

THERMAL IMAGING FOR R&D / SCIENCE APPLICATIONS





The World's **Sixth Sense**™



FLIR: THE WORLD LEADER IN THERMAL IMAGING CAMERAS

FLIR is the world leader in the design and manufacturing of thermal imaging systems for a wide variety of commercial, industrial and government applications.

FLIR thermal imaging systems use state-of-the-art infrared imaging technology that detects infrared radiation - or heat. Based on detected temperature differences, thermal imaging cameras produce a visible image of a target's thermal profile. Advanced algorithms also make it possible to read correct temperature values from this image. We design and manufacture all of the critical technologies inside our products, including detectors, electronics, and lenses ourselves.

Serving the R&D / Science community with flexible solutions and expert support

FLIR Systems is totally dedicated to serving the demanding R&D / Science community. A dedicated R&D / Science group designs and develops the most advanced thermal imaging cameras on the market today. These camera systems are designed and developed in our state-of-the-art facilities in Taby, Sweden and Niceville, FL USA.

FLIR employs a direct staff of R&D/Science application specialists. These specialists are located throughout the globe with the sole purpose to provide our R&D/Science customers local expert support.

Thermal imaging for R&D / Science

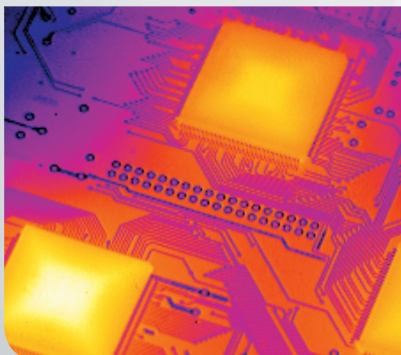
FLIR Systems thermal imaging cameras are ideal for a wide range of R&D / Science applications when flexibility and unequalled performance is vital. In Research and Development applications: accuracy, reliability, sensitivity and high performance are vitally important. That's why FLIR thermal imaging cameras are widely used around the world for applications that include: industrial R&D, academics, research, non-destructive testing, materials testing, defense, and aerospace.



Motorcycle brake



Product development



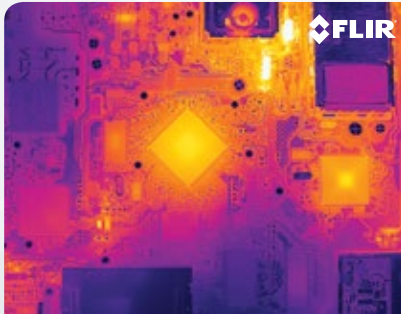
Printed circuit board



FLIR Systems Sweden

INDUSTRIAL R&D

Thermal imaging cameras help developers study, see and quantify the heat dissipation and thermal characteristics of their development projects. This allows them to keep the thermal efficiency of development projects under constant control shortening the design cycle and preventing costly product recalls.



Printed Circuit Board

Electronics inspection

Printed circuit board designs are challenged with the heat dissipation management without sacrificing performance or cost. Accurately understanding heat has been extremely difficult as the size of electronic components have continued to shrink in size. However, thanks to thermography, engineers are able to easily visualize and quantify heat patterns in the devices that they create. Thermal imaging can be used whilst complex PCBs are still at the design stage, for the avoidance of subsequent faults and expensive recalls.



Automotive Casting

Automotive industry

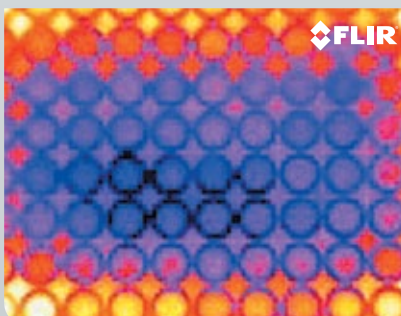
The automobile industry invests more in research and development than any other industry with the aim to produce more efficient, safer, and higher performing automobiles. Being able to bring reliable new models faster to the market is one of the key factors of success in the automobile industry. Thermal imaging allows automotive engineers to improve the designs of air bag systems, validate the efficiencies of heating and cooling systems, quantify thermal impacts on tire wear, perform quality checks on bonds and welds, and much more...



Glass bulb dimmer

Industrial lab test bench

Bringing new products faster to the market. This is one of the “key factors of success” in many industries. It is most beneficial to make use of infrared thermography early in the product design cycle for thermal model verification, failure analysis or even just to properly position thermocouples. Thanks to infrared, companies can shorten the development phase and improve product quality to boost the bottom line.



Microtiter plate

Pharmaceutical industry

New drugs are being developed with the help of infrared. Scientists look at temperature changes in chemical reactions and study what is happening in microtiter plates.

ACADEMICS & RESEARCH

Thermal imaging technology has become increasingly popular at colleges and universities for applications in both the classroom and the lab. In the teaching environment, instructors use thermal imagery to help students visualize the theories of heat transfer and thermodynamics improving student comprehension of key concepts.

Fast motion events

High-speed infrared imaging allows microsecond exposure times that stop the apparent motion of dynamic scenes and permit capture frame rates exceeding 10,000 frames per second. Research applications exist in the areas of ballistics, supersonic projectiles, explosives, combustion processes, lasers, and more.

Life sciences

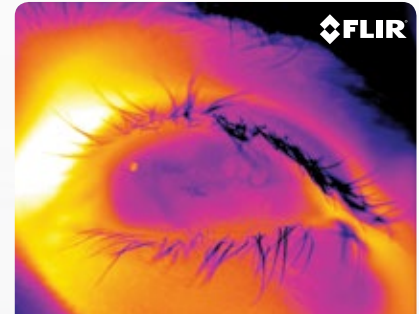
Thermography is an accurate, quantifiable, non-contact diagnostic technique used to visualize and quantify changes in surface temperatures. Applications include vascular evaluation, tissue condition, muscle strain assessment, and bleed point detection.

Infrared microscopy

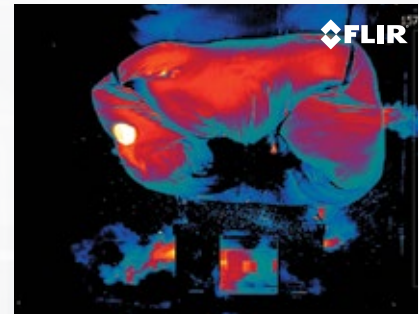
An infrared camera combined with a microscope becomes a thermal imaging microscope, capable of accurate temperature measurement on targets as small as 3 microns. Researchers use thermal imaging scopes to characterize the thermal performance of components and semiconductor substrates without physical contact.

Large temperature range phenomena

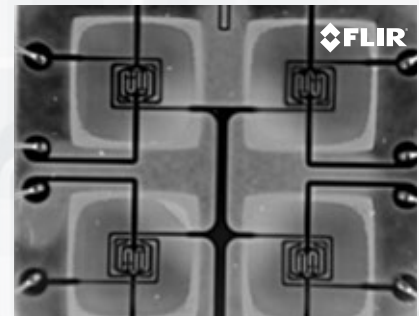
JET Fusion plasma reactor temperature measurement requires a thermal imaging camera with a rolling integration time, superframing and a real-time extended temperature range.



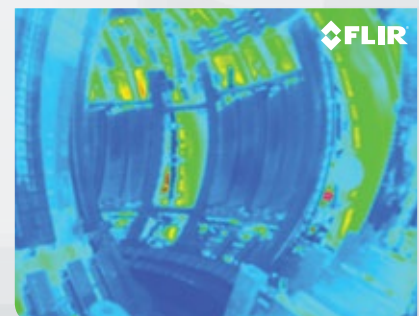
Analysis of eye



Initial airbag deployment



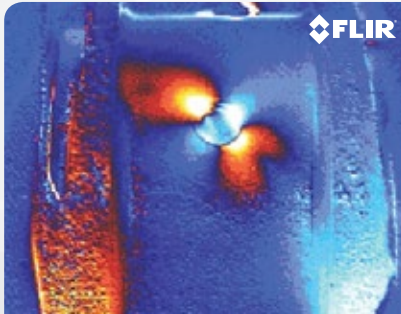
Integrated circuit evaluation



JET Fusion plasma reactor

NON-DESTRUCTIVE TESTING (NDT) / MATERIALS TESTING

NDT is a widely used method to evaluate the properties of a material, component, or system without causing damage. FLIR cameras with Lock-In capability possess the ability to perform advanced inspections such as NDT, stress mapping, and can also be used to resolve temperature differences as low as 1 mK.



Stress map of auto part

Stress analysis

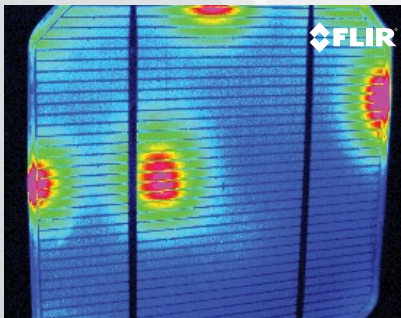
Stress and fatigue testing are common test methods in mechanical engineering and materials science, but provide limited information on complex structures. Thermal stress mapping provides thousands of stress measurements simultaneously, even on geometrically complex components. Compared to strain gauges, this technique provides faster, more complete information to researchers.



Composite flaw detection

Composite materials

Thermal non-destructive testing can detect internal defects through target excitation and the observation of thermal differences on a target surface. It is a valuable tool for detecting voids, delaminations, and water inclusion in composites.



Lock-in solar cell diagnostic

Solar cells

Solar cells may have electrical shunt defects. When the cell is energized, these shunts can be detected easily with Lock-In thermography. Lock-In photoluminescence testing can be done with near-infrared cameras.



Inductive crack detection

Crack Detection

Lock-in thermographic inspection of critical parts for cracks is done by synchronizing the camera image capture with the frequency of vibration or ultrasonic energy going into a part. Friction at the crack surface creates heat allowing fine cracks and fractures to be seen without the application of dyes or penetrants. This form of NDT allows for the inspection of large or complex parts without ultraviolet radiation.

DEFENSE & AEROSPACE

Most people associate thermal imaging in the defense sector with “seeing the enemy”. However, thermal imaging cameras are used today in the research and development of firearms, ammunition, guided missiles, and aircraft. The information contained in thermal imagery allow researchers to characterize objects in the thermal spectrum for target identification, counter measure deployment, and multi-spectral camouflage research.

Tracking

Thermal imaging camera systems complement video tracking systems by increasing visibility in low light or unfavorable haze conditions, allowing the tracking system to maintain target contact and constantly update the target’s bearing, range, and elevation.



Jet aircraft

Infrared signatures

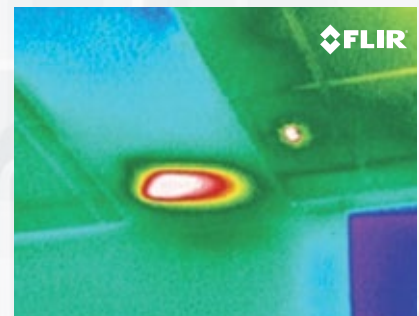
IR signatures measure a target’s apparent infrared brightness as a function of wavelength and reveal the appearance of a target to sensors under varying conditions of standoff distance and atmosphere. IR signatures are valuable tools in the design of vehicle, sensor, and camouflage systems.



Helicopter thermal signature

Technical surveillance and countermeasures

Infrared imaging is used to identify heat signatures from covert surveillance devices. Even devices hidden within objects can be revealed by the minute energy given off in the form of IR energy.



Covert surveillance device in ceiling

Laser designation

Laser designators emit a beam of laser energy used to mark a specific place or object, usually for precision-guided munitions. Near Infrared (NIR) cameras can detect these otherwise invisible beams and are used in designator research and targeting validation.



SWIR Laser designator on truck

A FULL PRODUCT RANGE FOR THE MOST DEMANDING R&D APPLICATIONS

FLIR Systems is active in all markets where the power of thermal imaging is being used for the most diverse applications. Whether it is for non-contact temperature measurement applications such as condition monitoring, automation of firefighting or for night vision applications such as security and maritime, FLIR Systems markets a full range of cameras that is totally dedicated to the needs of the user.

he same goes for R&D / Science. Some of our R&D customers are just discovering the power of thermal imaging. For these customers we manufacture entry level packages at extremely affordable prices that will help them in their daily R&D work. Other customers have long since discovered the power of thermal imaging and require the most technologically advanced thermal imaging cameras for extremely demanding applications.

At FLIR we understand that different users have different needs. That is why we are offering a full product range for R&D / Science applications.

Look at your application, look at our product range and discover the FLIR thermal imaging camera that will offer you the best solution. FLIR product specialist and our network of highly skilled distribution partners are always ready to guide you in the correct direction.

Technical specifications of our products can be consulted on our website or ask for a product leaflet.



FLIR thermal Bench Top Test Kits provide a turn key camera, lens, and software kit for basic thermal bench top testing and analysis.



FLIR A655sc fixed mount thermal imaging camera.



FLIR T650sc: Portable thermal imaging camera



FLIR A6700sc MWIR: high performance at an affordable price point



FLIR GF335 Portable MWIR thermal imaging camera



FLIR X8400sc Series: High speed MWIR Megapixel Science-Grade Infrared Camera

SOFTWARE SOLUTIONS

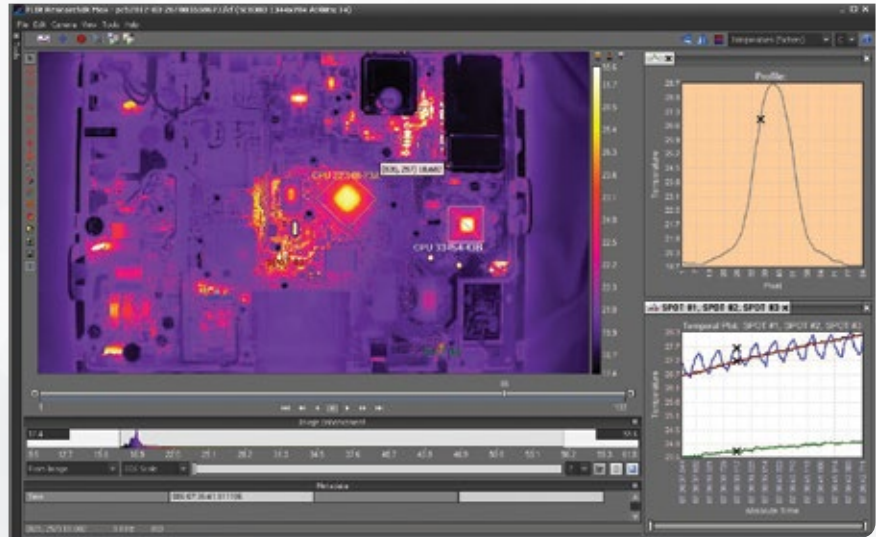
At FLIR, we recognize that our job is to go beyond just producing the best possible thermal imaging camera systems. We are committed to enabling all users of our thermal imaging camera systems to work more efficiently and productively by providing them with the most professional camera-software combination.

FLIR ResearchIR

ResearchIR is a powerful and easy-to-use thermal analysis software package for FLIR R&D / Science cameras. It provides camera control, high-speed data recording, image analysis, and data sharing.

Key features:

- Thermal movie and snapshot analysis
- Multiple measurement analysis tools
- Charts and graphs
- Customized workspaces
- Image processing filters
- Temporal plotting
- License free data and analysis sharing



Detailed analysis with FLIR ResearchIR.

Specific features include:

- Direct camera control and acquisition from MATLAB
- Thermal image analysis and enhancement including filtering, segmentation, morphology, statistics, sensor fusion, and geometric camera calibration
- Object detection and tracking
- Solutions for PC deployment and embedded implementations

Software Developers Kits (SDK)

A flexible, full-function SDK is available for all FLIR R&D camera products. The SDK allows users to create custom programming for camera control and data acquisition.

Third Party Software Compatible

FLIR thermal imaging cameras work seamlessly together with standard R&D software programs like MATLAB. It has signal and image processing software with a language and programming environment for algorithm development, image analysis, and visualization.



ACCESSORY SOLUTIONS

In today's fast-changing environment, requirements for purchased capital equipment can change from year to year or from project to project. Things that are vital today can be redundant tomorrow. That makes it important for the equipment in which you invest to be flexible enough to meet the ever-changing needs of your applications.

No other infrared camera manufacturer offers a wider variety of accessories than FLIR Systems.

Optics

From microscope optics that resolve down to 3 μm to 1 meter telescopes, FLIR has the right optic for your application needs.

Mounts & Stands

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

Filters

FLIR offers a standard set of spectral and neutral density filters. Custom filters can also be provided upon request.

Calibration

FLIR has a state-of-the-art calibration lab for providing NIST traceable calibrations. Various calibration services are available for different lenses and filter combinations.

Cables and Connectors

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



DATA SYSTEMS SOLUTIONS

FLIR offers a variety of data recording solutions optimized for high speed digital data recording, advanced analysis, and full control of FLIR high-performance science and range-grade cameras. Designed to meet a wide array of demanding requirements, each system is built, configured, and tested at our factory, and comes standard with a FLIR one year warranty.

Portable High-Speed Data Recorder (PHSDR) – Records images at full frame rates while simultaneously allowing for real time image display, analysis, and camera control. Up to 3 hours of data can be recorded to removable, nonvolatile storage with zero dropped frames.

Portable Data Recorder (PDR) – Ideal for applications that demand portability and remote operation. The PDR offers high speed Gigabit Ethernet connectivity, runs on a customized laptop, and is optimized for fast data transfer.



High Speed Data Recorder module (HSDR)

AFTER SALES SERVICE

At FLIR, building a relationship with a customer takes more than just selling a thermal imaging camera. After the camera has been delivered, FLIR is there to help meet your needs.

Because FLIR designs and manufactures their cameras from the sensor up, they can quickly troubleshoot and effectively service all aspects of FLIR camera systems.

FLIR Systems offers different types of service contracts. A service contract offers you the advantage that you will never have unforeseen expenses if something should happen to your thermal imaging camera after the warranty period. Some service contracts even guarantee that you will have a replacement camera at your service if necessary.



FLIR's IR Camera Calibration

INFRARED EDUCATION & TRAINING

Our mission is to make our customers and partners successful by enhancing their knowledge of IR technology, thermal imaging products, and relevant applications. FLIR offers a portfolio of educational seminars, courses, and services that presents the right mix of theoretical and practical content to help researchers, engineers, technicians, and scientists quickly apply thermal imaging technology to real life applications.



One of Many FLIR IR Camera Training Courses

FLIR offers education and training programs at its production facilities, regionally, or at your location. FLIR assists beginners to seasoned professionals in the following areas:

- On-line training courses
- Infrared thermography for research and development
- Advanced radiometry
- Thermography R&D application webinars
- Infrared technology & Application Seminars
- Customer site consultation services

More information is available at www.flir.com/IReducation

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 [Created 01/12/15]

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