AUTOMATION
PUTTING THERMAL IMAGING TO WORK FOR YOUR APPLICATION

Condition Monitoring ■ Early Fire Prevention ■ Process Control & QA
When precision and control are mission critical

There is a wide range of automation and industrial safety applications for FLIR high performance thermal imaging solutions. New applications emerge every year as more industries identify a need for thermal imaging to:

• Find temperature problems before they lead to failures.
• Prevent costly production stoppages.
• Spot process anomalies that can flag dangerous situations early, improving safety in the workplace.

Automated FLIR applications must be in condition monitoring, early fire detection, and process control monitoring/quality assurance. We created this primer to illustrate thermal imaging value in specific industry applications. It’s been done before: now you have a template for implementation. If yours is a new application, then perhaps one of these examples will give you an idea of what’s possible. Either way, if the value of thermal imaging intrigues you, then we ask that you determine if it’s the right fit.

Get started on this primer by continuing to the table of contents. It will direct you to all the applications covered in this primer. Each example provides a summary of the application and a list of relevant FLIR thermal imaging cameras. You can find a description of each camera in the FLIR Automation Solutions section of this document; to read more about any application, download the entire story from flir.com/automation/appstories. Additional information about all FLIR automation cameras is available at FLIR.com/Automation.

If you’re new to the thermal imaging technology, then the FLIR Automation Handbook provides details about the science, technology, and capabilities of thermal imaging. If you’re more comfortable learning directly from our thermal experts, then call us with your questions at 1-866-477-3687.

Automated FLIR applications are most prolific in condition monitoring, early fire detection, and process control monitoring/quality assurance. We created this primer to illustrate thermal imaging value in specific industry applications. If it’s been done before, now you have a template for implementation. If it’s new, then perhaps one of these examples will give you an idea of what’s possible. Either way, if the value of thermal imaging intrigues you, then we ask that you determine if it’s the right fit.

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You can download the entire story from flir.com/automation/appstories.
**CONDITION MONITORING**

Condition monitoring identifies problems before failures occur in order to prevent costly production stops. Typical equipment that is monitored includes high- and low-voltage installations, turbines, compressors, and other electrical and mechanical equipment. Sometimes processes need to be monitored because an anomaly can cause dangerous situations. For example, flares that have a flame invisible to the naked eye need to be monitored to see if they are effectively burning gas exhaust.

**FLARE STACKS**

Thermal Imaging Value
Flare stacks are used in many industries to burn off unwanted waste gas byproducts, or flammable gases released by pressure relief valves during unplanned over-pressuring of plant equipment. Thermal imaging cameras are ideal monitoring tools because they allow full-time automated remote monitoring in virtually any weather condition. Additionally, thermal imaging cameras avoid many of the technical and cost-related problems associated with other technologies such as ultraviolet (UV) flame detectors, flame ionization spectrometers, spectroscopies, and pyrometers.

Application Story
Customers use FLIR thermal imaging cameras such as the FLIR A310 to not only monitor flare stack flames, but also actively regulate assist gas control programs. If a flame is not burning within preset parameters, the FLIR A310-based automated system will alarm, prompting immediate adjustments to air or steam volume to maintain proper combustion. As a bonus, automated assist gas injection control can help prevent excessive steam consumption and provide significant cost savings.

**STEEL MILL LADLES**

Thermal Imaging Value
Steel mill ladles have limited lives. As their refractory linings wear or break due to shock, the outer part of a ladle can be exposed to excessively high temperatures. If not caught in time, the result can be ladle disintegration and a molten metal breakout, threatening the lives of workers and destroying equipment. FLIR thermal imaging camera systems monitor ladles in real time and warn of a breakout before it happens.

Application Story
Customers place the FLIR A310 thermal imaging cameras in robust housings, located in fixed positions where they have a clear view of a filled ladle as it passes by on a gantry crane. Those cameras capture video images of the ladle in real time and calculate temperatures over the ladle’s surface. A few cameras can cover the entire surface, but typically one or two regions of interest are prioritized by closer scrutiny and analysis. If a temperature exceeds the predefined parameters, an alarm is triggered. The exact temperature parameters for alarms can be easily adjusted, based on mill experience.

**ELECTRIC SUBSTATIONS**

Thermal Imaging Value
Electric power utilities today are faced with an aging infrastructure, increasing cost of blackouts and brownouts as well as security threats. Unplanned maintenance can be disastrous in the form of outages and catastrophes. With FLIR thermal imaging equipment and software monitoring and identifying equipment failures and security breaches can be prevented in advance. FLIR thermal imaging devices monitor substations in real-time, improving equipment reliability and security.

Application Story
Sensei Solutions LLC, a North Carolina-based provider of smart grid solutions, uses thermal imaging technology to improve station security and ensure predictability of electric substations. According to tulsi Thapar, Sensei Solutions founder and CEO, “Continuous automated monitoring has been beneficial. This enables early intervention, it minimizes human errors and mitigates the risk of greater failure.” Their customers use automated thermal imaging for temperature measurement of bushings, breakers, and capacitor banks, as well as to detect the heat signatures of intruders.
Modern farms increasingly resemble factories in their makeup as they become more and more industrialized. The present-day farmer spends less time performing menial tasks and more time behind the computer. In these circumstances good automatic monitoring systems are a must to ensure quality and continuity. Thermal imaging cameras make sense in an automated system anywhere you need to monitor temperature change on the farm, including: livestock health, herd management, irrigation control, and commodity storage and handling.

**Application Story**

Agricam uses a FLIR A310 thermal imaging camera in its automated inflammation detection tool to diagnose mastitis. Mastitis is the inflammation of a dairy cow’s udders caused by a bacterial infection. If it’s caught early enough, then a cow can be treated non-medically. Early detection gets cows back to producing viable milk faster to minimize the bacteria’s financial impact to farmers, which can add up to tens of thousands of dollars each year. “With a thermal sensitivity of 50 mK, the FLIR A310 thermal imaging cameras provide exactly the kind of detailed images and thermal data that we need for this application,” said Stefan Sjökvist, CEO of FLIR distributor, Termisk Systemteknik.

**Thermal Imaging Value**

Some critical electrical and mechanical installations in manufacturing companies are monitored 24/7 with a thermal imaging camera. Heat buildup indicates poor equipment health and possible impending failure. A fixed-mounted thermal imaging camera gives you the advantage, so you don’t have to rely on visual inspections. Alarms can be set to go off once a temperature threshold is exceeded.

**Application Story**

ADE Technology Inc., in Taiwan developed an affordable and durable monitoring solution for electrical and mechanical installations that is compact enough to fit in a cabinet with the installation. All told, FLIR AX8 cameras can manage up to 16 FLIR AX8 cameras to be incorporate with power, management, asset management, Environmental Control Systems (ECS), and more. According to Jeffery Chow, ADE’s general manager, “The AX8 is definitely a game changer for traditional condition monitoring.”

**FUEL STORAGE**

Fuel storage is notoriously hazardous because the commodity itself is so flammable. Corrosion, leaks, and human error can lead to explosions, sometimes catastrophic, consequences. Automatically monitoring temperature changes in fuel storage depots with thermal imaging cameras can avert disaster, satisfy insurer oversight, and improve safety for workers and the public.

**Application Story**

On the French-Belgian border, in the town of Wattrelos, a Transpole bus depot stores all of the natural gas for its bus fleet. Natural gas is stored under high pressure and is highly flammable. An explosion can be devastating for employees and citizens. The ALOATEC-developed fuel storage monitoring system, comprised of 10 FLIR A310 thermal imaging cameras, “Not only do thermal imaging cameras function regardless of the light conditions, they also help to prevent fires by detecting hot spots before they ignite.”

**EARLY FIRE DETECTION**

Fire can destroy multiple buildings or installations within an extremely short time frame. The value of the goods destroyed during a fire can be tremendous, and the cost of a life that is lost during a fire is impossible to calculate. With their non-contact method of measuring temperatures, thermal imaging cameras can prevent fires by detecting hot spots before they ignite.
FLIR A310 ex
FLIR A310 f
REMOTE FIRE FIGHTING
Thermal Imaging Value
Identifying the hot spot is only part one of a fire prevention solution. Part two is remediation. And that can be challenging in remote monitoring scenarios. FLIR thermal imaging cameras and software can pinpoint hot spots and then initiate an automated fire-fighting response, such as turning on a sprinkler system, shutting down a system, or targeting the hot spot to be soaked in firefighting foam—all controlled remotely over the Internet.

Application Story
Watchdog Security created the Fire Rover to fight fires remotely. When an alarm is triggered by a FLIR A310 f thermal imaging camera, a self-contained system of tanks disperses concentrated foam called FireAde 2000 on a specific hot spot. Operators can also manually control Fire Rover using a joystick. Jeremy Dusing, Watchdog Security operations manager, said, “We trust the name FLIR because of how widely it’s used, plus they had all the technical specs we needed to connect their equipment to ours. With the information it gives us we know how to fight a fire and where to aim the foam.”

Thermal Imaging Value
Similar to combustible pile applications, waste is potentially flammable when stored. Self-combustion, heat development due to pressure, spontaneous chemical reactions between disposals and methane gas-building are all potential fire hazards. Thermal imaging cameras can help to remotely detect hot spots with the potential to flare up.

Application Story
Czech company Workswell developed Waste Bunker Monitor, an end-to-end solution that includes FLIR thermal imaging cameras. Glassworks, foundries, cement plants, municipal waste incinerators, and more use Waste Bunker Monitor to combat spontaneous chemical combustion and other causes of fire in waste bunkers. After a site evaluation, Workswell determines how many FLIR A315 or FLIR A615 thermal imaging cameras are needed. The Waste Bunker Monitor system is flexible and can consist of several thermal imaging cameras with high spatial resolution and with thermal sensitivity greater than 0.05°C.

COMBUSTIBLE PILES
Thermal Imaging Value
Storage of some material invites the risk of spontaneous combustion. Prevention, generally, is more cost-effective than cure. A thermal imaging camera can help to ensure safety and detect spontaneous combustion. It provides continuous, remote monitoring of temperatures in piles of coal, wood chips, fertilizers, and more.

Application Story
When coal is exposed to oxygen, it can react and heat up. This is more likely to happen when there is insufficient ventilation for cooling, such as in the massive coal piles at OBA Bulk Terminal Amsterdam. OBA uses three rugged FLIR A310 f thermal imaging cameras to monitor coal in piles and on conveyor belts. “We used to engage external measurement professionals for this, which was an extra cost for the end customer. Now we can do the measurement ourselves, not only at one moment in time, but continuously on a 24/7 basis,” said Dick Meijer, OBA planner.

Thermal Imaging Value
Even though warehouses are equipped with fire alarms and firefighting systems, once a fire starts, asset damage is almost certain. FLIR thermal imaging cameras can identify hot spots before they ignite and provide an early warning response to avoid full-on conflagration before assets are harmed or safety is compromised.

Application Story
Watchdog Security ensured the FireFlow to fight fires internally. The system incorporates a FLIR A310 f thermal imaging camera, a self-contained system of tools designed to combat fire internally. FLIR’s advanced technology means that, “In some FHM because of how widely it’s used, plus they had all the kinks and bugs out, it’s guaranteed that we can get the job done,” said Steve Reuland, FLIR’s program manager. With the information it gives us we know how to fight a fire and where to aim the foam.

WAREHOUSES
Thermal Imaging Value
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Application Story
An enclosed chemical waste storage facility used a thermal imaging camera to ensure no change in temperature during the day. When exposed to sun or water could become available and possibly combustible. FLIR’s thermal imaging camera helps to monitor the entire storage area, 24/7. Now, these cameras and software can be used to monitor the entire area, without the need for an in situ monitor. Thermal imaging cameras can also integrate with the automation of alarms and extinguishing systems to ensure the likelihood of a fire is reduced. If ignite before preventative measures can be imposed.

THermal Imaging
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WASTE BUNKER MONITORING
Thermal Imaging Value
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Application Story
Class A Security (which later merged with Northmark) worked on an end-to-end solution that includes FLIR thermal imaging cameras, a self-contained system of tools designed to combat fire internally. FLIR’s advanced technology means that, “In some FHM because of how widely it’s used, plus they had all the kinks and bugs out, it’s guaranteed that we can get the job done,” said Steve Reuland, FLIR’s program manager. With the information it gives us we know how to fight a fire and where to aim the foam.
Thermal Imaging Value
New vehicles are subjected to many individual and automated quality control tests. Many automobile manufacturers are using thermal imaging cameras for quality control. Typical applications include inspection of rear window heating, heated seats, checking exhaust flaps, sea encapsulating, and more.

Application Story
The BMW M5 has distinctive, powerful engine sound. This intentional acoustic design is the result of a second tailpipe exhaust pipe that opens only at higher RPMs. Company engineers needed a way to confirm that the flap worked properly without opening the exhaust system. Thermal imaging cameras were automated proved to be the answer. Through thermal imaging, BMW can record exhaust flow to confirm that the flap is opening and closing correctly. The system of 10 fixed FLIR A310 cameras with 45-degree wide-angle lenses was simple to integrate and provides easy access to the PAL video format, which is common in Europe.

AUTOMOTIVE MANUFACTURING

Thermal Imaging Value
Cutting down failure rates of electronic components is essential for companies that want to supply a flawless product to their customers. The only way to ensure this is by checking each individual component to provide 100 percent quality control. Thermal imaging enables electronic components manufacturers to detect hot spots, which are indicative of defective products.

Application Story
Isabellenhütte manufactures electronic components that are used by the automotive industry in fuel injection systems and other control units. With a reputation for high-quality workmanship, Isabellenhütte prioritizes quality control throughout its manufacturing process. They use a FLIR A310 in their automated process to observe a component’s thermal cycle within only 20 milliseconds. “Our initial investment in the thermal imaging camera repaid itself within an extremely short period of time. What is more important, each and every resistor is now checked, allowing us to deliver a perfect product to our customers,” said the Isabellenhütte production manager.

ELECTRONIC COMPONENTS

Thermal Imaging Value
Heat treatment is used in metal manufacturing to alter the chemical and physical properties of the resulting metal parts. Careful application of a specific sequence of heating and cooling cycles for predetermined intervals enables metallurgists to control the parts’ hardness or softness. Thermal imaging can be used to monitor the temperature of metal parts after leaving a cooling bath, or “quench pit.”

Application Story
Thermography specialist MoviTHERM developed a dedicated thermal inspection system with cameras from FLIR Systems to inspect parts immediately following a critical quenching process. A FLIR A310 thermal imaging camera records hot spots on parts in a cooling chamber to see if additional cooling cycles will be necessary.

PROCESS CONTROL & QA

Process control monitoring and quality assurance is all about measuring the temperature and/or determining the shape of certain products on a production line. The acquired thermal imaging data is used to control and improve the process so that the resulting products will meet specifications.

METAL MANUFACTURING

Thermal Imaging Value
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THE FLIR SOLUTION

The FLIR A310 f offers the perfect high-performance camera for automated critical quenching processes when high temporal and spatial resolution is required. The FLIR A310 f’s advanced performance and high frame rate delivers the highest image quality and reliability to avoid any product rejections. Whether you are in the process of cooling a part after quenching or inspecting parts after a heat treatment process, the FLIR A310 f is the perfect solution.
FOOD PROCESSING

Thermal Imaging Value

In the food industry, it's essential to carefully control the temperature and shape of perishable goods throughout production, transportation, storage, and sales. Food processors need tools that automate crucial operations in a way that helps minimize human error while holding down costs.

Application Story

Food processing companies use thermal imaging cameras to make automated non-contact temperature measurements of cooked foods, ovens, refrigeration, and packaging. FLIR customers have used thermal imaging to improve food quality and control. For example, a company made sure every nail in a conveyor oven cooking belt and confirming calf-leather seals on finished microwave meals.

PACKAGING

Thermal Imaging Value

Thermal imaging cameras make a clear distinction between what is hot and what is not. This, combined with emissivity effects, can provide additional thermal imaging cameras to see through plastic or other materials to confirm adhesive placement for packaging.

Application Story

Recochem, a Canada-based manufacturer and distributor of chemical products and fluids, uses infrared imaging to continuously monitor the quality of its packaging. Recochem uses a FLIR AX8 to inspect the glue spots on their boxes. Thanks to its compact size, the AX8 fits in a tight area and is able to inspect the bottom of boxes. “If you look at the AX8 thermal images, then you clearly see the hotter spots where the glue has been applied,” said Adam Wolszczan, plant engineering manager at Recochem.

ADHESION

Thermal Imaging Value

Clear or black glue applied to a black background is very difficult for a visible light camera to see and measure. FLIR automation infrared cameras, however, use the gray scale to determine whether the glue bead has been applied correctly. In that case, it is easy to distinguish between what is hot and what is not.

Application Story

Modern car panels are made of a combination of a metal layer on top and a structural adhesive layer underneath. These layers are glued together using an induction process. The temperature is crucial for the adhesion to work properly, so that the adhesive can flow evenly. FLIR thermal imaging cameras can provide automatic feedback during the process. According to Marco Simoli, technical director at KGR, the temperature at the adhesive layer is “absolutely critical.” With the FLIR A615 system, we are able to reach the optimum performance of the production line. The thermal data allows us to evaluate and optimize the heating process.”

IR WELDING

Thermal Imaging Value

Infrared welding is a heat-based joining technique that creates a very strong bond. But inconsistencies in heating, subsurface defects, and other errors can cause problems in heat welding. Because thermal imaging cameras can visualize the IR weld as it’s applied, it allows manufacturers to monitor the welding process and verify the weld quality without pulling pieces apart for spot checks.

Application Story

Yanfeng Automotive Interiors relies on infrared welding to assemble plastic automotive parts in their Kentucky plant. They use this relatively new technology to join large plastic parts with high strength requirements, such as defroster grills. Ensuring proper weld strength and geometry in these large parts is a challenge, but with the help of four FLIR A315 thermal imaging cameras and analytical software, Yanfeng can monitor production, map heat trends, and provide continuous non-contact evaluation of the infrared welds without the need to interrupt production.
FLIR provides thermal imaging cameras, software, and services to make your condition monitoring, early fire detection, or process control monitoring system a reality.

**FLIR THERMAL IMAGING CAMERAS**

FLIR provides thermal imaging cameras, software, and services to create working systems for condition monitoring, early fire detection, and process control monitoring/quality assurance. To learn more about these tools and to download updates, please visit flir.custhelp.com.

**FLIR SOFTWARE**

FLIR offers a set of software tools and utilities to help companies fully integrate FLIR automation products into working systems for condition monitoring, early fire detection, and process control monitoring/quality assurance. To learn more about these tools and to download updates, please visit flircusthelp.com.

**FLIR SOFTWARE cont.**

**INDUSTRIAL SAFETY**

FLIR IR Monitor

Utility program for initial camera connection and control, web-based control of internal functions. The program supports up to nine cameras simultaneously. It allows you to view the IR image over the internet and stream images directly to FLIR Tools+.

Built-in Web server

Simple built-in camera control and image viewer, which can connect using the "Camera as a Service" in a Web browser or connect through the IP Config program. This utility program can be a complete setup and control interface for the camera.

**GENERAL**

IP Config

Utility program for network camera detection and IP address setting. The program comes with the Utility CD or can be downloaded from FLIR Custhelp.

FLIR Tools

Many of FLIR’s thermal imaging cameras for temperature monitoring are compliant with FLIR Tech, allowing you to view and analyze images. This continuous monitoring template suite has more than 200 templates and includes built-in assistance, making it possible to acquire an accurate temperature reading in as little as 15 seconds.

FLIR Camera Player

This utility program for third-party vision applications and FLIR A610 thermal cameras provides the ability to control the camera through an Ethernet/IP or Modbus TCP connection. This function is always turned on in the A610 camera.

**MACHINE VISION**

FLIR GigE Vision compliant SDKs

With the rapid and ever-changing needs of modern business, it’s important to invest in equipment that will last for a long range of applications. No other infrared camera manufacturer offers a wider variety of accessories than FLIR.

Optics

From microscope lenses that resolve down to 3μm to 1m telescopes, FLIR has the high-quality optics you need.

Mounts and Stands

FLIR offers multiple accessories for mounting camera systems, including tripod and microscope stands.

**FLIR ACCESSORY SOLUTIONS**

Cables and Connectors

FLIR offers a variety of cable, fiber optic cable, extended cable lengths, and Camera Link PC cards to meet a wide variety of application requirements.

**FLIR AFTER SALES SERVICE**

Because FLIR designs and manufactures thermal imaging cameras from the sensor up, we can quickly respond to your needs. To order replacement parts or accessories, different types of service contracts are available. A service contract will give you the advantage that you no longer have to wait to get your equipment repaired. Even larger repairs can be performed at the FLIR service center for a reasonable cost. Some service contracts even guarantee a replacement camera, if necessary.

**FLIR ACCESSORY SOLUTIONS cont.**