

## Combinations and Accessories

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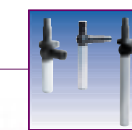
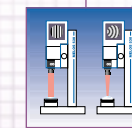
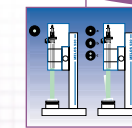
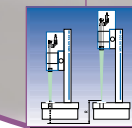
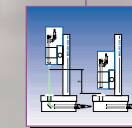
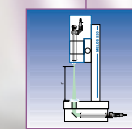
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# MEASURING EQUIPMENT FOR LENSES AND OPTICAL SYSTEMS

# MELOS 530

## Indispensable for Quality Control of Optics





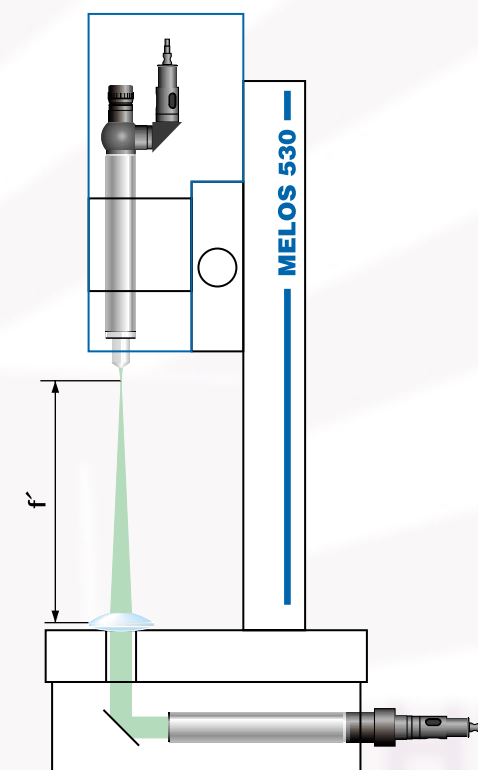
## Measuring Equipment for Lenses and Optical Systems

The measurement combination MELOS 530 is the optimum solution for the comfortable and fast determination of **effective focal length, back focal length, radii, wedge angles and surface form deviations**. The big advantages to other systems are:

- **Fast switching between the different measurement modes.** Due to an improved set-up, no time-consuming change of the measuring system is necessary.



- **Direct reading of the measurement results on a stand-alone display unit.** All calculations necessary for the evaluation of positive and negative effective focal length measurements are carried out on the display unit. Results can be stored in a table and transferred to a computer for e.g. documentation purposes at a later time. The user is supported by the integrated help function. It allows even the inexperienced user to quickly get familiar with the usage of the instrument.
- **Precise adjustment of the image planes,** by monitor display of the reticle image.
- **Easy conversion into an interferometric workstation** for measurement of flatness, wavefront and sphericity by use of an interferometric module.
- **Full control over the measurement process** by manual adjustment.

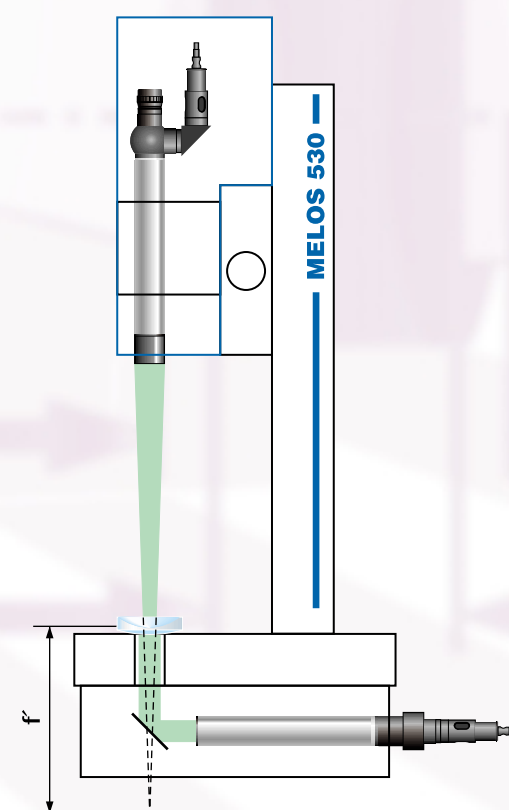


## Measurement of Positive Focal Lengths

The collimator projects a reticle to infinity. The specimen produces an image of the reticle in its focal plane. The size of the reticle image is determined solely by the known focal length of the collimator objective and the focal length of the specimen, which is to be measured. The measurement of the size of the projected reticle with a reading telescope consisting of an autocollimator and a microscope objective gives the focal length. The measurement process is done menu-controlled by the display unit.

*For measurement of positive focal lengths the combinations 1, 2, 3, 4, 5 (see page 9-10) can be used.*

Technical Data	
Range of focal length:	5 mm ... 500 mm
Free aperture:	28 mm
Maximum specimen diameter:	200 mm
Reproducibility:	0.04 % ... 0.2 %
Measurement accuracy:	0.3 %



## Measurement of Negative Focal Lengths

The collimator projects a reticle to infinity. The specimen produces a virtual image of the reticle in the focal plane. The measurement of the size of the virtual reticle image with a reading telescope consisting of an autocollimator and an attachment achromat gives the focal length.

The measurement process is done menu-controlled by the display unit.

*For measurement of negative focal lengths the combinations 2, 3, 4, 5 (see Page 9-10) can be used.*

Technical Data	
Range of focal length:	-5 mm ... -580 mm
Free aperture:	28 mm
Maximum specimen diameter:	200 mm
Reproducibility:	0.04 % ... 0.2 %
Measurement accuracy:	0.3 %



# TYPICAL APPLICATIONS

## Measurement of Back Focal Lengths

The collimator projects a reticle to infinity. The specimen produces an image of the reticle in its focal plane. The reading telescope consists of an autocollimator and a microscope objective. By vertical shifting of the reading telescope the distance of the reticle image to the specimen surface is determined. The measurement process is done menu-controlled by the display unit. For measurement of back focal length the combinations 1, 2, 3, 4, 5 (see page 9-10) can be used.

Technical Data	
Range of back focal length:	2 mm ... 530 mm
Free aperture:	28 mm
Maxi. specimen diameter:	200 mm
Reproducibility:	0.02 % ... 0.2 %
Measurement accuracy:	0.3 %

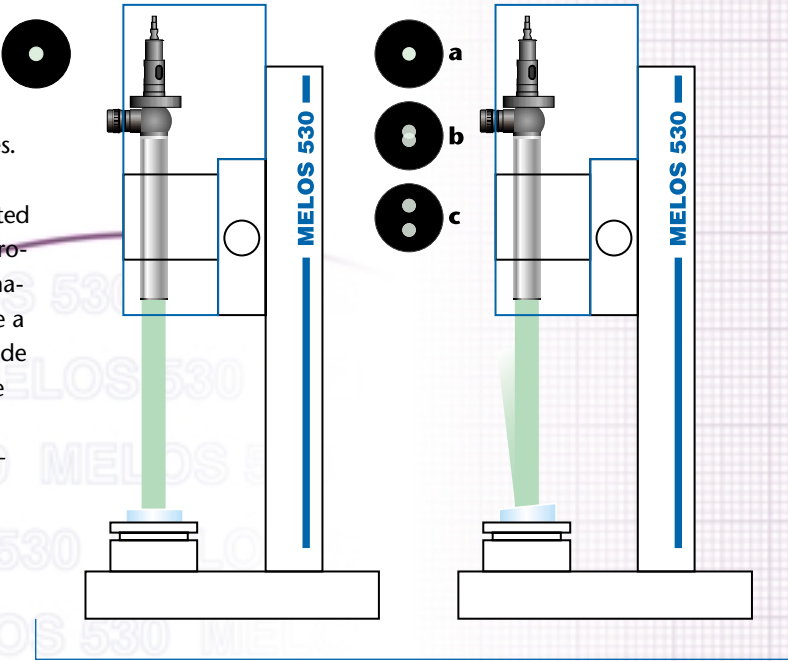
## Measurement of Convex and Concave Radii

An autocollimator with attachment achromat is used. The autocollimator produces a reticle image in the focal plane of the attachment achromat. This configuration produces autocollimation images in the vertex and the centre of curvature of the surface of the specimen. The vertical distance R is the radius, which is to be measured. The measurement process is done menu-controlled by the display unit. For measurement of convex and concave radii the combinations 3, 4, 5, 6 and 8 (see page 9-10) can be used.

Technical Data	
Measuring of range convex radii:	+2 mm ... +530 mm
Measuring of range concave radii:	-2 mm ... -480 mm
Free aperture:	28 mm
Maxi. specimen diameter:	200 mm
Reproducibility:	0.02 % ... 0.2 %
Measurement accuracy:	0.3 %

## Testing of Wedge Angles and Parallelism

An autocollimator with a reticle turret is used. The autocollimator is equipped with a set of six pinholes. Each pinhole represents a certain wedge angle. The parallel beam from the autocollimator is reflected at both surfaces of the specimen. Each reflection produces an autocollimation image. If both pinhole images coincide (a) the surfaces are parallel. Otherwise a double image occurs. The wedge angle can be inside (b) or outside (c) the tolerance limit defined by the pinhole. For testing of wedge angle and parallelism the combinations 4, 5 and 7 (see page 10-11) can be used.

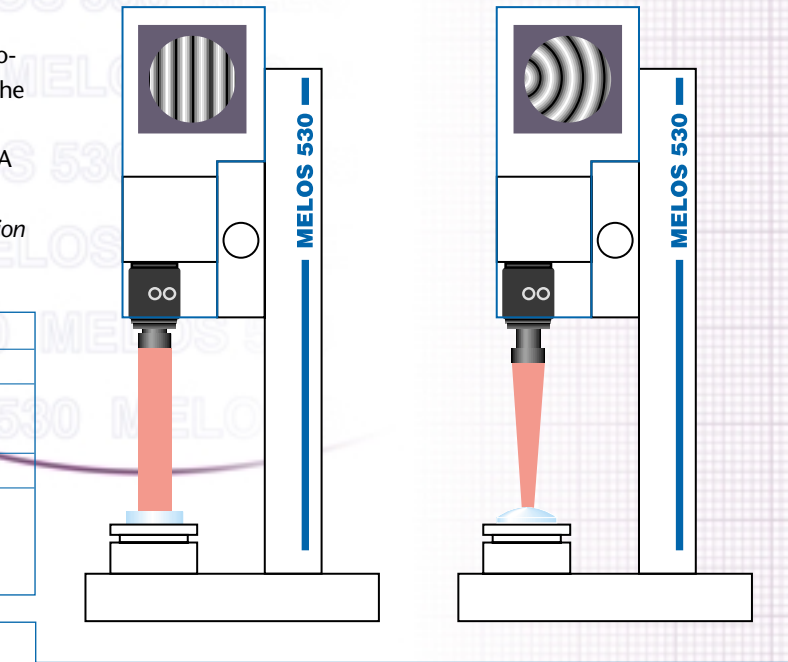


Optical parameter	Focal length of autocollimator	Tolerance limits of the pinholes	Measurement accuracy
Parallelism	140 mm	30", 1', 2', 3', 4', 5'	8"
	300 mm	10", 20", 30", 1', 2', 3'	3"
Angular error of 90°-prisms	140 mm	15", 30", 1', 1.5', 2', 2.5'	4"
	300 mm	5", 10", 15", 30", 1', 1.5'	2"
Angular error of roof prism	140 mm	7.5", 15", 30", 45", 1', 1.25'	2" - 3"
	300 mm	2.5", 5", 7.5", 15", 30", 45"	1" - 2"

## Interferometrical Measurement of Surface Form Deviations

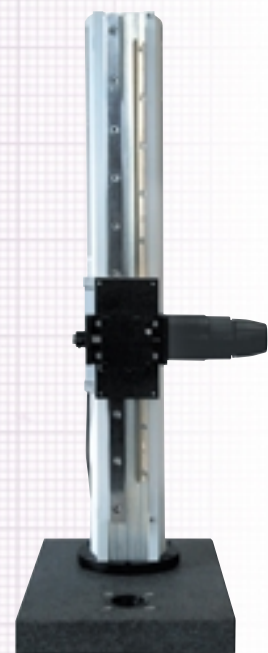
The interferometer INSPECT mini is used. The interferometer can be equipped with a reference element for the measurement of flat or spherical surfaces. In order to improve measurement accuracy the fringe software IFA can be used. For interferometrical measurement of surface form deviation the combinations 5 and 8 (see page 10-11) can be used.

Technische Daten	
Max. specimen diameter:	200 mm
Free aperture:	12.5 mm
with expander optics:	25 mm
Wavelength:	638 nm
Measurement accuracy:	
Visual evaluation:	$\lambda/10$
Software controlled evaluation:	$\lambda/30$





# COMPONENTS

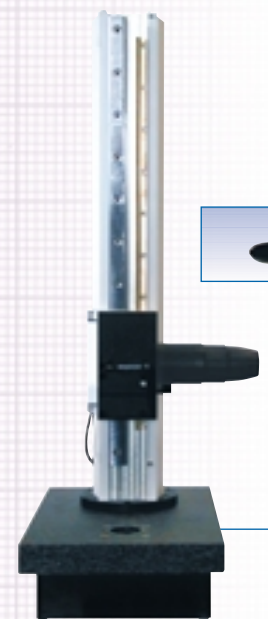


### Stand

Features:

- Vertical stand with excellent straightness and high stability
- One-hand operation for coarse and fine adjustment:  
adjustment range: 530 mm  
fine adjustment resolution: 1 µm
- Integrated measurement system:  
measurement range: 530 mm  
resolution: 1 µm  
accuracy: 3 µm
- Fixture for fast exchange of the measurement modules
- Granite base with threads for tilting table and/or XY-translation stage

Description	Ord.-No.
Stand	235 610



### Stand with measuring collimator

Features of the stand as listed under Ord.-No. 235 610. Additionally:

- Collimator K200/40 with especially designed reticle (combination of Siemens star and Porro test pattern)
- 90° folding mirror
- Set of mechanical stops (support for specimen)

Description	Ord.-No.
Stand with measuring collimator	235 620

### Autocollimator AKG 200/40/14.7

(A component of Ord.-No. 235 640).

Description	Ord.-No.
Radius-Module	235 640

### Autocollimator AKR 140/40/14.7 SWL

AKR with pinhole diaphragm turret (A component of Ord.-No. 235 645).

Description	Ord.-No.
Angle-Module 1	235 645

### Autocollimator AKR 300/40/14.7 SWL

AKR with pinhole diaphragm turret (A component of Ord.-No. 235 647).

Description	Ord.-No.
Angle-Module 2	235 647

### Focus-Module

Consisting of focal length measurement module, intelligent display unit and TV-monitor (not shown).

Features of the measurement module:

- Autocollimator with revolving nosepiece
- Horizontal translation stage with fine adjustment:  
measurement range: 20 mm  
resolution: 1 µm  
accuracy: 3 µm

Features of the intelligent display unit:

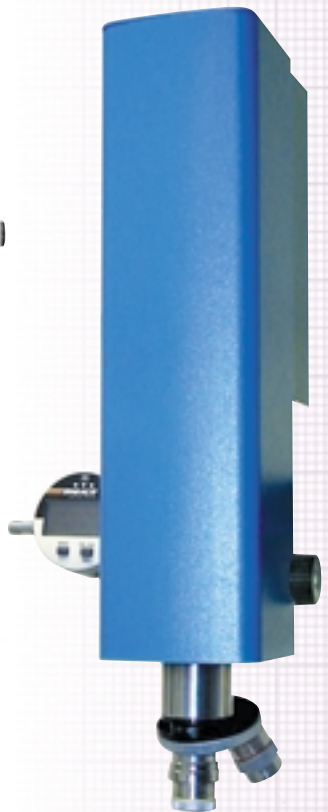
- Large LC-display with integrated software
- Easy to use due to menu-based user interface
- Integrated calculation of focal length, back focal length and radius by direct reading of the length measurement systems
- Adjustable GO / NO-GO tolerances
- Storing of the measurement results (in a table)
- Data transfer to PC via RS-232 interface
- Integrated help function

Description	Ord.-No.
Fokus-Module	235 630

### Display unit



### Measuring head



### TV-set

TV-set consisting of:

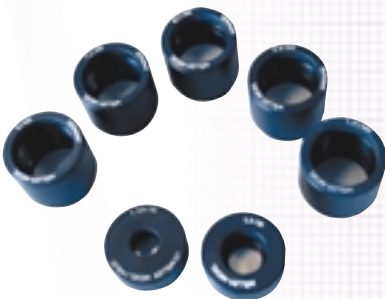
- Adapter for eyepiece
- CCD-camera
- B/W-monitor
- Connection cables

Description	Ord.-No.
TV-set	229 920



### Set of attachment achromats

Focal length mm	Free ø mm	Ord.-No.
50	10.5	221 048
90	16	221 051
140	28	221 053
200	28	221 055
300	28	221 059
500	28	221 063
600	28	221 067





# COMPONENTS



## Display module for radius measurement

Features:

- Zero setting in any position
- On-line display of vertical position for direct reading of radius

Description	Ord.-No.
Radius display module	773 170 05

## Two-axes tilting table

Features:

- $\pm 4^\circ$  angle of tilt in x- and y-axes
- 1 turn of the adjustment screw corresponds to  $0.35^\circ$  angle of tilt

Description	Ord.-No.
Two-axes tilting table	235 670

## Translation stage

Features:

- 5 mm translation in x- and y-direction
- 1 turn of the adjustment screw corresponds to 0.25 mm translation

Description	Ord.-No.
Translation stage	235 680

## Interferometer-Module and reference elements

Description	Ø	Form deviation	N.A.	R/D	Ord.-No.
Transm. flat	1/2"	$\lambda/10$ p-v	—	—	133 405 62
Transm. sphere	1/2"	$\lambda/10$ p-v	0.85	0.59	133 405 58
Transm. sphere	1/2"	$\lambda/10$ p-v	0.75	0.67	133 405 59
Transm. sphere	1/2"	$\lambda/10$ p-v	0.50	1.00	133 405 60
Transm. sphere	1/2"	$\lambda/10$ p-v	0.40	1.25	133 405 61
Transm. flat	1"	$\lambda/10$ p-v	—	—	133 405 57
Transm. sphere	1"	$\lambda/10$ p-v	0.75	0.59	133 405 51
Transm. sphere	1"	$\lambda/10$ p-v	0.67	0.67	133 405 52
Transm. sphere	1"	$\lambda/10$ p-v	0.55	1.00	133 405 53
Transm. sphere	1"	$\lambda/10$ p-v	0.40	1.25	133 405 54
Transm. sphere	1"	$\lambda/10$ p-v	0.28	1.25	133 405 55
Transm. sphere	1"	$\lambda/10$ p-v	0.15	1.25	133 405 56
Expander optics	$\varnothing 1/2'' \Rightarrow \varnothing 1''$				133 405 66

Interferometer-Module consists of INSPECT mini, adapter and fixture for reference elements.



# COMBINATIONS

## Combination 1

Measuring combination for measurement of positive focal lengths and back focal lengths.

Consisting of the 2 components:

Focus-Module	Stand with collimator
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### Technical Data

Measurement of pos. focal lengths see page 3  
Measurement of back focal lengths see page 4

## Combination 2

Measuring combination for measurement of positive and negative focal lengths as well as back focal lengths.

Consisting of the 3 components:

Focus-Module	Stand with collimator
Achromats	

### Technical Data

Measurement of pos. focal lengths see page 3  
Measurement of neg. focal lengths see page 3  
Measurement of back focal lengths see page 4

## Combination 3

Measuring combination for positive and negative focal lengths, back focal lengths as well as concave, convex radii.

Consisting of the 4 components:

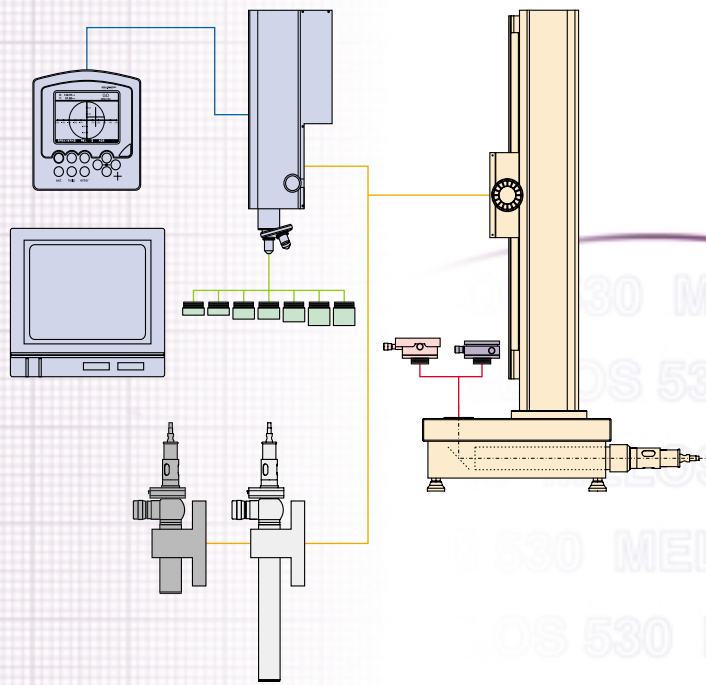
Focus-Module	Stand with collimator
Achromats	Translation stage

### Technical Data

Measurement of pos. focal lengths see page 3  
Measurement of neg. focal lengths see page 3  
Measurement of back focal lengths see page 4  
Measurement of concave/convex radii see page 4



# COMBINATIONS



## Combination 4

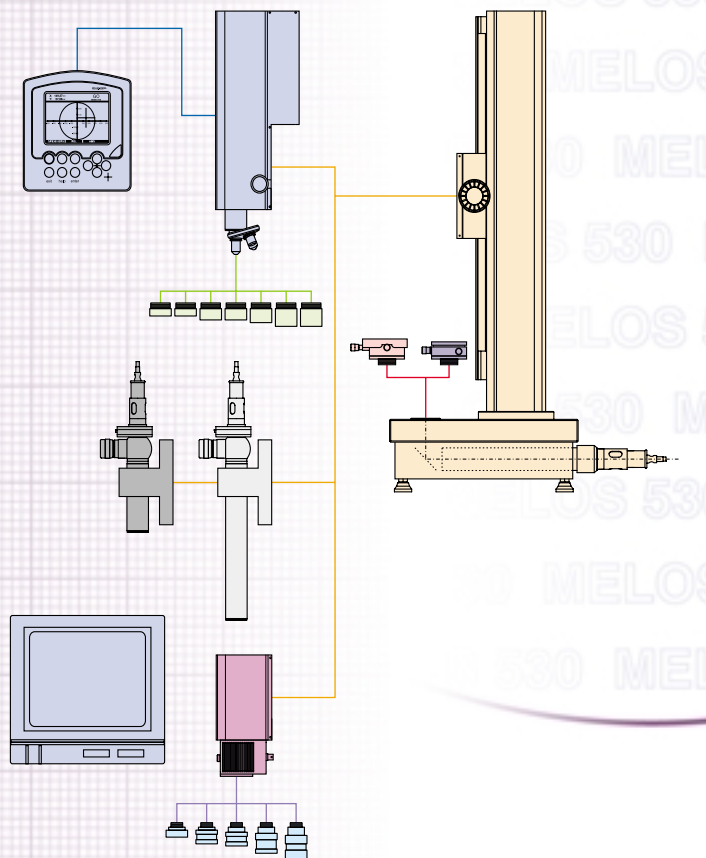
Measuring combination for measurement of positive and negative focal lengths, back focal lengths, concave and convex radii as well as wedge angles.

Consisting of the 7 components:

Focus-Module	Stand with collimator
Achromats	Translation stage
Angle-Module 1	Two-axes tilting table
Angle-Module 2	

### Technical Data

Measurement of pos. focal lengths see page 3  
Measurement of neg. focal lengths see page 3  
Measurement of back focal lengths see page 4  
Measurement of concave/convex radii see page 4  
Testing of wedge angles see page 5



## Combination 5

Measuring combination for measurement of positive and negative focal lengths, back focal lengths, concave and convex radii, wedge angles as well as surface form deviations.

Consisting of the 9 components:

Focus-Module	Stand with collimator
Achromats	Translation stage
Angle-Module 1	Interferometer-Module
Angle-Module 2	Reference elements
Two-axes tilting table	

### Technical Data

Measurement of pos. focal lengths see page 3  
Measurement of neg. focal lengths see page 3  
Measurement of back focal lengths see page 4  
Measurement of concave/convex radii see page 4  
Testing of wedge angles see page 5  
Measurement of surface form deviations see page 5

## Combination 6

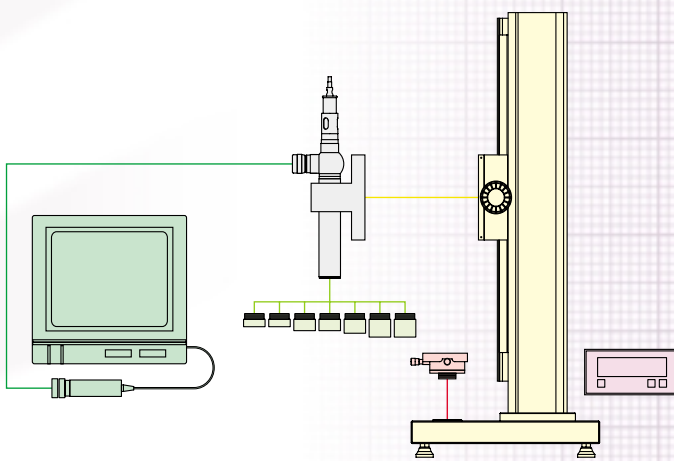
Measuring combination for measurement of concave and convex radii.

Consisting of the 6 components:

Stand	Translation stage
Radius-Module	Radius display unit
Achromats	TV-set

### Technical Data

Measurement of concave/convex radii see page 4



## Combination 7

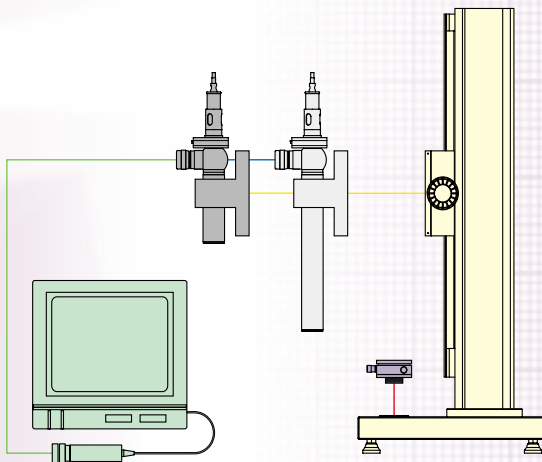
Measuring combination for testing of wedge angles.

Consisting of the 5 components:

Stand	Angle-Module 1	Angle-Module 2
TV-set	Two-axes tilting table	

### Technical Data

Testing of wedge angles see page 5



## Combination 8

Measuring combination for surface form deviations.

Consisting of the 6 components:

Stand	Translation stage
Two-axes tilting table	
Radius display unit	
Interferometer-Module	
Reference elements	

### Technical Data

Measurement of surface form deviations see page 5

