

optris® CTtrans



Operators manual



CE-Conformity

The product complies the following standards:

EMC: EN 61326-1
Safety Regulations: EN 61010-1:1993/ A2:1995



The product accomplishes the requirements of the EMC Directive 89/336/EEC
And of the low-voltage directive-Direktive 73/23/EEC.

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Scope of supply

- CT-sensor head 15:1
- High temperature emitter
- optris® CTtrans electronic box
- USB Interface
- Compact-Connect Software
- Power supply (8 AA Batterien)
- Calibrations switch
- Alignment appliance
- Operators manual

You will find the serial number on a label on the electronic box. Always use these numbers when you contact the customer service concerning maintenance, additional order of components, spare parts or repairs.

Warranty

Each single product passes through a quality process. Nevertheless, if failures occur please contact the customer service at once.

The warranty period covers 24 months starting on the delivery date. After the warranty is expired the manufacturer guarantees additional 6 months warranty for all repaired or substituted product components. Warranty does not apply to damages, which result from misuse or neglect. The warranty also expires if you open the sensing head. The manufacturer is not liable for consequential damage.

If a failure occurs during the warranty period the product will be replaced, calibrated or repaired without further charges. The freight costs will be paid by the sender. The manufacturer reserves the right to exchange components of the product instead of repairing it. If the failure results from misuse or neglect the user has to pay for the repair. In that case you may ask for a cost estimate beforehand.

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1 Quick Reference

Thank you for choosing the optris® CT infrared sensor.

In this chapter you will find concentrated information for a quick start with the CT sensor.

Comments to this manual

Read the manual carefully before the initial start-up.

You will find important information and notes in the grey coloured boxes.

IMPORTANT

The producer reserves the right to change the herein described specifications in case of technical advance of the product.

Mechanical Installation

The optris® CTtrans - sensor heads are equipped with a metrical M12x1-thread and can be installed either directly via the sensor thread or with the help of the hex nut (delivered as standard) to the mounting bracket available.

Various mounting brackets, which makes the adjustment of the sensing heads easier, can be additionally ordered as accessories. Make sure to keep the optical path clear of any obstacles while adjusting the head of the object.

The optris® CTtrans - sensor heads are a sensitive optical system. Please use only the thread for mechanical installations.

Avoid mechanical violence on the head - this may destroy the system (expiry of warranty).

► **More information in Chapter 3.1**

Electrical Installation

Please open at first the cover of the electronic box (4 screws). Below the display are the screw terminal for the cable connection.



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

Please use a power supply unit with an output voltage of 12 - 36 VDC/ 100mA

The standard delivery includes the connected cable of the sensing head to the electronic box. You may shorten but never lengthen the cable.

► **More information in chapter 3.2**

Sensor heads

The optris® CTtrans will be delivered with two pre-assembled sensor heads (one IR-miniature heater and one IR-receiver). The IR-miniature heater is connected with the terminals "HEATER". The IR-receiver is linked with a four-wired cable at the optris® CTtrans - electronic (the terminals underneath the display on the right side).

It is not possible to change the sensor heads at the optris® CTtrans.

Analogue Outputs

You can select the desired analogue output via the programming keys (please check the chapter “Operating)

Output	Range	Connection-Pin on CT-Board
Voltage	0..5 V	OUT-mV/mA
Voltage	0..10 V	OUT-mV/mA
Current	0..20 mA	OUT-mV/mA
Current	4..20 mA	OUT-mV/mA
Alarm Output	3,3V/ 30mA	Terminal Pink/ Gray

Factory default setting is 0-5 V.

► **More information in chapter 3**

Digital Interface (optional)

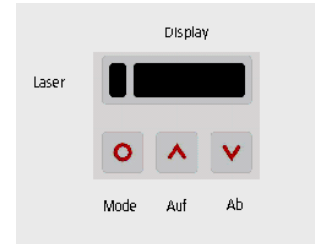
If you want to install an interface, please do the following:

- plug the interface board into the place provided, which is located beside the display
- use both M3x5 screws for fixing it onto the electronic box
- plug the preassembled interface cable with the terminal block into the male connector of the interface board.

If you use the USB-interface together with Optris® CTtrans please ensure to provide a power supply of min. 24 VDC. Otherwise you may cause problems with the power requirement.

Operating

The programming keys Mode, Up and Down enable the user to set the sensor on-site. The current measuring value of the chosen feature is displayed. With Mode the operator obtains the chosen feature, with Up and Down the functional parameters can be selected. If no key is pressed for more than 10 seconds, the display automatically shows the calculated object Transmission/ Emission.



Pressing the Mode button again recalls the last called function on the display.

Factory default settings

To set the optris® CTtrans back to factory default settings, please press at first the Down- key and then the Mode-key and keep both pressed for approximately 3 seconds.

The display shows RESET for confirmation.

Tab.1.1 shows the default settings of the optris® CTtrans.

Display	Modis [default settings]	range
59.3E	Emission level 59,3%	Can not be changed
70.3T	Transmission level 70,3%	Can not be changed
24.2TH	Current head temperature [24,2 °C]	Ca nnot be changed
25TB	Current box temperature [25 °C]	Can not be changed
-100A	Internal value	Ignore
□mV10	Signal analogue output Out mV/mA (0 - 10 V	<input type="checkbox"/> 0-20 0 - 20 mA current output <input type="checkbox"/> 4-20 4 - 20 mA current output <input type="checkbox"/> MV5 0 - 5 V voltage output <input type="checkbox"/> MV10 0 - 10 V voltage output
E0.000	Reflection level $f_R = 0\%$	0,000...0,4000
T0.013	Internal parameter	Ignore
A 0.3	Modulations time = 0,3s	0,1...999,9s
P 1.0	Hemispheric correction factor $f_m = 1,0$	0,9...4,0
V ----	Information parameter (calibration)	Only shown while calibration
u 10.0	Lower limit Emission/ Transmission level	10...110% (Emission ratio) 0...400% (Transmission ratio)
n 110.0	Upper limit Emission/ Transmission level	10...110% (Emission ratio)0...400% (Transmission ratio)
[0.00	Lower limit analogue signal [0V]	Signal scaling at the beginning of the range
] 10.00	Upper limit analogue signal [10V]	Signal scaling at the end of the range
U %E	Measurement mode Emission	E = Emission, T = Transmission
85.0	Alarm output (85% Emissionsgrad)	10...110% (Emission level) 0...400% (Transmission level)
110.0	Alarm ouput 2 (Display)	10...110% (Emission level) 0...400% (Transmission level)
XHEAD	Ambient head temperature compensation	Head temperature -40 - 900 °C as fixed value for the compensation
B 9.6	Baudrate = 9,6 kBaud	9,6/ 19,2/ 38,4/ 57,6/ 115,2 kBaud

Tab. 1.1

2 Technical Data

2.1 General Specification

	IR-Receiver and Heater	Elektronic box
Environmental rating	IP65 (NEMA-4)	IP65 (NEMA-4)
Ambient temperature	-20 - 100°C	0 - 65°C
Storage temperature	-40 - 120°C	-40 - 85°C
Relative humidity	10 - 95% non condensing	10 - 95% non condensing
Material	stainless steel	die casting zinc
Dimensions	28mm x 14mm	89mm x 70mm x 30mm
Weight	40g	420g
Vibration	IEC 68-2-6: any axis, 11 - 200HZ	
Schock	IEC 68-2-27: any axis, 11ms,	
Cable length	3m	
Kabel diameter	2,8mm	

2.2 Electrical Specifications

Power supply	12 VDC - 36 VDC While using an USB-Interface please ensure a external power supply of minimum 24 VDC.
Current draw	max. 100 mA
Outputs/ analogue	0...20 mA or 4...20 mA or 0...5 V or 0...10 V
Relais	2x60 VDC/ 42 VAC _{eff} , 0,4 A; optically isolated (optional module)
Alarm	3,3V/ 30mA
Output impedances	
mA	max. loop resistance 500 Ω (at 12 - 36 VDC)
mV	min. 100 K Ω load impedance
Functional inputs	F1 - F3; software programmable for the following functions: <ul style="list-style-type: none">- external emissivity adjustment- ambient temperature compensation- trigger (reset of hold functions)
Digital interface	USB, RS232, RS485 (optional module)

3 Installation

3.1 Mechanical Installation

The optris® CTtrans-heads are equipped with a metrical M12x1-thread and can be installed either directly via the sensor thread or with the help of the hex nut (delivered as standard) to the mounting bracket available. Various mounting brackets, which makes the adjustment of the sensing head easier, can be additionally ordered as accessories.

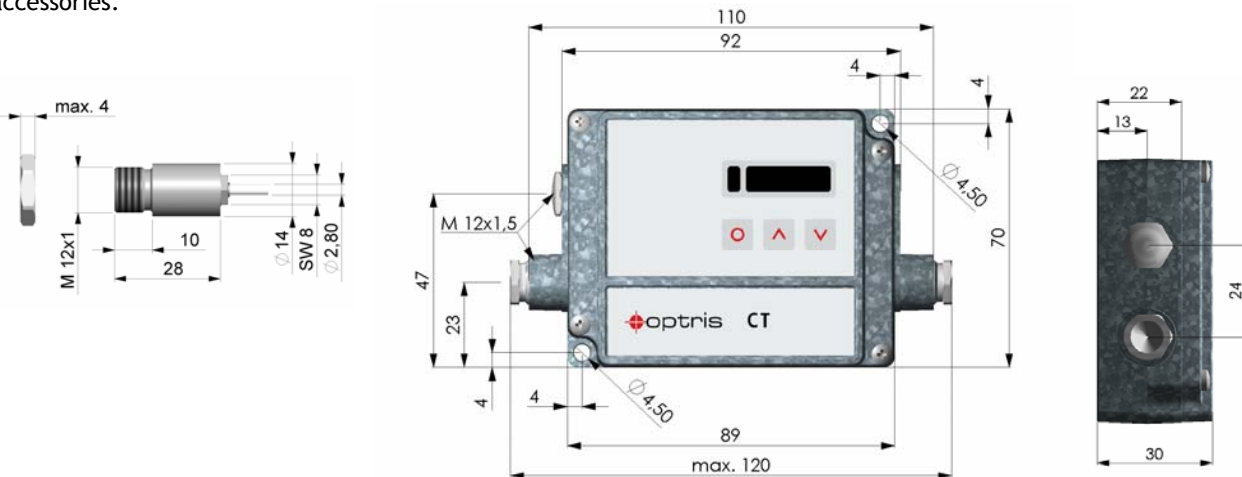
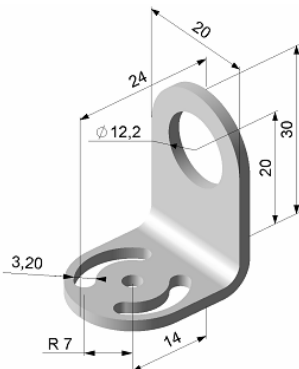


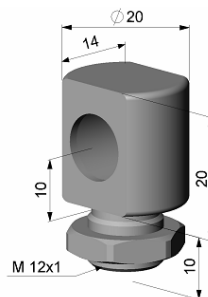
Fig. 3-1: Dimensions optris® CTtrans -head/ IR-heater and Elektronik box

A combination of mounting bracket and bolt forms a mounting bracket, which is adjustable in two axes.

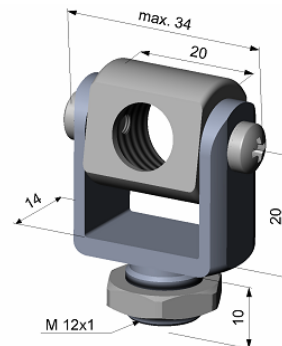
The mounting fork can be combined with the mounting bracket with the M12x1-thread.



Mounting bracket, adjustable in
One axes



Mounting bolt with M 12x1-tread,
adjustable in on axes



Mounting fork, with thread M12x1
adjustable in 2 axes

Fig. 3-2: Mounting Brackets

3.2 Electrical Installation

3.2.1 Cable Connections

For the electrical Installation please open at first the cover of the CT electronic box (4 screws). Below the display are the screw terminals for the cable connections.

Designation:

24 VDC

GND

HEATER

HEATER

GND

OUT mV/ mA

F1...F3

Pink

Gray

Brown

White

Green

Yellow

Power supply (12...36 VDC)

Ground (0V) of power supply

Connection of the Miniature-IR-heater

Connection of the Miniature-IR-heater

Ground (0V) for the analogue outputs

Analogue output mV/ mA

Functional inputs

Power supply laser (+)

Power supply laser (-)

Temperature probe head

Temperature probe head

Detector signal (-)

Detector signal (+)

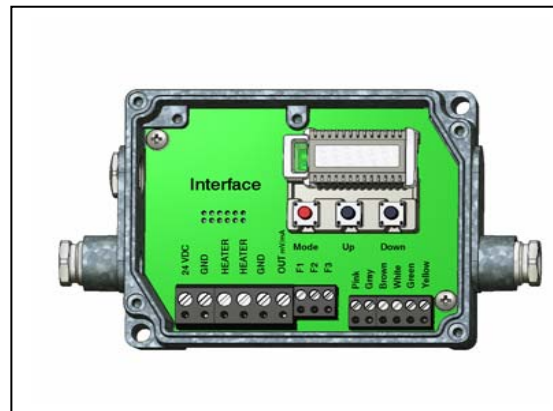


Fig. 3-3: Open Electronic box with screw terminals

Power supply:

Please use a power supply unit with an output voltage of 12 - 36 VDC/ 100mA

3.2.2 Digital Interfaces

The optris® CTtrans is optionally equipped with an USB-, RS232-, RS485- or relais-interface. If you want to install an interface, plug the interface board into the place provided, which is located beside the display (see Fig. 3-3). In the correct position the holes of the interface match with the thread holes of the electronic box. Now press the board down to connect it with the optris® CTtrans and use both M3x5 screws for fixing it. Plug the preassembled interface cable with ther terminal block into the male connector of the interface board. In case you want to use the delivered cable gland M12x5, for the preassembles cable, the terminal block has to be disassembled/ assembled. Make sure the wiring is correct (Fig. 3-4).

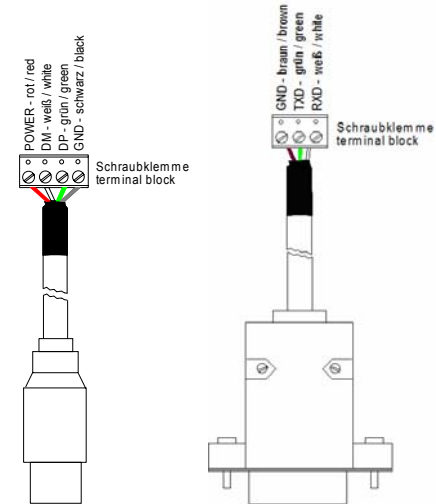


Fig 3-4: Interface cables: USB (left), RS232 (right)

USB-interface:

If you use the USB interface please ensure an external power of minimum 24 VDC. If an external power supply has already been installed, this will have no effect on the functionality of the optris® CTtrans. After the interface board has been installed and the USB-cable has been connected to the PC, please install the USB driver. After this you can start the CTconnect software and the communication will be established.

RS232-interface:

If the RS232-interface is used, the optris® CTtrans in any case needs an external power supply for operation. After the interface board has been installed and the RS232-cable has been connected to the PC, the communication will be established.

Relais-interface:

After installing the interface board as described above, please connect the electrical circuit with the terminal block. A red LED shows the closed current switch. The relais board provides two fully isolated switches, which have the capability to switch max. 60 VDC/ 42VAC_{eff}, 0,4 A DC/AC.

The factory default settings for the switching thresholds (alarm values) are: Alarm 1 = 30 %/ norm. closed (low-Alarm) and Alarm 2 = 100 %/ norm. open (high-Alarm). To make advanced settings (change of low- und high-Alarm) a digital interface (USB, RS232) and the software CTconnect is needed.

RS485-interface:

Please install the interface board as described above and connect the RS485-USB-adapter via the supplied USB cable with your computer. After it has been connected the computer will recognize a new USB-device and (if connected the first time) will ask for installation of the according driver software. Select Search and install the RS485-adapter USB-driver from the software CD.

The RS485-USB-adapter provides a 2-wire half-duplex mode. Please connect terminal A of the adapter with terminal A of the RS485-interface of the first optris® CTtrans and from there to terminal A of the next optris® CTtrans and so on. With the B terminals proceed as well.

Make sure, that you always connect A to A and B to B, not reverse. You may run up to 32 optris® CTtrans units on one RS485-USB-adapter. The 120R-switch is to be turned to ON at one of the connected optris® CTtrans units, only. Each optris® CTtrans unit connected to the RS485 needs a different multidrop address between 1 and 32.

Independent from the used interface the setting for baud rate in the software must be the same as on the optris® CTtrans (factory default: 9,6 kBaud).

3.2.3 Calibration Switch

The digital input F1 on the main board should be wired to ground.

If F1 is open (high level), the optris® CTtrans is running in measurement mode.

If F1 is pulled down to ground (low level) the Optris® CTtrans is now active for the calibration mode.

Alternativ können Sie auch das Optris® CTtrans durch drücken der Down-Taste (5 Sekunden lang) in den Kalibriermodus versetzen. Wenn sie die Down-Taste wieder loslassen, schaltet das Optris® CTtrans in den Messmodus um.

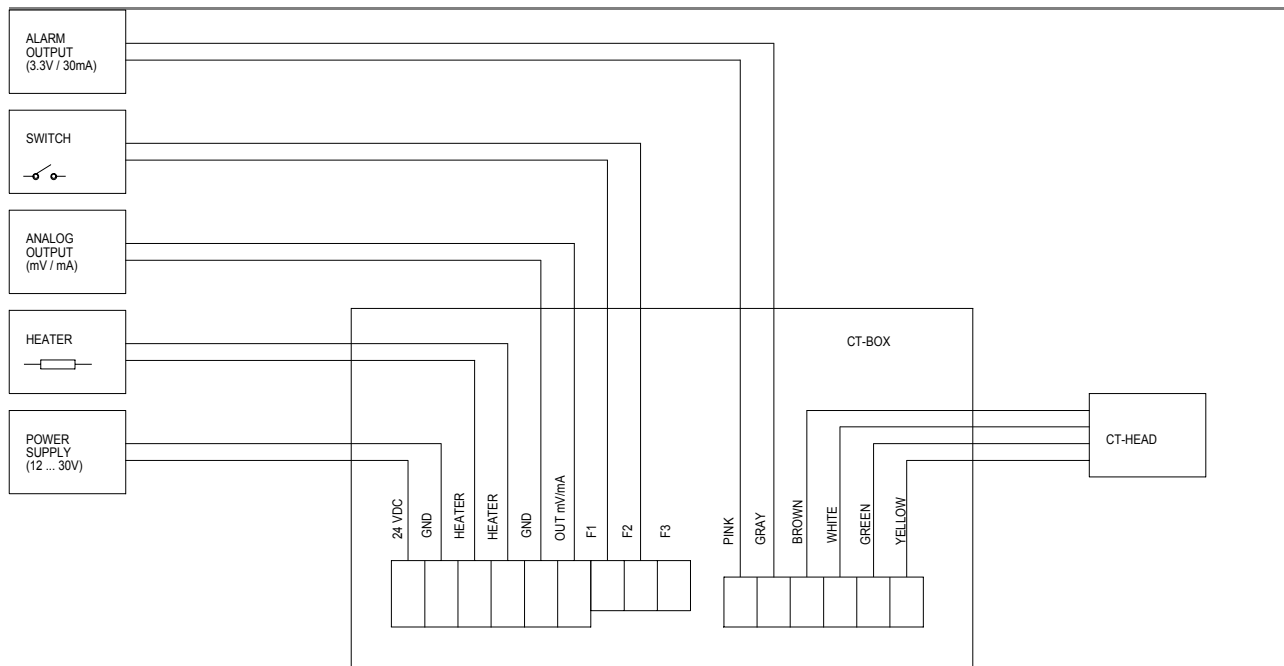


Fig.3 1: Wiring plan of the CT-electronic box

4 Operation mode Optris® CTtrans

The Optris® CTtrans will be delivered with 2 sensor heads. one miniatur-IR-emitter (emitter) and one temperature measurement device (receiver). The emitter turns on and off within a definable time.

For getting precise measurement results, the Optris® CTtrans has to be calibrated. The calibration consists of two steps. First it will be determined, how much infrared radiation from the receiver reaches the receiver, if the emitter is turned off (value saved as ADC I = Analog to Digital Converter). Second it will be determined, how much infrared radiation reaches the receiver, if the emitter is turned on (saved as ADC II). Both values are now conducting as a reference for the underlying measurement.

During and after the calibration the emitter will be turned on and off, made by the electronic box, within a frequency of approximately 0.5...20Hz (adjustable, see chapter 4.3). If the emitter is turned on, a temperature inside the sensor head of 500°C will be accomplished.

4.1 Operation mode Transmission Measurement

While the transmission measurement is an object, f.e. a foil, between the two sensor heads situated. Thus there is a change of the intensity of the infrared radiation, which reaches the receiver.

If the emitter is turned off, so will be detected only the infrared radiation of the foil by the receiver. The calculated value will be saved as ADC III. If the emitter is turned on, so will be detected the infrared radiation of the foil as well as the infrared radiation of the emitter, tailored off by the transmission of the foil (value saved as ADC IV).

The transmission value will be calculated as follows:

$$\text{Trans}_{\text{out}} = (\text{ADC III} - \text{ADC IV}) / (\text{ADC I} - \text{ADC II}) \times f_m - f_R$$

f_m - reflection level

f_R - hemispheric correction factor

4.2 Operation mode Emissions Measurement

While the emission measurement the receiver will be detect the intensity of the reflected infrared radiation of the object. As soon as a material is located between receiver and emitter, the intensity of the reflected infrared radiation will be changed. If the emitter is turned off, the emitted infrared radiation of the material will be detected only. The calculated value will be saved as ADC III. If the emitter is turned on, the infrared radiation of the material as well as the reflection radiation of the emitter will be detected by the receiver (value saved as ADC IV).

The Emission value will be calculated as follows:

$$\text{EPS}_{\text{out}} = 1 - (\text{ADC III} - \text{ADC IV}) / (\text{ADC I} - \text{ADC II}) \times f_m - f_R$$

f_m - reflection level

f_R - hemispheric correction factor

4.3. Modulations time

The modulations time indicates the time constant in which the emitter will be turned on and off. The modulation time is adjustable within the range 0,1...999,9 seconds. Within these adjusted range the receiver will be turned on and off for one time.

Example: If the modulation time of 0,5 seconds will be choose, the receiver will be turned on for 0,25 seconds and turned of for 0,25 seconds.

The factory default for the modulation time is 0,3 seconds.

After every changes of the modulation time, the Optris® CTtrans must be recalibrated.

5 Transmission measurement

5.1 Definition

The transmission value shows of how much of the infrared radiation passes through a material. The transmission can acquiring the value ($Trans_{out}$) between 0...1(conforms 0...100%).

5.2 Calibration of the Optris® CTtrans for the Transmission Measurement

First of all, please set Optris® CTtrans into the transmission measurement mode. For that please push the Mode-Button repeatedly until the display shows U %E. You now can change the setting into U %T with the buttons Up or Down.

The Optris® CTtrans is now adjusted in the transmission measurement.

For setting the Optris® CTtrans into the calibration mode, please push continuously the calibration switch. Alternativley the Down - button on the box can also be used to toggle between measurement mode and calibration mode. Holding the Down - button for > 5 seconds switches the unit to calibration mode for the time being held down. Loosing the Down - button or the calibration switch will let the Optris® CTtrans switch back to the measurement mode.

If the Optris® CTtrans is being in the calibration mode, the two sensor heads can be aimed to each other.

The optimal distance between the two sensor heads amounts 5 - 7 cm. Please note that during the calibration no object has to be located between the emitter and receiver.

As soon as the receiver is able to measure the infrared radiation from the emitter, the calculated energy value will be shown in the display (for example 232.58T).

For getting the best measurement results should be reached an energy value of more than 100.00T. It is valid that the highest shown energy value provides the best accuracy in measurement. For stopping the calibration please loose the calibration switch or the Down - button

The Optris® CTtrans is now calibrated ready for the transmission measurement.

After the calibration the display will show the value 100.00T. That means that the receiver interprets the signal from the emitter as 100%.



Fig. 5-1 Application example transmission measurement

5.3 Connection to an optris® CT for online determination of Transmission

It is possible to link an Optris® CTtrans with a regular Optris® CT to generate an online maintenance of transmission. Due to the fact that it is only possible to change the emissivity of the Optris® CT by an external signal, please not the

following: the emission value is defined as $\text{Emission} = 1 - \text{Transmission}$. Therefore it is possible to deduce indirect the emission value via the transmission.

For more information about how to switch from transmission to emission measurement please see chapter 5.3.1.

To link the Optris® CT with the Optris® CTtrans please proceed as follows:

Please connect the analogue output of the Optris® CTtrans with the functional input F2 of the Optris® CT. For a ground connection please use the GND - Terminals on both boards.

The analogue output of the Optris® CTtrans has to be adjusted at 0...10V because the function input F2 at the Optris® CT is defined as follows: 0V → $\epsilon=0,1$; 9V → $\epsilon=1$; 10V → $\epsilon=1,1$.

It is only possible with the software Compact-Connect to change the settings of the Optris® CT into an external change of the emission value. For further information please read the manual of the Optris® CT.

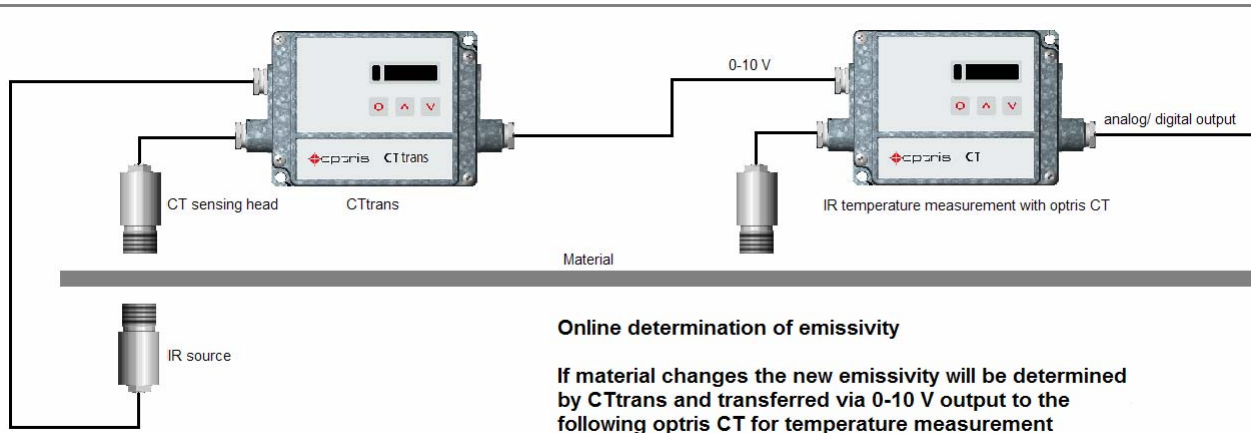


Fig. 5-2 example of an application

5.3.1 Switch over from Transmission to Emission Measurement

After the calibration of the Optris® CTtrans for transmission measurement please push the Mode button repeatedly until the display shows U %T. You now can change the setting into U %E with the buttons Up or Down. After 5 seconds the Optris® CTtrans will switch into the measurement mode.

6 Emission Measurement

6.1 Definition

The emission value indicates the intensity of infrared radiation emitted by an object. As a reference is a black body usable. The emission (EPS_{out}) can acquiring the value 0...1 (conforms 0...100%).

6.2 Calibration of the Optris® CTtrans for Emission Measurement

The presetting of the Optris® CTtrans is the emissions measurement. For verifying the presetting please push the Mode-button repeatedly until the Display shows U %E. In case the display indicates U %T please change the setting to U %E by pressing the button Up or Down. The Optris® CTtrans is now adjusted for the emission measurement.

For setting the Optris® CTtrans into the calibration mode, please push continuously the calibration switch. Alternatively the Down - button on the box can also be used to toggle between measurement mode and calibration mode. Holding the Down - button for > 5 seconds switches the unit to calibration mode for the time being held down. Loosing the Down - button or the calibration switch will let the Optris® CTtrans switch back to the measurement mode.

If the Optris® CTtrans is being in the calibration mode, the two sensor heads can be aimed to each other. (see chapter 6.2.1).

We are recommending the usage of a high reflecting surface, such as shiny metal, for the calibration of the Optris® CTtrans. Thereby a major part of the infrared radiation, send out by the emitter, will be reflected by the surface and can be detected by the receiver.

As soon as the receiver is able to measure the infrared radiation from the emitter, the calculated energy value will be shown in the display (for example 232.58T).

For getting the best measurement results should be reached an energy value of more than 100.00T. It is valid that the highest shown energy value provides the best accuracy in measurement. For stopping the calibration please loose the calibration switch or the Down - button

The Optris® CTtrans is now calibrated and ready for the emission measurement.

After the calibration the display will show the value 10.0E. That means that the receiver interprets the signal from the emitter as 10%.

6.2.1 Adjustment of the sensor heads

We are recommending mounting at first the emitter of the Optris® CTtrans. Please fix the emitter to the desired angle and recommended distance.

After fixing the emitter the receiver can be joggled. Based on the physical principle angle of incidence = angle of reflection the receiver has to be joggled in that way, that most of infrared radiation, reflected by the surface of the material, reaches the receiver.

The optimal distance between the sensor heads and the surface should be 5 - 7 cm. Please note that during the calibration no object has to be located between the emitter and receiver.



Fig. 6-1 possible adjustment of the sensor heads for the emission measurement

6.3 Connection to an optris® CT for online determination of the Emission

It is possible to link an Optris® CTtrans with a regular Optris® CT to generate an online maintenance of emission.

It is only possible to change via an external voltage the emission value of an Optris® CT.

The emission value is defined as follows: $\text{Emission} = 1 - \text{Transmission}$.

To link the Optris® CT with the Optris® CTtrans please proceed as follows:

Please connect the analogue output of the Optris® CTtrans with the functional input F2 of the Optris® CT. For a ground connection please use the GND - Terminals on both boards.

The analogue output of the Optris® CTtrans has to be adjusted at 0...10V because the function input F2 at the Optris® CT is defined as follows: 0V → $\varepsilon=0,1$; 9V → $\varepsilon=1$; 10V → $\varepsilon=1,1$.

It is only possible with the software Compact-Connect to change the settings of the Optris® CT into an external change of the emission value. For further information please read the manual of the Optris® CT.

7 The Alarm output

The Optris® CTtrans is usable to display the current status of the alarm. Pursuant to the configuration of the Optris® CTtrans can be provided a fixed voltage of 3.3VDC for overstepping or fall short of a default alarm for the emission or the transmission value.

Please use for all alarm outputs the screw terminals Pink und Grey, whereas the terminal Grey is defined as ground.

Over the terminals it is possible to define the alarm. Furthermore this alarm is also a visual alarm, that means it active affects the colour of the LCD-display:

- blue: alarm 1 active
- red: Alarm 2 active only for Optris® CT available
- green: no alarm active

The factory default setting for alarm 1 is normally closed. Thus the presetting for Alarm 1 is a high alarm.

This factory default can only be changed with the software Compact-Connect.

It is not fixed that the alarm 1 has to be defined as a high alarm. It is merely defined that after an overriding of the adjusted alarm level the status normally-closed or normally open changes only.

7.1 Configuration of the Alarm output

The alarm output is configured to 10...110% as standard.

Please push the Mode - button continuously, until the display shows | 85.0. This value indicates that an overriding of the emission or transmission value of 85% the alarm 1 will be exceeded. From the value of 85,1% the colour of the display will be changed into blue and the alarm 1 will be set to normally open.

With the buttons up and down it is possible to change the level of the alarm.

Appendix A – Visual Alarms

Alarm 1		Alarm 2		Alarm status		Blue LED	Green LED	Red LED	Preset	
normally	temperature	normally	temperature	1	2					
Close	Below	Open	Below	1	0	On	Off	Off	Standard alarms	visual
Close	Below	Open	Above	1	1	On	Off	On	Standard alarms	visual
Close	Above	Open	Below	0	0	Off	On	Off	Standard alarms	visual
Close	Above	Open	Above	0	1	Off	Off	On	Standard alarms	visual
Close	Below	Close	Below	1	1	On	Off	On	Blue backlight	
Close	Below	Close	Above	1	0	On	Off	Off		
Close	Above	Close	Below	0	1	Off	Off	On		
Close	Above	Close	Above	0	0	Off	On	Off		
Open	Below	Open	Below	0	0	Off	On	Off		
Open	Below	Open	Above	0	1	Off	Off	On		
Open	Above	Open	Below	1	0	On	Off	Off		
Open	Above	Open	Above	1	1	On	Off	On		
Open	Below	Close	Below	0	1	Off	Off	On		
Open	Below	Close	Above	0	0	Off	On	Off		
Open	Above	Close	Below	1	1	On	Off	On		
Open	Above	Close	Above	1	0	On	Off	Off		

The first four lines represent the standard mode for visualizing the alarms (in connection with TObj as source) on the LCD-display (alarm 1: Low-alarm [blue]; alarm 2: High-alarm [red]). If no alarm is activated the display color is green.