AUTOMATION and INDUSTRIAL SAFETY

FIXED THERMAL CAMERAS FOR CONDITION MONITORING

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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 stops.
- Spot process anomalies that can flag dangerous situations early, improving safety in the workplace.

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, then 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 want to help you determine if it's the right fit.

If you're new to thermal imaging technology, then the IR Automation Handbook provides details about the science, technology, and capabilities of thermal, or infrared, imaging. 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. Additional information about all FLIR automation cameras is available. If you're more comfortable learning directly from one of our thermal experts, just fill out our contact.

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CONDITION MONITORING

Monitoring the condition of assets across a manufacturing facility helps identify problems before failures occur, preventing costly production stops. Typical target assets include 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. In addition, 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, thermocouples, and pyrometers.

Application Story

Customers use FLIR thermal imaging cameras such as the FLIR A700f to not only monitor flare stack flames, but also to actively regulate assist gas control programs. If a flame is not burning within preset parameters, the camera-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.

FLIR SOLUTION

FLIR A500f/A700f

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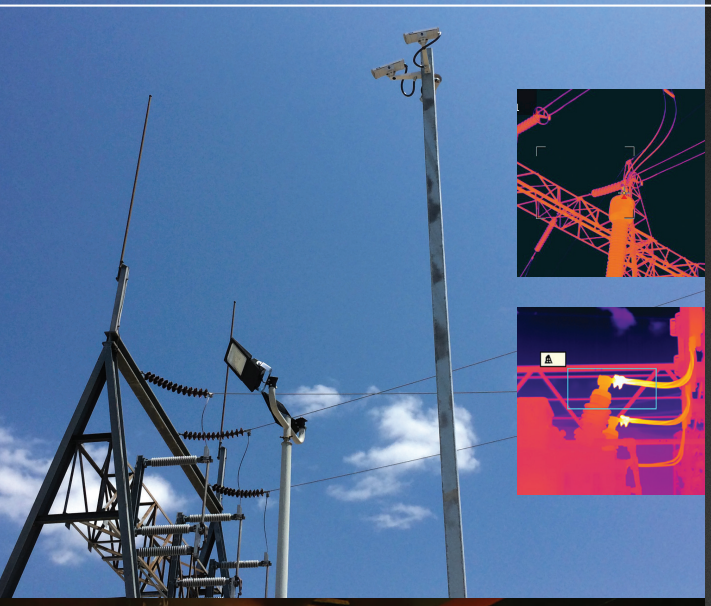

ELECTRIC SUBSTATIONS

Thermal Imaging Value

Electric power utilities today are faced with an aging infrastructure, increasing risk of blackouts and brownouts as well as security threats. Unplanned maintenance can be expensive in the best-case scenarios and catastrophic in the worst. With FLIR thermal imaging cameras and condition monitoring software, impending equipment failures and security breaches can be detected anytime, day or night, from a remote monitoring location.

Application Story

Sensei Solutions LLC, a North Carolina-based provider of smart grid solutions, uses thermal imaging technology to improve stability and security of electric substations. According to Robin Thompson, Sensei Solutions founder and CTO, "Continuous automated radiometry has many benefits. This method is non-invasive, it eliminates human errors and mitigates the risk of greater failures." 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.

FLIR SOLUTION

FLIR A500f/A700f

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 excessive 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 FLIR A50/A70 Smart Sensor Cameras in a robust housing or employ FLIR A500f/A700f cameras—with their protective housing—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 of the ladle, but typically some regions of interest are predefined for closer scrutiny and analysis. If a temperature exceeds the ladle's predefined parameters, an alarm is triggered. The exact temperature parameters for alarms can be adjusted easily, based on mill experience.

FLIR SOLUTIONS

FLIR A50/A70

FLIR A500f/A700f

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ELECTRICAL & MECHANICAL INSTALLATIONS

Thermal Imaging Value

Some critical electrical and mechanical installations in manufacturing companies and utilities are monitored 24/7 with a thermal imaging camera. Heat buildup indicates poor equipment health and possible impending failure. With a fixed-mounted thermal imaging camera, you don't need to rely on periodic inspections. Instead, the camera can monitor several pieces of equipment simultaneously, sending temperature data to your asset data historian and activating alarms if temperature thresholds are exceeded.

Application Story

ADE Technology Inc., in Taiwan developed an affordable condition monitoring solution for electrical and mechanical installations that is compact enough to fit inside of a cabinet with the installation. Called T-Guard, ADE's solution can manage up to nine FLIR AX8 cameras to monitor enterprise-wide electricity management, solar PV management, Environment Control Systems (ECS), and more. According to Jeffrey Chow, ADE's general manager, "The AX8 is a definitely a game changer for traditional condition monitoring."

FLIR SOLUTIONS

FLIR A50/A70

FLIR AX8

IIoT Integration

Thermal Imaging Value

Industrial thermal automation sensors provide multi-zone, wide-area, non-contact, continuous temperature monitoring of assets. This temperature data can be combined with vibration, current, dissolved gas, and many other types of sensor data so that companies can gain deep insight into their asset health. Electric utilities that are successful doing this can improve the reliability of their grid, lower operational and capital costs while extending asset life.

Application Story

Collecting data from sensors using different communication protocols into one preferred data lake can be difficult to achieve and even more difficult to scale up across an entire grid. Electric utilities can solve the issues of sensor-system incompatibility and lack of skilled IIoT programmers with the FLIR Bridge, a condition monitoring solution that makes integration of different sensors easy—no coding required. It can connect to a variety of systems, such as OSI PI Historian and OPC UA, to record and analyze time-series data. Bridging the gap between sensors, software, and hardware resources allows companies to aggregate the condition data needed to improve situational awareness, empower decisions that keep operations running, reduce maintenance costs, and improve productivity, reliability, and safety.

FLIR SOLUTIONS

FLIR Axxx-Series

FLIR Bridge

FLIR A50/A70

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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 help prevent fires by detecting hot spots before they ignite.

FUEL STORAGE

Thermal Imaging Value

Fuel storage is notoriously hazardous because the commodity itself is so flammable. Corrosion, leaks, and human error can lead to explosive, 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 would endanger employees as well as citizens in nearby towns. French FLIR products integrator ALOATEC developed a fuel storage monitoring system comprised of FLIR thermal imaging cameras. "Not only do thermal imaging cameras function regardless of the light conditions, they also help to spot a rise in temperature even before fire breaks out," said Philippe Bourrier, director of ALOATEC.

FLIR SOLUTIONS

FLIR FH-Series R

FLIR A310 ex

FLIR A500f/A700f

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WAREHOUSES

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

An enclosed chemical waste storage facility used stand-alone thermal imaging cameras to detect temperature changes among its stockpiles. Waste exposed to air or water could become unstable and possibly explosive. So, the company brought in FLIR thermal imaging cameras to monitor the entire storage warehouse, 24/7. Now, these cameras broadcast images on a control room monitor that can direct personnel to the exact location of a hot spot. Preconfigured temperature alarms can be adjusted to compensate for temporary changes such as the presence of a forklift or worker. Thermal imaging cameras can also integrate with automated fire alarms and extinguishing systems to minimize the footprint of fire damage if it ignites before preventative measures can be imposed.

FLIR SOLUTIONS

FLIR AX8

FLIR A50/A70

FLIR FH-Series R

COMBUSTIBLE PILES

Thermal Imaging Value

Storage of some material invites the risk of spontaneous combustion. As always, prevention is better than a 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 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.

FLIR SOLUTIONS

FLIR A500f/A700f

FLIR FH-Series R

FLIR A310 ex

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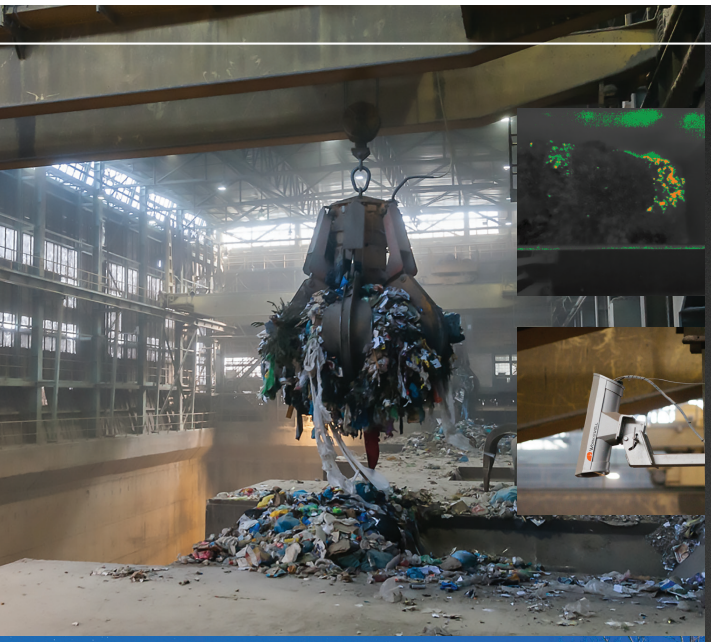

WASTE BUNKER MONITORING

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 prevent fires by identifying 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 thermal imaging cameras are needed. Jan Kovář, Workswell managing director said, "The whole system is scalable and can consist of several thermal imaging cameras with high spatial resolution and with thermal sensitivity greater than 0.05°C."

FLIR SOLUTIONS

FLIR Axxx-Series

FLIR FH-Series R

FLIR A500f/A700f

FLIR A50/A70

REMOTE FIREFIGHTING

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 the 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."

FLIR SOLUTIONS

FLIR A500f/A700f

FLIR A310 ex

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PROCESS CONTROL & QUALITY ASSURANCE

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

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 thermal imaging camera identifies hot spots on parts in a cooling chamber to see if additional cooling cycles will be necessary.

FLIR SOLUTIONS

FLIR Axxx-Series

FLIR A50/A70

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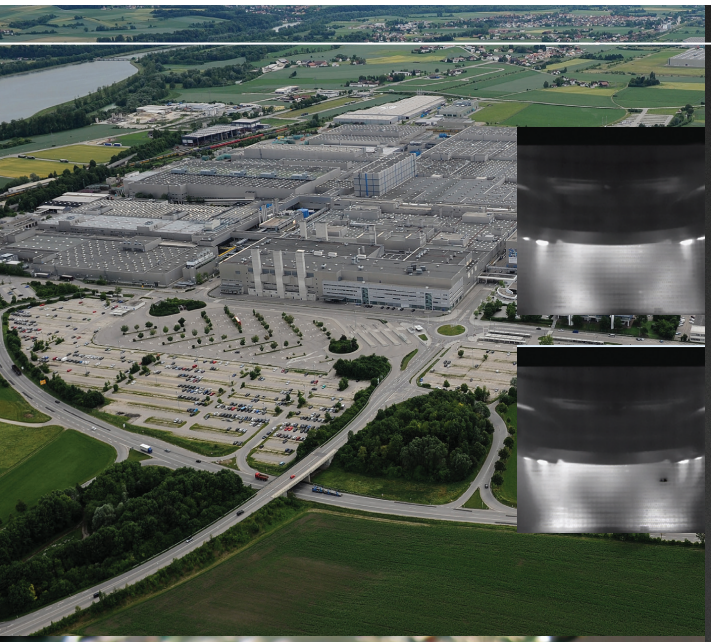


AUTOMOTIVE MANUFACTURING

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, air-conditioning outlets, and more.

Application Story

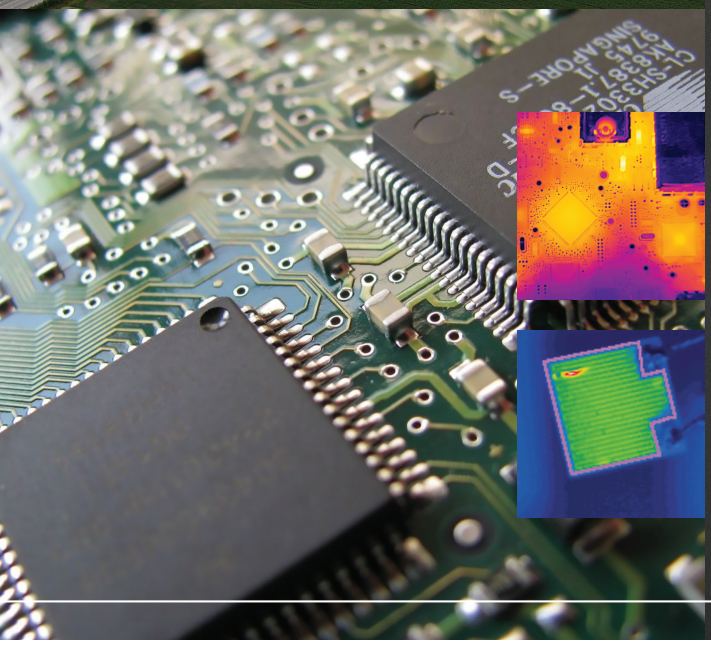
The BMW M5 has distinctive, powerful engine sound. This intentional acoustic design is the result of a second tailpipe exhaust pipe flap that opens only at higher RPMs. Company engineers needed a way to confirm that the flap worked properly without opening the exhaust system. Thermal imaging cameras for automation proved to be the answer. Through thermal imaging, BMW can record exhaust flow to confirm that the flap is opening and closing correctly.

FLIR SOLUTIONS

FLIR Axxx-Series

FLIR AX8

FLIR A50/A70



ELECTRONIC COMPONENTS

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 A-Series Smart Sensor thermal camera 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.

FLIR SOLUTIONS

FLIR A400/A700 Science Kits

FLIR A50/A70 R&D Kits

FLIR A6700/A6750

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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.

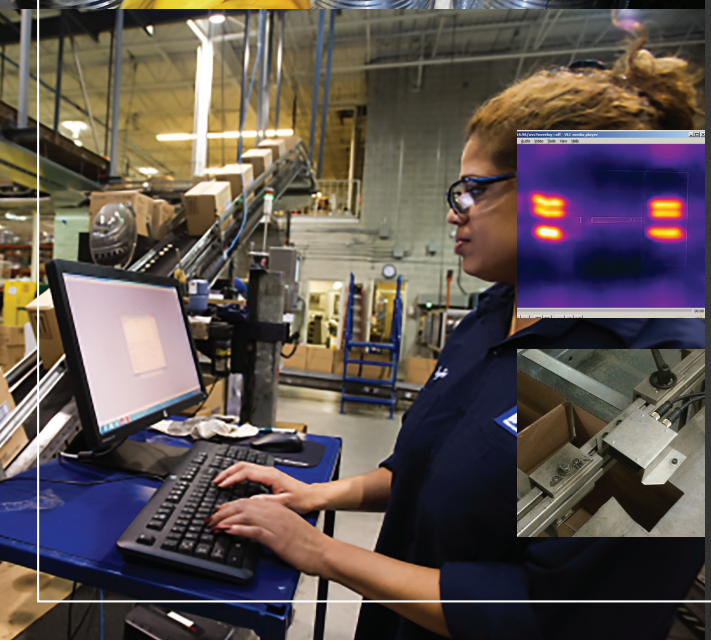
Application Story

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 cameras for quality control, monitoring temperature uniformity across the width of a conveyor oven cooking belt and confirming cellophane seals on finished microwave meals.

FLIR SOLUTIONS

FLIR Axxx-Series

FLIR A50/A70



PACKAGING

Thermal Imaging Value

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

Application Story

Recochem, a Canadian 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.

FLIR SOLUTIONS

FLIR AX8

FLIR Axxx-Series

FLIR A50/A70

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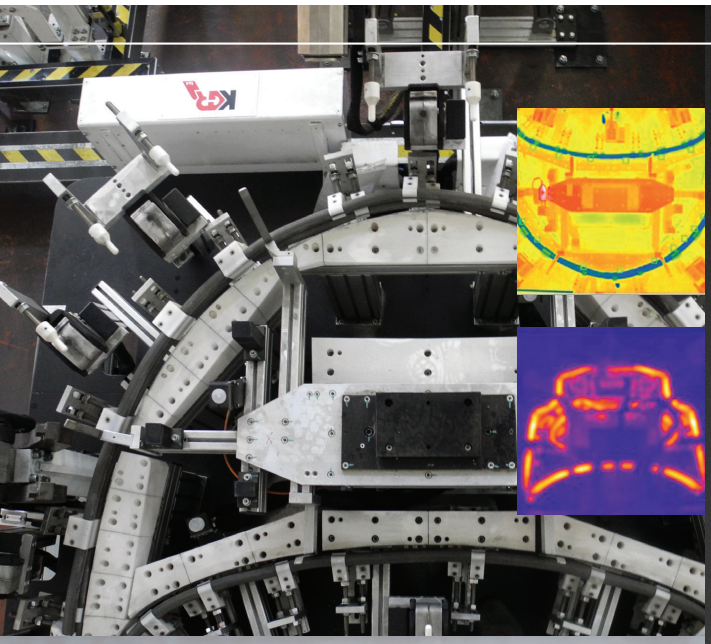

ADHESION

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, can easily determine whether the glue bead has been applied properly, has gaps and even if it is within the allowable temperature limits. FLIR thermal imaging is also integral to adhesive bonding using induction, a trending process in the automotive industry.

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 induction. The temperature must be exactly right for the adhesion to work properly. To ensure that the adhesion goes smoothly, FIAT uses FLIR thermal imaging cameras to provide automatic feedback during the process. According to Marco Simoli, technical manager at KGR (the induction equipment manufacturer), "With the FLIR thermal camera, we are able to reach the optimum performance of the production line. The thermal data allows us to evaluate and optimize the heating process."

FLIR SOLUTIONS

FLIR Axxx-Series

FLIR A50/A70

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 anomalies can cause an incomplete or bad weld pattern. Because thermal imaging cameras can visualize the IR weld as it's applied, it allows manufacturers to monitor the weld process as it happens 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 a proper weld required halting production for visual quality checks, as well as disassembling some pieces for more in-depth inspections. So Yanfeng consulted with Emitted Energy of Ohio, which brought in a monitoring system consisting of four FLIR thermal imaging cameras and analytical software. With this setup, Yanfeng can monitor production, map heat trends, and provide continuous non-contact evaluation of the infrared welds without the need to interrupt production.

FLIR SOLUTIONS

FLIR Axxx-Series

FLIR A50/A70

FLIR A6700/A6750

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AUTOMATION & INDUSTRIAL SAFETY SOLUTIONS

FLIR provides thermal imaging cameras, software, and services to make your condition monitoring, early fire detection, or process control monitoring system a reality.

INDUSTRY 4.0 SOLUTIONS

FLIR AX8

Combining thermal and visual cameras in a small, affordable package, the AX8 provides continuous temperature monitoring and alarming for uninterrupted condition monitoring of critical electrical and mechanical equipment.

FLIR A50/A70 Smart Sensor

The FLIR A50/A70 Smart Sensor Cameras integrate seamlessly into existing systems, offering comprehensive visual temperature monitoring with on-camera analytics and alarm capabilities.

FLIR Axxx-Series Smart Sensor

FLIR A400, A500, and A700 Smart Sensor Cameras target safety and automation applications where networking capabilities and compliance with networking protocols are mission critical.

FLIR Bridge/Bridge Pro

FLIR Bridge is an Industrial Internet of Things (IIoT) edge gateway that easily connects condition monitoring sensors and FLIR automation thermal cameras to your preferred software.

FLIR A500f/A700f Adv. Smart Sensor

FLIR A500f/A700f thermal systems offer on-camera anaylitics and alarming capabilities within a housing designed to withstand harsh elements, for reliable outdoor condition monitoring and early fire detection.

FLIR A310 ex

FLIR A310 ex is an ATEX-compliant solution, with a thermal imaging camera mounted in an enclosure, making it possible to monitor critical and other valuable assets in explosive atmospheres.

FLIR FH-Series R

FLIR FH-Series R thermal security cameras feature onboard, non-contact temperature measurement capabilities for fire detection, safety, and thermal monitoring of valuable equipment, plus 4K visual camera and easy VMS integration.

FLIR Axxx-Series Image Streaming

FLIR A400, A500, and A700 Image Streaming Cameras are plug-and-play devices within third-parties' machine vision software such as NIs IMAQ Vision™ and MVTec Halcon™.

FLIR A6700/A6750

Powerful cooled FLIR A67xx-Series thermal cameras can help you see minute temperature differences, capture high-speed processes and thermal events, and synchronize with other measuring devices.

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.

IP Config

Utility program for network camera detection and IP address setting that can be downloaded.

FLIR Research Studio

FLIR Research Studio provides robust recording and analysis capabilities with an intuitive user interface for a variety of research & development applications. This premium, advanced thermal analysis software offers a simplified workflow for displaying, recording, and evaluating data from multiple FLIR cameras simultaneously—allowing you to quickly interpret and understand critical information.

FLIR Atlas SDK

This software development kit allows developers to create custom applications, supporting communication, streaming, and recording using Gigabit, RTSP and USB interfaces. It also gives developers full access to the radiometric data for individual pixels.

FLIR GigE Vision Compliant SDKs

For application development, a Pleora eBus SDK or FLIR GEV Demo sample can be downloaded from FLIR Custhelp.

GigE Vision and GenICam Compliance

This machine vision camera standard is supported in many third-party image processing software.

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INDUSTRIAL PROTOCOL SUPPORT

FLIR Smart Sensors

- Easy web configuration interface
- FLIR Atlas SDK
- Ethernet IP
- Modbus client* and server
- MQTT
- REST API
- Digital I/O
- PTP (IEEE 1588)
- ONVIF "S" video and alarms*
- Most common ethernet protocols

*requires Advanced Smart Sensor configuration

FLIR Bridge "South" Sensor Plugins

- TI CC2650 SensorTag
- DAQ DT9837 Series
- JSON Payload
- Modbus
- MQTT
- OPC/UA Safe & Secure South
- Raspberry Pi GPIO many devices
- SenseHAT
- Simple REST with Payload Scripting
- Webcam
- Many more…

ACCESSORY SOLUTIONS

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

Optics

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

Mounts and Stands

FLIR offers multiple options for mounting camera systems, including tripods and microscope stands.

Cables and Connectors

Fiber-optic converters, fiber cable, extended cable lengths, and Camera Link PC cards are just a few of the options available from FLIR to help you meet any application requirement.

AFTER SALES SERVICE

Because FLIR designs and manufactures thermal imaging cameras from the sensor up, we can quickly troubleshoot and effectively service all aspects of the hardware and software. Our service and warranty programs, FLIR Care and FLIR Protect, offer a range of options that can ensure your FLIR products remain in top condition—and you won't have to worry about downtime if something goes wrong.

FLIR CARE

FLIR PROTECT

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NASDAQ: TDY

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