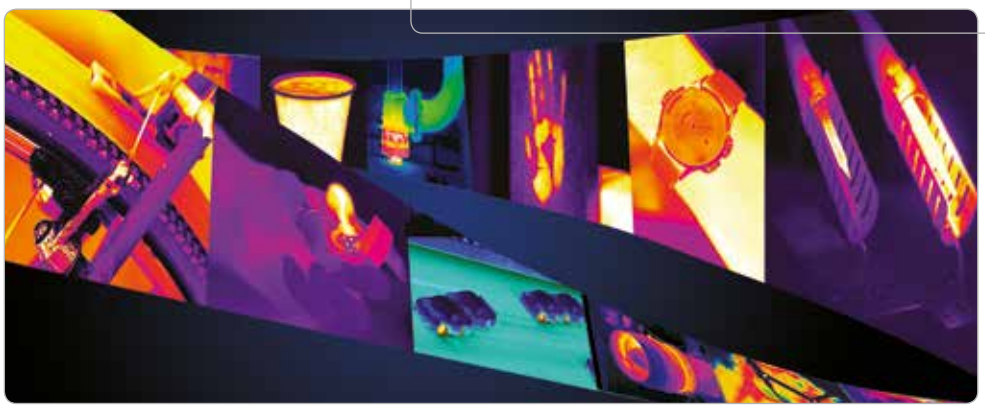
Advanced thermal imaging cameras for R&D and Science applications



Institutional R&D

Non Destructive Testing

Lock-In Thermography

Multi-spectral analysis

Range Phenomenology

Medical

FLIR: The world leader in thermal imaging cameras

FLIR is the world leader in the design, manufacturing and marketing 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 can create a crisp image. 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 special lenses ourselves.

FLIR, Stockholm

FLIR ATS, France

FLIR, Boston

FLIR Santa Barbara

Rapidly emerging markets and organisation
Interest for thermal imaging has grown considerably over the last few years in a large variety of markets. To face this increased demand, FLIR has expanded its organisation drastically. Today we employ more than 3,200 people. Together, these infrared specialists realise a consolidated annual turnover of more than 1 billion US dollars. This makes FLIR the largest manufacturer of commercial thermal imaging cameras in the world.

Manufacturing capabilities
FLIR currently operates 6 manufacturing plants: three in the USA (Portland, Boston and Santa Barbara, California) one in Stockholm, Sweden, one in Estonia and FLIR ATS - Advanced Thermal Solutions, near Paris, at Marne la Vallée.

More than a camera, a complete solution
There is more to the world of thermal imaging than building a camera. FLIR is not only committed to providing you with the best camera, we are also able to offer you the best software, service and training to suit your thermal imaging needs.

FLIR Advanced Thermal Solutions

Looking for the best performance
Thermal imaging cameras are being used for a wide variety of applications: predictive maintenance, building inspections, Security & Surveillance, automotive, maritime, firefighting to name just a few. FLIR is not only active in all these segments but is the undisputed market leader in each segment.

High-end R&D customers have, however, totally different needs and expectations. They look for high performance solutions that can support them in their specialised fundamental or applied research projects.

FLIR has recognised this and has founded a separate business unit near Paris, France, FLIR Advanced Thermal Solutions, fully dedicated to the development and manufacturing of such high performance solutions for High-end R&D and Science customers.

QUALITY: our constant mission
At FLIR we manufacture the critical components for our products, such as infrared detectors, Read Out Integrated Circuits (ROIC), lenses, electronic boards and mechanical designs ourselves. The main purpose of this technology investment is to ensure that all the components, and the systems as a whole, satisfy our stringent performance and quality expectations. Precise and thorough quality control before, during and after each stage of the manufacturing process ensures that all FLIR products meet the highest international quality standards.

Thermal imaging cameras
A thermal imaging camera is a compact, easy-to-use piece of equipment. However, it is based on advanced technology, in terms of both hardware and software.

At FLIR Systems we insist on having total control of our products. Our engineers therefore design all hardware and software themselves. The in-depth expertise of these infrared specialists ensures the accuracy and reliability of all the vital components that are assembled into a thermal imaging camera.

All the mechanical and electronic components are engineered and developed by these same infrared specialists. The result is that we build cameras that are extremely user-friendly for their operators.

A focus on optics

The optics of a thermal imaging camera are designed in a similar way to those of a normal camera. However, the types of glass that are used in a normal camera cannot be used for thermal imaging camera optics, because glass does not transmit infrared radiation well enough.

In most cases, the lens is made of germanium or silicium. These expensive materials have excellent mechanical properties, are made of the best optical material and do not break easily. To ensure the highest quality, FLIR turns all its optics at its own production facilities.

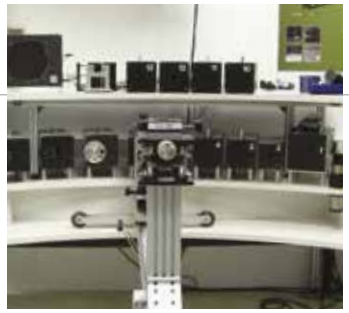
For manufacturing reflecting surfaces, mirrors, diffractive, spherical and aspherical types of lenses, FLIR operates two diamond-turning machines.

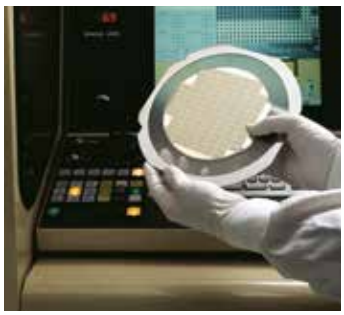
The heart of the matter: the detector

The infrared detector, which absorbs infrared radiation and converts it into an electrical signal, is the primary component of all thermal imaging systems.

FLIR is the only thermal imaging camera manufacturer that operates its own detector manufacturing facility. A world-class, high volume fabrication facility capable of producing and packaging InSb (Indium Antimonide), QWIP (Quantum Well Infrared Photon), uncooled Vanadium Oxide and InGaAs based detectors.

The handling of these ultra-sensitive, high-tech detectors is done in cleanrooms.





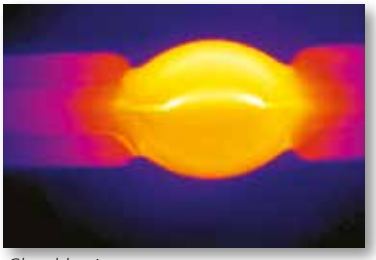
Testing and calibration: the final stage

Before shipment to its final destination, the camera is calibrated and undergoes a number of stringent quality tests. Calibrating the camera ensures that each and every pixel is able to measure temperatures accurately. The camera is placed in front of a temperature reference black body and it is checked that each pixel measures exactly the same temperature.

Each camera is exposed to the most adverse conditions in specially designed climatic chambers. This ensures that our camera systems perform accurately and give exact temperature readings.

Advanced Thermal Solutions for a wide range of R&D and Science applications

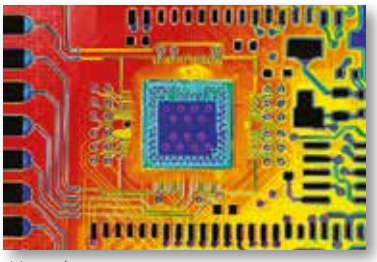
FLIR Advanced Thermal Solutions cameras are ideal for a wide range of R&D and Science applications when flexibility and unequaled performance is vital. We are pleased to present you some examples of dedicated applications for which FLIR is offering unique solutions. For more information or any question, feel free to contact us, our applications engineers will give all technical and application support in order to define the adequate solution.



Glass blowing

Research & Development

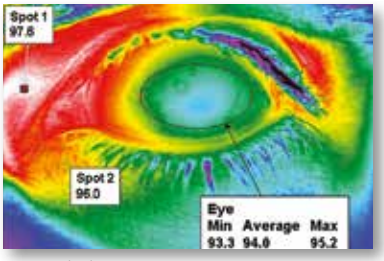
Thermal imaging cameras can characterise material properties and supply rapid non-contact temperature measurement in the most demanding conditions. A wide array of infrared sensor types and optics make thermal imaging indispensable in many research environments.



Microchip

Thermal imaging microscopy

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



Eye pathology

Medical thermography

Medical thermography is an accurate, quantifiable, non-contact diagnostic technique used to visualise and quantify changes in surface temperatures using high performance thermal imaging cameras. Applications include vascular evaluation, tumorous tissue identification, muscle strain assessment, and bleed point detection.

Muzzle flash

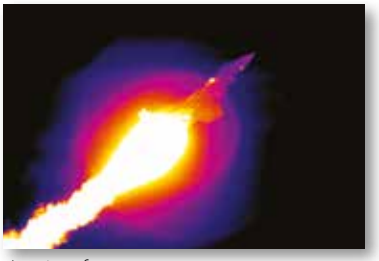
High speed/stop motion

High-speed thermal imaging allows microsecond exposure times that stop the apparent motion of dynamic scenes and permit capturing frame rates exceeding 62,000 frames per second. Applications include thermal and dynamic analysis of jet engine turbine blades, supersonic projectiles, and explosions.

Helicopter thermal signature

Thermal signatures

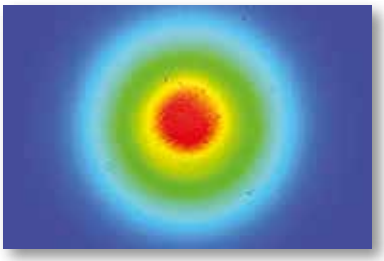
IR signatures measure a target's apparent infrared brightness as a function of wavelength and reveal the appearance of a target to sensors under varying conditions of standoff distance and atmosphere. IR signatures are valuable tools in the design of vehicle, sensor, and camouflage systems.



Jet aircraft

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.



Laser beam profile

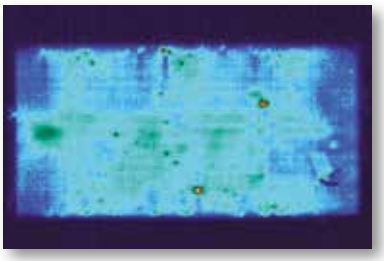
Directed energy

A directed-energy weapon (DEW) emits energy in an aimed direction without the means of a projectile. DEWs include laser, high power radio frequency, and particle beam technologies. Thermal imaging camera technology is deployed in the testing of DEW instrumentation and in the analysis of target impacts.

Laser targeting on truck

Laser Designation

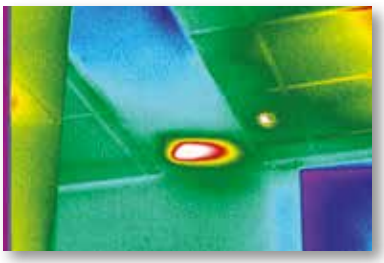
Laser designators emit a beam of laser energy used to mark a specific place or object, usually for precision-guided munitions. Thermal imaging cameras can detect these otherwise invisible beams and are used in designator research and targeting validation.



Lock-in solar cell diagnostic

Infrared Non-Destructive Testing (IR NDT)

IR NDT can detect internal defects through target excitation and the observation of thermal differences on a target surface. IR NDT is a valuable tool for detecting voids, delaminations, and water inclusion in composites. Another application is the detection of shunts and charge density in solar cells.



Hidden listening device

Technical surveillance and countermeasures

Thermal 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.

SWIR Image of moon

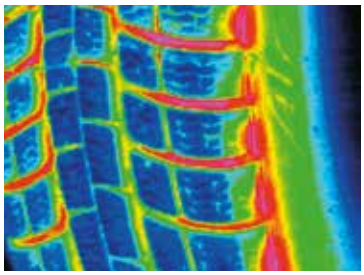
Short Wave Infrared (SWIR)

Short Wave IR (SWIR) Imaging provides non-destructive quantitative analysis of crops, pharmaceuticals, agricultural products, and lasers. Because SWIR can penetrate many opaque materials, it is also used to see through haze, examine art forgeries, and inspect semiconductor wafers.

Advanced Thermography measurements

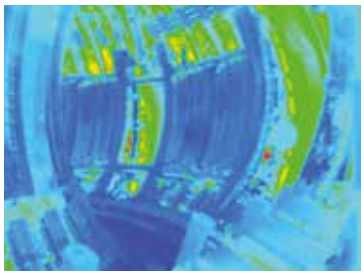
In many circumstances, R&D applications require advanced measurement capabilities. FLIR ATS offers cooled and uncooled solutions. The higher specification SC5000, X6000 sc, SC7000 and X8000 sc cooled cameras offer ultra-fast, ultra-sensitive performance in the MWIR and LWIR spectral bands, while the SC2500 operates in the NIR spectral band. These cameras provide superior measurement capabilities in challenging setups for fast motion and thermal events, wide temperature range, small amplitude phenomena, multispectral analysis or very small object evaluation. The FLIR SC2500 will be useful for laser profiling, paint analysis, silicon wafer inspection, high temperature measurement and all kind of application for which the SWIR spectral band offers measurement advantages.

For which application criterias do you need to use an Advanced Thermal Solution?



1) Fast motion - Short integration time

Application description:
Thermal image of a tyre during a quality test done at 200km/h.
Camera model:
FLIR SC7650 with an external synchronisation sensor.
Requirement:
Short Snapshot integration time, external trigger input with a slave camera mode for the data acquisition.



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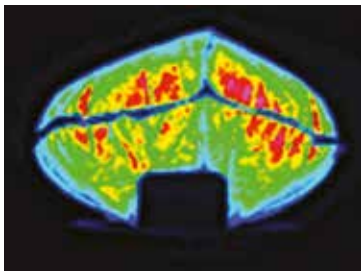
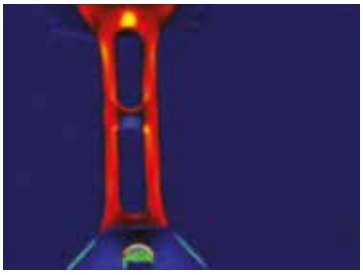
2) Large temperature range - DRX (Dynamic Range Extension) Mode

Application description:
JET Fusion plasma reactor temperature measurement.
Camera model:
FLIR SC7500 with rolling integration time.
Requirement:
Superframing and real time extended range.



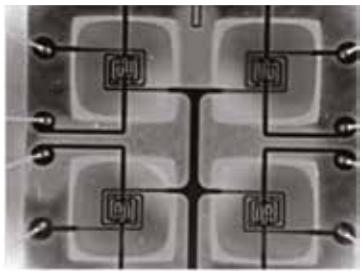
3) Fast thermal event - Fast frame rate

Application description:
Airbag deployment analysis.
Camera model:
FLIR SC5500 at 3.5 kHz in a windowing mode.
Requirement:
Fast frame rate in a Snapshot mode with an external trigger input.



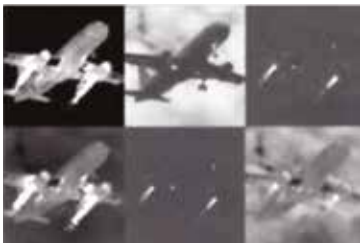
4) Small amplitude phenomena - Thermal resolution & Lock-in thermography

Application description:
Thermal stress analysis
Camera model:
FLIR SC7210 with a lock-in signal input
Requirement:
A very high thermal sensitivity (<20mK), a lock-in signal input, a snapshot mode



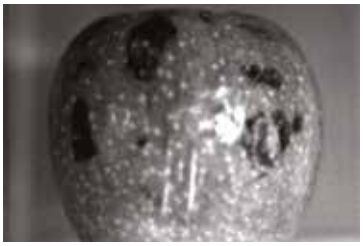
5) Very small object analysis - High spatial resolution

Application description:
Thermal evaluation of an integrated circuit.
Camera model:
FLIR SC5650 with x5 microscopic lens with a 3µm/pixel resolution.
Requirement:
High quality image resolution due to advanced design microscopic lens, a very low NETD and a large FPA detector. A very short integration time will also allow transient analysis.



6) Multispectral analysis – a large set of lenses and filters combinations

Application description:
Multispectral IR signature of airliner jet.
Camera model:
FLIR SC7500 ORION with high speed spectral filter wheel and dedicated long distance measurement lens.
Requirement:
Thermal analysis in different spectral bands, snapshot mode and dedicated set of filters and lenses.



7) Examples of SWIR applications

Application description :
Quality control on fruits.
Camera model :
FLIR SC2500 equipped with a dedicated spectral filter.
Requirement:
Spectral analysis.

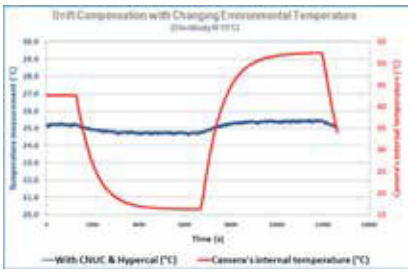
Thermal imaging cameras with advanced functionalities

FLIR Systems realises that thermal imaging cameras for high-end R&D specialists require special features. In order to facilitate the work of researchers, FLIR Systems has developed a number of FLIR proprietary features that are extremely useful for researchers in all fields. These unique features are included on almost all FLIR ATS SC and Xsc Series cameras.

Stability and versatility with FLIR CNUC™

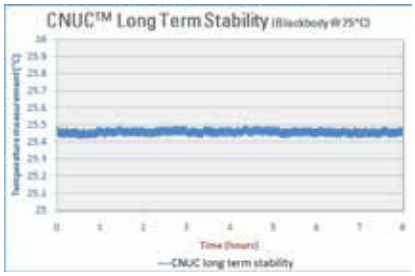
CNUC™ is a proprietary calibration process that provides extremely beautiful imagery and accurate measurement from a FLIR thermal imaging camera. A camera calibrated with CNUC™ allows for flexible integration time adjustments without the need to perform non-uniformity corrections.

Additionally the CNUC™ calibration produces accurate measurement stability regardless of camera exposure to ambient temperature variations.



Flexible temperature measurements with FLIR HyperCal™

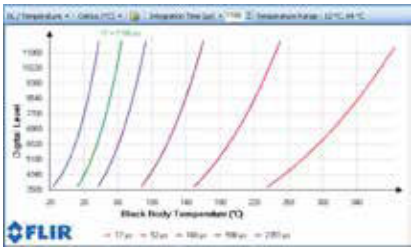
Factory set temperature ranges are a thing of the past with FLIR HyperCal™. The user simply sets the lower and upper limits of the temperature range and the camera will automatically adjust to the appropriate integration time. This ensures the best measurement range with the highest possible sensitivity.



Automatic DRX Capability

If the scene's temperature range varies greatly over time, the thermal imaging camera can be switched into DRX mode enabling accurate temperature measurements over a wider temperature range.

The technique of DRX consists of varying the exposure, or integration time of the camera from frame to frame in a cyclic manner and combining the resulting subframes into single superframes with greatly extended temperature ranges, allowing visualisation of scenes featuring extreme temperature differences.



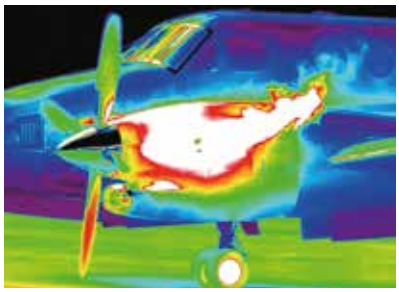


Figure 1: 2-millisecond image: saturated exhaust system

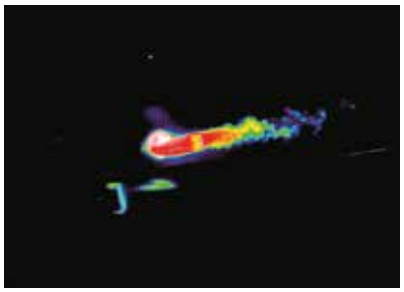


Figure 2: the 30-microsecond image shows the exhaust system very clearly without saturation, but the rest of the scene is too cold to see clearly above the system noise floor

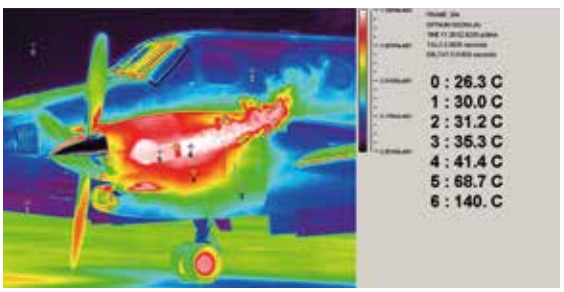


Figure 3: The solution: a picture both high in contrast and wide in temperature range

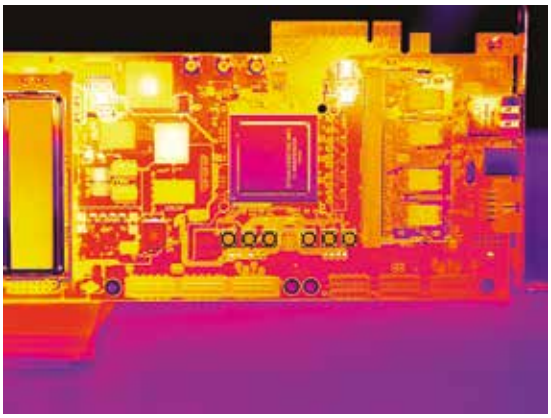
FLIR X8000 sc / X6000 sc Series

For the most demanding R&D professional

Thermal images up to 1280 x 1024 pixels (FLIR X8400 sc) will show you the smallest of details and assure excellent measurement accuracy, while fast dynamic scenes will be accurately recorded up to 355 Hz in full 640x512 resolution (FLIR X6580 sc) and up to 4500 Hz using a 320x8 sub-window (FLIR X6580 sc).

The FLIR X8000 sc / X6000 sc Series thermal imaging cameras are designed to provide the best thermal measurement performance together with the most advanced connectivity. They are ideal for Scientists and R&D professionals that are working on the most demanding applications. All FLIR's knowledge is concentrated in this full featured, yet compact camera, providing ultra-sensitive and accurate measurements. State-of-the-art connectivity and ease of use allow the user to concentrate on the experiment and not on the camera.

Thermal image of the Arc de Triomphe, Paris.



This thermal image of an electronic board shows even the smallest detail.

Best possible image quality
The FLIR X8400 sc is equipped with a cooled Indium Antimonide detector that produces crisp thermal images of 1280 x 1024 pixels. It allows seeing the smallest of details and offers 4 times more thermal data than the standard 640 x 512 pixels images.

Users that do not need this amount of pixels can choose for the FLIR X6000 sc Series. It provides thermal images of 640 x 512 pixels, available with both InSb and MCT detectors.

High sensitivity
The FLIR X8000 sc / X6000 sc Series detect temperature differences smaller than 25mK (18mK typically). With the "lock-in" process temperatures differences as small as 1mK will become clearly visible.

Auto exposure
The camera automatically adjusts its temperature range to best fit the thermal scene.

Outstanding measurement accuracy
High accuracy of +/- 1°C or +/- 1% produces sensitive thermal images. The FLIR X8000 sc / X6000 sc Series can measure temperatures up to +3,000° C

Ultra high frame rate with windowing
The FLIR X8000 sc Series have an adjustable frame rate of up to 106 Hz full frame. The FLIR X6000 sc Series have an adjustable frame rate in full frame format of up to 355Hz. The FLIR X8000 sc / X6000 sc Series can deliver images up to a speed of 4,500 Hz in windowing. Windowing allows a subset of the total image to be selectively read out with user adjustable window size. The sub-sample windows can be arbitrarily chosen and are easily defined.

ELR Detector working domain improvement
The Extended Linear Response increases the useful range of detector by removing residual non linearities. This unique industry first FLIR processing, extends the working domain of the camera to its limits.

CNUC™ Calibration
CNUC™ is a proprietary calibration process that provides beautiful imagery and accurate measurement stability. CNUC™ allows for flexible integration time adjustments without the need to perform non-uniformity corrections. CNUC™ calibration also produces accurate measurement stability regardless of camera exposure to ambient temperature variations.

Hypercal™
Ensures the best measurement range with the highest sensitivity. Simply set the desired lower and upper temperature limits and the camera will automatically adjust to the appropriate integration (exposure) time.

DRX - Dynamic Range Extension
Dynamic Range Extension allows the acquisition of thermal data from up to four user-defined temperature ranges simultaneously, then merges those streams into a single real-time data stream that spans all four temperature ranges, effectively extending dynamic range from 13- or 14-bit to 16-bit.

Wide range of interchangeable lenses
The FLIR X8000 sc / X6000 sc Series come with an advanced high performance optical design with lens recognition and automatic measurement adjustments. The X6000 sc Series also feature a high performance Ultrasonic Motor USL (Ultrasonic Smart Lens) mechanism for fast and smooth remote focusing. It is also possible to manually adjust the focus directly on the camera.
A temperature probe is integrated in the lens for improved measurement accuracy and drift compensation.

A wide range of lenses and various extension rings are available.

Motorized filter wheel
The FLIR X8000 sc / X6000 sc Series contain a 4 slots motorized filter wheel with automatic filter recognition and measurement parameter adjustment. A temperature probe is integrated for improved measurement accuracy.

Connectivity
The FLIR X8000 sc / X6000 sc Series offer a wide range of connectivity options:
- Camera Link medium for full bandwidth data acquisition
- Gigabit Ethernet for simple connectivity
- Standard BNC connectors for often used features such as Detector Sync, Acquisition trigger, analog lockin input.
- MicroSD-card slot
- DVI-output 1080p
- IRIG-B connector for external time stamping

An extension port with advanced features and connections is available
- Function generator with adjustable waveform and frequency

Removable Touchscreen LCD
The detachable touchscreen LCD provides you with on-site image feedback and camera configuration parameters. You can easily adjust the camera to your needs. One touch on the screen controls the acquisition on the computer or controls the focus (X6000sc).

The LCD touchscreen can be removed from the camera when the FLIR X8000 sc / X6000 sc Series needs to be installed in a hard to reach position. Just position your camera and control it from a distance.

The LCD touchscreen can be removed from the camera when the FLIR X8000sc / X6000sc Series needs to be installed in a hard to reach position.

Global Status LED
Located on the top of the camera, the global status LED provides you with instant system status, including ResearchIR status. When green, no doubt your experiment with be fully acquired. The back panel LEDs instantly inform you about the camera status.

FLIR X8000sc / X6000sc Series comparison table

	X8400sc	X6580sc	X6540sc/ X6550sc	X6530sc
Resolution	1280x1024	640x512	640x512	640x512
Frame rate (Full)	106 Hz	355 Hz	125 Hz	145 Hz
Frame rate (max value)	3000 Hz (1280x8)	4500 Hz (320x8)	4011 Hz (64x8)	3699 Hz (132x8)
USL mechanism	No	Yes	Yes	Yes

FLIR High Speed Data Recorder (HSDR)

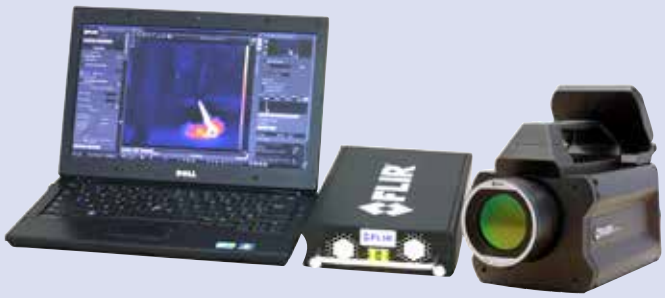
Extraordinary performance for thermal data recording

Thermal imaging data recorders can have a very limited performance. In many cases they allow you either to record fast frame rates over a short time period (burst recording), or record slow frame rates over a long period of time (time lapse recording).

The FLIR HSDR solves these performance issues by allowing fast frame rate data recording over extended time periods.

The system is compact in size and incorporates the latest connectivity protocol. Coupled with the ResearchIR Max software, the HSDR system is truly a one of a kind solution.

High-speed, large volume Recording
The FLIR High-Speed Digital Recorder (HSDR) is a digital recording system designed to collect, record, display, calibrate, and analyze images from FLIR Systems thermal imaging cameras utilizing the ResearchIR Max Software. The HSDR can record at the highest camera frame rate to removable non-volatile storage disks for up to 1 hour. The system features real time image display while recording.



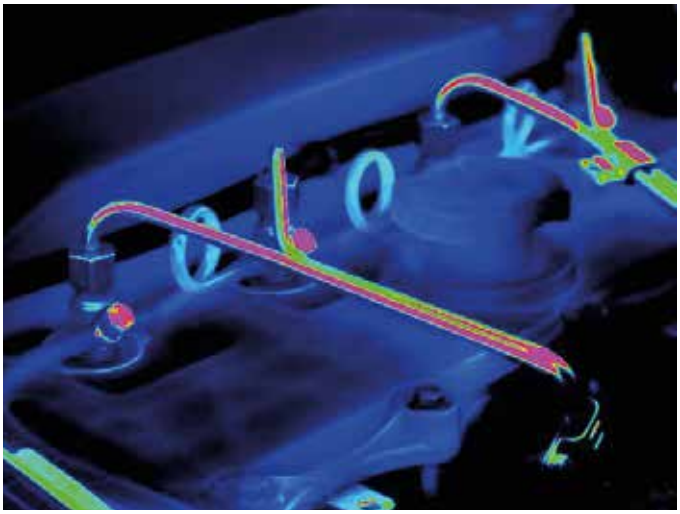
Software included
Every FLIR HSDR comes with an activation key for ResearchIR Max. The combination of the FLIR X8400 sc together with a FLIR HSDR and ResearchIR Max software will provide every scientist with the most powerful thermal imaging solution on the market today.

FLIR A3500sc/A6500sc-Series

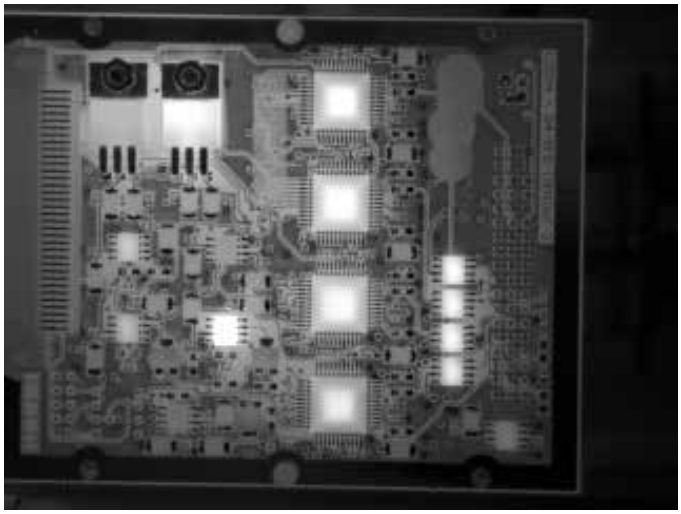
Fast thermal cameras for R&D applications

The FLIR A3500sc/A6500sc-Series are thermal imaging cameras that are equipped with a cooled detector. They are ideal tools for industrial R&D. For those applications that need better image quality, more sensitivity and a higher frame rate than what can be obtained from a thermal imaging camera with an uncooled detector.

When higher frame rates and better image quality are required Scientists can choose among the FLIR X8000 or X6000 series.



Thermal image of an engine



Thermal image of a PCB board

Choice of image quality
The FLIR A6500sc produces crisp thermal images of 640x512 pixels.

Users that do not need this high image quality for their application can choose the FLIR A3520sc which produces thermal images of 320x256 pixels. Furthermore, 320x256 arrays make use of larger pixels which enable the camera to be more sensitive.

External Triggering / Synchronization
External triggering allows synchronization of the image capture to the most fleeting events. It is also possible to configure one camera to be master and others to be slave for applications requiring more than one camera.

High sensitivity <25 mK
<25mK thermal sensitivity captures the finest image details and temperature difference information, only achievable with cryogenically cooled infrared detectors.

Mid-Wave Infrared
The FLIR A3500sc/A6500sc-Series cameras are all featuring Mid-Wave Infrared Cooled detectors, thus being able to see through or at materials that no other uncooled Long-Wave camera can, like certain types of glasses or plastics.

Snapshot operation
All FLIR A3500sc/A6500sc-series cameras work on a snapshot mode: all pixels are registering the thermal event simultaneously. In case of moving objects or on motion applications, such cameras can avoid image blur that would occur if a non-snapshot camera would be used.

GigE Vision™ standard compatibility
GigE Vision is a new camera interface standard developed using the Gigabit Ethernet communication protocol. GigE Vision is the first standard to allow for fast image transfer using low cost standard cables even over long distances. With GigE Vision, hardware and software from different vendors can interoperate seamlessly over GigE connections.

Software included
The FLIR A3500sc / A6500sc cameras work seamlessly together with FLIR ResearchIR/ResearchIR Max. It allows for viewing, recording and advanced processing of the infrared data provided by the camera.

Comparison table

	A3520sc	A6550sc	A6540sc	A6530sc
Image quality	320 x 256 pixels	640 x 512 pixels	640 x 512 pixels	640 x 512 pixels
Detector type	Cooled Indium Antimonide (InSb)	Cooled Indium Antimonide (InSb)	Cooled Indium Antimonide (InSb)	Cooled Mercury Cadmium Telluride (MCT)
F#	f/3.0	f/2.5	f/3.0	f/2.0
Digital frame rate	320 x 256 at 60 Hz 160 x 128 at 240 Hz 80 x 64 at 960 Hz	640 x 512 at 60 Hz 320 x 256 at 240 Hz 160 x 128 at 715 Hz	640 x 512 at 60 Hz 320 x 256 at 240 Hz 160 x 128 at 715 Hz	640 x 512 at 60 Hz 320 x 256 at 240 Hz 160 x 128 at 960 Hz

FLIR SC7000 Series

Complete range of state-of-the-art infrared technology systems for R&D and thermography

The FLIR SC7000 Series is a very flexible camera, with the highest sensitivity, accuracy, spatial resolution and speed.

The SC7000 Series is specifically designed for academic and industrial R&D applications as well as integrators who need to have a very flexible camera, with the highest sensitivity, accuracy, spatial resolution and speed at an affordable cost. The FLIR SC7000 Series provides for the first time the CNUC™ & Hypercal™ technologies which features NUC free operation and a large dynamic range choice.

Choice of detector
The FLIR SC7000 Series is available with a wide range of detectors to address any application in single and multispectral analysis. The researcher has a choice between mid-wave Indium Antimonide (InSb) and Mercury Cadmium Telluride (MCT) detectors. MCT detectors operating in the long-waveband are also available.

Removable lens interface
Gives complete flexibility in the optical path that needs to be followed for a specific application.

640 x 512 pixels
Some models of the SC7000 series produce crisp thermal images of 640 x 512 pixels. Users that do not need this high image quality for their application can choose a version that produces thermal images of 320x256 pixels. Furthermore, 320x256 arrays make use of larger pixels which enable the camera to be more sensitive.

High Sensitivity: as low as 20 mK NETD
20 mk thermal sensitivity captures the finest image details and temperature difference information

External triggering
External triggering allows synchronisation of the image capture to the most fleeting events. Three external analogue signals are synchronously acquired with the image allowing the embedding of external sensor measurements.

Ultra high frame rate with windowing
Depending on the model and detector, the FLIR SC7000 series can deliver thermal images up to a speed of 62,000 Hz. Windowing allows a subset of the total image to be selectively read out with user-adjustable window size at a much higher frame rate. The sub-sample window sizes and locations can be arbitrarily chosen and are easily defined using the camera control software.

Adjustable integration time
Integration time is adjustable in nanosecond increments. The smart external triggering feature allows synchronisation of the image capture to the most fleeting events.

Removable filter wheel
The FLIR SC7000 series comes standard with a removable, motorised 4 position filter wheel. This allows imaging of events in a very narrow part of the electromagnetic spectrum.

Multiple video outputs
The FLIR SC7000 series feature multiple independent video outputs including:
- Analog – Composite (BNC)
- Digital – CameraLink
- Digital – Gigabit Ethernet

Precise automatic IRIG time stamp of all images
IRIG timing receiver is built directly into the SC7000 camera providing accurate time stamping in the camera header information. IRIG is a standardised time code allowing equipment to be synchronised to a known reference time. The most common version is IRIG-B, which encodes day of year, hour, minute, and second data on a 1 kHz carrier frequency, with an update rate of once per second.

CNUC™ Calibration
CNUC™ is a proprietary calibration process that provides beautiful imagery and accurate measurement stability. CNUC™ allows for flexible integration time adjustments without the need to perform non-uniformity corrections. CNUC™ calibration also produces accurate measurement stability regardless of camera exposure to ambient temperature variations.

Hypercal™
Ensures the best measurement range with the highest sensitivity. Simply set the desired lower and upper temperature limits and the camera will automatically adjust to the appropriate integration (exposure) time.

DRX - Dynamic Range Extension
Dynamic Range Extension allows the acquisition of thermal data from up to four user-defined temperature ranges simultaneously, then merges those streams into a single real-time data stream that spans all four temperature ranges, effectively extending dynamic range from 14-bit to 16-bit.

Orion Series

The FLIR SC7000 Orion Series are infrared multispectral imagers capable of producing IR sub-band images at video rates within the SW-MWIR or LWIR region. Infrared radiation from the scene under investigation is collected through a front lens, designed to offer minimal aberration across the full IR wavelength range.

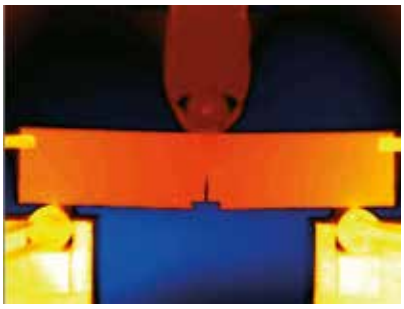
Configurable filter wheel setup to match different type of analysis

The Orion integrates a high speed 2x4 position filter wheel. It is inserted between the lens and the focal plane. The rotation of this filter wheel is driven synchronously with the FPA clocking, such that a single image snap shot is obtained for each particular filter position.

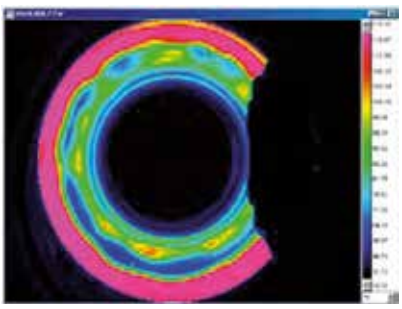
Versatile system with traditional thermal imaging camera mode

The Orion SC7000 is capable of capturing up to 400 frames per second in 320 x 240 pixels, each high quality image being captured in snap-shot mode. The integration time is variable by software and can be different for each filter. An image is captured for each given position of the filter wheel, providing true multispectral imaging. The Orion SC7000 Series can also be used as a normal IR camera at full speed by removing or stopping the filter wheel. In addition to image acquisition, ALTAIR software also processes the acquired image data.

Signature and Range phenomenology applications benefit from the extraordinary versatility of the SC7000.



SC7000 systems offer a solution for every R&D measurement situation.



Brake disk analysis being conducted with a SC7000 reveals never seen before details thanks to fast and ultra sensitive detectors and electronics.

Camera Functions

1 High performance FPA with high durability cooler
2 GigE Interface
3 CAMLINK interface to transfer digital video at the fastest frame rater
4 Removable lens interface with embedded filter wheel
5 Smart trigger Input with Ultra Low Jitter
6 Analogue Signal Inputs
7 High quality S-Video
8 Rugged cast aluminium housing

FLIR SC5000 Series

High performance thermal imaging cameras for industrial, educational & thermography

The FLIR SC5000 Series provides a high spatial resolution allowing a highest sensitivity & accuracy. Its 320 x 256 or 640 x 512 pixels format Indium Antimonide (InSb) focal plane array delivers respectively an outstanding 380 or 100 Hz frame rate while keeping extraordinary linearity and sensitivity figures. The use of our latest read out integrated circuit technology provides low noise and high pixel rate without compromising sensitivity.

The smart external triggering feature allows synchronisation of the image capture to the most fleeting of events. The FLIR SC5000 Series is truly plug & play using either GigE or CAMLINK interfaces to transmit both commands and full dynamic range digital video. Its autofocus embedded lens allows to easily setup the camera.

Choice of detector
The FLIR SC5000 series is equipped with a cooled Indium Antimonide detector that allows the smallest of temperature differences to be seen. It operates in the 2.5 to 5.1 µm waveband. A version equipped with a Mercury Cadmium Telluride (MCT) detector is also available.

640 x 512 pixels
Some models of the SC5000 series produce crisp thermal images of 640 x 512 pixels. Users that do not need this high image quality for their application can choose a version that produces thermal images of 320x256 pixels. Furthermore, 320x256 arrays make use of larger pixels which enable the camera to be more sensitive.

High Sensitivity: up to 20 mK
20 mk thermal sensitivity captures the finest image details and temperature difference information

Ultra high frame rate with windowing
Depending on the model and detector, the FLIR SC5000 series can deliver thermal images up to a speed of 31.7 kHz. Windowing allows a subset of the total image to be selectively read out with user-adjustable window size at a much higher frame rate. The sub-sample window sizes and locations can be arbitrarily chosen and are easily defined using the camera control software.

External triggering
External triggering allows synchronisation of the image capture to the most fleeting events. Three external analogue signals are synchronously acquired with the image allowing embedding external sensor measurements.

Adjustable integration time
Integration time is adjustable in nanosecond increments. The smart external triggering feature allows synchronisation of the image capture to the most fleeting events.

Temperature Range Extension
Temperature Range Extension (TRE) allows SC5000 cameras to acquire thermal data from up to 4 user defined temperature ranges simultaneously. The data can then be merged into a single data stream in real-time that spans all 4 temperature ranges and be displayed or recorded. TRE effectively extends the dynamic range from 14-bit to a 16-bit image.

Removable filter wheel
The FLIR SC5000 series comes standard with a removable, motorised 4 position filter wheel. This allows imaging of events in a very narrow part of the electromagnetic spectrum.

Multiple video outputs
The FLIR SC5000 series feature multiple independent video outputs to include:
- Analog – Composite (BNC)
- Digital – CameraLink
- Digital – Gigabit Ethernet

Precise automatic IRIG time stamp of all images
IRIG timing receiver is built directly into the SC5000 camera providing accurate time stamping in the camera header information. IRIG is a standardised time code allowing equipment to be synchronised to a known reference time. The most common version is IRIG-B, which encodes day of year, hour, minute, and second data on a 1 kHz carrier frequency, with an update rate of once per second.

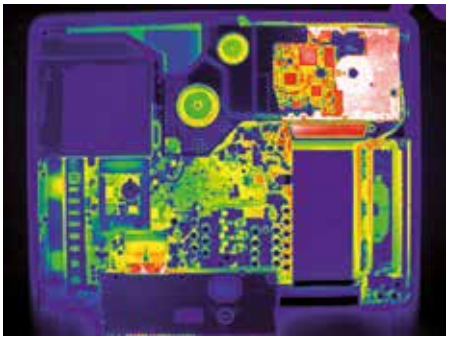
Compact & lightweight
The FLIR SC5000 series are compact cameras for fixed R&D installations.

Motorised focus
The SC5000 series are equipped with a motorised focus. It can not only auto focus the camera but also allows for fast manual focus when needed.

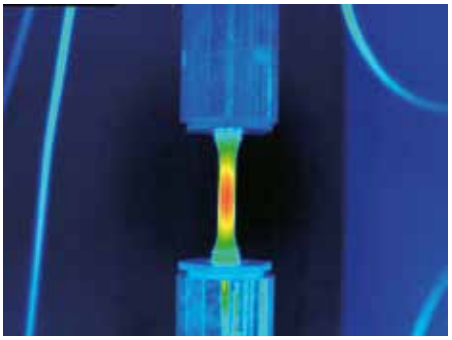
CNUC™ Calibration
CNUC™ is a proprietary calibration process that provides beautiful imagery and accurate measurement stability. CNUC™ allows for flexible integration time adjustments without the need to perform non-uniformity corrections. CNUC™ calibration also produces accurate measurement stability regardless of camera exposure to ambient temperature variations.

Hypercal™
Ensures the best measurement range with the highest sensitivity. Simply set the desired lower and upper temperature limits and the camera will automatically adjust to the appropriate integration (exposure) time.

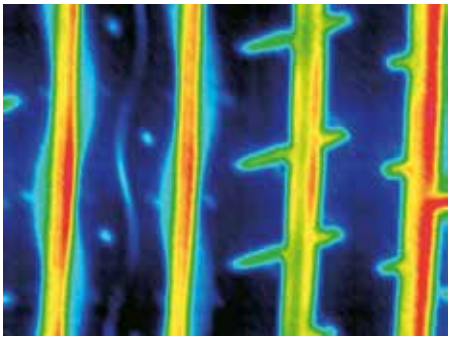
DRX - Dynamic Range Extension
Dynamic Range Extension allows the acquisition of thermal data from up to four user-defined temperature ranges simultaneously, then merges those streams into a single real-time data stream that spans all four temperature ranges, effectively extending dynamic range from 14-bit to 16-bit.



SC5000 cameras are well suited for electronic board, wafer and cells inspection thanks to their wide variety of lenses and accessories.



In addition with Thesa infrared Lock-in system, full field stress imaging and fatigue limit determination are done in second.



Short integration time of SC5000 cameras allows blurless high speed object imaging as rolling tire structure thermal evaluation.

Camera Functions

1 Heat dissipation by conduction only no fan = no dust inside
2 Temperature sensors for precise radiometric measurements
3 Smart trigger input with ultra low jitter
4 High quality S-Video
5 GigE or Camlink interface transfer digital video at the fastest frame rate
6 High performance InSb FPA
7 Long life durability cooler
8 Built-in lens motorised auto–focus
9 Removable filter wheel
10 Rugged cast aluminium housing

FLIR SC2500

Near IR Camera with Extended Wavelength from 0.9 µm to 1.7 µm (InGaAs) and from 0.4 µm to 1.7 µm (VisGaAs)

The FLIR SC2500 provides extraordinary sensitivity in the shortwave region of the infrared spectrum. It's unique embedded filter holder makes this camera a highly versatile instrument for a wide range of applications.

Typical applications are laser beam profiling, drug concentration evaluation, seeing through blood and paint, performing spectral data collection of chemicals, food inspections, furnace temperature measurements, ...

Choice of detector
Equipped with a InGaAs or VisGaAs detector, the SC2500 operates in the 0.9 to 1.7 or 0.4 to 1.7 micrometer waveband.

High sensitivity
The SC2500 series offers an extremely high sensitivity and a low noise operation.

Ultra high frame rate with windowing
The SC2500 produces crisp images at a full frame rate of 340 Hz, 15 kHz with windowing. This allows capturing 14-bit data at high speed

Accurate non-temperature measurement
The FLIR SC2500 provides accurate non-contact temperature measurements. The camera is able to be calibrated for temperatures up to 3.000˚C.

Spectral tuning capabilities
The SC2500 features a removable one inch filter. This allows selecting spectral sub-bands to adapt the system's response to the specific application.

Easy integration in other instruments
The fully removable C-Mount interface makes the camera easy to be integrated into complex optical instruments such as interferometers or spectrometers.

1 Digital Video/ Command & Control - RJ-45 Gigabit Ethernet
2 Video Out - NTSC
3 Power Switch
4 Lock-in - Input Range 0-10 V peak to peak / 1 Hz up to 5 kHz
5 Trigger Input/Output - LVTTL (0 – 3.3 V) under 50 Ohms
6 Power Input

Lenses

Flexible systems that meet your changing needs

FLIR offers a wide variety of lenses to tailor your camera to your needs.

The following lenses are available:

FLIR X8000 sc / FLIR X6000 sc

X8400 sc (2.5-5µm) HD

Focal length	f-number	FOV	Part nr.
28mm	f/2	38° x 31°	L1003
50mm	f/2	22° x 17°	L1002
100mm	f/2	11° x 9°	L1013
200mm	f/2	5.5° x 4.4°	L1101
Close up x3	f/2	6.4 x 5.1 mm	L1117

X6000 sc-Series (2.5-5µm) UltraSonic Smart Lens

Focal length	f-number	FOV	Part nr.
12mm	f/2	44° x 36° - USL Motorized	L1021
25mm	f/2	22° x 17° - USL Motorized	L1009
50mm	f/2	11° x 8.8° - USL Motorized	L1008
100mm	f/2	5.5° x 4.4° - USL Motorized	L1019
200mm	f/2	2.75° x 2.2° - USL Motorized	L1118
Close up x1	f/3	working distance 30cm 9.6 x 7.7 mm	L1202
Close up x3	f/2.5	3.2 x 2.6mm	L1114

FLIR A3500sc/A6500sc-Series

MWIR (2.5 – 5µm):

Focal length	f-number	FOV	Part nr.
12mm	f/2	44° x 36°	L0315
25mm	f/2	22° x 17°	L0116
50mm	f/2	11° x 8.8°	L0106
100mm	f/2	5.5° x 4.4°	L0118
200mm	f/2	2.75° x 2.2°	L0804
Close up x1	f/2	9.6 x 7.7 mm	L0120
Close up x3	f/2	3.2 x 2.6 mm	L0120E
Close up x1	f/3	working distance 30cm 9.6 x 7.7 mm	L0905

Broadband (1.5-5µm)

Focal length	f-number	FOV	Part nr.
27mm	f/3	20° x 16°	L0709T
50mm	f/3	11° x 8°	L0608T
100mm	f/3	5.5° x 4.4°	L0604T
200mm	f/3	2.75° x 2.2°	L0701

FLIR SC5000

Focal length	f-number	FOV	Part nr.
12mm	f/3	44° x 36°	L0515
27mm (built-in)	f/3	20° x 16°	L0504
54mm	f/3	10° x 8°	L0506
Close up x0.5	f/3	19.2 x 15.4 mm	L0510x0.5
Close up x1	f/3	9.6 x 7.7 mm	L0510
Close up x3	f/3	3.2 x 2.6 mm	L0605
Close up x5	f/3	1.9 x 1.5 mm	L0808

FLIR SC2500

Focal length	f-number	FOV	Part nr.
6 mm lens	f/1.4	77° x 65°	L0908
12 mm lens	f/1.4	44° x 35°	L0920
16 mm lens	f/1.4	33° x 27°	L0921
25 mm lens	f/1.6	22° x 17°	L0922
35 mm lens	f/1.6	16° x 12°	L0923
50 mm lens	f/2	11° x 9°	L0924
75 mm lens	f/2.5	7.3° x 5.8°	L0925
100 mm lens	f/2.8	5.5° x 4.4°	L0926
1000 mm lens	f/10	0.59° x 0.47°	L1001

High Performance 700-1900nm

Focal length	f-number	FOV	Part nr.
25mm	f/1.4	22° x 17°	L1010
35mm	f/1.4	16° x 12°	L1011
50mm	f/1.4	11° x 9°	L1012

FLIR SC7000

MWIR (2.5 – 5µm):

Focal length	f-number	FOV	Part nr.
12mm	f/2	44° x 36°	L0315
25mm	f/2	22° x 17°	L0116
50mm	f/2	11° x 8.8°	L0106
100mm	f/2	5.5° x 4.4°	L0118
200mm	f/2	2.75° x 2.2°	L0804
Close up x1	f/2	9.6 x 7.7 mm	L0120
Close up x3	f/2	3.2 x 2.6 mm	L0120E
Close up x1	f/3	working distance 30cm 9.6 x 7.7 mm	L0905

LWIR / VLWIR (8-12µm)

Focal length	f-number	FOV	Part nr.
12mm*	f/2	44° x 36°	L0306V
25mm	f/2	22° x 17°	L0324V
50mm	f/2	11° x 8.8°	L0302V
100mm	f/2	5.5° x 4.4°	L0201V
200mm*	f/2	2.75° x 2.2°	L0113TV
Close up x1*	f/2	9.6 x 7.7 mm	L0215
Close up x3*	f/2	3.2 x 2.6 mm	L0215E

* SC7300L / SC7900VL ONLY

Broadband (1.5-5µm)

Focal length	f-number	FOV	Part nr.
27mm	f/3	20° x 16°	L0709T
50mm	f/3	11° x 8°	L0608T
100mm	f/3	5.5° x 4.4°	L0604T
200mm	f/3	2.75° x 2.2°	L0701

R&D - Science Software

Turning tools into solutions

At FLIR, we recognise 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.

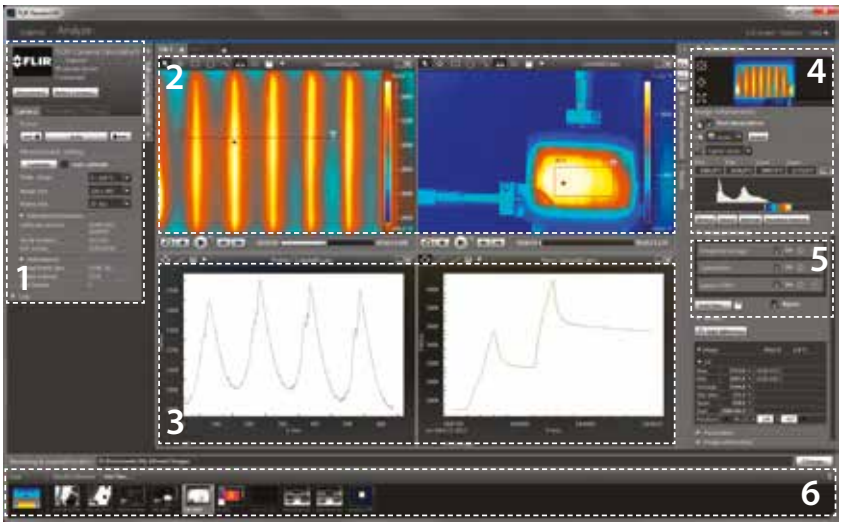
FLIR ResearchIR

FLIR ResearchIR is aimed at R&D-Science users of thermal imaging cameras with a cooled or uncooled detector. FLIR ResearchIR takes the most out of your thermal imaging camera and allows high speed recording and advanced thermal pattern analysis. ResearchIR is the perfect tool for industrial R&D. Users that are interested in more advanced science applications can choose for ResearchIR Max.

FLIR ResearchIR key features:

- More than 20 language versions available
- View, record and store images at high speed
- Post-processing of fast thermal events
- Generate time-temperature plots from live images or recorded sequences
- Advanced Start/Stop recording conditions from camera signal, serial port signal, measurement values, date and time
- Unlimited number of analysis functions (Spot, Line, Area)
- File organizer with Quick Collection and preview of sequences
- Zoom & Pan allows a closer look
- Multiple user-configurable tabs for live images, recorded images or plot. Workspaces can be saved and loaded for better measurement efficiency or setup reproductibility
- Sub sequence editing : Select the images of interest within a sequence
- Averaging and thermal subtraction toolbox
- Multiple exportation options : AVI, CSV, matlab files

FLIR ResearchIR User interface



1. **Camera and recording control:**
   FLIR ResearchIR software connects directly to FLIR thermal imaging cameras to acquire thermal snapshots or movie files. ResearchIR supports multiple acquisition options, including camera triggering or conditional start/stop, based on thermal measurements.

2. **Flexible measurement workspace:**
   Imagery, data and charts can be arranged by a simple drag and drop. Measurement analysis can be done live when connected to a thermal imaging camera or in playback with recorded snapshots or movie sequences.

3. **Charts and graphics:**
   Line profiles are easy to add. Measurement tools or complete image statistics can be plotted against time. A result table presents data statistics for all images in parallel allowing for seamless comparative analysis.

4. **Intuitive image colorization control:**
   Allows changing the color palette, color distribution, contrast and isotherms, zooming and panning.

5. **Image processing pipe:**
   Provides powerful real time processing such as image subtraction, sliding subtraction or averaging. Each process can be individually configured and its order can be easily managed.

6. **Quick collection bar:**
   Shows the active images and sequences.

FLIR ResearchIR Max key features:

FLIR ResearchIR Max contains all the features or FLIR ResearchIR. Furthermore it contains features for advanced thermal analysis, such as:

- Pre/Post Triggering
- Mathematical processing toolbox
- Image filtering toolbox
- Multiple camera support for parallel recording
- Native Support of Cameras Dynamic Range Extension (DRX)
- Radiometric Digital Detail Enhancement (DDE): improves dramatically the understanding of the thermal scene, still keeping the radiometric measurement accuracy.
- Support for High Speed Data Recorder (HSDR)

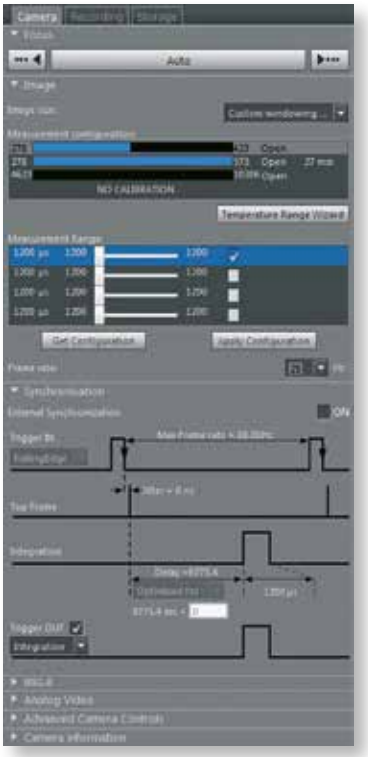
Advanced recording options

Controls multiple parameters and options to achieve the most reliable acquisition

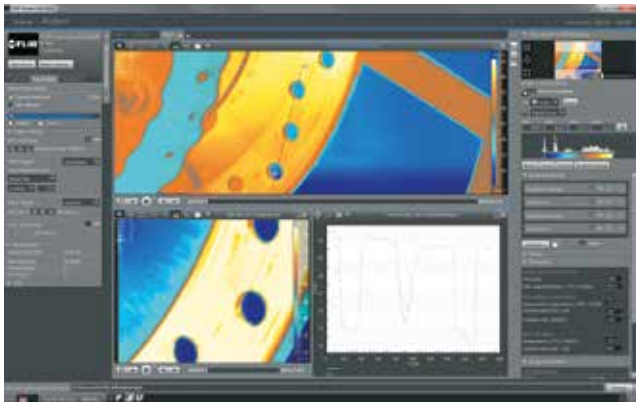
- Pre / Post triggering allows to catch the most fleeting event.
- Multiple start and stop acquisition options. Can be based on camera trigger signal status, image measurement threshold or time.
- Acquisition performance is clearly shown. No doubt remains about your acquisition quality.

Complete control of camera parameters

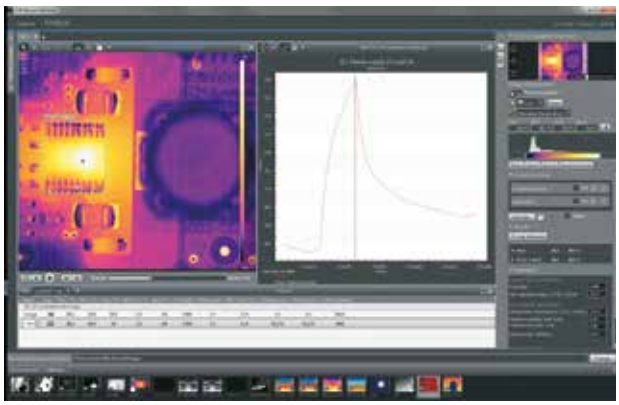
Complete, yet easy to use camera control. Measurement configuration, ranges, image size, frame frequency and synchronization to external signal is exposed.



Application examples



Recorded sequence of a brake disk



Electronic board thermal design

Software Development Kits

Optional Software Development Kit (SDK) for Visual Studio users and a LabVIEW™ toolkit are also available enabling the functionality of the camera to be optimised for specific needs.

ITC

FLIR Infrared Training Center

The Infrared Training Center (ITC) offers the world's leading infrared training and thermographer certification programs.

Although all our cameras are designed for easy installation and operation, there is a lot more to thermal imaging than just knowing how to handle the camera. As the leading company for thermal imaging technology, we like to share our knowledge with our customers and other interested parties.

We therefore organise regular courses and seminars. We also organise in-company training on request, so that you, or your staff, can gain familiarity with thermal imaging and its applications.

The ITC not only welcomes FLIR customers but also users of other brands of cameras. In fact, anyone who wants to learn more about thermal imaging for any applications, before deciding to purchase a camera, is also invited.

The mission of the ITC is to make our customers and partners successful by enhancing their knowledge of IR technology, thermal imaging products, and relevant applications. The ITC offers a portfolio of courses that presents the right mix of theoretical and practical content to help professionals quickly apply thermal imaging technology to real life applications.

All our instructors are experienced thermal imaging specialists. Not only do they have a profound theoretical knowledge but they also have practical experience with numerous applications. For our customers, this means that attending one of the ITC's courses will give them a real hands-on learning experience.

Follow one of our courses and become a thermal imaging expert.

Each ITC course is a perfect combination of theoretical fundamentals and practical excercises. It guarantees participants a real hands-on learning experience.

After Sales

FLIR After Sales

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.

Once purchased, thermal imaging cameras are vital pieces of equipment. To keep them running at all times, we operate a worldwide service network with subsidiaries in Belgium, China, France, Germany, Hong Kong, Italy, the Netherlands, Russia, Sweden, United Arab Emirates, the United Kingdom and the USA.

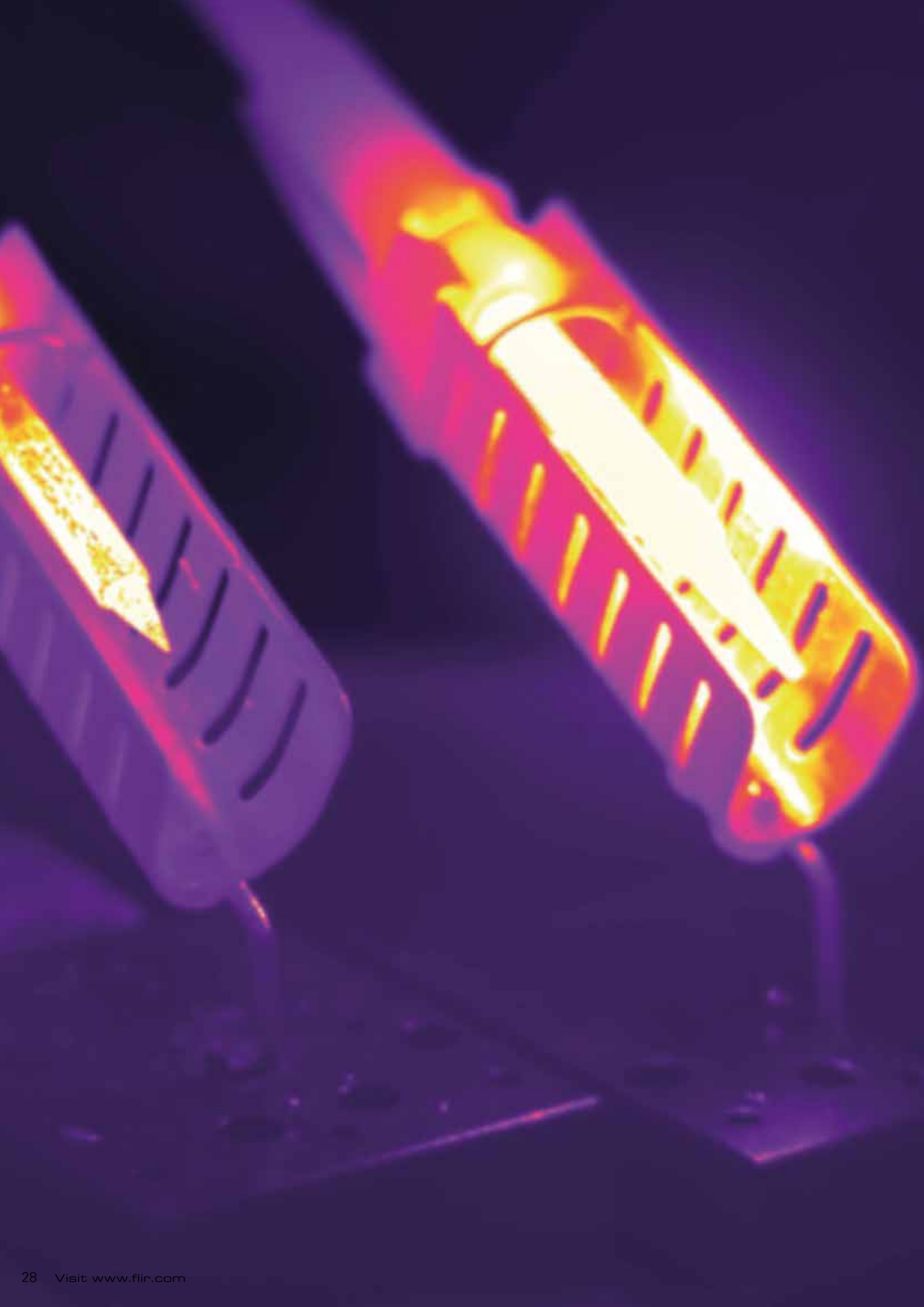
If there should be a problem with one of our camera systems, these local service centres have all the know-how and equipment to solve it within the shortest possible time. Local camera service gives you the assurance that your system will be ready for use again within an extremely short timeframe.

Buying a thermal imaging camera is a long-term investment. You need a reliable supplier who can provide you with support over a long period of time.

Our service personnel regularly follows training programs at our production facilities in Sweden, France or the USA. Not only to learn about the technical aspects of the products, but also to familiarise themselves with your individual customer requirements and the latest applications.

Different types of maintenance contracts can be offered to make sure that, whatever happens, your thermal imaging camera is always available for use.

CUSTOMER CARE is not just a slogan.
We write it in capital letters at FLIR.



FLIR X8000 sc / FLIR X6000 sc

Technical specifications

Model description

	X8400sc	X6580sc	X6540sc / X6550sc	X6530sc
Imaging performance				
Resolution	1280 x 1024	640 x 512	640 x 512	640 x 512
Frame rate	106 Hz : 640x512 Up to 3000 Hz : 1280x8	355 Hz : 640x512 Up to 4500 Hz : 320x8	125 Hz : 640x512 Up to 4011 Hz : 64x8	145Hz : 640x512 Up to 3699 Hz : 132x8
Motorized focus mechanism	no	yes	yes	yes
Well Capacity	5.8 M electrons	6.5 M electrons	6.5 M electrons	6.36 M electrons
Digital Data Streaming	- Simultaneous Gigabit Ethernet and Camera Link Base - Camera Link Medium	- Simultaneous Gigabit Ethernet and Camera Link Base - Camera Link Medium	- Simultaneous Gigabit Ethernet and Camera Link Base - Camera Link Medium	- Simultaneous Gigabit Ethernet and Camera Link Base - Camera Link Medium
Focus	Manual	USL mechanism or manual	USL mechanism or manual	USL mechanism or manual
Optics				
Available optics	28mm - 38° x 31° 50mm - 22° x 17° 100mm - 11° x 9° 200mm - 5.5° x 4.4° Close up x3 - 6.4 x 5.1 mm	12mm-44°x34°-USL Motorized 25mm - 22° x 17° - USL Motorized 50mm - 11° x 8.8° - USL Motorized 100mm - 5.5° x 4.4° - USL Motorized 200mm-2.75°x2.2°- USL Motorized Close up x3 - 3.2 x 2.6mm Close up x1 Working Distance 30cm - 9.6x7.7mm	12mm-44°x34°-USL Motorized 25mm - 22° x 17° - USL Motorized 50mm - 11° x 8.8° - USL Motorized 100mm - 5.5° x 4.4° - USL Motorized 200mm-2.75°x2.2°- USL Motorized Close up x3 - 3.2 x 2.6mm Close up x1 Working Distance 30cm - 9.6x7.7mm	12mm-44°x34°-USL Motorized 25mm - 22° x 17° - USL Motorized 50mm - 11° x 8.8° - USL Motorized 100mm - 5.5° x 4.4° - USL Motorized 200mm-2.75°x2.2°- USL Motorized Close up x3 - 3.2 x 2.6mm Close up x1 Working Distance 30cm - 9.6x7.7mm
Camera f/#	2.0	3	3 / 2.5	3
Detector				
Detector Type	Indium Antimonide (InSb)	Indium Antimonide (InSb)	Indium Antimonide (InSb)	Mercury Cadmium Telluride (MCT)
Operability	>99.5%	>99.5%	>99.5%	>99%
Measurement				
Standard Temperature Range	+5°C to +300°C	+5°C to +300°C	+5°C to +300°C	+5°C to +150°C
Optional Temperature Range	Up to +3,000°C From -20°C	Up to +3,000°C From -20°C	Up to +3,000°C From -20°C	Up to +2,500°C From -20°C

General

Detector	
Spectral Range	1.5 – 5.1 μm
Detector Pitch	15 μm
NETD	<25 mk (20 mk Typical)
Sensor Cooling	Closed Cycle Rotary
Electronics / Imaging	
Readout	Snapshot Digital (X8400sc/X6580sc) - Snapshot Analog (X6550sc/X6540sc/X6530sc)
Readout Modes	Asynchronous Integrate While Read; Asynchronous Integrate Then Read
Synchronization Modes	IRIG-B; Sync In, Trigger In
Image Time Stamp	Internal IRIG-B Decoder Clock / TSPI Accurate Time Stamp
Integration Time	160 ns to Full Frame rate, with auto exposure
Subwindow Mode	User-Defined
Dynamic Range	13- or 14-bit, 16 bits with DRX
HD Video	DVI 1080p
Command and Control	Gigabit Ethernet, Camera Link, Detachable LCD Display, WiFi
Measurement	
Accuracy	±1°C or ±1% of Reading
Calibration	Custom calibration on request
Optics	
Filtering	4× Position Motorized, with drift compensation and automatic identification
Image Presentation	
On-Camera Display	Detachable Touchscreen LCD Display (800 × 480)
Automatic Gain Control	Manual, Linear, ROI
Image Analysis	On-Camera Temperature Analysis
General	
Operating Temperature Range	-20°C to +50°C
Shock / Vibration	operational 15G, IEC 68-2-29 / Operational 2G, IEC 68-2-26
Power	24 VDC
Weight w/o Lens	5.05 kg
Size (L × W × H) w/o Lens	280 × 150 × 180 mm
Mounting	UNC 1/4"–20 + 3×M5 threads

* *After product registration on www.flir.com*

FLIR A3500sc / A6500sc Series

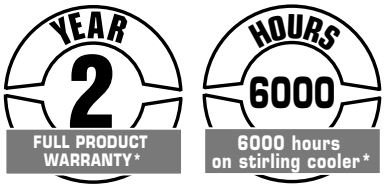
Technical specifications

Model description

	A3520sc	A6550sc	A6540sc	A6530sc
Imaging performance				
Sensor type	InSb	InSb	InSb	MCT
Pixel Resolution	320x256	640x512	640x512	640x512
Pixel Pitch	30µm	15µm	15µm	15µm
Spectral ranges	1.5 - 5.1 µm	1.5 - 5.1 µm	1.5 - 5.1 µm	3.7 - 4.8 µm
Measurement				
NETD	<20mK	<20mK	<20mK	<25mK
Standard Camera Calibration Range	5°C to 300°C for InSb	5°C to 300°C	5°C to 300°C	5°C to 150°C
Optional Camera Calibration Range	-20°C to 300°C 5°C to 1500°C up to 2500°C up to 3000°C	-20°C to 300°C 5°C to 1500°C up to 2500°C up to 3000°C	-20°C to 300°C 5°C to 1500°C up to 2500°C up to 3000°C	-20°C to 150°C 5°C to 150°C up to 2500°C
Digital Full Frame rate	60 Hz: 320x256 240 Hz: 160x128 960 Hz: 80x64	60 Hz: 640x512 240 Hz: 320x256 715 Hz: 160x128	60 Hz: 640x512 240 Hz: 320x256 715 Hz: 160x128	60 Hz: 640x512 240 Hz: 320x256 960 Hz: 160x128
Interfaces				
f/#	f/3.0	f/2.5	f/3.0	f/2.0
Optics				
Available optics	12mm - 44°x 36° (not available in SWB) 25mm - 22°x 17° 27mm - 20°x 16° in SWB 50mm - 11°x 8.8° 100mm - 5.5°x 4.4° 200mm - 2.75°x 2.2° Close up x1 - 9.6x7.7mm (n.a. in SWB) Close up x3 - 3.2x2.6mm (n.a. in SWB) Close up x1 - 9.6x7.7mm WD 300mm (n.a. in SWB)	12mm - 44°x 36° (n.a. in SWB) 25mm - 22°x 17° 27mm - 20°x 16° in SWB 50mm - 11°x 8.8° 100mm - 5.5°x 4.4° 200mm - 2.75°x 2.2° Close up x1 - 9.6x7.7mm (n.a in SWB) Close up x3 - 3.2x2.6mm (n.a in SWB) Close up x1 - 9.6x7.7mm WD 300mm (n.a in SWB)	12mm - 44°x 36° (n.a. in SWB) 25mm - 22°x 17° 27mm - 20°x 16° in SWB 50mm - 11°x 8.8° 100mm - 5.5°x 4.4° 200mm - 2.75°x 2.2° Close up x1 - 9.6x7.7mm (n.a in SWB) Close up x3 - 3.2x2.6mm (n.a in SWB) Close up x1 - 9.6x7.7mm WD 300mm (n.a in SWB)	12mm - 44°x 36° (n.a. in SWB) 25mm - 22°x 17° 50mm - 11°x 8.8° 100mm - 5.5°x 4.4° 200mm - 2.75°x 2.2° Close up x1 - 9.6x7.7mm (n.a in SWB) Close up x3 - 3.2x2.6mm (n.a in SWB) Close up x1 - 9.6x7.7mm WD 300mm (n.a in SWB)

General

Imaging performance	
Waveband	Midwave
Dynamic Range	14 bit
Camera Temp Calibration	Yes
Ambient Drift Compensation	Yes
Temp. Measurement Accuracy	+/-1% or +/-1°C
Hypercal™ / CNUC™ Functionality	Yes
Interfaces	
Digital Data Output	GigE, Camera Link
Command & Control	GigE, Camera Link
FPA Windowing	Full / Half / Quarter windowing
Filter Options	Fixed single filter holder (optional)
Analog Input	Yes
Analog Video	Composite or S-Video (optional)
Options	
Triggering Options	Yes (Trigger IN only)
Software	
SDK Support	Yes
Lab View Compatibility	Yes
Matlab Compatibility	Yes



** After product registration on www.flir.com*

FLIR SC7000 Series

Technical specifications

Model description

	SC7210-7500 / SC7300	SC7300L / SC7900VL	SC7600-7650 /SC7700	SC7750L / SC7790VL
Imaging performance				
Waveband	MW	LW	MW	LW
Sensor type	InSb / MCT	MCT	InSb / MCT	MCT
Pixel Resolution	320x256	320x256	640x512	640x512
Pixel Pitch	30µm	30µm	15µm	16µm
Spectral ranges	1.5 - 5.1 µm for InSb (BB) 3.7 - 4.8 µm for MCT	7.7 - 9.3 µm for SC7300L 7.7 - 11.5 µm for SC7900VL	1.5 - 5.1 µm	8.0 - 9.4 µm for the SC7750L 8.0-11.5 µm for the SC7790VL
Measurement				
NETD	<20mK for InSb / <25mK for MCT	<20mK / <25mK	<20mK / <25mK	<30mK / <37mK
Standard Camera Calibration Range	5ºC to 300ºC for InSb 5ºC to 150ºC for MCT	5ºC to 150ºC	5ºC to 300ºC for InSb 5ºC to 150ºC for MCT	5ºC to 80ºC
Optional Camera Calibration Range	-20°C to 300ºC / -20ºC to 150ºC 5ºC to 1500ºC / 5ºC to 500ºC up to 2500ºC / up to 1500°C up to 3000ºC (for InSb only)	-20ºC to 150ºC 5ºC to 150ºC up to 1500°C Down to -80°C with SC7900VL	-20°C to 300ºC / -20ºC to 150ºC 5ºC to 1500ºC / 5ºC to 150ºC up to 2500ºC / up to 1500°C up to 3000ºC for SC7700 -20°C to 250°C / 5°C to 150°C up to 1500°C	-20ºC to 80ºC 5ºC to 80ºC 80ºC to 300ºC 300ºC to 1100°C
Digital Full Frame rate	InSb: 190 Hz - 380 Hz full frame up to 3 kHz - 39.8 kHz with windowing	230 Hz full frame up to 23 kHz with windowing	InSb: 100 Hz full frame up to 3.425 kHz with windowing	115 Hz full frame up to 62 kHz with windowing
	MCT: 230 Hz full frame up to 25 kHz with windowing		MCT: 115Hz Full Frame up 3.0 kHz with windowing	
Interfaces				
Digital Data Output	GigE, Camera Link	GigE, Camera Link	GigE, Camera Link	GigE, Camera Link
Command & Control	GigE, Camera Link	GigE, Camera Link	GigE, Camera Link	GigE, Camera Link
FPA Windowing	Arbitrary Size and Location (fixed for SC7210)	Arbitrary Size and Location	Arbitrary Size and Location	Arbitrary Size and Location
f/#	f/3.0 for InSb and f/2.0 for MCT	f/2.0	SC7600 f/3.0 - SC7650 f/2.5 - SC7700 f/3.0	f/2.0
Filter Options	Fixed motorised 4 Position Filter Wheel. Field replaceable Filters	Fixed motorised 4 Position Filter Wheel. Field replaceable Filters	Fixed motorised 4 Position Filter Wheel. Field replaceable Filters. No Filter with the SC7650E (DACH only)	Fixed motorised 4 Position Filter Wheel. Field replaceable Filters
Optics				
Available optics	12mm - 44°x 36° (not available in SWB) 25mm - 22°x 17° 27mm - 20°x 16° in SWB 50mm - 11°x 8.8° 100mm - 5.5°x 4.4° 200mm - 2.75°x 2.2° Close up x1 - 9.6x7.7mm (n.a. in SWB) Close up x3 - 3.2x2.6mm (n.a. in SWB) Close up x1 - 9.6x7.7mm WD 300mm (n.a. in SWB)	12mm - 44°x 36° 25mm - 22°x 17° 50mm - 11°x 8.8° 100mm - 5.5°x 4.4° 200mm - 2.75°x 2.2° Close up x1 - 9.6x7.7mm Close up x3 - 3.2x2.6mm	12mm - 44°x 36° (n.a. in SWB) 25mm - 22°x 17° 27mm - 20°x 16° in SWB 50mm - 11°x 8.8° 100mm - 5.5°x 4.4° 200mm - 2.75°x 2.2° Close up x1 - 9.6x7.7mm (n.a in SWB) Close up x3 - 3.2x2.6mm (n.a in SWB) Close up x1 - 9.6x7.7mm WD 300mm (n.a in SWB)	25mm - 23.6°x 18.1° 50mm - 11.7°x 9.4° 100mm - 5.9°x 4.7°

General

Imaging performance	
Dynamic Range	14 bit, 16 bit with DRX
Camera Temp Calibration	Yes
Ambient Drift Compensation	Yes
Temp. Measurement Accuracy	+/-1% or +/-1°C
Hypercal™ / CNUC™ Functionality	Yes
Interfaces	
Analog Input	Yes
Analog Video	Composite or S-Video
Options	
Motorised Focus	Optional - Compatible with ==> SWB : 27mm/50mm MW : 12mm/25mm/50mm/x1/x1WD30 LW : 12mm/25mm/50mm/100mm/1x
Auto Focus	Optional
Built-in IRIG-B timing	Optional
Triggering Options	Yes
Software	
SDK Support	Yes
Lab View Compatibility	Yes
Matlab Compatibility	Yes

** After product registration on www.flir.com*

FLIR SC7000 ORION Series

Technical specifications

Model description

	ORION 7500 / 7900VL	ORION 7600
Imaging performance		
Sensor type	InSb / MCT	InSb
Pixel Resolution	320x256	640x512
Pixel Pitch	30µm	15µm
Spectral ranges	1.5 - 5.1 µm for InSb (BB) 7.7 - 11.5 µm for SC7900VL	1.5 - 5.1 µm for InSb (BB)
Measurement		
NETD	<20mK for InSb / <25mK for MCT	<20mK
Standard Camera Calibration Range	5ºC to 300ºC for InSb 5ºC to 150ºC for MCT	5ºC to 300ºC
Optional Camera Calibration Range	-20°C to 300ºC / -20ºC to 150ºC 5ºC to 1500ºC / 5ºC to 150ºC up to 2500ºC / up to 1.500°C up to 3000ºC (for InSb only)	-20°C to 300ºC 5ºC to 1500ºC up to 2500ºC up to 3000ºC
Digital Full Frame rate	InSb: 380 Hz full frame up to 39.8 KHz with windowing MCT: 230 Hz full frame up to 23 kHz with windowing Limited to 400Hz in ORION mode	InSb: 100 Hz full frame up to 3.425 kHz with windowing Limited to 400 Hz in ORION mode
Optics		
Available optics	**SWB** 27mm - 20°x 16° 50mm - 11°x 8.8° 100mm - 5.5°x 4.4° 200mm - 2.75°x 2.2° **MWB & LWB** 12mm - 44°x 36° 25mm - 22°x 17° 50mm - 11°x 8.8° 100mm - 5.5°x 4.4° 200mm - 2.75°x 2.2° Close up x1 - 9.6x7.7mm Close up x3 - 3.2x2.6mm Close up x1 - 9.6x7.7mm Working distance 300mm (not available in LWB)	**SWB** 12mm - 44°x 36° 27mm - 22°x 17° 50mm - 11°x 8.8° 100mm - 5.5°x 4.4° 200mm - 2.75°x 2.2°

General

Imaging performance	
Waveband	MW & LW
Dynamic Range	14 bit, 16 bit with DRX
Camera Temp Calibration	Yes
Ambient Drift Compensation	Yes
Temp. Measurement Accuracy	+/-1% or +/-1°C
Hypercal / CNUC Functionality	Yes
Interfaces	
Analog Input	Yes
Analog Video	Composite or S-Video
Digital Data Output	GigE, Camera Link
Command & Control	GigE, Camera Link
FPA Windowing	Arbitrary Size and Location
f/#	f/3.0 for InSb and f/2.0 for MCT
Filter Options	High speed 8 filters wheel with rotation driven synchronously with FPA clocking. 400 Hz max.
Options	
Built-in IRIG-B timing	Optional
Triggering Options	Yes
Software	
SDK Support	Yes
Lab View Compatibility	Yes
Matlab Compatibility	Yes

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FLIR SC7000 NIR / VNIR Series

Technical specifications

Model description

	SC7100-N	SC7100-VN
Imaging performance		
Sensor type	InGaAs	VisGaAs
Waveband	0.9-1.7 µm	0.4-1.7 µm
Pixel Resolution	320x256	320x256
Pitch	30 µm	30 µm
Sub array windowing	User defined : down to 48x8	User defined : down to 48x8
Frame rate	From 340 Hz (320x256) and up to 20 kHz (48x4)	From 340 Hz (320x256) and up to 20 kHz (48x4)
Integration time	400 ns to 999 ms (200 ns step)	400 ns to 999 ms (200 ns step)

General

Imaging performance	
Detector cooling	Special 2-stage TEC switchable (1 or 2 TEC operation)
FPA temperature	Down to -5°C with special 2-stage TEC operation
Optical Specifications	
Optical interface	C-Mount. Removable front interface for custom optical systems
Measurement	
NEI (Noise Equivalent Irradiance)	<2.10 ph/sec/cm²
Temperature calibration range	400°C to 3000°C in single ranges or extended mode
Temperature measurement accuracy	<1%
Filter wheel	4 slots – 1'' diameter filters up to 2.2mm thickness
Timing & Signals	
Analog Video	PAL or NTSC, S-Video & Composite
Digital Video	CAMLINK / Giga-Ethernet
Trigger Input/Output	LVTTL (3.3V)
IRIG-B	3 Vpp / 1 kHz carrier / 3:1 modulation ratio
Lock-In	Embedded – for synchronous detection applications
Analog Signal Input	For data correlation to an external device (-5 to +5V)
Physical Specifications	
Size (LxWxH) w/o lens [mm]	253x130x168
Weigth (w/o lens)	4.8 Kg
Operational temperature	-20°C / +50°C
Shock	Operational 15G, IEC 68-2-29
Vibration	Operational 2G, IEC 68-2-26
Input voltage	12 VDC
Power consumption	25W (single TEC) / 60W (double TEC)

Optics	**Field of View**
6 mm F/1.4	77° x 65°
12 mm F/1.4	44° x 35°
16 mm F/1.4	33° x 27°
25 mm F/1.6	22° x 17°
35 mm F/1.6	16° x 13°
50 mm F/2.0	11° x 9°
75 mm F/2.5	7° x 6°
100mm mm F/2.8	5° x 4°
500mm f/8	1.1° x 0.9°
1000mm f/10	0.55° x 0.44°

** After product registration on www.flir.com*

FLIR SC5000 Series

Technical specifications

	SC5210	SC5500	SC5600/5650
Imaging performance			
Sensor type	InSb	InSb	InSb
Pixel Resolution	320x256	320x256	640x512
Pixel Pitch	30µm	30µm	15µm
Digital Full Frame rate	190 Hz	383 Hz	100 Hz
	up to 3040 Hz with windowing	up to 39.8 kHz with windowing	up to 3.425 kHz with windowing
FPA Windowing	160x128 / 80x64	Arbitrary Size and Location	Arbitrary Size and Location
f/#	f/3.0	f/3.0	f/3.0 - f/4.0 for SC5650
Optics			
Available optics	27mm (Built in) - 20°x 16°	27mm (Built in) - 20°x 16°	27mm (Built in) - 20°x 16°
	12mm - 45°x 36°	12mm - 45°x 36°	12mm - 45°x 36°
	54mm - 10°x 8°	54mm - 10°x 8°	54mm - 10°x 8°
	0.5X Microscope - 60µm	0.5X Microscope - 60µm	0.5X Microscope - 30µm
	1X Microscope - 30µm	1X Microscope - 30µm	1X Microscope - 15µm
	3X Microscope - 10µm	3X Microscope - 10µm	3X Microscope - 5µm
	5x microscope - 6µm	5x microscope - 6µm	5x microscope - 3µm

General

Imaging performance	
Waveband	MW
Dynamic Range	16 bit with DRX
Spectral response	2.5-5.1 µm
NETD	<20mK
Measurement	
Standard Camera Calibration Range	5ºC to 300ºC
Optional Camera Calibration Range	-20ºC to 50ºC
	-280ºC to 1500ºC
	up to 2500ºC
	up to 3000ºC
Ambient Drift Compensation	Yes
Hypercal / CNUC Functionality	Yes
Interfaces	
Digital Data Output	GigE, Camera Link
Analog Video	Composite and S-Video
Command & Control	GigE, Camera Link
Focus	
Manual Tactile Focus	No
Motorised Focus	Yes
Auto Focus	Yes
Functions	
Built-in IRIG-B timing	Optional
Triggering Options	Yes
Software	
SDK Support	Yes
Lab View Compatibility	Yes
Filtering Options	Removable/motorised 4 Position Filter Wheel
Matlab support	Yes

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FLIR SC2500

Technical specifications

Imaging performance	
Sensor type	InGaAs (VisGaAs optional)
Spectral ranges	0.9 - 1.7 µm (0.4 - 1.7 µm optional)
Waveband	NIR
Pixel Resolution	320x256
Pixel Pitch	30µm
Dynamic Range	14 bit

Measurement	
Camera Temp Calibration	Yes
Standard Camera Calibration Range	400ºC up to 3000ºC

Interfaces	
Digital Data Output	GigE
Analog Video	Composite
Command & Control	GigE
FPA Windowing	Arbitrary Size and Location
Analog Input	Lock-In only

Focus	
Motorised Focus	No
Auto Focus	No
Built-in IRIG-B timing	No
Triggering Options	Yes

Functions	
SDK Support	Yes
Ambient Drift Compensation	Yes
Temp. Measurement Accuracy	+/-1% or +/-1°C
Digital Full Frame rate	340 Hz full frame up to 15 kHz with windowing
Lab View Compatibility	Yes
Matlab Compatibility	Yes

Optics	
f/#	Lens dependent
Filter Options	One filter holder
Available optics	6mm - 77°x 65° (f/1.4) 12mm - 44°x 36° (f/1.4) 16mm - 33°x 27° (f/1.4) 25mm - 22°x 17° (f/1.6) 35mm - 16°x 12° (f/1.6) 50mm - 11°x 8.8° (f/2) 75mm - 5.5°x 4.4° (f/2.5) 100mm - 5.5°x 4.4° (f/2.8) 300mm - 1.8°x 1.5° (f/4.5) 1000mm - 0.55°x 0.44° (f/10)

** After product registration on www.flir.com*

FLIR Systems

Export licensing

The products described in this publication may require government authorisation for export/re-export, or transfer. Contact FLIR for details.

Extended warranty

FLIR Systems is giving a full 2 years of warranty on all cameras in this catalogue excluding stirling cooler components and batteries. Stirling cooler components are warranted for a period of two (2) years or 6.000 operating hours from the purchase date, whichever occurs first. To qualify for FLIR's 2-Year warranty, purchaser must fully register the qualifying product directly with FLIR on-line at www.flir.com within sixty (60) days of the date the qualifying product was purchased by the first retail customer (the purchase date).

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Specifications are subject to change without notice.
Weights and dimensions are indicative. Imagery used for illustration purposes only.

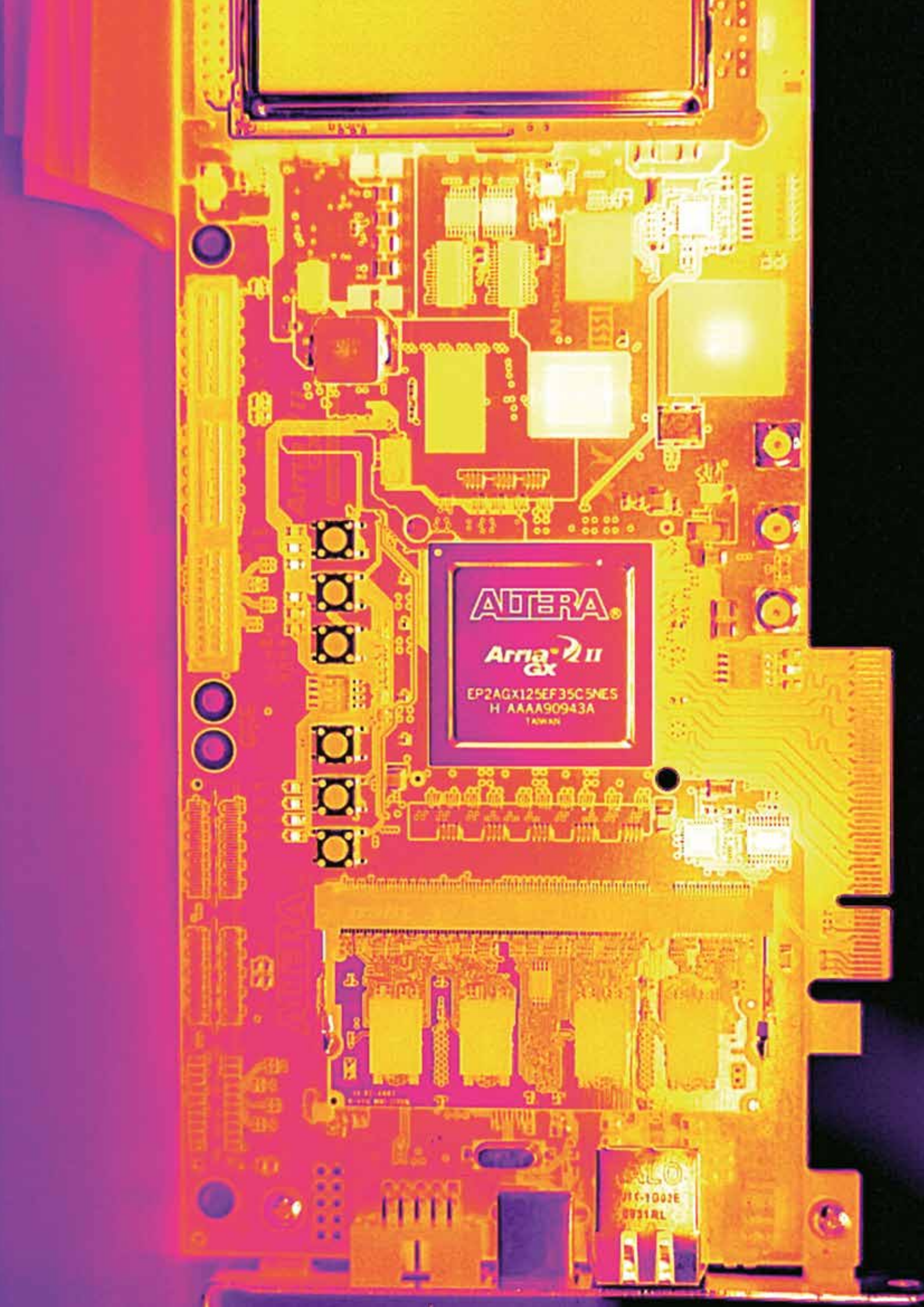
September 2013. All previous catalogues are obsolete.

FLIR Systems

Notes

FLIR Systems

Notes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TAIWAN

FLIR Commercial Systems
Luxemburgstraat 2
2321 Meer
Belgium
Tel. : +32 (0) 3665 5100
Fax : +32 (0) 3303 5624
e-mail : flir@flir.com

FLIR Systems AB
Antennvägen 6,
PO Box 7376
SE-187 66 Täby
Sweden
Tel. : +46 (0)8 753 25 00
Fax : +46 (0)8 753 23 64
e-mail : flir@flir.com

FLIR Systems UK
2 Kings Hill Avenue - Kings Hill
West Malling
Kent
ME19 4AQ
United Kingdom
Tel. : +44 (0)1732 220 011
Fax : +44 (0)1732 843 707
e-mail : flir@flir.com

FLIR Systems GmbH
Berner Strasse 81
D-60437 Frankfurt am Main
Germany
Tel. : +49 (0)69 95 00 900
Fax : +49 (0)69 95 00 9040
e-mail : flir@flir.com

FLIR Systems France
20, bld de Beaubourg
77183 Croissy-Beaubourg
France
Tel.: +33 (0)1 60 37 01 00
Fax: +33 (0)1 64 11 37 55
e-mail : flir@flir.com

FLIR Systems Italy
Via Luciano Manara, 2
I-20812 Limbiate (MB)
Italy
Tel. : +39 (0)2 99 45 10 01
Fax : +39 (0)2 99 69 24 08
e-mail : flir@flir.com

FLIR Commercial Systems
Avenida de Bruselas, 15- 3°
28108 Alcobendas (Madrid)
Spain
Tel. : +34 91 573 48 27
Fax. : +34 91 662 97 48
e-mail : flir@flir.com

FLIR Systems, Middle East FZE
Dubai Airport Free Zone
P.O. Box 54262
Office C-13, Street WB-21
Dubai - United Arab Emirates
Tel. : +971 4 299 6898
Fax : +971 4 299 6895
e-mail : flir@flir.com

FLIR Systems Russia
6 bld.1, 1st Kozjevnichesky lane
115114 Moscow
Russia
Tel.: + 7 495 669 70 72
Fax: + 7 495 669 70 72
e-mail: flir@flir.com

Asia Pacific Headquarter
HONG KONG
FLIR Systems Co. Ltd.
Room 1613 – 16, Tower 2,
Grand Central Plaza,
No. 138 Shatin Rural Committee
Road, Shatin, New Territories,
Hong Kong
Tel. : +852 2792 8955
Fax : +852 2792 8952
Email : flir@flir.com.hk

FLIR Systems (Shanghai) Co. Ltd.
Head Office
Tel. : +86 21 5169 7628
Fax : +86 21 5466 0289
Email : info@flir.cn

Beijing Representative Office
Tel. : +86 10 5979 7755
Fax : +86 10 5907 3180
Email : info@flir.cn

Guangzhou Representative Office
Tel. : +86 20 8600 0559
Fax : +86 20 8550 0405
Email : info@flir.cn

FLIR Systems Japan K.K.
Tel. : +81 3 6277 5681
Fax : +81 3 6277 5682
Email : info@flir.jp

FLIR Systems Korea Co., Ltd
Tel. : +82 2 565 2714
Fax : +82 2 565 2718
Email : flir@flirkorea.com

FLIR Systems Taiwan
Representative Office
Tel. : +886 2 2757 9662
Fax : +886 2 2757 6723
Email : flir@flir.com.hk

FLIR Systems India PVT. Ltd.
Tel. : +91 11 4560 3555
Fax : +91 11 4721 2006
Email : flirindia@flir.com.hk

FLIR Systems Australia Pty Ltd.
Head Office (Vic)
Tel. : 1300 729 987
NZ : 0800 785 492
Fax : +61 3 9558 9853
Email : info@flir.com.au

NSW Office
Tel. : +61 2 8853 7870
Fax : +61 2 8853 7877
Email : info@flir.com.au

WA Office
Tel. : +61 8 6263 4438
Fax : +61 8 9226 4409
Email : info@flir.com.

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