

Micro-Pyrometer **PV 11**

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Please note:

Technical alterations will be made without notice unless otherwise stated on the individual pages of this operating manual.

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Safety Remarks

The micro-pyrometer is a state-of-the-art design, reliable and complies with the commonly accepted safety rules. However, inexperienced handling can cause damage to the pyrometer or other tangible goods.

Each person charged with the operation and maintenance of the pyrometer, is obliged to read the manual first.

Operation of the pyrometers is only permitted under perfect conditions and in compliance with all local safety rules. In case of failure, the pyrometer has to be stopped immediately.

Intended Use

The micro-pyrometer is exclusively designed for the applications stated in this operating manual. Any other use is not intended and the manufacturer is not liable for any damages resulting thereof, the risk is borne by the user alone.

Only persons who know the pyrometer and have been informed about possible dangers are allowed to operate, maintain or repair them.

The common regulations for the prevention of accidents have to be observed.

Arbitrary alterations on the pyrometer or operation of the pyrometer beyond the allowed operating conditions rule out the liability of the manufacturer for any damages resulting thereof.

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1 General Description

The micro-pyrometer, operating according to the comparison radiation principle, is a spectral pyrometer provided with an optical enlarging system for measuring the temperature on small and smallest objects from 700 to 3500 ° C.

The application fields of the micro-pyrometer apply to wide ranges of industrial research and development as well as universities and colleges of advanced technology. The micro-pyrometer is used for measuring very small test objects with a high accuracy.

The instruments meet the safety regulations of EC-regulation 89/336/EWG about electromagnetic compatibility (law on electromagnetic compatibility).

European Standards:



EN 50081 - EN 50081 -2
EN 50082 - EN 50082 -2

KELLER HCW's quality assurance system meets DIN Standard ISO 9001 and the environment management system meets DIN Standard ISO 14001 for construction, production, repair and service of non-contact infrared temperature measuring instruments.



2 Scope of delivery

Make sure that all of the following components have been included with your shipment:

- Pyrometer
- Carrying case
- Power supply 100 – 240 VAC/ 15 VDC
- Crosshead PB 06/R

3 Application Examples

The micro-pyrometer is especially suited for the exact temperature control on the smallest test objects. Because of its restricted measuring point, the micro-pyrometer can preferably be used for solving temperature-measuring tasks on bulb filaments. The micro-pyrometer is used as universal temperature measuring instrument in many areas of research and science.

- **Production of Laboratory Instruments - Atomic Absorption Spectrometers**
Exact temperature determination on graphite cells
- **Vacuum Kilns - Metal Samples**
Temperature determination on small metal samples
- **Nuclear Research - Metal and Ceramic Samples**
Temperature determination on smallest samples with a high temperature
- **Bulb Producers**
For determining the thermal limit of filaments of different metal alloys
- **Universities and Colleges of Advanced Technology**
Many institutes of physics, chemistry and material technology use the micro-pyrometer as a universal temperature-measuring instrument.

4 Non-Contact Temperature Measurement

4.1 Principle of Measurement

Each substance sends out thermal radiation or infrared radiation according to its surface temperature in all its states of aggregation. The radiation arises from the oscillation of the atoms or molecules. The intensity of the infrared radiation is a measure for the temperature.

The micro-pyrometer uses the infrared radiation in the visible area. Here the brightness is a measure for the temperature.

The micro-pyrometer has an internal comparison radiation source. The user then has to adjust the brightness of the comparison radiator to the one of the object. After adjusting the brightness, the temperature can be read on the display.

4.2 Emissivity

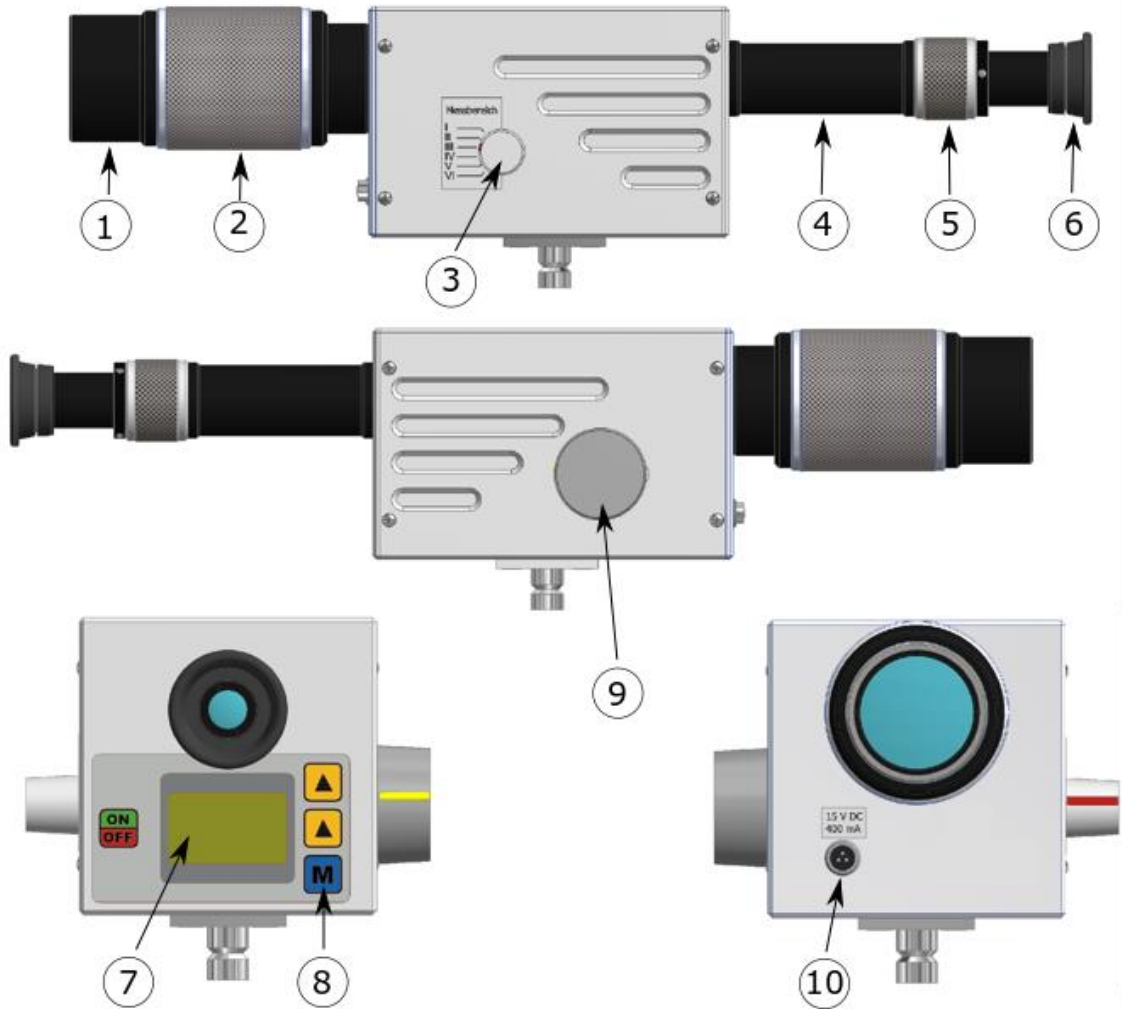
The ability of an object to emit thermal radiation depends on the material of its surface finish. This ability is expressed by the emissivity and has to be allowed for via the emissivity adjustment (ε). In order to get exact measuring results, the respective emissivity of the test object has to be adjusted. A wrongly adjusted emissivity leads to measuring faults when measuring the temperature. Due to the wavelength, at which the micro-pyrometer is measuring, the influence of the emissivity is considerably lower than with pyrometers that operate in the invisible infrared area.

The transmission losses occurring when using supplementary lenses (for small measuring distances) can also be corrected via emissivity adjustment (see 9.1).

4.3 Characteristics

The micro-pyrometer distinguishes itself especially by a sharply outlined illustration of the test object, with a large range of vision. Most of all the disappearance of the comparison marking, when adjusting the temperature, is carried out so that the photometric limit of the eye recognizing smallest brightness differences is completely used and a very high adjustment accuracy can be achieved without difficulties.

4.4 Outline of the Micro-Pyrometer



1	Lens
2	Focussing of the lens
3	Range switch
4	Eye piece
5	Eyepiece focusing
6	Eyecup
7	Display
8	Key panel
9	Fine-tuning
10	Power supply

5 Function Description

5.1 Switching-on and off

By actuating the ON-key, the instrument is switched on. After switching-on, a self-test is carried out. Then the adjusted emissivity of the last application appears for a short time. Now the instrument is ready for operation. It switches off automatically after the set time has expired if no key has been activated. Alternatively, the instrument can be switched off manually by actuating the ON-key again.

5.2 Emissivity - Quick Adjustment

In the basic position (temperature indication) the emissivity can be displayed and changed via arrow key. A single short tap on the arrow key shows the emissivity.

Several taps or keeping the key pressed change the value. There is an automatic return to the basic position.

5.3 Emissivity - Menu Adjustment

By pressing the mode key once in the basic position, the emissivity appears in the display. Adjustment is carried out via the two arrow keys.

Remark:



After selecting the test object, please take the correct adjustment of the emissivity into consideration, since otherwise a wrong temperature value will be displayed.

5.4 Locking of the Epsilon Adjustment

The emissivity adjustment of the micro-pyrometer can be safeguarded against accidental or unauthorized adjustment. By pressing the mode key and simultaneously actuating the

∇-key (approx. 3 secs.) the epsilon adjustment is locked. This is signalled by the *-symbol. By re-actuating the key combination, the safeguarding is switched off again and the *-symbol disappears.

6.2 Adjustment of Direction and Picture Quality

Before measuring, the picture quality has to be adjusted precisely.

Focussing on Comparison Marking:

First of all the pyrometer has to be switched on the filtering wheel to measuring range VI to get a dark background. Then the comparison marking has to be adjusted by means of the potentiometer to a medium, clearly visible brightness and focusable by means of the eyepiece.

Focussing on the Object:

Subsequently the measuring range has to be selected in which the object can be seen in a similar brightness as the comparison marking. Then the lens has to be adjusted until the measuring object can be seen sharply.

If the measuring distance is less than 1 m, the supplementary lenses have to be mounted in front of the lens according to table 9.1.

The micro-pyrometer has to be aligned to that part of the object that shall be measured. The top of the comparison marking is relevant for this.

6.3 Emissivity Adjustment

Adjust the emissivity according to the measuring object and the possibly used supplementary lens. Example:

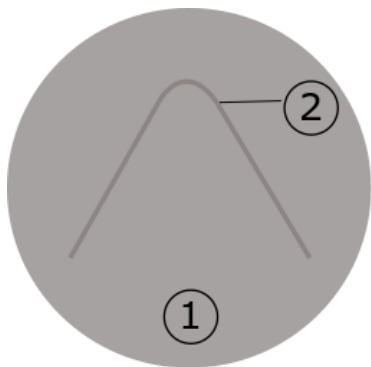
$$\begin{aligned} \text{Emissivity of the object} &= 0.98 \\ \text{Using front lens [+2]} &= 0.985 \\ \underline{\text{Emissivity to be adjusted}} &= 0.98 \times 0.985 = 0.97 \end{aligned}$$

Thus, the instrument is ready for measuring.

6.4 Measurement

By means of the potentiometer, the brightness of the bulb has to be adjusted in such a way that the comparison marking is as bright as the measuring object, so that it disappears more or less. If adjustment is not possible, the limit of the partial measuring range has been reached. In this case the display is blinking. The next measuring range has to be selected by turning the filter wheel and then adjustment can be carried out again.

After the adjustment, the object temperature can be read on the display.



View through the optics
 1. Measurement object
 2. Comparison marking

Remark:



Please note that the emissivity of the measuring object is adjusted on the pyrometer. Otherwise a larger measuring inaccuracy can occur.



When measuring, e.g. through small apertures, make sure that the optical path is not shadowed. If the optical path is shadowed, the signal is weakened and the object no longer appears with the same intensity. Visually, through the through-the-lens sight, a weakening cannot be detected. To find this out, you will find the Field of view Calculator on our website under Tools. This tool shows the complete field of view.

Hint:

Since there is a certain temperature range for the viewer, in which the brightness seems to be identical, we recommend carrying out several measurements. We recommend approaching the proper temperature from below and from above and then to take the average. Thus, you achieve reproducible readings by several measurements.

6.5 Extension of the Measuring Range up to 3500 ° C

The standard maximum measuring temperature is 3000°C. In connection with grey filter, which can be obtained as an option, the measuring range VI can be extended to 3500 °C. If a screwed-on grey filter extends the measuring range, the emissivity has to be adjusted to the value corresponding to the grey filter (the value is indicated on the grey filter). In case measurements with an emissivity < 100 % have been made before, multiply this emissivity with the value of the grey filter and adjust the emissivity accordingly.

Example:

Emissivity of the object	0.90 %
Transmission value of the grey filter	0.29 %
Emissivity to be adjusted	$0.9 \times 0.29 = 0.26 = 26 \%$

7 Connections on the Pyrometer

7.1 Voltage Supply

The micro-pyrometer is supplied with 15 V direct current via an external plug power supply unit. For this the plug of the power pack has to be plugged into the appropriate socket on the front side of the pyrometer.

After connecting the connector power pack to 230 V AC supply voltage, the micro-pyrometer is ready for use.

8 Technical Data

Measuring Ranges (switch able):

I	700 - 800 °C
II	780 - 950 °C
III	900 - 1100 °C
IV	1050 - 1500 °C
V	1450 - 2100 °C
VI	2000 - 3000 °C

up to 3500 °C with grey filter attached in front

Display Resolution: 1 K

Measuring Uncertainty:

1.5 % of the measured value	(700 ... 800 °C)
0.6 % of the measured value	(800 ... 2000 °C)
2.0 % of the measured value	(2000 ... 3500 °C)

Adjustment Accuracy:

The adjustment accuracy depends on the eye of the viewer. It is on average:

at 1000 °C	1.5 K
at 2000 °C	5.0 K
at 3000 °C	10.0 K

Repeatability: 3 K

Measuring Distance:

Without supplementary lens from 1 m onwards,
with supplementary lens 0.2 - 1 m possible
Objects of only 1 mm diameter can still be measured accurately from a distance of 5 m.

Min. Target Size:

0.3 mm at 1 m distance
0.1 mm at 0.2 m distance
(with supplementary lens)

Sighting Device:

- true-sided, through-the-lens sighting with dioptric compensation
- faded-in comparison marking, focusable lens

Aligning Aid:

Crosshead: horizontal: 360 °
vertical: 90 °

Display:

4-figure digital, LCD with background illumination

Adjustable Parameters:

- 1.) Emissivity: 0.1 ... 1 adjustable (step size 0.001 %)
- 1.) Time of automatic switching-off

Operation Voltage:

15V DC (400 mA) or 230 VAC via plug power supply unit (included in the delivery scope)

Spectral Sensitivity:

Partial measuring range I:
500 - 670 nm
Partial measuring range II:
620 - 670 nm
Partial measuring range III - VI:
650 - 670 nm

Focus Correction:

On lens and eye piece

Admissible Ambient Temperature:

10 ... 45 °C

Storage Temperature: 0 ... 55 °C

Housing: Aluminium

Dimensions:

(100 x 100 x 450) mm including lens

Software:

PZ 10/D (optional)

9 Accessories for the Micro-Pyrometer

9.1 Supplementary Lens (optional)

For measuring extremely small test objects or at measuring distances smaller than 1 m there are three supplementary lenses available with characteristics as shown below:

Supplementary Lens	Distance
without supplementary lens	1.0 ... ∞ m
[+1]	1.0 ... 0.5 m
[+2]	0.5 ... 0.33 m
[+1] + [+2]	0.33 ... 0.25 m
[+4]	0.25 ... 0.20 m

When using a supplementary lens, the transmission losses have to be taken into consideration.

It requires a correction of $\varepsilon = 985 \%$ per lens, which has to be carried out via the emissivity adjustment on the pyrometer. When using two lenses, the correction has to be carried out with

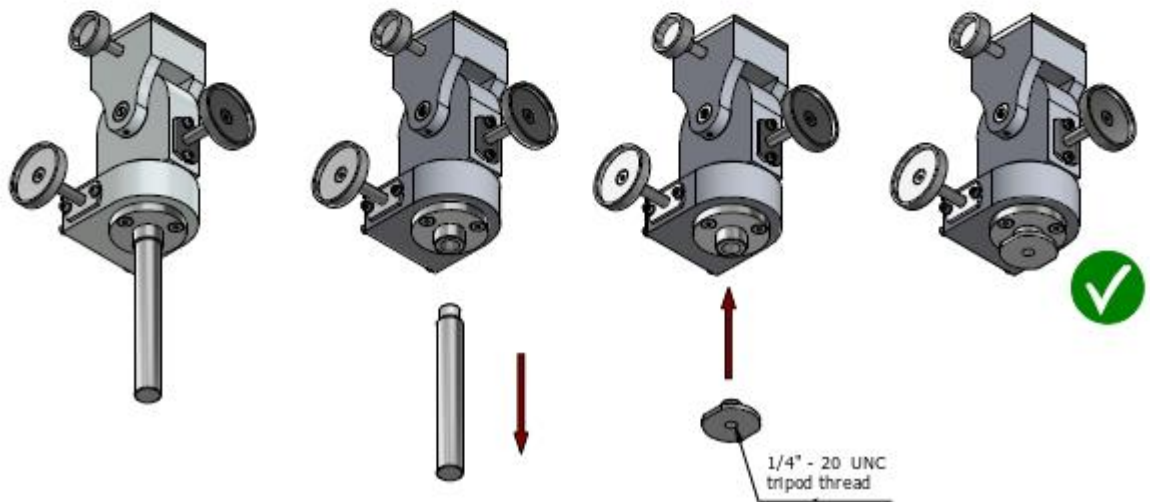
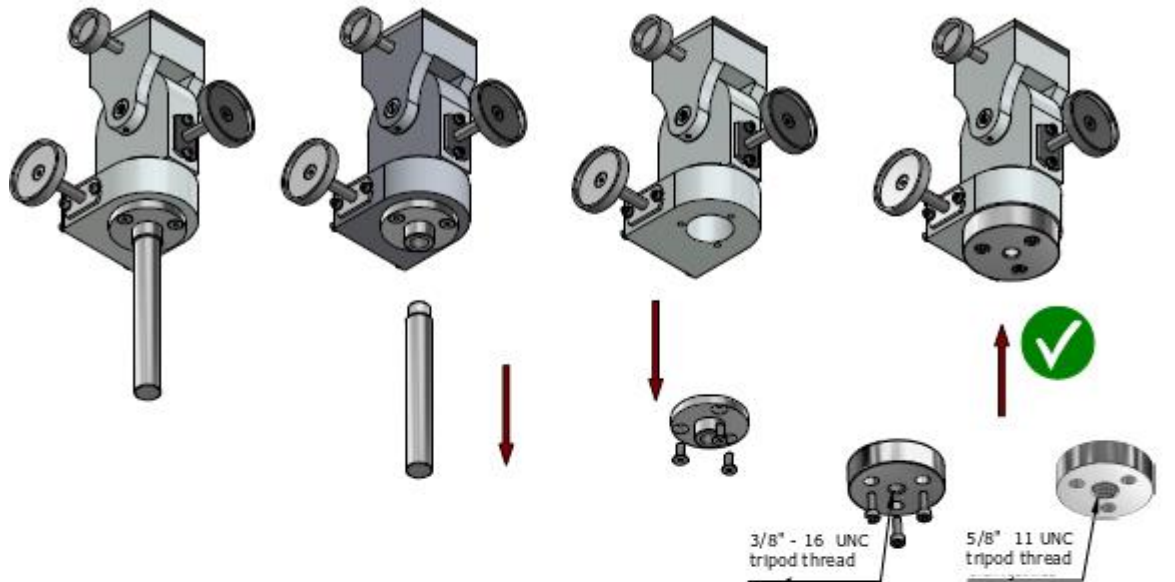
$$e = 0.985 \times 0.985 = \underline{0.97}.$$

9.2 Spare Bulb

A spare bulb belongs to the delivery scope as a standard. The bulb can be exchanged without recalibration. For changing the bulb, open the cover on the top of the instrument. The installed bulb can be taken out by means of the included threaded bolt. The replacement bulb has to be installed in the same position.

10 Crosshead

The crosshead is used to align the Micro-Pyrometer. As delivered, a round rod is mounted on the crosshead. It is possible to adapt the crosshead to standard stands using adapters.



11 Shipping, Packaging and Disposal

11.1 Inspecting your shipment

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

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

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

11.2 Packaging

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

11.3 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.



