

OptiCentric® 3D 101 (Single)

Operating Instructions (Hardware Description)

OptiCentric® 101
OptiCentric® 101 M
OptiCentric® 3D 101
OptiCentric® 3D 101 M



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1 Introduction

1

1.1 The OptiCentric® 3D 101 measurement system

The OptiCentric® 3D 101 measurement system was developed especially for the measurement of centration errors of objective lenses.

The applications range from endoscope and mobile phone optics to precise digital camera lenses.

The OptiCentric® 3D 101 measurement system is computer-controlled and equipped with a step motor drive. The measurement head can be moved to any focus position or center of curvature saved beforehand.

1.2 The OptiSurf® measuring method (optional)

The OptiSurf® measuring method can optionally be integrated into the measurement system to enable the non-contact measurement of center thicknesses and lens gaps for single lenses, plane optics and optical systems.

The OptiSurf® measuring method is based on a low-coherent interferometer and measures all distances in an optical system with an accuracy of $\pm 0.2 \mu\text{m}$ in a single pass.

The lens design input is carried out via an interface to OptiSurf® directly from Zemax® or via the design editor.

The Professional software supports operating and measurement tasks. The results of the measurement can be included in the calculation of the optical axis.

1.3 Documentation

This documentation contains all information necessary for the safe operation of the measurement system and the accompanying software.

Read the instructions carefully before you start working with the measurement system. Pay special attention to the safety instructions.

The documentation including all third party documents must be stored with the measurement system and must be readily available when needed.

Please contact the manufacturer or the respective local subsidiary for additional information.

1**1.3.1 Applicable documents**

The following documents are part of the operating instructions for the measurement system:

- OptiCentric® 3D 101, operating instructions (hardware description)
- OptiCentric® 9, Software Description (User Manual)

These documents are published separately.

1.3.2 Target group

This documentation is aimed at people who work with the measurement system:

Qualified person

A qualified person uses his or her technical training, expertise, and experience, as well as knowledge of the relevant rules and regulations to assess assigned work and identify potential hazards.

Trained person

A trained person has been






- informed,
- trained,
- and instructed about the required safety measures and safety equipment concerning the assigned work and possible hazards in case of improper conduct.

Persons working on or with the measurement system must be regularly trained about the associated dangers.










1.3.3 Safety notes layout

1

The operator's manual attaches different levels of importance to safety notes by using symbols and signal words.

Symbol	Signal word	Meaning
	DANGER	Imminent danger. Will result in death or severe bodily injury.
	WARNING	Possibly dangerous situation. May result in death or severe bodily injury.
	CAUTION Risk of injury	Possibly dangerous situation. May result in slight or minor injuries.
	CAUTION Risk of material damage	Possibly dangerous situation. May result in damage to property.
	NOTE	Notes that must be considered in order to ensure optimal results and secure operation of the system.

Additional symbols used

Symbol	Explanation
	Risk of electric shock
	Exposure to laser radiation
	Risk of optical radiation
	Risk of fire due to flammable substances
	Risk of explosion due to explosive substances
	Risk of crushing
	Risk of injury due to automatic start-up of plant, machinery or equipment components
	Risk of being drawn in by rotating plant, machinery or equipment components
	Use eye protection

The safety notes are structured as follows:

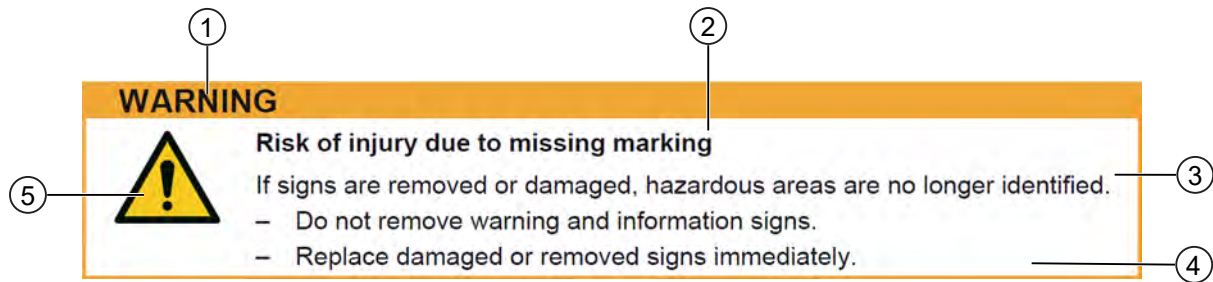


Fig. 1: Sample safety note

1	Signal word Specifies the severity of the hazard (see above).
2	Type and source of danger Specifies the type of danger associated with the warning and where this danger can occur.
3	Cause and effect Describes the cause of the danger or damage and its effects.
4	Remedy Describes how the danger can be avoided.
5	Symbol Indicates the severity and nature of the hazard.

1.3.4 Action instructions

Action instructions are numbered when the correct sequence of the individual steps is important. Results of the action instructions are directly underneath.

Example

1. This is the first step.
⇒ This is the result of the first step.
2. This is the second step.
⇒ This is the result of the second step.
- ⇒ This is the result of the entire instruction.

1.3.5 Operating and control elements

Operating and control elements such as buttons, keys and switches are depicted in bold.

Example:

The **emergency stop** button is located on the right-hand side of the measurement system.

1

1.3.6 Operation via software

The menus and buttons in the software are displayed in a different font.

Example 1:

1. Click Approach sample.



Fig. 2: Positions

Example 2:

1. Enter the password and click <Login>.

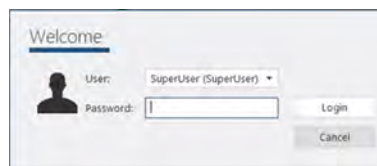


Fig. 3: Login

1.3.7 Cross references

Cross references to another place in the document appear in italics.

The cross reference comprises the title and the page number of the cross reference target.

In the PDF they work as a link.

Example:

Please refer to *Action instructions* [► 11] for a detailed description.

1.4 Designations

OptiCentric® and OptiSurf® are registered trademarks.

If a trademark is not expressly mentioned here, this omission does not indicate a license for using this trademark.

2 Safety notes

2

The measurement system was designed and built in accordance with accepted technical and safety rules.

Nevertheless, risks to the operator, to other people, for the system itself, and damage to property may still arise.

WARNING



Risk of injury and risk of property damage

Installation, initial startup, operation and disposal of the measurement system may cause or be associated with mechanical, electrical and thermal hazards.

- Observe all safety instructions in this operator's manual.

2.1 Intended use

WARNING



Risk of injury and risk of property damage

Improper use of the measurement system may lead to injuries and cause property damage.

- Always use the measurement system as intended and as described below.

The OptiCentric® 3D 101 measuring system is only intended for the following purpose:

- Measurement

of optical components or optical systems.

The measurement system is only intended for use in industrial and/or small or medium-sized companies.

Any other utilization is considered unintended use.

Only the accessories described in this operator's manual may be used. The measurement system and/or its accessories must not be modified in any way.

Intended use also includes compliance with the prescribed cleaning and maintenance intervals.

2**2.2 Foreseeable misuse**

Abuse is hereby included.

Any use that goes beyond the aforementioned intended use is regarded as improper. The manufacturer is not liable for any injury to persons or material damage resulting from such improper use.

- The use of attachments, spare parts or wearing parts other than those described in the operator's manual is prohibited. If necessary, TRIOPTICS must approve the use of other parts explicitly.
- It is prohibited to deliberately cause collisions between the moving elements and between the optical elements.
- It is prohibited to enter the position information ("Rel. pos") in the position table incorrectly.
- Measurements of too large or too heavy optics according to the limits may not be performed.
- The safety devices must never be bypassed.
- It is prohibited to operate the measurement system beyond the specified service life.
- It is prohibited to remove the variable limit stop of the upper linear axis or to place it at an incorrect lower position.
- Only light sources that are approved for this measurement system may be used.
- Cleaning and maintenance intervals must be adhered to.

2.3 General notes

2

- Be sure to read the operating instructions before working with the measurement system. Comply with all safety notes in the operating instructions and on the measurement system. Keep the operator's manual for later reference.
- If the measurement system emits unusual smells or smoke, immediately turn off the main switch and remove the plug from the wall outlet. Continued use of the measurement system constitutes a hazard and may result in fire, electrical shock, or injury. Immediately notify the manufacturer or the responsible local subsidiary.
- Do not use the measurement system if you suspect a malfunction or defect.
- The measurement system must be connected to a safety wall outlet with the specified voltage. Make sure the measurement system is grounded.
- Avoid damaging the connecting cables. Do not place any objects on cords or cables. Do not pull on cords or cables.
- Lay all cables in a way that prohibits the risk of tripping.
- Turn off the power and unplug the power plug from the measurement system and accessories, before cleaning or servicing the system.
- Never cover the ventilation slots. This is particularly important for the light source.
- The lighting for any work on the measurement system must be in accordance with DIN EN 12464.

2**2.4 Employees****WARNING**

Risk of injury or property damage when operated by inadequately trained employees

Inadequately trained employees are not familiar with the dangers associated with handling of the measurement system.

- The measurement system may only be operated and maintained by qualified and trained employees.

Installation and initial startup

Only employees of TRIOPTICS GmbH or correspondingly trained and authorized persons are permitted to install and operate the measurement system. This includes installing the software and the installation of accessories.

Operation

The measurement system may only be operated by trained employees. In particular, they must have read and understood the operator's manual and the safety notes.

Maintenance and repairs

All maintenance and repair work must be carried out by qualified employees.

2.5 Hazards during transportation and installation

2

WARNING



Risk of injury from heavy components

The transport and installation of the measurement system may be associated with hazards due to heavy and tipping parts.

- Observe the following safety instructions when transporting and installing the measurement system.

Transport

- Only employees of TRIOPTICS GmbH or correspondingly trained and authorized persons are permitted to move the measurement system.
- Make sure the measurement system is transported without being subjected to impact or jolting.
- Remove transports locks only during installation.
- Always use suitable and tested lifting equipment.
- Never step under suspended loads.

Installation and initial startup

Only employees of TRIOPTICS GmbH or correspondingly trained and authorized persons are permitted to install and operate the measurement system. Improper setup or incorrect installation may damage the measurement system or impair its function. This will result in inaccurate measurement results.

Ambient temperature

In order to prevent damage from condensation, all the components must be acclimatized to the ambient temperature prior to installation.

Different installation site

Please inform TRIOPTICS GmbH if you wish to transport the system to a different installation site. If necessary, a re-alignment must be performed.

2 2.6 Hazards during operation of the measurement system

2.6.1 Electrical hazards

DANGER



Risk of electric shock

Electrical currents may pose a hazard.

- Disconnect the main power supply before working on electrical equipment.

Power supply

- Disconnect the main power supply before working on electrical equipment. Additional information on the main power supply is listed in *Technical data* [► 27].
- Never touch live parts.
- Do not short-circuit or ground the power supply output.

Housing sections

- Do not remove any sections of the housing.
- Before you start work, make sure all sections of the housing are present and properly installed. Do not work on the measurement system if sections of the housing have been removed or are defective. Immediately reattach removed sections of the housing or notify the manufacturer or the responsible local subsidiary.

Humidity

- Make sure that moisture cannot penetrate into the housing of the measurement system.
- Do not consume beverages at the workplace.
- Do not place the measurement system in a humid environment or outdoors.
- To avoid condensation, do not place the measurement system in environments with high temperature fluctuations.

See also

- 📄 Technical Data [► 27]
- 📄 Customer Service [► 79]

2.6.2 Mechanical hazards

WARNING



Risk of injury

When working on the measurement system, injuries caused by crushing or shearing may occur.

- Please observe the following safety notes.

WARNING**Risk of injury**

In the vicinity of rotating machine components, there is a risk of limbs or clothing getting caught.

- Please observe the following safety notes.

- Tie back long hair.
- Wear close fitting clothing.
- Keep a safe distance from rotating axes while measuring.
- Keep a safe distance from horizontally or vertically articulated axes while measuring.
- Never block the linear stages.
- Do not stick any items into the linear stage housing.
- The limit switch must be set up before moving the measurement head to the sample.

2.6.3 Danger from light sources**WARNING****Risk of burns and fire**

Light-absorbing materials convert light into heat. High intensity visible light can cause damage to the eyes, skin or other materials in the environment.

- Wear suitable protective equipment.

- Read the enclosed documentation on the light source and follow the safety instructions therein.
- Avoid looking directly into the optical fiber output while the light source is switched on.
- Do not cover the optical fiber output.
- Never cover the optical fiber output with your hand or other parts of the body.
- Ensure that all optical fiber outputs not used in the operation are always located a safe distance away from heat sensitive or flammable light-absorbing materials when the light source is switched on.
- Do not cover the ventilation slots of the light source and never insert anything into these slots.
- Adjust the light source to the necessary power. Turn the light source off when not in use.

2

2.6.4 Danger due to optical radiation

WARNING



Risk of injury to the eyes

There is a risk of glare to the eyes by looking directly into the light source or the fiber optics.

- Avoid directly looking into the open clamping sleeve or the optical fiber output while the light source is switched on.

2.6.5 Danger due to laser

The intensity of the laser used is very high. The sensor can be destroyed by incorrect operation of the measurement system.

Please observe the following notes for handling the measurement system.

The operator shall be liable if the sensor is damaged by failure to observe these instructions.

WARNING



Risk of injury caused by laser

Improper use may endanger the health of the user or third parties due to laser radiation.

If the housing is mounted properly, it is a class 1 laser.

- Avoid radiation to the eyes due to scattered radiation.

CAUTION



Risk of material damage

The sensor can be destroyed by incorrect operation of the measurement system.

- The measurement system may only be operated by persons who are trained in its operation and the safety precautions.
- Never bring reflective surfaces into the beam path.
- Make sure that the shutter is closed when inserting samples.
- Always use a filter.
- Make sure that the shutter is closed when replacing a filter.

- Personal protective equipment (laser protective eye-wear) must be worn during operation to protect the eyes and the skin.
- Never look directly or indirectly into the laser outlet opening.

2.6.6 Danger to the rotary air bearing

CAUTION



Risk of material damage

Rotating the air bearing without compressed air will result in damage to the air bearing. Precise measurements will then no longer be possible.

- Always turn on the compressed air supply first before using the measurement system.

- Ensure that the requirements in terms of the compressed air supply are met (see *Compressed air* [► 29]).
- Protect the contact surfaces against mechanical influences.

2.6.7 Risk due to pneumatic connections

WARNING



Risk of injury from compressed air

Flailing compressed air lines or pressurized components can result in crushing or impact injuries.

- Make sure that the compressed air supply is connected properly.
- Before undertaking any maintenance and troubleshooting work, make sure that the lines are depressurized and secured against being switched back on.

2.6.8 Risk due to defective or missing parts or components

CAUTION



Risk of material damage

Defective or missing components, parts, or assemblies may pose mechanical, electrical or thermal hazards.

- Immediately replace or repair defective or missing parts or components.

If servicing is required or spare parts need to be ordered, please contact Customer Service (refer to the section on *Customer service* [► 79]) or the responsible national representative.

2

2.6.9 Risk due to remote maintenance

WARNING



Risk of injury

Remote maintenance via broadband connection can result in unexpected start-up of moving machine components.

- Keep a safe distance from the moving machine axes.

2.6.10 Software

NOTE



To avoid inaccurate measurements, familiarize yourself with the software and the correct settings before starting work.

Default settings

Changes to the default settings must only be made by authorized employees of the manufacturer.

2.7 Safety equipment

Do not operate the measurement system if the safety devices are not functioning correctly.

2.7.1 Emergency stop

The measurement system can be shut down in an emergency via two emergency stop buttons.

- Check the function of the emergency stop button once a year.
- If the emergency stop has been triggered, only restart the measurement system once the fault has been eliminated and there is no danger to persons or property.

Further information can be found in the *Emergency stop* [▶ 40] section.

2.7.2 Compressed air monitoring

If the inlet pressure falls below 3.5 bar, the device will not start or the movement of the axes is stopped.

2.7.3 Safety slide of the upper measurement head

2

Fig. 4: Objective changer, safety slide

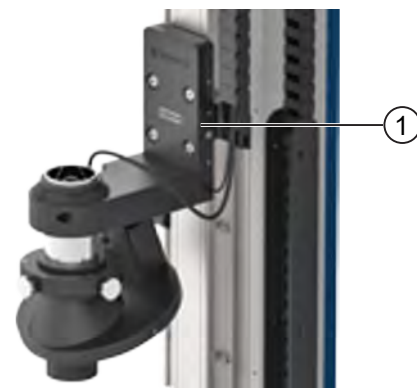


Fig. 5: Objective changer, safety slide

The objective changer is mounted on a safety slide (1).

When the safety slide is triggered (e.g., a head lens coming into contact with objects), it is moved upwards and the movement of the measurement head axis is stopped immediately.

This safety function must be checked once a year.

2**2.8 Operator obligations**

- The operator must ensure a general prohibition of alcohol and drugs for employees.
- The operator must ensure that only suitably qualified employees work on and with the measurement system. A briefing must be given when using for the first time, when personnel change and additionally at regular intervals.
- The operator must ensure that all necessary protective equipment is worn correctly.
- The operator must ensure that persons working on and with the measurement system have read and understood the Operating Instructions and the safety instructions.

2.9 Warning and information signs

2

Warning and information signs identify sites and locations where certain conditions may result in hazards.

WARNING



Risk of injury due to missing marking

If signs are removed or damaged, hazardous areas are no longer identified.

- Do not remove warning and information signs.
- Replace damaged or removed signs immediately.

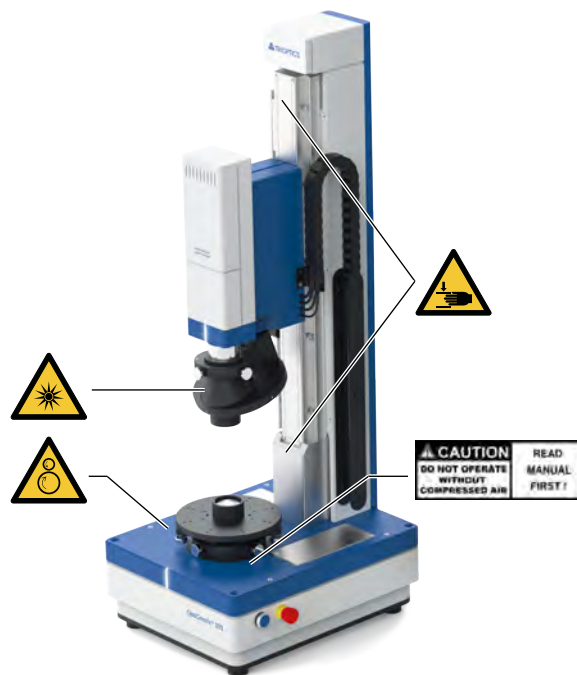
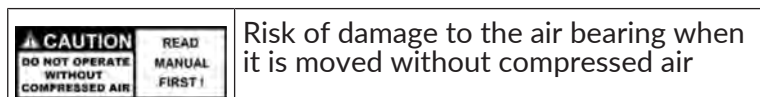


Fig. 6: Measurement system, warning and information signs



An explanation of the other symbols can be found in the *Safety notes layout* [► 9] section.

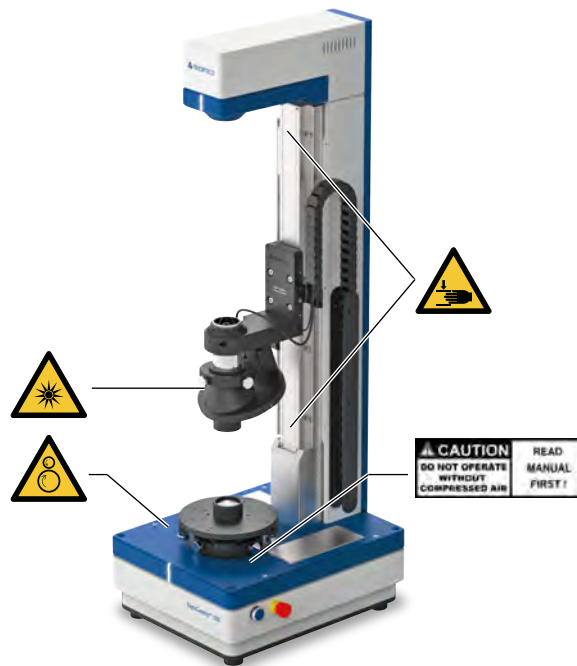


Fig. 7: Measurement system, warning and information signs

CAUTION DO NOT OPERATE WITHOUT COMPRESSED AIR	READ MANUAL FIRST!	Risk of damage to the air bearing when it is moved without compressed air
---	-----------------------------------	--

An explanation of the other symbols can be found in the *Safety notes layout* [► 9] section.

3 Technical Data

3

3.1 Dimensions of the measurement system

Height	approx. 1200 mm *)
• Top edge of upper measurement pillar	approx. 1200 mm **)
• Measuring head in reference position	approx. 1213 mm **)
Width	380 mm
Depth	580 mm
Weight	70 kg

*) Specification applies to OptiCentric® 3D 101

**) Specification applies to OptiCentric® 3D 101 M

These height specifications apply to the standard use of a measurement pillar with a length of 500 mm.

Optionally, a measurement pillar with a length of 750 mm or 1000 mm can be installed for both device types. This will change the height of the device accordingly.

3.2 Dimensions of the controller rack

Height	approx. 500 mm
Width	approx. 550 mm
Depth	approx. 505 mm
Weight	approx. 20 kg

3.3 Specifications (OptiCentric®)

Test parameter	Centering errors; center thicknesses and air gaps
Possible measurement method	Centering testing in reflection; MultiLens® for multi-lens objectives; Geometric distance and optical distance
Measurement accuracy on a single surface (OptiCentric® VIS)	0.1 µm
Maximum number of surfaces	20

*) Only for measurement systems with the integrated OptiSurf® measurement method (OptiCentric® 3D).

3.4 Sample

Height	not specified
--------	---------------

3

Diameter	225 mm, up to 280 mm with restrictions
Weight	50 kg (at 5 bar)
Weight (when using the tip-tilt table)	20 kg

3.5 Power supply

Voltage	90-260 VAC, 50-60 Hz
Current	Depends on the voltage source used
max. power consumption	max. 1500 W
Plug type	CEE 7/4 (EU Schuko)

3.6 Air bearing

Compressed air required	5 bar
Air requirement	approx. 1200 l/h (incl. service unit)

3.7 Tip-tilt-table

Tip-tilt-table

Name	TRT 200
Load capacity	max. 30 kg
Weight	approx. 22 kg

3.8 Light sources

OptiCentric® (VIS)

Type of light source	LED
Wavelength	525 nm

OptiSurf®

The following specifications apply only to measurement systems with the integrated OptiSurf® measurement method (OptiCentric®3D).

Type of light source	SLED
Wavelength	1310 nm (for lens material for the visual range)

3.9 Ambient conditions

3

Temperature range during transport

Temperature	+5°C to +40 °C
Humidity	40 to 65 %

Temperature range during storage

Location	Dry and free of dust
Temperature	+5°C to +32 °C
Humidity	40 to 65 %

Temperature range during normal operation

Temperature	Constant ambient temperature, ideally +20 °C to +22 °C, max. +25 °C
Humidity	40 to 65 %

3.10 Compressed air

Measurement system inlet pressure	4.5 - 5 bar
Air requirement	approx. 1200 l/h (incl. service unit)
Hose	6 mm, outside calibrated
Max. residual dust content class 1 (to DIN ISO 8573-1)	
Residual oil content	max. 0.01 mg/m ³
Residual dust (particle size)	max. 0.1 µm
Residual dust (quantity)	max. 0.1 mg/m ³
Max. residual water content class 3 (to DIN ISO 5873-1)	
Residual water (dew point)	-20 °C
Residual water (quantity)	max. 0.88 g/m ³

3.11 Noise emission

The sound pressure level emitted at the measurement system workstation is less than 70 dB(A).

3.12 Measuring system service life

The service life of the machine depends on type of use and number of hours used daily. The machine should be inspected after 10 years.

Safety-related maintenance

No hazardous situations are to be expected if maintenance was carried out properly and the maintenance intervals have been kept in accordance with the maintenance schedule included in the installation instructions.

Wear parts

Only original spare and wearing parts may be used. The use of alternative wear parts pose a risk and are therefore not permitted, even if these have the same function.

4 Design and function

4

4.1 The OptiCentric® 3D 101 measurement system

The OptiCentric® 3D 101 measurement system is available in two variants:

- OptiCentric® 3D 101 M
Further information can be found in the *OptiCentric® 3D 101 M* [▶ 32] section.
- OptiCentric® 3D 101
Further information can be found in the *OptiCentric® 3D 101* [▶ 33] section.

4

4.1.1 OptiCentric® 3D 101 M

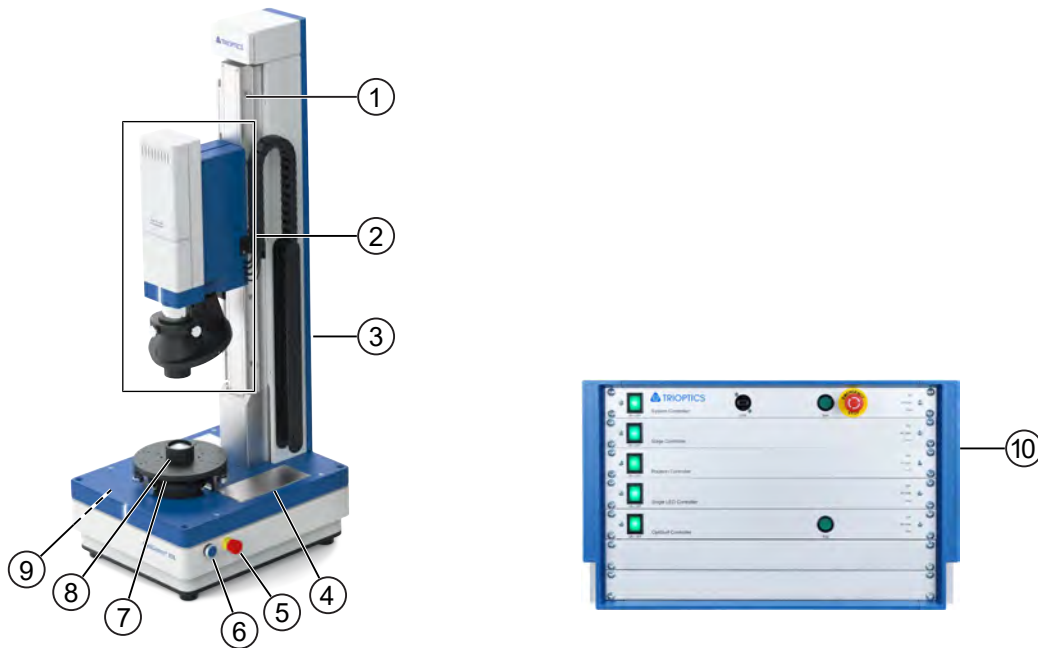


Fig. 8: Measurement system, complete view

1	Motorized linear stage The linear stage is used to adjust the height of the measurement head.
2	Measurement head Further information can be found in the <i>Upper measurement head</i> [► 34] section.
3	Optical delay line Further information can be found in the <i>Optical delay line (optional)</i> [► 35] section.
4	Plate Additional accessories can be mounted on the plate with the help of a magnetic base, (e.g. a flexible mount to hold a probe).
5	Emergency stop button Further information can be found in the <i>Emergency stop</i> [► 40] section.
6	Start button Further information can be found in the <i>Control panel</i> section.
7	Tip-tilt table Further information can be found in the <i>Tip-tilt table (optional)</i> [► 37] section.
8	Sample
9	OptiSurf® measurement head The measurement head for the OptiSurf® measurement method is located in the base of the device.
10	Controller rack Further information can be found in the <i>Controller rack</i> [► 41] section.

4.1.2 OptiCentric® 3D 101

4

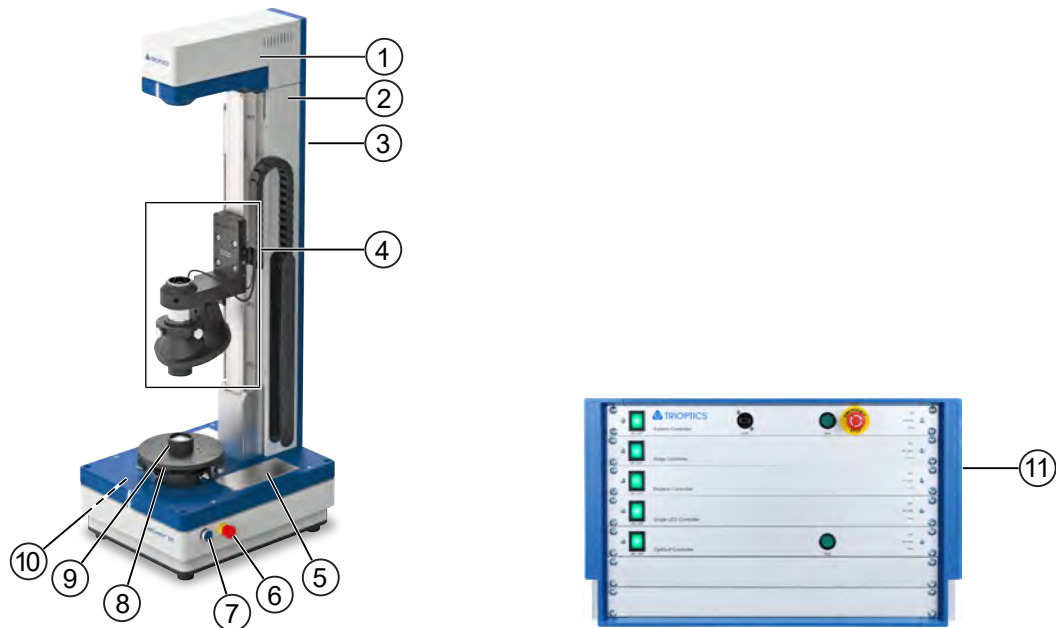


Fig. 9: Measurement system, complete view

1	Measurement head Further information can be found in the <i>Upper measurement head</i> [► 34] section.
2	Motorized linear stage The linear stage is used to adjust the height of the objective changer.
3	Optical delay line Further information can be found in the <i>Optical delay line (optional)</i> [► 35] section.
4	Objective changer (optional) Further information can be found in the <i>Objective changer (optional)</i> [► 36] section.
5	Plate Additional accessories can be mounted on the plate with the help of a magnetic base, (e.g. a flexible mount to hold a probe).
6	Emergency stop button Further information can be found in the <i>Emergency stop</i> [► 40] section.
7	Start button Further information can be found in the <i>Control panel</i> section.
8	Tip-tilt table (optional) Further information can be found in the <i>Tip-tilt table (optional)</i> [► 37] section.
9	Sample
10	OptiSurf® measurement head The measurement head for the OptiSurf® measurement method is located in the base of the device.
11	Controller rack

Further information can be found in the *Controller rack* [► 41] section.

4.2 Components

4.2.1 Upper measurement head

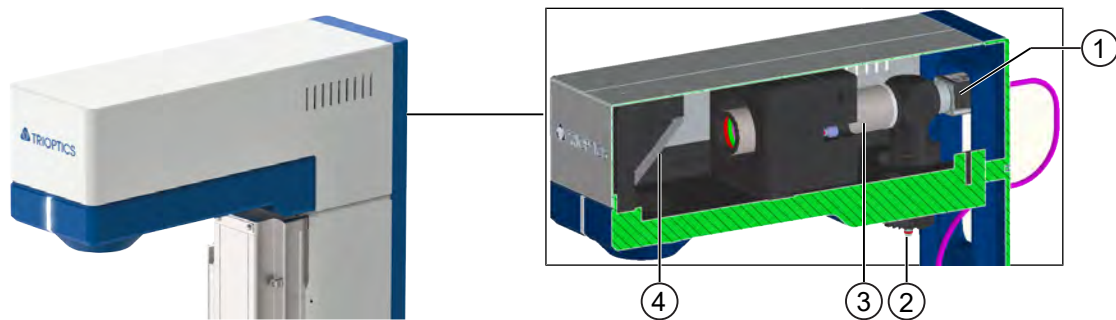


Fig. 10: OptiCentric® 3D 101, measurement head

1	Camera module
2	LED port
3	Autocollimator
4	Deflection mirror

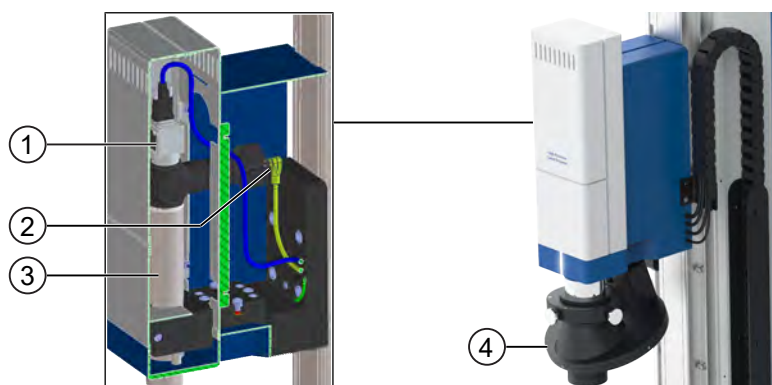


Fig. 11: OptiCentric® 3D 101 M, measurement head

1	Camera module
2	LED port
3	Autocollimator
4	Objective changer Further information can be found in the <i>Objective changer</i> [► 36] section.

4.2.2 Optical delay line (optional)

4

NOTE



The optical delay line is only available if the OptiSurf® measuring method is integrated into the measurement system.



The optical delay line consists of a movable mirror by which the optical path length can be varied during measurement.

1	Optical delay line For the non-contact measurement of the center thicknesses and air gaps of optical systems
---	--

Fig. 12: OptiSurf, optical delay line

4.2.3 Compressed air service unit



Fig. 13: Compressed air service unit

1. Mount the compressed air supply.
2. In order to prevent contamination of the measurement system, flush the hose with clean air before connecting the existing compressed air supply to the device.
3. Ensure a supply pressure of 5 bar.
4. If necessary, remove water and oil deposits in the cylinder.

NOTE



Please refer to the manufacturer's operating instructions in the *Appendix* [▶ 89].

4.3 Accessories

4

4.3.1 Objective changer (optional)

An objective changer is recommended to change head lenses quickly and easily. OptiCentric® 3D 101 provides a motorized 6x changer that can be equipped with head lenses from our product range.

Alternatively, a manual objective changer is also available.

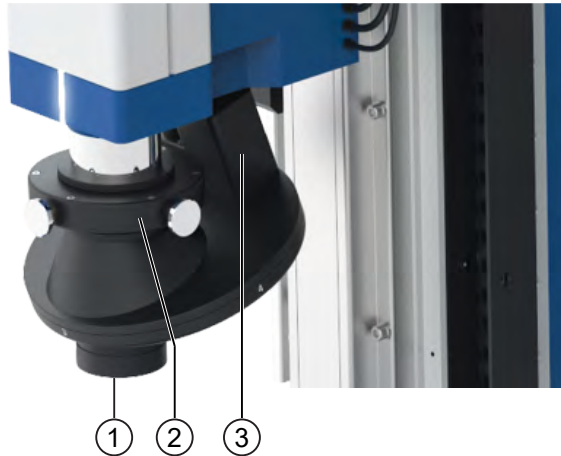


Fig. 14: Motorized objective changer

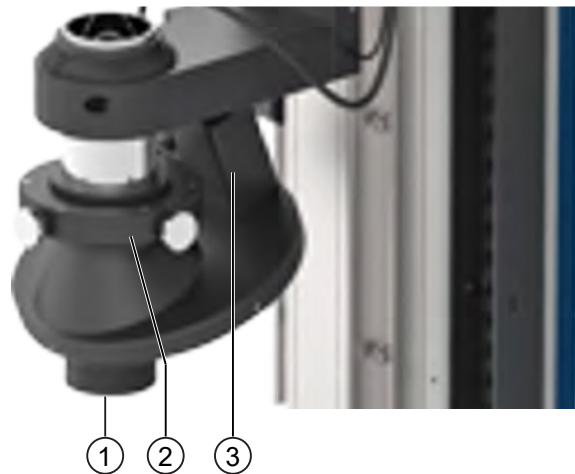


Fig. 15: Motorized objective changer

1	Head lens slots
2	X/Y adapter
3	Step motor drive

4.3.2 Tip-tilt table (optional)

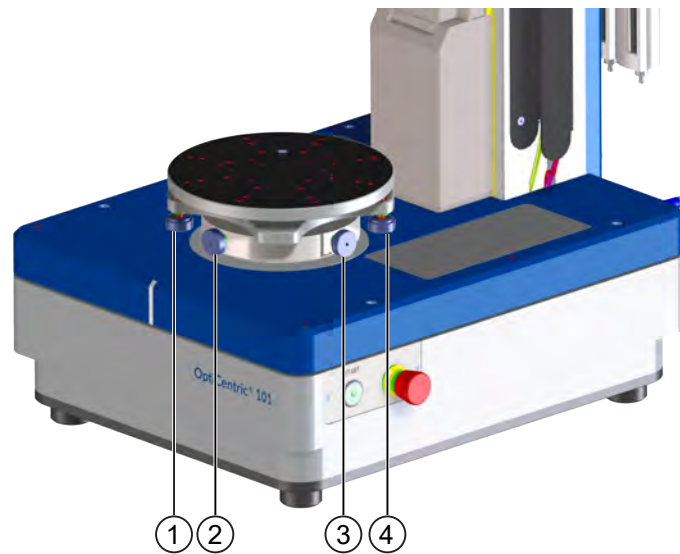
4

Fig. 16: Tip-tilt table TRT 200

1	Thumb screw To adjust the tilt in the Y direction
2	Thumb screw To adjust the offset in the Y direction
3	Thumb screw To adjust the offset in the X direction
4	Thumb screw To adjust the tilt in the X direction

4

4.3.3 Motorized lens rotation device with vacuum unit

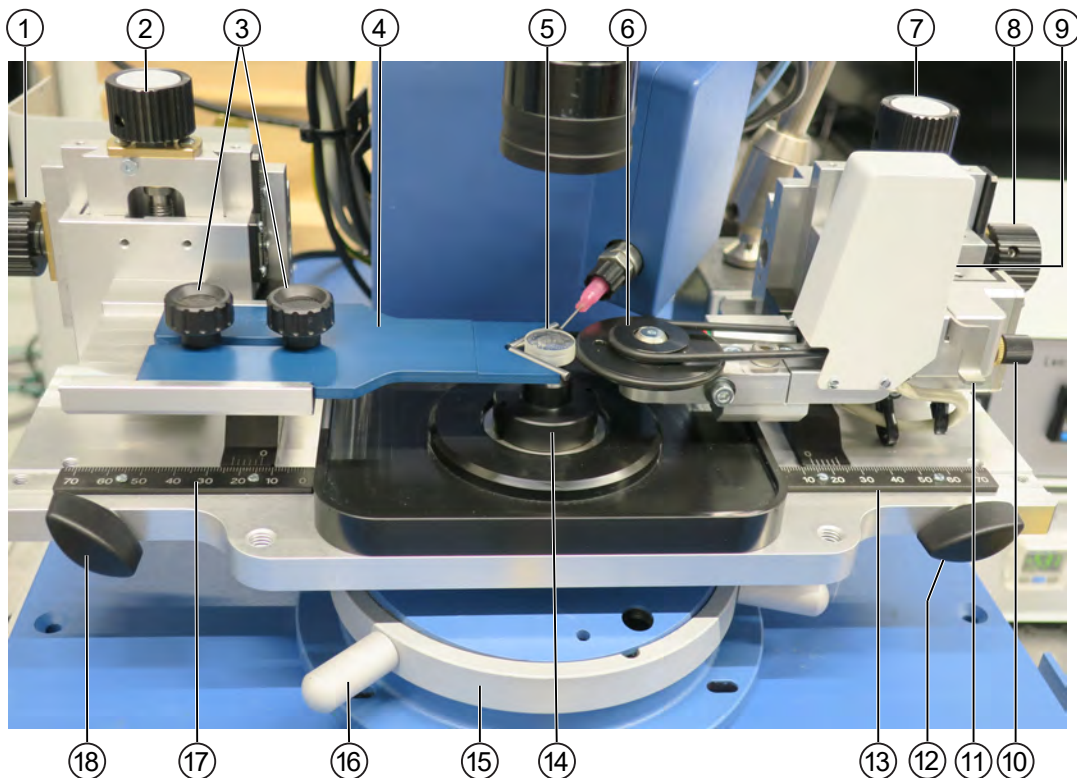


Fig. 17: Vacuum unit with lens rotation device

1	Thumb screw To adjust the V-blade in the X direction
2	Thumb screw To adjust the V-blade in the Z direction
3	Fastening screws for the V-blade
4	V-blade
5	Sample
6	Friction wheel
7	Thumb screw To adjust the friction wheel in the Z direction
8	Thumb screw To adjust the friction wheel in the X direction
9	Z-direction scale
10	Thumb screw To adjust the spring force of the friction wheel
11	Lever To release the setting unit for the friction wheel Actuating the lever moves the setting unit for the friction wheel to its outermost position, e.g. for assembling the cup point or the V-blade.

12	Wing nut, right For coarse adjustment of the friction wheel in the X direction
13	Scale, right Shows the shift of the friction wheel in the X direction
14	Cup point
15	Bridge Used to secure the vacuum unit above the air bearing
16	Lever for locking the bridge
17	Scale, left Shows the shift of the V-blade in the X direction
18	Wing nut, left For coarse adjustment of the V-blade in the X direction

4.3.4 Reference sensor for the lens rotation device with vacuum

The reference sensor measures the intensity of the light beam reflected by the lateral surface of the lens during one rotation. The sensor detects a changed signal at the position where the mark is located.

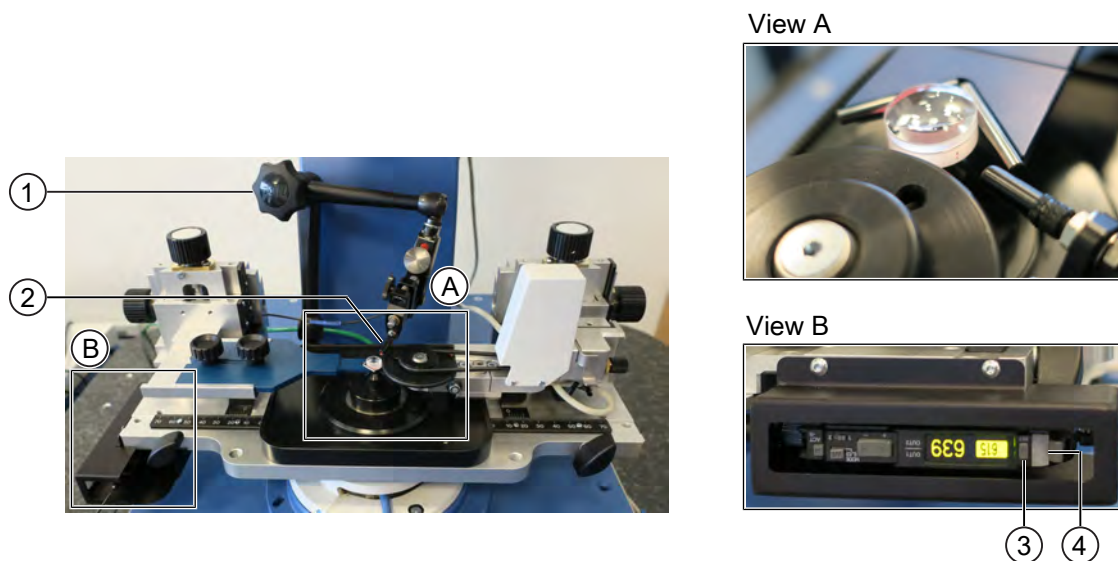


Fig. 18: Lens rotation device with vacuum and sensor

1	Mount for reference sensor
2	Reference sensor To ensure that the lens performs a complete rotation, the reference sensor detects a mark on the lateral surface of the lens.
3	Sensor Before starting a measurement, the intensity for the light and dark signals of the reference sensor must be set (see the <i>Setting light and dark signals for the reference sensor (optional)</i> [► 59] section).
4	Control lamp The LED lights up when the sensor has detected the signal.

4

4.4 Control elements

4.4.1 Emergency stop

View A

OptiCentric® 3D 101



OptiCentric® 3D 101 M



View B



Fig. 19: Emergency stop

The emergency stop buttons are located on the right-hand side of the measurement system from the operator's perspective (**view A**), as well as on the system controller (**view B**).

To immediately interrupt the power supply to the motors in a dangerous situation, press the emergency stop button. The power supply is interrupted and all movements of the measurement system are stopped immediately.

NOTE



Only use the emergency stop button in emergencies.

4.4.2 Controller rack

4



Fig. 20: Controller rack

The controller rack contains the control units of the measurement system.

Further information can be found in the *Control units* [► 42] section.

4

4.4.3 Control units

System controller

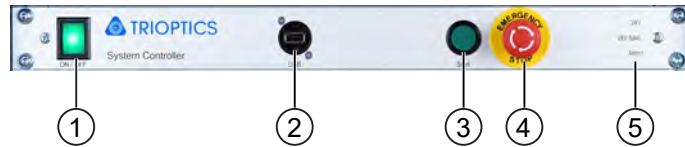


Fig. 21: System controller

1	ON/OFF Switching the system controller on/off. This switch is illuminated when the system controller is switched on
2	USB USB connection
3	Start Activate system controller <ul style="list-style-type: none"> • Button is illuminated when the controller can be activated. • Button goes off if the controller has not been activated.
4	EMERGENCY STOP Emergency stop button
5	Displays: <ul style="list-style-type: none"> • 24V is illuminated when the controller is connected to the supply voltage. • 24V safe is illuminated when the supply voltage is connected and the motors can be operated. • Error is illuminated when an error occurs.

Control unit for step motor drives (Stage 101 Controller)

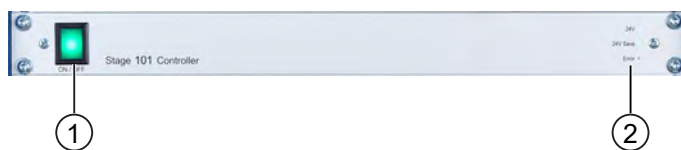


Fig. 22: Stage 101 Controller

1	ON/OFF (switch control unit on/off) The control unit can only be switched on after the system controller has been started (see <i>System controller</i> [► 42]). <ul style="list-style-type: none"> Lights up if the control unit is activated
2	Displays: <ul style="list-style-type: none"> 24V is illuminated when the controller is connected to the supply voltage. 24V safe is illuminated when the supply voltage is connected and the motors can be operated. Error is illuminated when an error occurs.

Control unit for LED light source (LED controller)

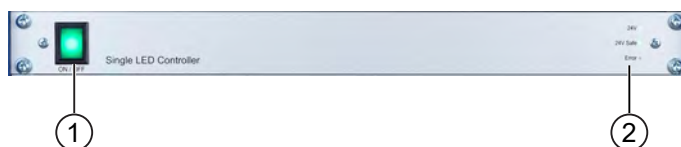


Fig. 23: Single LED Controller

1	ON/OFF (switch control unit on/off) The control unit can only be switched on after the system controller has been started (see <i>System controller</i> [► 42]). <ul style="list-style-type: none"> Lights up if the control unit is activated
2	Displays: <ul style="list-style-type: none"> 24V is illuminated when the controller is connected to the supply voltage. 24V safe is illuminated when the supply voltage is connected and the motors can be operated. Error is illuminated when an error occurs.

Control unit for OptiSurf® (OptiSurf® controller)

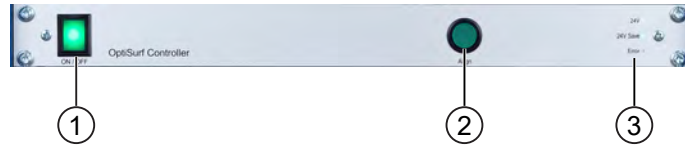


Fig. 24: OptiSurf controller

1	ON/OFF Switch control unit on/off; illuminated when the control unit is switched on
2	Align Switch alignment laser ON or OFF
3	Displays: <ul style="list-style-type: none"> • 24V is illuminated when the controller is connected to the supply voltage. • 24V safe is illuminated when the supply voltage is connected and the motors can be operated. • Error is illuminated when an error occurs.

NOTE



- Do not leave the alignment laser on for longer than is necessary.

See also

📄 System controller [► 42]

4.5 Measuring principle

4.5.1 Centering Error Measurement in Reflection

The basis for the measurement is an electronic autocollimator. The following graphic shows the functional method and the tried and tested principle of centering error measurement in reflection.

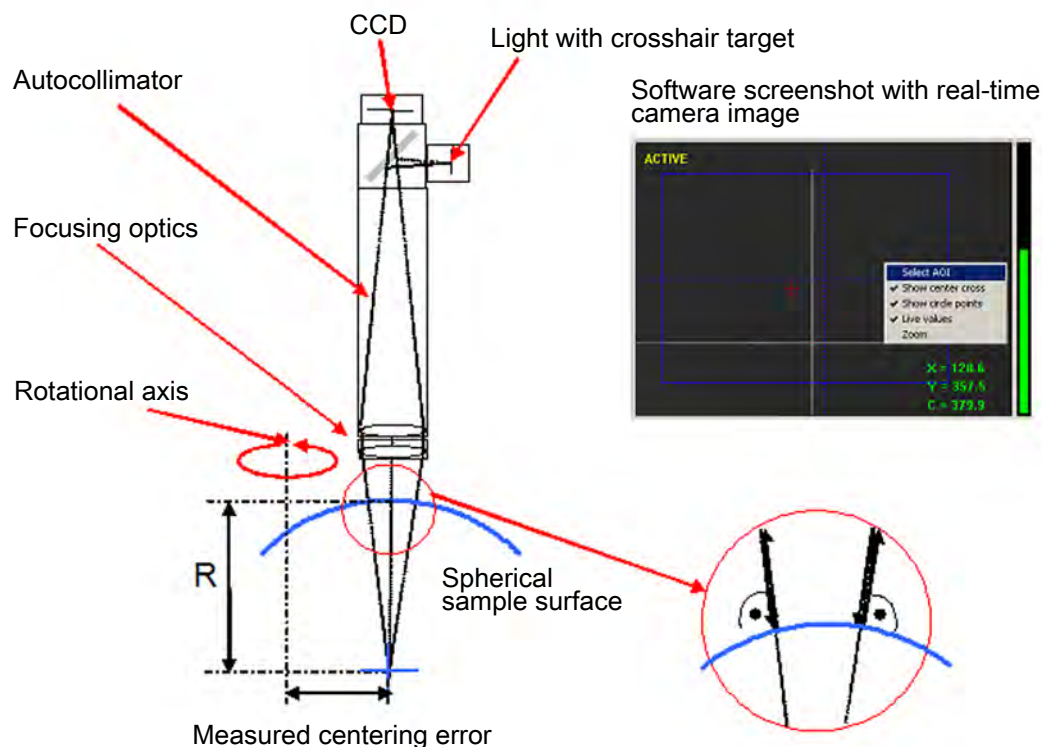


Fig. 25: Centering error measurement in reflection, schematic diagram

An illuminated target (bright crosshair on a dark background) is projected through a beam splitter and a focusing lens projected in the plane of the center of curvature of the sphere being studied. In this case, the light beams strike the surface nearly perpendicular.

A portion of the reflected light returns on precisely the same path on which it arrived (autocollimation condition) and is focused on a CCD chip. The image of the target appears on this chip.

A displacement of the center of curvature is represented directly in the image in a lateral displacement of the crosshair image.

If the sphere being examined is rotated about a reference axis, then circular movement of the center of curvature about the reference axis is transmitted to the CCD chip. The diameter or radius of this circle is directly proportional to the shift of the center of curvature to the reference axis.

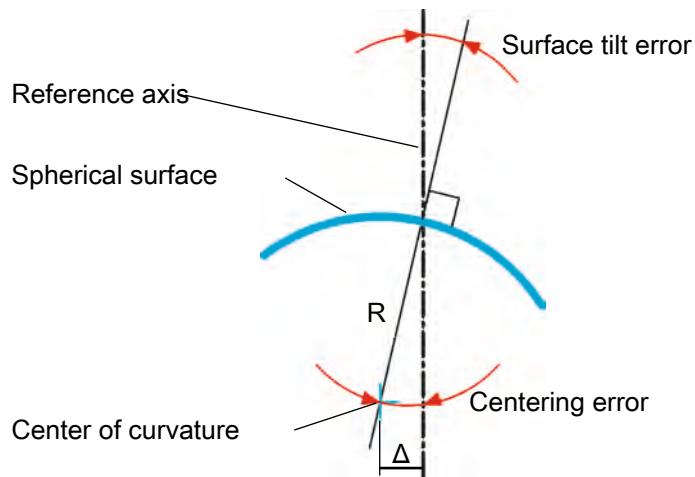


Fig. 26: Surface tilt error

The current crosshair image represents the exact position of the center of curvature in the XY plane.

Alternatively, the centering error of a spherical surface can also be represented as a surface tilt error.

$$\text{Surface tilt error} = \arcsin \frac{\text{Shift } \Delta}{\text{Radius of Curvature } R}$$

Powerful light sources and light-sensitive CCD sensors ensure that anti-reflective samples also provide an autocollimation image that is sufficiently strong.

4.5.2 MultiLens® measurement

4

This comprehensive software module is used to measure, align and assemble lens systems. The centering error of each surface of complex and already assembled optical systems is determined.

The MultiLens® software provides complete information about the individual centering errors of every surface, without destroying the optics. The centering errors are measured in the reflection mode, starting with the surface that is located closest to the measurement head, followed by the surface below, and so on.

When focusing in the respective centers of curvature, it is necessary to take into account the MultiLens® principle:

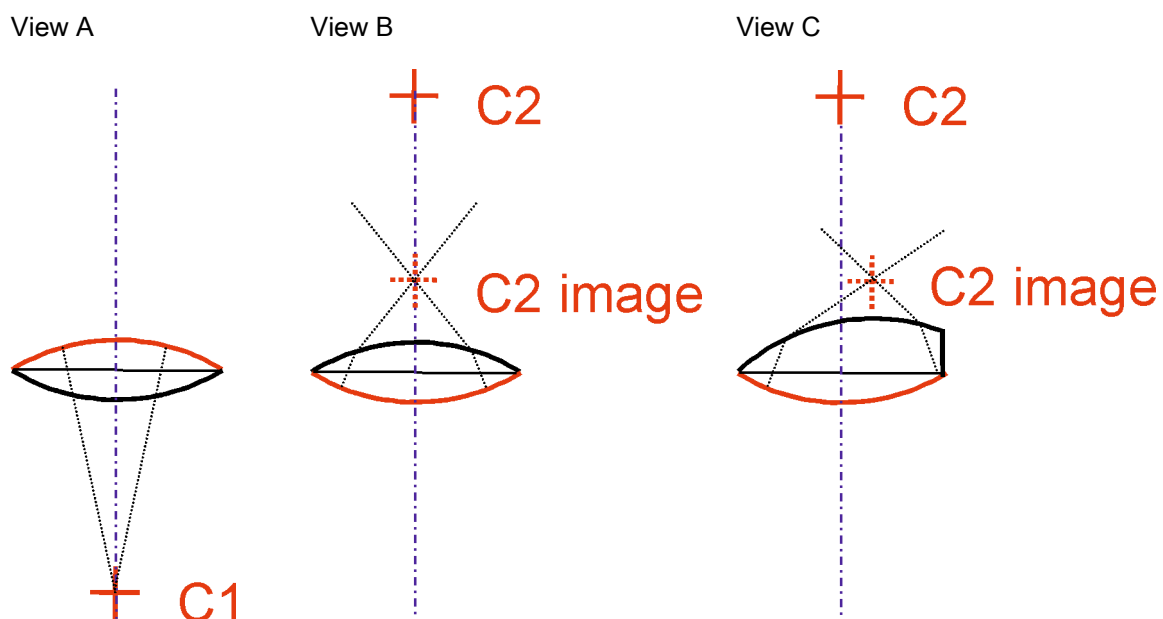


Fig. 27: MultiLens® measurement

- The focus point of the first surface is coincident with the center of curvature C1 (View A).
- Because the light beam is refracted at the first surface, in the second surface the focus point C2 image is shifted with respect to the geometrical center of curvature C2 (View B). This calculation requires the design data (radius, center thickness, refractive index) of the sample.
- The same applies to all of the following surfaces.
- When assessing the measurement, it is also necessary to take into account both the image-forming properties and the centering error of the first surface. If the exact centering error of the first surface is determined, it is possible to determine the centering error of the second surface, and so on (View C).

4

It is possible to measure 20 or more surfaces with a single autocollimator, with accuracies in the range of 1 μm and better.

Details can be found in the "Operator's manual and software description" for OptiCentric.

The measurement system uses the rotary axis of an air bearing as the reference axis. The air bearing has a radial runout in the range of 0.05 μm .

5 Installation and Initial Startup

5

CAUTION



Risk of material damage

The measurement system can be damaged by improper installation or its function impaired. This will result in inaccurate measurement results.

- Only employees of TRIOPTICS GmbH or correspondingly trained and authorized persons are permitted to unpack, install and commission the measurement system.

5.1 Transport

WARNING



Danger from transport vehicle, forklift truck or crane

During transport, assembly and installation as well as during dismantling and disposal, there is a risk of being driven over by a transporter, crane or forklift truck.

- Wear a safety vest.

Temperature range during transport

Temperature	+5°C to +40 °C
Humidity	40 to 65 %

Delivery

The measurement system is packed and delivered in an aluminum case.

The accessories are packed in boxes.

WARNING



Risk of injury by cutting, stabbing or crushing

Personal protective equipment required

- Wear protective gloves to DIN EN 388.
- Wear a safety vest.
- Wear safety shoes of grade S2 to DIN EN ISO 20345

Damage to the packaging

- Check the packaging for damage upon delivery.
- Document any damage to the packaging and report it immediately to *Customer Service* [► 79].

5

Transport equipment

- If possible, transport the measurement system to its final set-up location in its aluminum case.

CAUTION



Material damages

The measurement system may only be transported using appropriate means, such as a forklift or lift truck.

5.2 Storage

If the measurement system is to be stored until installation, ensure that the following ambient conditions are kept:

Location	Dry and free of dust
Temperature	+5°C to +32 °C
Humidity	40 to 65 %

WARNING



Risk of injury

Risk of injuries from rough, sharp surfaces of crates, pallets or nails.

- Wear protective gloves to DIN EN 388.
- Wear safety shoes of grade S2 to DIN EN ISO 20345.

5.3 Unpack and set up the measurement system

Required tools / appliances

- Screwdriver

WARNING



Risk of injury

Risk of injuries from rough, sharp surfaces of crates, pallets or nails.

- Wear protective gloves to DIN EN 388.
- Wear safety shoes of grade S2 to DIN EN ISO 20345.

CAUTION



Risk of material damage

The measurement system contains sensitive optical components.

- Open the package in a dust free environment only.
- Handle all components with care.

Accessories

- Have the accessory parts unpacked by the manufacturer's service technician.

NOTE



Keep the original packaging in order to return the measurement system to the manufacturer in the event of a repair.

Scope of delivery

Check that the delivery is complete by referring to the delivery note or packing list.

Damage to the components

Check the components for damage.

Document any damage to the components and report it to the manufacturer immediately or contact *Customer Service* [▶ 79].

Cleanroom operation

If the device was ordered for cleanroom operation, you must also note the following instructions:

- Unpack the main device outside the cleanroom.
- Do not bring any packing material into the cleanroom.
- If necessary: Clean the main device with suitable cleaning agents outside of the cleanroom.

5

5.4 Installation site

NOTE



Note the installation plan. Ensure that the requirements at the installation location are met.

Always observe the following conditions for the installation location of the measuring system:

Temperature	Constant ambient temperature, ideally +20 °C to +22 °C, max. +25 °C
Humidity	40 to 65 %

Location:

- In closed heated rooms
- Level and sturdy surface
- Free of vibrations
- Altitude: -50 to +2000 m above sea level
- Free of smoke and dust
- No direct sunlight
- Avoid installation directly under the output of the air conditioning unit

5.5 Required space

Information on the dimensions of the measurement system can be found in the *Technical data* [► 27] section.

NOTE



Required space

The operator must have at least 1 m of space in front of the device.
 Ventilation requires a clearance of at least 0.1 m to the rear and sides.

5.6 Required external connections

5

Power supply

DANGER



Danger to life due to electric shock!

Electrical currents may pose a hazard.

- Connect the measurement system and the equipment only to properly grounded electrical outlets.

The measurement system and accessories are designed for 90-260 VAC, 50-60 Hz.

One socket (with minimum C16 fuse) is required.

Compressed air

NOTE



Ask the provider what kind of compressor is best suited to ensure the following requirements.

Measurement system inlet pressure	4.5 - 5 bar
Air requirement	approx. 1200 l/h (incl. service unit)
Hose	6 mm, outside calibrated
Max. residual dust content class 1 (to DIN ISO 8573-1)	
Residual oil content	max. 0.01 mg/m ³
Residual dust (particle size)	max. 0.1 µm
Residual dust (quantity)	max. 0.1 mg/m ³
Max. residual water content class 3 (to DIN ISO 5873-1)	
Residual water (dew point)	-20 °C
Residual water (quantity)	max. 0.88 g/m ³

Network connection

Optional

Internet access

Not mandatory, but recommended for remote support.

5**5.7 Cabling****DANGER****Risk of electric shock**

Parts that are under tension due to faulty connections pose a risk of electric shock.

- Any work on the electrical system must be performed by appropriately qualified persons.
- Lock the switch cabinets.
- Check the electrical system regularly.

- Connect all cables, optical fibers, connecting lines and compressed air hoses according to the labeling.

5.8 Software

The and programs are pre-installed when the measurement system is delivered, if the measurement system is delivered together with a PC.

5.9 Copy protection key (hardware dongle)

- Insert the copy protection plug (hardware dongle) into a USB port on your PC.

6 Setting up the hardware

6

6.1 Mounting the tip-tilt-table

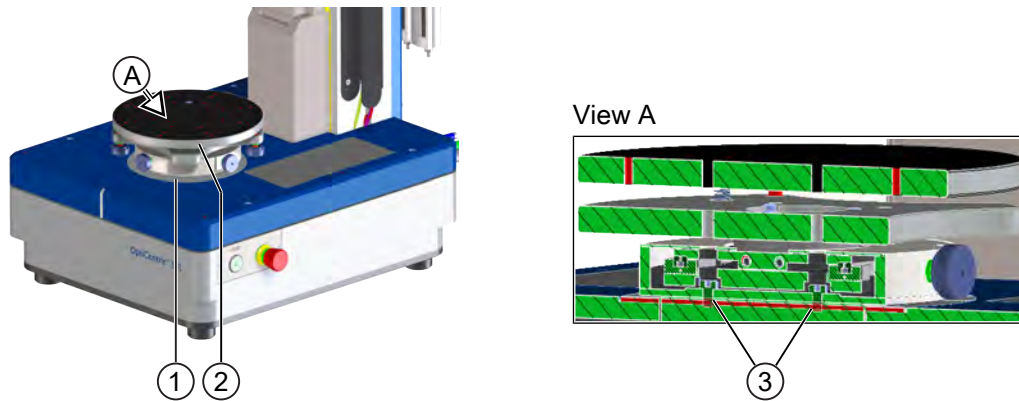


Fig. 28: Mounting the tip-tilt-table TRT 200

Required tools

- ✓ Allen key (hex), size 3 mm

1. Carefully place the tip-tilt-table (2) on the air bearing (1).
 ⇒ The adjusting screws should be located at the front and on the right-hand side.
2. Tighten the tip-tilt-table on the air bearing by using the four fastening screws (3).

6.2 Placing and securing the sample

The OptiCentric® 3D 101 can measure a broad spectrum of samples of various sizes and weights.

Preparation

To secure the sample, the air bearing and the tip-tilt table are equipped with various threaded holes. The dimensioned drawings can be found in the *Appendix* [► 89].

In many cases the sample can be screwed on directly.

If not, a suitable fastening dependent on the sample must be implemented.

Placing the sample

1. Lift the sample onto the measurement system.
2. Fasten the sample.

See also

- 📄 Appendix [► 89]

6

6.3 Lens rotation device

6.3.1 Mounting the lens rotation device

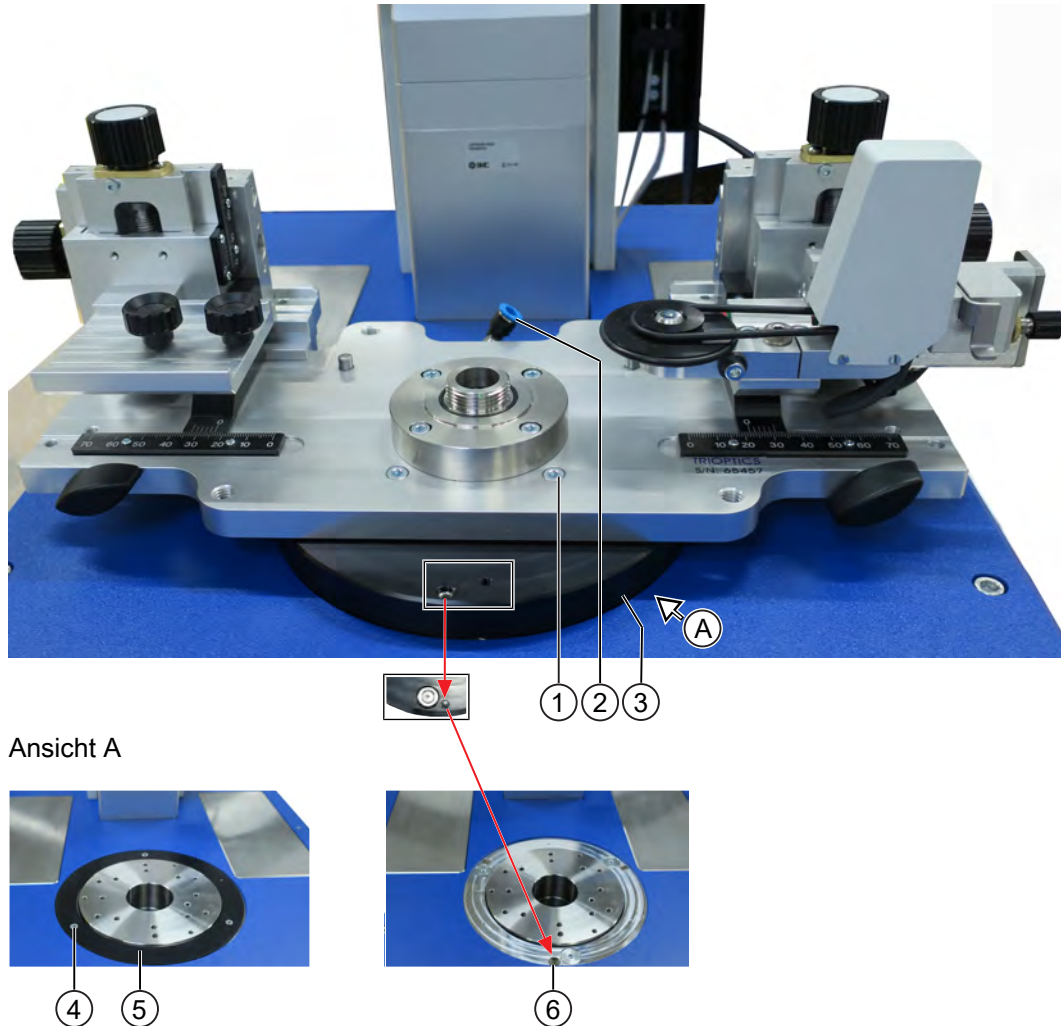


Fig. 29: Mounting the lens rotation device

NOTE



The tip-tilt table must be removed.

Required tools

Allen key (hex)

Material

Screws

Vacuum hose

Cable

1. Loosen the screws **(4)** and remove the cover ring **(5)**.
2. Place the lens rotation device with the kinematic holder **(3)** on the table of the measurement system. Make sure that the guide pins on the underside of the kinematic holder engage in the corresponding retainers on the table of the measurement system **(6)**.
3. Connect the vacuum hose of the vacuum control unit to the connection of the lens rotation device **(2)**.
4. Connect the motor connection cable to the lens rotation device.
5. Connect the foot switch, if you wish to use one.

6

6.3.2 Removing the lens rotation device

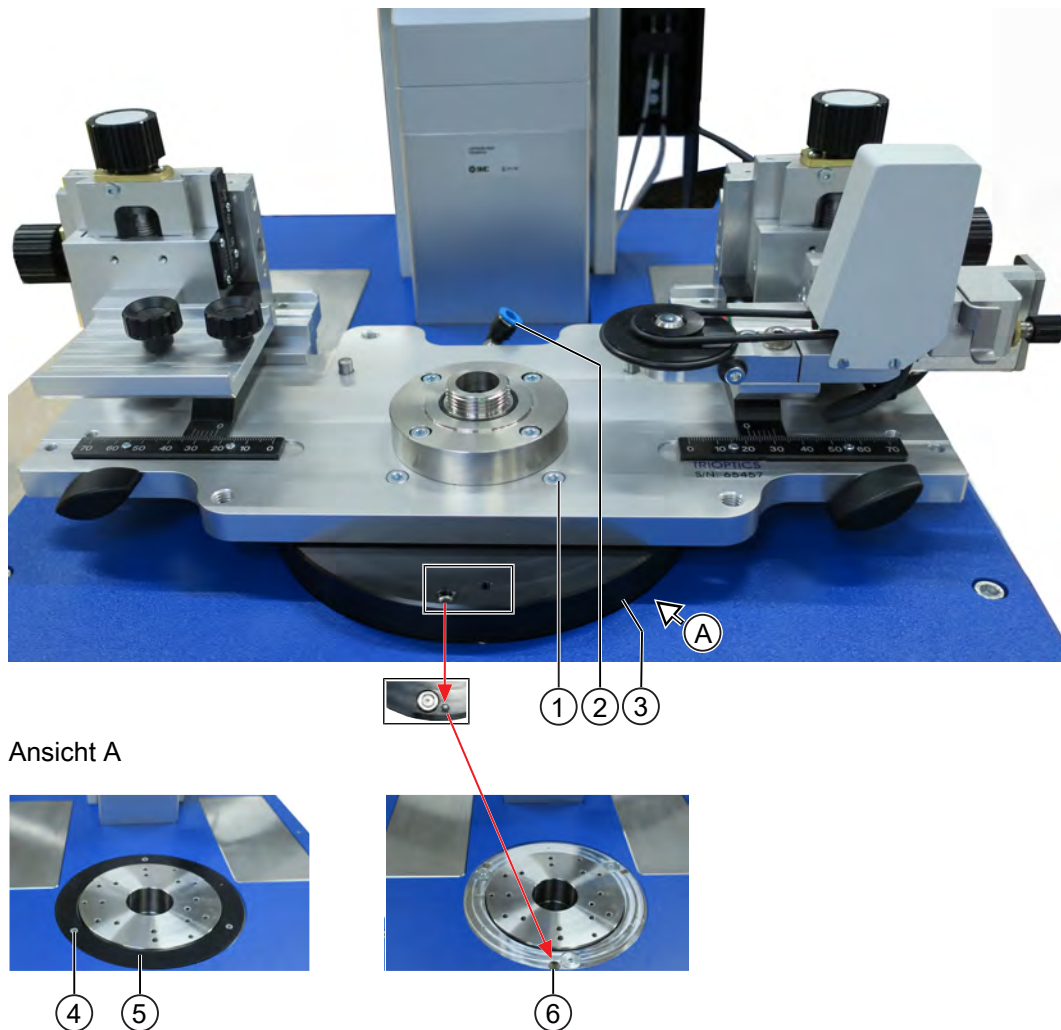


Fig. 30: Removing the lens rotation device

Required tools

Allen key (hex)

1. Loosen the vacuum (2) and motor connections from the lens rotation device.
2. Remove the lens rotation device from the table of the measurement system. The kinematic holder (3) should remain mounted on the lens rotation device.
3. Place the cover ring (5) on the table of the measurement system and secure it with the screws (4).

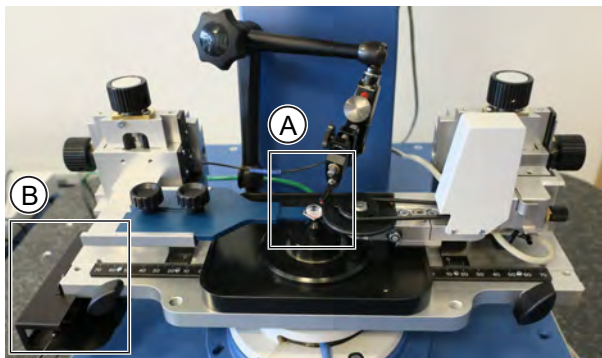
6.3.3 Setting light and dark signals for the reference sensor (optional)

6

NOTE



The reference sensor is only available if you have purchased the MultiLens® measurement option on the lens rotation device. The following steps are only necessary for this special application.



View A



View B

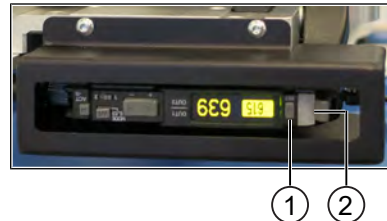


Fig. 31: Reference sensor, adjusting the intensity for light and dark signals

Before starting a measurement, the reference sensor must be adjusted to the light-dark areas on the lateral surface of the lens. To do so, proceed as follows:

1. Turn the lens so that the sensor illuminates an unmarked area of the lens (light area).
 2. Press the **SET** button (1) on the reference sensor.
⇒ The intensity value for the light area is set.
 3. Then turn the lens so that the sensor illuminates the marked area of the lens (dark area) (**view A**).
 4. Press the **SET** button again on the reference sensor.
⇒ The intensity value for the dark area is set.
- ⇒ This completes the sensor setup procedure.

Testing the function of the reference sensor

When the reference sensor detects the signal, the control lamp (2) lights up:



Fig. 32: Reference sensor, dark signal is detected

To ensure that the reference sensor detects the mark correctly, you can test the settings for the light and dark areas of the sensor. To do so, proceed as follows:

1. Select <tools> <FIND CENTER>.
2. Rotate the lens using the control menu of the lens rotation device.
To ensure that the lens performs a complete rotation, the sensor must detect the dark signal twice:
 - ⇒ The sensor evaluates the first dark signal as the starting point for the rotation of the lens.
 - ⇒ The second dark signal indicates to the sensor that a complete rotation has been completed. The rotational movement is stopped automatically.

7 Operation

7

7.1 Pre-operation checks

CAUTION

**Risk of material damage**

- Do not operate the measurement system if parts are damaged.

1. Make sure the housing of the measurement system and the connecting cables are not damaged.
2. Make sure that there are no loose parts on the linear stages.
3. Make sure the compressed air supply is properly connected and the connecting hoses are not damaged.
4. Ensure that the sample holder and the optical components are clean.

7.2 Switching the measurement system on

CAUTION

**Risk of material damage**

Rotating the air bearing without compressed air will result in damage to the air bearing. Precise measurements will then no longer be possible.

- Always turn on the compressed air supply first before using the measurement system.

OptiCentric® 3D 101

OptiCentric® 3D 101 M

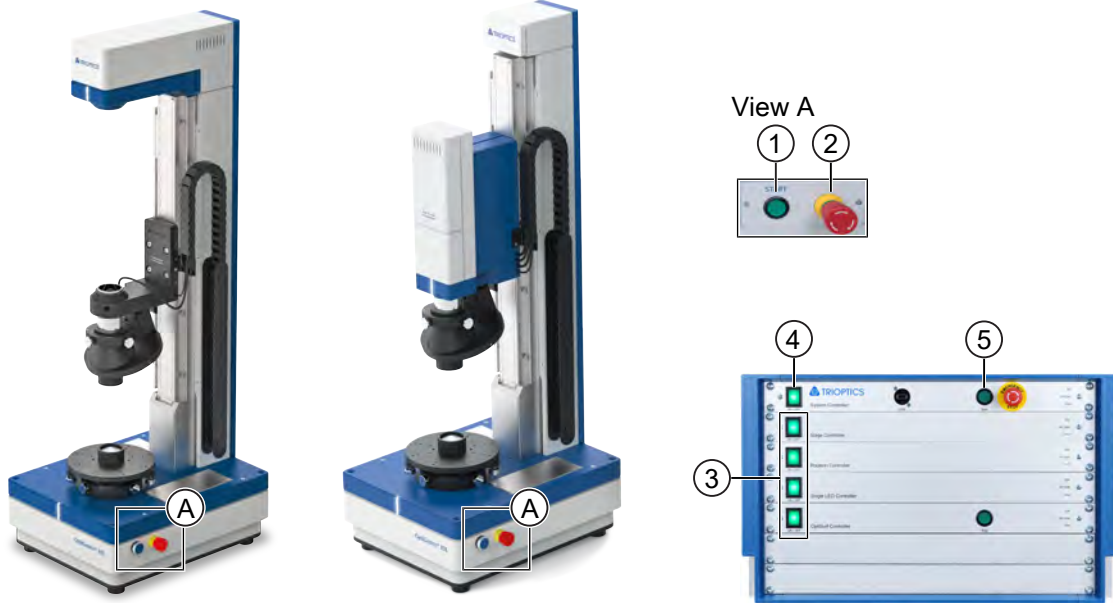


Fig. 33: Switching on the measurement system

1. Connect the measurement system to the power supply.
2. Switch on the compressed air supply.
3. If necessary, connect the network to the measurement system.
4. Switch the system controller to the **ON** position with the **ON/OFF** button (4).
⇒ The PC will start up.
5. Switch on the remaining control units with the corresponding **ON/OFF** button (3).
⇒ The **Start** buttons on the system controller (5) and on the control panel (1) light up green.
6. Press the **Start** button on the system controller (5) or on the control panel (1) to switch on the measurement system.
⇒ The **Start** buttons are no longer lit.
7. Start the software as described in the "OptiCentric® 9 Software Description" manual, which is supplied separately.
8. Reference the axes as described in the "OptiCentric® 9 Software Description" manual, which is supplied separately.
⇒ The measurement system is now ready for operation.

7.3 The coordinate system

7

OptiCentric® 3D 101



OptiCentric® 3D 101 M



Fig. 34: Measurement system, coordinate system

The measurement system is delivered with a right-handed coordinate system.

X-axis	<ul style="list-style-type: none"> • parallel to the front of the measurement system • points right from the operator's point of view
Y-axis	<ul style="list-style-type: none"> • points forwards from the operator's point of view
Z-axis	<ul style="list-style-type: none"> • points downwards in the table • parallel to the optical axis of the measurement head • corresponds to the rotational axis of the air bearing

7

7.4 Emergency stop in dangerous situations

View A

OptiCentric® 3D 101



OptiCentric® 3D 101 M



View B



Fig. 35: Emergency stop

The emergency stop buttons are located on the right-hand side of the measurement system from the operator's perspective (**view A**), as well as on the system controller (**view B**).

To immediately interrupt the power supply of the motors in a dangerous situation, press the **emergency stop** button.

The power supply is interrupted and all movements of the measurement system are stopped immediately.

The **emergency stop** button locks into place.

NOTE



The power supply for the PC is not connected to the emergency stop. All data entered and measurement results are retained.

NOTE



Only use the emergency stop button in emergencies.

7.5 Restarting after emergency stop

OptiCentric® 3D 101

OptiCentric® 3D 101 M



Fig. 36: Restarting after emergency stop

NOTE



The measures described below for restarting after an emergency stop may only be carried out by a qualified person.

1. Remove the reason for the danger and twist the corresponding **emergency stop** button (2, 4) to unlock it.
 2. Press the **Start** button on the system controller (3) or on the control panel (1) to put the measurement system back into operation.
 3. Perform a reference run as described in the "OptiCentric® 9 Software Description" manual, which is supplied separately.
- ⇒ The measurement system is again ready for operation.

NOTE



A reference cycle is mandatory after re-starting the measurement system or after an emergency stop. Otherwise, the positions of the individual axes are unknown and the measurement system may be damaged.

7

7.6 Switch off the measurement system



Fig. 37: Switching off the measurement system

1. Close the software.
2. Shut down the PC.
3. Switch the system controller to the **OFF** position with the **ON/OFF** button (1).
 - ⇒ The other control units (2) are automatically switched off as well.
4. Switch off the monitor.
5. Switch off the compressed air supply.
6. Disconnect the measurement system from the power supply.
 - ⇒ The measurement system is now completely switched off.

8 Software

8

8.1 OptiCentric® 9 software

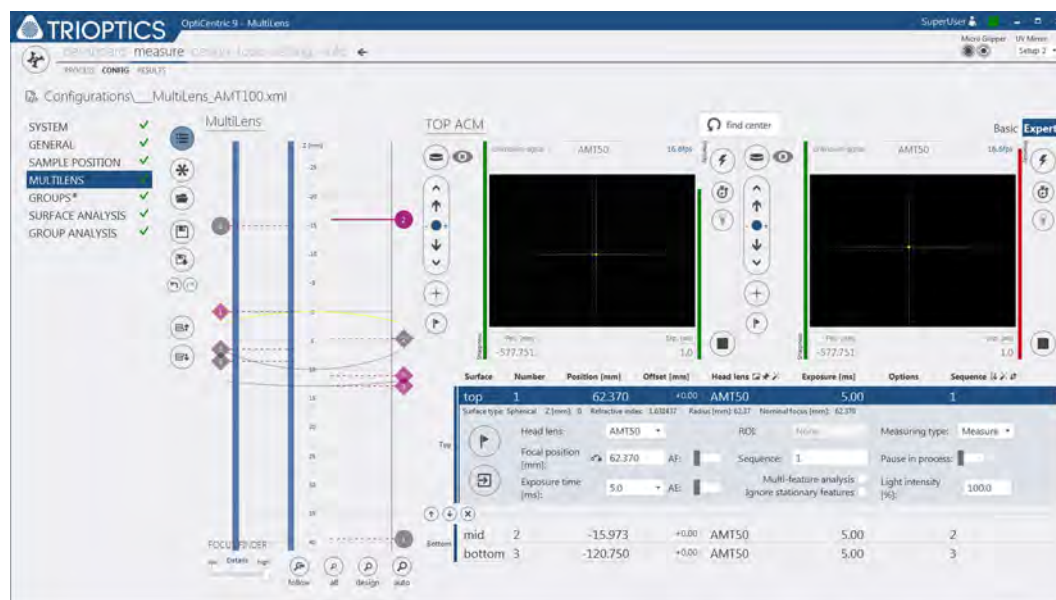


Fig. 38: OptiCentric® 9 software

NOTE



Information on operating the OptiCentric® 9 software can be found in the "OptiCentric® 9 Software Description" manual supplied separately.

8

8.2 OptiSurf® software

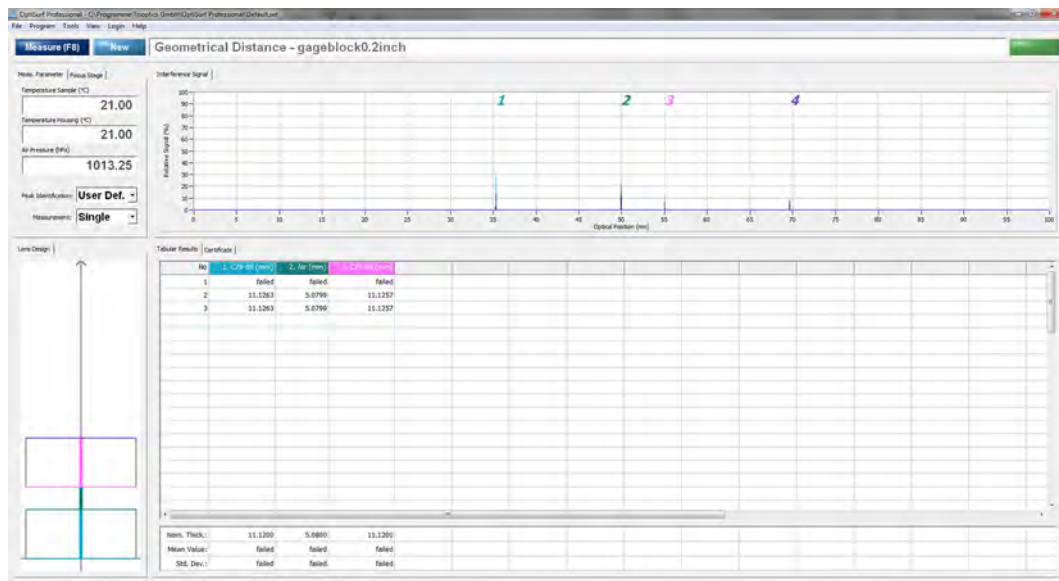


Fig. 39: OptiSurf® software

NOTE



Information on operating the OptiSurf® software can be found in the "OptiSurf® Software Description" manual, which is supplied separately.

9 Maintenance and repairs

9

9.1 Intervals

The components of the measurement system are largely designed to be maintenance free. However, changes to environmental parameters (temperature, humidity, etc.) may cause deviations in the alignment and thus the measurement results.

To detect such deviations promptly and to ensure the proper functioning of the measurement system components, please observe the following maintenance instructions.

Every 3 months

Check the calibration of the measurement system (refer to the Calibrate the measurement system section).

Every 6 months

Conduct a performance check (refer to the Conduct a performance check section).

As required

9.2 Calibrating the measurement system

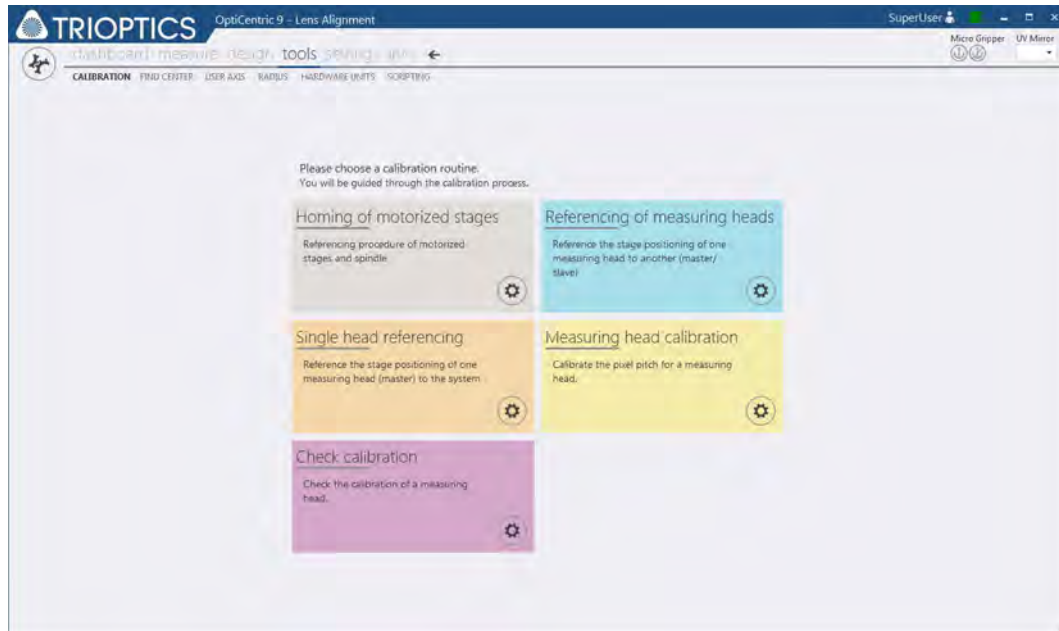


Fig. 40: Tools: Selection

Various tools are available for the calibration of the measurement system. The calibration of the measurement system should be performed in the following order:

1	Homing of motorized stages Referencing of the motorized axes Referencing of the axes must always be performed when the measurement system is switched on, after an emergency stop or, if necessary, after a reboot of the software.
2	Measuring head calibration Calibration of the measuring head with the aid of a reference sample (calibration wedge). With dual measurement systems, this step must be performed for both the upper and the lower measurement head.
3	Check calibration Check of the measurement head calibration with the aid of a reference sample (calibration wedge).
4	Single head referencing Referencing of the flange of the top autocollimator to the measurement plane of the OptiCentric® system. With dual measurement systems, the first measurement head (master) is referenced here.
5	Referencing of measuring heads Referencing of the flange of the bottom autocollimator to the flange of the top autocollimator. With dual measurement systems, the second measurement head (slave) is referenced here. The requirement here is that the first measurement head (master) has already been referenced (4).

NOTE

Further information on the tools can be found in the "OptiCentric® 9 Software Description" manual.

9.3 Conducting a performance check

The `Check calibration` tool is used for the performance check.

The alignment of the camera of a measurement head to the optical axis can be checked with this.

The two reflections of the calibration wedge are pulled apart horizontally and vertically so that a double cross can be seen in the camera window. The system measures the distance between the horizontal and vertical lines and from this calculates the wedge angle of the calibration wedge. The measured wedge angle must correspond to the specifications of the reference wedge.

The values are known for a reference sample. The reference values are compared with the values determined with the measurement system.

To ensure proper functioning and consistent accuracy of the measurement system, TRIOPTICS recommends a regular performance check. In this way, changes to the measurement system can be detected over a longer period of time.

NOTE

Further information on conducting the performance check can be found in the "OptiCentric® 9" operator's manual

9.4 PC and software

The measurement system is shipped with software that is installed under the Microsoft Windows® operating system.

The operator is responsible for keeping the software free from viruses while the measurement system is in operation.

9

9.5 Fuses

CAUTION



Risk of injury and risk of property damage

- Using incorrect fuses can result in injury and damage to property.
- Always replace defective fuses with fuses of the same type.

Information about the fuses used can be found in the operator's manuals for each device.

9.6 Cleaning

In order to ensure proper operation and accurate measurement results, the measurement system, accessories, samples and the environment must be clean and dust free.

Cover the measurement system with the dust protection sheet supplied when not in use.

The following cleaning operations should be carried out as required:

- The lenses should be cleaned at regular intervals with isopropyl alcohol. It is important that the lenses are streak-free after cleaning.
- The housings should ideally be cleaned at regular intervals, ideally with compressed air.

DANGER



Risk of fire

There is an elevated risk of fire during cleaning work with highly flammable alcohol.

- Observe the manufacturer's safety data sheet.
- Only store the quantity actually needed per day at the work station.

NOTE



If the measurement system is operated in a cleanroom, observe the cleaning guidelines in place.

NOTE



Improper cleaning of optical surfaces can lead to damage.

- The optical surfaces are highly sensitive and should not be contaminated. Lenses damaged by cleaning are not covered by the warranty.
- Cleaning optical surfaces may only be performed by appropriately trained personnel.

Housing

9

CAUTION



Risk of material damage

The use of solvents or abrasives can cause damage to the measurement system.

- Never use solvents or abrasives to clean the measurement system.
- Do not spray the cleaning solution directly onto the measurement system.

- Use a solution of mild detergent and water for cleaning.
- Regularly wipe the housing of the measurement system with a soft damp cloth.

Sample holder

NOTE



Risk of inaccurate measurement results

A dirty sample holder can contaminate the sample or cause it to become misaligned. This will result in inaccurate measurement results.

- Use isopropyl alcohol for cleaning
- Regularly wipe the sample holder with a soft damp cloth.

Optical components of the measurement system

CAUTION



Risk of material damage

The optical surfaces are highly sensitive and should not be contaminated. Lenses damaged by cleaning are not covered by the warranty.

- Do not touch the optical surfaces.
- Only use clean, oil-free compressed air for cleaning.
- Have cleaning carried out only by suitably trained personnel.

- Use compressed air to blow away dirt on optical components, using a spiral motion from the inside to the outside.
- For stubborn dirt, use a soft cloth with high-purity isopropyl alcohol.

Optical surfaces

The optical surfaces are highly sensitive. Avoid any contamination. If possible, do not clean them.

10 What to do if ... ?

10

10.1 Troubleshooting

Error	Cause	Troubleshooting measures
No camera image	The image is too dark.	<ul style="list-style-type: none"> – Check if the bar graph for the light intensity in the area of interest (AOI) is shown. – If necessary, change the exposure time in the <i>Shutter [µs]</i> drop-down menu until the bar graph for the light intensity is approximately at the center. – Change the brightness at the light source. Further information can be found in the "OptiCentric® 9 Software Description" manual, which is supplied separately.
	Camera cable is not properly attached to the PC.	<ul style="list-style-type: none"> – Make sure that the camera cable is connected to the PC and that its plug is screwed to the corresponding connection.
	FireWire card	<ul style="list-style-type: none"> – Go to the Control Panel on the PC and open the Device Manager. – Check that the FireWire card listed in the Device Manager is ready for use and shows no errors. – If the card is not listed, please contact <i>Customer service</i> [► 79].

Error	Cause	Troubleshooting measures
No camera image	Cable is damaged.	<ul style="list-style-type: none"> – Replace the camera cable (2) (see the Replacing the camera cable / checking the camera status image). Proceed as described in Replacing the camera cable.
No camera image	Camera is defective	<ul style="list-style-type: none"> – Unscrew the six screws (1) and remove the enclosure from the camera. – Check whether the status LED (3) (see the Replacing the camera cable / checking the camera status image) on the camera is illuminated during operation. If the LED is not illuminated, the camera is defective and must be replaced. Contact <i>Customer service</i> [► 79].

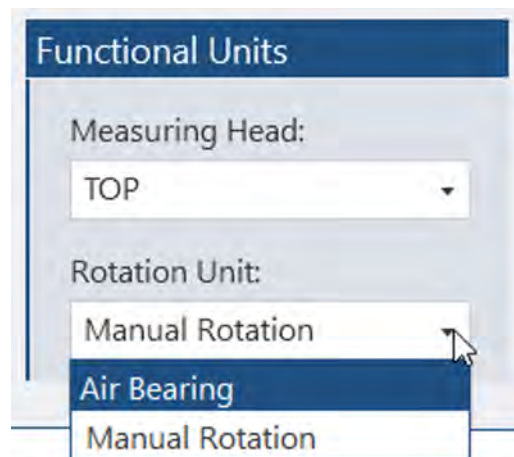


Fig. 41: Troubleshooting: Selecting the air bearing as the rotation unit

Error	Cause	Troubleshooting measures
Air bearing does not rotate	"Manual rotation" mode is selected	<ul style="list-style-type: none"> In the Functional Units area, select the entry for the air bearing.

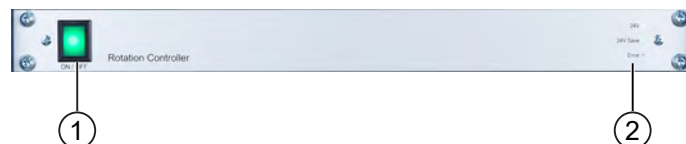


Fig. 42: Rotation controller

Error	Cause	Troubleshooting measures
Air bearing does not rotate	Control is not activated.	<ul style="list-style-type: none"> Check that the control unit for the rotation (rotation controller) is switched on. The ON/OFF button (1) must be illuminated (see the <i>Rotation controller</i> [▶ 76] image). If this is not the case, release the emergency stop button and turn on the controller. Close the software and restart it.
	Compressed air not switched on or insufficient.	<ul style="list-style-type: none"> Check the compressed air supply. The pressure must be between 4 and 5 bar.
	Incorrect connections	<ul style="list-style-type: none"> Check all connecting cables, connecting lines and pneumatic hoses. They must be undamaged and properly connected.

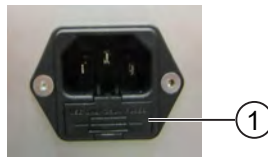


Fig. 43: Troubleshooting: Fuse compartment of the controller

Error	Cause	Troubleshooting measures
Controller cannot be switched on, the switch does not light up.	Emergency stop pressed.	<ul style="list-style-type: none"> Release the emergency stop button or turn on the emergency stop box.
Controller cannot be switched on, the switch does not light up.	Defective fuse	<ul style="list-style-type: none"> Open the fuse compartment (1) on the rear of the system controller (see the <i>Troubleshooting: Fuse compartment of the controller</i> [► 77] image) and install a new fuse of the same type.

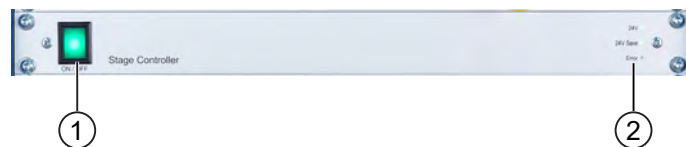


Fig. 44: Stage controller

Error	Cause	Troubleshooting measures
Linear stage does not move	Control is not activated.	<ul style="list-style-type: none"> Check that the control unit for the step motors (stage controller) is switched on. The ON/OFF button (1) must be illuminated (see the <i>Stage controller</i> [► 77] image). If this is not the case, release the emergency stop button and turn on the controller. Close the software and restart it.
	Safety limit switch is activated or not connected properly	<ul style="list-style-type: none"> Check whether the safety limit switch has been triggered.
	Incorrect connections	<ul style="list-style-type: none"> Check all connecting cables, connecting lines and pneumatic hoses. They must be undamaged and properly connected.
Poor reproducibility of the measurement results		<ul style="list-style-type: none"> Make sure that the sample is well mounted. Make sure that the sample is pre-centered. Make sure that the head lens is screwed tightly. Choose a different head lens to achieve an optimal enlargement ratio. Check whether the relative positions are correct and whether you can see the images properly focused.

10

Error	Cause	Troubleshooting measures
		<ul style="list-style-type: none"> - Make sure that the lighting is sufficient. - Avoid light disturbances from the outside. - Measure the reference sample.

10.2 Customer Service

10

If you cannot resolve the errors yourself, please contact Customer Service.

Accessibility

The customer service is available five days a week during normal office opening hours in your respective region.

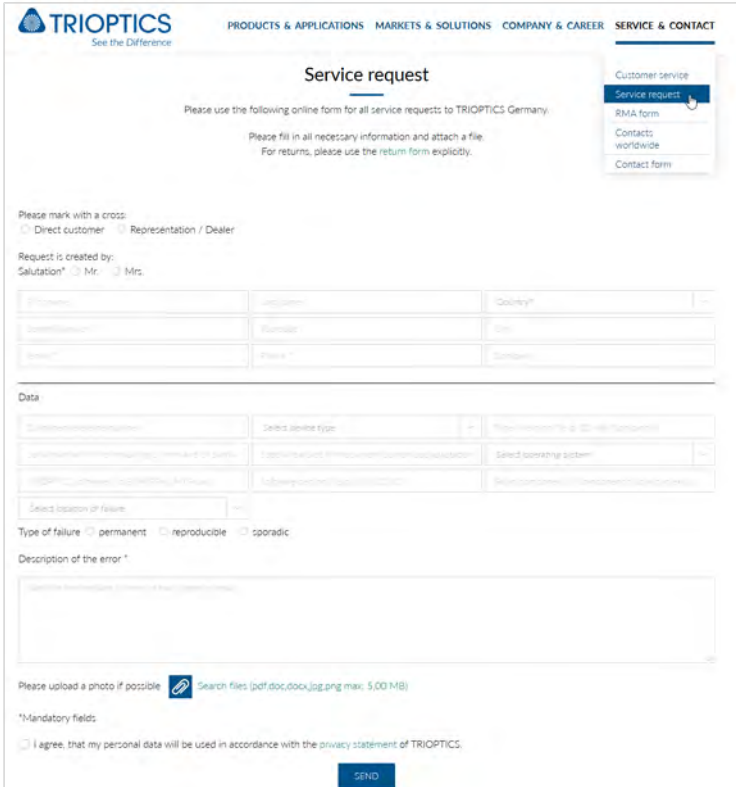
Costs

Service is free during the warranty period.

10.3 Start Customer Service request

Any request for service must be made online.

1. Open <http://www.trioptics.com>.
2. Select <Service & Contact><Service Request>.



The screenshot shows the TRIOPTICS website's "Service request" form. The header includes the TRIOPTICS logo and navigation links: PRODUCTS & APPLICATIONS, MARKETS & SOLUTIONS, COMPANY & CAREER, and SERVICE & CONTACT. The "Service request" section is active, with a dropdown menu showing options: Customer service, Service request (selected), RMA form, Contacts worldwide, and Contact form. The form instructions state: "Please use the following online form for all service requests to TRIOPTICS Germany. Please fill in all necessary information and attach a file. For returns, please use the return form explicitly." The form fields include: "Please mark with a cross" with radio buttons for "Direct customer" and "Representation / Dealer"; "Request is created by:" with a "Salutation*" dropdown (Mr., Mrs.); a grid of input fields for Name, Address, City, Country, Phone, and E-mail; a "Data" section with dropdowns for "Customer/representative", "Select agent type", "Product/series", "Select service type", "Select location of failure", "Type of failure" (permanent, reproducible, sporadic), and "Description of the error *"; a file upload section with a "Please upload a photo if possible" note and a "Search files" button; and a "Mandatory fields" section with a checkbox for "I agree, that my personal data will be used in accordance with the privacy statement of TRIOPTICS." and a "SEND" button.

Fig. 45: Service request form

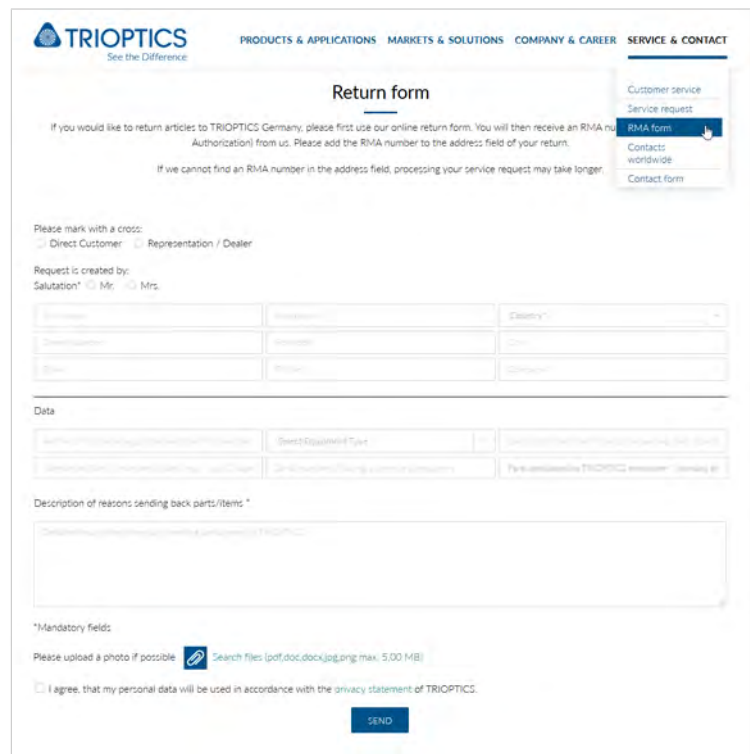
3. Check the corresponding box indicating whether you are a direct customer or an agency/dealer.
4. Choose your salutation.
5. Fill in the respective fields.
6. All fields marked with an asterisk (*) are mandatory. If you do not know what to enter, fill in "None".

7. Check the corresponding box to indicate the type of failure.
8. In the Description of the Error field, describe the problem or error of the system.
9. If necessary, select an attachment of the following file types: *.pdf, *.doc, *.docx, *.jpg, *.png.
 ⇒ The maximum size of the attachment is 5 MB.
10. Consent to the use of your personal data in accordance with the privacy policy.
11. Click SEND.

10.4 Returning parts

Please use an RMA number (Return Material Authorization) to return any parts to TRIOPTICS. You can retrieve this number online.

1. Open <http://www.trioptics.com>.
2. Select <Service & Contact><Return Form>.



The screenshot shows the TRIOPTICS website's "Return form" page. The header includes the TRIOPTICS logo and navigation links: PRODUCTS & APPLICATIONS, MARKETS & SOLUTIONS, COMPANY & CAREER, and SERVICE & CONTACT. A dropdown menu under "SERVICE & CONTACT" is open, showing options: Customer service, Service request, RMA form (highlighted), Contacts worldwide, and Contact form. The main content area is titled "Return form" and contains instructions: "If you would like to return articles to TRIOPTICS Germany, please first use our online return form. You will then receive an RMA number (Return Material Authorization) from us. Please add the RMA number to the address field of your return." and "If we cannot find an RMA number in the address field, processing your service request may take longer." Below this, there are fields for "Please mark with a cross:" (Direct Customer, Representation / Dealer), "Request is created by:" (Salutation, Mr, Mrs), and a table for "Data" with columns for Address, Street/Equipment Type, and Contact Information. A large text area is labeled "Description of reasons sending back parts/items *". At the bottom, there are checkboxes for "Mandatory fields", "Please upload a photo if possible" (with a file upload icon and text "Search files (pdf, doc, docx, jpg, png max. 5.00 MB)"), and a checkbox for "I agree, that my personal data will be used in accordance with the privacy statement of TRIOPTICS". A blue "SEND" button is at the bottom right.

Fig. 46: Service RMA Form

3. Check the corresponding box indicating whether you are a direct customer or an agency/dealer.
4. Choose your salutation.
5. Fill in the respective fields.
6. All fields marked with an asterisk (*) are mandatory. If you do not know what to enter, fill in "None".
7. In the Reasons for Return field, describe the problem or error of the system.

8. If necessary, select an attachment of the following file types: *.pdf, *.doc, *.docx, *.jpg, *.png.
⇒ The maximum size of the attachment is 5 MB.
9. Consent to the use of your personal data in accordance with the privacy policy.
10. Click **Submit**.
⇒ Your RMA number will be mailed to you.
11. State your address and the RMA number on the return package to TRIOPTICS.

NOTE



An RMA number is required to ensure your parts are assigned and processed quickly.

11 Disassembly and Disposal

11

WARNING



Risk of injury

Mechanical or electrical hazards can occur when disassembling the product.

- Ensure that disassembly is only carried out by authorized specialist personnel.
- Please contact the manufacturer or the respective local subsidiary.

NOTE



Observe local regulations and laws on the disposal of environmentally harmful substances.

NOTE



Should you have any questions about disposal, please contact the manufacturer or the responsible local subsidiary.

- <http://www.trioptics.com/contact-service/contacts-worldwide/>

11.1 Disposing of components

Components

The products mainly consist of steel and various copper and aluminum parts. Metallic materials are widely regarded as fully recyclable.

Separate the components for recycling according to the following categories:

- Steel and iron
- Aluminum
- Non-ferrous metal, such as motor windings
- Insulating materials
- Cables and wires
- Electronic scrap
- Batteries

11**Chemicals and additives**

Sort the process chemicals and additives for disposal, for example according to the following categories:

- Oil
- Grease
- Cleaners and solvents
- Paint residues
- Anti-corrosion agents
- Other hazardous substances

Dispose of the separated components according to local regulations or via a specialist disposal company. The same applies for cloths and cleaning substances which have been used to carry out work on the machine.

Packaging material

- If necessary, contact a specialist waste disposal company.
- Wooden packaging for sea transport consists of impregnated wood. Please observe the local regulations.

11.2 Returns**All products**

Returns must be registered with the manufacturer.

12 Warranty

12

TRIOPTICS grants a warranty of one year on material and processing defects, starting from delivery or installation at the customer (if the installation was carried out by TRIOPTICS).

Excluded from the warranty are supplied parts, such as the CCD array or FrameGrabber Board, which have a shorter manufacturer's warranty.

The warranty does not apply if the defects are caused by:

- Transport damages
- Damages from incorrect installation (if the installation was not carried out by TRIOPTICS)
- Accident, negligence or unauthorized influencing of the measurement system
- Failure to comply with the operating instructions
- Damages due to unauthorized changes to programming
- Damages due to unauthorized repair
- Use of incorrect spare parts

In a warranty case, TRIOPTICS is only obligated to replace or repair the defective parts. Consequential damages are not covered by this warranty. The customer is responsible for transport costs.

NOTE



Keep the original packaging in order to return the measurement system to the manufacturer in the event of a repair.

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13 Appendix

13

13.1 Compressed air service unit

See also

 DM 08 K_Gehäuse_de,gb,fr,nl_1003.pdf [► 91]

Installations- und Betriebsanleitung

deutsch

Instructions for installation and operation

english

Instructions de montage et de service

français

Installatie- en Gebruiksaanwijzing

nederlands

DRYPOINT® M

Gehäuseversion / Housing version

Version corps / Behuizingversie

DM 08 - 19 K (A, B, C)

DM 08 - 24 K (A, B, C)

DM 08 - 28 K (A, B, C)

DM 08 - 34 K (A, B, C)

Sehr geehrter Kunde,

vielen Dank, daß Sie sich für DRYPOINT® M - Druckluft-Membrantrockner entschieden haben. Bitte lesen Sie vor Montage und Inbetriebnahme diese Installations- und Betriebsanleitung aufmerksam durch und befolgen Sie unsere Hinweise. Nur bei Beachtung der Vorschriften und Hinweise ist eine einwandfreie Funktion des DRYPOINT® M - Druckluft-Membrantrockners für eine hohe Druckluftqualität sichergestellt.

Dear Customer,

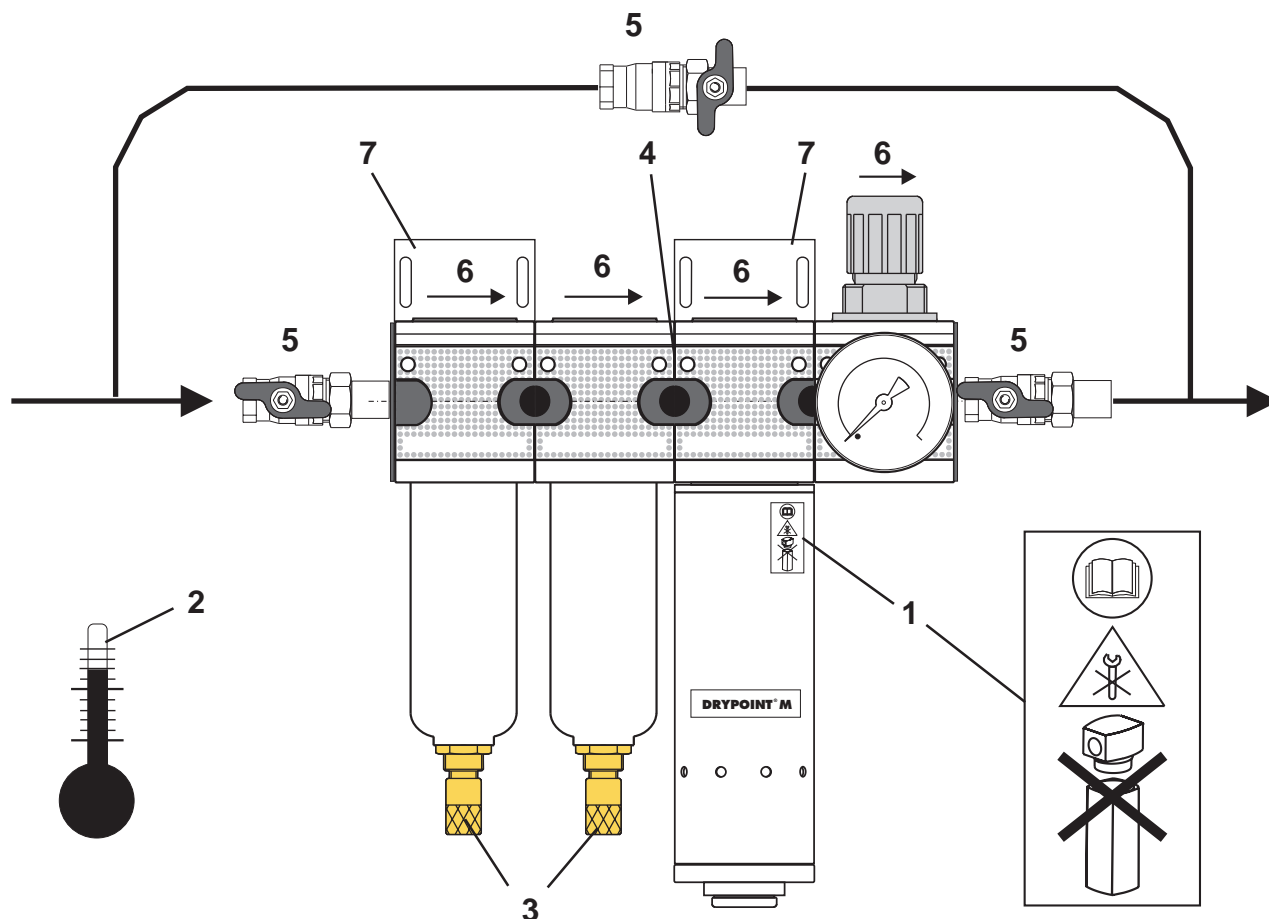
Thank you for deciding in favour of the DRYPOINT® M membrane dryer. Please read the present instructions carefully before installing the DRYPOINT® M unit and putting it into service. The perfect functioning of the DRYPOINT® M membrane dryer - and thus compressed-air quality of a high standard - can only be guaranteed if the instructions and conditions stated here are complied with.

Cher client,

Vous venez d'acquérir un DRYPOINT® M et nous vous en félicitons. Nous vous recommandons de lire attentivement ces instructions avant le montage et la mise en service et de suivre nos conseils. Car, seul le respect des prescriptions et consignes données, peut garantir le parfait fonctionnement du sécheur à membrane DRYPOINT® M et de ce fait, une haute qualité d'air comprimé.

Geachte klant,

Wij danken u voor het aanschaffen van de DRYPOINT® M membraandroger. Wij verzoeken u voor installatie en ingebruikstelling van de DRYPOINT® M membraandroger eerst deze handleiding goed te lezen. Alleen door het opvolgen van de voorschriften wordt een goede werking van de DRYPOINT® M - perslucht - membraandroger en daarmee een hoge persluchtkwaliteit gegarandeerd.



deutsch

1. Sachmängelhaftung

Bitte lesen Sie aufmerksam die nachfolgenden Hinweise.

Nur bei Beachtung dieser Hinweise und Einhaltung der Installationsanleitung kann eine Sachmängelhaftung übernommen werden.

Beim Einsatz der vorgesehenen Filter und einem jährlichen Tausch der Filterelemente besteht auf den Druckluft-Membrantrockner ein Anspruch auf Beseitigung von Sachmängeln innerhalb von 2 Jahren ab Rechnungsdatum.

BEKO haftet nicht für Schäden, die durch unsachgemäße Behandlung, Abnutzung, Lagerung oder sonstige Handlungen des Bestellers oder Dritter auftreten.

Dies gilt insbesondere für Verschleißteile.

2. Temperatur

Der Aufstellungsort muß frostfrei sein, die Temperaturen am Aufstellungsort sowie der Druckluft müssen zwischen +2 und +60 °C liegen.

3. Filter

Beachten Sie die Anforderung an Filter (siehe Seite 8 - 9) : Partikel, Ölanteile und flüssiges Kondensat müssen sicher zurückgehalten werden.

Hierzu ist ein Feinstfilter (0,01 µm) erforderlich. Bei hoher Schmutzbelastung oder starkem Kondensatanfall sind zusätzlich Feinfilter (1 µm) und ggf. Wasserabscheider einzusetzen.

Achtung: Die Filterelemente jährlich wechseln.

4. Rohrleitung zwischen Filter und Membrantrockner

Druckluft-Membrantrockner immer direkt hinter dem letzten Filter anbringen, damit erneute Kondensation vermieden wird. Wenn eine Verbindung zwischen Filter und DRYPOINT M erforderlich sein sollte, so muß diese aus nicht korrodierendem Material sein! **Achtung: Keine verzinkten Rohre bzw. Fittings zwischen Filter und Membrantrockner einsetzen (Korrosion)!**

5. Absperreinheiten

Absperrelemente nicht schlagartig öffnen.
Eine Bypassleitung um die Einheit wird empfohlen.

6. Montage/Inbetriebnahme

Vor Einbau des Membrantrockners Leitungen gründlich reinigen (z.B. durch Ausblasen).

Einbaurichtung von Filtern und Membrantrockner beachten (vgl. Kennzeichnung der Durchflussrichtung auf den Köpfen).

7. Befestigung DRYPOINT M

Im Lieferumfang des Membrantrockners sind Wandhalter enthalten. Die Befestigung so anbringen, dass beim Wechsel der Filterelemente keine Beschädigungen am Membrantrockner auftreten können.

8. Dichtmittel

Achtung: Alle Gewinde vor und am DRYPOINT M- Druckluft-Membrantrockner mit Teflonband eindichten. **Keine flüssigen Dichtmittel benutzen.**

3. Filters

Please observe the relevant filter requirements (see page 8 - 9):

Dirt particles, oil residues and liquid condensate have to be safely retained.

This requires the provision of a CLEARPOINT S super fine filter (0.01 µm). With high dirt loads or large amounts of condensate, it will be necessary to install a CLEARPOINT F fine filter (1 µm) in addition and, where appropriate, a W water separator.

Note: The filter elements need to be replaced once a year.

4. Pipe between filter and membrane dryer

The membrane dryer must be located directly downstream of the last filter in order to avoid renewed condensate formation. If a connection has to be installed between the filter and the DRYPOINT M device, this must be made of non-corroding material! **Note: Do not use any galvanized pipes or fittings between filter and membrane dryer (corrosion)!**

5. Shutoff units

The shutoff elements must not be opened suddenly. It is recommended to install a bypass around the unit.

6. Installation/putting into service

Clean the pipes thoroughly (e.g., by blowing through them) before installing the membrane dryer.

Observe the installation direction of filters and membrane dryer (see marking indicating the direction of flow on the heads).

7. Mounting of DRYPOINT M

The membrane dryer is supplied together with wall brackets. Ensure that replacement of the filter elements cannot damage the membrane dryer.

8. Sealing material

Note: Use Teflon tape to seal off all threaded connections upstream of the DRYPOINT M membrane dryer and on the device itself. **Do not use any liquid sealants.**

english

1. Liability for defects

Please read this information very carefully:

Liability for defects can only be accepted if the following rules and the instructions for installation are complied with.

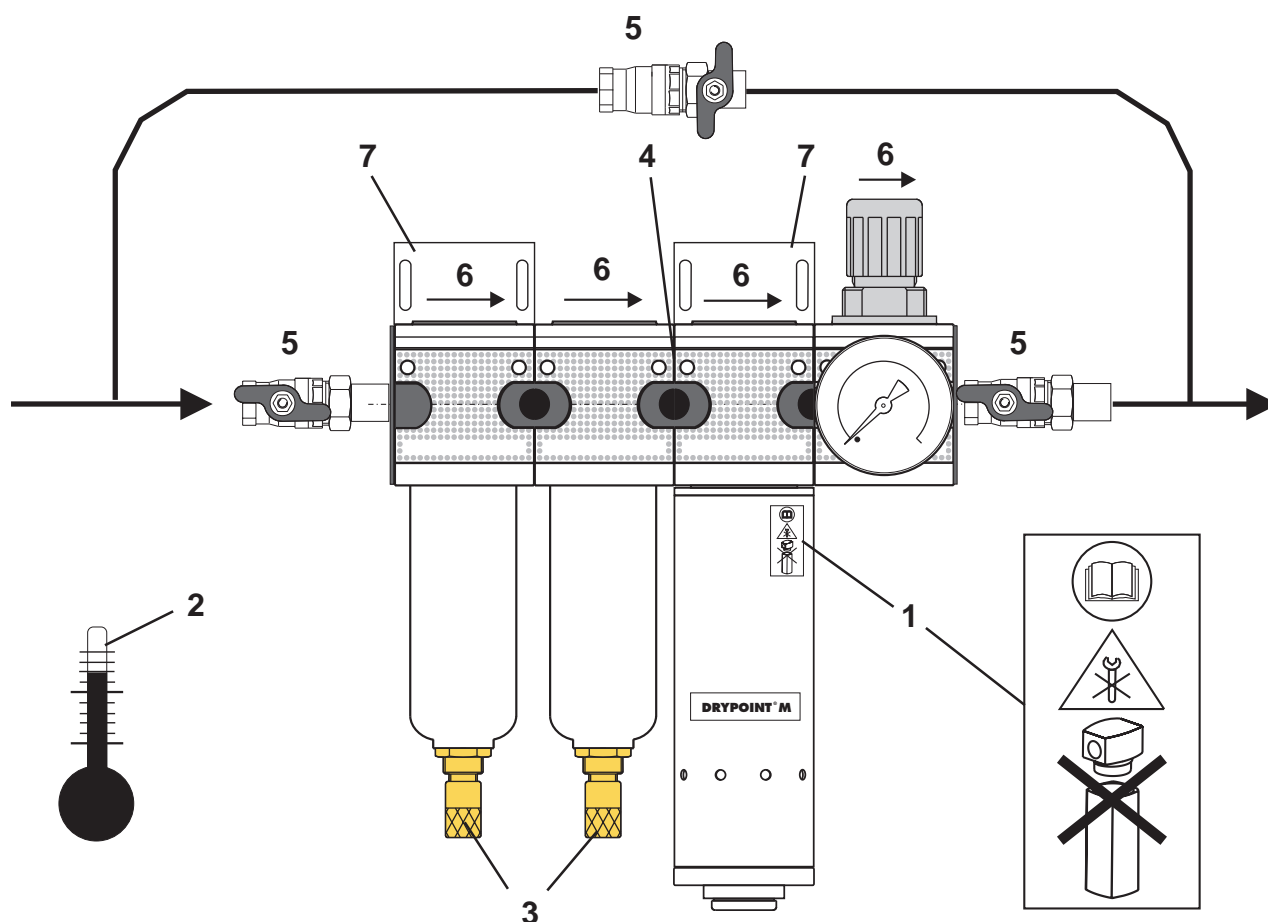
Provided appropriate filters are being used and the filter elements are replaced once a year, the purchaser of the compressed-air membrane dryer shall be entitled to claim remedy of defects within 2 years from date of invoice.

BEKO shall not be liable for damage due to improper or incorrect use, wear, storage or other actions by the purchaser or third parties.

This applies in particular to wearing parts.

2. Temperature

There must be no danger of frost at the place of installation; the temperatures at the place of installation and of the compressed air should be between +2 and + 60 °C.



françe

Responsabilité du fait des produits défectueux

Veuillez lire attentivement les consignes suivantes. La responsabilité du fait des produits défectueux n'est engagée que si ces consignes et instructions de montage et de service sont respectées.

Si les filtres préconisés sont utilisés, et si les éléments filtrants sont remplacés une fois par an, le sécheur d'air comprimé à membrane bénéficie d'une garantie d'élimination des vices pendant une période de 2 ans, à compter de la date de facturation.

BEKO n'engage pas sa responsabilité pour les dégâts occasionnés par une utilisation non conforme, par l'usure, par le stockage ou par d'autres manipulations effectuées par le donneur d'ordre ou un tiers.

Ceci est valable en particulier pour les pièces d'usure.

2. Température

Le lieu d'installation doit être à l'abri du gel, les températures ambiantes ainsi que celle de l'air comprimé doivent être comprises entre +2 et +60 °C.

3. Filtre

Respectez les exigences relatives au choix du filtre (voir page 8 - 9) : les particules solides, les particules d'huile et le condensat liquide doivent être retenus en toute fiabilité.

A cet effet, un filtre submicronique (0,01 µm) est requis. En cas de fortes concentrations en impuretés et de production importante de condensat, il faut utiliser en plus un filtre micronique (1 µm) et le cas échéant un séparateur d'eau.

Attention : Les éléments filtrants doivent être remplacés une fois par an.

4. Conduite entre le filtre et le sécheur à membrane

Installer le sécheur à membrane toujours directement derrière le dernier filtre, pour éviter toute recondensation. Si une conduite devait être nécessaire entre le filtre et le DRYPOINT M, celle-ci devrait être réalisée dans un matériau non soumis à la corrosion ! **Attention : ne pas utiliser de tubes ou raccords galvanisés entre le filtre et le sécheur à membrane (corrosion) !**

5. Vannes d'arrêt

Ne pas ouvrir brusquement les vannes d'arrêt.
La mise en place d'une conduite bypass est recommandée.

6. Installation / mise en service

Avant d'installer le sécheur à membrane, nettoyer soigneusement les conduites (par ex., les souffler à l'air comprimé).

Respecter le sens de montage des filtres et du sécheur à membrane (le sens de circulation est indiqué sur l'enveloppe têtes).

7. Fixation du DRYPOINT M

Les consoles murales font partie du matériel livré avec le sécheur à membrane. Mettre en œuvre la fixation de telle sorte que le sécheur ne risque pas d'être endommagé lors du remplacement des éléments filtrants.

8. Étanchéité

Attention : pour assurer l'étanchéité de tous les filetages, avant et sur le sécheur à membrane DRYPOINT M, utiliser du ruban de téflon. **N'utiliser aucun produit d'étanchéité liquide.**

nederlands

1. Aansprakelijkheid m.b.t. fouten en gebreken aan onderdelen

Gelieve de volgende aanwijzingen zorgvuldig door te lezen.

Alleen bij het in acht nemen van deze aanwijzingen en het opvolgen van de installatieaanwijzing bestaat er aansprakelijkheid op fouten of gebreken aan onderdelen.

Bij gebruik van de filters en een jaarlijkse vervanging van de filterelementen heeft u aanspraak op vervanging van foutieve onderdelen van de perslucht-membraandroger binnen 2 jaar vanaf de datum van de rekening.

BEKO is niet aansprakelijk voor schade die ontstaat door ondeskundige behandeling of opstelling, door slijtage of andere handelingen van de besteller of van derden.

Dit geldt vooral voor verslijtbare onderdelen.

2. Temperatuur

De opstellingsruimte moet vorstvrij zijn, de temperatuur in deze ruimte en van de perslucht moet tussen +2 en +60 °C liggen.

3. Filter

Let op de aanwijzingen m.b.t. geschikte filters (zie pagina 8 - 9):

Deeltjes, oliedeeltjes en vloeibaar condensaat moeten worden tegengehouden.

Hiervoor is een microfilter (0,01 µm) noodzakelijk. Bij een extreme vuilophoping of condensaataccumulatie dienen extra microfilters (1 µm) en eventueel waterafscheiders te worden ingezet.

Opgelet: de filterelementen jaarlijks vervangen.

4. Pijpleiding tussen filter en membraandroger

De membraandroger moet direct achter de laatste filter worden gemonteerd, zodat nacondensatie wordt vermeden. Wanneer een pijpleiding tussen filter en DRYPOINT M noodzakelijk is, moet deze van niet corroderend materiaal zijn vervaardigd! **Opgelet: geen verzinkte leidingen of fittings tussen de filter en de membraandroger monteren, deze kunnen corroderen!**

5. Afsluiter

De afsluiter geleidelijk openen.

Het verdient aanbeveling om een bypassleiding round de unit aan te brengen.

6. Montage/inbedrijfstelling

Vóór de montage van de membraandroger dienen de leidingen zorgvuldig te worden gereinigd (bijv. doorblazen).

Let op de inbouwrichting van de filters en de membraandroger (zie kenmerking van de doorstroomrichting op de koppen).

7. Bevestiging DRYPOINT M

In de leveringsomvang van de membraandroger zijn wandhouders inbegrepen. De bevestiging dient zo te worden aangebracht dat de membraandroger bij het vervangen van de filterelementen niet wordt beschadigd.

8. Afdichtmiddel

Opgelet: Alle schroefdraden vóór en aan de DRYPOINT M – perslucht-membraandroger moeten met teflonband worden afgedicht. **Gebruik géén vloeibare afdichtmiddelen.**

english

Aufbau des Membrantrockners

- A : Kopf (Eingang / Ausgang)
 B : Gehäuse
 C : Boden mit Blindstopfen
 D : Membranelement mit Kernrohr
 E : Düse mit Adapter

Funktion

(1) Feuchte Druckluft tritt durch den Kopf (A) ein und strömt durch das Kernrohr des Membranelements (D) nach unten.

Im Bodenbereich wird die Strömungsrichtung gedreht und die feuchte Druckluft durchströmt die Membranen des Membranelements (D) innen.

(2) Nach dem Membranelement wird kontinuierlich ein Teilstrom der Druckluft abgezweigt und an einer Düse (E) atmosphärisch entspannt.

Durch die Entspannung wird diese Spülluft wesentlich trockener, da sich die in der Druckluft enthaltene Feuchte auf ein Vielfaches des ehemaligen Volumens verteilt.

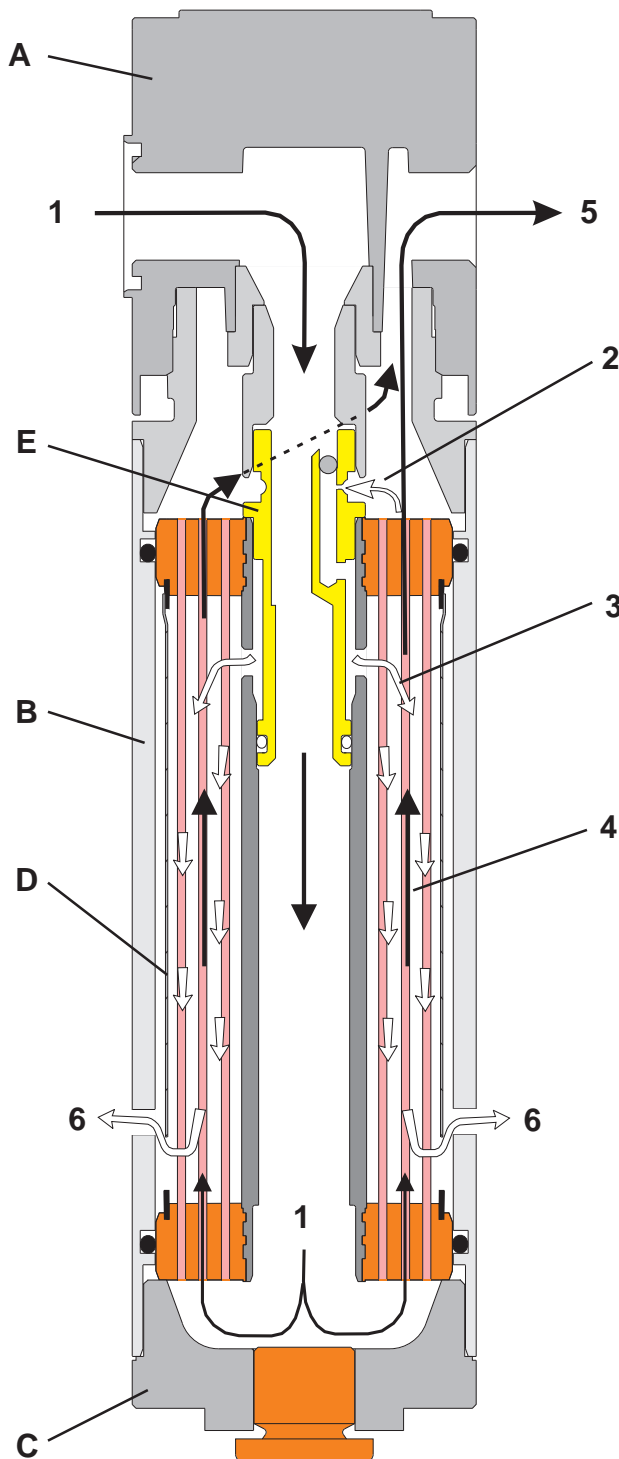
(3) Diese sehr trockene Spülluft wird im Membranelement (D) über die Aussenseite der Membranen geführt und durch die geordnete Lage der Membranen sehr gleichmäßig verteilt.

(4) Dadurch bewegen sich – nur getrennt durch die Membranwandung – zwei Luftströme mit unterschiedlichem Feuchtegehalt im Gegenstrom durch das Membranelement :

Innen die feuchte Druckluft, aussen die trockene Spülluft. Aufgrund des Feuchteunterschiedes diffundiert Feuchtigkeit aus der Druckluft in die Spülluft.

(5) Die Druckluft tritt getrocknet aus dem DRYPOINT M Druckluft-Membrantrockner aus.

(6) Die feuchte Spülluft gelangt in die Umgebung.



english

Membrane dryer layout

- A** : Head (inlet / outlet)
B : Housing
C : Bottom with blanking plug
D : Membrane element with core tube
E : Nozzle with adapter

Function

(1) Moist compressed air enters through the head (**A**) and flows downwards through the core tube of the membrane element (**D**).

In the bottom area, the direction of flow is reversed and the moist compressed air then flows through the membranes of the inner membrane element (**D**).

(2) At the end of the membrane element a partial flow of compressed air is continuously diverted and atmospherically expanded through a nozzle (**E**).

Due to the expansion, the diverted air – referred to as purge air – becomes much drier because the moisture contained in the compressed air is now distributed over a much greater volume.

(3) This extremely dry purge air is channelled through the membrane element (**D**) along the outside of the membranes. Due to the ordered structure of the membranes, the purge air is very evenly distributed.

(4) Consequently, two flows of air with different humidity levels move in a countercurrent direction through the membrane element, separated only by the membrane wall:

inside the moist compressed air, outside the dry purge air. As a result of the humidity difference, moisture diffuses from the compressed air into the purge air.

(5) Dry compressed air flows out of the DRYPOINT M membrane dryer.

(6) Moist purge air is discharged into the environment.

françe

Constitution du sécheur à membrane

- A** : Tête (entrée / sortie)
B : Corps
C : Sol avec obturateur
D : Élément de membranes avec tube support
E : Buse avec adaptateur

Fonctionnement

(1) L'air comprimé humide entre par la tête (**A**) et circule à travers le tube support de l'élément de membranes (**D**), du haut vers le bas.

Dans la zone du fond, le sens de circulation est inversé et l'air comprimé humide circule à l'intérieur des membranes de l'élément (**D**).

(2) Après l'élément à membranes, une partie du flux d'air comprimé est prélevée en continu puis détendue à la pression atmosphérique par une buse (**E**).

Suite à la détente, cet air de balayage devient beaucoup plus sec, étant donné que l'humidité contenue dans l'air comprimé se répand dans un multiple du volume initial.

(3) Cet air de balayage très sec circule au sein de l'élément à membranes (**D**) le long de la face extérieure des membranes et du fait de la position ordonnée des membranes, ce flux d'air est réparti de façon homogène.

(4) C'est ainsi que circulent à contre-courant à travers l'élément à membranes deux flux d'air d'un taux d'humidité différent - séparés uniquement par la paroi des membranes.

A l'intérieur, l'air comprimé humide, à l'extérieur, l'air de balayage sec. La différence d'humidité provoque une diffusion continue de la vapeur d'eau de l'air comprimé vers l'air de balayage.

(5) L'air comprimé sort du sécheur à membrane DRYPOINT M à l'état sec.

(6) L'air de balayage humide est refoulé dans l'atmosphère.

nederlands

Opbouw van de membraandroger

- A** : Kop (ingang / uitgang)
B : Behuizing
C : Bodem met blinde stop
D : Membraanelement met kernbuis
E : Mondstuk met adapter

Functie

(1) Vochtige perslucht treedt in via de kop (**A**) en vloeit naar beneden door de kernbuis van het membraanelement (**D**).

Op de bodem wordt de stromingsrichting omgedraaid en de vochtige perslucht vloeit langs de binnenkant door de membranen van het membraanelement (**D**).

(2) Na het membraanelement wordt continu een deelstroom van de perslucht afgetakt en aan een mondstuk (**E**) atmosferisch geëxpandeerd.

De spoellucht is door de expansie duidelijk droger omdat de vochtigheid in de perslucht zich over een veelvoud van het voormalige volume verdeelt.

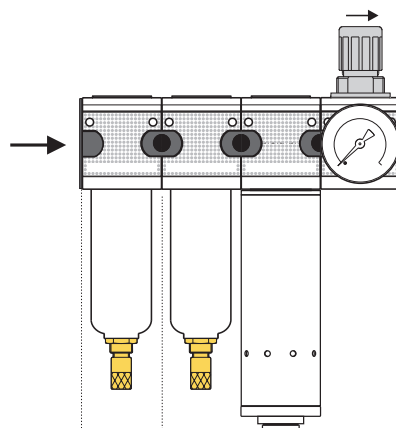
(3) Deze zeer droge spoellucht wordt in het membraanelement (**D**) langs de buitenzijde van de membranen geleid en vanwege de geordende positie van de membranen gelijkmatig verdeeld.

(4) Hierdoor bewegen zich – alleen door de membranenwand gescheiden – twee luchtstromen met verschillende concentraties van vochtgehalte in tegenstroom door het membraanelement:

aan de binnenzijde de vochtige perslucht, aan de buitenzijde de droge spoellucht. Dit verschil in vochtgehalte tussen pers- en de spoellucht zorgt voor een voortdurende opname van vocht in de spoellucht.

(5) De perslucht verlaat de DRYPOINT M persluchtmembraandroger in droge toestand.

(6) De vochtige spoellucht wordt aan de omgeving afgegeven.



hinter Kessel
downstream of receiver
en aval de la cuve
achter ketel

hinter Kältetrockner
downstream of refrigerated dryer
en aval du sécheur frigorifique
achter koeldroger

	Filter 1µm	Filter 0,01µm
ölgeschmiert / oil lubricated lubrifié à l'huile / oliegesmerd	X	X
ölfrei / oilfree non huileux / olievrij	X	
ölgeschmiert / oil lubricated lubrifié à l'huile / oliegesmerd		X
ölfrei / oilfree non huileux / olievrij	X	

deutsch

Eine effektive Partikel- und Kondensatabscheidung sowie eine bestmögliche Ölabscheidung vor dem Membrantrockner sind Grundvoraussetzung für eine sichere Funktion und eine lange Standzeit.

Für die Ölabscheidung ist immer ein Feinstfilter 0,01 µm erforderlich.

Grundanforderungen an die Druckluft für Eintritt in den Membrantrockner :

- kein Kondensat
- keine Partikel größer 1 µm
- Ölgehalt max. 0,01 mg/m³

Beachten Sie bitte die nachfolgend schematisch dargestellten Empfehlungen und Vorgaben für Hauptanwendungen zu den Filtrationsstufen vor dem Membrantrockner.

english

Effective particle and condensate separation as well as optimum oil removal upstream of the membrane dryer are fundamental requirements for the reliable operation and long lifetime of the unit.

For oil separation an 0.01 mm super fine filter needs to be installed.

Basic specifications for compressed-air entering the membrane dryer:

- Free of condensate
- No particles larger than 1 mm
- Residual oil content max. 0.01 mg/m³

It is essential to observe the recommendations and specifications for the filtration stages upstream of the membrane dryer, as set out here schematically in relation to the main applications.

france

La condition requise pour un fonctionnement fiable et une longue durée de vie des membranes est la présence en amont du sécheur, d'une séparation efficace des particules, des condensats et de l'huile en suspension.

Un filtre submicronique 0,01 µm est toujours requis pour la séparation de l'huile.

Exigences fondamentales pour que l'air comprimé puisse entrer dans le sécheur à membrane :

- pas de condensat
- pas de particules supérieures à 1 µm
- teneur en huile max. 0,01 mg/m³

Tenez compte des recommandations et indications représentées sous forme graphique ci-dessous et relatives aux différents étages de filtration en amont du sécheur à membrane.

nederlands

Een effectieve partikel- en condensaatafscheiding en een optimale olieafscheiding vóór de membraandroger is een basisvoorwaarde voor een veilige werking en een lange levensduur.

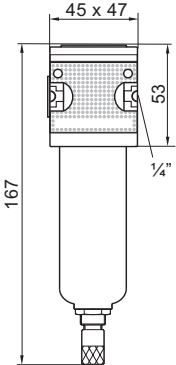
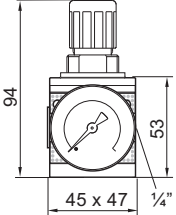
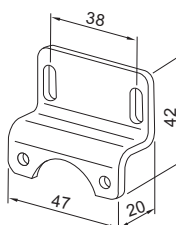
Voor de olieafscheiding is een microfilter 0,01 µm noodzakelijk.

Basiseisen aan de perslucht voor het binnenstromen in de membraandroger:

- geen condensaat
- geen partikel groter dan 1 µm
- oliegehalte max. 0,01 mg/m³

Let op de volgende schematisch weer gegeven aanbevelingen en gegevens over de hoofdtoepassingen van de filtratiestappen vóór de membraandroger.

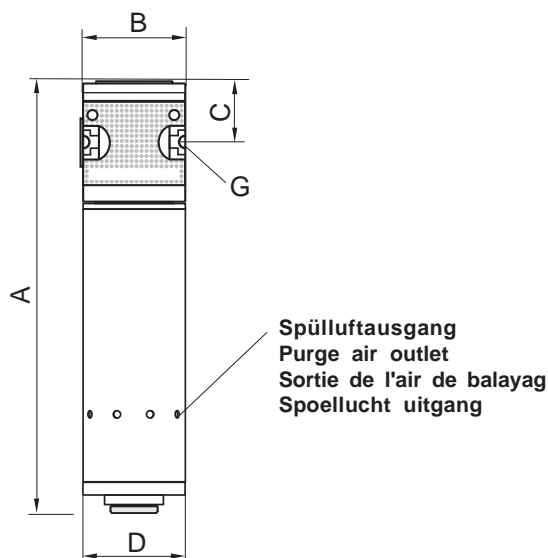
Zubehör • Assessories • Accessores • Accessoires

		Gewicht / Weight Poids / Gewicht	Bestell-Nr. • order ref. N° de com. • Bestelnr.
	Vorfilter / Pre filter / Vorfilter / Vorfilter 1,0 µm mit Schwimmerableiter und Koppelpaket with ball float trap including coupling packet avec purgeur à flotteur et kit d'accouplement met vlotteraftap met aansluitset	0,35	XZ DP MFD 03
	Mikrofilter / Micro filter / Vorfilter / Vorfilter 0,01 µm mit Schwimmerableiter und Koppelpaket with ball float trap including coupling packet avec purgeur à flotteur et kit d'accouplement met vlotteraftap met aansluitset	0,35	XZ DP MFD 07
	Aktivkohlefilter / mit Koppelpaket with coupling packet avec kit d'accouplement met aansluitset	0,30	XZ DP MFD 09
	Druckregler Prefilter Préfiltre Voorfilter	0,45	XZ DP MFD 13
	Wandhalter Wall bracket Fixation murale Wandbeugel	0,15	XZ DP MFD 15

**Technische Daten • Technical Data
Caractéristiques Techniques • Technische Gegevens**

Temperatur Druckluft ¹⁾ Compressed-air temperature Température air comprimé Temperatuur perslucht	+2 ... +60 °C
Umgebungstemperatur ¹⁾ Ambient temperature Température ambiante Omgevingstemperatuur	+2 ... +60 °C
Druckbereich ¹⁾ Pressure range Plage de pression Drukbereik	... 12,5 bar
Druckverlust ²⁾ Pressure loss Perte de charge Drukverlies	0,1 ... 0,3 bar
Feinfilter ³⁾ Fine filter Filtre micronique Fijnfilter	1 µm
Feinstfilter ³⁾ Super fine filter Filtre submicronique Superfijnfilter	0,01 µm
Geräuschpegel Noise level Niveau sonore Geluidsniveau	≤ 45 dB (A)
Einbaulage Installation position Position de montage Montagewijze	senkrecht vertical vertical loodrecht

Werkstoffe / Materials Matériaux / Materiaal	
Membran Membrane Membrane Membranen	Polyethersulfon Polyether sulphone Polyéthersulfone Polyethersulfoon
Vergussmaterial Cast material Pièces moulées Gietmateriaal	Polyurethan Polyurethane Polyuréthane Polyurethaan
Gehäuse Housing Corps Behuizing	Aluminium, eloxiert Aluminium, anodized Aluminium, anodisé Aluminium, geanodiseerd
Kernrohr Core tube Tube support Kernrohr	Aluminium, seewasserbeständig Aluminium, seawater-resistant Aluminium, résistant aux milieux salins Aluminium, zeewaterbestendig
Düse Nozzle Buse Buse	Messing Brass Laiton Messing
O-Ringe O ring Joint torique O-ringen	NBR



¹⁾ bei anderen Bedingungen bitte anfragen Wandhalter
with different conditions, please request
si les conditions diffèrent, consulter le constructeur
bij andere condities, a.u.b. leverancier raadplegen

²⁾ abhängig von der Druckluftdurchflußmenge
depending on compressed-air throughput
dépend du débit d'air comprimé
afhankelijk van de perslucht die erdoor vloeit

³⁾ die Luft darf nach den Filtern kein flüssiges Kondensat
enthalten, Ölgehalt < 0,01 mg/m³
the air must be free from liquid condensate, oil
content < 0.01 mg/m³.
l'air ne doit pas contenir de condensat liquide, teneur en
huile < 0,01 mg/m³
de perslucht mag geen vloeibaar kondensaat bevatten,
oliegehalte < 0,01 mg/m³

Baugröße Size Modèle Model	Abmessungen / Dimensions Dimensions / Afmetingen					Gewicht Weight Poids Gewicht
	A mm	B mm	C mm	D mm	G Zoll	
DM 08 - 19 K	190					0,54
DM 08 - 24 K	240					0,62
DM 08 - 28 K	280	46	27	ø 45	¼"	0,69
DM 08 - 34 K	340					0,78

Leistungsangaben • Performance data Capacités nominales • Capaciteitsgegevens

Die Leistungsdaten und Drucktaupunktabenkungen beziehen sich auf einen **Eintrittsdrucktaupunkt der Druckluft von +35 °C und einen Druck von 7 bar**.

The performance data and the lowering of the pressure dew point (PDP) relate to compressed air with an inlet pressure dew point of +35 °C and a pressure of 7 bar.

Les capacités et les abaissement du point de rosée se rapportent à un **point de rosée sous pression à l'entrée de l'air comprimé de +35 °C et à une pression de 7 bar**.

De capaciteitsgegevens en drukdauwpunten zijn gebaseerd op een **ingangsdauwpunt (ingangstemperatuur en 100% RV) van de perslucht van 35 °C en een bedrijfsdruk van 7 bar**.

Bei abweichenden Betriebsdrücken von 7 bar sind nachfolgende Korrekturfaktoren für den Volumenstrom einzusetzen :

With operating pressures other than 7 bar, the following correction factors should be used for the volumetric flow :

Lorsque la pression de service diverge de la pression nominale de 7 bar, :

Indien de werkdruk afwijkt van 7 bar, kunnen voor de capaciteitsbepaling de volgende correctiefactoren worden gebruikt :

Druck/Pressure/Pression/Druk (bar)	4	5	6	7	8	9	10	11	12
Faktor/Factor/Facteur/Factor	0,39	0,56	0,77	1	1,19	1,4	1,61	1,84	2,07

Beispiel für eine Drucktaupunktabenkung von 35 °C auf 3 °C, DM 08 - 19 K, Typ B :

Eingangsvolumenstrom: 35 l/min (bei 7 bar)

Leistung bei 5 bar: 35 l/min x 0,56 = 19,6 l/min

Example of pressure dew point suppression from 35 °C to 3 °C, DM 08 - 19 K, Type B :

Inlet volumetric flow: 35 l/min (at 7 bar)

Performance at 5 bar: 35 l/min x 0.56 = 19,6 l/min

Exemple de calcul pour un abaissement du PRSP de 35 °C à 3 °C, DM 08 - 19 K, Modèle B :

Débit d'entrée: 35 l/min (à 7 bar)

Capacité à 5 bar: 35 l/min x 0,56 = 19,6 l/min

Voorbeeld: drukdauwpuntsonderdrukking van 35 °C tot 3 °C, DM 08 - 19 K, Type B :

Intredende hoeveelheid lucht: 35 l/min (bij 7 bar)

Capaciteit bij 5 bar: 35 l/min x 0,56 = 19,6 l/min

Typ Type Modèle Type	Spülluft Purge air Air de balayage Spoellucht 4) l/min	7 bar, Drucktaupunktabenkung von 35 °C auf 3 °C 7 bar, pressure dew point suppression from 35 °C to 3 °C 7 bar, abaissement du PRSP de 35 °C à 3 °C 7 bar, drukdauwpuntverlaging van 35 °C af							
		15 °C 5)		3 °C 5)		-10 °C 5)		-20 °C 5)	
		Ein In	Aus Out	Ein In	Aus Out	Ein In	Aus Out	Ein In	Aus Out

DM 08 - 19 K	A	5	50	45	32	27	23	18	--	--
	B	3	31	28	21	18	15	12	12	9
	C	3	--	--	21	18	15	12	12	9

DM 08 - 24 K	A	10	100	90	66	56	49	39	--	--
	B	5	51	46	35	30	27	22	24	19
	C	5	--	--	35	30	27	22	24	19

DM 08 - 28 K	A	15	150	135	100	85	74	59	--	--
	B	10	102	92	70	60	55	45	48	38
	C	7	74	67	52	45	40	33	35	28

DM 08 - 34 K	A	20	200	180	133	113	99	79	--	--
	B	15	153	138	105	90	82	67	72	57
	C	10	106	96	74	64	57	47	50	40

- 4) Toleranz Spülluftmenge : +3 % bezogen auf Eingangs - Volumenstrom
Purge-air supply tolerance : +3 % related to volumetric flow at inlet
Tolérances Débit d'air de balayage : +3 % par rapport au débit d'air à l'entrée
Tolerantie spoellucht : +3 % van de doorstroomhoeveelheid

- 5) Toleranz Drucktaupunkt : +3 K
Pressure dew point tolerance : +3 K
Tolérances Point de rosée sous pression : +3 K
Tolerantie drukdauwpunt : +3 K

Herstellereklärung / QC-Declaration



Hiermit erklären wir, die / Herewith we

BEKO TECHNOLOGIES GMBH
Im Taubental 7, 41468 Neuss, Germany

daß das Produkt, / confirm that the product

Drucklufttrockner / Compressed Air Dryer

in der serienmäßigen Ausführung / in its serial version

DRYPOINT DM 08 – 19 K / 08 – 24 K ...
08 – 28 K / 08 – 34 K ...

gemäß Druckgeräterichtlinie Artikel 9, Absatz 2.2 als ein Druckgerät für Fluide der Gruppe 2 eingestuft ist / is classify according to PED article 9, paragraph 2.2 as a pressure equipment for fluid of group 2.

Beurteilung der Konformität nach Druckgeräterichtlinie Artikel 10, Absatz 1.3/
employed evaluation method of conformity to PED article 10, Paragraph 1.3:

DRYPOINT 08 – 19 K ... 08 – 34 K - keine Modulkategorie / no modul category

da das Druck – Inhalt Produkt < 50barLtr. ist / due to the Vol. pressure result < 50 bar Ltr.

Die Produkte sind gemäß der in den Mitgliedsstaaten geltenden guten Ingenieurspraxis ausgelegt und hergestellt.

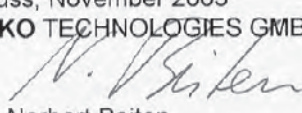
The products have been designed and manufactured to sound engineering practice witch be valid in the member states.

auf der Basis eines nach DIN EN ISO 9001 zertifizierten Qualitätsmanagement-Systems gefertigt wird. / is manufactured based on a Quality Management System which is certified according to DIN EN ISO 9001.

Die gleichbleibende Qualität der Produkte wird durch folgende Maßnahmen in unserem Hause gesichert. / The constant quality of the products is ensured by our house by means of the following measures:

1. Wareneingangsprüfung gemäß Prüfplan /
Inspection at the reception of goods according to quality plan
2. fertigungsbegleitende Prüfungen /
continuous inspections along with assemblage
3. 100%-Endkontrolle / 100%-final inspection with
 - Funktionsprüfung / test of function
 - Drucktest / pressure test
 - Spüllufteinstellung / adjustment of purge air


Neuss, November 2003
BEKO TECHNOLOGIES GMBH

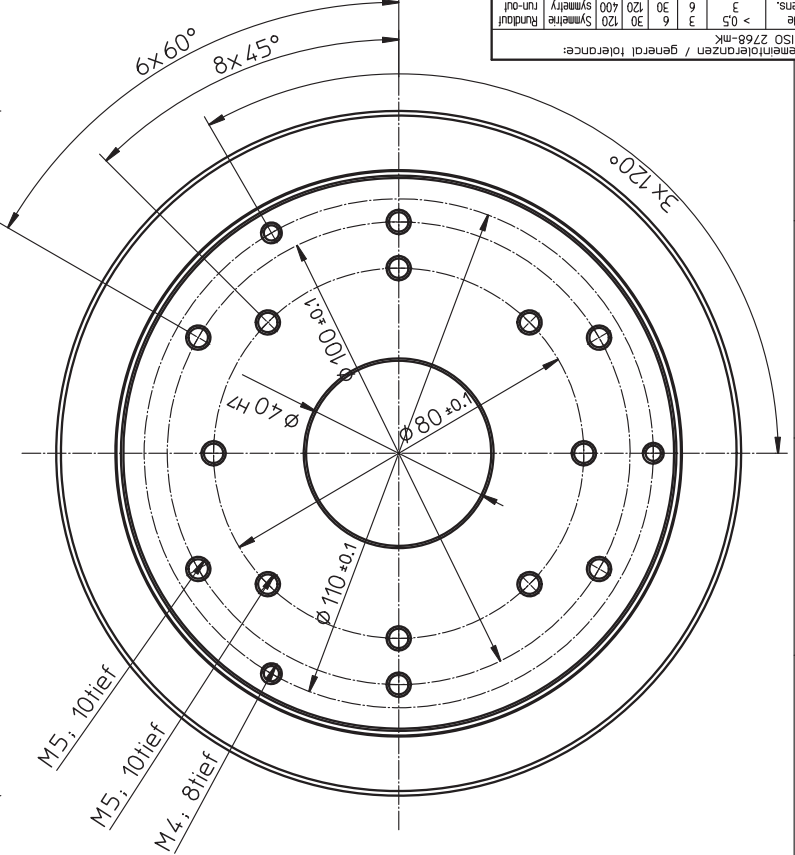
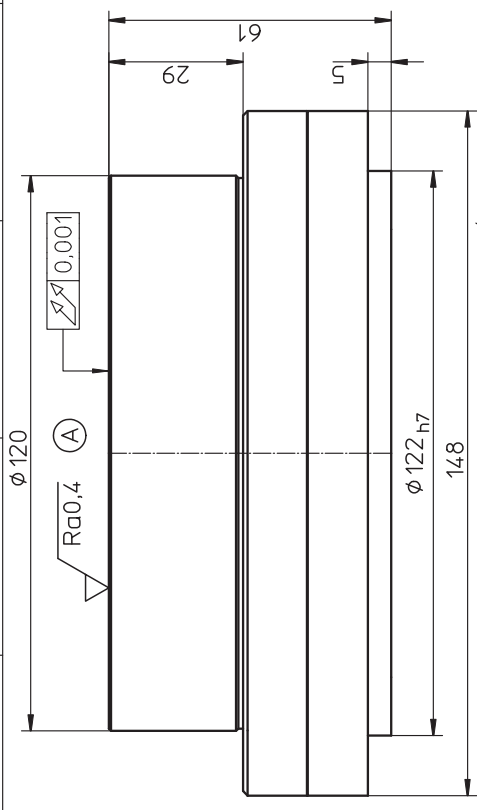

i.V. Norbert Beiten
Leiter Qualitätsmanagement /
Head of Quality Management

13.2 Rotary air bearings, dimensioned drawing

13

See also

 D100_Luftlager_4-000-300A.pdf [► 104]









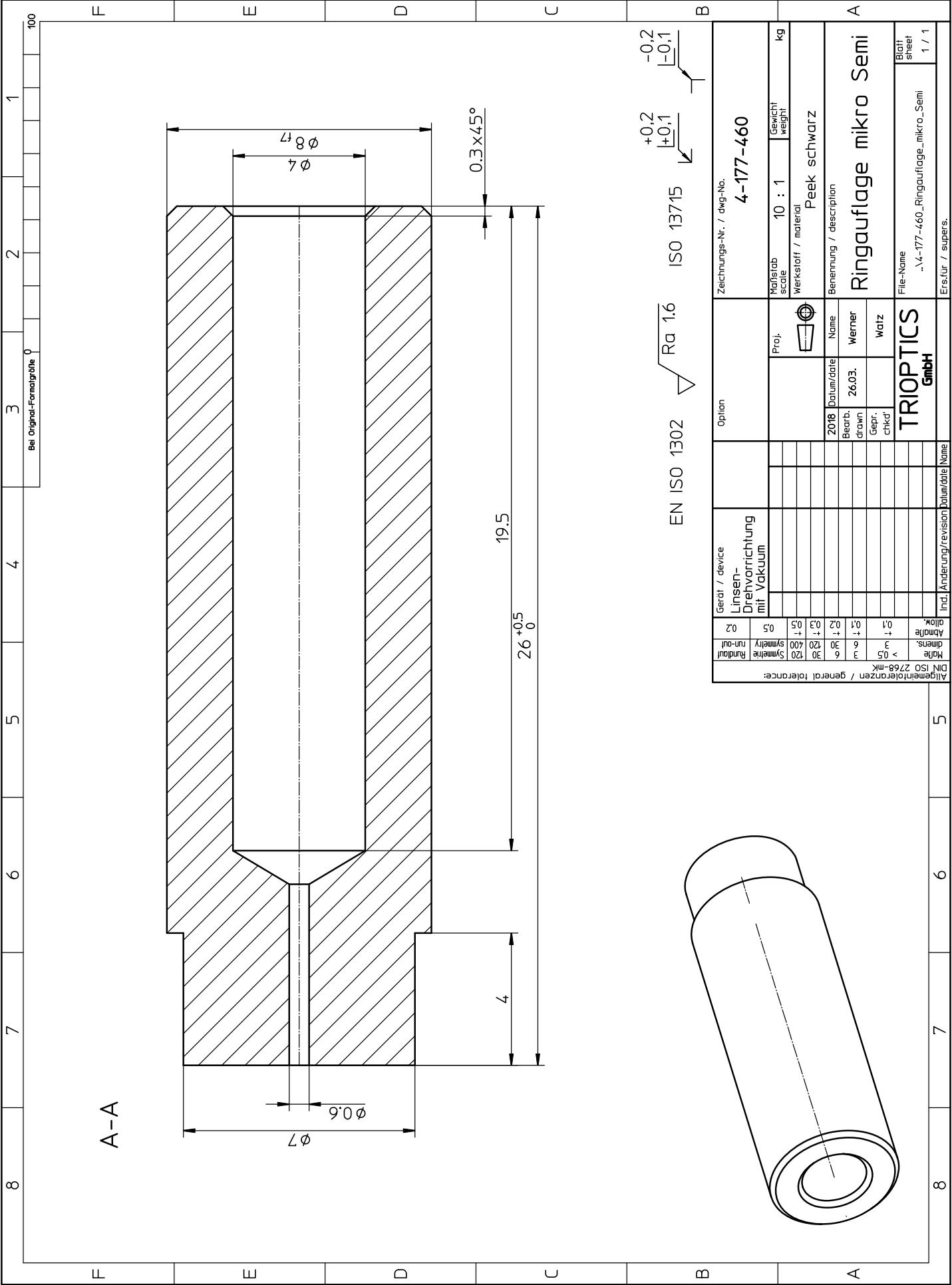
maximale axiale Belastung ca. 800N
 Laufgenauigkeit axial: <0,05µm
 Laufgenauigkeit radial: <0,05µm

EN ISO 1302  Ra 3.2  ISO 13715 $\frac{+0,3}{+0,1}$ $\frac{-0,3}{-0,1}$

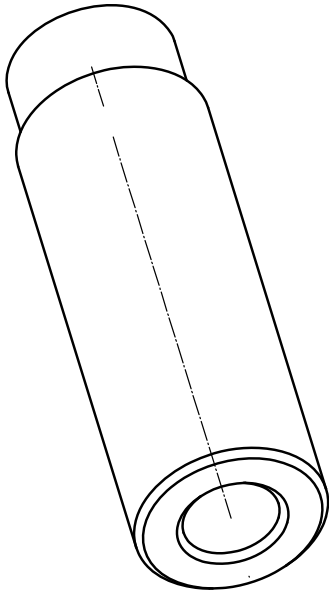
[illegible]

13**13.3 Tip-tilt table, dimensioned drawing****13.4 Accessories for the lens rotation device with vacuum****See also**

-  4-177-460_Ringauflage_mikro_Semi.pdf [► 107]
-  4-177-479_Ringauflage_mikro_Dm4.8.pdf [► 108]
-  4-177-392_Ringauflage_Dm7.pdf [► 109]
-  4-177-021A_Anschlag_Prisma_Dm_5-10_90°.pdf [► 110]
-  4-177-370A_Anschlag_Dm_5-10_90°.pdf [► 111]
-  4-177-372_HM_Stab_3x3x8.pdf [► 112]



Allgemeintoleranzen / general tolerance: DIN ISO 2768-mK		Karte		Abmaße		Gerät / device		Option		Zeichnungs-Nr. / dwg.-No.	
> 0.5		6		0.1		Linse		2018		4-177-460	
120		30		0.2		Drehvorrichtung		Bearb.		Maßstab	
400		120		0.3		mit Vakuum		drawn		10 : 1	
Symmetrie		0.5		0.5				Gepr.		Werkstoff / material	
								chkd		Peek schwarz	
								Name		Benennung / description	
								Werner		Ringauflage mikro Semi	
								Watz		Datei-Nr.	
										.\\4-177-460_Ringauflage_mikro_Semi	
										Blatt	
										sheet	
										1 / 1	
										Ersf. / supers.	



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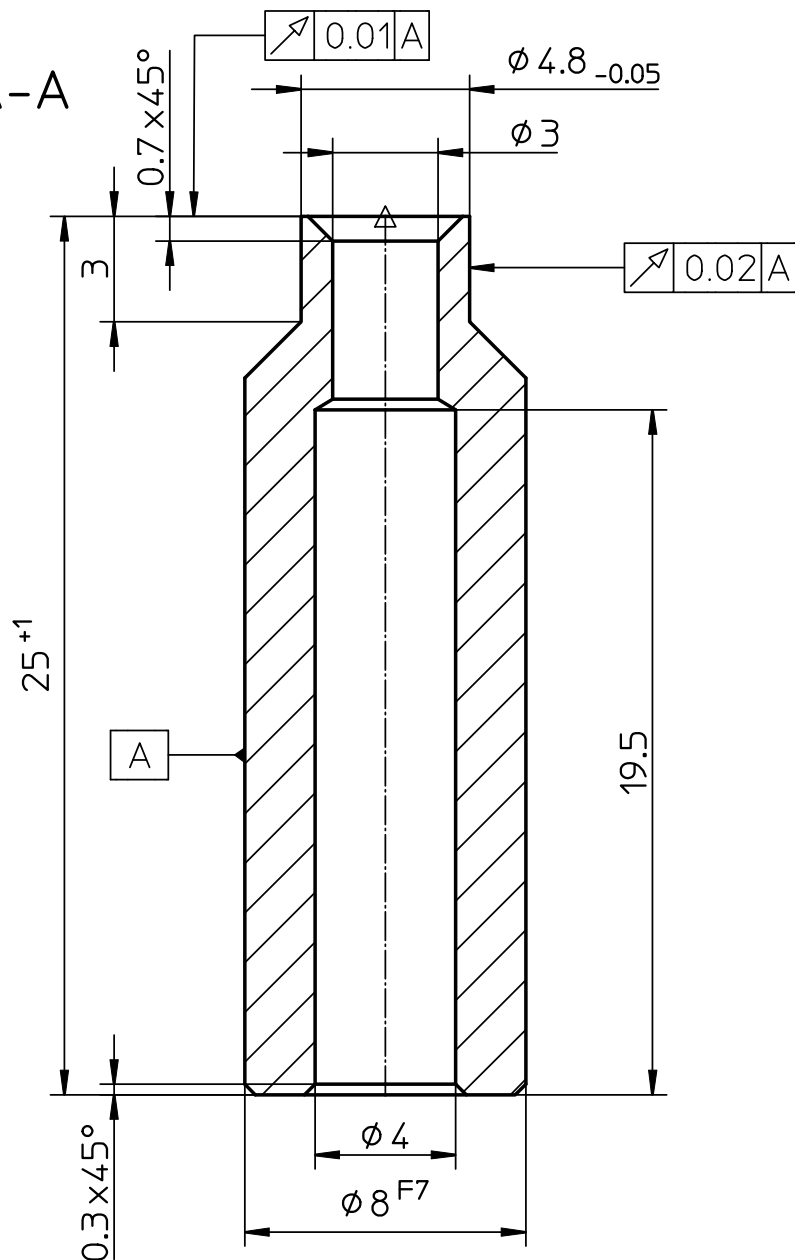
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D

C

B

A




EN ISO 1302

Ra 1.6

ISO 13715

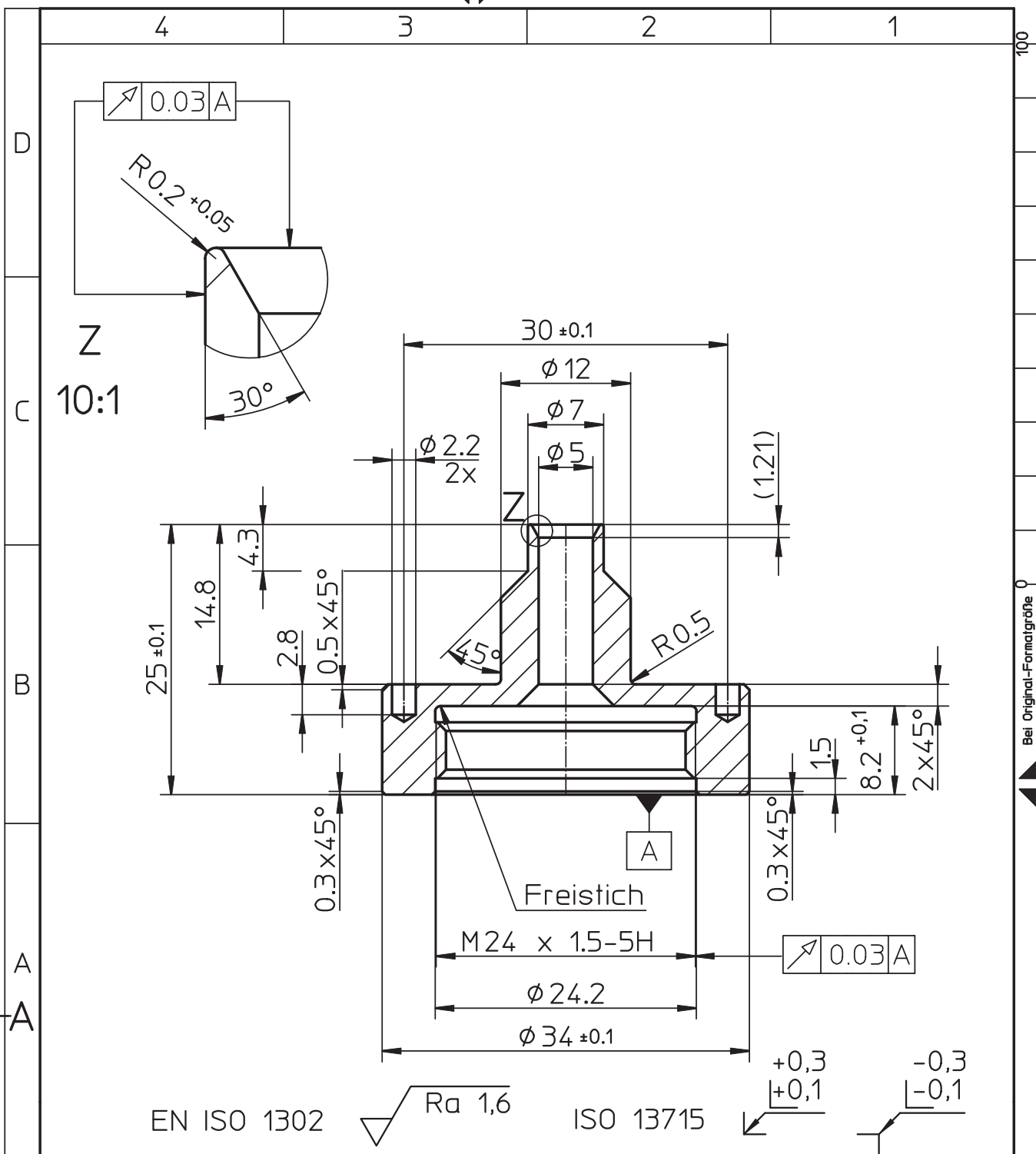
+0,2
+0,1

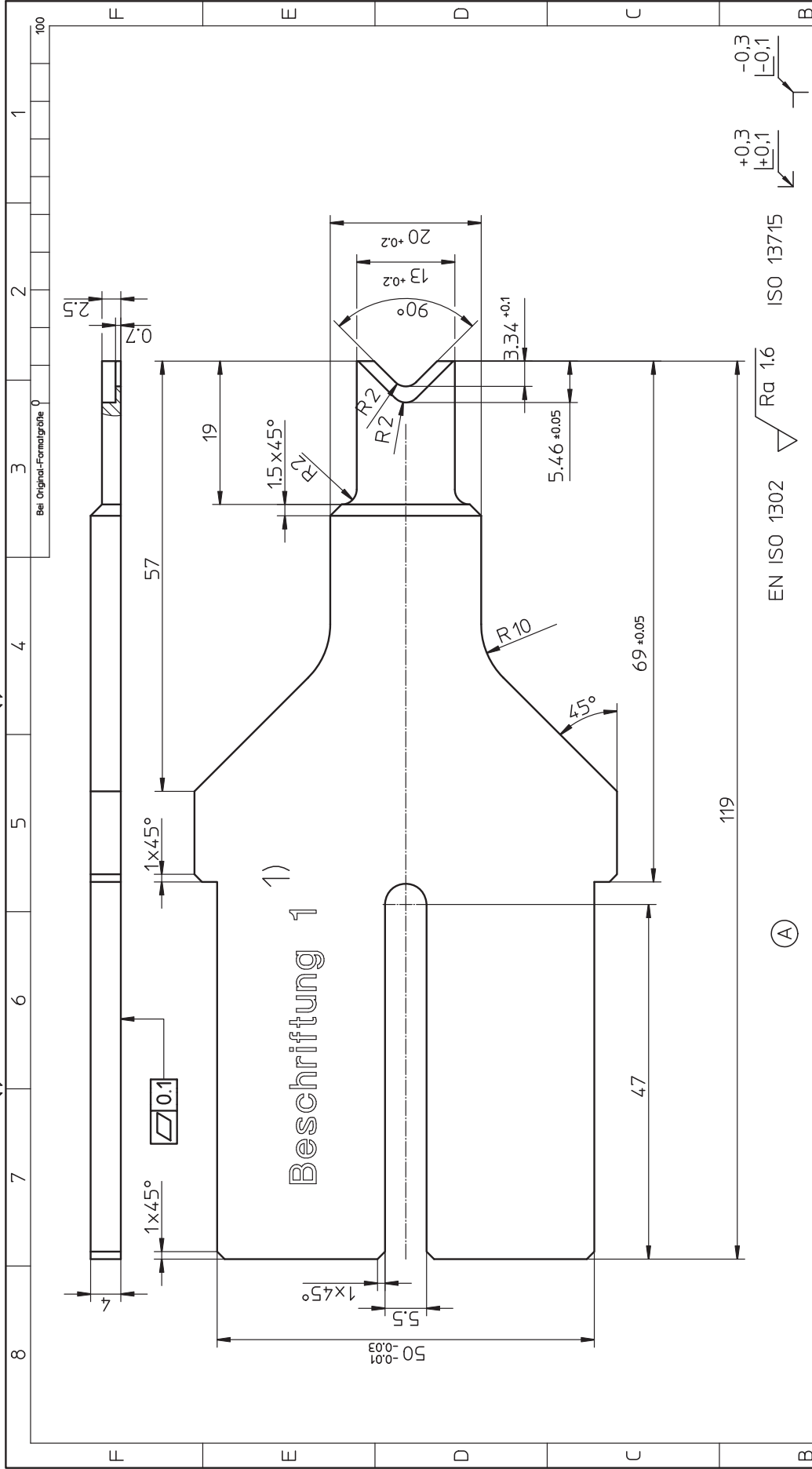
-0,2
-0,1

Allgemeintoleranzen / general tolerances: DIN ISO 2768-mK										Gerät / device Linse- Drehvorrichtung mit Vakuum				Option		Zeichnungs-Nr. / dwg-No. 4-177-479					
Maße dimens.	Abmaße allow.	+	3	6	30	120	Symmetrie symmetry	Rundlauf run-out	0.2					Proj. 	Maßstab scale		5 : 1	Gewicht weight		kg	
															Werkstoff / material PEEK schwarz						
															Benennung / description Ringauflage mikro Dm4.8						
													2018	Datum/date	Name						
												Bearb. drawn	27.03.	Werner							
													Gepr. chkd'		Watz						
													TRIOPTICS			File-Name			..4-177-479_Ringauflage_mikro_Dm4.8		Blatt sheet 1 / 1
												GmbH									
																Ers.für / supers.					
Ind.	Änderung/revision	Datum/date	Name																		

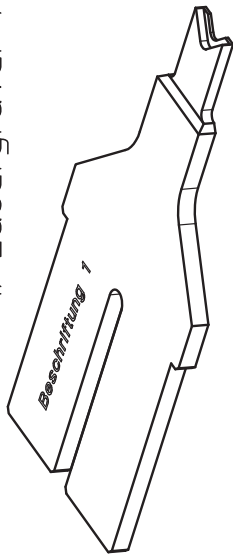
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A diagram of a horizontal beam balanced on a central triangular fulcrum. A vertical line passes through the fulcrum. On the left end of the beam, the letter 'A' is written. On the right end of the beam, the letter 'A' is written.

[illegible]



1) Lasergravur Ø 5-10 90°



Gerät / device Linse- Drehvorrichtung mit Vakuum		Option		Zeichnungs-Nr. / dwg-No. 4-177-370A	
2016 Bearb. drawn		Name Maidenhauer		Maßstab scale 2 : 1	
Gepr. chkd		Datum/date 12.01.		Werkstoff / material EN AW 6082 / AlMgSi1 blau eloxiert	
Format A3		Witz 1102.		Benennung / description Anschlag Dm 5-10 90°	
A Bezeichn. ged. Ind. Änderung/revision		Date 18.04.18		File-Name 4-177-370A_Anschlag_Dm_5-10_90°	
CS		Name		Blatt sheet 1 / 1	

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D

C

B

A

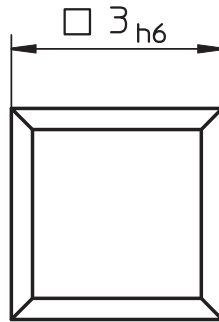
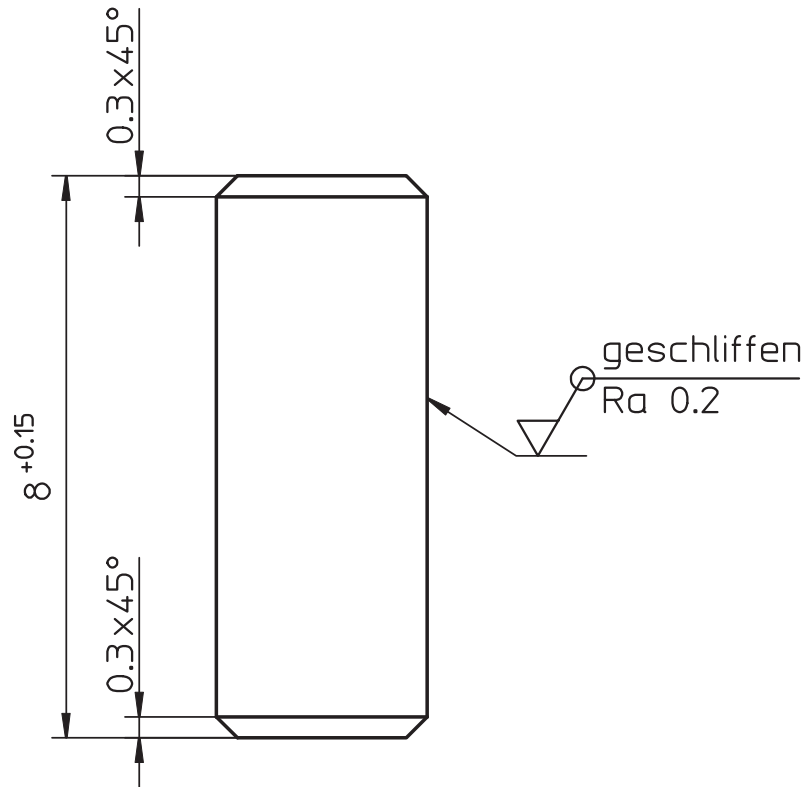
4

3

2

1

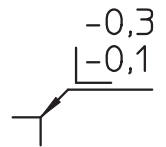
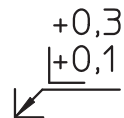
100



EN ISO 1302



ISO 13715



Allgemeintoleranzen / general tolerances: DIN ISO 2768-mK	Maße dimens.	> 0,5 3	3	6	30	120	Symmetrie symmetry	Rundlauf run-out	0,2
	Abmaße allow.	++	0,1	++	0,2	++	0,3	++	0,5
Gerät / device Linsen- Drehvorrichtung mit Vakuum									

13.5 CE Declaration

13

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