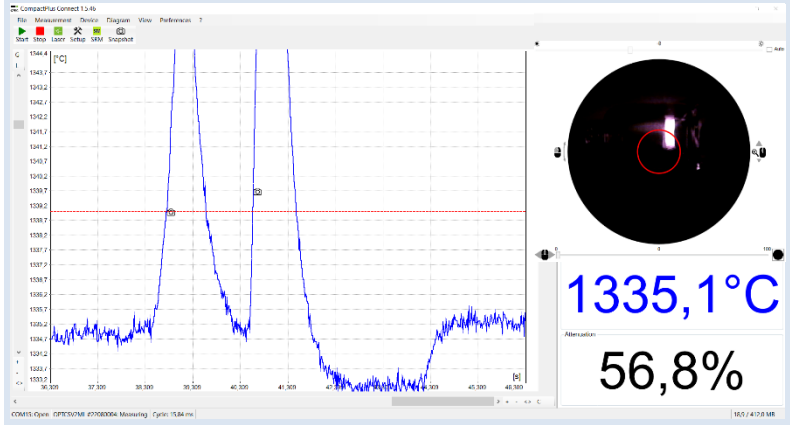
Operator's manual

optris® CompactPlus Connect

Software for Infrared-Thermometers



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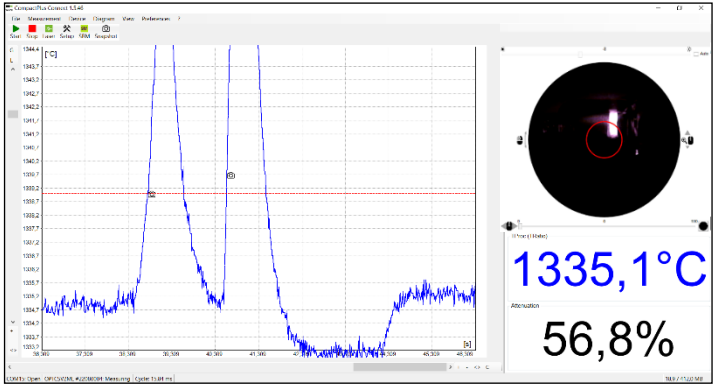
Welcome!

Thank you for choosing an infrared thermometer and corresponding CompactPlus Connect software!

The sensor calculates the surface temperature based on the emitted infrared energy of objects [► **Basics of Infrared Thermometry**].

Main features of CompactPlus Connect software:

- Temperature data analysis and documentation
- Automatic process control
- Customer specific software adjustments
- Complete parameterization of the device
- Temperature display and recording
- Videosignal (only for CSvision)



Legal disclaimer

All products are warranted against defective materials and workmanship for a period of two (2) years from the delivery date of the original purchase, provided such products have been under normal storage, use and service, and in accordance with the instruction. This warranty expires in case of inappropriate use of all delivered components.
All products not manufactured by us included in systems delivered by us to the original purchaser carry the warranty, if any, of the particular supplier only and we have no responsibility whatsoever for such products.
The manufacturer is not liable for any use of the software CompactPlus Connect including data recording. The manufacturer does not carry liability for error-free operation of the software in any hardware and operating system.

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The warranty is not expressed for possible quality changes, errors when presenting the software, occurring defects during operation or insufficiencies in certain applications. The user is liable for any defects or data processing insufficiencies when in using the software.
The manufacturer has no other liability inside the scope of supply other than mentioned above. The manufacturer shall not be liable for any business loss or claim for compensation, loss of the computer software, possible loss of data, additional costs for replacement software, claims of third parties or other occurring costs or failures and deficits.
The software is protected by copyright and is not allowed to be changed or sold to third parties.

Note
Read the manual carefully before you start the device. The manufacturer reserves the right to change the herein described specifications in case of technical advance of the product.

1. Basics

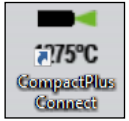
1.1. Software installation

Download the software from the Optris website. Please start **Setup.exe** and follow the instructions of the wizard until the installation is finished.

Minimum system requirements:

- Windows 10, 11
- USB interface
- Hard disc with at least 30 MByte free space
- At least 128 MByte RAM

The installation wizard will place a launch icon on the desktop and in the start menu: **[Start]\Programs\CompactPlus Connect**.



When using the Ethernet interface, the driver must be installed separately. This can be found in the download package in the Driver folder (Name: Ethernet).

Note
The software can be downloaded via the Optris website under the following link:
https://www.optris.global/downloads-software

IRmobile App

The pyrometers have a direct connection to an Android smartphone or tablet. All you have to do is download the IRmobile app for free in the Google Play Store. This can also be done via the QR code.

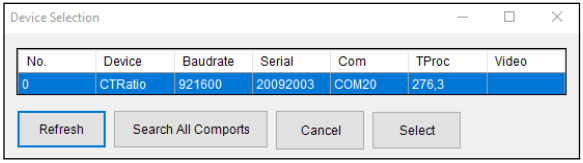
GET IT ON Google Play

Note
The IRmobile app works on most Android devices running 5.0 or higher with a micro USB or USB-C port supporting USB-OTG (On The Go).

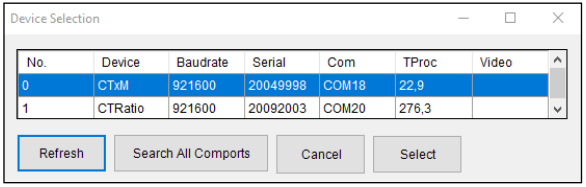
1.2. Connection Sensor - Computer

If you connect your sensor to your PC and start the software, the following message will appear (if option **Auto Start** is activated). ► **Menu Preferences/ Options**

Then please press the **Scan** button. All sensors found will be shown in a selection screen:



Example 1: A sensor was found. Press **Select** to close the window.
Refresh starts a new search.



Example 2: Two sensors were found. Please activate with the cursor the desired unit and after that press the **Select** button to close the window.
Refresh starts a new search.

After the selection of a sensor you will get to the previous screen again. Here you will find now information about the used virtual COM port (VCP), the serial number and the baud rate.

To finish please press **OK**. The window will be closed.

If **Auto start device** is activated ► **Menu Preferences/ Options** the measurement starts and the temperature values will be shown in the diagram.

After the sensor selection the status line (below the time axis) shows the following information:

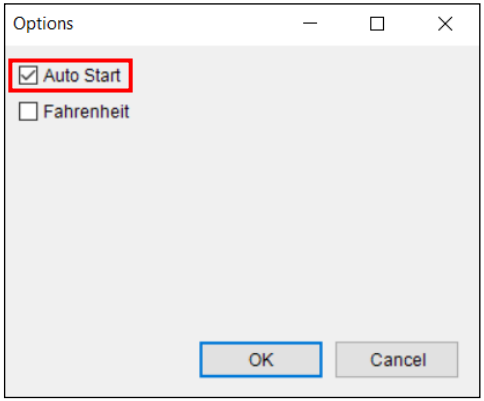
COMxx: Opened	active COM port
CTRatio: Measuring	successful communication with the connected sensor

1.3. RS485/ RS422

If a RS485 interface is used please activate the RS422 mode. Therefore you have to call this function with the programming keys on the sensor at first (menu item: multidrop address). You will need also the RS485 module and the RS485-USB adapter **[ACCTRS485USBK]**.

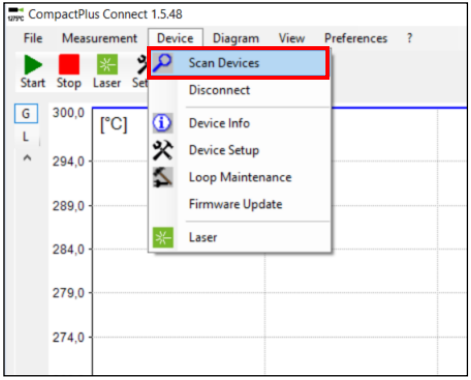
1.4. Easy Start-Up

If you restart the software and the last used sensor is connected to the computer and the **Auto Start** option is activated ► **Preferences/ Options** the connection will be made automatically (without sensor selection window).



If this option is deactivated, you must select the corresponding device in **[Menu: Device\ Scan Devices]** and press the **Select** button**.**

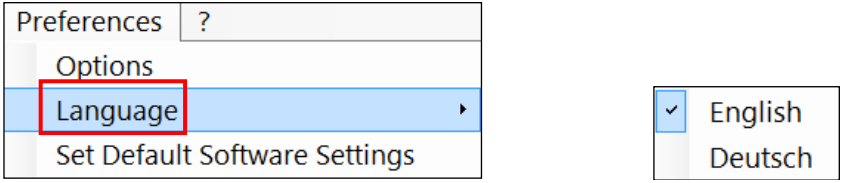
The button **Disconnect** in **[Menu: Device]** breaks the connection to the sensor and closes the COM port.



1.5. Basic Settings

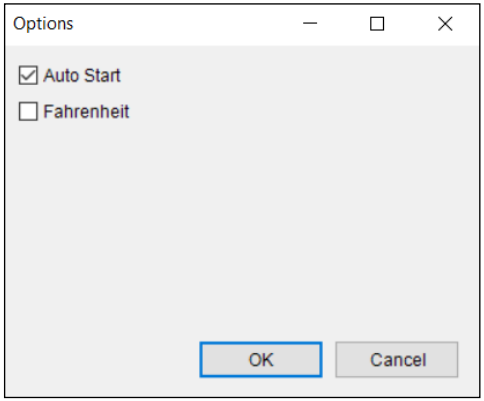
1.5.1. Language

You can choose the desired **language** in the menu **[Menu: Preferences\ Language]**.



1.5.2. Options

The menu item **[Menu: Preferences\ Options]** allows the following settings:



Auto Start	If activated, after each program start the measurement will be started automatically (if connected sensors have been found before).
Auto Apply	If activated the changing of the settings will be directly effected
Fahrenheit	If activated, the temperature is displayed in Fahrenheit.

The further options are described under **► Stop Measurement and Save Data**.

1.5.3. Diagram settings

The menu item Settings **[Menu: Diagram\ Settings]** enables the selection of the following diagram options:

Digital Display	Selection which signals should be displayed as digital display
Diagram	Selection which signals should be displayed as graph
Pen Width	Pen width of the temperature graphs **[1...5]**
Color	Color of the temperature graph and digital displays
Y-axis	Display of the graph on the primary or secondary Y-axis
Fast burst	Deactivation of all raws

1.6. Digital Display

If the sensor is connected to your computer and you start the software, the process temperature $\mathbf{T_{Proc}}$ will be shown as digital display.
You can add additional displays **[Menu: Diagram\ Settings]**. Dependent on the sensor type the available signals may vary.
$\mathbf{T_{Proc}}$ includes the current post processing functions (average, peak hold, etc.).

The once selected displays will also appear after a restart of the software. The **size** can be changed if you put the 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).

The colors of the different displays are equal to the colors selected under **[Menu: Diagram\ Settings]** for the corresponding temperature graphs.
►**Basic Settings**

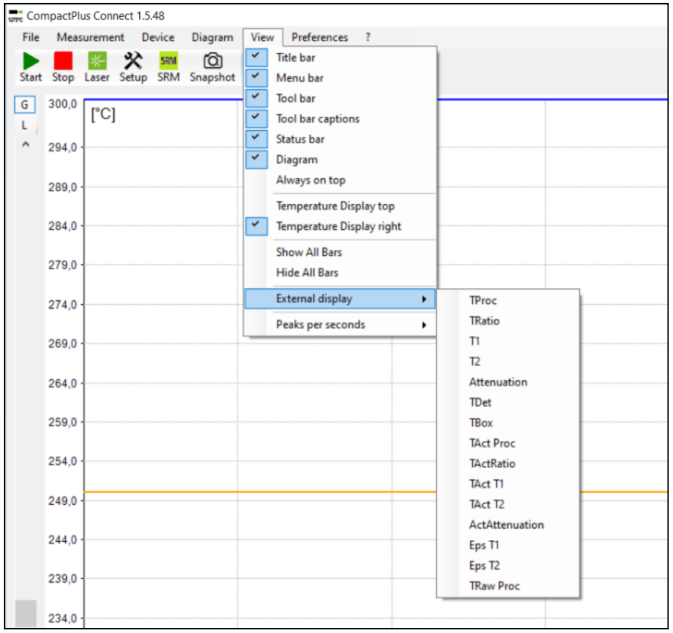
Overview of Digital Display

Notation		Description
T_{Proc}	Process temperature	With signal processing, including averaging
T_{Ratio}	Ratio temperature	Without signal processing, including averaging
T_1	1-channel temperature	Without signal processing, including averaging
T_2	2-channel temperature	Without signal processing, including averaging
$T_{ActRatio}$	Actual temperature of ratio	Without signal processing, without averaging
T_{TAct1}	Actual temperature of channel 1	Without signal processing, without averaging
T_{TAct2}	Actual temperature of channel 2	Without signal processing, without averaging
Attenuation	Signal attenuation	Signal attenuation
T_{Det} / T_{Int}	Head temperature	Temperature value of detector
T_{Box}	Box temperature	Temperature of electronic box
T_{Avg}	Average temperatur	Without signal processing, including averaging

Note
The available temperatures depend on the connected device type

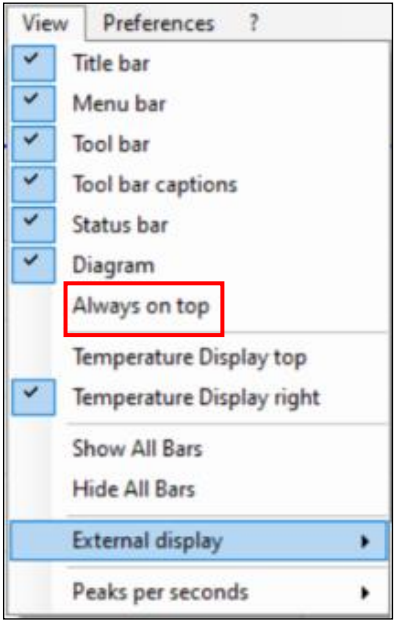
1.7. Views

The CompactPlus Connect allows the creation of free definable screens and views:



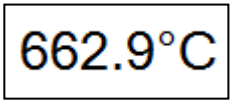
Note
The digital displays can be arranged optional on top or right side **[Menu: View\ Temp. displays top** or **Temp. displays right]**.

You can show the digital displays also separate by hiding of selected information (e.g. title bar, menu bar, etc.) in any size ► **Digital Displays** and, if desired, also always on top of your PC screen **[Menu: View\ Always on top]**.



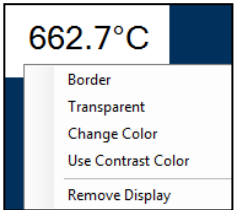
1.8. External Displays

By double click on one of the digital displays **[Menu: View\ External Display]** you can start an external display for the respective signal. This display will appear initially in the same color than the respective display in the software. By drag and drop these external displays can be placed at any desired location on the PC screen (the position of the according software display will not change). For an easy positioning a mark will appear on the left of the display if crossed with the cursor:

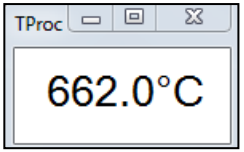


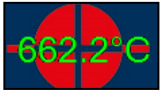
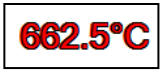
Note
To distinguish between several displays the name of the software/ instance (for multiple software calls) as well as the signal name will be shown shortly.

There are different options available for the design of the external displays which can be called with the right mouse button:



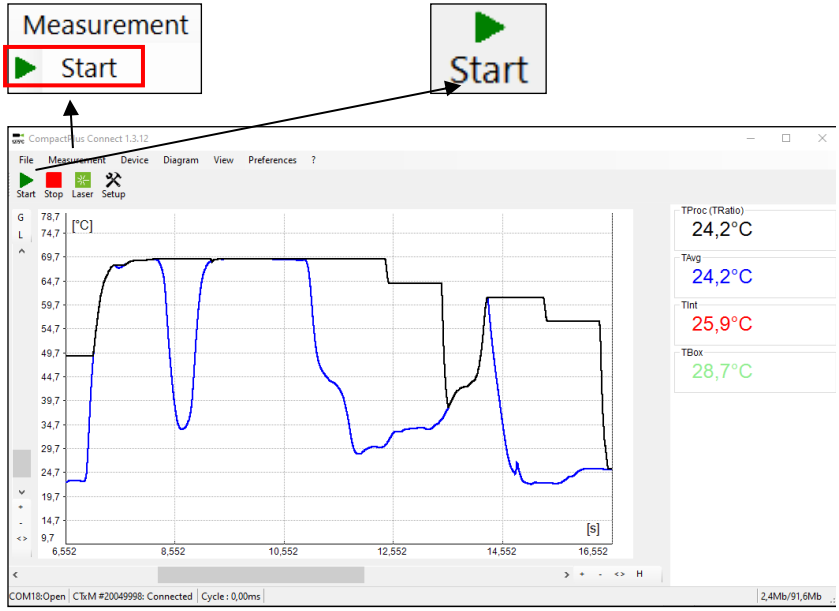
Border Presenting the display with a border – in this mode the size of the display can be changed.



Transparent	Transparent presenting – useful for a positioning of the display in front of pictures or wallpapers.	
Change color	For changing the display color.	
Use contrast color	Dependent on the used background the presenting of the display figures with contrast color (black edging) can be useful.	
Remove Display	Closes the associated external display.	

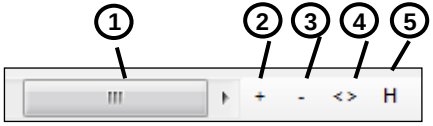
1.9. Start measurement

To start a measurement, please press the **Start** button in the tool bar **[Menu: Measurement\ Start]**.

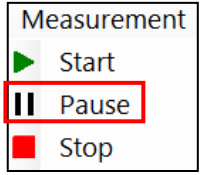


Control elements of the time axis:

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 or of the **Pause** button 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 again **[Menu: Measurement\ Pause]** or **C**.



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).

1.10. Scaling of the Temperature Axis

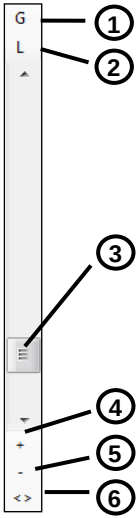
With **global scaling** the temperature range of the diagram will automatically be adapted to the respective peak values. The range will remain as set during the whole measurement.

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.

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

Control elements of the temperature axis:

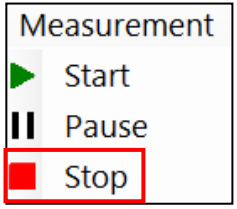
1	Global auto scaling
2	Local auto scaling
3	Scroll bar
4	Zoom in (increase)
5	Zoom out (decrease)
6	Whole range



Activation of the desired option:
Control elements (temperature axis)

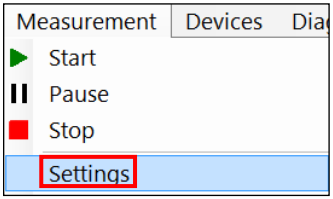
1.11. Stop Measurement and Save Data

To stop the current measurement please press the **Stop** button **[Menu: Measurement\ Stop]**.
The **Save** button **[Menu: File\ Save as]** opens an explorer window to select destination and file name **[file type: *.dat]**.



1.12. Measurement Configuration

With the menu item **[Menu: Measurement\ Settings]** you can define the following parameter for the measurement:

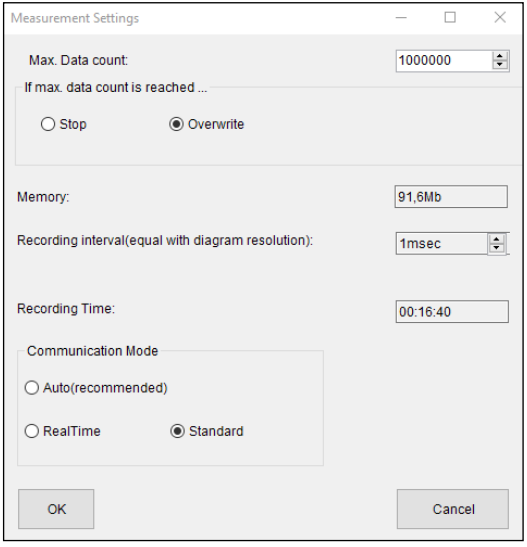


Max. data count Limitation of the maximum number of data values – when achieved the measurement will be stopped.

Stop/ Overwrite If the maximum number of data values is achieved,
at **Stop** the current measurement will be terminated automatically/
at **Overwrite** the measurement will continue and the first values will be overwritten (principle of ring memory)

Memory Memory, calculated from the max. data count value

Recording interval Time between single data **[1ms...10s]**



Recording time Maximum time of measurement, calculated from **Max data count** and **Recording interval**

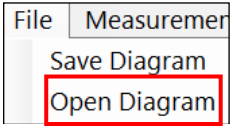
Note
A change of the parameter **Max data count** will have influence on the **Memory** and **Recording time**.

A change of the parameter **Recording interval** will have influence on the **Recording time** only.

Communication mode At **Auto** setting (recommended) the connected sensor works in **Realtime mode** (=Burst mode: Sensor is sending data continuously) if the recording interval is <200 ms. If the recording interval is >200 ms the sensor works in the **Standard mode** (= Polling mode: Temperature values will be polled by the software).

1.13. Opening of Files

To open a saved file please press the button **Open** **[Menu: File\ Open].** You can select the desired file in an explorer window which will be opened **[file type: *.dat]**.



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

If you open a file with a spreadsheet program you will find beside the relative time (starting with 000:00:00 – column A) also the absolute time for each measurement value (column N).
On video devices and if the function “Automatic Snapshots” is activated you will find further information to the recorded snapshots in the columns O and P:

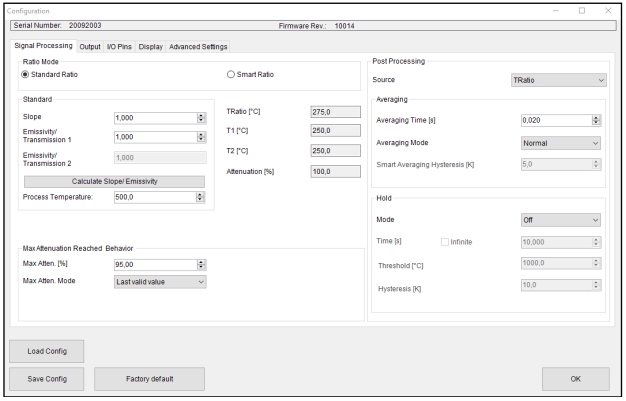
	A	B	C	D	E	F	G	H	I	J	K
1	[Connect DataFile][1.1]										
2	Date:	01.11.2019									
3	Time:	28:12,2									
4	Unit:	°C									
5	Resolutio	0,001									
6	Values:	10									
7	Time	TProc	TRatio	T1	T2	TActRatio	TAct1	TAct2	Attenuati	THead	TBox
8	00:00,0	525	525	506,2	499	525	506,3	499,5	100	60,3	38,9
9	00:00,1	525	525	506,2	499	525	506,2	499	100	60,3	38,9
10	00:00,2	525	525	506,2	499	525	506,3	499,3	100	60,3	38,9
11	00:00,2	525	525	506,2	499	525	506,4	499,5	100	60,3	38,9
12	00:00,3	525	525	506,2	499	525	506,6	499,6	100	60,3	38,9
13	00:00,4	525	525	506,3	499,1	525	506,5	499,4	100	60,3	38,9
14	00:00,5	525	525	506,5	499,3	525	506,5	499,3	100	60,3	38,9
15	00:00,6	525	525	506,6	499,4	525	506,6	498,9	100	60,3	38,9
16	00:00,7	525	525	506,5	499,3	525	506,4	498,9	100	60,3	38,9

2. CTratio

2.1. Sensor Setup CTratio

The button **Setup** **[Menu: Device\ Device Setup]** opens a window for the setting of all sensor parameters. The dialog window is separated into 4 categories:

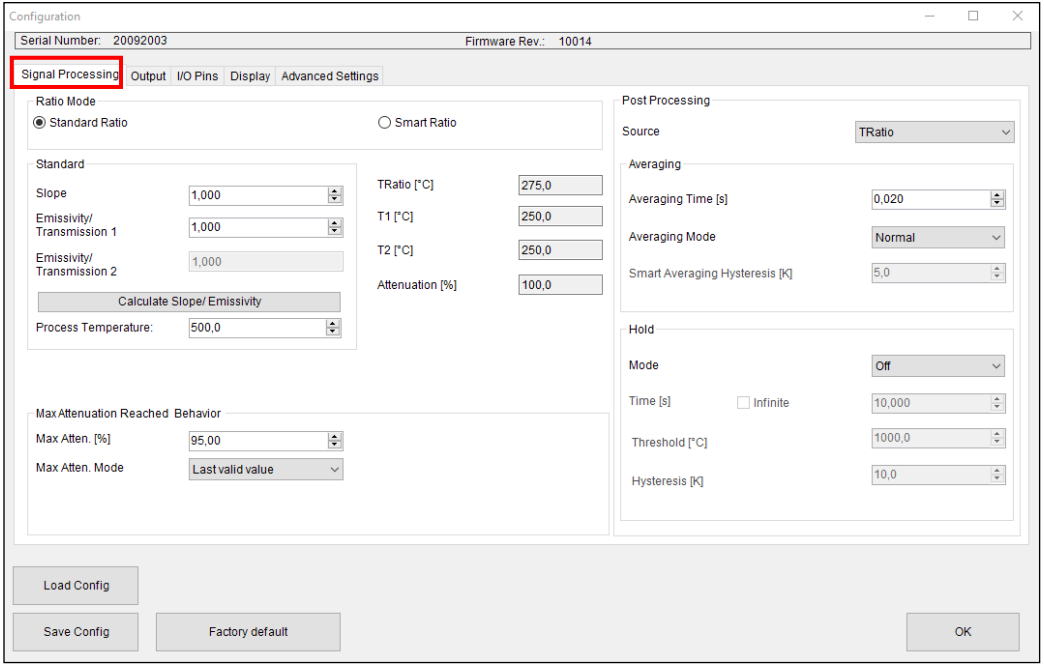
- Signal processing — Setting of Emissivity/ Slope and Post processing
- Output — Setting of Output 1 and Output 2
- I/O Pins — Setting the In- and Outputs
- Display — Display main value and Backlight/ Alarm setting
- Advanced settings — RS485 Multidrop address, Optical Set, Calibration



CTratio

2.2. Sensor Setup CTratio – Signal Processing

In this category you can adjust the parameters **Emissivity, Slope, Attenuation** and select the functions and define the parameters for **Post processing**. Furthermore, the desired ratio mode can be selected here. The Standard Ratio mode is activated as default setting.



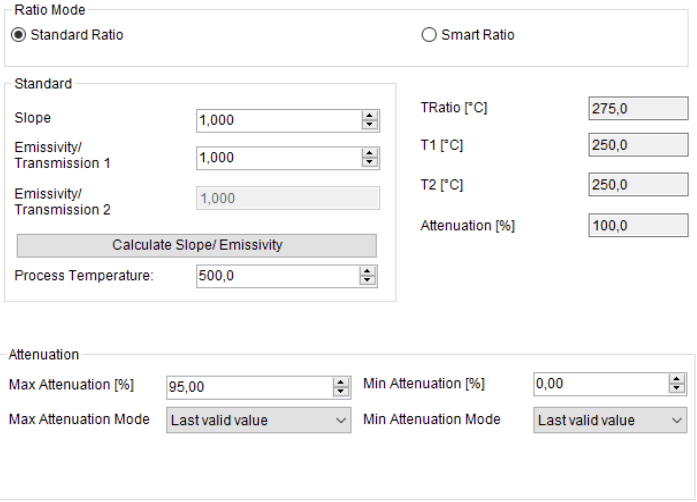
2.2.1. Ratio Mode - Standard Ratio

Emissivity/ Slope/ Attenuation

The **Slope** is the quotient of the emissivity's of both of the overlapping wavelengths and therewith the deciding parameter for measurements in 2-color-mode.

The **Emissivity** (ε – Epsilon) is a material constant factor to describe the ability of a body to emit infrared energy. The emissivity only affects measurements in the 1-color-mode.

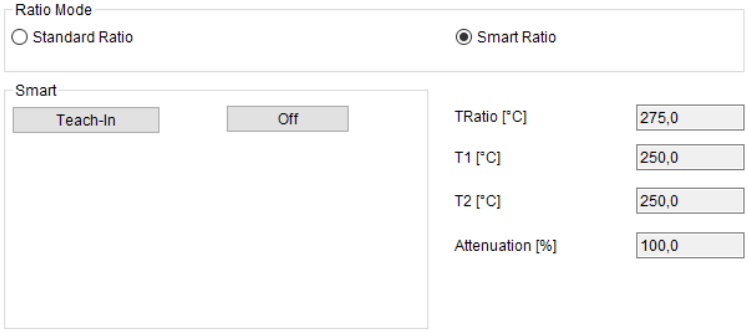
The function **Calculate Slope/Emissivity** allows the determination of an unknown emissivity and slope at a known process temperature.



Attenuation: The temperature display is fixed if the attenuation exceeds the limit specified here. You can decide whether the **last valid value** should be kept or a **fixed value** entered. This can be selected for **maximum** and **minimum attenuation**.

2.2.2. Ratio Mode - Smart Ratio

While the standard mode requires a constant emissivity ratio/slope, the **Smart Ratio** measurement allows a data set of different slopes to be recorded and applied for temperature calculation. This is required, for example, if the degree of contamination of the protective window changes during the process and the ratio temperature is no longer correct. This cannot be described with a constant slope.



A requirement for the measurement is that the object temperature must be known.

Note: Before the first use a data record must be recorded

In the **Teach-in** function, the data records are recorded.

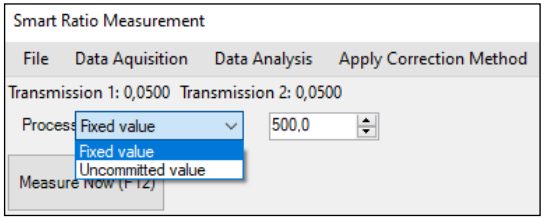
The Smart Ratio mode can be activated or deactivated with the **On/Off** buttons.

Teach-In

The process temperature must be known for the teach-in function. This temperature can be set using two variants:

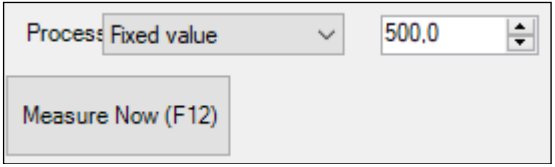
- **Variant 1:** Via a **fixed value**
  Here the known process temperature is entered manually.

- **Variant 2:** Via **Uncomitted value**
  The input is done via an analog signal, for example an external sensor.

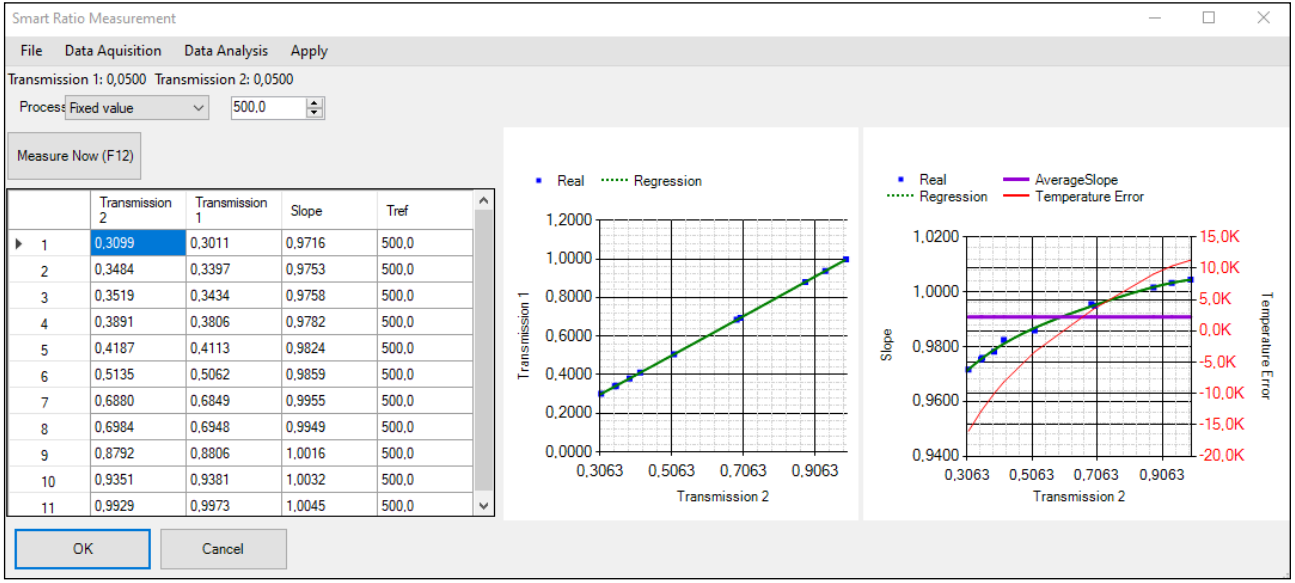


Procedure

Hold the dirty window in front of the sensor.
The **Measure Now button (F12)** can now be used to record measuring points. The current transmission and slope are entered into the table. Alternatively, the **F12** button can be pressed.



Note
When recording different measuring points, the current process temperature must always be taken into account. At least two measuring points with different degrees of contamination. Recommendation: The more measuring points the better

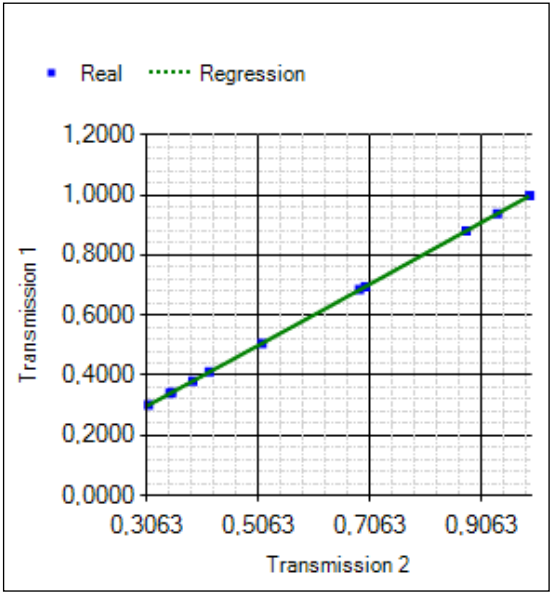


Smart Ratio example with 11 measuring points

The middle figure shows the transmission of diode 1 relative to the transmission of diode 2

The blue points are the recorded measuring points.

Green curve: Regression curve (polynomial) for calculating the values between the measuring points.



Note

The Smart Ratio method can only work if there is a monotonically increasing function progression. If this is not the case, the Smart Ratio method cannot be used. If this is not the case, repeat the measurement and check the measurement for measurement errors.

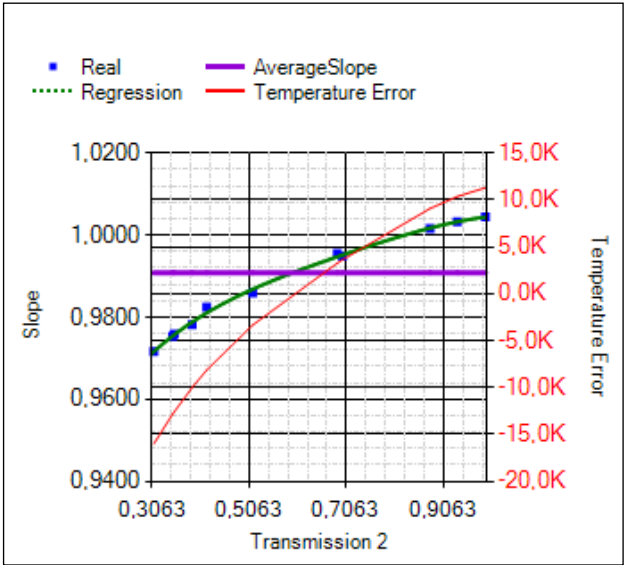
The right figure shows the transmission ratio (slope) relative to the transmission of diode 2.

The blue points are the recorded measuring points.

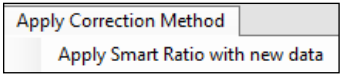
The violet horizontal line is the average slope calculated from the measured values.

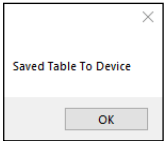
The red curve is an estimate of the quotient temperature error (in Kelvin) when using the average slope without the Smart Ratio method.

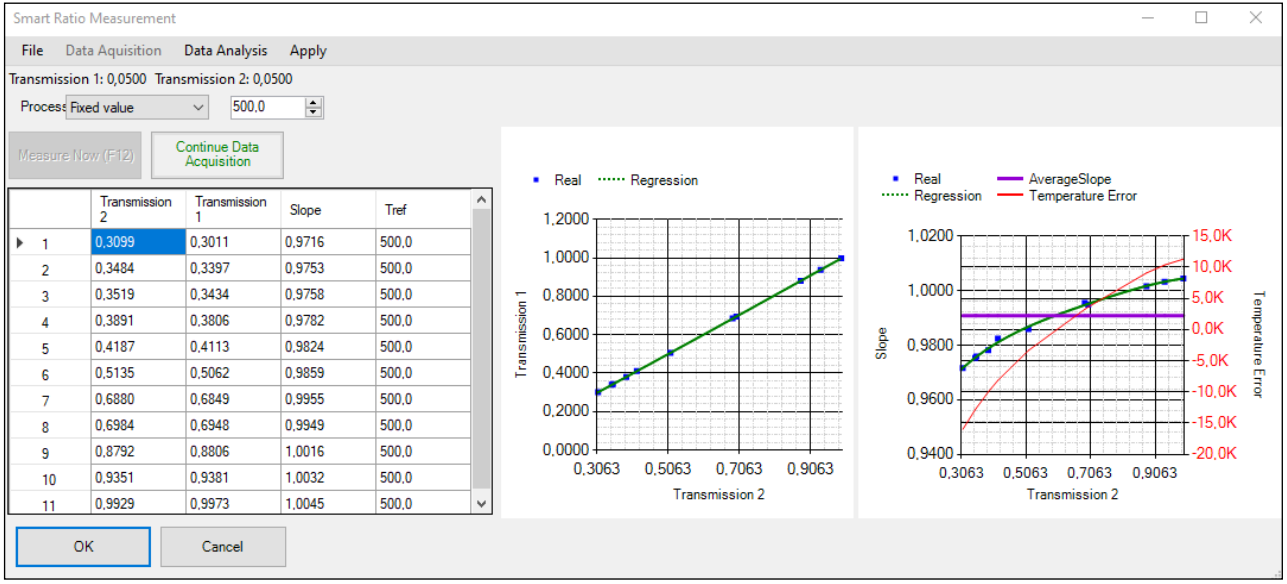
Green curve: Regression curve (polynomial) for calculating the values between the measurement points.



To write the created curves to the device, the **Apply Smart Ratio with new data** option must be selected in the menu under **Apply Correction Method**. The created regression curve is now written to the device. A message window appears indicating that the table is being saved to the device. The Smart Ratio mode is now automatically activated.







Smart ratio mode is now activated. Further data points can no longer be recorded in this mode. To add more data points, press the **Continue Data Acquisition** button (Smart Ratio mode is deactivated again).

After successful setting you can close the window with the **OK** button.

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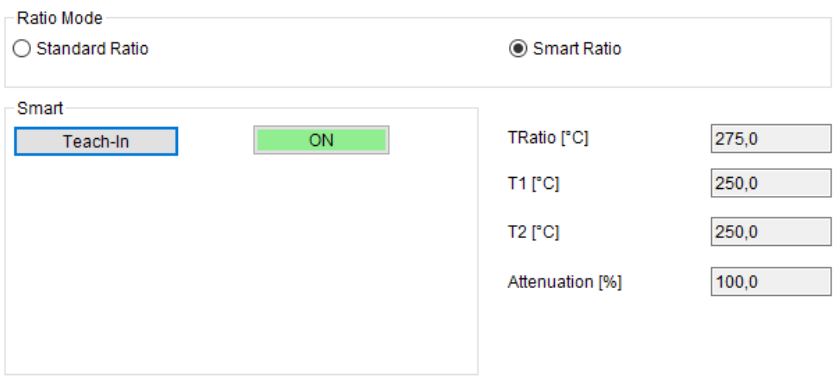
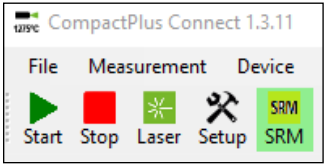
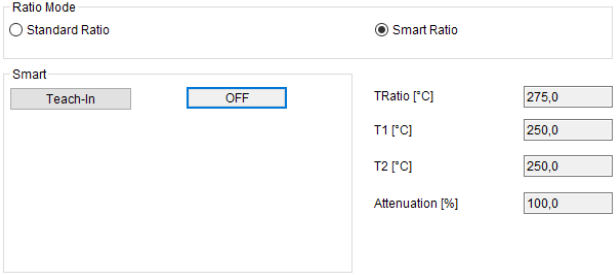




Activation of the Smart Ratio function is indicated by a green illuminated **On** button. In addition, there is an icon called **SRM**, which is framed in green when activated.

To deactivate the Smart Ratio function, you can either click on the icon or on the green on button.

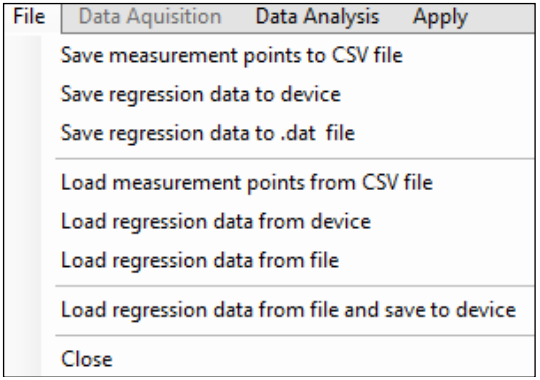


Further Settings

Further settings can be made in the menu under **File**.

Save measurement pionts to CSV file: The created data is stored on a hard disk.

Save regression data to device: The created data is stored on the device without activating or applying the Smart Ratio method.



Save regression data to .dat file: Here the data is stored on a hard disk for external data analysis.

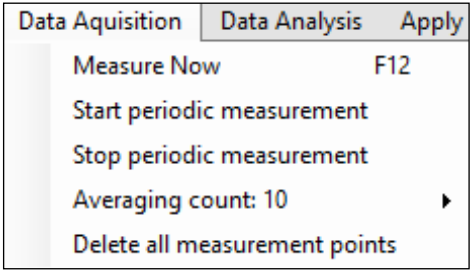
Load measurement points from CSV file: If data sets already exist, the values can be read in and loaded into the table.

Load regression data from device: To view the currently used regression curve.

Load regression data from file: The regression data is loaded from an existing file.

Load regression data from file and save to device: Here the regression data is loaded from an existing file and saved directly to the device.

The following settings can be made in the menu under **Data Acquisition**.



Measure Now: A single measuring point is created and written to the table.

Start periodic measurement: A predefined interval can be entered, in which the measuring points will be recorded automatically.

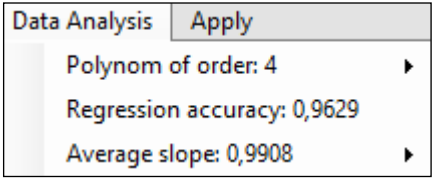
Stop periodic measurement: The recording of new measuring points is stopped.

Averaging count: Signal averaging during transmission measurement (response time is extended).

Delete all measurement points: All measuring points in the table are deleted (not from the device).

Note
To delete individual measuring points, you must mark them in the table and remove them with the delete key.

The following settings can be made in the menu under **Data Analysis**.



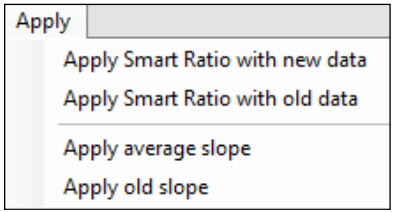
Polynom of order: The polynomial order is specified here. The factory setting is Auto and is determined automatically. Alternatively, it can be changed manually if required.

Regression accuracy: Characteristic value to evaluate the description of the measured values by the polynomial. Larger values are better. A value of 1 means perfect agreement. The regression accuracy is calculated automatically.

Average slope: The mean value of all slopes is calculated (violet straight line in the right diagram). The default setting is Auto. Alternatively it can be set manually. Allows to manually move the average slope (display optimization).

The following settings can be made in the menu under **Apply**.

Apply Smart Ratio with new data: The created regression curve is written to the device and the Smart Ratio mode is activated. A message window appears indicating that the table is being saved to the device.



Apply Smart Ratio with old data: Regression curve already stored in the device is retained and Smart Ratio mode is activated.

Apply average slope: Set average slope and activate standard ratio mode.

Apply old slope: Restore the slope value before opening the Smart Ratio configuration.

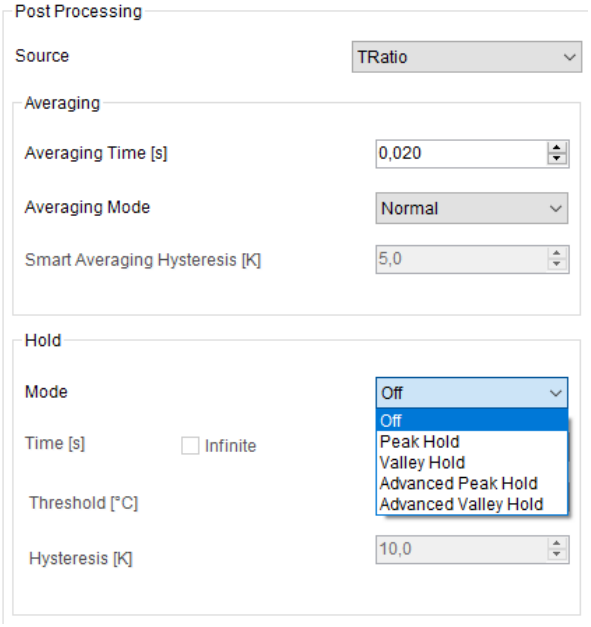
2.2.3. Post Processing

In the category **Post Processing** you can select the **Source** and make following settings:

- **Averaging** (Averaging time, average mode, smart threshold)
- **Hold** mode (Mode: Off, Peak Hold, Valley Hold, Advanced Peak Hold, Advanced Valley Hold)

You will find the description of the single functions on the next page.

Smart Averaging
If activated, a dynamic average adaptation at high signal edges is active. In addition you can enter the minimum temperature difference (**Smart Averaging Hysteresis**) to trigger this function.



Averaging

In this mode an arithmetic algorithm will be performed to smoothen the signal. The **Averaging Time** is the time constant. This function can be combined with all other post processing functions. The minimum adjustable average time is 0,001 s.

Peak hold

In this mode the sensor is waiting for descending signals. If the signal descends the algorithm maintains the previous signal peak for the specified **Hold time**.
The minimum adjustable hold time is 0,001 s.
After the hold time the signal will drop down to the second highest value or will descend by 1/8 of the difference between the previous peak and the minimum value during the hold time. This value will be held again for the specified time. After this the signal will drop down with slow time constant and will follow the current process temperature.
Therefore, if periodic events will be measured (bottles on a conveyor e.g.) this peak hold function avoids a drop down of the signal to the conveyor temperature in-between 2 events.

Valley hold

In this mode the sensor waits for ascending signals. If the signal ascends the algorithm maintains the previous signal valley for the specified **Hold time**. The definition of the algorithm is according to the peak hold algorithm (inverted).

Advanced Peak hold

In this mode the sensor waits for local peak values. Peak values which are lower than their predecessors will only be taken over if the temperature has fallen below the **Threshold** value beforehand. If **Hysteresis** is activated a

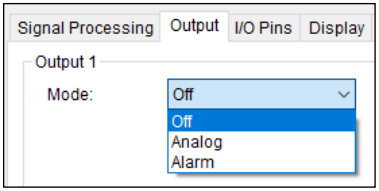
	peak in addition must decrease by the value of the hysteresis before the algorithm takes it as a new peak value.
Advanced Valley hold	This mode is the inverted function of Advanced Peak hold. The sensor waits for local minima. Minimum values which are higher than their predecessors will only be taken over if the temperature has exceeded the **Threshold** value beforehand. If **Hysteresis** is activated a minima in addition must increase by the value of the hysteresis before the algorithm takes it as a new minimum value.
Smart Averaging	If activated, a dynamic average adaptation at high signal edges is active.
Off	If **Off** is activated, no post processing will happen.

2.3. Sensor Setup CTratio – Output

2.3.1. Output 1 and 2

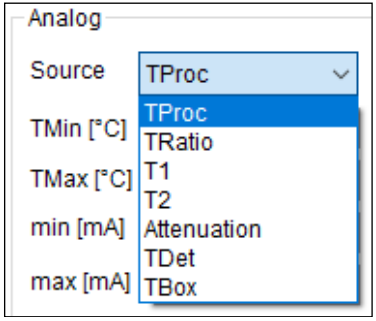
The device has two outputs (**OUT 1**, **OUT 2**) which can be configured as desired. The following options are available under **Mode**:

- Off
- Analog
- Alarm



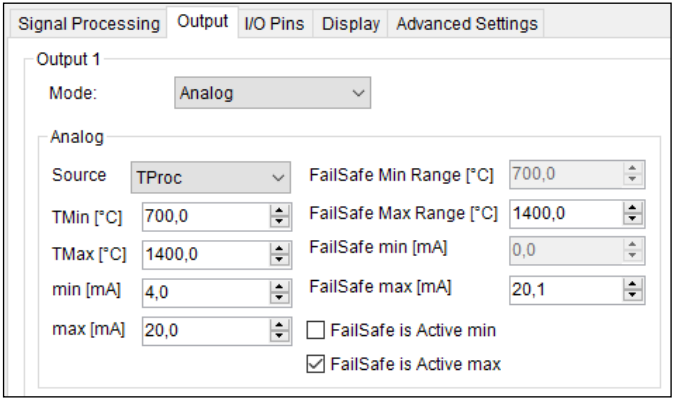
When Analog is activated, the following signal sources can be selected in the Source field:

- **TProc** Process temperature
- **TRatio** Ratio temperature
- **T1** 1 channel temperature
- **T2** 2 channel temperature
- **Attenuation** Signal attenuation in %
- **TDet** Temperature of detector
- **TBox** Box temperature



The desired temperature measuring range of the sensor can now be set. The range limits can be changed by entering them in the corresponding fields. The source can be selected between **T_{Proc}**, **T_{Ratio}**, **T1, T2, Attenuation, T_{Det}** or **T_{Box}**.

- **TMin:** lower temperature range limit
- **TMax:** upper temperature range limit
- **Min [mA]:** lower limit mA output
- **Max [mA]:** upper limit mA output



Alternatively, outputs 1 and 2 can be used as alarm outputs. To do this, select the Alarm setting.
As source you can choose between **T_{Proc}, T_{Ratio}, T1, T2, Attenuation, T_{Det}** or **T_{Box}**.

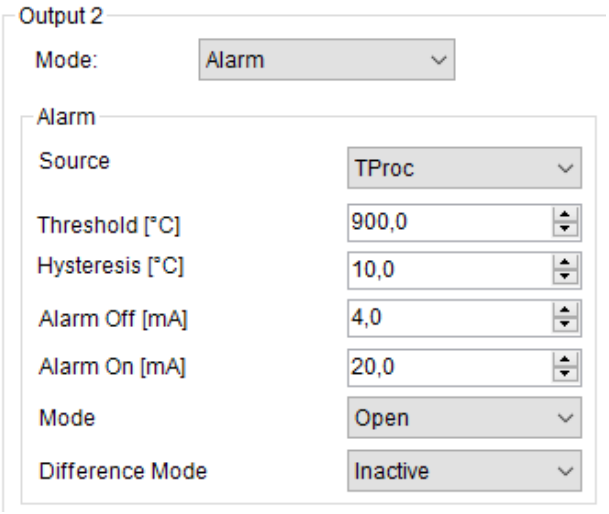
Under **Threshold** the threshold value for triggering the alarm is defined.

Hysteresis: Setting the minimum hysteresis

Alarm Off [mA/mV]: Value if no alarm

Alarm On [mA/mV]: Value on alarm

Selecting **Open/Closed** under **Mode** defines the output as High or Low alarm.



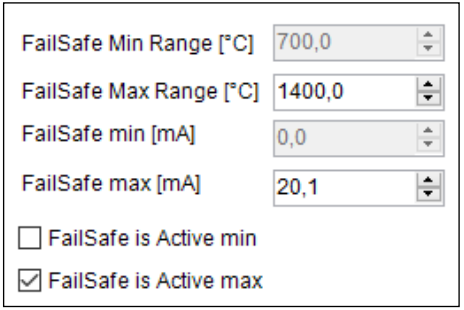
Difference Mode: When activated, no absolute value is used for the alarm threshold, but the difference between process temperature and ambient temperature (TProc-TUmg).

2.3.2. Failsafe

The pyrometer has a failsafe function that can be used in analog mode.

The range can be configured as desired. The settings for fail-safe operation allow a defined level to be output at the analog output depending on specified temperature limits.

Thus, a possible cable defect can be detected quickly.



2.4. Sensor Setup CTratio – I/O pins

The CTratio has three I/O pins which can be programmed as in- or outputs using the software. The following options are available:

Function	I/O pin acts as	Description
Alarm	output (digital)	Open collector output/ definition as HIGH- or LOW alarm via norm. open/ norm. close options in software dialog.
Valid Low	input (digital)	The output follows the process temperature as long as there is a Low level at the I/O pin. After discontinuation of the Low level the last value will be held.
Valid High	input (digital)	The output follows the process temperature as long as there is a High level at the I/O pin. After discontinuation of the High level the last value will be held.
Hold Low-High	input (digital)	The last value will be held if there is a signal with a rising edge on the I/O pin.

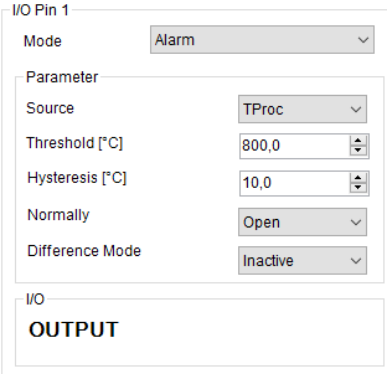
Hold High-Low	input (digital)	The last value will be held if there is a signal with a falling edge on the I/O pin
Hold Reset Low	input (digital)	Reset of a hold function on a Low level at the I/O pin
Hold Reset High	input (digital)	Reset of a hold function on a High level at the I/O pin
Slope external	input (analog)	External adjustment of the slope value using an analog voltage (0-10 V)
Emissivity external	input (analog)	External adjustment of the emissivity value using an analog voltage (0-10 V)
Uncommitted Value	input (analog)	Display of a freely scalable value
Laser on Low	input (digital)	Switch on laser (Low signal)
Laser on High	input (digital)	Switch on laser (High signal)

Low-/High-level: via software

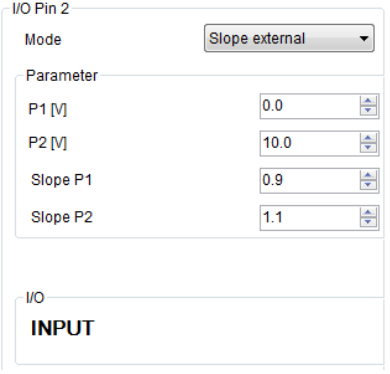
If you select the function **Alarm** the following signal sources can be selected:

- **TProcess** Process temperature
- **TRatio** Ratio temperature
- **T1** 1 channel temperature
- **T2** 2 channel temperature
- **Attenuation** Signal attenuation in %
- **TDet** Detector temperature
- **TBox** Box temperature

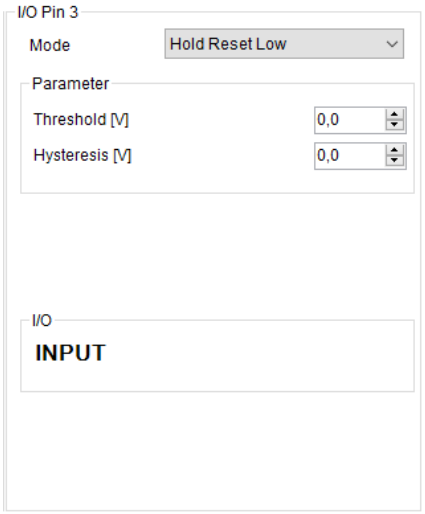
The definition as Low or High alarm can be done by switching between **Normally: open** and **Normally: closed**.



If you select the function **Slope external** or **Emissivity external** the I/O pin is set as analog input. The scaling can be done using the parameter fields **P1/P2** and **Slope P1/P2** / **Epsilon P1/P2**.



If you select the function **Hold Reset Low** or **Hold Reset High** the I/O-Pin is set as digital input. An activated hold function (MAX, MIN, advanced MAX, advanced MIN) will be reset if a low or high level is at the I/O pin.



2.5. Sensor Setup CTratio – Display

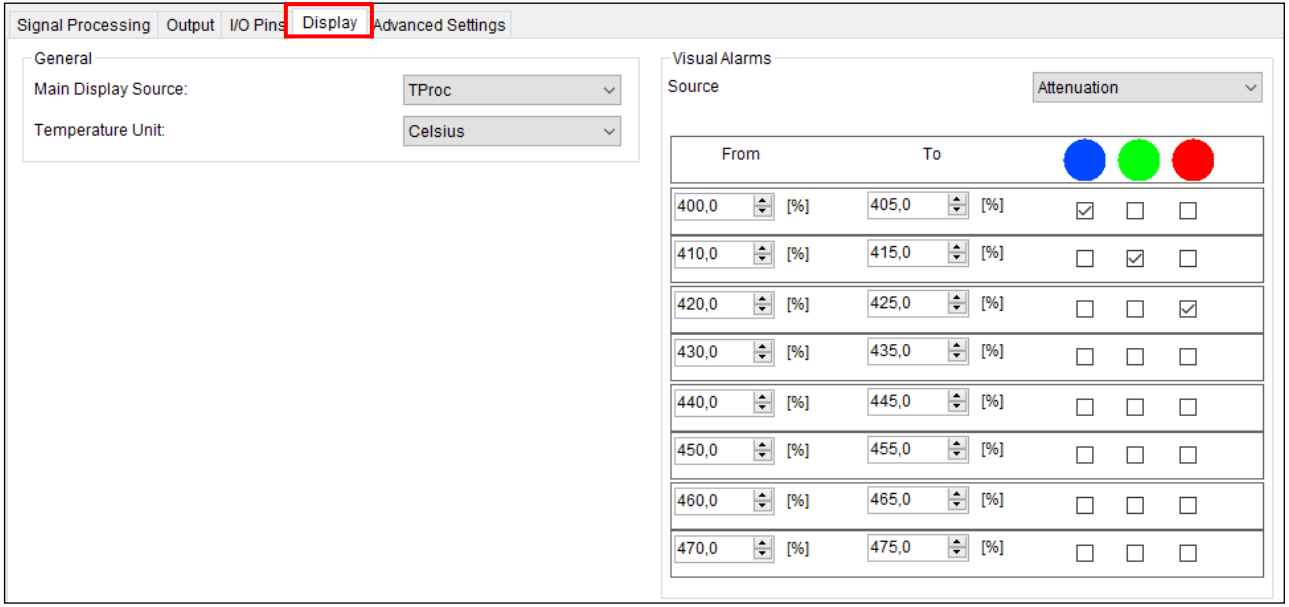
In this tab you can make settings for the display and the backlight (=visual alarms). Furthermore, the temperature unit can be selected here.

2.5.1. Visual Alarms

Independent of the selected signal for the analog output, a signal from the following list can be selected under General/ Main display source, which is shown in the digital display of the electronics:

TProc	Process temperature
TRatio	Ratio temperature
T1	Temperature value 1-color-mode
T2	Temperature value 2-color-mode
Attenuation	Signal attenuation in %
TDet	Temperature of the detector
TBox	Temperature of the electronics

For the visual alarm areas up to eight alarm limits can be assigned to a signal. The selected signal can be selected under **Source** independent of the value shown in the display and independent of the analog output.



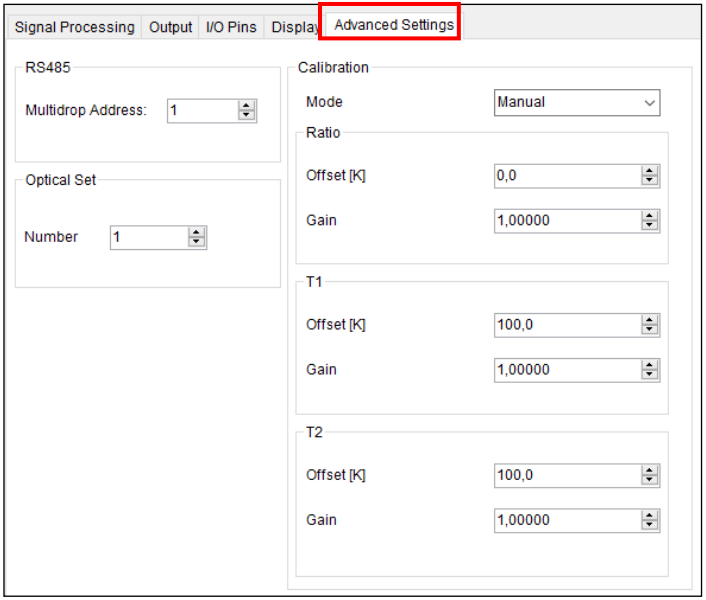
2.5.2. Temperature unit

The temperature unit can be changed between °C and °F under **Preferences/ Options**.

2.6. Sensor Setup CTratio – Advanced Settings

In the category **Advanced Settings** the following parameter can be adjusted:

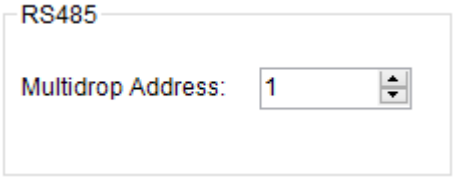
- RS485 - Multidrop address
- Optical Set
- Calibration



2.6.1. RS485 Multidrop Address

In combination with a RS485 interface you can build a network of several CTratio sensors (max. 32 sensors).
For the digital communication each sensor must have its own address which you can enter in the input field Multidrop address.

► RS485/ RS422



2.6.2. Optical Set

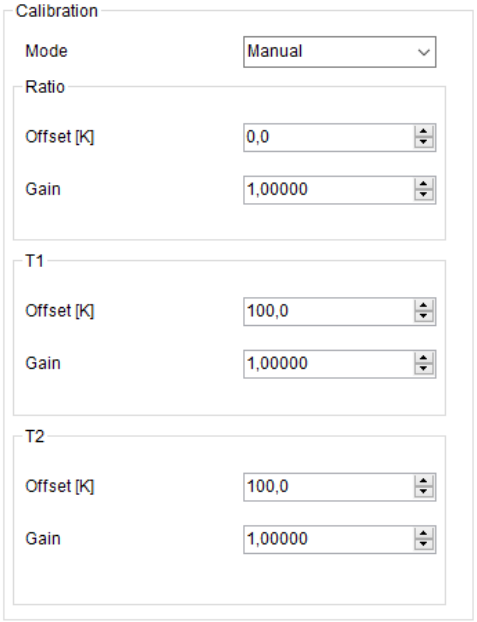
If replacement fibers are used, the correct number must be entered for exact allocation. Each fiber has a unique number.

2.6.3. Calibration

In the Advanced Settings tab, three different modes can be selected to perform a calibration of the device:

- Manual
- 1 Point (Calibration)
- 2 Point (Calibration)

These amplification factors can be entered for the Ratio, T1 and T2 temperature.



Manual Calibration

For certain applications or under certain circumstances a temperature offset or a change of the gain for the temperature curve may be useful.

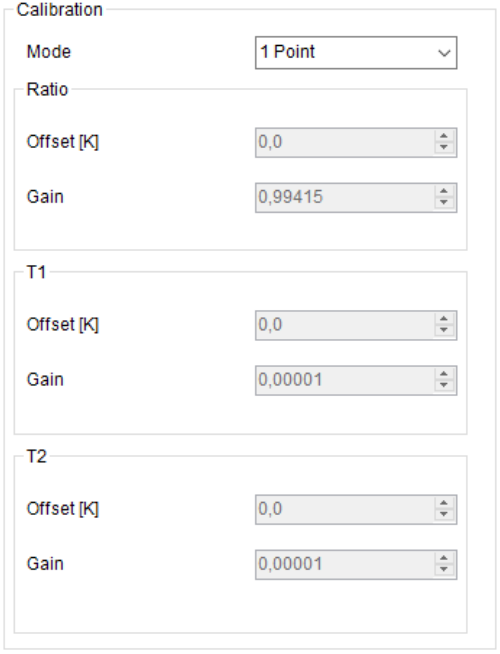
The **factory default settings** for Offset and Gain are:

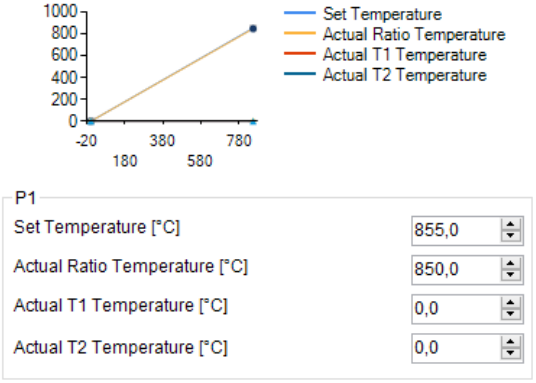
- Offset: 0,0 K
- Gain: 1,000

A changed **Offset** causes a parallel shifting of the temperature curve and therewith it has a linear effect on the temperature reading (change constant independent on process temperature). A change of the **Gain** will have a non-linear effect on the temperature reading (change depends on process temperature).

1 Point Calibration

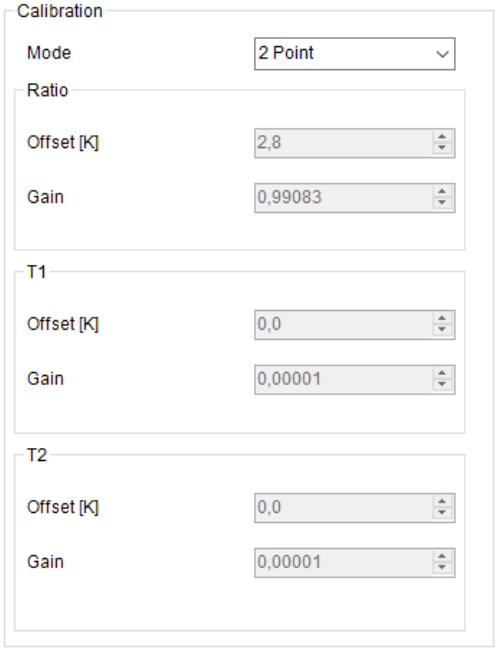
In this mode, a 1-point calibration can be made for the device. To do this, select under Mode **1 Point** (Calibration) and enter the **actual temperature** and the **set temperature**. An offset calculation takes place and is displayed.

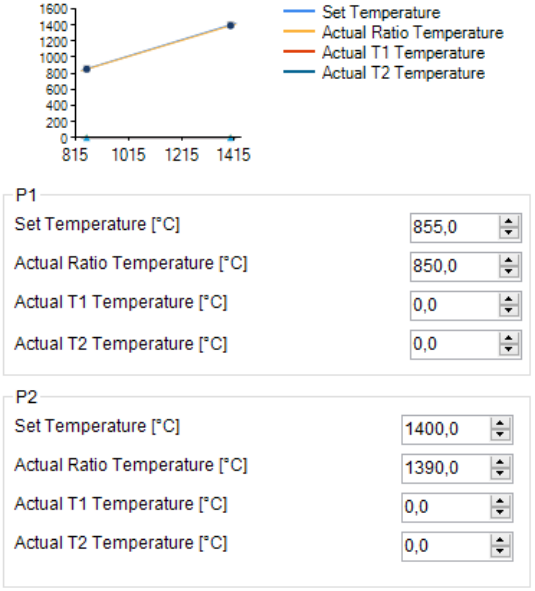




2 Point Calibration

In this mode, a 2 point calibration can be made. To do this, select under Mode **2 Point** (Calibration) and enter the **actual temperature** and the **set temperature** for two different points. An offset and gain is then calculated.



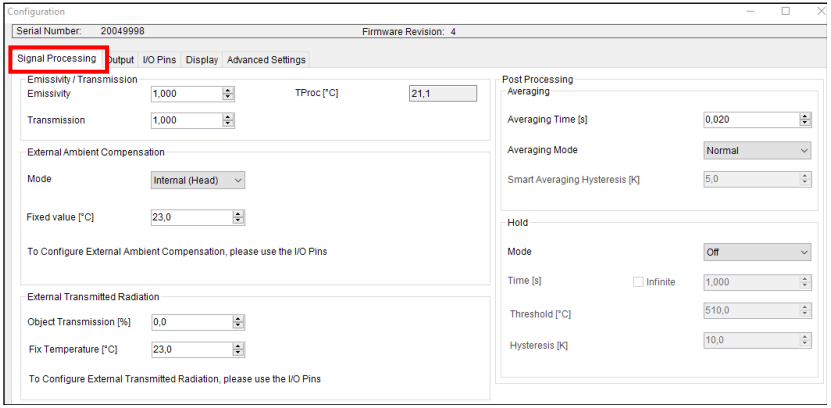


3. CT

3.1. Sensor Setup CT – Signal Processing

The button **Setup** **[Menu: Device\ Device Setup]** opens a window for the setting of all sensor parameters. The dialog window is separated into 5 categories:

- Signal processing — Setting of Emissivity/ Transmission and Post processing
- Output — Setting of Output 1 and Output 2
- I/O Pins — Setting the In- and Outputs
- Display — Display main value and Backlight/ Alarm setting
- Advanced settings — Calibration, USB connection, RS485 Multidrop address



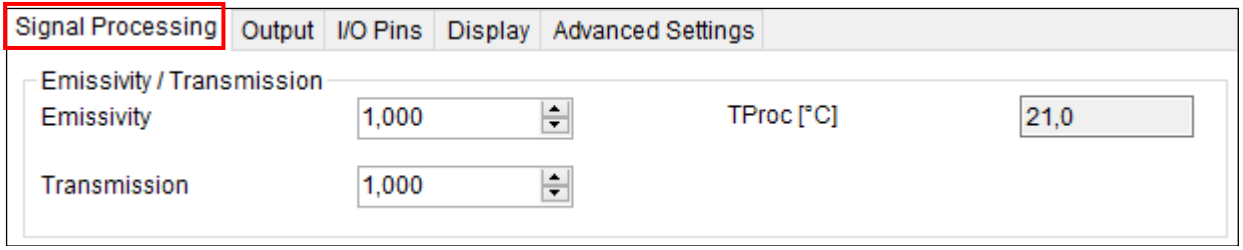
CT

3.1.1. Emissivity and Transmissivity

Under **Emissivity/Transmission** in the **Signal Processing** tab, you can set the two parameters:

Emissivity: The **Emissivity** (ε – Epsilon) is a material constant factor to describe the ability of a body to emit infrared energy. The emissivity only affects measurements in the 1-color-mode.

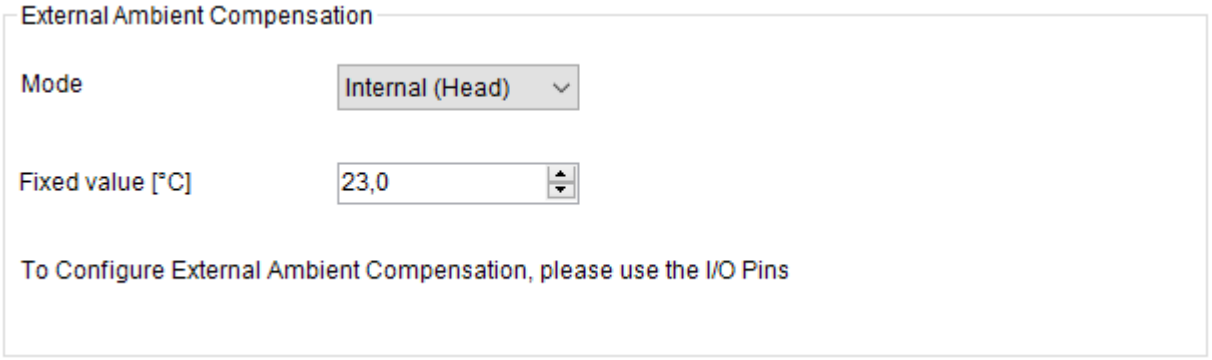
Transmission: In the input field **Transmission** you have to enter the transmission of optional optical components like an additional lens (e.g. CF optics **ACCTCF**) or a protective window (e.g. **ACCTPW**).



3.1.2. Ambient Temperature Compensation

In dependence on the emissivity value of the object a certain amount of ambient radiation will be reflected from the object surface. To compensate this impact, the software provides the feature **Ambient control**:

- **Internal (Head):** The ambient temperature will be taken from the head-internal Pt1000 probe (factory default setting).
- **Fixed value:** A fixed value can be entered in the edit box **Fixed value** (if the ambient radiation is constant).



Note
Especially if there is a big difference between the ambient temperature at the process and head temperature the use of Ambient control with **Fixed value** or via the I/O pins (mode: **External Ambient Compensation**).is recommended.

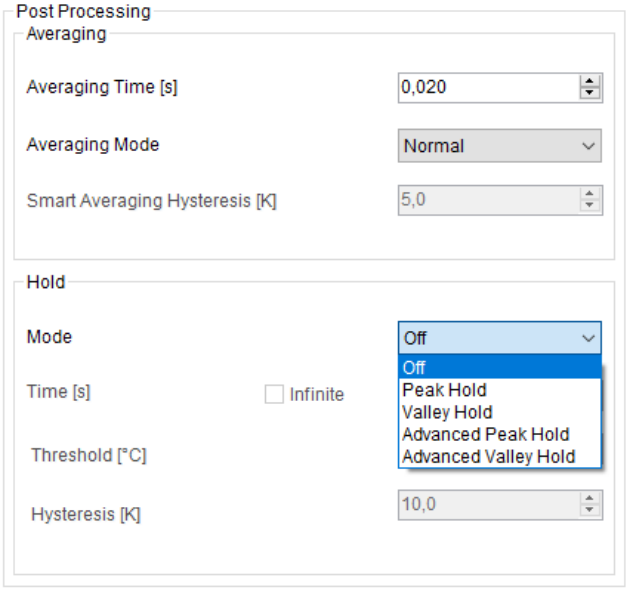
3.1.3. Post Processing

Under **Post Processing** you can set the **averaging** and **hold mode**.

Averaging: In this mode an arithmetic algorithm will be performed to smoothen the signal. The **Averaging Time** is the time constant. This function can be combined with all other post processing functions.

The minimum adjustable average time is for the CT 4M model 1ms (0,001s). On this model values below 0,1 s can be increased/ decreased only by values of the power series of 2 (0,002, 0,004, 0,008, 0,016, 0,032, ...).

Under the A**veraging Mode** you can choose between **Normal** and **Adaptive**. With Adaptive, a dynamic adjustment of the averaging process is performed for steep signal edges (**Smart Averaging**).



The following post-processing functions are available:

Off	If **Off** is activated, no post processing will happen ($T_{Proc} = T_{Avg}$).
Averaging	In this mode an arithmetic algorithm will be performed to smoothen the signal. The **Avg. time** is the time constant. This function can be combined with all other post processing functions. The minimum adjustable average

time is 0,1s; on the models 1M, 2M and 3M 1ms (0,001s). On these models values below 0,1s can be increased/ decreased only by values of the power series of 2 (0,002, 0,004, 0,008, 0,016, 0,032, ...).

Peak hold

In this mode the sensor is waiting for descending signals. If the signal descends the algorithm maintains the previous signal peak for the specified **Hold time**.
The minimum adjustable hold time is 1 ms (0,001 s).
After the hold time the signal will drop down to the second highest value or will descend by 1/8 of the difference between the previous peak and the minimum value during the hold time. This value will be held again for the specified time. After this the signal will drop down with slow time constant and will follow the current process temperature. ► **Signal Graphs**
Therefore, if periodic events will be measured (bottles on a conveyor e.g.) this peak hold function avoids a drop down of the signal to the conveyor temperature in-between 2 events.

Valley hold

In this mode the sensor waits for ascending signals. If the signal ascends the algorithm maintains the previous signal valley for the specified **Hold time**. The definition of the algorithm is according to the peak hold algorithm (inverted).

Advanced Peak hold

In this mode the sensor waits for local peak values. Peak values which are lower than their predecessors will only be taken over if the temperature has fallen below the **Threshold** value beforehand. If **Hysteresis** is activated a

	peak in addition must decrease by the value of the hysteresis before the algorithm takes it as a new peak value.
Advanced Valley hold	This mode is the inverted function of Advanced Peak hold. The sensor waits for local minima. Minimum values which are higher than their predecessors will only be taken over if the temperature has exceeded the **Threshold** value beforehand. If **Hysteresis** is activated a minima in addition must increase by the value of the hysteresis before the algorithm takes it as a new minimum value.
Smart Averaging	If activated, a dynamic average adaptation at high signal edges is active.

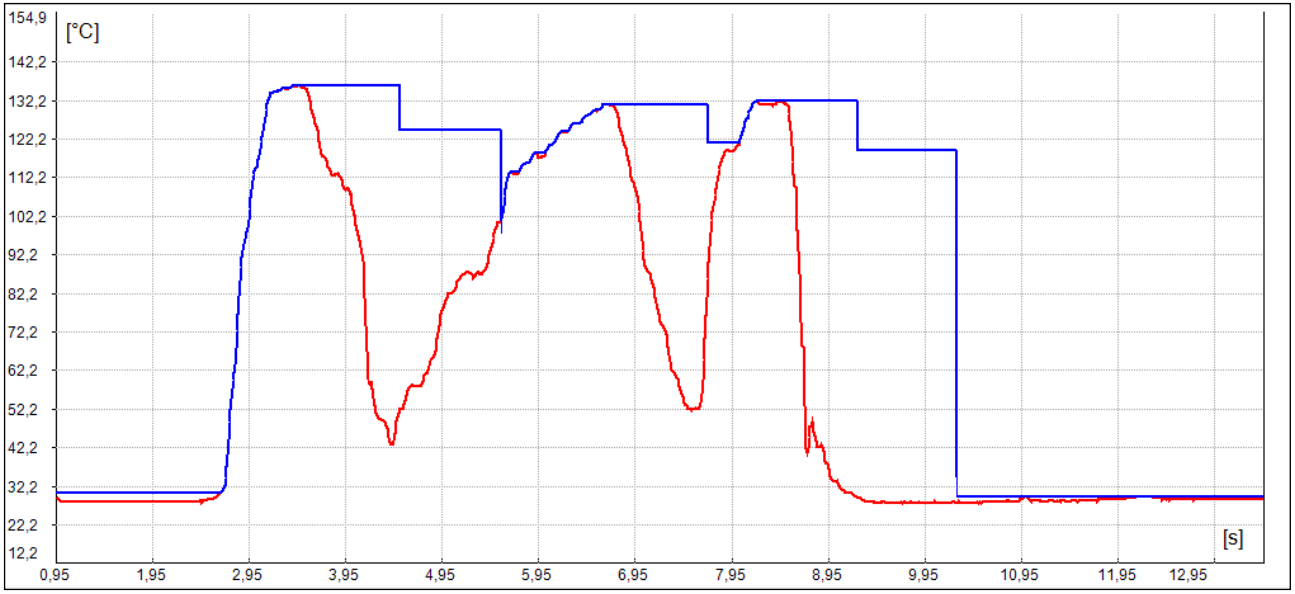
Peak picking function

For a detection of fast hotspots (detection time 90 µs) the averaging time must be set to 0.0 s.

Note

You can display the process temperature $\mathbf{T_{Proc}}$ (with post processing) and also the current average temperature $\mathbf{T_{Avg}}$ (without any post processing) in the diagram. In this way the result and functionality of the selected post processing features can easily be traced and controlled.

Signal Graphs



— T_{Proc} with Peak Hold (Hold time = 1s)
— T_{Avg} without post processing

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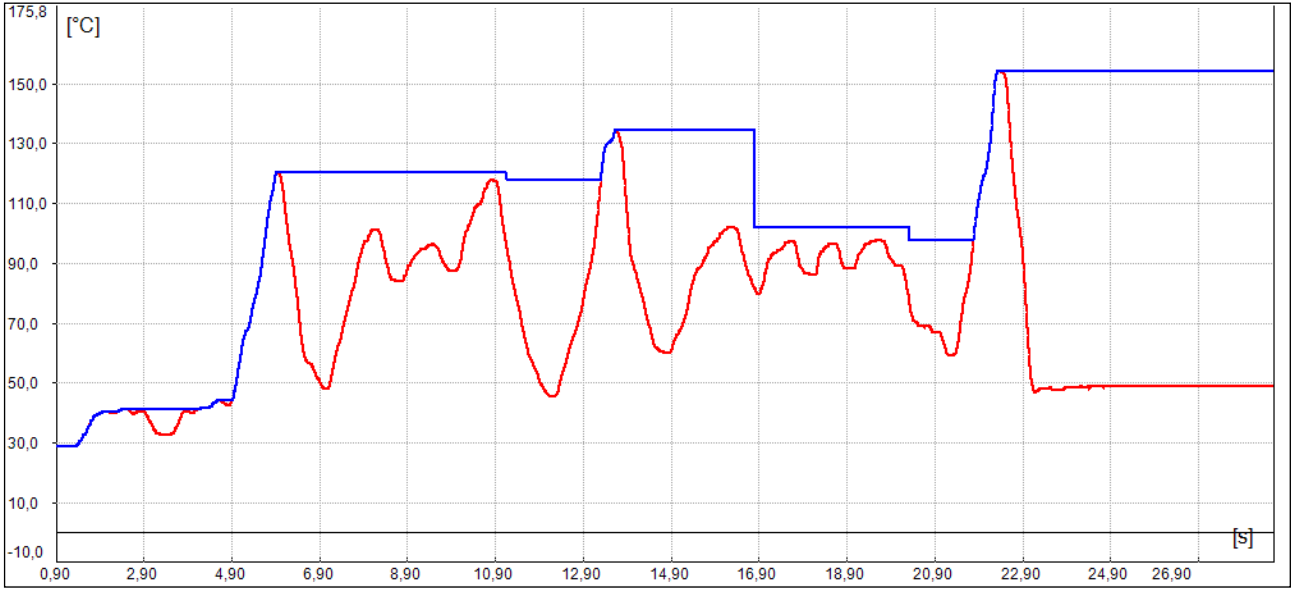
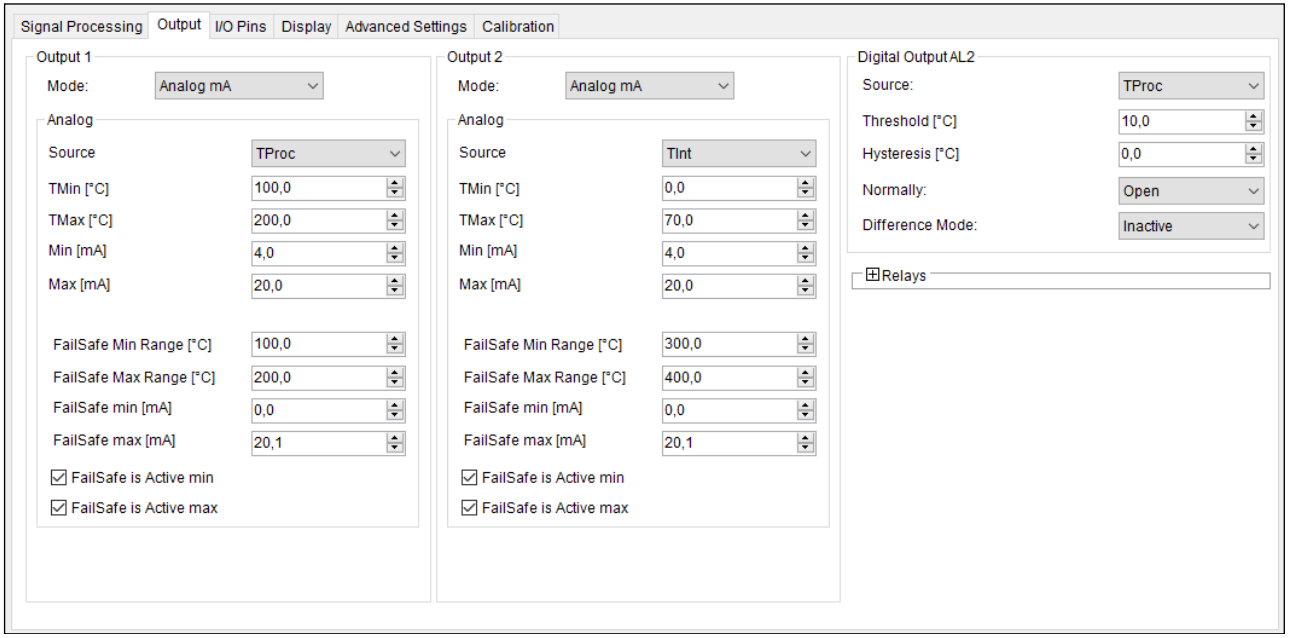


— T_{Proc} with Advanced peak hold (Threshold = 80 °C/ Hysteresis = 20 °C)
— T_{Avg} without post processing

3.2. Sensor Setup CT – Output

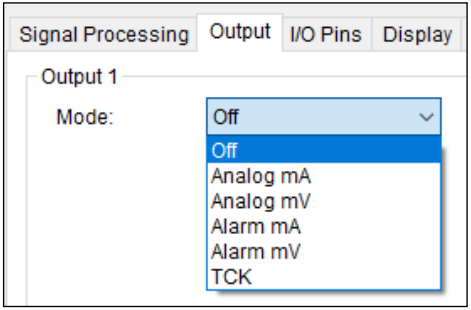
In the **Output** tab, you can set the **Output 1** and **2** and the **Digital Output AL2**. If the optional **Relay** interface is used, it can also be configured here.



3.2.1. Output 1 and 2

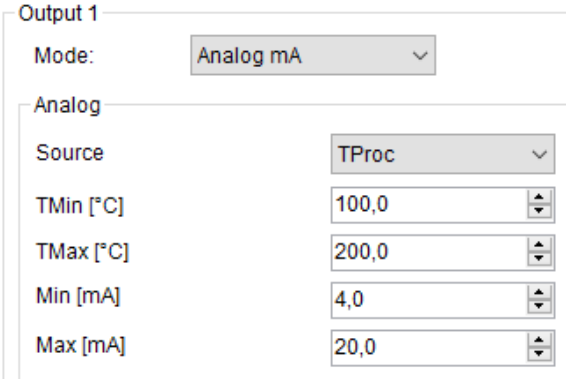
The device has two outputs (OUT-1, OUT-2) which can be configured as desired. The following options are available for selection:

- Off
- Analog mA
- Analog mV
- Alarm mA
- Alarm mV
- TCK



When using the analog mA or mV output, either **T_{Proc}**, **T_{Int}** or **T_{Box}** can be selected as source. The desired temperature measurement range of the sensor can now be set. The range limits can be changed by entering the values in the corresponding fields.

- **TMin:** lower temperature range limit
- **TMax:** upper temperature range limit
- **Min [mA/mV]:** lower limit mA/mV output
- **Max [mA/mV]:** upper limit mA/mV output



Alternatively, outputs 1 and 2 can be used as alarm outputs. To do this, select the **Alarm mA** or **Alarm mV** setting.
As source you can choose between $\mathbf{T_{Proc}}$, $\mathbf{T_{Int}}$ or $\mathbf{T_{Box}}$.

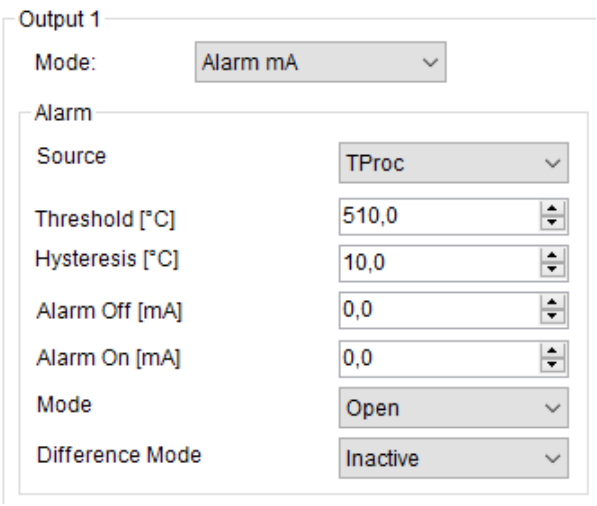
Under **Threshold** the threshold value for triggering the alarm is defined.

Hysteresis: Setting the minimum hysteresis

Alarm Off [mA/mV]: Value if no alarm

Alarm On [mA/mV]: Value if alarm

Selecting **Open/Closed** under **Mode** defines the output as High or Low alarm.



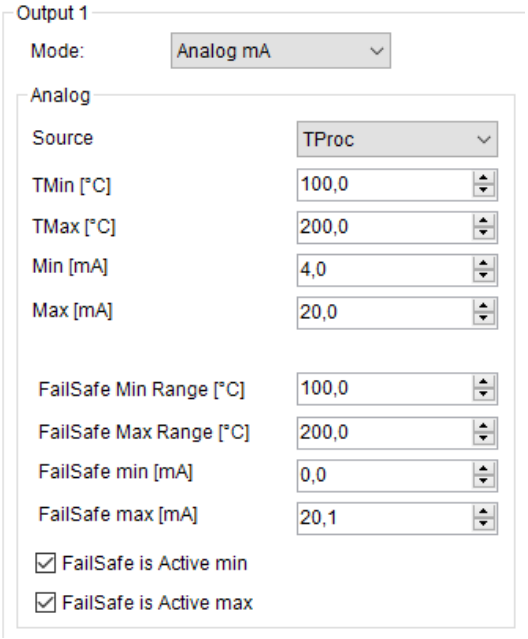
Difference mode: When activated, no absolute value is used for the alarm threshold, but the difference between process temperature and ambient temperature (TProc-TAmb).

3.2.2. Failsafe

The pyrometer has a failsafe function that can be used in analog mode. As source $\mathbf{T_{Proc}}$, $\mathbf{T_{Int}}$ or $\mathbf{T_{Box}}$ can be selected.

The range can be configured as desired. The settings for fail-safe operation allow the output of a defined level at the analog output depending on defined temperature limits.

Thus a possible cable defect can be detected quickly.

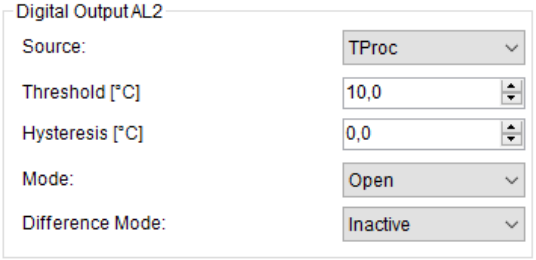


3.2.3. Digital Output AL2

The electronic box has an AL2 pin that can be configured as an open-collector output (24 V/ 50 mA) under **Digital Output AL2**.

As source $\mathbf{T_{Proc}}$, $\mathbf{T_{Int}}$ or $\mathbf{T_{Box}}$ can be selected.

Under **Threshold** the threshold value for triggering the alarm is defined.



Hysteresis: Setting the minimum hysteresis

Selecting **Open/Closed** under **Mode** defines the output as High or Low alarm.

Difference mode: When activated, no absolute value is used for the alarm threshold, but the difference between process temperature and ambient temperature (TProc-TAmb).

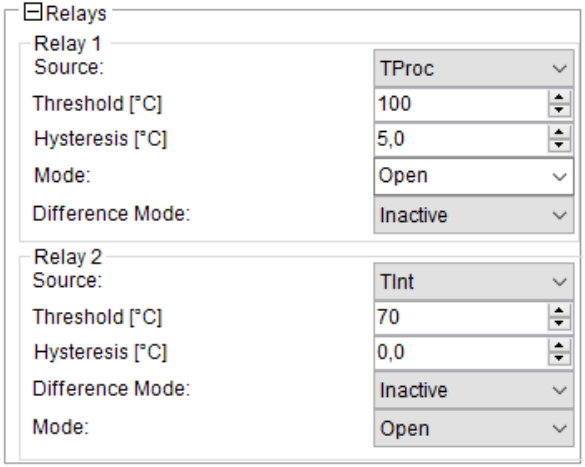
3.2.4. Relays

When using the optional relay interface, T_{Proc}, T_{Int} or T_{Box} can be selected as source.

Under **Threshold** the threshold value for triggering the alarm is defined.

Selecting **Open/Closed** under **Mode** defines the output as High or Low alarm.

Difference mode: When activated, no absolute value is used for the alarm threshold, but the difference between process temperature and ambient temperature (TProc-TAmb).



3.3. I/O Pins

The CT 4M has three I/O pins, which can be programmed as output or input using the software. The following functions are possible:

Function	I/O Pin is on	Description
Alarm	Output (digital)	Open collector output/ definition as High- or Low alarm via normally open/ normally close options in software dialog.
Valid Low	Input (digital)	The output follows the object temperature as long as there is a Low level at the I/O pin. After discontinuation of the Low level the last value will be held.
Valid High	Input (digital)	The output follows the object temperature as long as there is a High level at the I/O pin. After discontinuation of the High level the last value will be held.
Hold Low-High	Input (digital)	The last value will be held if there is a signal with a rising edge on the I/O pin.
Hold High-Low	Input (digital)	The last value will be held if there is a signal with a falling edge on the I/O pin.
Hold Reset Low	Input (digital)	Reset of Peak or valley hold (High-Low signal)
Hold Reset High	Input (digital)	Reset of Peak or valley hold (Low-High signal)
External Emissivity	Input (analog)	The emissivity value can be adjusted via a 0-10 V signal on the I/O pin (scaling possible via software).
Uncommitted value	Input (analog)	Display of uncommitted value
Laser on Low	Input (digital)	Turning on the laser (Low signal)
Laser off High	Input (digital)	Turning on the laser (High signal)
External Ambient compensation	Input (analog)	The ambient temperature will be determined by a voltage on the I/O-pin [0–10 V; range scalable].
External Transmitted compensation	Input (analog)	The transmitted ambient temperature will be determined by a voltage on the I/O-pin [0–10 V; range scalable].

Low/High level: Via Software

When selecting the Alarm function, the following signal sources can be selected:

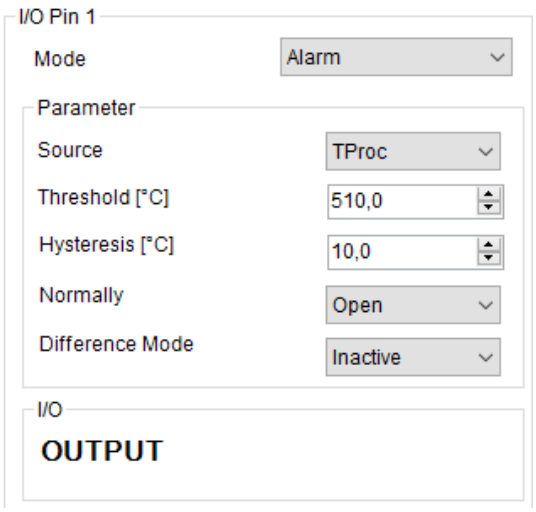
- **TProc** Process temperature
- **TInt** Temperature of detector
- **TBox** General internal temperature inside the housing

Under **Threshold** the threshold value for triggering the alarm is defined.

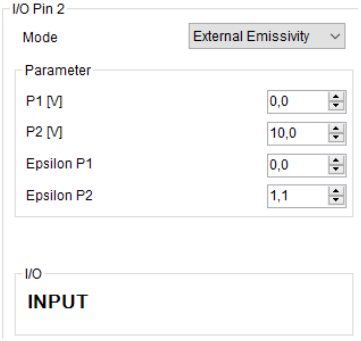
Hysteresis: Setting the minimum hysteresis

Selecting **Open/Closed** under **Mode** defines the output as High or Low alarm.

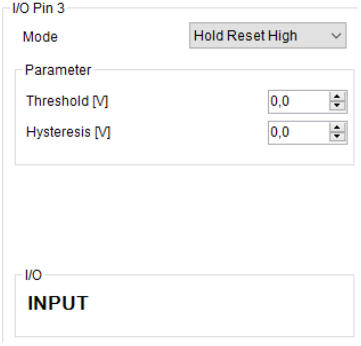
Difference mode: When activated, no absolute value is used for the alarm threshold, but the difference between process temperature and ambient temperature (TProc-TAmb).



If the function **External Emissivity** is selected, the I/O pin is programmed as analog input. The input can be scaled in the fields **P1 [V]**, **P2 [V]**, **Epsilon P1** and **Epsilon P2**.



When the **Hold Reset Low** or **Hold Reset High** function is selected, the I/O pin is programmed as digital input. When a Low or High level is applied, an activated Hold function (MAX, MIN, extended MAX, extended MIN) is reset.



3.4. Display

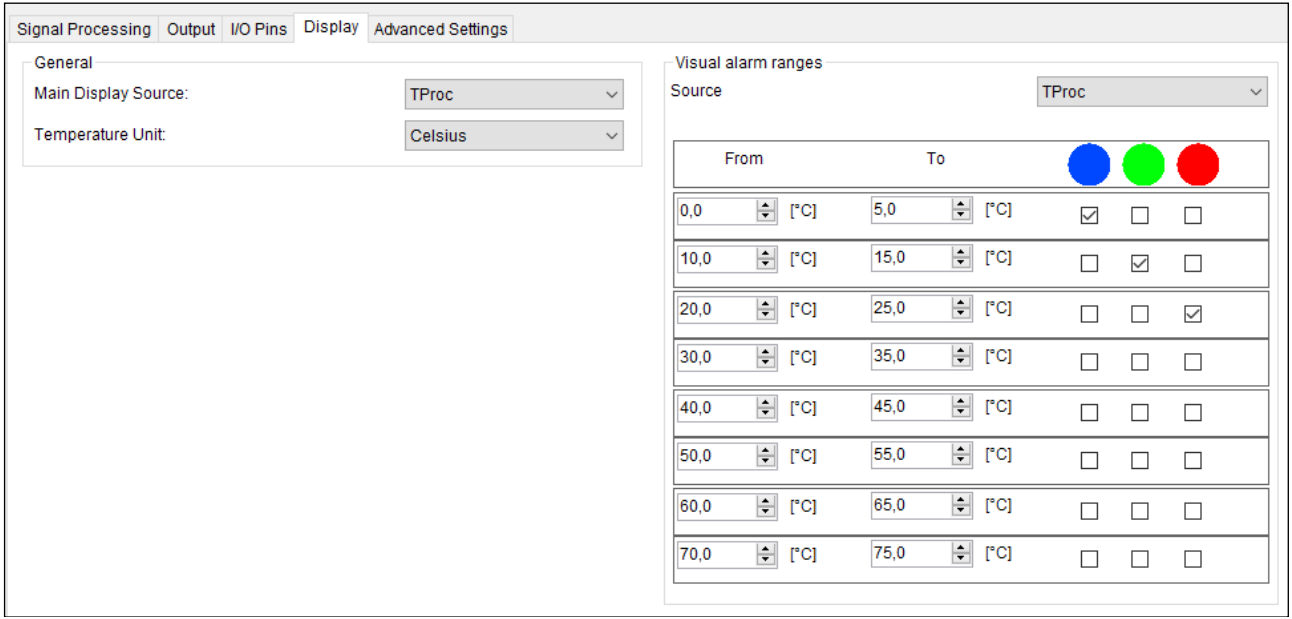
In this tab you can make settings for the display and the backlight (= visual alarms). Furthermore, the temperature unit can be selected here.

3.4.1. Visual Alarms

Independent of the selected signal for the analog output, a signal from the following list can be selected under **General/ Main display Source**, which is shown in the digital display of the electronics:

TProc	Process temperature
TInt	Temperature of detector
TBox	General internal temperature inside the housing

For the visual alarm areas up to eight alarm limits can be assigned to a signal. The selected signal can be selected under **Source** independent of the value shown in the display and independent of the analog output.



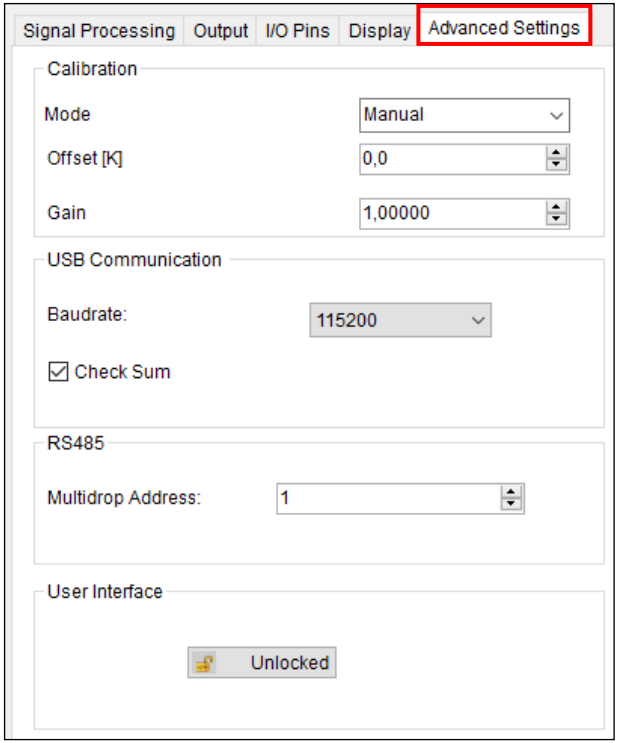
3.4.2. Temperature unit

The temperature unit can be changed between °C and °F under **Preferences/ Options**.

3.5. Sensor Setup CT – Advanced Settings

The following parameters can be set in the Advanced Settings tab:

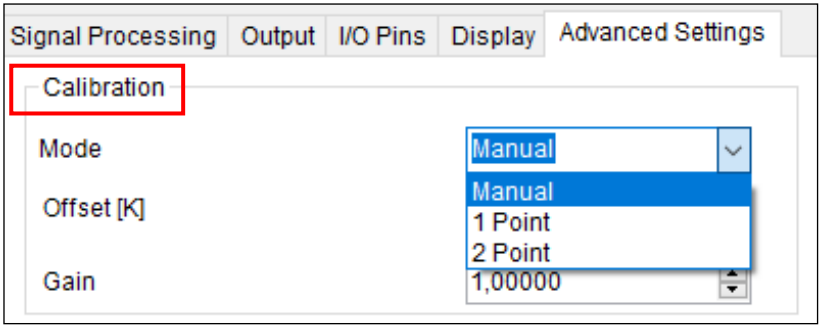
- Calibration
- USB Communication
- RS485 Multidrop address
- Locking and unlocking of the programming keys



3.5.1. Sensor Setup CT – Calibration

In the **Advanced Settings** tab, three different modes can be selected to perform a calibration of the device:

- Manual
- 1 Point (Calibration)
- 2 Point (Calibration)



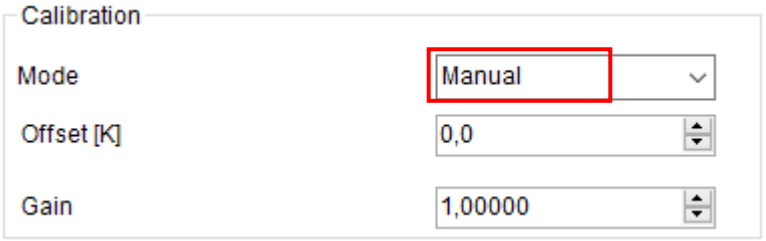
3.5.2. Manual Calibration

For certain applications or under certain circumstances a temperature offset or a change of the gain for the temperature curve may be useful.

The **factory default settings** for Offset and Gain are:

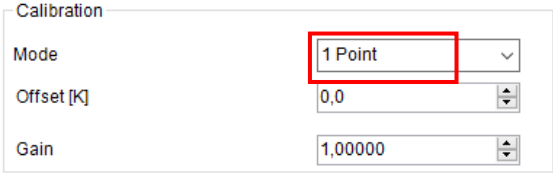
- Offset: 0,0 K
- Gain: 1,000

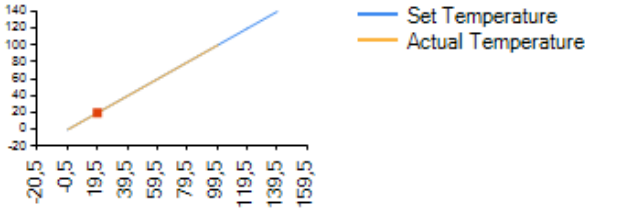
A changed **Offset** causes a parallel shifting of the temperature curve and therewith it has a linear effect on the temperature reading (change constant independent on process temperature). A change of the **Gain** will have a non-linear effect on the temperature reading (change depends on process temperature).

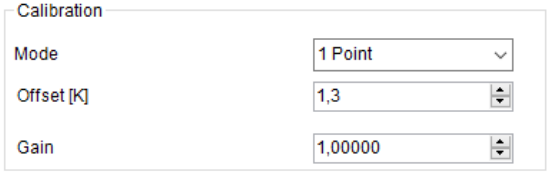


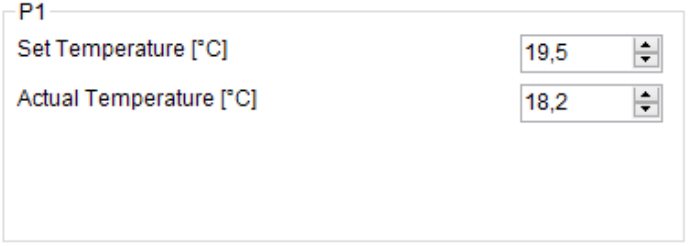
3.5.3. 1 Point Calibration

In this mode, a 1-point calibration can be made for the device. To do this, select under Mode **1 Point** (Calibration) and enter the **Actual Temperature** and the **Set Temperature**. An offset calculation takes place and is displayed.



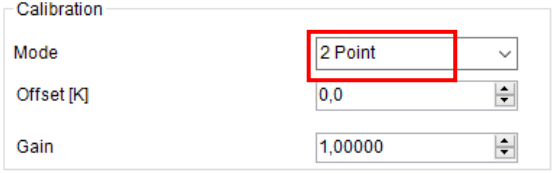


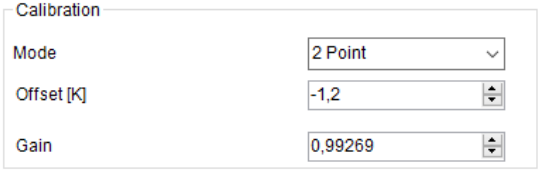


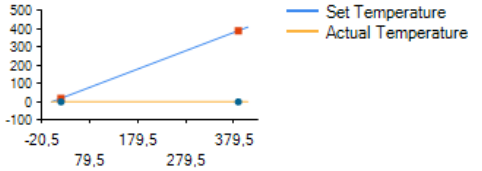


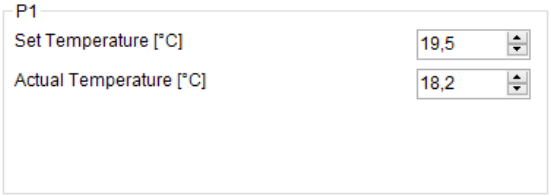
3.5.4. 2 Point Calibration

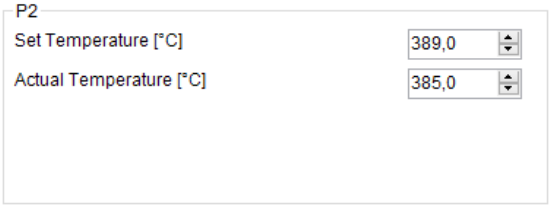
In this mode, a 2 point calibration can be made. To do this, select under Mode **2 Point** (Calibration) and enter the **Actual Temperature** and the **Set Temperature** for two different points. An offset and gain is then calculated.











3.5.5. USB Communication

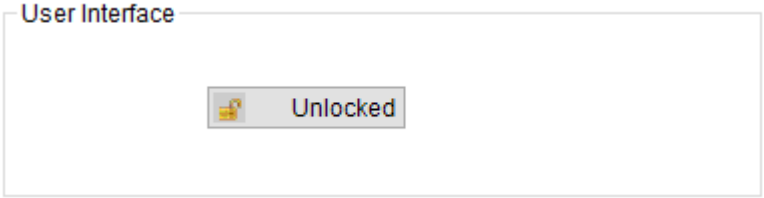
Under USB communication the baud rate of the sensor can be selected. You can choose between 115200 and 921600. With activation of the check sum

3.5.6. RS485-Multidrop address

In combination with a RS485 interface you can build a network of several CT sensors (max. 32 sensors).
For the digital communication each sensor must have its own address which you can enter in the input field Multidrop address. **► RS485/ RS422**

3.5.7. Locking the programming keys

With this function you can lock the programming keys on the CT electronics to avoid a non-authorized change of parameters on the unit. Pressing the button will set the unit into the **Locked** or **Unlocked** mode. In the locked mode all parameter and settings can be displayed on the unit by pressing the **Mode** button – a change of parameters with the **Up** or **Down** button is not possible.

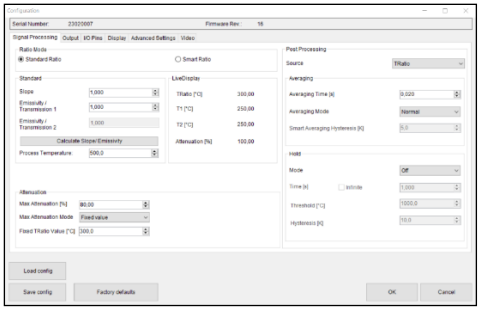


4. CSvision

4.1. Setup CSvision

The button **Setup** **[Menu: Device\ Device Setup]** opens a window for the setting of all sensor parameters. The dialog window is separated into 5 categories:

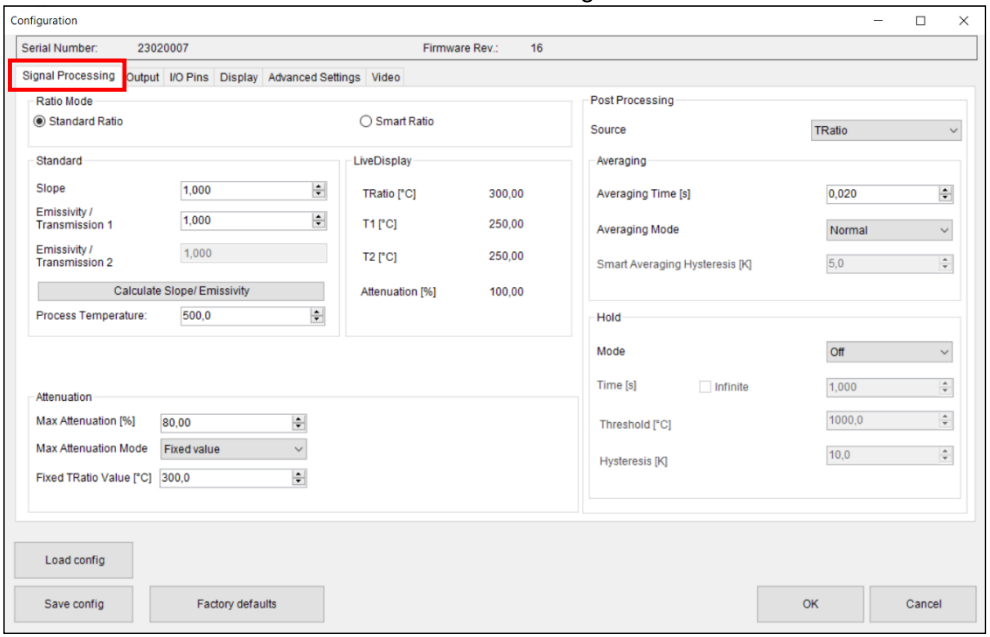
- Signal processing — Setting of Ratio Mode, Emissivity/ Slope, Max Attenuation and Post processing
- Output — Setting of Output 1 and Output 2
- I/O Pins — Setting the In- and Outputs
- Display — Display main value and Backlight/ Alarm setting
- Advanced settings — RS485/Modbus settings, Calibration
- Video — Setting of video signals



CSvision

4.2. Sensor Setup CSvision – Signal processing

In this category you can adjust the parameters **Emissivity, Slope, Attenuation** and select the functions and define the parameters for **Post processing**. Furthermore, the desired ratio mode can be selected here. The Standard Ratio mode is activated as default setting.



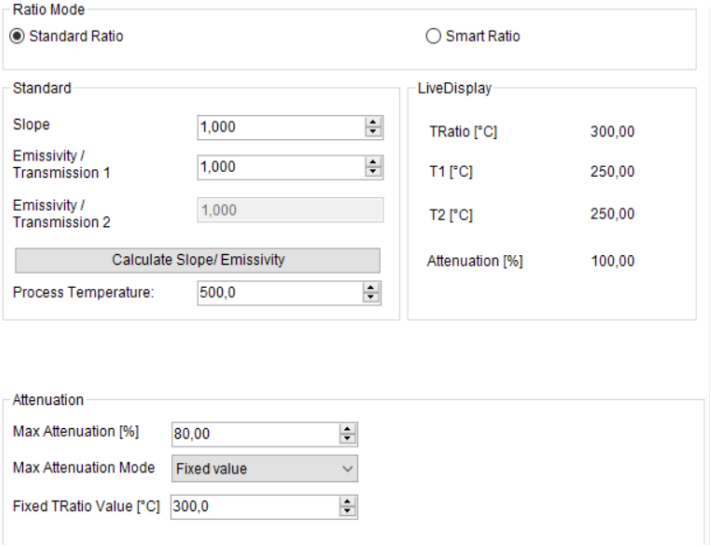
4.2.1. Ratio Mode - Standard Ratio

Emissivity/ Slope/ Attenuation

The **Slope** is the quotient of the emissivity's of both of the overlapping wavelengths and therewith the deciding parameter for measurements in 2-color-mode.

The **Emissivity** (**ε** – Epsilon) is a material constant factor to describe the ability of a body to emit infrared energy. The emissivity only affects measurements in the 1-color-mode.

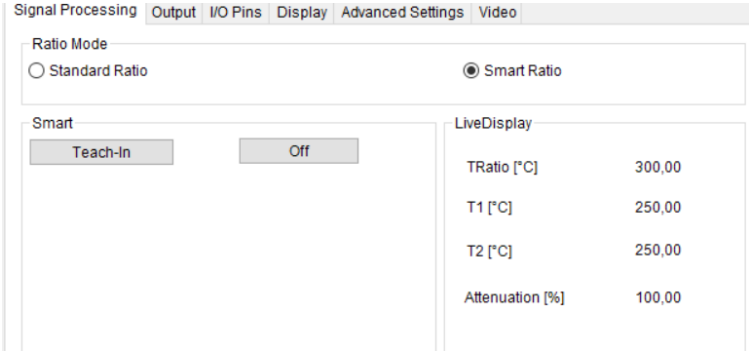
The function **Calculate Slope/Emissivity** allows the determination of an unknown emissivity and slope at a known process temperature.



Attenuation: The temperature display is fixed if the attenuation exceeds the limit specified here. You can decide whether the **last valid value** should be kept or a **fixed value** entered.

4.2.2. Ratio Mode - Smart Ratio

While the standard mode requires a constant emissivity ratio/slope, the **Smart Ratio** measurement allows a data set of different slopes to be recorded and applied for temperature calculation. This is required, for example, if the degree of contamination of the protective window changes during the process and the ratio temperature is no longer correct. This cannot be described with a constant slope.



A requirement for the measurement is that the object temperature must be known.

Note: Before the first use a data record must be recorded

In the **Teach-in** function, the data records are recorded.

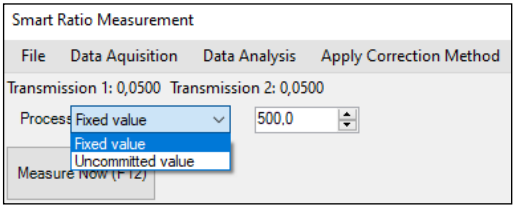
The Smart Ratio mode can be activated or deactivated with the **On/Off** buttons.

Teach-In

The process temperature must be known for the teach-in function. This temperature can be set using two variants:

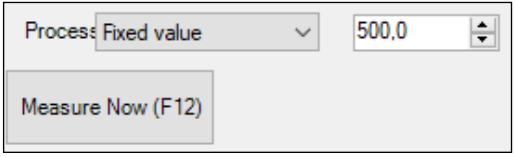
- **Variant 1:** Via a **fixed value**
  Here the known process temperature is entered manually.

- **Variant 2:** Via **Uncomitted value**
  The input is done via an analog signal, for example an external sensor.

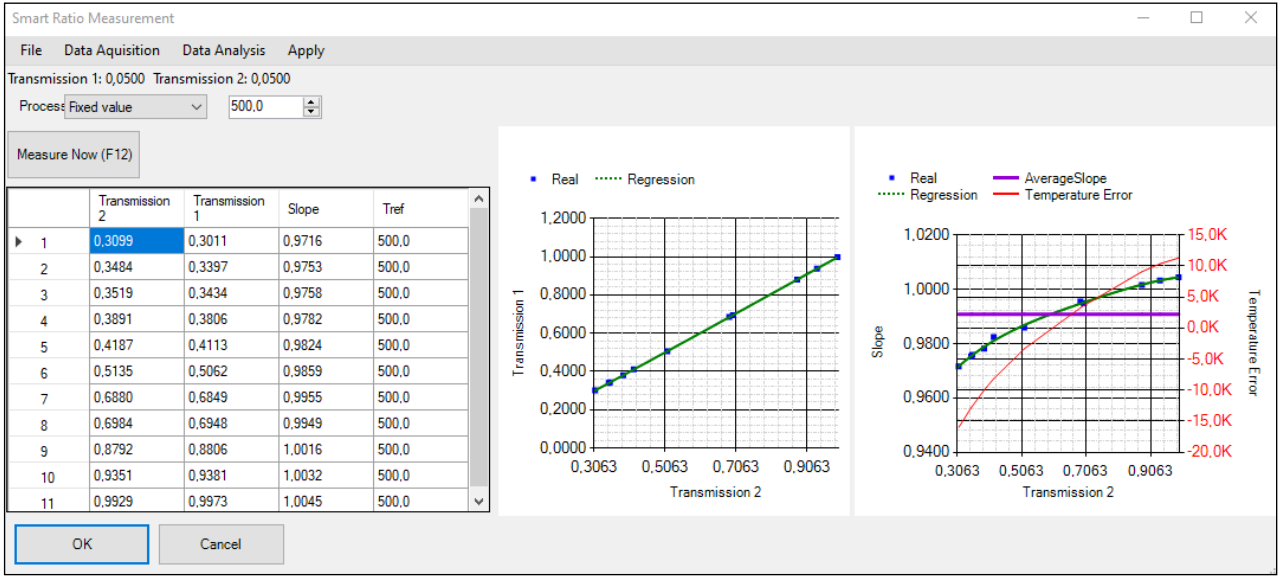


Procedure

Hold the dirty window in front of the sensor.
The **Measure Now button (F12)** can now be used to record measuring points. The current transmission and slope are entered into the table. Alternatively, the **F12** button can be pressed.



Note
When recording different measuring points, the current process temperature must always be taken into account. At least two measuring points with different degrees of contamination. Recommendation: The more measuring points the better

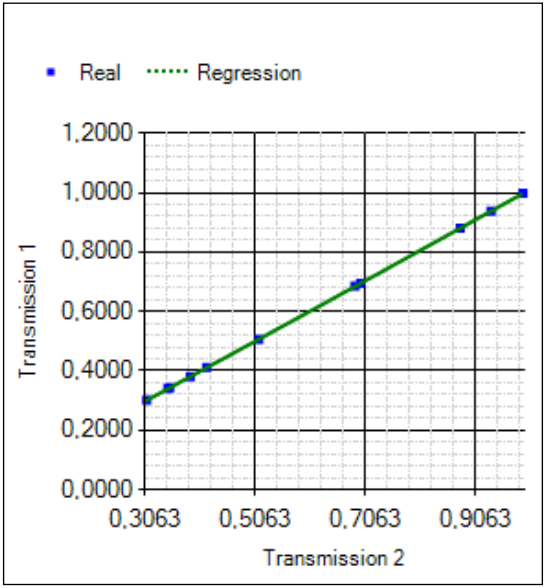


Smart Ratio Measurement: example with 11 measuring points

The middle figure in the **Smart Ratio Measurement** shows the transmission of diode 1 relative to the transmission of diode 2.

The blue points are the recorded measuring points.

Green curve: Regression curve (polynomial) for calculating the values between the measuring points.



Note

The Smart Ratio method can only work if there is a monotonically increasing function progression. If this is not the case, the Smart Ratio method cannot be used. If this is not the case, repeat the measurement and check the measurement for measurement errors.

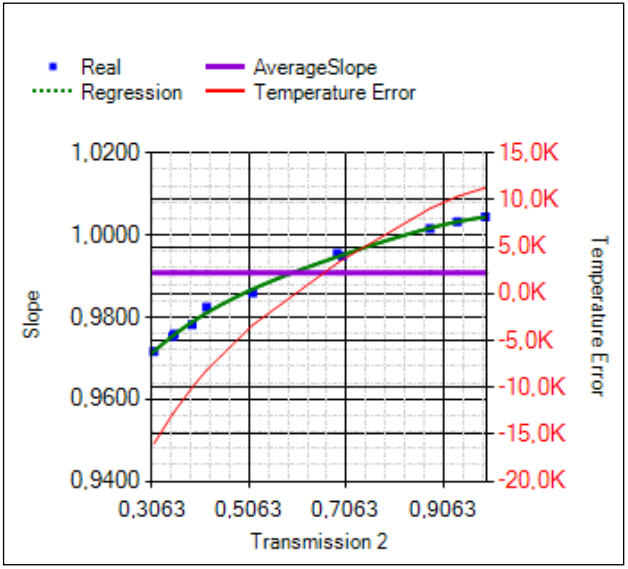
The right figure in the **Smart Ratio Measurement** shows the transmission ratio (slope) relative to the transmission of diode 2.

The blue points are the recorded measuring points.

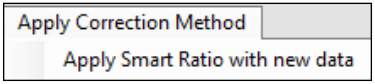
The violet horizontal line is the average slope calculated from the measured values.

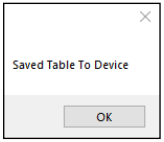
The red curve is an estimate of the quotient temperature error (in Kelvin) when using the average slope without the Smart Ratio method.

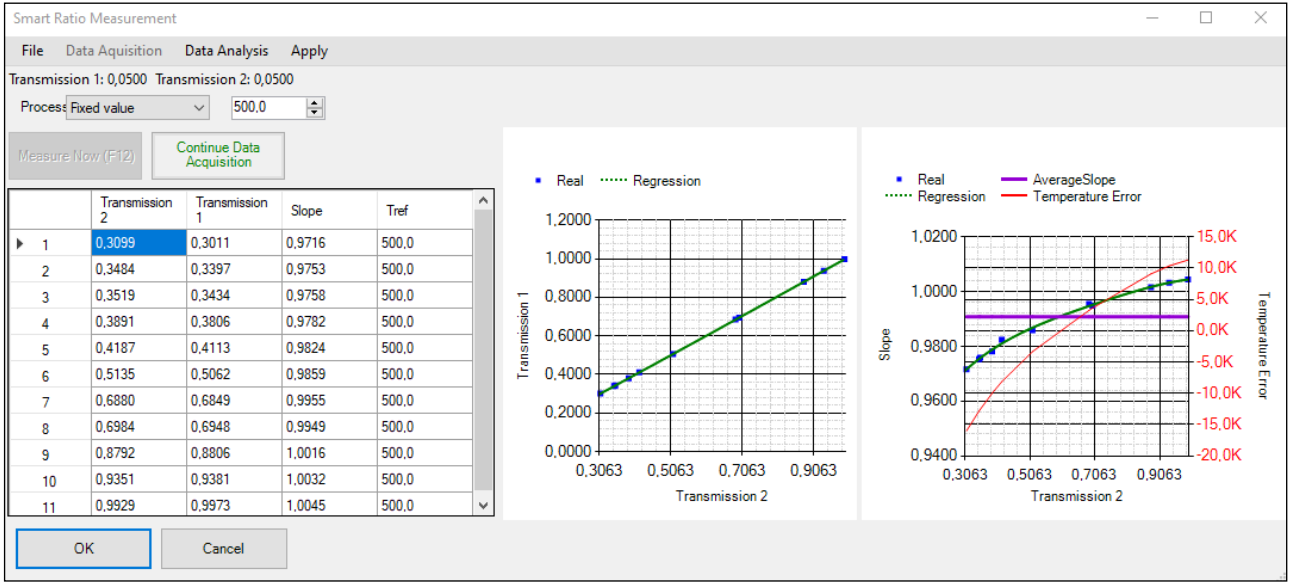
Green curve: Regression curve (polynomial) for calculating the values between the measurement points.



To write the created curves to the device, the **Apply Smart Ratio with new data** option must be selected in the menu under **Apply Correction Method**. The created regression curve is now written to the device. A message window appears indicating that the table is being saved to the device. The Smart Ratio mode is now automatically activated.

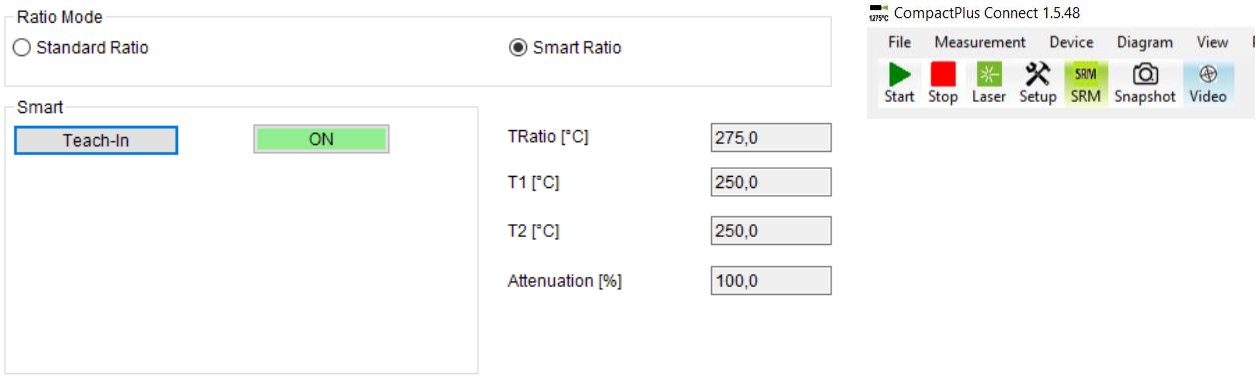






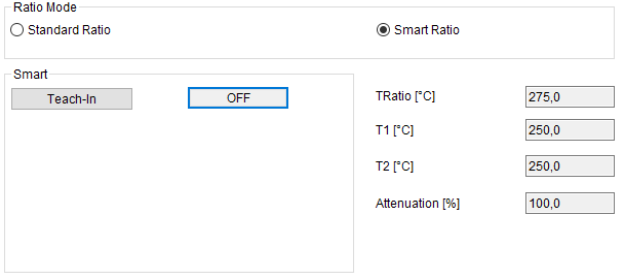
Smart ratio mode is now activated. Further data points can no longer be recorded in this mode. To add more data points, press the **Continue Data Acquisition** button (Smart Ratio mode is deactivated again).

After successful setting you can close the window with the **OK** button.



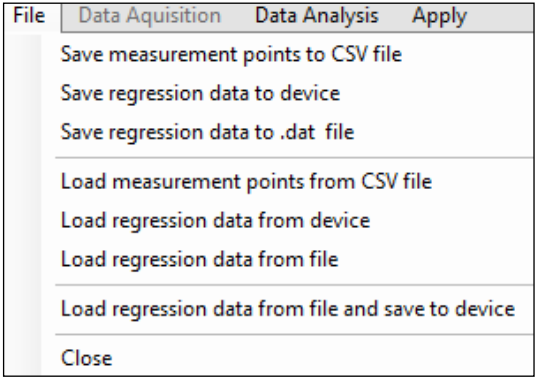
Activation of the Smart Ratio function is indicated by a green illuminated **ON** button. In addition, there is an icon called **SRM**, which is framed in green when activated.

To deactivate the Smart Ratio function, you can either click on the icon or on the green on button.



Further Settings

Further settings can be made in the menu under **File**.



Save measurement pionts to CSV file: The created data is stored on a hard disk.

Save regression data to device: The created data is stored on the device without activating or applying the Smart Ratio method.

Save regression data to .dat file: Here the data is stored on a hard disk for external data analysis.

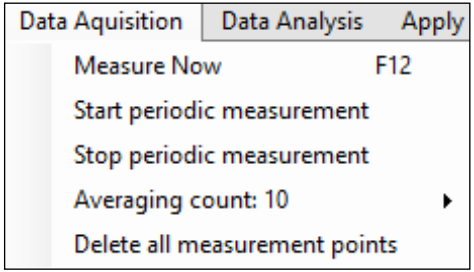
Load measurement points from CSV file: If data sets already exist, the values can be read in and loaded into the table.

Load regression data from device: To view the currently used regression curve.

Load regression data from file: The regression data is loaded from an existing file.

Load regression data from file and save to device: Here the regression data is loaded from an existing file and saved directly to the device.

The following settings can be made in the menu under **Data Acquisition**.



Measure Now: A single measuring point is created and written to the table.

Start periodic measurement: A predefined interval can be entered, in which the measuring points will be recorded automatically.

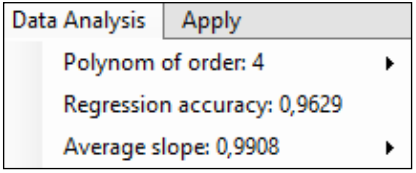
Stop periodic measurement: The recording of new measuring points is stopped.

Averaging count: Signal averaging during transmission measurement (response time is extended).

Delete all measurement points: All measuring points in the table are deleted (not from the device).

Note
To delete individual measuring points, you must mark them in the table and remove them with the delete key.

The following settings can be made in the menu under **Data Analysis**.

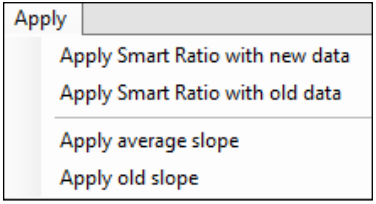


Polynom of order: The polynomial order is specified here. The factory setting is Auto and is determined automatically. Alternatively, it can be changed manually if required.

Regression accuracy: Characteristic value to evaluate the description of the measured values by the polynomial. Larger values are better. A value of 1 means perfect agreement. The regression accuracy is calculated automatically.

Average slope: The mean value of all slopes is calculated (violet straight line in the right diagram). The default setting is Auto. Alternatively it can be set manually. Allows to manually move the average slope (display optimization).

The following settings can be made in the menu under **Apply**.
Apply Smart Ratio with new data: The created regression curve is written to the device and the Smart Ratio mode is activated. A message window appears indicating that the table is being saved to the device.



Apply Smart Ratio with old data: Regression curve already stored in the device is retained and Smart Ratio mode is activated.

Apply average slope: Set average slope and activate standard ratio mode.

Apply old slope: Restore the slope value before opening the Smart Ratio configuration.

4.2.3. Post Processing

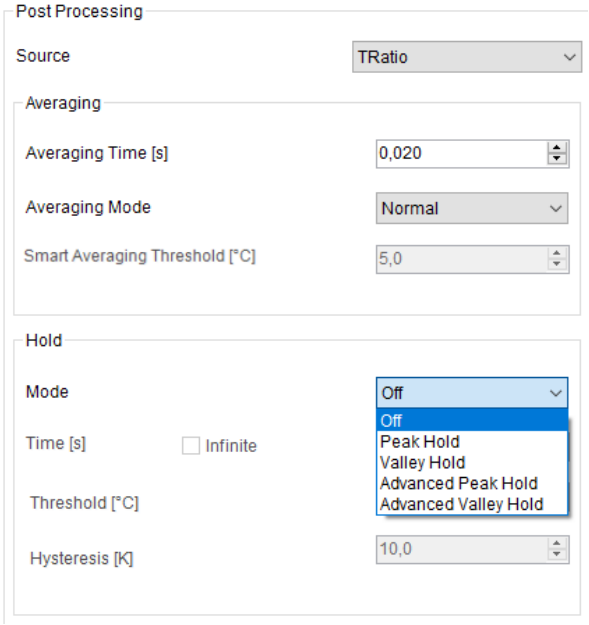
In the category **Post Processing** you can select the **Source** and make following settings:

- **Averaging** (Averaging time, average mode, smart threshold)
- **Hold** mode (Mode: Off, Peak Hold, Valley Hold, Advanced Peak Hold, Advanced Valley Hold)

You will find the description of the single functions on the next page.

Smart Averaging

If activated, a dynamic average adaptation at high signal edges is active. In addition you can enter the minimum temperature difference (**Smart Averaging Hysteresis**) to trigger this function.



Averaging

In this mode an arithmetic algorithm will be performed to smoothen the signal. The **Averaging Time** is the time constant. This function can be combined with all other post processing functions. The minimum adjustable average time is 0,001 s.

Peak hold

In this mode the sensor is waiting for descending signals. If the signal descends the algorithm maintains the previous signal peak for the specified **Hold time**.
The minimum adjustable hold time is 0,001 s.
After the hold time the signal will drop down to the second highest value or will descend by 1/8 of the difference between the previous peak and the minimum value during the hold time. This value will be held again for the specified time. After this the signal will drop down with slow time constant and will follow the current process temperature.
Therefore, if periodic events will be measured (bottles on a conveyor e.g.) this peak hold function avoids a drop down of the signal to the conveyor temperature in-between 2 events.

Valley hold

In this mode the sensor waits for ascending signals. If the signal ascends the algorithm maintains the previous signal valley for the specified **Hold time**. The definition of the algorithm is according to the peak hold algorithm (inverted).

Advanced Peak hold

In this mode the sensor waits for local peak values. Peak values which are lower than their predecessors will only be taken over if the temperature has fallen below the **Threshold** value beforehand. If **Hysteresis** is activated a

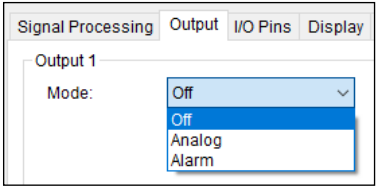
	peak in addition must decrease by the value of the hysteresis before the algorithm takes it as a new peak value.
Advanced Valley hold	This mode is the inverted function of Advanced Peak hold. The sensor waits for local minima. Minimum values which are higher than their predecessors will only be taken over if the temperature has exceeded the **Threshold** value beforehand. If **Hysteresis** is activated a minima in addition must increase by the value of the hysteresis before the algorithm takes it as a new minimum value.
Smart Averaging	If activated, a dynamic average adaptation at high signal edges is active.
Off	If **Off** is activated, no post processing will happen.

4.3. Sensor Setup CSvision – Output

4.3.1. Output 1 and 2

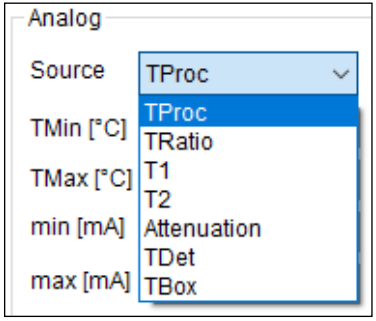
The device has two outputs (**OUT 1**, **OUT 2**) which can be configured as desired. The following options are available under **Mode**:

- Off
- Analog
- Alarm



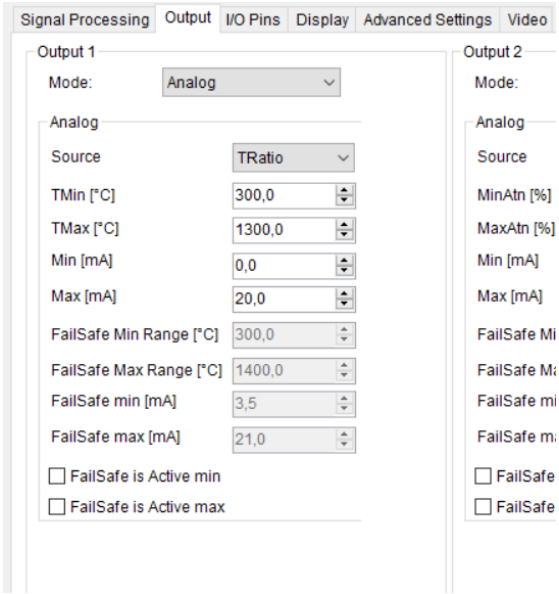
Bei Aktivierung von **Analog** stehen im Feld **Quelle** folgende Signalquellen zur Wahl:

- **TProc** Process temperature
- **TRatio** Ratio temperature
- **T1** 1 channel temperature
- **T2** 2 channel temperature
- **Attenuation** Signal attenuation in %
- **TDet** Temperature of detector
- **TBox** Sensor temperature

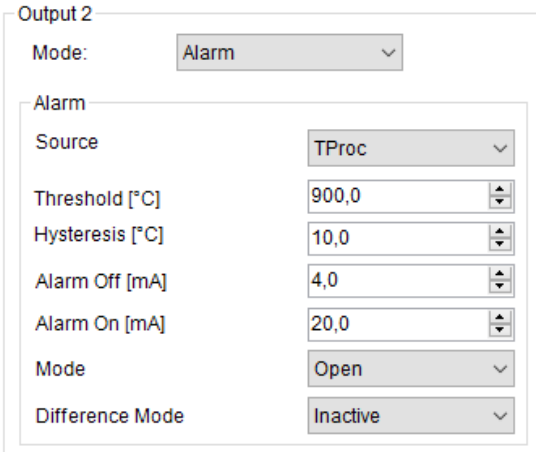


The desired temperature measuring range of the sensor can now be set. The range limits can be changed by entering them in the corresponding fields. The source can be selected between **T_{Proc}, T_{Ratio}, T1, T2, Attenuation, T_{Det}** or **T_{Box}**.

- **TMin:** lower temperature range limit
- **TMax:** upper temperature range limit
- **Min [mA]:** lower limit mA output
- **Max [mA]:** upper limit mA output



Alternatively, outputs 1 and 2 can be used as alarm outputs. To do this, select the Alarm setting.
As source you can choose between **T_{Proc}**, **T_{Ratio}**, **T1, T2, Attenuation, T_{Det}** or **T_{Box}**.
Under **Threshold** the threshold value for triggering the alarm is defined.
Hysteresis: Setting the minimum hysteresis
Alarm Off [mA]: Value if no alarm
Alarm On [mA]: Value on alarm
Selecting **Open/Closed** under **Mode** defines the output as High or Low alarm.

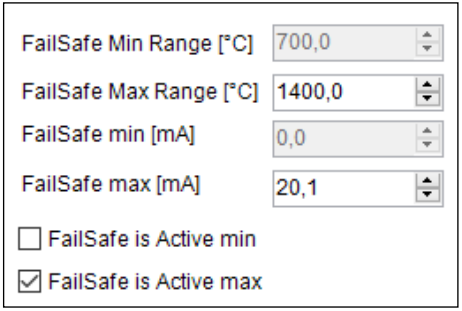


4.3.2. Failsafe

The pyrometer has a failsafe function that can be used in analog mode.

The range can be configured as desired. The settings for fail-safe operation allow a defined level to be output at the analog output depending on specified temperature limits.

Thus, a possible cable defect can be detected quickly.



4.4. Sensor Setup CSvision – I/O-Pin

The CSvision has one I/O pin which can be programmed as in- or output using the software. The following options are available:

Function	I/O pin acts as	Description
Alarm	output (digital)	Open collector output/ definition as HIGH- or LOW alarm via norm. open/ norm. close options in software dialog.
Valid Low	input (digital)	The output follows the process temperature as long as there is a Low level at the I/O pin. After discontinuation of the Low level the last value will be held.
Valid High	input (digital)	The output follows the process temperature as long as there is a High level at the I/O pin. After discontinuation of the High level the last value will be held.

Hold Low-High	input (digital)	The last value will be held if there is a signal with a rising edge on the I/O pin.
Hold High-Low	input (digital)	The last value will be held if there is a signal with a falling edge on the I/O pin
Hold Reset Low	input (digital)	Reset of a hold function on a Low level at the I/O pin
Hold Reset High	input (digital)	Reset of a hold function on a High level at the I/O pin
Slope external	input (analog)	External adjustment of the slope value using an analog voltage (0-10V)
Emissivity external	input (analog)	External adjustment of the emissivity value using an analog voltage (0-10V)
Uncommitted Value	input (analog)	Display of a freely scalable value
Laser on Low	input (digital)	Switch on laser (Low signal)
Laser on High	input (digital)	Switch on laser (High signal)

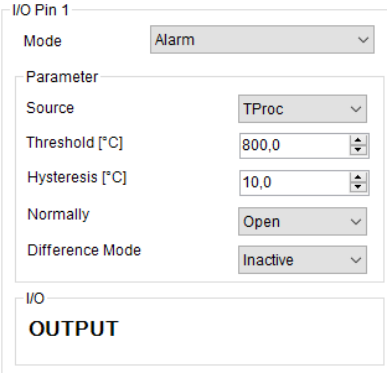
Low-/High-level: via software

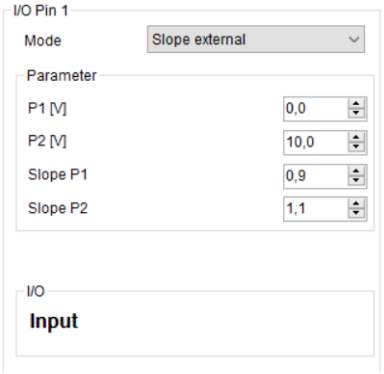
If you select the function **Alarm** the following signal sources can be selected:

- **TProcess** Process temperature
- **TRatio** Ratio temperature
- **T1** 1 channel temperature
- **T2** 2 channel temperature
- **Attenuation** Signal attenuation in %
- **TDet** Detector temperature
- **TBox** Sensor temperature

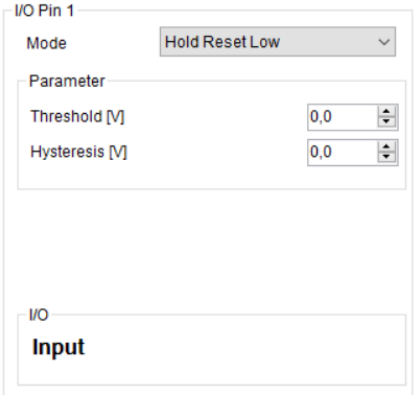
The definition as Low or High alarm can be done by switching between **Normally: open** and **Normally: closed**.

If you select the function **Slope external** or **Emissivity external** the I/O pin is set as analog input. The scaling can be done using the parameter fields **P1/P2** and **Slope P1/P2** / **Epsilon P1/P2**.





If you select the function **Hold Reset Low** or **Hold Reset High** the I/O-Pin is set as digital input. An activated hold function (MAX, MIN, advanced MAX, advanced MIN) will be reset if a low or high level is at the I/O pin.



4.5. Sensor Setup CSvision – Display

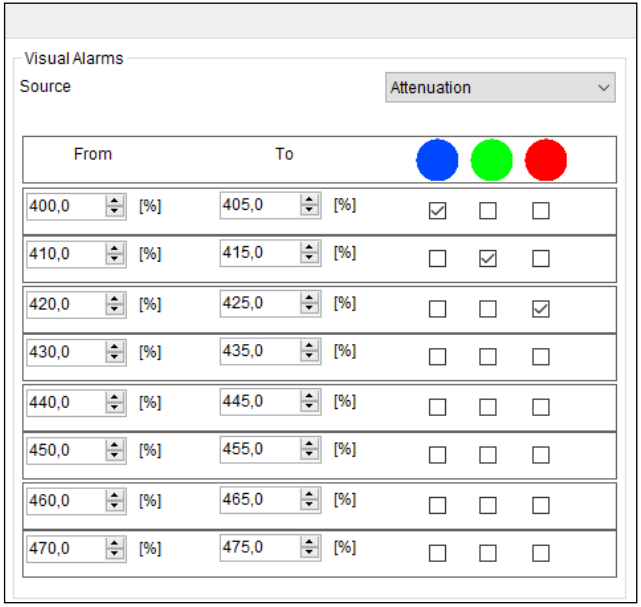
In this tab you can make settings for the **backlight LED** (=visual alarms).

4.5.1. Visual Alarms

Independent of the selected signal for the analog output, a signal from the following list can be selected under General/ Main display source, which is shown in the digital display of the electronics:

TProc	Process temperature
TRatio	Ratio temperature
T1	Temperature value 1-color-mode
T2	Temperature value 2-color-mode
Attenuation	Signal attenuation in %
TDet	Temperature of the detector
TBox	Temperature of the electronics

For the visual alarm areas up to eight alarm limits can be assigned to a signal. The selected signal can be selected under **Source** independent of the value shown in the display and independent of the analog output.



4.5.2. Temperature unit

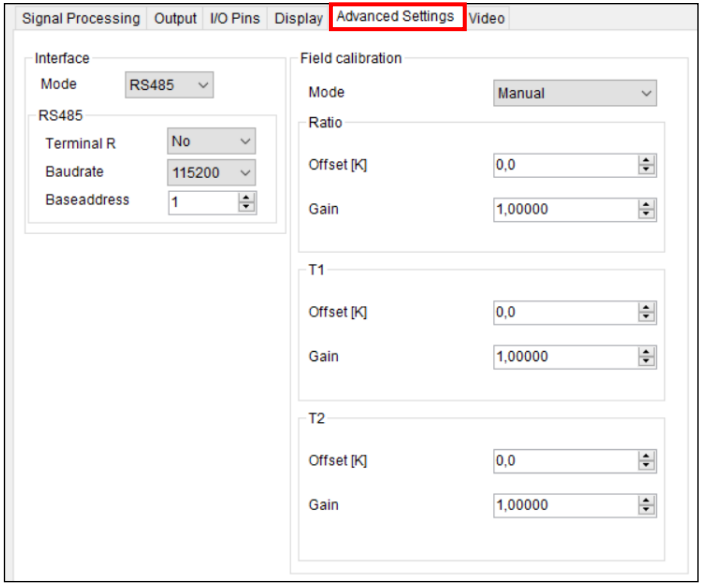
The temperature unit can be changed between °C and °F under **Preferences/ Options**.

4.6. Sensor Setup CSvision – Advanced Settings

In the category **Advanced Settings** the following parameter can be adjusted:

- **Interface**
  - RS485 – Terminal Resistor, Baudrate, Base Address
  - RS422 – Terminal Resistor, Baudrate
  - Modbus – Terminal Resistor, Baudrate, Bus address/Node ID

- **Field Calibration**
  - Manual
  - 1 Point
  - 2 Point



4.6.1. RS485 Base Address

In combination with a RS485 interface you can build a network of several CTratio sensors (max. 32 sensors). For the digital communication each sensor must have its own address which you can enter in the input field **Baseaddress**.

► **RS485/ RS422**

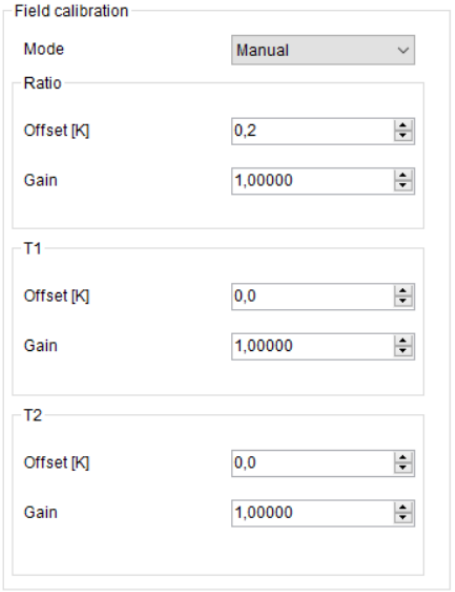
The Terminal resistor has to be set to **Yes** at the last unit in your network.

4.6.2. Field Calibration

In the **Advanced Settings** tab, three different modes can be selected to perform a calibration of the device:

- Manual
- 1 Point (Calibration)
- 2 Point (Calibration)

These amplification factors can be entered for the Ratio, T1 and T2 temperature.



Manual Calibration

For certain applications or under certain circumstances a temperature offset or a change of the gain for the temperature curve may be useful.

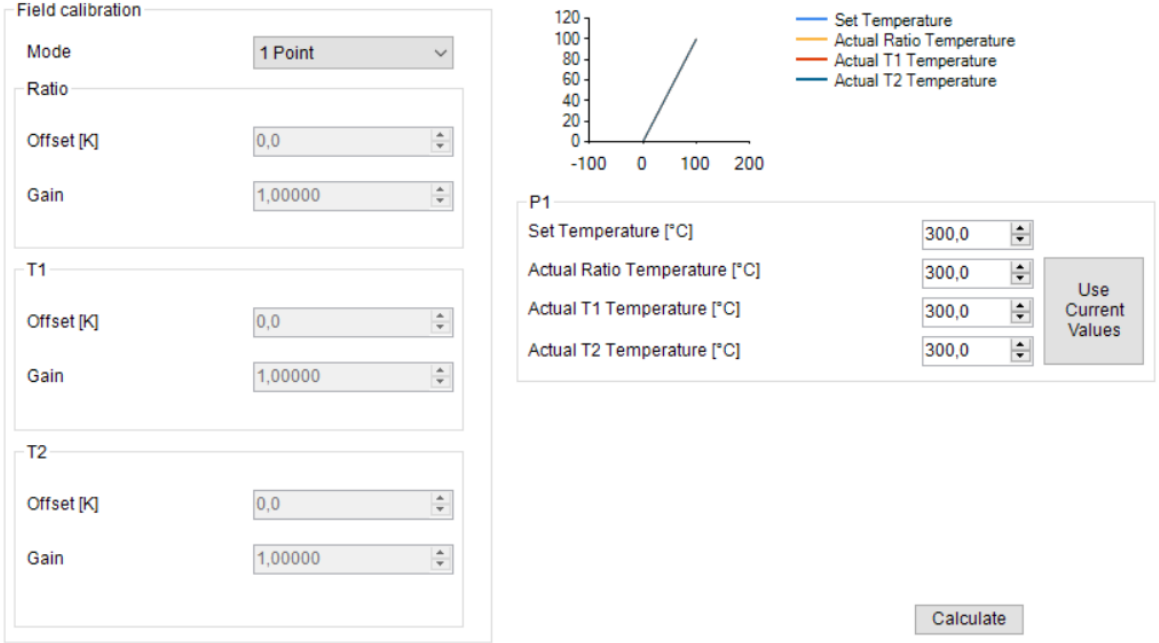
The **factory default settings** for Offset and Gain are:

- Offset: 0,0 K
- Gain: 1,000

A changed **Offset** causes a parallel shifting of the temperature curve and therewith it has a linear effect on the temperature reading (change constant independent on process temperature). A change of the **Gain** will have a non-linear effect on the temperature reading (change depends on process temperature).

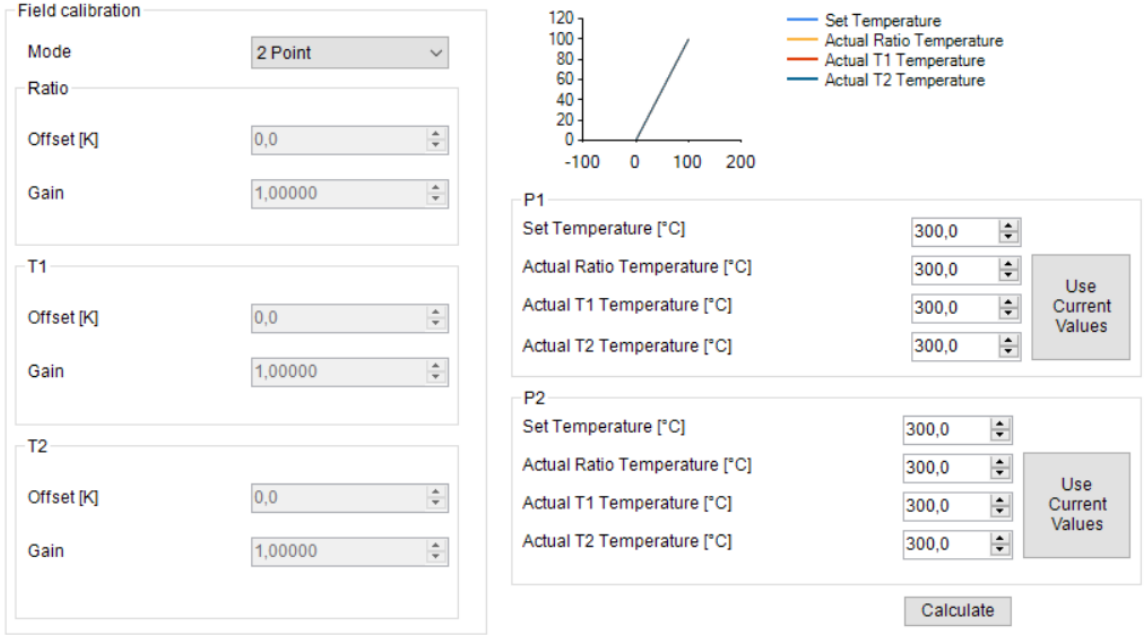
1 Point Calibration

In this mode, a 1-point calibration can be made for the device. To do this, select under Mode **1 Point** (Calibration) and enter the **actual temperature** and the **set temperature**. An offset calculation takes place and is displayed.



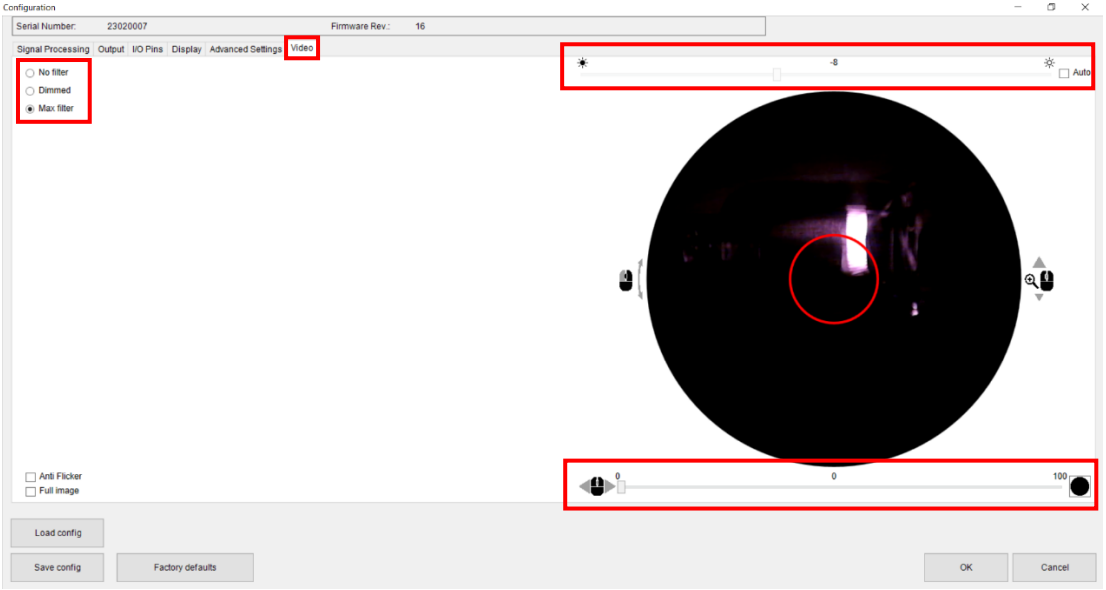
2 Point Calibration

In this mode, a 2-point calibration can be made. To do this, select under Mode **2 Point** (Calibration) and enter the **actual temperature** and the **set temperature** for two different points. An offset and gain is then calculated.



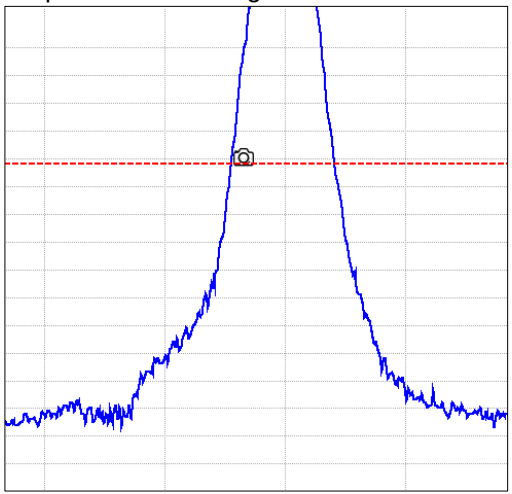
4.6.3. Videosignal

The CSvision has an integrated visual camera with a built-in two-step brightness reduction filter. For very overexposed objects, the filter can be switched in two steps. It also has digital exposure of the signal and can be adjusted in the brightness bar.
Additionally, the image can be zoomed in or out with the mouse wheel. If your pyrometer is not perpendicular to your target, the image can be rotated by drag and drop with the left mouse button.
If your image display is blurred, you can focus the image using the focus bar below the image.



4.6.4. Automatic Snapshots

You can have temperature-triggered snapshots of the video signal created automatically. To do this, go to **Measurement/ Automatic snapshots** and set the check mark under **Enable snapshot trigger**. Now you can make the settings for triggered snapshots. In addition, you can have the trigger threshold shown in the diagram.
If a trigger event has happened and a triggered photo has been taken, an icon of a camera is shown in the temperature-time diagram.

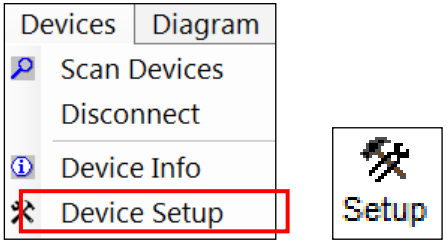


Further settings can be made under **Preferences/ Video snapshot Setup.** The description of the snapshot with information on the date, time, serial number of the sensor and other measuring point information can be made, and the file storage location for the snapshots can be changed.

5. Special Feature

5.1. Saving the Sensor Configuration

In each window which you enter with the button **Setup** **[Menu: Device\ Device Setup]** you will find at the bottom edge the following buttons for saving of the sensor configuration:

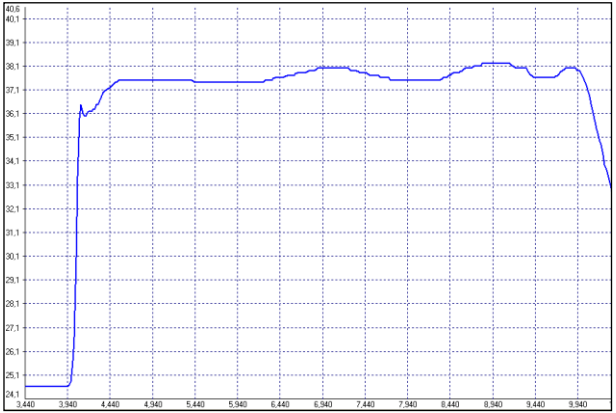


Save Config	With this button you can save the current configuration of the connected sensor in a file (ending: *.cfg). An explorer window will be opened and enables definition of filename and destination.
Load Config	A previous saved configuration can be opened and stored into the connected sensor.
Factory default	This button enables the user to reset the unit to the factory default values. It also can be reset by pressing at first the **Down** button and then the **Mode** button (keep both pressed for approx. 3 seconds).

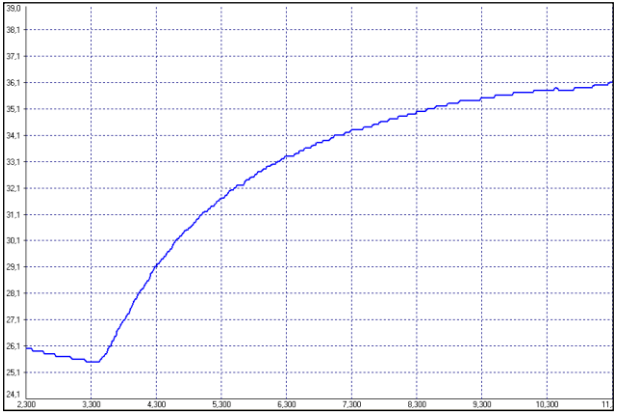
After pressing **OK** all changes and settings will apply.

5.2. Smart Averaging

The average function is generally used to smoothen the output signal. With the adjustable parameter time this function can be optimal adjusted to the respective application. One disadvantage of the average function is that fast temperature peaks which are caused by dynamic events are subjected to the same averaging time. Therefore those peaks can only be seen with a delay on the signal output.
The function **Smart Averaging** eliminates this disadvantage by passing those fast events without averaging directly through to the signal output.



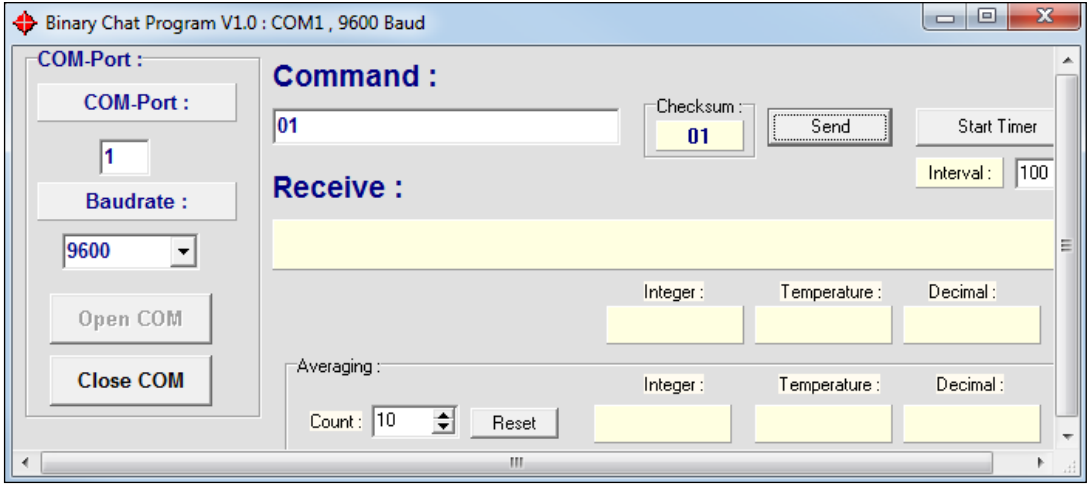
Signal graph with Smart Averaging function



Signal graph without Smart Averaging function

5.3. Binary Chat Program

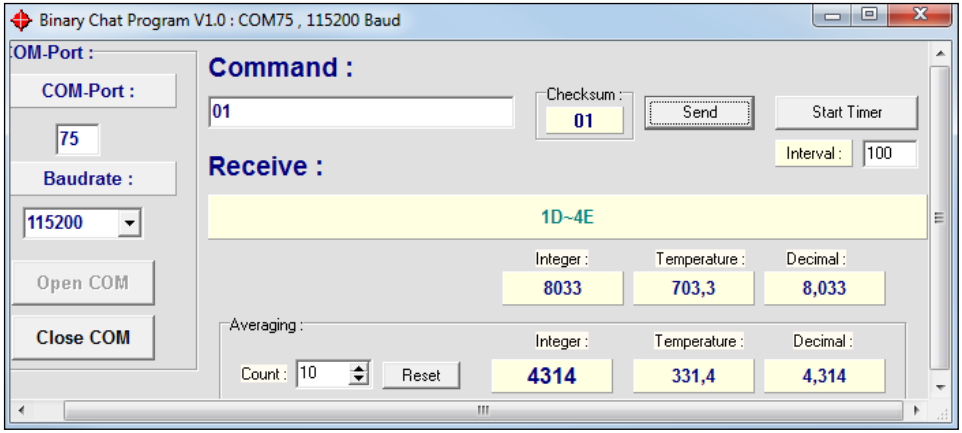
In the download package you will find an additional program for a simple check of the digital communication of the connected sensor. Please copy the application (BinaryChat.exe) out of the folder **\Binary Chat Program** on your desktop or into any desired folder on your hard disc drive of your PC. After starting the program the following window will appear:



Please select at first the COM port of the connected sensor (you will find this information in the status line of your CompactPlus Connect or in the device manager of your PC).
Please enter the **Baudrate** your sensor is working with.
Now you can open the COM port by pressing the button **Open COM**.

Note
Before you open the COM port please close the CompactPlus Connect software as this application may access the same sensor/ COM port.
Please make sure that the sensor is set to **bidirectional digital communication**.

Now you can enter a binary command as hexadecimal value out of the according command list of the connected sensor. After pressing **Send** the answer will be shown in the line **Receive** (also as HEX value). Below the receive line you will find the **Integer** decimal value of the answer as well as the calculated **Temperature** or the **Decimal** value which is calculated by dividing the answer by 1000. This calculation is used for the emissivity value e.g.



Example 1: CTratio/ Polling of the process temperature

Example 1 shows the polling of the process temperature from a CTratio. This is done according to the command list (Folder: Commands):

1 Basic Functions

DECIMAL	HEX	Command	Data	Answer	Result	Unit
1	0x01	READ Temp. - Process	none	byte1 byte2	= (byte1*256 + byte2 - 1000) / 10	°C
2	0x02	READ Temp. - Det	none	byte1 byte2	= (byte1*256 + byte2 - 1000) / 10	°C
3	0x03	READ Temp. - Box	none	byte1 byte2	= (byte1*256 + byte2 - 1000) / 10	°C
10	0x0A	READ Temp. - Ratio	none	byte1 byte2	= (byte1*256 + byte2 - 1000) / 10	°C
11	0x0B	READ Temp. – T2	none	byte1 byte2	= (byte1*256 + byte2 - 1000) / 10	°C
12	0x0C	READ Temp. – T1	none	byte1 byte2	= (byte1*256 + byte2 - 1000) / 10	°C
13	0x0D	READ Temp. - Attenuation	none	byte1 byte2	= (byte1*256 + byte2 - 1000) / 10	%

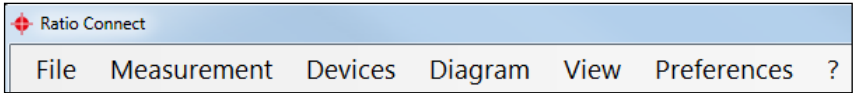
5.3.1. Additional Features

Under **Averaging** you can calculate the average value out of a defined number of values **Count**.

If you press the button **Start Timer** you can activate a repeated polling of values (useful for process temperature e.g.). The polling **Interval** can be set (in ms).
Please use only times >50 ms, as otherwise you may receive wrong data.

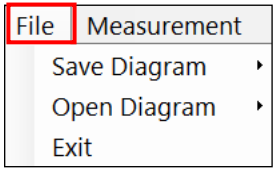
6. Menu Overview

Using the menu you can adjust all software settings. Each feature will be explained in detail in the following chapters of this manual:



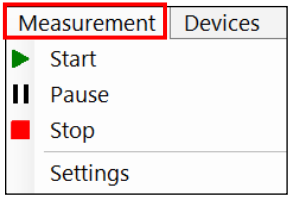
6.1. Menu: File

Save Diagram	To save temperature files
Open Diagram	To open saved temperature files (*.dat)
Exit	To exit the program



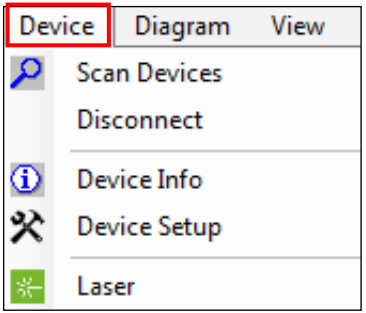
6.2. Menu: Measurement

Start	To start the measurement
Pause	To freeze the continuous diagram actualization
Stop	To stop the measurement
Settings	Opens the window: **Measurement Settings**
Configure Burst String	In the burst mode the sensor works in a unidirectional communication mode – the sensor is sending data continuously.



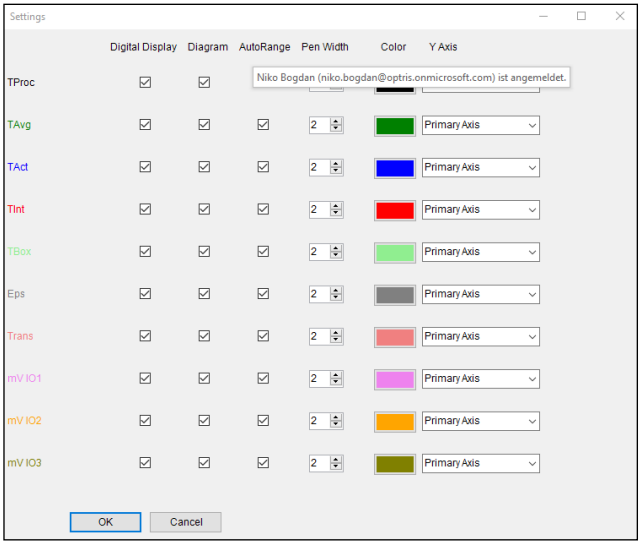
6.3. Menu: Device

Scan Devices	Scans for connected sensors (if Auto scan is deactivated)
Disconnect	The connection will be determined and the COM port will be closed.
Device Info	Shows information about the connected unit (firmware revision etc.).
Device Setup...	Opens the window: Device setup
Loop Maintenance	Verification of the analog output channels
Laser	To switch On and Off the Laser

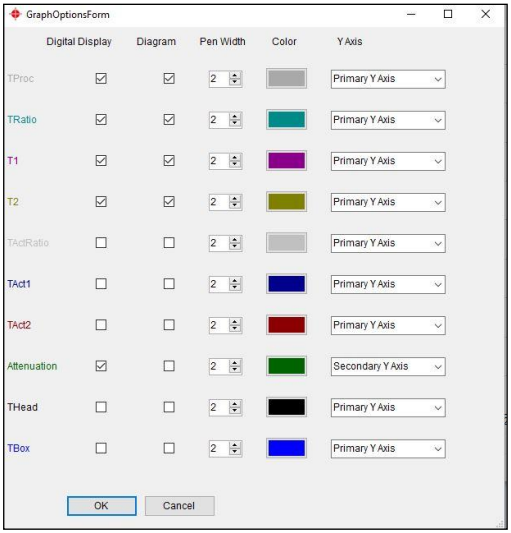


6.4. Menu: Diagram

Settings Opens the window: **Diagram settings** to select digital displays, temperature graphs, pen width and color of graphs



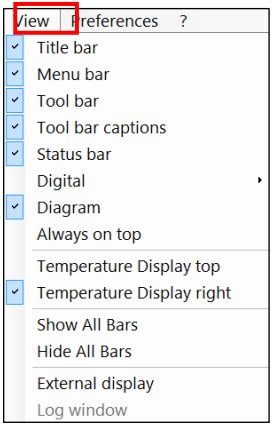
CT 4M



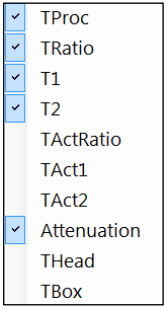
CTratio

6.5. Menu: View

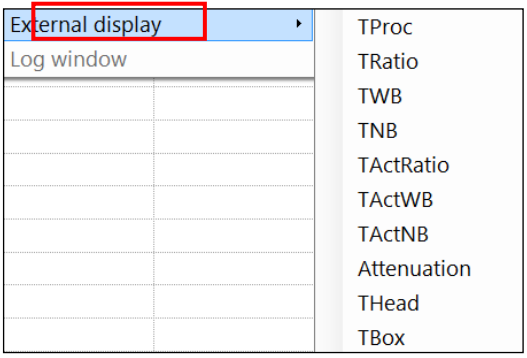
Title bar	To show or hide the title bar of the software window
Menu bar	To show or hide the menu bar of the software window
Tool bar	To show or hide the tool bar
Tool bar captions	To show or hide the captions of the tool bar
Status bar	To show or hide the status bar



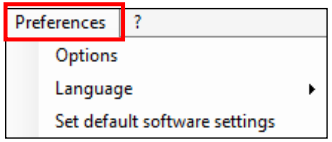
Digital	Selection of all available values which can be shown as a digital display
Diagram	To show or hide the temperature diagram



Always on top	If activated, the software screen will always visible on top (independent on other active applications)
Enable Video	To switch on and off the video display
Video snapshot	To make a snapshot
Temp. displays top	The digital display group will be located on the top right corner of the software screen
Temp. display right	The digital display group will be located on the right side of the software window
Show all bars	All bars will be shown (title-, menu-, tool- and status-bar)
Hide all bars	All bars will be hidden (title-, menu-, tool- and status-bar)
External Display	To open an **external display**
Log window	Display of logged software events

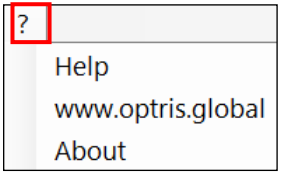


6.6. Menu: Preferences



Options	Opens the window: **Options** to make basic settings and define options for data saving
Language	To select the desired language
Set default software settings	The software will be reset to the factory default settings (The sensor settings are not affected by this)

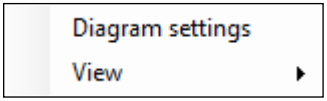
6.7. Menu: Help



Help...	To open the help file
www.optris.global	Opens the Optris homepage in your web browser
About...	To show the software version installed on your computer

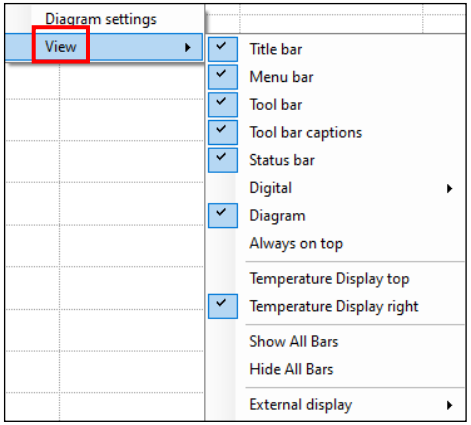
6.8. Context Menu (right mouse button)

Settings	Opens the window: **Diagram settings** to select digital displays, temperature graphs, pen width and color of graphs
View	Linking to the sub menu **View**



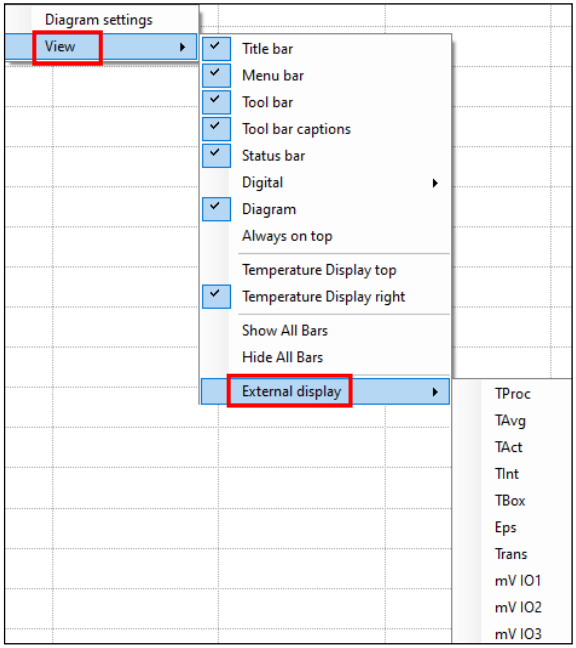
6.9. Context Menu [Sub menu: View]

Title bar	Shows or hides the title bar
Menu bar	Shows or hides the menu bar
Tool bar	Shows or hides the tool bar
Tool bar captions	Shows or hides the tool bar captions
Status bar	Shows or hides the status bar
Diagram	Shows or hides the diagram
Temperature Display top	Places the digital displays on top of the diagram
Temperature Display right	Places the digital displays right of the diagram
Show all bars	Shows all bars at once
Hide all bars	Hides all bars at once
External display	Linking to the sub menu **External display**
Log window	Display of logged software events



6.10. Context-Menu [Sub menu: External Display]

In this menu you can call separate digital displays for the different signals. These displays will also be shown if the application runs in the invisible mode. The displays are always on top of the PC screen.



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