Operating Instructions

for

Infrared Pyrometer

Model: TIN-SP

We don't accept warranty and liability claims neither upon this publication nor in case of improper treatment of the described products.

The document may contain technical inaccuracies and typographical errors. The content will be revised on a regular basis. These changes will be implemented in later versions. The described products can be improved and changed at any time without prior notice.

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1. Contents

Manufactured and sold by:

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2. Note

2.1 General

Before unpacking and commissioning the device, the operating instructions and the "General Safety Instructions" document must be read and followed carefully. The general safety instructions, the operating instructions, the data sheet as well as approvals and further information can be downloaded via the QR code on the device or under the respective product on www.kobold.com.

Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

The devices are only to be used, maintained and serviced by persons familiar with these operating instructions and in accordance with local regulations applying to Health & Safety and prevention of accidents.

When used in machines, the device should be used only when the entire machine fulfils the EU machinery directive.

2.2 Validity and version of the operating instructions

Due to technical changes, the device documentation available online may not always correspond to the product version you have purchased. If you need an instruction manual that corresponds to the purchased product version, you can request it from us free of charge by email (info.de@kobold.com) in PDF format, specifying the relevant invoice number and serial number. If you wish, the operating instructions can also be sent to you by post in paper form.

2.3 Hazard warnings

The following instructions are intended to ensure your personal safety and to prevent damage to the product described or connected devices. Safety instructions and warnings to prevent danger to the life and health of users or maintenance personnel, or to prevent damage to property, are highlighted in this documentation using the symbols defined here. *The symbols and terms used have the following meaning in the documentation itself:*

Symbol	Explanation	Symbol	Explanation
 Note	Is important information about the product, the handling of the product or the respective part of the documentation to which particular attention should be drawn.	 Caution	Means that minor personal injury or minor property damage may occur if proper precautions are not taken.

Symbol	Explanation	Symbol	Explanation
 Warning	Indicates that serious personal injury or substantial property damage may occur if proper precautions are not taken.	 Danger	Means that death can occur if proper precautions are not taken.
 Warning	Attention: Hot surface!	 Warning	Warning: Dangerous electrical voltage

3. Instrument Inspection

Instruments are inspected before shipping and sent out in perfect condition. Should damage to a device be visible, we recommend a thorough inspection of the delivery packaging. In case of damage, please inform your parcel service / forwarding agent immediately, since they are responsible for damages during transit.

Scope of delivery:
The standard delivery includes:

- Infrared Pyrometer model: TIN-SP

4. Intended Use

Any use of the device, which exceeds the manufacturer's specification, may invalidate its warranty. Therefore, any resulting damage is not the responsibility of the manufacturer. The user assumes all risk for such usage.

The sensors of the TIN-SP series are noncontact infrared temperature sensors. They calculate the surface temperature based on the emitted infrared energy of objects [see chapter 11 Basics of Infrared Thermometry]. The sensor housing of the TIN-SP head is made of stainless steel (IP65/ NEMA-4 rating) – the sensor electronics is placed in a separate box made of die casting zinc.

Note	The TIN-SP sensors are sensitive optical systems. Therefore, they should only be mounted using the existing thread.

- Avoid abrupt changes of the ambient temperature.
- Avoid mechanical violence on the head – this may destroy the system (expiry of warranty).
- If you have any problems or questions, please contact our service department.

5. Operating Principle

5.1 Model Overview

The sensors of the TIN-SP series are available in the following basic versions:

Model	Model codes	Measurement range	Spectral response	Typical applications
TIN-	SP	-50 to 1050 °C	8-14 µm	non-metallic surfaces

5.2 Factory Default Settings

The unit has the following presetting at time of delivery:

Setting	Value
Signal output 1 – object temperature	0-10 V
Signal output 2 – internal head temperature	0-10 V
Emissivity	1.000
Transmission	1.000
Averaging (AVG)	0.1 s
Smart Averaging	inactive
Maximum value hold (MAX)	inactive
Minimum value hold (MIN)	inactive
Temperature unit	°C
Ambient temperature compensation (Output to OUT-AMB as a 0-5 V signal at LT)	Internal sensor head
Baudrate	115 kBaud

5.3 General Specifications

	Sensor Head	Electronic housing
Protection rating	IP65 (NEMA-4)	IP65 (NEMA-4)
Ambient temperature	see metrological specification	-20…+85 °C
Storage temperature	see metrological specification	-40…+85 °C
Relative humidity	10…95 %, non-condensing	
Material (measuring head)	Stainless-steel	Zinc, cast
Dimensions	28 mm x 14 mm	89 mm x 70 mm x 30 mm
Weight	40 g	420 g
Cable length	3 m	
Cable diameter	2.8 mm	
Vibration	IEC 68-2-6: 3G, 11-200 Hz, each axis	
Pressure resistance (measuring head)	8 bar	
Software	Homepage: www.kobold.com/Infrared-Thermometer-pyrometer-TIN-SH-TIN-SS	

5.4 Electrical Specifications

Specification	Value
Power supply	8-30 VDC / 5 V USB (integrated) / max. 1.2 W
	Outputs 1 and 2 freely selectable: Analog mA/mV, Alarm mA/mV, TCK selectable: 0/ 4–20 mA, 0–5/ 10 V, Thermocouple (Type K) or Alarm output (signal source: object temperature)
Outputs/Analog	Head temperature as 0–5 V or 0–10 V output, or Alarm output (signal source switchable to object temperature or electronics box temperature when using as an alarm output)
Alarm output	Output open-collector (NPN type) on pin AL2 [24 V/ 50 mA]
Output impedances	
mA	max. Loop resistance 500 Ω (at 8 -36 VDC)
mV	min. 100 kΩ Load resistance
Thermocouple	20 Ω
Digital Interfaces	USB, RS232, RS485, Modbus RTU, Ethernet TCP, Modbus TCP
Relais output	2 x 60 VDC/ 42 VACRMS, 0,4 A; optically isolated/potential-free (optional plug-in module)
Function inputs / I/O pins	I/O1-3 pins freely selectable via software

5.5 Measurement Specifications [TIN-SP]

	SP version
Temperature measurement range	-50…1050 °C
Operating temperature range (head)[1]	-20…180 °C
Storgae temperature (head)	-40…180 °C
Spectral range	8-14 µm
Optical resolution	22:1
Measurement uncertainty [3)4)5)7)]	±1.0 °C oder ±1.0 %
Repeatability[2) 3) 4) 5) 7)]	±0.15 °C oder ±0.1 %
Short-term stability[4), 5), 7), 8)] (typical)	0.08 K/h
Ambient temperature influence [5)]	±0.05 K/K
NETD [4) 5) 6) 7)] (typical)	35 mK
Setup time (90 % signal)	320 µs
Acquisition time	115 ms
Warm-up time	10 min
Emissivity setting	0.050...1.100 (adjustable via software)
Transmittance setting	0.050...1.100 (adjustable via software)
Signal processing	Average, MAX, MIN (adjustable via programming buttons or software)

[1)] The LCD display's capacity may be limited at ambient temperatures below 0 °C.
[2)] The larger value applies.
[3)] Tobj > 0 °C
[4)] ε = 1
[5)] Settling time = 200 ms
[6)] Tobj = 25 °C
[7)] At room temperature 23 ± 5 °C
[8)] Tobj = 100 °C

5.6 Optical Charts

The following optical charts show the diameter of the measuring spot in dependence on the distance between measuring object and sensing head. The spot size refers to 90 % of the radiation energy.
The distance is always measured from the front edge of the sensing head.

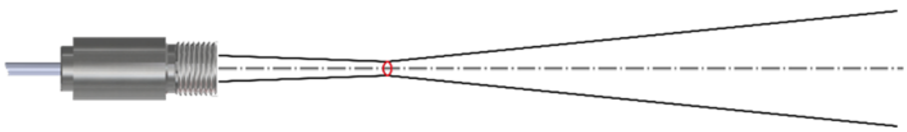
NOTE Note	The size of the measuring object and the optical resolution of the infrared thermometer determine the maximum distance between sensing head and measuring object. In order to prevent measuring errors, the object should fill out the field of view of the optics completely. Consequently, the spot should at all times have at least the same size like the object or should be smaller than that.

D = Distance from front of the sensing head to the object
S = Spot size
The D:S ratio is valid for the focus point.

Optics SF, D:S = 22:1

Model D:S		**Optical values**												
		0	**100**	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**	**1100**	**Distance (mm)**
	22:1	6.5	10.5	14.4	18.4	22.3	26.3	30.2	34.2	38.1	42.1	46.0	**50,0**	Spot size

Optics with CF attachment lense, D:S = 22:1 (Far field = 1,5:1)



Model D:S		**Optical values**												
		0	**25**	**40**	**50**	**60**	**75**	**100**	**125**	**150**	**175**	**200**	**Distance (mm)**
CF	22:1	6.5	4.4	3.1	2.3	4.0	6.7	11.1	15.5	19.9	24.3	28.7	Spot size

5.7 CF Lens and Protective Window

The optional CF lens allows the measurement of very small objects and can be used in combination with all TIN-SP models. The minimum spot size depends on the used sensing head. The distance is always measured from the front edge of the CF lens holder or laminar air purge collar.
The installation on the sensing head will be done by turning the CF lens until end stop. To combine it with the massive housing please use the version with external thread M12x1.

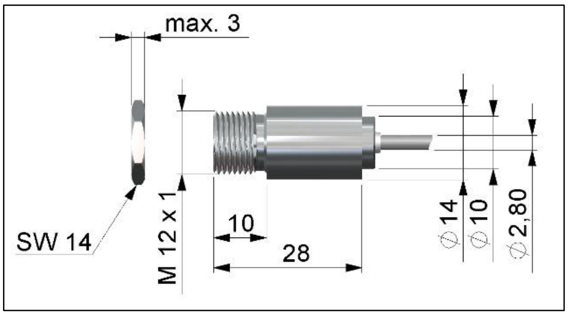
Typical Transmission values* if the CF lens is used (average values):
TIN-SP 0.78
***deviations possible**

Versions Overview:
TIN-ZTCF CF lens for installation on sensing head TIN-SP

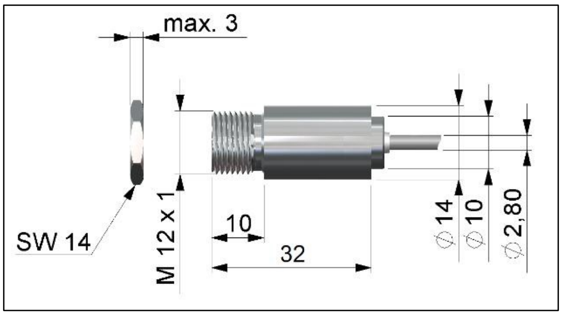
6. Mechanical Installation

The TIN-SP sensing heads are equipped with a metrical M12x1-thread and can be installed either directly via the sensor thread or with help of the hex nut (included in scope of supply) to the mounting bracket available. Various mounting brackets, which make the adjustment of the sensing head easier, can be additionally ordered as accessories.

Note	All accessories can be ordered using the according part numbers in brackets [ ].

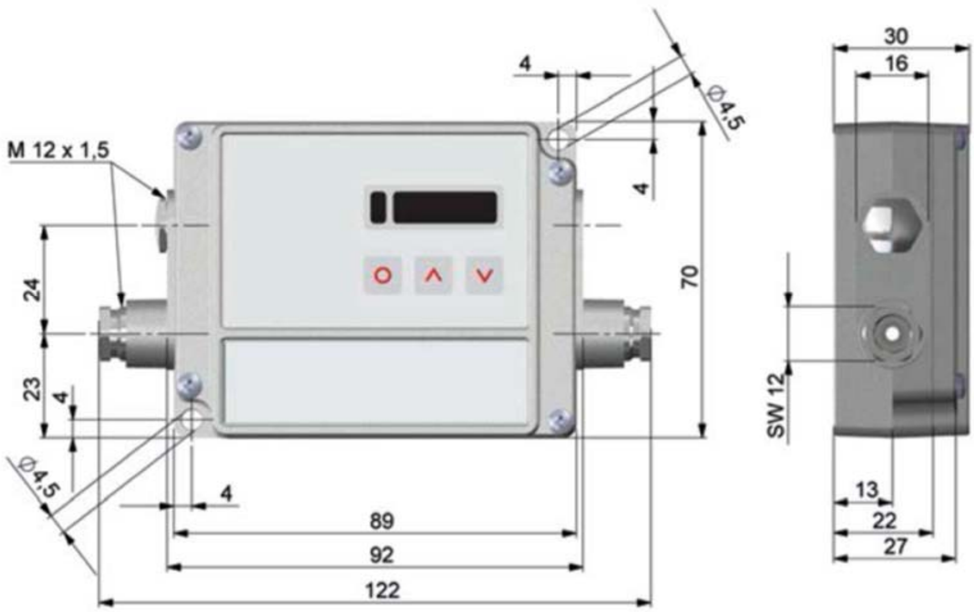


Dimensions of measuring head SF

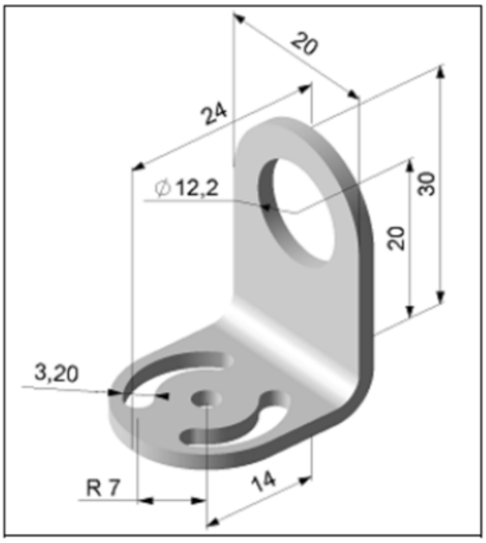


Dimensions of measuring head CF

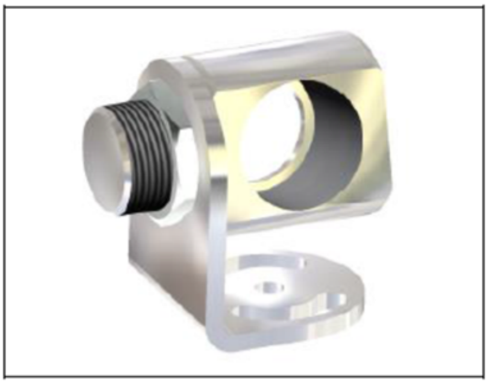
Elektronics



6.1 Mounting Accessories



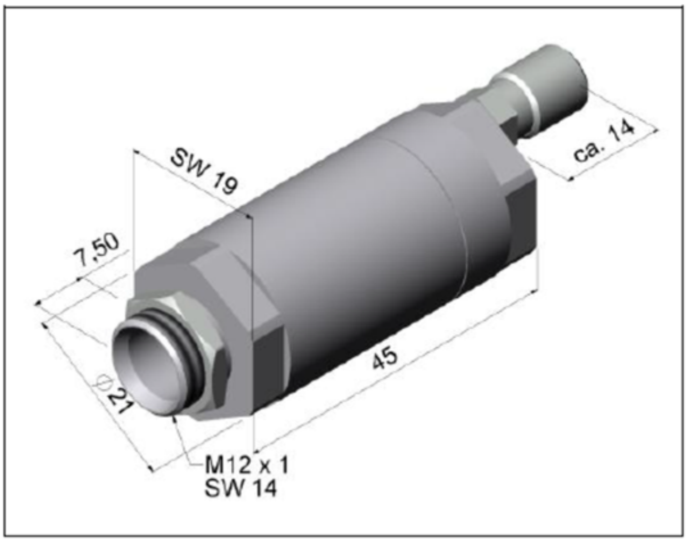
Mounting bracket, adjustable in one axis [TIN-ZTFB]



Mounting bolt with M12x1 thread, adjustable in two axis [TIN-ZTAB]

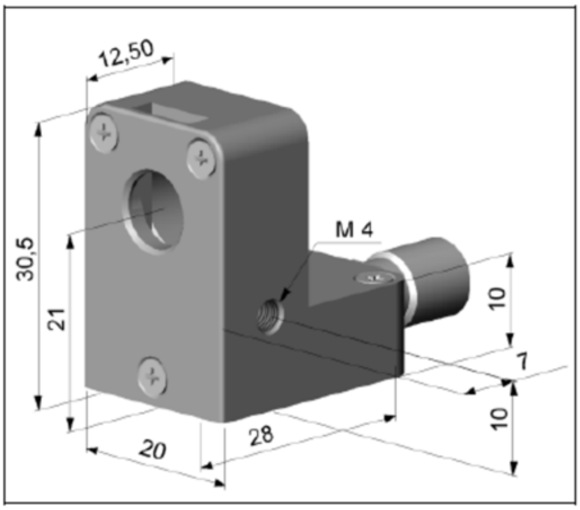
6.2 Air Purge Collars

The lens must be kept clean at all times from dust, smoke, fumes and other contaminants in order to avoid reading errors. These effects can be reduced by using an air purge collar. Make sure to use oil-free, technically clean air, only.



Standard air purge collar [TIN-ZTAP] for optics with
a D:S ≥ 10:1 (not for sensing heads with 32 mm length),
fits to the mounting bracket
Hose connection: 3x5 mm
Thread (fitting): M5

The needed amount of air (approx. 2...10 l/ min.) depends on the application and the installation conditions on-site.



Laminar air purge collar [TIN-ZTAP]
The sideward air outlet prevents a cooling
down of the object in short distances.
Hose connection: 3x5 mm
Thread (fitting): M5

Laminar air purge collar with mounting fork
[TIN-ZTAP], adjustable in 2 axes

- The needed amount of air (approx. 2...10 l/ min.) depends on the application and the installation conditions on-site.
- Maximum ambient temperature for TIN-ZTAP: 150 °C

6.3 Further Accessories

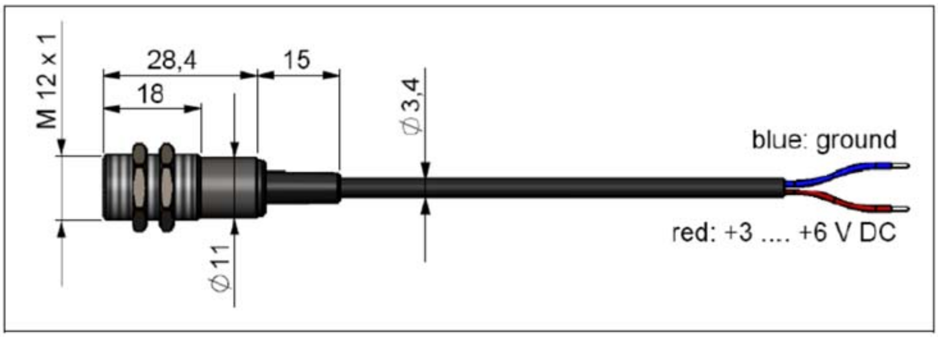
Laser-Sighting tool [TIN-ZTLS]
battery powered (2x Alcaline AA), for alignment of TIN-SP sensing heads. The laser head has the same mechanical dimensions as the TIN-SP sensing head.

 Caution	Do not point the laser directly at the eyes of persons or animals! Do not stare into the laser beam. Avoid indirect exposure via reflective surfaces!

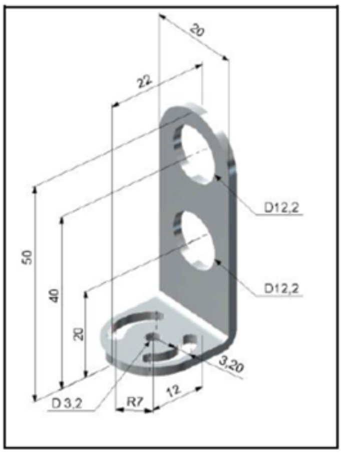
OEM-Laser-Sightingtool

The OEM-Laser-Sighting tool is available with 3.5 m [TIN-ZMLS] connection cable. The laser can be connected to the pins 3 V SW or PINK (only for TIN-SP 4M) and GND [see chapter 7 Electrical Installation] and switched on and off via the programming keys or via the software.

The special double-hole mounting bracket [TIN-ZTF2] allows a simultaneous mounting of the TIN-SP sensing head and the laser head.



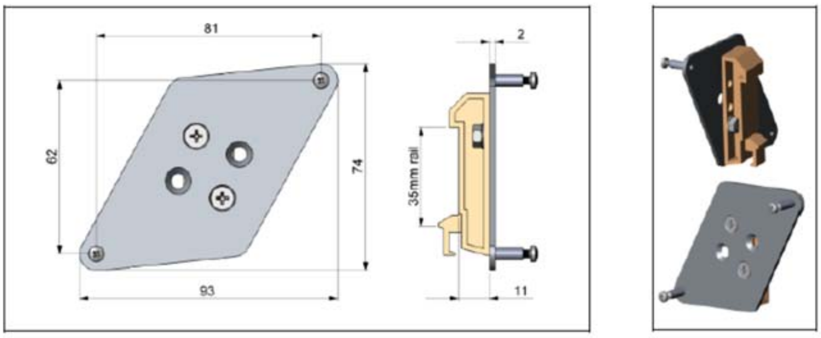
OEM-Laser-Sighting tool [TIN-ZMLS]



Mounting bracket [TIN-ZTF2]

Rail Mount Adapter for Electronic box

With the rail mount adapter the TIN-SP electronics can be mounted easily on a DIN rail (TS35) according EN50022.



Rail Mount Adapter [ACTIN-SPRAIL]

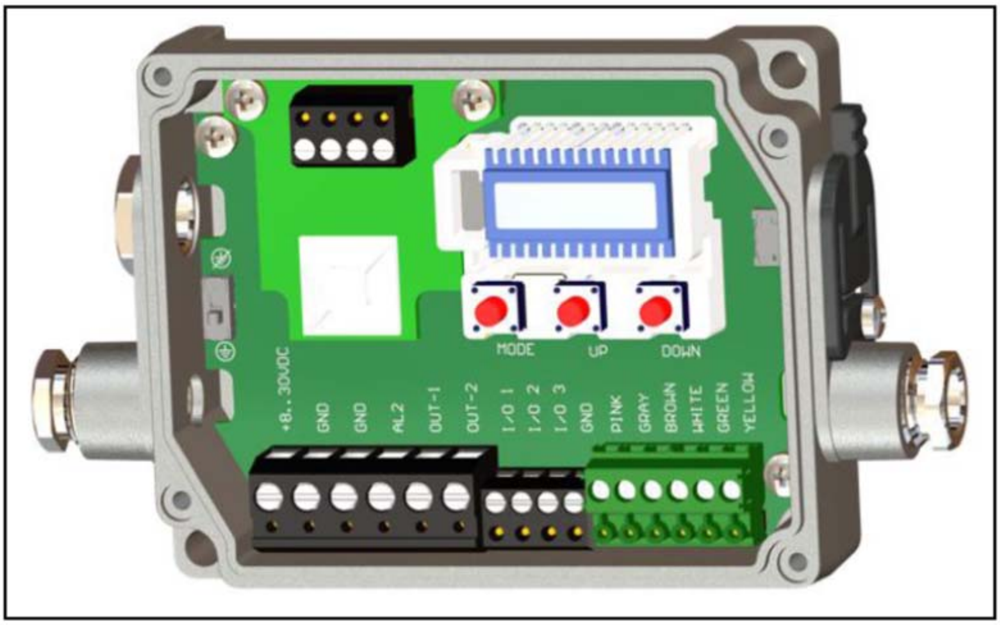
7. Electrical Installation

7.1 Cable Connections

For the electrical installation of the TIN-SP please open at first the cover of the electronic box (4 screws). Below the display are the screw terminals for the cable connection.

7.1.1 Designation

+8…36 VDC	Power supply
GND	Ground (0 V) of power supply
GND	Ground (0 V) of internal in- and outputs
AL2	Alarm 2 (Open collector output)
OUT-1	Analogue output mA, mV, TCK
OUT-2	Analogue output mA, mV, TCK
I/01-I/03	In- and outpus
GND	Ground (0 V)
Pink	3 VDC, switchable, for laser sighting aid
GRAY-YELLOW	cable sensor head



Opened electronic box with terminal connections

NOTE Note	The USB socket on the side is only intended for setup and service and not for continuous use.

The included USB cable can be connected to the side of the electronics box. The device can be operated directly using the CompactPlus Connect software or the IRmobile app.

The side-mounted USB port is intended for setup and service only and is not for continuous use.

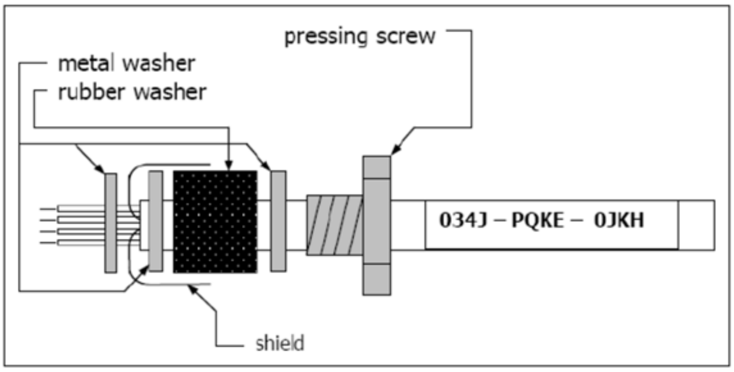
7.1.2 Power supply

Please use a stabilized power supply unit with an output voltage in the range of 8–36 VDC which can supply 100 mA. The ripple should be max. 200 mV.

Caution	Please do never connect a supply voltage to the analog outputs as this will destroy the output! The TIN-SP is not a 2-wire sensor!

7.1.3 Cable Assembling

The cable gland M12x1,5 allows the use of cables with a diameter of 3 to 5 mm. Remove the isolation from the cable (40 mm power supply, 50 mm signal outputs, 60 mm functional inputs). Cut the shield down to approximately 5 mm and spread the strands out. Extract about 4 mm of the wire isolation and tin the wire ends.
Place the pressing screw, the rubber washer and the metal washers of the cable gland one after the other onto the prepared cable end. Spread the strands and fix the shield between two of the metal washers. Insert the cable into the cable gland until the limit stop. Screw the cap tight.
Every single wire may be connected to the according screw clamps according to their colors.



 Note	Use shielded cables only. The sensor shield has to be grounded.

7.1.4 TIN-SP Grounding

On the left side of the mainboard is a black switch that, by default, connects the grounding terminals (GND power supply/outputs) to the ground of the electronics chassis.

To prevent ground loops and associated signal interference in industrial environments, it may be necessary to disconnect this connection. To do this, the switch must be toggled.

8. Outputs and Inputs

8.1 Analog Outputs

The two analog outputs – OUT-1 and OUT-2 of the CTi are freely selectable.
There is the possibility to choose between different Output channels.

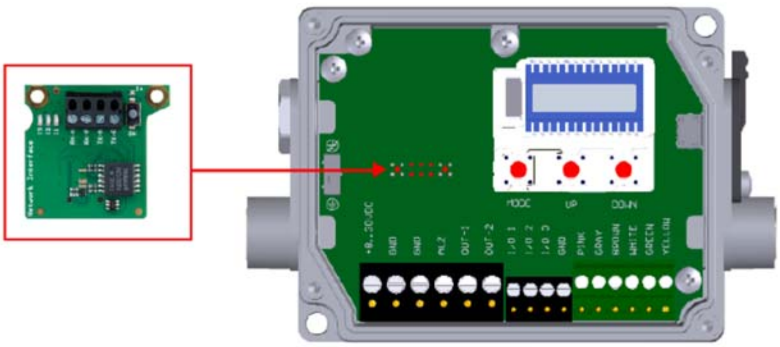
8.1.1 Output channel 1

The outputs can be used for the object temperature, internal temperature (head) and temperature of the electronic box. The selection of the output signal is done via software.

Output signal	Range	Connection pin on CTi-Board
Voltage	0…(5)10 V	OUT-1 or OUT-2
Current	0(4)…20 mA	OUT-1 or OUT-2
Thermocouple	TC K	OUT-1 or OUT-2
Alarm Voltage	On/Off scalable	OUT-1 or OUT-2
Alarm Current	On/Off scalable	OUT-1 or OUT-2

8.2 Digital Interfaces

The TIN-SP sensors can be optionally equipped with an IP67 USB-, RS232-, RS485-, Modbus RTU, Modbus TCP, Ethernet TCP, IP interface.
If you want to install an interface, plug the interface board into the place provided, which is located beside the display (see picture below). In the correct position the holes of the interface match with the thread holes of the electronic box. Now press the board down to connect it and use both M3x5 screws for fixing it. Plug the preassembled interface cable with the terminal block into the male connector of the interface board.



NOTE Note	Digital communication with the interface card is interrupted as long as the integrated USB cable is connected to the PC. Communication is restored as soon as the integrated USB cable is disconnected.

8.3 Relais outputs

The TIN-SP can optionally be equipped with a relay output. The relay board is installed in the same way as the digital interfaces. Simultaneous installation of a digital interface and the relay outputs is not possible. The relay board has two fully isolated switches capable of switching a maximum of 60 VDC/42 VACRMS, 0.4 A DC/AC. A red LED indicates when the switch is closed.

NOTE Note	The switching points correspond to the values for Alarm 1 and 2 [see Chapter 8.4 Alarms] and are set according to the factory default. Advanced settings (changing the Low and High alarms) require a digital interface (USB, RS232) and the software.

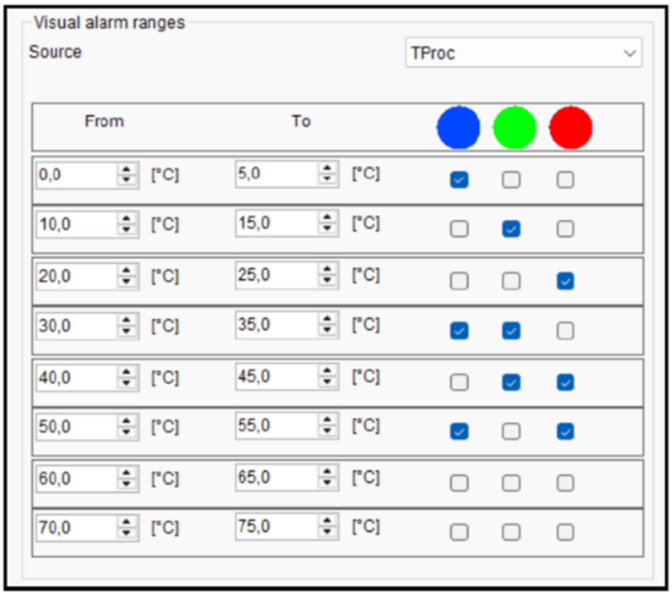
8.4 Alarms

The CT has the following Alarm features:

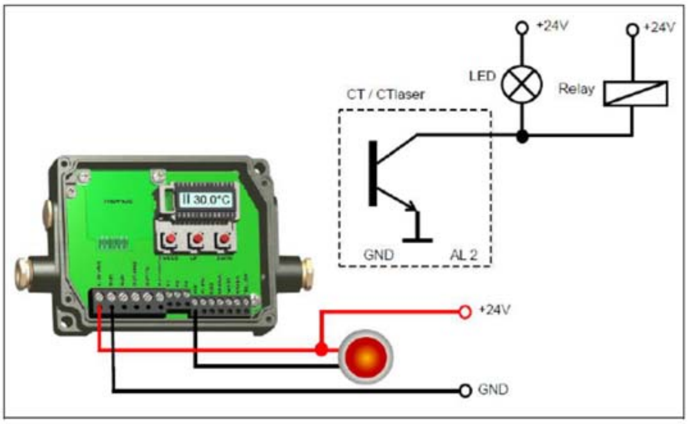
NOTE Note	All alarms (Alarm 1, Alarm 2, Output channel 1 and 2 (used as alarm output)) have a hysteresis of 2 K.

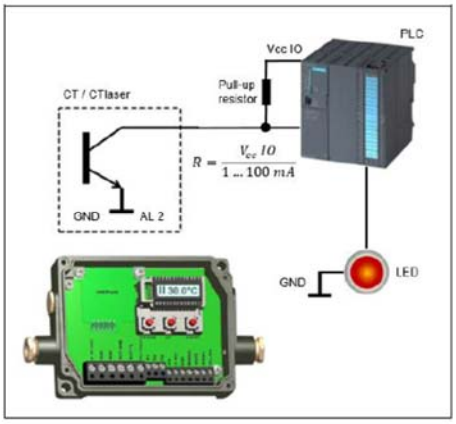
Visual Alarms
These alarms will cause a change of the colour of the LCD display and will also change the status of the optional relays interface. In addition, the Alarm 2 can be used as open collector output at pin AL2 on the mainboard [24 V/ 50 mA].

For extended setup like definition as low or high alarm [via change of normally open/ closed], selection of the signal source [T_{Proc}, T_{Head}, T_{Box}] in the software CompactPlus Connect is needed. The visual alarms are independent of the alarm settings. In the CompactPlus Connect software these can be defined as desired.



8.4.1 Open collector output / AL2:





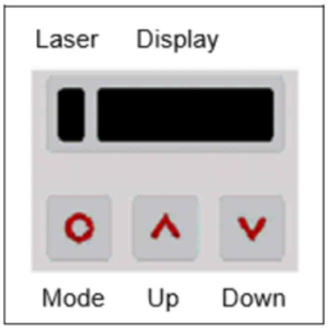
Note	• The transistor acts as a switch. In case of alarm, the contact is closed. • A load/consumer (Relay, LED or a resistor) must always be connected. • The alarm voltage (here 24 V) must not be connected directly to the alarm output (short circuit).

9. Operating

After power up the unit the sensor starts an initializing routine for some seconds. During this time the display will show INIT. After this procedure the object temperature is shown in the display. The display backlight colour changes according to the alarm settings [see chapter 8.4 Alarms].

9.1 Sensor Setup

The programming keys Mode, Up and Down enable the user to set the sensor on-site. The current measuring value or the chosen feature is displayed. With Mode the operator obtains the chosen feature, with Up and Down the functional parameters can be selected – a change of parameters will have immediate effect. If no key is pressed for more than 10 seconds the display automatically shows the calculated object temperature (according to the signal processing).



Pressing the Mode button again recalls the last called function on the display. The signal processing features **Peak hold** and **Valley hold** cannot be selected simultaneously.

Factory Default Setting
To set the TIN-SP back to the factory default settings, please press at first the **Down-key** and then the **Mode-key** and keep both pressed for approx. 3 seconds.
The display will show **RESET** for confirmation.

	Mode [Sample]	**Display**
TPROC 320.9	Process temperature (after signal processing) [320,9 °C]	fixed
T AVG 320.5	Average temperature [320.5°C]	fixed
T INT 50.1	Detector Temperature [50-1 °C]	fixed
T BOX 38.6	Electronic box Temperature [38.6 °C]	fixed
EMISS 1.000	Emissivity [1.000]	**0.050 ... 1.100**
TRANS 1.000	Transmission [1,000]	**0.050... 1.100**
AVG 0.020	Signal output Average [0.020 s]	**AVG 0.000** = inactive/ **0.1 … 65** s
HOLD **H TIM** **H TH** **H HY**	OFF PEAK/ VALL APEAK/ AVALL APEAK/ AVALL	**OFF/ PEAK/ VALL/ APEAK/ AVALL** **0…65 s** (65 = infinity) Threashold value [°C/°F] Hysteresis setting in °C/°F
U °C	Temperature unit [°C]	**°C/ °F**
M 01	Multidrop address [1] (only with RS485 interface) RS422 mode	**01 … 32** **RS422** (press down M01 button)
BAUD 115.2K	Baud rate in kBaud [115]	**115.2 / 921.6 kBaud**
S ON	Laser Sighting	**ON/ OFF**

EMISS 1.000
Setup of **Emissivity**. Pressing **Up** increases the value, **Down** decreases the value (also valid for all further functions). The emissivity is a material constant factor to describe the ability of the body to emit infrared energy.

TRANS 1.000
Setup of **Transmissivity**. This function is used if an optical component (protective window, additional optics e.g.) is mounted between sensor and object. The standard setting is 1.000 = 100 % (if no protective window etc. is used).

AVG 0.020
Setup of Average time. In this mode an arithmetic algorithm will be performed to smoothen the signal. The set time is the time constant. This function can be combined with all other post processing functions. The shortest value is 0,001 s. If the value is set to 0.0 the function is deactivated.

HOLD
Setup of **signal processing**. By pressing Up or Down the mode can be selected.

PEAK: Setup of **Peak hold**. In this mode the sensor is waiting for descending signals. If the signal descends the algorithm maintains the previous signal peak for the specified time.
After the hold time the signal will drop down to the second highest value or will descend by 1/8 of the difference between the previous peak and the minimum value during the hold time. This value will be held again for the specified time. After this the signal will drop down with slow time constant and will follow the current object temperature.
If the value is set to 0.0 the display will show --- (function deactivated).

VALL: Setup of **Valley hold**. In this mode the sensor waits for ascending signals. The definition of the algorithm is according to the peak hold algorithm (inverted).
If the value is set to 0.0 the function deactivated.

APEAK (Advanced Peak Hold): In this mode the sensor waits for local peak values. Peak values which are lower than their predecessors will only be taken over if the temperature has fallen below the **Threshold** value beforehand. If **Hysteresis** is activated a peak in addition must decrease by the value of the hysteresis before the algorithm takes it as a new peak value.

AVALL (Advanced Valley Hold): This mode is the inverted function of Advanced Peak hold. The sensor waits for local minima. Minimum values which are higher than their predecessors will only be taken over if the temperature has exceeded the **Threshold** value beforehand. If **Hysteresis** is activated a minima in addition must increase by the value of the hysteresis before the algorithm takes it as a new minimum value.

U °C
Setup of the Temperature unit [°C or °F].

M 01
Setup of the **Multidrop address**. In a **RS485** network each sensor will need a specific address. This menu item will only be shown if a RS485 interface board is plugged in. For using the **RS422** mode, press once the down button on M01.

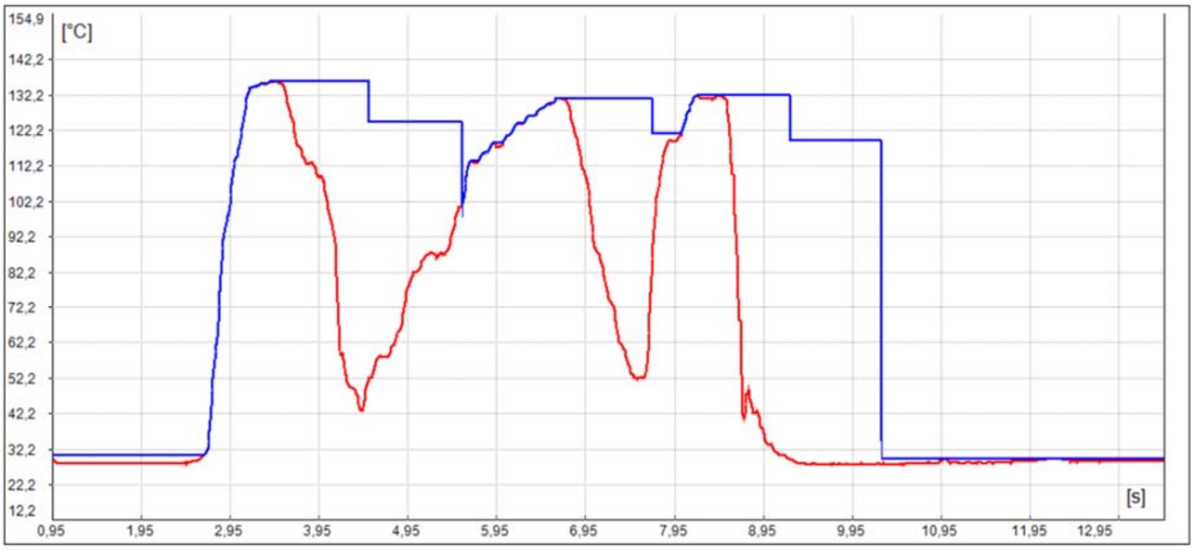
BAUD 115.2K
Setup of the **Baud rate** for digital data transfer.

S OFF
Activating **(ON)** and Deactivating **(OFF)** of an optional **Sighting Laser** [see Further Accessories]. By pressing Up or Down a voltage of 3 VDC will be switched to the PINK connection pin on the mainboard.

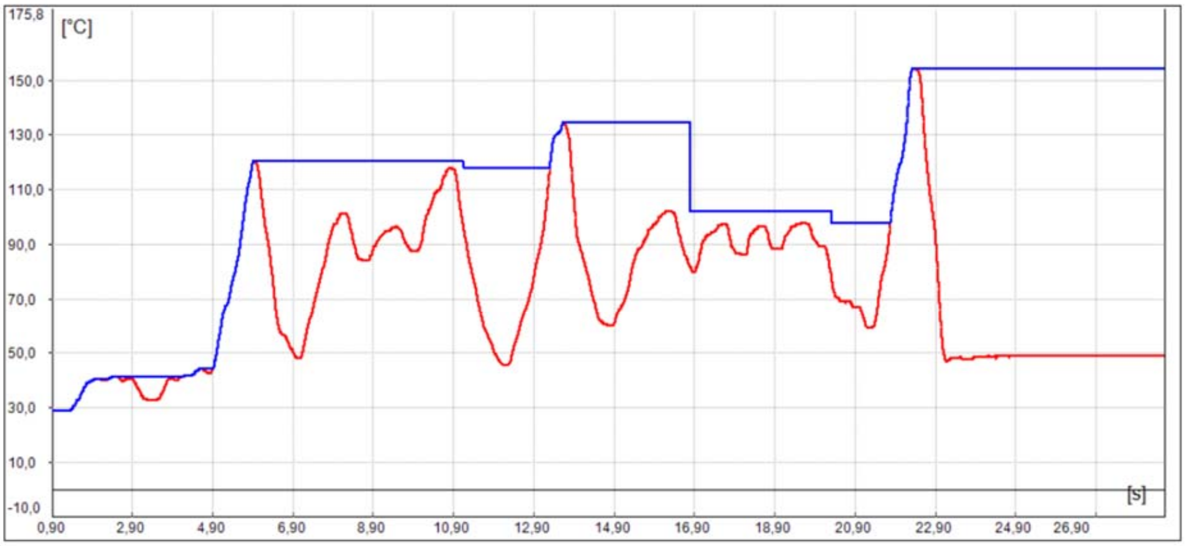
Peak picking function
To detect fast hotspots (detection time 110 µs), the averaging time must be set to 0.0 s.

NOTE Note	You can display the process temperature TProc (with post processing) and the current average temperature TAvg (without any post processing) in the diagram. This allows for easy tracking and control of the results and functionality of the selected post-processing features.

Signal Graphs



— T_{Proc} with Peak Hold (Hold time = 1s)
— T_{Avg} without post processing



— T_{Proc} with Advanced peak hold (Threshold = 80 °C/ Hysteresis = 20 °C)
— T_{Avg} without post processing

10. Software for parameterization

10.1 Installation

The software can be downloaded under the manufacturer website. Unzip and open the program and start the CDsetup.exe. Follow the instructions of the wizard until the installation is finished.

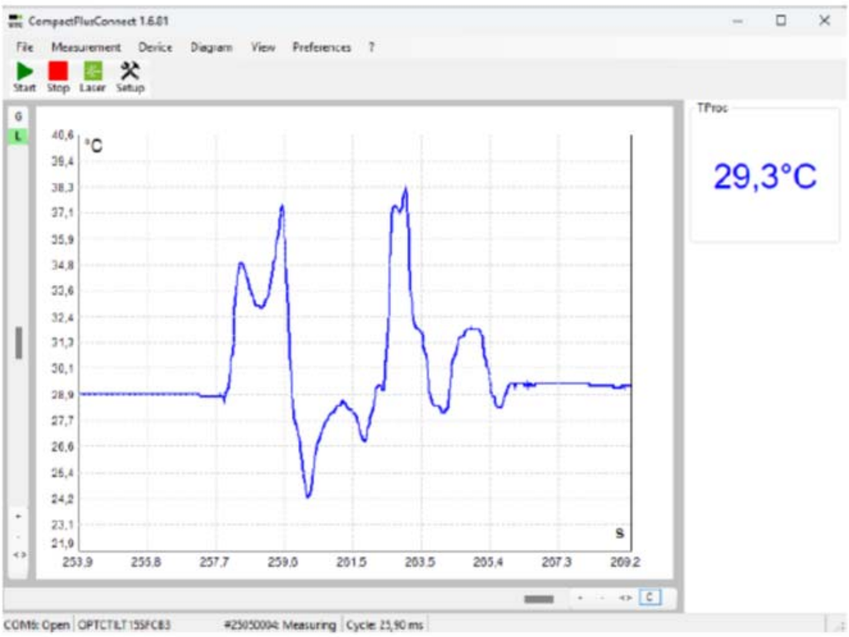
Minimum system requirements:

- Windows 8, 10, 11
- USB interface
- Hard disc with at least 60 MByte free space
- At least 128 MByte RAM

The installation wizard will place a launch icon on the desktop and on the start menu: [Start]\Programs\CompactPlus Connect.
If you want to uninstall the software from your system, please use the uninstall icon in the start menu.

Main Features:

- Graphic display for temperature trends and automatic data logging for analysis and documentation
- Complete sensor setup and remote controlling
- Adjustment of signal processing functions
- Programming of outputs and functional inputs



10.2 Communication Settings

10.2.1 Serial Interface

Baudrate:	9,6...115,2 kBaud (adjustable on the unit or via software) TIN-SP 4M: 115,2 oder 921,6 kBaud (adjustable on the unit or via software)
Data bits:	8
Parity:	none
Stop bits:	1
Flow control:	off

10.2.2 Protocol

All sensors of the TIN-SP series are using a binary protocol. To get a fast communication the protocol has no additional overhead with CR, LR or ACK bytes.

11. 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. 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 (see chapter 12 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. 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.

12. Emissivity

12.1 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 (ε – 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.

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.

12.2 Determination of unknown Emissivity

- irst, 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 number: ACLSED) onto the measuring object, which covers it completely. Now 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.
- Cove 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.

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

12.3 Characteristic Emissivity

In case none of the methods mentioned above help to determine the emissivity you may use the emissivity tables, see Appendix A – Table of Emissivity for metals and Appendix B – Table of Emissivity for non-metals. 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)

13. Maintenance

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).

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

14. Technical Information

Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

15. Order Codes

Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

16. Dimensions

Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

17. Disposal

See “General Safety Instructions” - via the QR code on the device or via www.kobold.com

18. EU Declaration of Conformance

We, KOBOLD Messring GmbH, Nordring 22-24, 65719 Hofheim, Germany, declare under our sole responsibility that the product:

Infrared Pyrometer **Model: TIN-SP**

to which this declaration relates is in conformity with the following EU directives stated below:

2014/30/EU	**EMC Directive**
2014/30/EU	**Low Voltage Directive**
2011/65/EU	**RoHS** (category 9)
2015/863/EU	Delegated Directive (RoHS III)

Also, the following standards are fulfilled:

EN IEC 61326-1:2021 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

EN 61326-2-3:2021 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-3: Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning

EN 61010-1:2010/A1:2019/AC:2019-04 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements

EN 60825-1:2014 + AC:2017 + A11:2021 + A11:2021/AC:2022 Safety of laser products - Part 1: Equipment classification and requirements

EN IEC 63000:2018 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Hofheim, 11 March 2026

H. Volz
General Manager

J. Burke
Compliance Manager

19. Appendix A – Table of Emissivity for metals

Material		typical Emissivity			
Spectral response		1,0 µm	1,6 µm	5,1 µm	8-14 µm
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

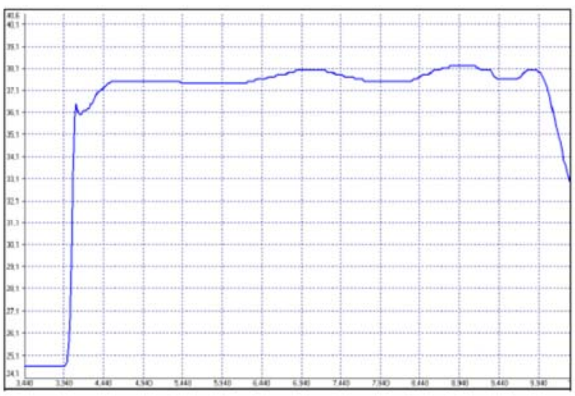
Material		typical Emissivity			
Spectral response		1,0 µm	1,6 µm	5,1 µm	8-14 µm
Lead	polished	0,35	0,05-0,2	0,05-0,2	0,05-0,1
	roughened	0,65	0,6	0,4	0,4
	oxidized		0,3-0,7	0,2-0,7	0,2-0,6
Magnesium		0,3-0,8	0,05-0,3	0,03-0,15	0,02-0,1
Mercury			0,05-0,15	0,05-0,15	0,05-0,15
Molybdenum	non oxidized	0,25-0,35	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

20. Appendix B – Table of Emissivity for non-metals

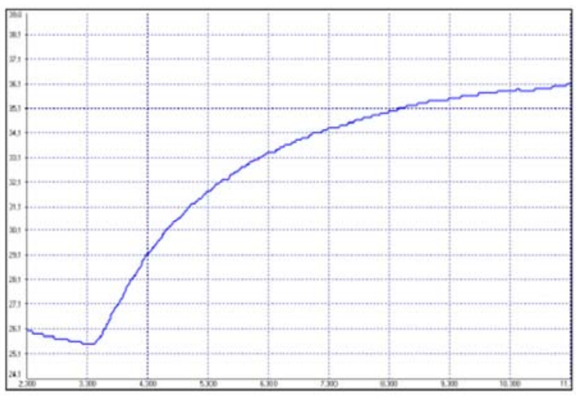
Material		typical Emissivity			
Spectral response		1,0 µm	2,2 µm	5,1 µm	8-14 µm
Asbestos		0,9	0,8	0,9	0,95
Asphalt				0,95	0,95
Basalt				0,7	0,7
Carbon	non oxidized		0,8-0,9	0,8-0,9	0,8-0,9
	graphite		0,8-0,9	0,7-0,9	0,7-0,8
Carborundum			0,95	0,9	0,9
Ceramic		0,4	0,8-0,95	0,8-0,95	0,95
Concrete		0,65	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 µm	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

21. Appendix C – Smart Averaging

The average function is generally used to smoothen the output signal. With the adjustable parameter time this function can be optimal adjusted to the respective application. One disadvantage of the average function is that fast temperature peaks which are caused by dynamic events are subjected to the same averaging time. Therefore those peaks can only be seen with a delay on the signal output.
The function **Smart Averaging** eliminates this disadvantage by passing those fast events without averaging directly through to the signal output.



Signal graph with Smart Averaging function



Signal graph without Smart Averaging function