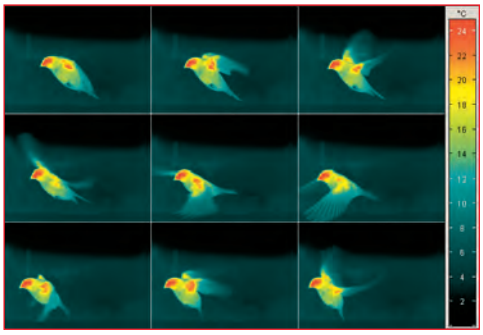
High-end Camera Series ImageIR®

Thermographic Systems to Match Highest Standards



1) High-speed image of a flying bird
2) Take-off of an Airbus A400M

InfraTec.

- Excellent thermal resolution
- Very high frame rate
- Modular design for individual system expansion
- Long-life Stirling cooler for continuous operation
- Robust light-weight metal housing
- Accurate and repeatable triggering
- Complete optical assortment

www.InfraTec.eu

www.InfraTec-infrared.com

Made in Germany

High-end System ImageIR®

1 Lens

High quality precision lenses allow the adaptation of the image geometry to almost every measuring situation. Its performance parameters are calibrated with respect to functionality, quality and flexible application. Due to proper IR-transparent lens materials and high-precision antireflexion coating, the lenses are optimised for different spectral ranges. Additional macro accessory lenses reduce the working distance, increase the geometrical resolution and guarantee highest imaging quality.

2 Interfacing and Communication

Numerous ports can be found on the front and backside of the ImageIR®. The front is equipped with ports for external sensors, motor focus and zoom lenses. At the back side of the ImageIR® the 10 GigE / GigE interface respectively CAMLink / DualCAMLink data interface are located as well as the trigger interface, CAN-Bus-RS232- and USB connector.

3 10 GigE-Interface

This GigE-Vision compatible, industrial-grade interface enables an extremely reliable high-speed data transmission with high electromagnetic noise immunity even across exceedingly long distances. In comparison to conventional GigE interfaces, it provides a 10 times higher transmission speed.

4 Trigger and Process Interface

The camera series ImageIR® is equipped with a snapshot detector. It guarantees a repeatable time-driven and event-driven high-precision data recording in conjunction with the internal trigger and process interface. Two respective inputs and outputs are used to control the camera or to generate digital control signals for external devices. Additional digital and analogue in- and outputs are available in connection with the process interface of the IRBIS® 3 software.

* Depending on model

5 Detector Unit

Modern high-performance photon detectors of different formats, spectral ranges and detector materials can be implemented application specifically.

6 Long-life Stirling Cooler

The high-quality Stirling coolers, used in the ImageIR®, guarantee a short cool-down time as well as a maintenance-free, long-term and low-vibration operation. Up to 15,000 hours of operation can be achieved with these latest generation long-life coolers.

7 Power Supply

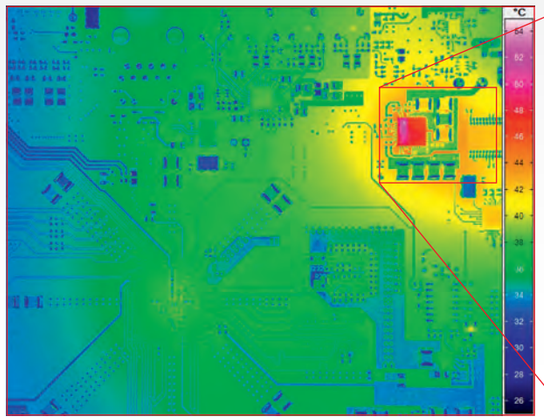
The camera comes with a wide range power supply but can also be powered with external DC sources or batteries.

8 Camera Housing with Handle

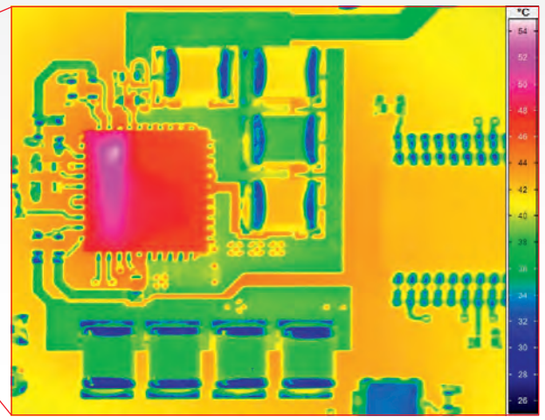
The housing is designed for use in industrial environments and is precision machined out of high-tensile aluminium alloys for maximum protection and thermal stability. The handle on top allows safe transportation.

9 Tripod Connector

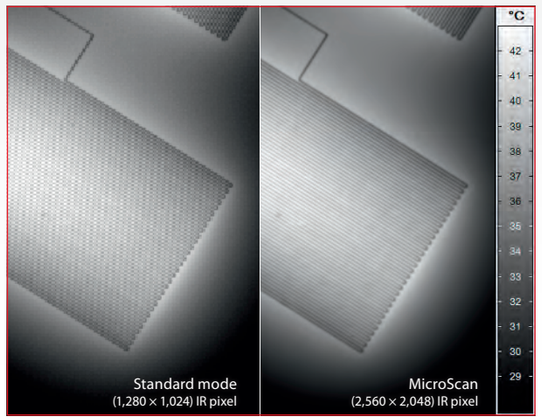
The standardised tripod connector allows an installation on different tripods or pan-tilt solutions for both process-integrated continuous operation and laboratory application. Additional mechanical connectors in line with the principal axis make integration into automated inspection systems easy.



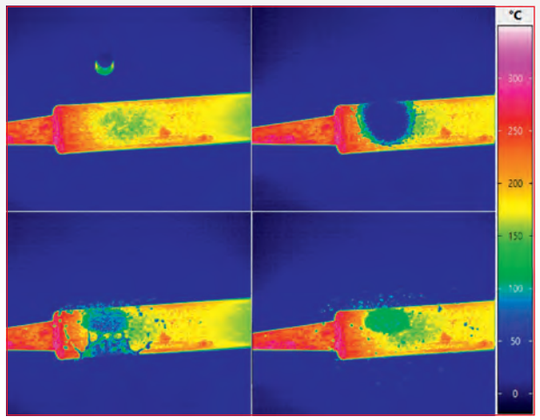
Full size HD image recording of a printed circuit board



Sharp, detailed images become visible through the digitally enlarged section



Printed circuit board without (left) and with MicroScan (right)



Impact of a drop of water on a soldering iron in high-speed mode

Innovations

Precision Calibration & Lenses – Highest Accuracy

±1 %

The multi-characteristic calibration algorithm developed by InfraTec is used to compensate the effect of fluctuations in ambient temperatures and enables great repeatability as well as optimum running-in behaviour of the system. In combination with thermally decoupled lenses a high image homogeneity and an excellent measurement accuracy with tolerances of 1% are achieved.

Separate Filter & Aperture Wheel – Spectral Thermography

The combination of a separate filter and aperture wheel, allowing a total of 30 freely selectable combinations, is prerequisite for an universal application in measurement tasks with high object temperatures and in the field of spectral thermography. The neutral density filters used for signal attenuation or the combination of spectral filters and apertures reliably prevent interference effects.

Example of a module with two wheels (5 positions each)

High-Speed Data Acquisition via Notebook

High-speed

Using a 10 GigE interface, real time image data can be transferred to a computer with the maximum possible resolution and frame-rate without the need for buffering. The transmission line can be several hundreds of meters long and is not susceptible to electromagnetic interference.

Motor Focus for ImageIR® Full Lenses – More Comfort

Focus

All interchangeable standard lens systems of the ImageIR® series can be combined with a motor focus unit, which is controlled by the camera operating software. It enables precise, remote and fast focusing. In addition, an autofocus function is available which operates reliably even with low image contrasts.

The motor focus unit is part of camera module 1 of the ImageIR®

HDR – Large Temperature Ranges in One Image

HDR

The High Dynamic Range (HDR) function is used for a continuous recording of measurement scenarios with extremely large temperature gradients. For these images, several thermograms with different integration times and different filters are recorded in rapid succession and combined to form an overall image with high dynamic range. This is done at the maximum frame rate of the camera. The measurement range can cover a range of up to 1,500 K. Users obtain high-contrast thermograms of test and measurement objects in a wide temperature range, which are characterised by high measurement accuracy.

MicroScan – Quadruplication of the Pixel Number

2,560 × 2,048 MicroScan

The MicroScan opto-mechanical unit allows images to be taken at up to (2,560 × 2,048) IR pixels. This is made possible by a rapidly rotating MicroScan wheel inside the camera. Each rotation of the wheel produces four different individual images, which are each offset laterally by half a pixel. These individual images are converted in real time into a thermogram with quadruple image format. Each pixel of the image represents a true temperature reading. This results in extremely low-noise and extremely fine-resolution images of the measurement objects.

Window Mode (Subwindowing) – Up to 105,000 Hz

Subwindow

The ImageIR® can be operated in full, half, quarter and sub mode. With the camera control software, it is possible to use the extended subwindowing function. Using click-and-drag, freely definable sections can be set up quickly and conveniently. Subwindow image frequencies of up to 105,000 Hz can thus be achieved.

Binning – Increasing Frame Rate & Sensitivity

High-speed Mode

Binning technology allows users to choose between two speed modes on the same camera. The full frame standard mode provides the known frame rates for full, half and sub frames with the full geometric resolution. In high-speed mode, the frame rate is increased to more than three times the previous value. The field of view remains constant, so that the scene section captured by the camera does not change and therefore readjustment of the camera to the measurement object is not necessary. At the same time, the thermal resolution improves by a factor of 2 in high-speed mode. This mode offers great advantages when frame rate is more important than (small) pitch size.

HighSense – More Flexibility

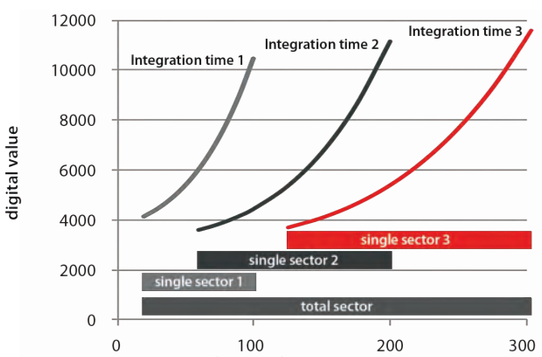
Calibration

Each ImageIR® is factory calibrated over a wide range of temperatures in the exact configuration in which it will be shipped to the customer. HighSense allows the user later to pick a temperature range and the camera will select the optimal integration time based on the factory calibration. If the user instead selects a specific integration time the ImageIR will automatically select the best calibration set.

Multi Integration Time (MIT) – Wide Measurement Ranges

MIT

The MIT function increases the dynamic range up to 16 bit and significantly extends the temperature measurement ranges. Measurement objects with large temperature gradients can be recorded with one measurement range while maintaining the maximum image refresh rate and temperature resolution. With constant aperture / filter setting, different integration times can be selected for up to four calibration ranges and combined with these to form a total range. The system calibration can remain unchanged. Manual switching of the measurement range becomes dispensable as well.



Significantly extended temperature range using the MIT function

Camera Models and Technical Specifications

Model	ImageIR® 4300	ImageIR® 5300	ImageIR® 7300	ImageIR® 8300	ImageIR® 8300 hp	ImageIR® 8300 hs	ImageIR® 8800	ImageIR® 9400	ImageIR® 9400 hs	ImageIR® 9400 hp	ImageIR® 9500	ImageIR® 10300
Feature	Entry-level model	High-speed camera with large pitch	Entry-level model into the VGA segment	Universal model for continuous operation applications	All-rounder in VGA format	High-speed in VGA format	Long wave model with shortest integration times	All-rounder in HD picture quality	High-speed in VGA format	All-rounder in HD format	HD image quality with MCT detectors	Highest geometric resolution
Spectral range	(2.0 … 5.5) µm	(2.0 … 5.5) µm	(2.0 … 5.7) µm	(2.0 … 5.7) µm	(2.0 … 5.7) µm	(1.5 … 5.5) µm	(7.7 … 10.2) µm	(2.0 … 5.5) µm	(2.0 … 5.5) µm	(2.0 … 5.5) µm	(3.5 … 4.8) µm	(3.6 … 4.9) µm
Pitch	30 µm	30 µm	15 µm	15 µm	15 µm	25 µm	15 µm	10 µm	20 µm	10 µm	12 µm	10 µm
Detector	MCT	MCT	MCT or InSb	MCT or InSb	MCT or InSb	T2SLS or InSb	MCT	InSb	InSb	InSb	MCT	InSb
Detector format (IR pixels)	(320 × 256)	(320 × 256)	(640 × 512)	(640 × 512)	(640 × 512)	(640 × 512)	(640 × 512)	(1,280 × 1,024)	(640 × 512)	(1,280 × 1,024)	(1.280 × 720)	(1,920 × 1,536)
Detector format with opto-mechanical MicroScan	–	–	–	–	(1,280 × 1,024)	–	(1,280 × 1,024)	(2,560 × 2,048)	–	(2,560 × 2,048)	(2,560 × 1,440)	–
Temperature measuring range	(-40 … 300) °C	(-40 … 1,200) °C, up to 3,000 °C*	(-40 … 300) °C	(-40 … 1,500) °C, up to 3,000 °C*	(-40 … 1,500) °C, up to 3,000 °C*	(-40 … 1,700) °C, up to 3,000 °C*	(-40 … 1,200) °C, up to 3,000 °C*	(-40 … 1,500) °C, up to 3,000 °C*	(-40 … 1,500) °C, up to 3,000 °C*	(-40 … 1,500) °C, up to 3,000 °C*	(-20 … 1,200) °C, up to 3,000 °C*	(-40 … 1,200) °C up to 3,000 °C*
Measurement accuracy	± 2 °C or ± 2 %	± 1 °C or ± 1 %	± 2 °C or ± 2 %	± 1 °C or ± 1 %	± 1 °C or ± 1 %	± 1 °C or ± 1 %	± 1 °C or ± 1 %	± 1 °C or ± 1 %	± 1 °C or ± 1 %	± 1 °C or ± 1 %	± 1 °C or ± 1 %	± 1 °C or ± 1 %
Temperature resolution @ 30 °C	Better than 0.02 K	Better than 0.015 K	MCT: Better than 0.02 K InSb: Better than 0.025 K	MCT: Better than 0.02 K InSb: Better than 0.025 K	MCT: Better than 0.02 K InSb: Better than 0.025 K	Better than 0.02 K	Better than 0.025 K	Better than 0.03 K	Better than 0.02 K	Better than 0.03 K / 0.02 K in high-speed mode	Better than 0.025 K	Better than 0.035 K / 0.022 K in high-speed mode
Max. frame rate (full / half / quarter / sub frame)*	Up to 75 / 265 / 706 Hz	Up to 481 / 1,906 / 7,229 / 105,000 Hz	MCT: Up to 75 / 300 / 1,200 Hz InSb: Up to 100 / 326 / 863 Hz	MCT: Up to 151 / 540 / 1,520 / 2,807 Hz InSb: Up to 205 / 570 / 1,020 / 5,000 Hz	MCT: Up to 232 / 828 / 2,300 / 3,725 Hz InSb: Up to 355 / 670 / 1,200 / 5,000 Hz	Up to 1,004 / 1,950 / 3,750 / 30,000 Hz	Up to 233 / 874 / 2,892 / 14,593 Hz	Up to 180 / 342 / 622 / 2,601 Hz	Up to 622 / 1,053 / 1,615 / 3,343 Hz	Up to 180 / 342 / 622 / 2,601 Hz	Up to 120 / 446 / 1,517 / 16,053 Hz	Up to 113 / 216 / 396 / 1,915 Hz
Max. frame rate with high-speed mode	–	–	–	–	–	–	–	–	–	Up to 622 / 1,053 / 1,615 / 3,343 Hz	–	Up to 400 / 692 / 1,088 / 2,493 Hz
Dynamic range	14 bit	Up to 16 bit*	14 bit	Up to 16 bit*	Up to 16 bit*	14 bit	Up to 16 bit*	Up to 16 bit*	Up to 16 bit*	Up to 16 bit*	14 bit	13 bit
Integration time	(1 … 20,000) µs	(1 … 20,000) µs	(1 … 20,000) µs	(0.6 … 20,000) µs	(0.6 … 20,000) µs	(0.5 … 20,000) µs	(10 … 20,000) µs	(1 … 20,000) µs	(1 … 20,000) µs	(1 … 20,000) µs	(1 … 20,000) µs	(1 … 20,000) µs
Filter wheel*	Up to 5 positions	Up to 5 positions	Up to 6 positions	Up to 6 positions	Up to 6 positions	Up to 6 positions	Up to 5 positions	Up to 6 positions	Up to 6 positions	Up to 6 positions	Up to 6 positions	Up to 6 positions
Aperture wheel*	Up to 5 positions	Up to 5 positions	Up to 5 positions	Up to 5 positions	Up to 5 positions			Up to 5 positions	Up to 5 positions	Up to 5 positions		
Interfaces	GigE, HDMI*	GigE, HDMI*	GigE, HDMI*	GigE, CAMLink*, HDMI*	GigE, 10 GigE*, 2× CAMLink*, HDMI*	10 GigE, HDMI*	GigE, 10 GigE*, 2× CAMLink*, HDMI*	GigE, 10 GigE, CAMLink, HDMI*	GigE, 10 GigE, CAMLink, HDMI*	GigE, 10 GigE, CAMLink, HDMI*	GigE*, 10 GigE, 2× CAMLink*, HDMI*	10 GigE, HDMI*
Trigger	1 IN / 1 OUT, TTL	4 IN / 2 OUT, TTL	2 IN / 2 OUT, TTL	4 IN / 2 OUT, TTL	4 IN / 2 OUT, TTL	4 IN / 2 OUT, TTL	4 IN / 2 OUT, TTL	4 IN / 2 OUT, TTL	4 IN / 2 OUT, TTL	4 IN / 2 OUT, TTL	4 IN / 2 OUT, TTL	4 IN / 2 OUT, TTL
Analog signals*, IRIG-B*	–	2 IN / 2 OUT, yes	2 IN / 2 OUT, no	2 IN / 2 OUT, yes	2 IN / 2 OUT, yes	2 IN / 2 OUT, yes	2 IN / 2 OUT, yes	3 IN / 2 OUT, yes	3 IN / 2 OUT, yes	3 IN / 2 OUT, yes	2 IN / 2 OUT, yes	2 IN / 2 OUT, yes
Dimensions (mm)*	241 × 120 × 160	241 × 120 × 160	MCT: 241 × 120 × 160 InSb: 235 × 120 × 160	MCT: 241 × 120 × 160 InSb: 235 × 120 × 160	MCT: 241 × 120 × 160 InSb: 235 × 120 × 160	235 × 120 × 160	244 × 120 × 160	241 × 123 × 160	241 × 123 × 160	241 × 123 × 160	241 × 123 × 160	241 × 123 × 160
Weight (without lens)	3.3 kg	3.3 kg	3.3 kg	3.3 kg	3.3 kg	4.0 kg	4.0 kg	4.3 kg	4.3 kg	4.3 kg	4.7 kg	4.7 kg

* Depending on model

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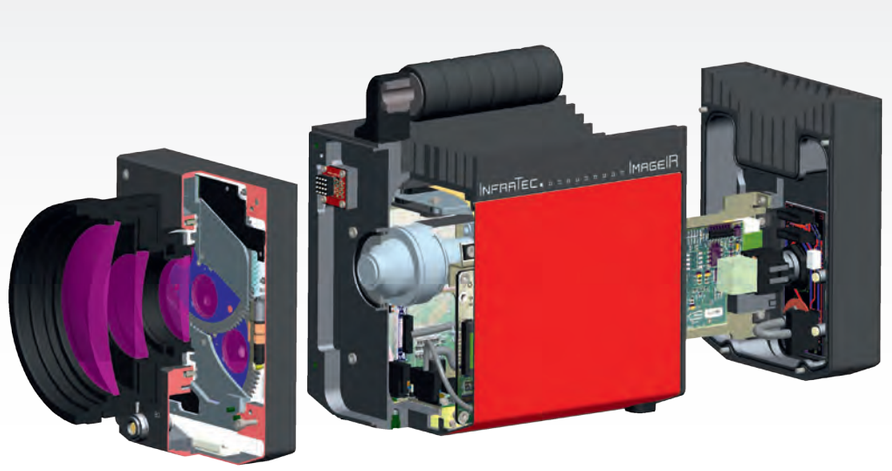


Module 1 Module 2 Module 3

The Right Lens for your Application

In thermography, as in the field of professional photography, the quality of the IR lenses, in addition to the camera sensors used, is decisive for the creation of detailed images. The fast precision infrared lenses used for the ImageIR® camera series have a very high IR transmission.

They help to ensure that even at low object temperatures sufficient radiation reaches the detector to generate low noise thermal images with reliable measurement values. Thus, a high thermal resolution of up to 0.015 K is achieved, resulting in outstanding image quality and detail accuracy.

To check the geometric resolution of the ImageIR® thermographic camera for your application, please use our image field calculator at **fov.infratec.de**

Choose from the following lenses:

- Wide angle lens 12 mm
- Wide angle lens 13 mm
- Wide angle lens 25 mm (HD format)
- Standard lens 25 mm
- Standard lens 50 mm (HD format)
- Telephoto lens 50 mm
- Telephoto lens 100 mm
- Close-Up for telephoto lens 50 mm
- Close-Up for telephoto lens 100 mm
- Solid Immersion Lens (SIL) für M=3× and M=8×
- Microscopic lens 1.0×
- Microscopic lens 3.0×
- Microscopic lens 8.0×
- Telephoto extender 200 mm
- Super zoom (28 … 850) mm
- Super zoom with telephoto extender (50 … 1,350) mm

Equipment and Accessories

The high-end camera series ImageIR® from InfraTec is characterised by outstanding metrological performance and previously unknown compactness and modular design. ImageIR® is the perfect camera for demanding users who need an extremely flexible thermal imaging system with maximum sensitivity, accuracy, geometric resolution and speed. The modular design facilitates individual system configurations that can be optimally tailored to the task on hand.

Module 1

- Lens interface
- Optomechanics controller
- Filter wheel*
- Aperture wheel*
- Shutter*
- Motor focus*
- Opto-mechanical MicroScan*

Module 2

- IDCA (detector + cooler)
- Data processing
- Controller for camera, detector, temperature sensor
- Power supply
- Fan attachment*
- Water cooling system*

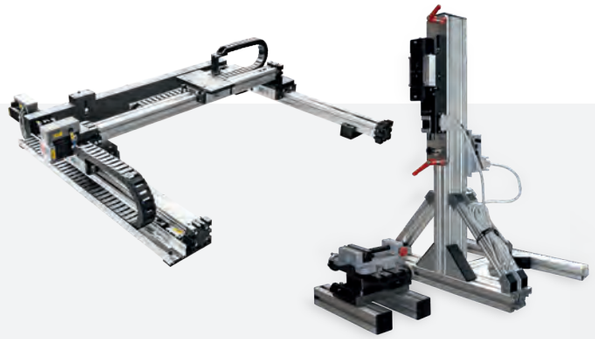
Module 3

- 10 GigE*, GigE, CAMLink* / DualCAMLink*
- Trigger interface
- Power on / off
- DC-IN

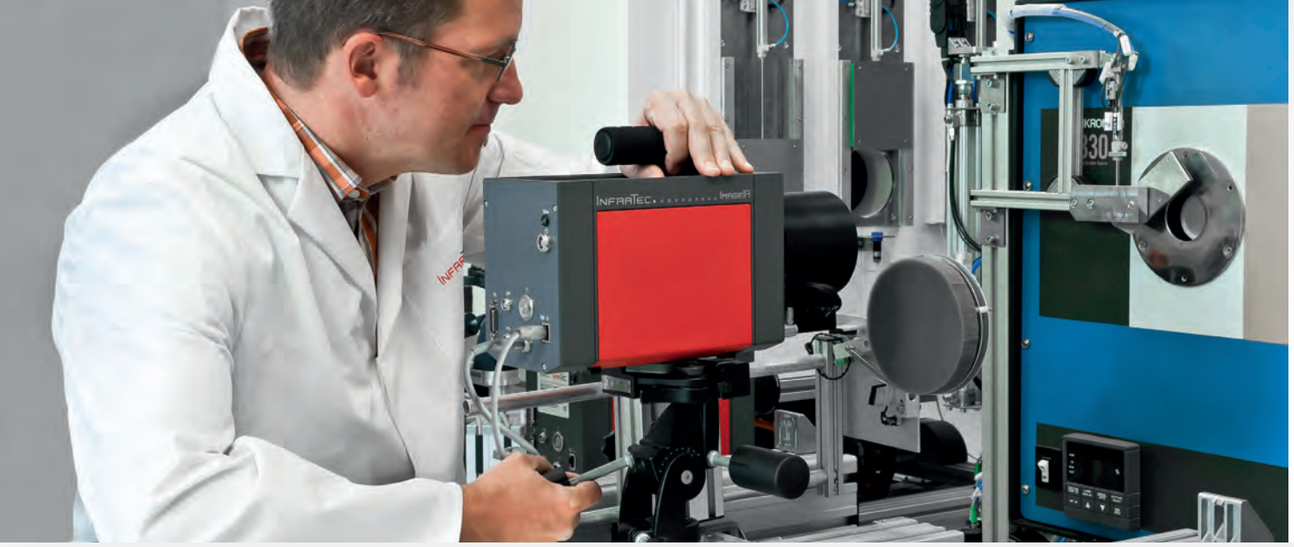
Accessories

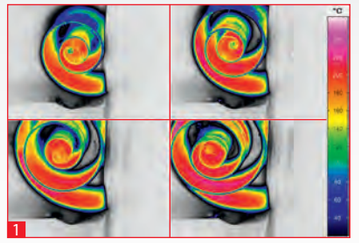
Versatile accessories and the ability to realise customer-specific solutions very quickly ensure the optimal fulfilment of every request. An extensive range of tested accessories is available to complete ImageIR® core configurations:

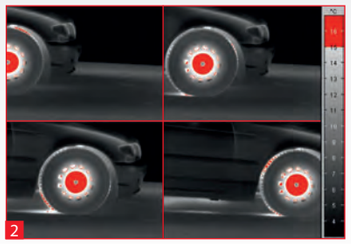
- Robust, airtight transport case with safety lock
- Interchangeable lenses for manual and motorised focusing
- Excitation units and controllers for active thermography
- Removable camera display
- Protection windows, various spectral filters and holders
- Notebooks and desktop PCs
- Cable, adapter
- Cross tables, motorised microscope stands
- Various software packages
- Installation software and manual

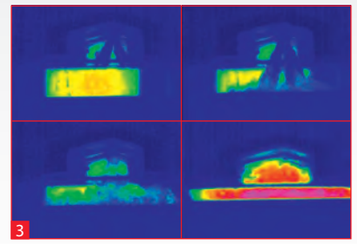


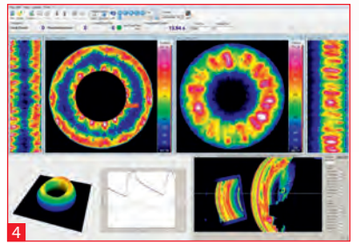
* Depending on model

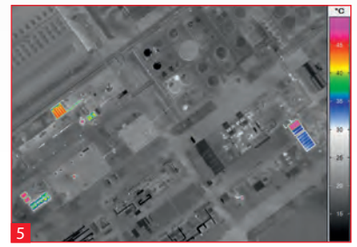












1 Thermal analysis of a turning process
2 Measurement of the effective area in ABS brake testing
3 Fuel-injection of an internal-combustion engine
4 Thermal analysis of brake discs using software IRBIS® 3
5 Thermal aerial image of an industrial facility

Challenging Measurement and Testing Tasks

ImageIR® is a high-end camera series designed for particularly demanding measurement and inspection tasks and whose outstanding performance features set the highest standards.

Spectral Thermography

The camera wavelength range is optimised for the spectral properties of the materials to be detected. ImageIR® thermography systems in the mid-infrared range are often used, as many technical materials exhibit prominent absorption bands, such as glass, plastics and gases. Equipped with motorised filter and aperture wheels with up to six positions each, various spectral filters can be swivelled into the optical path by motor and controlled by the camera operating software.

Micro Thermography

Micro thermography allows the thermal analysis of extremely small structures in the µm range – even from working distances of more than 30 cm. Various microscope lenses are available for measurements on components and assemblies, resolving smallest structures with a pixel size down to 1.3 µm.

Active Thermography

ImageIR is perfectly suited for active and lock-in thermography due to the extremely high thermal sensitivity, high frame rates as well as the snapshot capability of the detector, which allows instant triggering and thus extremely high phase synchronicity with external systems. ImageIR® is perfectly suited for active or lock-in thermography. The corresponding analytical software package IRBIS®3 active offers a comprehensive selection of algorithms to detect defects in the specimen.

High-speed Thermography

ImageIR® can be operated in both full and sub frame formats with high frame rates and fastest integration times. This allows an easy imaging of highly dynamic processes and the detection of fast-moving objects like brake discs and tires. For the measurement of fast, transient processes, frame rates of up to 105,000 Hz can be achieved.

Material Testing

Infrared thermography is a cost and time saving technology for material testing. It allows the characterisation of different properties in various materials. The choice of the appropriate method of thermography depends on the material properties, the geometry and the type of properties to be characterised. Thermographic cameras are used for both non-destructive and destructive testing, for example in stress tests.

Thermal Optimisation of Assemblies

Almost all devices we use consume energy and release some of it in the form heat. A detailed analysis of the resulting heat flow is important to improve component and product properties. Detected hotspots, for example, indicate the need for optimisation. The use of thermographic cameras with high geometric resolution can prevent incorrect measurements.

Industries and Application Fields

Basic Research

- Development of new material coatings (nanotechnology)
- Investigation of fundamental physical-chemical relationships (battery technology, new alloys)
- Biomedical research of thermal connections (neuroscience, dentistry)
- Investigation of the thermal-energetic behaviour of new semiconductor materials and material combinations

Electronics and Electrical Industry

- Thermal optimisation of assemblies and components starting in the early stages of product development
- Micro thermography for geometrically correct imaging of smallest parts and components in complex circuits
- Non-contact real-time measurement of temperatures and temperature distributions on boards and assemblies
- Differential image analysis for the focused evaluation of possible deviations from standard states
- Hotspot detection in multi-layer structures by lock-in thermography

Glass, Plastics and Metal Industry

- Thermographic characterisation of specific multi-component structures, for example in illuminants
- Optimised measurement of many technical materials by spectral adjustment of the camera wavelength using motorised filter wheels
- Analysis of component and material properties during stress tests, also in combination with visual 3D measurement technology
- Thermal optimisation of moulds and tools

You want to know more about the Application fields? Just scan this QR Code!

Aerospace Industry

- Thermal optimisation of electronic assemblies, structural and drive components
- Short integration times and high recording speeds enable the correct recording of highly dynamic processes
- Analysis of modern composite materials and lightweight construction elements using lock-in thermography
- Realisation of demanding airborne applications, for example environmental and geoscience studies, wind tunnel investigations or monitoring tasks

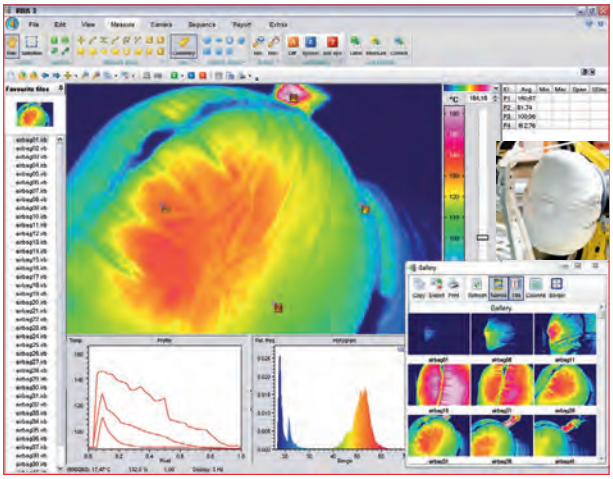
Automobile Industry and Mechanical Engineering

- Adjustment of the thermal behaviour of components in development, technological setup and production with standard behaviour
- Thermal optimisation of electronic assemblies, structural and drive components
- Non-destructive testing with thermographic camera for precise and efficient quality and process control
- Thermal characterisation of fast rotating objects like tires or brakes
- Characterisation of joints and composite bonds by lock-in thermography
- Further development of modern welding and joining processes using thermographic accompanying measurements

Other Industries and Application Fields

- Laser and welding technology
- Quality assurance for joining processes / shrink hole detection
- Recognition of thermal signatures
- Safety applications
- Medicine and pharmacy
- Chemical industry
- Bio- and geo studies
- Solar cells and modules

Software Family IRBIS® 3



The powerful IRBIS® 3 software family developed at InfraTec is part of a complete system of the ImageIR® camera series. This enables customer-specific, adaptable high-end thermographic solutions to be implemented for a wide range of measurement tasks and applications.

The user friendly IRBIS® 3 professional thermography software offers comprehensive analysis and processing tools. In addition to numerous implemented correction models, the compensation of temperature-dependent emissivity of objects, the macro editor and the IR sequence cutting tool, an optional active thermography module is available. By means of a calibration tool the ImageIR® can be calibrated on a basic level on your own computer.

IRBIS® 3 online / IRBIS® 3 process
The comfortable control- and acquisition software for high-speed digital thermographic image data acquisition allows time and action-triggered capturing of thermographic images as well as for an intensity- and temperature-sensitive control of processes via digital or analogue in- and outputs.

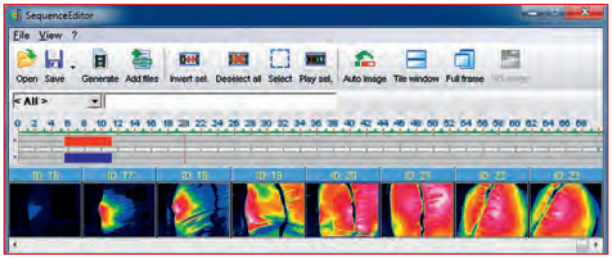
IRBIS® 3 active
The special software for non-destructive material testing allows the analysis of thermographic image sequences by means of the active thermography analysis algorithms “quotient-”, “pulse phase-” and “lock-in method”. All of these algorithms work independently of the degree of emissivity.

IRBIS® 3 rotate
The thermographic evaluation software is used to examine rotating parts in different load conditions. The measurement is carried out in different transformation views. An automatic hotspot detection as well as an alarm function when critical temperature limits are exceeded in a live load test provide security in routine work.

The Software Development Kit (SDK)
The SDK enables the easy handling of the integration of the ImageIR® into customer’s existing software modules. It supports several different program languages and offers an optional linking to MATLAB and LABVIEW.

IRBIS® 3 Sequence Editor

The Sequence Editor effectively enables manual or - according to user-defined criteria - automated selection of thermographic data from complex sequences as well as the creation of filtered image series. Thus, users can reduce the original data to the level of information appropriate to the task at hand and save the individually created material with a new designation.



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