

# Pyrometer CellaTemp **PA 40 AF 90**

Mat. No.: 106 7394 10/2018



Copyright prohibits the reproduction or distribution of this instruction manual, including text, photographs or images contained herein, in whole or in part, for any purpose whatsoever, without prior consent of the author. This applies to any form of mechanical or electronic reproduction as well as to electronic transmission in any form through any medium.

**Please note:**

Unless otherwise stated in this instruction manual, the instruments described herein are subject to change without prior notice, particularly modifications for the sake of technological advancement.

© 2010 KELLER HCW GmbH  
Carl-Keller-Straße 2 - 10  
D-49479 Ibbenbüren  
Germany  
[www.keller.de/its/](http://www.keller.de/its/)

# Contents

<b>1</b>	<b>Miscellaneous .....</b>	<b>1</b>
1.1	Information about this manual.....	1
1.2	Explanation of symbols .....	1
1.3	Liability and Warranty.....	1
1.4	Copyright .....	2
<b>2</b>	<b>Safety .....</b>	<b>2</b>
2.1	Intended use.....	2
2.2	User's responsibility .....	3
2.3	Safety requirements .....	3
2.4	Electromagnetic Compatibility .....	3
2.5	Quality Management Certification .....	3
2.6	Environmental Management.....	3
<b>3</b>	<b>General Description.....</b>	<b>4</b>
3.1	Integrated Digital Display.....	4
<b>4</b>	<b>Getting Started .....</b>	<b>5</b>
4.1	General installation tips .....	5
4.2	PA Connector Pin Assignment.....	6
4.3	Power Requirement 24 V DC .....	7
4.4	Current Outputs 0/4 - 20mA .....	7
4.5	Switching output .....	8
4.6	Setting the Emissivity Ratio (two-colour/ratio mode).....	9
4.7	Setting Emissivity (Spectral mode).....	9
4.8	Output current range .....	10
4.9	Simulated current signal for functional testing .....	10
4.10	Temperature offset using linear interpolation.....	10
4.11	Signal Smoothing Filter .....	11
4.12	Min/Max Data .....	12
4.13	Mixed-mode function.....	13
4.14	I/O Configuration .....	14
4.15	Digital inputs.....	19
4.16	Analogue input for emissivity correction or ambient temperature compensation (spectral mode) .....	19
4.17	Analogue input to control emissivity ratio (two-colour/ratio mode) .....	20
4.18	General functions (configuration layer $\square \square \uparrow \downarrow$ ).....	20
4.19	Simulate current signals for analogue output Ao1 and Ao2 (configuration layer: $\square \square \uparrow \downarrow$ ) .....	20
<b>5</b>	<b>Internal signal processing .....</b>	<b>21</b>
<b>6</b>	<b>Setting parameters at the pyrometer (basic configuration).....</b>	<b>22</b>
6.1	Configuration layers .....	23
<b>7</b>	<b>CellaView software .....</b>	<b>29</b>
<b>8</b>	<b>Installation of the USB driver.....</b>	<b>29</b>
<b>9</b>	<b>How to operate the pyrometer with the CellaView software.....</b>	<b>31</b>
9.1	CellaView via USB point-to-point connection .....	31
9.2	CellaView via RS485 point-to-point connection .....	31
9.3	CellaView via RS485 bus connection.....	33
9.4	Termination of RS485 bus .....	35
<b>10</b>	<b>Operation of the pyrometer via terminal program .....</b>	<b>36</b>
10.1	Serial Data Transmission of Temperature Data.....	36
10.2	Terminal connection via USB.....	38
10.3	Terminal connection via RS485 .....	38
<b>11</b>	<b>User-defined calibration / scaling of the current output/ Mixed Mode function .....</b>	<b>40</b>
11.1	Calibration/scaling via CellaView.....	41
11.2	Calibration/scaling via terminal connection .....	41

11.3	Mixed Mode function via terminal connection .....	42
<b>12</b>	<b>Shielding and Grounding .....</b>	<b>44</b>
12.1	Potential equalisation .....	44
<b>13</b>	<b>Connectivity Examples .....</b>	<b>46</b>
13.1	Connection to VK 02/A Cable.....	46
<b>14</b>	<b>Theory of Non-Contact Temperature Measurements .....</b>	<b>47</b>
14.1	Advantages of Non-Contact Temperature Measurement .....	47
14.2	Measurements at Black Bodies (Cavity Radiators).....	47
14.3	Measurements of Real Radiators.....	48
14.4	Emissivity Coefficient Table PA (Spectral mode).....	49
<b>15</b>	<b>Maintenance .....</b>	<b>50</b>
15.1	Cleaning the pyrometer lens .....	50
<b>16</b>	<b>Technical Data.....</b>	<b>51</b>
16.1	Field of View Diagram PA 40 AF 90.....	52
<b>17</b>	<b>Dimensions.....</b>	<b>53</b>
<b>18</b>	<b>Accessories.....</b>	<b>53</b>
18.1	Polarising filter.....	54
18.2	Cable VK 02/A.....	55
<b>19</b>	<b>Glossary.....</b>	<b>56</b>
<b>20</b>	<b>Shipping, Packaging and Disposal .....</b>	<b>57</b>
20.1	Inspecting your shipment .....	57
20.2	Packaging.....	57
20.3	Disposal of used apparatus.....	57
<b>21</b>	<b>Copyright .....</b>	<b>58</b>
<b>22</b>	<b>Default settings .....</b>	<b>59</b>
22.1	Temperature measurement using two-colour/ratio mode (Configuration layer: c 00 i).....	59
22.2	Temperature measurement using spectral mode (Lambda 1 configuration layer: c 002).....	60
22.3	Configuration Mix-Mode (layer c 004).....	61
22.4	Configuration I/O (configuration layer: C010).....	61
22.5	General Functions (configuration layer: c 0 i i).....	62

# 1 Miscellaneous

## 1.1 Information about this manual

The purpose of the Operating Manual is to provide the user with all necessary information to be able to install the pyrometer and any necessary accessories.

Before starting installation, be sure to read and understand this entire manual, in particular the chapter on safety! The instructions contained in this manual, especially those concerning safety, as well as site-specific regulations governing UV radiation must be complied with at all times!

## 1.2 Explanation of symbols

Important safety-related references in this manual are marked with a symbol.



### CAUTION!

This symbol indicates important information which, if neglected, might result in pyrometer damage, malfunction or breakdown.



### NOTE !

This symbol points out guidelines which should be followed for efficient and trouble-free operation.

## 1.3 Liability and Warranty

All information compiled in this manual is in accordance with applicable regulations. The statements made are based on state-of-the-art technology and reflect our extensive knowledge and many years of experience.



### NOTE !

*Always carefully read this Operating Manual before beginning any work on or with the instrument, especially prior to installation and initial setup! The Manufacturer shall not be held liable for any damages or malfunctions arising from a disregard of the warnings and instructions contained herein.*

This Operating Manual must be retained for future use. Please ensure that all persons who wish to operate the instrument have access to this manual.

## 1.4 Copyright

This Operating Manual should be treated as confidential. It is solely intended for use by persons involved with the instrument. This manual may not be made available to a third party without prior Manufacturer's consent. Please contact the Manufacturer if the need should arise.



### NOTE !

*The data, texts, charts, drawings, images or other representations contained in this manual are copyright-protected and furthermore, subject to intellectual property rights. Violators will be prosecuted. Unauthorised use and copyright infringement will be subject to penalty by law.*

Reproductions of any kind, in whole or in part, as well as the exploitation or disclosure of this manual's content without the explicit written approval of the Manufacturer are expressly prohibited by law. Violations shall be subject to compensation claims by the Manufacturer. The right to claim additional indemnities remains reserved.

## 2 Safety

This chapter outlines all important safety aspects to be considered for optimum employee protection and to ensure safe and reliable operations.

### 2.1 Intended use

The pyrometer is solely intended for non-contact measurement of temperatures as described in this manual. Any other use is not intended. Operational safety can only be ensured when the instrument is used for its intended purpose.



### CAUTION !

**It is prohibited to use the pyrometer for any other purpose beyond what is specified in this manual. Using the instrument in any other manner will be considered as improper.**

The manufacturer is only liable for damage that occurs during correct use. The prerequisite for any liability, however, is that the cause of the damage is due to a defective product and the defect in the product was caused by the manufacturer.

## 2.2 User's responsibility

The pyrometer may only be used when it is in perfect working condition.

## 2.3 Safety requirements

The instrument works with an operating voltage of 24 VDC. The voltage required for operation must be supplied by a separate power supply. This power supply unit must conform to directive DIN IEC 61010.

## 2.4 Electromagnetic Compatibility

The devices comply with the essential safety requirements of the Electromagnetic Compatibility Directive 2014/30/EU (EMC Act).

When connecting a power supply unit, make sure that it also conforms to these standards. Radio interference may arise if the pyrometer is interconnected with such peripheral devices which have not been properly interference-suppressed. This may necessitate additional interference suppression measures.

## 2.5 Quality Management Certification

The KELLER HCW Quality Management System meets the DIN EN ISO 9001 standards for design, production, repairs and service for non-contact infrared temperature measuring equipment.



## 2.6 Environmental Management

Sustainable environmental management is more important than ever. KELLER HCW's corporate environmental management system complies with DIN EN 14001/50001 standards.



### 3 General Description

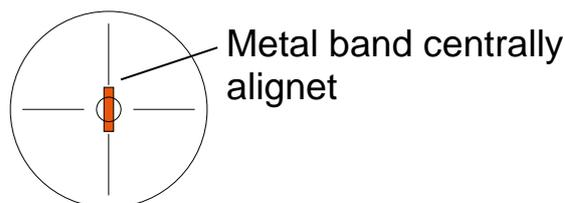
The CellaTemp PA 40 AF 90 is specially designed for non-contact temperature measurement of strip lamps.

The combination of two measuring methods provides a temperature span of 500 – 2400 °C.

The pyrometer works in spectral mode at the beginning of the span. Thus it can evaluate even small radiation intensities (starting at 500 °C). In the upper part of the span the pyrometer works in two-colour mode, therefore it is relatively unaffected by the strip lamp's emissivity or by partial illumination.

Between 680 °C and 700 °C a mixed-mode function switches from spectral to two-colour mode and vice versa, thus ensuring a continuous measurement. The display shows a continuous temperature span from 500 °C to 2400 °C.

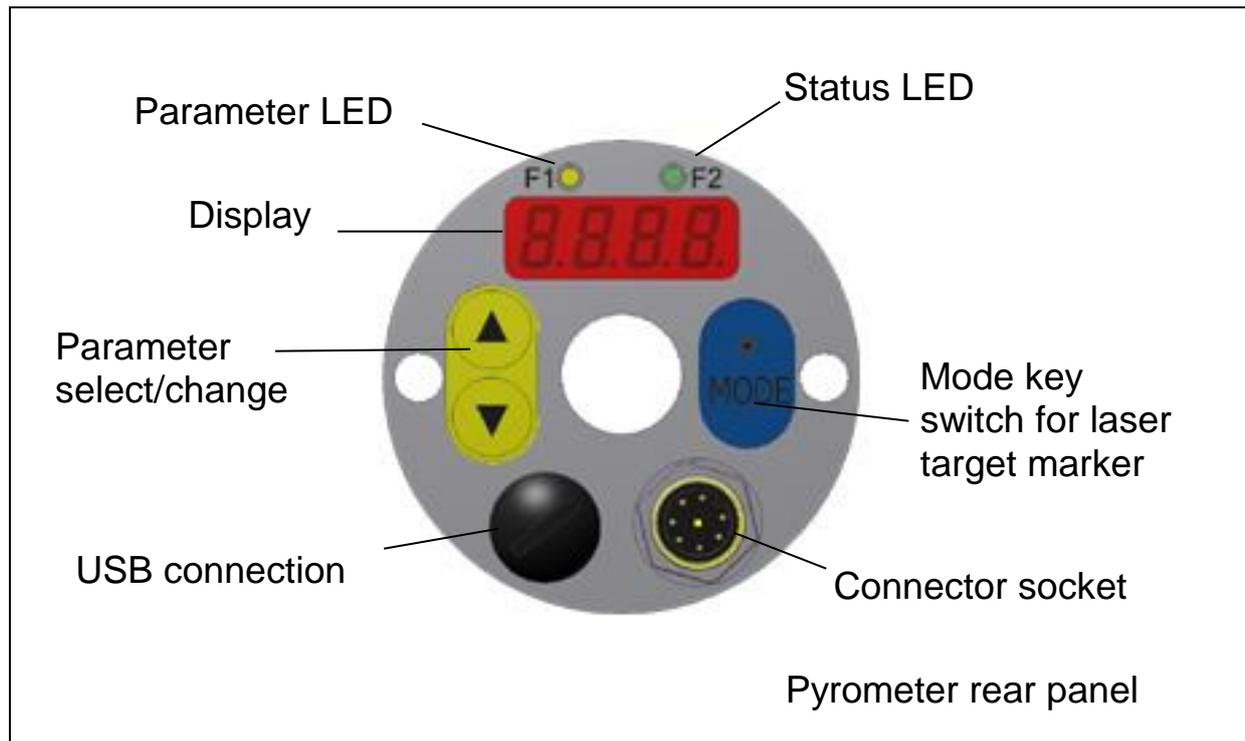
The quality of the temperature readings particularly depends on an exact alignment of the pyrometer to the metal strip and on the emissivity correction of spectral channel 1. The pyrometer is equipped with a through-the-lens-sighting feature with target marker to facilitate this alignment. Ideal conditions are given by heating up the metal strip to 1000 °C (red hot) as shown below:



#### 3.1 Integrated Digital Display

The rear panel of the CellaTemp PA has a 4-digit display and 3 push-buttons. The display shows the current temperature or, during configuration using the push-buttons, the display will show the corresponding parameter.

Whenever the display shows a parameter, the F1 Parameter LED (yellow) will light up. The function of the F2 Status LED (green) is user-configurable. In its initial state when supplied to the customer the F2 LED indicates current status for the switch able output Do1 as ready for operation.



## 4 Getting Started

### 4.1 General installation tips

Install the pyrometer in a location where it will not be unnecessarily exposed to smoke, ambient heat or water vapour.

A false reading (too low) will be displayed when the pyrometer lens is dirty. Therefore always ensure that the lens is clean.

The pyrometer's optical path must remain unobstructed. Any interference or obstacle may lead to measurement errors.

## 4.2 PA Connector Pin Assignment



### CAUTION!

*The pyrometer housing is connected to the signal ground via a 0.1µ F/50V capacitor. Isolate any unused wires in order to avoid the display of erroneous data.*

### 4.3 Power Requirement 24 V DC

The instrument works with an operating voltage of 24 V DC. The voltage required for operation must be supplied by a separate power supply. This power supply unit must conform to directive DIN IEC 61010.

The supply voltage is  $\leq 135$  mA for standard design,  $\leq 150$  mA for models with laser sighting and  $\leq 175$  mA for models with camera. CellaTemp PA is equipped with inverse polarity protection. The output currents and voltages share one ground connection via pin 8 of the connector.

A self-test is performed when the instrument is switched on. The display will briefly indicate the software version and after that the emissivity setting. When the self-test is completed the pyrometer is ready for operation and the display will show the current temperature reading.



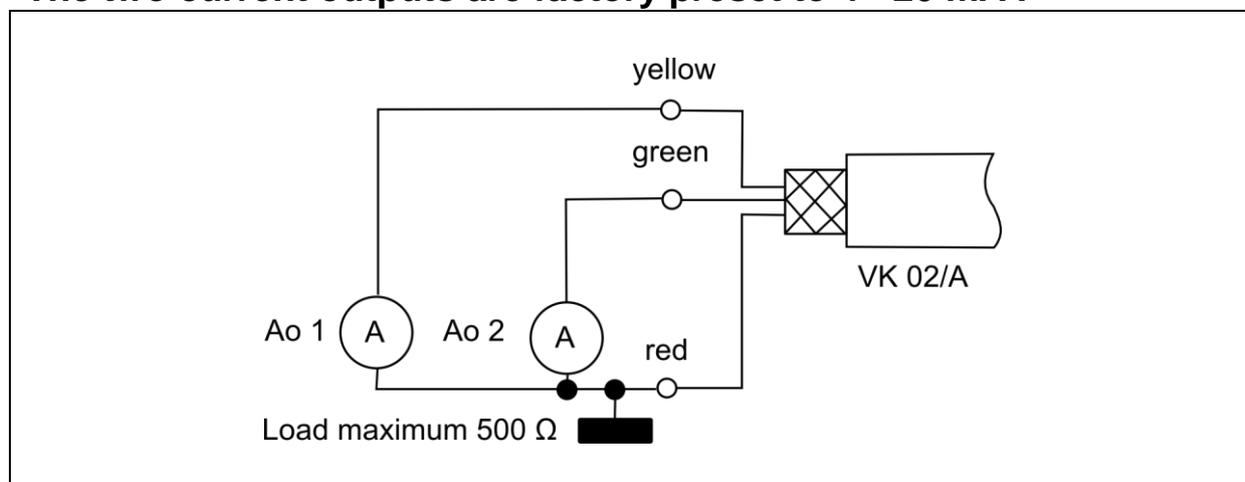
#### NOTE !

In order to achieve a high degree of measurement accuracy and repeatability it is important to allow the pyrometer time to warm up. Turn the power supply on about 10 minutes, with camera 20 min before starting. We recommend that you protect the feed line to the pyrometer against short circuit by using a 250 mA micro-fuse.

### 4.4 Current Outputs 0/4 - 20mA

CellaTemp PA features two current outputs. Both of these outputs are active current sources which supply linear output current. The user can select between two scales: either 0 - 20 mA or 4 - 20 mA. Maximum load is 500  $\Omega$ .

**The two current outputs are factory preset to 4 - 20 mA !**

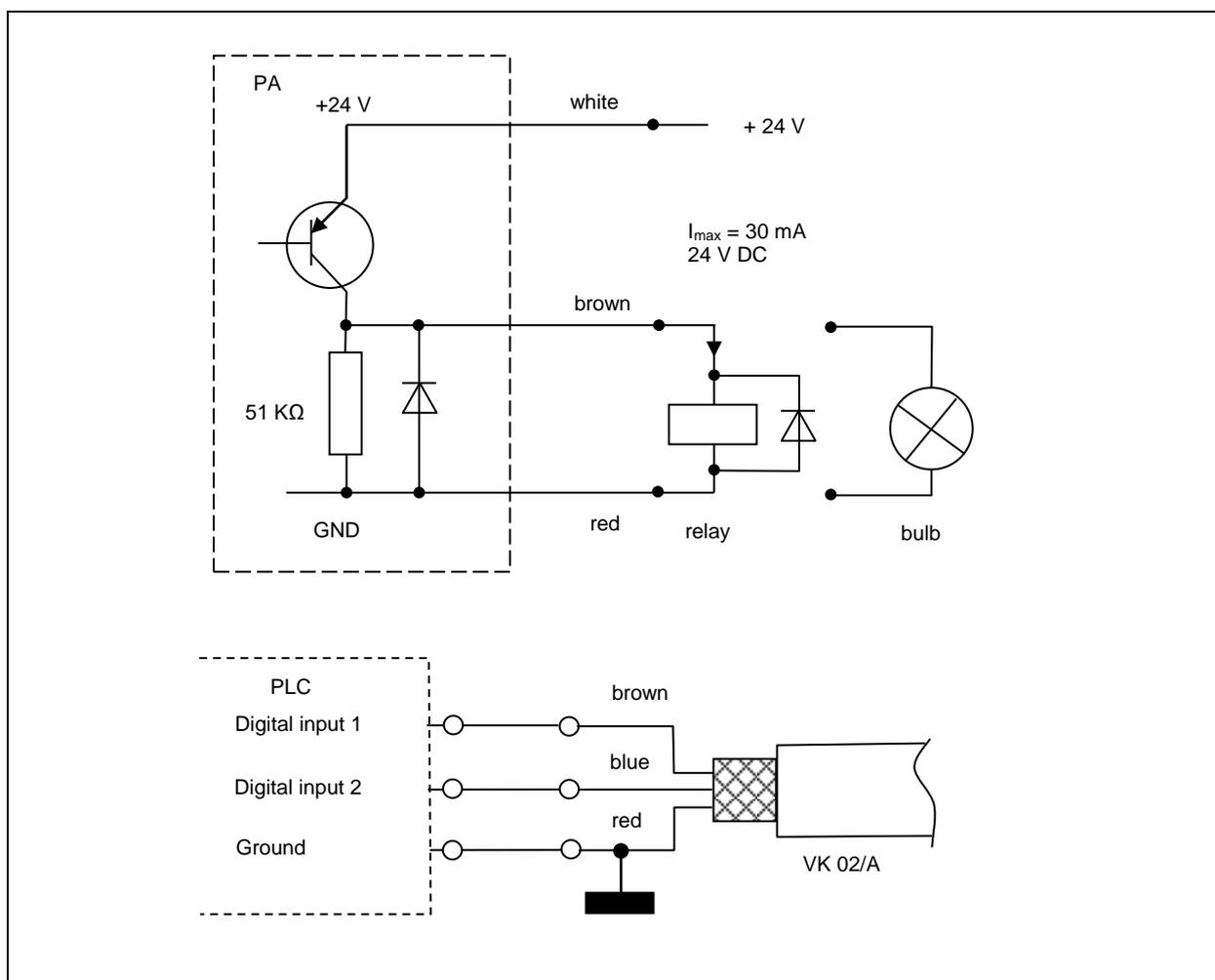


For all pyrometers of the PA Series the current outputs are short-circuit-proof and share one ground connection via pin 8 of the connector. Each current output can be individually scaled and can be set either at the display or via interface.

When only one current output is required, Output 1 should be selected (Pin 4)

### 4.5 Switching output

All pyrometers of the PA Series feature two switching outputs which can be configured as digital outputs or digital inputs. The open collector outputs allow for a voltage of +24 V DC. The maximum current of each open collector output is 30 mA.



#### 4.6 Setting the Emissivity Ratio (two-colour/ratio mode)

When the radiation properties of the target object's surface (emissivity) differ at two different wavelengths, or when interferences in the field of view—such as dust or steam—do not weaken the signal to the same degree at each wavelength, the pyrometer can be adjusted by setting the ratio of these two emissivity coefficients.



#### NOTE !

During normal operating mode, the emissivity ratio can be set at the pyrometer using the ▲▼ buttons. When simultaneously pressing the MODE key, the display shows the current measuring temperature while the emissivity ratio coefficient continues to be adjusted in the background. This is an easy way to determine the emissivity ratio when the object temperature is known. The modified values are directly adopted.



#### CAUTION!

**Once you have configured the emissivity ratio parameter, the pyrometer will maintain this specific setting. The pyrometer will always operate with this value unless you change the setting.**

#### 4.7 Setting Emissivity (Spectral mode)

A pyrometer measures temperature by detecting the radiant energy emitted from an object's surface in the form of electromagnetic waves. The temperature reading not only depends on the intensity of the object's thermal radiation (how hot the object is), but also on the material's particular surface characteristics and thus its specific ability to emit thermal energy. This is called emissivity. To obtain an accurate temperature reading, it is imperative that the pyrometer be adjusted for this emissivity prior to measurement.

Set the emissivity correction at configuration layer  $\epsilon 002 / \epsilon 003$ . See the Emissivity Coefficient Table in Chapter 14.4 to select the proper emissivity factor for your application. We recommend that you first perform a comparison temperature measurement with another device to determine the correct emissivity factor for the task.

#### 4.8 Output current range

For the pyrometer's two analogue current outputs, select the current loop scale – (0 - 20 or 4 – 20 mA)—which matches that of the downstream signal processing equipment (PLC, display device, controller, etc.). At the pyrometer and at the controller, set the upper and lower limits of the temperature range and the current loop output signal. Access this setting using configuration layer  $\llcorner 0 10$  .

#### 4.9 Simulated current signal for functional testing

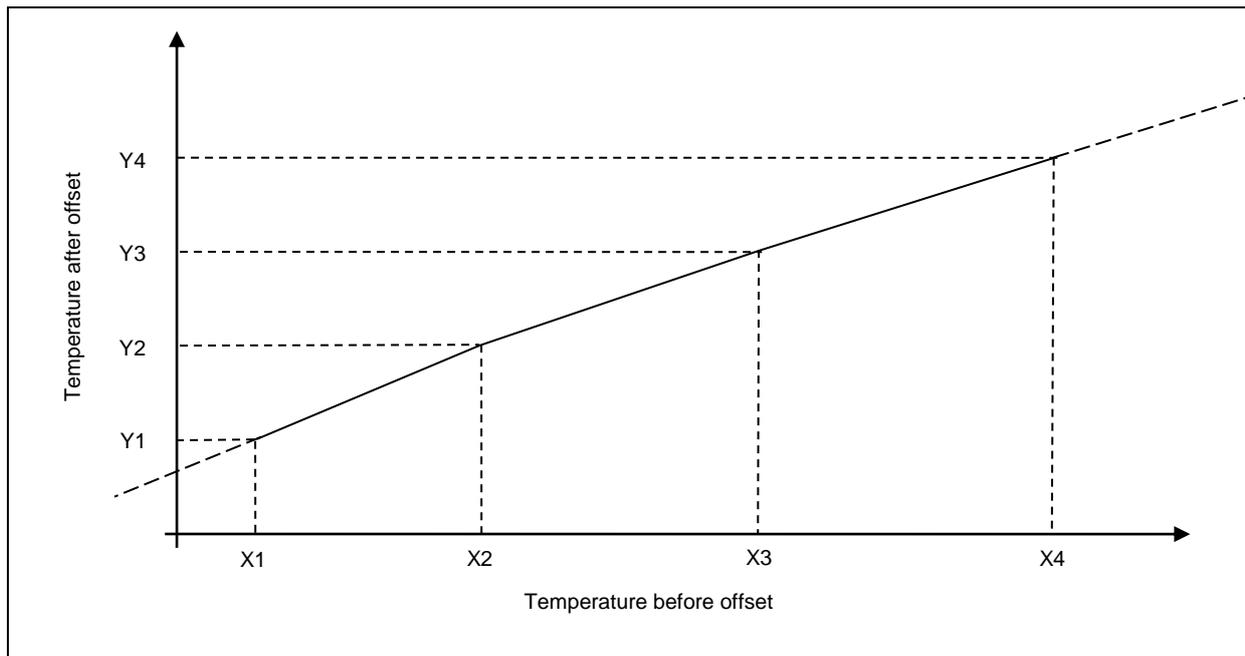
After initial installation, you should perform a function test to verify that temperature data is correctly transmitted to the controller. To do so, use the push-buttons on the pyrometer rear panel to simulate a temperature reading, which is applied as an output current signal scaled to the selected current range. The appropriate parameter can be accessed via configuration layer  $\llcorner 100$  .

If the pyrometer is set up correctly, the downstream controller should indicate the values you have entered (only within the scaled range). If there is a discrepancy, please check the current range scale or the cable connection.

When you have completed the function test, exit by pressing "E 5  $\llcorner$  " and return to normal operating mode.

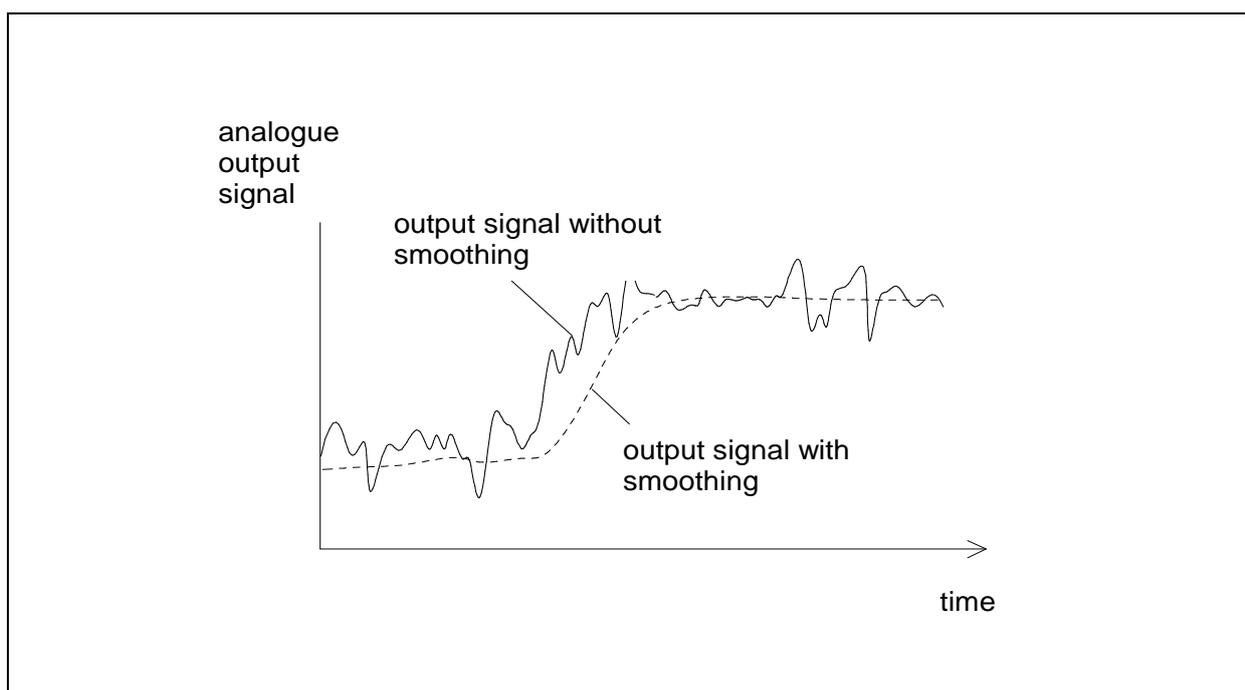
#### 4.10 Temperature offset using linear interpolation

When necessary, CellaTemp PA allows you to program an offset for the indicated temperature reading. The offset correction can be configured individually with a minimum of 2 and a maximum of 10 interpolating points (X/Y nodes). This information is stored in a user-defined temperature-indexed lookup table and used for signal conditioning. For values lower than the 1st node and higher than the last node, the first and last linear segments are extrapolated. Enter the nodes in ascending order. Use the rear panel display to access this function via  $\llcorner 00 1 / \llcorner 10.9$  .



#### 4.11 Signal Smoothing Filter

When the target object's temperature is erratic, it makes sense to smooth these temperature fluctuations in order to stabilize the signal. The greater the time constant  $t_{98}$ , (user definable), the lower the effect of these fluctuations on the yielded temperature reading. The pyrometer's response time is proportional to the time constant. Set for example signal smoothing via parameter  $\epsilon 00 \text{ : / F } .L.S$  for two quotient temperature.



## 4.12 Min/Max Data

CellaTemp PA features data memory to store minimum and maximum (peak) temperature readings. This feature can be configured in one of the following modes:

- Memory off
- Store minimum value (single)
- Store maximum value (single)
- Store double max. value for cyclical processes
- Double peak picker combined

Select and activate a min/max memory modes for ratio /dual wavelength measurement (quotient), Lambda 1 (L1) or Lambda 2 (L2) and configure as described below. The calculated value can be shown on the rear panel display and/or transmitted to the current output for further processing.

### ***Min/Max Memory***

In this mode—also called peak picker—the pyrometer determines the highest or lowest temperature reading and keep the temperature reading. As an option, one of the switching inputs can be configured to reset the min/max memory and to define the smoothing filter setting.

### ***Double Maximum Memory with hold time***

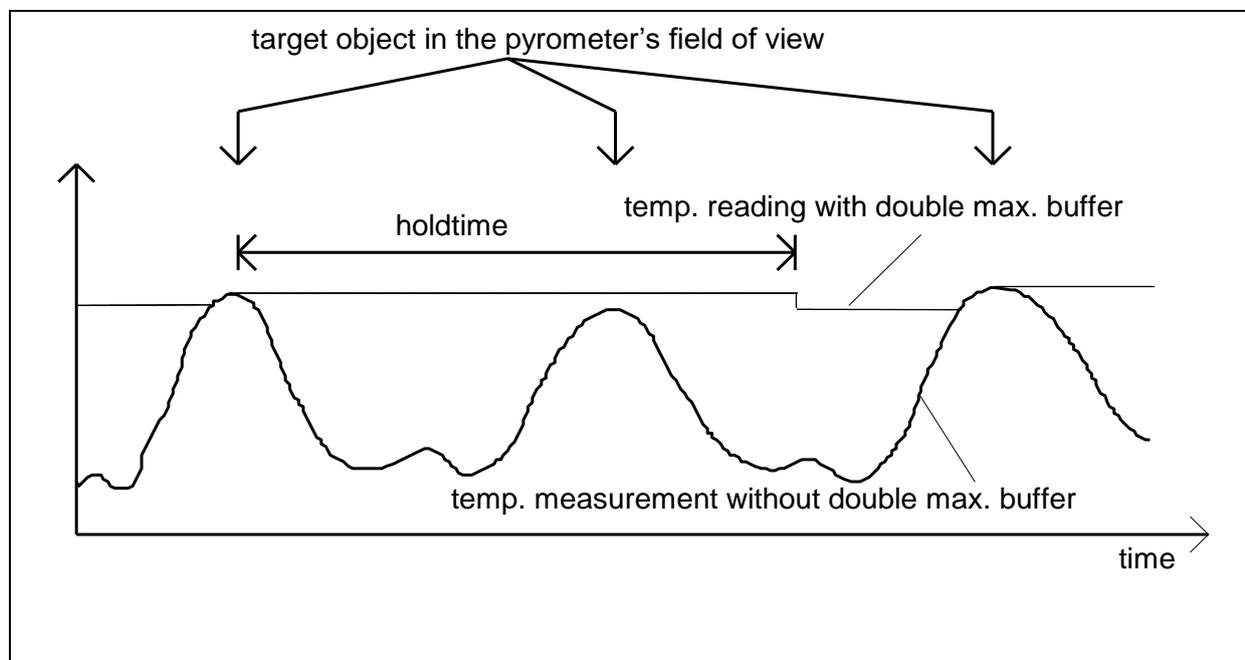
It might often be desirable to determine the peak temperature during a defined time period, for example when the objects to be measured move past the pyrometer, resulting in temperature readings which would appear to be cyclical. In this mode, the displayed temperature reading will not drop between targeted objects. The peak temperature reading will be held for a preset time period.

Configure a hold time between 0.01 to 999 sec. either from your PC terminal or using the pyrometer's rear panel buttons. The maximum temperature sampled during the defined hold time will be saved. This value is transmitted to the signal output. In mid-sequence-- after 50% lapse of the hold time—a second internal peak picker starts. When the hold time has expired, the output signal decreases to the value of the second peak temperature (if it turned out being lower than the first peak). It makes sense to choose a hold time which is approximately 1 ½ times as long as the cycle of the moving targets. This ensures that a temperature measurement gap is avoided and temperature changes are detected quickly.

As an option, one of the switching inputs can be configured to reset the min/max memory and to define the smoothing filter setting.

### Double peak picker combined

The function of the double peak picker "combined" is similar to that of the double peak picker. However, the hold time starts when the spectral temperature is at its highest point. Displayed is the corresponding two-colour temperature. If the spectral temperature decreases during the hold time, the corresponding two-colour temperature is only displayed when the hold time has elapsed. If the spectral temperature rises during the hold time, the corresponding two-colour temperature is directly displayed.



### 4.13 Mixed-mode function

In order to get a linear transition between spectral and two-colour measurement in mixed mode it is necessary to set the emissivity and the partial illumination with the help of emissivity Lambda 1. Proceed as follows:

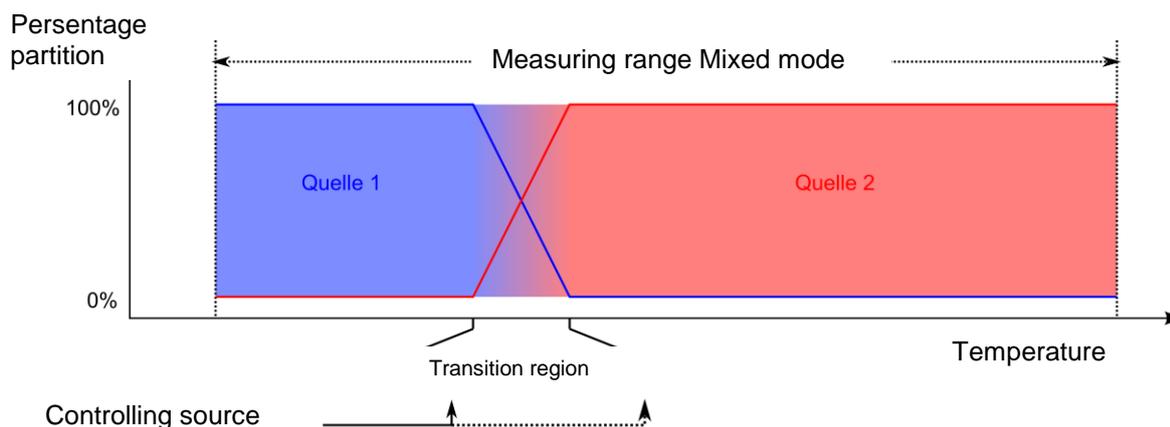
1. Align the pyrometer to the strip lamp (see above). Set the two-colour emissivity correction to 100 %.
2. Heat the strip to a temperature between 680 ... 700 °C. Attention: It may take some minutes until the temperature stabilises.
3. Take a note of the two-colour temperature. This temperature can be retrieved at configuration layer "C020".
4. Check the spectral pyrometer L1 also at configuration layer "C020". The two-colour temperature and the spectral temperature should be

identical. If the spectral temperature is higher than the two-colour temperature, increase the emissivity L1. Decrease the emissivity L1 if it is lower. The emissivity L1 can be set at configuration layer "C002".



#### NOTE !

After this procedure do not move the pyrometer anymore to avoid erroneous measurements.



Two signal sources are linked in the instrument in mixed mode. Only source 1 is transmitted for the lower temperature range and only source 2 for the higher temperature range. Both sources are weighted on a percentage basis in the transition area which is defined by the transition start and end temperatures. The "controlling source" checks whether the working point is below, within, or above the transition area.

The result is limited on both sides by the parameters for the mixed mode temperature span.

## 4.14 I/O Configuration

### Define current output range

You will need to define the current loop scale and define a source for an analogue output signal. For a spectral pyrometer, you can select one of the following signal sources for analogue output Ao1:

- Quotient
- Lambda 1
- Lambda 2
- Mixed mode

**In the normal operating mode, the selected source for Ao1 will be the current object temperature.**

The second analogue output Ao2 offers additional the following option:

- Quotient temperature before Min/Max memory
- Lambda 1 temperature before Min/Max memory
- Lambda 2 temperature before Min/Max memory
- Signal intensity
- Internal device temperature

Configure the scale of each of the two analogue outputs separately. Define the temperature span by adjusting the upper and lower limits of the measuring range. Select either 0 – 20 mA or 4 – 20 mA as the current output range. The temperature to current conversion is linear.

The desired current output range of either 0 – 20 mA or 4 – 20 mA can be configured as an absolute setting. Alternatively, the current range can be coupled to the specific voltages of Switching Output 1 or 2.

- 0 V -> 0—20 mA
- 24 V -> 4—20 mA

Make these settings in configuration layer  $\epsilon 0 10$  with parameters  $R_{015}$ ,  $R_{01_}$ ,  $R_{01_}$  und  $R_{014}$  for analogue output 1, and in the same manner for analogue output 2.

#### Configuration example for PA 40:

Ao1: temperature reading of two-colour measurement (quotient)  
650 - 1650 °C  $\equiv$  4 - 20 mA

Ao2: internal device temperature  
0 - 100 °C  $\equiv$  4 - 20 mA

It is also possible to configure analogue output 2 with a sub-range which covers a portion of the temperature span assigned to analogue output 1:

#### Second configuration example for PA 40:

Ao1: temperature reading of two-colour measurement (quotient)  
650 - 1650 °C  $\equiv$  4 - 20 mA

Ao2: temperature reading of two-colour measurement (quotient)  
800 - 1200 °C  $\equiv$  4 - 20 mA

## Digital outputs

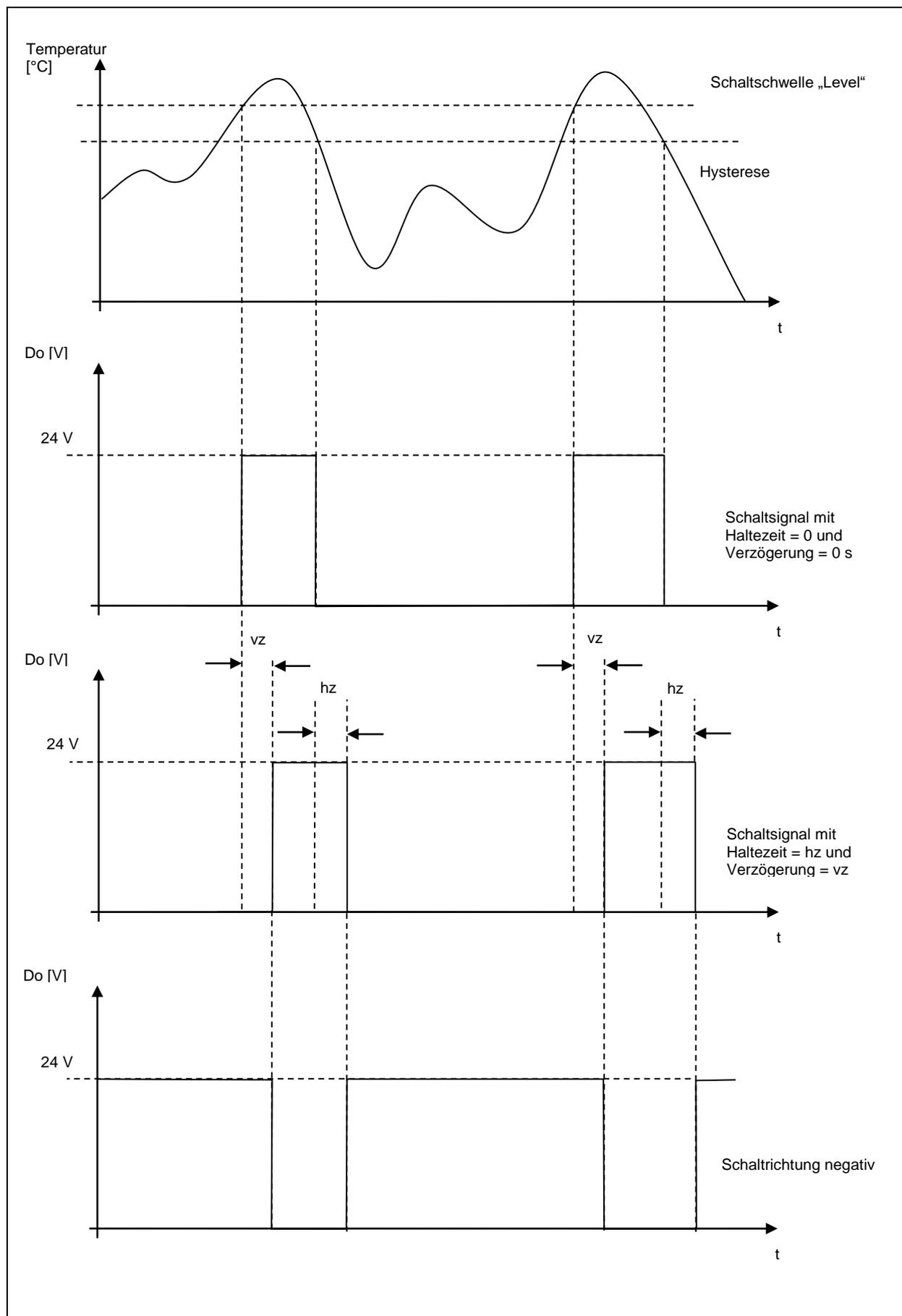
One of the following functions can be assigned to each of the digital outputs:

- **Deactivate** (This is required when you want to use the digital output as digital input).
- **Status LED** lights up to indicate that the temperature reading lies within the pyrometers available temperature range.
- **Limit switch** with adjustable signal threshold:
  - Quotient (two-colour)
  - Quotient before Min/Max before memory
  - Lambda 1
  - Lambda 1 before Min/Max
  - Lambda 2
  - Lambda 2 before Min/Max
  - Dirt Alert
  - Signal intensity
  - Internal device temperature

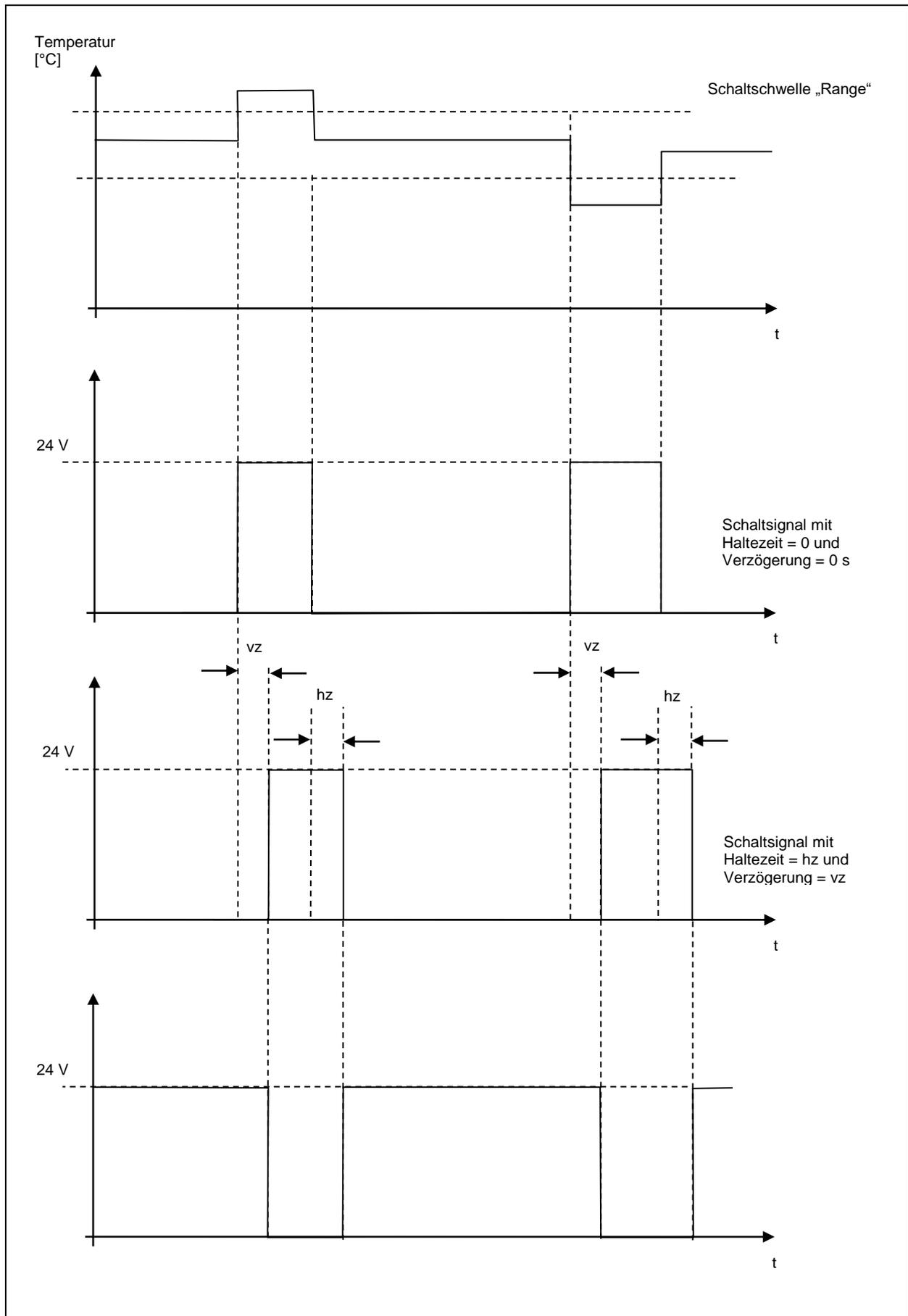
When the digital output is to be used as a limit switch, you can configure the following parameters:

- Signal source
- Signal function and direction
- Limit and hysteresis for „Level“ function
- Lower / upper limit for “Range” function
- Delay time for switching
- Hold time

**“Level“ function**



## “Range“ function



#### 4.15 Digital inputs

If you want to use the digital output as an input, you must first manually deactivate the digital output and configure the following parameters:

- Select a current output range (either 0 – 20 mA or 4 – 20 mA) for Ao1/Ao2
- Delete the temperature readings in Min/Max or DoubleMax

#### 4.16 Analogue input for emissivity correction or ambient temperature compensation (spectral mode)

When desired, current output 2 (Pin 3) can function as a voltage input. Target object emissivity can be configured from another remote device. Alternatively, the input signal can be used to define the temperature of reflected radiation from surroundings for the ambient temperature compensation function.

First, manually deactivate current output 2. Then select one of these two correction functions at configuration layer  $\llcorner \square \square$  using parameter  $\text{R } \cdot \text{F } \square$ .

When this is activated, it will not be possible to configure the emissivity setting or the ambient temperature compensation using the rear panel buttons, nor will it be possible to change the settings from a PC. The pyrometer display will alternate between showing the currently used value and showing  $\text{E H E}$  to indicate that these parameters were set from an external source.

Define the upper and lower voltage values using parameter  $\text{R } \cdot \text{U}$ . Set the input variables using parameter  $\text{R } \cdot \text{V}$ .

Example for setting emissivity:

$\text{R } \cdot \text{U } 1 = 0 \text{ V}$

$\text{R } \cdot \text{U } 2 = 10 \text{ V}$

$\text{R } \cdot \text{V } 1 = 0$  (emissivity 0 %)

$\text{R } \cdot \text{V } 2 = 100$  (emissivity 100 %)

Example for configuring the ambient temperature compensation function:

$\text{R } \cdot \text{U } 1 = 2 \text{ V}$

$\text{R } \cdot \text{U } 2 = 10 \text{ V}$

$\text{R } \cdot \text{V } 1 = 700$  (temperature 700 °C)

$\text{R } \cdot \text{V } 2 = 1200$  (temperature 1200 °C)

#### 4.17 Analogue input to control emissivity ratio (two-colour/ratio mode)

Sometimes particular process conditions will require that the ratio of the two emissivities be changed from a remote source such as by external control. This can be achieved using the analogue input. First, manually deactivate the current output 2. Then go to configuration layer `c 0 10` and assign parameter `R 1.F n` with your required application.

#### 4.18 General functions (configuration layer `c 0 1 1`)

##### Green Status LED

You can assign specific functions to the LED:

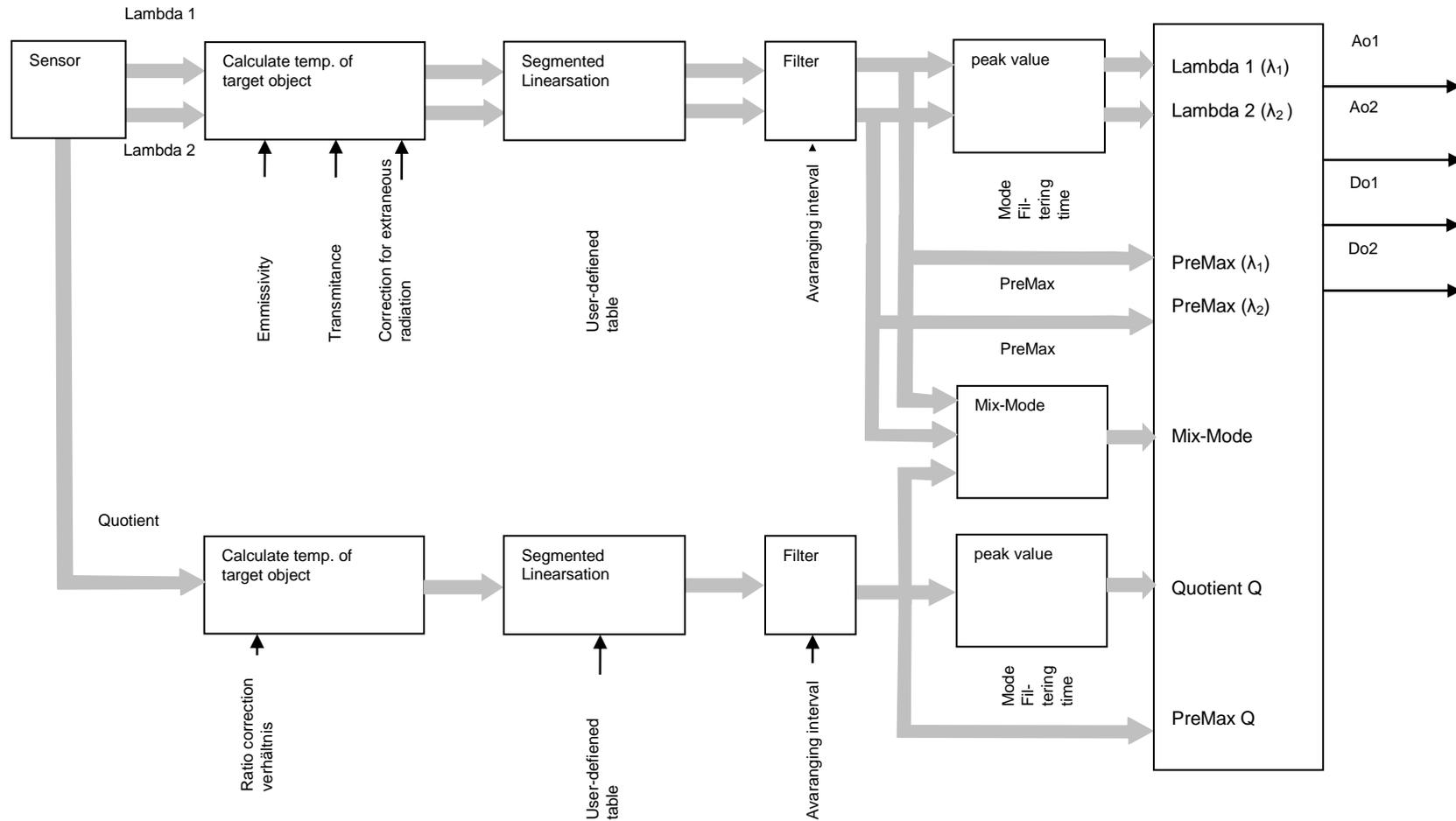
- LED is continuously lit to indicate 24 V operating voltage
- LED indicates status of switching output 1
- LED indicates status of switching output 2

Set the function using parameter `L E d E`.

#### 4.19 Simulate current signals for analogue output Ao1 and Ao2 (configuration layer: `c 100`)

CellaTemp PA features a function to simulate a temperature reading. This is especially useful after initial setup to verify that temperature data is correctly transmitted to the controller. Use the push-buttons on the pyrometer rear panel to simulate a temperature reading, which is applied as an output current signal scaled to the selected current range. The appropriate parameter can be accessed via configuration layer `c 100`. If the pyrometer is set up correctly, the downstream controller should indicate the values you have entered (only within the scaled range). If there is a discrepancy, please check the current range scale or the cable connection. When you have completed the function test, exit by pressing "E 5 c" and return to normal operating mode.

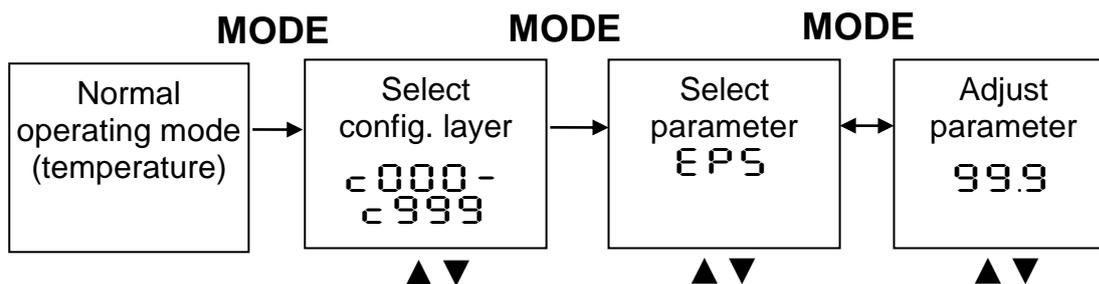
## 5 Internal signal processing



## 6 Setting parameters at the pyrometer (basic configuration)

Use the buttons ▲▼ and the „MODE" button on the rear panel to access and configure parameters. With these buttons you can view and adjust all settings required for pyrometer operation. (See Chap. 3.1).

Menu structure:



1. Press the MODE button while in normal operating mode to switch to "configuration layer" mode.
2. Use ▲▼ to select the configuration layer for the parameter you wish to set.
3. Press MODE to confirm. Press ▲▼ to select the particular parameter.
4. Press MODE to confirm. Press ▲▼ to adjust the parameter value.
5. Press MODE again to end. Press ▲▼ to select `End/SRUE`.
6. Now use MODE to either apply the changes you have made to the settings [`SRUE`] or to close without saving these changes [`End`]. After that, the display panel will resume showing the temperature reading.

## 6.1 Configuration layers

The configuration layers are structured according to function:

- c 00 1      Temperature measurement via two-colour/ratio mode
- c 00 2      Temperature measurement via Lambda 1
- c 00 3      Temperature measurement via Lambda 2
- c 00 4      Mixed mode
- c 0 10      I/O configuration
- c 0 11      General functions
- c 0 20      Display temperature readings
- c 100      Simulation der Ausgangsströme Ao1 und Ao2

The following charts list all parameters. Some parameter settings will be hidden if their basic function has been deactivated. For example, you will not be able to adjust the smoothing time of the filter if the filter has been turned off or switched to automatic mode.

### Temperature measurement using two-colour/ratio mode (Configuration layer: c 00 1)

Parameter	Function	Explanation
EPS.9	Ratio correction	
chr.9	Plausibility check ratio mode	off off on on deactivation when below limit on off deactivation when below or above limit
chr..	Relative limit min.	Relative lower limit [%] , two-colour temp. reading invalid (signal intensity)
chr.'	Relative limit max.	Relative upper limit [%] , two-colour temp. reading invalid (signal intensity)
chr.t	Absolute min. temp.	Absolute lower limit, two-colour temp. reading invalid
chr'.	Absolute minimum Emissivity	Absolute lower limit [%], two-colour temp. reading invalid
L in.9	Temperature offset using linear interpolation (user configurable table)	off off 2 - 10: number of nodes used
L. H 1	Node x 1 - 10	Signal input (initial value) node n
L. Y 1	Node y 1 - 10	Signal output (resulting value) node n
F .L.9	Smoothing filter	off on
F .L.t	Smoothing time	Time in seconds t98
MEM.9	Min/Max memory	off Off on on lowest (min.)temperature, single on on highest (max.) temperature, single off off double maximum off on Double Peak picker Combined

HELT	Hold time for Min/Max	Hold time in sec. (only available, if Double Maximum memory filter is active)
FLN	Smoothing filter for min/max *	OFF off ON on
FLT	Smoothing time *	Time in seconds t98
SAVE	Save	Save changes / exit menu
ESC	Escape	Discard changes / exit menu

\* Only available with Min/Max and Double Max modes

**One-colour (single-wavelength) measurement:**

Spectral channel 1: config. layer C002

Spectral channel 2: config. layer C003

Parameter	Function	Explanation
EPS1	Emissivity factor L1	See Chap. 4.7
TRU1	Transmission factor L1	Transmission factor, if the pyrometer has an additional lens or protection glass
BACT	Ambient temperature compensation	Switch on/off the ambient temperature compensation
BACT	Temperature of ambient source of radiation	
BACT%	Influence of ambient IR radiation	The reflected thermal radiation from the surroundings as a portion of the total IR radiation collected by the sensor in %
LIN1	Temperature offset using linear interpolation	OFF off 2-10: number of nodes used
LX1	node x 1..10	Signal input (initial value) node n
LY1	node y 1..10	Signal output (resulting value) node n
FL1	Smoothing filter	OFF smoothing not activated ON simple smoothing
FLT	Smoothing time	time t98 in sec. for simple smoothing
HELT	Min/Max memory	OFF off MIN lowest (min.) temperature, single MAX highest (max.) temperature, single DBLN double maximum
HELT	Hold time for Min/Max	Hold time in sec.
FLN	Smoothing filter for min/max *	OFF Off ON On
FLT	Smoothing time*	Time t98 in sec.
CLRN	external delete for Min/Max memory*	OFF no external deletion EXT1 delete when 0-24V for switching output 1 EXT2 delete when 0-24V for switching output 1
SAVE	Save	Save changes / exit menu
ESC	Escape	Discard changes / exit menu

\* Only available with Min/Max and Double Max modes



**NOTE !**

L1 stands for Lambda 1, meaning the temperature reading from single-wavelength channel 1

**Configuration Mix-Mode (layer c 004)**

Parameter	Function	Explanation
n.H.	Mixed-mode	OFF Aus ON An
r n 6 . -	define lower limit of temp. span	
r n 6 . -	define upper limit of temp. span	
t n 5 . -	Transition range begin	
t n 5 . -	Transition range end	
S r c . 1	Select source 1 1. Quelle	L 1 Lambda 1 L 2 Lambda 2 q Quotient
S r c . 2	Select source 2.	L 1 Lambda 1 L 2 Lambda 2 q Quotient
S r c . c	Selection of the controlling source	L 1 Lambda 1 L 2 Lambda 2 q Quotient
S R U E	Save	Save changes / exit menu
E S c	Escape	Discard changes / exit menu

**Configuration I/O (configuration layer: c 0 10)**

Parameter	Function	Explanation
A o 1 5	Ao1 select source	L 1 Lambda 1 L 2 Lambda 2 q ratio mode (quotient) n . H Mixed (the selected temp. reading source will be shown on the display)
A o 1 . -	Ao1 define lower limit of temp. span	
A o 1 . -	Ao1 define upper limit of temp. span	
A o 1 4	Ao1 0/4 - 20mA	0 - 20 0-20mA 4 - 20 4-20mA E H E . i digital input 1: 0V=0-20mA 24V=4-20mA

		EH2 digital input 2: 0V=0-20mA 24V=4-20mA
Ao2.	Analogue output 2	OFF Off ON ON
Ao2.5	Ao2 select source	L1 Lambda 1 L1Pr Lambda 1 without peak picker L2 Lambda 2 L2Pr Lambda 2 without peak picker Q Two-colour/ratio mode QPr Two-colour/ratio mode without peak picker EU internal device temperature EES Total Epsilon
Ao2.-	Ao2 define lower limit of temp. span	
Ao2.+	Ao2 define upper limit of temp. span	
Ao2.4	Ao2 0 / 4 - 20mA	0-20 0-20mA 4-20 4-20mA EH1 Switch. input 1: 0V=0-20mA 24V=4-20mA EH2 Switch. input 2: 0V=0-20mA 24V=4-20mA
do 1.	Switching output 1	OFF Off ON On
do 1.5	Do1 select source	rdy Status LED indicates 'ready' L1 Lambda 1 L1Pr Lambda 1 without peak picker L2 Lambda 2 L2Pr Lambda 2 without peak picker Q Two-colour/ratio mode QPr Two-colour/ratio mode without peak picker EU Internal device temperature inty Signal intensity drt Dirt Alert
do 1F	Do1 function	L1L Switch direction "Level" (output activ if limit excess) L1L- Switch direction "Level" / output inverted R1 Switch direction "Range" (output activ if limit excess) R1- Switch direction "Range" / output inverted
do 1t	Do 1 switching threshold	Temperature limit (only aviabale at function "Level")
do 1h	Do1 signal threshold	Hysteresis +/- relative to signal threshold (only available at function "Level")
do 1.-	Do1 lower limit of range	Lower limit of range for switch signal (only available function "range")
do 1.+	Do1 upper limit of range	Upper limit of range for switch signal (only available function "range")
do 1L	Do1 delay time	See Chap. 0
do 1H	Do1 Hold time	See Chap. 0
do 2.	Switching output 2	OFF Off ON ON
do 2.5	Do2 select source	rdy Status LED indicates 'ready' L1 Lambda 1 L1Pr Lambda 1 without peak picker

		Λ2 Lambda 2 Λ2P.L. Lambda 2 without peak picker 9 Two-colour/ratio mode 9. P.L. Two-colour/ratio mode without peak picker ΕΘ internal device temperature ΙηΕΥ Signal intensity δ.ρετ Dirt Alert
do2F	Do2 function	Λ.Λ. Switch direction "Level" (output activ if limit excess) Λ.Λ.- Switch direction "Level" / output inverted ρ.ρ. Switch direction "Range" (output activ if limit excess) ρ.ρ.- Switch direction "Range" / output inverted
do2t	Do 2 switching threshold	Temperature limit (only available at function "Level")
do2h	Do2 signal threshold	Hysteresis +/- relative to signal threshold (only available at function "Level")
do2..	Do2 lower limit of range	Lower limit of range for switch signal (only available function "range")
do2.-	Do2 upper limit of range	Upper limit of range for switch signal (only available function "range")
do2L	Do2 delay time	See Chap. 0
do2H	Do2 Hold time	See Chap. 0
A.F.η	Analogue input function	ο.Φ.Φ Analogue input deactivated Ε.Ρ.Σ. Emmisivity for Lambda 1 via analogue input β.Ρ.α.ε.τ. Temp. ambient radiation via analogue input Ε.Ρ.Σ.ρ emissivity ratio
A.υ1	Analogue in upper and lower voltage values	Define lower limit of voltage for input voltage (0 - 10V)
A.υ2	Analogue in upper and lower voltage values	Define upper limit of voltage for input voltage (0 - 10V)
A.υ1	Analogue in upper and lower input variables	Input of lower voltage value (example 100% for emissivity ratio)
A.υ2	Analogue in upper and lower input variables	Input of upper voltage value (example 105% for emissivity ratio)
SAυΕ	Save	Save changes / exit menu
ΕSc	Escape	Discard changes / exit menu



**NOTE !**

Ao1 and Ao2 stand for Analogue Output 1 and Analogue Output 2  
Do1 and Do2 stand for Switching Output 1 and Switching Output 2  
Ain stands for Analogue Input

**General Functions (configuration layer: C011)**

Parameter	Function	Explanation
L E d 6	Green status LED	<ul style="list-style-type: none"> <li>o n LED indicates 24V</li> <li>d o 1 LED indicates digital output 1</li> <li>d o 2 LED indicates digital output 2</li> </ul>
t E r n .	Assign Interface	<ul style="list-style-type: none"> <li>o F F non-terminal mode</li> <li>U S B terminal mode at USB interface</li> <li>r S 4 8 5 Terminal mode at RS485 (Halbduplex)</li> </ul>
A S t r .	Automatic temperature data output	<ul style="list-style-type: none"> <li>o F F automatic temp. data output is off.</li> <li>o n temp. data output at PC terminal</li> </ul>
A c y c .	Cycle for automatic temp. data output	Select cycle time in s
A d d r .	Device address	Enter address of device for non-terminal mode
d i s p .	Display panel	<ul style="list-style-type: none"> <li>''o n'' the display panel indicates "on"</li> <li>,R i indicate temperature of source Ao1</li> </ul>
U n i t	temperature scale	<ul style="list-style-type: none"> <li>o C degrees Celsius</li> <li>o F degrees Fahrenheit</li> </ul>
S A v E	Save	Save changes / exit menu
E S c	Escape	Discard changes / exit menu

**Displayed temperature readings(Configuration layer: C020)**

Parameter	Function	Explanation
q .	two-colour/ratio temp. reading	Shows current temperature reading in two-colour mode
L 1 .	Temp. reading Lambda1	Shows current temperature reading for L1
L 2 .	Temp. reading Lambda2	Shows current temperature reading L2
q . P r .	Reading two-colour mode without peak picker	Shows current temperature reading in two-colour/ratio mode prior to peak picker
L 1 P r .	Reading Lambda1 without peak picker	Shows current temperature reading for L1 prior to peak picker
L 2 P r .	Reading Lambda2 without peak picker	Shows current temperature reading for L2 prior to peak picker
i n t y .	Signal-Intensity	Calculated signal intensity
t . i n t .	Internal temperature	Current internal temp. of device

A <sub>in</sub>	Initial value at analogue input	Current value of analogue input when activated
Esc	Escape	Exit menu

### Simulated current signal for outputs Ao1 and Ao2 (configuration layer: C100)

Parameter	Function	Explanation
Ao1.	Current output 1	Enter a value in mill ampere to simulate a current signal for Ao1
Ao1t	Current output 1 incl. scaled temperature	Enter a temperature value to simulate a temperature reading for Ao1 (based on linear scale).
Ao2.	Current output 2*	Enter a value in mill ampere to simulate a current signal for Ao2
Ao2t	Current output 2 incl. scaled temperature*	Enter a temperature value to simulate a temperature reading for Ao2 (based on linear scale).
Esc	Escape	Exit menu

\* Function only available when Current Output 2 is activated.

## 7 CellaView software

The CellaView software displays, evaluates and stores the temperature readings of your pyrometer.

Download the CellaView software here:

[www.keller.de/en/its/mediacenter-its/](http://www.keller.de/en/its/mediacenter-its/)

## 8 Installation of the USB driver

The PA pyrometer can be addressed via a special driver. On systems with Windows 7, 8 or 10 the driver installs a virtual COM interface which allows access to the serial port of the pyrometer.

Use the link below to download the driver

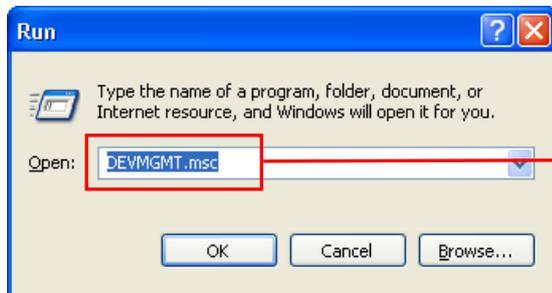
[www.prolific.com.tw](http://www.prolific.com.tw) (PL2303 Prolific Driverinstaller.zip v1.x.x)

Alternatively, the USB driver can be downloaded from our website in the CellaView download area.

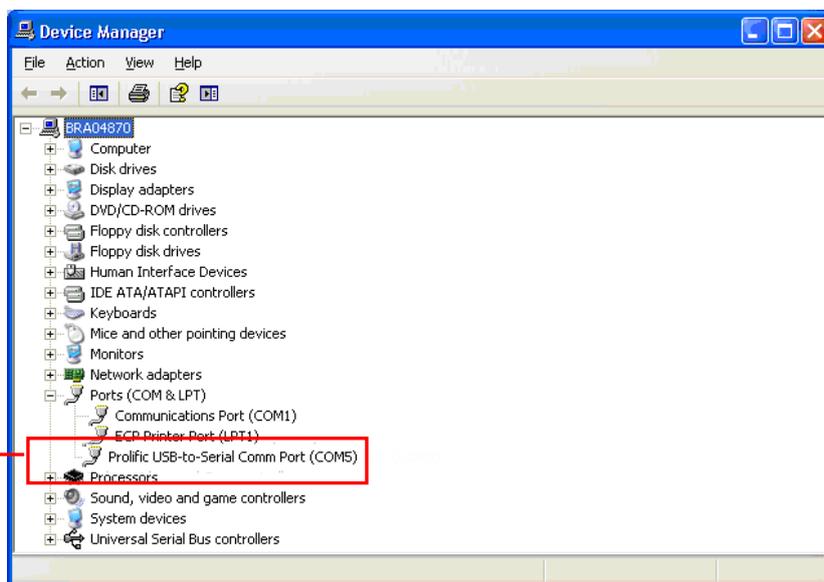
Install the driver and connect the pyrometer to the PC (USB cable is included in the scope of delivery). Windows will recognise the new hardware. Windows automatically assigns a virtual COM port. To determine

the COM port number assigned to the adapter, check the Device Manager as follows:

First, open the Run dialog box by using the Windows key + R key combination. Then enter the command “devgmt.msc.”



and click OK to open the Device Manager. Then click



Ports (COM and LPT). You will see a listing of ports and should now be able to see which COM Port the PA USB connection assigned to. The PA USB connection will be indicated as a USB-to-Serial Comm Port. In this example, COM Port 5 has been assigned to the adapter. You will need to select this particular COM Port in the software settings.

## 9 How to operate the pyrometer with the CellaView software

It is not necessary to change settings when using the CellaView software. The CellaView software both works via USB and RS485 interface. The interface can be operated either as a point-to-point connection to connect a device or as a bus to connect up to 31 pyrometers.

### 9.1 CellaView via USB point-to-point connection

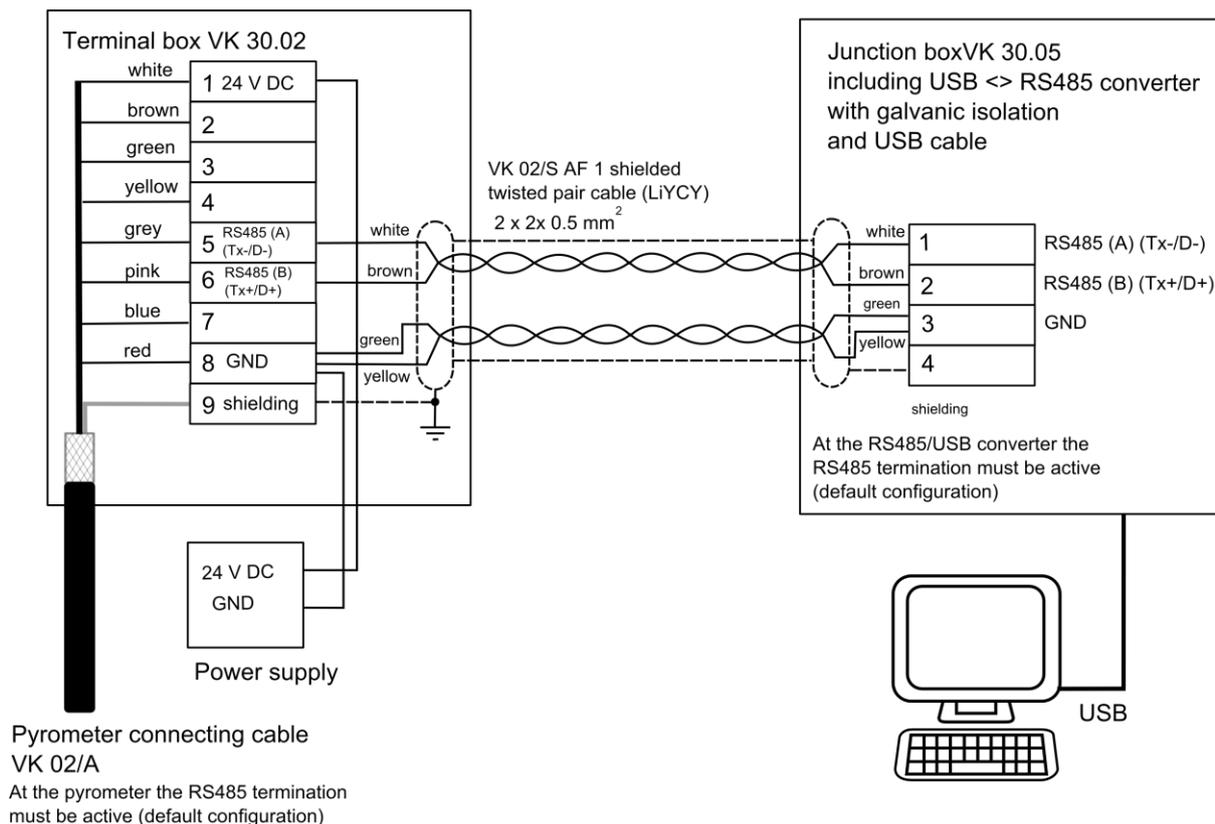
- Install the USB driver
- Connect the pyrometer to the PC
- Start CellaView
- Select the correct COM port or use the CellaView search function.

For more information on how to work with CellaView read the separate CellaView manual.

### 9.2 CellaView via RS485 point-to-point connection

A USB/RS485 converter is needed when working with the RS485 interface. The pyrometer can be directly connected if the PC has an integrated RS485 Interface board. The distance between pyrometer and PC can be up to 1200 m.

In order to prevent reflections on the RS485 connection, it is absolutely necessary to terminate the connection at the pyrometer and at the converter. The termination is integrated in the PA pyrometer and is active when delivered from the factory.



Moreover, use a converter with galvanic isolation (e.g. W&T 38211) to avoid problems with ground loops.



**Caution !**

If the supply voltage or current output are conducted via this cable, then make sure to consider the voltage drop if the cable length is greater than 100 m.

- Disconnect the pyrometer from any voltage source
- Install all required electric connections
- Connect the converter with the PC
- Install the converter according to instructions
- Connect the voltage supply for the pyrometer
- Start CellaView
- Select the correct COM port or use the CellaView search function.

For more information on how to work with CellaView read the separate CellaView manual.

### 9.3 CellaView via RS485 bus connection

The RS485 two-wire bus consists of the bus cable itself with a maximum length of 1200 m. The participants are connected to this cable via a branch line with a length of 5 m max.

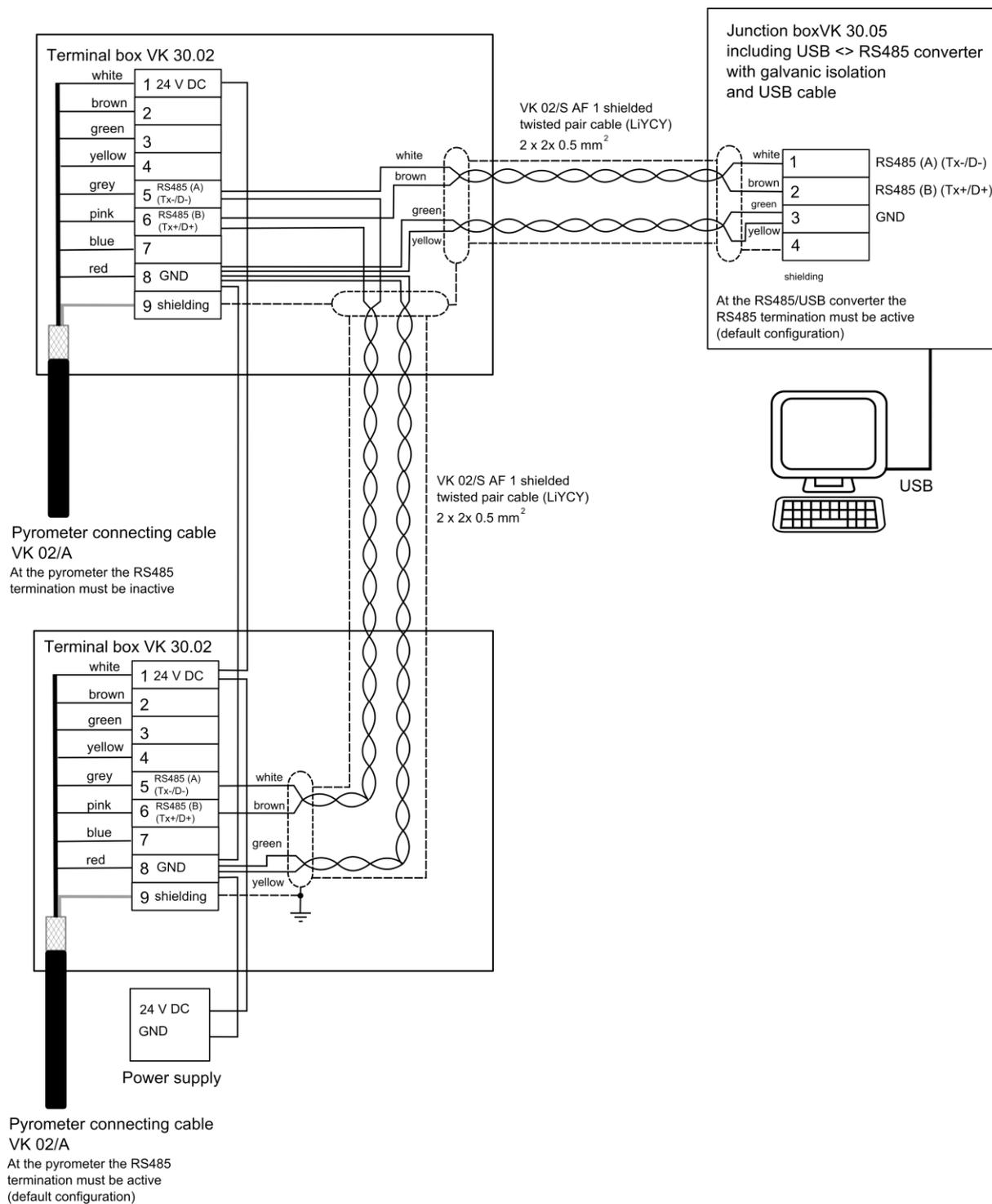
Up to 31 pyrometers can be connected to the RS485 bus. CellaView controls the communication on the bus and prompts allocated pyrometers to send or to receive data. Each participant will be addressed by a unique address. Configure this address during setup of each pyrometer using the keyboard.

#### Configuration layer: `c 0 ! !`

<code>Addr.</code>	Device address	Enter address of device for protocol mode
--------------------	----------------	--

A USB/RS485 converter is needed when working with the RS485 interface. The pyrometer can be directly connected if the PC has an integrated RS485 Interface board.

In order to prevent reflections on the RS485 connection, it is absolutely necessary to terminate the bus system with termination network. The termination can be activated or deactivated by a DIP switch on the PA pyrometer. The termination is active when delivered from the factory. Moreover, use a converter with galvanic isolation (e.g. W&T 38211) to avoid problems with ground loops.



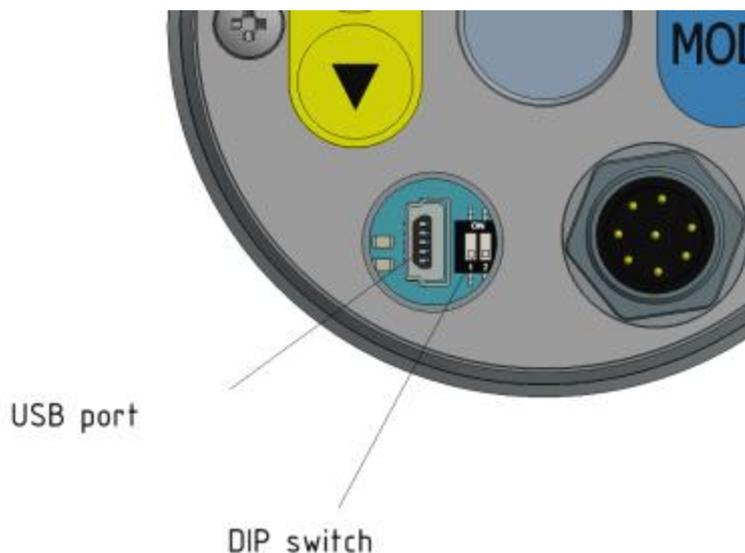
**Caution !**

All pyrometers must be connected to the same voltage supply. The maximum length of the branch lines to the pyrometer is 5 m.

- Disconnect the pyrometer from any voltage source
- Activate or deactivate the termination of the respective participant (see termination of RS485 bus)
- Install all required electric connections
- Connect the converter with the PC
- Install the converter according to instructions
- Connect the voltage supply for the pyrometers
- Adapt the addresses of the participants
- Start CellaView
- Select the correct COM port or use the CellaView search function.

#### 9.4 Termination of RS485 bus

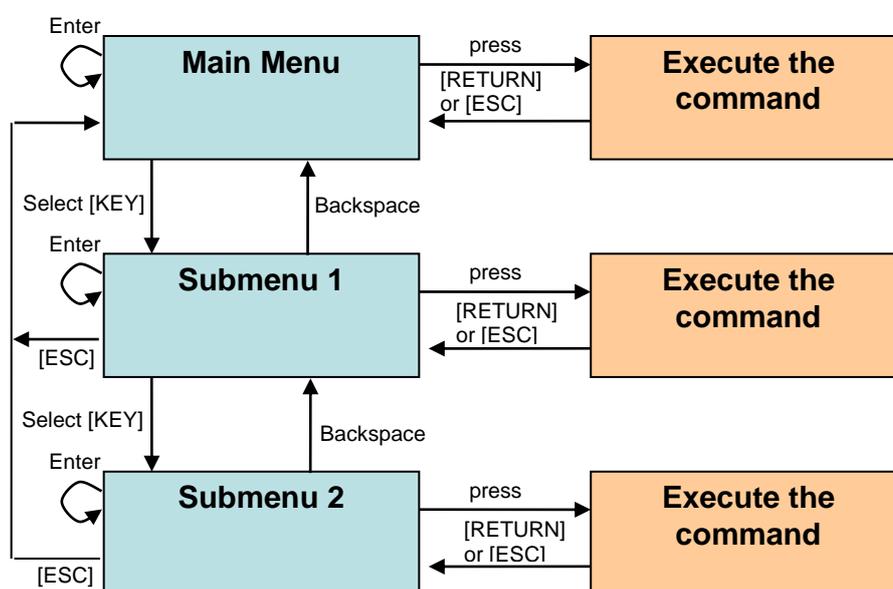
The terminal resistor of the pyrometer must be activated on the relevant bus end. For this purpose set the DIP switches to ON. Deactivate the termination with the remaining pyrometers.



## 10 Operation of the pyrometer via terminal program

By default, the pyrometer has fully integrated communications software to the point-to-point connection with a PC. As an alternative to the Cel-laView software, all parameters that are required for a measurement data acquisition or a general configuration of the pyrometer can be configured via a simple terminal connection using the terminal program.

Most key parameters are directly available in the main menu. Further functions are contained in submenus. Navigation within the menus is explained in the following graphics:



To set the pyrometer to the terminal mode, simultaneously hold down the **Ctrl key** and press the **E key** twice in rapid succession.

Direct commands have an assigned key. Example: E for emissivity (epsilon). Submenu settings are shown in brackets. Example: [LAMBDA 1]

### 10.1 Serial Data Transmission of Temperature Data

Transmission parameters for the serial interface:

57600 Baud / 8 data bits / odd parity / 1 stop bit / no handshake

**two-colour/ratio Lambda 1 – Lambda 2 (one cycle):**

Byte	Negative Temperature	Positive Temperature	Temperature exceeds measuring range	Temperature falls below measuring range
1	Space	Space	Space	Space
2	Minus symbol -	Space	Minus symbol -	Minus symbol -
3	Digit 1000	Digit 1000	O	U
4	Digit 100	Digit 100	V	N
5	Digit 10	Digit 10	E	D
6	Digit 1	Digit 1	R	E
7	Decimal point .	Decimal point .	Space	R
8	Decimal place	Decimal place	Space	Space
9	Space	Space	Minus symbol -	Minus symbol -
10	Unit C or F	Unit C or F	Space	Space
11	Tabulator	Tabulator	Tabulator	Tabulator
12	Space	Space	Space	Space
13	Minuszeichen -	Space	Minus symbol -	Minus symbol -
14	Digit 1000	Digit 1000	O	U
15	Digit 100	Digit 100	V	N
16	Digit 10	Digit 10	E	D
17	Digit 1	Digit 1	R	E
18	Decimal point .	Decimal point .	Space	R
19	Decimal place	Decimal place	Space	Space
20	Space	Space	Minus symbol -	Minus symbol -
21	Unit C or F	Unit C or F	Space	Space
22	Tabulator	Tabulator	Tabulator	Tabulator
23	Space	Space	Space	Space
24	Minuszeichen -	Space	Minus symbol -	Minus symbol -
25	Digit 1000	Digit 1000	O	U
26	Digit 100	Digit 100	V	N
27	Digit 10	Digit 10	E	D
28	Digit 1	Digit 1	R	E
29	Decimal point .	Decimal point .	Space	R
30	Decimal place	Decimal place	Space	Space
31	Space	Space	Minus symbol -	Minus symbol -
32	Unit C or F	Unit C or F	Space	Space
33	Carriage Return	Carriage Return	Carriage Return	Carriage Return



Please note:

All symbols are ASCII coded; preceding zeros will be included in the transmission

The cycle time in which the temperature reading is transmitted can be set at the PC terminal (minimum cycle duration is 0.1 second).

## 10.2 Terminal connection via USB

For communication through a terminal connection via USB set the parameter  $\text{E r n}$  on the pyrometer to USB (default setting).

The parameter  $\text{E r n}$  is available on configuration layer C011.

Parameter  $\text{E r n} = \text{USB}$

- Install the pyrometer's USB driver on the PC
- Connect the pyrometer with a USB cable to the PC
- Start a standard terminal program (e.g. Windows Hyperterminal or Putty)
- Select the correct COM port
- Set the interface parameters for the serial interface (see chapter transmission of measurement values)
- Open the connection

## 10.3 Terminal connection via RS485

For communication through a terminal connection via RS485 set the parameter  $\text{E r n}$  on the pyrometer to  $\text{r 485}$ .

The parameter  $\text{E r n}$  is available on configuration layer C011.

Parameter  $\text{E r n} = \text{r 485}$

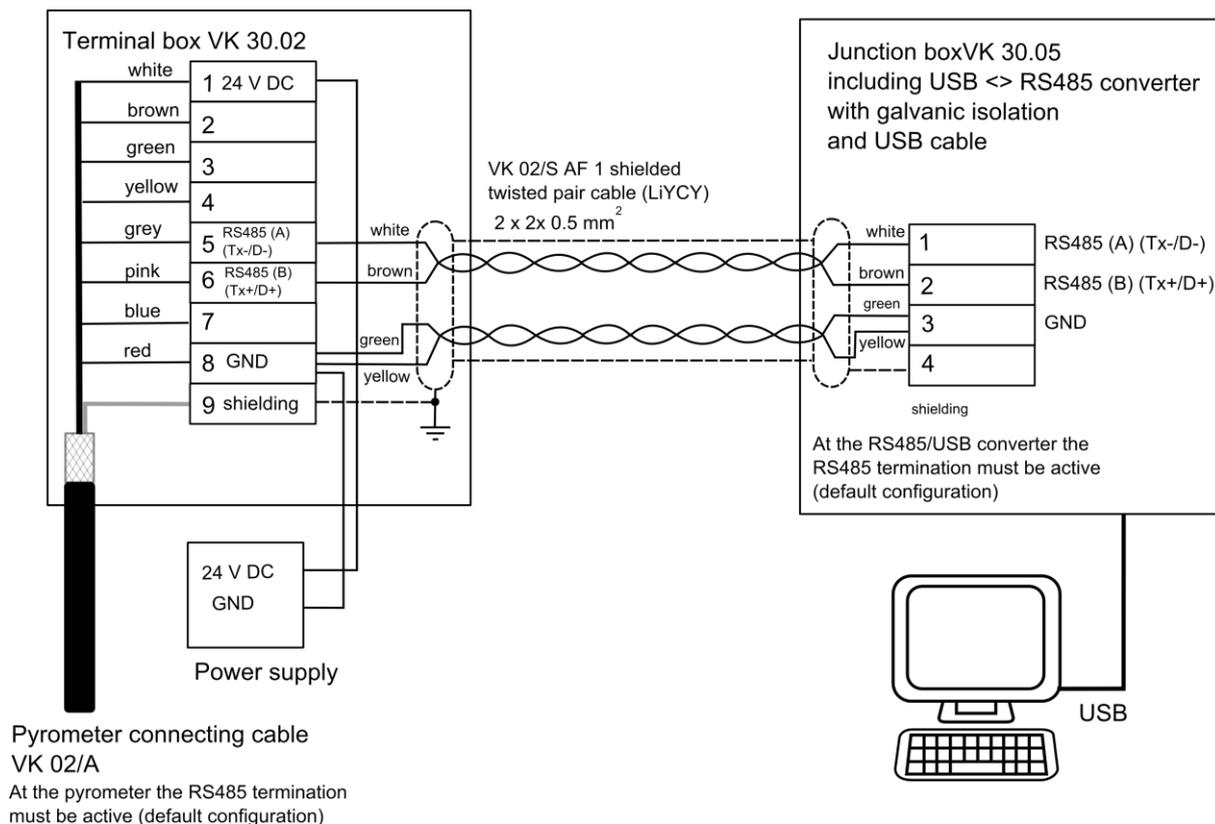


### Caution !

When using a terminal connection via the RS485 interface, Cel-laView cannot be used via the RS485 interface any longer.

A USB/RS485 converter is needed when working with the RS485 interface. The distance between pyrometer and PC can be up to 1200 m.

In order to prevent reflections on the RS485 connection, it is absolutely necessary to terminate the connection at the pyrometer and at the converter. The termination is integrated in the PA pyrometer and is active when delivered from the factory.



Moreover, use a converter with galvanic isolation (e.g. W&T 38211) to avoid problems with ground loops.



**Caution !**

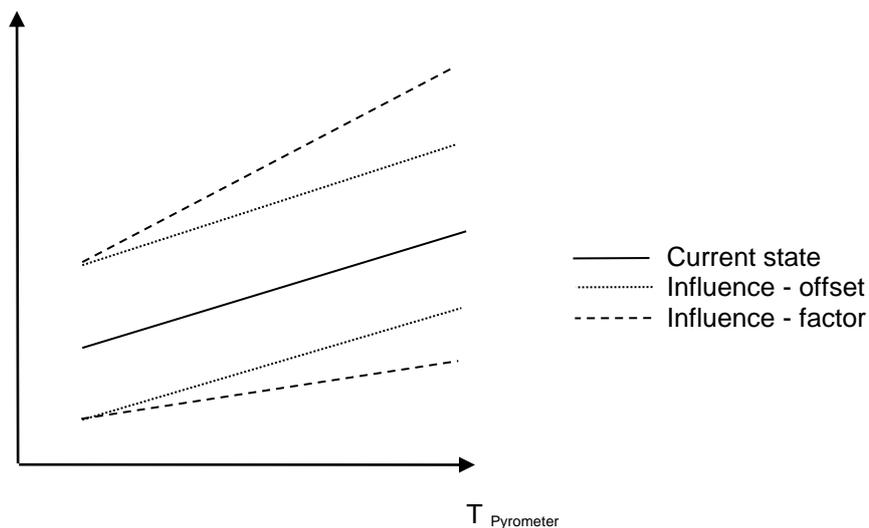
If the supply voltage or current output are conducted via this cable, then make sure to consider the voltage drop if the cable length is greater than 100 m.

- Disconnect the pyrometer from any voltage source
- Install all required electric connections
- Connect the converter with the PC
- Install the converter according to instructions.
- Connect the voltage supply for the pyrometer
- Change the parameter  $\text{E r n}$  to  $\text{r 485}$
- Start a terminal program such as Hyperterminal
- Select the correct COM port
- Set the correct parameters for the serial interface (see chapter transmission of measurement values)
- Open the connection

## 11 User-defined calibration / scaling of the current output/ Mixed Mode function

If necessary, the pyrometer can be adjusted with a user-defined calibration function. The following drawing explains the effects for offset and factor.

$T_{\text{shall}}$



Caution:

**To recalibrate your CellaTemp PA, you will require a calibration furnace and a reference standard.**

In addition to a user-defined calibration, the user-defined range function can also be activated. With this function being active, scaling of the current output can be extended.



Please note:

The measuring accuracy is not defined when the scaling is outside the pyrometer range.

## 11.1 Calibration/scaling via CellaView

To use the user-defined calibration function, activate it first in expert mode.

- Start CellaView
- Open the menu Settings Extras -> Settings
- Select expert mode and activate editable calibration
- Close the menu
- Open the menu Pyrometer settings

The parameters can now be edited under the tab Spectral channel 1.

## 11.2 Calibration/scaling via terminal connection

If ever required, the CellaTemp PA can be recalibrated using the sub-menu Calibration. Press command „K“ and then enter the password „100“ to access the calibration menu.

The calibration menu opens.

```

-----
-----
Submenu CALIBRATION
-----
Name .... "Pyrometer PA Series"

1: [LAMBDA 1 CALIBRATION]
A: Reset settings to factory default
S: Set pyrometer name
Z: End Calibration-Mode
ESC: Back to MAIN-MENU
-----
>CALIBRATION >

-----
-----
Submenu LAMBDA 1
-----
L1 range .... 0.0 - 1000.0 C
L1 User calibration ..... off
L1 User def. offset +0.00000
L1 User def. factor +1.00000

A: Set L1 - extended-range
B: Set L1 User-Cal. On/Off
C: Set L1 User-Cal. Offset
D: Set L1 User-Cal. Factor
ESC: Back to MAIN-MENU
-----
>CALIBRATION >LAMBDA 1 >

```

You can reset all configurations you have made to your CellaTemp PA and restore the factory default settings using Command „A“. This also applies to data acquisition parameters and input/output settings. Use keys "B", "C" and "D" for direct access to enable the adjustments.

If you make a mistake while making the adjustments, simply enter off-set=0.0 und factor=1.0, or set User Cal. to „off“.

Command "A" redefines the pyrometer's entire measuring range. This new temperature span may be smaller or larger than the range originally programmed by the manufacturer. When selecting a new temperature range for your CellaTemp PA, make absolutely sure that the temperature span you select is actually covered by the pyrometer model you have purchased. The only way to be certain is to perform measurement tests.

Press "S" to enter a short text to name the control point. View this text by selecting „Q“ in the Main Menu.

### 11.3 Mixed Mode function via terminal connection

In the sub menu „Mixed Mode“ you can adjust all relevant parameters:

- Activation/ deactivation of the temperature calculation
- Measuring range of the Mixed Mode
- Beginning off the transition zone
- Selection of the first source (100 % temperature below the transition zone)
- Selection of the second source (100 % temperature above the transition zone)
- Selection of the controlling source (temperature control for transition zone)

>M

```
-----
Submenu MIXED-MODE
-----
```

```
MIX function ..... on
MIX range ... 500.0 - 2400.0 C
MIX transition 680.0 - 700.0 C
1st source ..... lambda 1
2nd source ..... quotient
ctrl source ..... lambda 1
```

```
M: Function Mixed-Mode
A: Set range begin
B: Set range end
C: Set transition begin
D: Set transition end
E: Set 1st source
F: Set 2nd source
G: Set ctrl source
X: Show mixed temperature
ESC: Back to MAIN-MENU
-----
```

>MIXED MODE >

With command „T“ in the main menu you can select the source for the analogue output. Select “4” for Mixed Mode. The display shows the Mixed Mode temperature.

```
>T
Set Analog Out 1 SOURCE:
 1: Lambda 1
 2: Lambda 2
 3: Quotient
 4: Mixed
```

-----  
Your choice>

## 12 Shielding and Grounding

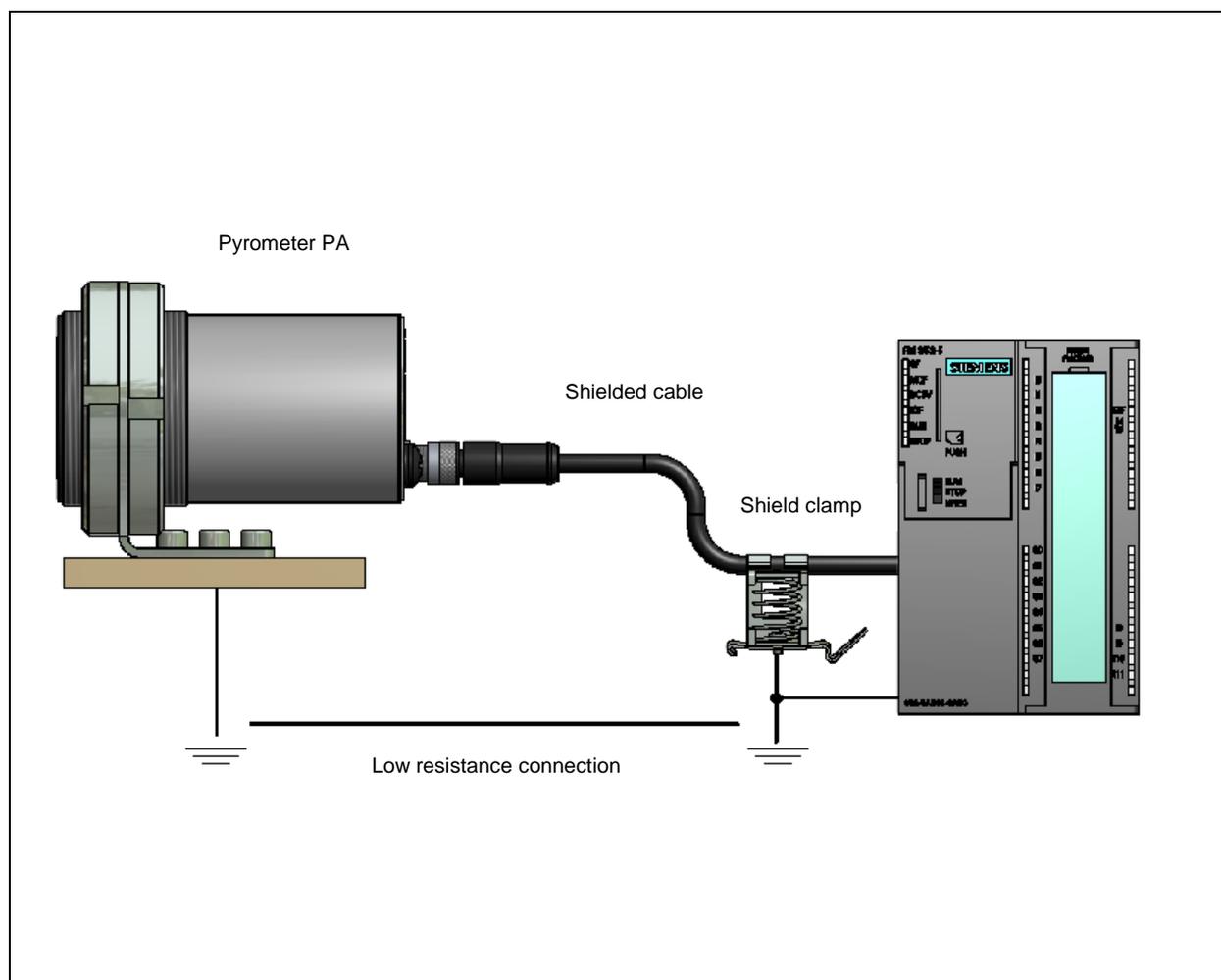
### 12.1 Potential equalisation



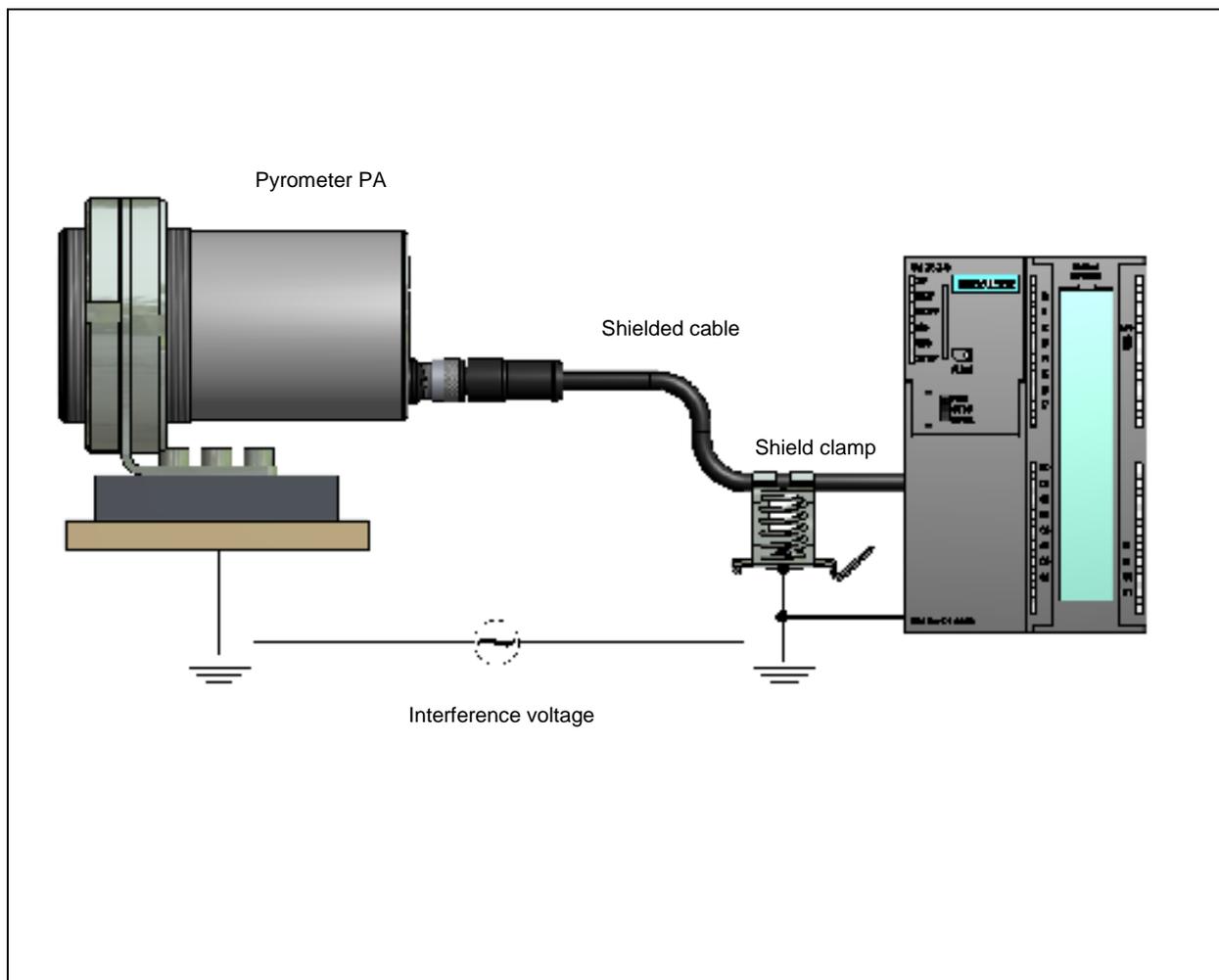
**Caution:**

All applicable laws and codes must be complied with at all times.

The pyrometer housing is connected to the shielding via the cable connector! Differences in ground potentials might cause an equalising current to flow between devices through a cable shielded at both ends.



In this case, be sure to install an additional potential equalisation line.



To avoid an equalising current, the pyrometer can be mounted electrically insulated. The shielding must be connected to the plant's earthing system.

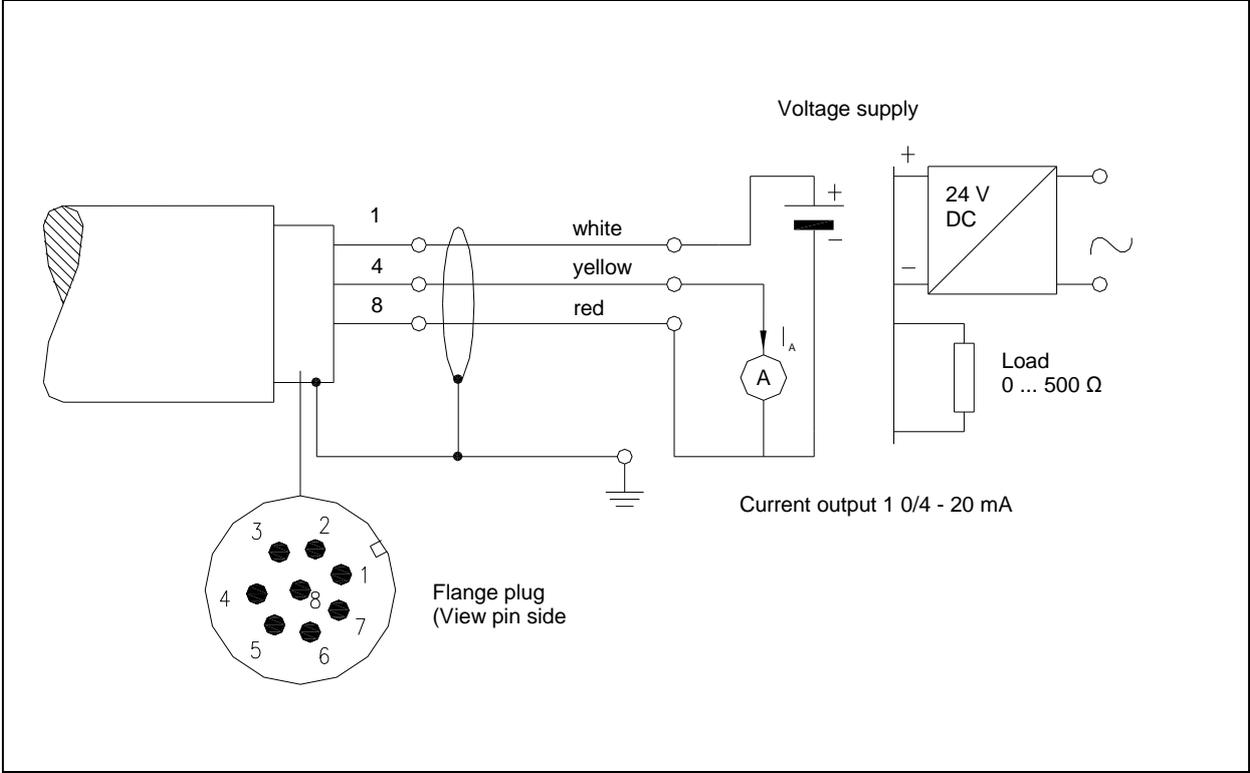


**Caution:**

If the pyrometer is installed without an insulator and without potential equalisation, the interference voltage may not exceed 48V.

### 13 Connectivity Examples

#### 13.1 Connection to VK 02/A Cable



## 14 Theory of Non-Contact Temperature Measurements

All materials radiate thermal energy in all states of aggregation above absolute zero. This radiation is mainly caused by atomic or molecular oscillations. This temperature radiation is only a limited sector within the total electromagnetic radiation spectrum. It extends from the visible range starting at wavelengths of approx. 0.5  $\mu\text{m}$  to the infrared range with wavelengths of more than 40  $\mu\text{m}$ . The KELLER HCW PA radiation pyrometers detect infrared radiation for non-contact temperature measurement.

### 14.1 Advantages of Non-Contact Temperature Measurement

Non-contact temperature detection means cost-effective temperature measurement because this technique only requires a single investment in an instrument without any follow-up costs for consumables such as thermocouples. This method enables temperature detection of moving objects - quick temperature measurements within milliseconds - for example at automatic welding processes. Small objects with medium and high temperatures can also be easily and accurately measured. When measuring materials with low specific heat, a non-contact method does not induce heat loss which would distort the temperature reading (as is the case with contact temperature probes). Non-contact temperature detection is ideal with corrosive molten materials for which the use of thermocouples is hardly feasible. Last but not least it is also possible to measure the temperature of voltage-carrying objects.

### 14.2 Measurements at Black Bodies (Cavity Radiators)

A black body or a black radiator is used to calibrate radiation pyrometers. This black body is designed in a way that its radiation does not depend on material characteristics, but only on its temperature. A black body emits at any wavelength the maximum energy possible for the specific temperature. Real bodies do not have this ability. In other words, a black body completely absorbs the radiation without reflection or transmission losses. The spectral emissivity coefficient  $\varepsilon(\lambda)$  of a black body is equal to 1 or 100 %. The emissivity coefficient indicates the ratio of radiation of a real body (target) to the radiation of an ideal black body.

$$\varepsilon(\lambda) = \frac{M}{M_s}$$

$\varepsilon(\lambda)$ : Emissivity coefficient of the object's surface (targeted spot) at wavelength  $\lambda$

$M$ : radiant energy actually emitted by a real object

$M_s$ : radiant energy emitted by a black body (perfect radiator)

Most burning, annealing and hardening furnaces emit a radiation of nearly '1' which corresponds to the conditions of a black body if the aperture through which the measurement is made is relatively small.

### **14.3 Measurements of Real Radiators**

Real radiation sources are characterized by the relation of the emitted radiation to the radiation of a black body with the same temperature. Measurements outside a furnace - which applies to all other self-contained targets - always, show a reading which is too low. Considerable errors can occur at targets with reflecting, polished or bright surfaces, e.g. molten steel and metal without oxide layer and ceramic materials. Exact results can only be obtained when the emissivity coefficient is correctly adjusted on the PA pyrometer.

The spectral emissivity coefficient of a body does not represent an exact material constant, but is also largely dependent on the surface properties. For different materials the spectral emissivity coefficient  $\varepsilon$  for the spectral ranges  $\lambda = 0.95 / 1.05$  (PA 40) is shown in the following tables:

**14.4 Emissivity Coefficient Table PA (Spectral mode)****List of emissivity coefficients of different materials in %**

<b>CellaTemp</b>	<b>PA 40</b>
<b>Wavelength <math>\lambda</math></b>	<b>0.8 - 1.1 <math>\mu\text{m}</math></b>
"Black Body"	100
Aluminium, polished	15
Aluminium, blackened	25
Asbestos cement	70
Bronze, polished	3
Bronze, blackened	30
Chromium, polished	30
Iron, heavily scaled	95
Iron, rolling skin	90
Iron, liquid	30
Gold and silver	2
Graphite, blackened	90
Copper, oxidized	90
Brass, oxidized (tarnished)	70
Nickel	20
Porcelain, glazed	60
Porcelain, rough	85
Soot	95
Fireclay	50
Slag	85
Pottery, glazed	90
Bricks	90
Zinc	60

**CAUTION!**

**The emissivity coefficients are valid for single-wavelength operating mode ( $\lambda 1$  and  $\lambda 2$ ). They do not apply to the emissivity ratio correction.**

## 15 Maintenance

### 15.1 Cleaning the pyrometer lens

A false temperature reading will be given when the lens is dirty. Therefore check the lens periodically and clean it, if necessary.

Dust can be removed by simply blowing it away or by using a soft brush. A special lens cleaning cloth is ideal, but any soft, clean, lint-free cloth will be suitable.

If the lens is quite dirty, use a very mild liquid detergent and rinse carefully with clear water while holding the pyrometer down. Apply as little pressure as possible to avoid scratching the lens.

Make sure to turn off the pyrometer prior to connecting or disconnecting the coupler connector (e.g. when cleaning). Failure to do so may result in damage to the instrument!



#### NOTE !

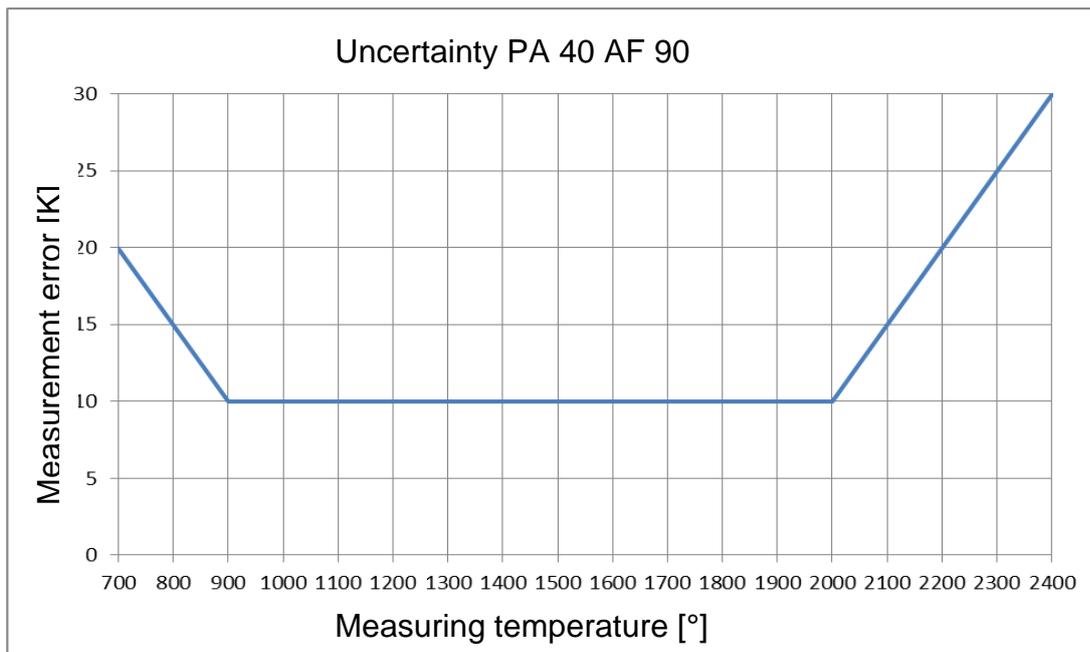
The pyrometer must be protected against high ambient temperatures, high air humidity, high voltage and strong electromagnetic fields. Never hold the lens directly into the sun.

## 16 Technical Data

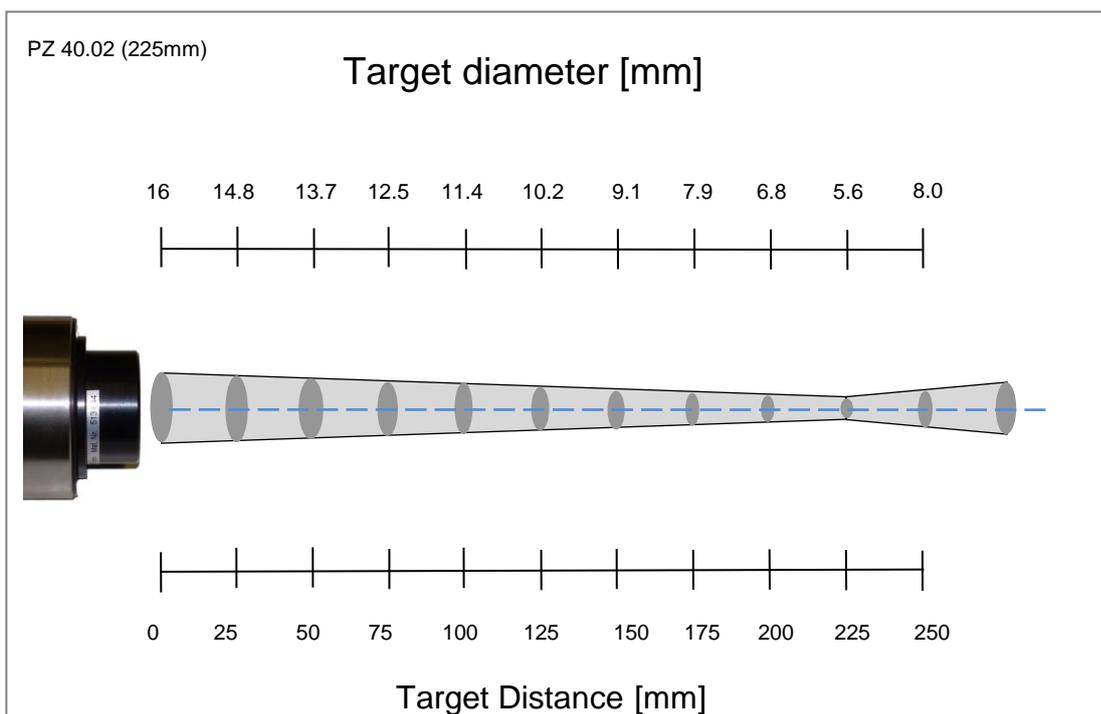
<b>Measuring range :</b> (adjustable in partial range): 750 ... 2500 °C	<b>Excess temperature signal:</b> When internal temperature exceeds > 80 °C, the analogue output value will be > 20.5 mA!	<b>Protection:</b> IP 65 according to DIN 40050 (with connector attached)
<b>Sensor:</b> Fotodiode	<b>Storage temperature:</b> -20 ... 80 °C	<b>Adjustable parameters:</b>
<b>Spectral sensitivity:</b> 0.95/ 1.05 µm	<b>Permissible humidity:</b> 95% r.H. max. (non-condensing)	<b>Analogue output 1 &amp; 2:</b> source/ scaling
<b>Focus:</b> Ø 5,6 mm @ 225 mm)	<b>Temperature coefficient with reference to 23 °C</b> ≤ 0.05 %/K of measured value	<b>Digital input output 1 &amp; 2:</b> source/ switch-point
<b>Digital output:</b> Periodic output of measurement data with adjustable cycle time	<b>Data communication:</b> USB / RS485 with integrated software to set parameters and transmit measurement data to a PC	<b>Transmission factor</b> $\lambda_1$ and $\lambda_2$
<b>Analogue output 1 &amp; 2:</b> 0(4) ... 20 mA linear, switchable, scalable (4...20 mA normally)	<b>Analogue input:</b> 0 – 10 V	<b>Compensation of background radiation</b> $\lambda_1$ and $\lambda_2$
<b>Resistance:</b> max. 500 Ω	<b>Digital output:</b> 2 Open collector outputs 24 V; ≤ 30 mA	<b>Look-up table for temperature alignment</b>
<b>Reponse time <math>t_{98}</math>:</b> ≤ 10 ms ( $T > 950$ °C)	<b>Digital input:</b> 2 to 24 V	<b>Ratio correction:</b> $\frac{\epsilon_1}{\epsilon_2}$ : 80 ... 120 % increment size 0.1 %
<b>Resolution Analogue output:</b> 0.2 K + 0.03 % of the adjusted span	<b>Power supply requirements:</b> 24 V DC +10% / -20% current input ≤135 mA/ ≤175 mA with camera, 150 mA with switched on spotlight Ripple: ≤ 200 mV	<b>Emissivity <math>\epsilon</math>:</b> $\lambda_1$ u. $\lambda_2$ : 10...110 % increment size 0.1 %
<b>Resolution Display:</b> 1 K	<b>Dimension:</b> φ 65 x 220 mm	<b>Smoothing function <math>t_{98}</math>:</b> 0 - 999 s
<b>Resolution USB / RS 485:</b> 0.1 K at terminal operation	<b>Housing material:</b> Stainless steel	<b>Memory modes:</b> - Min./Max. (peak picker) - Double maximum with adjustable hold time
<b>Measuring uncertainty:</b> 1 % of reading (at $\epsilon = 1.0$ and $T_A = 23$ °C)	<b>Weight:</b> Approx. 0.9 kg	<b>Optional accessories:</b> calibration certificate according to ISO 9001  calibration certificate according to DKD
<b>Repeatability:</b> 2 K	<b>Mounting:</b> External thread M 65 x 2 length 40 mm	large variety of mounting devices, digital displays, software, etc.
<b>Sighting device:</b> through-the-lens	<b>Connection:</b> with 8-pin connector	
<b>Ambient operating temperature:</b> 0 ... 65 °C		
<b>Ambient operating temperature:</b> 0 ... 65 °C		

With standard configuration, temperatures of the spectral channels and mixed mode are displayed starting at 500 °C. The precision of the range between 500 -700 °C is not specified and is only used to show the trend.

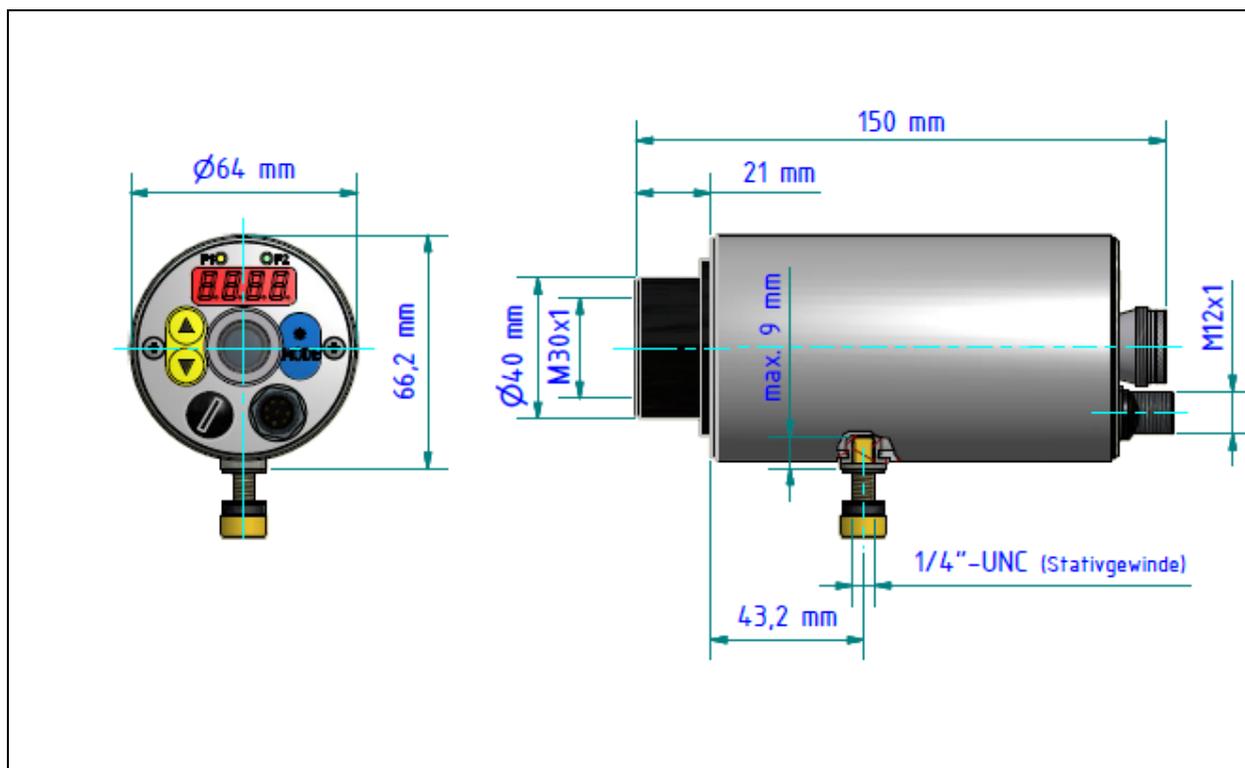
The data are based on the Keller test setup with a strip lamp 1.6 mm at a distance of 225 mm with a 50 % neutral filter at an ambient temperature of 23 °C. The reading error may be larger with another partial illumination (bandwidth) or incorrect alignment of the pyrometer.



### 16.1 Field of View Diagram PA 40 AF 90



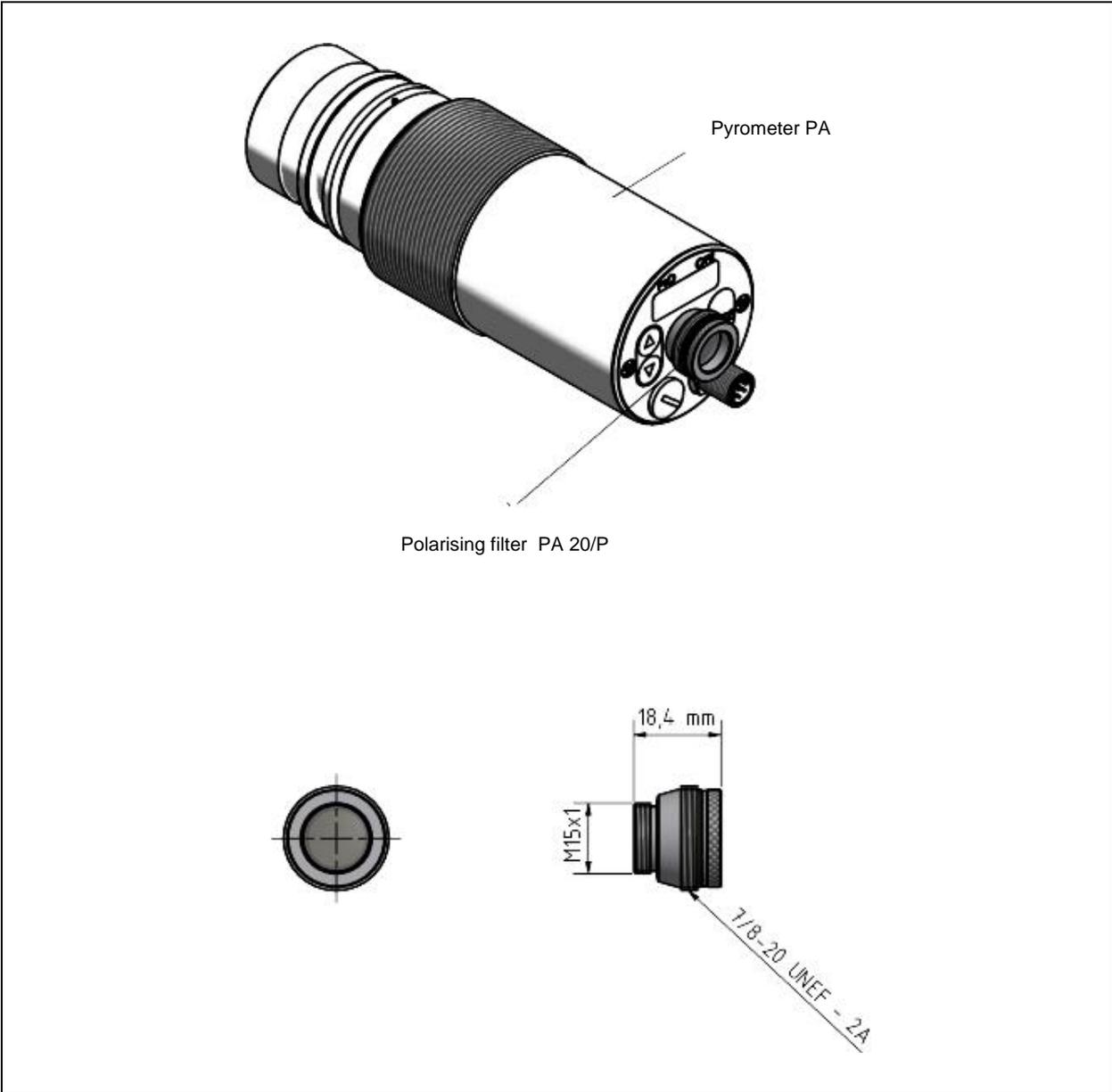
## 17 Dimensions



## 18 Accessories

Description	Product Name	Article No.
Cable length 5 m, 8 x 0.25 mm <sup>2</sup> , shielded	VK 02/A	101 3909
Video cable	VK 02/F	103 1446
Polarising filter	PA 20/P	100 9974
Quarz window	PA 20/I	1008144
USB cable	VK 11/D	100 9677

**18.1 Polarising filter**



## 18.2 Cable VK 02/A

Mat. No. 101 3909

8 polig  
8 poles

Belegung <i>Configuration</i>	Pol <i>contacts</i>
weiß <i>white</i>	an 1 <i>at 1</i>
braun <i>brown</i>	an 2 <i>at 2</i>
grün <i>green</i>	an 3 <i>at 3</i>
gelb <i>yellow</i>	an 4 <i>at 4</i>
grau <i>grey</i>	an 5 <i>at 5</i>
rosa <i>pink</i>	an 6 <i>at 6</i>
blau <i>blue</i>	an 7 <i>at 7</i>
rot <i>red</i>	an 8 <i>at 8</i>

Schirm durchgängig an Verschraubung  
*Shield constantly at screw connection*

( Maßstab 3:1 )

Anschlussquerschnitt 0,25mm<sup>2</sup> (AWG 24)  
 Schutzart IP68 / IP67 geschirmt  
 Obere Grenztemperatur + 85°C  
 Untere Grenztemperatur - 25°C

*Wire gauge 0,25mm<sup>2</sup> (AWG 24)  
 Degree of protection IP68 / IP67 shielded  
 Upper temperature + 85°C  
 Lower temperature - 25°C*

## 19 Glossary

<b>Autoprint</b>	After connecting the power supply, the pyrometer automatically begins transmitting measurement data via the serial interface.
<b>Print cycle time</b>	The cycle time for the temperature data output via the serial interface.
<b>Distance to target size ratio</b>	Describes the ratio between the pyrometer-to-object distance and the target spot diameter.
<b>Double Max-Memory</b>	Brief temperature peaks will be held for an adjustable holding time.
<b>Emissivity</b>	A measure of a material's ability to emit energy by radiation. The emissivity value is the ratio of energy radiated by a particular material's surface to energy emitted by an ideal radiator (black body) at the same temperature. A pyrometer's emissivity setting must be adjusted for the specific material to be measured.
<b>Switching outputs</b>	The digital outputs can be used as digital inputs
<b>Two-colour pyrometer</b>	Detects infrared radiation at two different wavelengths at the same time. Based on that ratio, the pyrometer calculates the temperature value.
<b>Spectral pyrometer</b>	Detects infrared radiation at one particular wavelength and produces a temperature reading from that measurement.

## 20 Shipping, Packaging and Disposal

### 20.1 Inspecting your shipment

Unpack and inspect the entire shipment immediately upon receipt to make sure it is complete and undamaged.

If the container/package shows visible signs of damage, please refuse the shipment. If this is not possible, accept the shipment on the condition that the freight carrier's delivery record is noted with the extent of the damage in order to file a claim.

Should you discover a concealed loss or damage, report it to KELLER HCW and to the freight carrier immediately. If the period for filing claims has expired, you will no longer be able to make any claims for compensation of damage or loss.

### 20.2 Packaging

The packages used by KELLER HCW are made of carefully selected, environmentally compatible materials and are thus recyclable. We suggest you retain the packaging for possible future use; otherwise please ensure that they are disposed of in an ecologically sound manner.

### 20.3 Disposal of used apparatus

Used electrical and electronic equipment often contain valuable components. The owner/user may either return such an instrument to the manufacturer for disposal, or he must dispose of it himself in a professional and nonpolluting manner.

KELLER HCW will not be held accountable for any inappropriate disposal carried out by the user/owner of KELLER HCW instruments.



## 21 Copyright

Portions of avr-libc are Copyright (c) 1999-2007

Keith Gudger,  
Bjoern Haase,  
Steinar Haugen,  
Peter Jansen,  
Reinhard Jessich,  
Magnus Johansson,  
Artur Lipowski,  
Marek Michalkiewicz,  
Colin O'Flynn,  
Bob Paddock,  
Reiner Patommel,  
Michael Rickman,  
Theodore A. Roth,  
Juergen Schilling,  
Philip Soeberg,  
Anatoly Sokolov,  
Nils Kristian Strom,  
Michael Stumpf,  
Stefan Swanepoel,  
Eric B. Weddington,  
Joerg Wunsch,  
Dmitry Xmelkov,  
The Regents of the University of California.  
All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- \* Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- \* Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- \* Neither the name of the copyright holders nor the names of contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

## 22 Default settings

### 22.1 Temperature measurement using two-colour/ratio mode (Configuration layer: `c 00 i`)

Parameter	Function	Default	User settings
<code>EPS9</code>	Ratio correction	100 %	
<code>chr9</code>	Plausibility check ratio mode	<code>n in</code>	
<code>chr_</code>	Relative limit min.	5 %	
<code>chr_</code>	Relative limit max.	--	
<code>chrE</code>	Absolute min. temp.	600 °C	
<code>chr!</code>	Absolute minimum Emissivity	50 %	
<code>L in9</code>	Temperature offset using linear interpolation (user configurable table)	Off	
<code>L H 1</code>	Node x 1 - 10	--	
<code>L Y 1</code>	Node y 1 - 10	--	
<code>F L9</code>	Smoothing filter	Off	
<code>F L E</code>	Smoothing time	1 s	
<code>nEN9</code>	Min/Max memory	Off	
<code>nENE</code>	Hold time for Min/Max	--	
<code>F L n</code>	Smoothing filter for min/max *	--	
<code>F L E</code>	Smoothing time *	--	
<code>cLr n</code>	external delete for Min/Max memory**	--	
<code>SAVE</code>	Save		
<code>ESC</code>	Escape		

\* Only available with Min/Max and Double Max modes

## 22.2 Temperature measurement using spectral mode (Lambda 1 configuration layer: c 002)

Parameter	Function	Default	User settings
EPS.I	Emissivity factor L1	49 %	
TRU.I	Transmission factor L1	100 %	
bAc.I	Ambient temperature compensation	Off	
bAc.t	Temperature of ambient source of radiation	Off	
bAc.l	Influence of ambient IR radiation	--	
L.in.I	Temperature offset using linear interpolation	Off	
L.H.I	node x 1..10	--	
L.Y.I	node y 1..10	--	
F.L.I	Smoothing filter	On	
F.L.t	Smoothing time	1 s	
MEM.I	Min/Max memory	Off	
MEM.t	Hold time for Min/Max	--	
F.L.n	Smoothing filter for min/max *	--	
F.L.t	Smoothing time*	--	
cL.r.n	external delete for Min/Max memory*	--	
SAVE	Save	--	
ESC	Escape	--	

\* Only available with Min/Max and Double Max modes

## 22.3 Configuration Mix-Mode (layer c 004)

Parameter	Function	Default	User settings
$\Pi .H.$	Mixed-mode	On	
$r_{n6}.$	define lower limit of temp. span	500 °C	
$r_{n6}.$	define upper limit of temp. span	2400 °C	
$t_{n5}.$	Transition range begin	680 °C	
$t_{n5}.$	Transition range end	700 °C	
$S_{rc.1}$	Select source 1 1. Quelle	$\lambda$ : Lambda 1	
$S_{rc.2}$	Select source 2.	$\varnothing$ Quotient	
$S_{rcc}$	Selection of the controlling source	$\lambda$ : Lambda 1	
$S_{RUE}$	Save	--	
$Esc$	Escape		

## 22.4 Configuration I/O (configuration layer: C010)

Parameter	Function	Default	User settings
$Ao1.S$	Ao1 select source	Mix-Mode	
$Ao1.$	Ao1 define lower limit of temp. span	700 °C	
$Ao1.$	Ao1 define upper limit of temp. span	2400 °C	
$Ao1.4$	Ao1 0/4 - 20mA	0 – 20 mA	
$Ao2.$	Analogausgang 2	Off	
$Ao2.S$	Ao2 select source	--	
$Ao2.$	Ao2 define lower limit of temp. span	--	
$Ao2.$	Ao2 define upper limit of temp. span	--	
$Ao2.4$	Ao2 0 / 4 - 20mA	--	
$do1.$	Switching output 1	On	
$do1.S$	Do1 select source	Status Ready signal	
$do1.F$	Do1 function	Level/signal	
$do1.t$	Do1 switching threshold	--	
$do1.h$	Do1 signal threshold	--	
$do1.$	Do1 lower limit of range	--	
$do1.$	Do1 upper limit of range	--	
$do1.L$	Do1 delay time	0.00 s	
$do1.H$	Do1 Hold time	0.00 s	
$do2.$	Switching output 2	On	
$do2.S$	Do2 select source	$\lambda$ inner temperature	

do2F	Do2 function	Level/signal	
do2t	Do 2 switching threshold	60 °C	
do2h	Do2 signal threshold	2 °C	
do2_	Do2 lower limit of range	--	
do2_	Do2 upper limit of range	--	
do2L	Do2 delay time	--	
do2H	Do2 Hold time	--	
A .Fn	Analogue input function	--	
A .U 1	Analogue in upper and lower voltage values	--	
A .U 2	Analogue in upper and lower voltage values	--	
A .v 1	Analogue in upper and lower input variables	--	
A .v 2	Analogue in upper and lower input variables	--	
SAvE	Save		
ESc	Escape		

## 22.5 General Functions (configuration layer: c D ! !)

Parameter	Funktion	Default	Eigene Einstellungen
LEdE	Green status LED	DO1	
tErN.	Assign Interface	USB	
A.St.r.	Automatic temperature data output	Off	
A.c.Y.c.	Cycle for automatic temp. data output	0. s	
Addr.	Device address	001	
d.SP.	Display panel	active	
Un.it	temperature scale	Celsius	
SAvE	Save		
ESc	Escape		



