



JENOPTIK

Opticline – Optical Shaft Metrology

Fast and precise quality assurance in the production environment thanks to optical measuring systems.

**SHARING EXCELLENCE**

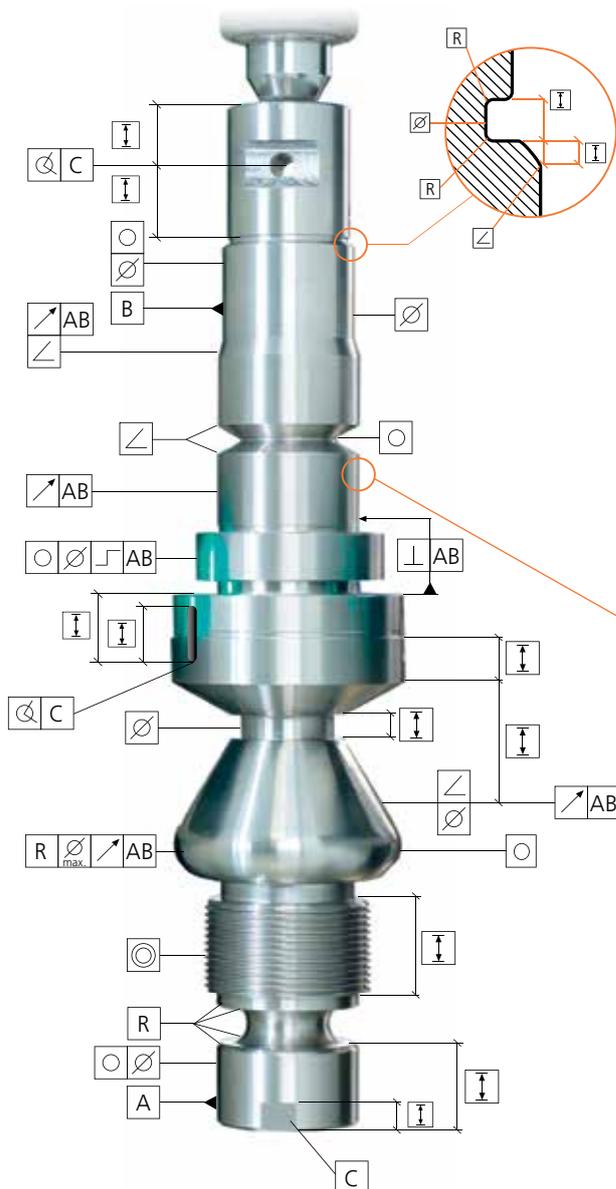
# Your partner for measuring solutions

We deliver solutions that help you optimize your manufacturing process regarding qualitative and economic objectives.

Our services range from complete solutions for different measuring tasks such as the inspection of surface and form as well as determining dimensions, throughout every phase of the production process including final inspection or in the metrology lab.

We are one of the leading international specialists in high-precision, tactile and non-tactile production metrology.

Our decades of experience in tactile, optical and pneumatic measurement combined with our global sales and service support network brings us close to you, our customers, enabling us to provide optimal support as a reliable partner.



State-of-the-art camera technology with the maximum possible resolution and accuracy, even when it comes to the smallest structures and geometry elements.

# Greater efficiency through multi-functional, optical shaft measuring systems

Our Opticline measuring solutions present a wide range of evaluation options and numerous areas of application for measuring shaft-type workpieces. Thanks to the fast, optical non-contact measuring principle, measurements are performed with an extremely high level of flexibility, repeatability and accuracy.

## Successfully implemented solutions worldwide

- Turned and precision turned parts
- Components used in the automotive industry such as electric motors, drive trains, steering parts and turbochargers
- Blanks and pressed parts for metal processing
- High-precision workpieces used in medical technology such as implants, bone screws and tools
- Jets and injection technology
- Components used in the bearings industry
- Turbines and emergency power units
- Parts used in the textile and printing industries
- Applications in the aerospace industry
- Pneumatic and hydraulic parts, such as pumps
- Various electric motors, e.g. for fans, household appliances, positioning and drive systems

## Characteristics measured

### Dimensional measurements

- Length
- Diameter
- Radius
- Angle

### Thread measurements

- Dimension
- Form

### Form measurement

- Straightness
- Roundness
- Cylinder form
- Conicity
- Flatness

### Profile forms

- Free form
- Tolerance range

### Length measurements

- Radial run-out/total radial run-out
- Axial run-out/total axial run-out
- Straightness
- Symmetry
- Parallelism
- Concentricity
- Coaxiality
- Perpendicularity

Model	Short description	Page
Opticline CS	Compact, optical shaft measuring systems for medium tolerance requirements	6 – 7
Opticline C	Optical shaft measuring systems with multi-sensor technology and maximum accuracy	8 – 11
Opticline C1000	Shaft measuring systems for large and heavy workpieces	12 – 13
Opticline CA and VMS	For optimizing measuring systems via automation and fast cycle times	16 – 18
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Technical data	Performance capability of all shaft measuring systems in one overview	24 – 26

# Rapid and precise quality assurance directly in the production process

Opticline solutions are the result of our extensive expertise in optical and tactile shaft measuring technology. Our technologically innovative and pioneering systems have been impressing a broad range of users around the world for over 25 years.

## Precise and fast – Innovative measuring systems

- Complete measurements in seconds
- High-resolution and  $\mu\text{m}$  precise
- Automatic measurement runs
- Integrated tactile probing system (option)
- High-precision headstock for improved form measurement capability (option)

## Safe and simple – Optimized for use in production

- Ergonomic design
- Optimized for operator-controlled inspections
- Light barriers for maximum safety
- Results display visible from a distance

## Flexible and versatile – Simple workpiece change

- Tailstock with convenient functions for quick vertical adjustment and engaging
- Flexible clamping device attachment via Morse taper
- Open enclosure for fast loading
- Minimum set-up times

## Ideal for production – Robust hardware and software

- Camera with IP52 protection
- Enclosure with thermal insulation
- Intelligent functions for compensating negative environmental influences
- Integrated roller shutter (optional)
- Integrated measuring computer (optional)

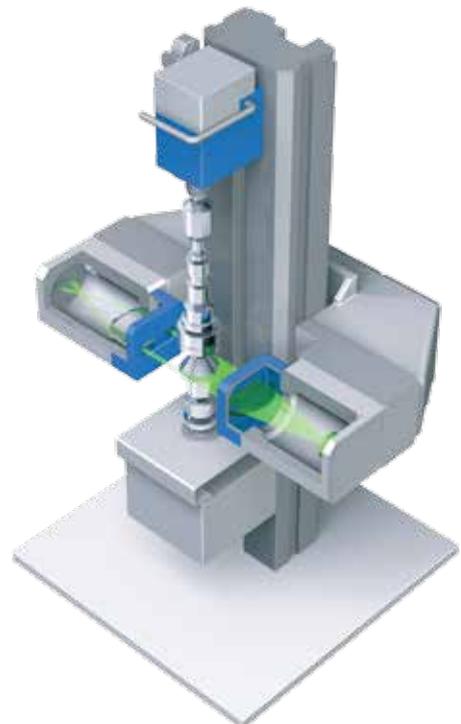
## Durable and reliable –

### Long-term gaging component capability

- Intelligent, automatic monitoring of the measuring system
- Integrated, automatic temperature compensation
- No setting master needed for daily use

## Intuitive and easy to understand – Operating and evaluation software

- Fast test plan generation
- Numerous tools and wizards
- Clear representation of results
- Easy mapping of complex test characteristics and tasks
- Quick and easy program change
- Very little training required



## Get better measurements



### ... in the production area

Quality assurance starts in the production process, which is why our Opticline systems are particularly robust and resistant. They offer numerous intelligent self-monitoring and compensation functions for lasting quality assurance. By deploying these systems in the actual production environment you can cut routes, bring outlay down to a minimum, save on rework and reduce the sources of errors.

### ... with speed

Opticline solutions deliver absolute precision within the shortest test times. These systems probe the workpiece in a fully automatic process based on the shadow image principle with vectorial measurement. The precise rotational axis allows up to three rotations a second.

### ... with precision

Opticline solutions feature optimized camera systems that offer simultaneous bidirectional measurement for measuring even the smallest geometry elements with maximum resolution. The high number of measuring points per rotation ensures absolute precision in form measurement. The mechanical precision of the headstock and rotational axis also guarantees maximum repetitive precision and stability of measured values.

### ... with versatility

Opticline solutions offer extensive measurement and evaluation options. Be it a compact standard measuring instrument or a project-specific solution, our optical shaft measuring systems are ideal for both operator-controlled and fully automatic use in complete inspections.

# Opticline CS. Flexible, optical measuring systems for quality assurance on turned parts.

CS series shaft measuring systems have been designed for production-related applications and offer a high degree of measuring performance and absolute precision from 2  $\mu\text{m}$  in an extremely compact design. They are available at an attractive price and are ideal for operator-independent workpiece checking within the production environment.

## Highlights Opticline CS series

### Reduced travel and wait time

- Robust instrument design facilitates direct use in the production environment
- The ideal instrument for operator-controlled inspections

### Reduced measuring time

- Complete measurements within a few seconds
- Flexible workpiece holder reduces setup times
- Software-optimized control of the measuring process
- Fully automated measuring cycles

### Prevention of potential errors

- User-independent measuring processes and results
- Several mechanisms for self-monitoring by the instrument

### Optimized quality process

- Electronic measuring reports and data storage
- Auditable reporting

### Fewer rejects

- More frequent sample inspections become economically viable
- Direct feedback during the production process

### Low purchase price and maintenance costs

- Measuring instrument can replace various profile projectors, form measuring instruments, manual gauges, etc.
- Universal, non-contact and wear-free optical measuring instrument, e.g. for dimensions, form and position



Opticline CS305 for cost-effective measurement of turned parts up to 300 mm in length



Workpieces weighing up to 15 kg can be measured with the Opticline CS series



A door protects the operator and ensures reliable measurements



Simple clamping of the workpiece between tips

### System features

- Universal measuring instrument for dimensions, form, position, etc.
- Simple, fast and precise
- Compact design and simple operation
- Traceable quality control
- Sophisticated technology at an attractive price
- Supports flexible production processes
- Simple operation and programming
- Numerous analysis functions
- Simple workpiece changes
- Flexible measuring instrument for a variety of parts
- Reliable measuring processes and clear measurement results
- Statistics-oriented, informative reporting

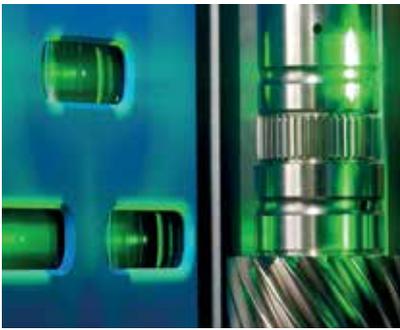


Opticline CS155, CS305 and CS308 product portfolio

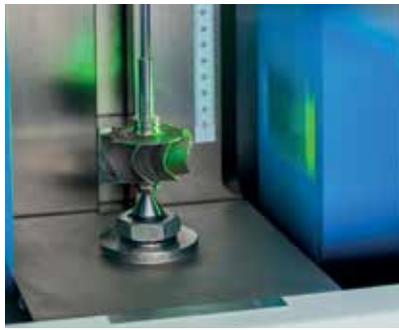
Measuring capacity	CS155	CS305	CS308
Max. diameter [mm]	50	50	80
Length [mm]	150	300	300

## Opticline C. Compact and robust systems for long-term gauge repeatability and reproducibility

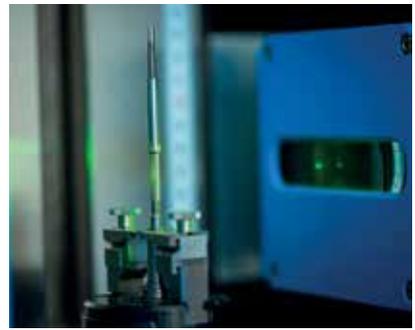
Opticline C series shaft measuring systems offer maximum gauge repeatability and reproducibility from 1  $\mu\text{m}$ . With different configurations, such as a high-precision C-axis or multi-sensor system, the performance capability can be customized to suit your requirements. The instruments thus offer the highest level of flexibility, accuracy and stability.



Safe and easy operation for a wide range of shaft sizes and types



Numerous geometry and form elements can be measured, even on broken contours



Workpiece-specific clamping devices for measuring small and very small parts



Thanks to its simple user control, the ergonomic Opticline C614 delivers measurement results within seconds

### Highlights Opticline C series

- Optimum precision properties in  $\mu\text{m}$  delivering measurements within seconds
- An individual camera offers bidirectional measurement for workpiece diameters of up to 80 mm
- The unique scaling of the optical system for measuring diameters of up to 140 mm without loss of resolution or quality
- Special tailstock and headstock design for rapid workpiece changes and maximum precision
- Simple and automatic workpiece alignment
- Real-time processing and fastest possible data transfer
- Self-monitoring functions for reliable use in the measuring room or directly in the production process
- Low-maintenance, robust measuring system including camera with IP52 protection

System features

- Compact measuring system for operator-controlled inspections in the production environment
- Multi-stage scaling for workpieces up to 900 mm in length and 140 mm in diameter
- User-friendly, clearly structured evaluation software for simple and individual definition of test plans (see software pages 22 – 23)
- Possibility to adapt to customer-specific applications

Product variants and options

- Tactile probing system for measuring additional lengths and form test characteristics
- High-precision headstock for higher form gauge repeatability and reproducibility and improved rotational measurements
- Integrated measuring and evaluation computer
- Roller shutter to protect against negative environmental influences
- Pneumatic clamping solutions for greater flexibility and workpiece variety
- Table racks for practical loading at working height and additional storage space
- Extensive range of accessories (see page 21)



Product portfolio Opticline C300 – C900, C308 and C614 with integrated roller shutter

Measuring capacity	C203	C305	C308	C314	C605	C608	C614	C908	C914	C1214
Max. diameter [mm]	30	50	80	140	50	80	140	80	140	140
Length [mm]	250	300	300	300	600	600	600	900	900	1200

## Opticline C. Maximum flexibility for various measuring requirements in production



Simple operation of the measuring machine thanks to fast tailstock adjustment



Simple, convenient starting of measurements for fast and reproducible measuring results



Results view visible from a distance for OK, NOK, warning limit and errors

Using the system directly in the production process makes it possible to achieve significant cost and time savings compared to conventional measurements in the measuring room. Our Opticline systems are therefore specially designed for use in tough environments.



Opticline C914 with optional, mobile gauge enclosure for flexible use in production

### Suitable for tough production environments

- Maximum gauge repeatability and reproducibility in the lower  $\mu\text{m}$  range
- Intuitive and user-friendly operating software
- Simple programming in just a few steps

### Ideal for operator-controlled inspections

- Widely accessible, open loading area
- Simple and fast shaft clamping between tips for repeatable measurements
- Ergonomic design for simple handling

### Highly robust system thanks to numerous compensation measures

- Hermetic and thermal insulation of key components
- Protected guides and scales
- Temperature compensation and supporting sensors
- Self-monitoring system
- Camera parking in secure home position



Integrated light barrier to protect operators in accordance with international safety standards



Integrated roller shutter to protect against negative environmental influences (optional)



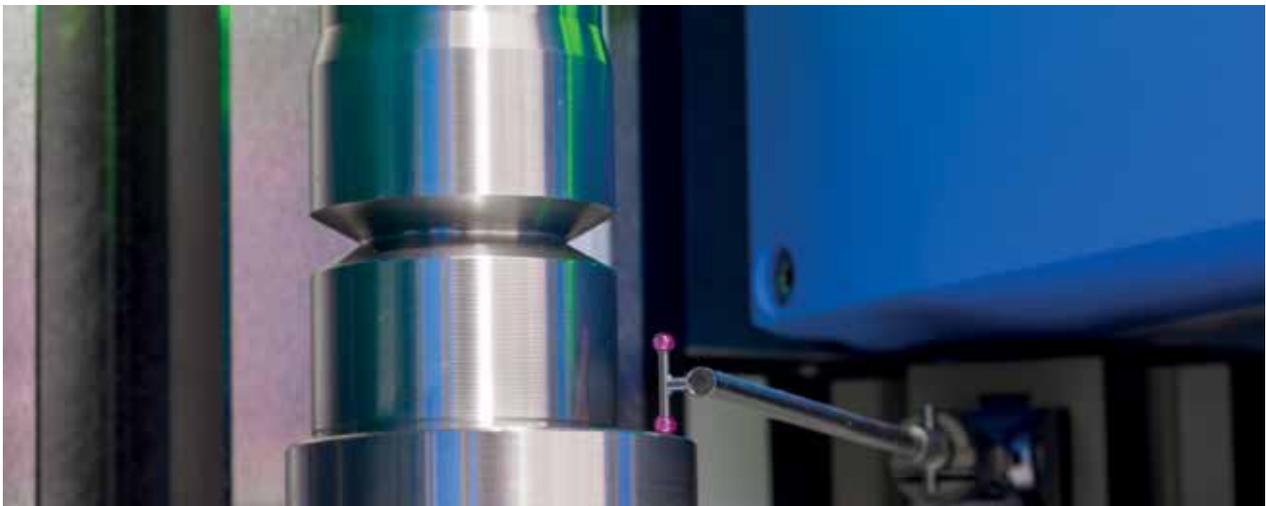
Flexible holder via MK2 Morse taper for fast changing of the workpiece

#### Suited for use in production

- Use in the measuring room or production environment
- Different designs: on the instrument table as a seated workstation, on a gauge stand as a standing workstation or on a mobile gauge enclosure as a complete solution for flexible production
- Standing workstations for the production area
- Roller shutter to protect against dirt and adverse environmental conditions when the device is not being used for measurements

#### Optional tactile probing system

- Tactile probing system for lengths, axial run-out, flatness and perpendicularity
- Tactile measurements are seamlessly integrated into the optical measurement run
- They complete the quality statements in a single measurement run



Optional tactile probing system for additional form measurements

# Opticline C1000. User-independent measurement of large shafts

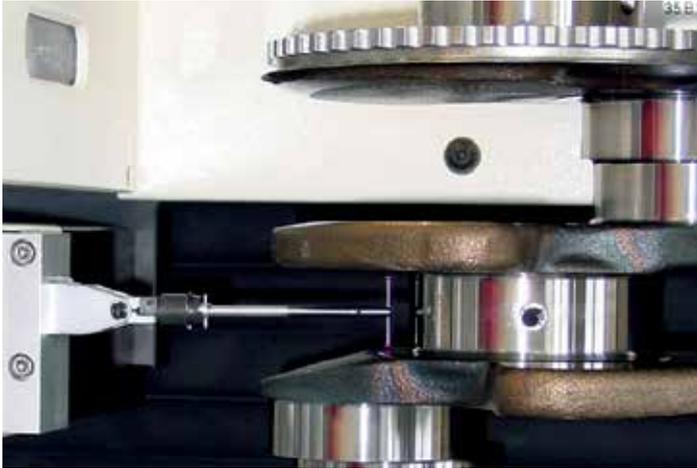
The shaft measuring systems of the Opticline C1000 series offer you an ideal combination of precision, suitability for production, ergonomics and operator friendliness.

## Highlights Opticline C1000

- Fast and reliable results for large and heavy workpieces
- Elaborate design for high demands on production suitability: air-conditioned cabinet for power electronics and measuring computers, height adjustable operating panel with TFT screen and a lockable cabinet with drawers for printer, tools and accessories
- Easy to set up and use thanks to simple tailstock positioning via a digital position indicator
- Fast loading and unloading of different workpieces combined with maximum operator safety through a light barrier
- Protected from negative environmental influence by closed and lockable housing with integrated motor-driven roller shutters



Opticline C1023 with safety light barrier and roller shutter



Optional tactile probing system for concentric lengths and axial run-outs



Measuring crank shafts with an Opticline C1023-75AE

#### Tactile measurement of axial run-outs and lengths

The Opticline C1000 shaft measuring systems can be optionally equipped with a tactile probing system. Tactile measurements can be seamlessly integrated into the optical measuring run and are ideal for axial runout and special length measurements.

These additional evaluation possibilities add to the evaluation functions of the optical measuring system as they complete the quality information within one single measurement run and offer higher flexibility.

#### Optimized for crank shaft measurement

The Opticline C1023-75AE measuring system has a specially optimized camera system. It is also equipped with a high-precision C-axis combined with a high-resolution angle measuring system.

The technical configuration enables the measurement of demanding pin bearing characteristics after grinding and during final processing. It can measure workpieces weighing up to 75 kg.

Measuring capacity	C1014	C1023	C1023-75AE
Max. diameter [mm]	140	230	230
Length [mm]	1000	1000	1000
Workpiece weight [N]	400	400	750

# Automated production. Measuring systems for intelligent, flexible production

For production that is largely self-organized, we offer integrated systems that can be seamlessly incorporated into the production process. Recorded measuring values are forwarded directly to the processing machine so that the production process can be corrected in real time.

## Networked measuring systems to support flexible production



Opticline CA618 with robot loading

### Accurate measurements

- Fewer measurement discrepancies and less measurement uncertainty
- High repeatability

### Reliable measuring processes

- Enables the fulfillment of the constantly increasing accountability obligation for measurement uncertainty

### Flexible use

- Increasing variety of measuring procedures
- Increased information density
- Automated processes

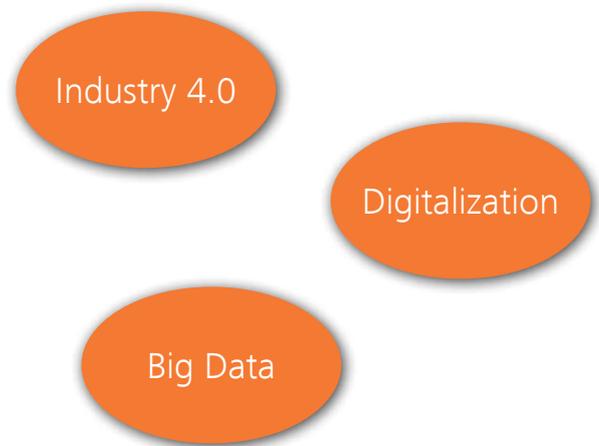
### Fast measuring times

- Closer integration of measuring systems
- Reduced measuring time
- Automated data processing

## Comprehensive measuring systems

- Increased degree of automation
- In-depth data integration and analysis for optimum quality assurance and reliable auditable reporting
- Stability and long-term accuracy during continuous operation
- Proactive maintenance and services
- Linking of measured values from different production steps
- Robust systems for minimal downtime
- All equipment involved in the process becomes more adaptable, such as the measuring technology in a more modern, more flexible production environment

## Potential increase in automation



### Ensures competitiveness and an optimized production process

Close integration of measuring systems enables feedback early in the production process. As a result, you can focus on reducing waste during production, ensuring that both your quality standards, as well as those of your customers, are met. This arrangement also provides comprehensive, clear — and therefore auditable — quality reporting.

### Ideal for concatenated use in production lines

Split-second measuring cycles coupled with intelligent hardware and software interfaces enable the seamless integration of our measuring systems in automated production processes and flexible manufacturing environments.

### Flexibility is the foundation of individual and customer-specific production

Flexible clamping device attachments for the measuring systems reduce setup time, allowing you to change alternating workpieces quickly.

### Tailored to your production processes

- Various features and designs depending on requirements (lying horizontally, hanging or vertical)
- Fully automated use in post-processing or 100 % inspections in production lines
- Various interfaces for integration in production lines and handling systems: from inexpensive digital I/O lines to PLC and PROFIBUS for implementing complex process connections
- Special software functions for automation and optional solutions for correction value control

# Opticline CA. Flexible and automated shaft measurement in production

Thanks to their special open machine concept, the high-precision Opticline CA systems are ideal for PLC measuring stations with manual loading and automated production.



Opticline CA618 for operator self-inspection

## Highlights Opticline CA

- Outstanding precision characteristics
- Excellent form measurement capacity
- Flexible in use, including for future workpieces and measuring tasks
- Ideal production suitability and reliability through long-term gaging component capability
- High-precision rotational axis with outstanding form measurement ability
- Automatic tailstock with a long stroke on precision guides
- Quick, easy and accurate workpiece clamping via a motorized tailstock
- Ideally suited for automated measuring of turned parts of different branches of industry and manufacturing



Optional tactile probing system for lengths and axial run-out

## Optional tactile measurement of length and axial run-out

As a complement to the evaluation options of the optical measuring system the optional tactile probing system enables the measurement of axial run-out and special lengths.



Opticline CA305 with customer-specific housing for automated measurement of turbochargers

#### Optimized for use in production

- Split-second speed and low maintenance requirements for outstanding productivity
- Ideal accessibility for manual and automatic loading
- Software adapted to the production environment and processes
- Active temperature control and temperature compensation
- Simultaneous control of several production systems by a single operator
- Reduction of rejects and material consumption

#### Customized solutions for flexible use

- Horizontal or vertical system design
- Project-specific housing solutions
- Various options for automated loading and clamping
- Various interfaces for machine integration and control
- Optional, project-specific automation

#### Flexible integration into automated production processes

- Without enclosure
- Partial enclosures
- Complete solutions with safety equipment

#### Flexible interfaces

- Project-specific implementation of hardware interfaces to PLC and loaders
- Free software interfaces safeguard results and allow tool compensation for upstream processing machines



Example integration of Opticline CA618 with robots and loading station

Measuring capacity	CA305	CA310	CA314	CA605	CA610	CA614	CA618
Max. diameter [mm]	50	100	140	50	100	140	180
Length [mm]	300	300	300	600	600	600	580

# Opticline CA. Tailored precisely to your workpieces

If you have any specific requirements for the design of Opticline CA systems with regard to the instrument design and workpiece, we can develop the appropriate measuring configuration based on standard systems.

## Fully automated engine valve measurement with Opticline VMS

- Super-fast complete measurements with cycle times of less than 5 seconds
- Specially designed, customized clamping devices



Opticline VMS305 for measuring engine valves; integrated in a production line

## Precision crank shaft measurement with Opticline CA-AE

- Optimized solution for process stages downstream from grinding and final processing
- Special camera and high-precision angle measuring system



Opticline CA618-AE for measuring crank shafts

Measuring capacity	CA614-AE	CA618-AE	VMS305
Max. diameter [mm]	140	180	50
Length [mm]	600	580	300

# Opticline AMV. Professionals for concatenated use in production

These Opticline AMV measuring systems designed specifically for concatenated use in production are available in horizontal and vertical designs depending on your requirements. They are ideal for the automated handling of large workpieces.



Opticline AMV923V with robot loading in a vertical design



Opticline AMV923H for concatenated post-process work sequence measurement in a horizontal design

## Highlights Opticline AMV

- Short measuring times for complex workpiece geometry
- Concatenated use in production; the integrated PLC connects to the superordinate loading system
- Fast correction of one or more processing machines with the help of intelligent software for tool correction

Measuring capacity	AMV923H	AMV923V
Max. diameter [mm]	230	230
Length [mm]	805	830

# Opticline WMS. Precision for particularly large and heavy workpieces

The machine design of the optical measuring systems Opticline WMS enables them to handle above-average workpiece sizes weighing up to 120 kg.



Use in production, loading a crank shaft with operator self-inspection



Opticline WMS1332V in a horizontal design



Opticline WMS1023 in a vertical design

## Highlights Opticline WMS

- Top resolution and measurement accuracy across the entire range thanks to a unique, cascaded camera system for workpieces with diameters of up to 320 mm
- Adaptation to your integration requirements: horizontal or vertical design
- Split-second measurements, even with very large workpieces
- Available for operator self-inspection and fully-automated use

Measuring capacity	WMS1032	WMS1332
Max. diameter [mm]	320	320
Length [mm]	1000	1300

# Accessories and clamping devices

## Clamping devices

Extensive program for a wide range of uses. Tips and application-specific solutions are easily installable via Morse tapers. Below is a selection of the most frequently used clamping devices.



Various fixed tips



Rotating tips and inserts



Chucks and plates

## Standard accessories, special clamping devices and housing variants



Clamping devices and tools included in standard scope of delivery



Chucks and plates, manual or pneumatic



Mobile or stationary workstations and enclosures

## Optional accessories for data input and interfaces for integrating additional measuring equipment



Barcode scanner for test plan selection and data input

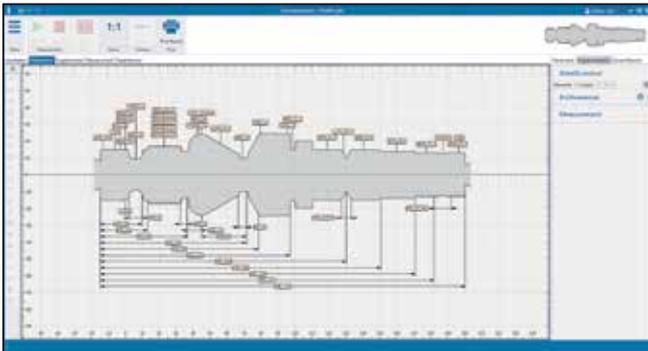


Workpiece temperature detection

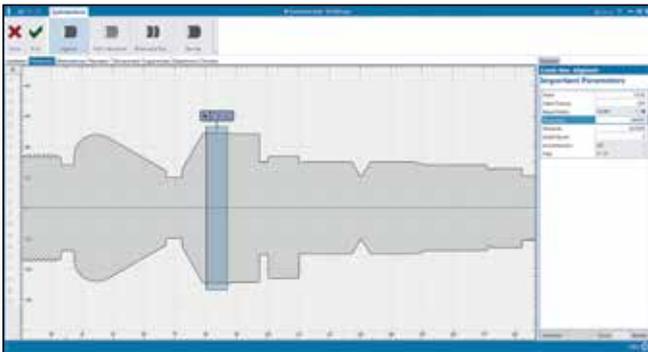


Interface box for external gaging components

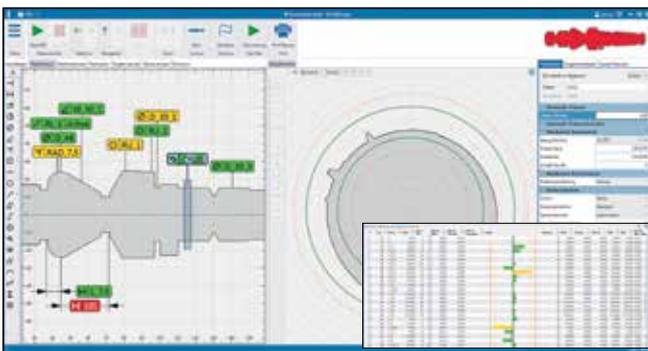
# Tolaris Optic. Precise results within seconds



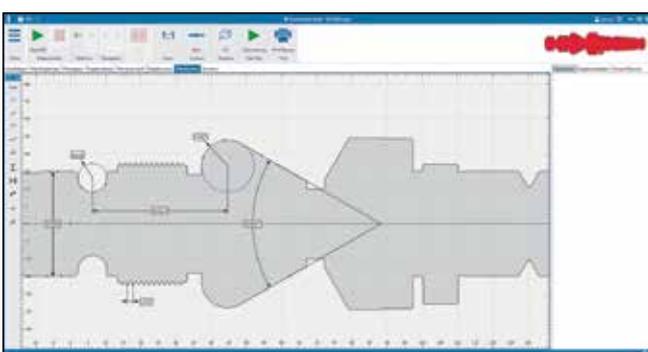
User interface: optimized view for operators



Setting of test characteristics



Results display with detailed contour, results list



Display functions

## Intuitive operation

- User-friendly, clearly structured graphical Windows user interface
- Wizards for easy creation of test plans and setting of test characteristics
- Clear presentation and subsequent processing of measurement results
- “Live” mode for direct feedback when creating test plans
- Scan of the part contour in different views

## Optimized measuring runs

- Easy selection of new characteristics by clicking with the cursor; workpiece contour definition in accordance with drawing specifications
- Scanning and evaluation of workpiece contours in the shortest possible time
- Fast combination of any measurement functions in one test plan
- Fully automated measurement process with results displayed within seconds

## Clear presentation and reliable analysis of measurement results

- Various views for displaying measurement values on screen
- Extensive analysis functions
- Documentation of measurement values in customizable reports
- Various export options for subsequent data processing or documentation
- Database tool for convenient saving and managing measurement results
- Fast and reliable analysis and interpretation of measurement results by the operator
- Comprehensible and practice-oriented result tracing

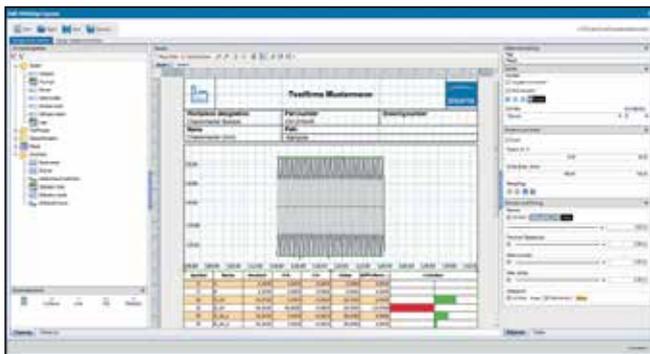
# User-friendly operating and evaluation software

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Teil:		ANL. Dtl.: 04.10.2012							
Teilbez.: HOMMEL Checkmaster	Werkst. Bez.:	Prüfart. Bez.:	HOMMEL ETARIC OPTICLINE						
Teilenummer: 1564361	FncName:	Prüfgrnd.:							
Bem.:									
Marken?	Marken-Bez.	$\mu_{\text{exp}}$	$\sigma_{\text{exp}}$	$R_{\text{exp}}$	$\mu_{\text{nom}}$	$\sigma_{\text{nom}}$	Index	Index	Comment
3	D_18	25	18,10360	0,0015	18,1029	18,1044	$C_p = 160,83$	$C_{pk} = 154,79$	
4	D_20	25	20,01952	0,0003	20,0108	20,0111	$C_p = 259,6$	$C_{pk} = 198,51$	
5	D_28_1	25	25,99316	0,0002	25,9912	25,9914	$C_p = 9,45$	$C_{pk} = 6,48$	
6	D_28_2	25	25,98778	0,0002	25,9877	25,9879	$C_p = 7,81$	$C_{pk} = 6,53$	

Statistical evaluation via optional statistic software

## Practice-oriented software interface

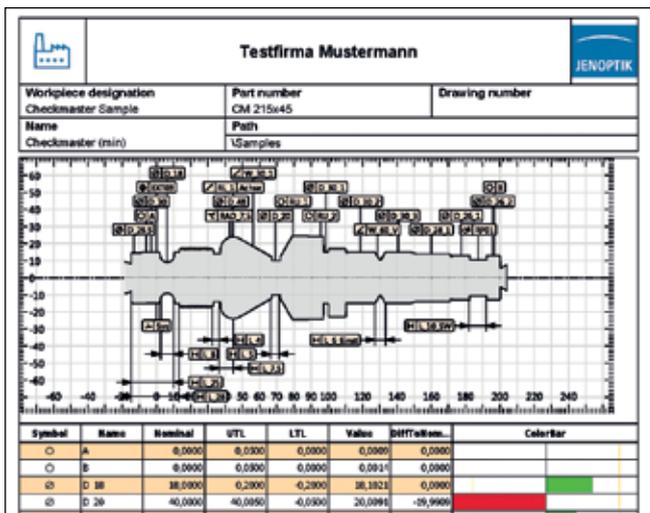
- Display and operating controls adapted to the requirement profiles of test plan designers and operators
- Simple and comprehensible evaluation software with numerous help functions for quality assuring and error-free workpiece control, even by untrained operators
- Quick and easy software adaptation to specified work processes



Report and template editor

## Convincing performance features

- Intuitive user guide
- Individual arrangement of software windows on one or more monitors
- Clear display of results
- Storage and management of measurement results
- Analysis tools for result tracing
- Certified interfaces (Q-DAS, AQDEF)
- Software interfaces via CSV and Script
- Connection of additional, external gaging components via interface box
- Simple generation of individual measurement logs
- Clear presentation of measurement results for comprehensive analysis and quality assurance



Result printing

## Documented quality

- Automated reporting
- Result reports customizable via an Editor function
- Output of graphic contour details
- Sampling reports
- Simultaneous single or multiple value pattern display for individual test characteristics

## Seamless IT integration

- Compatible with Windows 10

# Technical data

Model <sup>1)</sup>	CS155	CS305	CS308	C203	C305	C308	C314
<b>Measuring capacity [mm]</b>							
Max. diameter	50	50	80	36	50	80	140
Length <sup>2)</sup>	150	300	300	250	300	300	300
<b>Workpiece capacity</b>							
Diameter [mm]	90	90	90	150		150	
Length <sup>2)</sup> [mm]	150	300	300	250		300	
Workpiece weight <sup>3)</sup> [N]	100	150	150	100		200	
<b>Resolution</b>							
Diameter, length	≤0.2 µm			0.1 µm			
Rotation	0.0018°			0.0006°			
<b>Accuracy / MPE<sup>4)</sup></b>							
Diameter	(2.0+D[mm]/100) µm			(1.0+D[mm]/200) µm			
Length	(5.0+L[mm]/100) µm			(2.6+L[mm]/200) µm			
<b>Repeatability (4s)<sup>5)</sup></b>							
Diameter	0.5 µm			0.3 µm			
Length	3.0 µm			1.2 µm			
<b>Speed</b>							
Measuring	automatically optimized: 10 – 80 mm/s						
Measuring rotation	1 rps						
Positioning	200 mm/s						
Positioning rotation	1 rps						
Measuring cycle	dependent on type and number of test characteristics – typically 3 ... 30 s						
<b>Dimensions [mm]</b>							
Measuring system [W x D x H]	690 x 570 x 920	690 x 570 x 1070	690 x 570 x 1070	700 x 840 x 1055	700 x 840 x 1055		
<b>Weight [kg]</b>							
Measuring system <sup>6)</sup>	110	120	125	250 – 270	250 – 290		
<b>Clamping tool interfaces</b>							
Morse taper headstock	MT2			MK2			
Morse taper tailstock	MT2			MK2			
Clamping stroke tailstock	manual, 20 mm			manual, quick adjustment with holding function, 20 mm			
<b>Power supply</b>							
Connection	AC-PH, N, PE						
Voltage	200 – 240/100 – 120 V (127 V on demand)						
Power frequency	50/60 Hz						
Max. consumption	1.5 kVA						
Fuse	16 A						
<b>Optional tactile probing system</b>							
Precision <sup>4)7)</sup>		–		–		TSP	
Axial run-out		–		–		1.5 µm	
Length <sup>8)</sup>		–		–		(3.6 µm+L[mm]/200) µm	
Repeatability (4s)		–		–			
Length		–		–		1.5 µm	

<sup>1)</sup> Environmental conditions: not chemically aggressive, not explosive, not radioactive. Temperature range from +10° C to +40° C, max. relative humidity 85 % without condensation. Dust aerosol values: according to TRGS 900 (Industrial safety regulations and technical rules for workplace environment and hazardous substances).

<sup>2)</sup> Intermediate tips from the standard scope of delivery. Length may be reduced depending on the clamping device. When using the optional tactile probing system, the length (workpiece capacity) is reduced depending on type (with the exception of C203-C914).

<sup>3)</sup> Workpiece positioning without knocks or strong lateral forces. Max. mass moment of inertia: 0.04 kg/m<sup>2</sup>. Improper workpiece positioning may damage the headstock or bearings.

<sup>4)</sup> Maximum permissible error according to EN ISO 10360 / VDI/VDE 2617, relating to DAKs reference standard (uncertainty D: 0.3 µm and L: 0.4 µm). Environmental conditions in accordance with VDI/VDE 2617, 18 – 22° C, class 3 (gradient 1 K/h, 2 K/24h, 0.5 k/m). Mechanical ambient conditions in accordance with EN 60721-3-3 class 3M1.

Technical data

Model <sup>1)</sup>	C605	C608	C614	C908	C914	C1214	C1014	C1023	C1023-75AE
<b>Measuring capacity [mm]</b>									
Max. diameter	50	80	140	80	140	140	140	230	230
Length <sup>2)</sup>	600	600	600	900	900	1200	1000	1000	1000
<b>Workpiece capacity</b>									
Diameter [mm]		150		150	150	150	300		300
Length <sup>2)</sup> [mm]		600		900	900	1200	1000		1000
Workpiece weight <sup>3)</sup> [N]		200/600 <sup>9)</sup>		200/600 <sup>9)</sup>	200/600 <sup>9)</sup>	200/600 <sup>9)</sup>	400		750
<b>Resolution</b>									
Diameter, length				0.1 µm			0.1 µm		0.1 µm
Rotation				0.0006°			0.0018°		0.0005°
<b>Accuracy / MPE<sup>4)</sup></b>									
Diameter				(1.0+D[mm])/200 µm					(1.7+D[mm]/100) µm
Length				(2.6+L[mm])/200 µm					(4.6+L[mm]/100) µm
<b>Repeatability (4s)<sup>5)</sup></b>									
Diameter				0.3 µm				0.5 µm	
Length				1.2 µm				3 µm	
<b>Speed</b>									
Measuring				automatically optimized: 10 – 80 mm/s					
Measuring rotation				1 rps					
Positioning				200 mm/s					
Positioning rotation				1 rps					
Measuring cycle				dependent on type and number of test characteristics – typically 3 ... 30 s					
<b>Dimensions [mm]</b>									
Measuring system [W x D x H]		700 x 840 x 1355		700 x 840 x 1655		834x840x2070		1785 x 1700 x 2650	
<b>Weight [kg]</b>									
Measuring system <sup>6)</sup>		300 – 340		320 – 360		500 – 540		2200	
<b>Clamping tool interfaces</b>									
Morse taper headstock				MK2			MK3		MK4
Morse taper tailstock				MK2			MK3		MK3
Clamping stroke tailstock				manual, quick adjustment with holding function, 20 mm			manual, 40 mm		pneum., 40 mm
<b>Power supply</b>									
Connection				AC-PH, N, PE			AC-PH, N, PE		3PH, PE
Voltage				200 – 240/100 – 120 V (127 V on demand)			200 – 240/100 – 120 V		400/480 V
Power frequency				50/60 Hz			50/60 Hz		50/60 Hz
Max. consumption				1.5 kVA			2 kVA		3 kVA
Fuse				16 A			16 A		16 A
<b>Optional tactile probing system</b>									
Precision <sup>4)7)</sup>				TSP			BTS		BTS
Axial run-out				1.5 µm			3 µm		1.5 µm
Length <sup>8)</sup>				(3.6+L[mm])/200 µm			(7.6+L[mm]/100) µm		(7.6+L[mm]/100) µm
Repeatability (4s)									
Length				1.5 µm			–		–

<sup>5)</sup> Typical range over 25 repeat measurements on ground part surfaces. In accordance with VIM, International Dictionary of Metrology.

<sup>6)</sup> Weight depends on configuration in terms of variants and options.

<sup>7)</sup> Verification with and relating to standard(s) from Jenoptik.

<sup>8)</sup> Distance between end faces.

<sup>9)</sup> Available with high-precision headstock (optional HpSS).

# Technical data

Model <sup>1)</sup>	CA305	CA310	CA314	CA605	CA610	CA614	CA618	CA614-AE	CA618-AE	VMS305	AMV923H	AMV923V	WMS1032	WMS1332	
<b>Measuring capacity [mm]</b>															
Max. diameter	50	100	140	50	100	140	180	140	180	50	230	230	320	320	
Length <sup>2)</sup>	300	300	300	600	600	600	580	600	580	300	805	830	1000	1300	
<b>Workpiece capacity</b>															
Diameter [mm]	149			149			199	149	199	150	270	270	320	320	
Length <sup>2)</sup> [mm]	300			600			600	600	600	250	805	830	1000	1300	
Workpiece weight <sup>3)</sup> [N]	200			200			200	200	200	50	300	300	750	1200	
<b>Resolution</b>															
Diameter	0.1 µm						0.1 µm		0.1 µm		0.1 µm		0.1 µm		
Length	0.1 µm						0.1 µm		0.1 µm		0.1 µm		0.1 µm		
Rotation	0.0018°						0.0005°		0.018°		0.0018°		0.0005°		
<b>Accuracy / MPE<sup>4)</sup></b>															
Diameter	(1.7+D[mm]/100) µm														
Length	(4.6+L[mm]/100) µm														
<b>Repeatability (4s)<sup>5)</sup></b>															
Diameter	0.5 µm														
Length	3 µm														
<b>Speed</b>															
Measuring	automatically optimized: 10 – 80 mm/s														
Measuring rotation	1 rps														
Positioning	200 mm/s														
Positioning rotation	1 rps														
Measuring cycle	depending on type and quantity of test features, typical 3 ... 30 s														
<b>Dimensions [mm]</b>															
Measuring system [W x D x H]	1900 x 1600 x 2350 (including housing and switching cabinet)									780 x 650 x 912	2760 x 1000 x 2100 <sup>9)</sup>	1250 x 1250 x 2265 <sup>9)</sup>	1500 x 1500 x 2900 <sup>9)</sup>	1500 x 1500 x 3200 <sup>9)</sup>	
<b>Weight [kg]</b>															
Measuring system <sup>6)</sup>	540	550	560	560	570	580	640	580	640	270	2000		3000		
<b>Clamping tool interfaces</b>															
Morse taper headstock	MK2									Special	MK3		MK4		
Morse taper tailstock	MK2										MK3		MK3		
Clamping stroke tailstock	stroke variable over complete clamping range <sup>10)</sup>										analog CA		analog CA		
<b>Power supply</b>															
Connection	AC-Ph, N, PE									3PH, PE		3PH, PE		3PH, PE	
Voltage	200-240/100-120 V									400/480 V		400/480 V		400/480 V	
Power frequency	50/60 Hz									50/60 Hz		50/60 Hz		50/60 Hz	
Max. consumption	1.5 kVA									2 kVA		4 kVA		3 kVA	
Fuse	16 A									16 A		16 A		16 A	
<b>Optional tactile probing system</b>															
Precision <sup>47)</sup>	-	TSP		-	TSP				-	BTS		BTS			
Axial run-out	-	1.5 µm		-	1.5 µm				-	3 µm		1.5 µm			
Length <sup>8)</sup>	-	(4.6+L[mm]/100) µm		-	(4.6+L[mm]/100) µm				-	(7.6+L[mm]/100) µm		(7.6+L[mm]/100) µm			
<b>Repeatability (4s)</b>															
Length	-	-		-	-				-	-		-			

<sup>1)</sup> Environmental conditions: not chemically aggressive, not explosive and not radioactive. Temperature range from +10° C to +40° C, max. relative humidity 85 % without condensation. Dust aerosol values according to TRGS 900.

<sup>2)</sup> Between tips from the standard scope of delivery. Length may be reduced depending on the clamping devices. When using the optional tactile probing system, the length (workpiece capacity) is reduced depending on type (with the exception of C203-C914).

<sup>3)</sup> Workpiece positioning without knocks or strong lateral forces. Max. mass moment of inertia: 0.04 kg/m<sup>2</sup>. Improper workpiece positioning may damage the headstock or bearings.

<sup>4)</sup> Maximum permissible error according to EN ISO 10360 / VDI/VDE 2617, relating to DAkkS reference standard (uncertainty D: 0.3 µm and L: 0.4 µm). Environmental conditions in accordance with VDI/VDE 2617, 18 – 22° C, class 3 (gradient 1 K/h, 2 K/24h, 0.5 k/m). Mechanical ambient conditions in accordance with EN 60721-3-3 class 3M1.

<sup>5)</sup> Typical range over 25 repeat measurements on ground workpiece surfaces. In accordance with VIM, International Dictionary of Metrology.

<sup>6)</sup> Weight depends on configuration in terms of variants and options.

<sup>7)</sup> Verification with and relating to standard(s) from Jenoptik.

<sup>8)</sup> Distance between end faces.

<sup>9)</sup> Rough guideline dimensions excluding switching cabinet. Exact dimensions depend on the project.

<sup>10)</sup> Motorized positioning and clamping. Optional: tailstock with motorized positioning and manual clamping. Measuring stroke 20 mm.

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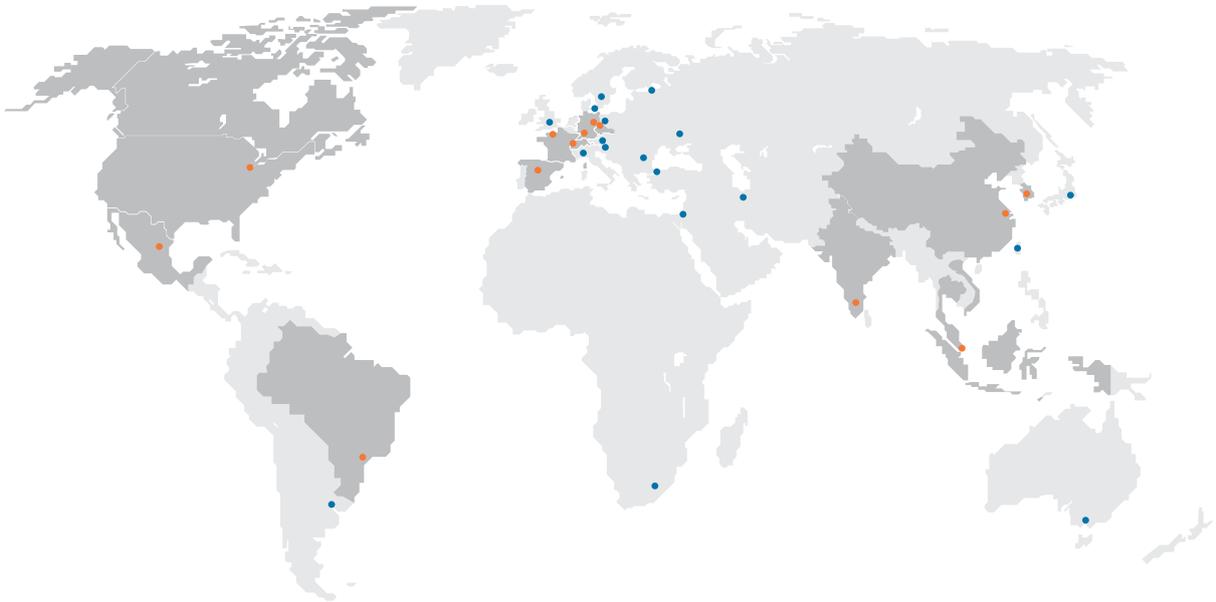
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