

**TP10**



**EN**

**OPERATING MANUAL**  
PYROMETER

 **TROTEC**  
AT WORK.

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**Notes regarding the operating manual****Symbols****Danger!**

Warns of a hazard which can lead to injuries.

**Risk from laser radiation!**

Warns of injury risk from laser radiation.

**Caution!**

Warns of a hazard which can lead to damage to property.

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The only party responsible for determining measured results to be valid, drawing conclusions and deriving actions is the user! TROTEC® accepts no claims of warranty for the correctness of the determined measured values or measured results. Further, TROTEC® accepts no liability whatsoever for possible mistakes or damage which have been caused by utilising the determined measured results. © TROTEC®

**Information about the device****Functional description**

The pyrometer TP10 uses an infrared sensor to measure surface temperatures without contact. An integrated dual laser pointer can be switched on for the precise determination of the measuring spot diameter.

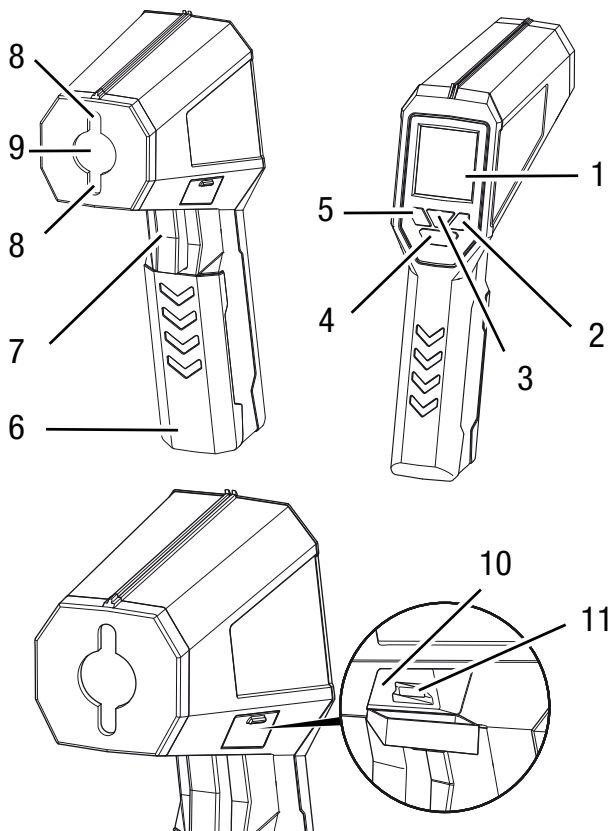
The degree of emission of the material to be measured can be set individually.

The device further features an alarm function. When exceeding or falling below the individually specified values, the device emits an acoustic signal.

The display can be illuminated as needed.

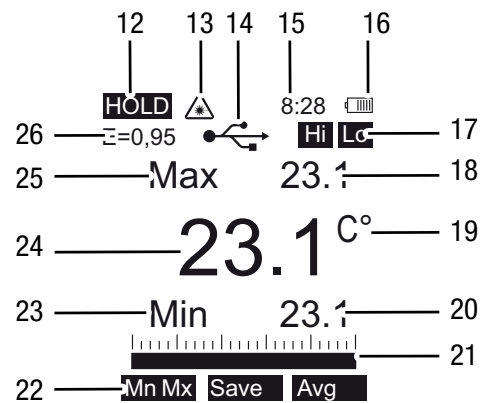
An automatic switch-off saves the battery.

**Device depiction**



No.	Operating element
1	Display
2	F3 button
3	F2 button
4	Mode key
5	F1 button
6	Battery compartment with cover
7	Measurement button
8	Dual laser pointer
9	Infrared sensor
10	Miniature contact pin connection
11	USB connection

**Display**



No.	Display element
12	Scan/Hold indication
13	Laser indication
14	USB indication
15	Time
16	Battery status
17	Saving/Hi/Lo indication
18	Measurement value display top
19	Temperature indication
20	Measurement value display bottom
21	Scale
22	Menu
23	Min/Dif indication
24	Measurement value display
25	Max/Avg indication
26	Indication of the emission value

## Technical data

<b>Model</b>		TP10
<b>Weight</b>		300 g
<b>Dimensions (H x W x D)</b>		168 mm x 56 mm x 225 mm
<b>Temperature range</b>		-50 °C to 1850 °C (-58 °F to 2912 °F)
<b>Resolution</b>	≤ 1000 °C	0.1 °C (0.1 °F)
	> 1000 °C	1 °C (1 °F)
<b>Target display</b>		Laser class (II), 630 to 670 nm, < 1 mW
<b>Accuracy</b> (at ambient temperatures of 23 to 25 °C (73 to 77 °F))	-50 to 20 °C (-58 to 68 °F)	±3.0 °C (5.4 °F)
	21 °C to 500 °C (69 °F to 932 °F)	± 1 %, ± 1 °C (1.8 °F)
	501 °C to 1000 °C (933 °F to 1832 °F)	± 1.5 %
	1001 °C to 1850 °C (1833 °F to 3362 °F)	± 2.0 %
<b>Repeatability</b>	-50 to 20 °C (-58 to 68 °F)	±1.5 °C (2.7 °F)
	21 °C to 1000 °C (69 °F to 1832 °F)	± 0.5 %, ± 0.5 °C (0.9 °F)
	1001 °C to 1850 °C (1833 °F to 3362 °F)	± 1 %
<b>Degree of emission</b>		Adjustable from 0.10 to 1.0
<b>Response time</b>		150 ms
<b>Spectral sensitivity</b>		8~14 μm
<b>Optical resolution (D:S)</b>		75:1
<b>Smallest measuring spot Ø</b>		18 mm
<b>Automatic switch-off</b>		after approx. 7 seconds
<b>Operating conditions</b>		0 °C to 50 °C (32 °F to 122 °F), 10 to 90 % RH
<b>Storage conditions</b>		-10 °C to 60 °C (-2 °F to 140 °F), < 80 % RH
<b>Power supply</b>		9 V battery

### Type K contact sensor

<b>Temperature range</b>	-50 °C to 300 °C (-58 °F to 572 °F)
<b>Resolution</b>	0.1 °C (0.1 °F)
<b>Accuracy</b>	± 1.5 %, ± 3 °C (5 °F)
<b>Repeatability</b>	± 1.5 %
<b>Operating conditions</b>	0 °C to 50 °C (32 °F to 122 °F), 10 to 90 % RH
<b>Storage conditions</b>	-10 °C to 60 °C (-2 °F to 140 °F), < 80 % RH

### Note:

Apart from the contact sensor included in the scope of delivery, other type K temperature probes with miniature contact pin can also be connected to the device. The pyrometer can process and display the measurement data of the external sensor in a measuring range from -50 °C to 1,370 °C.

### Scope of delivery

- 1 x Pyrometer TP10
- 1 x 9 V battery
- 1 x Device bag
- 1 x CD with software
- 1 x Type K contact sensor
- 1 x USB cable
- 1 x Mini tripod
- 1 x Getting started guide

## Safety

**Carefully read the operating manual before using the device and keep it within reach!**

- Do not use the device in atmospheres containing oil, sulphur, chlorine or salt.
- Protect the device from permanent direct sunlight.
- Avoid looking directly into the laser beam.
- Never point the laser beam at people or animals.
- Do not remove any safety signs, stickers or labels from the device. Keep all safety signs, stickers and labels in legible condition.
- Observe the storage and operating conditions (see chapter Technical data).

### Intended use

This device is exclusively intended for measuring temperature with an infrared sensor in the measuring range specified in the technical data. People who use this device must have read and understood the operating manual, especially the Safety chapter.

### Improper use

The device must not be used in potentially explosive atmospheres. It must not be pointed at people.

TROTEC® accepts no liability for damages resulting from improper use. In such a case, entitlements to a warranty are forfeited.

### Personnel qualifications

People who use this device must:

- have read and understood the operating manual, especially the Safety chapter.
- be aware of the dangers that occur when working with laser measuring devices.

## Residual risks



### Risk from laser radiation!

Class 2 laser radiation.

Lasers of class 2 only radiate in the visible range and during continuous wave operation (lasting beam) no more than 1 milliwatt (mW) of output will be emitted. Looking directly into the laser beam for a longer period of time (more than 0.25 seconds) can cause damage to the retina. Avoid looking directly into the laser beam. Never look into the laser beam using optical aides. Do not suppress the winking reflex when looking into the laser beam unintentionally. Never point the laser beam at people or animals.



### Danger!

Keep a sufficient distance away from sources of heat.



### Danger!

Do not leave the packaging lying around. Children may use it as a dangerous toy.



### Danger!

The device is not a toy and does not belong in the hands of children.



### Danger!

Dangers can occur at the device when it is used by untrained people in an unprofessional or improper way. Observe the personnel qualifications.



### Caution!

To prevent damages to the device, do not expose it to extreme temperatures, extreme humidity or moisture.



### Caution!

Do not use abrasive cleaners or solvents to clean the device.

## Transport and storage

### Transport

Use the supplied device bag to transport the device.

### Storage

When the device is not being used, observe the following storage conditions:

- Dry.
- Protected from dust and direct sunlight.
- With a plastic cover to protect it from invasive dust, if necessary.
- The storage temperature is the same as the range given in the chapter Technical data.
- When storing the device for a long time, remove the battery.
- Preferably use the supplied device bag to store the device.

## Operation

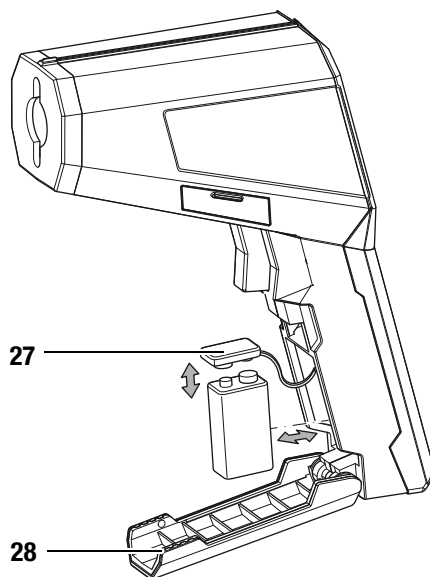
### Inserting the batteries

- Insert the supplied battery before first use.



#### Caution!

Make certain that the surface of the device is dry and the device is switched off.



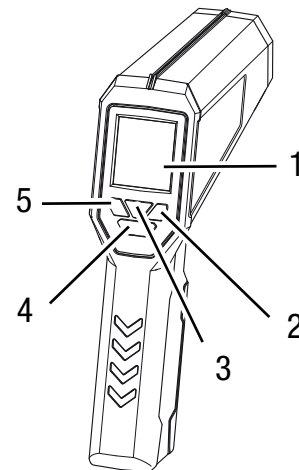
1. Open the cover of the battery compartment (28).
2. Use the battery clip (27) to connect the new battery with correct polarity.
3. Insert the battery in the battery compartment.
4. Close the cover of the battery compartment (28).

## Carrying out a measurement

### Note:

Note that moving from a cold area to a warm area can lead to condensation forming on the device's circuit board. This physical and unavoidable effect can falsify the measurement. In this case, the display shows either no measured values or they are incorrect. Wait a few minutes until the device has become adjusted to the changed conditions before carrying out a measurement.

- Ensure that the surface to be measured is free of dust, dirt or similar substances.
- To be able to gain exact measurement results on surfaces which reflect heavily, stick matt masking tape to the surface or apply matt black paint with a very high and known degree of emission.
- Note the 75:1 ratio of the distance to the measuring spot size. For accurate measurements the measuring object should be at least twice as large as the measuring spot.



1. Point the device at the object to be measured.
2. Press the Measurement button (7).
  - Hold onto the Measurement button (7) if you want to perform a prolonged measurement.
  - The device turns on and carries out a measurement. The SCAN symbol (12) appears in the display. The current measured value is indicated.
3. Let go of the Measurement button (7) again.
  - The device stops measuring. The HOLD symbol (12) appears in the display.
  - Depending on the setting of the device, either the Max/Min value or the Avg/Dif value of the last measurement will be displayed.

## Settings

The bottom line of the display contains a three-part menu. Within this menu different settings can be selected. You can switch through the different menus using the Mode key (4).

Menu example:

MxMn	Save	Avg
------	------	-----

The menu is controlled as follows:

- The F1 button (5) select the function on the left, MxMn in our example.
- The F2 button (3) select the function in the centre, which is Save in our example.
- The F3 button (2) select the function on the right, Avg in our example.

### Setting the Max/Min function

1. Repeatedly press the Mode key (4) until the following menu is displayed:

MxMn	Save	Avg
------	------	-----

2. Press the F1 button to select MxMn.
  - The maximum value is displayed in the upper measurement value display (18).
  - The minimum value is displayed in the lower measurement value display (20).
  - The discrepancy between the current measured value and the minimum value is indicated as deflection on the scale (21).

### Setting the Avg/Dif function

Please bear in mind, that the average value is continually determined anew during a measurement, which means that there can be deviations of the displayed *Dif* value in the in the hundredth °C range.

1. Repeatedly press the Mode key (4) until the following menu is displayed:

MxMn	Save	Avg
------	------	-----

2. Press the F3 button (2) to select Avg.
  - The average value is displayed in the upper measurement value display (18).
  - The difference between the current measured value to the average value is displayed in the lower measurement value display (20).
  - The difference between the current measured value to the average value is indicated on the scale (21).

## Using the Save function

1. Repeatedly press the Mode key (4) until the following menu is displayed:

MxMn	Save	Avg
------	------	-----

2. Press the F2 button to select *Save*.
    - The following menu will be displayed:
- |     |  |     |
|-----|--|-----|
| Yes |  | Esc |
|-----|--|-----|
3. Press the F1 button (*Yes*) to save the measured value.
    - It takes a short moment until the measured value will be saved. The indication *Saving* (18) lights up on the display. After that the last measured value will be displayed again.
  4. Or you press the F3 button (*Esc*) to cancel the operation.
    - The last measurement will be displayed.

## Using the Memory function

Using the Memory function you can call up values previously saved with the Save function. The device comes with 30 internal storage locations.

1. Repeatedly press the Mode key (4) until the following menu is displayed:

Unit	Mem	ε
------	-----	---

2. Press the F2 button.
    - The last saved value appears on the display.
    - The following menu will be displayed:
- |   |     |   |
|---|-----|---|
| ▼ | Del | ▲ |
|---|-----|---|
3. Either press F3 or F1 to view the saved values.
  4. Press the F2 button to select *Del*.
    - The following menu will be displayed:
- |     |     |     |
|-----|-----|-----|
| Yes | All | Esc |
|-----|-----|-----|
5. If you want to delete a measured value (*Yes*), press the F1 button.
    - The currently displayed measured value will be deleted.
  6. If you want to delete all measured values (*All*), press the F2 button.
    - All saved measured values will be deleted.
  7. If you want to cancel the operation (*Esc*), press the F3 button.
    - The following menu will be displayed:
- |   |     |   |
|---|-----|---|
| ▼ | Del | ▲ |
|---|-----|---|
8. Press the Mode key (4) to return into measuring mode.

**Setting the temperature unit**

1. Repeatedly press the Mode key (4) until the following menu is displayed:

Unit	Mem	ε
------	-----	---

2. Press the F1 button.
  - The following menu will be displayed:

Unit	°C	°F
------	----	----

3. Press F2 for °C or F3 for °F.
4. Press the Mode key (4) to leave the submenu.

**Setting the degree of emission**

1. Repeatedly press the Mode key (4) until the following menu is displayed:

Unit	Mem	ε
------	-----	---

2. Press the F3 button.
  - The last saved value for the degree of emission appears on the display.
  - The following menu will be displayed:

▼	Tab	▲
---	-----	---

3. Either press F3 or F1 to change the degree of emission.
  - The value range is between 0.10 and 1.00.
  - The selected setting will be saved automatically.

4. Press the F2 button to select a specific degree of emission.
  - The following menu will be displayed:

▼	Tab	▲
---	-----	---

- A list with different degrees of emission will be displayed:

Default	0.95
Ox Aluminium	0.30
Ox Brass	0.50
Ox Copper	0.60
Paint	0.93

5. Either press F3 or F1 to select a specific degree of emission.
6. Confirm the selection by pressing F2.
  - The new degree of emission is set.
7. Press the Mode key (4) to leave the menu.

**Note:**

A set specific degree of emission will not be stored in the device, after it has been switched off. Upon being switched on again, the device will always return to the degree of emission previously set by hand.

**De-/activating continuous measurements**

Once the function is activated, the measurement will continue until the function is terminated again. Within this time frame settings can only be made in the following menu:

🔒	Lit	Laser
---	-----	-------

1. Repeatedly press the Mode key (4) until the following menu is displayed:

🔒	Lit	Laser
---	-----	-------

2. Press the F1 button.
  - Continuous measurement is activated.
  - The following menu will be displayed:

🔒	Lit	Laser
---	-----	-------

3. Press the F1 button.
  - Continuous measurement is deactivated.
  - The menu again looks as follows:

🔒	Lit	Laser
---	-----	-------

**Adjusting the display illumination**

Ex works the display illumination is switched off. There are two ways to adjust the display illumination.

Option 1: Via the menu.

1. Repeatedly press the Mode key (4) until the following menu is displayed:

🔒	Lit	Laser
---	-----	-------

2. Repeatedly press the F2 button until the display is illuminated as desired.

Option 2: Via the additional settings.

1. Repeatedly press the Mode key (4) until the following menu is displayed:

Hi	Set	Lo
----	-----	----

2. Press the F2 button.
  - The following menu will be displayed:

▼	Set	▲
---	-----	---

3. Either press F3 or F1 to select the *Backlight* option.
4. Confirm the selection by pressing F2.
  - The following menu will be displayed:

▼	OK	▲
---	----	---

5. Either press F3 or F1 until the display is illuminated as desired.
6. Confirm the selection by pressing F2.
7. Press the Mode key (4) to return to the measurement value display.

**Note:**

The device memorizes the selected setting when switching off.



## Switching the laser pointer on or off

Ex works the laser pointer is switched off.

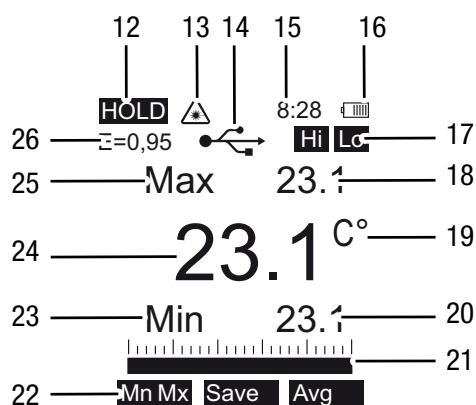
- Please observe that with a switched-on laser the laser pointer will go on as soon as you press the Measurement button (7) or activate continuous measurement.



### Risk from laser radiation!

Class 2 laser radiation.

Lasers of class 2 only radiate in the visible range and during continuous wave operation (lasting beam) no more than 1 milliwatt (mW) of output will be emitted. Looking directly into the laser beam for a longer period of time (more than 0.25 seconds) can cause damage to the retina. Avoid looking directly into the laser beam. Never look into the laser beam using optical aides. Do not suppress the winking reflex when looking into the laser beam unintentionally. Never point the laser beam at people or animals.



1. Repeatedly press the Mode key (4) until the following menu is displayed:

	Lit	Laser
--	-----	-------

2. Press the F3 button.
  - The Laser indication (13) appears on the display.
  - The laser pointer is active and will switch on when starting with the next measurement.
3. Press the F3 button again.
  - The Laser indication (13) disappears.
  - The laser pointer is switched off.

The device memorizes the selected setting when switching off.

## Setting the alarm

The device is equipped with an alarm function for which an upper and a lower alarm threshold can be specified. When exceeding or falling below these values, an acoustic signal will be emitted.

### Setting the lower alarm threshold:

1. Repeatedly press the Mode key (4) until the following menu is displayed:

Hi	Set	Lo
----	-----	----

2. Press the F3 button to set the lower alarm threshold.

– The following menu will be displayed:

▼	On	▲
---	----	---

– The current value for the lower alarm threshold appears on the display.

3. Press the F2 button to enable (*On*) or disable (*Off*) the lower alarm threshold.

– With enabled lower alarm threshold the indication *Lo* (17) will be displayed.

4. Either press F3 or F1 to set the value.

– For larger temperature changes hold onto these buttons, as needed.

5. Press the Mode key (4) to return to the measurement value display.

– The setting for the lower alarm threshold is saved.

### Setting the upper alarm threshold:

1. Repeatedly press the Mode key (4) until the following menu is displayed:

Hi	Set	Lo
----	-----	----

2. Press the F1 button to set the upper alarm threshold.

– The following menu will be displayed:

▼	On	▲
---	----	---

– The current value for the upper alarm threshold appears on the display.

3. Press the F2 button to enable (*On*) or disable (*Off*) the upper alarm threshold.

– With enabled upper alarm threshold the indication *Hi* (17) will be displayed.

4. Either press F3 or F1 to set the value.

– For larger temperature changes hold onto these buttons, as needed.

5. Press the Mode key (4) to return to the measurement value display.

– The setting for the upper alarm threshold is saved.

The device memorizes the selected setting when switching off.

**Further setting options**

In the submenu *Set* you can make further settings for the device.

1. Repeatedly press the Mode key (4) until the following menu is displayed:

Hi	Set	Lo
----	-----	----

2. Press the F2 button.

– The following menu will be displayed:

▼	Set	▲
---	-----	---

– The following list of setting options will be displayed:

Option	Setting
Time	Setting the time
Date	Setting the date
Backlight	Adjusting the display illumination
Buzzer	Setting the touch tone and alarm sound
Contrast	Setting the display contrast
APO Time	Setting the automatic switch-off
Send Data	De-/activating the USB function

3. Select the desired setting by use of the F3 or F1.
4. Confirm the selection by pressing F2.
5. Select the desired setting by use of the F3 or F1.
6. Press the Mode key (4) to confirm your selection.
  - The desired settings are saved.

**USB connection**

Via the USB connection (11) you can connect the device to a PC. While connected, the device will be supplied with power via the PC. Consequently, the device can be operated without battery for the duration of the connection.

1. Open the lateral sealing cap of the device.
2. Attach the USB cable to the USB connection of the device.
3. Connect the USB cable to a PC.
  - Wait for a few seconds until the connection is established.

**De-/activating the USB function**

**Note:**

Activating the USB function is not required, if you only want to use the USB connection for the sake of ensuring the power supply for the measuring device. The USB function is only required for the software-supported recording of measurement series in real time.

1. Repeatedly press the Mode key (4) until the following menu is displayed:

Hi	Set	Lo
----	-----	----

2. Press the F2 button.

– The following menu will be displayed:

▼	Set	▲
---	-----	---

3. Select *Send Data* and press the F2 button.
  - You can now choose between *Real Time* and *Memory*.
4. Select *Real Time*, if you want to activate the USB function.
5. Press F2 to switch between *On* (enable) and *Off* (disable).
6. Press the Mode key (4) to confirm your selection.
  - Depending on your selection the USB function is now de-/activated.
7. If you want to transfer the measured values saved in the device to the PC, select *Memory* and confirm with *OK*.
  - USB mode will then be activated for the transmission period and afterwards return to inactive state.

**Using the software for recording measurement series**

- Make sure the device is connected to a PC via USB cable.
- Make sure that the software for recording measurement series required for USB operation is installed on the PC.
- Ensure that the USB function is activated..

During the entire measuring procedure, both the temperature values of the infrared sensor and those of the external type K sensor (if connected) will be transmitted to the software and recorded.

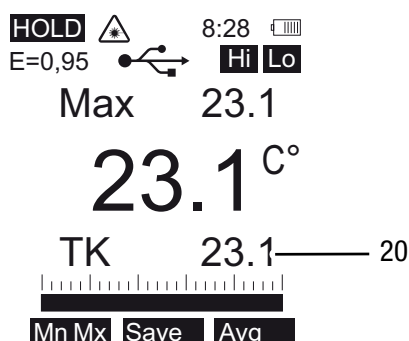
**Note:**

The supplied software is a complimentary bonus that does not belong to the standard scope of delivery and is offered for use without support or warranty. The program interface (only available in the English language) is generally easily comprehensible and can be used intuitively. Further information regarding the use is provided in the application.

### Using external sensors (contact sensor type K)

In addition to the non-contact temperature measurement, the measuring device can be used for contact measurements using an external type K contact sensor.

1. Open the lateral sealing cap of the device.
2. Affix the contact sensor to the sensor connection (10) of the device.
  - It takes a few seconds until the sensor is detected.
  - During the measurement the contact sensor's measured value is indicated in the lower measurement value display (20).

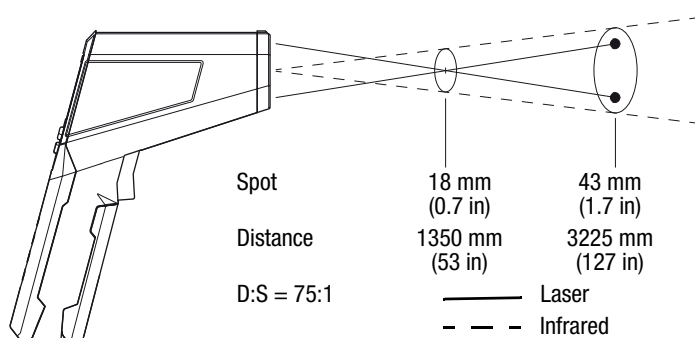


### Measuring principle

The device measures the temperature by means of an infrared sensor. Important factors are the measuring spot diameter and the degree of emission.

#### Measuring spot

Observe the ratio of the distance to the measuring spot diameter. The larger the distance to the object, the larger the measuring spot diameter and hence, the less precise the measured result.



#### Degree of emission

The degree of emission is used to describe the energy radiation characteristics of a material.

A material's degree of emission depends on various factors:

- composition,
- surface condition,
- temperature.

The degree of emission can be between 0.1 and 1 (in theory).

The following rule of thumb can be assumed:

- When a material is rather dark and its surface texture matt, it probably has a high degree of emission.
- The brighter and smoother the surface of a material, the lower will be its degree of emission, presumably.
- The higher the degree of emission of the surface to be measured, the better it is suited for non-contact temperature measurement by use of a pyrometer or thermal imaging camera, since falsifying temperature reflections become negligible.

Entering a degree of emission as accurate as possible is indispensable for a precise measurement.

Most organic materials have a degree of emission of 0.95. Metals or shiny materials come with a much lower value.

#### Degree of emission table

Material	Degree of emission
Aluminium, roughened	0.1 to 0.3
Aluminium, alloy A3003, oxidized	0.3
Aluminium, oxidized	0.2 to 0.4
Asbestos	0.92 to 0.95
Tarmac	0.92 to 0.95
Basalt	0.7
Concrete	0.92 to 0.95
Bitumen	0.98 to 1.00
Lead, oxidized	0.2 to 0.6
Lead, rough	0.4
Roofing felt	0.95
Ice	0.98
Iron (forged), blunt	0.9
Iron, oxidized	0.5 to 0.9
Iron, rusted	0.5 to 0.7
Enamel varnish, black	0.95
Earth	0.92 to 0.96
Paint (not alkaline)	0.90 to 0.95
Paint (non-metal)	0.95
Gypsum	0.6 to 0.95
Glass, pane	0.85 to 0.95
Rubber	0.92 to 0.95
Cast iron, molten	0.2 to 0.3
Cast iron, not oxidized	0.2
Skin	0.98
Haynes alloy	0.3 to 0.8
Radiator enamel	0.95
Timber (natural)	0.9 to 0.95
Inconel, electro-polished	0.15
Inconel, oxidized	0.7 to 0.95
Inconel, sand-blasted	0.3 to 0.6
Limestone	0.95 to 0.98
Carborundum	0.9
Ceramics	0.88 to 0.95
Gravel	0.95
Carbon, graphite	0.7 to 0.85
Carbon, not oxidized	0.8 to 0.9
Plastic, non-transparent	0.95
Copper, oxidized	0.4 to 0.8
Varnish	0.80 to 0.95
Marble	0.90 to 0.95

Material	Degree of emission
Brass, highly polished	0.3
Brass, oxidized	0.5
Molybdenum, oxidized	0.2 to 0.6
Nickel, oxidized	0.2 to 0.5
Paper (any colour)	0.9
Plastic	0.85 to 0.95
Plaster	0.90 to 0.95
Sand	0.9
Snow	0.9
Steel, heavy plate	0.4 to 0.6
Steel, cold-rolled	0.7 to 0.9
Steel, oxidized	0.7 to 0.9
Steel, polished sheet metal	0.1
Steel, stainless	0.1 to 0.8
Cloth	0.95
Wallpaper (non-metal)	0.95
Textiles (non-metal)	0.95
Titanium, oxidized	0.5 to 0.6
Clay	0.90 to 0.95
Water	0.93
Cement	0.90 to 0.96
Brick (rough)	0.90 to 0.95
Zinc, oxidized	0.1

## Maintenance and repair

### Battery change

The battery is to be changed when the battery indication (16) flashes in the display or the device can no longer be switched on. See Inserting the batteries on page 5.

### Cleaning

Clean the device with a soft, damp and lint-free cloth. Ensure that no moisture enters the housing. Do not use any sprays, solvents, alcohol-based cleaning agents or abrasive cleaners. Only use clean water to moisten the cloth.

### Repair

Do not modify the device. Never open the device housing or install any spare parts. For repairs or device testing, contact the manufacturer.

## Disposal



In the European Union, electronic equipment must not be treated as domestic waste, but must be disposed of professionally in accordance with Directive 2002/96/EC of the European Parliament and Council of 27th January 2003 concerning old electrical and electronic equipment. After the end of its use, please dispose of this device in a manner appropriate to the relevant legal requirements.

## Declaration of conformity

in accordance with the EC Low Voltage Directive 2006/95/EC and the EC Directive 2004/108/EC about electromagnetic compatibility.

Herewith, we declare that the pyrometer TP10 was developed, constructed and produced in compliance with the named EC directives.

Das CE-Kennzeichen finden Sie auf der Rückseite des Gerätes.

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Heinsberg, 31/03/2014

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