

IC085LV / IC125LV

EN

OPERATING MANUAL
THERMAL IMAGING CAMERA



 TROTEC

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Notes regarding the operating manual

Symbols


 **Warning of electrical voltage**
 This symbol indicates dangers to the life and health of persons due to electrical voltage.


 **Warning of laser radiation**
 This symbol indicates dangers to the health of persons due to laser radiation.

 **Warning**
 This signal word indicates a hazard with an average risk level which, if not avoided, can result in serious injury or death.

 **Caution**
 This signal word indicates a hazard with a low risk level which, if not avoided, can result in minor or moderate injury.

Notice
 This signal word indicates important information (e.g. material damage), but does not indicate hazards.

 **Info**
 Information marked with this symbol helps you to carry out your tasks quickly and safely.

 **Follow the manual**
 Information marked with this symbol indicates that the operating manual must be observed.

You can download the current version of the operating manual and the EU declaration of conformity via the following link:



IC085LV



<http://hub.trotec.com/?id=39794>

IC125LV



<http://hub.trotec.com/?id=39795>

Legal notice

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Changes to construction in the interests of constant improvements to the product, as well as changes to the shape and colour are reserved.

The scope of delivery may vary from product images. This document was created with all due care.

Trotec GmbH & Co. KG accepts no liability whatsoever for possible mistakes or omissions.

The only party responsible for determining valid measured results, drawing conclusions and deriving actions is the user.

Trotec GmbH & Co. KG accepts no claims of warranty for the correctness of the determined measured values or measured results.

Further, Trotec GmbH & Co. KG accepts no liability whatsoever for possible mistakes or damage which have been caused by utilising the determined measured results.

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Warranty and liability

The device complies with the fundamental health and safety requirements of the applicable EU regulations and was tested at the factory for perfect functionality multiple times.

If malfunctions occur nonetheless, please contact your dealer or distributor.

When making a warranty claim, supply the device number (see the side of the device).

When manufacturer's instructions or legal regulations have not been followed, or after unauthorised changes to the device are made, the manufacturer is not responsible for the resulting damages. Changes to the device or unauthorised replacement of individual parts can drastically impact the electrical safety of this product and will result in the loss of the warranty. Liability does not extend to damages to people or property caused by the device being used other than as described in the instructions in this operating manual. Subject to changes to technical design and model changes as part of constant development and product improvement without prior notice.

No liability is accepted for damages resulting from improper use. In such a case, any warranty claims will be voided also.

Safety

Read this manual carefully before starting or using the device. Always store the manual in the immediate vicinity of the device or its site of use!



Warning

Read all safety warnings and all instructions.

Failure to follow the warnings and instructions may result in electric shock, fire and / or serious injury.

Save all warnings and instructions for future reference.

This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved.

Children shall not play with the appliance. Cleaning and user maintenance shall not be made by children without supervision.

- Do not use the device in potentially explosive rooms.
- Do not use the device in aggressive atmosphere.
- Do not immerse the device in water. Do not allow liquids to penetrate into the device.
- The device may only be used in dry surroundings and must not be used in the rain or at a relative humidity exceeding the operating conditions.
- Protect the device from permanent direct sunlight.
- Do not remove any safety signs, stickers or labels from the device. Keep all safety signs, stickers and labels in legible condition.
- Do not open the device with a tool.
- Observe the storage and operating conditions (see chapter Technical data).
- Never point the integrated laser pointer at people or animals.

Intended use

Only use the device for visual or thermographic representation of objects whilst adhering to the technical data.

To use the device for its intended use, only use accessories and spare parts which have been approved by Trotec.

Improper use

Do not use the device in potentially explosive areas. Never use the device on persons or animals. Trotec accepts no liability for damages resulting from improper use. In such a case, any warranty claims will be voided. Any unauthorised modifications, alterations or structural changes to the device are forbidden.

Personnel qualifications

People who use this device must:

- have read and understood the operating manual, especially the Safety chapter.
- know and understand the dangers of performing measurements near hot surfaces.

Residual risks



Warning of electrical voltage

There is a risk of a short-circuit due to liquids penetrating the housing!
Do not immerse the device and the accessories in water. Make sure that no water or other liquids can enter the housing.



Warning of electrical voltage

Work on the electrical components must only be carried out by an authorised specialist company!



Warning of electrical voltage

Before any work on the device, remove the mains plug from the mains socket and the battery from the device!
Hold onto the mains plug while pulling the power cable out of the mains socket.



Warning of explosive substances

Do not expose the battery to temperatures above 45 °C! Do not let the battery come into contact with water or fire! Avoid direct sunlight and moisture. There is a risk of explosion!



Warning of laser radiation

Laser class 2, P max.: > 1 mW, λ: 650 nm, EN 60825-1:2014

Do not look directly into the laser beam or the opening from which it emerges.

Never point the laser beam at people, animals or reflective surfaces. Even brief eye contact can lead to eye damage.

Examining the laser output aperture by use of optical instruments (e.g. magnifying glass, magnifiers and the like) entails the risk of eye damage.

When working with a laser of class 2, observe the national regulations on wearing eye protection.



Warning

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



Warning

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



Warning

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



Caution

Keep a sufficient distance from heat sources.

Notice

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

Notice

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

Information about the device

Device description

The thermal camera IC085LV / IC125LV creates a visible image depicting infrared radiation which is otherwise invisible to the human eye. The thermal image and temperature are displayed on the screen in real time. To improve the view, you can select various colour palettes for depicting the thermal image.

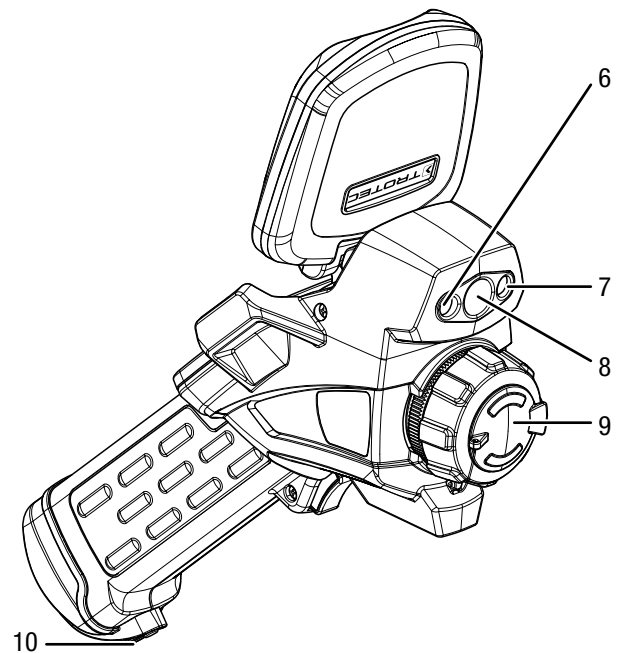
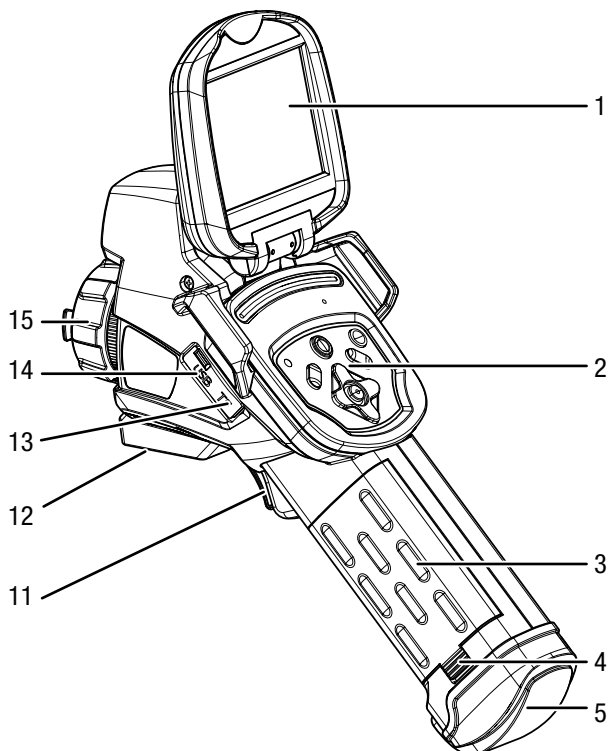
Furthermore, you can superimpose IR and digital images (IR DuoVision Plus) in order to obtain a higher-contrast thermal image.

For a measured result which is as precise as possible the ambient temperature, reflected temperature, relative humidity, distance and emissivity can be entered.

A list of emissivities for various surfaces is provided in the chapter Emissivity. For a precise evaluation, the thermal image on the screen can be frozen or, if the microSD memory card is inserted, saved in the device. The saved images can later be viewed either directly on the camera screen or on a PC using an analysis software.

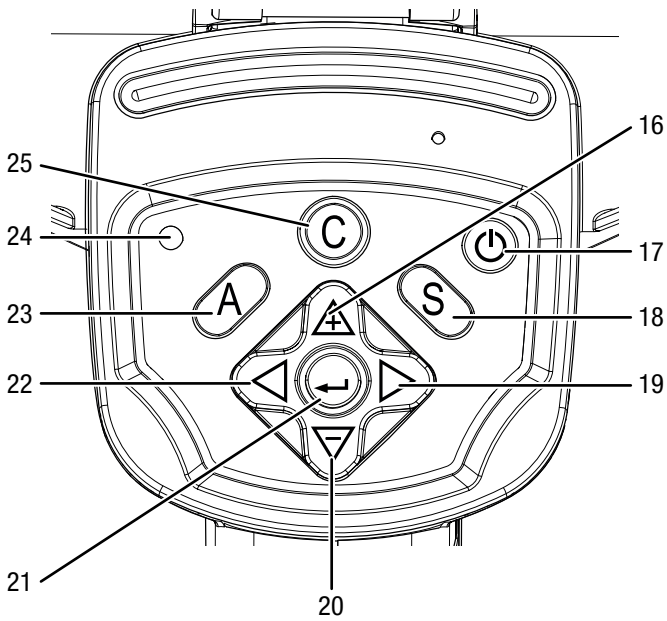
To edit the images, you can download the IR-Report 2.X STD software from the download (or *Service*) section of www.trotec.com.

Device depiction



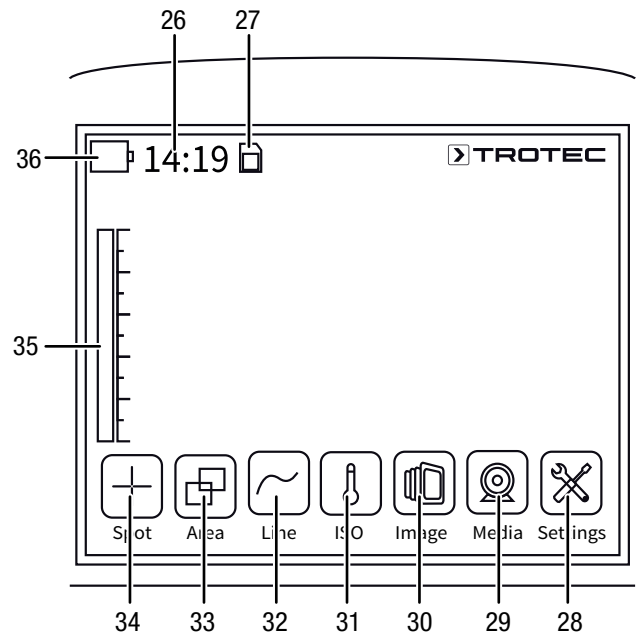
No.	Designation
1	Display
2	Control panel
3	Battery
4	Battery locking mechanism
5	AV output with sealing cap
6	LED
7	Laser pointer
8	Camera
9	Infrared lens with protective cap
10	Wrist strap holder
11	Multifunction button
12	1/4" tripod thread
13	microSD memory card slot
14	Micro USB port
15	Focus ring

Control panel



No.	Designation
16	Arrow button up / increase SPAN
17	Power button
18	S button: Freeze / Activate image or save (press and hold for approx. 3 s)
19	Arrow button right / LEVEL up
20	Arrow button down / decrease SPAN
21	Enter button
22	Arrow button left / LEVEL down
23	A button: Shutter button / Auto adjustment
24	Operating LED
25	C button: Main menu or Back button

Display



No.	Designation
26	Time indication
27	SD memory card inserted indication
28	Settings menu
29	Media menu
30	Image menu
31	ISO mode menu
32	Line menu
33	Area menu
34	Spot menu
35	Temperature scale (dynamic)
36	Battery status indicator

Technical data

Parameter		Value	
Model		IC085LV	IC125LV
Article number		3.110.003.014	3.110.003.023
Measurement	Temperature range	-20 °C to +600 °C	
	Accuracy	± 2 °C, ± 2 % from the measured value	
Radiometric image performance	Detector type	Focal Plane Array (FPA), uncooled microbolometer	
	Detector resolution	384 x 288 pixels	
	Spectral range	8 to 14 µm	
	Field of vision (FOV)	24° x 18°	
	Geometric resolution	1.3 mrad	
	Thermal sensitivity	0.05 °C at 30 °C	
	Refresh rate	50/60 Hz	
	Focus / min. focus distance	Manual / 0.5 m	
Visual image performance	Digital photo camera	5 megapixels, integrated photo lamp	
	Video norm	PAL / NTSC	
Image representation	Display	3.5-inch LCD touchscreen, capacitive	
	Image display	Pseudo colours, 6 colour palettes	
	Image display options	IR image, real image, DuoVision Plus display (fusion of infrared and real image as contour emphasizing detail-enhanced thermogram)	
Measurement and analysis	Measuring spots	8 movable temperature measuring spots (can be freely configured)	
	Measuring functions	Isotherm, line profile analysis, sector analysis (rectangle), alarm function for hot/cold spot, differential measurements at up to 8 dynamic temperature measuring spots	
	Area measurement	2 areas	
	Emissivity	User-defined variably adjustable from 0.01 to 1.0	
	Measurement correction	Correction of the reflected object temperature; automatic correction based on user-defined specifications for ambient temperature, distance, relative humidity	
Data storage	Memory	512 MB internal flash memory; microSD memory card slot	
	File format	Radiometric image: 14 bit JPEG; visual image: JPEG; non-radiometric thermographic video: MPEG-4; fully radiometric infrared video: 14-bit IR format	
	Data storage / transmission	Storage of non-radiometric IR videos (MPEG-4) as well as radiometric and real images on internal memory or SD card; storage of fully radiometric IR videos* on PC via USB 2.0	
	Voice recording	Comments can be stored along with every IR image (optionally available Bluetooth headset required)	
	Interfaces	USB 2.0, analogue video (PAL / NTSC)	
Laser	Type	Semiconductor AlGaInP diode laser class 2, 1 mw / 635 nm red	
Power supply	Battery type	Standard lithium-ion; rechargeable, exchangeable	
	Operating time	Approx. 3h	
	Mains power	4.2 - 4.8V DC	
	Energy saving mode	User-defined	
Surrounding conditions	Temperature	-20 °C to +50 °C (operation), -40 °C to +70 °C (storage)	
	Humidity	10 % to 95 % RH (non-condensing)	
	Type of protection / shock / vibration	IP54 / 25G / 2G	
	Impact resistance (falling from)	1.8 m	
Physical characteristics	Dimensions (length x width x height)	230 x 80 x 195 mm	
	Weight	650 g	
	Tripod mounting	1/4 inch – 20	

* Saving fully radiometric IR videos requires the optionally available real-time upgrade

Scope of delivery

- 1x Thermal imaging camera
- 1x Battery
- 1x Charger
- 1x Power adapter for charger
- 1x microSD memory card
- 1x Micro USB cable
- 1x Transport case
- 1x Lens hood
- 1x Cinch AV cable
- 1x USB SD memory card reader

Transport and storage**Notice**

If you store or transport the device improperly, the device may be damaged.

Note the information regarding transport and storage of the device.

Transport

For transporting the device, use the transport case included in the scope of delivery in order to protect the device from external influences.

The supplied Li-ion batteries are subjects to the requirements of dangerous goods legislation.

Observe the following when transporting or shipping Li-ion batteries:

- The user may transport the batteries by road without any additional requirements.
- If transport is carried out by third parties (e.g. air transport or forwarding company), special requirements as to packaging and labelling must be observed. This includes consulting a dangerous goods specialist when preparing the package.
 - Only ship batteries if their housing is undamaged.
 - Mask open terminals with tape and pack the battery in a way that it cannot move inside the packaging.
 - Please also observe any other national regulations.

Storage

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

- dry and protected from frost and heat
- in an upright position where it is protected from dust and direct sunlight
- with a cover to protect it from invasive dust if necessary
- The storage temperature is the same as the range given in the Technical data chapter.
- When storing the device for an extended period of time, remove the batteries.

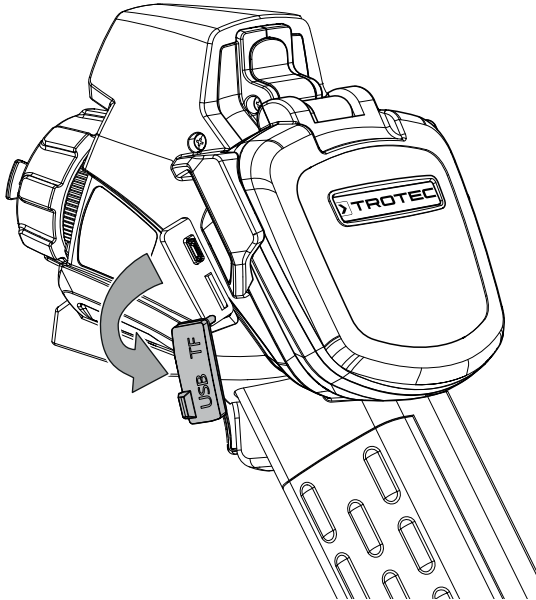
Operation

Inserting the microSD memory card

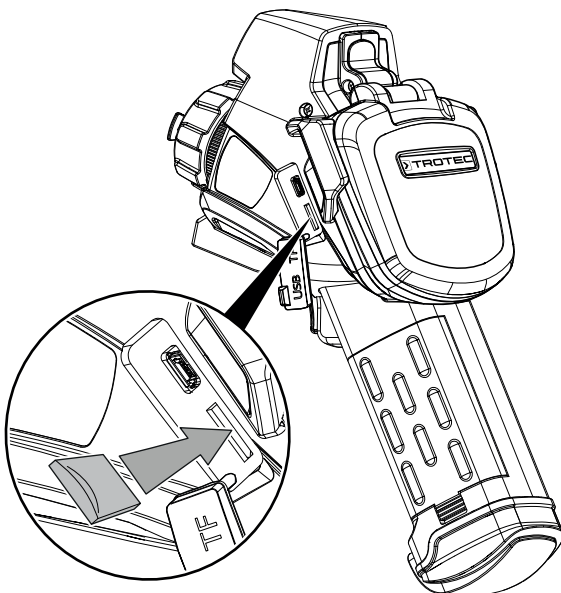
The microSD memory card can be used to extend the device's internal memory in order to store images and videos.

Please proceed as follows to insert the microSD memory card:

1. Open the cover at the microSD memory card slot (13).



2. Insert the microSD memory card into the slot with the contacts facing up until the microSD memory card clicks into place.

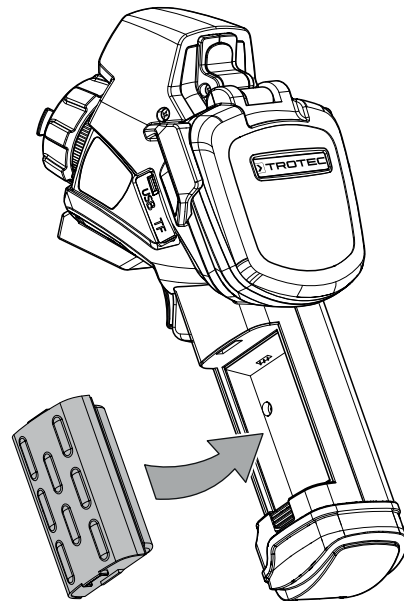


Inserting / Changing the battery

Notice

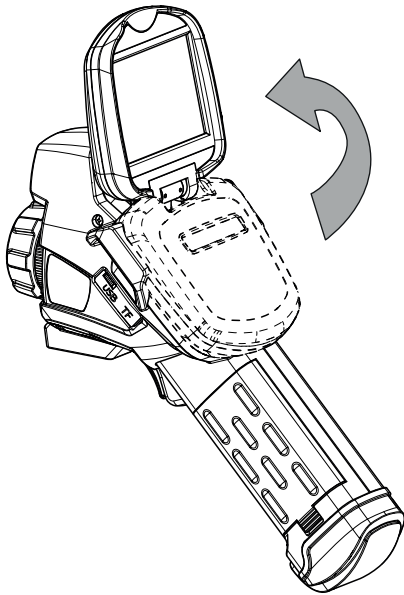
Make sure that the surface of the device is dry and the device is switched off.

1. Charge the battery as described in the section Charging the battery in the Maintenance chapter.
2. If applicable, remove the empty battery. To do so, slide the locking mechanism at the battery down.
3. Insert the fully charged battery into the holder with correct polarity until the battery perceptibly clicks into place.

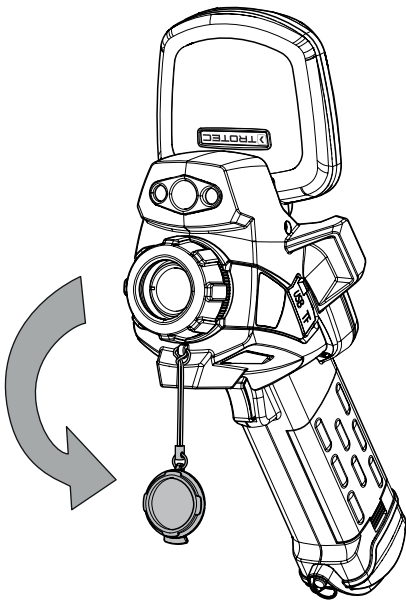


Switching the device on

1. Open the display.



2. Open the protective cap at the IR lens.



3. Press the Power button (17) for approx. 5 seconds.
 - ⇒ The operating LED (24) lights up in blue.
 - ⇒ The Trotec logo is displayed.

4. Wait a moment until the device has started up completely.
 - ⇒ A current IR image and the start screen appear on the display:



Setting the language

Please proceed as follows to set the language for the menu texts:

1. Press the C button (25).
 - ⇒ The main menu is displayed.
2. Select the *Settings* menu.
3. Select the *System* menu.
4. Press the *Language* button.
5. Swipe your finger through the list of available languages.
6. Swipe to select the desired language.
7. Confirm your selection with *OK*.
 - ⇒ The desired language has been selected and set.

Setting date and time

Please proceed as follows to set the date and time for the system and the time stamp on the images / videos:

1. Press the C button (25).
⇒ The main menu is displayed.
2. Select the *Settings* menu.
3. Select the *System* menu.
4. Press the *Date & Time* button.
5. Press the *Set date* button.
6. Swipe to select the desired date.
7. Confirm your selection with *OK*.
8. Press the *Set time* button.
9. Swipe to select the desired time.
10. Confirm your selection with *OK*.
11. Press the *Set timezone* button.
12. Swipe to select the desired timezone.
13. Confirm your selection with *OK*.
⇒ Date and time have been selected and set.

Focussing and calibrating the IR camera

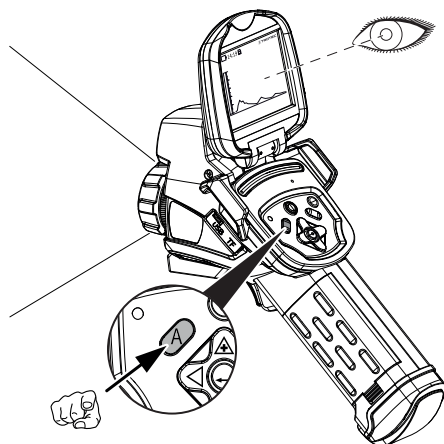


Info

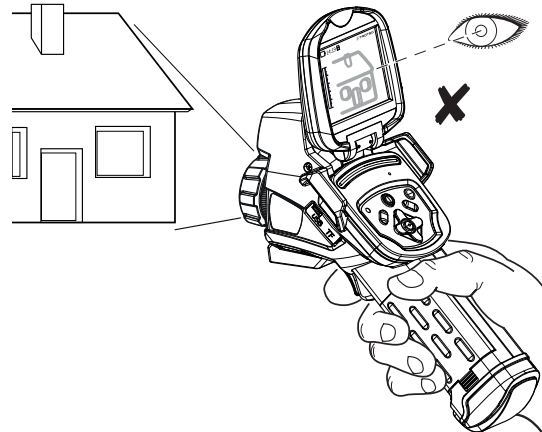
You can also assign this function to the multifunction button. Further information on the multifunction button is provided in the chapter *Configuring the multifunction button*.

1. Turn the focus ring (15) to the left or right until the object to be thermographed is sharply focussed. An image that is not sharply focussed leads to deviations in the temperature measurement!
2. Press the Shutter button (23).
⇒ The internal shutter of the IR camera closes briefly and an automatic adjustment (calibration) to the temperatures in the image section is performed.

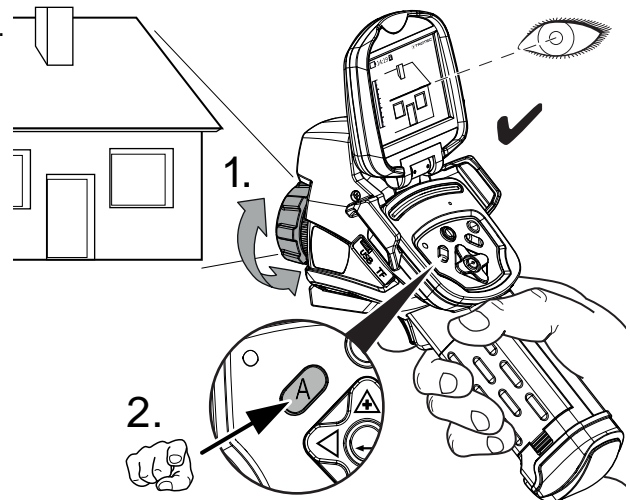
A.



B.



C.



Taking/recording an infrared image/video



Info

You can also assign this function to the multifunction button. Further information on the multifunction button is provided in the chapter *Configuring the multifunction button*.

Recording of IR images and videos can be started from the main menu (C button).

1. Press the C button (25).
⇒ The main menu is displayed.
2. Select the *Media* menu.

Please proceed as follows to record and save an infrared image:

1. Press the *Snapshot* button.
⇒ The photo is taken and saved.
⇒ The *Media* menu is displayed again.

Please proceed as follows to record and save a video:

1. Press the *Video* button.
 - ⇒ The recording is started.
 - ⇒ A recording icon (red circle) and the recording time appear at the top of the display.
2. Press the *Video* button again to stop recording.
 - ⇒ The video is saved.

Configuring the multifunction button

The multifunction button (11) can be assigned with various functions.

Setting	Function
<i>Shutter</i>	Shutter function for calibration
<i>Freeze</i>	Activate or deactivate freezing the image
<i>Snapshot</i>	Taking a picture
<i>Laser</i>	Switching the laser on or off
<i>LED</i>	Switching the LED on or off

Please proceed as follows to configure the multifunction button:

1. Press the C button (25).
 - ⇒ The main menu is displayed.
2. Select the *Settings* menu.
3. Select the *System* menu.
4. Select the *Control* menu.
5. Press the *Multi-Func Key* button.
6. Select the desired setting.
7. Leave the *Settings* menu.
 - ⇒ The desired setting is saved.

Configuring the quick launch button

The quick launch button allows fast access to the *Image* menu and can be freely positioned on the screen.

Please proceed as follows to activate / deactivate the quick launch button:

1. Press the C button (25).
 - ⇒ The main menu is displayed.
2. Select the *Settings* menu.
3. Select the *Image* menu.
4. Activate the quick launch button by sliding the selector switch to the right.
5. Leave the *Settings* menu.
 - ⇒ The quick launch button is activated and displayed.
6. Press and hold the quick launch button to move it to the desired position.
7. Briefly press the quick launch button to open the *Image* menu.



Data transfer via USB

You can either access and read out the microSD memory card inserted in the device using a micro USB data cable, or transfer the data to the software (optional PRO version) in real time and thus record fully radiometric infrared videos.

To do so, first select the desired transmission mode in the settings:

- *USB Mode* (data memory access)
- *Trans.* (real-time data transmission to software)

1. Press the **C** button (25).
⇒ The main menu is displayed.
2. Select the *Settings* menu.
3. Select the *System* menu.
4. Select the *Control* menu.
5. Press the *USB Mode* button.
6. Swipe to select the desired transmission mode.
7. Leave the *Settings* menu.
8. Connect the supplied micro USB data cable to the device.
9. Connect the data cable to a PC or notebook.



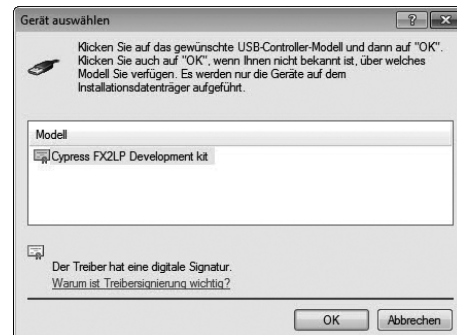
Info

You also have to start data transmission in the software (optional PRO version) in order to connect the device.

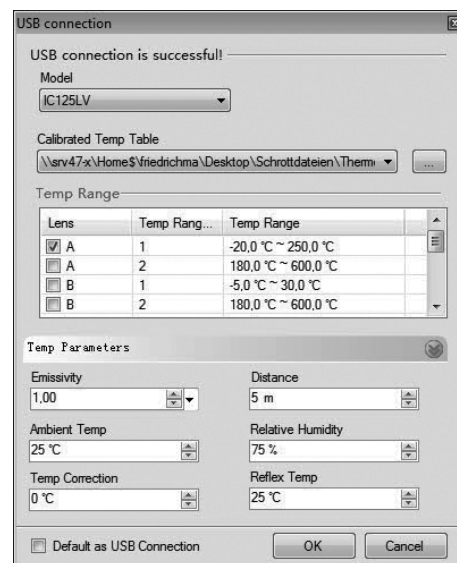
To transmit fully radiometric real-time IR videos to your PC using a micro USB data cable (only possible in combination with the optionally available IC report PRO software), please proceed as follows:

1. Connect the optionally available dongle of the IC report analysis software PRO version to a free USB port of your PC. Without the dongle, the extension of the USB interface in the analysis software is locked.
2. Open the IC report software and activate the *Trans.* transmission mode at the camera.
3. Connect the PC to the camera using the supplied micro USB cable.

4. If the IC report analysis software was properly installed beforehand, the PC's operating system will automatically identify the connected camera and install all necessary drivers.



5. After the drivers have been successfully installed, the camera will be detected as mass storage device every time it is connected to the PC.
6. In the menu of the analysis software select the item *Monitoring – Connect USB* or click directly onto the USB symbol.
7. Select the type of camera you want to connect to your computer in the submenu that opens.



8. Now enter the path of the location where the calibration table (dataload.bin file) is to be saved on your computer.
9. Select the applicable temperature range.
10. Confirm with *OK*.
⇒ The live image of the camera appears in the software's analysis window.



Info

The calibration table that corresponds to the camera is bound to the serial number and only valid for the respective device connected.

Switching the laser pointer on or off

Please proceed as follows to switch the laser pointer on or off:



Warning of laser radiation

Laser class 2, P max.: > 1 mW, λ: 650 nm, EN 60825-1:2014

Do not look directly into the laser beam or the opening from which it emerges.

Never point the laser beam at people, animals or reflective surfaces. Even brief eye contact can lead to eye damage.

Examining the laser output aperture by use of optical instruments (e.g. magnifying glass, magnifiers and the like) entails the risk of eye damage.

When working with a laser of class 2, observe the national regulations on wearing eye protection.

1. Press the C button (25).
 - ⇒ The main menu is displayed.
2. Select the *Settings* menu.
3. Select the *System* menu.
4. Select the *Control* option.
5. Activate the laser permanently by sliding the selector switch to the right.
 - ⇒ The laser pointer is switched and permanently illuminated.
 - ⇒ The *Laser* selector switch is highlighted in blue.
6. Deactivate the laser by sliding the selector switch to the left.



Info

You can also assign this function to the multifunction button. Further information on the multifunction button is provided in the chapter *Configuring the multifunction button*.

Using the AV port

You can connect the device to a screen via an AV cable. The image can be transmitted in PAL or NTSC format.

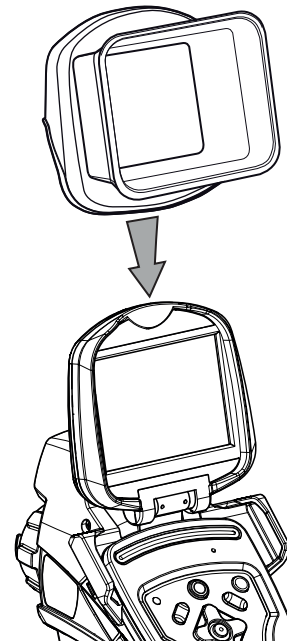
1. Select the *Settings* menu.
2. Select the *System* menu.
3. Select the *Control* menu.
4. For the option *TV-Out Mode* select the desired format PAL or NTSC.
5. Enable the *TV-Out* option by sliding the selector switch to the right.
 - ⇒ The *TV-Out* selector switch is highlighted in blue.
 - ⇒ The TV output is activated.
6. Open the sealing cap at the AV output (5).
7. Connect the supplied or a suitable AV cable to the device and to the screen.

Attaching the lens hood

If required, you can attach the lens hood in order to shield the display from the ambient light.

Please proceed as follows:

1. Slide the lens hood onto the opened display from the top.



Switching the device off

1. Remove the lens hood if you have attached it.
2. Press the Power button (17).
3. Confirm the prompt with *OK*.
4. Close the display.

Software

You can either select the functions directly via the touch display, or using the arrow buttons and the Enter button (21).

Main menu

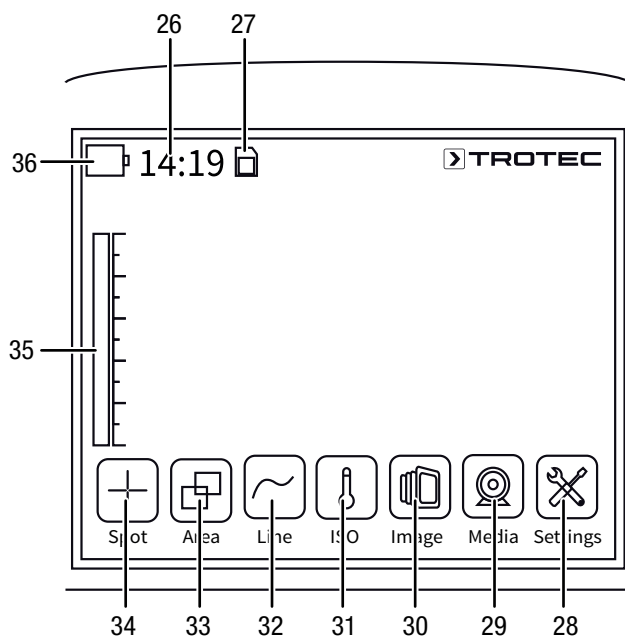
- ✓ The start screen is displayed.



The main menu consists of the following menus:

Symbol	Function
	Spot menu (34)
	Area menu (33)
	Line menu (32)
	ISO menu (31)
	Image menu (30)
	Media menu (29)
	Settings menu (28)

1. Press the C button (25) or touch the Trotec logo on the display to open the main menu.



2. You can either select the submenus directly via the touch display, or using the arrow buttons and the Enter button (21).

Spot menu

The following settings can be made in this menu:

- Setting a measuring spot
- Deleting a measuring spot
- Making settings for a measuring spot

Setting a measuring spot

1. Select the *Spot* menu.
 - ⇒ A measuring spot appears on the display.
 - ⇒ Next to the measuring spot, a number (e.g. 1) and the current temperature are displayed, provided that this was set in the general settings for this spot.
2. Tap the measuring spot and drag it to the desired position.
 - ⇒ The currently active measuring spot is highlighted in green.
3. You can add up to eight measuring spots if needed.

Deleting a measuring spot

1. Tap the measuring spot and drag it to the recycle bin appearing in the bottom right corner.
 - ⇒ The measuring spot has been deleted.

Making settings for a measuring spot

1. When the measuring spot is active, press the Enter button (21) or briefly tap the measuring spot twice.
 - ⇒ The settings for the measuring spot are displayed.



Setting		Function
Display	Hide	Hide measuring spot
	Show	Show measuring spot
Mode	Manual	The position of the measuring spot can be changed manually.
	Max	The measuring spot automatically switches to the position with the highest temperature.
	Min	The measuring spot automatically switches to the position with the lowest temperature.
Temp.	Off	Temperature for the measuring spot is not displayed.
	On	Current temperature for the measuring spot is displayed next to the measuring spot.
Background	Hide	Temperature and number of the measuring spot are displayed without a background.
	Show	Temperature and number of the measuring spot are framed by a background.
Alarm Mode	Off	Alarm function for the measuring spot is switched off.
	Above	Acoustic alarm sounds as soon as the temperature at the measuring spot is above the alarm temperature.
	Below	Acoustic alarm sounds as soon as the temperature at the measuring spot is below the alarm temperature.
	Equal	Acoustic alarm sounds as soon as the temperature at the measuring spot equals the alarm temperature.
Alarm Temp		Enter temperature for alarm mode

Area menu

The following settings can be made in this menu:

- Creating an area
- Deleting an area
- Making settings for an area

Creating an area

1. Select the *Area* menu.
 - ⇒ An area appears on the display.
 - ⇒ Next to the area a number (e.g. A1) is displayed.
2. Tap the middle of the area and drag it to the desired position.
3. Tap the corners of the area to increase or reduce the size of the area.
4. You can add up to two areas if needed.

Deleting an area

1. Tap the area and drag it to the recycle bin appearing in the bottom right corner.
 - ⇒ The area has been deleted.

Making settings for an area

1. When the area is active, press the Enter button (21) or briefly tap the area twice.
 - ⇒ The settings for the area are displayed.



Setting		Function
Display	Hide	Hide area
	Show	Show area
Max	Off	Display deactivated
	On	A spot inside the area indicates the highest temperature. To the right of the area, the highest temperature inside the area is displayed as a number.
Min	Off	Display deactivated
	On	A spot inside the area indicates the lowest temperature. To the right of the area, the lowest temperature inside the area is displayed as a number.
Averg.	Off	Display deactivated
	On	To the right of the area, the average temperature inside the area is displayed as a number.

Line menu

The following settings can be made in this menu:

- Activating a line
- Deleting a line

Activating a line

1. Select the *Line* menu.
 - ⇒ A line and the temperature profile along this line are displayed.
 - ⇒ Above the line, a triangle pointing to a spot on the line appears. The temperature at this spot is displayed as a number.
2. When the line is activated, press the up / down arrow buttons (16 / 20) or tap the line and drag it up or down. The triangle marks the measuring spot on the line and can be shifted to the left or right.

Deleting a line

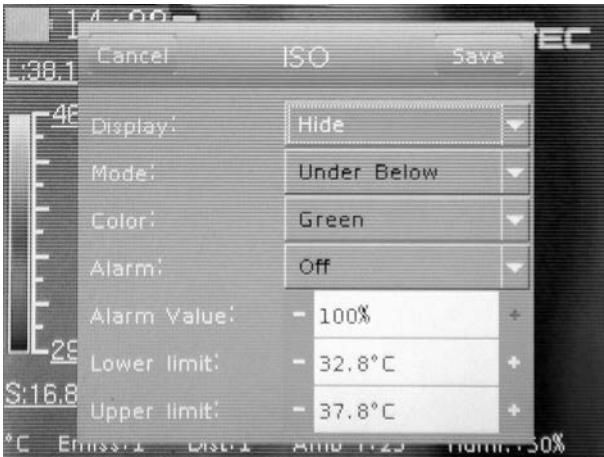
1. Tap the line and drag it to the recycle bin appearing in the bottom right corner.
 - ⇒ The line has been deleted.

ISO menu

Isotherms are colours of the same temperature. In this mode the thermal imaging camera highlights all areas within a certain previously specified temperature range (isotherm window) by means of a selected, particularly noticeable colour. This can e.g. be drops below dew point at building surfaces or thermally critical areas in control cabinets etc.

The following settings can be made in this menu:

- Display
- Mode
- Colour
- Alarm

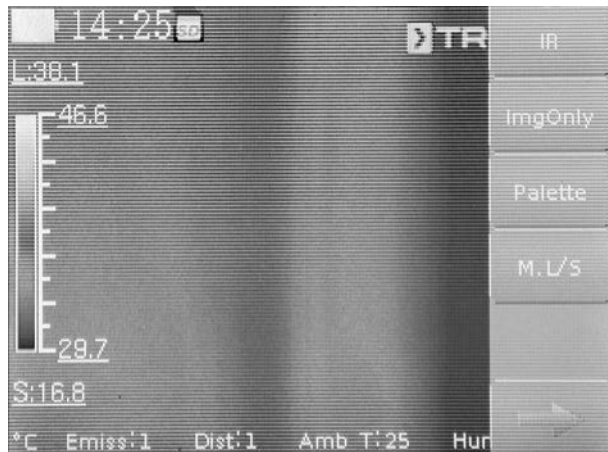


Setting		Function
Display	Hide	Hide isotherms
	Show	Show isotherms for the selected area
Mode	Under Below	Show isotherms below the lower limit
	Over Above	Show isotherms above the upper limit
	Interval	Show isotherms within the lower and upper limit (interval)
	Dual Below	Show isotherms within the lower and upper limit (interval) and below the lower limit
	Dual Above	Show isotherms within the lower and upper limit (interval) and above the upper limit
Colour	Green	Colour isotherms green
	Black	Colour isotherms black
	White	Colour isotherms white
	Translucent	Show isotherms in a translucent manner
Alarm	Off	Switch alarm off
	On	Switch alarm on
Alarm Value	Enter percentage value for the alarm; refers to the percentage of ISO colours in the image	
Lower limit	Enter temperature for lower limit	
Upper limit	Enter temperature for upper limit	

Image menu

The following settings can be made in this menu:

- Selecting the camera mode
- Showing / Hiding image bars / analysis tools
- Selecting the colour palette
- Setting the span and level



Setting	Designation	Function
Selecting the camera mode	IR	IR image is displayed
	CCD	Camera image is displayed
	Merg	The IR image and contours from the camera image are superimposed (DuoVision Plus)
	Pos	Position of the camera image can be shifted: <ul style="list-style-type: none"> • Move the image with your finger until the contours match the IR image. • Confirm and save the settings by pressing the <i>Done</i> button.
	Done	Confirm settings for image fusion <ul style="list-style-type: none"> • Please note that the setting must be confirmed to be able to make further settings to the measuring spots, areas or line.
Showing / Hiding image bars / analysis tools	ImgOnly	Shows or hides the information bars
Selecting the colour palette	Palette	Select the desired colour palette for the IR image
Setting the span and level	M.L/S	Select the span and level manually
	A.L/S	Span and level are constantly set automatically
	A.Level	Set span manually; level is constantly set automatically
	A.Span	Set level manually; span is constantly set automatically

Media menu



The following settings can be made in this menu:

Symbol	Setting	Function
	Snapshot	Take a photo
	Edit	Edit a photo
	Video	Record a video / Stop recording
	Replay	Play video
	File	Open file manager
	Back	Open main menu

Taking a photo submenu



Info

Images and videos can only be recorded and saved if a microSD memory card is inserted.

Please proceed as follows to take a photo:

1. Press the *Snapshot* button.
 - ⇒ The photo is taken and saved.
 - ⇒ The *Media* menu is displayed again.

Editing a photo submenu



You can access the following functions from this menu:

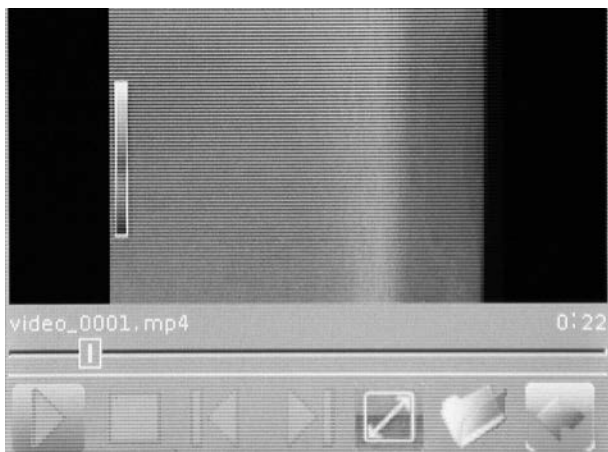
Symbol	Function
	Display photo
	Delete photo
	Start slide show
	Display photo on full screen
	Add image description

Starting / Stopping video recording submenu

Please proceed as follows to record a video:

1. Press the *Video* button.
 - ⇒ The recording is started.
 - ⇒ A recording icon (red circle) and the recording time appear at the top of the display.
2. Press the *Video* button again to stop recording.
 - ⇒ The video is saved.

Replay video submenu

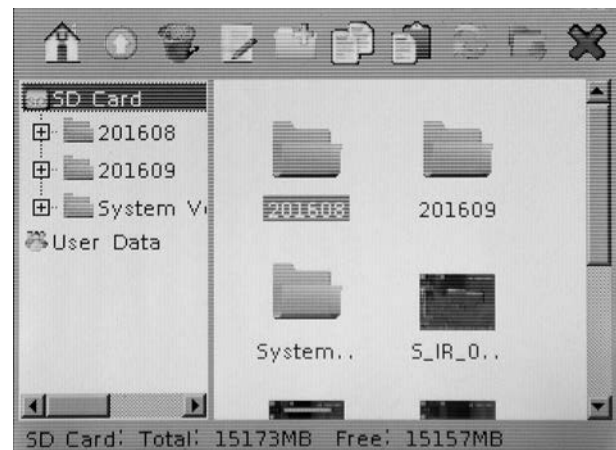


You can access the following functions from this menu:

Symbol	Function
	Play video
	Stop video
	Select previous video
	Select next video
	Play video on full screen
	Show videos
	Return to <i>Media</i> menu

File system submenu

The system-internal file manager is opened.



Symbol	Function
	Show file manager homepage
	Select parent folder
	Delete selected file / folder
	Change file name
	Create new folder
	Copy selected file
	Paste copied file
	Refresh display
	Use selected folder as storage location for videos and photos
	Return to <i>Media</i> menu

Settings menu

The following submenus can be selected in this menu:

- Analysis
- Image
- System

Analysis submenu

The following settings can be made in this menu:

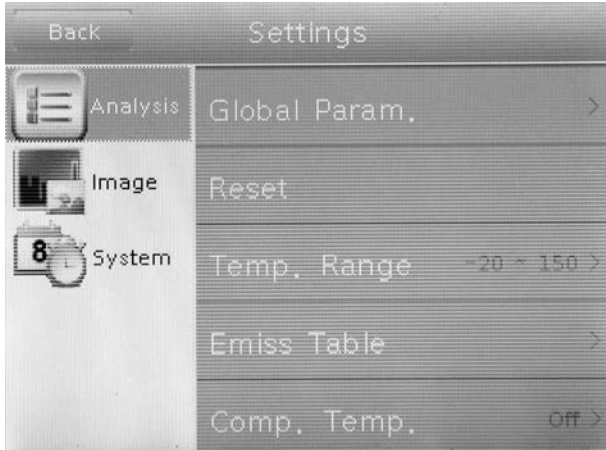
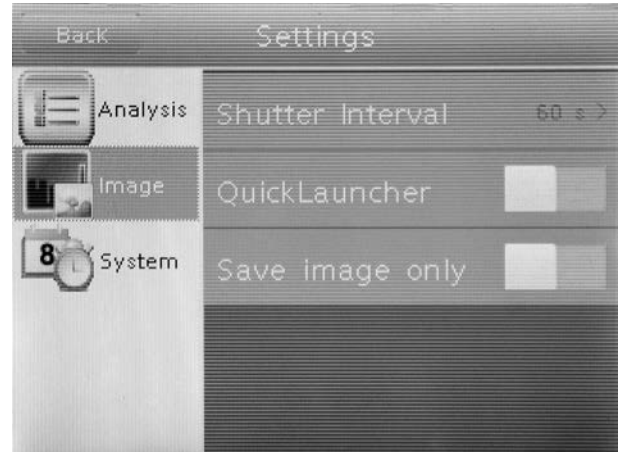


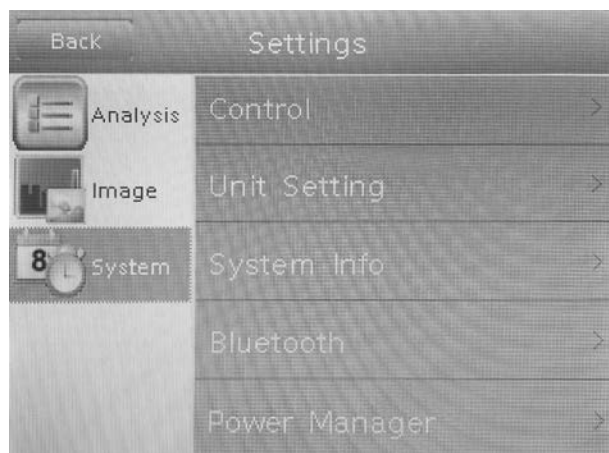
Image submenu



Submenu	Settings
Shutter Interval	Set shutter interval for IR lens
Quick Launcher	Activate or deactivate quick launch button
Save image only	Activate or deactivate <i>Save image only</i>

Designation	Function	
<i>Global Param.</i>	<i>Emissivity</i>	Set emissivity, value range 0.00 to 1.00
	<i>Distance</i>	Set distance to object
	<i>Ambi. Temp</i>	Set ambient temperature
	<i>Refl.Temp</i>	Set reflected temperature of the environment
	<i>Humidity</i>	Set relative humidity of the environment
	<i>Offset</i>	Set temperature offset (shift of the camera's internal calibration curve around zero)
	<i>Background</i>	Hide Show
<i>Reset</i>	Reset factory settings	
<i>Temp. Range</i>	Select temperature range: -20 °C to +150 °C or 140 °C to 600 °C	
<i>Emiss Table</i>	List of different emissivities	
<i>Comp. Temp.</i>	Comparison of a selected measuring spot with a set reference temperature	
<i>Lens</i>	When using an optional interchangeable lens, enter the aperture angle of the lens used (and specified in the menu)	

System submenu



Submenu	Settings
Language	Select language for menu texts
Update	Start software update / Perform backup
Date & Time	Set date and time
Control	Make settings regarding laser, TV output, LED and USB
Unit Setting	Set units for length (metres or feet) and temperature (Celsius or Fahrenheit)
System Info	Displays the system information including the serial number and firmware version. The device can be reset to factory settings by pressing the red button.
Bluetooth (optional)	Activate / Deactivate Bluetooth interface and manage connected Bluetooth devices
Power Manager	Activate / Deactivate screen saver and automatic switch-off

Emissivity

The emissivity is used to describe the energy radiation characteristic of a material (see also chapter Thermography terms).

A material's emissivity depends on various factors:

- composition,
- surface condition,
- temperature.

The emissivity can be between 0.01 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 emissivity.
- The brighter and smoother the surface of a material, the lower will be its emissivity, presumably.
- The higher the emissivity 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 can be neglected.

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

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

Material	Temperature (°C)	Emissivity (approximate)
Aluminium		
Polished aluminium	100	0.09
Customary aluminium foil	100	0.09
Electrolytically chromium-plated aluminium oxide	25 - 600	0.55
Mild aluminium oxide	25 - 600	0.10 - 0.20
Strong aluminium oxide	25 - 600	0.30 - 0.40
FE		
Polished cast iron	200	0.21
Processed cast iron	20	0.44
Polished tempered iron	40 - 250	0.28
Polished steel ingot	770 - 1040	0.52 - 0.56
Raw, welded steel	945 - 1100	0.52 - 0.61
Surface iron oxide	20	0.69
Fully rusted surface	22	0.66
Rolled iron plate	100	0.74
Oxidized steel	198 - 600	0.64 - 0.78
Cast iron (oxidizing at 600 °C)	198 - 600	0.79
Steel (oxidizing at 600 °C)	125 - 520	0.78 - 0.82
Electrolytic iron oxide	500 - 1200	0.85 - 0.95
Iron plate	925 - 1120	0.87 - 0.95
Cast iron, heavy iron oxide	25	0.80
Tempered iron, iron oxide	40 - 250	0.95

Material	Temperature (°C)	Emissivity (approximate)
Melting surface	22	0.94
Molten cast iron	1300 - 1400	0.29
Molten structural steel	1600 - 1800	0.28
Liquid steel	1500 - 1650	0.28
Pure iron ore	1515 - 1680	0.42 - 0.45
Galvanized, shiny iron plate	28	0.23
Copper		
Copper oxide	800 - 1100	0.13 - 0.16
Copper mirror	100	0.05
Strong copper oxide	25	0.078
Liquid copper	1080 - 1280	0.13 - 0.16
Brass		
Brass mirror	28	0.03
Brass oxide	200 - 600	0.59 - 0.61
Chromium		
Polished chrome	40 - 1090	0.08 - 0.36
Gold		
Gold mirror	230 - 630	0.02
Silver		
Polished silver	100	0.05
Nickel		
Nickel chromium (heat-resistant)	50 - 1000	0.65 - 0.79
Nickel chromium alloy	50 - 1040	0.64 - 0.76
Nickel chromium alloyed (heat-resistant)	50 - 500	0.95 - 0.98
Nickel silver alloy	100	0.14
Polished, galvanized	25	0.05
Galvanized	20	0.01
Nickel wire	185 - 1010	0.09 - 0.19
Lead		
Pure lead (not oxidized)	125 - 225	0.06 - 0.08
Stainless steel		
18 - 8	25	0.16
304 (8Cr, 18Ni)	215 - 490	0.44 - 0.36
310 (25Cr, 20Ni)	215 - 520	0.90 - 0.97
Tin		
Finished tin plate	100	0.07
Heavily oxidized	0 - 200	0.60
Zinc		
Oxidizing at 400 °C	400	0.01
Zinc oxide ash	25	0.28
Magnesium		
Magnesia	275 - 825	0.20 - 0.55
Metallic materials		
Hg	0 - 100	0.09 - 0.12
Sheet metal		0.88 - 0.90
Non-metallic materials		
Brick	1100	0.75

Material	Temperature (°C)	Emissivity (approximate)
Fire brick	1100	0.75
Graphite (lamp black)	96 - 225	0.95
Porcelain enamel (white)	18	0.90
Asphaltum	0 - 200	0.85
Glass (surface)	23	0.94
Calcimine	20	0.90
Oak	20	0.90
Piece of coal		0.85
Isolation piece		0.91 - 0.94
Glass tube		0.90
Loop type		0.87
Porcelain enamel products		0.90
Porcelain enamel designs		0.83 - 0.93
Solid materials		0.80 - 0.93
Ceramic (vase)		0.90
Film		0.90 - 0.93
Heat-resistant glass	200 - 540	0.85 - 0.95
Mica		0.94 - 0.95
Flume mica		0.90 - 0.93
Glass		0.91 - 0.92
Level chalk layer		0.88 - 0.93
Top loop		0.91 - 0.92
Epoxy glass plate		0.86
Epoxy hydroxybenzene plate		0.80
Block talcum terminal		0.87
Electric materials		
Semiconductor		0.80 - 0.90
Transistor (plastic sealed)		0.30 - 0.40
Transistor (metal diode)		0.89 - 0.90
Pulse transmission		0.91 - 0.92
Gold-plated copper sheet		0.30
Soldered plated copper		0.35
Zinc-plated lead wire		0.28
Brass wire		0.87 - 0.88

Thermography terms

Span (contrast)

If the temperatures in the image are homogeneously distributed and close together, the image might not be very colourful / contrasty, and the contours might not be easily visible. To increase the image's contrast, press the up or down button of the central menu keyboard. This increases or reduces the temperature range set. The representation of individual thermal areas in the image changes and becomes more contrasty.

Level (average temperature / temperature level / brightness)

When changing the span (see Span), it often makes sense to also adjust or shift the average temperature (Level). If, for instance, the span is reduced to a minimum first and then the level of this extremely narrowed temperature range is shifted up/down, the image will become useless even in parts as it will either have a totally excessive or insufficient contrast. However, this allows you to visualize even the smallest temperature differences in the object when traversing the individual temperature sections.

Emission

Any object whose temperature lies above absolute zero (-273.15 °C) emits heat radiation. Its surface condition (e.g. colour, structure, material composition etc.) and temperature, among other things, determine how well the heat is emitted. The emissivity of an object indicates how much heat it radiates compared to an ideal black body. An ideal black body has a theoretical emissivity of 1. Other factors such as transmission and reflection can be neglected in this ideal case. In practice, however, this is not possible. Surfaces that strongly reflect in the visible light spectrum are often also highly reflective in the infrared spectral range, as is the case with polished aluminium for instance.

The formula is: **transmission + reflection + emission = 1**

In most cases, the transmission factor can be neglected. If the surface to be thermographed is highly reflective, the share of reflection increases correspondingly and the share of emission decreases.

Example:

- transmission = 0
- reflection = 0.8
- emission = 0.2

Highly reflective surfaces reflect all temperatures whatsoever from surrounding heat sources, which are thus indirectly captured and measured by the thermal imaging camera, while the surface temperature of the actual measuring object is not being measured. To overcome this problem, special labels or sprays with a high defined emissivity are often applied on the surface to be measured.

The general rule is: The higher the emissivity, the lower the reflectance, the easier the thermography.

Reflected temperature

The location of heat sources in the surroundings influencing the measurement and the determination of the average temperature which is emitted by them and can be reflected by the object to be thermographed.

Errors and faults

Error	Cause	Remedy
Camera does not take/record pictures/videos	Internal memory full.	Delete files no longer needed to free up storage space.
Battery quickly discharged	Battery too old or damaged.	Use a new battery.
Battery not charging	Charging cable not inserted correctly.	Check the connection for proper fit.
	Battery too old or damaged.	Use a new battery.
	Contacts dirty.	Use a dry, clean cloth to clean the contacts.
SD memory card is not recognized	Contacts dirty.	Use a dry, clean cloth to carefully clean the contacts.
	File formatting incorrect	The SD memory card should be formatted to FAT32 in order to be recognized by the device.

Maintenance and repair

Charging the battery

Charge the battery when the battery status indicator (36) turns yellow or the device can no longer be switched on.

Always use the power adapter and charger included in the scope of delivery to charge the battery. Please proceed as follows:

1. Plug the charger into a sufficiently fused power socket. Only use the original charger or one with identical specifications, for otherwise both battery and camera could be damaged!
2. Plug the micro USB connector of the power adapter into the micro USB port of the charger.
 - ⇒ The LED on the charger is illuminated in blue.
3. Insert the battery into the charger.
 - ⇒ The LED on the charger is illuminated in red.
 - ⇒ The battery is fully charged when the LED on the charger is illuminated in blue.
4. Remove the charged battery from the charger.
5. Remove the power adapter from the mains socket and from the charger.

If you want to continue working with the device during charging, you can also charge the battery inside the device. Only use the supplied power adapter to do so. Please proceed as follows:

- ✓ The battery is inserted in the device
1. Plug the charger into a sufficiently fused power socket. Only use the original charger or one with identical specifications, for otherwise both battery and camera could be damaged!
 2. Plug the micro USB connector of the power adapter into the micro USB port of the device.
 - ⇒ The battery is fully charged when the battery status indicator is completely green.
 3. Remove the power adapter from the mains socket and from the device.



Info

The device may also be operated with the charger connected while no battery is inserted.

Changing the battery

To change the battery, please proceed as described under Inserting / Changing the battery.

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, but only clean water to moisten the cloth.

Repair

Do not modify the device or install any spare parts. For repairs or device testing, contact the manufacturer.

Disposal



■ The icon with the crossed-out waste bin on waste electrical or electronic equipment stipulates that this equipment must not be disposed of with the household waste at the end of its life. You will find collection points for free return of waste electrical and electronic equipment in your vicinity. The addresses can be obtained from your municipality or local administration. For further return options provided by us please refer to our website www.trotec24.com. The separate collection of waste electrical and electronic equipment aims to enable the re-use, recycling and other forms of recovery of waste equipment as well as to prevent negative effects for the environment and human health caused by the disposal of hazardous substances potentially contained in the equipment. You are responsible for deleting any personal data stored on the waste equipment to be disposed of.



Li-Ion

In the European Union, batteries and accumulators must not be treated as domestic waste, but must be disposed of professionally in accordance with Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators. Please dispose of batteries and accumulators according to the relevant legal requirements.

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