



## 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 and 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

### Applications Support

Optris application engineers and distribution partners have the experience and technical background necessary to apply its extensive portfolio of IR cameras and accessories to your temperature measurement challenge. Contact us directly or attend our numerous technical training events and YouTube presentations.

For more infos on application examples see page 19.

## Have you seen our YouTube – Channel?

Learn more about Optris' infrared temperature measurement devices and their setup, properties and special features.

The Optris YouTube channel will give you an overview of our company and the world of infrared measurement technology.

Our videos will help you discover the functionality of our products and learn how to use them for your business:

- **New products,**
- **How to's,**
- **Software tutorials**
- **Hands-on-trainings**



The advertisement features the Optris logo at the top left. Below it is a row of six thermal images with captions: 'Safety Applications' (showing a hand holding a tool), 'Condition Monitoring' (showing a mechanical part), 'Substation Monitoring' (showing power lines), 'Injection molding' (showing a mold), 'Automotive' (showing a car), and 'Plastics' (showing a light bulb). Below these images is the text 'optris® Xi series Spot finder IR camera' and a photograph of the camera itself.



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

## Advantages Xi Compact Line

- Compact affordable industrial imager for temperature measurements from  $-20$  to  $900\text{ }^{\circ}\text{C}$
- 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)

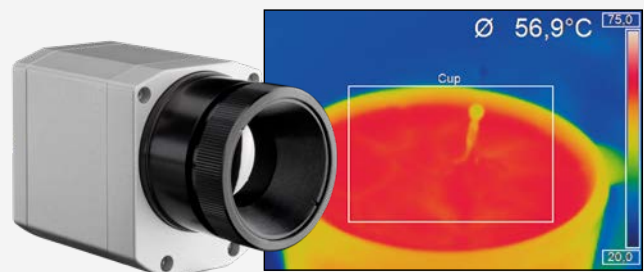


### Automatic hot spot search

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

## 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 x 480 Pixel)
- Laser blocking filters
- Temperature measuring ranges from  $-20$  to  $2450\text{ }^{\circ}\text{C}$
- 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

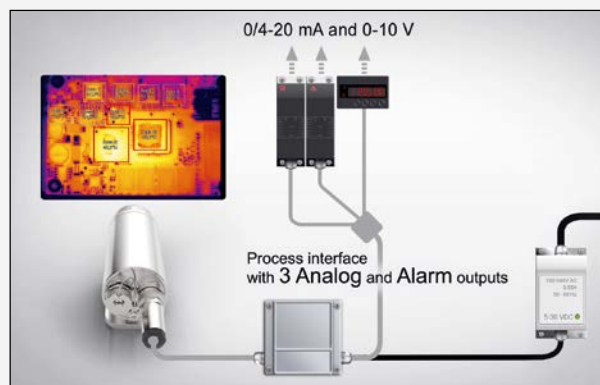


### Fast measurements

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

### 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.



### 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.



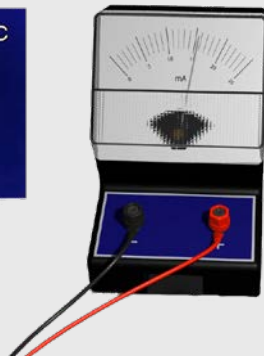
# optris Xi 80 / 400 / 410

AFFORDABLE INFRARED CAMERAS  
FOR MULTI-LOCATION INSTALLATIONS

## Compact spot finder IR camera



- Industrial imager for precise temperature measurements from  $-20$  to  $900$  °C
- 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

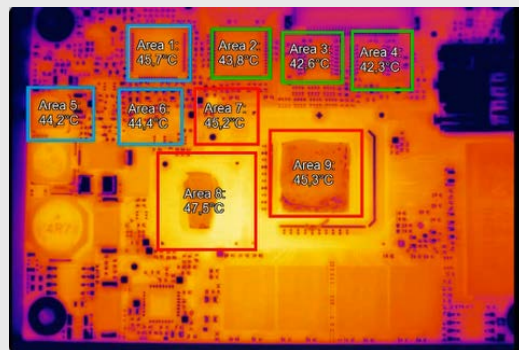
The integrated spot finder function allows for precise temperature measurements of moving objects - without having to readjust the sensor.

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

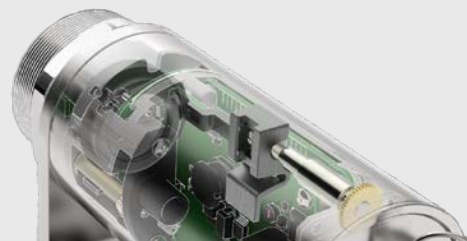
### Pyrometer or camera?

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.



### Easy integration into PLCs via RS485 interface



### Motor focus simplifies handling

The Xi models are equipped with a motorized focus.



# optris Xi 400 Microscope optics

RELIABLE TEMPERATURE MEASUREMENT  
ON TINY OBJECTS

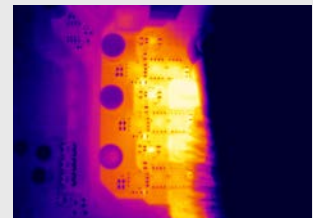
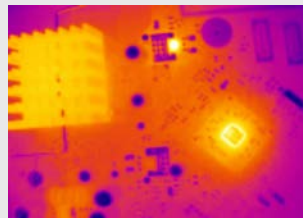
## Microscope optics for the inspection of assembled circuit boards

- Optical resolution of 382 x 288 pixels for exact temperature measurement of -20 °C to 900 °C
- 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. The built-in motor focus allows for an easy focussing of the camera with the included software PIX Connect.






### 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



<p><b>Compact spot finder IR camera</b> for use in harsh industrial environments, autonomous operation possible.</p>			
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; 0 ... 250 °C; (20) 150 ... 900 °C <sup>1)</sup>	–20 ... 100 °C; 0 ... 250 °C; (20) 150 ... 900 °C; 200...1500 °C (option)	–20 ... 100 °C; 0 ... 250 °C; (20) 150 ... 900 °C <sup>1)</sup> ; 200 ... 1500 °C (option) <sup>2)</sup>
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 / F = 0.9) 12° (f = 12.7 mm / F = 1.0) 55° (f = 3.1 mm / F = 0.9) 80° (f = 2.3 mm / F = 0.9)	29° x 22° (f = 12.7 mm / F = 0.9) 18° x 14° (f = 20 mm / F = 1.1) 53° x 38° (f = 7.7 mm / F = 0.9) 80° x 54° (f = 5.7 mm / F = 0.9)	29° x 18° (f = 12.7 mm / F = 0.9) 18° x 12° (f = 20 mm / F = 1.1) 53° x 31° (f = 7.7 mm / F = 0.9) 80° x 44° (f = 5.7 mm / 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) <sup>3)</sup>	100 mK	80 mK	80 mK
System accuracy (at T <sub>Amb</sub> = 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), fail-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 Ethernet: 100 m, RS485: 500 m	USB: 1 m, 3 m, 5 m, 10 m, 20 m	USB: 1 m, 3 m, 5 m Ethernet: 100 m, RS485: 500 m
Ambient temperature (T <sub>Amb</sub> )	0 °C ... 50 °C	0 °C ... 50 °C	0 °C ... 50 °C
Size	Ø 36 x 90 mm (M30x1 thread)	Ø 36 x 100 mm (M30x1 thread)	Ø 36 mm x 100 mm (M30x1 thread)
Environmental rating	IP 67 (NEMA 4)	IP 67 (NEMA 4)	IP 67 (NEMA 4)
Weight (without mounting bracket)	201 - 210 g (depending on lens)	216 - 220 g (depending on lens)	216 - 220 g (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)	<ul style="list-style-type: none"> <li>• Xi camera</li> <li>• USB cable (1 m)</li> <li>• Cable for in-/outputs (1 m) with terminal block</li> <li>• Mounting bracket with tripod thread, mounting nut</li> <li>• Software package optris PIX Connect</li> <li>• Quick start guide</li> </ul>	<ul style="list-style-type: none"> <li>• Xi camera</li> <li>• USB cable (1 m)</li> <li>• Cable for in-/outputs (1 m) with terminal block</li> <li>• Mounting bracket with tripod thread, mounting nut</li> <li>• Software package optris PIX Connect</li> <li>• Quick start guide</li> </ul>	<ul style="list-style-type: none"> <li>• Xi camera</li> <li>• Ethernet / PoE cable (1 m) / USB cable (1 m)</li> <li>• Cable for in-/outputs (1 m) with terminal block</li> <li>• Mounting bracket with tripod thread, mounting nut</li> <li>• Software package optris PIX Connect</li> <li>• Quick start guide</li> </ul>

# Accessories Xi series

Air purge unit	Water cooled housing	Shutter
<b>ACXIAPL + ACXIAPLAB (Mounting bracket)</b>	<b>ACXIW</b>	<b>ACXISCBxx* + ACXIAPLAB (Mounting bracket)</b>
<p><b>Features</b></p> <ul style="list-style-type: none"> <li>The air purge attachment can be used in combination with the water cooled housing and protects the optics from contamination</li> <li>Used in rough and dusty areas to guarantee a reliable temperature measurement</li> </ul>	<p><b>Features</b></p> <ul style="list-style-type: none"> <li>The rugged water cooled housing allows the Xi infrared cameras to be employed in hot environments up to 250°C</li> <li>Respective heat-resistant cables are also available</li> </ul>	<p><b>Features</b></p> <ul style="list-style-type: none"> <li>In addition Xi cameras can be equipped with a shutter</li> <li>The shutter protects the optics from falling parts within a response time of 100 ms</li> </ul>
		

\*) 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
<b>ACXIOPH24</b>	<b>ACPIUSBSGB</b>	Xi 80 / Xi 410: <b>ACXIPIFCBx*</b> Xi 400: <b>ACXIPIFMACBx*</b>
<p><b>Features</b></p> <ul style="list-style-type: none"> <li>Environmental rating IP 66</li> <li>Additional air purge collar allows continuous operation in dusty and humid environments</li> <li>Heating element and built-in fan enable for a 24/7 operation from -40 °C to 50 °C</li> <li>Installation of USB Server Gigabit 2.0 and industrial process interface possible for integration into control systems over large outdoor distances</li> </ul>	<p><b>Features</b></p> <ul style="list-style-type: none"> <li>Fully USB 2.0 compatible, Data rates: 1.5 / 12 / 480 mbps, USB transfer mode: Isochronous</li> <li>Network connection via Gigabit Ethernet</li> <li>Full TCP/IP support incl. routing and DNS</li> <li>Two independent USB ports</li> <li>Supply from PoE or external power supply with 24 – 48 V DC</li> <li>Galvanic isolation 500 V<sub>RMS</sub> (network connection)</li> <li>Remotely configurable via Web Based Management</li> </ul>	<p><b>Features</b></p> <ul style="list-style-type: none"> <li>Industrial process interface for Xi 400 with 3 analog / alarm outputs, 2 analog inputs, 1 digital input, 3 alarm relays</li> <li>Industrial process interface for Xi 80 and Xi 410 with 3 analog- / alarm outputs, 3 inputs (analog or digital), 3 alarm relays</li> <li>500 V AC<sub>RMS</sub> isolation voltage between camera and process</li> <li>Separate fail-safe relay output</li> <li>Xi hardware including all cable connections and PIX Connect software are permanently observed during operation</li> <li>Option Xi 80: stackable up to 3 PIFs</li> </ul>
		

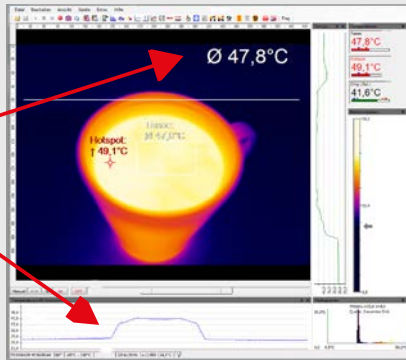
# optris PIX Connect Software

## 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



**Our layouts – as individual as your applications**

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 pre-set layout to suit your individual requirements.

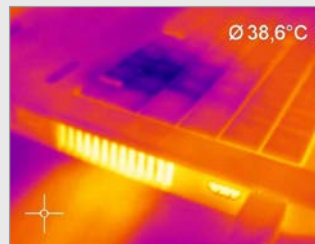
The user interface of the PIX Connect software can also be adapted to suit your personal workflow: Software windows can be easily arranged using drag & drop; in the toolbar you can save shortcuts for functions relevant to your application – or even remove links which you do not need.

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

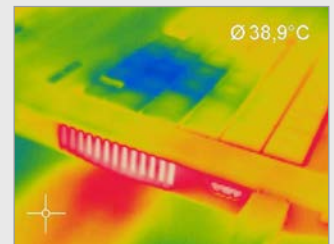
The PIX Connect software makes a wide range of preset color palettes available. This allows optimal depiction of thermal contrasts. The pre-defined color palettes can be individually adapted to be able to cater for the specific requirements of your respective application.

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.

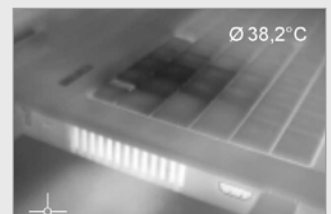
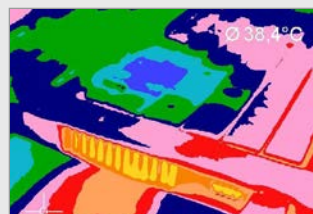
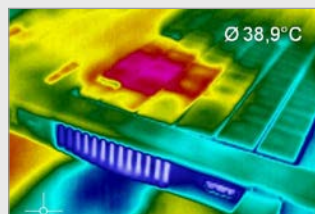


Palette Iron



Palette Rainbow

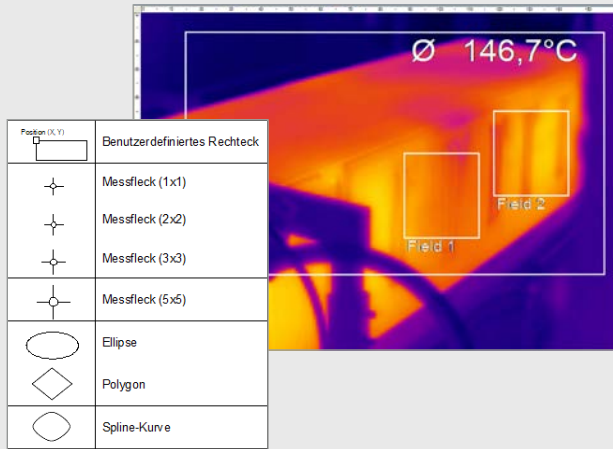
**The right color palette for every application**





# 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.

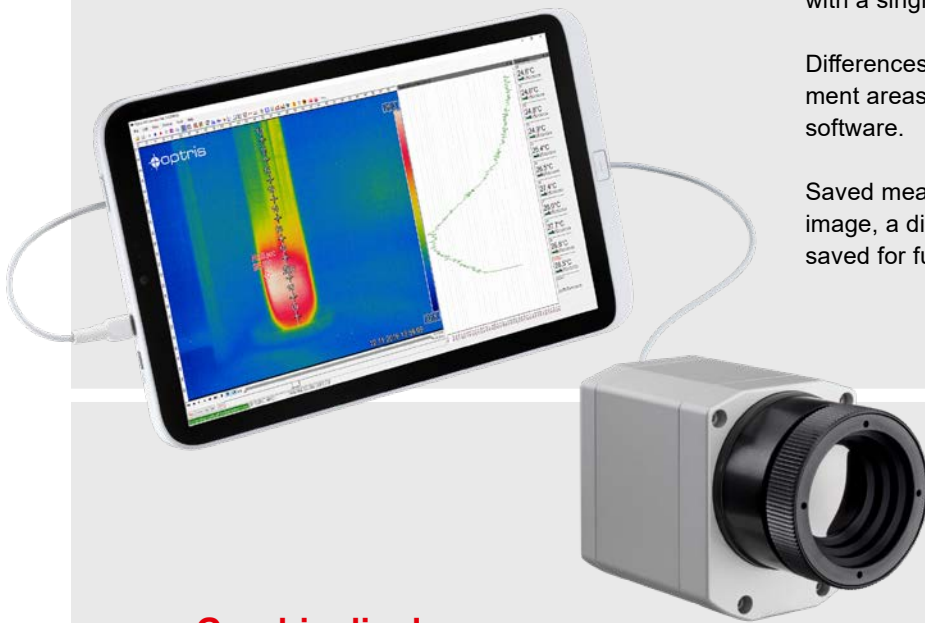
You can set up as many measurement areas as you like in the camera's field of view. To do this, it is possible to make a distinction between main and ancillary fields.

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.

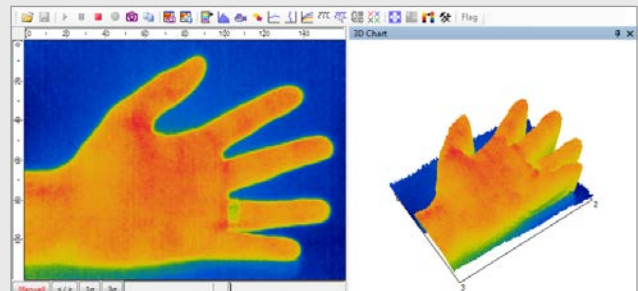
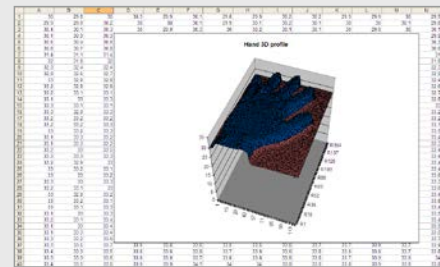


## **Graphic display of the temperature values**

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.

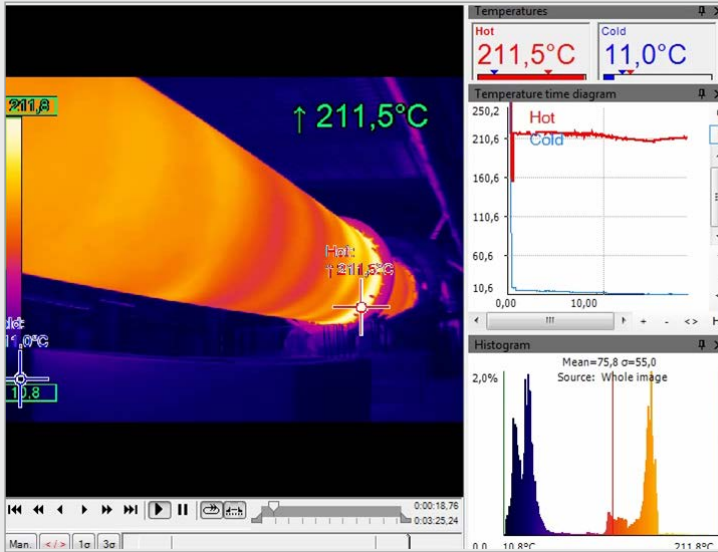


# optris PIX Connect Software

## FEATURES

### 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.

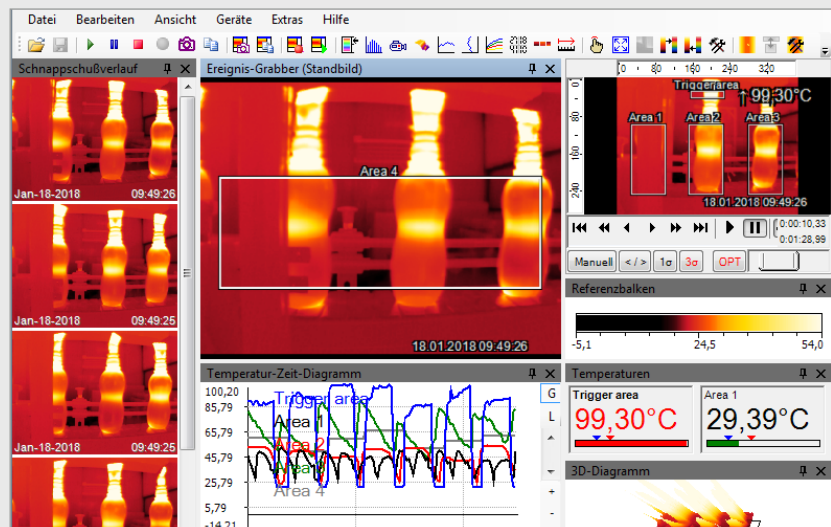
### Event grabber

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.

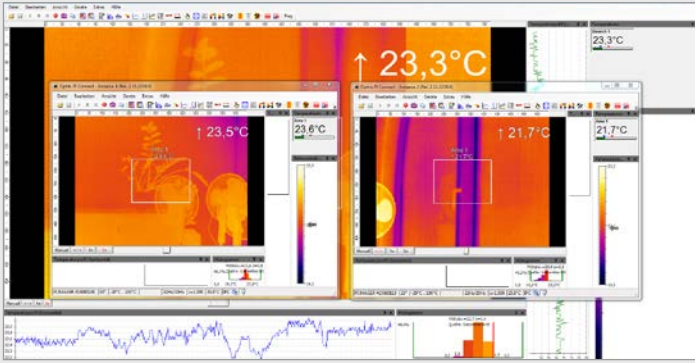
Saving and exporting the image for further analysis in Excel is possible thanks to the option of saving the temperature matrix in text format, e.g. as comma-separated values (.csv format). It is also possible to continue processing the image data with standard programs such as Photoshop or Windows Media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

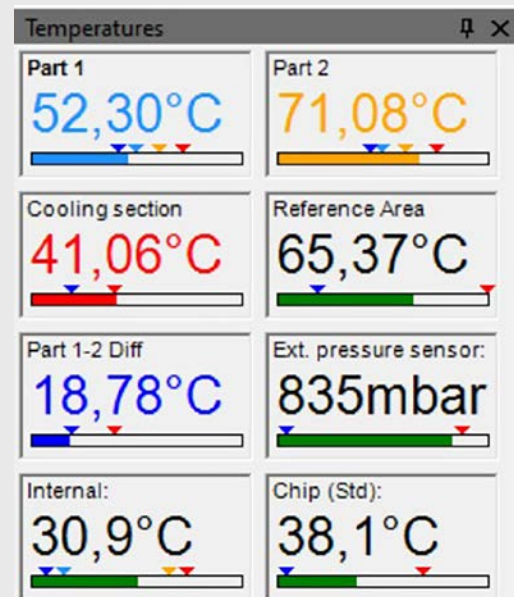
You can merge several cameras either using a direct USB connection or via Ethernet. While in the first case, every camera needs to have its own USB port; for the second option, one Ethernet connection is enough. The cameras here are each connected to the Ethernet switch on the PC via a USB Server Gigabit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

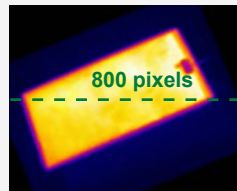
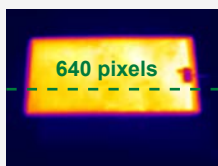
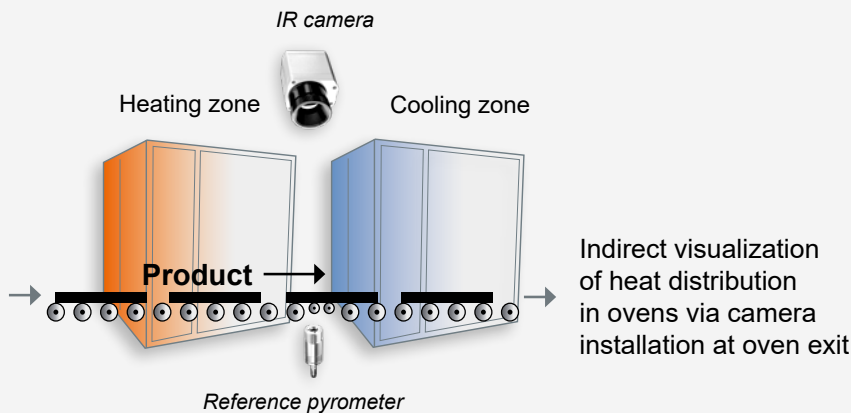
The line scanner is primarily used for processes involving moving measurement objects, like **rotary kiln measurements** or large quantities on conveyor belts (**batch process**).



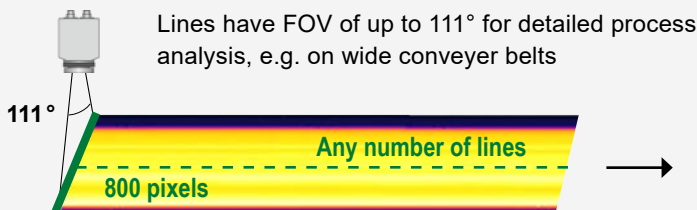
*Application example:  
rotary kiln in the chemical industry*

### 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.

### Only 3 steps to initialize the function

#### Step 1

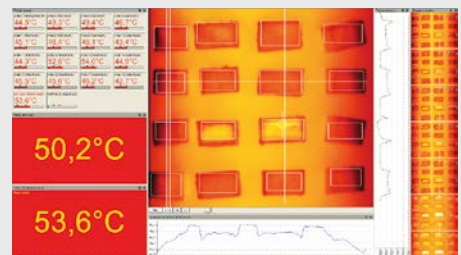
Activation of the line scan camera function (continuous, self-triggered, external trigger) and definition of the position of the lines in the thermal image. For this the camera itself serves as an orientation aid.

#### 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 Top Down GIS 640 R

## Glass inspection system for process control in glass tempering machines



New

With the new glass inspection system, temperature differences during glass hardening processes can be quickly detected, thus avoiding rejects and providing automatic quality monitoring.

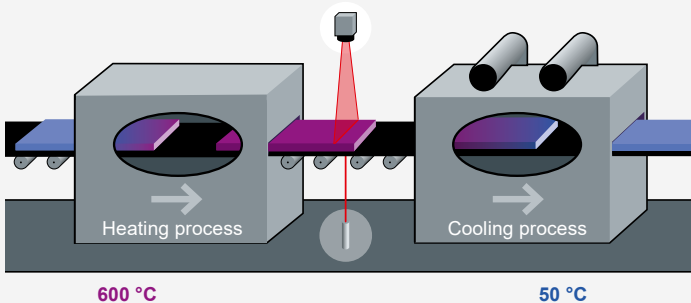
The Top Down GIS 640 R system with temperature referencing by means of a sensor from below as well as automatic emissivity correction for standard and low-E glasses was specially developed for process control in glass tempering machines.



### Measurement principle

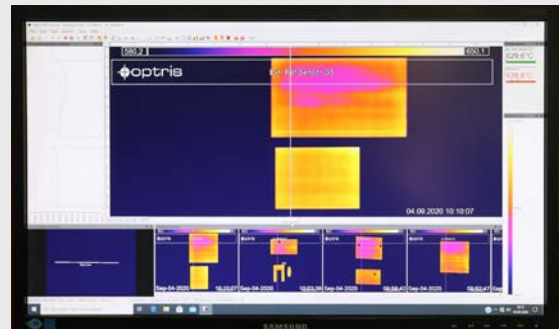
A variety of optics with different field of views allows an optimal mounting of the camera at a larger distance (no cooling needed) and avoids influences by the angle dependent emissivity.

*Positioning of IR camera and reference pyrometer in a Top Down Glass Inspection System.*



### PIX Connect Software

Comprehensive IR camera software without licensing restrictions and with intuitive user interface.



Monitoring temperatures of glass sheets

### Important specifications

- Top down system with additional reference pyrometer from underneath for automatic emissivity correction
- Digitally controlled lens protection system (DCLP) avoids extra air purging
- Glass area calculation
- Pre-assembled system for easy installation on glasstempering furnaces

# optris IRmobile

APP



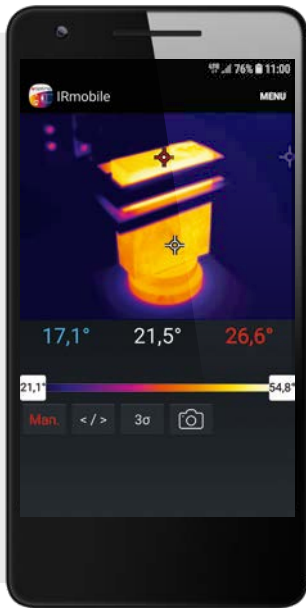
Tool for all optris infrared cameras



- 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

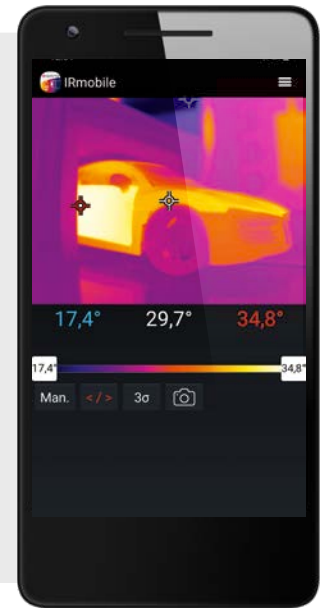
**Xi 80 / 410 Part number: ACXI80IACM (Micro-USB) or ACXI80IACC (USB-C)**

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



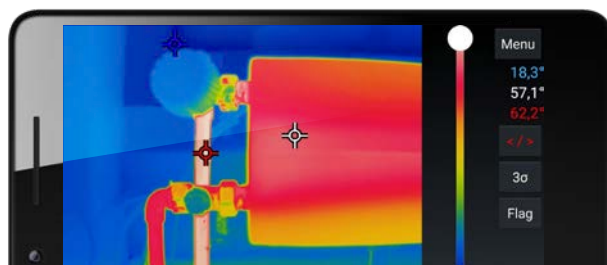
## IRmobile app features:

- Live IR image with automatic hot and cold spot search
- Taking snapshots and analyze them later with PIX Connect 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



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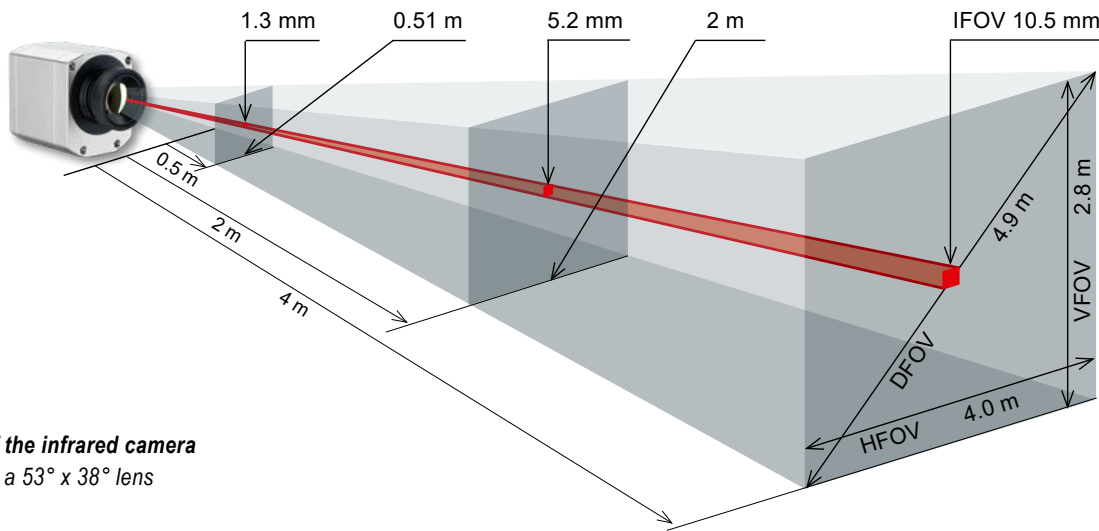
# optris Calculator APP

## 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

### 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

### Features

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



### Supported for

- All android devices (5.0 or higher)



# OPTICAL DATA

Xi 80		Focal length [mm]	Minimum measurement distance*	Angle	Distance to measurement object [m]											
						0.05	0.1	0.2	0.3	0.5	1	2	4	6	10	30
80 x 80 px																
F05 Standard lens	5	0.2 m	30°	HFOV [m]	0.028	0.056	0.11	0.17	0.28	0.56	1.1	2.2	3.3	5.6	16.7	55.8
			30°	VFOV [m]	0.028	0.056	0.11	0.17	0.28	0.56	1.1	2.2	3.3	5.6	16.7	55.8
			43°	DFOV [m]	0.039	0.079	0.16	0.24	0.39	0.79	1.58	3.15	4.7	7.9	23.7	78.9
			7 mrad	IFOV [mm]	0.3	0.7	1.4	2.1	3.5	7.0	13.9	27.9	41.8	69.7	209.2	697.1
F13 Telephoto lens	13	0.3 m	12°	HFOV [m]		0.022	0.043	0.065	0.11	0.21	0.43	0.85	1.28	2.1	6.4	21.3
			12°	VFOV [m]		0.022	0.043	0.065	0.11	0.21	0.43	0.85	1.28	2.1	6.4	21.3
			17°	DFOV [m]		0.031	0.061	0.092	0.15	0.30	0.60	1.20	1.81	3.0	9.0	30.1
			2.7 mrad	IFOV [mm]		0.3	0.5	0.8	1.3	2.7	5.3	10.6	16.0	26.6	79.8	266
F03 Wide angle lens	3	0.2 m	55°	HFOV [m]	0.057	0.11	0.21	0.32	0.52	1.04	2.1	4.1	6.2	10.4	31.1	103.7
			55°	VFOV [m]	0.057	0.11	0.21	0.32	0.52	1.04	2.1	4.1	6.2	10.4	31.1	103.7
			77°	DFOV [m]	0.081	0.15	0.30	0.45	0.74	1.47	2.9	5.9	8.8	14.7	44.0	146.6
			13 mrad	IFOV [mm]	0.7	1.4	2.7	3.9	6.5	13.0	25.9	51.7	77.8	129.7	388.9	1296
F02 Super wide angle lens	2	0.2 m	80°	HFOV [m]	0.089	0.17	0.34	0.51	0.85	1.69	3.4	6.7	10.1	16.9	50.7	169.0
			80°	VFOV [m]	0.089	0.17	0.34	0.51	0.85	1.69	3.4	6.7	10.1	16.9	50.7	169.0
			113°	DFOV [m]	0.126	0.24	0.49	0.72	1.2	2.4	4.8	9.5	14.3	23.9	71.7	239.0
			21 mrad	IFOV [mm]	1.1	2.2	4.3	6.4	10.6	21.2	42.2	84.3	126	211	634	2113

Xi 400		Focal length [mm]	Minimum measurement distance*	Angle	Distance to measurement object [m]											
						0.05	0.1	0.2	0.3	0.5	1	2	4	6	10	30
382 x 288 px																
F13 Standard lens	13	0.35 m	29°	HFOV [m]		0.059	0.111	0.16	0.27	0.53	1.06	2.1	3.2	5.3	15.8	52.5
			22°	VFOV [m]		0.043	0.082	0.12	0.20	0.39	0.78	1.5	2.3	3.9	11.6	38.5
			37°	DFOV [m]		0.073	0.138	0.20	0.34	0.66	1.31	2.6	3.9	6.5	19.5	65.1
			1.5 mrad	IFOV [mm]		0.2	0.3	0.4	0.7	1.4	2.8	5.5	8.3	13.8	41.2	137.4
F20 Telephoto lens	20	0.35 m	18°	HFOV [m]			0.069	0.102	0.17	0.33	0.66	1.30	1.9	3.2	9.7	32.4
			14°	VFOV [m]			0.051	0.076	0.12	0.25	0.49	0.98	1.5	2.5	7.4	24.6
			23°	DFOV [m]			0.086	0.127	0.21	0.41	0.82	1.63	2.4	4.1	12.2	40.7
			0.9 mrad	IFOV [mm]			0.2	0.3	0.4	0.9	1.7	3.4	5.1	8.5	25.4	84.8
F08 Wide angle lens	8	0.25 m	53°	HFOV [m]		0.099	0.20	0.30	0.49	0.99	2.0	4.0	5.9	9.9	29.6	98.6
			38°	VFOV [m]		0.071	0.14	0.21	0.34	0.68	1.4	2.7	4.1	6.8	20.4	68.1
			65°	DFOV [m]		0.122	0.25	0.36	0.60	1.20	2.4	4.8	7.2	12.0	36.0	119.9
			2.6 mrad	IFOV [mm]		0.26	0.53	0.78	1.3	2.6	5.2	10.4	15.5	25.9	77.5	258.2
F06 Super wide angle lens	6	0.2 m	80°	HFOV [m]	0.084	0.16	0.32	0.48	0.81	1.6	3.3	6.5	9.8	16.6	49.9	166.4
			54°	VFOV [m]	0.056	0.11	0.21	0.31	0.51	1.0	2.0	4.1	6.1	10.2	30.6	101.9
			96°	DFOV [m]	0.101	0.19	0.38	0.57	0.96	1.9	3.8	7.7	11.6	19.5	58.5	195.1
			4.3 mrad	IFOV [mm]	0.2	0.4	0.8	1.3	2.1	4.2	8.5	17.0	25.7	43.6	130.7	435.5

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 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	Focal length [mm]	Minimum measurement distance*	Angle	Distance to measurement object [m]													
					0.05	0.1	0.2	0.3	0.5	1	2	4	6	10	30	100	
384 x 240 px F13 Standard lens	13	0.35 m	29°	HFOV [m]			0.059	0.112	0.17	0.27	0.53	1.07	2.1	3.2	5.3	15.9	52.9
			18°	VFOV [m]			0.036	0.068	0.10	0.16	0.32	0.64	1.3	1.9	3.2	9.5	31.7
			35°	DFOV [m]			0.069	0.131	0.19	0.32	0.62	1.24	2.5	3.7	6.2	18.5	61.6
			1.4 mrad	IFOV [mm]			0.2	0.3	0.4	0.7	1.4	2.8	5.5	8.3	13.8	41.3	137.7
F20 Telephoto lens	20	0.35 m	18°	HFOV [m]			0.069	0.102	0.17	0.33	0.66	1.31	2.0	3.3	9.8	32.6	
			12°	VFOV [m]			0.043	0.064	0.10	0.21	0.41	0.82	1.2	2.1	6.1	20.5	
			21°	DFOV [m]			0.081	0.120	0.20	0.39	0.78	1.55	2.3	3.9	11.5	38.5	
			0.9 mrad	IFOV [mm]			0.2	0.3	0.4	0.9	1.7	3.4	5.1	8.5	25.5	84.8	
F08 Wide angle lens	8	0.25 m	53°	HFOV [m]		0.100	0.20	0.30	0.49	0.99	2.0	4.0	5.9	9.9	29.7	98.9	
			31°	VFOV [m]		0.057	0.11	0.17	0.28	0.55	1.1	2.2	3.3	5.5	16.5	54.9	
			61°	DFOV [m]		0.115	0.23	0.34	0.57	1.13	2.3	4.5	6.8	11.3	33.9	113.1	
			2.6 mrad	IFOV [mm]		0.3	0.5	0.8	1.3	2.6	5.1	10.3	15.5	25.8	77.2	257.4	
F06 Super wide angle lens	6	0.2 m	80°	HFOV [m]	0.084	0.16	0.32	0.48	0.81	1.6	3.3	6.5	9.8	16.6	49.9	166.4	
			44°	VFOV [m]	0.044	0.08	0.17	0.25	0.41	0.8	1.6	3.2	4.8	8.0	24.1	80.4	
			91°	DFOV [m]	0.095	0.18	0.36	0.54	0.91	1.8	3.6	7.3	10.9	18.5	55.4	184.8	
			4.3 mrad	IFOV [mm]	0.2	0.4	0.8	1.3	2.1	4.2	8.5	16.9	25.5	43.4	130.0	433.2	

PI 400i / 450i PI 450i G7	Focal length [mm]	Minimum measurement distance*	Angle	Distance to measurement object [m]												
					0.05	0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
382 x 288 px O29 Standard lens	13	0.35 m	29°	HFOV [m]		0.060	0.11	0.17	0.27	0.53	1.06	2.1	3.2	5.3	15.8	52.5
			22°	VFOV [m]		0.044	0.083	0.12	0.20	0.39	0.78	1.5	2.3	3.9	11.6	38.5
			37°	DFOV [m]		0.075	0.14	0.21	0.34	0.66	1.31	2.6	3.9	6.5	19.5	65.1
			1.4 mrad	IFOV [mm]		0.2	0.3	0.4	0.7	1.4	2.8	5.5	8.3	13.8	41.2	137.4
O18 Telephoto lens	20	0.5 m	18°	HFOV [m]				0.102	0.16	0.33	0.66	1.3	2.0	3.3	9.8	32.5
			14°	VFOV [m]				0.076	0.13	0.25	0.50	1.0	1.5	2.5	7.4	24.7
			23°	DFOV [m]				0.127	0.21	0.41	0.83	1.6	2.5	4.1	12.3	40.9
			0.9 mrad	IFOV [mm]				0.3	0.4	0.86	1.7	3.4	5.1	8.5	25.6	85.2
O53 Wide angle lens	8	0.25 m	53°	HFOV [m]	0.059	0.107	0.21	0.31	0.51	1.01	2.0	4.0	6.0	10.0	29.9	99.5
			38°	VFOV [m]	0.041	0.076	0.14	0.21	0.35	0.70	1.4	2.8	4.2	6.9	20.8	69.2
			65°	DFOV [m]	0.072	0.131	0.25	0.37	0.62	1.23	2.4	4.9	7.3	12.1	36.4	121.2
			2.7 mrad	IFOV [mm]	0.2	0.3	0.5	0.8	1.3	2.6	5.2	10.5	15.7	26.1	78.2	260.5
O80 Super wide angle lens	6	0.2 m	80°	HFOV [m]	0.093	0.17	0.33	0.49	0.81	1.6	3.2	6.5	9.8	16.6	49.9	166.4
			54°	VFOV [m]	0.059	0.11	0.21	0.31	0.52	1.0	2.0	4.1	6.1	10.2	30.6	101.9
			96°	DFOV [m]	0.110	0.21	0.39	0.58	0.96	1.9	3.8	7.7	11.6	19.5	58.5	195.1
			4.2 mrad	IFOV [mm]	0.2	0.5	0.9	1.3	2.1	4.2	8.5	17.0	25.7	43.6	130.7	435.5

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 our 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.