



Instruction Manual
thermoMETER LS

Infrared sensor

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Certified acc. to DIN EN ISO 9001: 2008

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1. Safety

The handling of the system assumes knowledge of the instruction manual.

1.1 Symbols Used

The following symbols are used in the instruction manual.



Indicates a hazardous situation which, if not avoided, may result in minor or moderate injuries.



Indicates a situation which, if not avoided, may lead to property damage.



Indicates a user action.



Indicates a user tip.

Measure

Indicates a hardware or a button/menu in the software.

1.2 Warnings



Connect the power supply and the display/output device in accordance with the safety regulations for electrical equipment.

- > Danger of injury
- > Damage to or destruction of the infrared sensor



Avoid shock and vibration to the infrared sensor.

- > Damage to or destruction of the infrared sensor

The power supply must not exceed the specified limits.

- > Damage to or destruction of the infrared sensor

Protect the USB cable against damage.

- > Damage to the infrared sensor, failure of the measuring device

No solvent-based cleaning agents may have an effect on the sensor (neither for the optics nor the housing).
> Damage to or destruction of the infrared sensor

Avoid static electricity, arc welders and induction heaters. Keep away from very strong EMF (electromagnetic fields).
> Damage to or destruction of the infrared sensor

Don't leave the unit on or near objects of high temperature.
> Faulty measurement

Avoid abrupt changes in ambient temperature. If this occurs, allow 20 minutes for thermal stabilization.
> Faulty measurement

1.3 Notes on CE Identification

The following applies to the thermoMETER LS:

- EU directive 2004/108/EC
- EU directive 2011/65/EC, "RoHS" category 9

Products which carry the CE mark satisfy the requirements of the quoted EU directives and the European standards (EN) listed therein. The EC declaration of conformity is kept available according to EC regulation, article 10 by the authorities responsible at

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The system is designed for use in industry and laboratory and satisfies the requirements of the standards

- EN 61326-1: 2006
- EN 61326-2-3: 2006
- EN 61010-1: 2001
- EN 60825-1: 2007

The system satisfies the requirements if they comply with the regulations described in the instruction manual for installation and operation.

1.4 Proper Use

- The thermoMETER LS is designed for use in industrial and laboratory areas. It is used for non-contact temperature measurement.
- The system may only be operated within the limits specified in the technical data, see Chap. 2..
- Use the system in such a way that in case of malfunctions or failure personnel or machinery are not endangered.
- Take additional precautions for safety and damage prevention for safety-related applications.

1.5 Proper Environment

- Operation temperature: 0 ... 50 °C (+32 ... +122 °F)
- Storage temperature: -30 ... 65 °C (-22 ... +149 °F); without batteries
- Humidity: 10 - 95 %, non-condensing
- EMC acc. to:
 - EN 61326-1: 2006
 - EN 61326-2-3: 2006
 - EN 61010-1: 2001

2. Technical Data

Model	thermoMETER LS
Temperature range IR	-35 ... 900 °C (-30 ... 1650 °F)
Temperature range probe	-35 ... 900 °C (-30 ... 1650 °F)
Temperature unit	°C/ °F (switchable)
Spectral range	8 ... 14 μm
Optical resolution	75:1 (16 mm@1200 mm/ 90 % energy) switchable to CF (close focus): 1 mm@62 mm/ 90 % energy
Minimum spot size	1mm@62mm (CF mode)
Temperature resolution	0.1 °C
Accuracy IR ¹⁾	±0.75 °C or ±0.75 % of measured value (whichever is greater)
Accuracy t/c input	±0.75°C or ±1.0 % of measured value (whichever is greater)
Temperature coefficient ²⁾	±0.05 K/K or ±0.05 %/K (whichever is greater)
Response time	150 ms (95 % signal)
Display	LCD Flip-Display with backlight (horizontal and vertical viewing)
Display backlight	Green and alarm colors (red/ blue)
Bar graph display	Auto scaling
Laser	<1 mW, class II, 630 - 650 nm SF: patented crosshair laser (Size of crosshairs = spot size @ any distance) CF: Two point laser (Size of crosshairs = spot size @ focus distance) EN 60825-1: 2007
Measurement functions	MAX, MIN, DIF, AVG, HOLD

Model	thermoMETER LS
Alarm functions	High and Low alarm, audible and visual
Emissivity/ Gain	0.100 ... 1.100 (adjustable)
Interface	USB
Input	t/c type K
Data logger	100 measurement protocols with time stamps, 4 digit material and location names (editable)
Software	IR-Connect, 20 measured values per second
Power supply	2xAA (Mignon Alkaline) batteries or via USB cable (if connected to a PC)
Battery life time	5 h (operating with laser and display backlight 50 % on) 10 h (operating with laser and no display backlight) 25 h (operating without laser and display backlight)
Operation temperature	0 ... 50 °C (+32 ... +122 °F)
Storage temperature	-30 ... 65 °C (-22 ... +149 °F); without batteries
Relative humidity	10 – 95 %, non-condensing
Electromagnetic compatibility (EMC)	EN 61326-1: 2006 and EN 61326-2-3: 2006 and EN 61010-1: 2001
Weight	420 g
Vibration	IEC 68-2-6: 3 G, 11 – 200 Hz, any axis
Shock	IEC 68-2-27: 50 G, 11 ms, any axis
Tripod mounting	¼ - 20 UNC



1) At 23°C (73.4 °F) ambient temperature and object temperature: 20 ... 900 °C (+68 ... 1652 °F)

2) Below 20°C (+68 °F) and above 30°C (+86 °F) ambient temperature

3. Delivery

3.1 Unpacking

- 1 thermoMETER LS infrared sensor
- 2 Batteries (type AA)
- 1 t/c insertion probe type K
- 1 USB interface cable
- 1 Software
- 1 Pouch
- 1 Hard case
- 1 Instruction manual

-  Check the delivery for completeness and shipping damage immediately after unpacking.
-  In case of damage or missing parts, please contact the manufacturer or supplier.

3.2 Storage

- Storage temperature: -30 ... 65 °C (-22 ... +149 °F)
- Humidity: 10 ... 95 %, non-condensing

4. Operation

4.1 Batteries

- ➡ To open the battery compartment gently press the cover lid on the left side of the handle in direction of the arrow, see [Fig. 1](#).



Fig. 1 Battery compartment

- ➡ Insert the batteries.

Orientation as shown inside the compartment.

- ➡ Close the cover lid in reverse order.

The infrared sensor thermoMETER LS is already equipped with batteries. They are protected with a plastic strip against discharge during the transport.

- ➡ Please remove the plastic strip before use.

If batteries are low the battery symbol will appear in the display, see [Fig. 2](#),



Fig. 2 Symbol battery

- ➡ Please change the batteries immediately if the symbol is flashing.

i Do not use old and new batteries together. Use only alkaline or rechargeable batteries (Type: Mignon AA, R6, UM3)

4.2 Control and Display Elements

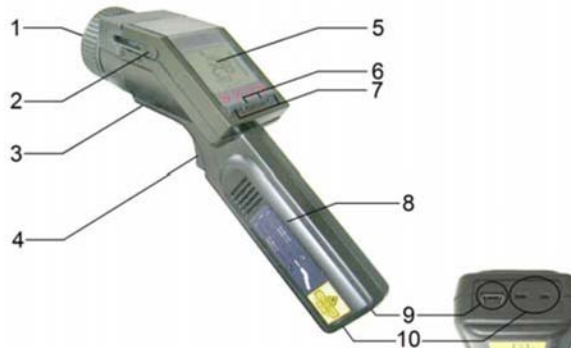


Fig. 3 Control and display elements

1	Precision glass optics
2	Optics toggle switch SF/ CF
3	Tripod mount
4	Trigger
5	Display
6	Up and Down buttons
7	Mode (I and II) buttons
8	Handle and battery compartment
9	USB interface
10	T/c input

4.3 Display



Fig. 4 Displays in display

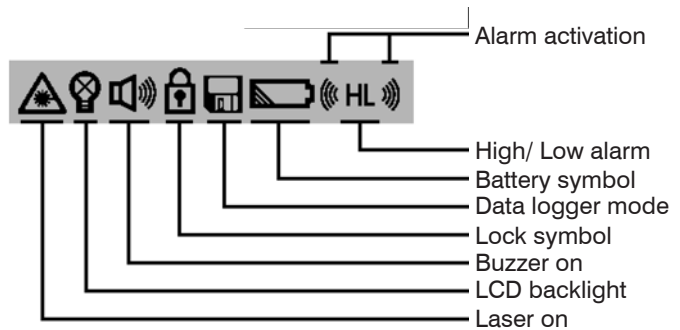


Fig. 5 Status informations

1	Status information	
2	Upper display	Measurement functions (MIN-, MAX-, DIF-, AVG indication), Data logger position
3	Main display	IR-temperature and unit (°C/ °F)
4	Lower display	HOLD, emissivity, probe temperature, Tamb-value, material and location name
5	Assignment of buttons	Mode I <input type="checkbox"/> I Mode II <input type="checkbox"/> II Auf <input type="checkbox"/> A Ab <input type="checkbox"/> V
6	Bar graph display	
7	Up and Down buttons	
8	Mode buttons	

5. Measurement

5.1 Handling

- ➡ Please hold the device as shown, see [Fig. 6](#), and aim at the target.
- ➡ Pull the trigger (1) and keep it pressed, see [Fig. 6](#).



Fig. 6 View normal use



Fig. 7 View vertical use

If the laser is activated the true size and location of the measurement spot will be shown on the object surface. The temperature of the object is shown in the display (2).

The thermoMETER LS can also be used in vertical position, i.e. measurement downwards, see [Fig. 7](#). With this handling small objects like electronic SMD components can easily be aimed and measured.

- ➡ For this purpose please hold the device as shown, see [Fig. 7](#).

If the display switch is set to `Auto` (default setting) or set to `On`, the `I` button automatically gets the function of the trigger (1) and the measured values in the display (2) are turned by 180°, see [Chap. 7.3](#).

i Please note, that at vertical use (Flip modes) in context with a switched display also the assignment of the Mode buttons (`I` and `II`) will change.

5.2 Measurement Functions

The measured temperature will be shown in the main display (1). In the upper display the according maximum temperature (2) and in the lower display the set emissivity (3) will be displayed. The bar graph in the right part of the display (4) shows temperature trends. The scaling will be done automatically between minimum measured value (no segment) and maximum measured value (all segments).




Fig. 8 Display measurement functions

HOLD function

The temperature will be displayed for 7 seconds after the trigger is released. The display shows HOLD, see Fig. 9. The device automatically switches off after this time, if no button is pressed.



Fig. 9 View HOLD

After taking a measurement the following functions can be displayed in turn by pressing the  button (starting from the HOLD mode):

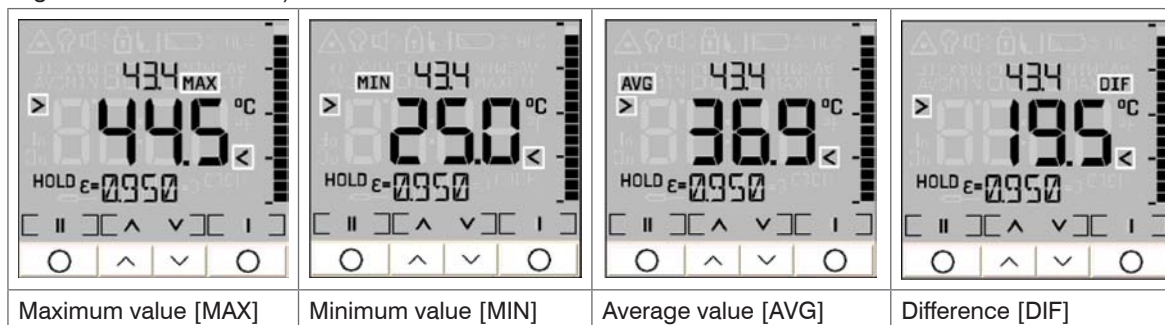


Fig. 10 Different measurement functions

MAX	Maximum value determined during measurement
MIN	Minimum value determined during measurement
AVG	Average value (related to duration of measurement)
DIF	The difference between MIN and MAX

This values will be shown in the main display, which is marked with the symbols > and < in this case. The current temperature (in the HOLD mode: the last measured value) will be shown in the upper display.

After turning into the `measure` mode or after switching off the device the selected measurement function will be kept.

Recall (Last Value)

The last measured value remains stored in the device after switch off.

 To recall this value please press (in the switched off condition) the I or II button.

The unit will be set into the HOLD mode.

In the emissivity menu the last measured temperature value can be corrected afterwards by changing the emissivity.

5.3 Display Backlight

➡ Pull the `trigger` by keeping it pressed.

➡ Then press the `I` button to activate/ deactivate the display backlight, see [Fig. 11](#).



Fig. 11 Symbol display backlight

The symbol in the display flashes to confirm.

Default setting: On ¹

1) This function is not available in the Flip mode.

CAUTION

Never deliberately look into the laser beam!

Consciously close your eyes or turn away immediately if the laser beam should hit your eyes.

CAUTION

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

5.4 Laser Sighting

- ➡ Pull the **Trigger** by keeping it pressed.
- ➡ Then press the **II** button to activate respectively deactivate the laser.

The laser symbol in the display, see [Fig. 12](#) (only if the trigger is pulled) indicates the active laser.



Fig. 12 Laser symbol

Default setting: On



Fig. 14 Laser label

During operation the pertinent regulations acc. to DIN EN 60825-1: 2007 on “radiation safety of laser equipment” must be fully observed at all times.

5.5 Optics

The thermoMETER LS has switchable optics. The two possible operating modes are indicated as SF mode (Standard Focus) and CF mode (Close Focus).

In the SF mode (standard operating mode) objects ≥ 16 mm can be measured. The measurement spot will be exactly marked with the patented crosshair laser, i.e. the real size and location of the spot is shown on the object independently from the distance and with no optical offset, see [Fig. 15](#).



Fig. 15 Crosshair laser

In the CF mode objects ≥ 1 mm (e.g. electronic components) can be measured. In this operating mode a two point laser shows the spot on the target. Both laser beams cross at the focus distance (62 mm from front of housing) and indicate the minimum spot size at this distance (diameter: 1 mm).

To switch between SF and CF mode please shift the optic switch which is located beside the display, to the corresponding position, see [Fig. 16](#).

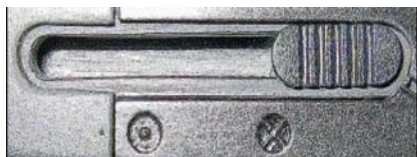
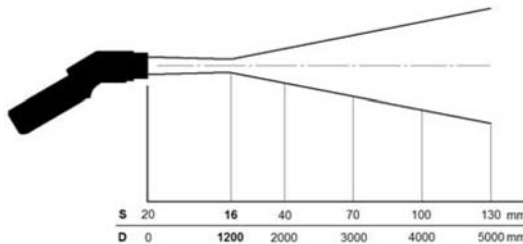


Fig. 16 Optic switch

The symbols on the housing have the following meaning:

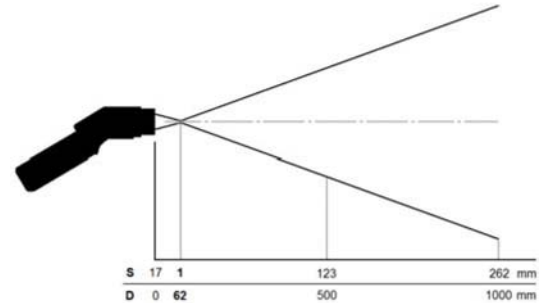
SF/ Crosshair laser

CF/ Two point laser



D:S (focus point) = 75:1/ 16 mm@1200 mm
 D:S (far field) = 36:1

D = Distance from front of the unit to the object
 S = Spotsize



D:S (focus point) = 62:1/ 1 mm@62 mm
 D:S (far field) = 4:1

i The measured area of the object (spot size) depends on the distance. For a correct measurement the spot size should have at least the same size like the object or should be smaller than that at all times.

6. Setup Menu 1

In this menu Emissivity, Alarm values and the Lock mode can be set up.

Each setting or change of values and parameters will be saved by pressing the **Trigger** or the **I** button.

To activate the **Setup** menu the unit must be in the **HOLD** mode.

Trigger ⇒ **SAVE** ⇒ **Measurement mode**

I ⇒ **SAVE** ⇒ **next menu item**

If none of these buttons is pressed the settings or changes done before will not be saved and the unit switches off after approx. 30 s.

6.1 Emissivity Setting

The emissivity (ϵ - Epsilon) is a material constant which describes the ability of the body to emit infrared energy. It can range between 0 and 1 (0 and 100 %), see Chap. 13.

Setting range: 0,100 ... 1,100 (values > 1,000 = amplification)

Default setting: 0,950

HOLD ⇒ **II** ⇒ ϵ flashes ⇒ **Λ** ⇒ **INCREASE ϵ**

⇒ **V** ⇒ **DECREASE ϵ**



Fig. 17 Emissivity symbol



Fig. 18 Display measurement function emissivity setting

6.2 High Alarm

Setting of a temperature value (alarm setpoint). If the temperature range is above the setpoint a visual

display color = red + **flashing alarm symbol**

and an acoustic warning signal (buzzer) will be generated, see Chap. 7.2:

Setting range: -35 ... 900 °C

Default setting: 900 °C

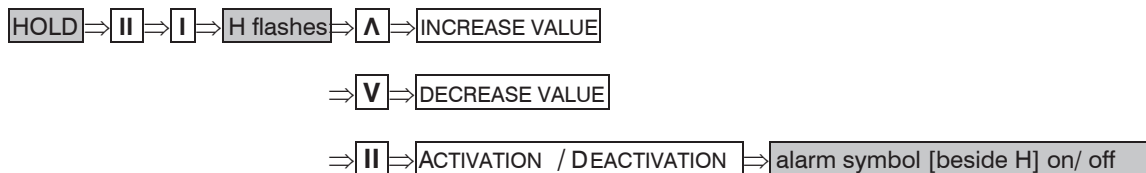


Fig. 19 Symbol high alarm



Fig. 20 Display measurement function high alarm

6.3 Low-Alarm

Setting of a temperature value (alarm setpoint). If the temperature value is below this setpoint a visual

Display color = blue + **flashing alarm symbol**

and an acoustic warning signal, see Chap. 7.2:

Setting range: -35 ... 900 °C

Default setting: -35 °C

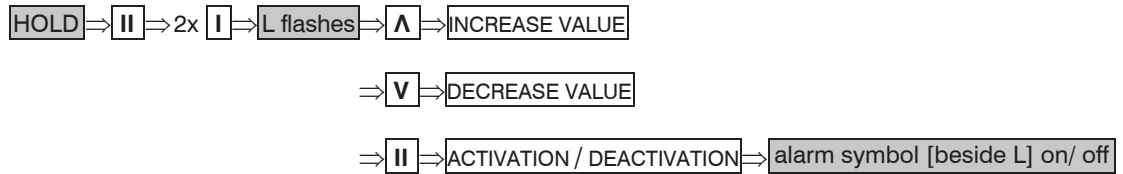


Fig. 21 Symbol low alarm



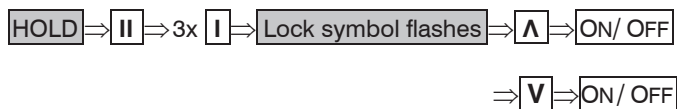
Fig. 22 Display measurement function low alarm

6.4 Long-Term Measurement (Lock Mode)

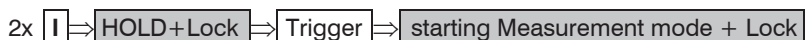
This function allows a continuous measurement without pulling the `trigger` for that time. The laser is only working if the `trigger` is pulled.

Setting range: On/ Off

Default setting: Off



after setting to **On** :



or:

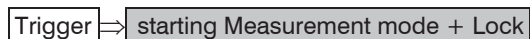


Fig. 23 Symbol long-term measurement (Lock Mode)



Fig. 24 Display measurement function long-term measurement (Lock Mode)

You can activate the `Lock` function in the same order, but starting from `Measurement mode + Lock` .

The data logger functions are also available in the `Lock` mode, see Chap. 10.6.

For a long-term temperature measurement of an object it is recommended to mount the unit on a tripod, see Fig. 25.



Fig. 25 Tripod for thermoMETER LS

7. Setup-Menu 2

In this menu temperature unit, buzzer, flip display, ambient temperature compensation and factory settings can be set up.

HOLD → II → 4x I → 2. Menu

The procedure is the same as described in the setup menu 1, see Chap. 6.:

Trigger → SAVE → Measurement mode

I → SAVE → next menu item



Fig. 26 Display setup menu 2

7.1 Temperature Unit

With this function you can switch the temperature unit in the display between °C and °F.

Setting range: °C/ °F

Default setting: °C

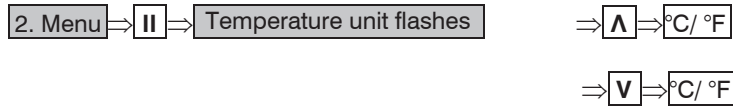


Fig. 27 Symbol temperature unit



Fig. 28 Display measurement function temperature unit

7.2 Buzzer

With this function the buzzer (acoustic alarm symbol) can be switched on and off. Independent from this button tone (confirmation by pressing **Mode** , **Up** and **Down** button) will remain **On**.

Setting range: On/ Off

Default setting: On

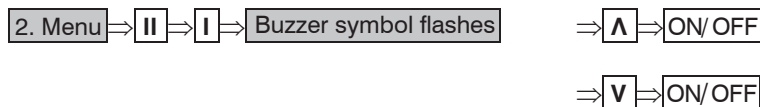


Fig. 29 Symbol buzzer



Fig. 30 Display measurement function buzzer

7.3 Flip Display

The thermoMETER LS has a so called Flip display (turn around display). As the unit can be used in horizontal and in vertical position (preferably in combination with the CF mode), the ability to switch allows a comfortable operation in both positions.

Setting range: Auto/ Off/ On

Default setting: Auto

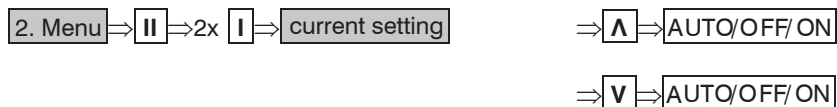


Fig. 31 Symbol Flip display

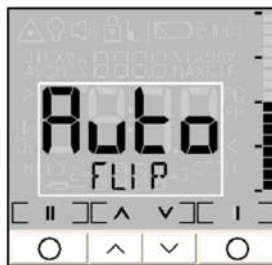


Fig. 32 Display measurement function Flip display 1

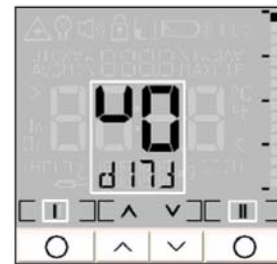


Fig. 33 Display measurement function Flip display 2

AUTO	Automatic position detection (by internal position sensor) and display switch according to the handling of the unit
OFF	No switch (for reading at horizontal measurements)
ON	Permanent switch for vertical measurements

i If ON is activated the display will switch immediately, see [Fig. 33](#).
Please note, that in this context also the assignment of the mode buttons (I and II) changes.

7.4 Ambient Temperature Compensation

In dependence of the emissivity value a certain amount of ambient radiation will be reflected from the object surface. To compensate this impact you can use this function to enter a temperature value for the ambient radiation (Tamb):

Setting range: -35 ... 900 °C

Default setting: Deactivated

i An activation of this function on the thermoMETER LS for the first time is only possible with the supplied software, see Chap. 10.10.8.

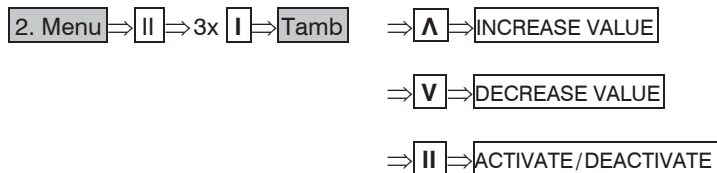


Fig. 34 Symbol ambient temperature compensation



Fig. 35 Display measurement function ambient temperature compensation 1

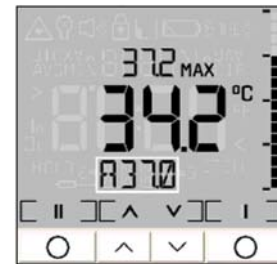
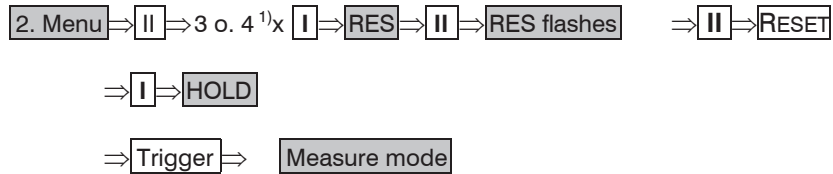


Fig. 36 Display measurement function ambient temperature compensation 2

If the T_{amb} function is activated, the current set T_{amb} value can be easily displayed as follows:



If, in addition, a thermocouple probe is connected, the lower display will toggle between emissivity, t/c probe temperature and T_{amb} value, see [Fig. 36](#), see [Chap. 9](#).

7.5 Reset

With this function the device can be set back to the factory default values, see Chap. A 1.

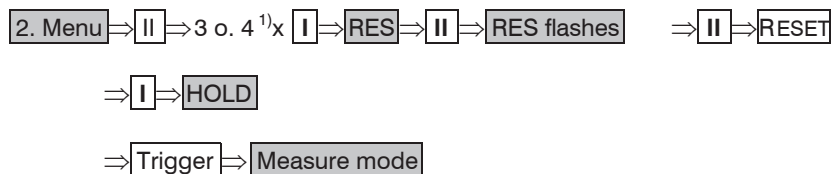


Fig. 37 Symbol reset



Fig. 38 Display measurement function reset

i The stored values in the data logger will not be deleted with the *Reset* function.

1) depends on the status of *T_{amb}* function

8. Data Logger

The thermoMETER LS has an internal data logger with a maximum capacity of 100 measurement protocols.

Every protocol contains the following values, which can also be opened on the device:

Position number (P 00...P 99), object temperature, MAX-, MIN-, AVG- and DIF value, emissivity, probe temperature (if connected), material and location name

8.1 Storing Data

To store any data the device must be in the `HOLD` mode.

➡ At first please take your measurement and after this release the `Trigger`:



Fig. 39 Symbol storing measurement values



Fig. 40 Display storing measurement values

If you pull the `Trigger` no storage will be made and the unit changes to the `Measurement` mode.

If no button is pressed, also no storage will be made and the unit switches off after approx. 30 s.

If the storage mode is started the next free position will automatically be shown. If you select an occupied position, the `P` flashes in the upper display.

The storage function can also be executed after recall of the last value (Recall = Recall last value), see Chap. 5.2.

1) The storage will be confirmed with a double buzzer tone.

8.2 Material and Position Names

You can assign a 4-digit alpha numeric description to any data logger position. This description will be shown in the bottom display and has the following presetting:

P000 (for position 1) – P099 (for position 100)



Fig. 41 Display material and Position names

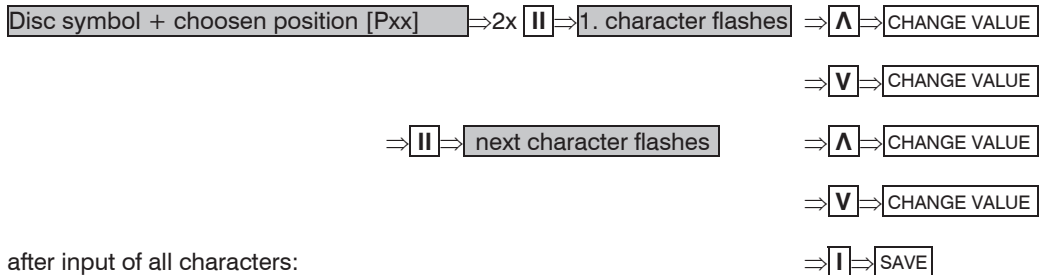
In the editing mode you can choose between 20 pre-defined descriptions (SURF, ENG, ..., GLAS, ..., PVC, etc.).

➡ To do this please start the data logger mode and choose a desired position:



You can also define own descriptions. The following character set can be used:

[A...Z] [0...9] [-/<>] [empty]



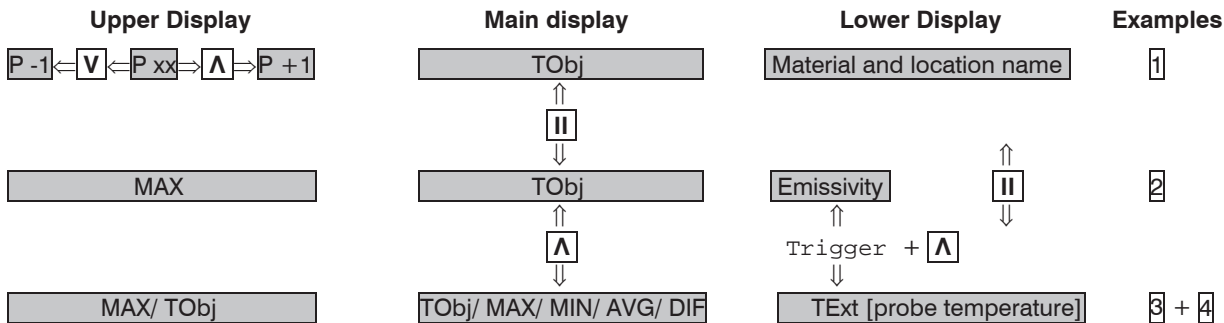
after input of all characters:

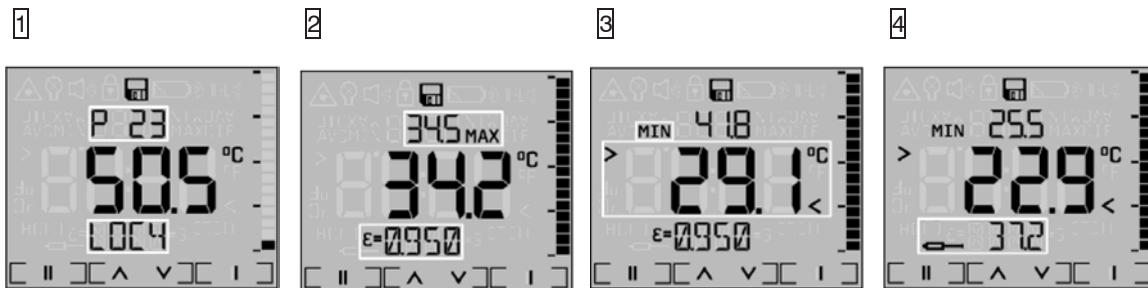
8.3 Data Logger Recall

To recall a stored measurement protocol, the device must be set into the **Measure mode**:

Trigger and V [while keeping the trigger pressed] ⇒ Disc symbol flashes ⇒ P xx [starting with position 00]

➡ To switch between the data logger positions and different displays please proceed as follows:



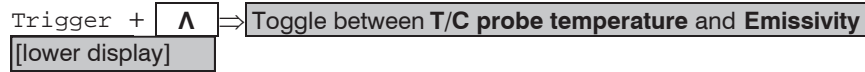


To leave the data logger mode please press again the Trigger and V simultaneously.
If no button is pressed, the unit switches off after approx. 30 s.

9. Thermocouple Probe

The thermoMETER LS has an input for thermocouple probes. You will find the connection at the end of the handle, see Chap. 4.2. You can connect the supplied insertion probe as well as any other t/c probe type K.

➡ To show the t/c temperature in the display, proceed as follows:



If, in addition, the T_{amb} function is activated, the lower display will toggle between emissivity, t/c probe temperature and T_{amb} value, see Chap. 7.4.



Fig. 42 Symbol thermocouple probe

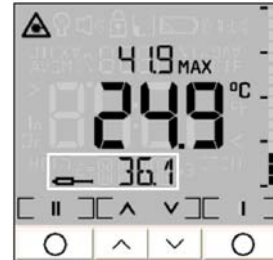


Fig. 43 Display measurement function thermocouple probe

The t/c probe in combination with the thermoMETER LS can be used to determine an unknown emissivity value, see Chap. 13.

10. Software IR Connect

10.1 Installation and Start

➡ Insert the installation CD into the according drive on your computer.

If the auto run option on your computer is activated the installation wizard will start automatically. Otherwise please start setup.exe on the CD-ROM.

➡ Follow the instructions of the wizard until the installation is finished.

The installation wizard will place a launch icon on the desktop and in the start menu.

If you want to uninstall the software from your system please use the `Uninstall` icon in the start menu

[Start]\Programs\IR-Connect.

You will find detailed software manual on the IRConnect CD.



Fig. 44 Symbol software

10.2 System Requirements

- Windows XP, 7, 8
- USB interface
- Hard disc with at least 30 MByte free space
- At least 128 MByte RAM
- CD-ROM drive

10.3 Main Features

- Download of logger data
- Display and record of temperature trends

- Setup of parameters

10.4 Connection to the Computer

➡ Please connect the thermoMETER LS with your computer by using the special USB adapter cable.

After you have started the software and the communication has been established the status line (below the time axis) will show the following information, see Fig. 46, see Fig. 47.:



Fig. 45 Symbol connection to the computer

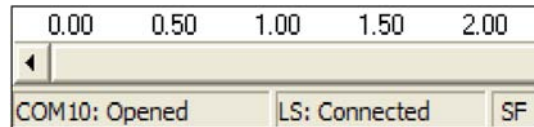


Fig. 46 Display connection to the computer

COMxx: Opened	Active COM-Port if a USB adapter cable is connected
LS: Connected	Successful communication with the connected thermoMETER LS
SF/ CF	Selected optic mode on the thermoMETER LS

Fig. 47 Overview COM-port menu

- ⓘ Please use for a connection between the LS and a computer only the supplied USB adapter cable, as otherwise there will be no function.
The connection cable supplied is not a standard USB cable!

As long as the LS is connected to your computer it will be powered via the USB interface. In this case operation is also possible if no batteries are inside the unit. At digital communication the unit display shows the HOLD –mode but the unit is measuring continuously and is sending temperature data via the interface to the

computer, see Chap. 10.9.

If you cannot establish a communication in spite of correct connection between thermoMETER LS and computer please choose the correct COM-Port under `Setup > Interface` menu. If the USB adapter cable is connected this port is marked (Infrared Thermometer Adapter), see Fig. 48:

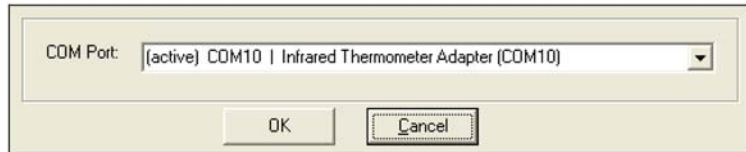


Fig. 48 Display COM-Port

10.5 Language

You can select the desired language under menu `Setup > Language`.

10.6 Data Logger Functions

➡ To download the logger data from the unit please press the **Logger** -button in menu Measurement > Download logger data.

All data from the logger will be displayed in an extra window as a table, see [Fig. 50](#):



Fig. 49 Symbol or button data logger function

Index	Date	Time	TObj	TObjMin	TObjMax	TObjAvg	TObjDif	Tint	TExt	Hi Alarm	Lo Alarm	Eps	Name
1	14.10.2005	20:58:14	25,8°C	25,8°C	25,9°C	25,8°C	0,1°C	26,0°C	25,7°C	29,7°C	40,0°C	0,946	PO00
2	14.10.2005	20:13:50	26,8°C	26,8°C	29,8°C	27,9°C	3,0°C	27,3°C	-----	28,7°C	40,0°C	0,946	PO01
3	14.10.2005	20:58:24	26,0°C	25,6°C	26,0°C	25,8°C	0,4°C	26,0°C	25,7°C	29,7°C	40,0°C	0,946	PO02
4	14.10.2005	20:58:28	25,7°C	25,6°C	25,8°C	25,7°C	0,2°C	26,0°C	25,8°C	29,7°C	40,0°C	0,946	LH12
5	14.10.2005	20:58:58	25,5°C	25,5°C	25,8°C	25,6°C	0,3°C	26,0°C	25,9°C	29,7°C	40,0°C	0,946	PO04
6	14.10.2005	20:17:20	599,6°C	29,2°C	600,5°C	538,2°C	571,3°C	27,2°C	-----	28,7°C	40,0°C	0,947	PO05
7	14.10.2005	20:14:06	26,8°C	26,8°C	29,8°C	27,9°C	3,0°C	27,3°C	-----	28,7°C	40,0°C	0,946	PO06
8	18.10.2005	13:16:46	22,3°C	22,0°C	23,0°C	22,4°C	1,0°C	25,6°C	-----	900,0°C	40,0°C	1,000	PO07
9	19.10.2005	17:05:06	23,0°C	21,3°C	23,2°C	22,6°C	1,9°C	26,8°C	-----	900,0°C	40,0°C	0,999	PO08
10	19.10.2005	17:05:12	23,0°C	21,3°C	23,2°C	22,6°C	1,9°C	26,8°C	-----	900,0°C	40,0°C	0,999	PO09
11	19.10.2005	17:05:28	34,6°C	24,8°C	34,6°C	28,8°C	9,8°C	26,8°C	-----	900,0°C	40,0°C	0,999	PO10
12	20.10.2005	13:50:46	24,6°C	24,2°C	26,0°C	24,5°C	1,8°C	27,1°C	-----	30,0°C	40,0°C	1,000	PO11
13	20.10.2005	13:28:24	24,1°C	24,1°C	24,3°C	24,1°C	0,2°C	27,0°C	-----	29,1°C	40,0°C	0,950	PO12
14	20.10.2005	13:51:12	51,1°C	21,0°C	51,2°C	37,3°C	30,2°C	27,1°C	-----	30,0°C	40,0°C	1,000	PO13
15	20.10.2005	13:53:28	21,8°C	21,8°C	21,9°C	21,8°C	0,1°C	27,3°C	-----	30,0°C	40,0°C	1,000	PPSL
16	20.10.2005	18:06:44	48,7°C	24,3°C	48,6°C	41,2°C	24,3°C	24,5°C	-----	30,0°C	40,0°C	0,950	PO15
17	20.10.2005	18:08:48	-11,1°C	-11,4°C	4,8°C	-10,7°C	16,2°C	24,6°C	-----	30,0°C	10,0°C	0,950	PO16

Fig. 50 Screen data logger functions

The individual columns are described in the following table:

Columns in the logger table	
Index	Serial number
Date	Date of measurement
Time	Time of measurement
TObj	Object temperature
TObj Min	Min. object temperature
TObj Max	Max. object temperature
TObj Avg	Average object temperature
TObj Diff.	Difference between TObj Min and TObj Max
TInt	Internal unit temperature
Text	T/c temperature (if connected)
Hi-Alarm	High-Alarm value
Lo-Alarm	Low-Alarm value
Eps	Emissivity
Name	Material or position name

Fig. 51 Columns in the logger table

Logger temperatures, on which the set Hi-Alarm value has been exceeded, will be shown in the table red and bold, see [Fig. 50](#).

Logger temperatures, on which the set Lo-Alarm value has been exceeded, will be shown in the table blue and bold, see [Fig. 50](#).

Save as	Opens an explorer window to save the logger data on your computer (*.lgg).
Open File	Opens an explorer window to open existing logger files ¹ .
Clear logger	After confirmation of the security query all logger data inside the LS will be deleted (unit display shows: CLR).

Fig. 52 Buttons in the display data logger functions

The status line inside the data logger window (beneath the table) shows the location and file name of the current data.

10.7 Time Stamp

If you store data inside your thermoMETER LS for the first time (after insertion of the batteries), an internal timer will be started automatically. When connected to a computer the timer will be synchronized with the computer time. Thus, every logger entry is stored with date and time of the measurement.

i Please store the logger data on your computer before you change the batteries. Otherwise an exact assignment of the time of measurement is not possible (Restart of the timer).

1) The logger file can also be opened and edited with any text editor or Microsoft Excel.

10.8 Material and Location Names

You can assign descriptions to each logger position by choosing between 20 predefined descriptions or defining own descriptions. The table of the predefined descriptions can be edited with the software.

➡ To open the table please press the **Names** button in the menu `Device < Material and location names`.

➡ Then mark the entry which you would like to edit with the cursor and enter the desired name.

The maximum length is four digits. The following character set can be used: `[A...Z] [0...9] [-/<>] [Space]`.

i If a wrong input is made (no character/ more than 4 characters/ invalid character) the position number in the table appears red and the table cannot be closed with **OK**.



Fig. 53 Symbol material and position names

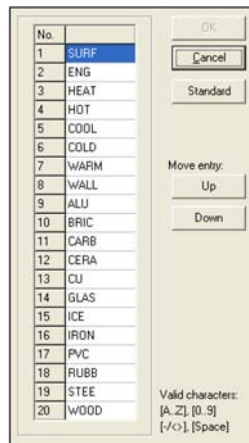


Fig. 54 Screen material and position names

OK	Saves the changed table inside the thermoMETER LS.
Standard	Loads the standard table (factory setting) in the connected device.
Up	Moves the selected entry up.
Down	Moves the selected entry down.

Fig. 56 Buttons in the display material and location names

10.9 Digital Displays

If the thermoMETER LS is connected to your computer and you start the software, the current temperature T_{Obj} will be shown top right as digital display, see [Fig. 58](#).

You can add additional displays for the internal temperature T_{Int} and the temperature of a connected t/c probe T_{Ext} under menu `VIEW > Digital displays`.

The once selected displays will also appear after a restart of the software. The size can be changed if you put the mouse cursor on the line beneath the display and pull it down. The buttons of the tool bar will also be moved (depending on the display size).



Fig. 57 Symbol digital displays



Fig. 58 Screen digital displays

10.10 Diagram Functions

10.10.1 Starting the Measurement

➡ To start a measurement, please press the **Start** button in the tool bar of Measurement menu.



Fig. 59 Button Start

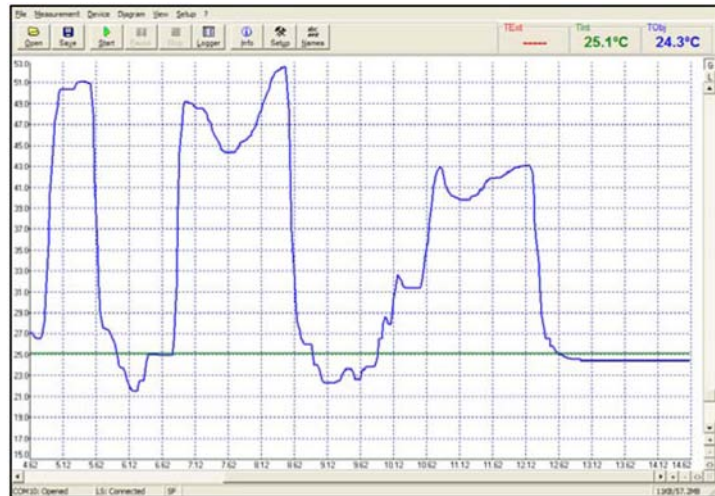


Fig. 60 Screen digital displays

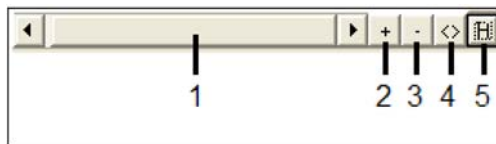


Fig. 61 Screen time axis detail

Control elements of the time axis	
1	Scroll bar
2	Zoom in (increase)
3	Zoom out (decrease)
4	Whole range
5	H: Hold/ C: Continue

Any activation of a control element of the time axis will stop the further actualization of the measurement graph. The measurement itself continues in the background.

➡ To return to the current measurement graph please press the **Pause** button or **C** in the menu **Measurement**.



Fig. 62 Button Pause

During the stopped status any parts of the diagram can be selected with the Time scroll bar. With the zoom in-button + these parts can be stretched (enlarged) and with the zoom out-button – clinched (minimized).

10.10.2 Scaling of the Temperature Axis

With global scaling the temperature range of the diagram will automatically be adapted to the respective peak values. The range will remain as set during the whole measurement.

With local scaling the temperature range of the diagram will be adapted dynamically to the respective peak values. After the respective peak has left the diagram in the further process of the measurement, the range will be readapted. This option enables an optimum display of the temperature graph.

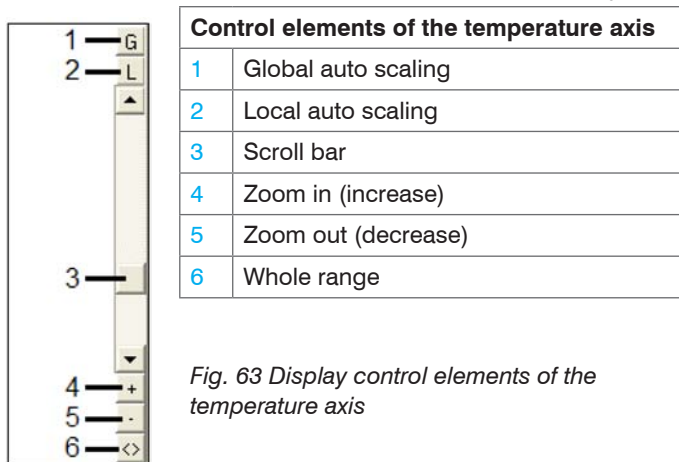


Fig. 63 Display control elements of the temperature axis

A manual scaling can be done at any time using the control elements of the temperature axis.

- ➡ Activate the desired option by the control elements of the temperature axis respectively in the menu Diagram.

10.10.3 Stop Measurement



Fig. 64 Button Stop

To stop the current measurement please press the `Stop` button in the menu `Measurement`.

The `Save` button in menu `File > Save as` opens an explorer window to select destination and file name [file type: *.dat].

10.10.4 Saving of Data

The menu item `Options` in menu `Setup > Options` enables the following settings for data protection:

Warning if unsaved data exist	If activated, each <code>Stop</code> and new <code>Start</code> will be followed by the query: There is unsaved data. Save now? (Default setting: activated)
Force data saving after "stop"	If activated, after each <code>Stop</code> an explorer window for saving the data will be opened automatically.
Decimal separator	System uses the computer system based separator for saving the data. If you want to use a user defined (which may be helpful for further use of the data files with other applications) you can enter the desired separator in the according field.

Fig. 65 Buttons in the display Saving of Data

i If none of the options is activated, a new measurement will be started after termination of one measurement and pressing of the `Start` button. In this case the former data are deleted!



Fig. 66 Symbol Save

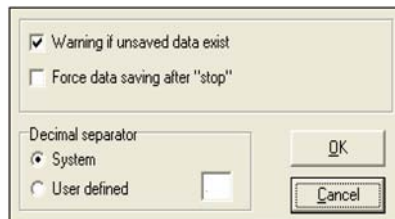


Fig. 67 Screen storage security

10.10.5 Opening of Files

To open a saved file please press the button `Open` in menu `File > Open`. You can select the desired file (file type: *.dat) in the newly opened explorer window.

i The data files can also be opened and edited with any text editor or with Microsoft Excel.

10.10.6 Diagram Settings

The menu item `Settings` in menu `Diagram > Settings` enables the selection of the following diagram options, see [Fig. 70](#):

Digital	Selection which signals should be displayed as digital display.
Diagram	Selection which signals should be displayed as graph (<code>TObj</code> , <code>TInt</code> , <code>TExt</code>).
Pen Width	Pen width of the temperature graphs (1 5)
Color	Color of the temperature graph and digital displays
Initial time	Time frame on the x-axis, which should be displayed at the beginning of a measurement.

Fig. 68 Buttons in the display diagram settings



Fig. 69 Symbol Open

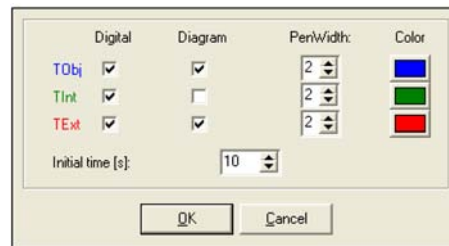


Fig. 70 Screen Diagram settings

10.10.7 Measurement Configuration

The menu item `Measurement > Settings` opens the following dialog, see [Fig. 72](#):

Max. data count	Limitation of the maximum number of data values – when achieved the measurement will be stopped.
Memory	Memory, calculated from the max data count value (will also be displayed in the status line).
Recording interval	Time between single data (1 ms ... 10 s)
Recording time	Maximum time of measurement, calculated from Max. data count and Recording interval.

Fig. 71 Buttons in the display measurement configuration

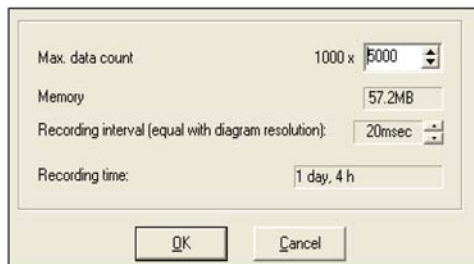


Fig. 72 Screen measurement configuration

- i** A change of the parameter `Max. data count` will have influence on the `Memory` and `Recording time`.
- A change of the parameter `Recording interval` will have influence on the `Recording time` only.

10.10.8 Device Setup

The button **Setup** in the menu **Device > Setup** opens a dialog window for setting up the following parameters:

Emissivity	Backlight
High alarm	Laser
Low alarm	Buzzer
Ext. Ambient Temp.	Lock mode
Temperature unit	Flip mode

Fig. 73 Buttons in the display device setup



Fig. 74 Symbol Setup

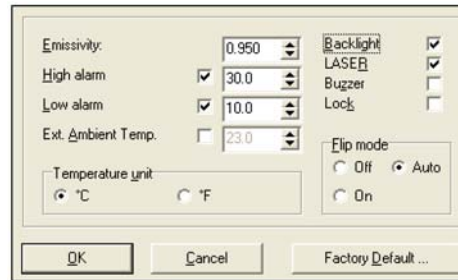


Fig. 75 Screen device setup

The first activation of Ext. Ambient Temp. will initiate this feature inside the thermoMETER LS device. From this time the feature will appear in the Setup Menu 2 on the device, also if deactivated again in the device setup, see Chap. 7.4.

A reset of the device to the factory default values will delete the display of this function during operation, see Chap. 7.5.

To load the factory default settings into the device please press the `Factory Default` button (same functionality as `Reset`, see Chap. 7.5.). An additional query avoids a reset of the device by mistake.

i A change of parameters will be taken over from the connected device immediately and vice versa.

10.10.9 Device Information

The button `Info` in menu `Device > Device Info` will display the following unit-specific information:

Device type	Description from the manufacturer
Firmware Rev.	Revision number of the internal software
Hardware Rev.	Revision number of the internal hardware
Serial No.	Serial number of the device
IR Temperature range	Measurement range (IR)

Fig. 77 Buttons in the display device information



Fig. 78 Symbol Info

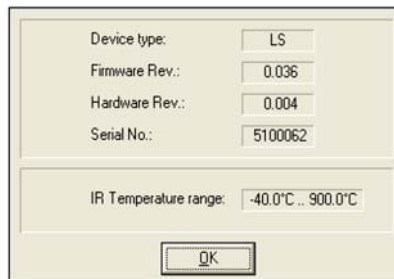


Fig. 79 Screen device information

11. Instructions for Operation

11.1 Cleaning

Lens cleaning: Blow off loose particles using clean compressed air. The lens surface can be cleaned with a soft, humid tissue moistened with water or a water based glass cleaner.

NOTICE

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

> Destruction of the sensor and/or the controller

11.2 Troubleshooting

Display	Problem	Action
Temperature display: LLL	Object temperature below measurement range	➡ Choose target within measuring range.
Temperature display: HHHH	Object temperature above measurement range	➡ Choose target within measuring range.
Battery symbol is on or flashing.	Low batteries	➡ Check/ replace batteries.
Blank display	Empty batteries	➡ Check/ replace batteries immediately.
Laser does not work.	Low batteries/ Laser deactivated	➡ See above. Activate the laser.

12. Functional Principle

12.1 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 1μ and $20 \mu\text{m}$.

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 Chap. 13.

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.

13. Emissivity

13.1 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, chamotte). To minimize measuring errors in such cases, the handling should be performed very carefully and the unit should be protected against reflecting radiation sources.

13.2 Determination of Unknown Emissivity

- First, determine the actual temperature of the measuring object with a thermocouple or contact sensor. Secondly, 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 260 °C you may place a special plastic sticker 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.
- Cover a part of the surface of the measuring object with 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.

i

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

13.3 Characteristic Emissivities

In case none of the methods mentioned above help to determine the emissivity you may use the emissivity tables, see Chap. A 2, see Chap. A 3. These are average values, only. The actual emissivity of a material depends on the following factors:

- Temperature
- Measuring angle
- Geometry of the surface (flat, convex, concave)
- Thickness of the material
- Constitution of the surface (polished, oxidized, rough, sandblast)
- Spectral range of the measurement
- Transmissivity (e.g. with thin films)

14. Warranty

All components of the device have been checked and tested for perfect function in the factory. In the unlikely event that errors should occur despite our thorough quality control, this should be reported immediately to MICRO-EPSILON.

The warranty period lasts 12 months following the day of shipment. Defective parts, except wear parts, will be repaired or replaced free of charge within this period if you return the device free of cost to MICRO-EPSILON. This warranty does not apply to damage resulting from abuse of the equipment and devices, from forceful handling or installation of the devices or from repair or modifications performed by third parties.

No other claims, except as warranted, are accepted. The terms of the purchasing contract apply in full. MICRO-EPSILON will specifically not be responsible for eventual consequential damages. MICRO-EPSILON always strives to supply the customers with the finest and most advanced equipment. Development and refinement is therefore performed continuously and the right to design changes without prior notice is accordingly reserved.

For translations in other languages, the data and statements in the German language operation manual are to be taken as authoritative.

15. Service, Repair

In the event of a defect on the infrared sensor, please send us the affected parts for repair or exchange.

In the case of faults the cause of which is not clearly identifiable, the entire measuring system must be sent back to:

For customers in USA applies:

Send the affected parts or the entire measuring system back to:

For customers in Canada or South America applies:

Please contact your local distributor.

16. Decommissioning, Disposal

➡ Disconnect the USB cable from the infrared sensor.

The thermoMETER LS is produced according to the directive 2011/65/EU, "RoHS".

➡ Do the disposal according to the legal regulations (see directive 2002/96/EC).

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Appendix

A 1 Factory Default Settings

The device has the following preferences at the time of delivery:

Emissivity	0.950
Optics	SF
High alarm	900 °C/ deactivated
Low alarm	-35 °C/ deactivated
Temperature unit	°C
Lock	Off
Buzzer	On
Laser	On
Display backlight	On
Display turn	Auto

The Reset function will set the unit back to these default values (exception: optics).

A 2 Emissivity Table Metals

i Please note that these are only approximate values, which were taken from various sources.

Material		Typical Emissivity
Aluminum	Non oxidized	0.02 - 0.1
	Polished	0.02 - 0.1
	Roughened	0.1 - 0.3
	Oxidized	0.2 - 0.4
Brass	Polished	0.01 - 0.05
	Roughened	0.3
	Oxidized	0.5
Copper	Polished	0.03
	Roughened	0.05 - 0.1
	Oxidized	0.4 - 0.8
Chrome		0.02 - 0.2
Gold		0.01 - 0.1
Haynes	Alloy	0.3 - 0.8
Inconel	Electro polished	0.15
	Sandblast	0.3 - 0.6
	Oxidized	0.7 - 0.95
Iron	Non oxidized	0.05 - 0.2
	Rusted	0.5 - 0.7
	Oxidized	0.5 - 0.9
	Forged, blunt	0.9
Iron, casted	Non oxidized	0.2
	Oxidized	0.6 - 0.95

Material		Typical Emissivity
Lead	Polished	0.05 - 0.1
	Roughened	0.4
	Oxidized	0.2 - 0.6
Magnesium		0.02 – 0.1
Mercury		0.05 – 0.15
Molybdenum	Non oxidized	0.1
	Oxidized	0.2 - 0.6
Monel (Ni-Cu)		0.1 – 0.14
Nickel	Electrolytic	0.05 – 0.15
	Oxidized	0.2 – 0.5
Platinum	Black	0.9
Silver		0.02
Steel	Polished plate	0.1
	Rustless	0.1 - 0.8
	Heavy plate	0.4 - 0.6
	Cold-rolled	0.7 - 0.9
	Oxidized	0.7 - 0.9
Tin	Non oxidized	0.05
Titanium	Polished	0.05 - 0.2
	Oxidized	0.5 - 0.6
Wolfram	Polished	0.03 – 0.1
Zinc	Polished	0.02
	Oxidized	0.1

A 3 Emissivity Table Non Metals

i Please note that these are only approximate values, which were taken from various sources.

Material	Typical Emissivity	
Asbestos	0.95	
Asphalt	0.95	
Basalt	0.7	
Carbon	Non oxidized	0.8 – 0.9
	Graphite	0.7 - 0.8
Carborundum		0.9
Ceramic		0.95
Concrete		0.95
Glass		0.85
Grit		0.95
Gypsum		0.8 - 0.95
Ice		0.98
Limestone		0.98
Paint	Non alkaline	0.9 – 0.95
Paper	Any color	0.95
Plastic > 50 μ m	Non transparent	0.95
Rubber		0.95
Sand		0.9

Material	Typical Emissivity
Snow	0.9
Soil	0.9 – 0.98
Textiles	0.95
Water	0.93
Wood	Natural 0.9 - 0.95



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X9751195-B011035HDR
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