

## Operator's Manual

**optris<sup>®</sup> Xi**

80/ 400



**Spot finder IR camera**

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# 1 General Notes

## 1.1 Intended use

Thank you for choosing the **optris® Xi** spot finder infrared camera.

The optris Xi calculates the surface temperature based on the emitted infrared energy of objects [►6 Basics of Infrared Thermometry]. The two-dimensional detector (FPA - focal plane array) allows a measurement of an area and will be shown as thermal image using standardized palettes. The radiometric processing of the picture data enables the user to do a comfortable detailed analysis with the software PIX Connect.

The Xi is a precise instrument and contains an extremely sensitive infrared detector and a high-quality lens.



The alignment of the camera to **intensive energy sources** (e.g. devices which emit laser radiation or reflections of such equipment) can cause an **irreparable defect of the infrared detector**. This is also valid if the camera is switched off.

Such kinds of damages are excluded from warranty.



Read the manual carefully before the initial start-up. The producer reserves the right to change the herein described specifications in case of technical advance of the product.



- Avoid abrupt changes of the ambient temperature.
- Avoid static electricity, arc welders, and induction heaters. Keep away from very strong EMF (electromagnetic fields).
- In case of problems or questions which may arise when you use the infrared camera, please contact our service department.



- ▶ All accessories can be ordered according to the referred part numbers in brackets [ ].

## 1.2 Warranty

Each single product passes through a quality process. Nevertheless, if failures occur contact the customer service at once. The warranty period covers 24 months starting on the delivery date. After the warranty is expired the manufacturer guarantees additional 6 months warranty for all repaired or substituted product components. Warranty does not apply to damages, which result from misuse or neglect. The warranty also expires if you open the product. The manufacturer is not liable for consequential damage or in case of a non-intended use of the product.

If a failure occurs during the warranty period the product will be replaced, calibrated or repaired without further charges. The freight costs will be paid by the sender. The manufacturer reserves the right to exchange components of the product instead of repairing it. If the failure results from misuse or neglect the user has to pay for the repair. In that case you may ask for a cost estimate beforehand.



### 1.3 Scope of delivery

- Xi 80 or Xi 400
- USB cable: 1 m (standard scope of supply, no IP67 protection class)  
1 m, 3 m, 5 m, 10 m, 20 m (optional, for industrial applications, with IP67)
- Mounting nut and mounting bracket (adjustable in one axis, tripod thread)
- Process interface cable incl. terminal block (1 m)
- Software package PIX Connect
- Quick start guide

### 1.4 Maintenance



Never use cleaning compounds which contain solvents (neither for the lens nor for the housing).

#### 1.4.1 Cleaning

Blow off loose particles using clean compressed air. The lens surface can be cleaned with a soft, humid tissue (moistened with water) or a lens cleaner (e.g. Purosol or B+W Lens Cleaner).

## 1.5 Model overview

The cameras of the PI-series are available in the following basic versions:

Modell	Model code	Temperature range	Spectral range	Frame rate	Typical applications
Xi 80	IR	-20 to 900 °C	7.5 - 13 µm	50 Hz	Surface measurements in industrial application, autonomous operation with automatic spot finder
Xi 400	IR	-20 to 900 °C	7.5 - 13 µm	80 Hz/ 27 Hz	Real-time thermographic images in high speed; Detection of smallest temperature differences

**Table 1:** Model overview

## 2 Technical Data

### 2.1 General specifications

Environmental rating:	IP67 (NEMA-4)
Ambient temperature:	0...50 °C
Storage temperature:	-40...70 °C
Relative humidity:	10...95 %, non-condensing
Material (housing):	Stainless steel
Dimensions:	Xi 80: 36 x 90 mm / M30 Xi 400: 36 x 100 mm / M30
Weight:	Xi 80: 185 g Xi 400: 200 g
Cable length:	USB: 1 m (standard), 3 m, 5 m, 10 m, 20 m Ethernet / RS485 (Xi 80): 100 m
Vibration <sup>1)</sup> :	IEC 60068-2-6 (sinus shaped) IEC 60068-2-64 (broadband noise)
Shock <sup>1)</sup> :	IEC 60068-2-27 (25 G and 50 G)

<sup>1)</sup> Used standards for vibration and shock:

<b>IEC 60068-1:1988 + Corr. 1988 + A1: 1992</b>	<b>DIN EN 60068-1:1995-03</b>
„Umweltprüfungen - Teil 1: Allgemeines und Leitfaden“	
<b>IEC 60068-2-6:2007</b>	<b>DIN EN 60068-2-6; VDE 0468-2-6:2008-10</b>
„Umgebungseinflüsse - Teil 2-6: Prüfverfahren - Prüfung Fc: Schwingen (sinusförmig)“	
<b>IEC 60068-2-27:2008</b>	<b>DIN EN 60068-2-27; VDE 0468-2-27:2010-02</b>
„Umgebungseinflüsse - Teil 2-27: Prüfverfahren - Prüfung Ea und Leitfaden: Schocken“	
<b>IEC 60068-2-47:2005</b>	<b>DIN EN 60068-2-47:2006-03</b>
„Umgebungseinflüsse - Teil 2-47: Prüfverfahren - Befestigung von Prüflingen für Schwing-, Stoß- und ähnliche dynamische Prüfungen“	
<b>IEC 60068-2-64:2008</b>	<b>DIN EN 60068-2-64; VDE 0468-2-64:2009-04</b>
„Umgebungseinflüsse - Teil 2-64: Prüfverfahren - Prüfung Fh: Schwingen, Breitbandrauschen (digital geregelt) und Leitfaden“	

**Figure 1:** Used standards

Stress program (camera in operation):

<b>Shock, half sinus 25 G – testing Ea 25 G (acc. IEC 60068-2-27)</b>			
Acceleration	245 m/s <sup>2</sup>	(25 G)	
Pulse duration	11 ms		
Number of directions	6	(3 axes with 2 directions each)	
Duration	600 Shocks	(100 Shocks each direction)	

<b>Shock, half sinus 50 G – testing Ea 50 G (acc. IEC 60068-2-27)</b>			
Acceleration	490 m/s <sup>2</sup>	(50 G)	
Pulse duration	11 ms		
Number of directions	6	(3 axes with two directions each)	
Duration	18 Shocks	(3 Shocks each direction)	
<b>Vibration, sinus shaped – testing Fc (acc. IEC60068-2-6)</b>			
Frequency range	10 - 500 Hz		
Acceleration	29.42 m/s <sup>2</sup>	(3 G)	
Frequency change	1 Octave/ min		
Number of axes	3		
Duration	1:30 h	(3 x 0.30 h)	
<b>Vibration, broadband noise – testing Fh (acc. IEC60068-2-64)</b>			
Frequency range	10 - 2000 Hz		

Acceleration	39.3 m/s <sup>2</sup>	(4.01 G <sub>RMS</sub> )	
Frequency spectrum	10 - 106 Hz	0.9610 (m/s <sup>2</sup> ) <sup>2</sup> /Hz	(0.010 G <sup>2</sup> /Hz)
	106 - 150 Hz	+6 dB/ Octave	
	150 - 500 Hz	1.9230 (m/s <sup>2</sup> ) <sup>2</sup> /Hz	(0.020 G <sup>2</sup> /Hz)
	500 - 2000 Hz	-6 dB/ Octave	
	2000 Hz	0.1245 (m/s <sup>2</sup> ) <sup>2</sup> /Hz	(0.00126 G <sup>2</sup> /Hz)
Number of axes	3		
Duration	3 h	(3 x 1 h)	

## 2.2 Electrical specifications

Power Supply:	Xi 80: USB/ PoE/ 5-30 VDC Xi 400: USB
Current draw:	Max 500 mA
AO: Output Process Interface (PIF out)	0 - 10 V (Main measure area, measure area, internal temperature, flag status, alarm, frame sync, fail-safe, external communication), 0/4 – 20 mA (Xi 80) ▶ <b>Appendix F – Wiring diagrams PIF]</b>
AI: Input Process Interface (PIF in)	0 - 10 V (Emissivity, ambient temperature, reference temperature, uncommitted value, flag control, triggered recording, triggered snapshots, triggered line-scanner, triggered event grabber, reset peak-/valley-hold) ▶ <b>Appendix F – Wiring diagrams PIF]</b>
DI: Digital Input Process Interface	Flag control, triggered recording, triggered snapshots, triggered line-scanner, triggered event grabber, reset peak-/valley-hold ▶ <b>Appendix F – Wiring diagrams PIF]</b>
DO: Digital Output Process Interface	Flag Status, alarm, frame sync, fail-safe, external communication
Digital interface:	Xi 80: USB 2.0/ Ethernet/ RS485 Xi 400: USB 2.0/ optional USB to GigE (PoE) conversion

## 2.3 Measurement specifications

	<u>Xi 80</u>	<u>Xi 400</u>
Temperature ranges	-20...100 °C; 0...250 °C; (20) 150...900 °C	
Spectral range	7.5 - 13 $\mu$ m	
Detector	UFPA, 80 x 80 pixel @ 50 Hz	UFPA, 382 x 288 pixel @ 80 Hz/ 27 Hz
Lenses (FOV)	12° x 12°; 30° x 30°; 55° x 55°; 80° x 80°	18° x 14°; 29° x 22°; 53° x 38°; 80° x 54°
Optical resolution	190:1 (12° optic)	390:1 (18° optic)
System accuracy <sup>2)</sup>	$\pm 2$ °C or $\pm 2$ %	
Temperature resolution (NETD):	100 mK	80 mK
Warm-up time	10 min	
Emissivity	0.100...1.100	
Software	PIX Connect	


<sup>1)</sup> Accuracy statement effective from 150 °C

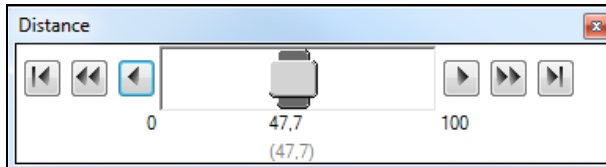
<sup>2)</sup> At ambient temperature  $23 \pm 5$  °C; whichever is greater



## 2.4 Optical specifications



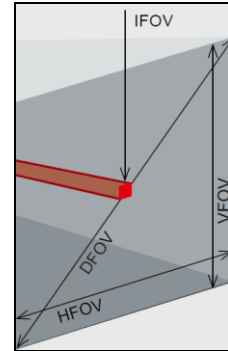
Make sure that the focus of thermal channel is adjusted correctly. The cameras have a **motorized focus**, which can be adjusted in the PIX Connect software (Menu **View/ Windows/ Distance** or over the icon ). An adjustment to the left leads to the focus setting "near" and an adjustment to the right to the focus setting "infinite".



**Figure 2:** Motorized focus settings in PIX Connect

The variety of different lenses offers the possibility to precisely measure objects in different distances. We offer lenses for close, standard distances and large distances. Please note that the Xi has a fixed optic. A change of optics is not possible. Different parameters are important if using infrared cameras. They display the connection between the distance of the measured object and the size of the pixel (**Table 2**).

- **HFOV**: Horizontal enlargement of the total measuring at object level
- **VFOV**: Vertical enlargement of the total measuring at object level
- **IFOV**: Size at the single pixel at object level
- **DFOV**: Diagonal dimension of the total measuring field at object level
- **MFOV**: Recommended, smallest measured object size of 3 x 3 pixel (Xi 400) and 2 x 2 pixel (Xi 80)



The following tables with examples showing what spot sizes and pixel sizes will be reached in which distance. For individual configuration there are different lenses available. Wide angle lenses have a radial distortion due to their large opening angle; the software PIX Connect has an algorithm which corrects this distortion. As an alternative to the tables below, the optics calculator can also be used on the optris website (<https://www.optris.global/optics-calculator>).

Table 2:

Xi 80 80 x 80 px	Focal length [mm]	Minimum measurement distance*	Angel	Distance to measurement object [m]												
					0.05	0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
F05 Standard lens	5	0,2 m	30°	HFOV [m]	0.028	0.056	0.111	0.167	0.279	0.557	1.115	2.230	3.346	5.6	16.7	55.8
			30°	VFOV [m]	0.028	0.056	0.111	0.167	0.279	0.557	1.115	2.230	3.346	5.6	16.7	55.8
			43°	DFOV [m]	0.039	0.079	0.158	0.24	0.39	0.79	1.58	3.15	4.7	7.9	23.7	78.9
			6,67 mrad	I FOV [mm]	0.33	0.67	1.33	2.0	3.33	6.67	13.33	26.67	40.00	66.67	200.00	666.67
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
			2,66 mrad	I FOV [mm]		0.3	0.5	0.8	1.3	2.7	5.3	10.6	15.9	26.6	79.7	265.6
F03 Wide angle lens	3	0,2 m	55°	HFOV [m]	0.057	0.110	0.218	0.325	0.539	1.07	2.14	4.27	6.41	10.7	32.0	106.7
			55°	VFOV [m]	0.057	0.110	0.218	0.325	0.539	1.07	2.14	4.27	6.41	10.7	32.0	106.7
			79°	DFOV [m]	0.080	0.156	0.308	0.459	0.762	1.52	3.02	6.04	9.06	15.1	45.3	150.9
			11,15 mrad	I FOV [mm]	0.6	1.2	2.3	3.4	5.6	11.2	22.4	44.6	66.9	111.5	334.5	1114.8
F02 Super wide angle lens	2	0,2 m	80°	HFOV [m]	0.090	0.174	0.343	0.509	0.884	1.682	3.357	6.708	10.058	16.8	50.3	167.5
			80°	VFOV [m]	0.090	0.174	0.343	0.509	0.88	1.682	3.357	6.708	10.058	16.8	50.3	167.5
			113°	DFOV [m]	0.127	0.246	0.483	0.72	1.19	2.38	4.75	9.49	14.2	23.7	71.1	236.9
			15,45 mrad	I FOV [mm]	0.08	1.6	3.2	4.7	7.8	15.5	31.0	61.9	92.8	154.6	463.7	1545.5

\* Note: The accuracy of measurement can be outside of the specifications for distances below the defined minimum distance.

Xi 400	Focal length [mm]	Min. measuring distance*	Angle	Distance to Measuring object [m]												
					0.05	0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
382 x 288 px F12 Standard lens	12	0.2 m	29°	HFOV [m]		0.051	0.104	0.16	0.26	0.53	1.06	2.11	3.17	5.3	15.9	52.9
			22°	VFOV [m]		0.038	0.078	0.12	0.20	0.39	0.79	1.58	2.36	3.9	11.8	39.4
			37°	DFOV [m]		0.064	0.130	0.20	0.33	0.66	1.32	2.64	3.96	6.6	19.8	66.0
			1.34 mrad	IFOV [mm]		0.1	0.263	0.4	0.7	1.3	2.7	5.4	8.1	13.4	40.3	134.4
F20 Tele lens	20	0.3 m	18°	HFOV [m]		0.068	0.101	0.17	0.33	0.66	1.31	1.97	3.3	9.8	32.7	
			14°	VFOV [m]		0.051	0.076	0.13	0.25	0.49	0.99	1.48	2.5	7.4	24.6	
			23°	DFOV [m]		0.086	0.13	0.21	0.41	0.82	1.64	2.46	4.1	12.3	40.9	
			0.85 mrad	IFOV [mm]		0.170	0.26	0.4	0.9	1.7	3.4	5.1	8.5	25.5	85.0	
F08 Wide angle lens	8	0.2 m	53°	HFOV [m]		0.107	0.21	0.31	0.51	1.01	2.00	4.00	6.00	10.0	29.9	100.0
			38°	VFOV [m]		0.076	0.15	0.22	0.35	0.70	1.39	2.78	4.17	6.9	20.8	69.5
			66°	DFOV [m]		0.132	0.25	0.38	0.62	1.23	2.44	4.87	7.30	12.2	36.5	121.8
			2.20 mrad	IFOV [mm]		0.3	0.5	0.7	1.1	2.2	4.4	8.8	13.2	22.0	66.0	220.0
F06 Super wide angle lens	6	0.2 m	80°	HFOV [m]	0.069	0.149	0.30	0.46	0.78	1.57	3.14	6.29	9.43	15.7	47.3	157.7
			54°	VFOV [m]	0.047	0.098	0.20	0.30	0.51	1.01	2.03	4.06	6.10	10.2	30.5	101.7
			94°	DFOV [m]	0.084	0.178	0.36	0.55	0.93	1.87	3.74	7.49	11.23	18.7	56.3	187.6
			3.01 mrad	IFOV [mm]	0.2	0.3	0.6	0.9	1.5	3.0	6.0	12.0	18.1	30.1	90.3	300.9

\* Note: The accuracy of measurement can be outside of the specifications for distances below the defined minimum distance.

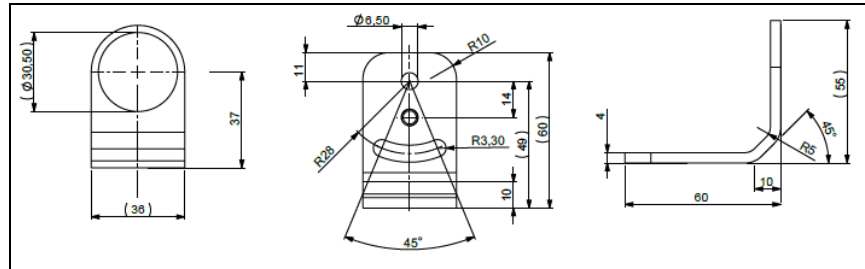
### 3 Mechanical Installation

#### 3.1 Dimensions

The Xi is equipped with a metric M30x1 thread and can be installed either directly via the sensor thread or with help of the supplied mounting nut (standard) and adjustable mounting bracket (standard) to a mounting device available.



**Figure 3:** Xi with mounting bracket



**Figure 4:** Mounting bracket, adjustable in one axis, with tripod thread  
[Order No. - ACXIFB] – standard scope of supply



For correct orientation, the USB port must be on the left side and the PIF port on the right side, see **Figure 5** or **Figure 6**.

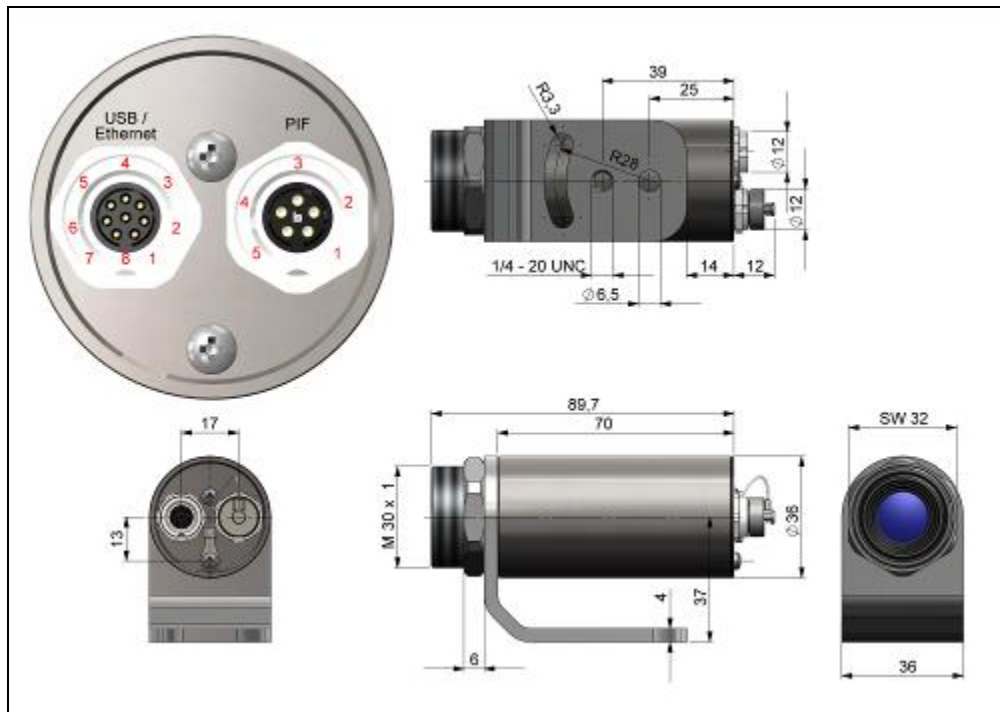


Figure 5: Xi 80, dimensions [mm]

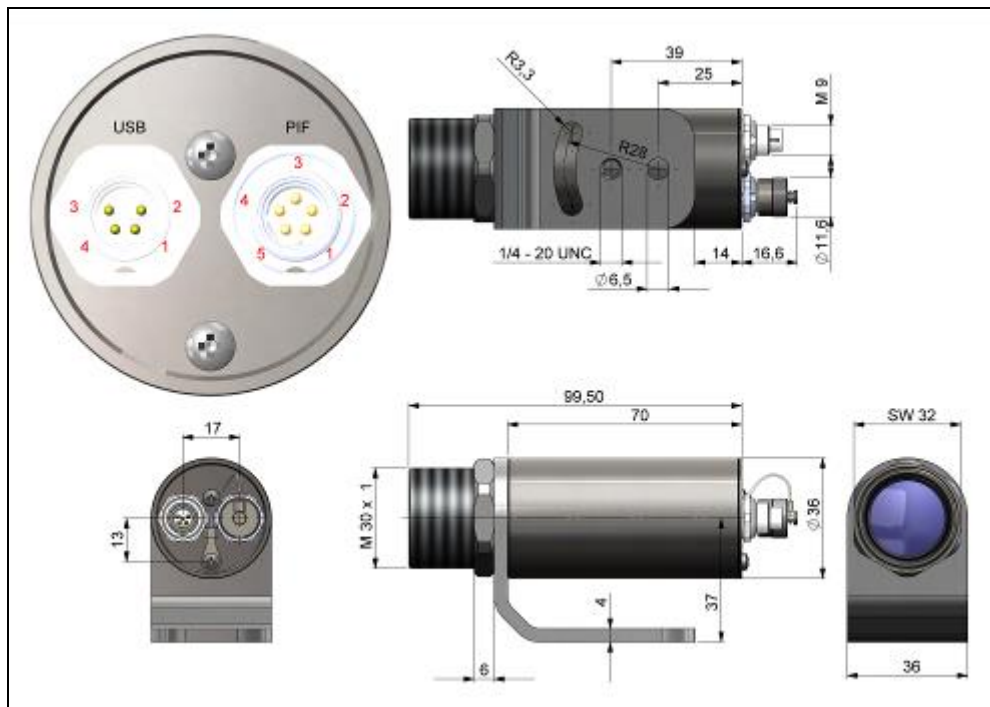


Figure 6 : Xi 400, dimensions [mm]

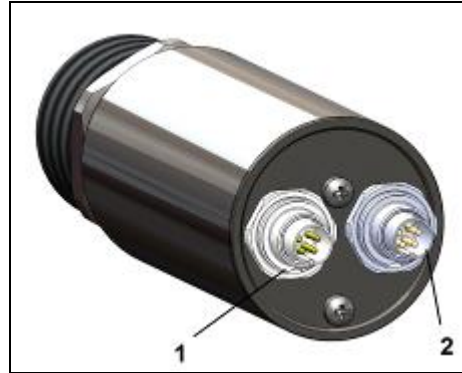
## 4 Electrical Installation

At the back side of the Xi there are the two connector plugs (see **Figure 7** and **Figure 8**).



**Figure 7:** Backside of the Xi 80 with connectors

- 1 Plug for USB / Ethernet<sup>1)</sup> / PoE cable
- 2 Plug for in- and outputs or RS485



**Figure 8:** Backside of the Xi 400 with connectors

- 1 Plug for USB cable
- 2 Plug for PIF cable

<sup>1)</sup> When using the Ethernet connector, a 5...30 V DC power supply must be ensured via the terminal block



## 4.1 Process interface

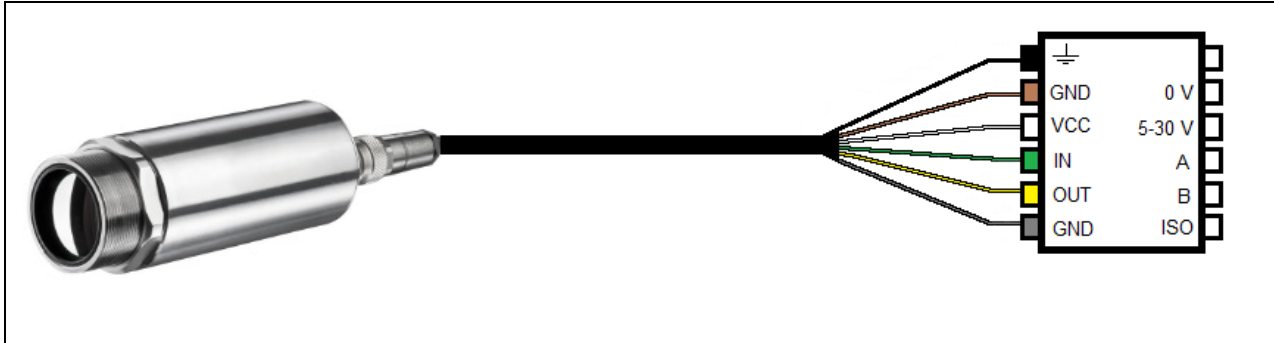
### 4.1.1 Process interface Xi 80

The Xi 80 is equipped with an integrated process interface (cable with terminal block included in scope of supply), which can be programmed via the software as a direct analog input (AI), as a direct analog output (AO) in order to control the process or as an RS485 interface<sup>1)</sup>. The signal level is 0-10 V for AI and 0/4-20 mA for AO.


The process interface can be activated via the software choosing the following options:

Analog Input (AI):	Emissivity, ambient temperature, reference temperature, uncommitted value, flag control, triggered recording, triggered snapshots, triggered line-scanner, triggered event grabber, reset peak-/valley-hold
Analog Output (AO):	Main measure area, measure area, internal temperature, flag status, alarm, frame sync, fail-safe, external communication

<sup>1)</sup> Direct out- and inputs are not available while using the RS485 interface



**Figure 9:** Configuration terminal block Xi 80

		Shield	Black
<b>GND</b>	<b>0 V</b>	Ground	Brown
<b>VCC</b>	<b>5-30 V</b>	Power <sup>1)</sup>	White
<b>IN</b>	<b>A</b>	Analog/Digital Input or RS485 (A)	Green
<b>OUT</b>	<b>B</b>	Analog Output or RS485 (B)	Yellow
<b>GND</b>	<b>ISO</b>	Isolated Ground for IN and OUT	Gray

<sup>1)</sup> Power supply only necessary when using the Ethernet connection (without PoE) or self-sufficient operation

The Xi 80 provides the following direct inputs and outputs:

<b><u>Name</u></b>	<b><u>Description</u></b>	<b><u>max range / status</u></b>
AI	Analog input	0-10 V <sup>1)</sup>
or DI	Digital input (active-low = 0...0,6 V)	24 V
AO	Analog output Alarm output	0/4-20 mA 0/4-20 mA

<sup>1)</sup> The AI is designed for max. 24 V, the voltage level above 10 V is not interpreted

In addition to the above direct in- and outputs, the Xi 80 has an RS485 interface. This interface can be used to control the external industrial PIF.

### 4.1.2 Process interface Xi 400

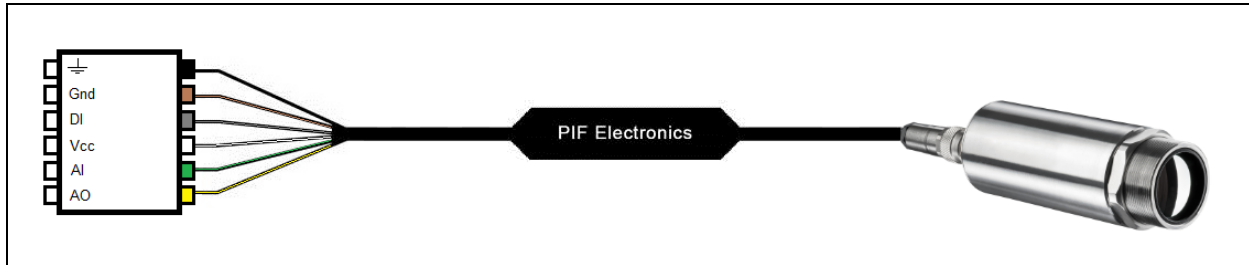


The process interface (electronics within cable as well as industrial interface) must be powered separately (5-24 VDC). Before switching on the power the PIF cable must be connected to the camera.


The Xi is equipped with a process interface (cable with integrated electronics and terminal block), which can be programmed via the software as an Analog Input (AI) and Digital Input (DI) in order to control the camera or as an Analog Output (AO) in order to control the process. The signal level is always 0-10 V (DI = 24 V).

The process interface can be activated choosing the following options:

Analog Input (AI):	Emissivity, ambient temperature, reference temperature, uncommitted value, flag control, triggered recording, triggered snapshots, triggered line-scanner, triggered event grabber, reset peak-/valley-hold
Analog Output (AO):	Main measure area, measure area, internal temperature, flag status, alarm, frame sync, fail-safe, external communication
Digital Input (DI):	Flag control, triggered recording, triggered snapshots, triggered line-scanner, triggered event grabber, reset peak-/valley-hold



**Figure 10:** Configuration Standard Process Interface (PIF) Xi 400

	Shield	Black
<b>Gnd</b>	Ground	Brown
<b>DI</b>	Digital Input	Gray
<b>Vcc</b>	Power supply, 5...24 V DC	White
<b>AI</b>	Analog Input	Green
<b>AO</b>	Analog Output	Yellow

The standard process interface provides the following inputs and outputs:

<u>Name</u>	<u>Description</u>	<u>max range<sup>1)</sup>/ status</u>
AI	Analog input	0-10 V <sup>2)</sup>
DI	Digital input (active-low = 0...0,6 V)	24 V
AO	Analog output Alarm output	0-10 V 0/ 10 V

<sup>1)</sup> Depending on supply voltage; for 0-10 V on the AO the PIF has to be powered with min. 12 V.

<sup>2)</sup> The AI is designed for max. 24 V, the voltage level above 10 V is not interpreted

### 4.1.3 PIN allocation Xi 80



**Figure 11:** Rear side of Xi 80

USB	Ethernet	PIF
1 VCC		1 VCC
2 D +		2 RS485 or AO
3 D -		3 RS485 or AI
4	Tx +	4 GND
5	Tx -	5 GND-ISO
6	Rx +	
7	Rx -	
8 GND		

#### 4.1.4 PIN allocation Xi 400

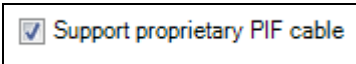


USB	PIF
1 VCC	1 INT
2 GND	2 SDA (I <sup>2</sup> C)
	3 SCL (I <sup>2</sup> C)
4 D -	4 DGND
5 D +	5 3,3 V (Out)

Figure 12: Rear side of Xi 400



If the process interface of the camera is directly connected to external hardware<sup>1)</sup> (without using the supplied PIF cable) an activation of the field „Support proprietary PIF cable” in the menu **Tools/ Configuration/ Device (PIF)** in the PIX Connect software is necessary.



**Figure 13:** Support proprietary PIF cable



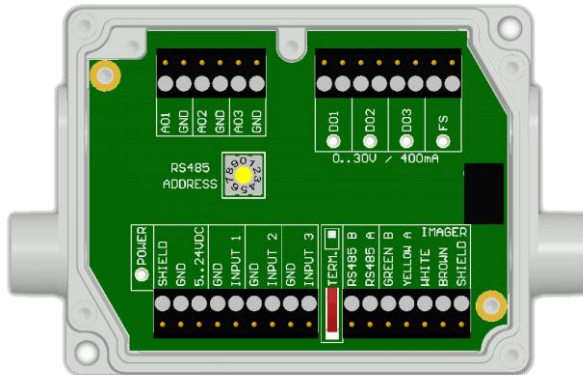
Consider that the input of the PIF is not protected if there is a direct PIF connection!  
A voltage > 3 V on the INT pin will destroy the device!

<sup>1)</sup> We recommend using only a switching contact between INT and DGND as external hardware (button, relay).

#### 4.1.5 Industrial Process Interface for Xi 80 (optional)

For use in industrial environment the industrial process interface with 500 V AC<sub>RMS</sub> isolation voltage between Xi and process is available (connection box with IP65, 5 m, 10 m or 20 m standard or high temperature cable for camera connection, terminal for process integration). [► **Appendix F – Wiring diagrams PIF**]

##### Pin assignment PIF cable (industrial process interface)



GREEN	RS485 B
YELLOW	RS485 A
WHITE	12 V
BROWN	GND
SHIELD	GND

**Figure 14:** Connections of the industrial Process Interface for Xi 80

The industrial process interface provides the following in- and outputs:

<u>Name</u>	<u>Description</u>	<u>max range<sup>1)</sup>/ status</u>
INPUT 1 / 2 / 3	Analog or digital input	0-10 V <sup>2)</sup>
AO1 / 2 / 3	Analog output 1, 2 and 3 Alarm output 1, 2 and 3	0-10 V 0/4-20 mA
DO1 / 2 / 3	Relay output 1, 2 and 3 <sup>3)</sup>	open/ closed (red LED on) / 0...30 V, 400 mA
FS	Fail-safe relay	open/ closed (green LED on) / 0...30 V, 400 mA

<sup>1)</sup> depending on supply voltage; for 0-10 V on the AO the PIF has to be powered with min. 12 V.

<sup>2)</sup> the AI is designed for max. 24 V, the voltage level above 10 V is not interpreted

<sup>3)</sup> active if AO1, 2 or 3 is/ are programmed as alarm output



The industrial PIF has a maximum of 3 analog outputs. To use more outputs, you can cascade up to three PIFs, allowing you to use up to 9 analog or alarm outputs in total.

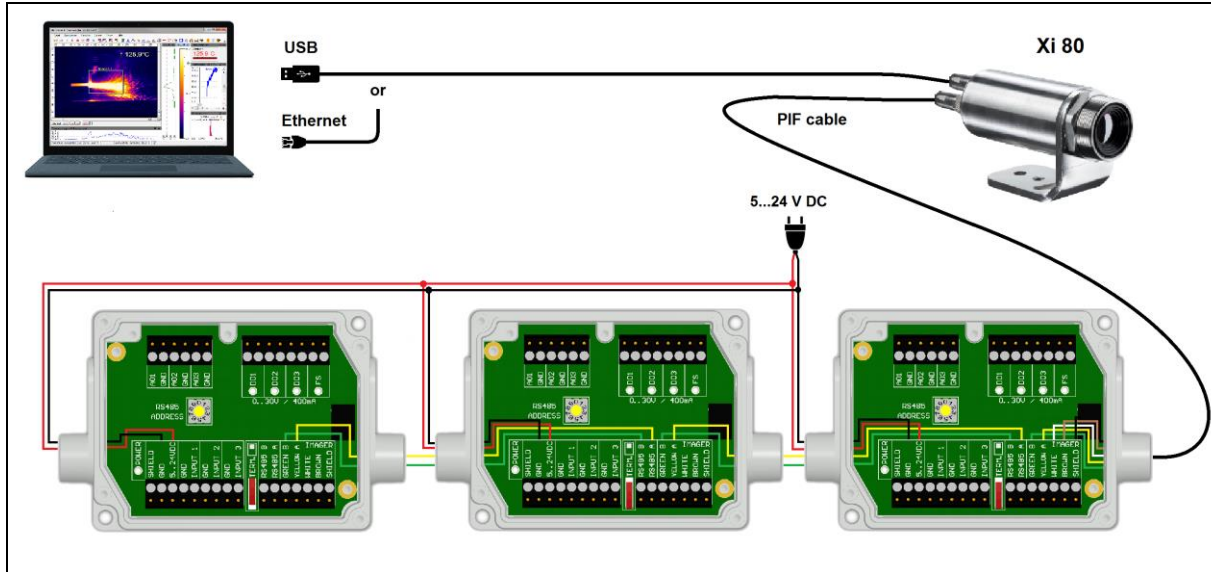


Figure 15: Connection of 3 industrial PIFs via RS485



Each stackable industrial PIF must have its own **RS485 address**. The address must be set directly on the board and in the software. For the PIF which is the furthest away the **120R switch (TERM. – Termination)** has to be set.

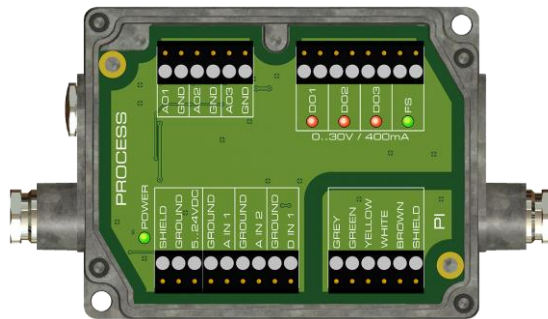
The process interface has an integrated fail-safe mode. This allows to control conditions like interruption of cables, shut-down of the software etc. and to give out these conditions as an alarm.

Controlled conditions on camera and software	Standard Process interface ACXIIOCB1	Industrial Process interface ACXIPIFCBxx
Interruption USB cable to camera	✓	✓
Interruption data cable camera - PIF	✓	✓
Interruption power supply PIF	✓	✓
Shut-down of PIX Connect software	✓	✓
Crash of PIX Connect software	-	✓
Fail-Safe-Output	0 V at analog output (AO)	open contact (fail-safe relay)/ green LED off

#### 4.1.6 Industrial Process Interface for Xi 400 (optional)

For use in industrial environment the industrial process interface with 500 V AC<sub>RMS</sub> isolation voltage between Xi and process is available (connection box with IP65, 5 m, 10 m or 20 m standard or high temperature cable for camera connection, terminal for process integration). [► **Appendix F – Wiring diagrams PIF**]

##### Pin assignment PIF cable (industrial process interface)



GREY	Interrupt
GREEN	SCL (I <sup>2</sup> C)
YELLOW	SDA (I <sup>2</sup> C)
WHITE	3.3 V
BROWN	GND
SHIELD	GND

**Figure 16:** Connections of the industrial Process Interface for Xi 400

The industrial process interface provides the following inputs and outputs:

<u>Name</u>	<u>Description</u>	<u>max range<sup>1)</sup>/ status</u>
A IN 1 / 2	Analog input 1 and 2	0-10 V <sup>2)</sup>
D IN 1	Digital input (active-low = 0...0,6 V)	24 V
AO1 / 2 / 3	Analog output 1, 2 and 3 Alarm output 1, 2 and 3	0-10 V 0/ 10 V
DO1 / 2 / 3	Relay output 1, 2 and 3 <sup>3)</sup>	open/ closed (red LED on) / 0...30 V, 400 mA
FS	Fail-safe relay	open/ closed (green LED on) / 0...30 V, 400 mA

<sup>1)</sup> depending on supply voltage; for 0-10 V on the AO the PIF has to be powered with min. 12 V.

<sup>2)</sup> the AI is designed for max. 24 V, the voltage level above 10 V is not interpreted

<sup>3)</sup> active if AO1, 2 or 3 is/ are programmed as alarm output

The process interface has an integrated fail-safe mode. This allows to control conditions like interruption of cables, shut-down of the software etc. and to give out these conditions as an alarm.

Controlled conditions on camera and software	Standard Process interface ACPIPIF	Industrial Process interface ACPIPIF500V2CBxx
Interruption USB cable to camera	✓	✓
Interruption data cable camera - PIF	✓	✓
Interruption power supply PIF	✓	✓
Shut-down of PIX Connect software	✓	✓
Crash of PIX Connect software	-	✓
Fail-Safe-Output	0 V at analog output (AO)	open contact (fail-safe relay)/ green LED off



## 4.2 Autonomous operation Xi 80

A special feature of the Xi 80 is the autonomous operation. There is no need for a permanent connection to the PIX Connect software. Only a few settings must be set in advance in the software.

To do this, connect the PIF and USB cables to the device. Then connect the Xi to your PC and start the PIX Connect software (see **5 Software PIX Connect**)

Position and focus (see **2.4 Optical specifications**) the camera so that your object to be measured is perfectly visible in the image. First define the desired measurement area with the corresponding mode you want to output.

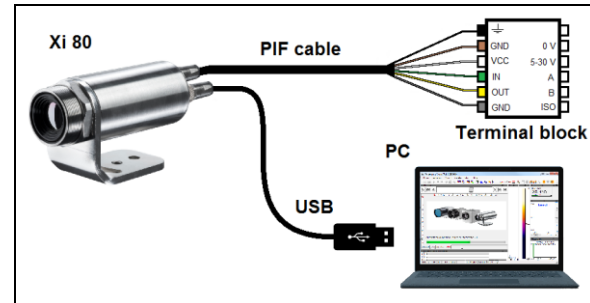


Figure 17: Connection Xi 80 to PC via USB

Now go to the configuration menu on **Device (PIF)**. There you first select the **PIF type** (in this case: **Internal PIF**). Then select under **Analog Outputs (AO)** the function that is to be output autonomously. Then press **Setup**, make your settings and make sure that the checkbox is set to **using autonomously by device**. By pressing the **OK** button an @ sign can be found in the configuration menu Devices (PIF), which indicates the autonomous operation.

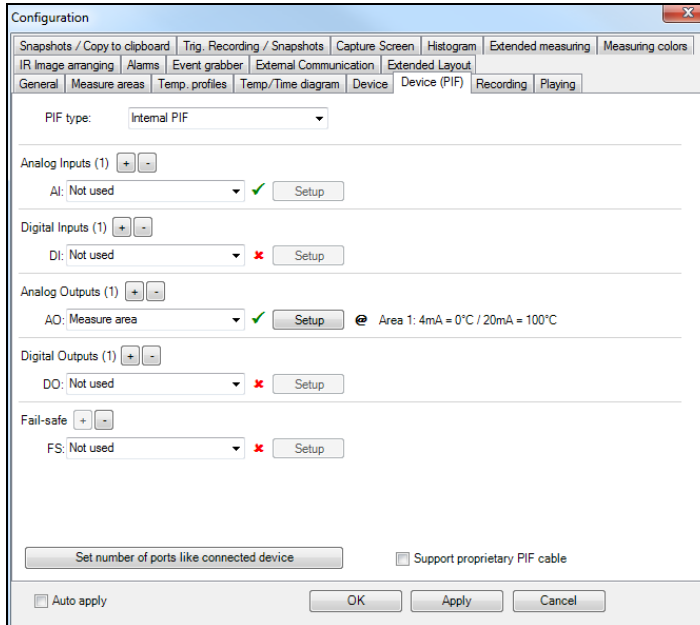


Figure 18: Configurations menu Device (PIF)

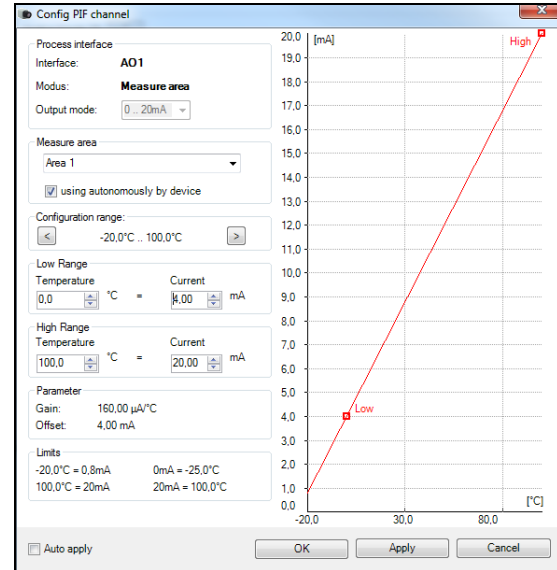
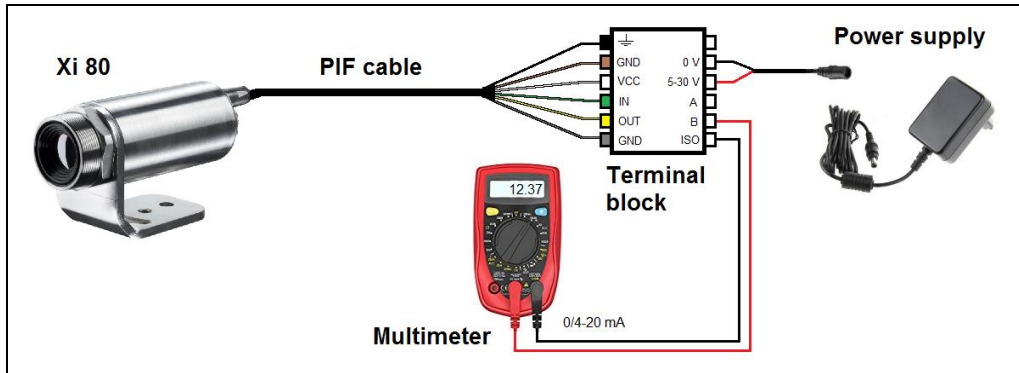


Figure 19: Setup

In general these are all the settings that must be set in the PIX Connect software in order to operate the device autonomously. You can now close the software and then disconnect the USB cable. In order to start up the device autonomously, a 5-30 V power supply must be connected to the terminal block. Now the used input/output has to be connected. The resulting value can be displayed for example on a multimeter (see **Figure 20**).



**Figure 20:** Electrical installation for autonomous operation Xi 80



Autonomous operation also works via the industrial PIF of the Xi 80. The device is powered by the power supply of the PIF.

### 4.3 Example for a Fail-Safe monitoring of the Xi with a PLC

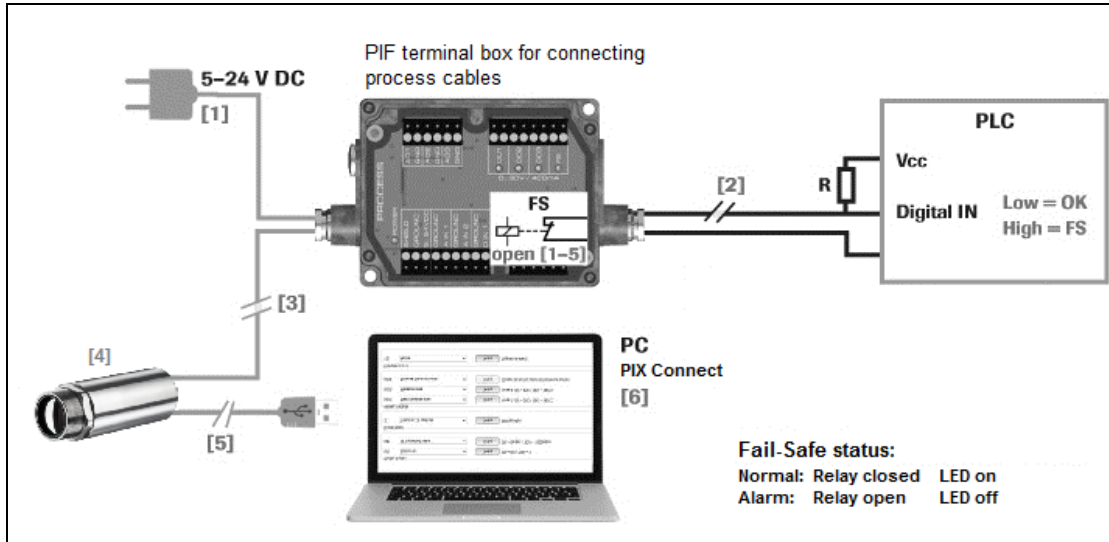


Figure 21: Fail-Safe monitoring states

#### Fail-Safe monitoring states

- |                                    |   |
|------------------------------------|---|
| [1] Breakdown of PIF power supply  | [4] Malfunction of Xi                                       |
| [2] Cable break of fail-safe cable | [5] Breakdown of Xi power supply/ Interruption of USB cable |
| [3] Interruption of cable Xi-PIF   | [6] Malfunction of PIX Connect software                     |

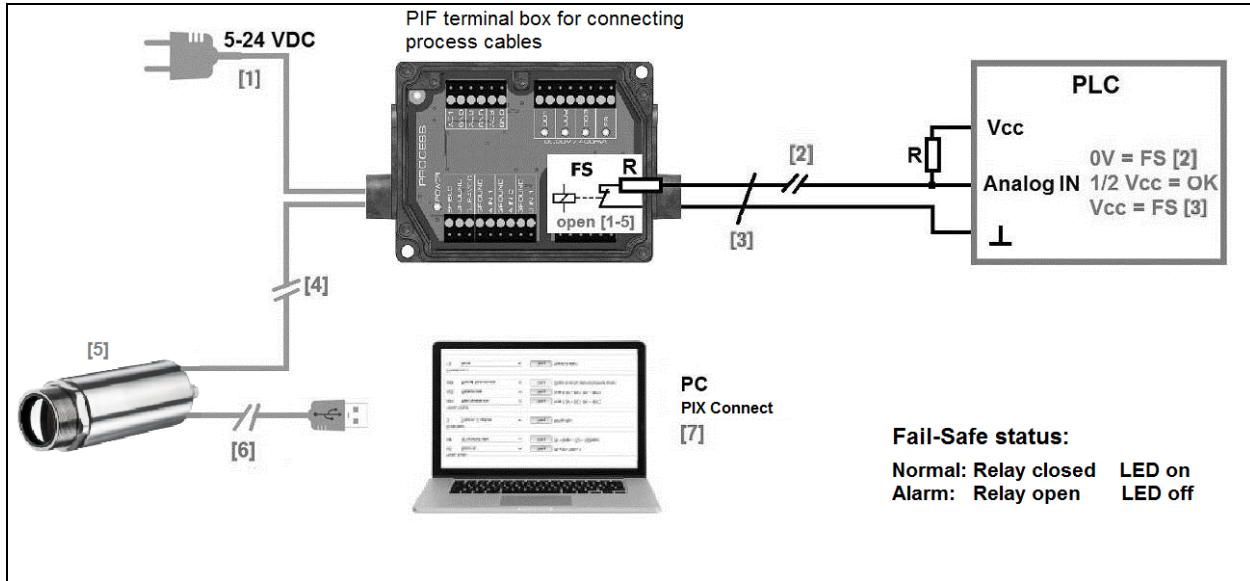


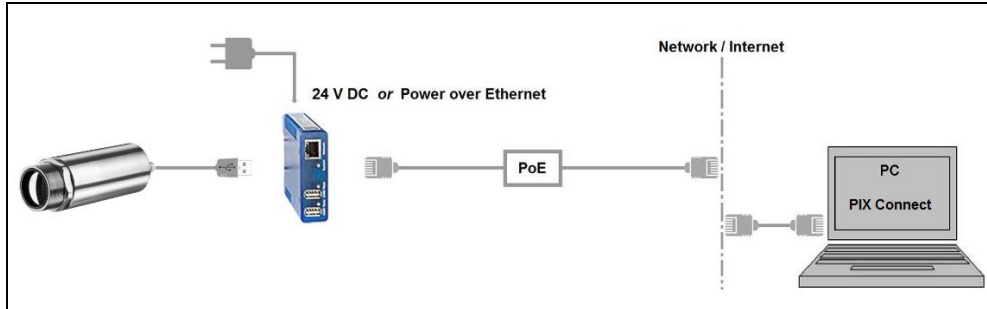
Figure 22: Fail-Safe monitoring states

**Fail-Safe monitoring states**

- |                                      |   |
|--------------------------------------|---|
| [1] Breakdown of PIF power supply    | [5] Malfunction of Xi                                       |
| [2] Cable break of fail-safe cable   | [6] Breakdown of Xi power supply/ Interruption of USB cable |
| [3] Short circuit of fail-safe cable | [7] Malfunction of PIX Connect software                     |
| [4] Interruption of cable Xi-PIF     |   |

## 4.4 USB cable extension for Xi 400

The maximum USB cable length is 20 m. For greater distances between Xi 400 and computer or for stand-alone solutions the optional USB Server Gigabit is provided:



**Figure 23:** USB Server Gigabit

## 5 Software PIX Connect

### Minimum system requirements:



- Windows Vista, Windows 7, Windows 8, Windows 10
- USB interface
- Hard disc with at least 30 MByte of free space
- At least 128 MByte RAM
- CD-ROM drive



A detailed description is provided in the software manual on the software CD. See also **Help** menu in the PIX Connect software (**Help** → **Documentation**).

## 5.1 Installation and initial start-up



- All drivers are booted via Windows OS automatically. A driver installation is not necessary.
- By default the program starts automatically in the installed language.

1. Insert the installation CD into the according drive on your computer. If the **autorun** option is activated the installation wizard will start automatically.
2. Otherwise start **setup.exe** from the CD-ROM. Follow the instructions of the wizard until the installation is finished.

The installation wizard places a launch icon on the desktop and in the start menu:

**Start\Programs\Optris GmbH\PIX Connect**


3. To connect the camera to the PC, plug the USB cable to the camera first. Afterwards connect it with the PC (to disconnect the camera and the computer remove the USB cable from the computer first and then disconnect it from the camera).
4. Start the software.

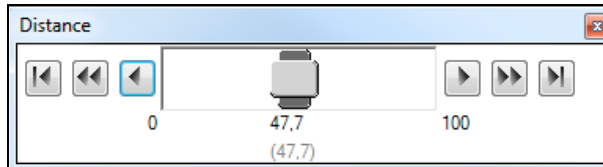
At the initial start the software asks for the calibrations files which are available via internet or on the CD (only for Xi 400). With the Xi 80, the calibration files are already included in the device.



5. Install the calibration files at first start of the software (only necessary for Xi 400).

After the calibration files have been installed the live image from the camera is shown inside a window on your PC screen.

6. Choose the desired language in the menu **Tools** → **Language**.
7. Adjust the focus of the image by using the distance function in the software (Menu **View/ Windows/ Distance** or over the icon ):



## 5.2 Software window

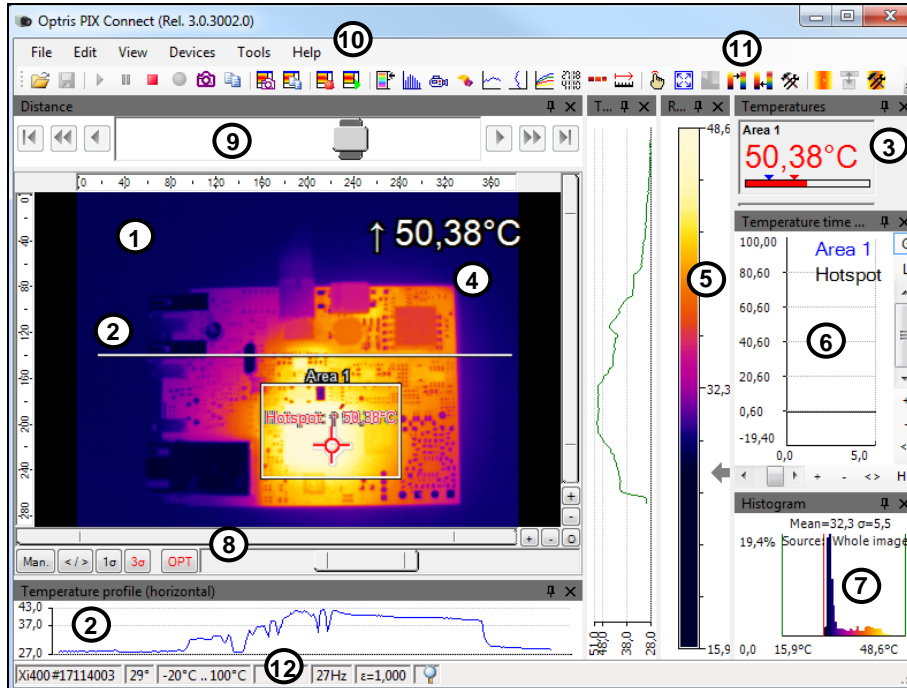


Figure 24: Software window

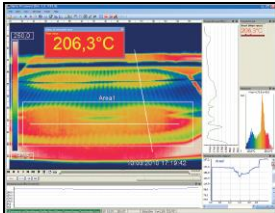
- 1 IR image from the camera
- 2 Temperature profile: Shows the temperatures along max. 2 lines at any size and position in the image.
- 3 Control displays: Displays all temperature values in the defined measure areas like Cold Spots, Hot Spots, temperature at cursor, internal temperature and chip temperature.  
  
Alarm settings: Bar showing the defined temperature thresholds for low alarm value (blue arrow) and high alarm value (red arrow). The color of numbers within control displays changes to **red** (when temp. above the high alarm value) and to **blue** (when temp. below the low alarm value).
- 4 Temperature of measure area: Analyses the temperature according to the selected shape, e.g. average temperature of the rectangle. The value is shown inside the IR image and the control displays.
- 5 Reference bar: Shows the scaling of temperature within the color palette.
- 6 Temperature time diagram: Shows the temperature curves over time for selectable region of interest (ROI)
- 7 Histogram: Shows the statistic distribution of single temperature values.
- 8 Automatic / manual scaling of the palette (displayed temperature range): Man., </> (min, max),  $1\sigma$  : 1 Sigma,  $3\sigma$  : 3 Sigma, OPT: Palette optimization
- 9 Distance function: Adjustment of the motor focus to focus the IR picture
- 10 Menu and Toolbar (Icons)
- 11 Icon enabling switching between color palettes
- 12 Status bar: Serial number, optic, temperature range, cursor position, device framerate/ display framerate, emissivity, ambient temperature, flag status

## 5.3 Basis features of the software PIX Connect



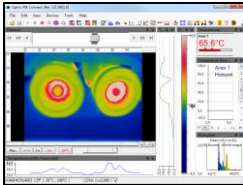
### Extensive infrared camera software

- No restrictions in licensing
- Modern software with intuitive user interface
- Remote control of camera via software
- Display of multiple camera images in different windows
- Compatible with Windows Vista, 7, 8 and 10



### High level of individualization for customer specific display

- Various language option including a translation tool
- Temperature display in °C or °F
- Different layout options for an individual setup (arrangement of windows, toolbar)
- Range of individual measurement parameter fitting for each application
- Adaption of thermal image (mirror, rotate)
- Individual start options (full screen, hidden, etc.)



### Video recording and snapshot function (IR)

- Recording of video sequences and detailed frames for further analysis or documentation
- Adjustment of recording frequency to reduce data volume
- Display of snapshot history for immediate analysis



### Extensive online and offline data analysis

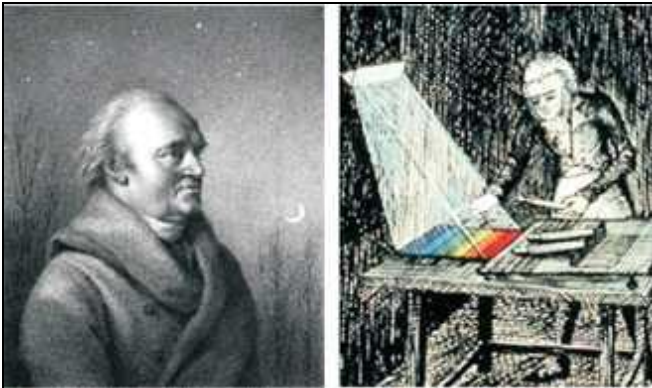
- Analysis supported by measurement fields, hot and cold spot searching, image subtraction
- Real time temperature information within main window as digital or graphic display (line profile, temperature time diagram)
- Slow motion repeat of radiometric files and analysis without camera being connected
- Editing of sequences such as cutting and saving of individual images
- Various color palettes to highlight thermal contrasts



## 6 Basics of Infrared Thermometry

Depending on the temperature each object emits a certain amount of infrared radiation. A change in the temperature of the object is accompanied by a change in the intensity of the radiation.

Searching for new optical material William Herschel by chance found the infrared radiation in 1800.

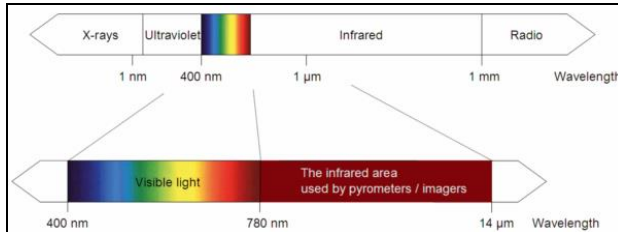


**Figure 25:** William Herschel (1738-1822)

He blackened the peak of a sensitive mercury thermometer. This thermometer, a glass prism that led sun rays onto a table made his measuring arrangement. With this, he tested the heating of different colors of the spectrum. Slowly moving the peak of the blackened thermometer through the colors of the spectrum, he

noticed the increasing temperature from violet to red. The temperature rose even more in the area behind the red end of the spectrum. Finally he found the maximum temperature far behind the red area.

Nowadays this area is called “infrared wavelength area”.

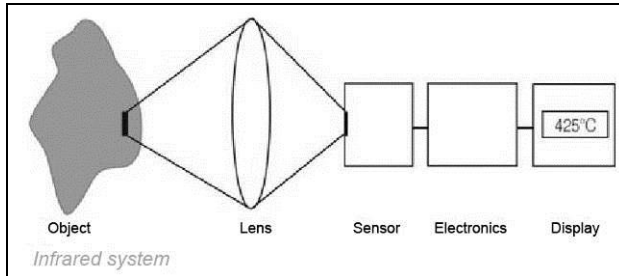


**Figure 26:** The electromagnetic spectrum and the area used for temperature measurement

For the measurement of “thermal radiation” infrared thermometry uses a wave-length ranging between 1 μm and 20 μm. The intensity of the emitted radiation depends on the material. This material contingent constant is described with the help of the emissivity which is a known value for most materials (► **7 Emissivity**).

Infrared thermometers are optoelectronic sensors. They calculate the surface temperature on the basis of the emitted infrared radiation from an object. The most important feature of infrared thermometers is that they enable the user to measure objects contactless. Consequently, these products help to measure the temperature of inaccessible or moving objects without difficulties.





**Figure 27:** Main principle of non-contact thermometry

Infrared thermometers basically consist of the following components:

- Lens
- Spectral filter
- Detector
- Electronics (amplifier/ linearization/ signal processing)

The specifications of the lens decisively determine the optical path of the infrared thermometer, which is characterized by the ratio Distance to Spot size. The spectral filter selects the wavelength range, which is relevant for the temperature measurement. The detector in cooperation with the processing electronics transforms the emitted infrared radiation into electrical signals.

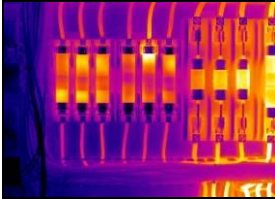
The advantages of non-contact thermometry are clear - it supports:

- temperature measurements of moving or overheated objects and of objects in hazardous surroundings
- very fast response and exposure times
- measurement without inter-reaction, no influence on the measuring object
- non-destructive measurement
- long lasting measurement, no mechanical wear

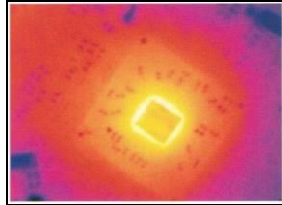


**Figure 28:** Non-contact thermometry

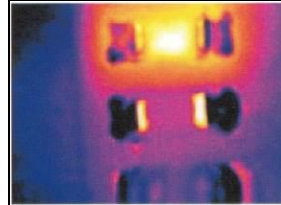
**Application field:**



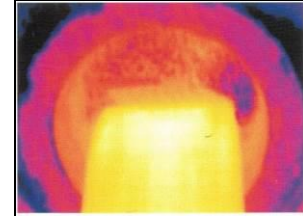
Monitoring of electronic cabinets



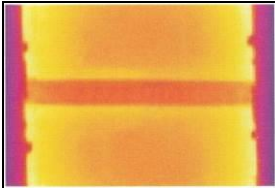
R&D of electronics



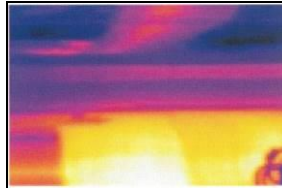
R&D of electronic parts



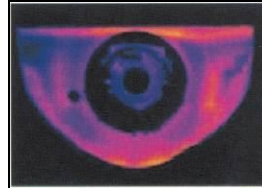
Process control extruding plastic parts



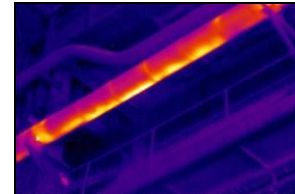
Process control manufacturing solar modules



Process control at calendering



R&D of mechanical parts

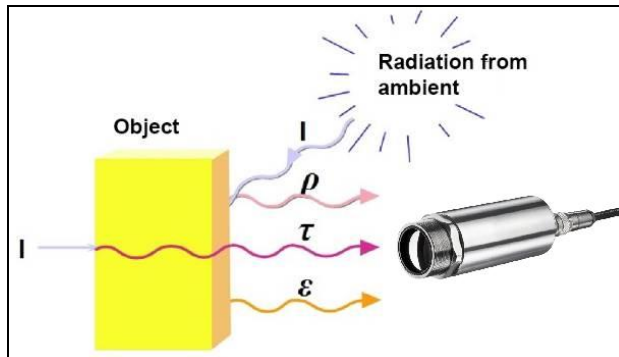


Monitoring of cables

## 7 Emissivity

### 7.1 Definition

The intensity of infrared radiation, which is emitted by each body, depends on the temperature as well as on the radiation features of the surface material of the measuring object. The emissivity ( $\epsilon$  – Epsilon) is used as a material constant factor to describe the ability of the body to emit infrared energy. It can range between 0 and 100 %. A “blackbody” is the ideal radiation source with an emissivity of 1.0 whereas a mirror shows an emissivity of 0.1.



I IR radiation

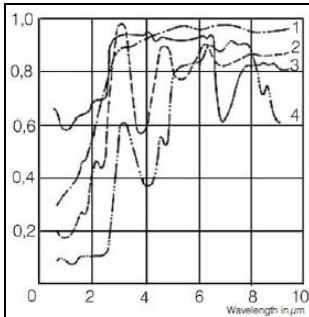
$\epsilon$  Emission

$\rho$  Reflection

$\tau$  Transmission

$$\epsilon + \rho + \tau = 1$$

**Figure 29:** Composition of IR radiation

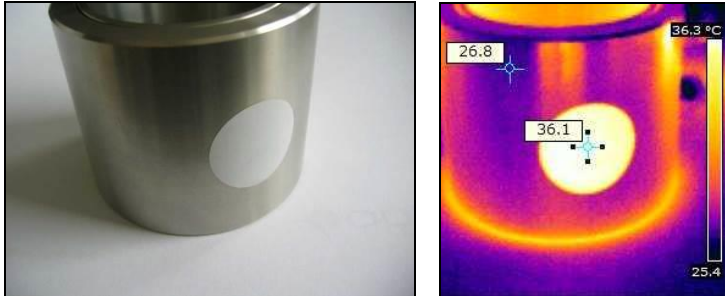


**Figure 30:** Spectral emissivity of several materials: **1** Enamel, **2** Plaster, **3** Concrete, **4** Chamotte

If the emissivity chosen is too high, the infrared thermometer may display a temperature value which is much lower than the real temperature – assuming the measuring object is warmer than its surroundings. A low emissivity (reflective surfaces) carries the risk of inaccurate measuring results by interfering infrared radiation emitted by background objects (flames, heating systems, chamottes). To minimize measuring errors in such cases, the handling should be performed very carefully and the unit should be protected against reflecting radiation sources.

## 7.2 Determination of unknown emissivity

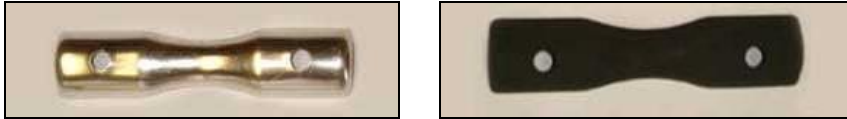
- ▶ First determine the actual temperature of the measuring object with a thermocouple or contact sensor. Second, measure the temperature with the infrared thermometer and modify the emissivity until the displayed result corresponds to the actual temperature.
- ▶ If you monitor temperatures of up to 380 °C you may place a special plastic sticker (emissivity dots – **Part No.: ACLSED**) onto the measuring object, which covers it completely.



**Figure 31:** Plastic sticker at metal surface

Set the emissivity to 0.95 and take the temperature of the sticker. Afterwards, determine the temperature of the adjacent area on the measuring object and adjust the emissivity according to the value of the temperature of the sticker.

- ▶ Cover a part of the surface of the measuring object with a black, flat paint with an emissivity of 0.98. Adjust the emissivity of your infrared thermometer to 0.98 and take the temperature of the colored surface. Afterwards, determine the temperature of a directly adjacent area and modify the emissivity until the measured value corresponds to the temperature of the colored surface.



**Figure 32:** Shiny metal surface **left** and blackened metal surface **right**

**CAUTION:** On all three methods the object temperature must be different from ambient temperature.

### 7.3 Characteristic emissivity

In case none of the methods mentioned above help to determine the emissivity you may use the emissivity table ► **Appendix A** and **Appendix B**. These are average values, only. The actual emissivity of a material depends on the following factors:

- temperature
- measuring angle
- geometry of the surface
- thickness of the material
- constitution of the surface (polished, oxidized, rough, sandblast)
- spectral range of the measurement
- transmissivity (e.g. with thin films)

Fixed radiometric values

Emissivity:	<input type="text" value="1,000"/>	▲▼
Transmissivity: (IR-window compensation)	<input type="text" value="1,000"/>	▲▼
Ambient temperature:	<input type="checkbox"/> <input type="text" value="23,0"/>	▲▼ [°C]

**Figure 33:** Adjustment of the emissivity in the software PIX Connect (menu **Tools/ Configuration/ Device**)



## Appendix A – Table of emissivity for metals

Material		typical Emissivity			
		1.0 $\mu\text{m}$	1.6 $\mu\text{m}$	5.1 $\mu\text{m}$	8-14 $\mu\text{m}$
Aluminium	non oxidized	0.1-0.2	0.02-0.2	0.02-0.2	0.02-0.1
	polished	0.1-0.2	0.02-0.1	0.02-0.1	0.02-0.1
	roughened	0.2-0.8	0.2-0.6	0.1-0.4	0.1-0.3
	oxidized	0.4	0.4	0.2-0.4	0.2-0.4
Brass	polished	0.35	0.01-0.05	0.01-0.05	0.01-0.05
	roughened	0.65	0.4	0.3	0.3
	oxidized	0.6	0.6	0.5	0.5
Copper	polished	0.05	0.03	0.03	0.03
	roughened	0.05-0.2	0.05-0.2	0.05-0.15	0.05-0.1
	oxidized	0.2-0.8	0.2-0.9	0.5-0.8	0.4-0.8
Chrome		0.4	0.4	0.03-0.3	0.02-0.2
Gold		0.3	0.01-0.1	0.01-0.1	0.01-0.1
Haynes	alloy	0.5-0.9	0.6-0.9	0.3-0.8	0.3-0.8
Inconel	electro polished	0.2-0.5	0.25	0.15	0.15
	sandblast	0.3-0.4	0.3-0.6	0.3-0.6	0.3-0.6
	oxidized	0.4-0.9	0.6-0.9	0.6-0.9	0.7-0.95
Iron	non oxidized	0.35	0.1-0.3	0.05-0.25	0.05-0.2
	rusted		0.6-0.9	0.5-0.8	0.5-0.7
	oxidized	0.7-0.9	0.5-0.9	0.6-0.9	0.5-0.9
	forged, blunt	0.9	0.9	0.9	0.9
	molten	0.35	0.4-0.6		
Iron, casted	non oxidized	0.35	0.3	0.25	0.2
	oxidized	0.9	0.7-0.9	0.65-0.95	0.6-0.95

Material		typical Emissivity			
		1.0 $\mu\text{m}$	1.6 $\mu\text{m}$	5.1 $\mu\text{m}$	8-14 $\mu\text{m}$
Lead	polished	0.35	0.05-0.2	0.05-0.2	0.05-0.1
	roughened	0.65	0.6	0.4	0.4
	oxidized		0.3-0.7	0.2-0.7	0.2-0.6
Magnesium		0.3-0.8	0.05-0.3	0.03-0.15	0.02-0.1
Mercury			0.05-0.15	0.05-0.15	0.05-0.15
Molybdenum	non oxidized	0.25-0.35	0.1-0.3	0.1-0.15	0.1
	oxidized	0.5-0.9	0.4-0.9	0.3-0.7	0.2-0.6
Monel (Ni-Cu)		0.3	0.2-0.6	0.1-0.5	0.1-0.14
Nickel	electrolytic	0.2-0.4	0.1-0.3	0.1-0.15	0.05-0.15
	oxidized	0.8-0.9	0.4-0.7	0.3-0.6	0.2-0.5
Platinum	black		0.95	0.9	0.9
Silver		0.04	0.02	0.02	0.02
Steel	polished plate	0.35	0.25	0.1	0.1
	rustless	0.35	0.2-0.9	0.15-0.8	0.1-0.8
	heavy plate			0.5-0.7	0.4-0.6
	cold-rolled	0.8-0.9	0.8-0.9	0.8-0.9	0.7-0.9
	oxidized	0.8-0.9	0.8-0.9	0.7-0.9	0.7-0.9
Tin	non oxidized	0.25	0.1-0.3	0.05	0.05
Titanium	polished	0.5-0.75	0.3-0.5	0.1-0.3	0.05-0.2
	oxidized		0.6-0.8	0.5-0.7	0.5-0.6
Wolfram	polished	0.35-0.4	0.1-0.3	0.05-0.25	0.03-0.1
Zinc	polished	0.5	0.05	0.03	0.02
	oxidized	0.6	0.15	0.1	0.1

## Appendix B – Table of emissivity for non-metals

Material	typical Emissivity				
	Spectral response	1.0 $\mu\text{m}$	2.2 $\mu\text{m}$	5.1 $\mu\text{m}$	8-14 $\mu\text{m}$
Asbestos		0.9	0.8	0.9	0.95
Asphalt				0.95	0.95
Basalt				0.7	0.7
Carbon	non oxidized		0.8-0.9	0.8-0.9	0.8-0.9
	graphite		0.8-0.9	0.7-0.9	0.7-0.8
Carborundum			0.95	0.9	0.9
Ceramic		0.4	0.8-0.95	0.8-0.95	0.95
Concrete		0.65	0.9	0.9	0.95
Glass	plate		0.2	0.98	0.85
	melt		0.4-0.9	0.9	
Grit				0.95	0.95
Gypsum				0.4-0.97	0.8-0.95
Ice					0.98
Limestone				0.4-0.98	0.98
Paint	non alkaline				0.9-0.95
Paper	any color			0.95	0.95
Plastic >50 $\mu\text{m}$	non transparent			0.95	0.95
Rubber				0.9	0.95
Sand				0.9	0.9
Snow					0.9
Soil					0.9-0.98
Textiles				0.95	0.95
Water					0.93
Wood	natural			0.9-0.95	0.9-0.95

## Appendix C – Quick start for serial communication

### Introduction

One special feature of the PIX Connect software contains the possibility to communicate via a serial COM-Port interface. This can be a physical COM-Port or a virtual COM-Port (VCP). It must be available on the computer where the PIX connect software is installed.

### Setup of the interface

1. Open the **Options** dialog and enter the tab “**Extended Communication**” to enable the software for the serial communication.
2. Select the mode “**COM-Port**” and choose the appropriate port.
3. Select the baud rate that matches the baud rate of the other communication device. The other interface parameters are 8 data bits, no parity and one stop bit (8N1).

These parameters are used in many other communication devices too. The other station must support 8 bit data.

4. Connect the computer with the communication device. If this is a computer too, use a null modem cable.

## Command list



The command list is provided on the software CD and in the PIX Connect software (**Help** → **SDK**). Every command must expire with CR/LF (0x0D, 0x0A).

## Appendix D – Interprocess Communication (IPC)



The description of the initialization procedure as well as the necessary command list is provided on the CD and in the PIX Connect software (**Help** → **SDK**).

2 SDK packages are available (can be found on the included software CD):

1. **Connect SDK:** requires the PIX Connect software
2. **Direct SDK:** no PIX Connect software required, supports Linux and Windows

The communication to the process imager device is handled by the PIX Connect software (**Imager.exe**) only. A dynamic link library (**ImagerIPC2.dll**) provides the interprocess communication (IPC) for other attached processes. The DLL can be dynamically linked into the secondary application. Or it can be done static by a lib file too. Both **Imager.exe** and **ImagerIPC2.dll** are designed for Windows Vista/ 7/ 8/ 10 only. The application must support call-back functions and polling mode.

The **ImagerIPC2.dll** will export a bunch of functions that are responsible for initiating the communication, retrieving data and setting some control parameters.

The main difference to the former Version 1 (**ImagerIPC.dll**) is the support of more than one Optris Xi via multiple instances of Optris PIX Connect.

## Appendix E – PIX Connect Resource Translator



A detailed tutorial is provided on the CD.

PIX Connect is a **.Net Application**. Therefore it is ready for localization. Localization as a Microsoft idiom means a complete adaption of resources to a given culture. Learn more about the internationalization topics consult Microsoft's developer documentation on

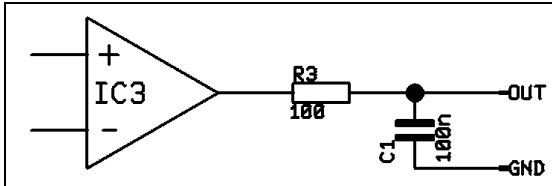
<http://msdn.microsoft.com/en-us/goglobal/bb688096.aspx>.

If desired the localization process can be illustrated in detail. Also the resizing of buttons or other visible resources and the support of right-to-left-languages are supported. Experts who have the appropriate tools should handle it. Nevertheless we have developed the small tool "**Resource Translator**" to make the translation of the resources of the PIX Connect application possible for everybody.

This tool helps to translate any visible text within the PIX Connect application.

## Appendix F – Wiring diagrams PIF for Xi 400

### Analog Output:



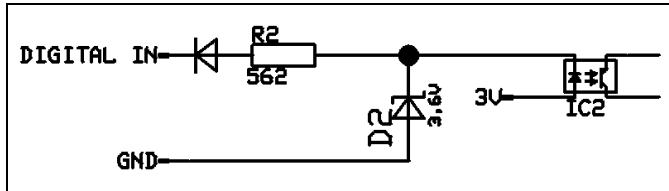
**Figure 34:** Analog output

For voltage measurements the minimum load impedance must be 10 kOhm.

The analog output can be used as a digital output too. The voltage for “no alarm” and “alarm on” is set within the software. The analog output (0 ... 10 V) has a 100 Ohm resistor in series. With a maximum current of 10 mA the voltage drop is 1 V.

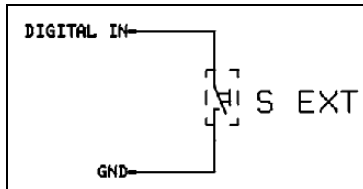
To use an alarm LED with a forward voltage of 2 V the analog output value for “alarm on” must be 3 V as maximum.



**Digital Input:****Figure 35:** Digital input

The digital input can be activated with a button to the Xi GND-Pin or with a low level CMOS/TTL signal: Low level 0...0.6 V; High level 2...24 V

Example Button:

**Figure 36:** Button

Analog input (usable voltage range: 0 ... 10 V):

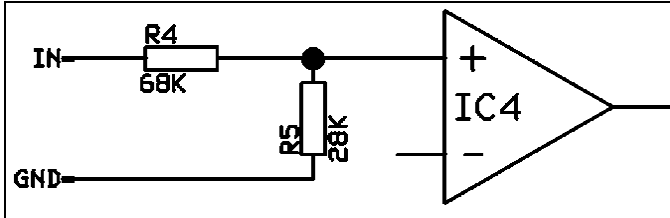


Figure 37: Analog input

### Relay output at industrial PIF [Part No.: ACPIPIF500V2CBxx]

The analog output must be set to "Alarm". The voltage level for AO1-AO3 can be set in the software (no alarm: 0 V/ alarm: 2-10 V).

REL1-3 (DO1-DO3):  $U_{\max} = 30 \text{ VDC}$

$I_{\max} = 400 \text{ mA}$

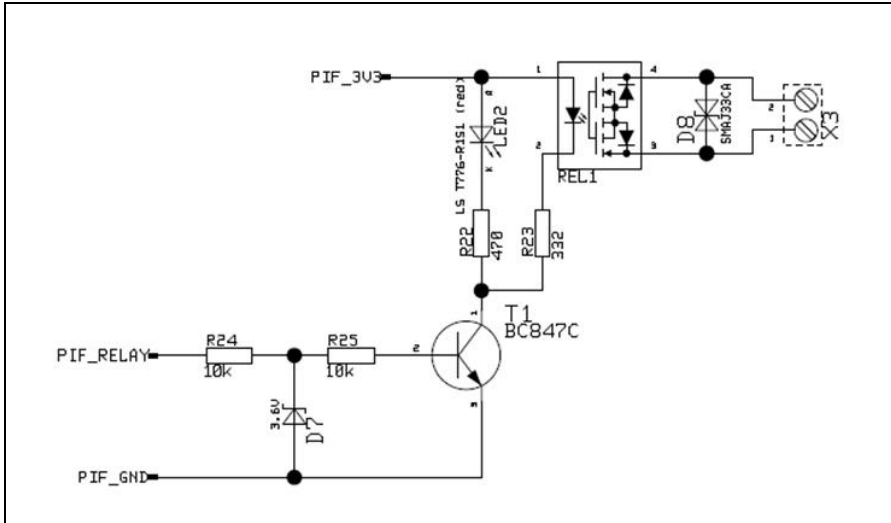


Figure 38: Relay output at industrial PIF

## Appendix G – Declaration of Conformity

### EG-Konformitätserklärung EU Declaration of Conformity



Wir / We

Optris GmbH  
Ferdinand Buisson Str. 14  
D-13127 Berlin

erklären in alleiniger Verantwortung, dass  
declare on our own responsibility that

die Produktserie optris Xi  
the product group optris Xi

den Anforderungen der EMV-Richtlinie 2014/30/EU und der Niederspannungsrichtlinie 2014/35/EU entspricht.  
meets the provisions of the EMC Directive 2014/30/EU and the Low Voltage Directive 2014/35/EU.

Angewandte harmonisierte Normen:  
Applied harmonized standards:

EMV Anforderungen / EMC General Requirements:

**EN 61326-1:2013** (Grundlegende Prüfanforderungen / Basic requirements)  
**EN 61326-2-3:2013**

Gerätesicherheit von Messgeräten / Safety of measurement devices:

**EN 61010-1:2010**  
**EN 60825-1:2015** (Lasersicherheit / Laser safety)

Dieses Produkt erfüllt die Vorschriften der Richtlinie 2011/65/EU (RoHS) des Europäischen Parlaments und des Rates vom 8. Juni 2011 zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten.

This product is in conformity with Directive 2011/65/EU (RoHS) of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Berlin, 13.11.2017

Ort, Datum / place, date



Dr. Ulrich Kientz  
Geschäftsführer / General Manager



optris Xi-MA-E2018-03-A