MÖLLER-WEDEL OPTICAL
A HAAG-STREIT COMPANY

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MÖLLER-WEDEL OPTICAL GmbH
Rosengarten 10
D-22880 Wedel

Tel : +49 - 41 03 - 9 37 76 10
Fax: +49 - 41 03 - 9 37 76 60
www.moeller-wedel-optical.com
e-mail: info@moeller-wedel-optical.com

HS INTERNATIONAL

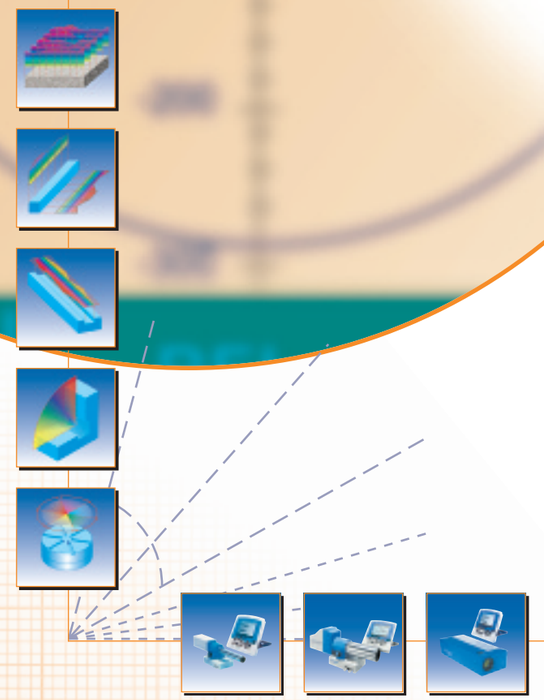
MÖLLER-WEDEL OPTICAL
A HAAG-STREIT COMPANY

α

Electronic

AUTOCOLLIMATORS

Measure With Precision

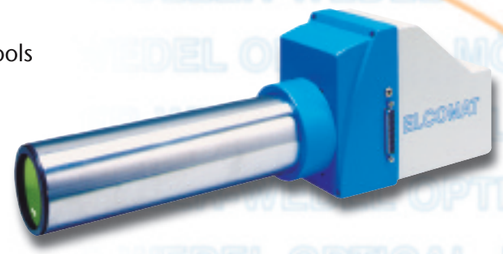


HS INTERNATIONAL

OVERVIEW

Years of experience by MOELLER-WEDEL OPTICAL GmbH and its employees in the development, production and calibration of visual and electronic autocollimators has resulted in the ELCOMAT line of high-precision measuring instruments.
ELCOMAT autocollimators are specifically designed for the following measurement tasks:

- measurement of small angles
- ultra-precision angular adjustment and calibration
- quality control of machine tools (straightness, parallelism, squareness, flatness, rotary position uncertainty)
- automation of assembly
- control of angular position

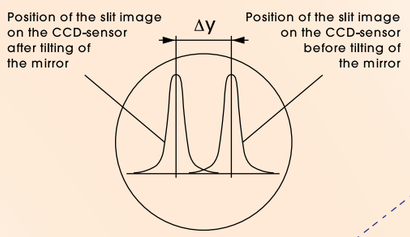


ELCOMAT 3000

ELCOMAT vario

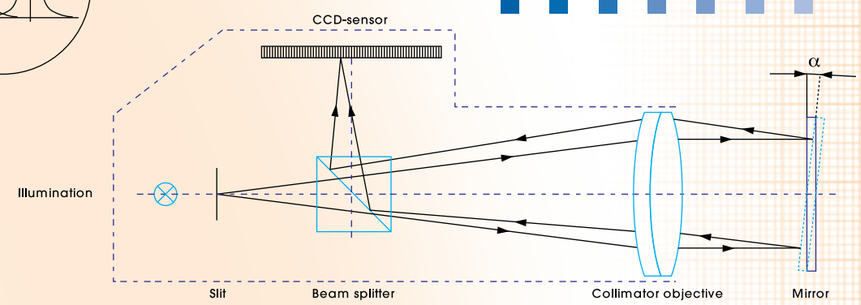
ELCOMAT HR

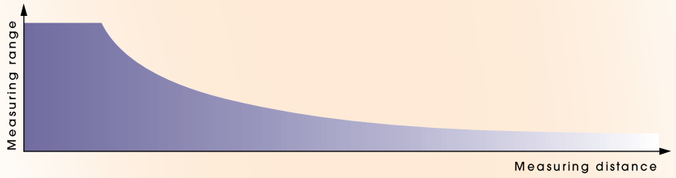
Every electronic autocollimator of the ELCOMAT product line consists of an autocollimation sensor and an universal display unit, that is compatible to all autocollimation sensors. Extensive mechanical and optical accessories as well as application oriented software are the basis for the solution of a wide variety of measurement tasks.



Measuring Principle

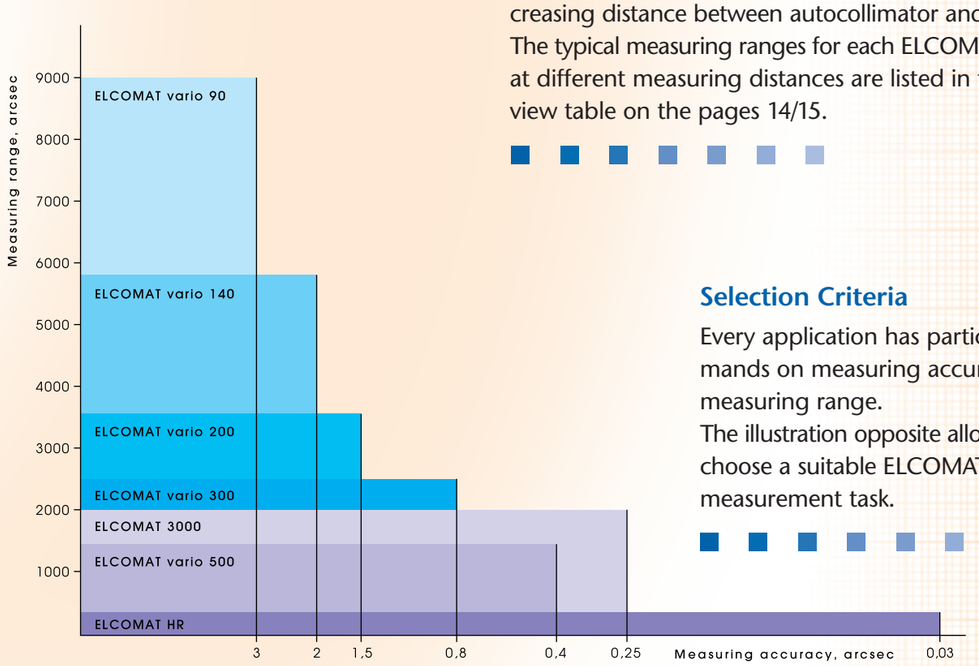
The measuring principle is illustrated in the following figure.





Measuring Range And Distance

The measuring range of any autocollimator decreases as the measuring distance increases.
The measuring accuracy, ignoring environmental influences, is independent of the distance. For autocollimators of the ELCOMAT product line the measuring range is constant up to a certain distance and then decreases with increasing distance between autocollimator and reflector. The typical measuring ranges for each ELCOMAT device at different measuring distances are listed in the overview table on the pages 14/15.



Selection Criteria

Every application has particular demands on measuring accuracy and measuring range.
The illustration opposite allows you to choose a suitable ELCOMAT for your measurement task.

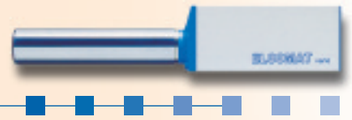
ELCOMAT vario

The inexpensive ELCOMAT vario autocollimation sensors can be supplied with a wide variety of objective tubes. This variety allows the choice of the most suitable ELCOMAT vario for the measuring task. The ELCOMAT vario is intended mainly for use in production.

ELCOMAT vario 90/40		
Measuring range	X-Axis 2.5°	Y-Axis 1.7°
Recommended resolution 1 arcsec		
Accuracy	± 3 arcsec	
Ord.-No. 229 801		

ELCOMAT vario 140/40		
Measuring range	X-Axis 1.5°	Y-Axis 1.1°
Recommended resolution 0.5 arcsec		
Accuracy	± 2 arcsec	
Ord.-No. 229 802		

ELCOMAT vario 200/40		
Measuring range	X-Axis 1.0°	Y-Axis 0.7°
Recommended resolution 0.2 arcsec		
Accuracy	± 1.5 arcsec	
Ord.-No. 229 803		



ELCOMAT vario 300/40		
Measuring range	X-Axis 0.7°	Y-Axis 0.5°
Recommended resolution 0.1 arcsec		
Accuracy	± 0.8 arcsec	
Ord.-No. 229 804		

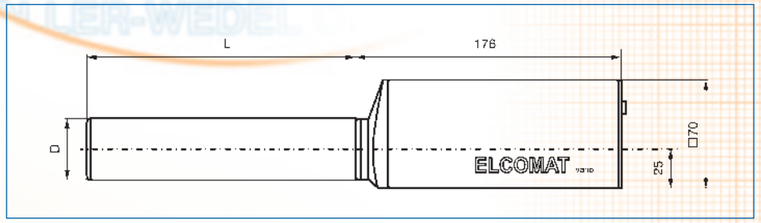
ELCOMAT vario 500/40		
Measuring range	X-Axis 0.4°	Y-Axis 0.3°
Recommended resolution 0.05 arcsec		
Accuracy	± 0.4 arcsec	
Ord.-No. 229 805		

ELCOMAT vario 300/65		
Measuring range	X-Axis 0.7°	Y-Axis 0.5°
Recommended resolution 0.1 arcsec		
Accuracy	± 0.8 arcsec	
Ord.-No. 229 806		

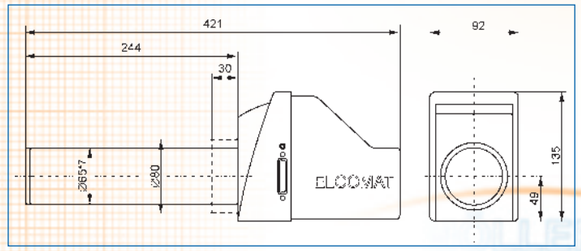
ELCOMAT vario 500/65		
Measuring range	X-Axis 0.4°	Y-Axis 0.3°
Recommended resolution 0.05 arcsec		
Accuracy	± 0.4 arcsec	
Ord.-No. 229 807		

ELCOMAT vario 500T/65		
Measuring range	X-Axis 0.4°	Y-Axis 0.3°
Recommended resolution 0.05 arcsec		
Accuracy	± 0.4 arcsec	
Ord.-No. 229 808		

	L, mm	D, mm
ELCOMAT vario 90/40	**67.5**	**Ø 40 f7**
ELCOMAT vario 140/40	**120.5**	**Ø 40 f7**
ELCOMAT vario 200/40	**175.5**	**Ø 40 f7**
ELCOMAT vario 300/40	**276.5**	**Ø 40 f7**
ELCOMAT vario 500/40	**476.5**	**Ø 40 f7**
ELCOMAT vario 300/65	**297**	**Ø 65 f7**
ELCOMAT vario 500/65	**479**	**Ø 65 f7**
ELCOMAT vario 500T/65	**297**	**Ø 65 f7**



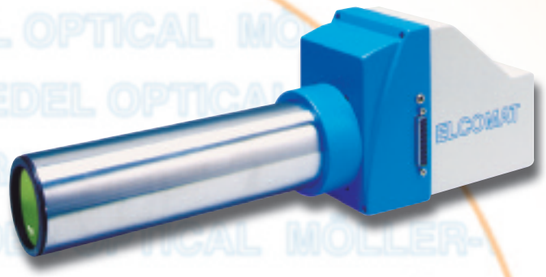
ELCOMAT 3000



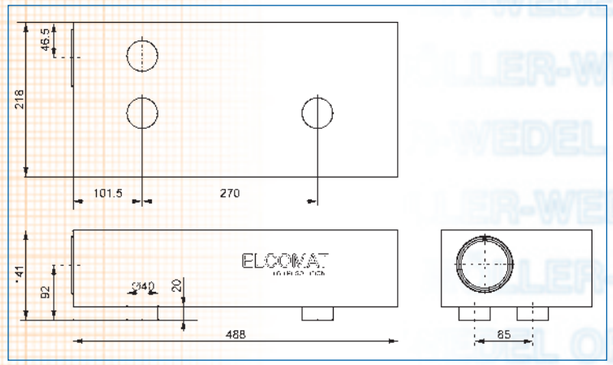
Technical Data	
Measuring range	2000 arcsec
Recommended resolution	0.05 arcsec
Accuracy	± 0.10 arcsec over any 20 arcsec range
	± 0.25 arcsec over total range
Best.-Nr. 229 919	

ELCOMAT 3000

The ELCOMAT 3000 is an universal instrument with large measuring range combined with high accuracy.
It can be used in production as well as in the laboratory.



ELCOMAT HR



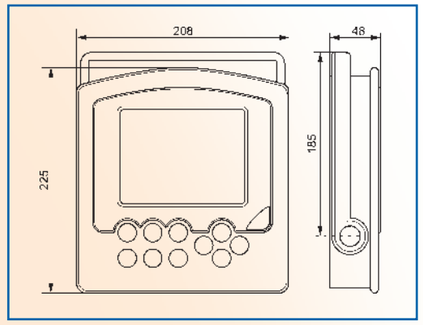
Technical Data	
Measuring range	300 arcsec
Recommended resolution	0.005 arcsec
Accuracy	± 0.01 arcsec over any 10 arcsec range
	± 0.02 arcsec over any 40 arcsec range
	± 0.03 arcsec over total range
Best.-Nr. 229 923	

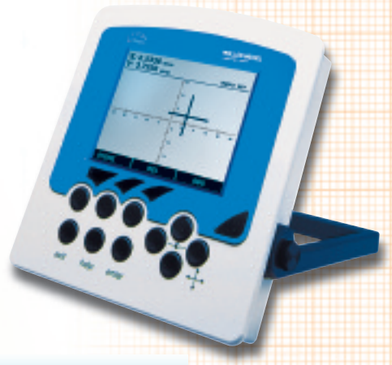
ELCOMAT HR

The ELCOMAT HR is a measuring instrument for applications requiring extremely high accuracy. Its ultra-robust mechano-optical design, as well as specially developed evaluation and calibration algorithms, are the basis for its excellent accuracy. These outstanding features make it the reference instrument of choice for many national calibration institutes.

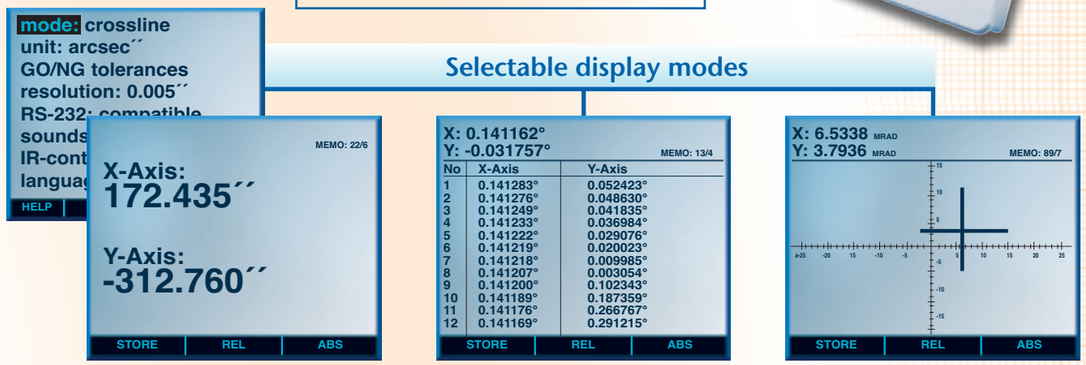
Subject to change without prior notice

DISPLAY UNIT



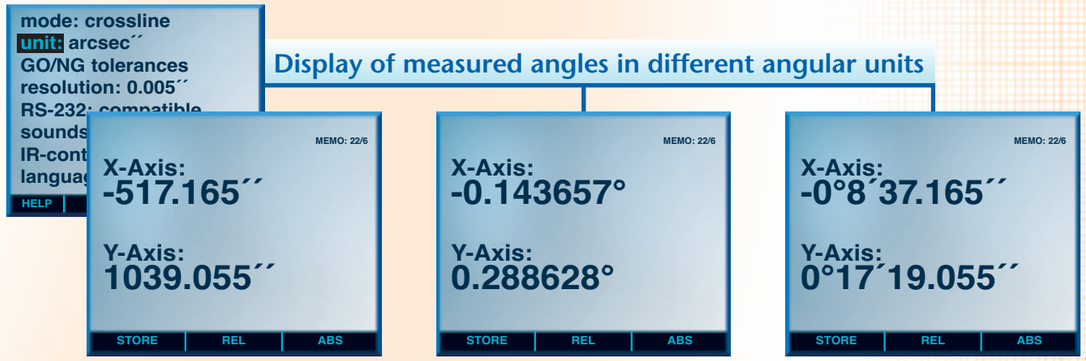


Selectable display modes



numerical display of data in large digits | numerical display of data in a table | graphical display with crossline and digits

Display of measured angles in different angular units



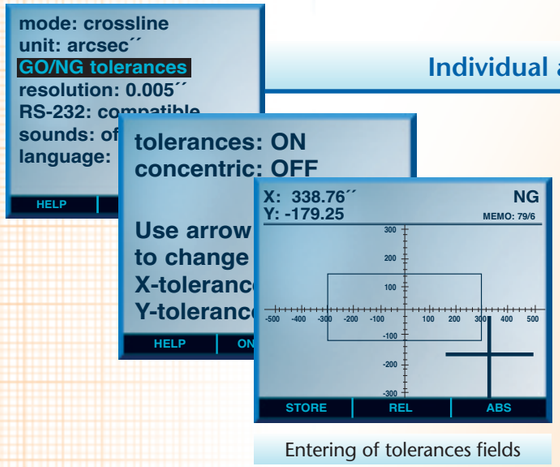
arcsec´´ | degree° | degree° / min´ / sec´´

microns per meter | milliradian

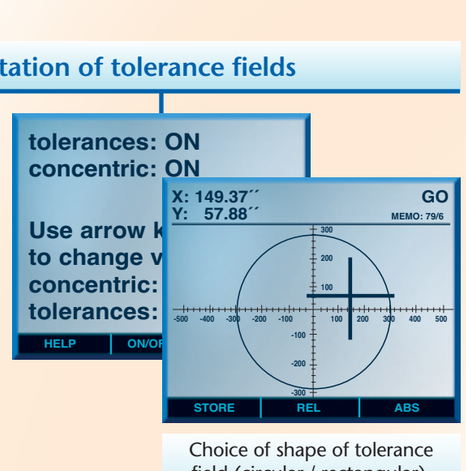
The universal display unit evaluates the autocollimation image and can be combined with all autocollimation sensors. The large display allows a comfortable reading of the displayed angle values. For further evaluation and documentation a computer can be connected to the display unit.

DISPLAY UNIT

Individual adaptation of tolerance fields

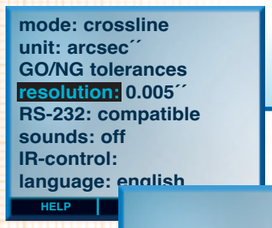


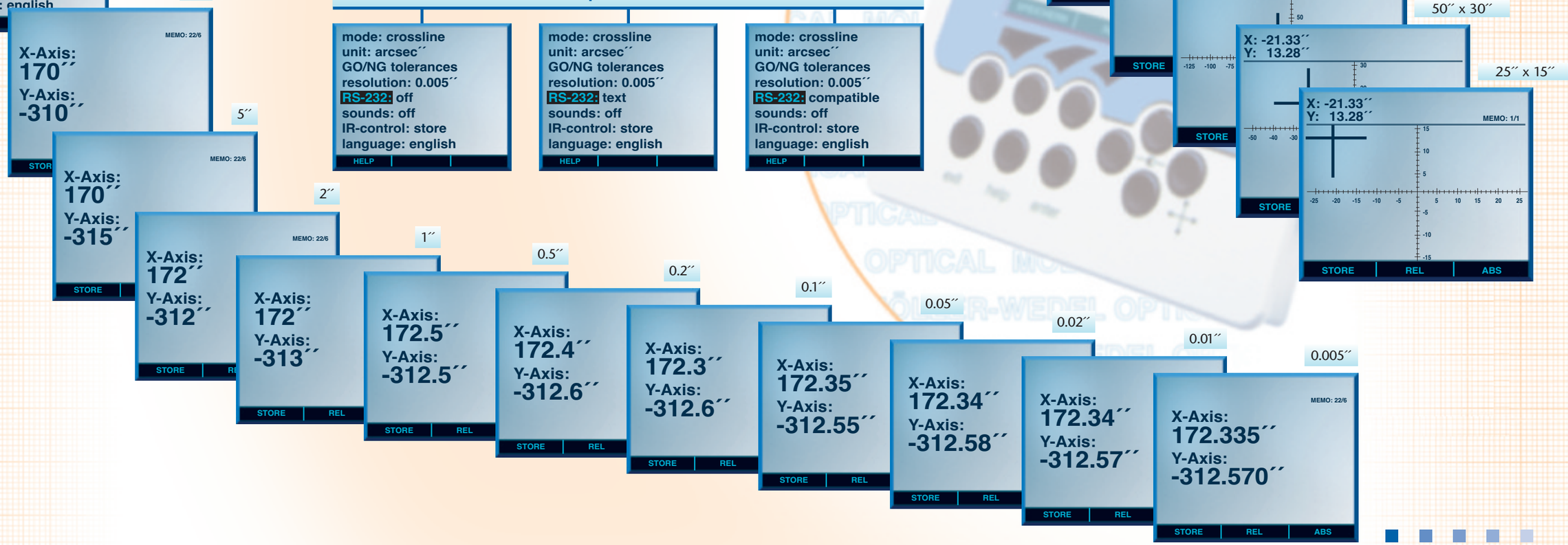
Entering of tolerances fields



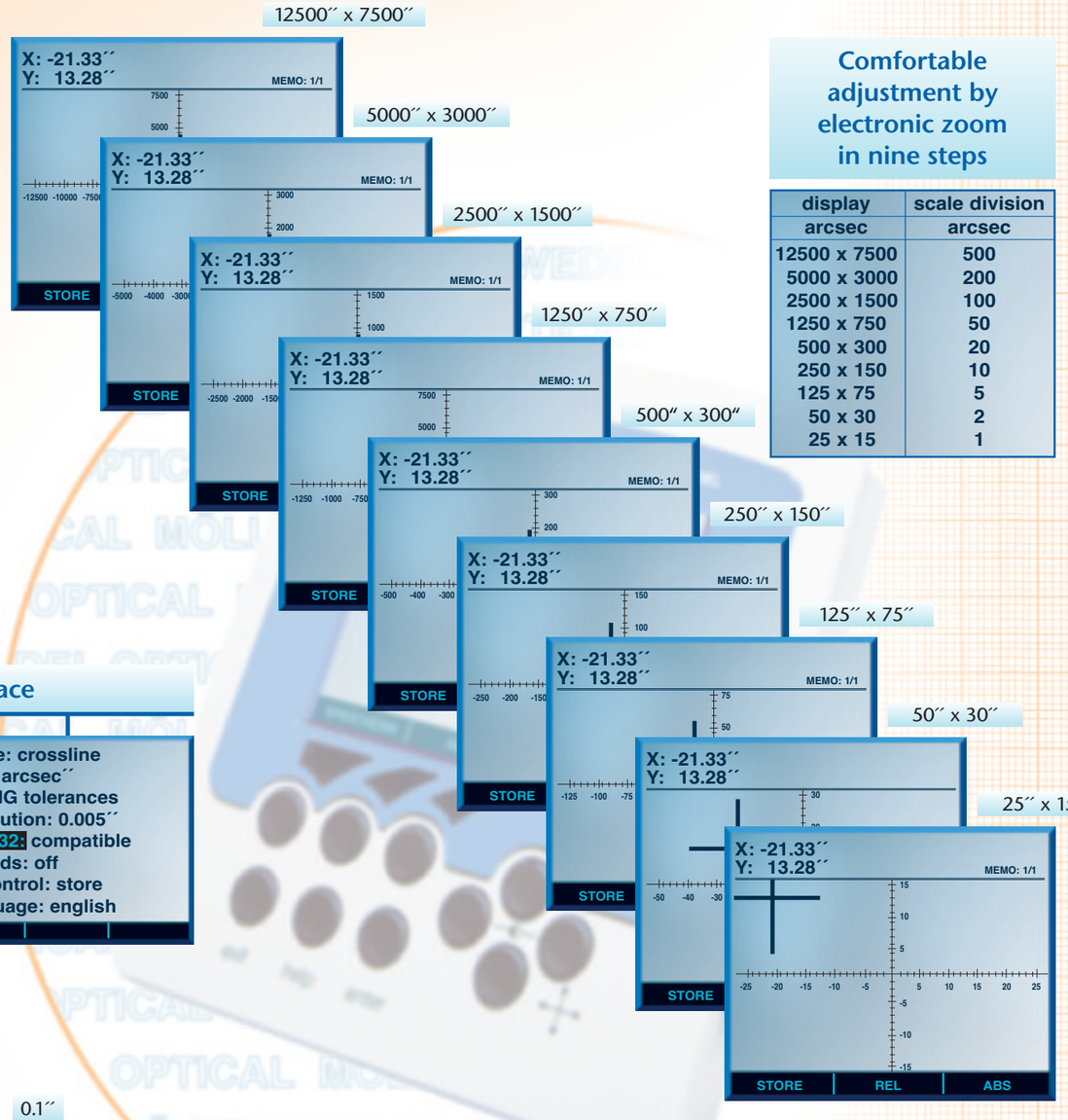
Choice of shape of tolerance field (circular / rectangular), quick assessment with GO / NO-GO indication

Resolution selectable in eleven steps





Connection to a computer via RS-232 interface



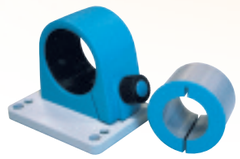
Comfortable adjustment by electronic zoom in nine steps

display	scale division
arcsec	arcsec
12500 x 7500	500
5000 x 3000	200
2500 x 1500	100
1250 x 750	50
500 x 300	20
250 x 150	10
125 x 75	5
50 x 30	2
25 x 15	1

ACCESSORIES

Clamp Fixture

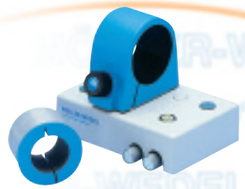
for integration of an ELCOMAT vario or ELCOMAT 3000 in existing set-ups
Height of the axis: 62 mm
Mounted with 4 screws M6 possible



Article description	Ord.-No.
Clamp fixture D40	223 035
Clamp fixture D65	223 037

Adjustable Holder

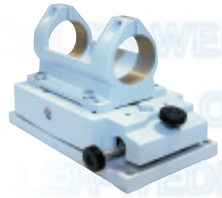
for adjustable mounting of an ELCOMAT vario or ELCOMAT 3000, also for attaching to the tripod (Ord.-No. 223 082)
Adjustment range ± 2° in both axes
Height of the axis: 100 mm



Article description	Ord.-No.
Adjustable holder D65	223 056
Adapter D40	223 035 01

Adjustable Holder (alternative)

for adjustable mounting of an ELCOMAT vario or ELCOMAT 3000, for high demands on stability and adjustment accuracy, also for attaching to the tripod (Ord.-No. 223 081)
Adjustment range ± 4° in both axes
Height of the axis: 132 mm



Article description	Ord.-No.
Adjustable holder with clamp fixture, double-sided D65	223 024
Adjustable holder with clamp fixture, double-sided D40	223 023

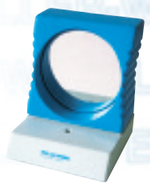
Tripod

for use with the adjustable holders
Min. height 630 mm
Max. height 1320 mm

Article description	Ord.-No.
Tripod for adjustable holder 223 024 / 223 023	223 081
Tripod for adjustable holder 223 056	223 082

Mirror In Mount

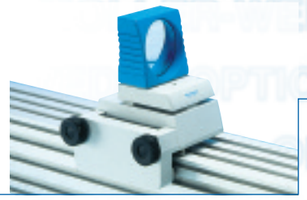
combine with base (Ord.-No. 223 264)
or with magnetic base (Ord.-No. 223 282)
Application: measurement of straightness, squareness, parallelism and flatness
Height of the axis: 55 mm



Article description	Ord.-No.
Mirror in mount, one-sided	223 260
Mirror in mount, double-sided	223 262

Base with Stop Bar

combine with mirror in mount
(Ord.-No. 223 260 or 223 262)
Application: measurement of straightness, squareness, parallelism and flatness
Height of the axis: 100 mm (incl. mirror)



Article description	Ord.-No.
Base 100	223 264
Stop bar for base 100	223 269
Base mirror, complete (223 262 + 223 264 + 223 269)	223 271

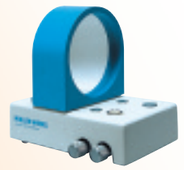
Magnetic Base

for attaching of the mirror in mount
(Ord.-No. 223 260 or 223 262)
to any magnetic surface
Application: measurement of straightness, squareness and parallelism
Height of the axis: 100 mm (incl. mirror)

Article description	Ord.-No.
Magnetic base	223 282
Additionally required:	
Mirror in mount, one-sided	223 260
or	
Mirror in mount, double-sided	223 262

Mirror D100, Adjustable

for use as auxiliary or turning mirror
Adjustment range ± 2° in both axes
Height of the axis: approx. 100 mm



Article description	Ord.-No.
Mirror D100 adjustable, double-sided	223 221

Laser Attachment

for quick and easy alignment of ELCOMAT vario oder ELCOMAT 3000 to target mirrors

Article description	Ord.-No.
Laser attachment D40	219 767
Laser attachment D65	219 757

Pentaprism (Optical Square)

for integration in existing set-ups, also for combination with
the base (Ord.-No. 221 027) or with
the holder (Ord.-No. 221 023)
Application: measurement of squareness and parallelism

Article description	Ord.-No.
Pentaprism 2“	205 331
Pentaprism 2“ in mount	221 015
Pentaprisma 2“ with wedge in mount	221 016

Base for Pentaprism

for mounting of the pentaprism (Ord.-No. 221 015 or 221 016)
Application: measurement of squareness and parallelism
Height of the axis: 100 mm

Article description	Ord.-No.
Base for fixing of the pentaprism in mount (without stop bar)	221 027

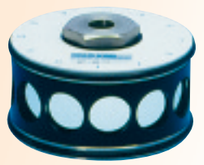
Holder for Pentaprism

for mounting of the pentaprism to any 65 mm diameter objective tube
Application: measurement of squareness

Article description	Ord.-No.
Holder D65 for pentaprism	221 023

Polygon Mirror

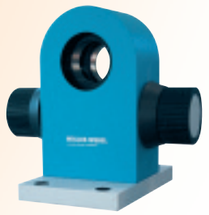
angular measuring standard for measurement of the rotary position uncertainty of index or rotary tables
Mirror: Ø 38 mm (8 fl.)
Ø 25 mm (12 fl.)



Article description	Ord.-No.
Polygon mirror 12 faces 2´´	205 313
Polygon mirror 8 faces 2´´	205 307

Autocollimator-Test-Wedge

The certified Autocollimator-Test-Wedge is used as quick reference for on site testing of visual and electronic autocollimators

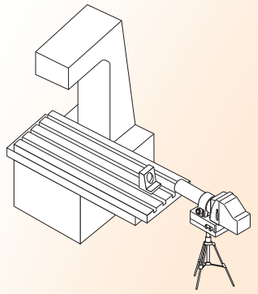


Article description	Ord.-No.
Autocollimator-Test-Wedge	223 244

APPLICATIONS

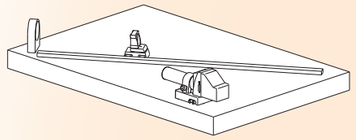
Straightness, Parallelism, Tilt

Measurement of **straightness** and **parallelism** of machine ways and straight edges, **tilt** measurement of carriages, **deformation** measurement of machine parts up to a length of 25 m with an accuracy up to 0.5 µm/m (0.1 arcsec).



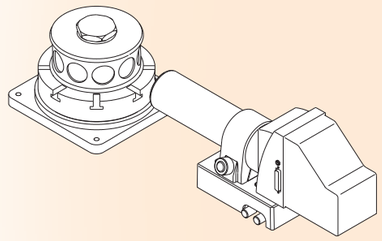
Flatness

Testing of **flatness** of large plane surfaces such as metal or granite surface plates and optical tables.
Accuracy up to 1 µm/m²



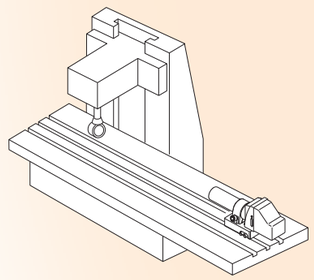
Position Uncertainty

Testing of the **position uncertainty** of index and rotary tables, absolute measurement of polygon mirrors.
Accuracy up to 0.1 arcsec.



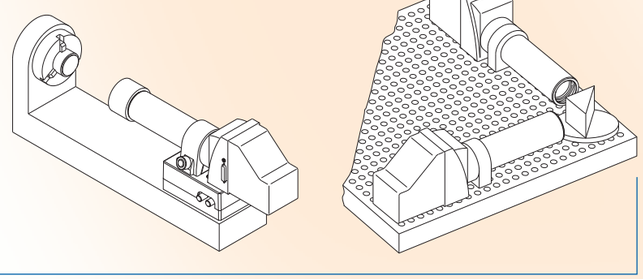
Squareness

Measurement of **squareness** of spindle axis to worktable, between spindle and machine way, between machine ways and between straight edges.
Accuracy up to 0.5 µm/m (0.1 arcsec).



Centring, Adjustment, Angle Measurement

Centring of lens systems, **adjustment** of optical components (e.g. prisms and mirrors), **angle measurement** of prism and wedges, etc.



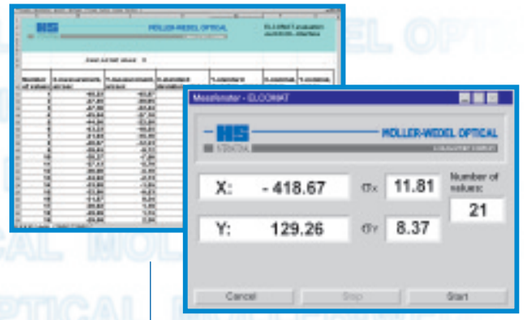
SOFTWARE

INCOLINK

Software interface for transfer of measurement data from an ELCOMAT to a computer, time controlled recording of measurement data, universal interface for simple integration in customer specific software (e.g. EXCEL®) possible.
Executable under WINDOWS® XP
Ord.-No. 219 739

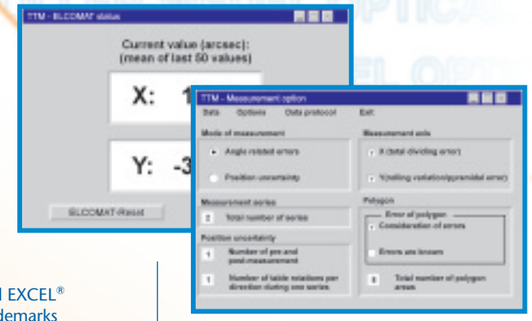
ELCOWIN

Software for the ELCOMAT product line for the measurement of straightness, squareness, parallelism and flatness.
Executable under WINDOWS® XP
Ord.-No. 219 736



ELCOMEX

Software interface for the ELCOMAT product line in connection with EXCEL® 97, extensive possibilities for data evaluation and visualisation.
Executable under WINDOWS® XP
Ord.-No. 219 738



TTM

Software for the ELCOMAT product line for the measurement of position uncertainty of the index and rotary tables as well as for the absolute measurement of polygon mirrors.
Executable under WINDOWS® XP
Ord.-No. 219 734

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TECHNICAL DATA

	ELCOMAT vario 90/40	ELCOMAT vario 140/40	ELCOMAT vario 200/40	ELCOMAT vario 300/40	ELCOMAT vario 500/40	ELCOMAT vario 300/65	ELCOMAT vario 500/65	ELCOMAT vario 500T/65	ELCOMAT 3000	ELCOMAT HR
Accuracy, arcsec	± 3	± 2	± 1.5	± 0.8	± 0.4	± 0.8	± 0.4	± 0.4	± 0.1 over any 20" range ± 0.25 over total range	± 0.01 over any 10" range ± 0.02 over any 40" range ± 0.03 over total range
Number of Measuring Axes	2	2	2	2	2	2	2	2	2	2
Measuring Range, (X) x (Y), arcsec	9000 x 6120 up to 0.1 m 8240 x 6120 at 0.2 m 5490 x 5490 at 0.3 m 4120 x 4120 at 0.4 m 3290 x 3290 at 0.5 m 2740 x 2740 at 0.6 m 2350 x 2350 at 0.7 m 2060 x 2060 at 0.8 m 1830 x 1830 at 0.9 m	5900 x 4180 up to 0.3 m 5600 x 4180 at 0.4 m 5040 x 4180 at 0.5 m 4600 x 4180 at 0.6 m 4040 x 4040 at 0.7 m 3400 x 3400 at 0.8 m 2960 x 2960 at 0.9 m 2660 x 2660 at 1 m 990 x 990 at 2 m 400 x 400 at 3 m	3760 x 2520 up to 0.7 m 3610 x 2520 at 0.8 m 3200 x 2520 at 0.9 m 2880 x 2520 at 1 m 1140 x 1140 at 2 m 700 x 700 at 3 m 400 x 400 at 4 m 200 x 200 at 5 m	2520 x 1800 up to 1 m 1440 x 1440 at 2 m 960 x 960 at 3 m 720 x 720 at 4 m 570 x 570 at 5 m 420 x 420 at 6 m 300 x 300 at 7 m 240 x 240 at 8 m 180 x 180 at 9 m 140 x 140 at 10 m	1440 x 1140 up to 2 m 1240 x 1140 at 3 m 880 x 880 at 4 m 640 x 640 at 5 m 480 x 480 at 6 m 380 x 380 at 7 m 300 x 300 at 8 m 260 x 260 at 9 m 200 x 200 at 10 m	2520 x 1800 up to 2 m 1700 x 1700 at 3 m 1260 x 1260 at 4 m 970 x 970 at 5 m 770 x 770 at 6 m 640 x 640 at 7 m 540 x 540 at 8 m 390 x 390 at 9 m 300 x 300 at 10 m	1440 x 1140 up to 4 m 1380 x 1140 at 5 m 1040 x 1120 at 6 m 860 x 860 at 7 m 700 x 700 at 8 m 600 x 600 at 9 m 520 x 520 at 10 m 360 x 360 at 12 m	1440 x 1140 up to 4 m 1380 x 1140 at 5 m 1040 x 1120 at 6 m 860 x 860 at 7 m 700 x 700 at 8 m 600 x 600 at 9 m 520 x 520 at 10 m 360 x 360 at 12 m	2000 x 2000 up to 2.5 m 1770 x 1770 at 3 m 1320 x 1320 at 4 m 1030 x 1030 at 5 m 850 x 850 at 6 m 730 x 730 at 7 m 640 x 640 at 8 m 570 x 570 at 9 m 510 x 510 at 10 m 340 x 340 at 15 m 260 x 260 at 20 m	300 x 300 up to 4 m
Acquisition Range, arcsec	equal to measuring range					equal to measuring range			approx. 3600 both axes	approx. 1200 both axes
Resolution, arcsec	0.005 up to 10; selectable					0.005 up to 10; selectable				
Reproducibility, arcsec	0.4	0.3	0.2	0.1	0.05	0.1	0.05	0.05	0.05	0.01
Focal length, mm	90	140	200	300	500	300	500	500	300	1100
LED Wavelength, nm	660	660	660	660	660	660	660	660	660	660
Min. Reflector Dia, mm **R > 85%** **R ≅ 4%**	Ø 3 reflection coated Ø 4 uncoated	Ø 4 reflection coated Ø 6 uncoated	Ø 5 reflection coated Ø 10 uncoated	Ø 5 reflection coated Ø 10 uncoated	Ø 6 reflection coated Ø 16 uncoated	Ø 6 reflection coated Ø 16 uncoated	Ø 6 reflection coated Ø 16 uncoated	Ø 8 reflection coated Ø 20 uncoated	Ø 5 reflection coated Ø 6 uncoated	Ø 12.5 reflection coated Ø 40 uncoated
Free Aperture, mm	16	28	28	28	28	50	50	50	50	50
Height of Optical Axis, mm	100 (in adjustable holder 223 056) 62 (in clamp fixture 223 035 or 223 037)					100 (in adjustable holder 223 056) 62 (in clamp fixture 223 035 or 223 037)				92
Computer Interface	RS-232 / USB					RS-232 / USB				
Mains Voltage	90...250 V / 50...60 Hz					90...250 V / 50...60 Hz				
Dimensions, mm Autocollimation Sensor	244 x 70 x 70	297 x 70 x 70	352 x 70 x 70	453 x 70 x 70	655 x 70 x 70	473 x 78 x 70	655 x 78 x 70	473 x 78 x 70	420 x 95 x 135	488 x 218 x 141
Dimensions, mm Display Unit	208 x 230 x 48					208 x 230 x 48				
Tube Diameter, mm	Ø 40 f7	Ø 40 f7	Ø 40 f7	Ø 40 f7	Ø 40 f7	Ø 65 f7	Ø 65 f7	Ø 65 f7	Ø 65 f7	.....
Weight, kg Autocollimation Sensor	1.2	1.3	1.5	1.9	2.5	2.8	4	3.2	3.8	12.2
Weight, kg Display Unit	1.2					1.2				
Scope of Delivery	AC-sensor, display unit, software INCOLINK, AC-adapter, IR-remote control, RS-232 cable, USB cable, transportation- and storage box									
Ord.-No.	**229 801**	**229 802**	**229 803**	**229 804**	**229 805**	**229 806**	**229 807**	**229 808**	**229 919**	**229 923**