Operating Instructions
for
Infrared Pyrometer

Model: TIN-SH

1. Contents

Manufactured and sold by:

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2. Note

Please read these operating instructions before unpacking and putting the unit into operation. Follow the instructions precisely as described herein.
The instruction manuals on our website www.kobold.com are always for currently manufactured version of our products. Due to technical changes, the instruction manuals 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 against an applicable postage fee.

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 measuring unit should be used only when the machines fulfil the EC machinery directive.

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-SH

4. Regulation 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-SH 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-SH head is made of stainless steel (IP65/ NEMA-4 rating) – the sensor electronics is placed in a separate box made of die casting zinc.

The CS sensing head is a sensitive optical system. Please use only the thread for mechanical installation.

- 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-SH series are available in the following basic versions:

Model	Model codes	Measurement range	Spectral response	Typical applications
TIN-	SH	-50 to 975 °C	8-14 µm	non-metallic surfaces

5.2 Factory Default Settings

The unit has the following presetting at time of delivery:

Signal output object temperature	0-5 V
Signal output channel 2 (only with TIN-SH 4M)	Internal head temperature: 0-5 V = 0-70 °C
Emissivity	0.970
Transmissivity	1.000
Averaging (AVG)	0.2 s
Smart Averaging	inactive
Peak hold	inactive
Valley hold	inactive
Lower limit temperature range [°C]	0
Upper limit temperature range [°C]	500
Lower alarm limit [°C] (normally closed)	30
Upper alarm limit [°C] (normally open)	100

5.3 General Specifications

	Sensing head	**Electronic box**
Environmental rating	IP65 (NEMA-4)	IP65 (NEMA-4)
Operating Temperature	see: Measurement Specifications	-20...85 °C [1)]
Storage temperature	see: Measurement Specifications	-40...85 °C
Relative humidity	10...95 %, non-condensing	
Material	stainless steel	die casting zinc
Dimensions	28 mm x 14 mm or 32 mm x 14 mm, M12x1	89 mm x 70 mm x 30 mm
Dimensions CThot/ CT P3/ P7	55 mm x 29,5 mm, M18x1 (with massive housing)	
Weight	40 g	420 g
Weight CThot/ CT P3/ P7	205 g (with massive housing)	
Cable length	3 m	
Cable diameter	2,8 mm	
Ambient temperature cable	max. 180 °C [High temperature cable for CThot: 250 °C]	
Vibration	IEC 68-2-6: 3G, 11 – 200 Hz, any axis	
Shock	IEC 68-2-27: 50G, 11 ms, any axis	
Pressure resistance (head)	8 bar	
Software / App (optional)	CompactConnect / CompactPlus Connect / IRmobile	

5.4 Electrical Specifications

Power Supply	8–36 VDC 8-30 VDC / 5 V USB / max. 1,2 W
Outputs/ analog	
Channel 1	selectable: 0/ 4–20 mA, 0–5/ 10 V, thermocouple (J or K) or alarm output (Signal source: object temperature)
Channel 2 [LT/ G5/ P3/ P7 only]	Head temperature [-20...180 °C/ -20...250 °C on LT02H and LT10H] as 0–5 V or 0–10 V output or alarm output (Signal source switchable to object temperature or electronic box temperature if used as alarm output)
Alarm output	Open collector output (NPN type) at Pin AL2 [24 V/ 50 mA]
Output impedances	
mA	max. loop resistance 500 Ω
mV	min. 100 kΩ load impedance
Thermocouple	20 Ω
Digital interfaces	USB
Relay outputs	2 x 60 VDC/ 42 VAC_{RMS}, 0,4 A; optically isolated (optional plug-in module)
Functional inputs / I/O Pins	F1-F3; software programmable for the following functions: • external emissivity adjustment • ambient temperature compensation • trigger (reset of hold functions) Input impedance F2 and F3: 43 kΩ

5.5 Measurement Specifications [TIN-SH]

			TIN-SH
Temperature range (scalable)			-50...975 °C
Ambient temperature (head)		-20...180 °C	
Storage temperature (head)		-40...180 °C	
Spectral range	8...14 µm		
Optical resolution			22:1
System accuracy [1) 2) 3)]	±1,0 °C or ±1,0 %		
Repeatability [1) 3)]	±0,5 °C or ±0,5 %		
Temperature coefficient [4)]	±0,05 K/ K or ±0,05 %/ K		
NETD [3) 5)]		50 mK	
Response time (95 % signal)	150 ms		
Warm-up time	10 min		
Emissivity/ Gain	0,100...1,100 (adjustable via programming keys or software)		
Transmissivity	0,100...1,100 (adjustable via programming keys or software)		
Interface (optional)	USB (programmable adapter)		
Signal processing	Average, peak hold, valley hold (adjustable via programming keys or software)		

[1)] at ambient temperature 23±5 °C; whichever is greater; at object temperatures >0 °C; response time=1s
[2)] Accuracy for thermocouple output: ±2,5°C or ±1%
[3)] ε = 1
[4)] for ambient temperatures (head) <18 °C and >28 °C; whichever is greater
[5)] at time constant 200 ms and an object temperature of 25 °C

5.6 Optical Charts

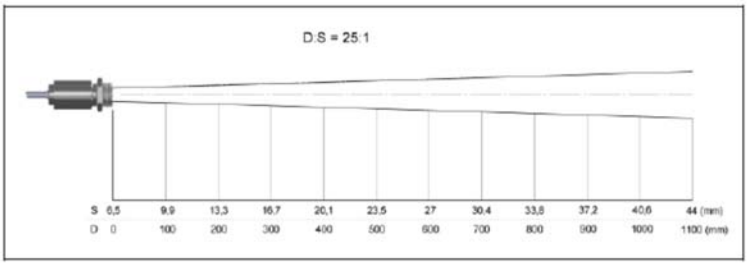
The following optical charts show the diameter of the measuring spot in dependence on the distance between measuring object and sensing head. The spot size refers to 90 % of the radiation energy.
The distance is always measured from the front edge of the sensing head.

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.

TIN-SH

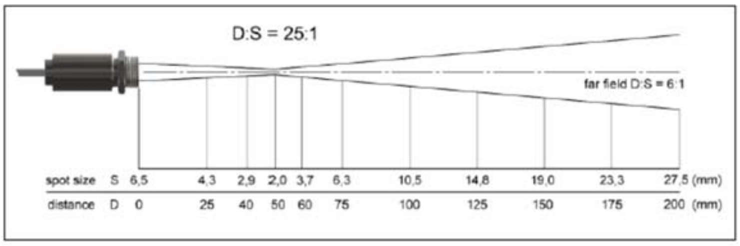
Optics: SF
D:S: 25:1



TIN-SH

Optics: CF
D:S: 25:1

2,0mm@ 50mm
D:S (far field) = 6:1



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-SH 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.

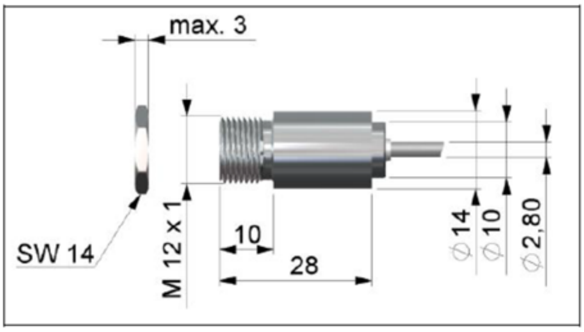
Typical Transmission values* if the CF lens is used (average values):
TIN-SH 0.78
***deviations possible**

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

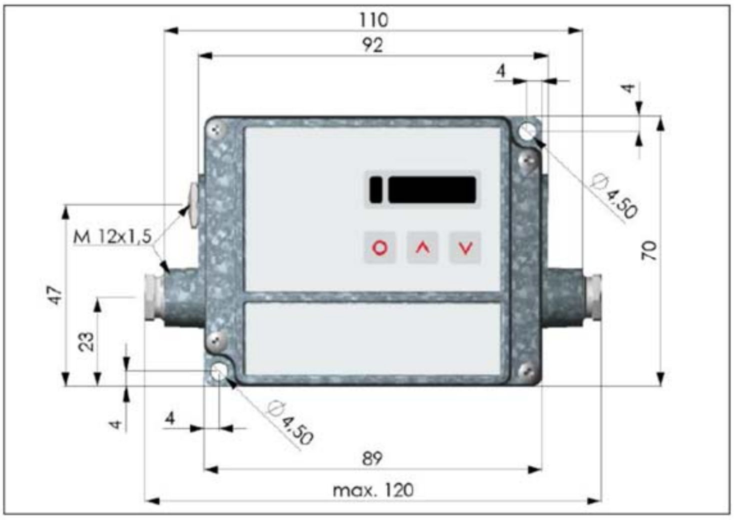
6. Mechanical Installation

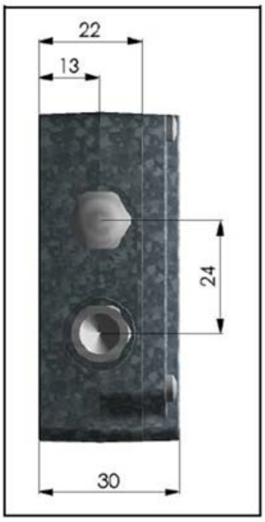
The TIN-SH sensing heads are equipped with a metrical M12x1-thread and can be installed either directly via the sensor thread or with help of the hex nut (included in scope of supply) to the mounting bracket available. Various mounting brackets, which make the adjustment of the sensing head easier, can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

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

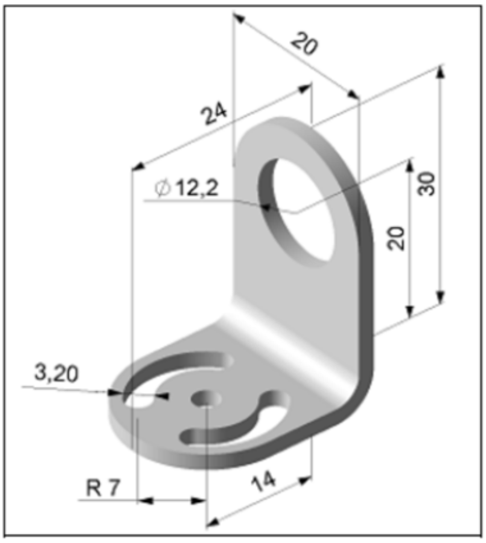


Sensing head

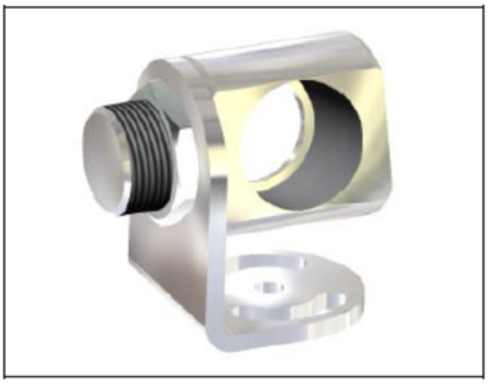




6.1 Mounting Accessories



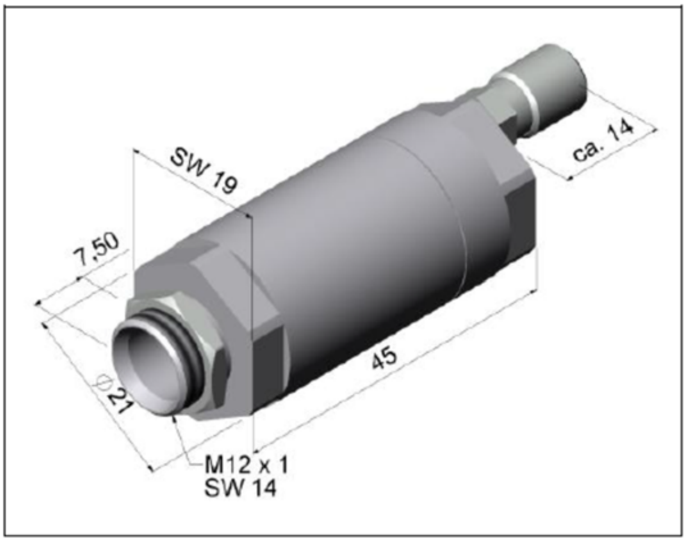
Mounting bracket, adjustable in one axis [TIN-ZTFB]



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

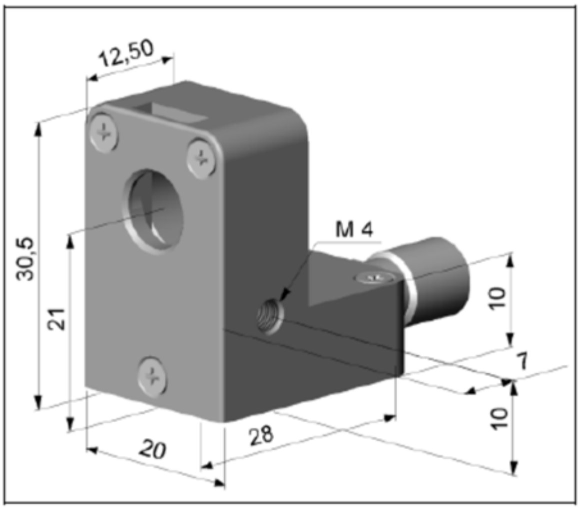
6.2 Air Purge Collars

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

aminar 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.

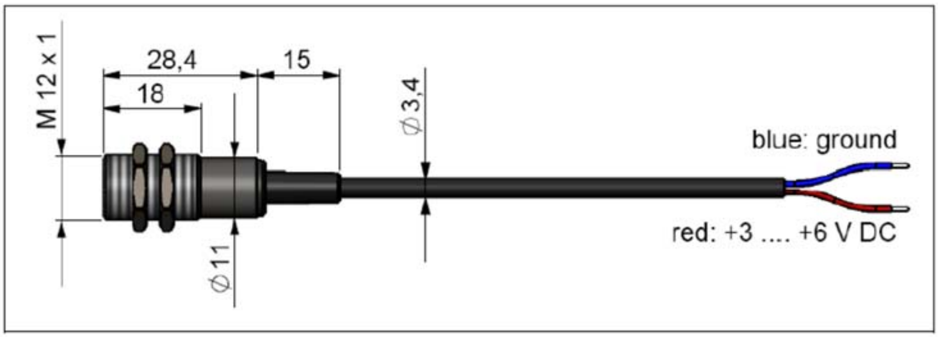
6.3 Further Accessories

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

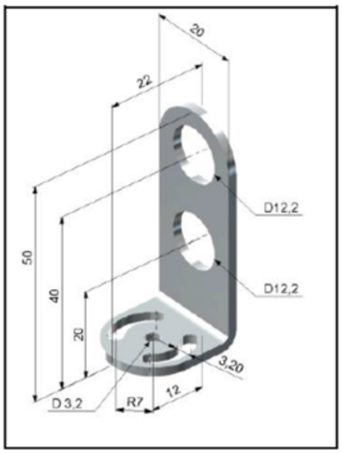
WARNING: Do not point the laser directly at the eyes of persons or animals! Do not stare into the laser beam. Avoid indirect exposure via reflective surfaces!

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-SH 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-SH sensing head and the laser head.

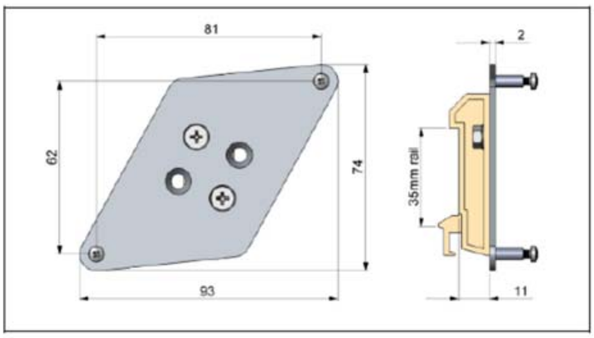


OEM-Laser-Sighting tool [TIN-ZMLS]



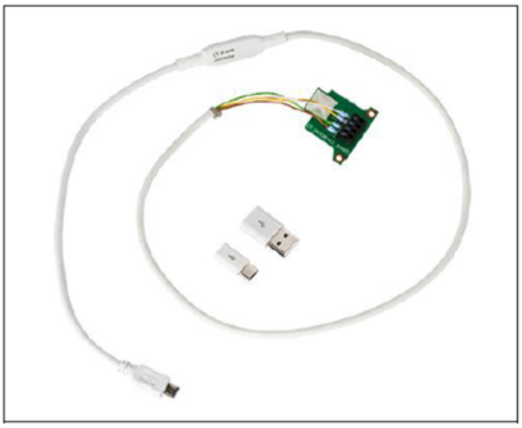
Mounting bracket [TIN-ZTF2]

Rail Mount Adapter for Electronic box
With the rail mount adapter the TIN-SH electronics can be mounted easily on a DIN rail (TS35) according EN50022.




Rail Mount Adapter [ACTIN-SHRAIL]

USB programming adaptor
The connector cable can be used for the connection to your PC in combination with the software which can be downloaded for free on the Kobold website. www.kobold.com/qr/TIN



USB programming adaptor [TIN-ZHIA]

7. Electrical Installation

7.1 Cable Connections

For the electrical installation of the TIN-SH 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
OUT-AMB	Analog output head temperature (mV)
OUT-TC	Analog output thermocouple (J or K)
OUT-mV/mA	Analog output object temperature (mV or mA)
F1-F3	Functional inputs
AL2	Alarm 2 (Open collector output)
3 V SW	3 VDC, switchable, for laser-sightingtool
GND	Ground (0 V) for laser-sightingtool
BROWN	Temperature probe head
WHITE	Temperature probe head
GREEN	Detector signal (–)
YELLOW	Detector signal (+)

Opened electronic box with terminal connections

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

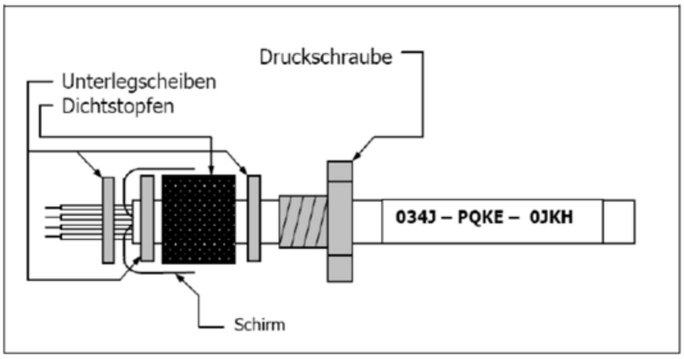
7.1.2 Power supply

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.

Please do never connect a supply voltage to the analog outputs as this will destroy the output!
The TIN-SH 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.



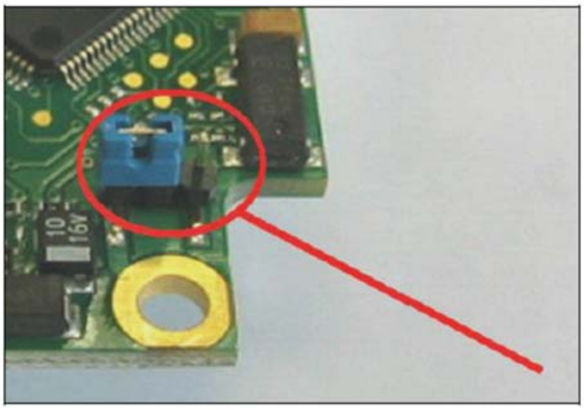
Use shielded cables only. The sensor shield has to be grounded.

7.1.4 TIN-SH

At the bottom side of the mainboard PCB you will find a connector (jumper) which has been placed from factory side as shown in the picture [bottom and middle pin connected]. In this position the ground connections (GND power supply/ outputs) are connected with the ground of the electronics housing.

To avoid ground loops and related signal interferences in industrial environments it might be necessary to interrupt this connection. To do this put the jumper in the opposite position [middle and top pin connected].

If the thermocouple output is used the connection GND – housing should be interrupted generally.



7.2 Exchange of the Sensing Head

From factory side the sensing head has already been connected to the electronics and the calibration code has been entered. Inside a certain model group any exchange of sensing heads and electronics is possible.

After exchanging a head, the calibration code of the new head must be entered into the electronics.

Entering of the Calibration Code
Every head has a specific calibration code, which is printed on the head cable. For a correct temperature measurement and functionality of the sensor this calibration code must be stored into the electronic box. The calibration code consists of 3 blocks (1M, 2M, 3M = 5 blocks) with 4 characters each.

Example: A6FG – 22KB – 0AS0
Block 1 Block 2 Block 3

For entering the code, please press the Up and Down key (keep pressed) and then the Mode key. The display shows HCODE and then the 4 signs of the first block. With Up and Down each sign can be changed; Mode switches to the next sign or next block.

The entering of a new calibration code can also be made via the software (optional).

You will find the calibration code on a label fixed on the head cable (near the electronics). Please do not remove this label or make sure the code is noted anywhere. The code is needed if the electronics has to be exchanged or in case of a necessary recalibration of the sensor.

After you have modified the head code a reset is necessary to activate the change. [see chapter 9 Operating]

7.2.1 Sensing Head Cable

On all TIN-SH models the sensing head cable can be shortened if necessary.

8. Outputs and Inputs

8.1 Analog Outputs

The TIN-SH has two analog output channels.

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

8.1.1 Output channel 1

This output is used for the object temperature. The selection of the output signal can be done via the programming keys [see chapter 9 Operating]. The software allows the programming of output channel 1 as an alarm output.

Output signal	Range	Connection pin on CT board
Voltage	0 ... 5 V	OUT-mV/mA
Voltage	0 ... 10 V	OUT-mV/mA
Current	0 ... 20 mA	OUT-mV/mA
Current	4 ... 20 mA	OUT-mV/mA
Thermocouple	TC J	OUT-TC
Thermocouple	TC K	OUT-TC

According to the chosen output signal different connection pins on the mainboard are used (**OUT-mV/mA** or **OUT-TC**).

8.1.2 Output channel 2

The connection pin OUT-AMB is used for output of the head temperature [-20-180 °C or -20-250 °C (on LT02H and LT10H) as 0–5 V or 0–10 V signal]. The software allows the programming of output channel 2 as an alarm output. Instead of the head temperature T_{Head} also the object temperature T_{Obj} or electronic box temperature T_{Box} can be selected as alarm source.

8.2 Digital Interfaces

The TIN-SH sensors can be optionally equipped with an USB-interface.
If you want to install an interface, plug the interface board into the place provided, which is located beside the display. 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.

8.3 Functional Inputs

The three functional inputs F1 – F3 can be programmed with the software only.

F1 (digital): trigger (a 0 V level on F1 resets the hold functions)
F2 (analog): external emissivity adjustment
[0–10 V: 0 V ► ε = 0,1; 9 V ► ε = 1; 10 V ► ε = 1,1]
F3 (analog): external compensation of ambient temperature/ the range is scalable via software
[0–10 V ► -40-900 °C/ preset range: -20-200 °C]
F1-F3 (digital): emissivity (digital choice via table)

A non-connected input represents:
F1 = High |F2, F3 = Low
[High-Level: ≥ +3 V…+36 V | Low level: ≤ +0,4 V…–36 V]

8.4 Alarms

The CT has the following Alarm features:

All alarms (alarm 1, alarm 2, output channel 1 and 2 if used as alarm output) have a fixed **hysterese of 2 K (CThot: 1 K)**.

8.4.1 Output channel 1 and 2 [channel 2 on LT/ G5/ P3/ P7 only]

To activate the according output channel has to be switched into digital mode. For this purpose, the software is required.

On the TIN-SH model 4M both outputs are freely selectable. Analog mA/mV, Alarm mA/mV and TCK are available.

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].

From factory side the alarms are defined as follows:

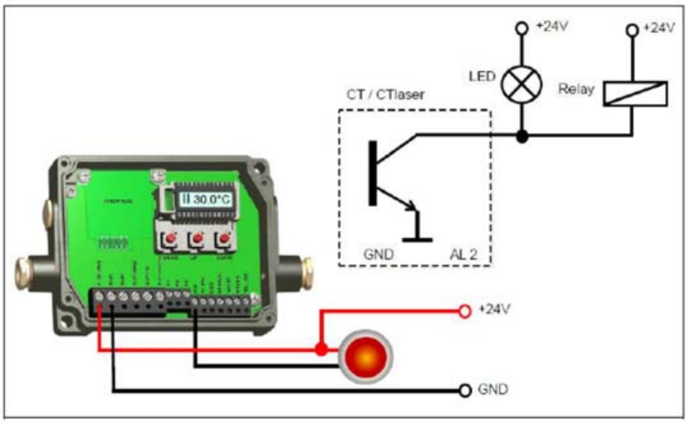
Alarm 1	Norm. closed/ Low-Alarm
Alarm 2	Norm. open/ High-Alarm

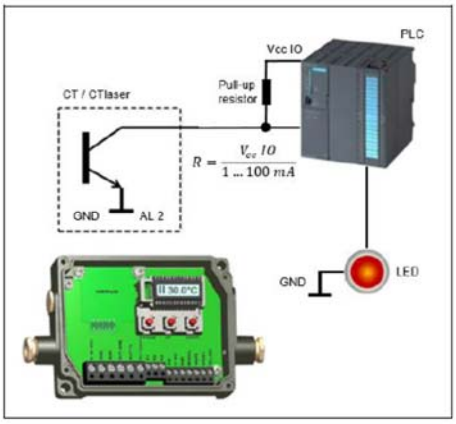
Both of these alarms will have effect on the LCD color:

BLUE: alarm 1 active
RED: alarm 2 active
GREEN: no alarm active

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}] a digital interface (e.g. USB, RS232) including the software is needed.

8.4.2 Open collector output / AL2:





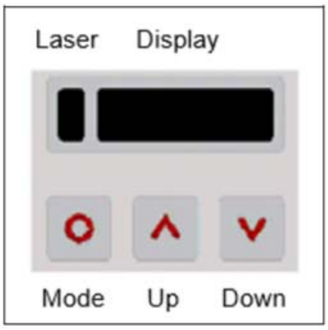
- The transistor acts as a switch. In case of alarm, the contact is closed.
- A load/consumer (Relay, LED or a resistor) must always be connected.
- The alarm voltage (here 24 V) must not be connected directly to the alarm output (short circuit).

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).



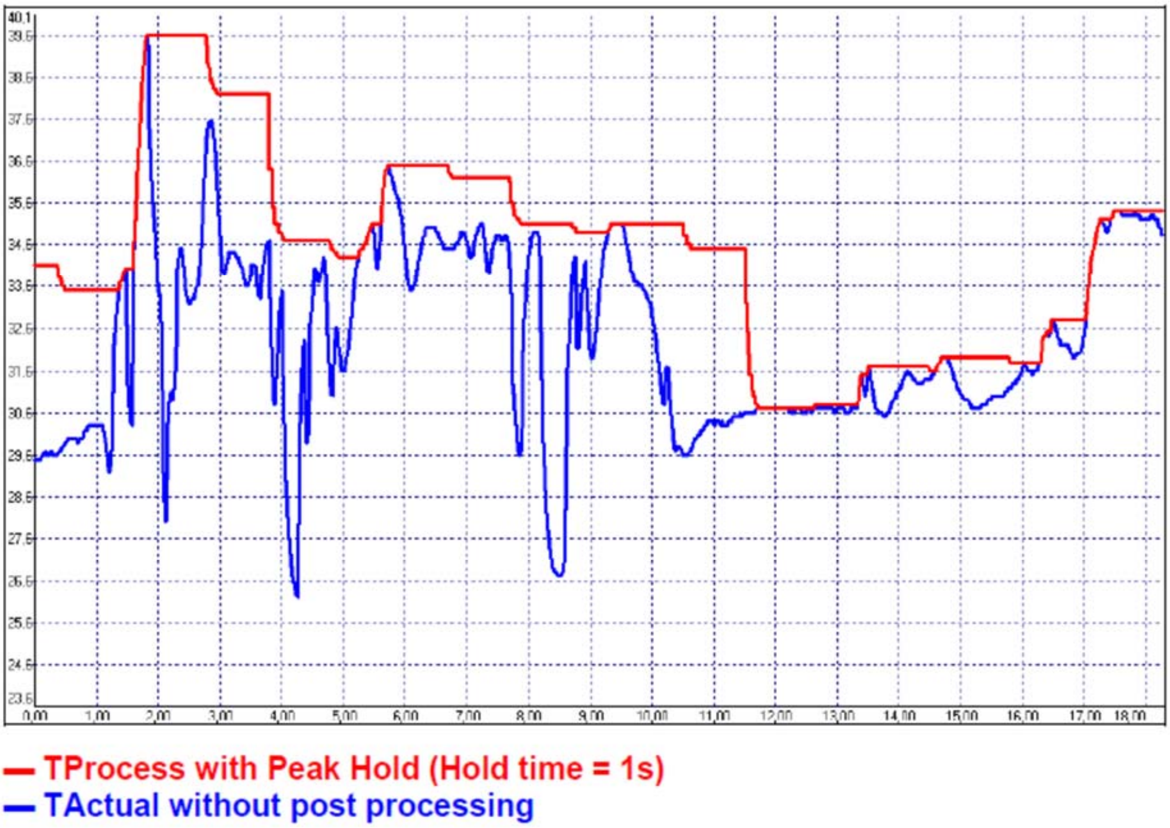
Pressing the Mode button again recalls the last called function on the display. The signal processing features **Peak hold** and **Valley hold** cannot be selected simultaneously.

Factory Default Setting
To set the CT 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.

Display	Mode [Sample]	Adjustment Range
142.3C	Object temperature (after signal processing) [142,3 °C]	fixed
127CH	Head temperature [127 °C]	fixed
25CB	Box temperature [25 °C]	fixed
142CA	Current object temperature [142 °C]	fixed
ð MV5	Signal output channel 1 [0-5 V]	**ð 0-20** = 0–20 mA/ **ð 4-20** = 4–20 mA/ **ð MV5** = 0–5 V/ **ð MV10** = 0-10 V/ **ð TCJ** = thermocouple type J/ **ð TCK** = thermocouple type K
E0.970	Emissivity [0,970]	**0,100 ... 1,100**
T1.000	Transmissivity [1,000]	**0,100 ... 1,100**
A 0.2	Signal output Average [0,2 s]	**A----** = inactive/ **0,1 … 999,9 s**
P----	Signal output Peak hold [inactive]	**P----** = inactive/ **0,1 … 999,9 s/ P oo oo oo oo** = infinite
V----	Signal output Valley hold [inactive]	**V----** = inactive/ **0,1 … 999,9 s/ V oo oo oo oo** = infinite
u 0.0	Lower limit temperature range [0 °C]	**depending on model**/ inactive at TCJ- and TCK-output
n 500.0	Upper limit temperature range [500 °C]	**depending on model**/ inactive at TCJ- and TCK-output
[0.00	Lower limit signal output [0 V]	according to the range of the selected output signal
] 5.00	Upper limit signal output [5 V]	according to the range of the selected output signal
U °C	Temperature unit [°C]	**°C/ °F**
| 30.0	Lower alarm limit [30 °C]	**depending on model**
|| 100.0	Upper alarm limit [100 °C] AL2	**depending on model**
XHEAD	Ambient temperature compensation [head temperature]	**XHEAD** = head temperature/ **-40,0 … 900,0 °C** (for LT) as fixed value for compensation/ returning to XHEAD (head temperature) by pressing **Up** and **Down** together
M 01	Multidrop adress [1] (only with RS485 interface) RS422 mode	**01 … 32** **RS422** (Press Down button on M01)
B 9.6	Baud rate in kBaud [9,6]	**9,6/ 19,2/ 38,4/ 57,6/ 115,2** kBaud
S ON	Laser Sighting (3 VDC switch to connection pin 3V SW)	**ON/ OFF** This menu item appears on first position on 1M/ 2M/ 3M models.

ð MV5	Selection of the **Output signal**. By pressing **Up** or **Down** the different output signals can be selected (see table).
E0.970	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 [see chapter **12 Emissivity**].
T1.000	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).
A 0.2	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. On 1M/ 2M/ 3M models the shortest value is 0,001 s (other models: 0,1 s) and can be increased/ decreased only by values of the power series of 2 (0,002, 0,004, 0,008, 0,016, 0,032, ...). If the value is set to 0.0 the display will show **---** (function deactivated).
P----	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).
V----	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 display will show **---** (function deactivated).

Signal graph with P----



u 0.0	Setup of the **Lower limit of temperature range**. The minimum difference between lower and upper limit is **20 K**. If you set the lower limit to a value ≥ upper limit the upper limit will be adjusted to **[lower limit + 20 K]** automatically.
n 500.0	Setup of the **Upper limit of the temperature range**. The minimum difference between upper and lower limit is **20 K**. The upper limit can only be set to a value = lower limit + 20 K.
[0.00	Setup of the **Lower limit of the signal output**. This setting allows an assignment of a certain signal output level to the lower limit of the temperature range. The adjustment range corresponds to the selected output mode (e.g. 0-5 V).
] 5.00	Setup of the **Upper limit of the signal output**. This setting allows an assignment of a certain signal output level to the upper limit of the temperature range. The adjustment range corresponds to the selected output mode (e.g. 0-5 V).
U °C	Setup of the **Temperature unit** [°C or °F].
| 30.0	Setup of the **Lower alarm limit**. This value corresponds to Alarm 1 **[see chapter 8.4 Alarms]** and is also used as threshold value for relay 1 (if the optional relay board is used).
|| 100.0	Setup of the **Upper alarm limit**. This value corresponds to Alarm 2 **[see chapter 8.4 Alarms]** and is also used as threshold value for relay 2 (if the optional relay board is used).
XHEAD	Setup of the **Ambient temperature compensation**. In dependence on the emissivity value of the object a certain amount of ambient radiation will be reflected from the object surface. To compensate this impact, this function allows the setup of a fixed value which represents the ambient radiation.

Especially if there is a big difference between the ambient temperature at the object and the head temperature the use of Ambient temperature compensation is recommended.

B 9.6	Setup of the **Baud rate** for digital data transfer.
S ON	Activating **(ON)** and Deactivating **(OFF)** of an optional **Sighting Laser [see chapter 6.3 Further Accessories]**. By pressing **Up** or **Down** a voltage of 3 VDC will be switched to the **PINK** connection pin on the mainboard.

9.2 Error messages

The display of the sensor can show the following error messages:

Modell TIN-SH

OVER	Object temperature too high
UNDER	Object temperature too low
^^^CH	Head temperature too high
vvvCH	Head temperature too low

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.

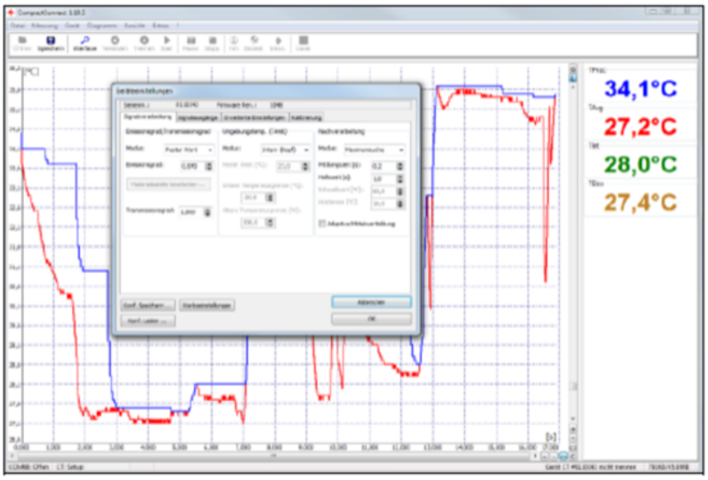
Minimum system requirements:

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

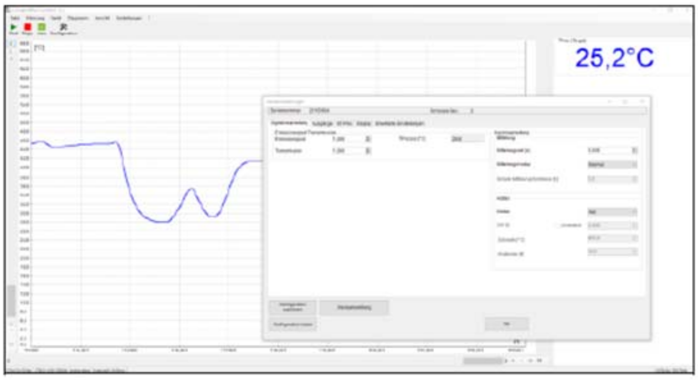
The installation wizard will place a launch icon on the desktop and in the start menu: [Start]\Programs\CompactConnect or [Start]\Programs\CompactPlus Connect.
If you want to uninstall the software from your system, please use the uninstall icon in the start menu.

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



Software for Windows



Software for Windows

10.2 Communication Settings

10.2.1 Serial Interface

Baudrate: 9,6...115,2 kBaud (adjustable on the unit or via software)
TIN-SH 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-SH series are using a binary protocol. Alternatively, they can be switched to an ASCII protocol (only LT versions). To get a fast communication the protocol has no additional overhead with CR, LR or ACK bytes.

10.2.3 ASCII protocol

The models LT02, LT15, LT22, LT02H and LT10H can be switched to ASCII by changing the first figure of block 3 of the head calibration code. This figure has to be changed from 0 to 4 (old sensing head) or 8 to C (new sensing head). [see chapter 7.2 Exchange of the Sensing Head]

Old sensing head	**CTex (+1)**	**ASCII (+4)**	**CTex + ASCII (+5)**
0	1	4	5
New sensing head			
8	9	C	D

Beispiel neuer Messkopf: Binär-Protokoll: A6FG – 22KB – 8AS0 ASCII-Protokoll: A6FG – 22KB – CAS0
1. Block 2. Block 3. Block

After you have modified the head code a reset is necessary to activate the change. [see chapter 9 Operating]

To switch to the ASCII protocol, you can use also the following command:

Dezimal: **131**
HEX: **0x83**
Data, Answer: **byte 1**
Result: **0 – Binary protocol**
1 – ASCII protocol

10.2.4 Saving of parameter settings

After power on of the TIN-SH sensor the flash mode is active. It means, changed parameter settings will be saved in the TIN-SH-internal Flash-EEPROM and will be kept also after the sensor is switched off.
In case settings should be changed quite often or continuously the flash mode can be switched off by using the following command:

Decimal: **112**
HEX: **0x70**
Data, Answer: **byte 1**
Result: **0 – Data will be written into the flash memory**
1 – Data will not be written into the flash memory

If the flash mode is deactivated, all settings will only be kept as long as the unit is powered. If the unit is switched off and powered on again all previous settings are lost.
The command 0x71 will poll the current status.

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).

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

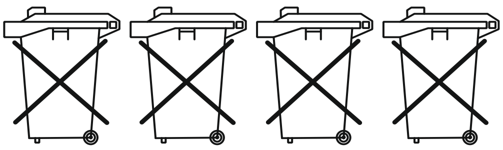
17. Disposal

Note!

- Avoid environmental damage caused by media-contaminated parts
- Dispose of the device and packaging in an environmentally friendly manner
- Comply with applicable national and international disposal regulations and environmental regulations.

Batteries

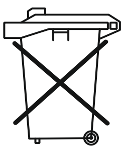
Batteries containing pollutants are marked with a sign consisting of a crossed-out garbage can and the chemical symbol (Cd, Hg, Li or Pb) of the heavy metal that is decisive for the classification as containing pollutants:



Cd[1] Hg[2] Pb[3] Li[4]

1. „Cd" stands for cadmium
2. „Hg" stands for mercury
3. „Pb" stands for lead
4. „Li" stands for lithium

Electrical and electronic equipment



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-SH**

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 + A1:2019/AC:2019 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, 03 Nov. 2023

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

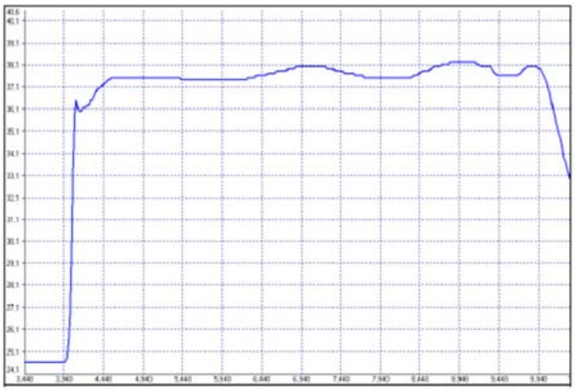
Material		typical Emissivity			
Spectral response		1,0 µm	1,6 µm	5,1 µm	8-14 µm
Lead	polished	0,35	0,05-0,2	0,05-0,2	0,05-0,1
	roughened	0,65	0,6	0,4	0,4
	oxidized		0,3-0,7	0,2-0,7	0,2-0,6
Magnesium		0,3-0,8	0,05-0,3	0,03-0,15	0,02-0,1
Mercury			0,05-0,15	0,05-0,15	0,05-0,15
Molybdenum	non oxidized	0,25-0,35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

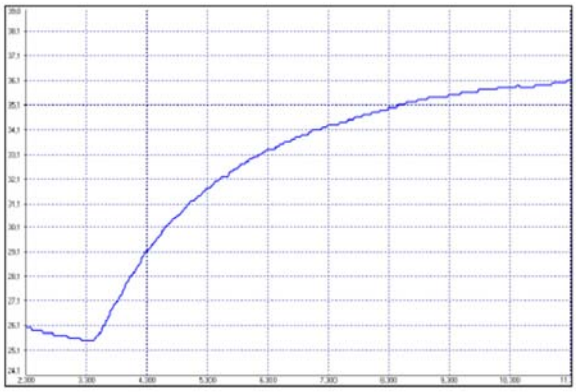
Material		typical Emissivity			
Spectral response		1,0 µm	2,2 µm	5,1 µm	8-14 µm
Asbestos		0,9	0,8	0,9	0,95
Asphalt				0,95	0,95
Basalt				0,7	0,7
Carbon	non oxidized		0,8-0,9	0,8-0,9	0,8-0,9
	graphite		0,8-0,9	0,7-0,9	0,7-0,8
Carborundum			0,95	0,9	0,9
Ceramic		0,4	0,8-0,95	0,8-0,95	0,95
Concrete		0,65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