MICRO-EPSILON

More Precision

thermoIMAGER TIM // Compact thermal imaging cameras

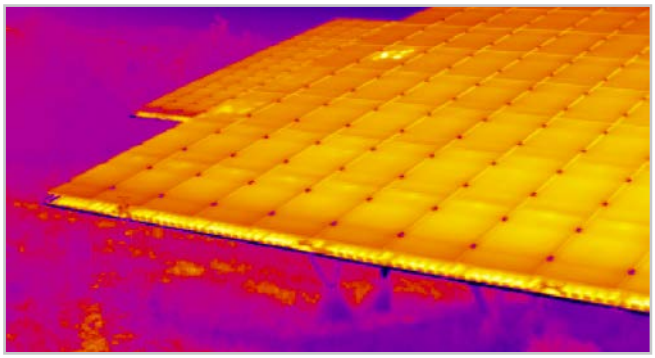
- *Temperature range from -20°C to 1800°C*
- *Compact cameras ideal for OEM applications*
- *Up to 1kHz for fast processes*
- *Resolution up to 764 x 480 pixels*
- *License-free analysis software and complete SDK included*

thermoIMAGER TIM - compact USB thermal imaging cameras for precise thermography

Non-contact measurements of temperature distribution using thermal imaging cameras enable to efficiently monitor and control temperature-criticial processes in various fields of application. The thermoIMAGER infrared cameras are ideal for stationary thermography providing an excellent price/performance ratio. The thermal imaging cameras are connected via USB 2.0 to a computer and are promptly ready for use. The license-free TIMConnect software visualises and records the detected temperature data as thermal images. Additionally, the software provides set up and configuration and enables to control the infrared cameras.

Functioning principle of Micro-Epsilon thermal imaging cameras

Thermal imaging cameras from Micro-Epsilon are designed to measure surface temperatures from -20°C to 1800°C. The infrared radiation emitted by a body is used for the measurement. As the measurement is a non-contact technology, the devices perform wear-free and can therefore be reliably used in the long term. Selectable models and optical systems enable to install the cameras in different distances from the surface. This enables measurements to the target from a safe distance in critical operation areas.

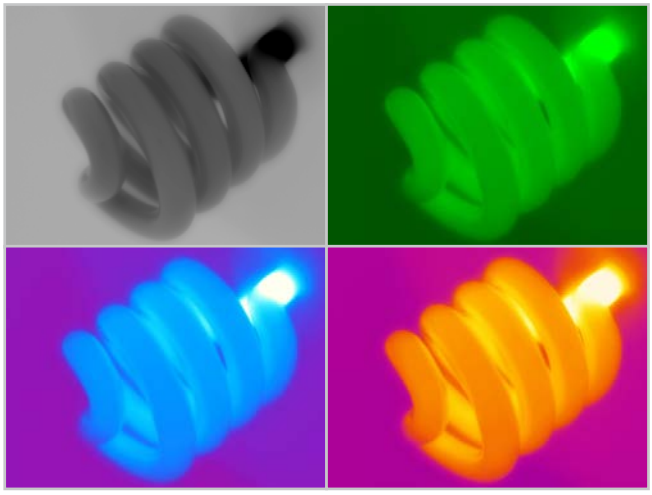


Fast temperature measurement even on large surfaces
Due to this non-contact technology, measurement objects can be detected precisely and wear-free. Large surfaces can be measured accurately at millisecond intervals. The camera can be operated in the line monitoring mode in order to continuously monitor the process.

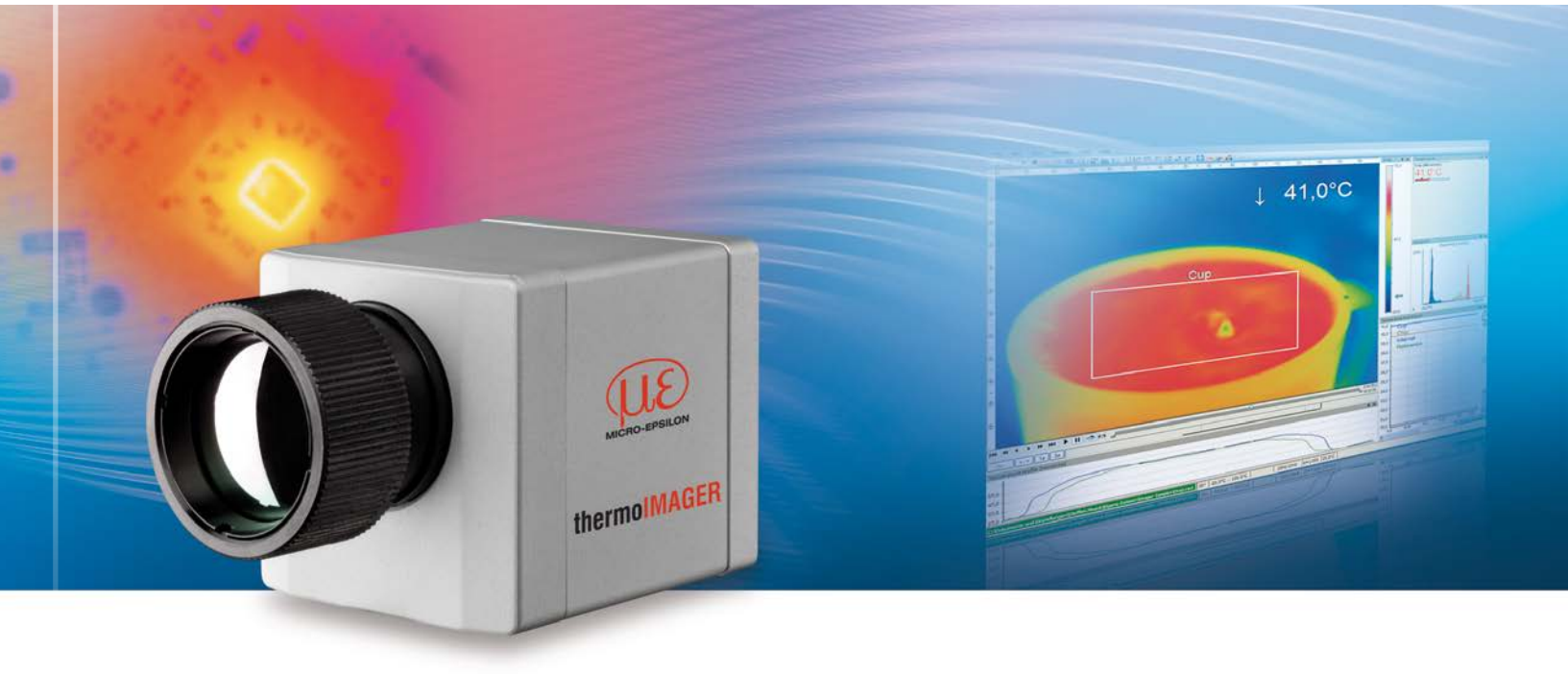
Compact design for mobile and stationary use
The thermoIMAGER cameras close the previous gap between portable infrared snapshot cameras and devices for stationary use.
Exemplary fields of applications:
- Process automation
- Test stations
- Research & Development
- Mobile measurement tasks

License-free software
- Automatic process and quality control
- Individual alarm threshold settings depending on the respective process
- Analog and digital signal input
- External communication of software via COM-Ports, DLL and LabVIEW driver
- Compatible with Windows XP and Windows 7 / 10

Easy process integration via Advanced interfaces
- USB cable extension up to 100m (Ethernet)
- Process interface (PIF) as analog or digital input/output
- Serial data communication via RS232



Large temperature measuring range
Thermal imaging cameras from Micro-Epsilon are suitable for use across a wide measuring range - from low temperatures prevalent in cooling chains or laboratories, to the highest temperatures in metal processing applications.



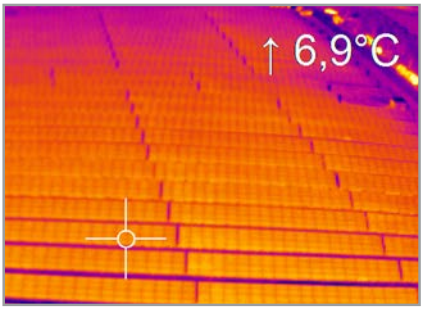
thermoIMAGER TIM 160

Miniaturized thermal imaging camera with USB interface

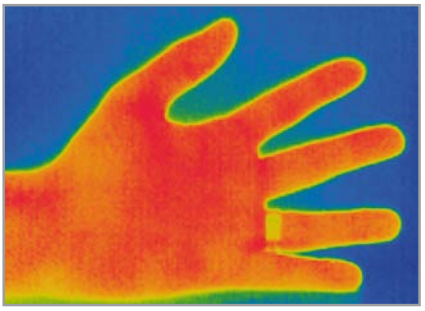
- Measuring range from -20°C to 900°C (special edition up to 1500°C)
- Excellent thermal sensitivity (NEDT) of 0.08K
- Exchangeable lenses with 6°/23°/48°FOV or 72°FOV
- Real-time thermography with 120Hz frame rate via USB 2.0 interface
- Power supply and data transfer via USB interface
- Extremely lightweight (195g) and robust (IP67)
- Extremely compact dimensions 45x45x62mm
- Analog input and output, trigger interface
- Software Developer Kit and LabVIEW samples included

Software

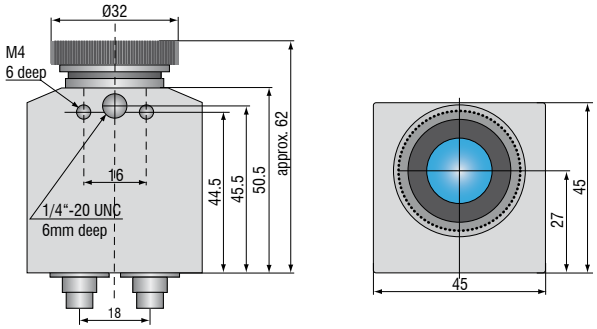
- Display of the thermal image in real time (120Hz) with recording function (video, snapshot)
- Complete set up of parameters and remote control of the camera
- Detailed analysis of fast, thermodynamic processes
- Output of analog temperature or alert values via the process interface
- Digital communication via RS232 or DLL for software integration



Surface measurements in industrial applications



Suitable lenses for every measurement distance



Model	TIM 160
Optical resolution	160 x 120 pixels
Temperature ranges	-20°C to 100°C / 0°C to 250°C / 150°C to 900°C, optional range: 200°C to 1500°C
Spectral range	7.5 to 13µm
Frame rate	120Hz
System accuracy	±2°C or ±2%, whichever is greater
Resolution (Display)	0.1°C
Lenses	72° / f = 3.3mm (min. distance 20mm); 48° / f = 5.7mm (min. distance 20mm); 23° / f = 10mm (min. distance 20mm); 6° / f = 35.5mm (min. distance 500mm)
Emissivity	0.10 to 1.00 adjustable
Thermal sensitivity (NETD)	0.1K with 48° FOV and 72° FOV [1] / 0.08K with 23° FOV [1] / 0.3K with 6° FOV [2]
Detector	Focal Plane Array (FPA) - uncooled micro bolometer 25x25µm²
Measurement modes	Flexible spot with crosshair marking, measuring field with automatic display of maximum-, minimum- or average value
Color palettes	Iron, rainbow, black-white, black-white inverted etc.
Operation and set up (via menu)	Measurement modes fully automatic or manual, color palettes, emissivity, file management, date/time,°C/°F, language
Outputs/digital	USB 2.0 / optional GigE
Process interface (electrically isolated)	0-10V output, 0-10V input, trigger input
Digital communication	via RS232 of PC / DLL interface used
Cable length	1m (standard), 5m, 10 m, 20m
Power supply	USB powered
Tripod mount	¼-20 UNC
Protection class	IP67
Ambient temperature	0°C to 50°C (with cooling jacket up to 315°C)
Storage temperature	-40°C to 70°C
Relative humidity	20 to 80%, non-condensing
Vibration	IEC 60068-2-6 (sine-shaped) /IEC 60068-2-64 (broadband noise)
Shock	IEC 60068-2-27 (25g and 50g)
Weight	195g, incl. lens

PC requirements: minimum 1.5GHz, 1GB RAM, Windows XP SP 2 or Windows 7

[1] Please note: measurement accuracy can be out of specification with distances below 200mm

[2] Please note: measurement accuracy can be out of specification with distances below 500mm

Scope of supply

TIM 160

- TIM process camera incl. a selectable lens
- Operation manual
- USB cable 1m
- Software for real-time processing and analysing thermal images
- Tripod mount
- PIF cable 1m
- Aluminum case

TIM 160/DK

- TIM process camera incl. three lenses 6°, 23°, 48°
- Certificate of calibration, adjusted to the included lenses
- Tripod mount 200 to 1000mm
- Aluminum case
- Operation manual
- USB cable 1m and 10m
- Software for real-time processing and analysing thermal images
- PIF cable 1m

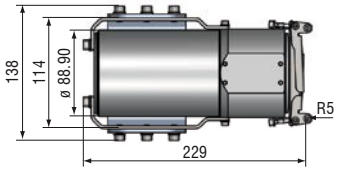
Cooling Jacket and Cooling Jacket Advanced
Universal cooling housing for infrared cameras up to 315°C

- Operation at ambient temperatures up to 315°C
- Also available as protection housing with cooling function up to 180°C
- Air/Water cooling with integrated air purging and optional protective windows
- Modular design for easy fitting of different devices and lenses
- Easy sensor removal on site due to quick-release chassis
- Integration of additional components like TIM NetBox, USB Server Gigabit and Industrial Process Interface (PIF) in the extended version

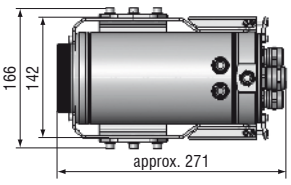
Model	Cooling Jacket	Cooling Jacket Advanced Standard	Cooling Jacket Advanced Extended
Protection class	IP 65	IP 65	IP 65
Ambient temperature	up to 180°C	up to 315°C[1)]	up to 315°C[1)]
Relative humidity	10 to 95% (non-condensing)	10 to 95% (non-condensing)	10 to 95% (non-condensing)
Material (housing)	V2A	V2A	V2A
Dimensions	237mm x 117mm x 138mm	271mm x 166mm x 182mm	426mm x 166mm x 182mm
Weight	4.5kg	5.7kg	7.8kg
Air purge collar	G1/4“ internal thread G3/8“ External thread	G1/4“ Internal thread G3/8“ External thread	G1/4“ Internal thread G3/8“ External thread
Cooling water fittings	G1/4“ Internal thread G3/8“ External thread	G1/4“ Internal thread G3/8“ External thread	G1/4“ Internal thread G3/8“ External thread
Cooling water pressure	max. 15 bar (217 psi)	max. 15 bar (217 psi)	max. 15 bar (217 psi)
Scope of supply	▪ Cooling Jacket, consisting of housing and chassis	▪ Cooling Jacket Advanced, consisting of casing with mounting angle, chassis ▪ Assembly instructions ▪ Focusing unit or front attachment [2)]	▪ Cooling Jacket Advanced, consisting of casing with mounting angle, chassis ▪ Mounting accessories for TIM NetBox or USB Server Gigabit and Industry PIF ▪ Assembly instructions ▪ Focusing unit or front attachment [2)]

[1)] Cable for up to 250°C ambient temperature as well as cable cooling for up to 315°C available.
[2)] Must be ordered separately.

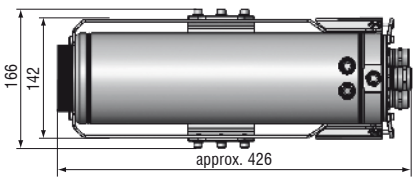
Cooling Jacket

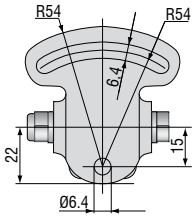


Cooling Jacket Advanced – Standard version

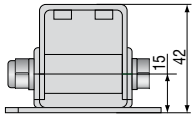


Cooling Jacket Advanced – Extended version





TM-MB-TIM Mounting base, adjustable

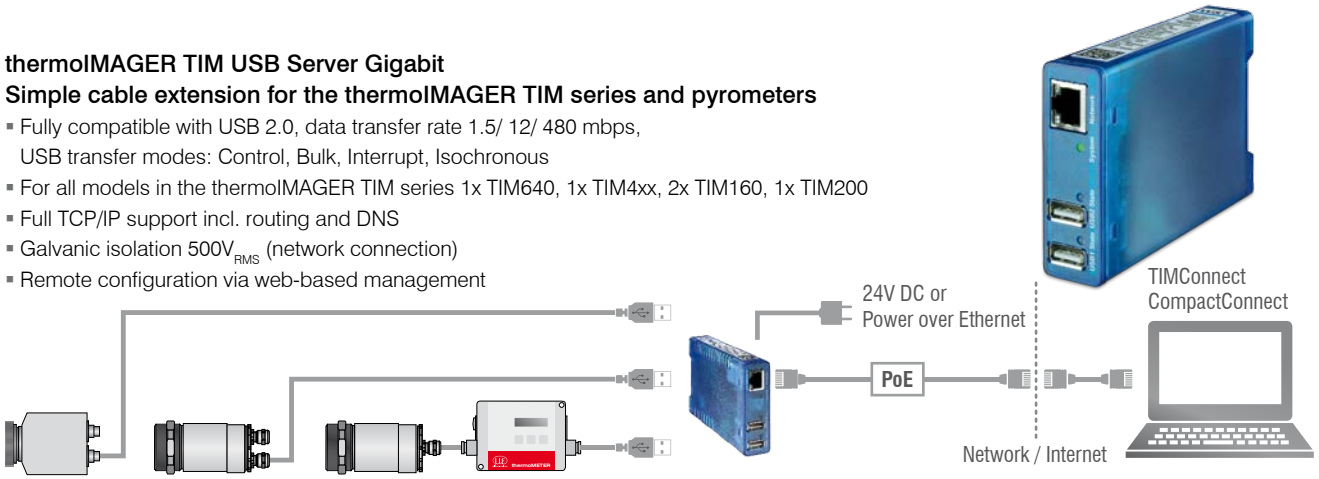


TM-PH-TIM Protective housing incl. mounting base

thermoIMAGER TIM USB Server Gigabit

Simple cable extension for the thermoIMAGER TIM series and pyrometers

- Fully compatible with USB 2.0, data transfer rate 1.5/ 12/ 480 mbps, USB transfer modes: Control, Bulk, Interrupt, Isochronous
- For all models in the thermoIMAGER TIM series 1x TIM640, 1x TIM4xx, 2x TIM160, 1x TIM200
- Full TCP/IP support incl. routing and DNS
- Galvanic isolation 500V_{RMS} (network connection)
- Remote configuration via web-based management



Model	TIM USB Server Gigabit
USB ports	Two independent USB ports
USB speed	480Mbit/s
Network	10/100/1000 BaseT (max. 1000Mbit/s)
Power supply	Power over Ethernet (PoE) class 3 (6.49 - 12.95W) or via screw terminal DC 24V ... 48V (±10%)
Power consumption	External power supply (24V DC) without USB devices: typ. 120mA External power supply (24V DC) with 2 USB devices each 2.5W: typ. 420mA
Ambient temperature	Storage: -40 ... 85°C | In operation, individually assembled: 0 ... 50°C
Permissible relative humidity	0 - 95% (non-condensing)
Housing	Compact plastic housing for DIN rail mount, 105 x 75 x 22mm
Weight	200g
Scope of supply	1 x USB Server Gigabit | 24 V DC wall plug transformer | Quick guide [1]
USB protocols	USB 1.0 / 1.1 / 2.0 Control / Bulk / Interrupt / Isochronous
Protocols for direct network connection	TCP/IP: Socket | Auxiliary protocols: ARP, DHCP, HTTP, PING Inventory keeping, group management

[1] TIMConnect CD or Compact Connect CD: USB redirector \| WuTility Management Tool \| Operating instructions (DE/EN)

Industrial process interface

Camera and process control for use in industrial environments

- Separate fail-safe relay output
- TIM hardware with all cable connections and the TIMConnect software are permanently monitored during operation

Model	Industrial process interface
Protection class	IP65 (NEMA-4)
Ambient temperature	-30°C to 85°C
Storage temperature	-30°C to 85°C
Relative humidity	10 to 95% (non-condensing)
Vibration resistance	IEC 60068-2-6 (non-condensing)/ IEC 60068-2-64 (broadband noise)
Shock	IEC 60068-2-27 (25g and 50g)
Weight	610g (with 5m cable)
Cable length	5m, optional 10m and 20m or HT cable (180° or 250°)
Power supply	5 – 24V DC
LED indicators	2 green LEDs for voltage and fail safe / 3 red LEDs for alarm relay status
Isolation	500V AC_{RMS} between TIM camera und process
Outputs	3 analog/ alarm outputs | 3 alarm relays [1]
Inputs	2 analog inputs |1 digital input
Ranges	0 – 10V (for AO 1 – 3) [2] | 0 – 30V / 400mA (for alarm relays DO1 – 3) | 0 – 10V (for AI 1 – 2) | 24V (for DI)
Analog inputs	Emissivity setting | Ambient temperature compensation | Reference temperature | Uncommitted value Flag control | Triggered snapshots, triggered recordings, triggered line scan camera
Digital input	Flag control | Triggered snapshots, triggered recordings, triggered line scan camera
Analog outputs	Main measuring range | Measuring range | Internal temperature | Flag status

[1] active when AO1, 2 or 3 is / are programed as alarm output [2] dependent on supply voltage

thermoIMAGER TIM NetPC / NetPCQ
PC solution for thermoIMAGER TIM applications

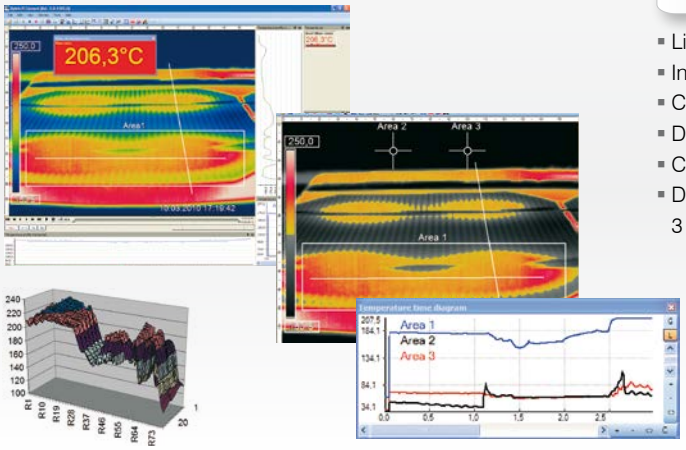
TIM NetPC is a professional, embedded industrial PC solution with a passive cooling (fanless) for thermoIMAGER applications and is suitable for top hat rail mounting. The NetPC and the TIM camera can be operated in combination as stand-alone system. Remote maintenance via Ethernet is possible. Data provided by the TIM camera can be stored directly on the NetPC where customer-specific software can also be installed. A recovery-stick is included in the scope of delivery.

thermoIMAGER TIM NetPC

- Supports all thermoIMAGER TIM models
- Supports 120Hz (TIM 160), up to 80Hz (TIM 4x0), up to 32Hz (TIM 640) frame rates
- Including TIMConnect software
- Monitor via VGA (analog)
- Integrated watchdog feature
- Optional: up to 20m USB cable, high temperature USB cable, extendable up to 100m Ethernet cable (PoE)

Model	TIM NetPC	TIM NetPCQ
Ambient temperature	0 to 50°C	
Storage temperature	-20 to 60°C	
Relative humidity	10 to 95% (non-condensing)	
Dimensions	165 x 65 x 130mm (W x H x D)	
Material (housing)	Anodized Aluminum	
Weight	1000g	
Vibration	IEC-2-6: 3G, 11 - 200Hz, each axis	
Shock	IEC-2-27: 50G, 11ms, each axis	
Operating system	Windows 7 embedded	
Power supply	12 - 24V DC	
Power consumption	approx. 9.5W without TIM [0.76A with 12V]	
Cooling	passive cooling (fanless)	
Processor	Intel® Atom™ 2600 @ 2x1.6GHz Dual	Intel® Atom™ J1900 @ 4x2.4GHz
Hard disc drive	integrated 64GB SSD	
RAM	2GB DDR3 RAM 800MHz	
Ports	1 Gbit/s (Gig E), 2 x RS 232, 4 x USB 2.0, VGA	1 Gig E, 2 x RS 232 / 485, 3 x USB 2.0, 1 x USB 3.0, VGA
Additional functions	1x status LED	

SOFTWARE FEATURES **TIMConnect**



Comprehensive IR camera software

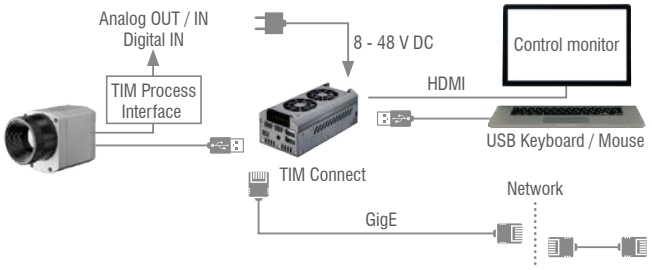
- License-free analysis software and complete SDK included
- Intuitive user interface
- Camera remote control via software
- Displays several camera images in different windows
- Compatible with Windows 7 and 8 and Linux (ubuntu)
- Data output via PIF hardware interface using up to 3 analog channels

Windows 7

Windows 10

thermoIMAGER TIM NetBox
Miniature PC for thermoIMAGER TIM

- Can be integrated into CoolingJacket Advanced Extended
- Miniature PC for TIM 160/ 4x0 standalone mode or for cable extension
- Supports 120Hz (TIM 160) up to 70Hz (TIM 4x0) frame rate, 32Hz (TIM 640)
- Integrated hardware and software watchdog
- Optional: up to 20m USB cable, high temperature USB cable, extendable up to 100m Ethernet cable (PoE)

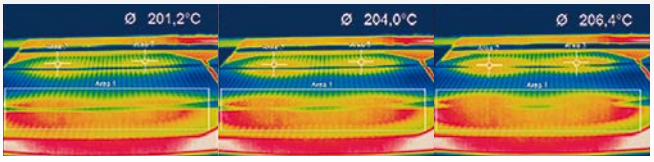


thermoIMAGER TIM NetBox

Model	TIM NetBox
Operating temperature	0 to 50°C
Storage temperature	-20 to 75°C
Relative humidity	10 to 95% (non-condensing)
Material (housing)	Anodized Aluminum
Dimensions	113 x 57 x 39mm
Weight	385g
Vibration	IEC 60068-2-6 (sine-shaped) / IEC 60068-2-64 (broadband noise)
Shock	IEC 60068-2-27 (25g and 50g)
Operating system	Windows 7 Professional
Power supply	8 ... 48VDC or Power over Ethernet (PoE/ 1000BASE-T)
Power consumption	7.5W (+ additional 2.5W for TIM camera)
Cooling	Active via two integrated fans
Module	COM Express® mini embedded board
Processor	Intel® E3845 Quad Core, 1.91GHz
Hard disc drive	16GB SSD
RAM	2GB (DDR2, 533MHz)
Ports	2x USB 2.0, 1x USB 3.0, 1x Mini USB 2.0, Micro HDMI, Ethernet (Gigabit Ethernet)
Extensions	micro SDHC/ SDXC card
Additional functions	4x status LEDs

Online and offline data analysis

- Real time temperature information (°C or °F) in main window, as digital display or graphic display
- Detailed analysis using measuring fields, automatic hotspot/cold-spot search
- Logical linking of temperature information
- Slow-motion replay without connected camera
- Various color palettes to highlight thermal contrasts



Video recording and snapshot feature (IR or BI-SPECTRAL)

- Recording of video sequences and individual images for later analysis or documentation
- Adjustable frame rate to reduce data volume
- Display of snapshot process for direct analysis

Temperature data analysis and documentation

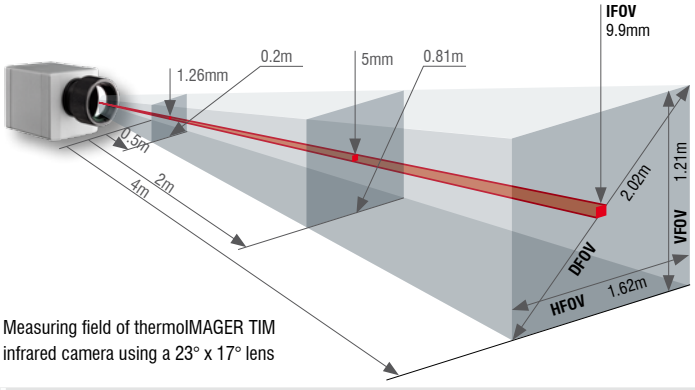
- Triggered data collection
- Radiometric video sequences (*.ravi) and snapshots (*.tiff)
- Thermal images as *.avi / *.tiff or text file *.csv, *.dat incl. complete temperature information
- Data transfer in real time to other software programs via DLL or COM port interfaces

TIM 160 / 200 160 x 120 px	Focal length [mm]	Angle	Minimum measurement distance*		Distance to measurement object [m]											
					0.02	0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
23° Standard lens	10	23° 17° 29° 2.48 mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.012 0.009 0.015 0.1	0.043 0.032 0.054 0.3	0.08 0.06 0.10 0.5	0.12 0.09 0.16 0.8	0.21 0.15 0.26 1.3	0.41 0.30 0.51 2.5	0.81 0.60 1.01 5.0	1.62 1.21 2.02 9.9	2.44 1.81 3.03 14.9	4.1 3.0 5.1 24.8	12.2 9.0 15.2 74.4	40.6 30.1 50.5 248.0
6° Telephoto lens	35.5	6° 5° 8° 0.70 mrad	0.5m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]					0.06 0.04 0.07 0.4	0.11 0.09 0.14 0.7	0.23 0.17 0.28 1.4	0.45 0.34 0.57 2.8	0.68 0.51 0.85 4.2	1.1 0.8 1.4 7.0	3.4 2.5 4.2 21.1	11.3 8.5 14.2 70.4
48° Wide angle lens	5.7	41° 31° 51° 4.39 mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.022 0.016 0.027 0.1	0.082 0.059 0.101 0.4	0.16 0.11 0.19 0.9	0.23 0.17 0.29 1.3	0.38 0.28 0.47 2.2	0.76 0.55 0.94 4.4	1.51 1.10 1.86 8.8	3.00 2.19 3.72 17.5	4.50 3.28 5.57 26.3	7.5 5.5 9.3 43.9	22.5 16.4 27.8 131.6	74.9 54.5 92.7 438.6
72° Wide angle lens	3.3	72° 52° 89° 7.51 mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.039 0.027 0.048 0.2	0.152 0.106 0.186 0.8	0.29 0.20 0.36 1.5	0.43 0.30 0.53 2.3	0.72 0.50 0.87 3.8	1.42 0.99 1.74 7.5	2.84 1.98 3.46 15.0	5.66 3.95 6.91 30.0	8.49 5.92 10.35 45.0	14.1 9.9 17.2 75.1	42.4 29.6 51.7 225.2	141.4 98.6 172.3 750.8

TIM 400 / 450 / G7 382 x 288 px	Focal length [mm]	Angle	Minimum measurement distance*		Distance to measurement object [m]											
					0.02	0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
38° Standard lens	15	38° 29° 48° 1.67 mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.024 0.018 0.030 0.1	0.079 0.060 0.099 0.2	0.15 0.11 0.18 0.4	0.21 0.16 0.27 0.5	0.35 0.26 0.44 0.9	0.70 0.52 0.87 1.7	1.39 1.04 1.73 3.4	2.76 2.07 3.46 6.7	4.14 3.11 5.18 10.0	6.9 5.2 8.6 16.7	20.7 15.5 25.9 50.0	68.9 51.7 86.2 166.7
13° Telephoto lens (not G7)	41	13° 10° 17° 0.61 mrad	0.5m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]					0.12 0.09 0.15 0.3	0.23 0.17 0.29 0.6	0.47 0.35 0.58 1.2	0.94 0.70 1.17 2.5	1.40 1.05 1.75 3.7	2.3 1.7 2.9 6.1	7.0 5.2 8.8 18.4	23.4 17.5 29.2 61.2
62° Wide angle lens	11	62° 49° 79° 2.27 mrad	0.5m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.040 0.030 0.050 0.1	0.136 0.103 0.170 0.2	0.26 0.19 0.32 0.5	0.38 0.28 0.47 0.7	0.62 0.47 0.77 1.2	1.22 0.92 1.53 2.29	2.42 1.83 3.03 4.56	4.83 3.65 6.05 9.11	7.23 5.47 9.06 13.65	12.0 9.1 15.1 22.7	36.1 27.3 45.2 68.2	120.3 90.9 150.8 227.3
80° Wide angle lens	7.7	80° 56° 97° 3.25 mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]		0.182 0.119 0.218 0.3	0.35 0.23 0.41 0.7	0.84 0.55 1.00 1.6	0.84 0.54 1.00 1.6	1.65 1.08 1.97 3.3	3.29 2.14 3.92 6.5	6.55 4.28 7.83 13.0	9.82 6.41 11.73 19.5	16.4 10.7 19.5 32.5	49.0 32.0 58.5 97.4	163.4 106.6 195.1 324.7

FOV = Field of view; HFOV = Horizontal field of view; VFOV = Vertical field of view; DFOV = Diagonal dimension of the total measuring field at the object level; IFOV = Indicated field of view
Table with examples showing which measuring field sizes and pixel sizes are reached at which distance. Various lenses are available for optimal configuration of the camera. Wide angle lenses have radial distortion due to the angle of their aperture. The TIMConnect software has an algorithm which corrects this distortion.

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



Measuring field of thermoIMAGER TIM infrared camera using a 23° x 17° lens

- Standard-, telephoto- and wide angle lenses for different applications
- High quality germanium lenses and special anti-reflective coating for excellent optics
- Factory-calibrated lenses for easy exchange of optical system without recalibration

Measuring field sizes can be calculated online at www.micro-epsilon.com/optikkalkulator.

TIM 640 640 x 480 px	Focal length [mm]	Angle	Minimum measurement distance*	Distance to measurement object [m]											
					0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
33° Standard lens	18.7	33° 25° 41° 0.91 mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.068 0.051 0.085 0.1	0.13 0.09 0.16 0.2	0.19 0.14 0.23 0.3	0.31 0.23 0.38 0.5	0.60 0.45 0.75 0.9	1.20 0.89 1.49 1.8	2.38 1.77 2.97 3.6	3.57 2.65 4.45 5.5	5.9 4.4 7.4 9.1	17.8 13.2 22.2 27.3	59.3 44.2 74.0 90.9
15° Teleoptik	41.5	15° 11° 19° 0.41 mrad	0.5m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]				0.13 0.10 0.17 0.2	0.26 0.20 0.33 0.4	0.52 0.39 0.66 0.8	1.05 0.79 1.31 1.6	1.57 1.18 1.96 2.5	2.6 2.0 3.3 4.1	7.8 5.9 9.8 12.3	26.1 19.6 32.7 41.0
60° Weitwinkeloptik	10.5	60° 45° 75° 1.62 mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.128 0.091 0.157 0.2	0.25 0.18 0.30 0.3	0.36 0.26 0.44 0.5	0.59 0.42 0.72 0.8	1.17 0.83 1.43 1.6	2.32 1.66 2.85 3.2	4.63 3.31 5.69 6.5	6.94 4.96 8.52 9.7	11.6 8.3 14.2 16.2	34.6 24.7 42.6 48.6	115.4 82.4 141.8 161.9
90° Super wide angle lens	7.7	90° 64° 111° 2.21 mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.220 0.138 0.260 0.2	0.43 0.27 0.50 0.4	0.63 0.39 0.73 0.7	1.03 0.64 1.21 1.1	2.03 1.27 2.39 2.2	4.04 2.53 4.76 4.4	8.06 5.05 9.50 8.8	12.07 7.57 14.24 13.2	20.1 12.6 23.7 22.1	60.3 37.8 71.1 66.2	200.8 125.9 237.0 220.8

TIM M1 382 x 288 px	Focal length [mm]	Angle	Minimum measurement distance*	Distance to measurement object [m]											
					0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
f=16mm Wide angle lens	16	20° 15° 25° 0.94 mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]		0.07 0.05 0.09 0.2	0.11 0.08 0.13 0.3	0.18 0.14 0.22 0.5	0.36 0.27 0.45 0.9	0.72 0.54 0.90 1.9	1.43 1.08 1.79 3.8	2.15 1.62 2.69 5.6	3.6 2.7 4.5 9.4	10.7 8.1 13.5 28.1	35.8 27.0 44.9 93.8
f=25mm Standard lens	25	13° 10° 16° 0.60 mrad	0.5m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.023 0.017 0.029 0.1	0.05 0.03 0.06 0.1	0.07 0.05 0.09 0.2	0.11 0.09 0.14 0.3	0.23 0.17 0.29 0.6	0.46 0.35 0.57 1.2	0.92 0.69 1.15 2.4	1.38 1.04 1.72 3.6	2.3 1.7 2.9 6.0	6.9 5.2 8.6 18.0	22.9 17.3 28.7 60.0
f=50mm Telephoto lens	50	7° 5° 8° 0.30 mrad	1.5m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]				0.06 0.04 0.07 0.2	0.11 0.09 0.14 0.3	0.23 0.17 0.29 0.6	0.46 0.35 0.57 1.2	0.69 0.52 0.86 1.8	1.1 0.9 1.4 3.0	3.4 2.6 4.3 9.0	11.5 8.6 14.4 30.0
f=75mm Super telephoto lens	75	4° 3° 5° 0.20 mrad	2.0m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]					0.08 0.06 0.10 0.2	0.15 0.12 0.19 0.4	0.31 0.23 0.38 0.8	0.46 0.35 0.57 1.2	0.8 0.6 1.0 2.0	2.3 1.7 2.9 6.0	7.6 5.8 9.6 20.0

Please note: the camera provides 382 x 288 px in the 80Hz mode

TIM M1 with VGA resolution 764 x 480 px	Focal length [mm]	Angle	Minimum measurement distance*		Distance to measurement object [m]										
					0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
f=16mm Wide angle lens	16	39° 25° 46° 0.94 mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]		0.14 0.09 0.17 0.2	0.21 0.14 0.25 0.3	0.36 0.23 0.42 0.5	0.72 0.45 0.85 0.9	1.43 0.90 1.69 1.9	2.87 1.80 3.38 3.8	4.30 2.70 5.08 5.6	7.2 4.5 8.5 9.4	21.5 13.5 25.4 28.1	71.6 45.0 84.6 93.8
f=25mm Standard lens	25	26° 16° 30° 0.60 mrad	0.5m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.046 0.029 0.054 0.1	0.09 0.06 0.11 0.1	0.14 0.09 0.16 0.2	0.23 0.14 0.27 0.3	0.46 0.29 0.54 0.6	0.92 0.58 1.08 1.2	1.83 1.15 2.17 2.4	2.75 1.73 3.25 3.6	4.6 2.9 5.4 6.0	13.8 8.6 16.2 18.0	45.8 28.8 54.1 60.0
f=50mm Telephoto lens	50	13° 8° 15° 0.30 mrad	1.5m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]				0.11 0.07 0.14 0.2	0.23 0.14 0.27 0.3	0.46 0.29 0.54 0.6	0.92 0.58 1.08 1.2	1.38 0.86 1.62 1.8	2.3 1.4 2.7 3.0	6.9 4.3 8.1 9.0	22.9 14.4 27.1 30.0
f=75mm Super telephoto lens	75	9° 5° 10° 0.20 mrad	2.0m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]					0.15 0.10 0.18 0.2	0.31 0.19 0.36 0.4	0.61 0.38 0.72 0.8	0.92 0.58 1.08 1.2	1.5 1.0 1.8 2.0	4.6 2.9 5.4 6.0	15.3 9.6 18.0 20.0

Please note: the camera provides 764 x 480 px in the 32Hz mode

MICRO-EPSILON

MICRO-EPSILON USA
8120 Brownleigh Dr. · Raleigh, NC 27617 / USA
Phone +1/919/787-9707 · Fax +1/919/787-9706
me-usa@micro-epsilon.com · **www.micro-epsilon.com**