Operating Manual

Pyrometer
PZxx /D

Mat. No.: 155 230 (English) 08/2006

KELLER H.C.W.
MESSEN · STEUERN · REGELN

Please note:
Unless otherwise stated in this instruction manual, technical alterations, particularly those serving technical progress, may be made without notice.

Warranty can only be assumed if the instrument has not been tampered with and is returned intact to KELLER HCW GmbH for repair and / or service.

Messen · Steuern · Regeln
Carl-Keller-Strasse 2 – 10
D-49479 Ibbenbüren-Laggenbeck
Germany

880-rol / 842-kle
PZxx_e.doc
16.08.2006

Safety Instructions

General Instructions

The measuring head is designed according to state-of-the-art technology, complies with commonly accepted safety rules and is highly reliable. Improper handling however, may cause damage to the measuring head or to other goods involved.

All persons involved with operation and maintenance of the measuring head must first read the instruction manual.

The measuring head may only be used when it is in good order and condition and under the observance of all local safety regulations. In case the measuring head malfunctions, it is imperative that operation be ceased immediately.

Intended Use

The measuring head is exclusively built for non-contact measuring of temperatures. Any other use is not intended. The manufacturer is not liable for any damages resulting from such unintended use; in this case the risk is solely borne by the user.

Only persons who are familiar with the use of the measuring head and who have been informed of possible dangers, are allowed to operate and maintain them.

Arbitrary alterations to the measuring head or operation of the measuring head beyond the permitted operating conditions exclude the liability of the manufacturer for any damages resulting thereof.

The common regulations for the prevention of accidents must be observed.

Contents

1 General Description

The PZ1x - PZ5x series provides five efficient, microprocessor-controlled pyrometers for non-contact temperature measurements.

The field of application of the radiation pyrometer PZ 10 includes the measurement of materials such as synthetic materials, rubber, textiles, paper, coated steel sheets, wood or varnish within a temperature range of 0 °C to 1000 °C.

The spectral pyrometers PZ 20 and PZ 30 are used for temperature measurements from 250 °C to 2500 °C or 500 °C to 3000 °C, respectively. Their applications lie in wide fields of the iron and steel producing industry and the metal, glass, ceramics and chemical industry.

The two-colour pyrometers PZ 4x, PZ 5x measure the intensity of infrared radiation at two different wavelengths. The ratio of these two intensities is proportional to the temperature. Thus the two-colour pyrometer supplies a constant measuring signal even with weakened signals, caused, for example, by vapour and dirt in the sighting path, condensed optical lenses or changing surface properties of the target. The applications encompass broad sectors of the iron and steel producing industry and the metal, glass, cement and chemical industries.

The pyrometers of the PZ 2x, PZ 3x, PZ 4x and PZ 5x series are both available with through-the-lens sighting and as pyrometers with fibre optics.

The pyrometers with fibre optics are preferably used for high ambient temperatures up to 250 °C without cooling or in areas with limited access.

The instruments have rugged aluminium housings which make them ideal for use in hostile industrial environments.

All PZ pyrometers are splash water proof according to IP65 (DIN 40050)

All PZ pyrometers with through-the-lens sighting are equipped with an interchangeable optical system with focussing capability. The through-the-lens sighting with target marker allows an alignment to the target without any problems.

The PZ pyrometers with fibre optics have an included spot light to permit easy direction of the sensing head to the target.

The PZ 10 type has a dynamic signal filtering or “smoothing” function. It provides a steady measuring signal and a quick response of the filter for erratic temperature changes of the target.

The adjustable emissivity factor makes it easy to adapt the pyrometer to the different radiation characteristics of the target.

All pyrometers of the PZ series have an analogue current output switchable from 0 - 20 mA to 4 - 20 mA.

The output current is linear to the measured temperature. The required temperature range can be set on the pyrometer.

When ambient temperatures are higher than the admissible working temperature, the output current selected should be > 20 mA.

A serial interface is available to change all operating parameters such as emissivity coefficient, measuring range, smoothing function or output current range during operation.

The instruments correspond to the protection requirements of the EC Regulation 89/336/EWG on electromagnetic compatibility (EMC law).

European standards: CE EN 50081 - 1, EN 50081 – 2
EN 50082 - 1, EN 50082 – 2

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

TÜV CERT
DIN EN ISO 9001

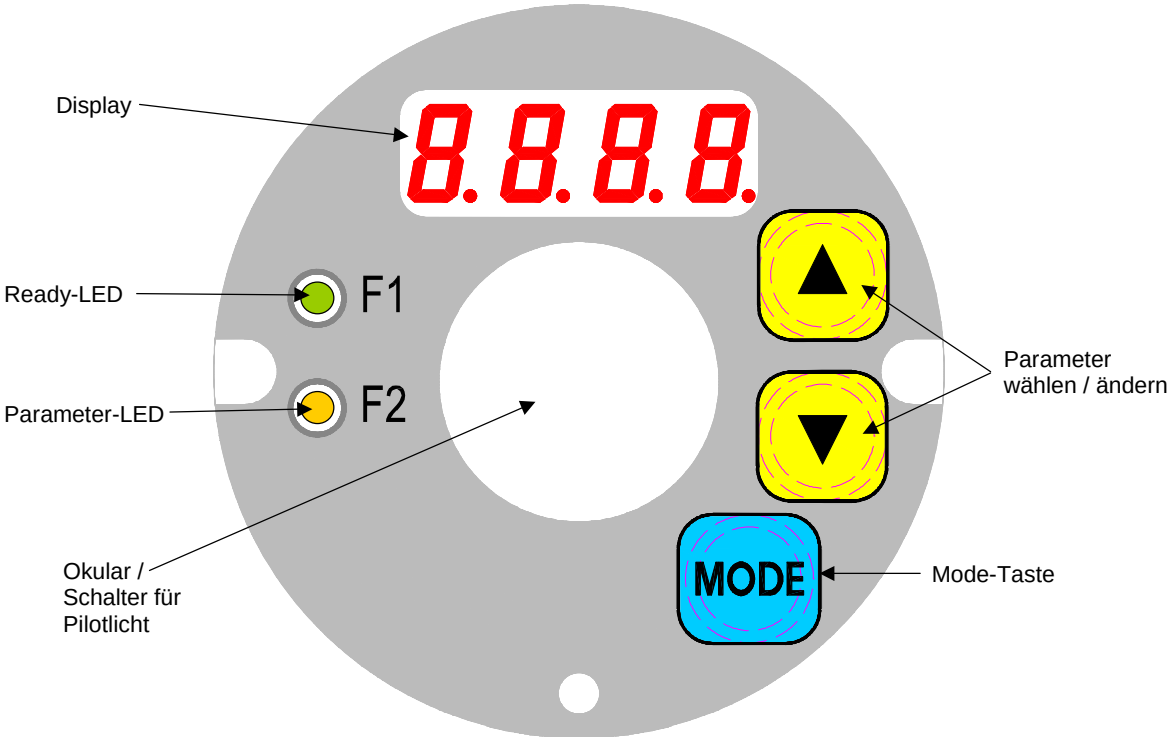


Fig. 1: the instrument display

2 Installation

The instrument works with an operating voltage of 24 VDC. The pin assignment and an example for connection are shown in chapter 5. A self test is performed when the instrument is switched on, after successful completion the instrument is then ready for operation. In order to achieve a high degree of measurement accuracy and repeatability it is important to turn on the power supply 15 minutes prior to starting; the pyrometer should have assumed the ambient temperature.

3 Handling, Adjustment and Focus

3.1 Pyrometer with through-the-lens sighting

When directing the pyrometer with through-the-lens sighting to a target, the lens must be simultaneously focussed on the target and the target marker. The target marker in the sighting path must be covered by the target completely.

To protect the eye of the viewer against bright light a pivotable polarisation filter for continuously adjustable intensity reduction is provided at the ocular lens (exception: PZ 1x series).

3.2 Pyrometer with fibre optics

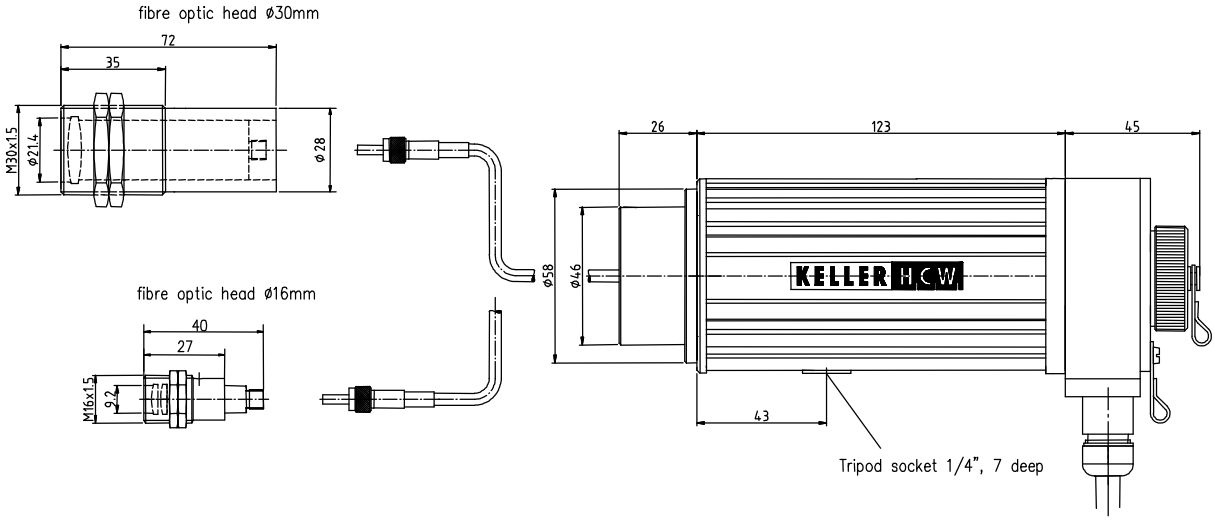


Fig. 3.1 Pyrometer with fibre optics

For focal adjustment loosen the shown socket screw (hexagon socket screw DIN 916) with a wrench (DIN 911) and shift the internal body of the tube towards the lens tube.

Due to the O-ring sealing between the internal body of the tube and the lens tube the focal adjustment must be carried out very slowly so that the air pressure in the space between lens and internal body of the tube can be be equalised.

A laser spot light which can be switched on and off with a switch on the rear side of the pyrometer serves as a sighting aid. It will automatically switch off after approximately 2 min. (see Chapter 3.3)

Focus the sensing head until the spot light is shown as a sharp round laser spot in the target area. In bright daylight or in an excessively lit environment it is recommendable to dim the area around the target.

One end of the optical fibre has a name plate showing the serial number of the corresponding basic pyrometer. This is the end which must be screwed onto the pyrometer. For proper connection, the arrow on the name plate of the fibre optic cable and the arrow on the pyrometer should point toward each other. The serial number of the measuring head should also correspond to the pyrometer.

General Remarks:
The fibre optic cable must not be exposed to tensile load and must not be twisted. The minimum bending radius is 20 mm. A bending radius of ≥ 60 mm is recommended in case of frequent mechanical movements.

A minimum headroom of 184 mm should be provided for mounting the pyrometer including the fibre optics: sensing head 72 mm + kink guard 52 mm + bend radius 60 mm.

3.3 Pyrometer with laser spot light

The pyrometer models PzxxAF4xx/L feature an integrated laser spot light which can be activated to facilitate instrument alignment to the target spot. To activate the laser, first unscrew and remove the back cover, then press the button. **Please read and follow the safety precautions in Chapter 3.5!** The laser spot light will automatically deactivate after 2 minutes. Alternatively, press the button once more to turn the laser off.

The laser is automatically protected against capacity overload by a protective circuit. When the internal temperature of the pyrometer exceeds 40 °C the laser will blink; the blinking will become more rapid as the temperature increases. The laser will automatically shut off and cannot be reactivated at internal temperatures above 65 °C. The LED located on the pyrometer's back side next to the button will also light up to indicate that the laser is activated. Likewise, the LED will extinguish when the laser deactivates.

3.4 Focussing

To determine optimal focussing of very small targets (when the actual measured spot is the same size or only insignificantly larger than the required minimum target spot size according to the distance ratio), it is optimal to use one of the spectral channels as it will indicate the highest intensity and thus the maximum temperature value better than the pyrometer's two-colour measuring function.

3.5 General Laser Use and Precautions

3.5.1 Laser Influence on Temperature Reading

For pyrometers featuring an integrated laser spot light, the light may, when activated, influence the instrument's temperature reading. This influence will vary, depending on the instrument model and the temperature. To ensure an accurate and reliable temperature reading, the laser spot light will automatically deactivate after approximately 2 minutes. The laser is not to be activated during normal operation; its purpose is only to facilitate pyrometer alignment and focussing.

3.5.2 Laser Radiation Hazard

Laser radiation can be harmful to eye!

The PZ Pyrometer operates with a class 2 red light laser. Direct prolonged viewing of a laser beam can injure the retina. Therefore, the following safety precautions must be strictly observed, otherwise the laser may not be operated!

- Only use the laser to align and focus the pyrometer. Deactive the laser immediately afterwards. Alternatively, the laser will automatically switch off after 2 minutes.
- Never look directly into the laser beam path.
- Do not leave the instrument unattended when the laser is activated.
- Do not point the laser beam at any person.
- During pyrometer installation and alignment, make sure to avoid the possibility of laser light reflections caused by reflective surfaces.
- All currently valid laser safety standards must be observed.

3.5.3 Laser Power

The laser operates at a wavelength of 630 - 680 nm (visible red light). The emitted power of the laser beam at the lens opening is max. 1.0 mW. Under normal operating conditions, the emitted radiation does not present a danger to human skin. This laser product is classified according to laser class 2, EN60825-1, IEC60825-1.

3.5.4 Laser Warning Label

The black and yellow laser warning label is affixed to the bottom side of the instrument. An arrow indicates the laser emission path (lens opening).

Fig. 3.2 Laser warning label affixed to the pyrometer

Laser warning label must be visible!

If the pyrometer is installed within a machine or equipment in such a way that the instrument's warning label is visibly blocked, additional laser warning labels (not included in scope of delivery) must be affixed to the equipment or accessory in immediate vicinity to the laser beam emission path opening.

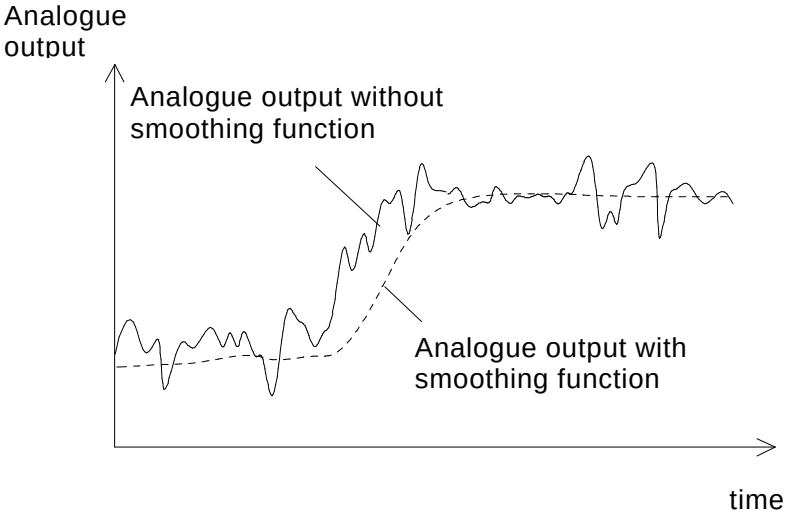
3.6 Smoothing Function

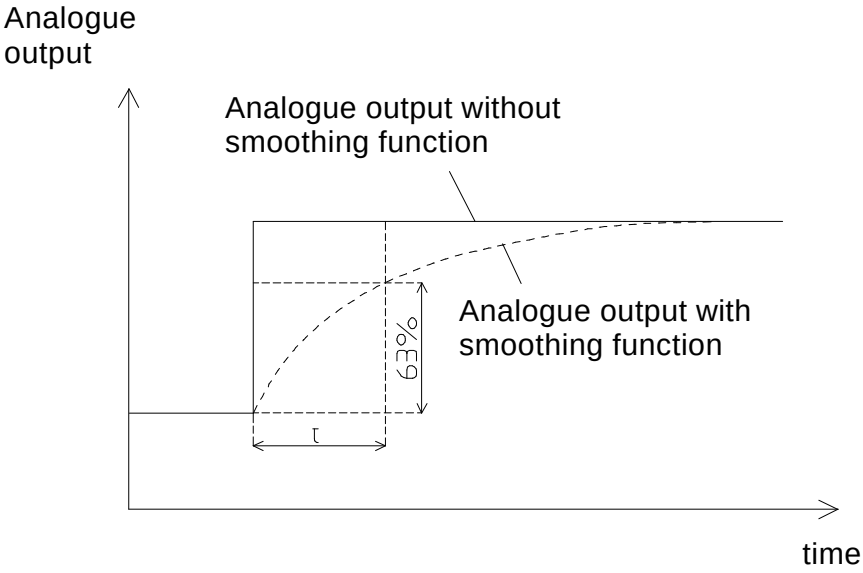
Momentary variations in the temperature of the target are eliminated by a smoothing function which provides a steady measuring signal. This function has an effect on the analogue output and the data transmission to the serial interface. The higher the time constant t is set, the less the disturbing temperature variations will effect the reading.

The response time of the pyrometer is proportional to the time constant. It is therefore necessary to allow more time when directing the pyrometer to the target.

The smoothing time can be set via the Parameter (see chapter 5.3) or via the serial interface by the command „A“ (see chapter 6.10).

Effects of the smoothing function





3.7 Peak picker

Internal Peak picker
In this mode the pyrometer determines the highest and lowest value since the last reset. The minimum and maximum values do not show up at the current output but rather are available by means of the serial interface, where they can also be reset (see chapter 6.10; command „MM“ and „MD“).

Peak picker with External Reset
In this mode the pyrometer determines the highest value since the last reset. This stored value is available on the current output and by means of the serial interface. Reset the peak by a signal on the MODE-input (see chapter 6.3) or by the command „MD“ via the interface. This mode can only be activated via the serial interface with the command „MS1“ (see chapter 6.10).

Double Maximum Memory with Hold Time T_h
It might often be desirable to determine the timelimited peak value, for example when the objects to be measured move past the pyrometer resulting in a temperature which appears cyclical. In this mode, the shown value does not drop between targeted objects, but rather holds the peaks temperature.

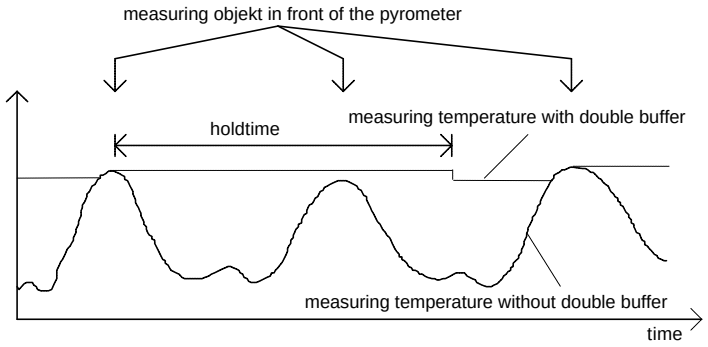
A peak will be held for a certain setable hold time. The hold time is setable from 0.01 to 250 sec. via serial interface. The maximum temperature occuring within the hold time will be held and appears on the output. After 50% of the hold time a second internal peak picker starts. After expiration of the hold time the output signal decreases to the value of the second peak picker. 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 gaps in the measured temperature are avoided and temperature changes are picked up quickly.

For two-colour pyrometers we recommend using the Double Maximum Memory only together with a smoothing time of at least 30 ms to avoid picking up very short peaks. This mode can be activated via the serial interface (command „MS2“; see chapter 6.10) or via the switch S5 on the backside (see chapter 9.0).

Tip:

By using the modes „Peak Picker with External Reset“ and „Double Maximum Memory with Hold Time“ the minimum and maximum values are not available.
The stored peak appears directly on the current output and on the serial interface.

Function of the Double Maximum Memory (Buffer)



4 Theory of Non-Contact Temperature Measurements

Every material emits heat radiation 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 µm to the infrared range with wavelenghs of more than 40 µm. The KELLER HCW PZ radiation pyrometers use this infrared radiation for non-contact temperature measurements.

4.1 Advantages of Non-Contact Temperature Measurements

Non-contact temperature measurement means cost-effective temperature measurement, i. e. only one investment in the measuring instrument without any follow-up costs for consumption materials such as thermocouples for temperatures higher than 1000 °C. It is also possible to detect moving objects - quick temperature measurements within milliseconds - for example at automatic welding processes. Small objects with medium and high temperatures are also measured without any problems. Erroneous values will not be obtained when measuring targets with low heat capacity caused by heat drain when applying a contact temperature probe. Moreover, non-contact temperature measurements are ideal for aggressive melts where thermocouples can only be used within limits. Last but not least it is also possible to measure voltage-carrying objects.

4.2 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 e(λ) of a black body is equal to 1. The emissivity coefficient indicates the relation of radiation of a real body (target) to the radiation of an ideal black body.

$$e(l) = \frac{M}{M_S}$$

e(l): Emissivity coefficient of the target at the wavelengh λ

M: specific radiation of any temperature radiator (target)

M_S*::* specific radiation of a black body

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.

4.3 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 PZ 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 ε for the spectral ranges λ = 8...14 µm (PZ 10), λ = 1.23...1,66 µm (PZ 20 / PZ 21) and λ = 0.78... 1.06 µm (PZ 30 / PZ 31 / PZ 40 / PZ 41) is shown in the following table:

4.4 Emissivity Coefficient Table PZ 10

List of emissivity coefficients of different materials in %

	PZ 10
Wavelength l	**8 - 14 µm**
"Black body"	100
Aluminium oxide	76
Asphalt	90 - 98
Baking oven, dark colour	96
Concrete	55 - 65
Bitumem (roofing paper)	96
Bread in baking oven	88
Ferrous oxide	85 - 89
Enamel	84 - 88
Earth	92 - 96
Paint and varnish, bright	92
‘’ ‘’ ‘’ , pale	96
Gypsum	80 - 90
Glass	85 - 95
Graphite	98
Rubber, black	94
Skin, human	98
Wood	80 - 90
Radiator	80 - 85
Lime cast	91
Clinker bricks, glazed	75
Cooking plate	95
Synthetic material, nontransparent	65 - 95
Copper, oxidized	78
Leather	75 - 80
Marble	94
Brass, oxidized	56 - 64
Paper	70 - 94
Sand	90
Fireclay	75
Steel, stainless	45
Steel, rusty	69
Textiles	75 - 88
Water	92 - 98
Cement	90
Bricks	93 - 96

4.5 Emissivity Coefficient Table PZ 20 – PZ 50

List of emissivity coefficients of different materials in %

	PZ 20 PZ 21 / PZ 25 PZ 50 λ2	**PZ 30 / 31 / 35 PZ 40 / 41 PZ 50 λ1**
Wavelength λ	**1,1...1,7 µm**	**0.8...1,1 µm**
"Black Body"	100	100
Aluminium, polished	5	15
Aluminium, blackened	10	25
Asbestos cement	60	70
Bronce, polished	1	3
Bronze, blackened	15	30
Chromium, polished	15	30
Iron, heavily scaled	90	95
Iron, rolling skin	75	90
Iron, liquid	15	30
Gold and silver	1	2
Graphite, blackened	85	90
Copper, oxidized	70	90
Brass, oxidized (tarnished)	50	70
Nickel	8	20
Porcelain, glazed	50	60
Porcelain, rough	75	85
Soot	90	95
Fireclay	40	50
Slag	80	85
Pottery, glazed	85	90
Bricks	85	90
Zinc	40	60

5 Operating Controls and Display

The backside of the CellaTemp PZ 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 Parameter LED F2 (yellow) will light up. The Ready LED F1 (green) indicates the current status as ready for operation (see Chap. 6.4).

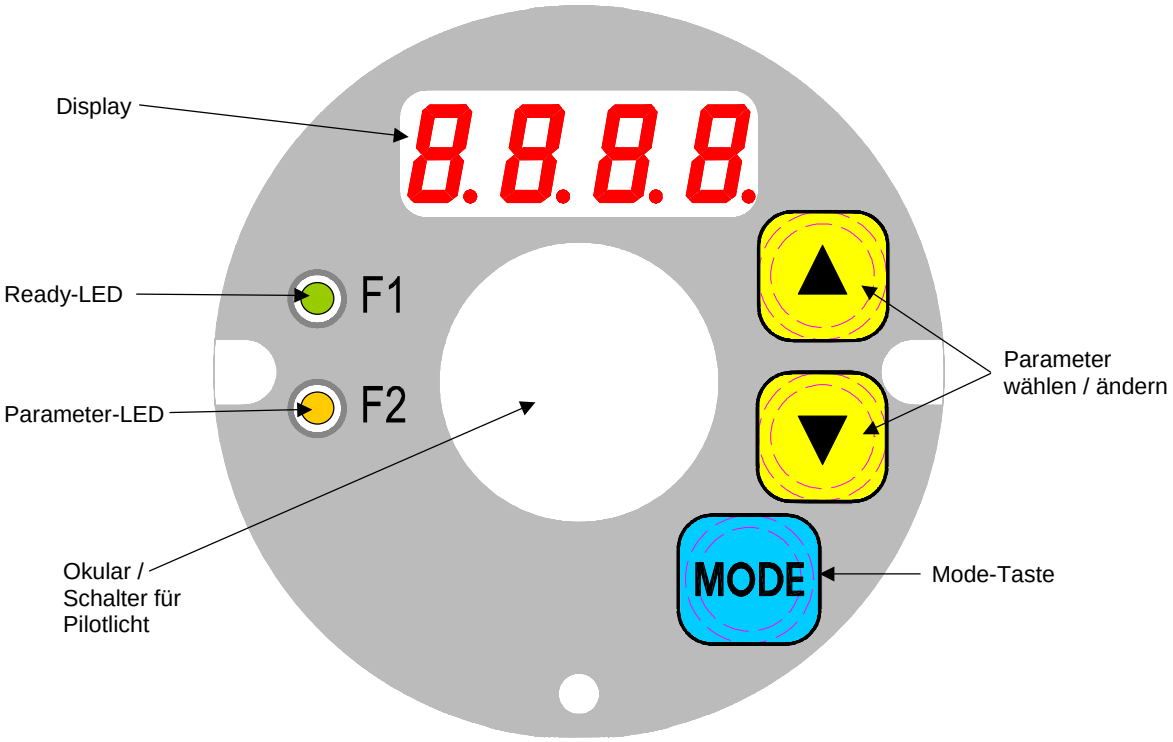


Fig. 2: The instrument's display

The display will blink when the temperature values are above or below the measuring range, or when the signal intensity is weak (applies to two-colour pyrometers). This serves to warn the user of a potential error in the measurement reading.

fig. 3: Displayed temperature

For temperatures below 200 °C. the value will be displayed with a decimal point. For temperatures above 200 °C, the value will be displayed in 1 degree Celsius increments.

5.1 Emissivity Quick Adjustment Feature

To instantly view or change the emissivity setting, the pyrometer has an emissivity quick adjustment feature. Anytime during temperature display, simply press the ↑oder ↓ push-button. The display will then show the current emissivity setting (for two-colour pyrometers, the display will show the emissivity setting of the currently activated channel, either Q, L1 or L2). Using the arrow buttons, the emissivity setting can now be quickly adjusted.

fig. 4: Emissivity ratio = 100.0 % for two-colour measurements

If the two-colour pyrometer is set to spectral channel 1 or spectral channel 2, then the word “oder” (meaning “or”) will preceed the displayed emissivity value.

fig. 5: Emissivity ratio = 100 % for Spectral channel 2

After making the adjustment (4 seconds after pressing a button), the display will automatically return to temperature display. Alternatively, by pressing the Mode-key, the display can be manually switched back to showing the temperature value.

Please note:
After you have changed the emissivity value, the pyrometer will function permanently with this fixed value!

If the push-buttons have been deactivated (this can be done via the serial interface), all parameters can be displayed but cannot be changed.

5.2 Access to the Menu Layers

Using the push-buttons, it is possible to access various CellaTemp PZ parameters/measurement values. First press the Mode-button. The code query "c000" will appear. Now enter the access code for the desired menu layer using the ↑ and ↓ buttons.

Fig. 6: Enter access code

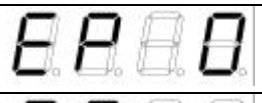
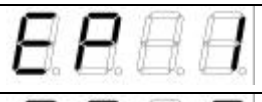
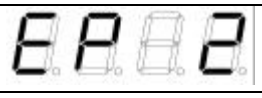
There are three menu layers with different access codes:

Access code	Menu layer
	Set CellaTemp PZ parameters and store in a nonvolatile memory
	Display temperature readings and the internal temperature of CellaTemp PZ
	Preset output current for installation and commissioning

Table 1: Menu layers

After entering the access code, the Mode-button must be pressed once again in order to get to the corresponding menu layer.

5.3 Menu layer c001 – Setting the parameters

Parameter/ Function	PZ1x	PZ2x/3	PZ4x/5	Description
			•	Temperature channel for two-colour pyrometers. Defines which channel is used for the measurement and thus displayed. 0: Quotient 1: Spectral channel Lambda 1 2: Spectral channel Lambda 2
			•	Emissivity ratio for the two-colour measurement. Adjustable from 74.4 – 125.5 %
	•	•	•	Emissivity correction spectral channel 1 Adjustable from 10 – 100 %
			•	Emissivity correction spectral channel 2 Adjustable between 10 – 100 %

			•	Smoothing function time for two-colour measurement Adjustable between 0.00 – 16.00 sec.
	•	•	•	Smoothing function time for spectral channel 1 Adjustable between 0.00 – 16.00 sec.
			•	Smoothing function time for spectral channel 2 Adjustable between 0.00 – 16.00 sec.
	•			Dynamic smoothing function 0: =off 1: =on
		•		Signal smoothing – peak picker 0: first smoothing – then peak picker 1: first peak picker – then smoothing
	•	•	•	Peak picker 0: Internal peak picker 1: Peak picker with external reset 2: Double max-memory with adjustable hold time 3: Double max-memory Q/L2 combined with adjustable hold time (only PZ4x/5x)
	•	•	•	Hold time of the peak picker in modes 2 and 3 Adjustable between 0.1 – 250.0 sec.
			•	"Low Signal" Warning Necessary radiated energy for valid measurment of two-colour channel (0% = warning off). When radiation intensity is too low, temperature display will blink. Adjustable between 0.0 – 100.0 %
	•	•	•	Scale of current output "beginning" Temperature display blinks when value too low. Adjustable range depends on pyrometer model
	•	•	•	Scale of current output "end" Temperature display blinks when value too high. Adjustable range depends on pyrometer model
	•	•	•	Scale of current output 0: = 0 – 20 mA 1: = 4 – 20 mA

	•	•	•	Automatic temperature data transmission to serial interface 0: =off 1: =on
	•	•	•	Cycle time for automatic temperature data transmission Adjustable between 0.1 – 999.9 sec.
	•	•	•	Unit of displayed temperature 0: = Degrees Celsius 1: = Degrees Fahrenheit
	•	•	•	Load all instrument parameters from the volatile Memory (**Press Mode button 4 sec.**)
	•	•	•	Save all instrument parameters in volatile Memory (**Press Mode Button 4 sec.)**
	•	•	•	Return to temperature display

Table 2: Menu layer "c001"

5.4 Menu layer c002 – Display of internal measurement data

Parameter / Function	PZ1x	PZ2x/3	PZ4x/5	Description
			•	Display current temperature two-colour channel (without switching at current output)
	•	•	•	Display current temperature spectral channel 1 (without switching at current output)
			•	Display current temperature spectral channel 2 (without switching at current output)
	•	•	•	Display current internal temperature
	•	•	•	Return to display temperature reading

Table 3: Menu layer "c002"

5.5 Menu layer c100 – Special functions for Installation and Commissioning

In this menu layer the current output can be manually controlled. The output current can be selected in either increments of 1 mA or 1 °C

Parameter / Function	PZ1x	PZ2x/3	PZ4x/5	Description
	•	•	•	Manual setting for current output Adjustable 0 – 20 mA (in 1mA increments)
	•	•	•	Manual setting for current output To be set as a temp. value; based on the previously configured scale of the current output (in °C increments)
	•	•	•	Return to temperature display

Table 4: Menu layer "c100"

Please note:
The display will automatically return to showing the temperature reading approx. 2 minutes after the last time the button has been pressed (except when menu layer “c100” for manual control of current output is activated).

6 Outputs and Control Signals

6.1 Supply voltage

Connect a power supply within the range of 22 - 27 VDC to set up the instrument. The current input is £ 150 mA for spotlight version (135 mA standard version). The pyrometer is equipped with a protection device against reverse polarity. We recommend protecting the pyrometer with a 250 mA fuse.

The standard connection cables are shielded. The shield is led out via a grey wire (0,5 $mm^{2)}$.

Important:

The pyrometer housing is connected to the shielding through the connecting plug of the cable. When connecting the shielding make sure that equipotential bonding between the pyrometer housing and the terminal of the shielding does not occur.

Either make a ground connection to the pyrometer housing without connecting the shielding or install the pyrometer as a self-contained unit thereby connecting the shielding with the grounding of the facility.

6.2 Analogue Output

The analogue output of the PZ pyrometers is a current source which supplies a linear output current. It is switchable from 0...20 mA to 4...20 mA and can be loaded with maximum 500 Ω.

For all pyrometers of the PZ series the current output is short-circuit-proof and galvanically separated from the supply voltage. The range of the current output (beginning and span) can be set either with switches or through the interface.

6.3 MODE Control

(Reset input for Peak picker with Ext. Reset)

The pyrometer PZ 4x / PZ 5x can be operated as a two-colour or as a one-colour pyrometer. The setting is made externally with the MODE input. The mode change takes place with a delay of 200 ms.

0V or open	=	two-colour measurement
+24 VDC	=	one-colour measurement

The voltage is related to the ground of the power supply. When the setting is made please note the modified effect of the epsilon switches (see chapter 3.7.

A short pulse on the Mode-input (≤ 150 ms) resets the stored maximum value without changing the measuring mode. This reset function applies to all PZ pyrometers. See also chapter 6.3 peak storage.

6.4 READY Control Signal

All pyrometers of the PZ series are equipped with a control output which signals the validity of the measurement.
The output is switched as an "open collector to +24 VDC. A "pull down" resistance can be connected with the ground of the supply voltage to evaluate the signal voltage.

The reading is valid for voltages > 22 VDC.

6.5 Serial Interface

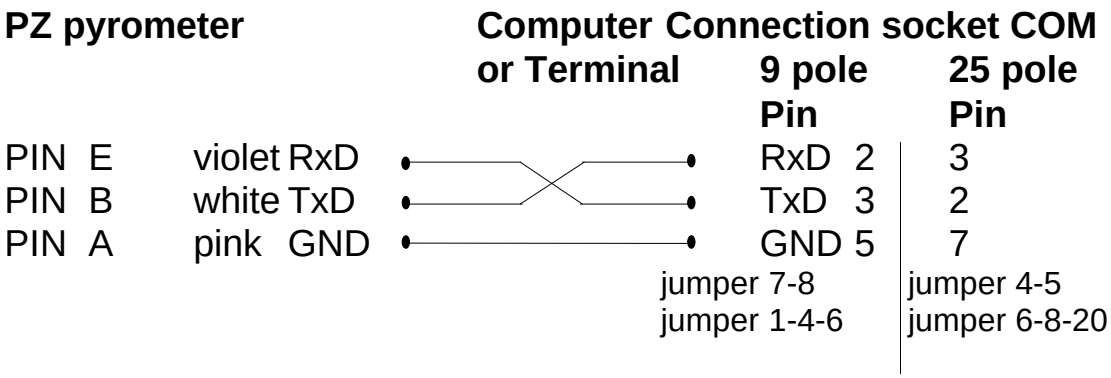
As a standard, the pyrometers of the PZ series are provided with a serial interface which is in accordance with the RS 232 standard. The PZ signal level TxD is ± 5 V. The pyrometer can be connected to a common serial COM-interface. The pyrometer requires only a terminal programm, which is, e.g. part of a Windows® system:

Windows® 3.11: Terminal
Windows® 95, 98, NT, XP : Hyper Terminal

The assignment of the connecting cable is shown in chapter 7.0.

The PZ pyrometer may be connected by an adaptor cable (see chapter 23) to the serial interface of a PC according the following wiring. You can also use the PC-connecting cable VK 01 / C (see chapter 24).

Example for a connection:



6.6 Serial Interface RS 422 with AF 2xx

All PZ pyrometers of Type 2xx are equipped with an RS 422 compatible interface. This means that both the serial transmit and receive signals are designed according to the RS 485 standard. Only a point-to-point connection is permitted which uses an ASCII code as described in chapter 6.8. The connection is nonsensitive to interference and can be as long as 100 meters. For the connection to a PC, the PC requires an RS 422 interface card or an RS 232 to RS 422 converter. For longer transmission paths we recommend using a converter with galvanic isolation to avoid problems with ground loops. See chapter 7 for the pin assignment.

A transmission path of up to 1200 m in length (at 4800 Baud) is acceptable according to the RS 485 Norm. 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 less than 100 m. The standard cable VK 01/R has a cross section of 0.14 mm². This results in a supply voltage drop of approximately 1.5 volts per 100 meters, or 4 volts per 100 meters for instruments with an aiming light spot. A cable with a greater cross section can be used to correct this problem.

6.7 Serial Interface and Electric Current Output

Important:

A galvanic isolation is necessary for a simultaneous operation of the analogue output and the serial interface, because the ground of the analogue output and the serial interface have different potentials. Either the current output or the serial interface must be isolated when connected. The transmission signal is driven with ± 5 volts. Therefore the connecting cable to the PC or the terminal should not be longer than 2.5 metres. For longer transmission paths we recommend the RS 422 option.

6.8 Serial Transmission of Measured Values

Transmission parameters for the serial interface:

4800 Baud / 8 data bits / no parity / 1 stop bit / XON / XOFF
No Handshake at automatic transmission mode

Temperature format (one cycle):

Byte	Negative Temperature	Positive Temperature	Temperature exceeds measuring range	Temperature falls below measuring range
1	Minus symbol "-"	Space	Space	Space
2	Digit 1000	Digit 1000	Minus symbol "-"	Minus symbol "-"
3	Digit 100	Digit 100	"O"	"U"
4	Digit 10	Digit 10	"V"	"N"
5	Digit 1	Digit 1	"E"	"D"
6	Decimal point "."	Decimal point "."	"R"	"E"
7	Decimal place	Decimal place	Space	"R"
8	Space	Space	Space	Space
9	Unit "C" or "F"	Unit "C" or "F"	Minus symbol "-"	Minus symbol "-"
10	Space	Space	Space	Space
11	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).

6.9 Automatic activation of measurement value output

In general:

When *automatic* measurement value output is activated, the pyrometer will not firstly show the instrument parameters; immediately upon switching on the pyrometer it will transmit the current temperatures according to the selected cycle time.

When operating the pyrometer in combination with the CellaMevis software it is imperative to change the pyrometer over to *automatic* measurement value output, otherwise no measurement data will be transmitted.

Activation:

The automatic measurement value output can be activated by means of the terminal program. The following steps are necessary:

To put the pyrometer in terminal mode, hold the control key while simultaneously double-clicking the E key. The help menu will be displayed on the monitor.

Command **"MA"** activates (on) / deactivates (off) the automatic measurement value output after the pyrometer is restarted.

```
Your Choice: Toggle Automatic Print
PRINT AUTOSTART: ......... ON
```

Command **"MT"** sets the cycle time in which the current measurement values are output via the serial interface. The following example indicates only one value per second. (Enter “1“).
A maximum of 6500 s may be selected.

```
Your Choice: Set Cycle Time
PRINT CYCLE TIMER:   0000.1 s
Cycle Time [s] : 1
(Enter)
```

Command **"S"** stores the pyrometer settings, so that after restarting the instrument the output will take place in the previously selected cycle time.

Command **"P"** displays a list of the selected parameters for checking purposes.

6.10 Operating Instructions

When the instrument is switched on it reports the current version number and runs through a self test. The last configuration stored in the EEPROM is loaded and activated. The measurements begin and the configuration is shown. An example for the pyrometer PZ 40:

```
******** PZ 40 V2.11 ********
*     MB:  700...1600 C     *
*                           *
*     KELLER HCW GmbH - MSR *
*     D-49479 Laggenbeck    *
*                           *
*       (C) 10 / 2001       *
*****************************
CONTROLLER-TYPE: ..... 80C528
R/W MEMORY: ............... OK
PROGRAM MEMORY: .......... OK
SENSOR TYPE: ........ DUAL SI

 LOAD CONFIGURATION (EEPROM)
         USER DATA:
============================
RANGE:  0700.0 C ... 1600.0 C
OUTPUT MODE: ....... Quotient
OUTPUT CURRENT: .... 0..20 MA
EPSILON Quotient: ... 100.0 %
EPSILON Lambda 1: ..... 100 %
EPSILON Lambda 2: ..... 100 %
AVERAGING QUOTIENT:  00030 ms
AVERAGING LAMBDA 1:  00030 ms
AVERAGING LAMBDA 2:  00030 ms
TERMINAL UNIT: ...... CELSIUS
TERMINAL EMULATION: .... VT52
HEX - SWITCH:.......... ACTIV
QUOTIENT-CHECK:.......... FIX
QUOTIENT-WARNING : ...... OFF
PRINT AUTOSTART: ........ OFF
PRINT CYCLE TIMER:   0000.1 s
MAX BUFFER:           INTERNAL
HEX-Switches 1..5   8 0 1 5 3
```

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

A help menu with all user commands appears. This menu can be activated any time with the 'H' command.

```
*************** INSTRUCTION CODE -- USER MODE ***************

A: Set Averaging Time              B: Automatic Baudrate
                                      Configuration
C: Output Current (0-20mA/4-20mA)  D:
E: Emissivity Factor (EPSILON)     F: Fahrenheit / Celsius
G:                                 H: This Help Display
I: Internal Hex Switch (ON/OFF)    J:
K:                                 L: Load Parameter From
                                      EEPROM
M: Miscellaneous                   N: Softwarerevision Info
O:                                 P: Show Actual Parameter
Q: Show Calibration Data           R: Restart And Self Check
S: Save Parameter To EEPROM        T: Set Current Output Mode
U: Set Q-Check                     V: VT52 / VT100-VT220
W: Show Internal Temperature       X: Show Last Measure
Y: Set Begin Of Measuring Range    Z: Set End Of Measuring
                                      Range
```

The functions available in the terminal mode are explained below. Just enter the command letter (no return key). When entering a numerical value close with the return key.

These parameter adjustments are described in the following:

Important:
Permanent parameter settings must be saved with „S“ in the EEPROM, so that the changes will also be effective after restart.

Depending on the position of the switches S1 - S5 the parameters of the switches or of the EEPROM will be loaded after restart (see chapter 9.0).

Command '**A**' asks for a new time for the average value of the readings. Allowed are entries between 0 (filter off) to 16000 msec.
For a two colour pyrometer the chanel must be selected.

Example: old time for filter - 30 ms
new time for filter - 100 ms

```
YOUR INPUT: A
AVERAGING QUOTIENT:  00030 ms
AVERAGING LAMBDA 1:  00030 ms
AVERAGING LAMBDA 2:  00030 ms

Choose Channel:
0:  Quotient
1:  Lambda 1
2:  Lambda 2

Your Choice:
Quotient AVERAGING T98 [ms] = 100
```

Command '**C**' changes the current output from 0...20 mA to 4...20 mA (no return key).

```
YOUR INPUT: C

NOW:  CURRENT OUTPUT =.... 4..20 MA
```

Command 'D' scans the signal strength to alert the user if the input signal is too low for accurate measurement. If, during the measurement, the signal falls below the preset threshold point, the READY output will switch off. Selecting a 0% threshold level will also cause the warning function to switch off.

```
YOUR INPUT: D

Set new warning level [%]: 84.3
New warning level accepted
```

Command '**E**' sets the emissivity factor of the current sensor type. With the setting 0, 1 or 2 one can choose between Quotient, Lambda1, or Lambda2. 10 ... 100 % are possible for one-colour measurements and 80 - 120 % for two-colour measurements.

The example shows the Epsilon change at the PZ 40 for the two-colour measurement from 100 % to 98.2 %.

```
YOUR INPUT: E
 EPSILON Quotient: ... 100.0 %
 EPSILON Lambda 1: ..... 100 %
 EPSILON Lambda 2: ..... 100 %

 Choose Channel:
 0:  Quotient
 1:  Lambda 1
 2:  Lambda 2

 Your Choice:
 Quotient EPSILON [%] = 98.2
```

Command '**I**' activates or deactivates the switches on the rear side of the housing. After activation, the switch adjustments are assumed and displayed. Now every change of the switch position effects the parameters.

```
YOUR INPUT: I

NOW:  HEX - SWITCH:.......... ACTIV

USER DATA:
============================
RANGE:  0700.0 C ... 1600.0 C
OUTPUT MODE: ....... Quotient
OUTPUT CURRENT: .... 0..20 MA
EPSILON Quotient: ... 100.0 %
EPSILON Lambda 1: ..... 100 %
EPSILON Lambda 2: ..... 100 %
AVERAGING QUOTIENT:  00030 ms
AVERAGING LAMBDA 1:  00030 ms
AVERAGING LAMBDA 2:  00030 ms
TERMINAL UNIT: ...... CELSIUS
TERMINAL EMULATION: .... VT52
HEX - SWITCH:.......... ACTIV
QUOTIENT-CHECK:.......... FIX
QUOTIENT-WARNING: ....... OFF
PRINT AUTOSTART: ........ OFF
PRINT CYCLE TIMER:   0000.1 s
MAX MEMORY:          INTERNAL
HEX-Switches 1..5:  8 0 1 5 3
```

Reentering the command 'I' will deactivate the switches. Now it will no longer be possible to influence the measurement when turning switches, not even after a restart.

```
YOUR INPUT: I
NOW:  HEX - SWITCH:...... NOT ACTIV
```

Command '**L**' loads previously stored adjustments from the internal EEPROM. This applies to all parameters which are shown under the command 'P'.

```
YOUR INPUT: L
LOAD CONFIGURATION (EEPROM)
```

Command '**N**' shows the software revision and the PZ instrument type.

```
******** PZ 40 V2.16 ********
*     MB:  700...1600 C     *
*    PZ40 AF1   02/00189    *
*       26.05.98   Job      *
*                           *
*   KELLER HCW GmbH – MSR   *
*     D-49479 Laggenbeck    *
*                           *
*       (C) 10 / 2001       *
*****************************
```

Command '**P**' shows the current configuration of the pyrometer.

```
YOUR INPUT: P
USER DATA:
============================
RANGE:  0700.0 C ... 1600.0 C
OUTPUT MODE: ....... Quotient
OUTPUT CURRENT: .... 0..20 MA
EPSILON Quotient: ... 100.0 %
EPSILON Lambda 1: ..... 100 %
EPSILON Lambda 2: ..... 100 %
AVERAGING QUOTIENT:  00030 ms
AVERAGING LAMBDA 1:  00030 ms
AVERAGING LAMBDA 2:  00030 ms
TERMINAL UNIT: ...... CELSIUS
TERMINAL EMULATION: .... VT52
HEX - SWITCH:.......... ACTIV
QUOTIENT-CHECK:.......... FIX
QUOTIENT-WARNING: ....... OFF
PRINT AUTOSTART: ........ OFF
PRINT CYCLE TIMER:   0000.1 s
MAX MEMORY:          INTERNAL
HEX-Switches 1..5:  8 0 1 5 3
```

Command '**Q**' shows the calibration data of the pyrometer. They can **only be changed in the calibration mode** and are protected against overwriting during current operation.

```
YOUR INPUT: Q
CALIBRATION DATA:
============================
IA  0mA                : 00087
IA  4mA                : 00859
IA 20mA                : 03947
----------------------------
Lambda 1   MultDA      : 00110
Lambda 1   Offset      :+00520
Lambda 1   Faktor      :+01400
Lambda 1   Lin-Corr.   :+00000
----------------------------
Lambda 2   MultDA      : 00080
Lambda 2   Offset      :+00780
Lambda 2   Faktor      :+01600
Lambda 2   Lin-Corr.   :+00000
----------------------------
Quotient   ZeroDA      : 00180
Quotient   MultDA      : 00067
Quotient   Offset      :+02500
Quotient   Faktor      :-01500
Quotient   Lin-Corr.   :+00000
----------------------------
PTC        MultDA      : 00060
PTC        Offset      :+02343
```

Command '**S**' stores the current parameters (see command P) in the internal EEPROM. They are available again after giving command 'L'.
It is also possible to load the stored settings automatically by switching on the pyrometer. For this purpose deactivate the HEX switch on the instrument (command 'I') and store these settings with 'S'.

```
YOUR INPUT: S
SAVE CONFIGURATION  (EEPROM)

EEPROM User SAVE OK
```

Command '**T**' (only for PZ 4x / PZ 5x) queries the requested sensor type. All following measurements are made in the given operating mode even the analogue output is switched to this channel. The example shows a conversion from two-colour measurement to spectral measurement with Lambda 2.

```
YOUR INPUT: T

Pyrometer is set to Quotient

SET Sensor Type:
0:  Quotient
1:  Lambda 1
2:  Lambda 2

Your Choice: 2
Pyrometer is set to Lambda2
```

By means of command '**U**' one may select the mode of comparison between the two-colour channel and the spectral channel in order to ensure the secure deactivation when temperatures fall too low. The following modes are available:

OFF: The comparison is switched off. The pyrometer still functions with very low radiation intensities, but cannot determine a defined value for temperatures which fall below the intended measuring range.

FIX: The pyrometer checks if a minimum radiation intensity is exeeded. This minimum radiation is commensurate to the intensity at the beginning of the measuring range at 10 % emissivity.

AUTO: The two-colour temperature needs to match to the spectral temperature with an emissivity of 10 - 50 %. In case of fault the output is set to „out of range“.

VAR: The temperature is considered as valid when the object fills the target area to at least a certain percentage. This percentage is adjustable and can be set from 0.1 to 99.9 % filled target area.

```
YOUR INPUT: U

 Quotient-Check is set to Fix-Mode

 Set Quotient-Check Mode:
 0: Off
 1: Fix
 2: Auto
 3: Var

 Your Choice:
 Quotient-Check is set to Auto-Mode
```

Command '**V**' changes the terminal mode of the PZ from VT52 to VT100 / 220. The identical terminal mode must be set at the communicating PC.

```
 YOUR INPUT: V

 NOW:  TERMINAL:..... VT100 - VT220
```

Command '**W**' shows continuously the internal temperature of the pyrometer.

```
 YOUR INPUT: W
 Internal Temperature: 0021.7 C
```

Command '**X**' continuously shows the temperature measured by the pyrometer.

```
YOUR INPUT: X

LAST MEASURE:
[t= 0000.1 s]
Quotient     Lambda 1     Lambda 2
e=100.0%     e= 100 %     e= 100 %
0769.1 C      0834.1 C     0808.6 C
```

Command '**Y**' queries a new starting point of the measuring range. A possible entry, e.g. for PZ 40 AF1, could be from 700 - 1400ºC. The range beginning must be at least 2K below the range end. The example shows the conversion of the measuring range from 700-1400 °C to 800-1400 °C.

```
YOUR INPUT: Y
RANGE:  0700.0 C ... 1600.0 C
SET BEGIN OF MEASURE RANGE T[C]= 800
RANGE:  0800.0 C ... 1600.0 C
```

Command '**Z**' queries a new end of the range. A possible entry, e.g. for PZ 40 AF1, could be from 800 – 1600°C. The range beginning must be at least 2K below the range end. The example shows the conversion of the measuring range from 800 - 1600 °C to 800 -1500 °C.

```
YOUR INPUT: Z
 RANGE:  0800.0 C ... 1600.0 C
 SET END OF MEASURE RANGE T[C]= 1500
 RANGE:  0800.0 C ... 1500.0 C
```

Command '**M**' opens a submenu which provides various functions as shown below:

```
YOUR INPUT: M
MISCELLANEOUS:
   A: Toggle Automatic Print
   D: Delete Min/Max-Memory
   M: Show Min/Max-Memory
   P: Set Average Time  Pre/Post-Mode
   S: Set Min/Max Mode
   T: Set Measure Time
```

Command '**MA**' activates / deactivates the automatic value output via the serial interface after restart. With „Automatic print“ the temperature values appear at the serial interface directly after connecting the power supply. Reset the pyrometer to the terminal mode by double pressing CTRL-E.

```
Your Choice: Toggle Automatic Print
 PRINT AUTOSTART: ......... ON
```

Command '**MD**' resets the Peak picker.

```
Your Choice: DELETE MIN/MAX MEMORY
```

Command '**MM**' shows the highest and lowest temperature since the last reset.

```
Your Choice: MIN/MAX MEMORY
         Quotient  Lambda 1   Lambda 2
 MIN=    0640.5 C  0643.7 C   0641.8 C
 MAX=    0987.9 C  0989.9 C   0983.5 C
```

Command '**MS1**' sets the peak picker to the „peak picker with external reset“-mode. See also chapter 3.7 "peak picker".

```
Your Choice:
 MAX BUFFER: Internal Min/Max-Memory

 Set MIN/Max Mode
   0: Internal Min/Max-Memory
   1: Max-Memory with external Reset
   2: Double Max-Memory With Hold Time
```

Command '**MS2**' sets the Peak picker to the „Double Maximum Memory with Hold Time“-mode. See also chapter 3.7 "peak picker".

```
Your Choice:
 MAX BUFFER: Max-Memory with external
 Reset

 Set MIN/Max Mode
   0: Internal Min/Max-Memory
   1: Max-Memory with external Reset
   2: Double Max-Memory With Hold Time
[s] : 5
```

Command "**MP**" defines in which order signal processing occurs. Select the setting "**Pre Max-Mem**" to effect smoothing of the signal prior to saving the peak values, whereas "**Post Max-Mem**" performs the smoothing function of the two values afterward. With "**Post Max-Mem**" the peak values are ascertained based on the unaveraged measurement values. These peak values are then applied to perform the smoothing function. The standard setting is "**Pre Max-Mem**"**.**

```
Your Choice:
 AVERAGING MODE: .. AV PRE MAX

 Set Average Pre/Post-Mode
   0: Average Pre  Max-Mem
   1: Average Post Max-Mem
```

Command '**MT**' sets the cycle time. This is the cycle time for the temperature output via the serial interface. The example below shows a cycle time of 1 sec..

```
Your Choice: Set Cycle Time
 PRINT CYCLE TIMER:   0000.1 s
 Cycle Time [s] : 1
```

7 Pin Assignment

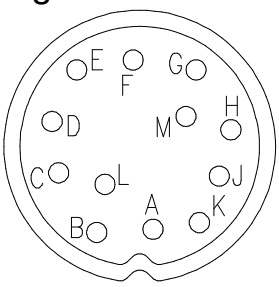
Assignment of the flange plug of the PZ standard design and wire assignment of the standard VK01 / A and VK01 / B

PIN	Function and Direction		VK01/B 4 wires	VK01/A 12 wires (RS232)	VK01/R 6x2 wires (RS422)	Remarks
J	+24V	E	red	red	red	**24V** supply voltage ≤ 135 mA for standard design, ≤150mA for option model with spot light
M	ground	E	black	black	blue	The supply voltage is galvanically isolated from the current loop (D,L) and the serial interface (A,B,C,E,F).
D	Iout +	A	white	yellow	violet	Current loop 0..20 or 4..20 mA
L	Iout -	A	blue	blue	black	**A galvanic isolation is necessary when simultaneously using the current output and serial interface (see chap. 6.5).**
C	T(A) with RS422	A			green	RS422 Transmit Data (A)
B	T(B) with RS422	A			yellow	RS422 Transmit Data (B)
	TxD with RS232	A		white		RS232 Transmit Data ±5 Volt
F	R(A) with RS422	E			grau*	RS422 Receive Data (A)
E	R(B) with RS422	E			pink*	RS422 Receive Data (B)
	RxD with RS232	E		violet		RS232 Receive Data max. ±15 Volt
A	GND			pink	white + brown	Ground of the serial interface
H	MODE / RESET	E		red/blue	red/blue	Conversion of the measuring procedure: 0V two-colour measurement +24 V spectral measurement Delete the Max-Memory (chap.2 ; 4.3)
K	READY	A		grey/pink	grey/pink	Output signal indication: 0V reading is invalid approx. 22 V reading is valid The output is switched as an "Open Collector" to 24 V. A "Pull Down" resistance can be connected to the ground of the supply voltage.
R	Release for calibration			green		Release for calibration of the pyrometer at the manufacturer. It is not permitted to connect this contact.

*The receive wires of the VK01 / R are connected in the plug with 120 Ohms.

The shielding (grey 0.5 mm^2) must either be connected with protective ground or with a shielding board, depending on the application (see chapter 6.1).

Outside view of the flange plug:



7.1 Examples for Connection

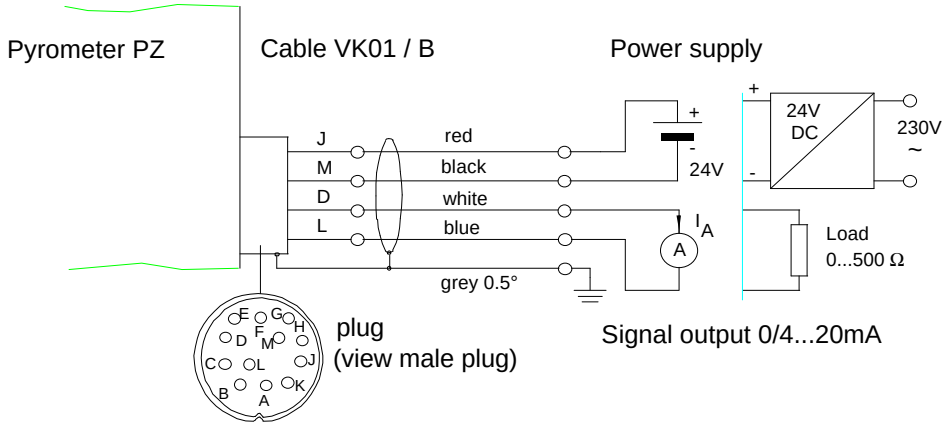


Abb.1: Example for the connection PZ..

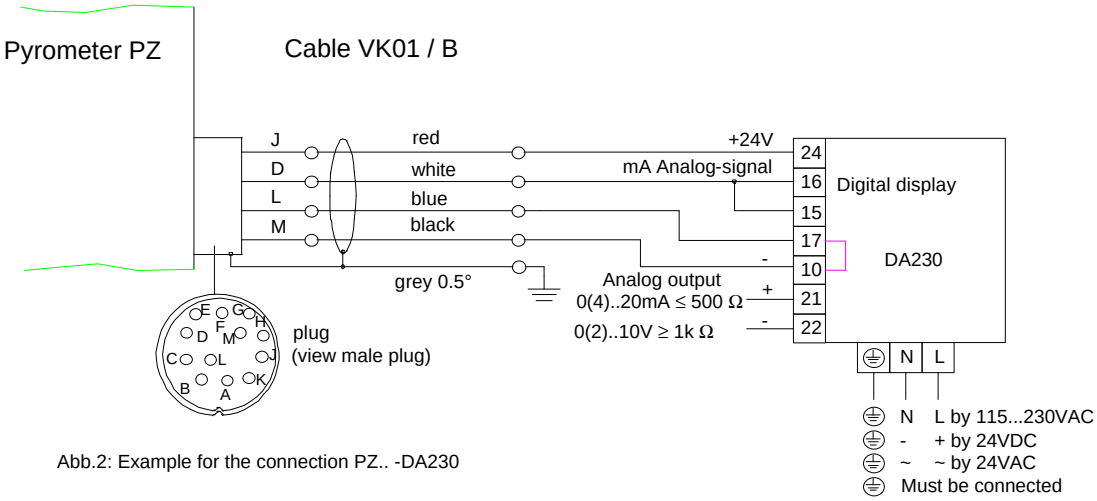


Abb.2: Example for the connection PZ.. -DA230

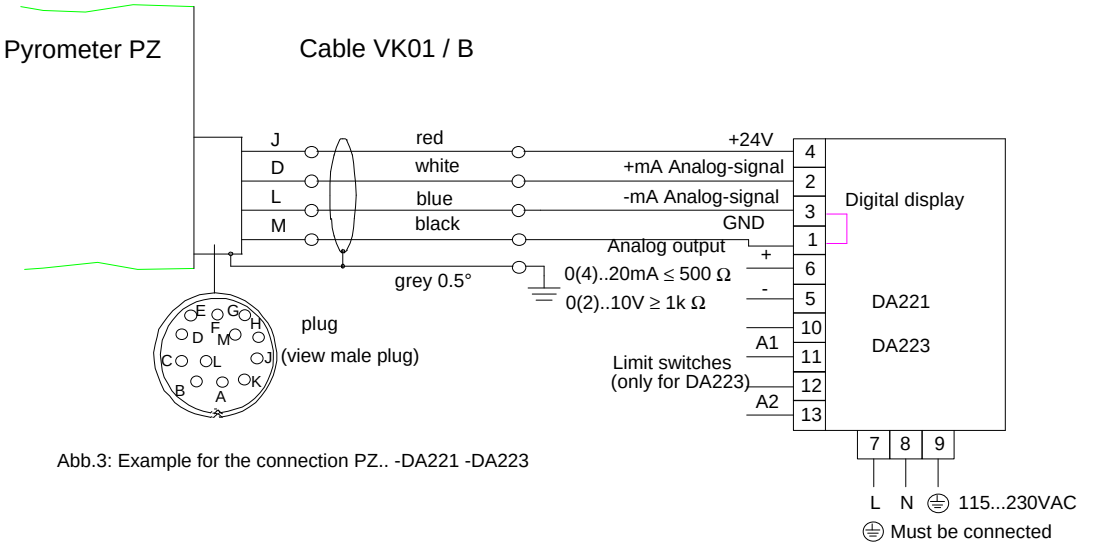
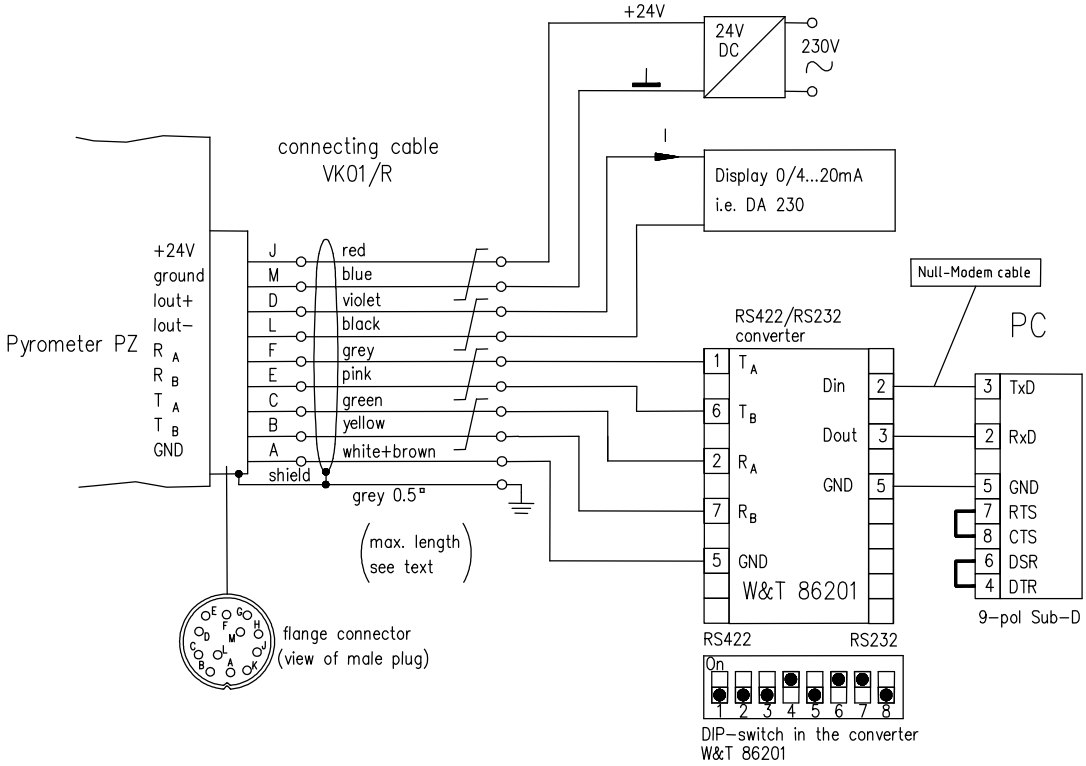


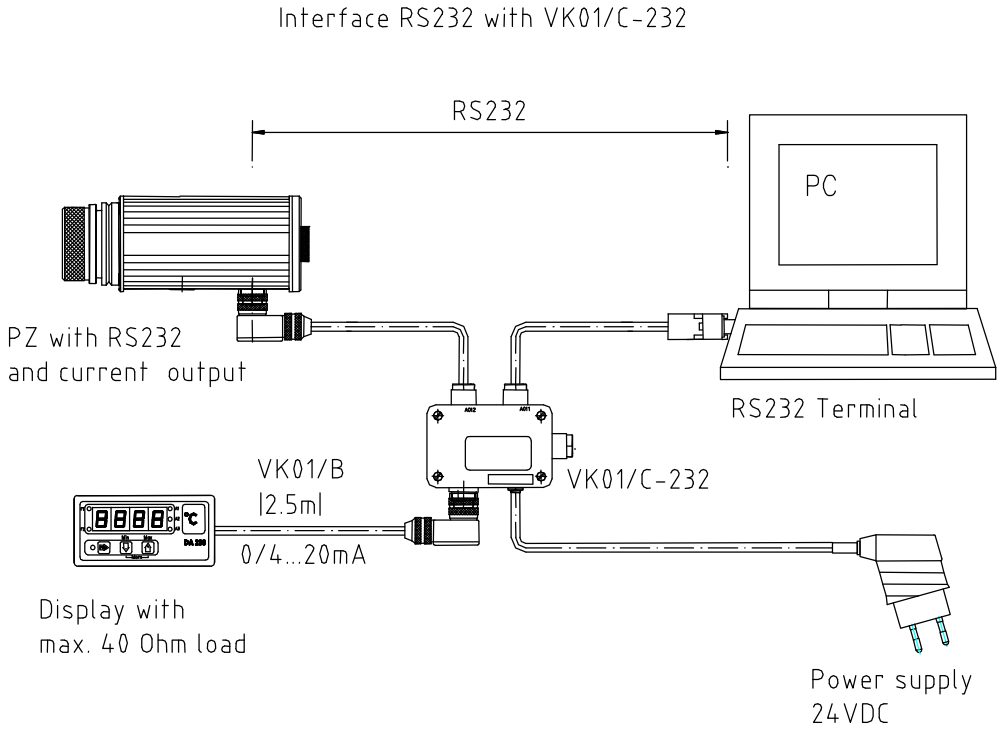
Abb.3: Example for the connection PZ.. -DA221 -DA223

PZ12

7.2 Examples for VK01 / R (RS422)



7.3 Examples for VK01 / C



operating voltage fed either via digital display or connecting plug

8 Maintenance

8.1 Cleaning the pyrometer lens

A false 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. If the lens is quite dirty, use a very mild liquid detergent and rinse carefully with clear water. Apply as little pressure as possible to the lens to avoid scratches.

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!

Please 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.

9 Technical Data PZ10

Measuring ranges (adjustable in partial ranges):
0 ... +1000 °C

Sensor:
thin-film thermopile

Spectral sensitivity:
8 - 14 µm

Focussing range:
0.15 0.3 m (close-up lens)
0.3 m … ∞ (standard lens)

Distance to target size ratio:
38 : 1 at 300 mm
(close-up lens)
40 : 1 at 300 mm
(standard lens)

Digital output:
Periodic output of measurement data with adjustable cycle time

Analogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Resistance:
Max. 500 Ω

Response time t_{98}:
≤ 100 ms

Resolution:
≤ 0.5 K
(if smoothing is ≥ 30 ms)

Linearisation:
digital via microcontroller
≥ 2000 adjustment points

Measuring uncertainty:
1 % of range and but at least 2 K (at ε = 1.0 and Ta +23°C)
higher accuracy on request by special calibration

Repeatability:
1 K

Sighting device:
through-the-lens sighting with target marking

Ambient operating temperature range:
0 ... + 60 °C

Indication of Overheating
If the internal temperature of the pyrometer exceeds 75 °C the analog output will show a value > 21mA.

Storage temperature range:
-20 ... + 70 °C

Temperature coefficient with reference to 23 °C:
≤ 0.1K / K (to Ta < 200 °C)
≤ 0.05 % / K (to Ta > 200 °C)
of measured value

Interface:
RS 232 with integrated software to set parameters and transmit measurement data to a PC.

Alternative option:
RS 422 4-wire measuring bus according to DIN 66348 part 2 (DIN-measuring bus)

Power supply requirements:
22 - 27 V DC / ≤135 mA
(150 mA with switched on spotlight)
Ripple: ≤ 200 mV

Dimensions:
ϕ 65 x 180 mm

Housing material:
aluminium

Connection:
with 12-pin connector

Weight:
≤ 0.5 kgs

Protection:
IP 65 according to DIN 40050
(when connector is attached)

Adjustable parameters:

Emissivity ε:
10 % to 99.9 %
increment size 0.1 %

Smoothing function t_{98}:

0 - 10 sec in 8 settings
or 0.03 ... 4 sec selfadaptive

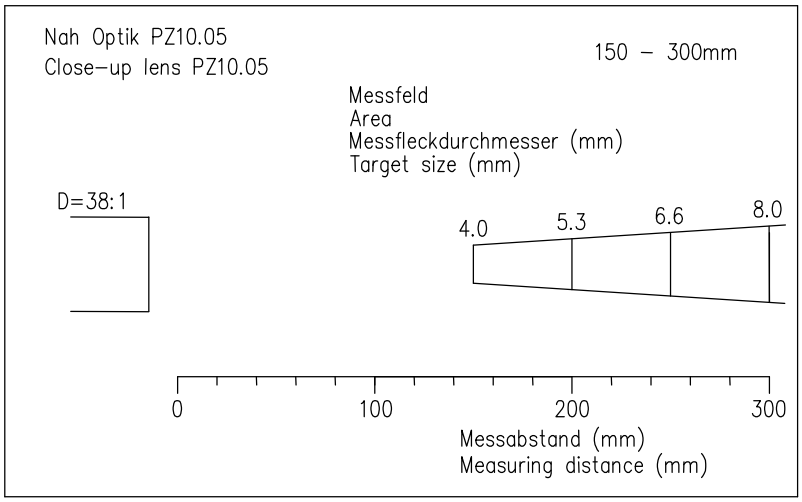
Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

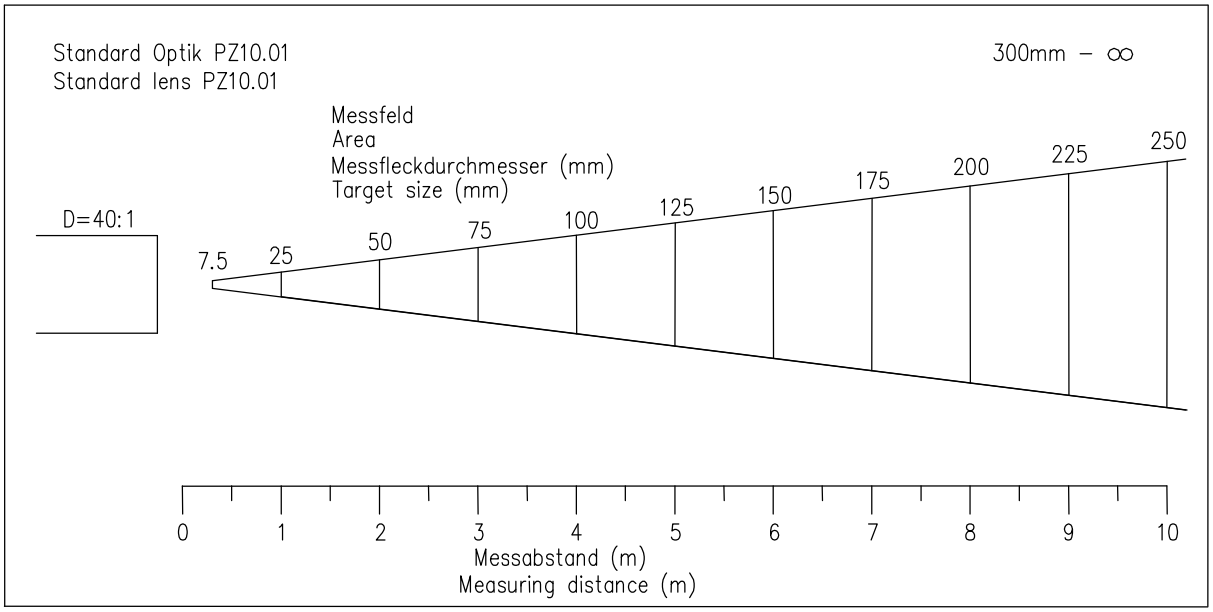
Optional accessories:
calibration certificate according to ISO 9001

calibration certificate according to DKD

large variety of mounting devices, digital displays, software, etc.

9.1 Target Diagram PZ 10





10 Technical Data PZ15

Measuring ranges (adjustable in partial ranges):
1000 ... 2500 °C

Sensor:
thin-film thermopile

Spectral sensitivity:
4,46…4,82 µm

Focussing range:
0.6 m …∞

Distance to target size ratio:
55 : 1 at 600 mm (90 %)

Digital output:
Periodic output of measurement data with adjustable cycle time

Analogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Resistance:
Max. 500 Ω

Response time t_{98}:
≤ 100 ms

Resolution:
≤ 1.5 K
(if smoothing is ≥ 30 ms)

Linearisation:
digital via microcontroller
≥ 2000 adjustment points

Measuring uncertainty:
1 % of range and but at least 2 K (at ε = 1.0 and Ta +23°C)
higher accuracy on request by special calibration

Repeatability:
±3.0 K

Sighting device:
through-the-lens sighting with target marking

Ambient operating temperature range:
0 ... + 60 °C

Indication of Overheating
If the internal temperature of the pyrometer exceeds 75 °C the analog output will show a value > 21mA.

Storage temperature range:
-20 ... + 70 °C

Temperature coefficient with reference to 23 °C:
≤ 0.05 % / K (to Ta ≥ 200 °C) of measured value

Interface:
RS 232 with integrated software to set parameters and transmit measurement data to a PC.

Alternative option:
RS 422 4-wire measuring bus according to DIN 66348 part 2 (DIN-measuring bus)

Power supply requirements:
22 - 27 V DC / ≤135 mA
(150 mA with switched on spotlight)
Ripple: ≤ 200 mV

Dimensions:
ϕ 65 x 200 mm

Housing material:
aluminium

Connection:
with 12-pin connector

Weight:
≤ 0.5 kgs

Protection:
IP 65 according to DIN 40050
(when connector is attached)

Adjustable parameters:

Emissivity ε:
10 % to 99.9 %
increment size 0.1 %

Smoothing function t_{98}:

0 - 10 sec in 8 settings
or 0.03 ... 4 sec selfadaptive

Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

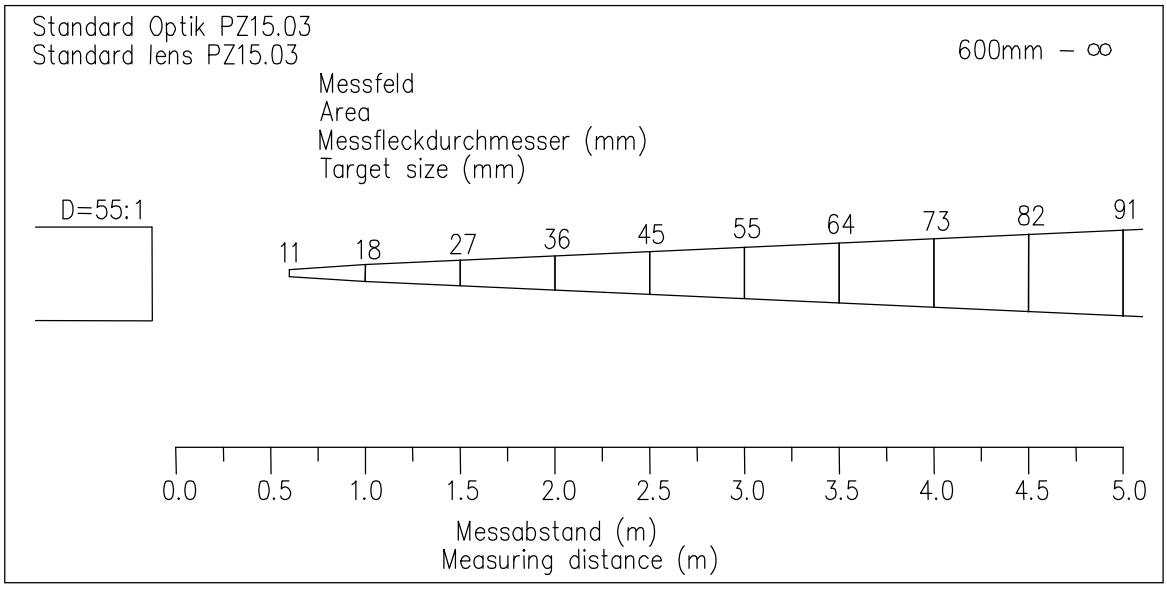
Optional accessories:
calibration certificate according to ISO 9001

calibration certificate according to DKD

large variety of mounting devices, digital displays, software, etc.

The Instrument should be powered on for at least 30 min. before use!

10.1 Target Diagram PZ 15



11 Technical Data PZ 20

Measuring ranges (adjustable in partial ranges):
250 ... 2000 °C
350 ... 2500 °C

Sensors:
photo diode

Spectral sensitivity:
1.1 - 1.7 µm

Focussing range:
0.2 ... 0.4 m (close-up lens)
0.4 m ... ∞ (standard lens)
0.2 m ... ∞ (wide-angle lens)
1.2 m ... ∞ (telephoto lens)

Distance to target-size ratio:
140:1 at 400 mm Close-up
150:1 at 400 mm Stand. lens
32:1 at 400 mm Wide angle
200:1 at 1200 mm Tel. lens

Digital output:
Periodic output of measurement data with adjustable cycle time

Analogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Resistance:
Max. 500 Ω

Response time t_{98}:
≤ 50 ms for T ≥ 250 °C
≤ 2 ms for T ≥ 750 °C

Linearisation:
digital via microcontroller
≥ 2000 adjustment points

Measuring Uncertainty:
0.75 % of measured value or 2K
(at ε = 1.0 and Ta +23 °C)
Higher accuracy on request by special calibration

Repeatability:
1 K

Sighting device:
through-the-lens sighting with target marking

Ambient operating temperature range:
0 ... + 60 °C

Indication of Overheating
If the internal temperature of the pyrometer exceeds 75 °C the analog output will show a value > 21mA

Storage temperature range:
-20 ... + 70 °C

Temperature coefficient with reference to 23 °C:
0.25 K / K (for T < 500 °C)
0.05 % / K (for T > 500 °C)
of measured value

Interface:
RS 232 with integrated software to set parameters and transmit measurement data to a PC

Alternative option:
RS 422 4-wire measuring bus
according to DIN 66348 part 2
(DIN measuring bus)

Power supply requirements:
22 - 27 V DC / ≤135 mA
(150 mA with switched on spotlight)
Ripple: ≤ 200 mV

Dimensions:
ϕ 65 x 200 mm

Housing material:
aluminium

Connection:
With 12-pin connector

Weight:
≤ 0.8 kg

Protection:
IP 65 according to DIN 40050
(when connector is attached)

Adjustable parameters:

Emissivity ε:
10 % to 99 %
increment size 1 %

Smoothing function t_{98}:
0 - 10 sec in 8 settings

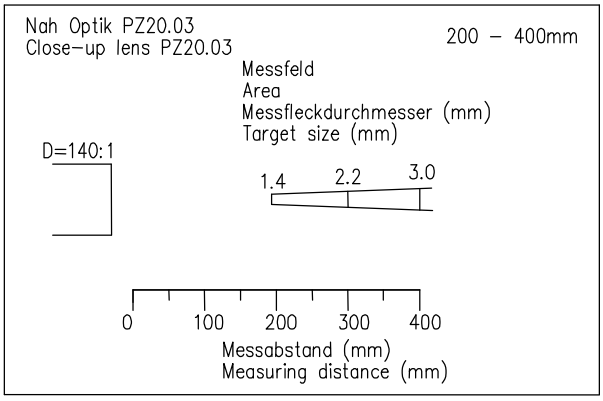
Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

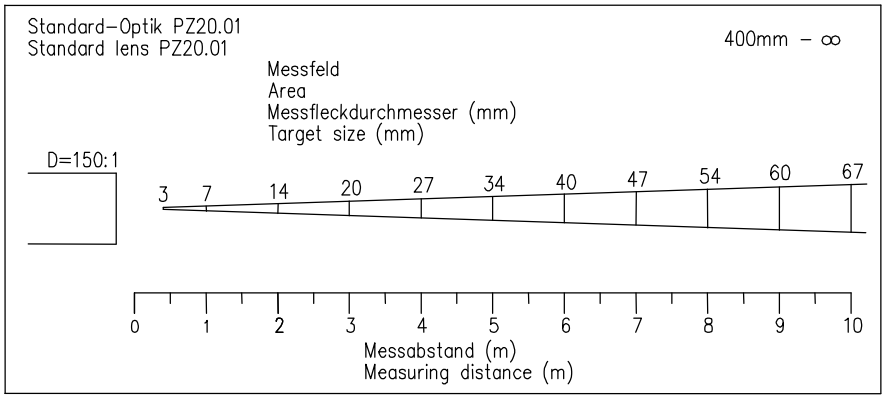
Optional accessories:
calibration certificate according to ISO 9001

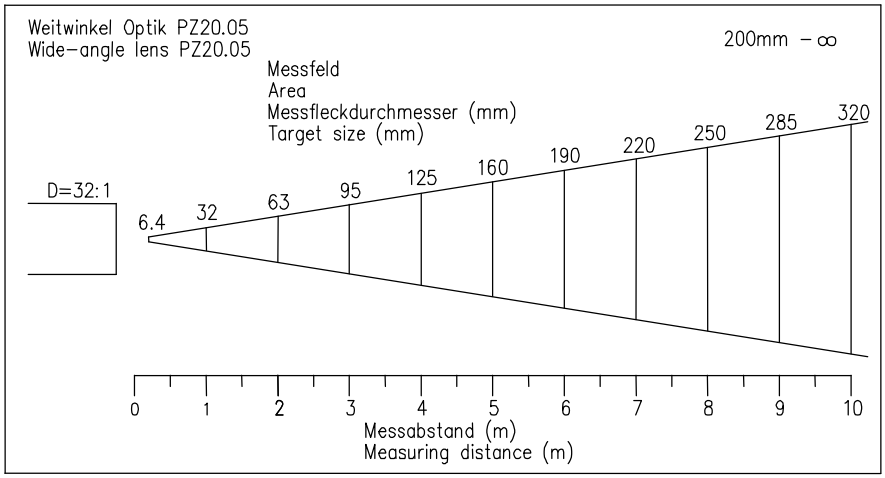
calibration certificate according to DKD

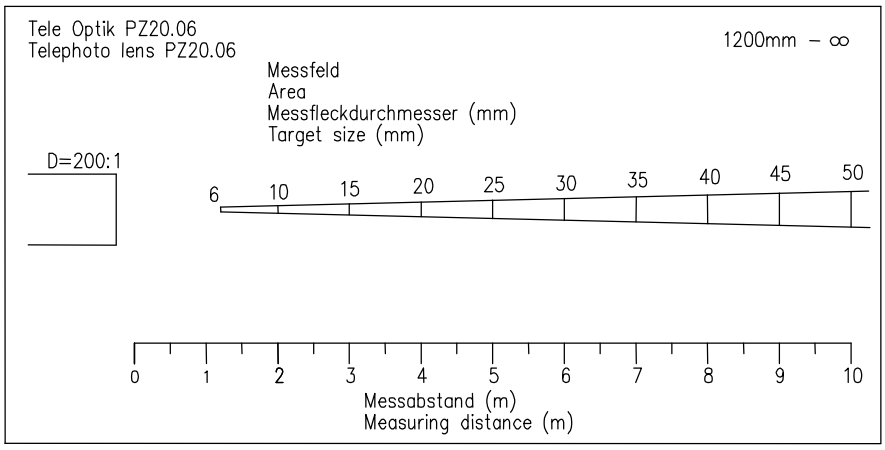
large variety of mounting devices digital displays, software, etc.

11.1 Target Diagram PZ 20









12 Technical Data PZ 21

Measuring ranges (adjustable in partial ranges):
350 ... 2000 °C

Sensors:
photo diode

Spectral sensitivity:
1.1 - 1.7 µm

Focussing ranges:
0.15 m ... ∞ (standard lens)
0.40 m .. ∞ (Telephoto ens)
0.07 m . 0.1 (close-up lens)

Distance to target size ratio:
80 : 1 (standard lens)
120 : 1 (telephoto lens)
50 : 1 (close-up-lens)

Fibre optic waveguide:
quartz fibre, can be screwed off at both sides, length and design are variable

Digital output:
periodic output of measurement data with adjustable cycle time

Resistance:
Max. 500 Ω

Analogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Response time t_{98}:
≤ 2 ms for T ≥ 1000 °C

Resolution:
≤ 1 K
(if smoothing is ≥ 30 ms)

Power supply requirements:
22 - 27 V DC / ≤135 mA
(150 mA with switched on spotlight)
Ripple: ≤ 200 mV

Linearization:
digital via microcontroller
≥ 2000 adjustment points

Measuring uncertainty:
1 % of measured value
(at ε = 1.0 and Ta + 23 °C)
higher accuracy on request by special calibration

Repeatability:
2 K

Sighting device:
Laser target marker

Ambient operating temperature range:
sensor: - 20 ...+250 °C
fibre optic cable:- 20 ..+85 °C
optional up to +250 °C
electronic: 0 ...+60 °C

Storage temperature range:
sensor: - 20 ... +250 °C
fibre optic cable:- 20 . +85 °C
optional up to +250 °C
electronic: -20 ...+70 °C

Indication of Overheating
If the internal temperature of the pyro meter exceeds 75 °C the analog output will show a value > 21mA

Temperature coefficient with reference to 23 °C:
0.25 K / K (for T < 500 °C)
0.05 % / K (for T > 500 °C)
of measured value

Interface:
RS 232 with integrated software to set parameters and transmit measurement data to a PC

Alternative option:
RS 422 4 wire measuring bus to DIN 66348 part 2 (DIN measuring bus)

Dimensions:
sensor: ϕ 30 x 75 mm
(length depending on the measuring distance)
electronic: ϕ 65 x 160 mm

Housing material:
aluminium

Connection:
with 12-pin connector

Weight:
≤ 0.8 kg

Protection:
IP 65 according to DIN 40050
(when connector is attached)

Adjustable parameters

Emissivity ε:
10 % to 99 %
increment size 1%

Smoothing function t_{98}:

0 - 10 sec. in 8 settings

Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

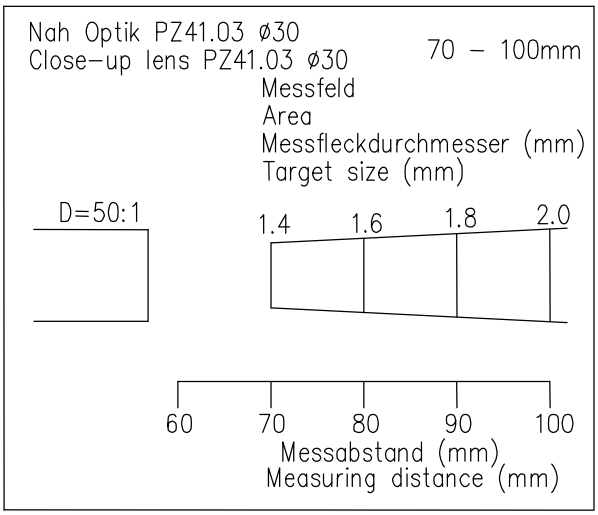
Optional accessories:

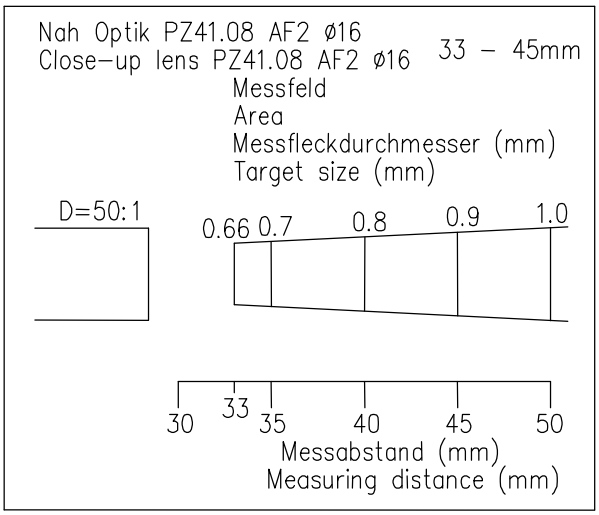
calibration certificate according to ISO 9001

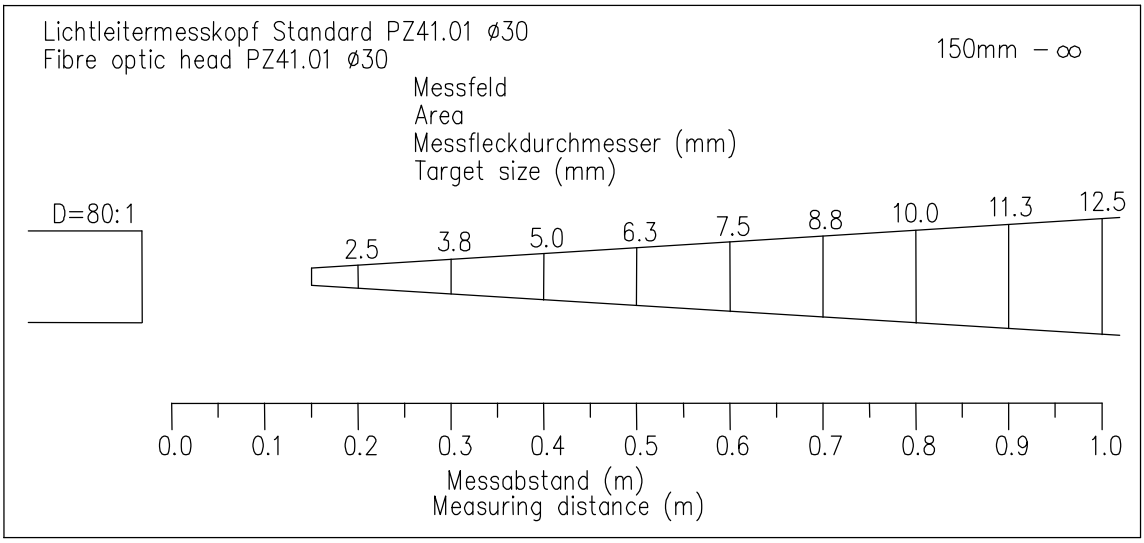
calibration certificate according to DKD

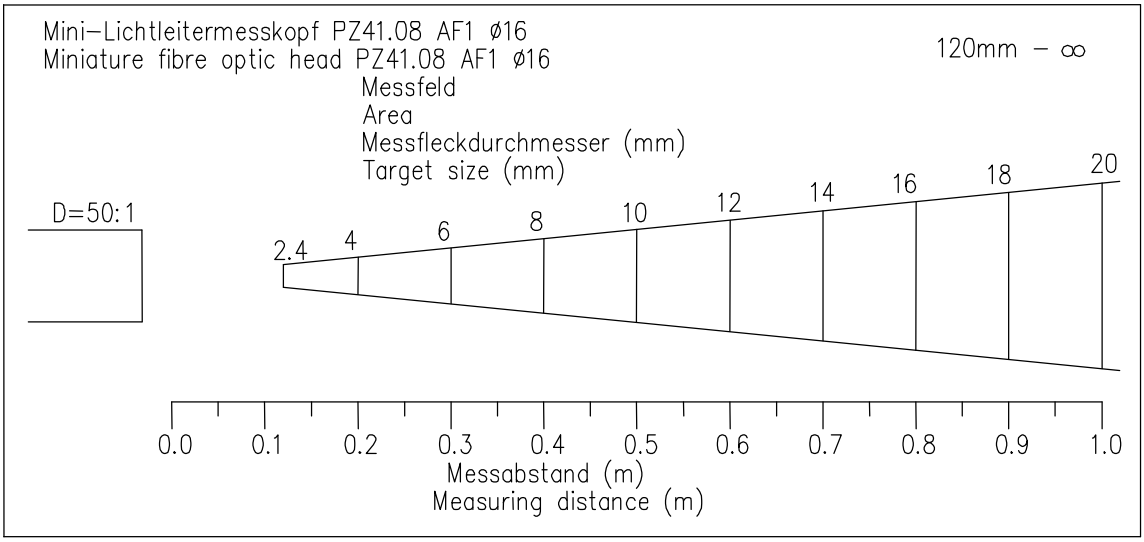
large variety of mounting devices, digital displays, software, etc.

12.1 Target Diagram PZ 21









13 Technical Data PZ 25

Measuring ranges (adjustable in partial ranges):
180 ... 1200 °C

Sensors:
photo diode

Spectral sensitivity:
1.1 - 1.7 µm

Focussing range:
0.3 m ... ∞ (standard lens)

Distance to target-size ratio:
D=80:1 (95%) at 600 mm dist.
D=60:1 (98%) at 600 mm dist.

Digital output:
Periodic output of measurement data with adjustable cycle time

Analogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Resistance:
Max. 500 Ω

Response time t_{98}:
≤ 10ms for T ≥ 400 °C
≤ 500ms for T = 180 °C

Linearisation:
digital via microcontroller
≥ 2000 adjustment points

Measuring Uncertainty:
0.75 % of measured value or 2K
(at ε = 1.0 and Ta +23 °C)
Higher accuracy on request by special calibration

Repeatability:
1 K for T ≥ 250 °C

Sighting device:
through-the-lens sighting with target marking

Ambient operating temperature range:
0 ... + 60 °C

Indication of Overheating
If the internal temperature of the pyrometer exceeds 75 °C the analog output will show a value > 21mA

Storage temperature range:
-20 ... + 70 °C

Temperature coefficient with reference to 23 °C:
0.25 K / K

Interface:
RS 232 with integrated software to set parameters and transmit measurement data to a PC

Alternative option:
RS 422 4-wire measuring bus
according to DIN 66348 part 2 (DIN measuring bus)

Power supply requirements:
22 - 27 V DC / ≤135 mA
(150 mA with switched on spotlight)
Ripple: ≤ 200 mV

Dimensions:
ϕ 65 x 200 mm

Housing material:
aluminium

Connection:
With 12-pin connector

Weight:
≤ 0.8 kg

Protection:
IP 65 according to DIN 40050
(when connector is attached)

Adjustable parameters:

Emissivity ε:
10 % to 99 %
increment size 1 %

Smoothing function t_{98}:
0 - 10 sec in 8 settings

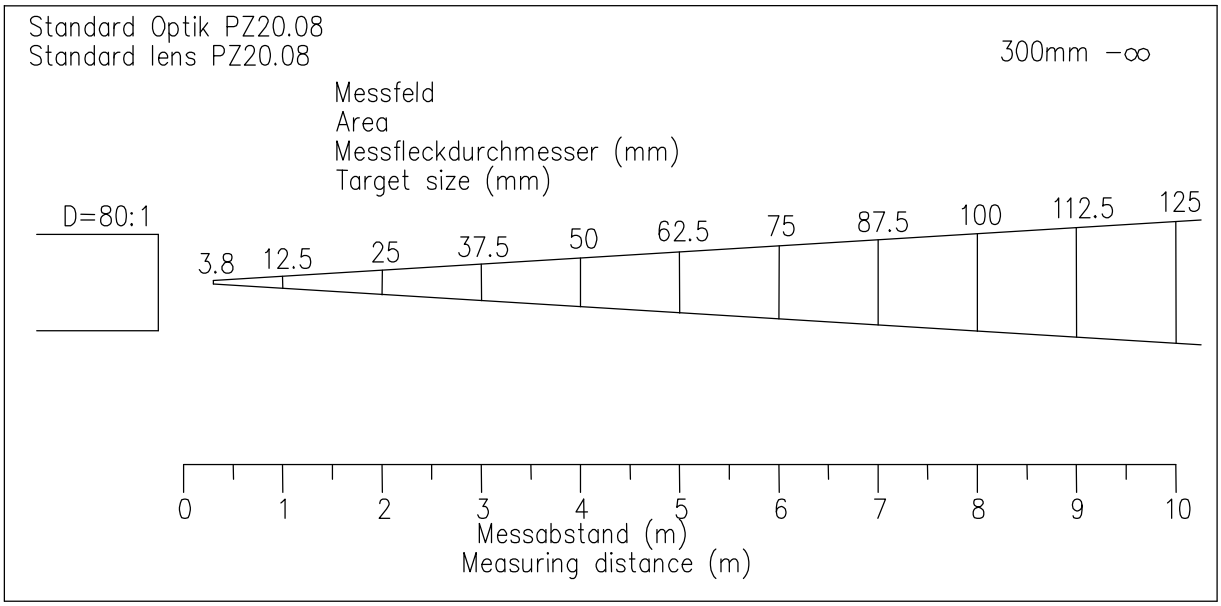
Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

Optional accessories:
calibration certificate according to ISO 9001

calibration certificate according to DKD

large variety of mounting devices digital displays, software, etc.

13.1 Target Diagram PZ 25



14 Technical Data PZ 27

Measuring ranges (adjustable in partial ranges):
250 ... 2000 °C

Sensors:
photo diode

Spectral sensitivity:
1.8 - 2.2 µm

Focussing range:
0.2 ... 0.4 m (close-up lens)
0.4 m ... ∞ (standard lens)
0.2 m ... ∞ (wide-angle lens)
1.2 m ... ∞ (telephoto lens)

Distance to target-size ratio:
Close-up 140:1 at 400 mm
Stand. lens150:1 at 400 mm
Wide angle 32:1 at 400 mm
Tel. lens 200:1 at 1200 mm

Digital output:
Periodic output of measurement data with adjustable cycle time

Analogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Resistance:
Max. 500 Ω

Response time t_{98}:
≤ 50 ms for T ≥ 250 °C
≤ 2 ms for T = 750 °C

Linearisation:
digital via microcontroller
≥ 2000 adjustment points

Measuring Uncertainty:
0.75 % of measured value or 5K
(at ε = 1.0 and Ta +23 °C)
Higher accuracy on request by special calibration

Repeatability:
1 K

Sighting device:
through-the-lens sighting with target marking

Ambient operating temperature range:
0 ... + 60 °C

Indication of Overheating
If the internal temperature of the pyrometer exceeds 75 °C the analog output will show a value > 21mA

Storage temperature range:
-20 ... + 70 °C

Temperature coefficient with reference to 23 °C:
0.25 K / K (for T < 500 °C
0.05 K / K (for T = 500 °C

Interface:
RS 232 with integrated software to set parameters and transmit measurement data to a PC

Alternative option:
RS 422 4-wire measuring bus
according to DIN 66348 part 2
(DIN measuring bus)

Power supply requirements:
22 - 27 V DC / ≤135 mA
(150 mA with switched on spotlight)
Ripple: ≤ 200 mV

Dimensions:
ϕ 65 x 200 mm

Housing material:
aluminium

Connection:
With 12-pin connector

Weight:
≤ 0.8 kg

Protection:
IP 65 according to DIN 40050
(when connector is attached)

Adjustable parameters:

Emissivity ε:
10 % to 99 %
increment size 1 %

Smoothing function t_{98}:
0 - 10 sec in 8 settings

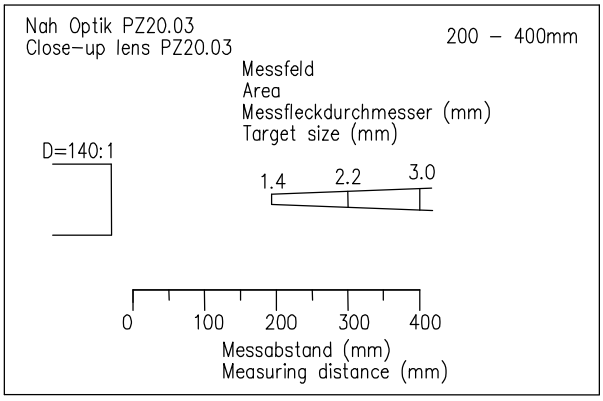
Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

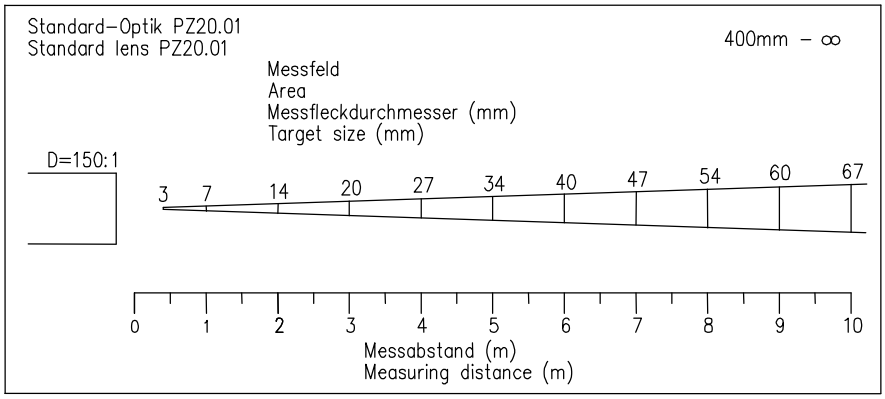
Optional accessories:
calibration certificate according to ISO 9001

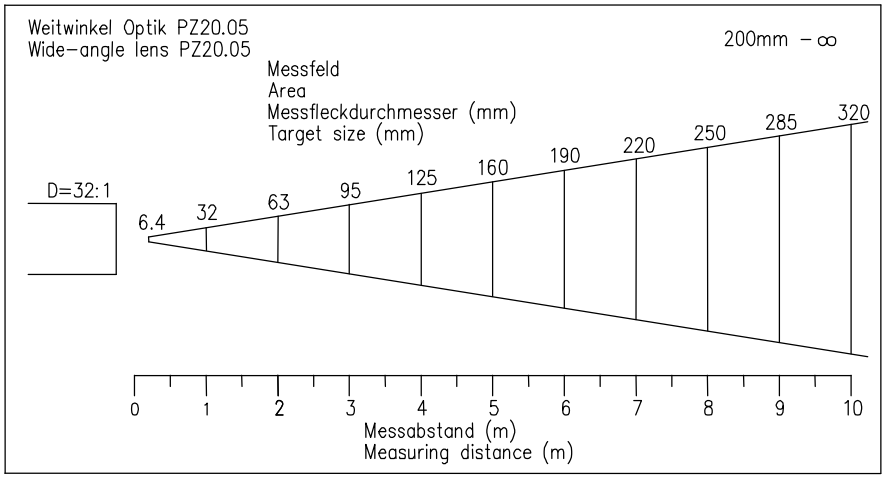
calibration certificate according to DKD

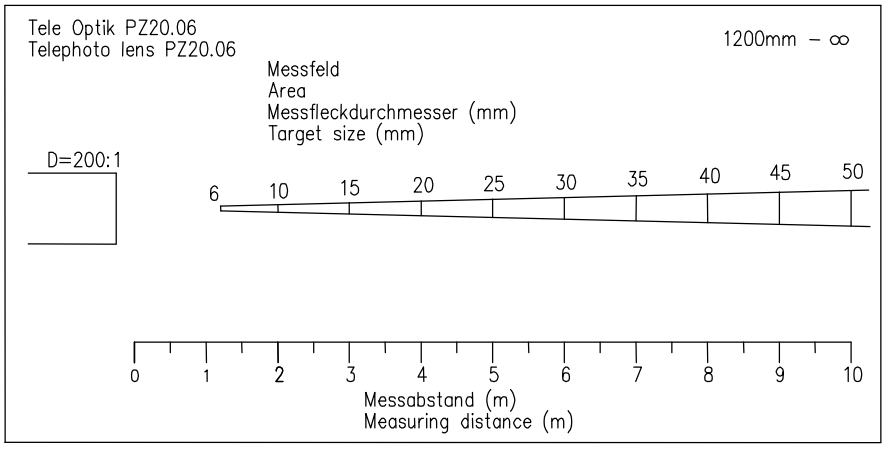
large variety of mounting devices digital displays, software, etc.

14.1 Target Diagram PZ 27









15 Technical Data PZ 27 AF10

Measuring ranges:
100*to 800°C for Ta=0 to 30°C
120 to 800°C for Ta=0 to 0 °C

- Beginning of measuring range for e=100 %. The measurement uncertainty increases with temperatures above 80 °C

Sensors:
Semiconductor photodiode

Spectral sensitivity:
1.8 to 2.2 µm

Focussing range:
0.3 m to ∞

Distance to target-size ratio
40 : 1
(at 90% enclosed energy)
35 : 1
(at 95% enclosed energy)

Analogue Output:
0(4) to 20 mA linear, switchable, output insulated from power suppley

Load:
Max. 500 Ohm

Response time t_{98}:
≤ 2 ms for T ≥ 250 °C
≤ 5 ms for T ≥ 200 °C
≤ 15 ms for T ≥ 150 °C
≤ 25 ms for T ≥ 120 °C
≤ 50 ms for T ≥ 100 °C
(at e=100 %; smoothing turned off)

Linearisation:
digital via microcontroller

Resolution:
≤ 0.8 K
(if smoothing is ≥300 ms, ε = 100 % and Ta = 23 °C)

Measuring Uncertainty:
0.75 % of measured value, at least 5K (when smoothing is ≥ 300 ms, ε = 1.0 and Ta = 23 °C)

Repeatability:
2K
(if smoothing is ≥ 300 ms)

Sighting device:
through-the-lens sighting with target marking

Ambient operating temperature range:
0 to 50 °C

Storage temperature range:
-20 to + 70 °C

Temperature coefficient with reference to 23 °C:
≤0.25 K/K (for T< 500 °C)
≤0.05 %/K (for T = 500 °C)
of measured value [°C] per Kelvin
Deviation to Ta = 23 °C

Interface:
RS 232 with integrated software to set parameters and transmit measured values to a PC
Optional:
RS 422 4-wire measurement bus according to DIN 66348 Part 2 (DIN-Messbus)

Power supply requirements:
22 - 27 V DC / ≤ 135mA
(150 mA with switched on spotlight)
Ripple: ≤200 mV

Dimensions:
ϕ 65 x 200 mm

Housing material:
aluminium

Connection:
with plug socket

Weight:
approx. 0.7 kg

Protection:
IP 65 according to DIN 40050
(when connector is attached)

Adjustable parameters:

Measuring range:
beginning of range and span are adjustable

Emissivity coefficient e:
10% to 99%
increments of 1%

Smoothing function t_{98}:
0 to 10 sec. in 8 steps

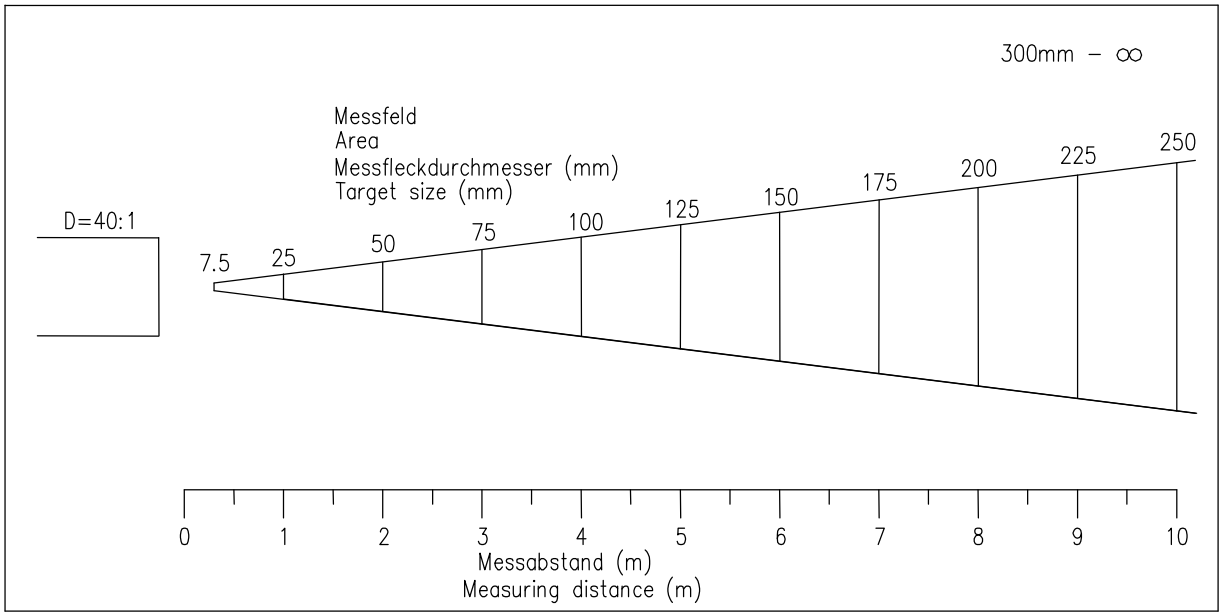
Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

Optional accessories:
calibration certificate according to ISO 9001

calibration certificate according to DKD

large variety of mounting devices, digital displays, software, etc.

15.1 Target Diagram PZ 27 AF10



16 Technical Data PZ 30

Measuring ranges (adjustable in partial ranges):
500 ... 2500 °C
800 ... 3000 °C

Sensors:
photo diode

Spectral sensitivity:
0.8 - 1.1 µm

Focussing range:
0.2 ... 0.4 m (close-up lens)
0.4 m ... ∞ (standard lens)
0.2 m ... ∞ (wide-angle lens)
1.2 m ... ∞ (telephoto lens)

Distance to target-size ratio:
Close-up 140:1 at 400 mm
Stand. lens150:1 at 400 mm
Wide angle 32:1 at 400 mm
Tel. lens 200:1 at 1200 mm

Digital output:
Periodic output of measurement data with adjustable cycle time

Analogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Resistance:
Max. 500 Ω

Response time t_{98}:
≤ 2 ms for T ≥ 750

Linearisation:
digital via microcontroller
≥ 2000 adjustment points

Measuring Uncertainty:
0.75 % of measured value
(at ε = 1.0 and Ta +23 °C)
Higher accuracy on request by special calibration

Repeatability:
1 K

Sighting device:
through-the-lens sighting with target marking

Ambient operating temperature range:
0 ... + 60 °C

Indication of Overheating
If the internal temperature of the pyrometer exceeds 75 °C the analog output will show a value > 21mA

Storage temperature range:
-20 ... + 70 °C

Temperature coefficient with reference to 23 °C:
0.25 K / K (for < 500 °C)
0.05 % / K (for T > 500 °C)
of measured value

Interface:
RS 232 with integrated software to set parameters and transmit measurement data to a PC

Alternative option:
RS 422 4-wire measuring bus
according to DIN 66348 part 2 (DIN measuring bus)

Power supply requirements:
22 - 27 V DC / ≤135 mA
(150 mA with switched on spotlight)
Ripple: ≤ 200 mV

Dimensions:
ϕ 65 x 200 mm

Housing material:
aluminium

Connection:
With 12-pin connector

Weight:
≤ 0.8 kg

Protection:
IP 65 according to DIN 40050
(when connector is attached)

Adjustable parameters:

Emissivity ε:
10 % to 99 %
increment size 1 %

Smoothing function t_{98}:
0 - 10 sec in 8 settings

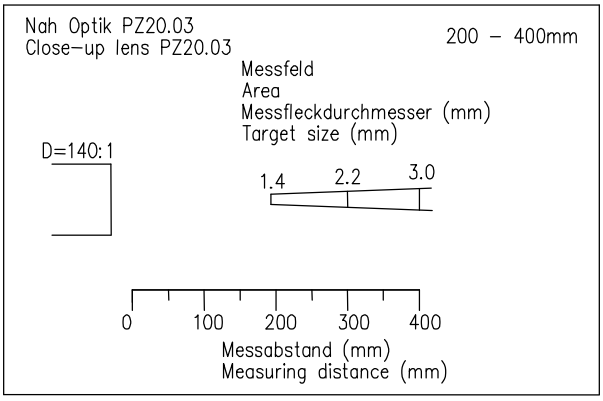
Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

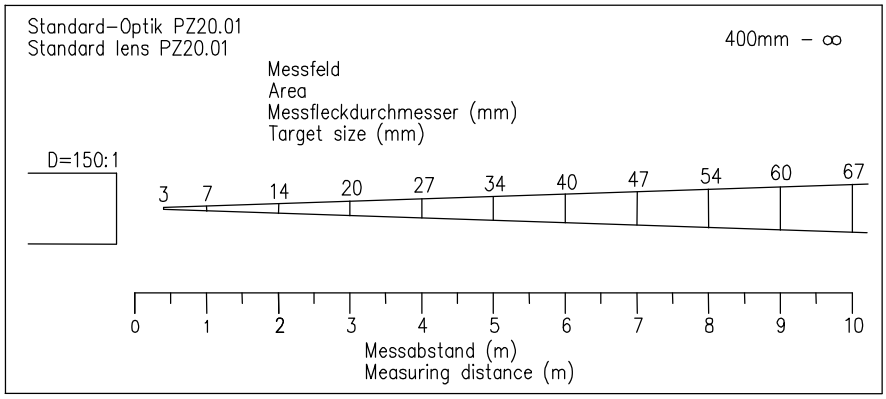
Optional accessories:
calibration certificate according to ISO 9001

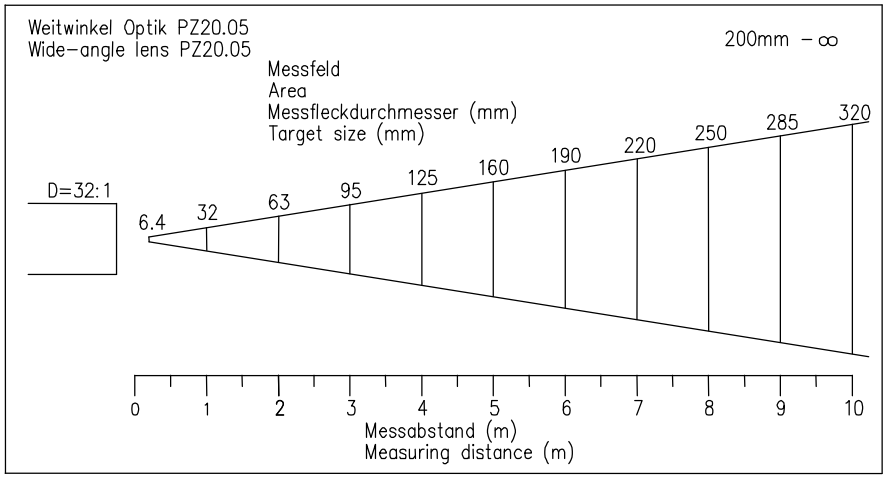
calibration certificate according to DKD

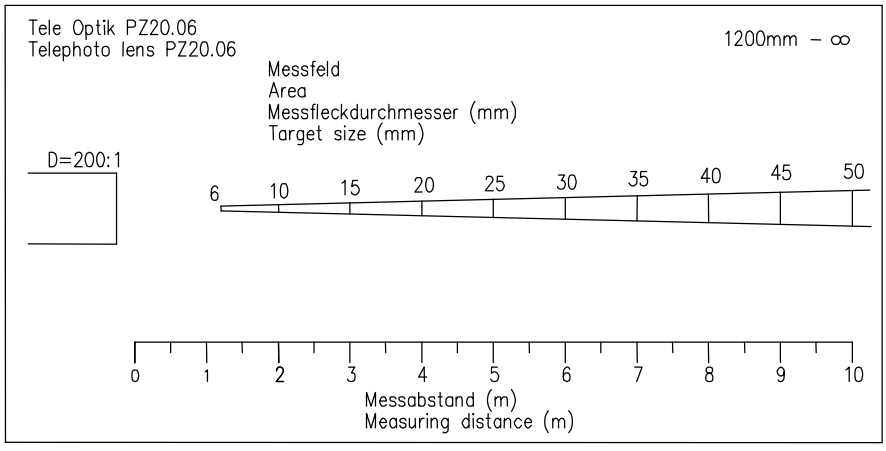
large variety of mounting devices digital displays, software, etc.

16.1 Target Diagram PZ 30









17 Technical Data PZ 31

Measuring ranges (adjustable in partial ranges):
800 ... 2500 °C

Sensors:
photo diode

Spectral sensitivity:
0.8 - 1.1 µm

Focussing ranges:
0.15 m ... ∞ (standard lens)
0.40 m ... ∞ (Telephoto lens)
0.07 m ... 0.1 (close-up lens)

Distance to target size ratio:
80 : 1 (standard lens)
120 : 1 (telephoto lens)
50 : 1 (close-up-lens)

Fibre optic waveguide:
quartz fibre, can be screwed off at both sides, length and design are variable

Digital output:
periodic output of measurement data with adjustable cycle time

Resistance:
Max. 500 Ω

Analogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Response time t_{98}:
≤ 2 ms for T ≥ 1200 °C

Resolution:
≤ 1 K
(if smoothing is ≥ 30 ms)

Power supply requirements:
22 - 27 V DC / ≤135 mA
(150 mA with switched on Spotlight)
Ripple: ≤200 mV

Measuring uncertainty:
1 % of measured value
(at ε = 1.0 and Ta + 23 °C)
higher accuracy on request by special calibration

Repeatability:
2 K

Sighting device:
Laser target marker

Ambient operating temperature range:
sensor: - 20 ...+250 °C
fibre optic cable:- 20 ..+85 °C
optional up to +250 °C
electronic: 0 ...+60 °C

Storage temperature range:
sensor: - 20 ... +250 °C
fibre optic cable:- 20 . +85 °C
optional up to +250 °C
electronic: -20 ...+70 °C

Indication of Overheating
If the internal temperature of the pyro meter exceeds 75 °C the analog output will show a value > 21mA

Temperature coefficient with reference to 23 °C:
0.25 K / K (for T < 500 °C)
0.05 % / K (for T > 500 °C)
of measured value

Interface:
RS 232 with integrated software to set parameters and transmit measurement data to a PC

Alternative option:
RS 422 4 wire measuring bus to DIN 66348 part 2 (DIN measuring bus)

Linearization:
digital via microcontroller
≥ 2000 adjustment points

Dimensions:
sensor: ϕ 30 x 75 mm
(length depending on the measuring distance)
electronic: ϕ 65 x 160 mm

Housing material:
aluminium

Connection:
with 12-pin connector

Weight:
≤ 0.8 kg

Protection:
IP 65 according to DIN 40050 (when connector is attached)

Adjustable parameters

Emissivity ε:
10 % to 99 %
increment size 1%

Smoothing function t_{98}:

0 - 10 sec in 8 settings

Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

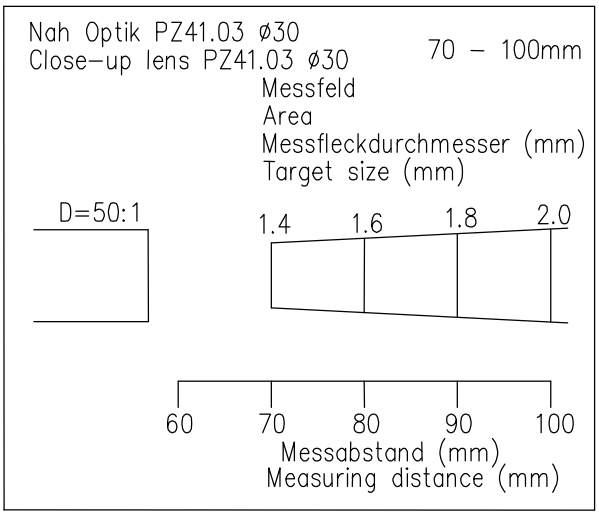
Optional accessories:

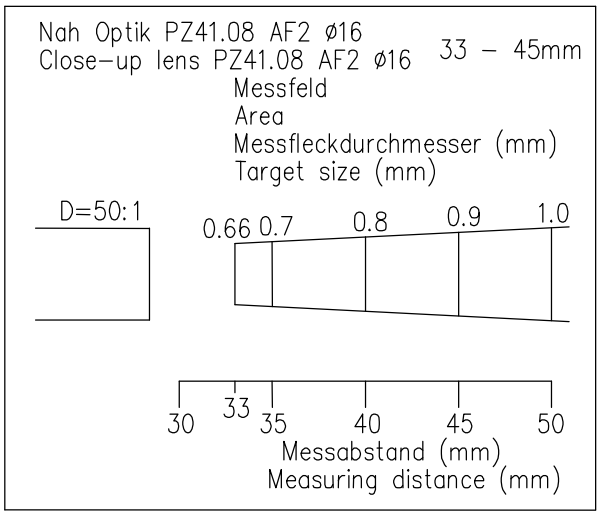
calibration certificate according to ISO 9001

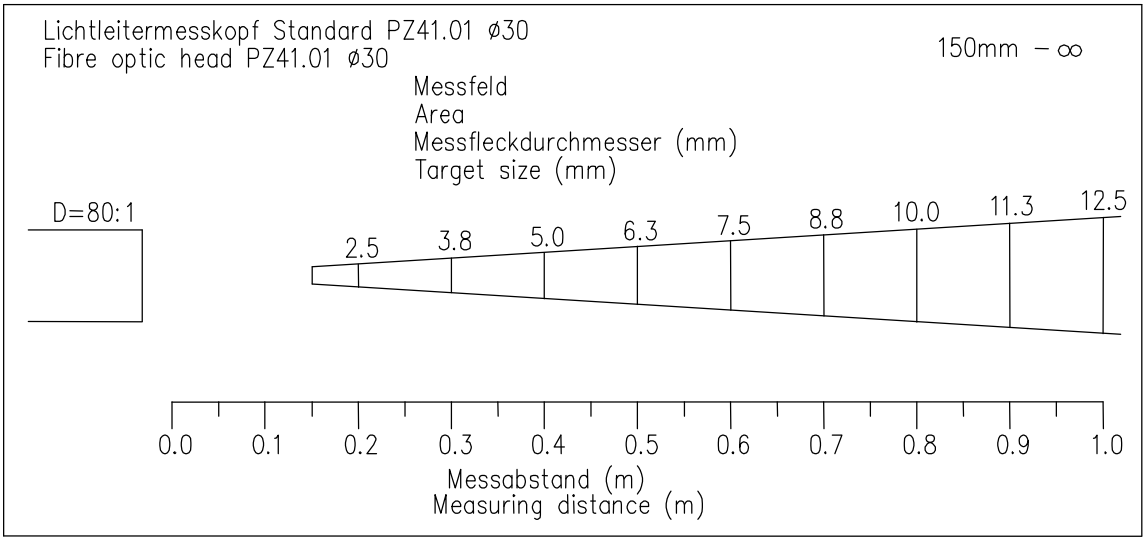
calibration certificate according to DKD

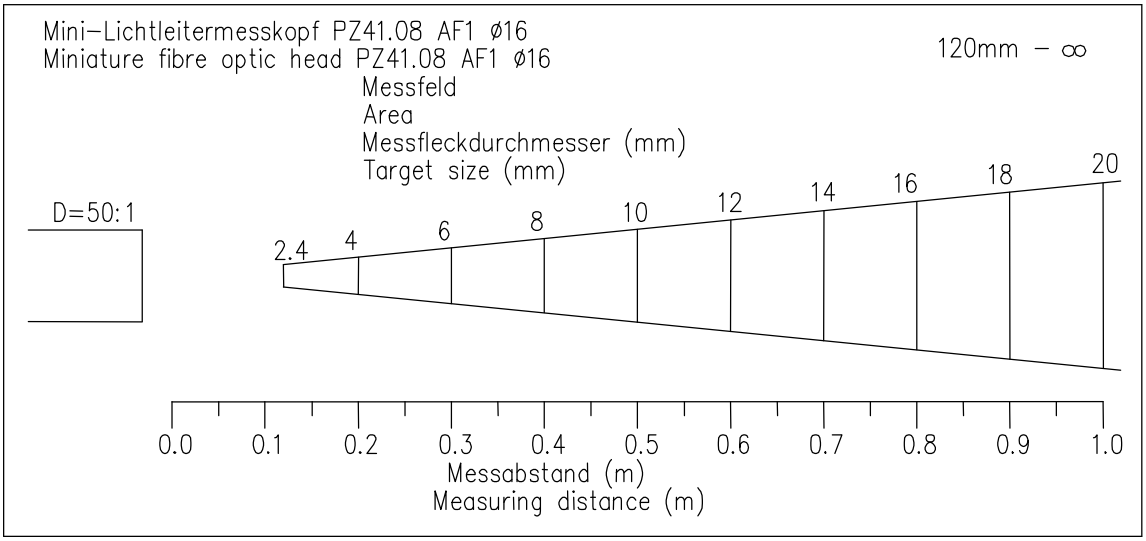
large variety of mounting devices, digital displays, software, etc.

17.1 Target Diagram PZ 31









18 Technical Data PZ 35

Measuring ranges (adjustable in partial ranges):
600 ... 2500 °C

Sensors:
photo diode

Spectral sensitivity:
0.85 – 0.91 µm

Focussing range:
0.2 ... 0.4 m (close-up lens)
0.4 m ... ∞ (standard lens)
0.2 m ... ∞ (wide-angle lens)
1.2 m ... ∞ (telephoto lens)

Distance to target-size ratio at 95% enclosed energy:

AF 1	175 : 1
AF 2	140 : 1
AF 3	240 : 1
AF 4	35 : 1

Digital output:
Periodic output of measurement data with adjustable cycle time

Anlogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Resistance:
Max. 500 Ω

Response time t_{98}:
≤ 2 ms for T ≥ 1000 °C

Linearisation:
digital via microcontroller
≥ 2000 adjustment points

Measuring Uncertainty:
0.5 % of measured value, at least 4K; plus the inexactness of the calibration standard
(at ε = 1.0 and Ta +23 °C)

Repeatability:
1 K

Sighting device:
through-the-lens sighting with target marking

Ambient operating temperature range:
0 ... + 60 °C

Indication of Overheating
If the internal temperature of the pyro meter exceeds 75 °C the analog output will show a value > 21mA

Storage temperature range:
-20 ... + 70 °C

Temperature coefficient with reference to 23 °C:
0.04 % / K of measured value

Interface:
RS 232 with integrated software to set parameters and transmit measurement data to a PC.

Alternative option:
RS 422 4-wire measuring bus
according to DIN 66348 part 2 (DIN measuring bus)

Power supply requirements:
22 - 27 V DC / ≤135 mA
(150 mA with switched on spotlight)
Ripple: ≤200 mV

Dimensions:
ϕ 65 x 200 mm

Housing material:
aluminium

Connection:
With 12-pin connector

Weight:
≤ 0.8 kg

Protection:
IP 65 according to DIN 40050
(when connector is attached)

Adjustable parameters:

Emissivity ε:
10 % to 99 %
increment size 1 %

Smoothing function t_{98}:
0 - 10 sec in 8 settings

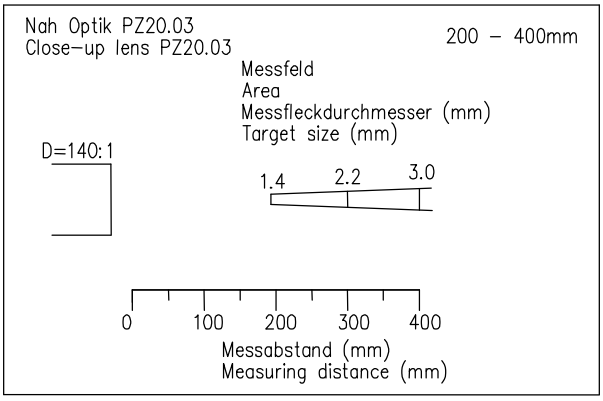
Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

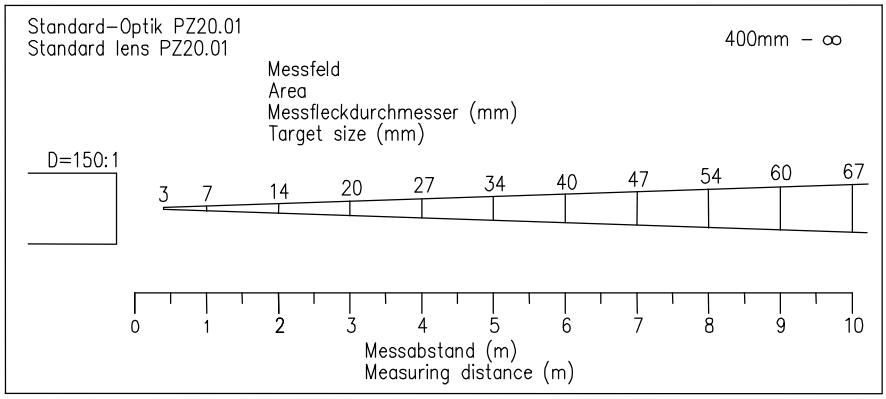
Optional accessories:
calibration certificate according to ISO 9001

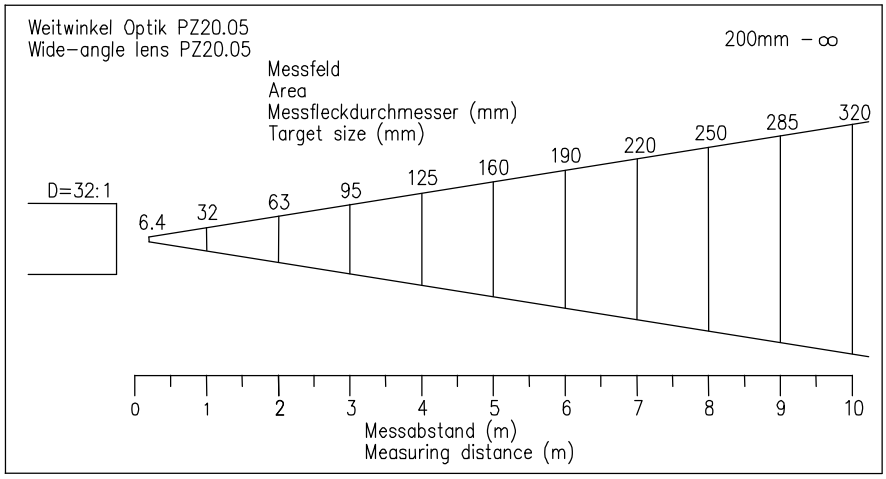
calibration certificate according to DKD

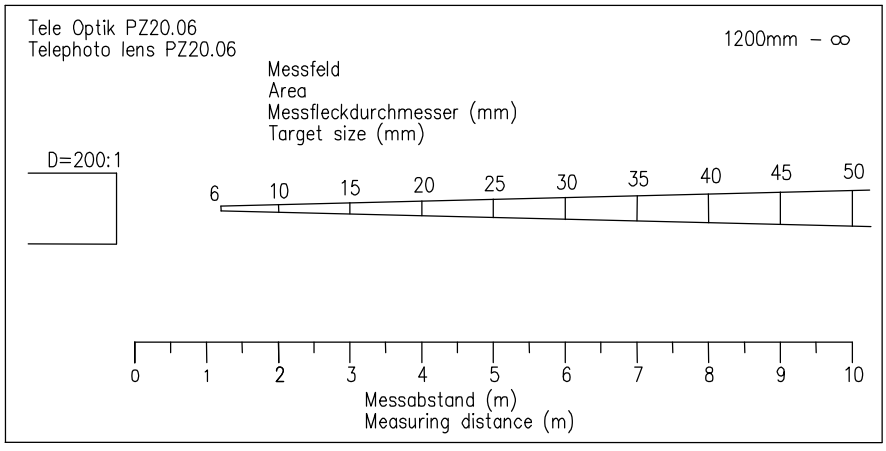
large variety of mounting devices digital displays, software, etc.

18.1 Target Diagram PZ 35









19 Technical Data PZ 40

Measuring ranges (adjustable in partial ranges):
700 ... 1600 °C
900 ... 2400 °C
1000 ... 3000 °C

Extended measuring ranges for ε > 0.5:
650 ... 1600 °C
800 ... 2400 °C
900 ... 3000 °C

Sensor:
photo diode

Spectral sensitivity:
0.95 / 1.05 µm

Distance to target-size ratio:

$T_{anf.}$	=700°C	>900°C
Close-up	75:1	140:1
Stand. lens	80:1	150:1
Wide angle	17:1	35:1
Tel. lens	120:1	240:1

Focussing range:
0.2 ... 0.4 m (close-up lens)
0.4 m ... ∞ (standard lens)
1.2 m ... ∞ (telephoto lens)
0.2 m ... ∞ (wide-angle lens)

Digital output:
periodic output of measurement data with adjustable cycle time

Analogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Resistance:
Max. 500 Ω

Response time t_{98}:
≤ 10 ms for
T ≥ 750 °C
(MR: 700 – 1600 °C)
T ≥ 950 °C
(MR: 900 °C – 2400°C)
T ≥ 1050°C
(MR: 1000°C-3000°C)

Resolution:
1.5 K
(if smoothing is ≥ 30 ms)

Linearisation:
digital via microcontroller
≥ 2000 adjustment points

Measuring uncertainty:
1 % of measured value
(at ε = 1.0 and Ta +23 °C)
higher accuracy on request by special calibration

Repeatability:
2 K

Sighting device:
through-the-lens sighting with
target marking

Ambient operating Temperature range:
0 ... + 60 °C

Indication of Overheating
If the internal temperature of the pyro meter exceeds 75 °C the analog output will show a value > 21mA

Storage temperature-range:
-20 ... + 70 °C

Temperature coefficient with reference to 23 °C:
0.05 % of measured value

Interface:
RS 232 with integrated software to set parameters and transmit measurement data to a PC

Alternative option:
RS 422 4-wire measuring bus according to DIN 66348 part 2 (DIN measuring bus)

Power supply requirements:
22 - 27 V DC / ≤135 mA
(150 mA with switched on spotlight)
Ripple: ≤200 mV

Dimensions:
ϕ 65 x 200 mm

Housing material:
aluminium

Connection:
with 12-pin connector

Weight:
≤ 0.8 kg

Protection:
IP 65 according to DIN 40050
(when connector is attached)

Adjustable parameters:

Ratio correction: $\varepsilon_1/\varepsilon_2$:
87.2 to 112.7 %
increment size 0.1 %

Emissivity λ1 and λ2:
10 % ... 100 %
increment size 1 %

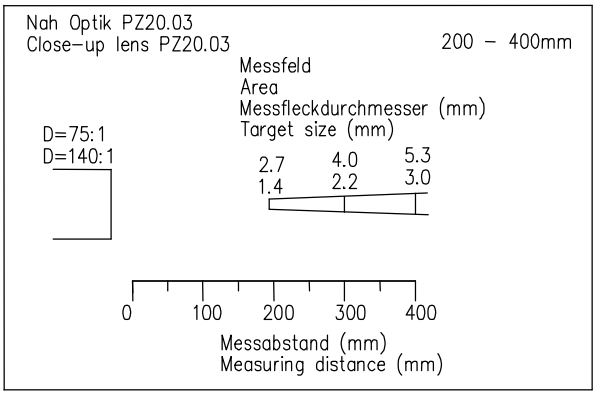
Smoothing function t_{98}:

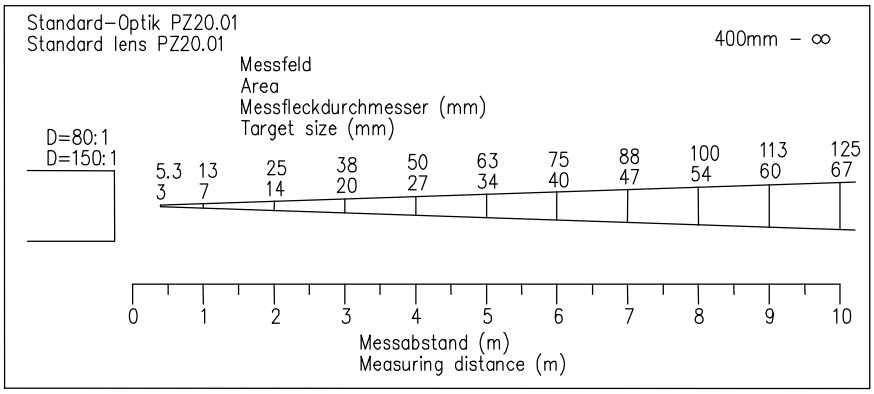
0 - 10 sec in 8 settings

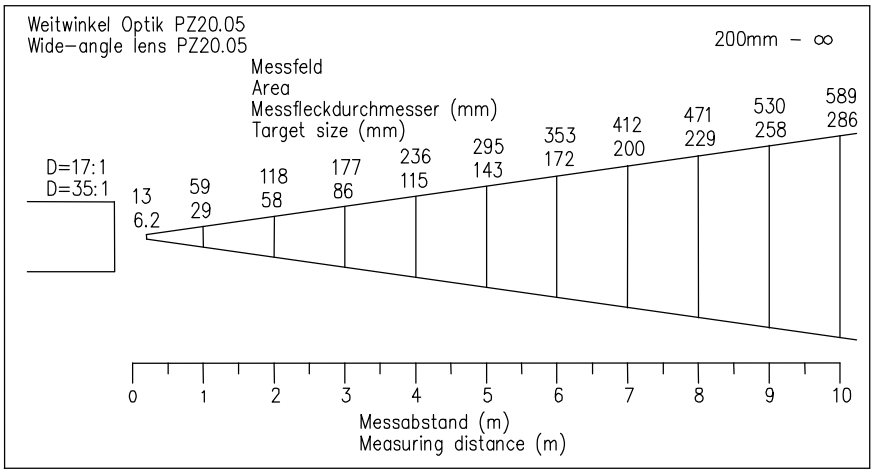
Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

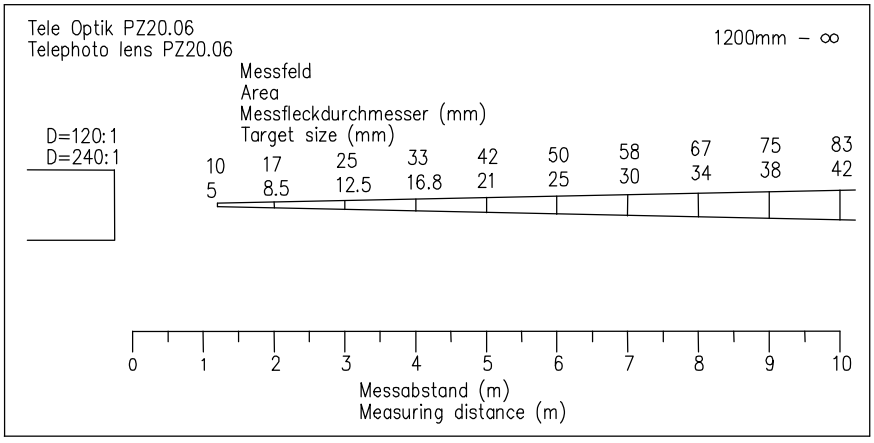
Optional accessories:
calibration certificate according to ISO 9001
calibration certificate accord ing to DKD
large variety of mounting devices digital displays, software, etc.

19.1 Target Diagram PZ 40









20 Technical Data of the PZ 41

Measuring ranges (ajustable in partial ranges):
900 ... 2400 °C
1000 ... 3000 °C

Extended measuring ranges for ε > 0.5:
800 ... 2400 °C
900 ... 3000 °C

Sensor:
photo diode

Spectral sensitivity:
0.95 / 1.05 µm

Focussing ranges:
0.15 m ... ∞ (standard lens)
0.40 m ... ∞ (telephoto. lens)
0.07 m . 0.1 m (close-up-lens)

Distance to target size ratio:
80 : 1 (standard lens)
120 : 1 (telephoto lens)
50 : 1 (close-up-lens)

Fibre optic waveguide:
quartz fibre, can be screwed off at both sides, length and design are variable

Digital output:
periodic output of measurement data with adjustable cycle time

Analogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Resistance:
Max. 500 Ω

Resolution:
≤2.0 K
(if smoothing is ≥ 30 ms and Ta 23 °C)

Response time t_{98}:
≤ 10 ms for
T ≥ 1000 °C
(MR: 900 – 2400 °C)
T ≥ 1100 °C
(MR: 1000 °C – 3000 °C)

Linearisation:
digital via microcontroller
≥ 2000 adjustment points

Measuring uncertainty:
1.5 % of measured value
(at ε = 1.0 and Ta +23 °C)
higher accuracy on request by special calibration

Repeatability:
3 K

Sighting device:
Laser target marker

Ambient operating temperature range:
sensor: - 20 ...+250 °C
fibre optic cable: 20 ...+85 °C
optional up to +250 °C
electronics: 0 ...+60 °C

Storage temperature range:
sensor: - 20 ...+250 °C
fibre optic cable:- 20 ..+85 °C
optional up to +250 °C
electronics: -20 ...+70 °C

Temperature coefficient with reference to + 23 °C
0.05 % of reading / K

Interface:
RS 232 with integrated software to set parameters and transmit measurement data to a PC

Alternative option:
RS 422 4-wire measuring bus according to DIN 66348 part 2 (DIN measuring bus)

Power supply:
22 - 27 V DC / ≤ 135 mA
(150 mA if the spot light target marker is switched on)
Ripple ≤200 mV

Dimensions:
sensor: ϕ 30 x 75 mm
(length depending on the measuring distance)
electronic: ϕ 65 x 160 mm

Housing material:
aluminium

Connection:
With 12-pin connector

Weight:
≤ 0.8 kg

Protection:
IP 65 according DIN 40050
(when connector is attached)

Adjustable parameters:
Emissivity :

87.2 ... 112.7 %
increment size 0.1 %

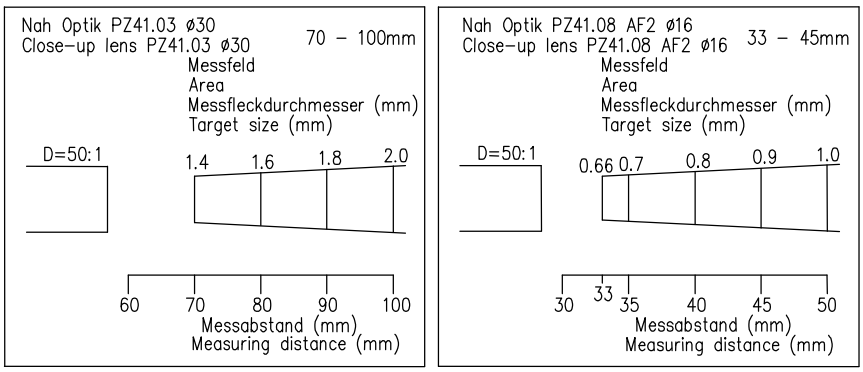
Emissivity λ1 and λ2:
10 % ... 100 %
increment size 1%

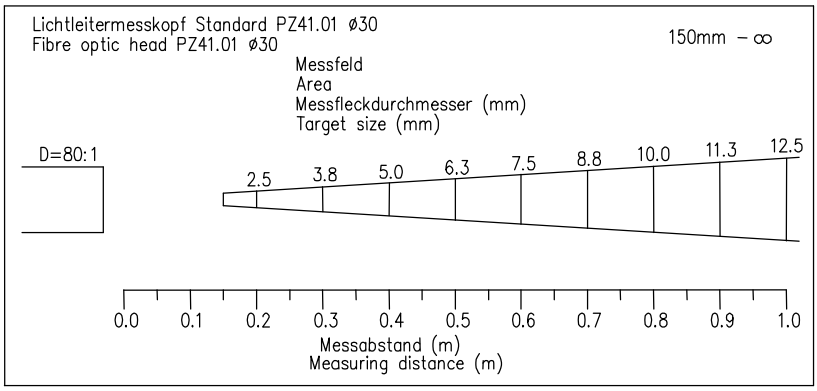
Smoothing function t_{98}:
0 - 10 sec in 8 steps

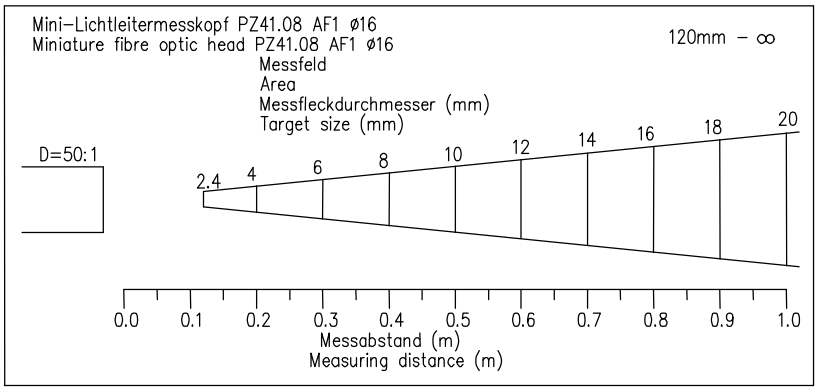
Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

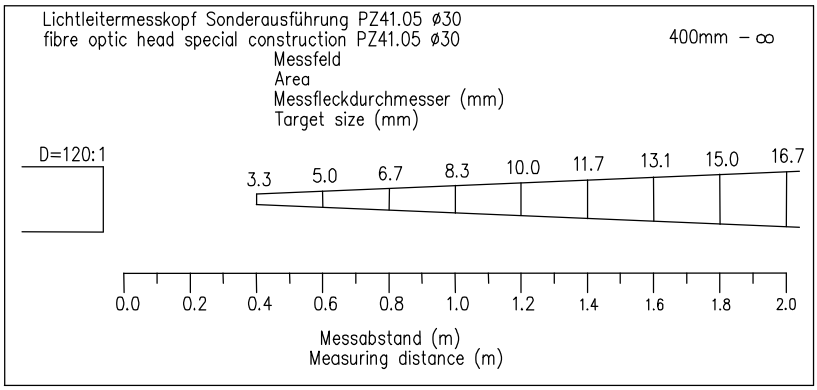
Optional accessories:
calibration certificate according to ISO 9001
calibration certificate according to DKD
large variety of mounting devices, digital displays, software, etc.

20.1 Target Diagram PZ 41









21 Technical Data PZ 50 / 55

Measuring ranges (adjustable in partial ranges):
500 - 1400 °C

Sensor:
Photo diode

Spectral sensitivity:
0.95 µm / 1.55 µm

Focussing ranges:
0.2 ... 0,4 m (close-up lens)
0.4 m ... ∞ (standard lens)
0.2 m ... ∞ (wide - angle lens)
1.2 m ... ∞ (telephoto lens)

Distance to target size ratio:
75 : 1 (close-up lens)
80 : 1 (standard lens)
15 : 1 (wide - angle lens)
120 : 1 (telephoto lens)

Digital output:
periodic output of measurement data with adjustable cycle time

Analogue output:
0(4) ... 20 mA linear, switchable, output insulated from power suppley

Resistance:
Max. 500 Ω

Response time t_{98}:
≤ 16 ms for T ≥ 600 °C

Resolution:
≤ 1.5 K (if smoothing is ≥ 30 ms and Ta = 23 °C)

Linearisation:
digital via microcontroller
≥ 2000 adjustment points

Measuring uncertainty:
1.0 % of measured value
(at ε = 1.0 and Ta +23 °C)
higher accuracy on request by special calibration

Repeatability:
2 K

Sighting device:
through-the-lens sighting with target marking

Ambient operating temperature range:
PZ 50: 0 ... + 60 °C
PZ 55: 0 ... + 45 °C

Storage temperature range:
PZ 50: - 20 ... + 70 °C
PZ 55: - 20 ... + 45 °C

Temperature coefficient with reference to 23 °C:
0.05 % of reading / K

Interface:
RS 232 with integrated software to set parameters and transmit mea-surement data to a PC

Alternative option:
RS 422 4-wire measuring bus ac-cording to DIN 66348 part 2 (DIN measuring bus)

Power supply requirements:
22 - 27 V DC / ≤135 mA
(150 mA with switched on spotlight)
Ripple: ≤200 mV

Dimensions:
ϕ 65 x 200 mm

Housing material:
Aluminium

Connection:
with 12-pin connector

Weight:
≤ 0.8 kg

Protection:
IP 65 according to DIN 40050
(when connector is attached)

Adjustable parameters:

Ratio correction :

87.2 to 112.7 %
increment size 0.1 %

Emissivity ε:
10% to 100 %
increment size 1 %

Smoothing function t_{98}:
0 - 10 sec in 8 settings

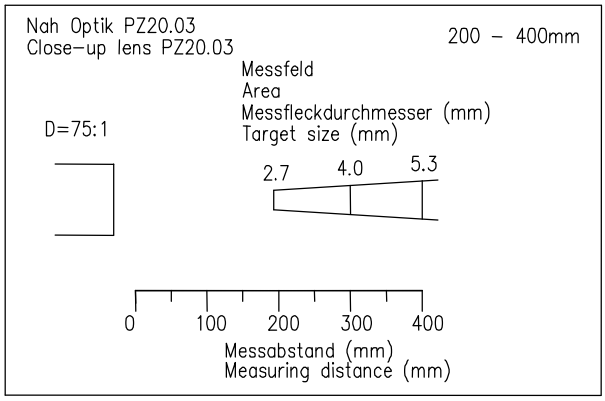
Memory modes:
- Min./Max. (peak picker)
- Double maximum with adjustable hold time

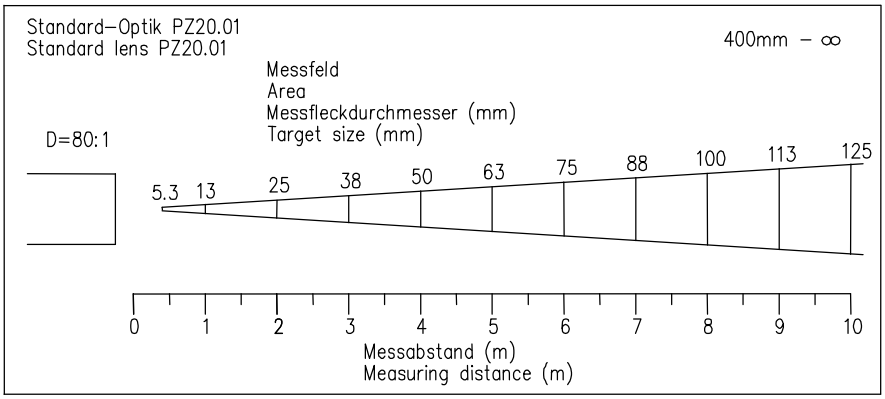
Optional accessories:
calibration certificate according to ISO 9001

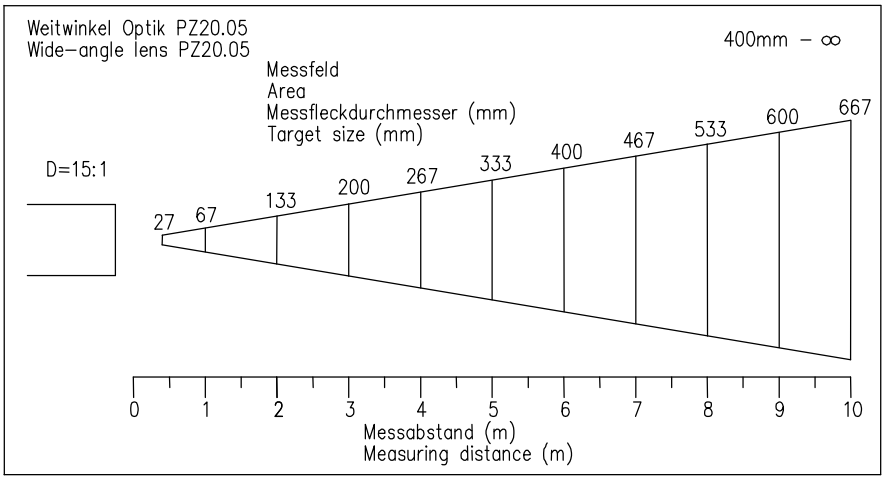
calibration certificate according to DKD

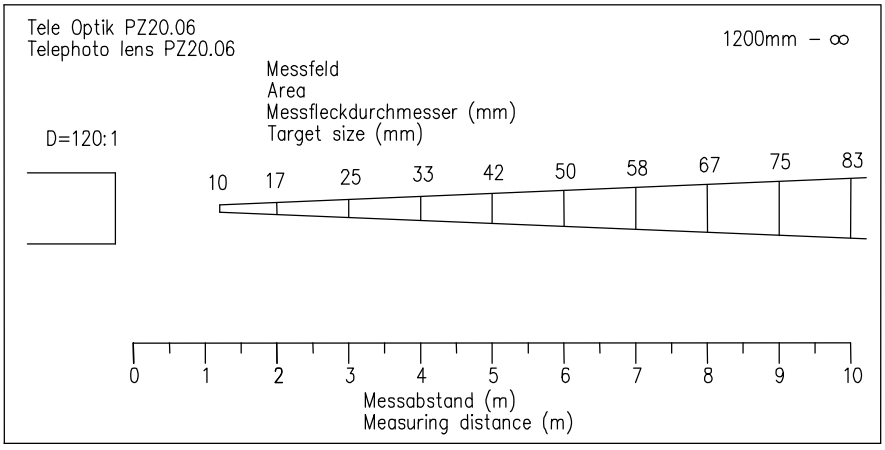
large variety of mounting devices, digital displays, software, etc.

21.1 Target Diagram PZ 50 / 55

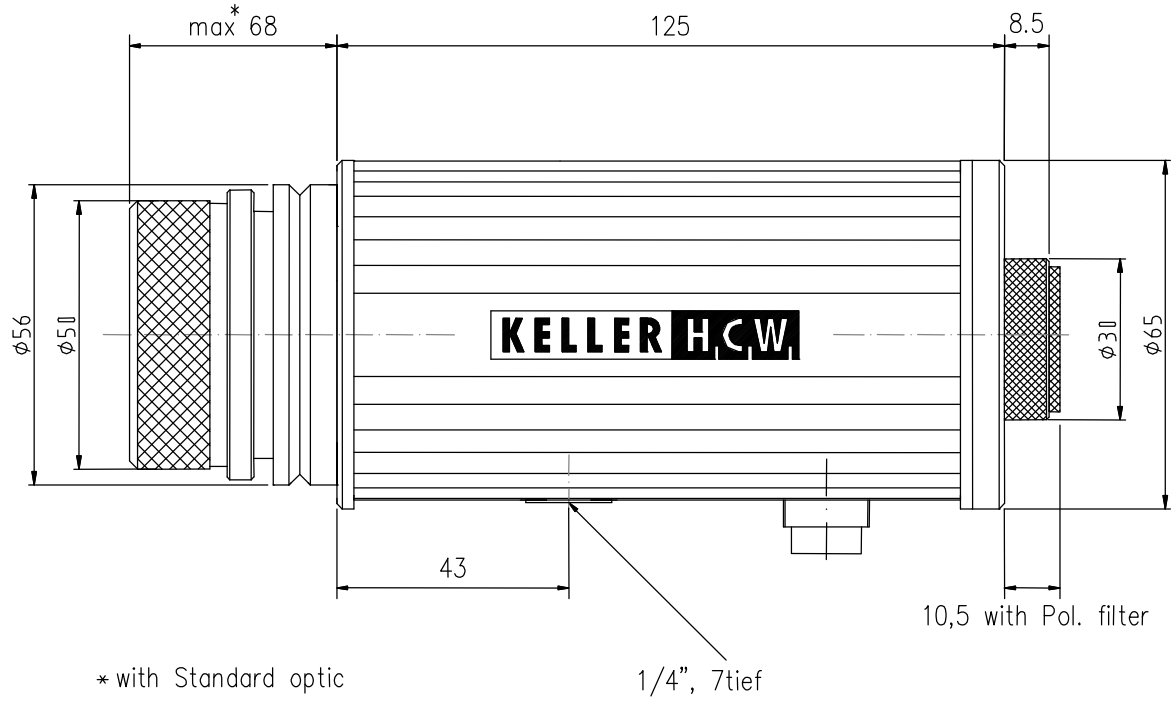








22 Dimension Drawing



23 Optional Accessories

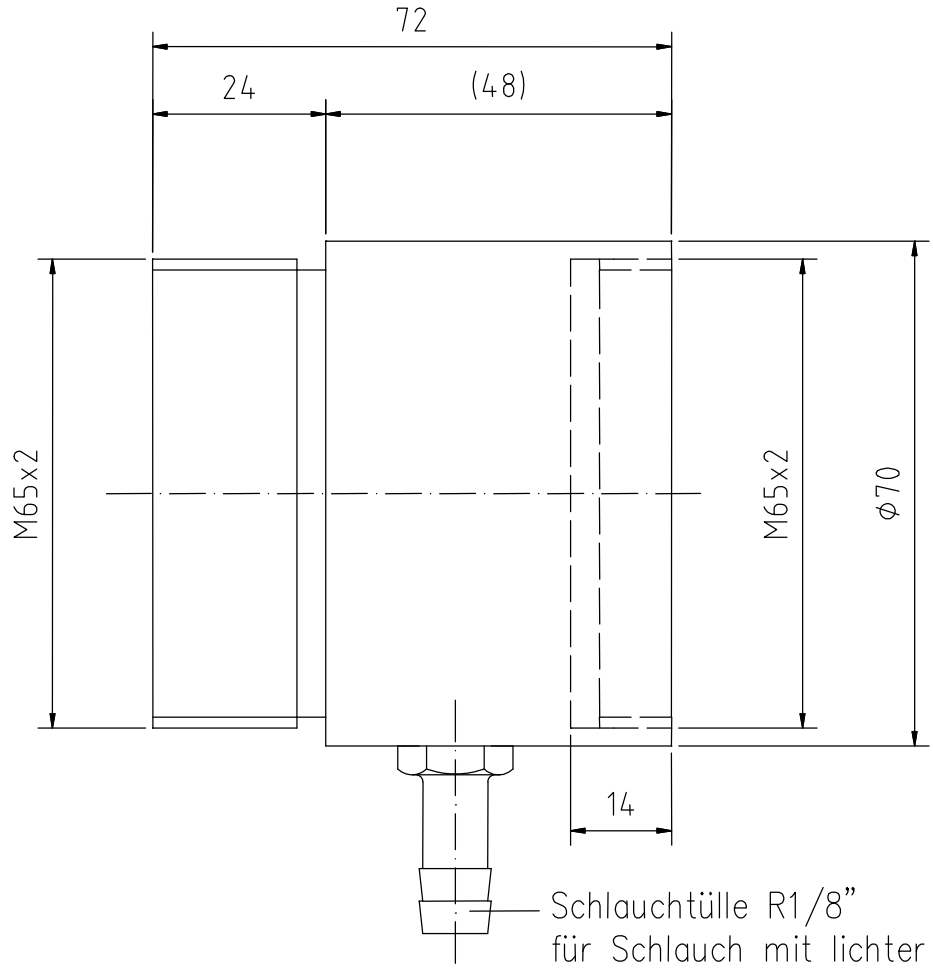
Instrument type			Mat.- No.
Connection cable Length 2.5 m, other lengths on request 12 x 0.14 mm², emissivity coefficient adjustable via cable	VK01 / A		513 744
Connection cable Length as ordered 4 x 0.14 mm²	VK01 / B		513 743
PC-connection-box Length 2.5 m	VK01 / C		513 909
Connecting plug (one plug is supplied with the instrument)	Cable box		119 474
	Manufacturer:	Franz Binder GmbH & Co Elektronische Bauelemente KG P. O. Box 11 52 74172 Neckarsulm Germany	
	Item Name Order No.:	Cable box 99 - 5130 - 75 - 12	

Adapting lens	PZ 10 / A	513 837
Dust aperture	PZ 10 / S	561 256
Dust aperture	PZ 10 / T	561 257
Air purge	PZ 20 / A	561 176
Cooling device	PZ 20 / B	561 179
Intermediate tube	PZ 20 / C	561 174
Supporting ring	PZ 20 / E	561 177
Mounting flange	PZ 20 / F	561 172
Fixing device	PZ 20 / G	561 188

Adapter flange for hole circle D = 90	PZ 20 / H	561 192
Quartz screen hinge	PZ 20 / I	561 173
Heat trap	PZ 20 / K	561 178
Holding clamp	PZ 20 / L	561 202
Cooling device	PZ 20 / M	561 217
Holding clamp	PZ 20 / N	561 226
Adapting lense	PZ 20 / O	513 840
Spot lamp adapter	PZ 20 / P	561 236
Laser-Pointer	PZ 20 / Q	561 235
Adapter from PZ to PS	PZ 20 / R	561 237
Dust aperture	PZ 20 / S	561 252
Dust aperture	PZ 20 / T	561 253
Steel bars for mounting on wall	PZ 20 / U	561 254
Ball Flange	PB 08 / I	508 167
Holding Device	PB 08 / K	508 233
Telephoto lens F=120 mm lens, focussing range 1.2 m - ∞	PZ 20.06	513 818
Close-up lens	PZ 20.03	513 574
Standard lens	PZ 20.01	513 568
Wide-angle lens	PZ 20.05	513 813
Fibre optic head M 30 x 1.5	PZ 41.01	513 873
Miniature fibre optic head 16 x 1,5	PZ 41.08	514 955

Air Purge PZ 20 / A

Mat.- No. 561 176



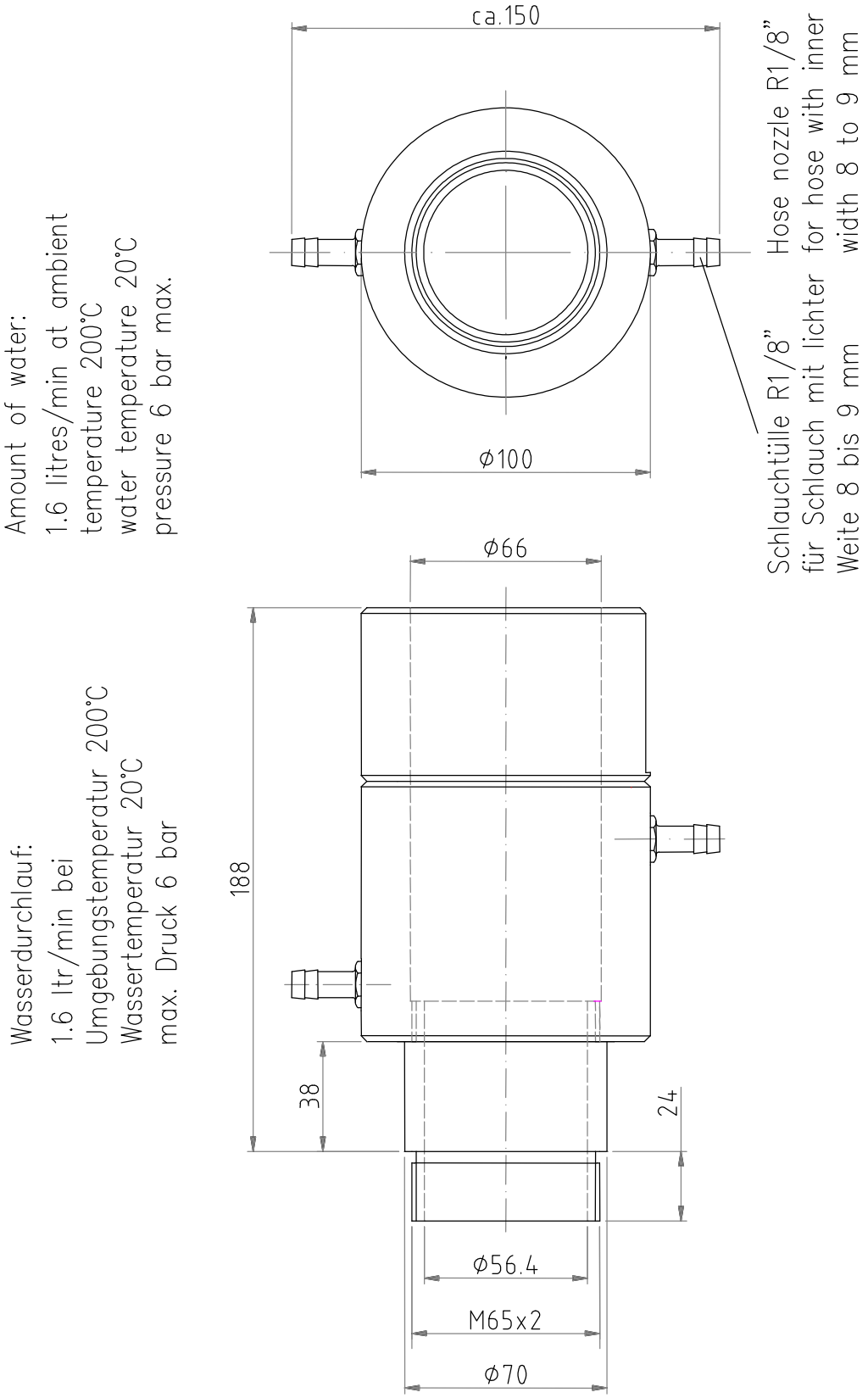
Spülluftbedarf:

ca. 50 ltr/min,
je nach erforderlicher Freiblaswirkung
max. Druck 6 bar

Purging air requirements:
aprox. 50 litres/min.
depending on blowing effect
max. pressure 6 bar

Cooling device PZ 20 / B

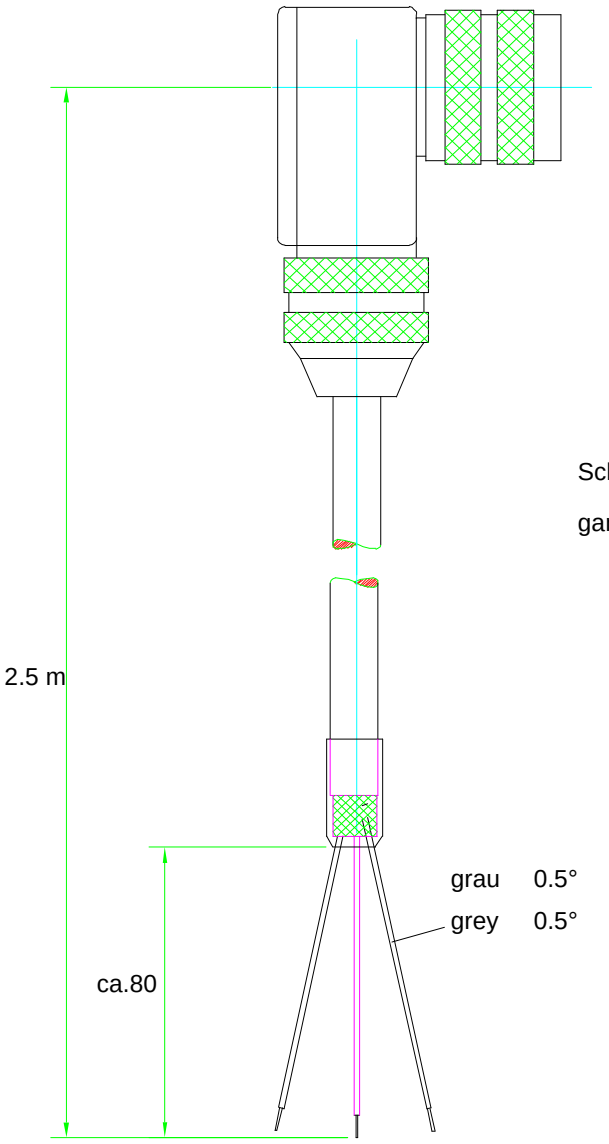
Mat.- No. 561 179



24 Cable types

24.1 VK01 / A

Mat.- No. 513 744



rosa	an A
weiß	an B
grau	an C
gelb	an D
violett	an E
braun	an F
grün	an G
rot-blau	an H
rot	an J
grau-rosa	an K
blau	an L
schwarz	an M

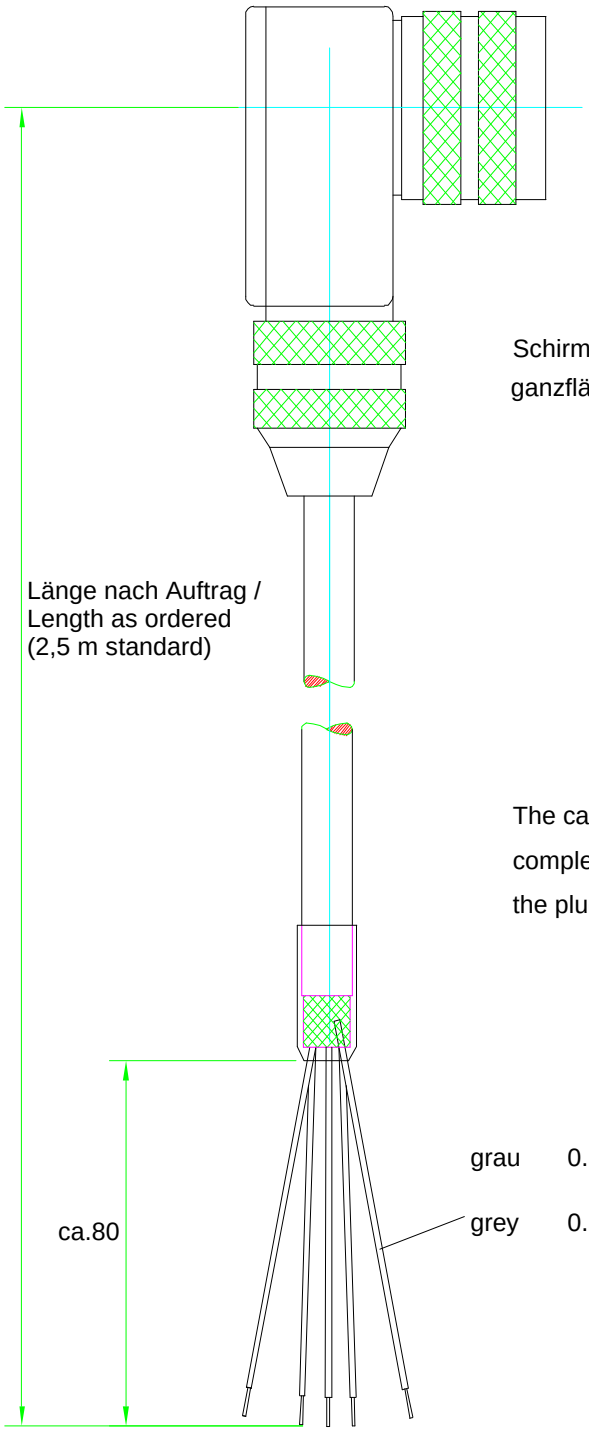
Schirm am Dosengehäuse ganzflächig aufgelegt

pink	at A
white	at B
grey	at C
yellow	at D
violet	at E
brown	at F
green	at G
red-blue	at H
red	at J
grey-pink	at K
blue	at L
black	at M

The cable shielding is compledly attached to the plug housing

24.2 VK01 / B

Mat.- No. 513 743

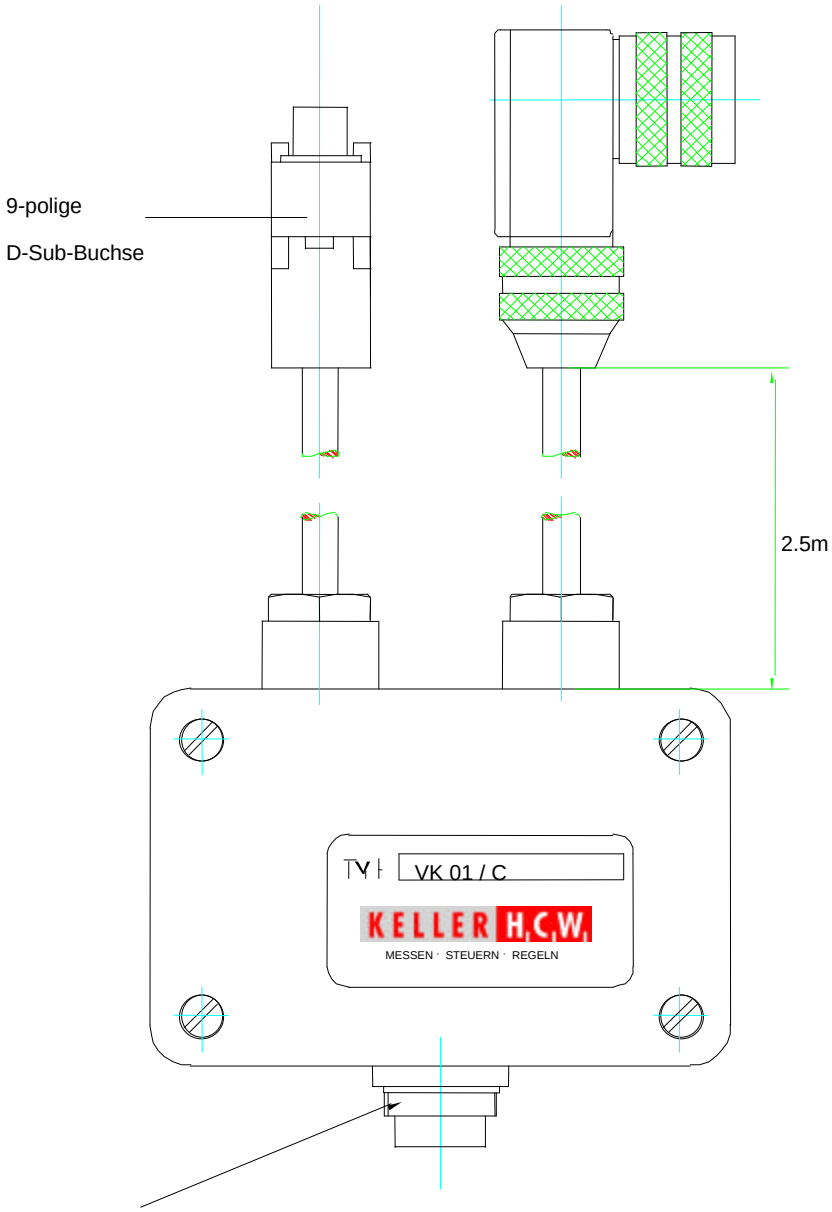


24.3 VK01 / C

Mat.- No. 513 909

PC-Anschluß Pyrometeranschluß

PC-connection Pyrometerconnection



Flanschstecker für Verbindungskabel VK01/A oder VK01/B
für 24V Spannungsversorgung und Stromausgang
(gleiche Aderbelegung wie direkter Pyrometeranschluß)

Plug for connecting cable VK01/A or VK01/B
for 24V power supply and current output
(same wires as direct connecting to pyrometer)

25 Glossary

Automatic print	After connecting the power supply the pyrometer starts transmitting the measured values via the serial interface automatically.
Cycle timer	The cycle time for the temperature output via the serial interface
Distance to target size ratio	Describes the ratio between the pyrometer to-object distance and the target diameter.
Double Max-Memory	Short temperature peaks will be held for an adjustable hold time.
Emissivity	Ratio between the real radiation intensity of the object to the maximum theoretically possible radiation intensity at the same temperature. The epsilon needs to be adjusted at the pyrometer to correct the measured value.
Hold time	Hold time for the mode „double peak picker hold time“
Two-colour pyrometer	Special kind of pyrometer which records two measurements at the same time at two different wavelengths and by means of this ratio calculates the object temperature.
One colour pyrometer	Radiation pyrometer, which determines the temperature by receiving a certain intensity of infrared radiation.

26 Shipping, Packaging and Disposal

26.1 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.

Concealed damages
Should you discover a concealed loss or damage, report it to KELLER 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.

26.2 Packaging

The packages used by KELLER are made of carefully selected, environmentally compatible materials and are thus recyclable.

26.3 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.