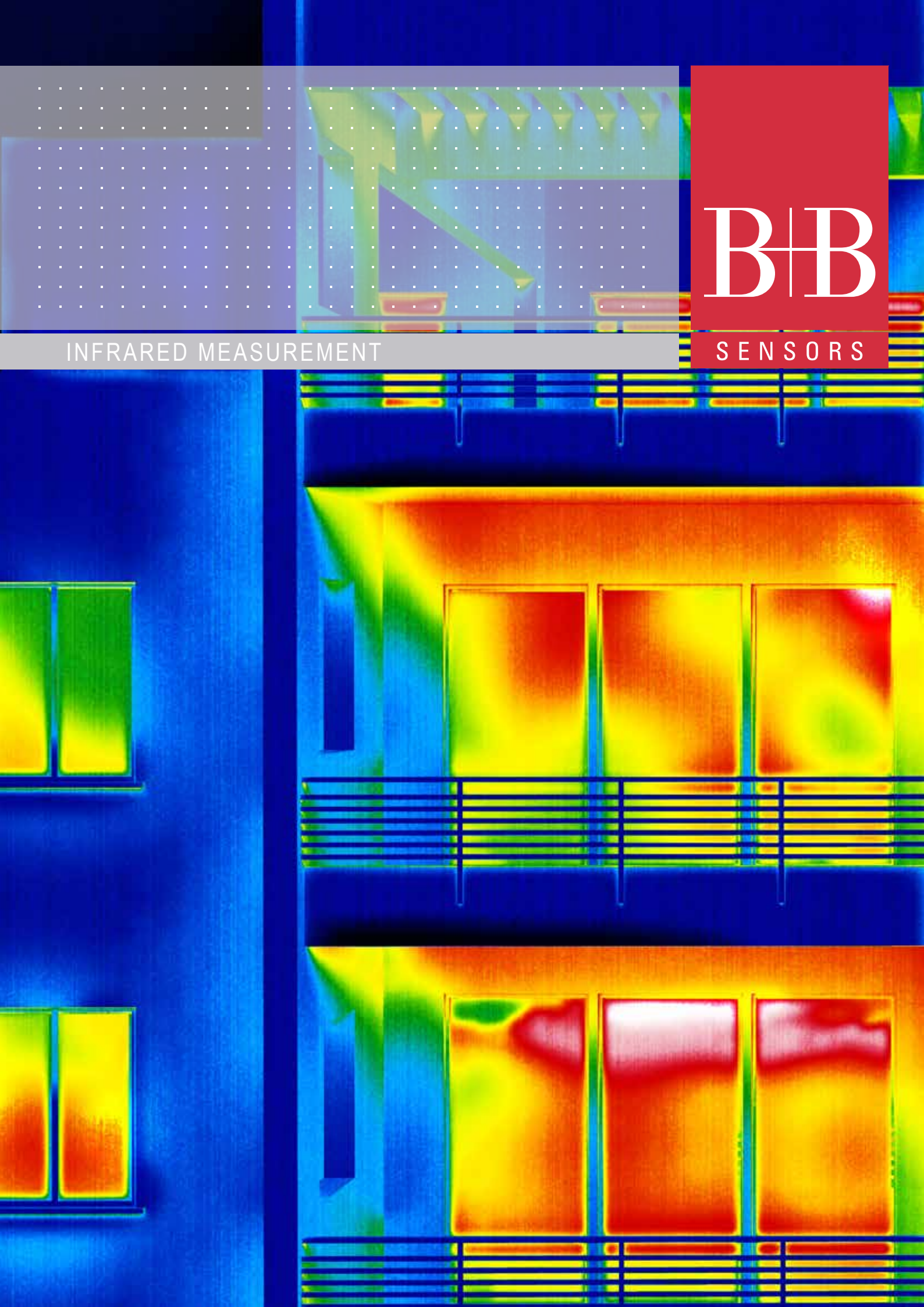
INFRARED MEASUREMENT
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TEMPERATURE | HUMIDITY | PRESSURE
INFRARED MEASUREMENT TECHNOLOGY BY B+B!

CONTENT

B+B Thermo-Technik GmbH offers you the solution for your temperature, humidity or pressure measurement!

B+B is located in Donaueschingen a city in the southwest of Germany. From there the quality products are sold worldwide.

A clear proof of our Quality Management Policy which you can trust is our Quality Management System according to DIN EN ISO 9001:2008 and DIN EN ISO 13485:2012

Take advantage of B+B Thermo-Technik GmbH´s long-term experience in the temperature- and humidity measurement.

In this brochure we put together our standard infrared products for you. Of course this brochure does not represent our whole product range, so if you need something special do not hesitate to send us your enquiry. Our competent sales team will find the right solution for you!

Temperature measurement on rotating or live parts

If industrial handheld thermometer or handy basic model for fast measurements here and there:
B+B Thermo-Technik has the right thermometer.
The portable laser thermometers for non-contact temperature measurements are characterized by connecting modern industrial design with excellent technical parameters. High-quality precision optics guarantee the precise measurements of objects in every distance.

Infrared-temperature measuring device Flash MiniSight

with built-in targeting laser

Description

Technical data

Measuring range	-32...+530 °C or -20...+980 °F
Accuracy	±1% or ±1 °C at +20…+530 °C, ±1,5 °C at 0…+19,9 °C, ±2,5 °C at -20…-0,1 °C, ±3 °C at -32…-20,1 °C
Optical resolution (D:S)	20:1
Smallest measuring spot	13 mm
Display resolution	0,1 °C/ 0,1 °F
Response time	300 ms
Spectral range	8...14 µm
Emission factor	Adjustable 0,100...1,100
Measuring value display	Min/ Max/ Hold/ °C/ °F/ Offset
Alarm function	Visual and acoustical high-/low-alarm
Interface, Software	USB-interface, OptrisConnect Reportsoftware
Laser	< 1 mW Laser Class II2, beam input with 9 mm offset
Battery	9 V Alkaline
Dimensions	(LxWxH) 195x134x50 mm
Scope of delivery	Flash Mini Sight device incl. 9 V-battery, operation manual, hand strap, device bag, protection case, OptrisConnect-Software, USB-cable, stand adapter

Article	Art.-no.
Infrared temperature measuring device with built-in targeting laser	0560 0448

Features:

- Temperature range from -32...+530 °C
- Precision optics for accurate non-contact temperature measurement
- Fast 0.3 second scanning of cold and hot spots
- Laser sighting with narrow beam aiming for accurate readings
- Adjustable acoustic HIGH-/LOW-alarm with changing backlight colors
- USB interface, thermocouple input type K, OptrisConnect Report Software
- Extremely lightweight

Areas of application:

- Electrical and mechanical maintenance
- Heating, air-condioning and ventilation
- Automotive testing
- Electrics
- Handymen

Infrared-temperature measuring device 8869
with built-in targeting laser

Description

Technical data

Measuring range	-20...+420 °C
Accuracy	±2% at -20…+100 °C, ±3% at +100…+420 °C
Resolution	1 °C
Emission factor	Default 0,95
Display	LCD-Display illuminated
Optical resolution (D:S)	8:1
Response time	1 s
Laser	Laser 570 nm
Automatic switching off	After approx. 4 s
Ambient temperature	0...+50 °C
Battery	9 V alkaline
Dimensions	(LxWxH) 170x44x40 mm
Scope of delivery	Temperature measuring device with hand strap, protection case, 1 battery, operation manual on CD

Article	Art.-no.
Infrared temperature measuring device with built-in targeting laser	0560 8869

Features:

- Laserpointer
- Emissivity 0,95 by default
- HOLD function
- Automatic switching off
- Illuminated display
- Battery change signal

Areas of application:

- Reliable tempearture measurements in moving parts
- Proven on inaccessible measuring points
- Fast and non-contact temperature measurement
- Absolutely hygienic temperature measurement

Infrared-temperature measuring device 8895

with built-in targeting laser

Description

Technical data

Measuring range	-40...+816 °C or -40...+1500 °F
Accuracy	±2 °C at <0 °C, ±2% / 2 °C at <300 °C, ±2,5% / 5 °C at 300 ...500 °C, ±3% at > 500 °C
Resolution	0,1 °C / 0,1 °F at < 280 °C, 1,0 °C / 1,0 °F at > 280 °C
Emission factor	Adjustable 0,3...1,0
Display	Illuminated LCD-display, switchable in °C or °F
Optical resolution (D:S)	12:1
Response time	500 ms
Laser	Laser 670 nm, <1 mW, Class 2
Automatic switching off	After approx. 10 s
Battery	2x1,5 V, Mignon AA
Dimensions	(LxWxH) 195x134x50 mm
Scope of delivery	Measuring device with protection case and hand strap, incl. 2 batteries in handy service case

Artikel	Art.-Nr.
Infrared temperature measuring device with built-in targeting laser	IR 8895

Features:

- Laserpointer
- Emissivity adjustable 0,3…1,0
- Limit values MIN / MAX adjustable
- Acoustic MIN / MAX alarm
- Last 9 measurements can be saved
- Illuminated display
- Automatic switching off

Areas of application:

- Measuring on moving objects e.g. engines and waves
- Measuring on sterile objects and food
- Measuring on live parts e.g. transformators and power rails
- Measuring on objects that can not be touched e.g. newly painted parts or chemicals
- Measuring on objects that are far away
- Measuring on dangerous parts or parts that are difficult to access

Infrared-temperature measuring device Dual Focus

with cross hair laser sight

Description

Technical data

Measuring range	-35 °C at 900 °C
Accuracy (at T_{Amb} of 23 °C (±5))	±0,75 % at +100...+900 °C) ±0,75 °C at +20...+99,9 °C ±1,5 °C at -20...+19,9 °C ±2,5 °C at -35... -20,1 °C
Optical resolution (D:S)	75:1
Smallest measuring spot	1 mm
Display resolution	0,1 °C
Spectral range	8...14 µm
Emission factor	Adjustable 0,100...1,100
Measurement display	MAX, MIN, DIF, AVG, HOLD
Alarm function	Visual and acoustic-/ Low-Alarm
Interface, Software	USB-interface, OptrisConnect oscilloscope-software for 20 measuring values per second
Laser	<1mW, Class II, 630-650 nm SF: patented cross hairs laser (Size of cross hairs = measuring spot size at every distance) CF: Twopoint-laser (size of laser point = measuring spot size at focus distance)
Battery	2x AA Alkaline-batteries or USB
Dimensions	(LxWxH) 195x134x50 mm
Scope of delivery	Dual Focus device incl. USB cable & software, Thermocouple probe type K, Transportcase, padded device bag, carrier bag, batterys

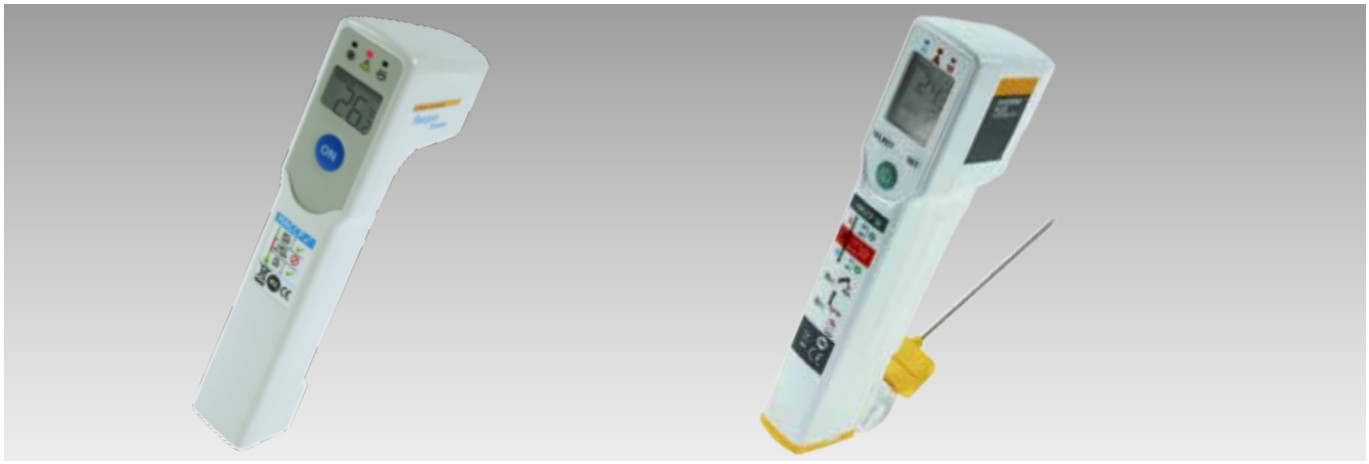
Article	Art.-no.
Infrared temperature measuring device with built-in targeting laser	0560 0027

Features:

- The new performance standard of infrared thermometers with spot sizes as small as 1 mm
- Patented crosshair laser sighting marks the actual spot size at any distance
- Tempearture range from -35...900 °C
- Switchable optics with resolution 75:1
- Thermocouple input type K
- USB interface and graphic software with oscilloscope function
- Multi function flip display

Areas of application:

- Portable measuring tasks on non-metalic surfaces
- Preventive maintenance
- Punctual control processes, e.g. in the quality assurance, research amd development, etc.
- Detection of thermic heat bridges on house fronts and indoors



Thermometers for food safety

The Fluke FoodPro thermometer provides a complete temperature measurement and monitoring solution for food-service professionals. It includes two useful temperature inspection tools, which are designed to enable foodservice professionals a quickly and accurately measure of food product temperatures and to help detect potential food safety problems.

The Fluke FoodPro non-contact thermometer is the first line of defense against improper receiving, storage and holding temperatures. Using an infrared measurement technique, the highly accurate FoodPro quickly reads surface temperatures, allowing workers to make rapid and frequent temperature measurements – faster than contact units and without fear of cross contamination. The easy-to-see illumination light shows the measurement area.

Infrared temperature measuring device FoodPro

Description

Technical data

Measuring range	-30...+200 °C
Accuracy (at an operating temperature of 23 °C (±2 °C))	±1 °C at -0...+65 °C ±1 °C per °C under 0 °C ±1,5 % of the measuring value over 65 °C
Optical resolution (D:S)	2,5:1 at 90% energy, typical
Smallest measuring spot	12 mm
Display resolution	0,2 °C
Spectral range	8...14 µm
Emission factor	0,97
Battery	1 Alkali-Battery type AA (LR 6)
Dimensions	(LxWxH) 150x30x50 mm

Article	Art.-no.
Infrared temperature measuring device FoodPro	0560 0030

Features:

- Laserpointer
- Hold function (7 seconds)
- Emission factor (0,97) default for food
- Recommended distance: 25 to 250 mm (Measuring spot Ø12...100 mm)
- HACCP control display (Symbol display of critical values in the food area, green/red/green)
- Ingress protection IP54 washable

Areas of application:

- Cold and hot buffets
- Transport controlling
- Incoming goods inspection
- Gastronomy

Infrared temperature measuring device FoodPro plus

Description

Technical data

Measuring range infrared	-35...+275 °C
Accuracy (at an operating temperature of 23 °C (±2 °C))	±1 °C at -0...+65 °C ±1 °C per °C under 0 °C ±1,5 % of the measured value over 65 °C
Measuring range measuring probe	-40...+200 °C
Accuracy measuring probe (at an operating temperature of 23 °C (±2 °C))	±0,5 °C at -5...+65 °C ±1 °C at under -5 °C ±1% of the measured value over 65 °C
Dimensions probe	Length 90 mm, diameter 3 mm
Optical resolution (D:S)	2,5:1 at 90% energy, typical
Smallest measuring spot	12 mm
Display resolution	0,1 °C
Spectral range	8...14 µm
Emission factor	0,97
Measuring value display	Hold, Max
Battery	9 V Alkaline
Dimensions	(LxWxH) 165x32x50 mm

Article	Art.-no.
Infrared temperature measuring device FoodPro plus	0560 0031

Features:

- Laserpointer
- Hold function (7 seconds)
- Emission factor (0,97) default for food
- Illuminated display
- Recommended distance: 25 to 250 mm
- Maximal temperature display
- Integrated timer with alarm function
- Integrated penetration probe Pt100, Class A, L=80 mm, Ø 3 mm
- HACCP controll display
- Ingress protection IP54 washable
- Foldable

Areas of application:

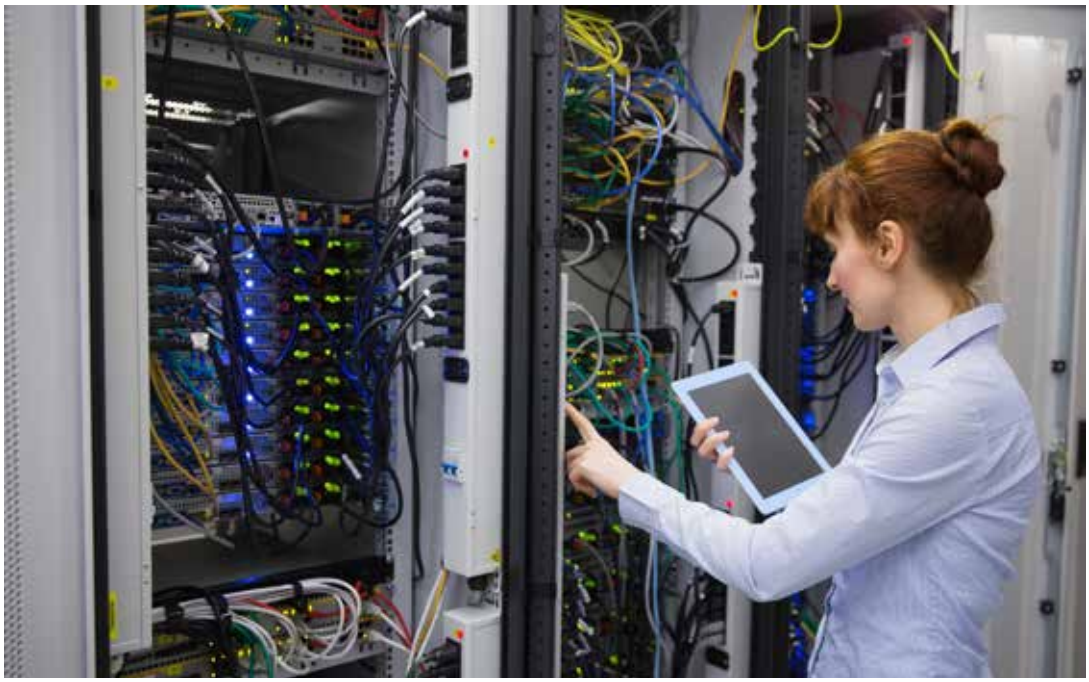
- Cold and hot buffets
- Transport controlling
- Incoming goods inspection
- Gastronomy

Temperature measurement in small and narrow environments

The infrared pyrometer DM 301 D is ideally suited for measuring temperature in small and narrow environments.
The rugged measuring heads have been developped for applications in a measuring range from -40...1030 °C and can be used up to 80 °C without additional cooling. The inexpensive IP-pyrometers are ideally suited for OEM-applications.
They also are well suited for multiple applications of infrared measuring points.

Typical areas of application:

- Temperature control in the plastics production, e.g. thermoforming of foil
- Preventive electronical maintenance



Infrared temperature measuring device
DM301 D

Description

Features:

- Temperature range from -40...+1030 °C
- Setting time: 25 ms
- Optical resolution: 15:1
- Green LED as alarm signaling, target aid, self diagnosis or temperature-code display
- Applicable up to 80 °C ambient temperature without cooling
- Multiple outputs choosable: 0...10 V or 0...5 V free scalable or thermoelement type K, alarm output, digital ouput
- USB-interface and direct, serial 9,6 kBaud Interface - optionally available, please send us your enquiry!
- Power supply: 5...30 V DC

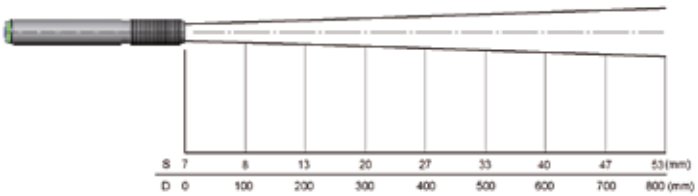
Technical data

Measuring range	-40...+1030 °C
Ambient temperature	-20...+80 °C
Relative humidity	10...95% RH, not condensating
Optical resolution (D:S)	15:1
Smallest measuring spot	7 mm
Accuracy	±1,5% or ±1,5 °C (the higher value applies)
Reproducibility	±0,75% or ±0,75 °C (the higher value applies)
Response time T95	25 ms
Emissivity	0,100...1,100 (adjustable over 0...10 V DC input or software)
Transmission factor	0,100...1,100 (adjustable over software)
Spectral range	8...14 µm
Output analogue	Choosable: 0...5 V or 0...10 V free scalable or thermo-couple type K/Alarm with adjustable voltage regulater
Output digital	Uni/bidirektional, 96 kBaud, 0/3 V level/USB optional
Alarm output	0...30 V/ 50 mA (open collector)
Cable length measuring head	1000 mm also available in 3 m, 8 m and 15 m length, on request
Dimensions sensing head	Length 87 mm
Connection	M12x1
Power supply	5...30 V DC
Power consumption	Max. 10 mA
Ingress protection	IP63
Scope of delivery	Infrarot temperature measuring device incl. 2 mounting nuts, connection cable, operation manual

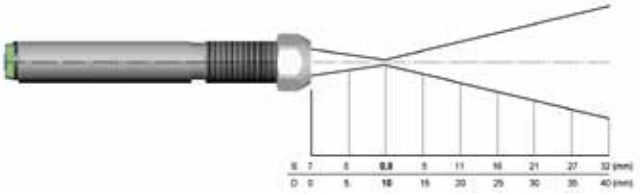
Article	Art.-no
Infrared temperature measuring device DM301 D	SHOP 0560 0447-20

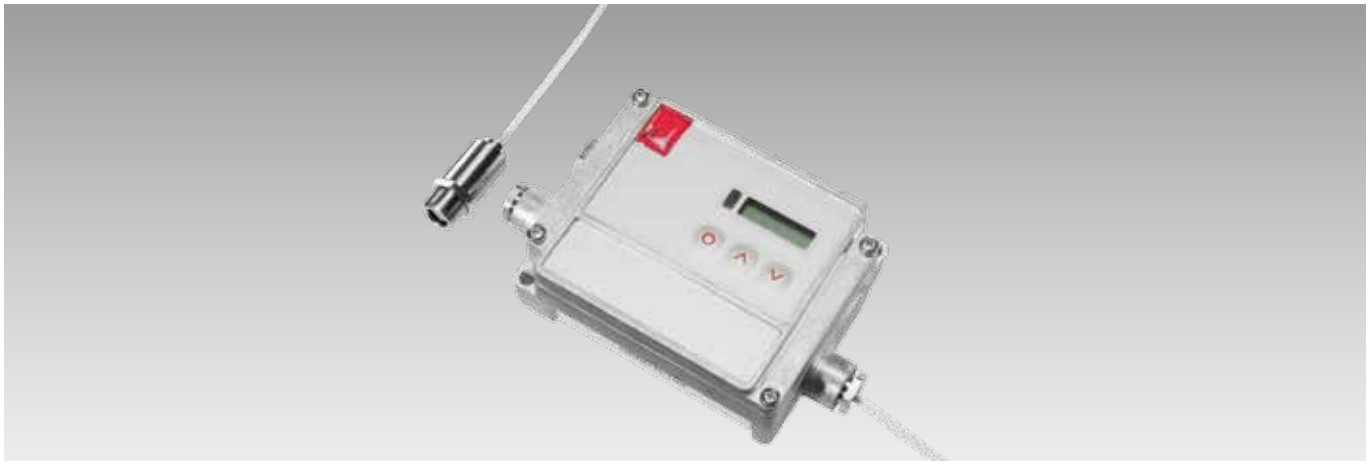
Optical parameter:

15:1 Optic



15:1 Optic with CF-lens





Contactless measuring of non-metalic surfaces

The small, compact infrared measuring devices DM201 D, DM151 or DM21 D are equipped with one of the world's smallest infrared sensors with a high optic resolution of 22:1 (15:1 , 2:1).
Additionally, it offers a high variability due to selectable analog outputs as well as several digital interfaces in the electronics box.

Typical areas of application:

- Surveillance of surface temperatures during lamination processes in vehicle interiors, which take place at temperatures of about 120°C
- Temperature regulation during thermoforming of foils
- Function tests of equipped circuit boards

Infrared temperature measuring device

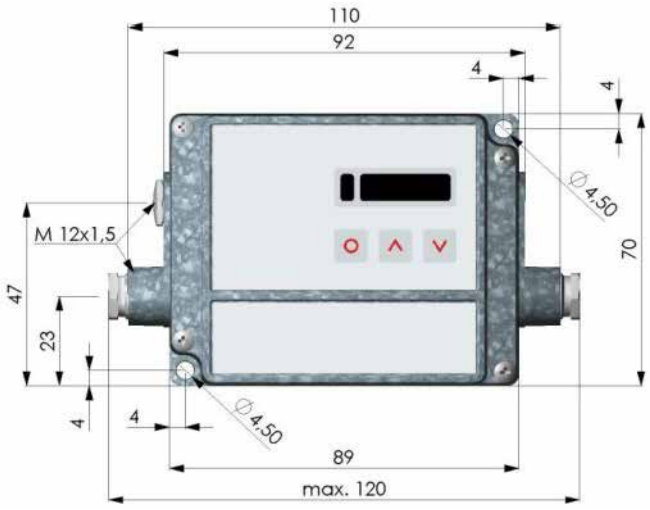
DM201 D, DM151, DM21 D

Description

Features:

- One of the world's smallest infrared sensors with a high optic resolution of 22:1
- Rugged and can be used up to 180 °C ambient temperare without additional cooling
- Separate electronics with easy accessible programming keys and illuminated LCD-display
- Choosable analogue output: 0/4...20 mA, 0...5 V, 0...10 V, thermocouple type K or J
- Optionale pluggable USB, RS232, RS485, CAN or Profibus DP-Interface incl. software or. GSD-file
- Installation of max. 32 sensors in one network (with RS485)

Dimensions electronics



Technical data

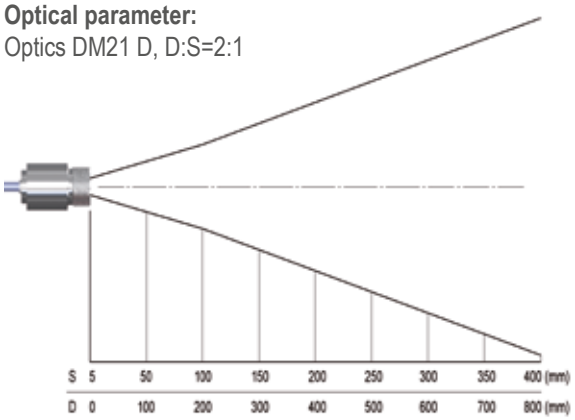
Measuring range	DM201 D: DM151: DM21 D:	-50...+975 °C -50...+600 °C -50...+600 °C
Ambient temperature	Sensor head: -20...+180 °C (...+130 °C at DM21 D), Electronics: 0...+85 °C	
Relative humidity	10...95% RH, non condensating	
Optical resolution (D:S)	DM201 D: DM151: DM21 D:	22:1 15:1 2:1
Smallest measuring spot	7 mm	
Accuracy	±1% or ±1 °C (the higher value applies)	
Reproducibility	±0,5% or ±0,5 °C (the higher value applies)	
Response time T95	150 ms	
Emissivity	0,100...1,100	
Transmission rate	0,100...1,100	
Spectral range	8...14 µm	
Resolution	0,1 °C	
Output adjustable	Canal 1: 0(4)...20 mA, 0...5...10 V, thermocouple type J, K; Canal 2: measuring head temperature (-20...+180 °C as 0...5 V or 0...10 V), alarm output	
Alarm output	24 V/ 50 mA (open collector)	
Cable length measuring head	DM201 D: DM151/DM21 D: also available in 3 m, 8 m and 15 m length, on request	3000 mm 1000 mm
Dimensions sensing head	(LxØ)28x14 mm	
Dimensions electronics	(LxWxH) max.120 x70x30 mm	
Connection	M12x1	
Power supply	8...36 V DC	
Power consumption	Max. 100 mA	
Ingress protection	IP65 (NEMA-4)	
Scope of delivery	Infrared temperature measuring device incl. 2 mounting nuts, high temperature measuring head cable, electronic-box with LCD-display and programming keys, operation manual	

Article	Art.-no.
Infrared temperature measuring device DM201 D	0560 0447-03
Infrared temperature measuring device DM151	0560 0447-17
Infrared temperature measuring device DM21 D	0560 0447-21

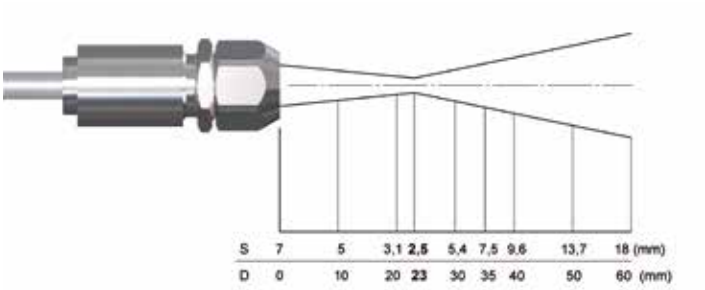
Infrared temperature measuring device
DM201 D, DM151, DM21 D

Optical parameter:

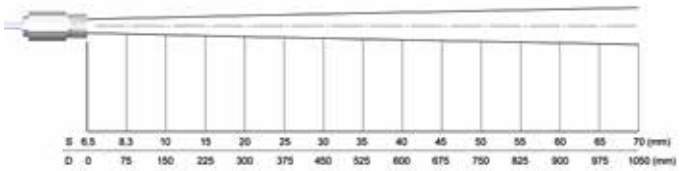
Optics DM21 D, D:S=2:1



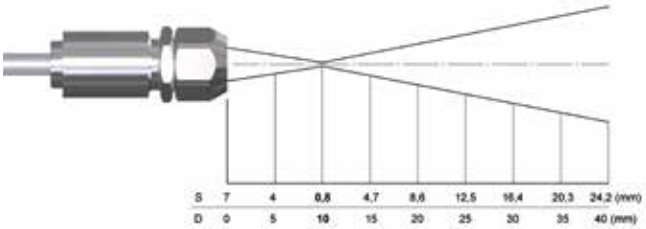
Optics DM21 D, D:S=2:1 (Far field=2,5:1)



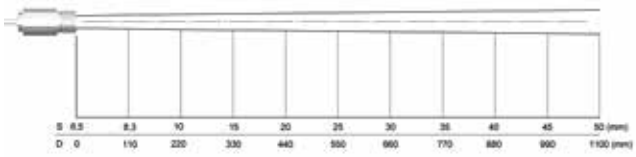
Optics DM151 D, D:S=15:1



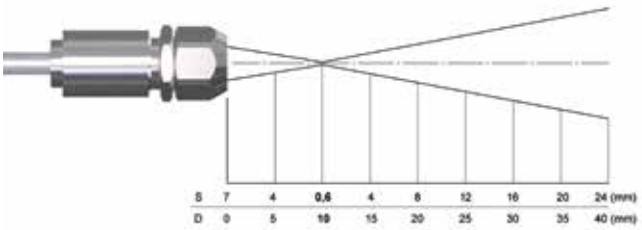
Optics DM151, D:S=15:1 (Far field=1,5:1)



Optics DM221 D, D:S=22:1

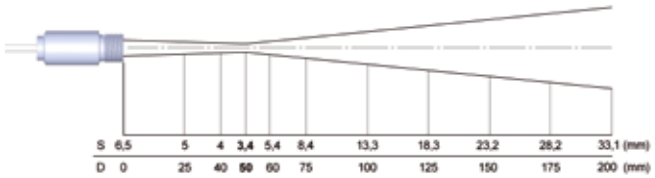


Optics DM221 D, D:S=22:1 (Far field=1,5:1)

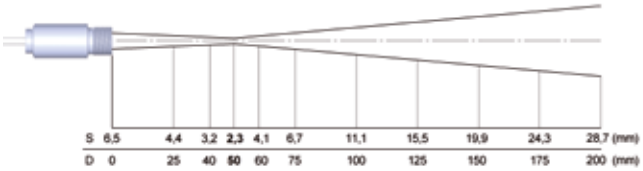


Variant with built-in CF-lens:

Optics DM151, D:S=15:1 (Far field=5:1)



Optics DM151, D:S=22:1 (Far field=6:1)



Contactless measuring of non-metalic surfaces in hot envorinments

The pyrometer D101 hot has been developed for the most extreme conditions in high-temperature areas and is acclaimed for its especially high temperature resistance. Employment of the inrared thermometer at ambient temperatures of up to 250°C without additional cooling poses absolutely no problems.

Typical areas of application:

- In driers and ovens
- In tempering facilities of metal and glass industries
- In plastics and textile processing, and semiconductor production

Infrared temperature measuring device
DM101D hot

Description

Features:

- The new infrared thermometer for hot ambient temperatures up to +250 °C without cooling
- For multiple applications in driers, ovens, tempering facilities of metal and glass industries, plastics and textile processing, and semiconductor production
- From -40…+975 °C and a adjusting time of 100 ms
- Choosable optics 10:1 or 2:1, compact measuring head
- Elektronics box with programmable keys and illuminated temperature display
- Analogue outputs 0/4...20 mA, 0...5/10 V , thermocouple type K or J and integrated, digital interface
- (Optional): Profibus DP, USB, RS232, RS485, CAN-Bus or Ethernet

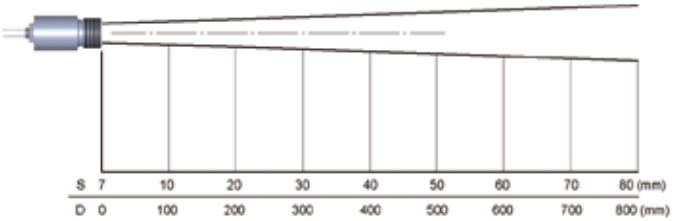
Technical data

Measuring range		-40...+975 °C
Ambient temperature		Sensor head: -20...+250 °C, electronics: 0...+85 °C
Relative humidity		10...95% RH, not condensating
Optical resolution (D:S)	DM101D hot: DM101D hot KL15:	10:1 2:1
Smallest measuring spot		10 mm
Accuracy		±1% oder ±1,5 °C (the higher value applies)
Reproducibility		±0,5% or ±0,5 °C (the higher value applies)
Response time T95		100 ms
Emissivity		0,100...1,100
Transmission rate		0,100...1,100
Spectral range		8...14 µm
Resolution		0,5 °C
Output adjustable		Canal 1: 0(4)...20 mA, 0...5...10 V, Thermocouple type J, K; Canal 2: measuring head temperature (-40...+250 °C as 0...5 V or 0...10 V), alarm output
Alarm output		24 V/ 50 mA (open collector)
Cable length measuring head	DM101D hot: DM101D hot KL 15: also available in 3 m, 8 m and 15 m length, on request	3000 mm 15000 mm
Dimensions sensing head		(LxØ)29,5x55 mm
Dimensions Electronics		(LxWxH) max.120 x70x30 mm
Connection		M18x1
Power supply		8...36 V DC
Power consumption		Max. 100 mA
Ingress protection		IP65 (NEMA-4)
Scope of delivery		Infrared temperature measuring device with mounting nut, high tenperature measuring head cable, electronics box with LCD-display and programmable keys, operation manual

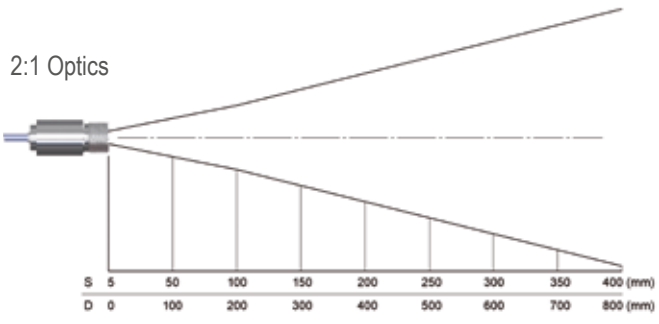
Article	Art.-no.
Infrared temperature measuring device DM101 hot	0560 0447-10
Infrared temperature measuring device DM101 hot KL15	0560 0447-14

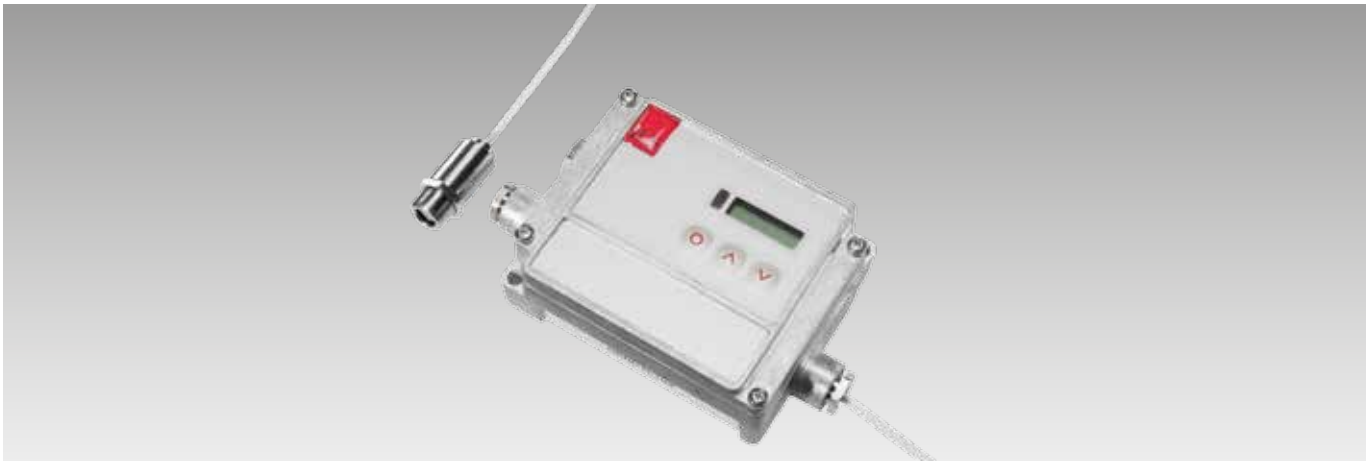
Optical parametera:

10:1 Optics



2:1 Optics





Low-temperature measurements of metals and composite materials

Due to its short measuring wavelength and a temperature range from 50°C on, the pyrometer of the DM501 series, is ideally suited for employment in low-temperature measurements of metals and composite materials. The quick response time of only 1 ms allows a problem-free use of the metal thermometer in fast processes.
The electronics box of the measuring device allows a flexible terminal device through selectable analog outputs as well as various optional digital interfaces.

Typical areas of application:

- Low-temperature measurements of metals and composite materials
- Especially its low temperature range from 50°C on make the temperature sensor a popular measuring device for every kind of low-temperature measurement of metals.

Infrared temperature measuring device
DM501

Description

Features:

- Miniaturised infrared-thermometer with a spectral range of 2,3 µm
- Measuring wavelength for measurement of metal and composite materials from 50 °C
- Very small sensor head with 14 mm diameter and 28 mm length for installation even under confined spatial conditions and ambient temperatures up to 85 °C without cooling
- With measuring range of 50...2500 °C and acquisition times from 1 ms, available on request
- Short measuring waves prevent measuring errors on surfaces with low or unknown emmision factor

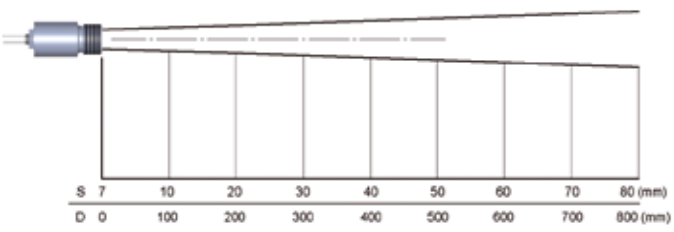
Technical data

Measuring range	DM501: DM501 3MH2: DM501 3MH1:	+50...+400 °C +200...+1500 °C +150...+1000 °C
Ambient temperature	Sensorhead: -20...+85 °C, Electronics: 0...+85 °C	
Relative humidity		10...95% RH, non condensating
Optical resolution (D:S)	DM501: DM501 3MH2/1:	22:1 (Far field) 75:1 (Far field)
Smallest measuring spot		7 mm (Near field)
Accuracy		±0,3% of measured value +2 °C
Reproducibility		±0,1% of measured value +1 °C
Response timeT95		1 ms
Emissivity		0,100...1,100
Transmission factor		0,100...1,100
Spectral range		2,3 µm
Resolution		0,1 °C
Output adjustable	0(4)…20 mA, 0…5…10 V, thermocouple J, K, alarm	
Alarm output		24 V/ 50 mA (open collector)
Cable length measuring head		3000 mm also available in 3 m, 8 m and 15 m length, on request
Dimensions sensing head		(LxØ) 28x14 mm
Dimensions Electronics		(LxWxH) max.120 x70x30 mm
Connection		M12x1
Power supply		8...36 V DC
Power consumption		Max. 100 mA
Ingress protection		IP65 (NEMA-4)
Scope of delivery	Infrared temperature measuring device with mounting nut and mounting angle, measuring head cable, electronics box with LCD-display and programmable keys, operation manual	

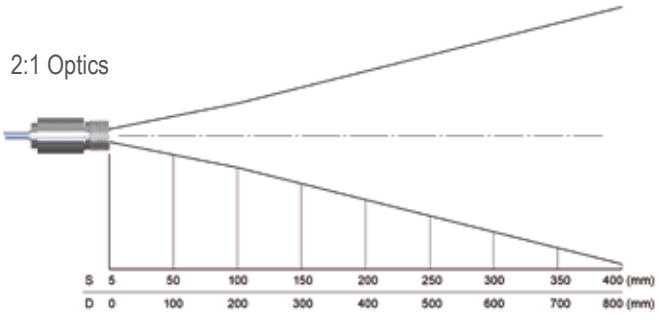
Artikel	Art.-Nr.
Infrared temperature measuring device DM501	0560 0447-50
Infrared temperature measuring device DM501 3MH2	0560 0447-51
Infrared temperature measuring device DM501 3MH1	0560 0447-52

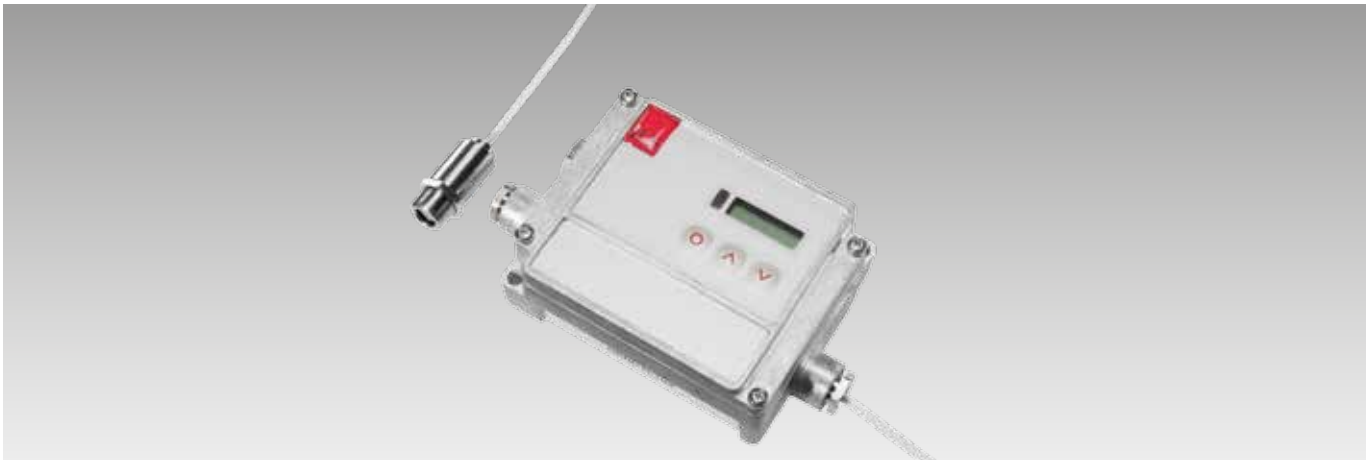
Optical paramaters:

10:1 Optics



2:1 Optics





High-temperature measurements of metals, metal oxides, and ceramics up to 2200 °C

Due to their short measuring wavelength and the high temperature range of up to 2200°C the pyrometers of the DM401 series are ideally suited for employment in high-temperature measurements of metals, metal oxides, and ceramics. The short measuring wavelength of the infrared pyrometers additionally decreases measuring errors during low or changing emission levels.
The small sensor head allows for easy installation in limited and cramped spaces. Moreover, it reliably measures temperatures even in ambient temperatures of up to 125°C.

Typical areas of application:

- Temperature measurements requiring short measuring wavelengths
- Precise and reliable measuring of metallic suraces in metal processing (e.g. welding, sintering) as well as metal oxides and ceramics in temperatures of up to 2200 °C

Infrared temperature measuring device
DM401

Description

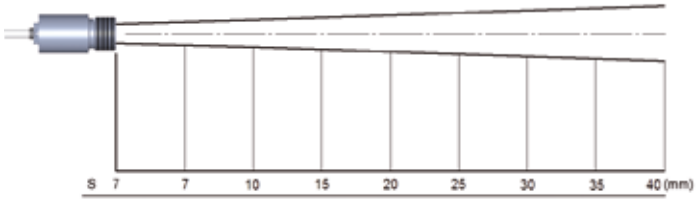
Features:

- Miniaturised infrared thermometer with 1,0 or 1,6 µm measuring wavelength for metal processing (e.g. welding, sintering) as well as metal oxides and ceramics
- Very small sensor head with 14 mm diameter and 28 mm length for installation even under confined spatial conditions and ambient temperatures up to 125 °C without cooling
- Short measuring waves prevent measuring errors at emmisivity level changes or misadjustment
- High tolerability against electromagnetic fields e.g. induction welding

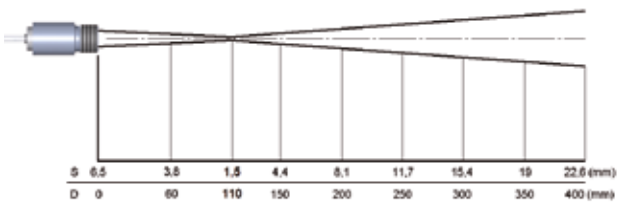
Article	Art.-no.
Infrared temperature measuring device DM401 D 2ML	0560 0447-40
Infrared temperature measuring device DM401 D 1ML	0560 0447-41
Infrared temperature measuring device DM401 D 1MH	0560 0447-42
Infrared temperature measuring device DM401 D 2MH	0560 0447-60

Optical parameters:

DM 401 D 1ML/2ML, D:S=40:1



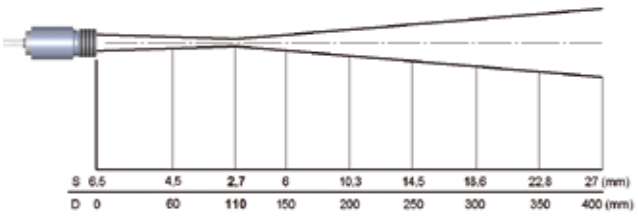
DM 401 D 1MH/2MH, D:S=75:1



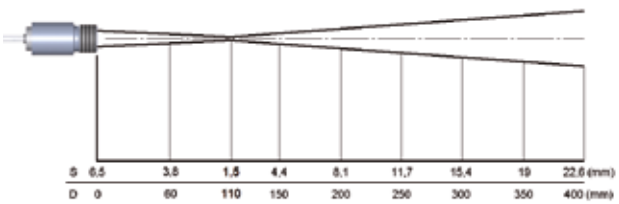
Technical data

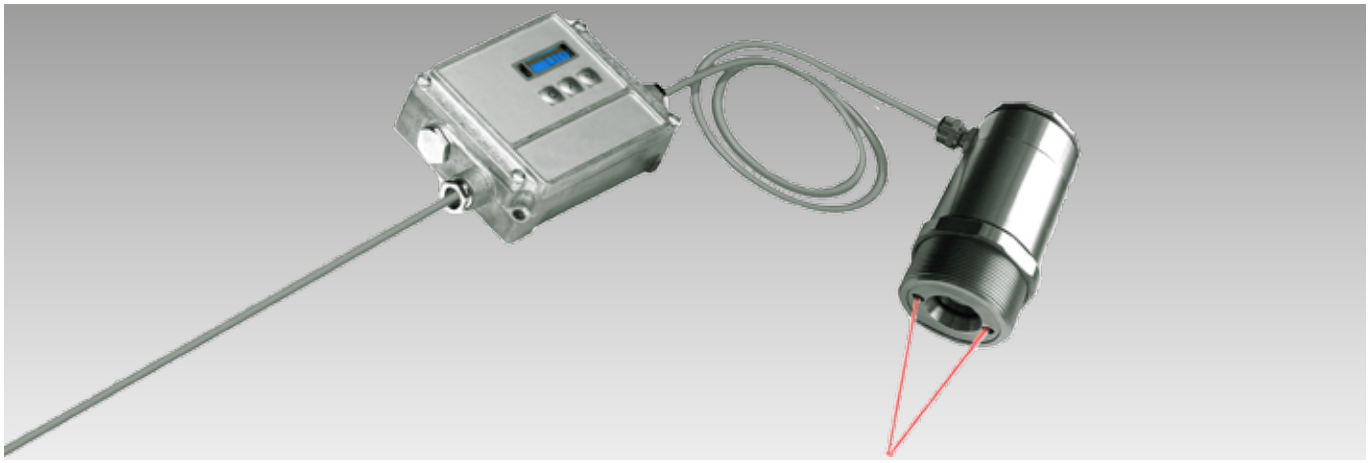
Measuring range	DM401 D 2ML: DM401 D 1ML: DM401 D 1MH: DM401 D 2MH:	+250...+800 °C +485...+1050 °C +650...+1800 °C +385...+1600 °C
Ambient temperature	Sensorhead: -20...+100°C (1M) or ...+125 °C (2M) Electronics: 0...+85 °C	
Relative humidity	10...95% RH, not condensating	
Optical resolution (D:S)	DM401 D 2ML/DM401 D 1ML: DM401 D 1MH(DM401 D 2MH:	40:1 75:1 (Far field 14:1)
Smallest measuring spot	DM401 D 2ML/DM401 D 1ML: DM401 D 1MH: DM401 D 2MH:	2,7 mm at 110 mm 1,5 mm at 110 mm 1,7 mm at 110 mm
Accuracy	±0,3% of measured value +2 °C	
Reproducibility	±0,1% of measured value +1 °C	
Response time T95	1 ms	
Emissivity	0,100...1,100	
Transmission factor	0,100...1,100	
Spectral range	1,0 µm (1M) or 1,6 µm (2M)	
Resolution	0,1 °C	
Output adjustable	0(4)…20 mA, 0…5…10 V, thermocouple J, K, alarm	
Alarm output	24 V/ 50 mA (open collector)	
Cable length measuring head	3000 mm also available in 3 m, 8 m and 15 m length, on request	
Dimensions sensing head	(LxØ)28x14 mm	
Dimensions Electronics	(LxWxH) max. 120 x70x30 mm	
Connection	M12x1	
Power supply	8...36 V DC	
Power consumption	Max. 100 mA	
Ingress protection	IP65 (NEMA-4)	
Scope of delivery	Infrared temperature measuring device with 2 mounting nuts, high temperature measuring head cable, electronics box with LCD display & programmable keys, operation manual	

DM 401 D 1ML/2ML, D:S=40:1 (Far field= 12:1)



DM 401 D 1MH/2MH, D:S=75:1 (Far field=14:1)





Target and non-contact measuring of non-metalic surfaces in hot environments

Opposite to many conventional pyrometers with single laser, which are only marking the center and not the real size of the measuring spot, the devices of the DM751 series have an innovative double sighting laser.
The two laser beams of the thermometer follow exactly the infrared-optical path and marking exactly the real spot size at any distance. Wrong measurements will be avoided. The smallest spot is reached at the cross point of both laser beams. A variety of different focus versions allows an adaptation to the current installation circumstances.

Typical areas of application:

- Perfectly suited for temperature measurement of non-metallic surfaces
- Mechanical and plant engineering
- Materials like plastics, varnishes, wood, or paper
- Temperature control during welding of plastic components
- In testing stations in the automobile industry

Infrared temperature measuring device
DM751

Description

Features:

- Smallest measuring spots from 0,9 mm are captured even by low object temperatures
- Double laser aiming marks real spot location and spot size at any distance
- Optics 75:1 with selectable focus
- Usable up to 85 °C ambient temperature without cooling and automatic laser switch off at 50 °C
- Selectable analog outputs 0/4...20 mA, 0...5/10 V, thermocouple type K or J
- Optional plug in digital interfaces USB, RS232,
- RS485, CAN or Profibus DP

Technical data

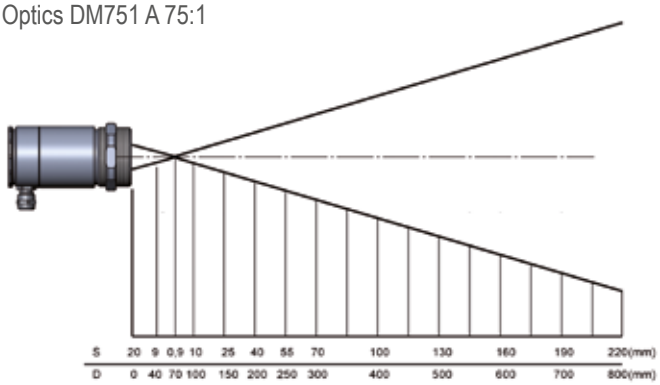
Measuring range		-50...+975 °C
Ambient temperature		Sensorhead: -20...+85 °C (50 °C Laser ON), Electronics: 0...+85 °C
Relative humidity		10...95% RH, not condensating
Optical resolution (D:S)		75:1
Smallest measuring spot	DM751 C: DM751 A: DM751 B: DM751 D: DM751 E:	2,75 mm at 200 mm 0,9 mm at 70 mm 1,9 mm at 150 mm 5,9 mm at 450 mm 16 mm at 1260 mm
Accuracy		±1% or ±1,0 °C (the higher value applies)
Reproducibility		±0,5% or ±0,5 °C (the higher value applies)
Response time T95		120 ms
Emissivity		0,100...1,100
Transmission factor		0,100...1,100
Spectral range		8...14 µm
Resolution		0,1 °C
Output adjustable		Canal 1: 0(4)...20 mA, 0...5...10 V, thermocouple type J, K; Canal 2: Measuring head temperature (-40...+85 °C as 0...5 V or 0...10 V), alarm output
Alarm output		24 V/ 50 mA (open collector)
Cable length measuring head		3000 mm also available in 3 m, 8 m and 15 m length, on request
Dimensions sensing head		(LxØ) 100x50 mm
Dimensions Electronics		(LxWxH) max.120 x70x30 mm
Connection		M48x1,5
Power supply		8...36 V DC
Power consumption		Max. 150 mA
Ingress protection		IP65 (NEMA-4)
Scope of delivery		Infrared temperature measuring device with mounting nut and mounting angle, measuring head cable, electronics box with LCD-display and programmable keys, operation manual

Article	Art.-no.
Infrared temperature measuring device DM751 C	0560 0447-77
Infrared temperature measuring device DM751 A	0560 0447-75
Infrared temperature measuring device DM751 B	0560 0447-76
Infrared temperature measuring device DM751 D	0560 0447-78
Infrared temperature measuring device DM751 E	0560 0447-79

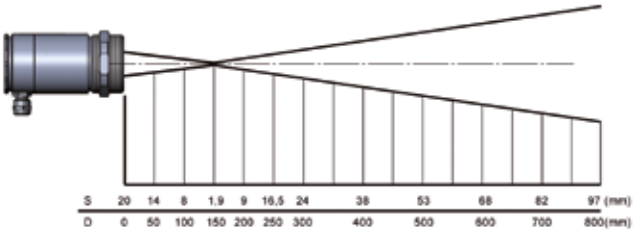
Infrared temperature measuring device
DM751

Optical parameters:

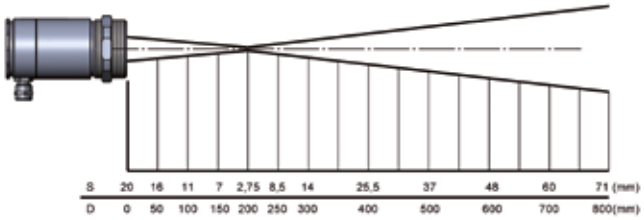
Optics DM751 A 75:1



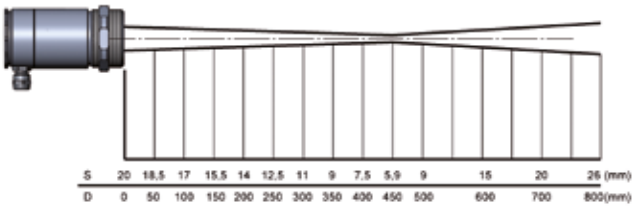
Optics DM751 B 75:1



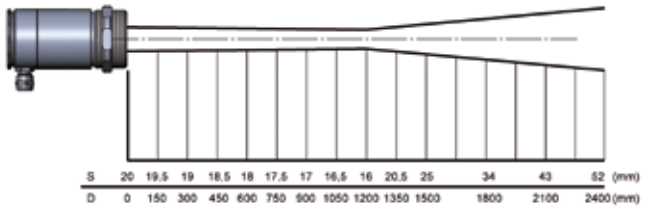
Optics DM751 C, 75:1



Optics DM751 D, 75:1



Optics DM751 E, 75:1



Thermography

The infrared camera ThermoCam 400 is the basic model of the award-winning optris PI series*. It allows for exact measurements from an object size of 1.5 mm on and is, due to its measurement speed of 120 Hz, perfectly suited for employment in research and development, test stations, and process automation as well as for portable measurement tasks.

The infrared camera's standard version offers a temperature range from -20°C up to 900°C, which can be optionally expanded to 1500°C. It is available with four alternative optics and can either be ordered in a standard or a thermal analysis package[1)] . The software optris PI Connect offers video and snapshot recordings, extensive analyses (offline, online) and is equipped with an integrated line scan camera function. Our ThermoCam package consits of an infrared camera with an objective of your choice, an USB-cable (1 m), a table tripod, a PIF-cable with connection terminal block (1 m) for easy process control and the software package ThermoCam with line camera function in a high-quliaty aluminium case.

*Readers of the "Technische Revue" voted the PI the most popular product 2012

[1)] on request

Infrarot Kamera ThermoCam

Mobile camera with USB interface

Description

Technical data

Measuring range		-20...+900 °C
Ambient temperature		0...+50 °C
Stock temperature		-40...+70 °C
Relative humidity		20...80% RH, not condensating
Optical resolution		160x120 pixel, 120 Hz
Objektiv	0560 0904: 0560 0905: 0560 0906:	6°x5°/ f=35,5 mm 23°x17°/f=10 mm 41°x31°/f=5,7 mm
Spectral range		7,5...13 µm
Frame rate		120 Hz
Power supply		5 v DC (Supply over USB 2.0-interface)
Power consumption		Max. 500 mA
Output process interface (PIF out)		0...10 V (Main measuring field, measuring field, inner temperature, flag status, alarm, Framesynchronisation, Fail-Safe, External communication)
Process Inrterface (PIF in)		0…10 V (Emission factor, ambient temperature, reference temperaturer, Flag control, triggered recording, snapshots and line camera, free size)
digitale input process interface		Flag control, triggered recording, snapshots and line camera
Digital interface		USB 2.0
Cable length (USB 2.0)		1 m
System accuracy		±2 °C or ±2%
Temperature resolution (NETD)		0,08 K with 23°; 0,3 K with 6°; 0,1 K with 41° and 72°
Warm-up period		10 min
Emissivity		0,100...1,100
Software		PIConnect
Ingress protection		IP65 (Nema-4)
Material housing		Aluminium anodised plastic
Scope of delivery		Infrared camera incl. 1 objective, USB-cable, 1 m[1)], table tripod, process-interface-cable with connection terminal block (1 m), Softwarepackage PI Connect, operation manual, aluminium case [1)] The plug of the USB-cable (1 m) does not have a IP67 protection. For industrial applications cables with length from 5 m with IP67 are optionally available.

Features:

- Excellent price-performance ratio
- Very good thermical sensitivity from 80 mK
- Thermal images in real time with up to 120 Hz
- Thermo-Analysis-kit incl. 3 optics (optional)
- Detector with 160 x 120 pixel
- Small size (Dimensions: 45 x 45 x 62 mm)
- Royalty-free analysis-software and complete SDK inclusive

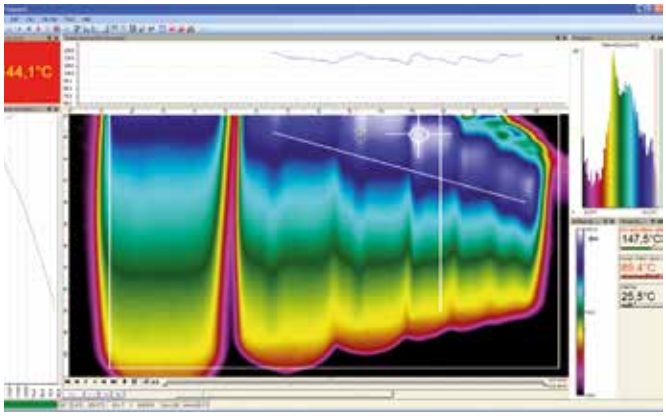
Article Description	Art.-No.
Infrared Camera ThermoCam, with lens 6° x 5° incl. software	0560 0904
Infrared Camera ThermoCam, with lens 23° x 17° incl. software	0560 0905
Infrared Camera ThermoCam, with lens 48° x 37° incl. software	0560 0906

Applications

The ThermoCam shows where it is hot and moreover measures the exact temperatures - in 10 millisecond intervals! The camera provides excellent infrared images in a wide temperature range from -20 °C up to 900 °C. The standard and comprehensive software packages feature to capture and edit infrared snapshots and videos, for thermal analysis with hot and cold spot detection display of isotherms and much more!

The ThermoCam is the thermographic solution for:

- Real estate diagnostics
- Construction surveillance
- Energy consulting
- Stationary and portable measuring tasks



Within the range for building automation the ThermoCam is a reliable instrument to detect thermal bridges, energy loss and related weaknesses. The ThermoCam is also a powerful tool to detect leakages in pipeworks. The leaks can be detected easily, before walls or floors are affected extensively.

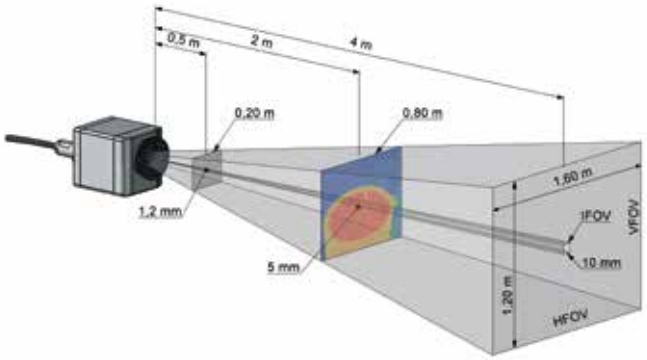
Analogue output 0-10 V and an alarm signal are direct communication interfaces to the process.

This interface issues temperatures of the main measuring area analogue or with an alarm. A process interface input allows the synchronization of the camera and external control of emissivity values and moreover background radiation compensation and triggering video or snapshot recordings.

Exchangeable lenses

The ThermoCam has a very small, waterproof and rugged camera sensing head with exchangeable lenses of 6°, 23° and 48° field of view.

Objective	Focal length	Minimum distance	
6° x 5° Tele lens	35,5 mm	0,5 m	
23° x 17° Standard lens	10 mm	0,02 m	
48° x 37° Wide angle lens	4,5 mm	0,02 m	



Function of measuring field of view (FOV) and distance (lens 23° x 17°)

User-friendly software ThermoCam

With its variability and functionality the added real-time software sets new standards: It offers extensive opportunities:

- Video recordings and snapshots with up to 120 Hz
- Digital real-time temperature data correction for all pixels
- Hot and cold spot analysis
- Editing of captured infrared videos for reports and presentations

The software can combine flexible spots with crosshair marking and programmable measurement areas with an automatic display of maximum, minimum or average temperature readings.

Thermography

The infrared camera system IR-ThermoControl has been develloped especially for the quality control and security in the running injection moulding process of moulded parts in the plastics industry.
With the used IP thermography method the demoulding process temperatures an the moulded parts can be effectively monitored. Particularly critical areas of the moulded part can be defined for intensive monitoring with the ThermoControl software which has been specially developped for this application. The software controlls the connected terminal devices and manages the parameters which have to be monitored. Moulded parts whose demoulding process temperatures exceed the borders, that have been defined with the ThermoControl, get placed in quarantine. The user has futher input options available and can define in which case which action should take place.

The profitool „IR-ThermoControl" has been developped with the partners GTT-W. Steinko GmbH – Nassau and Plexpert GmbH – Aalen.

Typical areas of application:

- Quality control/ security while injection moulding
- Systematic parameter setting when injection moulding tools have been newly installed

IR-ThermoControl camera system

for quality asurance in the plastics industry

Description

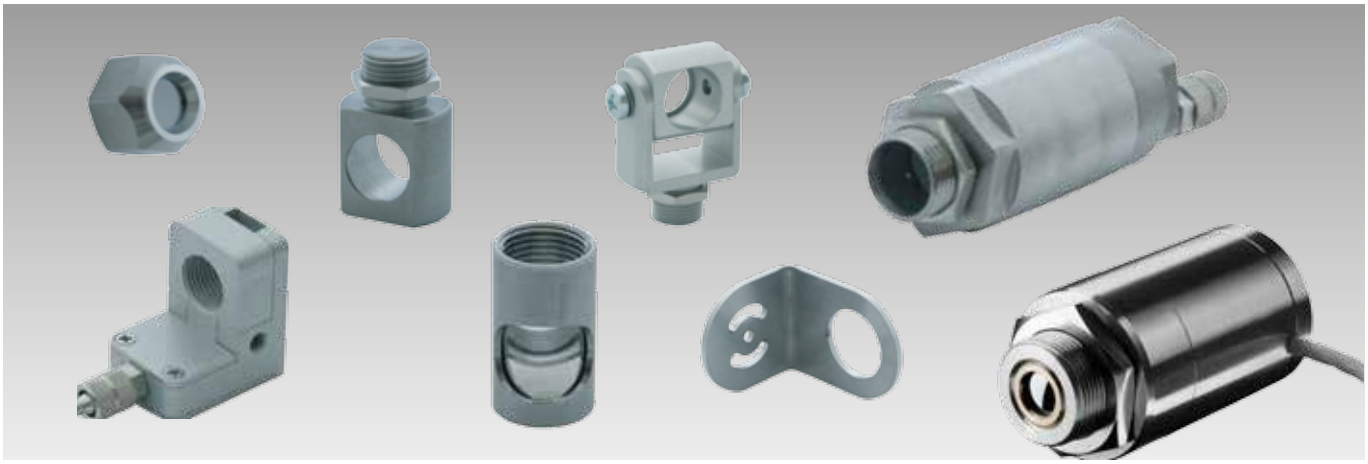
Features:

- IR-Thermography on moulded parts
- Effective detection of deformed injection mould
- Easy and flexible installation due to extensive range of accessories
- Excellent price-performance-ratio
- Powerful, user-friendly software for Windows® PCs
- Definition of practically unlimited critical zones on the moulded part and their border values
- Definition of different actions when border values are violated

Technical data

Optical resolution	160 x 120 px
Spectral range	7,5...13 µm
Mesasuring range	-20...+900 °C Splitted in 3 areas for a better contrast -20...+100 °C, 0...+250 °C, und +150...+900 °C
Regeneration frequency	120 Hz
Standard objektive	23° x 17° / f = 10 mm
Optional objektives	41°x 31°/ f = 5,7 mm 72°x 52°/ f = 3,3 mm 6°x 5° / f = 35,5 mm
Thermal sensitivity	80 mK with 23°x17° / F = 0,8 300 mK with 6°x5° / F = 1,6 100 mK with 41°x31° and 72°x 2° FOV / F = 1
Accuracy	± 2 °C or ± 2%
PC-interface	USB 2.0, Inclusive shielded 5 m USB-cable
Process-interface (PIF):	0...10 V Input, digital Input, 0...10 V Output inclusive Communication module DIO55, with netadapter for triggering the records and feedback at the injection moulding machine
Power supply	via USB
Ambient temperature	0 ..+50 °C
Storage temperature	-40...+70 °C
Relative humidity	20...80%, not condensating
Dimensions (LxWxH)	62x45x45 mm
Ingress protection	IP 67 (NEMA 4)
Shock / Vibration:	25G, IEC 68-2-29 / 2G, IEC 68-2-6
Mechanical installation	flexible with magnet stand
Software	ThermoControl, completely, with image editing module, setting of process critical paramters , AOI, border temperatures,plattform WIN XP®, WIN 7®
Scope of delivery	1 x USB infrared camera ThermoCam, 160 x120 pixel with standard objectiv 23°x17° 1 x IR-ThermoControl software , basic version 1 x communication modul DIO55 (digital) 1 x mains adapter for DIO55 1 x magnetic stand inclusive threaded pin for camera fixing, 2 x USB cable length 1 m, standard and length 5 m shielded 1 x Active PIF cable for process control of the camera; set in aluminium case, operation manual

Article	Art.-no.
IR-ThermoControl camera system	0560 0950



Mechanical accessories

Features:

- Extensive standard accessories enable the universal use of the infrared measuring devices
- Special accessories for selected applications
- High flexibility at the installation due to high combinability

Mounting accessories

Mounting angle, adjustable in one axis	
Articlenumber	0560 0447-16
Environmental data	RoHs 2002/95/EG compliant
Please note: If you connect the mounting angle with the mounting bolt (art.no. 0560 0447-34) you get an mounting angle which is adjustable in two axis.	

Mounting bolt with M12x1-thread, adjustable in one axis	
Articlenumber	0560 0447-34
Environmental data	RoHs 2002/95/EG compliant
Please note: If you connect the mounting bolt with the mounting angle (art.no. 0560 0447-16) you get an mounting angle which is adjustable in two axis.	

Mounting fork with M12x1-thread, adjustable in one axis	
Articlenumber	0560 0447-13
Environmental data	RoHs 2002/95/EG compliant
Please note: The mounting fork can be combined with the mounting angle (art.no. 0560 0447-16) through the M12x1 foot.	

CF-lens

CF-lens	
Articlenumber	0560 0447-04
Environmental data	RoHs 2002/95/EG compliant
The CF-lens is combinable with all measuring heads (20:1, 15:1 and 2:1).	

(Figure is enlarged)

Air-purge collars and right angle mirror

Standard air-purge collar	
Articlenumber	0560 0447-01
Environmental data	RoHs 2002/95/EG compliant
Please note: The air-purge collar is combinable with the mounting angle (art.no. 0560 0447-16).	

Laminar air-purge collar- the air outlet at the side prevents cooling down the objects at a small measuring distance.	
Articlenumber	0560 0447-205
Environmental data	RoHs 2002/95/EG compliant
Please note: If you combine the laminar air-purge collar with the lower part of the mounting fork (art.no. 0560 0447-13) an unit which is adjustable in 2 axis results.	

Right angle mirror, makes measurements with 90° angle possible	
Articlenumber	0560 0447-09
Environmental data	RoHs 2002/95/EG compliant

Massive housing

Massiv housing, compact	
Articlenumber	0560 0447-25
Environmental data	RoHs 2002/95/EG compliant
The massive housing compact is optimized for being used in the mechanical engineering. Available in brass, anodized aluminium and stainless steel.	

Emissivity table

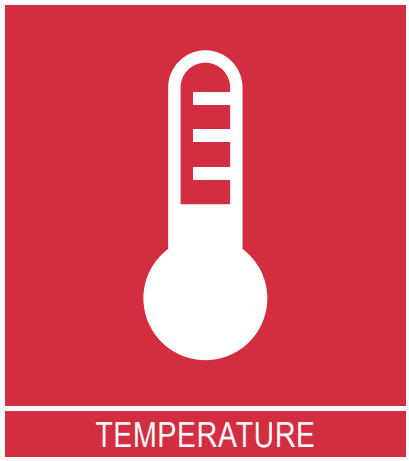
Extract

Material	Specification	Temperature in °C	Spec-trum	Emissivity
Aluminium	Sheet metal, 4 samples			
	differently scratched	70	LW	0,03 - 0,06
Aluminium	anodized sheet metal	100	T	0,55
Aluminium	Foil	27	3 µm	0,09
Aluminium	roughened	27	10 µm	0,18
Aluminium	Cast, sandblasted	70	SW	0,47
Aluminium	dipped in HNO3, plate	100	T	0,05
Aluminium	polished	50 - 100	T	0,04 - 0,06
Aluminium	coarse surface	20 - 50	T	0,06 - 0,07
Aluminium	strongly oxidized	50 - 500	T	0,2 - 0,3
Aluminium	unchanged, sheet metal	100	T	0,09
Aluminium	vacuum-coated	20	T	0,04
Aluminium bronze		20	T	0,6
Aluminiumhyd-roxide	Powder		T	0,28
Aluminiumoxide	activated, powder		T	0,46
Asbestos	Floor tiless	35	SW	0,94
Asbestos	Powder		T	0,40 - 0,60
Asphal road surface		4	LLW	0,967
Concrete		20	T	0,92
Concrete	rough	17	SW	0,97
Concrete	dry	36	SW	0,95
Concrete	shiny	20 - 50	T	0,04 - 0,06
Lead	shiny	250	T	0,08
Lead	not oxidized, polished	100	T	0,05
Lead red		100	T	0,93
Bronze	Phosphorbronze	70	LW	0,06
Bronze	Powder		T	0,76 - 0,80
Chrome	polished	500 - 1000	T	0,28 - 0,38
Ebonite			T	0,89
Ice	see water			
Galvanised iron	sheet metal	92	T	0,07
Iron and steel	elektrolytic	100	T	0,05
Iron and steel	ektrolytic, mirror polished	175 - 225	T	0,05 - 0,06
Iron and steel	sanded sheet metal	950 - 1100	T	0,55 - 0,61
Iron and steel	forged			
	mirror polished	40 - 250	T	0,28
Iron and steel	shiny, corroded	150	T	0,16
Iron and steel	oxidized	125 - 525	T	0,78 - 0,82
Iron and steel	oxidized	200 - 600	T	0,8
Iron and steel	polished	400 - 1000	T	0,14 - 0,38
Iron and steel	rough, flat surface	50	T	0,95 - 0,98
Iron and steel	rusted, red	20	T	0,69
Iron and steel	strongly oxidized	50	T	0,88
Iron and steel	strongly rusted	17	SW	0,96
Tinned iron	Sheet metal	24	T	0,064
Emaille	Varnish	20	T	0,85 - 0,95
Dirt	dry	20	T	0,92

Material	Specification	Temperature in °C	Spec-trum	Emissivity
Fibreboard	hard, untreated	20	SW	0,85
Fibreboard	Ottrelithe	70	LW	0,88
Fibreboard	Particle plate	70	LW	0,89
Fibreboard	porous, untretaed	20	SW	0,85
Varnish	on oak parquet floor	70	LW	0,90 - 0,93
Varnish	matt	20	SW	0,93
Gypsum		20	T	0,8 - 0,9
Gypsum plaster		17	SW	0,86
Gold	mirror polished	200 - 600	T	0,02 - 0,03
Granite	polished	20	LLW	0,849
Rubber	hard, soft, grey, rough	20	T	0,95
Cast iron	processed	800 - 1000	T	0,60 - 0,70
Cast iron	untreated	900 - 1100	T	0,87 - 0,95
Skin	Human	32	T	0,98
Wood		17	SW	0,98
Lime			T	0,3 - 0,4
Carbon	Graphite, surface filed	20	T	0,98
Carbon	Graphite powder		T	0,97
Carbon	Charcoal powder		T	0,96
Carbon	Candle soot	20	T	0,95
Carbon	Lampblack	20 - 400	T	0,95 - 0,97
Plastic	Glass-fibre laminates			
	(circuit board)	70	SW	0,94
Plastic	Polyurethane-insulation plate	70	LW	0,5
Plastic	Polyurethane-insulation plate	70	SW	0,29
Plastic	PVC, plastic floor			
	blunt, structured	70	SW	0,94
Copper	electrolytic,			
	mirror polsihed	80	T	0,018
Copper	Scraped	27	T	0,07
Copper	melted	1100 - 1300	T	0,13 - 0,15
Copper	commecial, shiny	20	T	0,07
Copper	oxidized	50	T	0,6 - 0,7
Copper	oxidized, dark	27	T	0,78
Copper	oxidized, strongly	20	T	0,78
Copper	oxidized, black		T	0,88
Copper	polished	50 - 100	T	0,02
Copper	polished	100	T	0,03
Copper	polished, comercially	27	T	0,03
Copper	polished, mechanically	22	T	0,015
Copper	pure,			
	carefully prepared surface	22	T	0,008
Copper dioxide	Powder		T	0,84
Varnish	Aluminium on rough surface	20	T	0,4
Varnish	black, matt	100	T	0,97
Varnishes	Aluminium,			
	different age	50 - 100	T	0,27 - 0,67
Varnishes	Oil, black, matt	20	SW	0,94
Leather	browned, tanned		T	0,75 - 0,80
Magnesium		260	T	0,13

Material	Specification	Temperature in °C	Spec-trum	Emissivity
Magnesium	polshed	20	T	0,07
Magnesium powder			T	0,86
Brass	oxidized	70	SW	0,04 - 0,09
Brass	polished	200	T	0,03
Molybdenum		1500 - 2200	T	0,19 - 0,26
Molybdenum	thread	700 - 2500	T	0,1 - 0,3
Mortar	dry	36	SW	0,94
Nickel	oxidized	227	T	0,37
Nickel	polished	122	T	0,045
Nickelchrome	rolled	700	T	0,25
Nickeloxide		1000 - 1250	T	0,75 - 0,86
Oil, libricating oil	0,125-mm-film	20	T	0,72
Paper	white	20	T	0,7 - 0,9
Platinum		1000 - 1500	T	0,14 - 0,18
Porcelain	glazed	20	T	0,92
stainless steel	sheet metal, polished	70	LW	0,14
stainless steel	rolled	700	T	0,45
Sand		20	T	0,9
Sandstone	polished	19	LLW	0,909
Slag	boiler	600 - 1200	T	0,76 - 0,70
Sandpaper	rough	80	T	0,85
Snow	see water			
Silver	poshed	100	T	0,03
Silver	pure, polished	200 - 600	T	0,02 - 0,03
Chipboard	untreated	20	SW	0,9
Stucco	rough, yellow-green	Okt 90	T	0,91
Styrofoam	thermal insulation	37	SW	0,6
Wallpaper	Lightly patterned, light grey	20	SW	0,85
Wallpaper	Lightly patterned, red	20	SW	0,9
Tar			T	0,79 - 0,84
Titanium	oxidized at 540 °C	500	T	0,5
Titanium	polished	500	T	0,2
Clay	burned	70	T	0,91
Cloth	black	20	T	0,98
Water	destilled	20	T	0,96
Water	Ice, covered with strong frost	0	T	0,98
Water	Ice, smooth	0	T	0,97
Water	Ice crystals	-10	T	0,98
Water	Layer >0,1 mm thick	0 - 100	T	0,95 - 0,98
Water	Snow		T	0,8
Water	Snow	-10	T	0,85
Wolfram		200	T	0,05
Wolfram		1500 - 2200	T	0,24 - 0,31
Wolfram	Thread	3300	T	0,39
Brick	Aluminiumoxide	17	SW	0,68
Brick	Dinas-Silicon oxide, Refractory product	1000	T	0,66
Brick	Dinas-Silicon oxide, glazed, rough	1100	T	0,85
Brick	Refractory product, Magnesit	1000 - 1300	T	0,38
Brick	Refractory product, weakly gleaming	500 - 1000	T	0,65 - 0,75
Brick	Fire brick	17	SW	0,68
Brick	glazed	17	SW	0,94
Brick	Measonry	35	SW	0,94
Brick	Measonry, plastered	20	T	0,94
Brick	normal	17	SW	0,86 - 0,81
Brick	red, normal	20	T	0,93
Brick	red, rough	20	T	0,88 - 0,93
Brick	Fireclay	1000	T	0,75
Brick	Silicon, 95% SiO2	1230	T	0,66
Brick	waterproof	d17	SW	0,87
Zinc	sheet metal	50	T	0,2
Zinc	oxidized surface	1000 - 1200	T	0,50 - 0,60
Zinc	polished	200 - 300	T	0,04 - 0,05

Our product range


TEMPERATURE


HUMIDITY


PRESSURE


Brightness/Motion


Air quality


Fill level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https://shop.bb-sensors.com

Our quality assurance

B+B Thermo-Technik has been manufacturing top-quality products since 1984.

Certificates

Certificate DIN EN ISO 9001 : 2008
Since April 2000 B+B Thermo-Technik is certified according to ISO 9001-2000 and has actualized the certificate according to ISO 9001 - 2008.
Therefore our customers are enabled to process more effective product audits in our house.

VDE
Since 2006 B+B Thermo-Technik GmbH is an approved place of manufacture for electronic controls for cooking ranges and ovens.

ESD Certificate
Since April 2013 B+B Thermo-Technik GmbH is also certified according to ESD (part of DIN EN 61340-5-1).

We constantly examine the quality of our products to meet the requirements of our customers.

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