Instructions for Use

TO18/6.0-95-F8-B-RF

Telecentric measurement lens

999.995.905.10-en-2.0

Impress

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Validity

These instructions for use are valid for the following device:

	Order no.
TO18/6.0-95-F8-B-RF	2-05-540

Product Identification

Designation	Description
TO	Telecentric measurement lens
18	Maximum object field diameter in mm
6.0	Maximum image sensor diagonal in mm
95	Working distance in mm
F8	Fixed aperture: F8
B	Spectral range: 450 nm - 660 nm (visible light) optimized at 450 nm - 490 nm (B - blue light)
RF	Vibration-proof

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1 INFORMATION ABOUT THE INSTRUCTIONS OF USE

This document contains technical information, important instructions for correct installation, commissioning and use, as well as product information which were up-to-date at the time of going to press.

Using this document makes it easier for you to familiarise yourself with the device and avoid malfunctions caused by improper operation.

The instructions of use and the local regulations and rules must be followed.

To ensure a save and proper application, please read the instructions of use carefully and keep them for future reference.

1.1 Intended Use

The device is intended exclusively for use as an imaging element for industrial image processing.

The device is intended for use in a confined environment.

The device may only be used if it is in technically faultless condition and only for its intended purpose, and only in accordance with the specifications in this instructions of use by authorised operative personnel, who are aware of the safety rules and hazards.

If the device is planned to be used for any other purpose or in a different environment, the express authorisation of the manufacturer must be obtained in advance. Any modifications or adaptations required may only be made by the manufacturer.

1.2 Improper Use

All unintended use and all device-related activities not described in these instructions of use is to be deemed as unauthorised misuse outside the legal limits of indemnity of the manufacturer.

Reasonably foreseeable misuse is:

- Non-compliance with the instructions for use,
- Faulty operation,
- Operating by personnel not qualified or instructed,
- Operating the device if it is not in a proper technical condition,
- Operating the device in ambient conditions differing from the corresponding specifications in the instructions of use,
- Using spare parts which are not original parts from the manufacturer,
- Using incompatible accessory components,
- Improper maintenance and repair works,
- Unauthorised modifications to the device.

1.3 Qualified Personnel

The device may only be assembled, commissioned, operated, maintained, installed, set up, cleaned, repaired and transported by qualified skilled personnel.

A qualified person is deemed to be someone who has been trained and instructed for his/her activities with the device, and who has proven his/her capability to the purchaser. The operating personnel must be authorised by the purchaser for those activities at the device.

For the installation and operation of the device, the skilled personnel must know and comply with the applicable guidelines and standards for handling the device.

1.4 Warranty and Liability

The contents of this document have been checked carefully and correspond to current legislation and best practise at the time of going to press.

However, the manufacturer shall not be liable for any damage arising from the use of this edition of the manual, and rejects any warranty derived therefrom.

Within the bounds of the legal requirements, the manufacturer shall only be responsible for the technical safety characteristics of the device if the maintenance, repairs and modifications to the device are performed by himself or by authorised skilled personnel in accordance with his instructions.

Loss of warranty

The manufacturer shall accept no liability or warranty in the event of improper use, opening of the device or incorrect maintenance.

2 SAFETY

2.1 Presentation of Safety Instructions

Each safety instruction is introduced by a key word and colour highlighted.

The key word indicates the degree of danger. The danger and its cause are described, and then the measures to prevent conceivable consequences of the danger. These measures must be taken.

⚠ DANGER

Indicates an imminent danger with high risk, resulting in severe injuries or death if not avoided.

⚠ WARNING

Indicates a hazardous situation with medium risk, possibly resulting in severe injuries or death if not avoided.

⚠ CAUTION

Indicates a hazardous situation with low risk, resulting in minor or medium injuries if not avoided.

NOTICE

Indicates a situation that may result in property damage.

2.2 Safe Handling of the Device

Read the following applicable safety instructions carefully and completely. Follow the instructions for your own safety, the safety of other people, and to avoid damage to the device and the connected technical equipment. Hazards going beyond the general safety instructions are referred to separately at the relevant points in this manual.

⚠ CAUTION

Eye damage

- Do not look directly through the lens.

⚠ CAUTION

Cutting injuries caused by glass breakage

The lenses of the objective are made of glass.

- Protect the objective against impact and do not drop it.
- In case of glass breakage do not touch any breakage edges.
- In case of glass breakage use cut-resistant protective gloves.
- Dispose of glass breakage using appropriate waste containers.

3 SCOPE OF DELIVERY AND ACCESSORIES

3.1 Scope of Delivery

Designation	Quantity
Device TO18/6.0-95-F8-B-RF	1 x
Covering cap	2 x
Instructions for Use TO18/6.0-95-F8-B-RF	1 x

3.2 Accessories

The following accessories are available for the lens.

Lens holder

Designation	Description	Order no.
Lens Holder d28	Holder for telecentric lenses and lightings with clamping diameter d = 28 mm, for vibration-free attachment	2-90-138

Deflection mirrow

Designation	Description	Order no.
Deflection mirrow 90-28	90° deflection, attachment for telecentric lenses and lightings with front diameter 28 mm	2-25-126

CS to C-mount adapter / Extension rings

Designation	Description	Order no.
CS to C-mount adapter 5.0 mm	for connecting C-mount lenses with CS-mount cameras, length: 5 mm	2-90-414
Extension tube set C-mount	consist of extension rings with each 0.5 mm, 1 mm, 5 mm, 10 mm, 20 mm and 40 mm	2-90-410
Extension ring 0.5 mm	26 x 31 x 0.5 reduces the minimum object distance (MOD)	2-90-415
Extension ring 1.0 mm	26 x 31 x 1.0 reduces the minimum object distance (MOD)	2-90-416

Filter for filter thread object-side

Designation	Description	Order no.
UV blocking filter M26x0.5	Long-pass filter with edge length λ = 350 nm (UV absorbing filter), usable as protective glass	2-91-123
IR filter M26x0.5	Long-pass filter with edge length λ = 830 nm (daylight absorbing filter)	2-91-133

4 DEVICE DESCRIPTION

4.1 Device Views

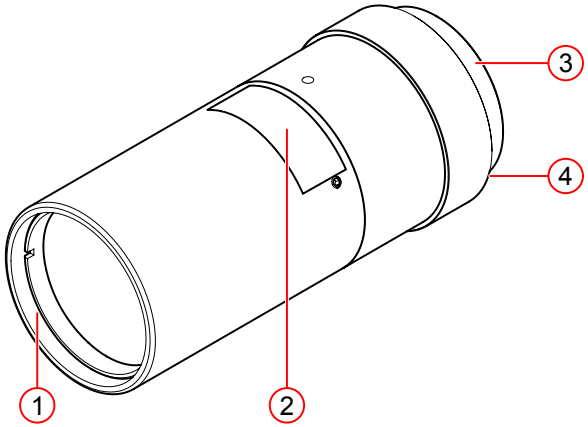


Image 1: Device view

1	Filter thread M26x0.5	3	C-mount camera connection
2	Type plate	4	Contact edge camera

4.2 Notices on the device

Type plate

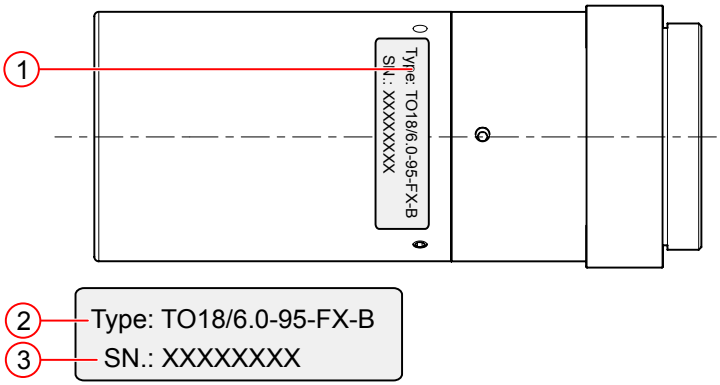


Image 2: Type plate

1 Position on the lens
2 Device designation
3 Serial number

5 TECHNICAL DATA

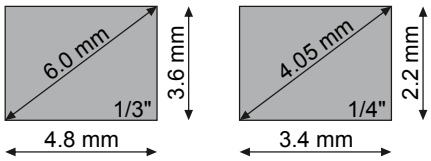
5.1 General Parameters

Parameter	Value
Housing material	Aluminium, black anodised
Optical material	Glass
Housing dimensions	Length: 63.5 mm (without connection thread) Diameter: 29.4 mm Clamping diameter: 28 mm
Filter thread object-side	M26 x 0.5
Lens mount	C-mount
Flange focal distance	17.526 mm
Aperture	F8
Maximum object field diagonal	18 mm
Maximum image field diagonal	6.0 mm
Maximum sensor size	1/3"
Weight	74.5 g

Optimal sensor size

ADVICE

The illustrated image sensor serves as an overview. Other image sensors with image field diagonals up to 6 mm are also possible.



Object fields at different sensor formats

Sensor			Object field
Type	**Size**	**Diagonal**	**Size**
1/3"	4.8 mm x 3.6 mm	6.2 mm	14.3 mm x 10.7 mm
1/4"	3.4 mm x 2.2 mm	4.05 mm	10.1 mm x 6.5 mm

5.2 Optical Parameters

Parameter	Value
Spectral range	450 nm - 660 nm (visible light) optimized at 450 nm - 490 nm (blue light)
Effective F-number	F8
Object-sided numerical aperture	0.021
Image-sided numerical aperture	0.062
Image scale	0.334
Working distance	95 ± 2 mm
Image length	176.0 mm

5.2.1 Resolution

MTF at 50 LP/mm, wavelength 470 nm, over the entire image area.

Aperture	Value
F8	> 60 %

5.2.2 Depth of field

MTF = 20 % at 20 LP/mm - Wavelength: 470 nm

Aperture	Total	Range further from the lens	Range nearer to the lens
F8	6.0 mm	3.0 mm	3.0 mm

5.2.3 Absolute Distortion

Image field diagonal	Wavelength	Distortion
6.0 mm (1/3")	Blue: 450 nm Blue: 470 nm Blue: 490 nm	< 0.10 % < 0.15 % < 0.20 %

5.2.4 Telecentricity

Parameter	Value
Telecentricity type	Object-sided
Object-side telecentricity angle φ	< 0.05 °
Image resizing at 1 mm object depth	< 1.75 µm
Image resizing at 2 mm object depth	< 3.50 µm

5.3 Optical characteristics (design data)

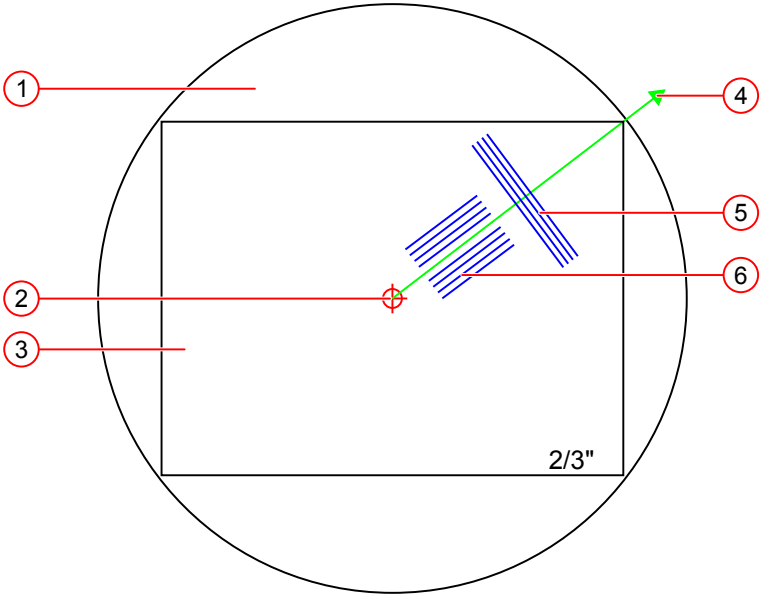


Image 3: Illustrative sketch of optical characteristics

1	Image plane	4	Image field
2	Image centre (axis points)	5	Line grid tangential (T)
3	Image sensor	6	Line grid sagittal (S)

ADVICE

The following design data was determined with the optics design software Zemax.

The values refer to the image space.

5.3.1 MTF depending on the Spatial Frequency

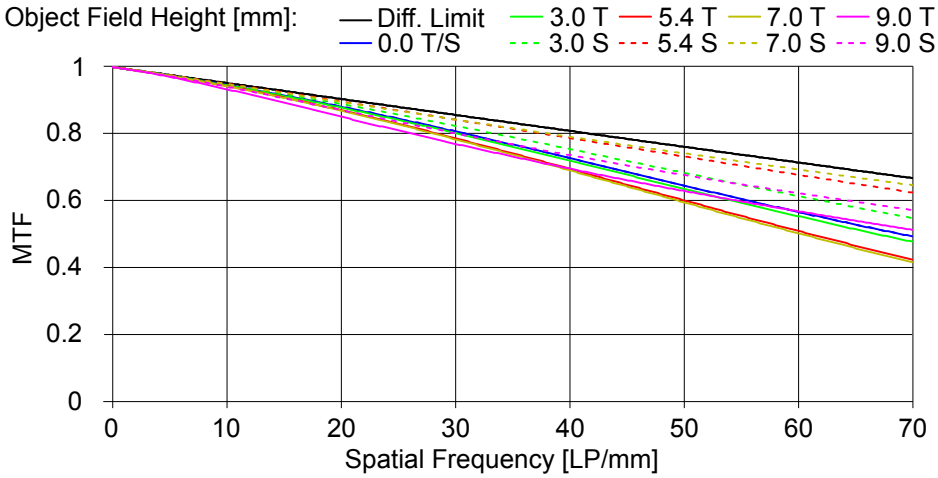


Image 4: MTF - spatial frequency dependent (450 nm - 490 nm, F8)

5.3.2 MTF depending on the Object Field

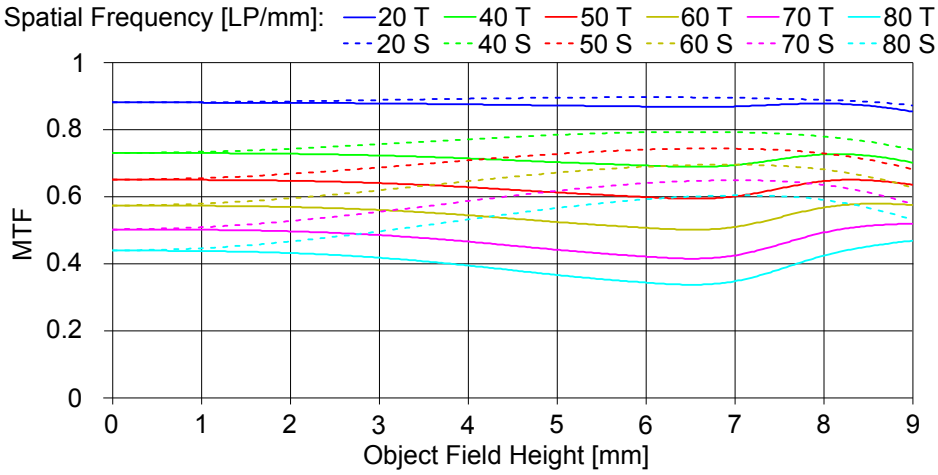


Image 5: MTF - image field dependent (450 nm - 490 nm, F8)

5.3.3 Lateral chromatic aberration

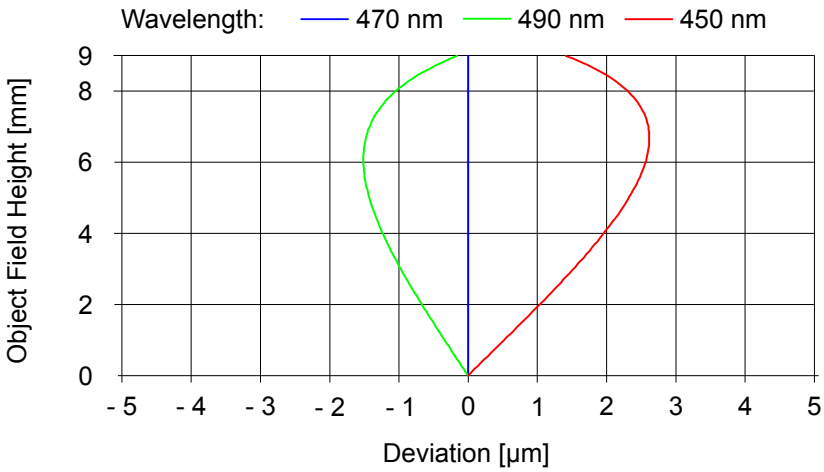


Image 6: Lateral chromatic aberration - wavelength dependent

5.3.4 Longitudinal Chromatic Aberration

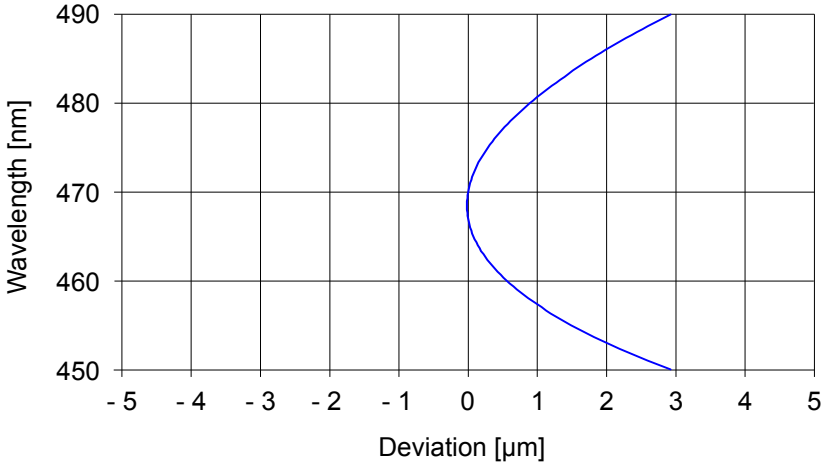


Image 7: Longitudinal chromatic aberration - wavelength dependent

5.3.5 Distortion

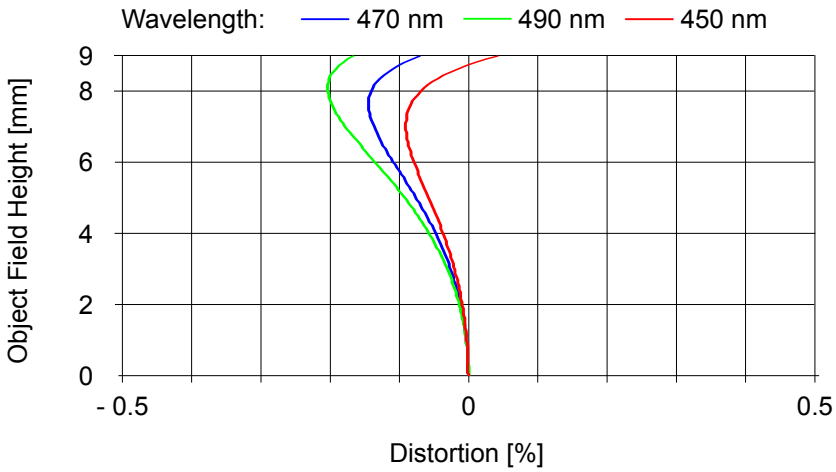


Image 8: Distortion - wavelength dependent

5.3.6 Vignetting

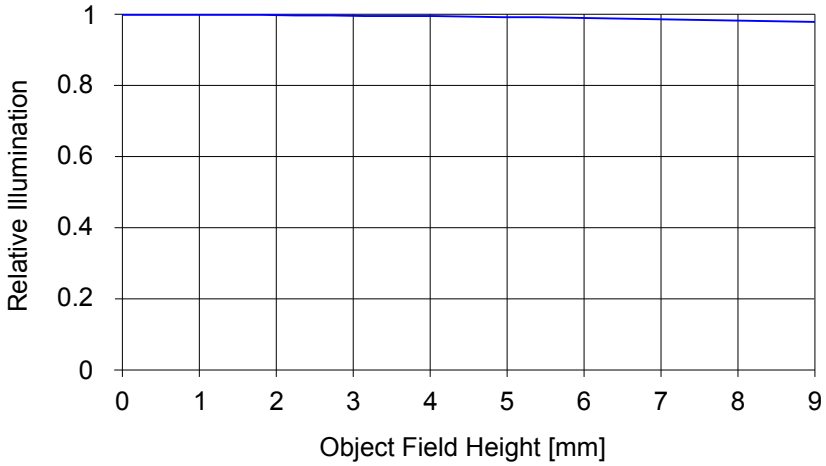


Image 9: Vignetting

5.4 Conditions for Operation, Storage and Transport

NOTICE

The device is shock and vibration sensitive. Loads of this type lead to loss of performance or to the destruction of the device.

Store and transport the device in shock-proof box, if possible in the original packaging.

For accessories, connected devices and components observe the specific information in the associated instructions for use.

Transport and Storage

The lens is packed in a round plastic packaging tube with screw cap.

The packaging is reusable.

The covering cap (scope of delivery) are screwed on for protection.

The lens is to be transported and stored in its original packaging or other suitable transport packaging.

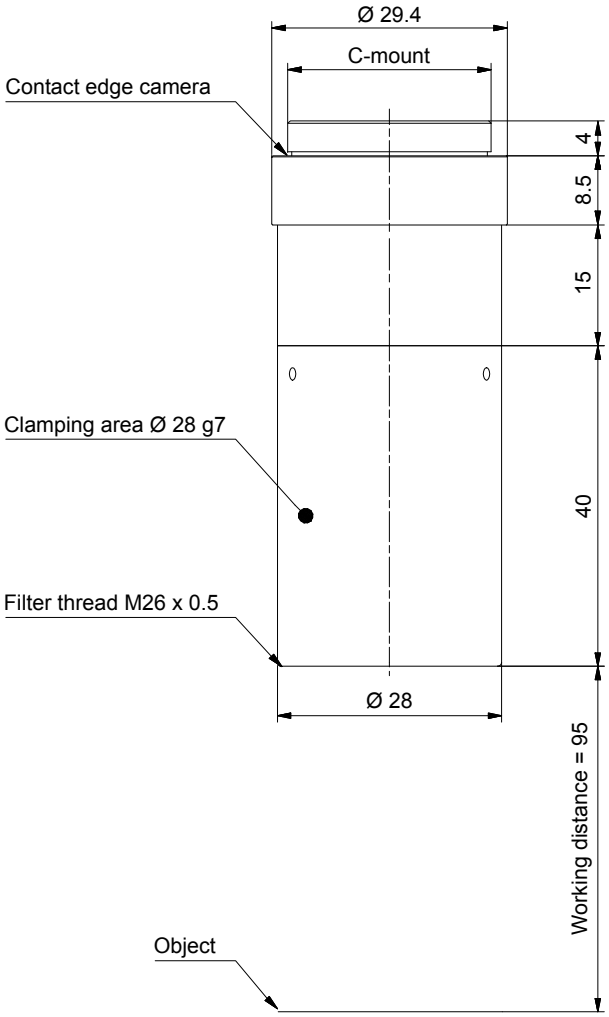
The covering caps are to be set during storage and transport.

Adapters and attachments are to be disassembled.

Ambient Conditions

	Operation	Storage / Transport
Temperature	0 °C to 60 °C	- 20 °C to 60 °C
Air humidity	20 % to 80 %	20 % to 80 %
Condensation water	not permissible	not permissible

5.5 Technical Drawings



The dimensions given are in millimetres.

Image 10: Technical Drawings

6 COMMISSIONING

6.1 Unpacking

The lens is locked in a rotary pack sleeve.

1. Unscrew the cap of the rotating pack sleeve.
2. Remove the lens.
3. Remove the cover caps only after complete installation and shortly before use at the place of use.
4. Dispose or store the packaging material.

6.2 Mounting

Assembly regions

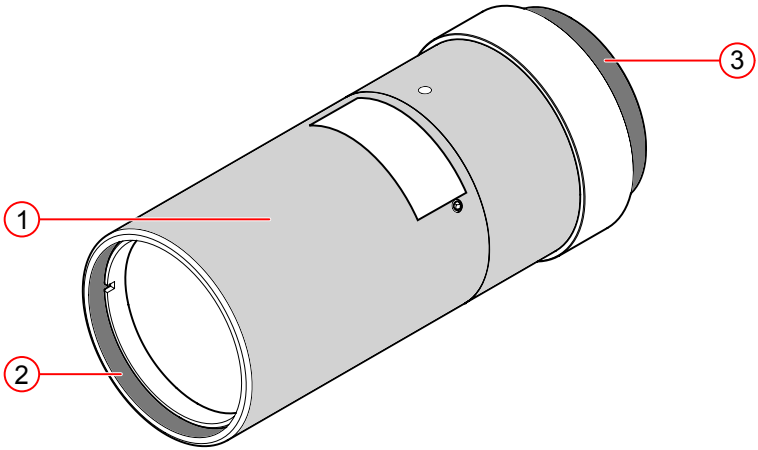


Image 11: Assembly regions

1 Clamping area, diameter: 28 mm
2 Filter thread M26x0.5
3 C-mount thread, 1-32 UN 2A

6.2.1 Mounting at the clamping area

The assembly of the lens takes place at the clamping area (1). The appropriate mounting adapters are available as accessories.
see "Lens holder", page 11

1. Loosen the socket head cap screws of the objective holder.
2. Place the objective holder in the desired position in the clamping area.
3. Tighten the socket head cap screws of the objective holder by hand.

6.2.2 Mounting of filters

Lens filters are connected to the lens via the filter connection (2).

1. Insert the filter into the filter thread (2) of the lens.
2. Screw the filter to the lens hand-tight.

6.2.3 Mounting at the camera

The lens is connected to a suitable camera via the C-mount connector (3).

1. Attach the lens to the C-mount connector on the camera.
2. Screw the lens to the camera hand-tight.

6.3 Configuration

6.3.1 Setting the working distance

The lens has a fixed working distance. The distance is specified from the front edge of the lens to the test object.

Mount the lens at this working distance above the test object.

ADVICE

Optical elements e.g. filters, protective glasses, deflecting mirrors and mechanical accessories can slightly change the working distance.

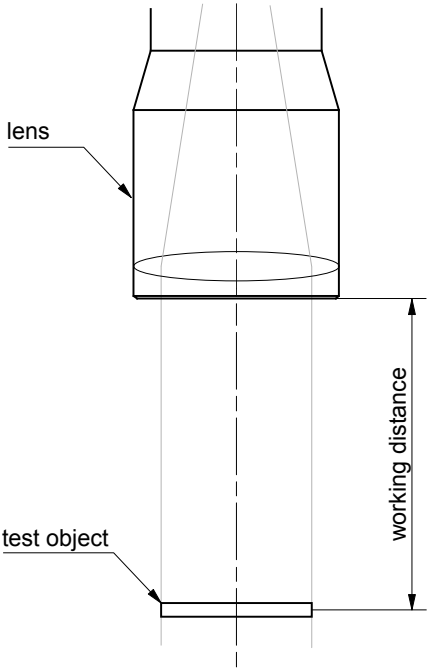


Image 12: Illustrative sketch - working distance

7 OPERATION

ADVICE

The front lens can be protected from foreign bodies by using the UV filter (protective glass).

see "Filter for filter thread object-side", page 12

Keep the lens away from foreign objects (dusts, mist, water splashes or similar) during operation. These substances can damage the optical surfaces. Vapours may be permanently deposited on the front lens and affect imaging performance.

If possible, use the covering caps (scope of delivery) outside the factory to protect against foreign objects.

8 MAINTENANCE AND SERVICE

8.1 Maintenance

The device is maintenance-free. Depending on the operating environment, it may have to be cleaned.

Perform cleaning only if the imaging characteristics are noticeably disrupted.

Only clean surfaces accessible from the outside. Do not open the lens.

If there is dirt inside the lens, contact the support.

When cleaning the outside, cover the lenses with the caps (scope of delivery).

Perform cleaning operations on optics in bright, dust-free, dry, wind and weather-proof workplaces.

When cleaning the lenses wear clean, dust-, lint- and grease-free gloves.

Do not apply cleansers directly to the housing or the lens. Do not bathe the device.

Cleaning the outside (non-optical surfaces)

- Clean the outside with a damp cloth.
- Remove excessive dirt with an approved anodised aluminium cleaner. Refer to the instructions of the cleaner.

Cleaning the optical surfaces

NOTICE

Follow the specified cleaning sequence. Never use dry cloths for cleaning. This allows dust and other contaminants to be rubbed into the lens surface, thereby damaging it.

1. Remove non-adherent dusts with a blower brush or cleaned compressed air.
2. Remove lager non-adherent contaminants such as chips or granules by dabbing with a cloth. Never rub under any circumstances.
3. When all non-adherent particles have been removed, use an untreated lens cleaning paper for lenses or an optical cleaning cloth that was soaked in an especially for optics suitable detergent. Observe the instructions of the manufacturer.

Cleaning by the manufacturer

The device can be sent to the manufacturer for cleaning (for a fee). Please contact our technical support.

8.2 Service

Technical Support

Please contact our technical support if you have any technical questions concerning our products.

We will be glad to be of service:

Monday to Thursday 8:00 to 17:00, and Friday 8:00 to 15:00.

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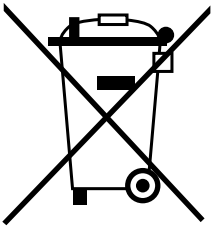
Defective device

If the device has a defect, the manufacturer can repair or exchange it. Please contact your local sales partner or technical support.

9 DISPOSAL

The device and its accessories and packaging must be sent to environmentally compatible recycling.



Disposal, including that of individual components, must also always be in a way that does not harm the environment, that is it must be done in accordance with the currently valid legal regulations.

Please contact the manufacturer, your local specialist dealer or the relevant national authority for the proper disposal of old devices.

The components must be sent to a specialist recycling company or to the manufacturer for proper disposal.

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