



INFRARED CAMERAS

The most versatile infrared cameras in the world

when temperature matters

Advanced thermal measurement systems

Optris' infrared cameras are fully radiometric stationary thermographic systems with an excellent price-performance ratio. The thermal imaging cameras are connected to a PC via USB or Ethernet and they are immediately ready to be used. Temperature data is displayed through optris PIX Connect – the license-free analysis software.

Non-contact temperature measurement made in Germany

Optris IR measurement devices enable constant monitoring and control of virtually every manufacturing process, and reductions in production costs through specific process optimization.

Once purchased, thermal imager are essential pieces of equipment used in a numerous industrial applications, e.g.

- Glass
- Plastics
- Metal
- Automotive
- Electric utility sector
- Fire prevention / Safety
- Maintenance
- Life Science / Medical
- 3D printing & Additive manufacturing

For more infos on application examples see page 19.

The Compact and the Precision Line offer thermal imagers for all applications

when temperature matters

Advantages Xi Compact Line

- Compact affordable industrial imager for temperature measurements from -20 to $900\text{ }^{\circ}\text{C}$ (-4 to $1652\text{ }^{\circ}\text{F}$)
- Motorized focus
- Autonomous operation (without PC) with automatic spot finder and direct analog output – ideal for OEM use (Xi 80 / 410)
- Direct Ethernet interface (Xi 80 / 410)

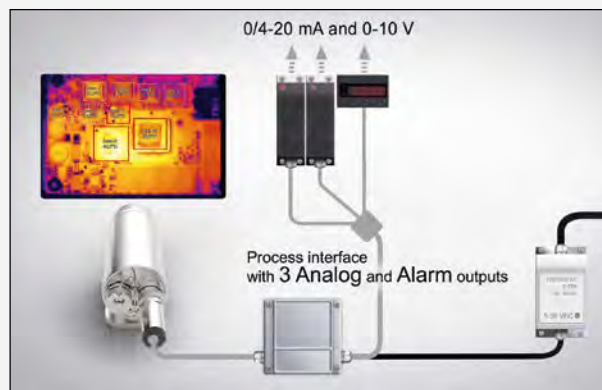


Automatic hot spot search

Objects can be thermally analyzed and hot or cold spots can be found automatically.

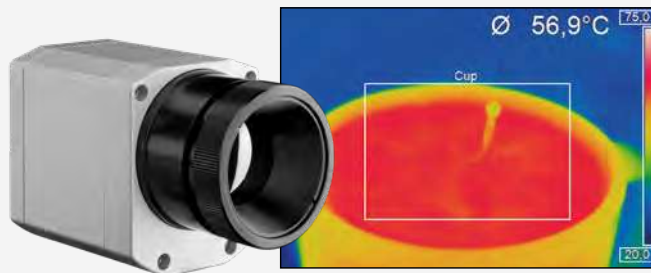
Autonomous operation with direct analog output

Up to 9 freely definable measuring areas may be used as analog outputs when using an external process interface.



Advantages PI Precision Line

- Interchangeable lenses
- Suited for fast processes (up to 1 kHz)
- High thermal sensitivity (up to 40 mK NETD)
- High optical resolution (up to $764 \times 480\text{ Pixel}$)
- Laser blocking filters
- Temperature measuring ranges from -20 to $2450\text{ }^{\circ}\text{C}$ (-4 to $3632\text{ }^{\circ}\text{F}$)
- Different spectral ranges (500 nm 800 nm / $1\text{ }\mu\text{m}$ / $7.9\text{ }\mu\text{m}$ / $8 - 14\text{ }\mu\text{m}$)
- Delivered with test certificate



Fast measurements

Temperature distributions on a surface can be precisely recorded at millisecond intervals.

Simple process integration

Software Development Kit (SDK) for integration of the camera into customer-specific software via Dynamic Link Library (DLL) or COM-Port.

Interfaces to LabView and MATLAB are included as well.

optris Microscope optics

The interchangeable and focusable microscope optics enable electrical testing and thermal analysis of smallest components at the same time - with an optical resolution of up to $28\text{ }\mu\text{m}$. Fast processes can easily be monitored with a frame rate of up to 125 Hz and, with the recording of radiometric video sequences and images, be saved for later analysis.



All optris infrared cameras are compatible with the Data Acquisition (DAQ) Software Dewesoft X by  **DEWESoft®**.

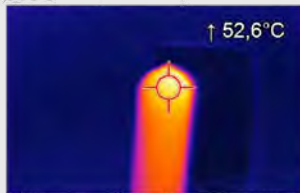
optris Xi 80 / 400 / 410

AFFORDABLE INFRARED CAMERAS
FOR MULTI-LOCATION INSTALLATIONS

Compact spot finder IR camera



- Industrial imager for precise temperature measurements from -20 to 900°C (-4 to 1652°F)
- Rugged, compact imager with motorized focus
- Autonomous operation with automatic spot search and direct analog output
- up to 80 Hz frame rate for the monitoring of fast thermal processes
- Extensive ready-to-use package for an attractive price – incl. versatile image processing software with line scan mode and connection cables



Integrated spot finder function

The integrated spot finder function allows for precise temperature measurements of moving objects - without having to readjust the sensor.

The camera figures it out on its own, without being connected to a PC.

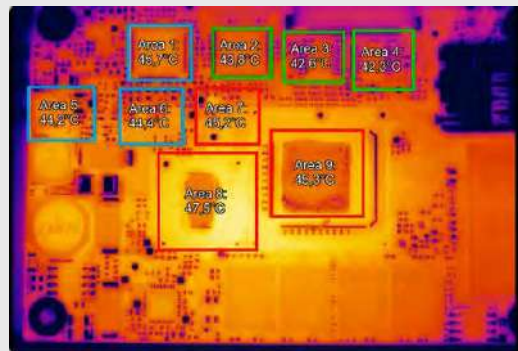
Easy integration into PLCs via RS485 interface



Pyrometer or camera?

The Xi series is a fusion of a rugged, compact pyrometer and a modern IR camera.

Thanks to analog and digital outputs as well as the option to process up to nine freely definable measuring areas using an external process interface, the Xi camera is perfectly suited for OEM applications.



Motor focus simplifies handling

The Xi models are equipped with a motorized focus.

The free PIX Connect software enables a remote focusing from the distance.

RELIABLE TEMPERATURE MEASUREMENT ON TINY OBJECTS

Microscope optics for the inspection of assembled circuit boards

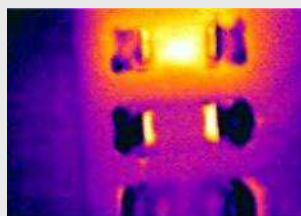
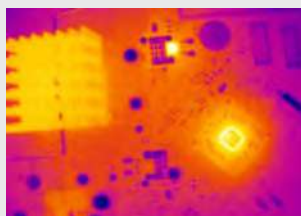
- optical resolution of 382 x 288 pixels for exact temperature measurement of -20 °C to 900 °C (-4 to 1652 °F)
- Small sized rugged camera with motorized focus
- 80 Hz frame rate for monitoring of fast thermal processes - Real-time thermographic images in high speed
- Recording of radiometric videos
- Extensive ready-to-use package for an attractive price – including versatile image processing software and connection cables



The microscope optics for the Xi 400 allows reliable temperature measurement on tiny objects from 240 µm. In combination with a suitable stand, this enables professional measurement of printed circuit boards and components in the electronics industry.

The measuring distance between camera and object is variable between 90 and 110 mm (3.54 and 4.33 in).

The built-in motor focus allows for an easy focussing of the camera with the included PIX Connect software.



Areas of application

Circuit boards are a core part of electronic devices. They keep getting smaller while having to be more powerful at the same time.

Temperatures of assembled circuit boards can easily be measured with the microscope optics of the optris Xi 400 thermal imager, thus identifying overheated areas quickly and preventing possible defects.

The causes for excessive temperatures can be manifold: defective components, incorrectly dimensioned circuit paths or poorly soldered joints.



Compact spot finder IR camera for use in harsh industrial environments, autonomous operation possible.			
Basic model	Xi 80	Xi 400	Xi 410
Detector	FPA, uncooled (34 µm pitch)	FPA, uncooled (17 µm pitch)	FPA, uncooled (17 µm pitch)
Optical resolution	80 x 80 pixels	382 x 288 pixels	384 x 240 pixels
Spectral range	8–14 µm	8–14 µm	8–14 µm
Temperature ranges	–20 ... 100 °C (–4 to 212 °F) 0 ... 250 °C (32 ... 482 °F) (20) 150 ... 900 °C (302 ... 1652 °F) ¹⁾	–20 ... 100 °C (–4 to 212 °F) 0 ... 250 °C (32 ... 482 °F) (20) 150 ... 900 °C ([68]302 ... 1652 °F) ¹⁾ 200 ... 1500 °C (392 ... 2732 °F) (option)	–20 ... 100 °C (–4 to 212 °F) 0 ... 250 °C (32 ... 482 °F) (20) 150 ... 900 °C (302 ... 1652 °F) ¹⁾ 200 ... 1500 °C (392 ... 2732 °F) (option) ²⁾
Frame rate	50 Hz	80 Hz / 27 Hz	Ethernet: 25 Hz / USB: 4 Hz autonomous operation: (without PC) 1.5 Hz
Optics (FOV)	30° (f = 5.1 mm [0.2 in] / F = 0.9) 12° (f = 12.7 mm [0.5 in] / F = 1.0) 55° (f = 3.1 mm [0.12 in] / F = 0.9) 80° (f = 2.3 mm [0.09 in] / F = 0.9)	29° x 22° (f = 12.7 mm [0.5 in] / F = 0.9) 18° x 14° (f = 20 mm [0.79 in] / F = 1.1) 53° x 38° (f = 7.7 mm [0.3 in] / F = 0.9) 80° x 54° (f = 5.7 mm [0.22 in] / F = 0.9)	29° x 18° (f = 12.7 mm [0.5 in] / F = 0.9) 18° x 12° (f = 20 mm [0.79 in] / F = 1.1) 53° x 31° (f = 7.7 mm [0.3 in] / F = 0.9) 80° x 44° (f = 5.7 mm [0.22 in] / F = 0.9)
Microscope optics	–	18° x 14° (f = 20 mm / F=1.1), Smallest measuring spot (IFOV): 80 µm	–
Focus	Motorized focus	Motorized focus	Motorized focus
Optical resolution (D:S)	190:1 (12° optics)	390:1 (18° optics)	390:1 (18° optics)
Thermal sensitivity (NETD) ³⁾	100 mK	80 mK	80 mK
System accuracy (at T _{Amb} = 23 ± 5 °C)	± 2 °C or ± 2 %, whichever is greater	± 2 °C or ± 2 %, whichever is greater	± 2 °C or ± 2 %, whichever is greater
PC interfaces	USB 2.0 / Ethernet (100 Mbit/s) / PoE	USB 2.0 / optional USB to GigE (PoE) interface	USB 2.0 / Ethernet (100 Mbit/s) / PoE
Direct in-/outputs / Standard process interface (PIF)	1x 0/4–20 mA output, 1x input (analog or digital) electrically isolated	1x 0–10 V input, 1x digital input (max. 24 V), 1x 0–10 V output	1x 0/4–20 mA output, 1x input (analog or digital), electrically isolated
Industrial process interface (PIF)	3x analog outputs (0/4–20 mA or 0–10 V) or alarm OUT (relais), 3x inputs (analog or digital), fail-safe (LED and relay), stackable up to 3 PIFs; electrically isolated	2 x 0–10 V inputs, 1 x digital input (max. 24 V), 3x 0/4–20 mA outputs, 3 x relais (0–30 V / 400 mA), faile-safe relay	3x analog outputs (0/4–20 mA or 0–10 V) and 3x alarm outputs (relais) / 3x inputs (analog or digital) / fail-safe (LED and relay) stackable up to 3 PIFs; electrically isolated
Cable length	USB: 1 m, 3 m, 5 m (3.3 ft, 9.8 ft, 16.4 ft) Ethernet: 100 m (328 ft), RS485: 500 m (1640 ft)	USB: 1 m, 3 m, 5 m, 10 m, 20 m (3.3 ft, 9.8 ft, 16.4 ft, 32.8 ft, 65.6 ft)	USB: 1 m, 3 m, 5 m (3.3 ft, 9.8 ft, 16.4 ft) Ethernet: 100 m (328 ft), RS485: 500 m (1640 ft)
Ambient temperature (T _{Amb})	0 °C ... 50 °C (32 ... 122 °F)	0 °C ... 50 °C (32 ... 122 °F)	0 °C ... 50 °C (32 ... 122 °F)
Size	Ø 36 x 90 mm (1.4 x 3.5 in) (M30x1 thread)	Ø 36 x 100 mm (1.4 x 3.9 in) (M30x1 thread)	Ø 36 mm x 100 mm (1.4 x 3.9 in) (M30x1 thread)
Environmental rating	IP 67 (NEMA 4)	IP 67 (NEMA 4)	IP 67 (NEMA 4)
Weight (without mounting bracket)	201 - 210 g (7.09 - 7.41 oz) depending on lens	216 - 220 g (7.62 - 7.76 oz) depending on lens	216 - 220 g (7.62 - 7.76 oz) depending on lens
Power supply	USB / PoE / 5-30 VDC	via USB	USB / PoE / 5-30 VDC
Power consumption (typical values)	1.5 W	1.5 W	1.5 W
Scope of supply (standard)	• Xi camera • USB cable (1 m [3.3 ft]) • Cable for in-/outputs (1 m [3.3 ft]) with terminal block • Mounting bracket with tripod thread, mounting nut • Software package optris PIX Connect • Quick start guide	• Xi camera • USB cable (1 m [3.3 ft]) • Cable for in-/outputs (1 m [3.3 ft]) with terminal block • Mounting bracket with tripod thread, mounting nut • Software package optris PIX Connect • Quick start guide	• Xi camera • Ethernet / PoE cable (1 m [3.3 ft]) • USB cable (1 m [3.3 ft]) • Cable for in-/outputs (1 m [3.3 ft]) with terminal block • Mounting bracket with tripod thread, mounting nut • Software package optris PIX Connect • Quick start guide

1) Accuracy effective starting at 150 °C (302 °F)

2) If this option is ordered the (20) 150 ... 900 °C (302 ... 1652 °F) range is not available

3) LT: Measurement of the noise equivalent temperature difference (NETD) according to VDI 5585 standard, method B; 25 °C (77 °F) black body temperature (–20 ... 100 °C [–4 ... 212 °F] range), frame rate 20 Hz averaged

Air purge unit	Water cooled housing	Shutter
ACXIAPL + ACXIAPLAB (Mounting bracket)	ACXIW	ACXISCBxx* + ACXIAPLAB (Mounting bracket)
Features - The air purge attachment can be used in combination with the water cooled housing and protects the optics from contamination - Used in rough and dusty areas to guarantee a reliable temperature measurement	Features - The rugged water cooled housing allows the Xi infrared cameras to be employed in hot environments up to 250°C (482 °F) - Respective heat-resistant cables are also available	Features - In addition Xi cameras can be equipped with a shutter - The shutter protects the optics from falling parts within a response time of 100 ms
		

*) xx = for different cable lengths

Outdoor protective housing for Xi series	USB server Gigabit 2.0 for Xi 400	Industrial process interface (PIF) for Xi series
ACXIOPH24	ACPIUSBSGB	Xi 80 / Xi 410: ACXIPIFCBx* Xi 400: ACPIPIFMACBx*
Features - Environmental rating IP 66 - Additional air purge collar allows continuous operation in dusty and humid environments - Heating element and built-in fan enable for a 24/7 operation from -40 °C to 50 °C (-40 °F to 122 °F) - Installation of USB Server Gigabit 2.0 and industrial process interface possible for integration into control systems over large outdoor distances	Features - Fully USB 2.0 compatible, Data rates: 1.5 / 12 / 480 mbps, USB transfer mode: Isochronous - Network connection via Gigabit Ethernet - Full TCP/IP support incl. routing and DNS - Two independent USB ports - Supply from PoE or external power supply with 24 – 48 V DC - Galvanic isolation 500 V_{RMS} (network connection) - Remotely configurable via Web Based Management	Features - Industrial process interface for Xi 400 with 3 analog / alarm outputs, 2 analog inputs, 1 digital input, 3 alarm relays - Industrial process interface for Xi 80 and Xi 410 with 3 analog- / alarm outputs, 3 inputs (analog or digital), 3 alarm relays 500 V AC_{RMS} isolation voltage between camera and process - Separate fail-safe relay output - Xi hardware including all cable connections and PIX Connect software are permanently observed during operation - Option Xi 80: stackable up to 3 PIFs
		

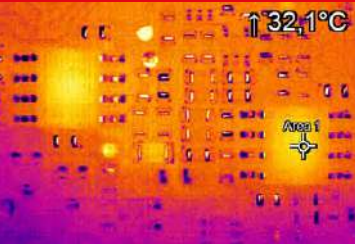
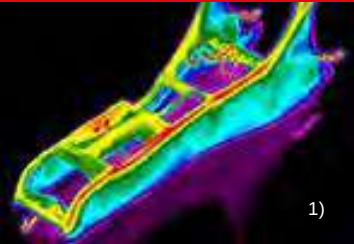
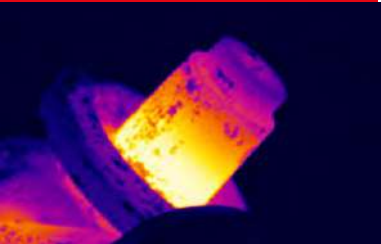
*) x = for different cable lengths

Applications

Application examples for non-contact temperature measurement

The process and product temperature is an important physical indicator for manufacturing processes and ensures a high quality level of the production line.

All Optris products apply in different areas, covering the non-contact temperature measurement. This covers the automotive industry, the food industry as well as 3D printing & additive manufacturing.

Electronics industry	Plastics industry	Fire prevention	Metal industry
			
Component inspection of circuit boards More and more manufacturers of electronic circuit boards rely on noncontact temperature measurement due to the constantly increasing performance of their components. Recommended devices: PI 640i Microscope optics, Xi 400 Microscope optics	Injection molding In order to prevent component distortion during injection molding, the process is monitored by thermal imaging cameras detecting and adjusting temperature over- or undershoots during molded part measurement. Recommended device: PI 450i	Infrared technology in waste processing Early fire detection with infrared cameras is an important protective measure in industry to prevent irreparable damage to industrial plants and buildings. Recommended device: Xi 400	Workpiece control during drop forging In drop forging, the semi-finished products must be at a certain forging temperature before forming. In order to achieve the optimum production result, the surface temperature of the material is controlled accordingly. Recommended devices: PI 1M, PI 05M

References: 1) GTT Willi Steinko

Industries	Application notes
Fire prevention / Safety	Battery monitoring with IR temperature measurement
	Early fire detection with infrared cameras
	Infrared cameras monitor planing systems - from fire protection to quality control
Electric utility sector	Web Access Converter Module

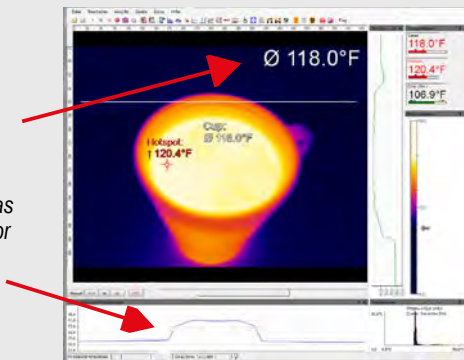
optris PIX Connect Software

FEATURES

Comprehensive IR camera software

- No additional costs or licensing restrictions
- Modern software with intuitive user interface
- Remote control of camera
- Display of numerous images in different windows
- Compatible with Windows 7, 8, 10 and 11
- Two Software Development Kits for Windows and Linux included
- Various language options, incl. translation function
- Temperature display in °C or in °F

Temperature
information in
main window, as
digital display or
as graphic



Pre-defined layouts make it quick and easy to start with your applications. And because we know that every measurement task has its own individual requirements, we have ensured that it is quite easy to adapt the preset layout to suit your individual requirements.

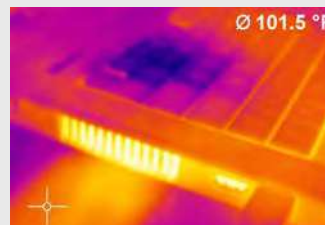
The user interface of the PIX Connect software can also be adapted to suit your personal workflow: Software windows can be easily arranged using drag & drop; in the toolbar you can save shortcuts for functions relevant to your application – or even remove links which you do not need.

Regardless of whether you are working on a desktop PC or a tablet, the user interface can be adapted.

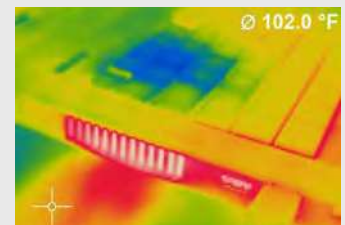
Our layouts – as individual as your applications

The PIX Connect software makes a wide range of preset color palettes available. This allows optimal depiction of thermal contrasts. The pre-defined color palettes can be individually adapted to be able to cater for the specific requirements of your respective application.

Associated temperature groups (isotherms) can be identified by color markers and highlighted. It is also possible to define temperature values in advance; pixels above, below, or between these values are highlighted in color.

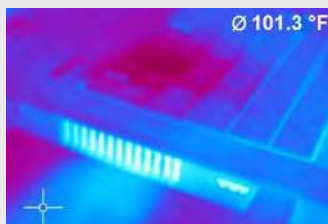


Palette Iron

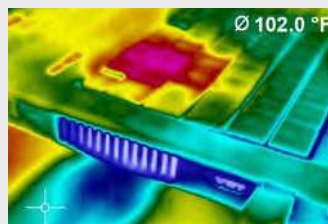


Palette Rainbow

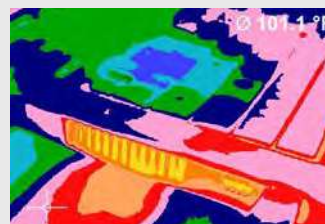
The right color palette for every application



Palette Blue Hi



Palette Rainbow Hi



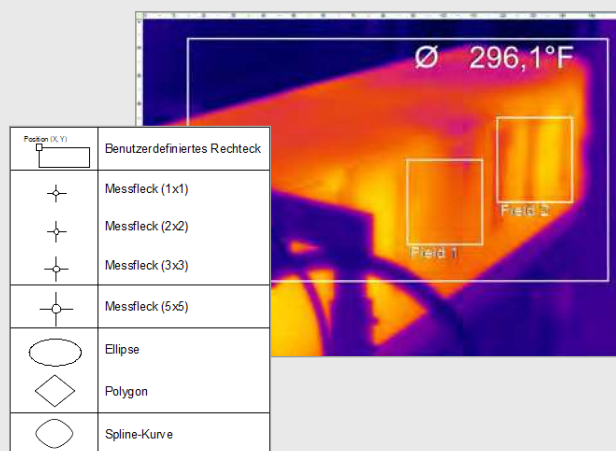
Palette Rainbow Medical



Palette Gray (Black = Cold)

Measuring areas

**It is not just a matter of size, but also depends on the content:
designing a suitable measurement area**



The size and shape of measurement area can be freely designed and moved. For an easy introduction, a large selection of pre-defined measurement area shapes is available.

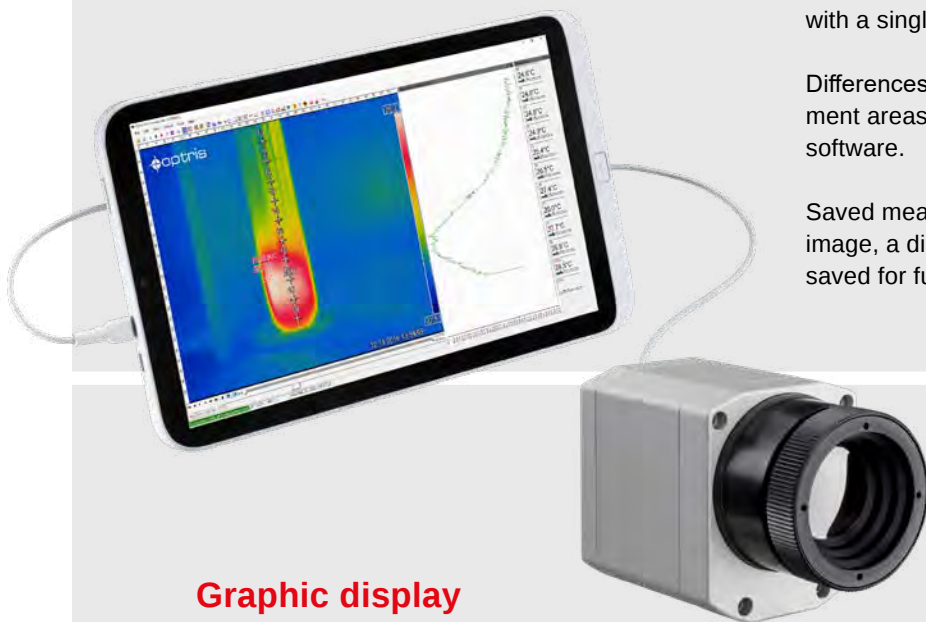
You can set up as many measurement areas as you like in the camera's field of view. To do this, it is possible to make a distinction between main and ancillary fields.

Various modes can be set in a measurement area, such as minimum value, maximum value, or average value, or you can rule out the detection of hot or cold spots.

The separate setting of the emissivity for measurement areas allows various material surfaces to be monitored with a single camera.

Differences and averaging between different measurement areas are easy to calculate with the PIX Connect software.

Saved measurement areas can be displayed as an image, a digital display or a diagram and can then be saved for further analysis.

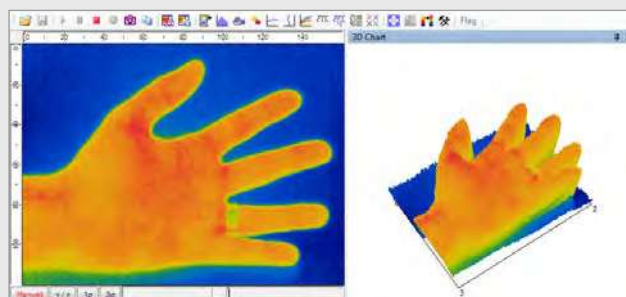
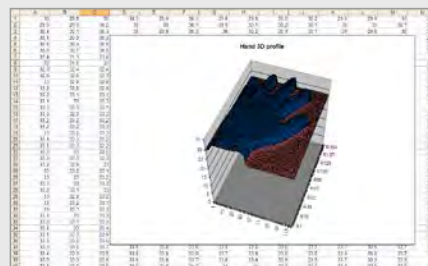


Graphic display of the temperature values

Temperature values can be shown along a straight line as temperature profiles as well as as 3D diagrams.

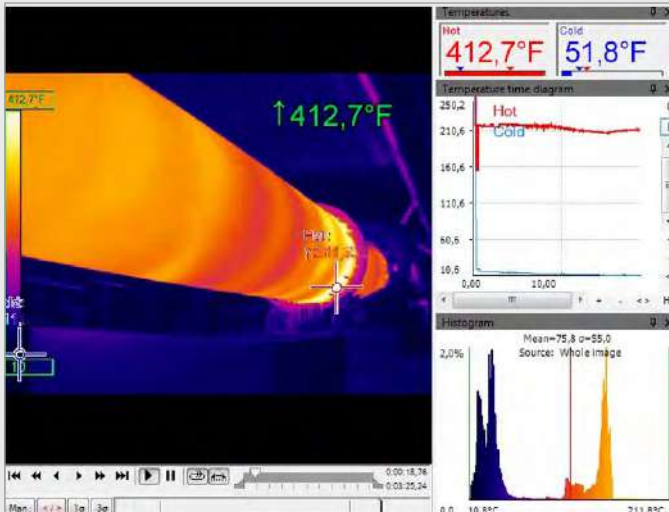
A temperature/time diagram can be used to analyze the temperature development over time. Individual time sections can be lifted out of the diagram and be analyzed in detail by zooming in and out.

Diagrams defined in this way can be exported from the software and be saved in Excel for further analysis.



Recording and display

Recording video sequences – for later analysis and documentation



Beside of single snapshots also video recordings can be made with the software, both with radiometric data included. This allows a detailed analysis of the measurement results afterwards.

An integrated screen capture function makes it simple to retrospectively generate videos in wmv format.

Videos recorded can be processed retrospectively. For example, individual sections can be cut out of a recording and can be saved as an independent sequence.

Saved video recordings are available for analysis. The sequences can be played back in slow motion or time lapse for this purpose. It is also possible to play back as a continuous loop.

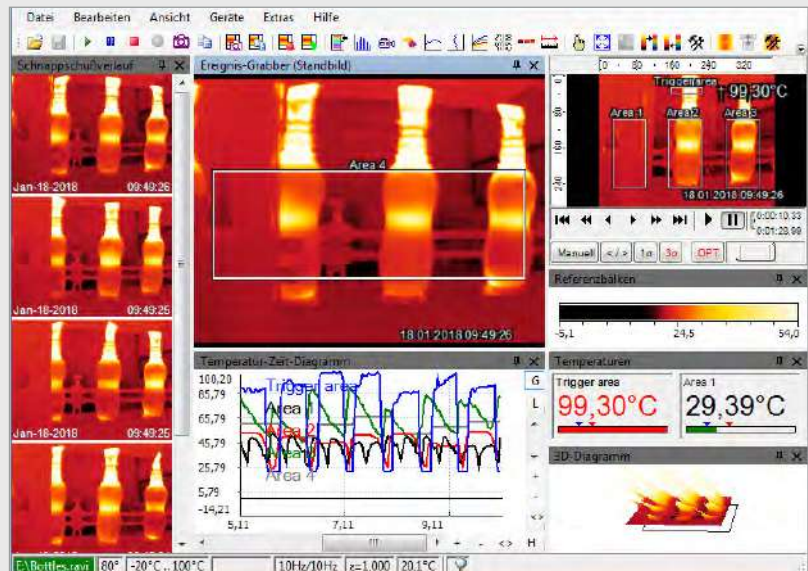
Event grabber

The snapshot option works like a screenshot; an individual image is recorded from the live picture. This snapshot is a radiometric image (*.tiff), where all the temperature and measurement area information at the time of the recording is saved for every pixel.

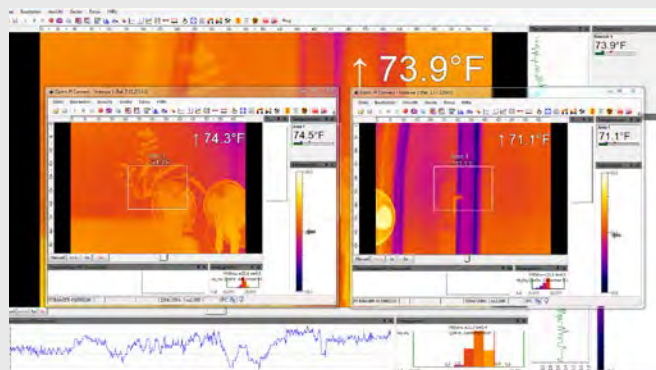
Saving and exporting the image for further analysis in Excel is possible thanks to the option of saving the temperature matrix in text format, e.g. as comma-separated values (.csv format). It is also possible to continue processing the image data with standard programs such as Photoshop or Windows Media Player.

Sections of the saved image can be zoomed in to get a closer look. 3D display is also possible.

Snapshots – all temperature information in one picture



Merging



The fields of vision of three cameras (top) are converted into one single image via the merging function. (bottom)



The merging function combines several camera angles together in a single picture

The PIX Connect software gives you the option of grouping together several cameras within a software instance, i.e. the field of view of several infrared cameras are merged together to make a single picture. For processes with several control points in particular, it is helpful to concentrate the various angles on one screen. Merging several cameras also makes it possible to get an all-round view of a 3D object.

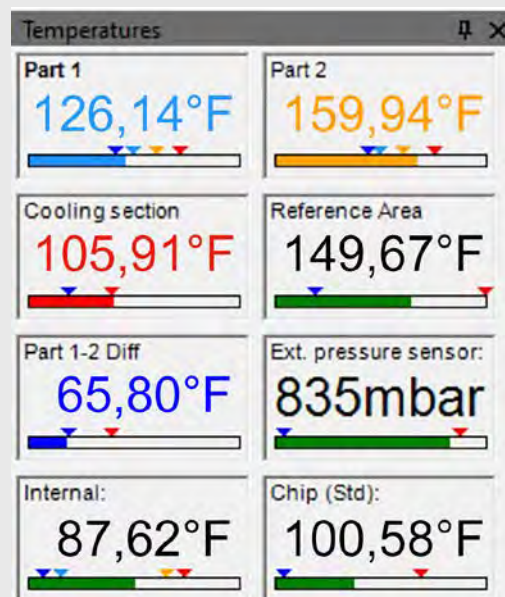
You can merge several cameras either using a direct USB connection or via Ethernet. While in the first case, every camera needs to have its own USB port; for the second option, one Ethernet connection is enough. The cameras here are each connected to the Ethernet switch on the PC via a USB Server Gigabit 2.0.

Alarms

Defining several alarm values – allows quick intervention

Alarms for freely definable measurement areas, calculated objects, uncommitted values of external transmitters as well as the internal temperature of the camera can be chosen via the software. Apart from minimum and maximum values, it is also possible to set so-called advance alarms. These will emit a warning when the measured temperature approaches the defined minimum or maximum value, therefore giving you more options and time to react.

If the measured temperature reaches one of the previously defined values, then the software will trigger an alarm which can be forwarded to a PLC via the process interface. In addition to that, the critical event can be easily documented as a snapshot or video recording and be used for analysis later on.



optris PIX Connect Software

FEATURES

For the measurement of moving objects

The optris PIX Connect software is equipped with a **line scan camera function**.

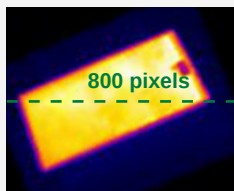
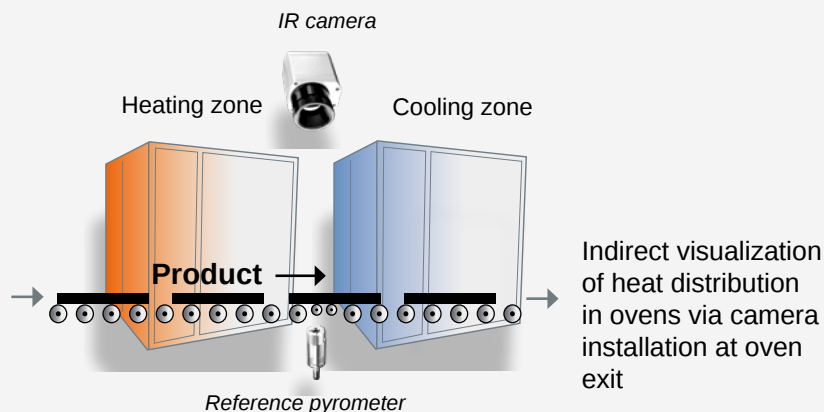
The line scanner is primarily used for processes involving moving measurement objects, like **rotary kiln measurements** or large quantities on conveyor belts (**batch process**).



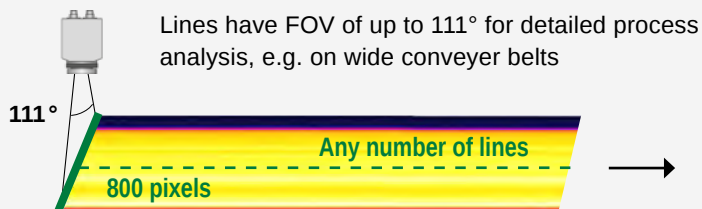
Application example: rotary kiln in the chemical industry

The advantages

Simple monitoring of processes with limited visual access



Increase the number of pixels, e.g. from 640 pixels to 800 pixels by diagonal screen measurement



Up to 32 Hz data recording* of unlimited lines which in turn produce a thermal image of any given resolution.

*Up to 125 Hz data recording when using 90° in subframe mode (640 x 120px)

Only 3 steps to initialize the function

Step 1

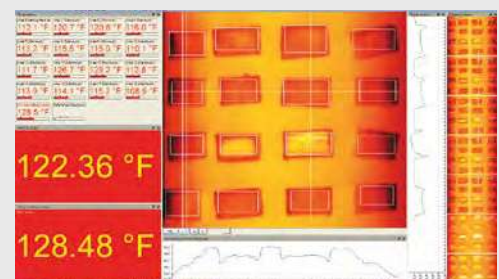
Activation of the line scan camera function (continuous, self-triggered, external trigger) and definition of the position of the lines in the thermal image. For this the camera itself serves as an orientation aid.

Step 2

Configuration of line scan function, e.g. number of lines displayed or set trigger for automatic saving of images.

Step 3

Definition of individual layouts, e.g. display of saved images in the snapshot process.



Layout example for display of line scan camera function

optris IRmobile

APP



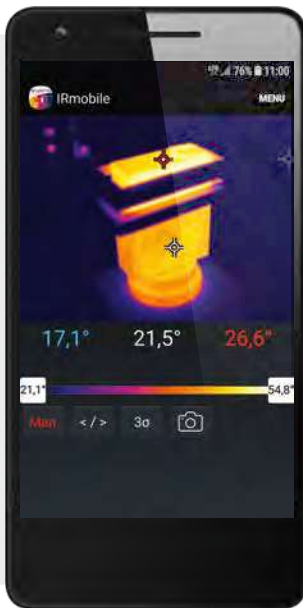
Tool for all optris infrared cameras



- The cameras of the PI series have a direct connection to an android smartphone or tablet
- IRmobile App downloadable for free from the Google Play Store
- For connection to the device the IR App Connector is recommended

Xi 80 / 410 Part number: ACXI80IACM (Micro-USB) or ACXI80IACC (USB-C)

Xi 400 Part number: ACPIIACM (Micro-USB) or ACPIIACC (USB-C)



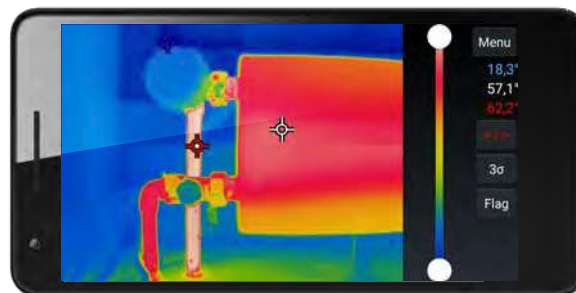
IRmobile app features:

- Live IR image with automatic hot and cold spot search
- Taking snapshots and analyze them later with PIXConnect software
- Adjustable camera features like temperature measuring range, frame rate and selectable color palettes
- Changing the temperature unit: Celsius or Fahrenheit
- Integrated simulator



Supported for

- PI and Xi series and all pyrometers
- For android devices from version 5.0 or higher with micro-USB or USB-C connectors that support USB OTG

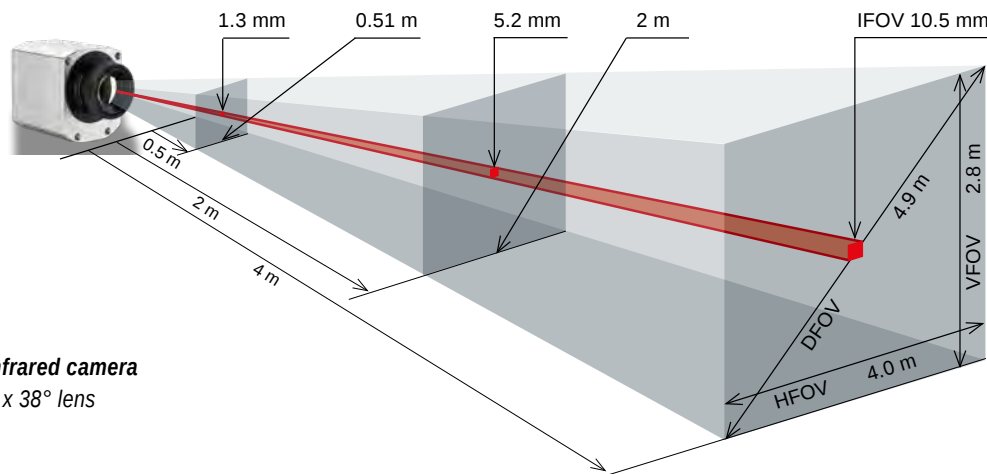


Precise measuring at various distances

A choice of lenses allows you to precisely measure objects at various distances, from close and standard distances right up to large distances. The IR cameras of the optris PI series allow for changing between several lenses.

With infrared cameras there are various parameters which display the relationship between the distance from the measuring object and the size of the pixel on the object plane. In choosing the correct lens, the following should be taken into account:

HFOV	Horizontal expansion of the total measuring field on the object plane
VFOV	Vertical expansion of the total measuring field on the object plane
IFOV	Size of individual pixels on the object plane
DFOV	Diagonal expansion of the total measuring field on the object plane
MFOV	Recommended, smallest measuring object size of 3 x 3 pixels or 2 x 2 pixels when using the PI microscope optics or the Xi 80, respectively



Measuring field of the infrared camera
optris PI 450i using a 53° x 38° lens

Optris Calculator

Combines the measuring spot size calculator of the IR pyrometers and the optics calculator of the IR cameras

The measuring spot size of the respective device is calculated for each distance



Pyrometers

- The spot size calculator determines the exact spot size for all sensor / optics combinations for any entered distance
- For reliable measurements

Features

- Calculates for each distance the measuring spot size of the respective device
- Always the current software and features through regular updates

IR cameras

- Based on camera / lens combination and the distance to the object, the measuring field dimensions and pixel size are calculated precisely.
- Ensures an optimal positioning of the camera and the avoidance of measuring errors

Supported for

- All android devices (5.0 or higher)



Optical data

OPTICS

Xi 80	Focal length [mm (in)]	Minimum measurement distance*	Angle	Distance to measurement object [m (ft)]												
					0.05 (0.16)	0.1 (0.33)	0.2 (0.66)	0.3 (0.98)	0.5 (1.64)	1 (3.28)	2 (6.56)	4 (13.12)	6 (19.69)	10 (32.81)	30 (98.43)	100 (328.08)
F05 Standard lens	5 (0.2)	0.2 m (0.66 ft)	30°	HFOV [m (ft)]	0.028 (0.09)	0.056 (0.18)	0.11 (0.36)	0.17 (0.55)	0.28 (0.91)	0.56 (1.83)	1.1 (3.6)	2.2 (7.21)	3.3 (10.82)	5.6 (18.37)	16.7 (54.79)	55.8 (183.07)
			30°	VFOV [m (ft)]	0.028 (0.09)	0.056 (0.18)	0.11 (0.36)	0.17 (0.55)	0.28 (0.91)	0.56 (1.83)	1.1 (3.6)	2.2 (7.21)	3.3 (10.82)	5.6 (18.37)	16.7 (54.79)	55.8 (183.07)
			43°	DFOV [m (ft)]	0.039 (0.12)	0.079 (0.25)	0.16 (0.52)	0.24 (0.78)	0.39 (1.28)	0.79 (2.59)	1.58 (5.18)	3.15 (10.33)	4.7 (15.42)	7.9 (25.91)	23.7 (77.75)	78.9 (258.85)
			7 mrad	IFOV [mm (in)]	0.3 (0.01)	0.7 (0.02)	1.4 (0.05)	2.1 (0.08)	3.5 (0.13)	7.0 (0.27)	13.9 (0.54)	27.9 (1.09)	41.8 (1.64)	69.7 (2.74)	209.2 (8.23)	697.1 (27.44)
F13 Telephoto lens	13 (0.51)	0.3 m (0.98 ft)	12°	HFOV [m (ft)]		0.022 (0.07)	0.043 (0.14)	0.065 (0.21)	0.11 (0.36)	0.21 (0.68)	0.43 (1.41)	0.85 (2.79)	1.28 (4.2)	2.1 (6.89)	6.4 (20.1)	21.3 (69.9)
			12°	VFOV [m (ft)]		0.022 (0.07)	0.043 (0.14)	0.065 (0.21)	0.11 (0.36)	0.21 (0.68)	0.43 (1.41)	0.85 (2.79)	1.28 (4.2)	2.1 (6.89)	6.4 (20.1)	21.3 (69.9)
			17°	DFOV [m (ft)]		0.031 (0.1)	0.061 (0.2)	0.092 (0.3)	0.15 (0.49)	0.3 (0.98)	0.6 (1.97)	1.2 (3.94)	1.81 (5.94)	3.0 (9.84)	9.0 (29.53)	30.1 (98.75)
			2.7 mrad	IFOV [mm (in)]		0.3 (0.01)	0.5 (0.19)	0.8 (0.03)	1.3 (0.05)	2.7 (0.1)	5.3 (0.2)	10.6 (0.41)	16.0 (0.63)	26.6 (1.04)	79.8 (3.14)	266 (10.47)
F03 Wide angle lens	3 (0.12)	0.2 m (0.66 ft)	55°	HFOV [m (ft)]	0.057 (0.18)	0.11 (0.36)	0.21 (0.68)	0.32 (1.05)	0.52 (0.36)	1.04 (3.41)	2.1 (6.89)	4.1 (13.45)	6.2 (20.34)	10.4 (34.12)	31.1 (102.03)	103.7 (340.22)
			55°	VFOV [m (ft)]	0.057 (0.18)	0.11 (0.36)	0.21 (0.68)	0.32 (1.05)	0.52 (0.36)	1.04 (3.41)	2.1 (6.89)	4.1 (13.45)	6.2 (20.34)	10.4 (34.12)	31.1 (102.03)	103.7 (340.22)
			77°	DFOV [m (ft)]	0.081 (0.26)	0.15 (0.49)	0.30 (0.98)	0.45 (1.48)	0.74 (2.43)	1.47 (4.82)	2.9 (9.51)	5.9 (19.36)	7.8 (28.87)	14.7 (48.23)	44.0 (114.36)	146.6 (480.97)
			13 mrad	IFOV [mm (in)]	0.7 (0.02)	1.4 (0.05)	2.7 (0.10)	3.9 (0.15)	6.5 (0.25)	13.0 (0.51)	25.9 (1.02)	51.7 (2.03)	77.8 (3.06)	129.7 (5.10)	388.9 (15.31)	1298.6 (51.02)
F02 Super wide angle lens	2 (0.08)	0.2 m (0.66 ft)	80°	HFOV [m (ft)]	0.089 (0.29)	0.17 (0.55)	0.34 (1.12)	0.51 (1.67)	0.85 (2.79)	1.69 (5.54)	3.4 (11.15)	6.7 (21.98)	10.1 (33.14)	16.9 (55.45)	50.7 (166.34)	169.0 (554.46)
			80°	VFOV [m (ft)]	0.089 (0.29)	0.17 (0.55)	0.34 (1.12)	0.51 (1.67)	0.85 (2.79)	1.69 (5.54)	3.4 (11.15)	6.7 (21.98)	10.1 (33.14)	16.9 (55.45)	50.7 (166.34)	169.0 (554.46)
			113°	DFOV [m (ft)]	0.126 (0.41)	0.24 (0.78)	0.49 (1.61)	0.72 (2.36)	1.2 (3.94)	2.4 (7.87)	4.8 (15.75)	9.5 (31.17)	14.3 (46.92)	23.9 (78.41)	71.7 (235.24)	239.0 (784.12)
			21 mrad	IFOV [mm (in)]	1.1 (0.04)	2.2 (0.08)	4.3 (0.16)	6.4 (0.25)	10.6 (0.41)	21.2 (0.83)	42.2 (1.66)	84.3 (3.31)	126 (4.96)	211 (8.30)	634 (24.96)	2113 (83.18)

Xi 400	Focal length [mm (in)]	Minimum measurement distance*	Angle	Distance to measurement object [m (ft)]												
					0.05 (0.16)	0.1 (0.33)	0.2 (0.66)	0.3 (0.98)	0.5 (1.64)	1 (3.28)	2 (6.56)	4 (13.12)	6 (19.69)	10 (32.81)	30 (98.43)	100 (328.08)
382 x 288 px																
F13	13 (0.51)	0.35 m (1.15 ft)	29°	HFOV [m (ft)]		0.059 (0.19)	0.111 (0.37)	0.16 (0.52)	0.27 (0.88)	0.53 (1.73)	1.06 (3.48)	2.1 (4.26)	3.2 (10.5)	5.3 (17.39)	15.8 (51.84)	52.5 (172.24)
Standard lens			22°	VFOV [m (ft)]		0.043 (0.14)	0.082 (0.27)	0.076 (0.24)	0.20 (0.65)	0.39 (1.27)	0.78 (2.55)	1.5 (4.92)	2.3 (7.54)	3.9 (12.79)	11.6 (38.05)	38.5 (126.31)
			37°	DFOV [m (ft)]		0.073 (0.24)	0.138 (0.44)	0.20 (0.65)	0.34 (1.11)	0.66 (2.16)	1.31 (4.29)	2.6 (8.53)	3.9 (12.79)	6.5 (21.32)	19.5 (63.97)	65.1 (213.58)
			1.5 mrad	IFOV [mm (in)]		0.2 (0.01)	0.3 (0.01)	0.4 (0.01)	0.7 (0.02)	1.4 (0.05)	2.8 (0.11)	5.5 (0.21)	8.3 (0.32)	13.8 (0.54)	41.2 (1.62)	137.4 (5.4)
F20	20 (0.79)	0.35 m (1.15 ft)	18°	HFOV [m (ft)]			0.069 (0.22)	0.102 (0.33)	0.17 (0.55)	0.33 (1.08)	0.66 (2.16)	1.30 (4.26)	1.9 (6.23)	3.2 (10.5)	9.7 (31.82)	32.4 (106.29)
Telephoto lens			14°	VFOV [m (ft)]			0.051 (0.16)	0.076 (0.24)	0.12 (0.39)	0.25 (0.82)	0.49 (1.61)	0.98 (3.21)	1.5 (4.92)	2.5 (8.2)	7.4 (24.27)	24.6 (80.7)
			23°	DFOV [m (ft)]			0.086 (0.28)	0.127 (0.41)	0.21 (0.68)	0.41 (1.34)	0.82 (2.69)	1.63 (5.34)	2.4 (7.87)	4.1 (13.45)	12.2 (40.02)	40.7 (133.53)
			0.9 mrad	IFOV [mm (in)]			0.2 (0.01)	0.3 (0.01)	0.4 (0.01)	0.9 (0.03)	1.7 (0.06)	3.4 (0.13)	5.1 (0.2)	8.5 (0.33)	25.4 (1.0)	84.8 (3.33)
F08	8 (0.31)	0.25 m (0.82 ft)	53°	HFOV [m (ft)]		0.099 (0.32)	0.20 (0.65)	0.30 (0.98)	0.49 (1.61)	0.99 (3.24)	2.0 (6.56)	4.0 (13.12)	5.9 (19.36)	9.9 (32.48)	29.6 (97.11)	98.6 (323.49)
Wide angle lens			38°	VFOV [m (ft)]		0.071 (0.23)	0.14 (0.45)	0.21 (0.68)	0.34 (1.12)	0.68 (2.23)	1.4 (4.59)	2.7 (8.86)	4.1 (13.45)	6.8 (22.31)	20.4 (66.93)	68.1 (223.43)
			65°	DFOV [m (ft)]		0.122 (0.4)	0.25 (0.82)	0.36 (1.18)	0.60 (1.97)	1.20 (3.93)	2.4 (7.87)	4.8 (15.75)	7.2 (23.62)	12.0 (39.37)	36.0 (118.11)	119.9 (393.37)
			2.6 mrad	IFOV [mm (in)]		0.26 (0.01)	0.53 (0.02)	0.78 (0.03)	1.3 (0.05)	2.6 (0.1)	5.2 (0.2)	10.4 (0.4)	15.5 (0.61)	25.9 (1.02)	77.5 (3.05)	258.2 (10.16)
F06	6 (0.24)	0.2 m (0.66 ft)	80°	HFOV [m (ft)]	0.084 (0.27)	0.16 (0.52)	0.32 (1.05)	0.48 (1.57)	0.81 (2.65)	1.6 (5.25)	3.3 (10.82)	6.5 (21.33)	9.8 (32.15)	16.6 (54.46)	49.9 (163.71)	166.4 (545.93)
Super wide angle lens			54°	VFOV [m (ft)]	0.056 (0.18)	0.11 (0.36)	0.21 (0.68)	0.31 (1.01)	0.51 (1.67)	1.0 (3.28)	2.0 (6.56)	4.1 (13.45)	6.1 (20.01)	10.2 (33.46)	30.6 (100.39)	101.9 (334.32)
			96°	DFOV [m (ft)]	0.101 (0.33)	0.19 (0.62)	0.38 (1.24)	0.57 (1.87)	0.96 (3.15)	1.9 (6.23)	3.8 (12.47)	7.7 (25.26)	11.6 (38.06)	19.5 (63.98)	58.5 (191.93)	195.1 (640.09)
			4.3 mrad	IFOV [mm (in)]	0.2 (0.01)	0.4 (0.01)	0.8 (0.03)	1.3 (0.05)	2.1 (0.08)	4.2 (0.16)	8.5 (0.33)	17.0 (0.66)	25.7 (1.01)	43.6 (1.71)	130.7 (5.14)	435.5 (17.14)

Table with examples showing which measurement field sizes and pixel sizes will be reached at which distance. For optimal configuration of the camera there are various lenses available. Wide angle lenses have radial distortion due to the angle of their aperture. The PIX Connect software has an algorithm which corrects this distortion.

*Please note: Please use the optics calculator on website in order to calculate measurement fields with shorter measurement distances:

The measurement accuracy of the camera may lie outside of the specifications for distances below the defined minimum measurement distance.

Xi 410 384 x 240 px	Focal length [mm]	Minimum measurement distance*	Angle	Distance to measurement object [m (ft)]												
					0.05 (0.16)	0.1 (0.33)	0.2 (0.66)	0.3 (0.98)	0.5 (1.64)	1 (3.28)	2 (6.56)	4 (13.12)	6 (19.69)	10 (32.81)	30 (98.43)	100 (328.08)
F13 Standard lens	13 (0.51)	0.35 m (1.15 ft)	29°	HFOV [m (ft)]		0.059 (0.16)	0.112 (0.36)	0.17 (0.55)	0.27 (0.88)	0.53 (1.73)	1.07 (3.51)	2.1 (6.88)	3.2 (10.49)	5.3 (17.38)	15.9 (52.16)	52.9 (173.55)
			18°	VFOV [m (ft)]		0.036 (0.12)	0.068 (0.22)	0.10 (0.32)	0.16 (0.52)	0.32 (1.04)	0.64 (2.09)	1.3 (4.26)	1.9 (6.23)	3.2 (10.49)	9.5 (31.16)	31.7 (104.00)
			35°	DFOV [m (ft)]		0.069 (0.22)	0.131 (0.42)	0.19 (0.62)	0.32 (1.04)	0.62 (2.03)	1.24 (4.06)	2.5 (8.20)	3.7 (12.13)	6.2 (20.34)	18.5 (60.69)	61.6 (202.10)
			1.4 mrad	IFOV [mm (in)]		0.2 (0.007)	0.3 (0.01)	0.4 (0.01)	0.7 (0.02)	1.4 (0.05)	2.8 (0.11)	5.5 (0.21)	8.3 (0.32)	13.8 (0.54)	41.3 (1.62)	137.7 (5.42)
F20 Telephoto lens	20 (0.79)	0.35 m (1.15 ft)	18°	HFOV [m (ft)]			0.069 (0.22)	0.102 (0.33)	0.17 (0.55)	0.33 (1.08)	0.66 (2.16)	1.31 (4.29)	2.0 (6.56)	3.3 (10.82)	9.8 (32.15)	32.6 (106.95)
			12°	VFOV [m (ft)]			0.043 (0.14)	0.064 (0.20)	0.10 (0.32)	0.21 (0.68)	0.41 (1.34)	0.82 (2.69)	1.2 (3.93)	2.1 (6.88)	6.1 (20.01)	20.5 (67.25)
			21°	DFOV [m (ft)]			0.081 (0.26)	0.120 (0.39)	0.20 (0.65)	0.39 (1.27)	0.78 (2.55)	1.55 (34.61)	2.3 (7.54)	3.9 (12.79)	11.5 (37.72)	38.5 (126.31)
			0.9 mrad	IFOV [mm (in)]			0.2 (0.007)	0.3 (0.01)	0.4 (0.01)	0.9 (0.03)	1.7 (0.07)	3.4 (0.13)	5.1 (0.20)	8.5 (0.33)	25.5 (1.00)	84.8 (3.33)
F08 Wide angle lens	8 (0.31)	0.25 m (0.82 ft)	53°	HFOV [m (ft)]		0.100 (0.32)	0.20 (0.65)	0.30 (0.98)	0.49 (1.60)	0.99 (3.24)	2.0 (6.56)	4.0 (13.12)	5.9 (19.35)	9.9 (32.48)	29.7 (97.44)	98.9 (324.47)
			31°	VFOV [m (ft)]		0.057 (0.19)	0.11 (0.36)	0.17 (0.55)	0.28 (0.92)	0.55 (1.80)	1.1 (3.60)	2.2 (7.21)	3.3 (10.82)	5.5 (18.04)	16.5 (54.13)	54.9 (180.12)
			61°	DFOV [m (ft)]		0.115 (0.38)	0.23 (0.75)	0.34 (1.11)	0.57 (1.87)	1.13 (3.70)	2.3 (7.54)	4.5 (14.76)	6.8 (22.31)	11.3 (37.07)	33.9 (111.22)	113.1 (371.06)
			2.6 mrad	IFOV [mm (in)]		0.3 (0.01)	0.5 (0.19)	0.8 (0.03)	1.3 (0.05)	2.6 (0.10)	5.1 (0.20)	10.3 (0.40)	15.5 (0.61)	25.8 (1.01)	77.2 (3.03)	257.4 (10.13)
F06 Super wide angle lens	6 (0.24)	0.2 m (0.66 ft)	80°	HFOV [m (ft)]	0.084 (0.27)	0.16 (0.52)	0.32 (1.04)	0.48 (1.57)	0.81 (2.65)	1.6 (5.24)	3.3 (10.82)	6.5 (21.32)	9.8 (32.15)	16.6 (54.46)	49.9 (163.71)	166.4 (545.93)
			44°	VFOV [m (ft)]	0.044 (0.14)	0.08 (0.26)	0.17 (0.55)	0.25 (0.82)	0.41 (1.34)	0.8 (2.62)	1.6 (5.24)	3.2 (10.49)	4.8 (15.74)	8.0 (26.24)	24.1 (79.06)	80.4 (263.77)
			91°	DFOV [m (ft)]	0.095 (0.31)	0.18 (0.59)	0.36 (1.18)	0.54 (1.77)	0.91 (2.98)	1.8 (5.90)	3.6 (11.81)	7.3 (23.95)	10.9 (35.76)	18.5 (60.69)	55.4 (181.75)	184.8 (606.30)
			4.3 mrad	IFOV [mm (in)]	0.2 (0.007)	0.4 (0.01)	0.8 (0.03)	1.3 (0.05)	2.1 (0.08)	4.2 (0.16)	8.5 (0.33)	16.9 (0.66)	25.5 (1.00)	43.4 (1.70)	130.0 (5.11)	433.2 (17.05)

Microscope optics Xi 400 382 x 288 px	Focal length [mm (in)]	Minimum measurement distance*	Angle	Distance to measurement object [m (ft)]			
					0.09 (0.3)	0.1 (0.33)	0.11 (0.36)
F20 CF Microscope optics	20 (0.79)	0.09 m (0.3 ft)	18°	HFOV [m (ft)]	0.031 (0.1)	0.034 (0.11)	0.037 (0.12)
			14°	VFOV [m (ft)]	0.024 (0.07)	0.026 (0.08)	0.028 (0.09)
			23°	DFOV [m (ft)]	0.039 (0.12)	0.043 (0.14)	0.047 (0.15)
			0.9 mrad	IFOV [mm (in)]	0.08 (0.01)	0.09 (0.01)	0.10 (0.01)