wenglor
the innovative family

TIF352U0089

Temperature Sensor for Contactless Temperature Measurement

Operating Instructions

Table of Contents

1. General

1.1. Information Regarding these Instructions

- These instructions are intended for the product with the order code TIF352U0089.
- They make it possible to work with the product safely and efficiently.
- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
- Furthermore, local accident prevention regulations and national work safety regulations must also be observed.

Note!
The operating instructions must be read carefully before using the product and kept on file for future reference!

1.2. Explanation of Symbols

- Safety instructions and warnings are emphasized by means of symbols and keywords.
- Safe use of the product is only possible if these safety instructions and warnings are observed.
- Safety instructions and warnings are laid out on the basis of the following principle:

Keyword!
Type and source of danger!
Possible consequences in the event that instructions or warnings are disregarded.
– Risk prevention measure.

The meanings of the keywords and the scope of the associated hazards are explained below:

Danger!
This keyword indicates a hazard with a high degree of risk which, if not avoided, results in death or severe injury.

Warning!
This keyword indicates a hazard with a moderate degree of risk which, if not avoided, may result in death or severe injury.

Caution!
This keyword indicates a hazard with a low degree of risk which, if not avoided, may result in minor or moderate injury.

Attention!
This keyword indicates a potentially hazardous situation which, if not avoided, may result in property damage.

1.3. Limitation of Liability

- The product was developed in consideration of the current state-of-the-art and applicable standards and directives. The product is subject to change without notice.
- Liability on the part of wenglor is excluded in the case of:
    - Non-observance of the instructions
    - Use of the product for other than its intended purpose
    - Use of untrained personnel
    - Use of unapproved replacement parts
    - Unapproved modification of products

1.4. Copyrights

- The contents of these instructions are protected by copyright law.
- All rights are reserved by wenglor.
- Commercial duplication or any other commercial use of the content and information made available in these instructions, including graphics and images as well, is prohibited without obtaining written permission from wenglor.

2. For Your Safety

2.1. Use for Intended Purpose

The product is based on the following functional principle:

Contactless Temperature Measurement
The temperature sensor measures infrared radiation emitted by an object in a contactless fashion, on the basis of which it determines the object's temperature. The sensor detects all objects within its working range which emit adequate amounts of infrared radiation within a spectral range of 8 to 14 μm.

The product can be used in the following industry sectors:

• Special machinery manufacturing
• Heavy equipment manufacturing
• Logistics
• Automotive industry
• Food industry
• Packaging industry
• Pharmaceuticals industry
• Clothing industry
• Plastics industry
• Woodworking industry
• Consumer goods industry
• Paper Industry
• Electronics industry
• Glass industry
• Steel industry
• Printing industry
• Aviation industry
• Construction industry
• Chemicals industry
• Agriculture industry
• Alternative energy
• Raw materials production
• Others

2.2. Use for Other than the Intended Purpose

• No safety components in accordance with the machinery directive

• The product is not suitable for use in potentially explosive atmospheres.

• Only accessories obtained from or approved by wenglor may be used with the product.

Danger!
Danger of property damage in the event of use for other than the intended purpose!
Damage to the sensor and other components.
– Use the product for its intended purpose only.

2.3. Personnel Qualifications

• Suitable technical training is a prerequisite.

• Electrotechnical training within the company is required.

• Qualified personnel must have uninterrupted access to the operating instructions.

Caution!
Danger of property damage and personal injury in the event of improper initial start-up and maintenance!
– Train and qualify personnel adequately.

2.4. Modification of Products

Caution!
Risk of personal injury or property damage if the product is modified!
Personal injury and damage to equipment may occur. Nonobservance may result in loss of the CE mark, and may render the guarantee null and void.
– Modification of the product is prohibited.

2.5. General Safety Precautions

Note!
• These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.

• In the event of possible changes, the respectively current version of the operating instructions can be accessed at www.wenglor.com in the product's separate download area.

• Read the operating instructions carefully before using the product.

• Protect the sensor against contamination and mechanical influences.

2.6. Laser/LED Warnings

| LASER CLASS 1 |
| EN60825-1 |
| 2007 |

Laser Class 1 (EN 60825-1)
Standards and safety regulations must be complied with.

2.7. Approvals and Protection Class

CE UL LISTED — IND. CONT. EQ. 72HL — For use in class 2 circuits — Environmental Type 1 RoHS ⟨III⟩

3.   Technical Data

Technical Data	Order Number: TIF352U0089
Temperature Data	
Working range	−25…350° C (−13…662° F)
Measuring range	375° C (675° F)
Spectral sensitivity	8…14 μm
Switching hysteresis	1 K
Aperture angle:	10°
Emission factor	0.10…1.00
Settling time (warm-up time)	200 ms
Electrical Data	
Supply power	18…30 V DC
Current consumption (operating voltage = 24 V)	< 60 mA
Switching frequency	≤ 15 Hz (at a response time of 0.065 s)
Response time	0.065…30 s
Temperature range	−20…60° C
Temperature drift (−20° C < T_a ≤ 0° C); T_{Obj} = 150° C	< 0.63 °C/K
Temperature drift (0 °C < T_a ≤ 60° C); T_{Obj} = 150° C	< 0.14 °C/K
Number of switching outputs	2
Switching output switching current	200 mA
Analog output	0…10 V
Analog output	4…20 mA
Reproducibility *	2.5 K
Linearity error (−25° C < T_{Obj} ≤ 350° C); Ta = 20° C	3.4 K

Linearity error (−20 °C < T_{Obj} ≤ 200 °C); Ta = 20 °C	0.7 K
Service life (Ta = 25 °C)	100,000 hours
Laser class (EN 60825-1)	1
Short-circuit proof	Yes
Reverse polarity protected and overload proof	Yes
Interface	RS 232
Baud rate	38,400 baud
Mechanical Data	
Housing material	Stainless steel 1.4305
Protection	IP67
Connector type	8-pin M12×1 plug
Protection class	III
Setting method	Menu-driven via 2-key control panel
Output Function	
Analog output	Yes
Can be switched to NC or NO operation	Yes
Programmable as PNP/NPN	Yes

* Maximum possible Switching point or measurement value deviation at successive measurements under the same conditions (Tobj = 200 °C, Tu = 23 °C +/−5 °C; Response Time = 1,33 s; Emission Factor = 0,99). This deviation comprises 100 % of the measurement values determined in a test over the course of 8 hours according to EN60947-5-7.

The following table specifies tightening torques for plugs and mounting options in order to assure compliant, error-free operation:

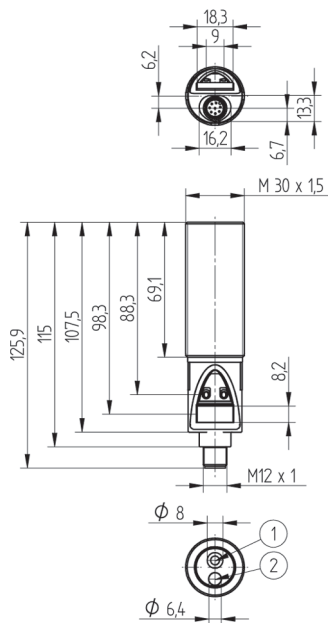| Connector Type	Tightening Torque (Nm)
M12	0.4

3.1. Field of Vision

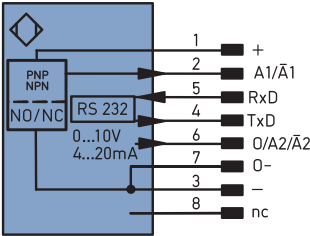The object to be measured must be at least as large as the sensor's field of vision.
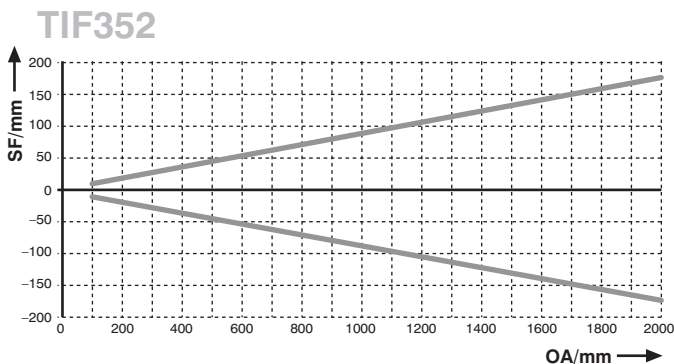
SF = width of the field of vision, OA = distance to object

3.2. Housing Dimensions

1 = lens
2 = laser

3.3. Connection Diagram

Legend

+	Supply Voltage +	
−	Supply Voltage 0 V	
∼	Supply Voltage (AC Voltage)	
A	Switching Output	(NO)
Ā	Switching Output	(NC)
V	Contamination/Error Output	(NO)
V̄	Contamination/Error Output	(NC)
E	Input (analog or digital)	
T	Teach Input	
Z	Time Delay (activation)	
S	Shielding	
RxD	Interface Receive Path	
TxD	Interface Send Path	
RDY	Ready	
GND	Ground	
CL	Clock	
E/A	Output/Input programmable	
◉	**IO**-Link	
PoE	Power over Ethernet	
IN	Safety Input	
OSSD	Safety Output	
Signal	Signal Output	
BI_D+/−	Ethernet Gigabit bidirect. data line (A-D)	

PT	Platinum measuring resistor
nc	not connected
U	Test Input
Ū	Test Input inverted
W	Trigger Input
W −	Ground for the Trigger Input
O	Analog Output
O −	Ground for the Analog Output
BZ	Block Discharge
AMW	Valve Output
a	Valve Control Output +
b	Valve Control Output 0 V
SY	Synchronization
SY−	Ground for the Synchronization
E+	Receiver-Line
S+	Emitter-Line
⏚	Grounding
SnR	Switching Distance Reduction
Rx+/−	Ethernet Receive Path
Tx+/−	Ethernet Send Path
Bus	Interfaces-Bus A(+)/B(−)
La	Emitted Light disengageable
Mag	Magnet activation
RES	Input confirmation

ENA RS422	Encoder A/Ā (TTL)
ENB RS422	Encoder B/B̄ (TTL)
ENA	Encoder A
ENB	Encoder B
AMIN	Digital output MIN
AMAX	Digital output MAX
AOK	Digital output OK
SY In	Synchronization In
SY OUT	Synchronization OUT
OLT	Brightness output
M	Maintenance
rsv	reserved

Wire Colors according to IEC 60757

BK	Black
BN	Brown
RD	Red
OG	Orange
YE	Yellow
GN	Green
BU	Blue
VT	Violet
GY	Grey
WH	White
PK	Pink

3.4. Complementary Products (see catalog)
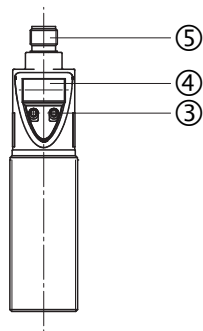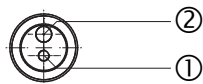
wenglor offers Connection Technology for field wiring.

Suitable mounting technology no.	130
Suitable connection technology no.	89
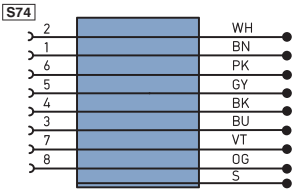
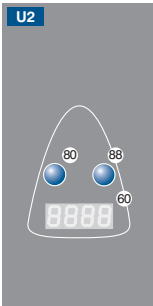## 3.5. Layout

① = Lens

② = Laser

③ = Control Keys

④ = Display

⑤ = Plug Connector

3.6. Control Panel

60 = Display
80 = Mode Key / Switching Status Indicator
88 = Plus Key / Error Display / Switching Status Indicator

Designation	Status	Function
Mode Key / Switching Status Indicator	Yellow off	Switching point A1 / $\overline{A1}$ off
	Yellow on	Switching point A1 / $\overline{A1}$ on
	Yellow blinking	Sensor enabled The sensor is in the configuration menu.
Plus Key / Error Display / Switching Status Indicator	Yellow off	Switching point A2 / $\overline{A2}$ off
	Yellow on	Switching point A2 / $\overline{A2}$ on
	Yellow blinking	Error

3.7. Scope of Delivery

• TIF352U0089 Temperature Sensor
• 2 hex nuts, M30×1.5
• Quick start

4. Transport and Storage

4.1. Transport

Upon receipt of goods, check for transport damage. If damage is apparent, accept the package conditionally and notify the manufacturer regarding the damage. Then return the package making reference to transport damage.

4.2. Storage

The following points must be taken into consideration with regard to storage:

• Do not store outdoors.
• Store the product in a dry, dust-free environment.
• Protect the product against mechanical impacts.
• Protect the product against direct sunlight.

⚠️ **Attention!**
Danger of property damage in the event of improper storage!
Possible damage to the product.
– Observe storage requirements.

5. Installation and Electrical Connection

5.1. Installation

- Protect the product from contamination during installation (see also "2.5. General Safety Precautions" on page 7).
- Corresponding electrical and mechanical regulations, standards and safety rules must be complied with.
- Protect the product against mechanical influences.
- Make sure that the sensor is mounted in a mechanically secure fashion.
- If at all possible, mount the sensor at a right angle to the object to be measured. If this is not possible, the emission factor must be adjusted or determined.
- Minimize ambient influences (air drafts, radiation from other objects) by means of appropriate mounting or shielding.
- The aperture angle must be taken into consideration when mounting the sensor.
- Specified torques must be complied with (see "3. Technical Data" on page 8).

Laser Aligning Tool
- The object can be quickly aligned with the help of the integrated laser.
- The laser beam extends over the entire working range parallel to the axis of the field of vision.
- Distance between the two axes: 9.5 mm
- For correct alignment, the center of the object must always be positioned at the specified distance underneath the sensor.
- The laser does not represent the actual field of vision.
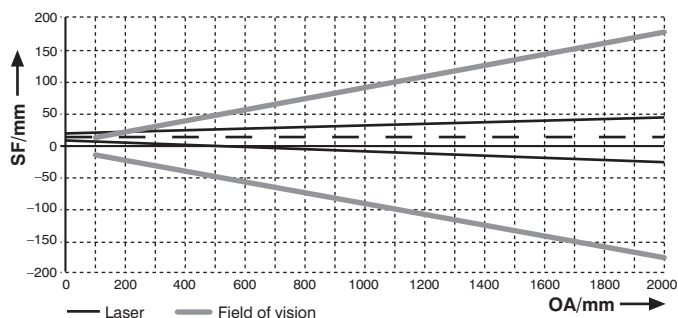
SF = width of the field of vision, OA = distance to object

⚠️ **Attention!**
Danger of property damage in the event of improper mounting!
Possible damage to the product.
– Observe mounting requirements.

5.2. Electrical Connection

• Connect the sensor to 18 to 30 V DC (see "3.3. Connection Diagram" on page 11).

6. Overview of Functions

6.1. Default Settings

Configuration Menu	Submenu	Function
run		Display mode
PInF	AnA	Analog output
AnA	U	Analog voltage output
A.Lo	−25	4 mA / 0 V = −25° C
A.hI	350	20 mA / 10 V = 350° C
SP1	−25	Switching point = −25° C
OFn1	PnP	PNP switching logic
SL1	nc	Normally closed output function
SP2	350	Switching point 2 = 350° C
OFn2	PnP	PNP switching logic
SL2	no	Normally open output function
EP	OFF	Expert menu off
Lasr[1]	On	Laser on
d.U[1]	°C	Temperature unit of measure: °C
EF[1]	0.95	Emission factor: 0.95
S.EF.[1]	Current object temperature at emission factor 1	Temperature-calibrated reference object
rESP[1]	1.33	Response time = 1.33 s
Ser.O[1]	OFF	Continuous temperature read-out off
rES[1]		Reset

[1] Only visible if the expert menu is set to "On".

6.2. Function Definitions

Designation	Function	Page
run	Display mode	19
PInF	Set pin function (analog or switching output)	19
AnA	Adjust analog voltage or current output	19
A.Lo	Temperature which corresponds to 4 mA or 0 V at the analog output	20
A.hl	Temperature which corresponds to 20 mA or 10 V at the analog output	20
SP1	Switching point or switching temperature 1	21
OFn1	Select switching logic, for SP1 (PNP or NPN)	21
SL1	Select output function, for SP1 (NC or NO)	21
SP2	Switching point or switching temperature 2	22
OFn2	Select switching logic, for SP2 (PNP or NPN)	22
SL2	Select output function, for SP2 (NC or NO)	22
EP	Expert menu	23
Lasr	Set laser function (laser on or off)	23
d.U	Select temperature unit of measure (degrees Celsius or Fahrenheit)	24
EF	Adjust emission factor	24
S.EF.	Teach in emission factor	24
rESP	Adjust response time	25
Ser.O	Continuous temperature read-out on or off	25
rES	Reset: restore default settings	26

6.3. Menu Structure

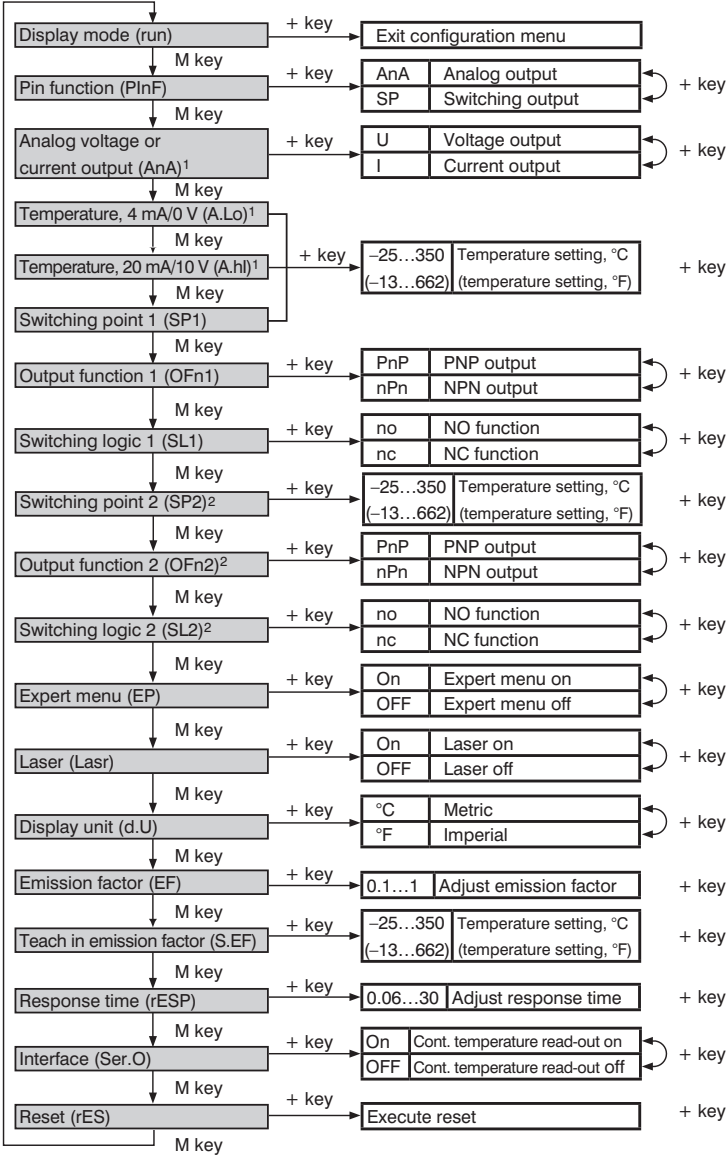| Action	Procedure
Enable	Enabling takes place after pressing and holding the M key for roughly 5 seconds. After 5 seconds, the M key LED starts blinking and the sensor is in the configuration menu.
Navigation	After enabling, you can navigate through the configuration menu by briefly tapping the M key repeatedly. The next menu item appears at the display each time the key is tapped. The current setting in the submenu can be displayed by acknowledging with the + key. If the + key is pressed once again, the respective setting is changed.
Change the setting	If a submenu has been accessed, the current setting is displayed after acknowledging with the + key. If the + key is pressed again, the value is changed or the numeric value is increased. Scrolling quickly through the values can be initiated by pressing and holding the key for more than 3 seconds. After scrolling to the last possible setting for the respective submenu (e.g. 350° C), the values start over again from the beginning (e.g. −25° C). A brief pause in scrolling upon reaching the first setting (e.g. −25° C) indicates that the lowest value has been reached.
Save	Pressing the M key not only advances the display to the next menu item: values changed with the + key in the respective submenu are saved at the same time as well. If the M key is pressed when a submenu is open, the display is returned to the configuration menu.

Lock	The configuration menu can be exited by pressing and holding the M key for roughly 5 seconds, after which the current temperature value is displayed along with the selected settings. If no keys are activated for more than 1 minute, the standard display appears. The last change which has not been acknowledged is lost.

Important: Do not use any sharp objects to press the keys when configuring settings, because they might otherwise be damaged.

⚠️ **Attention!**
Danger of property damage in the event that sharp objects are used!
Possible damage to the keys.
– Do not use sharp objects to enter settings.

The sensor's configuration menu is laid out as follows:

Display mode (run)	+ key	Exit configuration menu	
M key			
Pin function (PInF)	+ key	AnA — Analog output / SP — Switching output	+ key
M key			
Analog voltage or current output (AnA)[1]	+ key	U — Voltage output / I — Current output	+ key
M key			
Temperature, 4 mA/0 V (A.Lo)[1]			
M key			
Temperature, 20 mA/10 V (A.hl)[1]	+ key	−25…350 — Temperature setting, °C / (−13…662) — (temperature setting, °F)	+ key
M key			
Switching point 1 (SP1)			
M key			
Output function 1 (OFn1)	+ key	PnP — PNP output / nPn — NPN output	+ key
M key			
Switching logic 1 (SL1)	+ key	no — NO function / nc — NC function	+ key
M key			
Switching point 2 (SP2)[2]	+ key	−25…350 — Temperature setting, °C / (−13…662) — (temperature setting, °F)	+ key
M key			
Output function 2 (OFn2)[2]	+ key	PnP — PNP output / nPn — NPN output	+ key
M key			
Switching logic 2 (SL2)[2]	+ key	no — NO function / nc — NC function	+ key
M key			
Expert menu (EP)	+ key	On — Expert menu on / OFF — Expert menu off	+ key
M key			
Laser (Lasr)	+ key	On — Laser on / OFF — Laser off	+ key
M key			
Display unit (d.U)	+ key	°C — Metric / °F — Imperial	+ key
M key			
Emission factor (EF)	+ key	0.1…1 — Adjust emission factor	+ key
M key			
Teach in emission factor (S.EF)	+ key	−25…350 — Temperature setting, °C / (−13…662) — (temperature setting, °F)	+ key
M key			
Response time (rESP)	+ key	0.06…30 — Adjust response time	+ key
M key			
Interface (Ser.O)	+ key	On — Cont. temperature read-out on / OFF — Cont. temperature read-out off	+ key
M key			
Reset (rES)	+ key	Execute reset	+ key
M key			

[1] Only visible if the pin function is set to "AnA".
[2] Only visible if the pin function is set to "SP".
.

7. Settings

7.1. run (display mode)

run You can immediately switch to the display mode by pressing the + key.

7.2. PInF (pin function)

PInF

Setting	Description
AnA	**Analog Output**
AnA	Use of the analog output (pin 6 is used as an analog output). Output type (AnA) and temperature for 4 mA/0 V (A.Lo) and 20 mA/10 V (A.hI) must be selected.
SP	**Switching Outputs**
SP	Use of the switching output (pin 6 is used as switching output 2). Switching points (SP1, SP2), output function (OFn1, OFn2) and switching logic (SL1, SL2) must be selected.

7.3. AnA (select analog voltage output or current output)

AnA

Setting	Description
U	**Voltage Output**
U	Temperature is read out at the analog output as a voltage value within a range of 0 V to10 V.
I	**Current Output**
I	Temperature is read out at the analog output as a current value within a range of 4 mA to 20 mA.

7.4. A.Lo (temperature for 4 mA/0 V)

Setting	Description
Value in °C (°F)	**Temperature which Corresponds to 4 mA/0 V at the Analog Output**
	Value within a range of –25…350° C (–13…662° F).

7.5. A.hI (temperature for 20 mA/10 V)

Setting	Description
Value in °C (°F)	**Temperature which Corresponds to 20 mA/10 V at the Analog Output**
	Value within a range of –25…350° C (–13…662° F).

7.6. SP1 (set switching point or switching temperature 1)

SP1 Set the switching point for switching output A1/$\overline{A1}$.

Setting	Description
Value in °C (°F)	**Switching Temperature 1**
-5.0	Value within a range of −25…350° C (−13…662° F). Mode key LED / switching status indicator lights up when set to ON.

7.7. OFn1 (select output function)

OFn1 Select the output function for switching output A1/$\overline{A1}$.

Setting	Description
PnP	**PNP Output**
PnP	The load is connected between the minus pole and the output. When switched, the output is connected to the plus pole via an electronic switch.
nPn	**NPN Output**
nPn	The load is connected between the plus pole and the output. When switched, the output is connected to the minus pole via an electronic switch.

7.8. SL1 (select switching logic)

SL1 Select switching logic for switching output A1/$\overline{A1}$.

Setting	Description
no	**Normally Open (NO)**
no	The switching output is set to ON when the measured object temperature is higher than the selected switching point (SP1). The switching output is set to OFF when the measured object temperature is lower than the selected switching point (SP1).
nc	**Normally Closed (NC)**
nc	The switching output is set to ON when the measured object temperature is lower than the selected switching point (SP1). The switching output is set to OFF when the measured object temperature is higher than the selected switching point (SP1).

7.9. SP2 (set switching point or switching temperature 2)

SP2 Set the switching point for switching output A2/A̅2̅.

Setting	Description
Value in °C (°F)	**Switching Temperature 2**
1830	Value within a range of −25…350° C (−13…662° F). Plus key LED / error display / switching status indicator lights up when set to ON.

7.10. OFn2 (select output function)

OFn2 Select the output function for switching output A2/A̅2̅.

Setting	Description
PnP	**PNP Output**
PnP	The load is connected between the minus pole and the output. When switched, the output is connected to the plus pole via an electronic switch.
nPn	**NPN Output**
nPn	The load is connected between the plus pole and the output. When switched, the output is connected to the minus pole via an electronic switch.

7.11. SL2 (select switching logic)

SL2 Select switching logic for switching output A2/A̅2̅.

Setting	Description
no	**Normally Open (NO)**
no	The switching output is set to ON when the measured object temperature is <u>higher</u> than the selected switching point (SP2). The switching output is set to OFF when the measured object temperature is <u>lower</u> than the selected switching point (SP2).
nc	**Normally Closed (NC)**
nc	The switching output is set to ON when the measured object temperature is <u>lower</u> than the selected switching point (SP2). The switching output is set to OFF when the measured object temperature is <u>higher</u> than the selected switching point (SP2).

7.12. EP (expert menu)

 Different menu items and submenu items appear depending on whether the expert menu is set to ON or OFF. The expert menu is set to OFF as a default value. The menu is shorter and easier to use as a result. If the displayed menu items are insufficient for the respective application, the expert menu can be switched on in order to be able to take advantage of the sensor's full scope of functions.

Setting	Description
On	Expert Menu On
	The expert menu is switched on and all menu items can be viewed.
OFF	Expert Menu Off
	The expert menu is switched off and only a few menu items can be viewed.

7.13. Lasr (set laser function)

Setting	Description
On	Laser On
	The laser is switched on.
OFF	Laser Off
	The laser is switched off.

7.14. d.U (select temperature unit of measure)

Setting	Description
°C	**Metric Unit of Measure for Temperature**
	The temperature is read out in °C.
°F	**Imperial Unit of Measure for Temperature**
	The temperature is read out in °F.
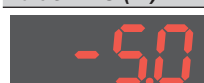
7.15. EF (adjust emission factor)

Setting	Description
EF	**Adjust Emission Factor**
	The emission factor can be set within a range of 0.1 to 1 in steps of 0.01. The emission factor must be accurately adjusted in order to obtain a precise temperature measurement. The emission factor should be set as high as possible, and should not be less than 0.25. See "Emission Factor" on page 28 regarding selected materials and options for determining emission factors. If the emission factor has been adjusted and saved, "S.EF" is deactivated. The last saved value is valid.

7.16. S.EF (determine emission factor with a reference device)

Setting	Description
Value in °C (°F)	**Teach In Emission Factor**
	Teach in the object temperature using values within a range of −25…350° C (−13… 662° F). If the emission factor of the object to be measured is unknown, it can be determined automatically by entering the object's temperature (ascertain temperature with the help of a contact sensor, for example). If "S.EF" has been adjusted and saved, "EF" is deactivated. The last saved value is valid. No temperatures can be taught in with an emission factor of greater than 1.0 or less than 0.1.

7.17. rESP (set response time)

Setting	Description
Value in s	**Response time can be set to one of the following values:**
	0.065 s, 0.10 s, 0.34 s, 1.10 s, 1.33 s, 3.00 s, 5.00 s, 10.00 s, 30.00 s The higher the response time setting, the greater the extent to which temperature peaks and fluctuations can be filtered. Adjusting response time changes the switching frequency. **Note!** Switching frequency is reduced as response time is increased.

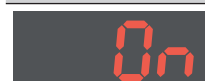## 7.18. SEr.O (activate or deactivate the continuous temperature read-out)

 The sensor is equipped with an RS 232 port for communication with a device such as a PC or a controller.
All sensor settings can be selected digitally with a PC, and all values generated by the sensor can be read out at a PC.

Interface configuration:
Baud rate: 38,400 baud, COM: 34800,n,8,1

Setting	Description
On	**Continuous temperature read-out On**
	The sensor reads out the measured temperature once every 100 ms. **Note!** Configuration via wTeach software is not possible in this setting.
OFF	**Continuous temperature read-out Off**
	The sensor can be configured and/or queried via the serial port. All read-outs, including temperature, are executed as the result of an RS 232 command. **Note!** If the sensor will be set up via the serial port (wTeach software), this setting must be selected.

7.19. rES (reset)

Setting	Description
rES	**Affected sensor setting are returned to their default values.**
	• Press and hold the + key for roughly 5 seconds. • "rESE" appears at the display to confirm that resetting has been successfully completed. • The sensor is then returned to normal operation (temperature display) with its default settings.

7.20. Diagnostics

Display	Description	Corrective Measure
	Object temperature outside of the working range.	The temperature of the object must lie within the working range.

In the event of an error, the plus key LED / error display / switching status indicator blinks.

8. RS 232 Port

Process and parameter data can be accessed in the download area for the product at www.wenglor.com.

9. Maintenance Instructions

Note!
• This wenglor sensor is maintenance-free.

• It's advisable to clean the lens and the display, and to check plug connections at regular intervals.

• Do not clean the sensor with solvents or cleansers which could damage the product.

• Contamination on the lens results in incorrect measured values.

• The lens must therefore be inspected at regular intervals and cleaned when necessary.

• Dust should be removed first with an air jet or a soft brush.

• Clean, soft, lint-free cloths are also suitable.

• As little pressure as possible should be applied to the lens during cleaning, in order to avoid scratching.

10. Proper Disposal

wenglor sensoric GmbH does not accept the return of unusable or irreparable products. Respectively valid national waste disposal regulations apply to product disposal.

11. Exclusion of Liability

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12. Appendix

12.1. Operating Instructions Change Index

Version	Date	Description/Change
1.0.0	21.05.2015	Layout revised
1.1.0	24.02.2016	Correction of the description of the SEr.O function (serial interface)
1.2.0	04.07.2019	Supplementing the Definition of Reproducibility (Chapter 3)

12.2. Emission Factor

The following table includes a selection of emission factors provided as examples within a spectral range of 8 to14 μm at a temperature of 70° C. To a great extent, the actual emission factor depends on the object's surface finish (especially in the case of metals).

Material	Specification	Emission Factor
Aluminum	Sheet	0.03…0.06
Aluminum	Anodized, light gray, dull	0.95…0.97
Aluminum	Cast, sandblasted	0.46
Bronze	Phosphor bronze	0.06
Stainless steel	Polished	0.07
Galvanized iron	Sheet, oxidized	0.85
Iron and steel	Cold rolled	0.09
Fiberboard	Chloritoid	0.88
Fiberboard	Particle board	0.89
Veneer	Oak parquet floor as well	0.90…0.93
Granite	Rough	0.77…0.87
Wood	Planed oak	0.88
Plastic	Fiberglass laminate (PCB)	0.91
Plastic	PVC, dull, textured	0.93
Paint	3 colors sprayed onto aluminum	0.92…0.94
Paint	8 different colors and qualities	0.92…0.94
Brass	Oxidized	0.03…0.07
Paper	4 different colors	0.92…0.94
Paper	White, various degrees of gloss	0.88…0.90
Stainless steel	Sheet, untreated	0.28

Determining the Emission Factor

If the material of the object to be measured is known, the values in the table can be used as approximations. Most organic materials such as plastics, textiles and wood have an emission factor of approximately 0.95. In the case of objects made of unknown materials or where highly precise measurements are required, one of the following methods can be used in order to accurately determine the emission factor.

Comparative Measurement

1 Measure and make a note of the temperature of the object with the help of a thermocouple or another temperature measuring device which makes contact with the object.
2 Adjust the wenglor temperature sensor so that it's aligned to the object. The object must entirely fill out the sensor's field of vision.
3 Set the emission factor as described in "7.15. EF (adjust emission factor)" on page 24.

Heat Up to a Known Value

1 Heat up the object (or a specimen of the object's material) to a known temperature. The sensor and the air surrounding the specimen must have the same temperature.
2 Adjust the wenglor temperature sensor so that it's aligned to the object. The object must entirely fill out the sensor's field of vision.
3 Set the emission factor so that the temperature measured in step 1 is displayed.

Mask the Object using a Material with a Known Value

1 This method is suitable for objects with temperatures of less than 260° C.
2 Cover the object or a specimen of the object's material using masking tape with a known emission factor. Wait long enough for the temperature of the masking tape to adjust to the temperature of the object.
3 Set the emission factor at the sensor to the known value of the masking tape. Measure the temperature of the masking tape (surface "A" in the figure below) with the temperature sensor. Make sure that the measured area entirely fills out the sensor's field of vision.
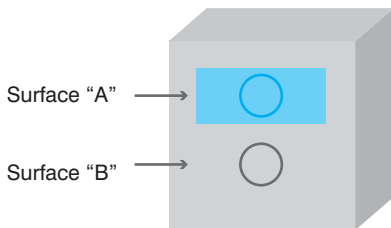
Surface "A"

Surface "B"

4 Adjust the wenglor temperature sensor so that it's aligned to an uncovered area on the object (surface "B" in the figure). Make sure that the measured area entirely fills out the sensor's field of vision. This surface should be as close as possible to the area covered with masking tape.
5 Set the emission factor so that the temperature measured in step 3 is displayed.

Paint the Object

1 Paint part of the object (or a specimen of the object's material) using a black paint with a known emission factor, and allow the paint to dry.
2 Set the emission factor at the sensor to the known value of the paint. Measure the temperature of the painted part of the object (surface "A" in the figure above) with the sensor. Make sure that the measured area entirely fills out the sensor's field of vision.
3 Adjust the wenglor temperature sensor so that it's aligned to an unpainted area on the object.
4 Set the emission factor so that the temperature measured in step 2 is displayed.

12.3. EU Declaration of Conformity

The EU Declaration of Conformity can be found in the download area for the product on our website at www.wenglor.com.