems, which is one of the major application areas for thermal monitoring with infrared sensors.

5. **Pre-commissioning tests**: Technicians need to run mechanical, electrical, and visual tests before a new transformer can be commissioned in the field. When combined with a conditioning monitoring system and software, the sensors—for voltage, current, temperature and thermal imaging—can provide data confirming that the transformer is operating correctly and establish baseline data for future checks.
Fluke Connect Measurements is the free version that includes auto recording of measurements taken with compatible Fluke tools as well as sharing, graphing, and storage of measurements in the cloud.

Fluke Connect Assets includes all the features of the free version as well as software to organize measurements by test points, assets, facility or plant. The software also provides the ability to capture and trend status, generate reports and work orders.

Fluke Condition Monitoring Software includes all functionality plus adds real-time measurements and alarms that indicate how your equipment is running. Diagnose unpredictable faults by viewing measurements before, during and after an equipment event.

Learn more about Fluke Connect here: www.flukeconnect.com