

User Manual



KLEIBER 740-LO INFRARED PYROMETER with fibre optics

for non-contact temperature measurement

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1 Basic Information

1.1 Notes for the User Manual

This user manual describes the structure of the KLEIBER 740-LO infrared pyrometer for non-contact temperature measurement and gives the operators all the necessary information related to installation, operation, de-installation along with information related to maintenance and repairs of the pyrometer. When malfunctions occur, the user manual provides suggestions for their potential causes and their repair.

This user manual is intended for qualified service and maintenance personnel with appropriate technical expertise including a basic knowledge of temperature measuring technology.

Before you use the pyrometer for temperature measurement, you must have read and understood these operating instructions! Keep the manual so that it is available at all times.

Take into account all the requirements given in this user manual. This is a pre-condition for:

- ☐ the correct and professional use of the pyrometer,
- ☐ proper maintenance, cleaning and care of the pyrometer
- ☐ prevention of risks and strict observance of the essential technical safety regulations.

Document structure and Symbols

Operating instructions to be performed in sequence are numbered in chronological order. They are grouped together in operational units and accompanied by the corresponding results.

Listings without a sequential order are presented as bullet points and items in sub-lists are preceded by dashes.

Safety precautions are shown with pictograms and key words. They provide information about the type, source and consequences of the hazard, and safety precautions. The meanings of the pictograms and key words are explained in the „Safety Instructions“ chapter.

1.2 Purpose

The KLEIBER 740-LO pyrometer with fibre optics is particularly intended for the non-contact measurement of surface temperatures on metal, ceramic, plastics and is specially designed for industrial applications as well as applications in the area of research and development.

The 730-LO also enables you to solve high speed applications in laser areas by using laser rejection filters and challenging temperature measurement on silicon or tungsten.

1.3 Intended Use

The KLEIBER 740-LO pyrometer is to be used exclusively for the non-contact measurement of surface temperatures of the materials specified in section 1.2. Any applications beyond that area are not allowed! Any damage resulting from this is the sole responsibility of the operator.

Proper use of the plant also includes:

- ☐ the observance of the requirements of these operating instructions for transport and storage, assembly, operation and care of the pyrometer
- ☐ the observance of the power requirements specified in section 2 and the operating and environmental conditions
- ☐ the compliance with the legal accident prevention and environmental regulations

Among applications/conditions for which the pyrometer is **not intended for use** are in particular:

- ☐ the use of the pyrometer within medical areas
- ☐ the use of the pyrometer in the food industry
- ☐ the use of the pyrometer in areas where there is danger of explosion
- ☐ the use of the pyrometer outside of the operating and environmental conditions specified in section 2

1.4 Warranty and Liability

The KLEIBER Infrared GmbH offers a warranty of 2 years for the pyrometer starting from the date of billing. The warranty covers manufacturing defects as well as defects which are determined during operation and which can be imputed to defects of KLEIBER Infrared GmbH. In these cases, the pyrometer will be repaired free of charge. The freight charges are the responsibility of the respective sender.

KLEIBER Infrared GmbH reserves the right to exchange the equipment or parts of the instrument instead of a repair. After a repair, KLEIBER Infrared GmbH offers a warranty of 12 months on all repaired and/or exchanged instrument components.

Deviations from the proper use described in this user manual will result in restricted warranty and liability or the loss in case of damage. Damage to wearing parts (e.g. fuses) is excluded from the guarantee.

Warranty and liability claims for personal injuries and/or material damage are excluded if this or these result from one or more of the following causes:

- ☐ Improper use of the pyrometer
- ☐ inappropriate operation and servicing of the pyrometer
- ☐ unauthorized modifications to the pyrometer without prior consultation with KLEIBER Infrared GmbH
- ☐ rough, mechanical actions or deliberate destruction of the pyrometer
- ☐ Connection error (overvoltage)
- ☐ Frost damage by not observing the permitted environmental conditions and/or by inappropriate storage
- ☐ Malfunctions that are caused by non-conformance to this user manual

1.5 Scope of Supply

The scope of supply of the pyrometer includes:

- ☐ High Speed infrared pyrometer KLEIBER 740-LO
(KS 740-LO or KG 740-LO or KGA 740-LO)
- ☐ retaining pin Ø 14.9 mm, length 100 mm
- ☐ inspection sheet
- ☐ user manual

IMPORTANT

Connecting cables are not included in scope of delivery. Please order the length for the fibre cable depending on the application.

2 Technical Data

Manufacturer's data :	
Manufacturer:	KLEIBER Infrared GmbH
Name of the pyrometer :	KLEIBER 730-LO
Design data:	
Length (basic instrument):	170 mm
Width:	70 mm
Height:	70 mm
Weight:	approx. 880 g
Characteristic data:	
Measurement range in °C/ Spectral range in µm:	
KS 740-LO	[600 ... 1.600] °C [0.85 ... 1.05] mm [800 ... 2.300] °C [0.85 ... 1.05] mm
KG 740-LO	[300 ... 1.400] °C [1.58 ... 1.80] mm [500 ... 2.500] °C [1.58 ... 1.80] mm
KGA 740-LO	[200 ... 1.000] °C [1.58 ... 2.20] mm [300 ... 2.300] °C [2.00 ... 2.20] mm
Measurement outlet analogue:	[0 ... 20] mA or [4 ... 20] mA maximum burden 500 Ω, [0 ... 10] BNC
Accuracy:	0,75 % of measured value (at 25°C, ε=1)
Reproducibility:	< 0,3 % of measured value (at 25°C, ε=1)
Response time t_{95} :	9µs at current output 6µs at voltage output
Emissivity (ε):	adjustable from 0.1...1
Fibre optics:	for measuring distances and measuring fields please refer to table below
Sighting mechanism:	LED pilot light
Operating temperature:	[0 ... +40] °C [0 ... +260] °C for optical head and fibre cable [0 ... +250] °C
Storage temperature:	[-20 ... +70] °C
Power supply:	24 V DC 0,2 A or 24 V AC 0,2 A
Test base:	EN 55 011 : 1998, limit class A
CE marking:	according to EU regulations

Fibre optical heads*

Optic	Measuring distance [mm]	Measuring field ø [mm]	Fibre cable ø [µm]	Measuring range	Aperture ø [mm]
LVA 25	110 ... 800	0.8 ... 5.0	200 (red)	all	17
LVO 25	80 ... 300	1.6 ... 4.3	400 (blue)	all	18
LVO 25 S-1	115 ... 300	0.4 ... 1.5	200 (red)	>400 °C	10
LVO 25 S-2	200 ... 240	0.85 ... 1.1	200 (red)	>350 °C	12
LVO 25 S-3	76	0.3	200 (red)	>400 °C	10
LVO 25 S-4	60	0.5	200 (red)	all	11
LVO 25 S-5	70 ... 200	1.0 ... 2.6	400 (blue)	all	12
LVO 25 S-6	250 ... 500	3.5 ... 6.3	400 (blue)	all	18
LVO 35	250 ... 1000	3.5 ... 11.0	400 (blue)	all	28

* other optical heads on request

3 Safety

3.1 Symbols and signal words used

The following symbols and key words are used in the user manual to indicate hazards and instructions. Safety precautions always appear before an action.



DANGER

Indicates a potentially dangerous situation. Failure to abide may result in light or minor injury and damage.



CAUTION

Indicates a potentially damaging situation. Failure to abide may result in damage to the product or to anything near the product.



IMPORTANT

Indicates useful tips and other specifically useful information that allow any dangerous or damaging situations to be avoided.



REFERENCE TO ENVIRONMENTAL PROTECTION

Important instructions for protecting the environment.

3.2 General Safety Notes

The KLEIBER 740-LO pyrometer has been built in accordance with the currently valid standards of the technology and the recognized safety regulations and ensures the highest safety level.

The fundamental safety and occupational safety requirements of applicable laws, standards, and guidelines have been taken into account in the pyrometer design. The safety of the pyrometer is confirmed by the declaration of conformity and the CE mark.

All information related to safety is with reference to the regulations of the European Union currently in force. In other countries, applicable laws, national directives and safety regulations have to be met.

Apart from the safety instructions given in these operating instructions, you should also take into account the generally valid regulations for accident prevention and environmental protection as well as the regulations of the respective professional associations and strictly comply with them.

Note the general safety instructions:

- ☐ Commissioning of the pyrometer may only be carried out by persons qualified to do so, taking the safety instructions into account.
- ☐ Pay attention to the installation site requirements and notes for commissioning (see section 6).
- ☐ Only use the original cables provided as accessories for the connection of the pyrometer. Other cables, especially cables manufactured by your self, are not permitted
- ☐ Lay all cables in such a way that they are not exposed to any tension and are not clamped or squashed.
- ☐ Before start-up, carry out a visual inspection for damage to the components of the pyrometer (housing, optics, cable and pipes). Never operate the pyrometer with damaged components.

4 Technical Description

4.1 System Design/Principle of Operation

Fig. 1 shows the basic structure of the pyrometer. The basic parts of a pyrometer are the lens, aperture, filter, detector and the signal processing unit.

The infrared radiation coming in from the object to be measured is gathered by the lens. The aperture blocks unwanted rays at the edges. The filter permits only the desired spectral range to enter.

The rays then pass through to the detector which transforms the infrared radiation into electric signals.

These signals are then linearised in the signal processing unit and changed into a standard output signal which can then be read in the display and be used for process control.

The operating elements as well as the connections/interfaces are located at the back of the pyrometer (see pages 10 to 11) .

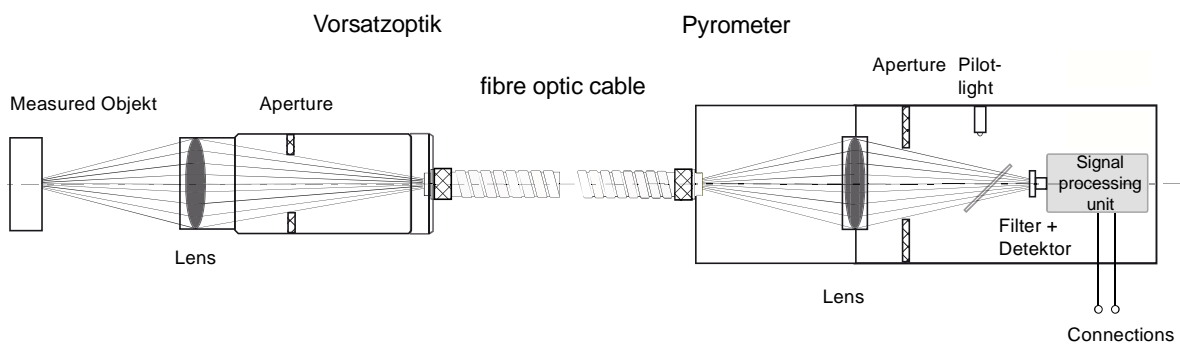


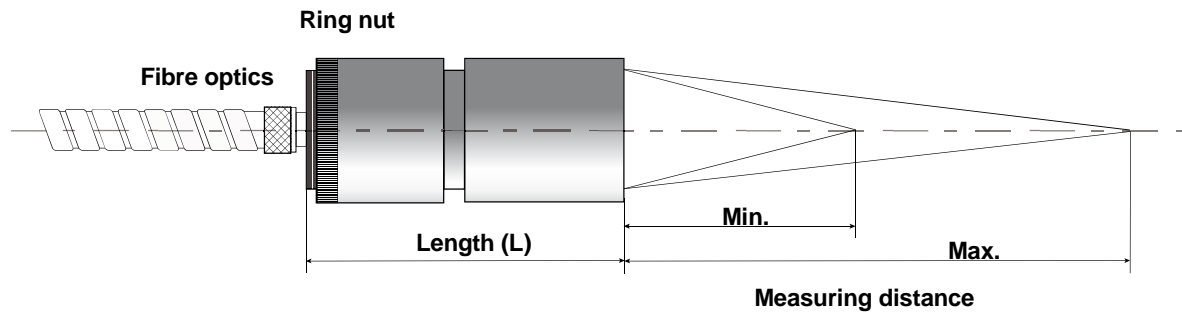
Fig. 1

4.1.1 Fibre Optics

The pyrometer is equipped with fibre optics and depending on the application (measuring distance, measuring field diameter, etc.) the pyrometer can be used with a vario optic head or a fixed optical head.

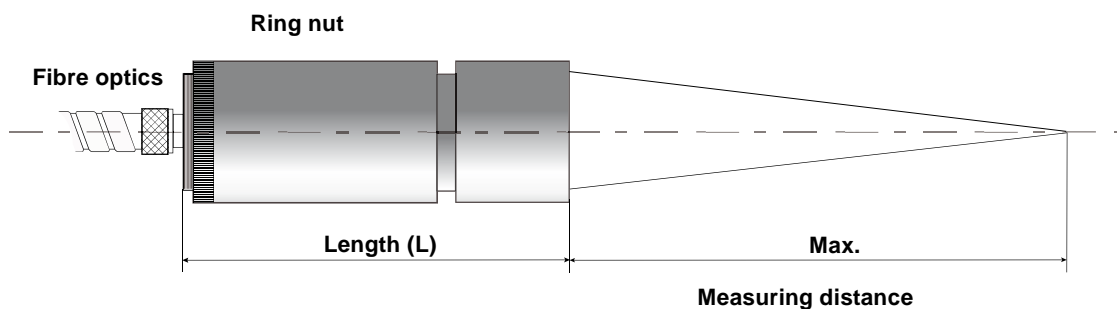
Vario optics

The vario optic can be adjusted according to the measuring field and distance to realise small spot sizes.



Fixed optics

The fixed optics allows very small measuring fields, i.e. a certain measuring field diameter is given for a certain measuring distance.



IMPORTANT

The fixed optics cannot be adjusted. The distances mentioned (page 5) must be respected absolutely in order to ensure the small measuring field.

4.1.2 Bedienelemente

The controls and indicators are located on the rear side of the device. For the meaning of individual elements refer to legend Fig. 4, for operation of the pyrometer see section 7.

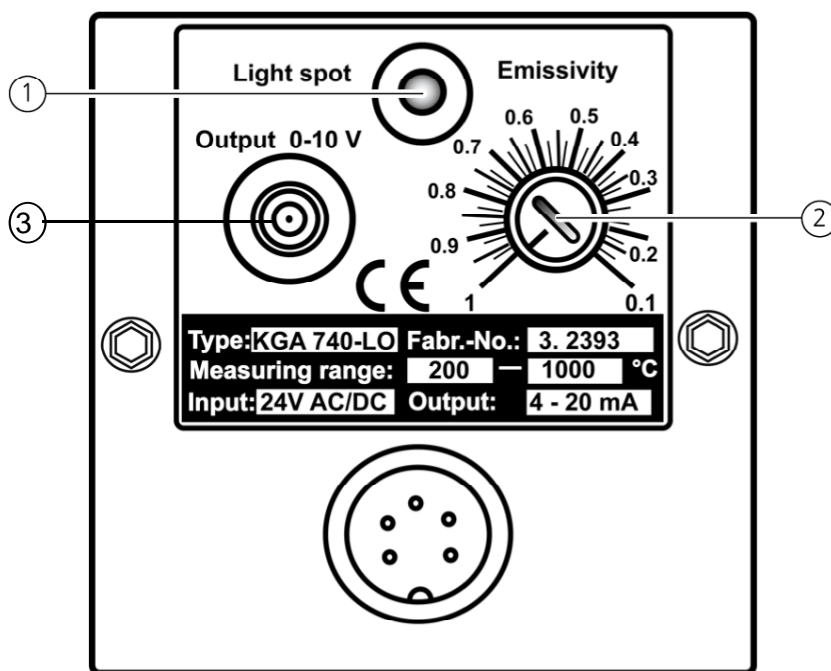


Fig. 4 Operating and display elements

Operating and display element		Meaning
1	Push button for pilot light	switch on/ off the pilot light
2	Potentiometer [response time]	adjustment of response time from 180 μ s to 5 s
3	BNC Output	BNC output 0 ... 10 V for connection to storage oscilloscope

4.1.3 Connections and interfaces

Connection for 5-pole connecting cable

The 5-pole plug to connect the instrument is at the rear side of the unit (see Fig. 5).

The contacts of the 5-pole plug are arranged as follows:

Plug pin	Meaning
1	+24 V Supply voltage (DC or AC)
2	Supply voltage 0 V (DC or AC)
3	ground output
4	Analogue output [0 (4) ... 20] mA
5	shield

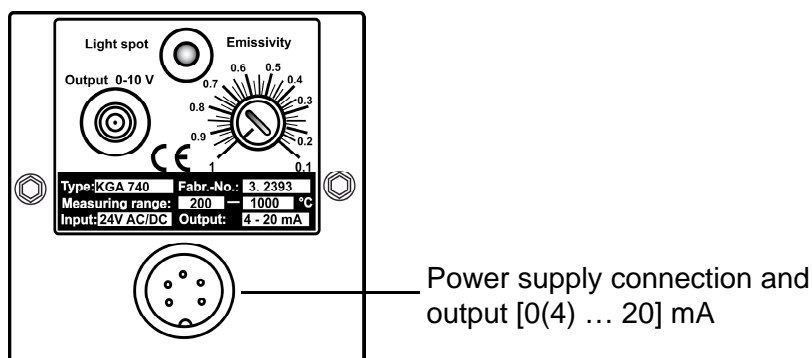


Fig. 5 Connecting plug for 5-pin connecting cable

Mounting

There is a retaining pin (scope of delivery) through which the pyrometer can be fixed using various brackets.

We recommend fixing the pyrometer using the retaining pin and optional available ball and socket mounting support with clamp or thread.

This mounting plate ensures secure assembly of the pyrometer as well as optimal adjustment with respect to the object being measured (for order data see page 22).

5 Transport and Storage

5.1 Transport of the pyrometer



CAUTION

Environmental factors, impacts and the formation of water condensation may damage some components!



CAUTION

When transporting the pyrometer, take suitable measures to protect all components from environmental factors, impacts and the formation of water condensation! Temporary storage of the pyrometer in the open air is not permitted!

Prepare the pyrometer for transport as follows:

1. Switch the pyrometer off so that there is no tension and remove the connecting cable and the signal cable
2. Protect the fibre optics against scratches through suitable measures (e.g. protective cap, foil, ...).
3. Pack the pyrometer in the original packaging paying attention to the means of transport (see transport instructions below).

ü **The pyrometer is thus ready to be shipped.**

It is advisable to use the original packaging for the shipping of the pyrometer. If the original packaging is no longer available, the pyrometer should be shipped in a cardboard box with shock-absorbing PE material.

When transporting the pyrometer observe the following instructions:

- ☐ Take great care when transporting the pyrometer to avoid damage through the effect of force, or careless loading or unloading.
- ☐ Avoid jerks, vibrations and the formation of condensed water due to severe temperature deviations while transporting.
- ☐ In the case of overseas shipping, a suitable desiccator (e.g. Silicagel) should be inserted and the pyrometer should be sealed together with the desiccator in a protective plastic sheet.
- ☐ If the pyrometer is not immediately installed after delivery and put into operation, then it should be carefully stored in a location protected against dust and humidity (storage conditions - see section 5.2).

5.2 Storage of the pyrometer



CAUTION

Environmental factors and water condensing may damage some components! Store the pyrometer only in dry areas without large variations in temperature! The atmosphere should be free of dust and corrosive vapours!

Store the pyrometer appropriately in the original packaging. Put a suitable desiccant inside the packing (e.g. silica-gel) to prevent damage by moisture. Protect the pyrometer against dust through suitable measures.

The following climatic conditions are required in the storage room of the pyrometer:

- ☐ temperature range: -20 °C to +70 °C
- ☐ maximum air humidity: bis 70 %
- ☐ atmosphere: free of dust and corrosive vapours

6 Starting Up

6.1 Installation Site Requirements



CAUTION

Measurement errors and damage to the pyrometer through – ambient temperatures too high , - strong contamination of the optics due to dust, smoke, steam or other causes – air pollution,- electromagnetic interference sources You must take into account the following climatic conditions and the requirements of the place of use of the pyrometer!

Climatic conditions

The following requirements must be fulfilled with respect to the climatic conditions at the place of use of the pyrometer:

- temperature range: 0 °C to +40 °C,
0 °C to +260 °C (for optical head and fibre cable)
- maximum air humidity: 60 % at room temperature
- Atmosphere: free of dust, corrosive vapours, and fume gases

Requirements at the place of use

Take into account the following requirements at the place of use of the pyrometer:

- Take care with the choice of the place of use and take into account the ergonomic and the legal guidelines for industrial safety in order to ensure safe operation of the pyrometer.
- Set up the pyrometer on a firm, stable base. The base must be free from concussion and vibration.

Note:

We recommend using the rail mounting plate available as an accessory for the attachment of the pyrometer as well as a clamping attachment (see page 23).

- Do not expose the system to direct sunlight or radiation from heating (e.g. radiators).
- Do not set the pyrometer near strong electromagnetic fields or near electromagnetic interference sources.
- Make sure that the pilot light falls unhindered on the object being measured and that there is nothing in the path of the rays.

6.2 Installation

6.2.1 Fix and connect the pyrometer



DANGER

There is danger of injury and possible equipment damage by connection of cables under power!

Never connect cables under power! Make sure that the voltage supply is switched off before connection of the cables to the pyrometer!

Install the pyrometer as follows:

1. Mount the pyrometer with the help of the retaining pin and taking into account the conditions specified in section 6.1 for the intended place of use. The fibre optical head can also be mounted by using suitable mounting supports with available accessory (page 22).
2. Connect the coloured wires of the 5-pole connecting cable to appropriate connections of a switchboard.
For wire configuration please see legend to fig. 6.
3. Connect the 5-pole connecting cable to the pyrometer at the back of the instrument and to the power supply.
4. Double check stable set up of the pyrometer.

ü **The pyrometer is ready for use and can be switched on.**

Pyrometer wire connection

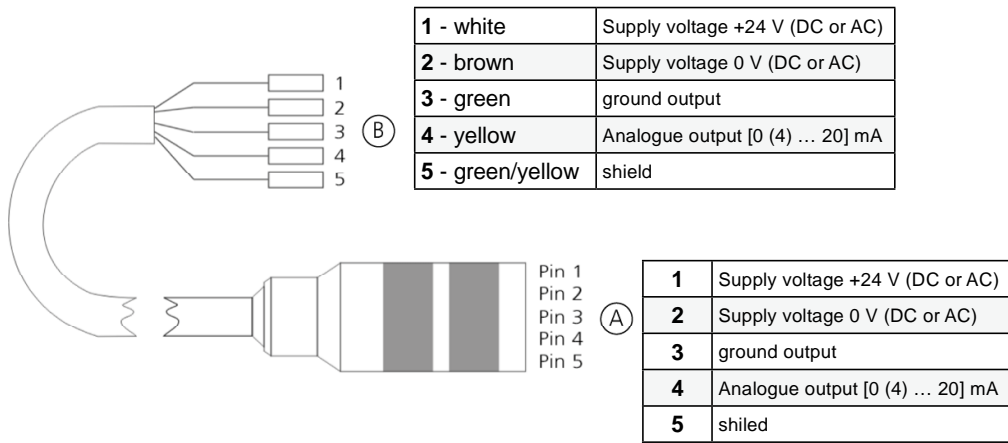


Fig. 6 Pyrometer wire connection with configuration

6.2.2 Align pyrometer

The pyrometer is equipped with an LED pilot light for accurate alignment of the sensor with the object to be measured. Align the pyrometer with the object to be measured as follows:

1. Switch on the supply voltage to the pyrometer.
2. Allow a starting time of approx. 5 minutes for thermo-stabilization. Than the pyrometer has stabilised and is ready to work with the given accuracy.
3. Switch on the pilot light by pressing the push button at the rear side. Make sure that there is nothing in the path of rays.
Note: In order to avoid measuring errors, the area of the pilot light must not be larger than the object to be measured
4. If you have a pyrometer with vario optic head, adjust the necessary measuring distance (see page 18).
Note: The fixed optics cannot be adjusted

ü **The pyrometer is thus aligned and ready for the temperature measurement.**

7 Operation of the pyrometer

7.1 Setting the optic

Please make sure which optic your pyrometer works with. The fixed optic has to be installed at the given measuring distance to ensure the small measuring field. For the vario optic please adjust the necessary measuring distance as follows:

1. If necessary switch on the pilot light by pressing the [OK] key.
2. Loosen the ring nut (fig. 7) by turning it in a counter-clockwise direction.
3. Move the vario optic forwards and/or backwards, in order to adjust the pyrometer to the required measuring distance.

Note:

The size of the pilot light is identical to the size of the measuring field.
The measuring field may not be larger than the object to be measured at the adjusted distance!

4. After adjusting the measuring distance, lock the annular nut by turning it in a clockwise direction.

ü **The vario optic is thus adjusted to the required measuring distance.**

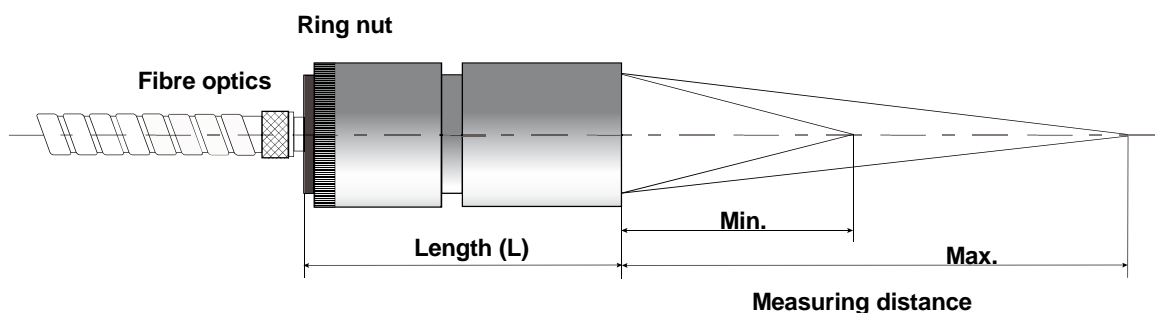


Fig. 7 Setting the vario optic head

Example:

Measuring distance	80	100	120	140	160	180	200	220	240	260	280	300
Measuring field Ø	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,1	3,4	3,7	4,0	4,3
Length L	63,2	60,0	58,1	56,2	55,4	54,6	54,0	53,6	53,1	52,7	52,4	52,1

7.2 Adjusting the Parameters

7.2.1 Emissivity

The emissivity is the relationship between infrared energy radiated from an object and the radiation energy of a perfect emitter (black emitter) at the same temperature and the same spectral range.

The emissivity is material-dependent and of a considerable size in order to be able to determine the temperature of an object accurately without contact. The emissivity of the object being measured must therefore be known and be adjusted at the pyrometer. Adjust the emissivity suitable for the measurement in accordance with the procedural steps on page 18. The adjusted emission value is indicated in the main menu.

Typical emissivities for various materials are available on our homepage at www.kleiberinfrared.com under practical knowledge or in relevant literature.

The instrument is calibrated at black body radiation ($\epsilon = 1.00$). Real objects have an emissivity less than 1.0. This difference can be stepless adjusted between 0.1 and 1.0 with the potentiometer at the back of the instrument.

How to find out correct emissivity:

1. First measure the real temperature of measuring object with a contact thermometer e.g. thermocouple or resistance probes. The "black" temperature (spectral temperature) measured with a pyrometer adjusted to emissivity = 1.0 usually gives a measuring value differing to real temperature because of the real emissivity of <1.0 . The value given by the instrument usually will be less than the real temperature. The emission ratio of most materials depends on temperature as well as wave length being measured.
2. You can get a correlation of the temperature scales, if you adjust the pyrometer at the exact temperature with the help of the potentiometer of emissivity.

ü **After adjusting the emissivity factor through a correlation measurement you can now measure temperatures for the calibrated temperature range at an accuracy mentioned in the technical data.**



IMPORTANT

Please pay attention if you take over table values of emissivity to give the value of emissivity factor at a certain wave length. Adjusting emissivity following table values is not as exactly as adjusting following a comparing measurement.

Changing emissivity:

With the help of a suitable screw driver and without any violence you can adjust emissivity at the rear side of the pyrometer stepless between 0.1 and 1.

7.3 Mounting

There is a retaining pin (scope of delivery) through which the pyrometer can be fixed using various brackets.

We recommend fixing the pyrometer using the retaining pin and optional available ball and socket mounting support with clamp or thread. This mounting plate ensures secure assembly of the pyrometer as well as optimal adjustment with respect to the object being measured (for order data see page 23).

8 Troubleshooting



DANGER

There is a danger of injury and possible equipment damage through incorrect power supply! Let problems relating to an incorrect power supply be eliminated by an electrical specialist! Do not carry out arbitrary work on the electrical components of the pyrometer!

Only eliminate such problems yourself when their causes obviously relate to incorrect power supply, under-cooling or contamination of the lens.

Do not undertake any interventions into the pyrometer. If problems arise which do not relate to the causes mentioned above, inform the service staff of the KLEIBER Infrared GmbH (for contact data see page 22).

Fault	Cause	Solution
Pyrometer does not provide any measured values	Power supply faulty or interrupted	<ul style="list-style-type: none"> - Check the power supply - Check plugs and connections - Inspect cable
If the pyrometer supplies inaccurate measured values or measured values which lie outside the range to be expected	dirty optics or condensation on the lens	Clean optics (see section 9.2)

9 Maintenance and Care

9.1 General information



CAUTION

Humidity can lead to the destruction of the electrical and electronic components! Do not use any liquids for cleaning the pyrometer or cleaning the immediate environment of the pyrometer!



IMPORTANT

The servicing period depends particularly on the operating and environmental conditions and is therefore to be specified by the operator!

The pyrometer is largely maintenance-free. Its function depends, however, considerably on the condition of the optics.

The optics must therefore be checked and if necessary cleaned at regular intervals according to the operating and environmental conditions (see section 9.2).

This is necessary in particular if the measured temperature levels do not lie in the expected range

In the case of excessive contamination or scratches of the optics, please contact the technical customer service (contact address - see page 22).

Check the cables and the protective housing at regular intervals for damage and a firm seating.

9.2 Cleaning the Optics

Clean the lens with a soft cloth or cotton pad and with white spirits. The optics is thus cleaned and the pyrometer is again ready for use.

10 Accessories

Electrical accessory
5-pole connecting cable for power supply
BNC connecting cable, length 4 m (other length on request)
Power supply KNG-0
Power supply KNG-2
Optical accessory
90° mirror for fibre optics
laser rejection filters (1064 nm or 940 nm)
Fibre optics cable (1,5 m to 25 m)
Optical scanner SC 1
Maximum value storage (only in combination with SC 1)
Mechanical accessory
Ball and socket mounting screw mounted M12
Ball and socket mounting clamp mounted M12
Mounting support for optical head
Air purge unit

Order information:

Please send your orders for accessories to the following address. When ordering, please quote the pyrometer type, the name of the accessory part, and the quantity.

Service address:

LumaSense Technologies GmbH
Kleyerstr. 90
D - 60326 Frankfurt
Germany

Phone: +49-69-97373-0
Fax: +49-69-97373-167
E-Mail: impac@Lumasenseinc.com
Internet: www.Lumasenseinc.com

11 Taking out of service, Disposal

11.1 Taking out of service



DANGER

Removing electrically live cables risks injury and damage to equipment. Never remove electrically live connecting cables. Before removing a cable, ensure that the power supply has been switched off.

Take the pyrometer out of operation as follows:

1. Switch off the power supply to the pyrometer.
2. Remove the cables at the rear side of the pyrometer.
3. Remove the connections of the cooling system and empty the remaining cooling water from the cooling ducts of the pyrometer.
4. Dismantle the pyrometer from the mounting plate.
5. If necessary bring the optics in and tighten the annular nut.

ü **The pyrometer is thus out of operation.**

11.2 Disposal

For disposal, you can return the pyrometer to KLEIBER Infrared GmbH (for address see page 23). For this you should pack the pyrometer appropriately in the original packaging or use a cardboard carton with shock absorbing PE material.



REFERENCE TO ENVIRONMENTAL PROTECTION

Do not dispose of the pyrometer with domestic refuse!
