

OptiCentric® 100 Dual

Advanced Lens Centering Testing of Lenses and Complex Optical Systems

TRIOPTICS developed the principle of the double measurement head for aligning, assembling and testing complex and multi-lens assemblies. In the copyright-protected OptiCentric® 100 Dual design, a second measurement head is additionally installed under the air bearing. Its travel equals 250 mm.

Advantages of the OptiCentric® Dual System:

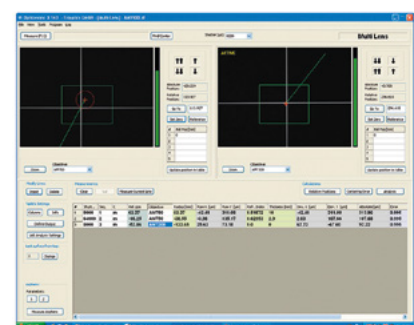
- Doubling of measurable surfaces during centering error testing within lens assemblies with the MultiLens software module.
 - VIS lens assembly: up to 40 surfaces
 - IR lens assembly up to 15 surfaces, depending on sample and with corresponding IR measurement head (OptiCentric®100 Dual IR)
- Ideal in combination with the MultiLens software module: centering measurement of complex lens assemblies, as well as lens groups within an optical system.
- The upper and lower measurement head determine the lens centering of the sample within one measurement
- Correction of the centering error of two optical surfaces in the x and y direction in real time
- Optional: Measurement of aspheres in combination with the AspheroCheck module

Additional Systems with Second Measurement Head:

- OptiCentric® 3D 100 Dual
- OptiCentric® 100 Dual IR
- OptiCentric® 3D 100 Dual IR

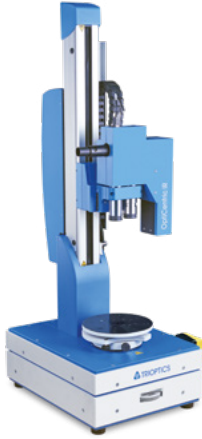


OptiCentric® 100 Dual



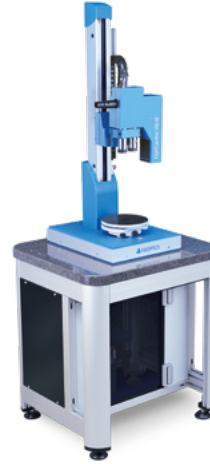
Screenshot with live images of the upper and lower measurement heads

Combinations of the Previously Presented Systems



OptiCentric® 3D 100 IR

- Lens centering testing
- Center thickness and air gaps measurement
- IR-measurement head (VIS-MWIR or VIS-LWIR)



OptiCentric® 100 Dual IR

- Lens centering testing
- IR-measurement head (VIS-MWIR or VIS-LWIR)
- Second measurement head setup underneath the air bearing



OptiCentric® 3D 100 Dual

- Lens centering testing and assembly of lenses
- Center thickness and air gaps measurement
- Second measurement head setup underneath the air bearing



OptiCentric® 3D 100 Dual IR

- Lens centering testing
- IR-measurement head (VIS-MWIR or VIS-LWIR)
- Center thickness and air gaps measurement
- Second measurement head setup underneath the air bearing

Technical Data OptiCentric® 100

Legend: ☒ Standard configuration ☐ Optional configuration

	OptiCentric® 100	OptiCentric® 100 IR	OptiCentric® 3D 100	OptiCentric® 100 Dual	OptiCentric® MultiCentric® Cementing
Measurement accuracy ¹	0.1 µm	1 – 2 µm	0.1 µm	0.1 µm	0.1 µm
Maximum sample weight	Air bearing 20 kg Lens Rotation Device 2 kg				
Maximum sample diameter	Air bearing 0.5 – 225 mm Lens Rotation Device 0.5 – 200 mm				
Optimal sample diameter	0.5 – 120 mm				
Lens rotation					
Air bearing	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lens Rotation Device	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Motorized stages²					
450 mm	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
250 mm, 550 mm oder 990 mm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Reflection Transmission					
Measurement in reflection	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Measurement in transmission	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Measurement head					
Visual measurement head	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IR measurement head (VIS-MWIR or VIS-LWIR)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MultiCentric® measurement head					<input type="checkbox"/>
Additional upgrades					
Center thickness and Air Gap Measurement	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Dual upgrade (2nd measurement head)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Effective Focal Length, Flange Focal Length, Radius, on-axis MTF (OptiSpheric® Upgrade)	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
Asphere axis measurement, AspheroCheck	<input type="checkbox"/>			<input type="checkbox"/>	
Cylinder Lens measurement, CylinderCheck	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Angle measurement, OptiAngle	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
Workstation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
Upgrade for Lens Alignment and Cementing - on arbor or with respect to the optical axis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

¹ Under stable environmental conditions at 100 mm height above the surface of the air bearing

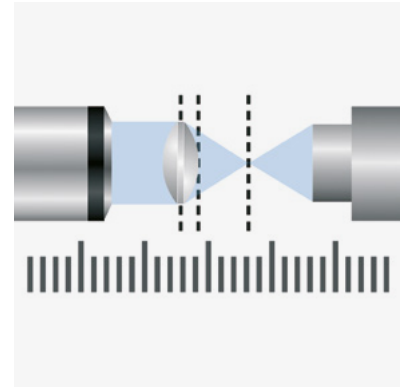
² Manual stages upon request

Upgrades for Special Measurement Tasks

OptiSpheric® Upgrade

With an OptiSpheric® Upgrade, an OptiCentric® system also measures the following parameters

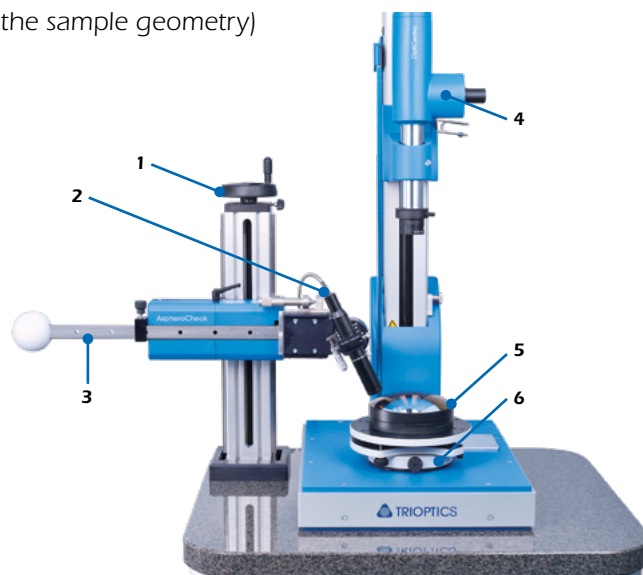
- Effective Focal Length (EFL)
- Back Focal Length (BFL)
- Flange Focal Length (FFL)
- Radius of curvature
- Modulation Transfer Function (MTF) on-axis



AspheroCheck: Measurement of Aspheres

AspheroCheck, patent application 10 2006 052.047.5-5, is a hardware and software module that measures the inclination and position of an asphere axis to a given reference axis. The upgrade is characterized by:

- Measurement in reference to the optical axis of the asphere or to a reference axis
- Specified reference axis according to DIN ISO 10110-6
- Measurement of lenses with one or two aspherical surfaces
- Sample diameters from 2 mm
- Accuracy up to 5 arcsec (depending on the sample geometry)
- Contact-free measurement



1. Height adjustment
2. AspheroCheck-Sensor
3. Adjustment of lateral position (x)
4. Focusable autocollimator
5. Sample
6. Tilt and translation table
with air bearing

OptiCentric® 100 with AspheroCheck

CylinderCheck: Measurement of Cylinder Lenses

CylinderCheck is a hardware and software module for measuring the centering error of cylindrical surfaces without contact. Depending on application and OptiCentric® configuration, the following parameters can be detected with the CylinderCheck module:

- Measurement of wedge errors on cylindrical single lenses
- Measurement of the distance between the vertex line and a reference edge on rectangular cylindrical single lenses
- Measurement of the angle between the vertex line and a reference edge on a rectangular cylindrical single lens
- Measurement of double cylindrical single lenses („clocking angle“ measurement)
- Lens alignment and bonding of cylindrical single lenses in a cell
- Measurement of lens assemblies with cylinder lenses



OptiCentric® 100 with
CylinderCheck module

Upgrade for the Measurement of Flat Optics

The OptiAngle® software module expands the OptiCentric® system into a tool for angle measurement. The following parameters can be measured

- Wedge angles
- 90°-prisms
- Parallelism of flat plates
- Deflection angle through wedges and prisms
- Tilt angle of mirrors
- Wobble error of rotating glass plates

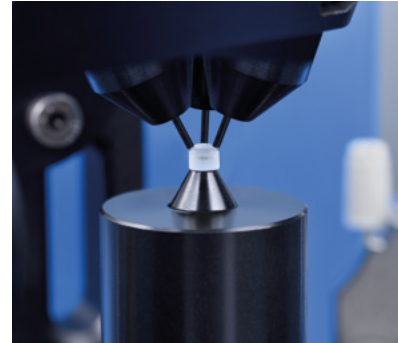


An operator measures
a cylinder lens

Manual and Automatic Alignment, Cementing and Bonding with OptiCentric® 100 Systems

All OptiCentric® 100 systems are used for alignment, cementing and bonding. TRIOPTICS continually develops in this field in order to optimize this complex and error-prone process for the user.

The SmartAlign software module provides a significant contribution to the manual as well as automated alignment processes. With the SmartAlign software module the lens is aligned fast and directly to the desired axis.



Advantages of the Automated Alignment, Cementing and Bonding Process

Manual alignment processes have long since been established in optics and are mastered by experienced workers with a high degree of accuracy and speed; however, automated processes offer significant advantages:

- Continually uniform quality,
- Alignment accuracy of better than 1 μm , regardless of the operator
- Faster and more direct process thanks to SmartAlign software module
- Cementing and bonding from micro-optics to microlithography optics (depending on configuration of the OptiCentric® system)



OptiCentric® Cementing cements two hemispherical lenses of different diameters



Employee performing automated lens alignment and cementing

OptiCentric® Cementing

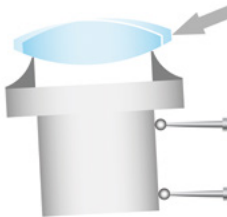
Efficient and Highly Accurate, Automated Cementing

With the OptiCentric® Cementing system, TRIOPTICS has developed an automated production device for lens alignment and cementing that significantly increases throughput, greatly reduces waste and simultaneously achieves higher alignment accuracy.

OptiCentric® Cementing is available in two versions:



**OptiCentric® Cementing for
lens alignment and cementing
with respect to the optical axis**



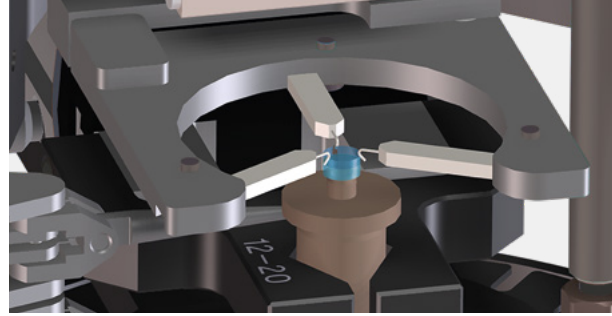
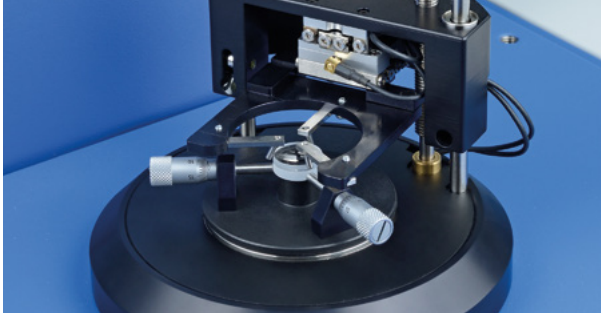
**OptiCentric® Cementing
for alignment on an arbor
with the arbor axis as reference**



At left, OptiCentric® Cementing as stand-alone system; at right, integrated in the workstation

Depending on Lens geometry, the OptiCentric® Cementing system is equipped with an alignment unit for the alignment process:

Alignment Unit Standard



left: alignment with respect to the optical axis, right: alignment with respect to the arbor axis, both with alignment unit standard

An OptiCentric® Cementing system equipped with the Alignment Unit Standard cements lenses with a geometry of $R/D \geq 0.7^1$. The unit can be easily customized to different sample geometries and is recommended when lenses must be aligned and cemented with respect to the optical axis or with respect to the arbor axis and the lens design is frequently changed.

¹ D = Lens diameter, R = curvature radius of the inside surface in doublets

Alignment Unit Advanced



For optimal cementing results, the radial positions of the actuators can be adjusted.

The Alignment Unit Advanced was developed in order to overcome the limitations of the Alignment Unit Standard. An OptiCentric® Cementing system equipped with the Alignment Unit Advanced aligns all lens geometries, including:

- Hemispherical lenses
- Lenses with $R/D < 0.7$
- Doublets in which the edge of the upper lens is not accessible
- Lenses with close alignment tolerances
- Lenses in which the cement wedge is especially critical

MultiCentric® Cementing

The Guarantee for Increasing Lens Alignment and Cementing Productivity

The MultiCentric® Cementing system is an OptiCentric® Cementing system with an integrated MultiCentric® measurement head. It provides the highest degree of productivity in optics production.

The MultiCentric® measurement head simultaneously measures three centers of curvature, reducing the duration for measurement and alignment to less than 10 sec. The measurement head is therefore particularly well suited for:

- Lens alignment and cementing of doublets in series production
- Series testing of identical doublets

Every OptiCentric® Cementing system can be upgraded with this measurement head as an upgrade.

Workstation

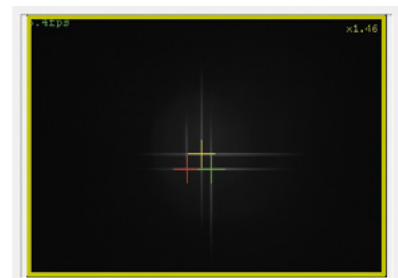
As a general rule, all devices of the OptiCentric® 100 series can be integrated in the workstation. Accessories, PC and various controllers in particular can be efficiently attached and stored in the specially developed table design. This makes daily work with the OptiCentric® systems easier and adds both efficiency and ergonomics to the workflow.

Cementing Upgrade

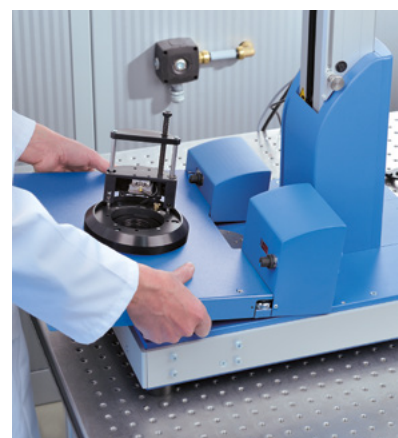
Every OptiCentric® 100 system equipped with an air bearing can be upgraded for highly precise, automated alignment and cementing of lenses without having to invest in a new system.



A MultiCentric® Cementing system is integrated in the ergonomic workstation.



Live image of a MultiCentric® measurement with three centers of curvature



OptiCentric® Cementing Upgrade

Technical Data OptiCentric® & MultiCentric® Cementing

	OptiCentric® Cementing Lens Alignment with respect to the optical axis	OptiCentric® Cementing Lens Alignment on arbor	MultiCentric® Cementing Lens Alignment with respect to the optical axis ³
Base unit	OptiCentric® 100 with air bearing and setup for aligning with respect to optical axis	OptiCentric® 100 with air bearing and setup for Lens Alignment and cementing on arbor	OptiCentric® 100 with air bearing and setup for aligning with respect to optical axis, MultiCentric® measurement head
Alignment Unit Standard			
Sample geometry ¹	$R/D \geq 0.7$	$R/D \geq 0.7$	$R/D \geq 0.7$
Alignment accuracy	better than 2 μm	better than 2 μm	better than 2 μm
Lens diameter ²	4 – 90 mm	4 – 90 mm	4 – 90 mm
Time required to change the sample type (predefined sample)	10 sec	10 sec	10 sec
Cycle time, OptiCentric® 100 measurement head	1 min (three surfaces)	10 sec (1 surface)	10 sec (three surfaces)
Alignment Unit Advanced			
Sample geometry	All geometries	Upon request	All geometries
Alignment accuracy	better than 1 μm		better than 1 μm
Lens diameter ²	5 – 100 mm		5 – 100 mm
Time required to change the sample type (predefined setup)	5 min		5 min
Cycle time	1 min		10 sec (three surfaces)

¹ D = lens diameter, R = curvature radius of inside surface with doublets

² Other diameters upon request

³ Optimized for the measurement of three centers of curvature,
lens alignment and cementing on arbor is possible

OptiCentric® Bonding 2D

Fully Automatic Centering Testing,
Automated Alignment and Bonding in
Two Degrees of Freedom

Modern lens assemblies increasingly consist of bonded components, which not only reduces costs but also saves on space and weight.

The OptiCentric® Bonding 2D tilts or shifts a lens in the cell so that the optical axis corresponds with the cell axis as much as possible

Advantages of OptiCentric® Bonding 2D

- Alignment accuracy of better than 2 μm (tilting or shifting)
- Highly accurate alignment of a single lens in the cell or assembly of a lens system in two degrees of freedom
- Fully automatic, PC-controlled bonding process: measuring, aligning, controlling of bonding dispenser and UV curing
- Alignment and bonding based on the SmartAlign software module
- Equipped with three actuators on z stepper motor stage for precise alignment of the lens
- Process time 2 min. (alignment and bonding process)



OptiCentric® Bonding 2D



OptiCentric® Bonding with three actuators for alignment of the lens in the cell

OptiCentric® Bonding 5D

Assembly, Bonding and Test of Precision Optics
Highly Accurately in Five Degrees of Freedom

The OptiCentric® Bonding 5D station was developed to achieve the maximum degree of accuracy when aligning and bonding lens systems.

The system aligns a lens within a cell automatically so that the optical axis of the lens and the symmetry axis of the cell correspond with respect to tilt and shift. The lens does not sit within the cell, but can instead be adjusted to any desired axis on a lens holder with ring chuck.

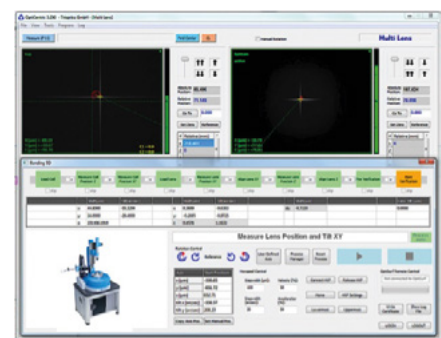
In addition, the Bonding 5D station determines the axial distance in the z direction between a reference surface, such as the top flange surface of the cell, and the lens vertex by means of the integrated OptiSurf® low-coherence interferometer and then shifts the lens to the target position.



OptiCentric® Bonding 5D

Advantages of OptiCentric® Bonding 5D

- Alignment of a lens in a cell in 5 degrees of freedom
- Positioning accuracy of the system:
 - $x/y/z < 1 \mu\text{m}$
 - $\theta_x, \theta_y < 2 \text{ arcsec}$
 (Alignment accuracy of the lens depends on the sample)
- Short cycle time: $< 5 \text{ min}$
(without applying adhesive and UV curing)
- Fully automatic, PC-controlled alignment and bonding process
- Stable process which is independent of the user's qualifications
- Simple and fast changeover to other sample geometries



The software of the OptiCentric® Bonding 5D system leads the operator in a simple and intuitive way through the assembly and bonding process

Technical Data OptiCentric® Bonding 2D & Bonding 5D

		OptiCentric® Bonding 2D	OptiCentric® Bonding 5D
Application		Bonding in 2 degrees of freedom Alignment with three actuators	Bonding in 5 degrees of freedom
Max. diameter of the Lens		200 mm	10 – 150 mm ¹
Max. diameter of the cell		10 – 200 mm	20 – 260 mm ¹
Lens weight		< 10 kg	1 kg ¹
Cell weight		< 10 kg	20 kg ¹
Measuring accuracy	x/y (Lens)	0.1 µm	< 0.1µm ²
	z (Lens)	no (optional)	< ±1 µm
	x/y (cell)	< 0.2 µm	< 0.2 µm
Positioning accuracy		x or y: 2 µm	x, y, z: < 1 µm ²
			0x, 0y < 2 arcsec
Process time		2 min ^{2,3}	< 5 min ^{2,3}
Air bearing		✓	✓
Motorized stage		✓	✓
Measurement in reflection		✓	✓
Visual measurement head		✓	✓
OptiSurf		○	✓

¹ others upon request, ² depending on lens geometry, ³ without UV curing



Software-Modules

MultiLens and SmartAlign are the two powerful software modules which make the OptiCentric® a highly precise system for testing complex lens assemblies and for manual or automated cementing and bonding.

MultiLens

MultiLens is the software module for measuring and aligning lens assemblies.

The centering errors of each individual surface of a lens assembly and the centering of the system are determined non-destructively.

SmartAlign

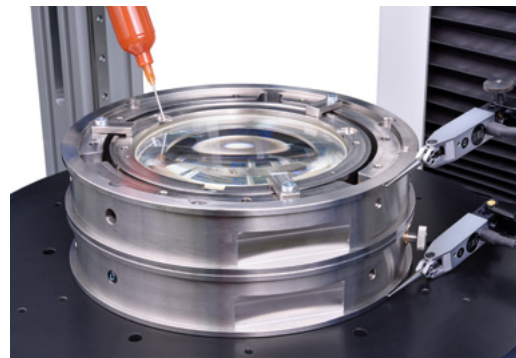
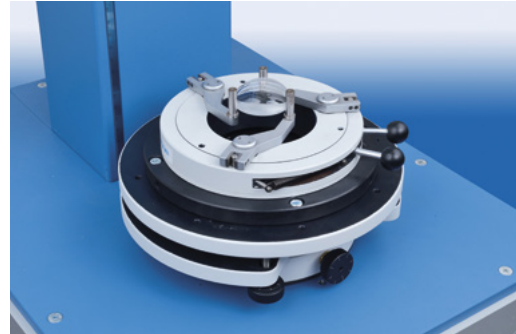
With the SmartAlign module, the position of the measured centering error is analyzed in reference to a user-defined optical or mechanical axis. This unique tool is used particularly successfully for cementing & bonding applications.



Screenshot of the OptiCentric® Cementing process

Accessories

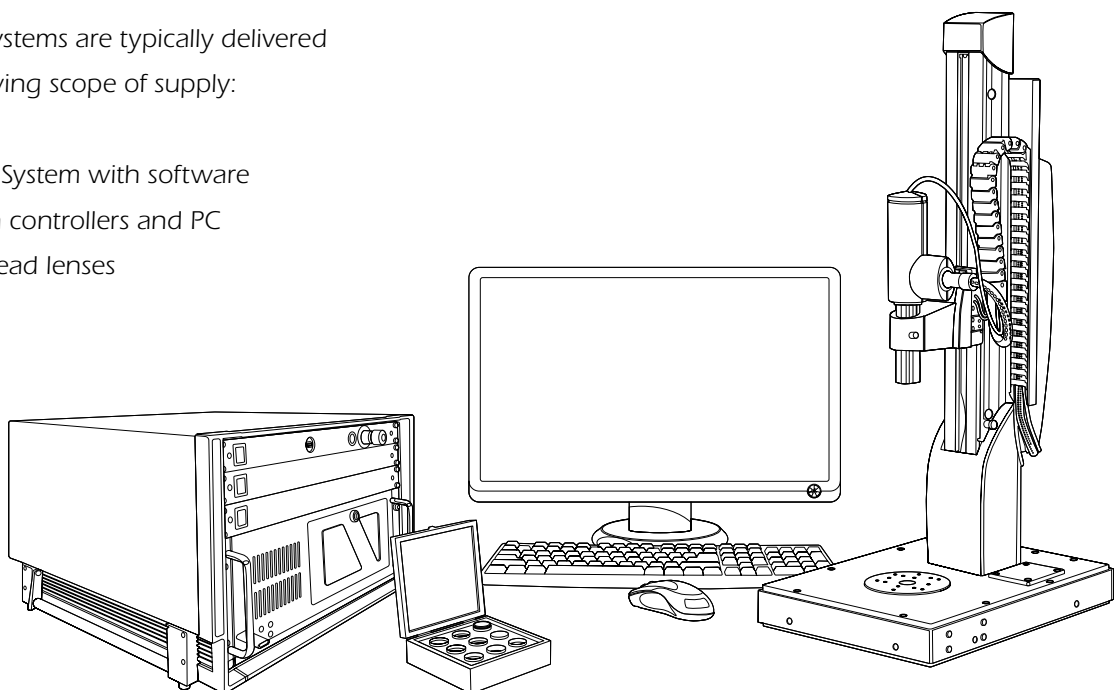
- Measuring probe
- Revolving turret for exchange of head lenses
- Lens rotation device, tilt and translation table (TRT)
- Lens holders
- Expansion of measurement range to effective focal lengths of up to ± 2000 mm
- Encoder for the motorized stage
- Alignment set, calibration wedge
- Ring chucks
- Manual air pusher for easy and non-contact alignment of lenses
- Foot-pedal control for the compressed air
- Tool-stage with kinematic seat for holding the alignment tools
- UV light source, manual bonding unit with foot pedal, automated bonding unit, needles and tubes for the bonding unit



Scope of Supply

OptiCentric® systems are typically delivered with the following scope of supply:

- OptiCentric® System with software
- 19" rack with controllers and PC
- One set of head lenses
- Accessories
- Monitor



Other OptiCentric® Systems

OptiCentric® 300

The OptiCentric® 300 series measures samples up to a diameter of 400 mm and an axial load of 300 kg. As a result, it is ideally suited for centering testing, cementing or bonding applications for which the OptiCentric® 100 is too small and for which the high degree of rigidity and thermal stability of the OptiCentric® UP series is not required.

The systems consist of a stable frame, anti-vibration dampers, a highly resistant air bearing and an optional, stable tilt and translation table (TRT 400)

A second measurement head, the low-coherence interferometer for center thickness measurement or IR measurement heads can optionally be integrated in the system.

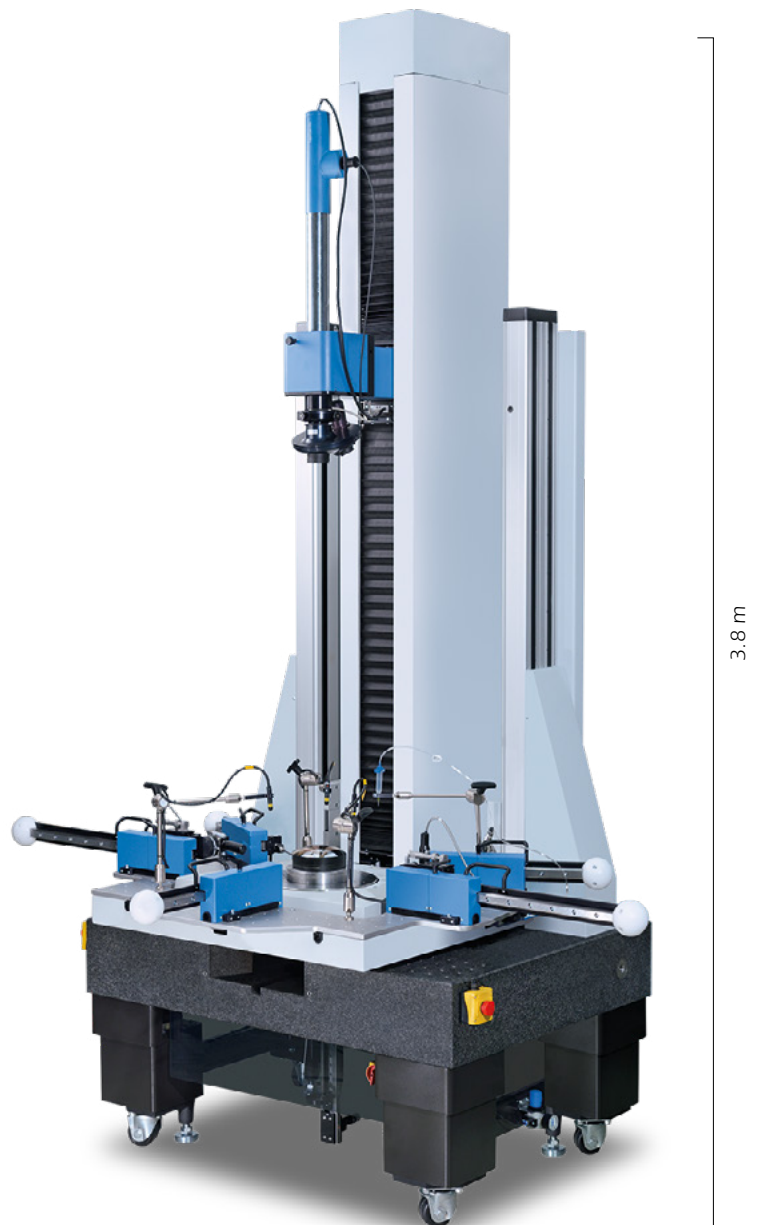


OptiCentric® 300 UP & 600 UP

Die OptiCentric® UP devices transfer the advantages of the OptiCentric® 100 series to the measurement of large, heavy lens assemblies with a weight of up to 1200 kg and a diameter of 800 mm.



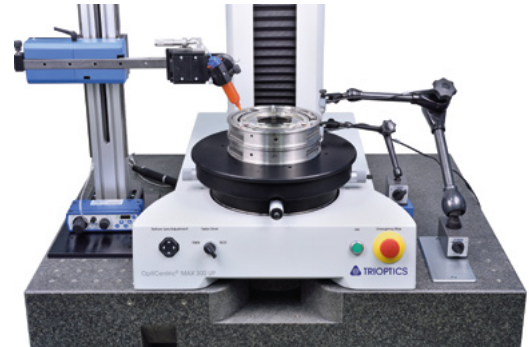
OptiCentric® 300 UP



OptiCentric® 600 UP with bonding frame

Like an OptiCentric® 100 system, an OptiCentric® UP system can also be equipped

- with a second measurement head underneath the air bearing
- with the OptiSurf® low-coherence interferometer for center thickness measurement
- with IR measurement heads for testing IR lens assemblies

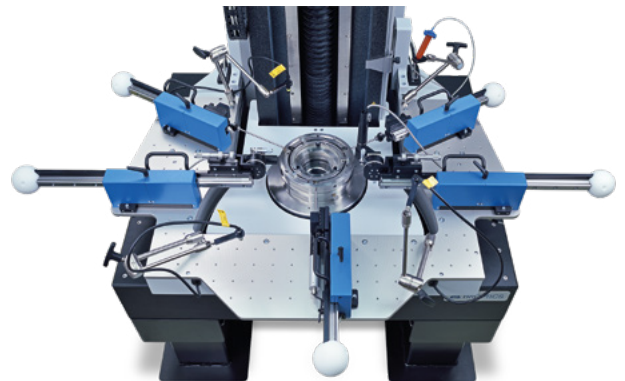


OptiCentric® UP with tool stage for manual lens alignment and bonding

The system's design on a granite base provides you with extraordinary rigidity and thermal stability, so that the greatest accuracy is achieved even with slowly curing adhesives.

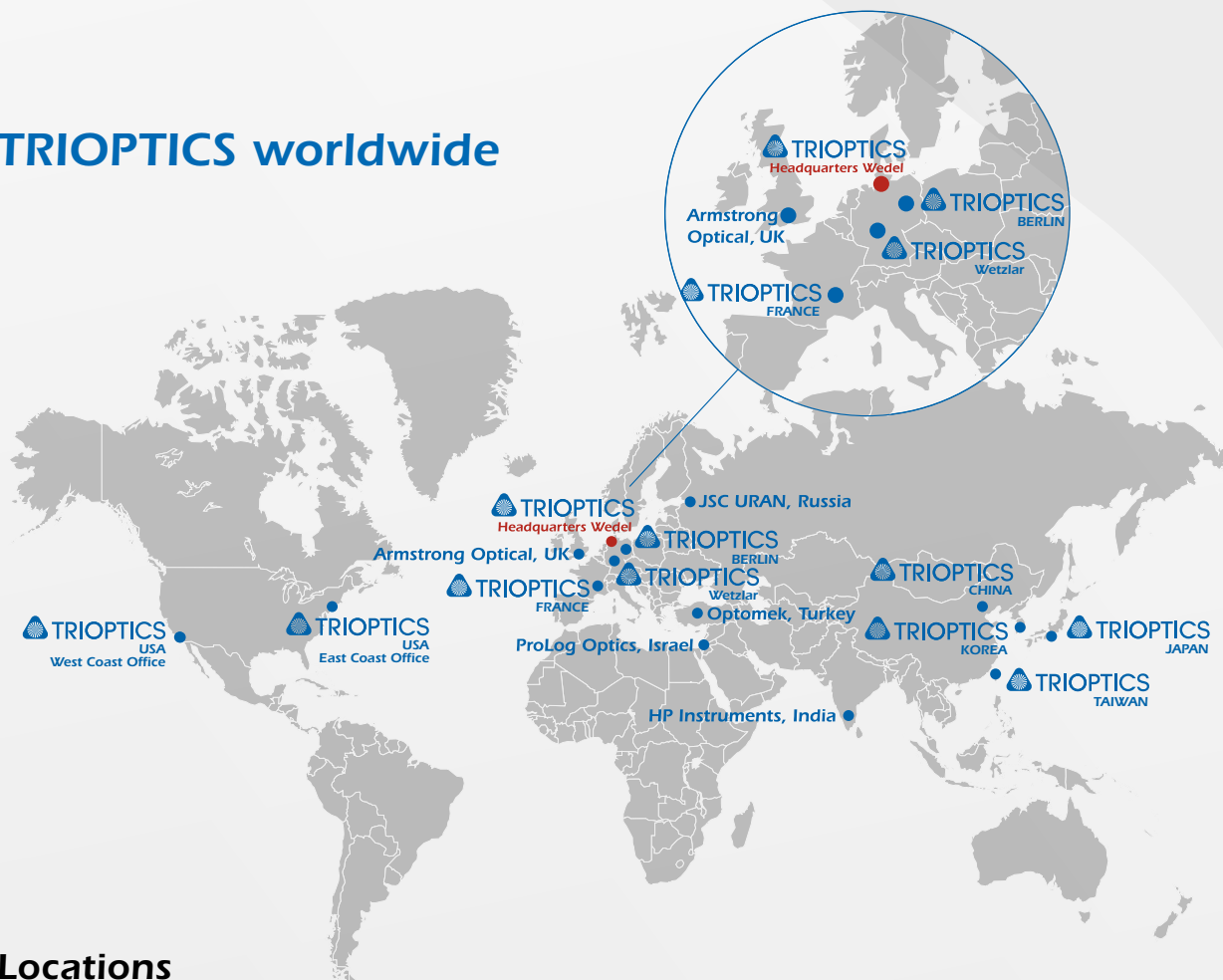
TRIOPTICS offers one bonding system for manual bonding and one system for semi-automatic bonding for OptiCentric® UP systems. For simple bonding processes in a small production, TRIOPTICS recommends the bonding system for manual bonding. It is equipped with an x-z linear stage with kinematic mount so that all tools required for the alignment and bonding process can be easily and quickly changed out.

The bonding system for semi-automatic lens alignment and bonding is ideal for recurring bonding processes or large quantities. All tools required for the bonding process are positioned on a frame so that aligning and bonding can be performed more quickly and precisely than with the manual process.



OptiCentric® UP with bonding frame for semi-automatic lens alignment and bonding

TRIOPTICS worldwide



Locations

Germany

TRIOPTICS GmbH

Strandbaddamm 6
22880 Wedel, Germany
Tel.: +49 4103 18006-0
sales@trioptics.com
www.trioptics.com

TRIOPTICS GmbH Wetzlar Branch

Tel.: +49 6441 4454 910
sales@trioptics.com
www.trioptics.com

TRIOPTICS Berlin GmbH

Tel.: +49 30 6392 3456
support@trioptics-berlin.com
www.trioptics.com

China

TRIOPTICS China

Tel.: +86 010 84566186
info@trioptics-china.com
www.trioptics-china.com

France

TRIOPTICS France

Tel.: +33 4 72 44 02 03
contact@trioptics.fr
www.trioptics.fr

Japan

TRIOPTICS Japan Co., Ltd.

Tel.: +81 54 203 4555
info@trioptics.jp
www.trioptics.jp

Korea

TRIOPTICS Korea Co., Ltd.

Tel.: +82 31 695 7450
info@trioptics.co.kr
www.trioptics.co.kr

Taiwan

TRIOPTICS Taiwan Ltd.

Tel.: +886 3 4620405
info@trioptics.tw
www.trioptics.com.tw

USA

TRIOPTICS, Inc.

Tel.: +1 626 962 5181
sales@trioptics-usa.com
www.trioptics-usa.com

India

HP Instruments

Tel.: +91 80 25521990
hpi@hp instruments.com
www.hp instruments.com

Israel

Prolog Optics Ltd.

Tel.: +972 3536 4011
info@prologltd.com
www.prologoptics.com

Russia

JSC URAN

Tel.: +7 812 335 0975
info@uran-spb.ru
www.uran-spb.ru

Turkey

Optomek Optical Mechanical Engineering Industry and Trade Ltd. Co.

Tel.: +90 312 219 4422
info@optomek.com.tr
www.optomek.com.tr

United Kingdom

Armstrong Optical Ltd.

Tel.: +44 1604 654220
info@armstrongoptical.co.uk
www.armstrongoptical.co.uk