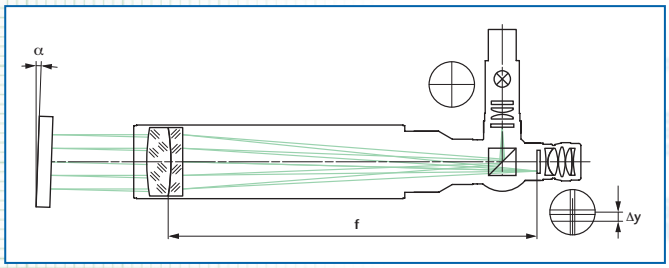
AUTOCOLLIMATORS
INTRODUCTION

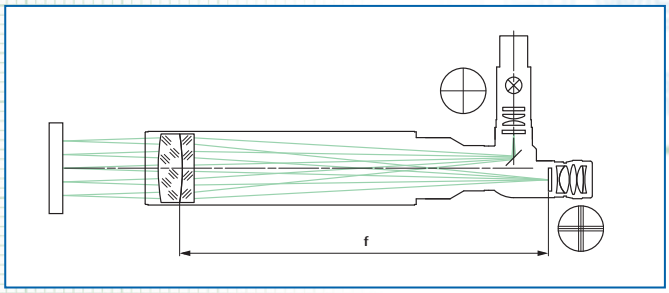
Layout and principle of operation

An autocollimation telescope (autocollimator) combines the function of a collimator and a telescope in one unit. The collimator and telescope share the same optical path, which is accomplished using either a physical or geometrical beam splitter.

The illustration below shows the schematic set-up of an autocollimator with straight viewing, a physical beam splitter and infinity adjustment. The autocollimation telescope projects the image of the collimator reticle to infinity. A target mirror, located in the beam path of the autocollimator objective, returns the projected image into the autocollimator and creates an image of the collimator reticle via the beam splitter in the eyepiece reticle plane (autocollimation image).
The mechanical (objective tube) axis is adjusted to the optical axis with angle accuracy of ±30 µm/*f* for autocollimators with *f*≤300 mm. The reticle adjustment amount ±10 µm.



An autocollimator with geometrical beam splitter is arranged similarly (see illustration below). The collimator reticle is reflected into the beam path by the path-folding mirror which has a small angle in relation to the optical axis. The beam reflected off the target mirror passes below the path-folding mirror and produces an image of the collimator reticle in the eyepiece reticle plane.



Calculation of the angles

An autocollimator can be used to measure the angle of a mirror in two axes with respect to the optical axis of the autocollimator. If the mirror is exactly perpendicular to the optical axis, the beam is reflected upon itself. If the mirror is tilted by the angles α_x and α_y, the reflected beam enters the objective obliquely. Depending on the amount of tilt, the autocollimation image in the eyepiece reticle plane is displaced to a greater or lesser amount. The displacement Δx and Δy of the autocollimation image in X and Y direction provides a measure of the angular displacement of the mirror:

$$\alpha_x = \arctan\left(\frac{\Delta x}{2f}\right) \approx \frac{\Delta x}{2f}$$

$$\alpha_y = \arctan\left(\frac{\Delta y}{2f}\right) \approx \frac{\Delta y}{2f}$$

f: focal length of the autocollimation objective.

Numerical example:
A displacement of the reticle image of 3 mm measured with an autocollimator with 300 mm focal length corresponds to a tilting angle of:

$\alpha \approx 3/2/300 \text{ rad} = 5 \cdot 10^{-3} \text{ rad} = 0{,}2865° = 17'11''$

The image displacement of 10 µm in the reticle plane corresponds to an angular tilt of:

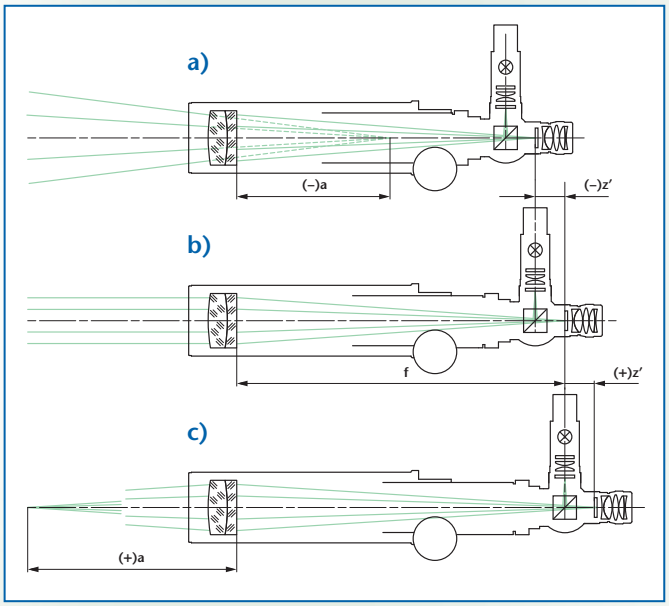
Focal length	Angular tilt
50 mm	21″
90 mm	11″
140 mm	7,4″
200 mm	5,2″
300 mm	3,4″
500 mm	2,1″
600 mm	1,7″
1100 mm	0,9″

Adjustable Focus

Autocollimators with adjustable distance between reticle and objective are also available. This adjustment allows objective focus at distances other than infinity. If the reticle is displaced out of the focal plane by a distance z', then the autocollimator is focused at a distance a according to:

$$a = \frac{f'^2 + z'f}{z'}$$

$z'<0$ corresponds to a decrease of the distance between objective and reticle. The resulting image distance is negative (virtual object position) (a).
$z'>0$ corresponds to a real image with positive object distance (c).
$z'=0$ produces an image at infinite distance (b).



Selection criteria

Long or short focal length?

Depending on the magnification of the instrument a longer focal length leads to a greater measuring sensitivity and measurement accuracy. As the focal length increases, the measuring range decreases proportionally. A longer focal length affects the mechanical extension of the tube, as well.

Small or large objective aperture?

Light conditions are more favourable when large apertures are used, and the evaluation of the results is easier and more accurate. A long distance between mirror and autocollimator or a partially reflective surface demands a relatively large free aperture (or aperture ratio). For these measurements a relatively large aperture diameter should be used.

Geometrical or physical beam splitter?

The geometrical beam splitter results in smaller image angles, but greater image brightness and less stray light. These autocollimators are used mainly with small targets. Due to their internal layout, these autocollimators cannot be used for measurement of triple mirrors or corner cubes. In most cases an autocollimator with physical beam splitter is recommended, due to the larger measuring range of this configuration.

Fixed or variable distance setting?

The measurement of the angles of plane mirrors in autocollimation is made with a parallel, or infinity focus, beam. Fixed, infinite focus is generally the best choice. For measurement tasks requiring an adjustable focal distance, use an objective tube with focus adjustment. Fixed focus tubes set at other than infinity can be ordered.

Eyepiece focal length?

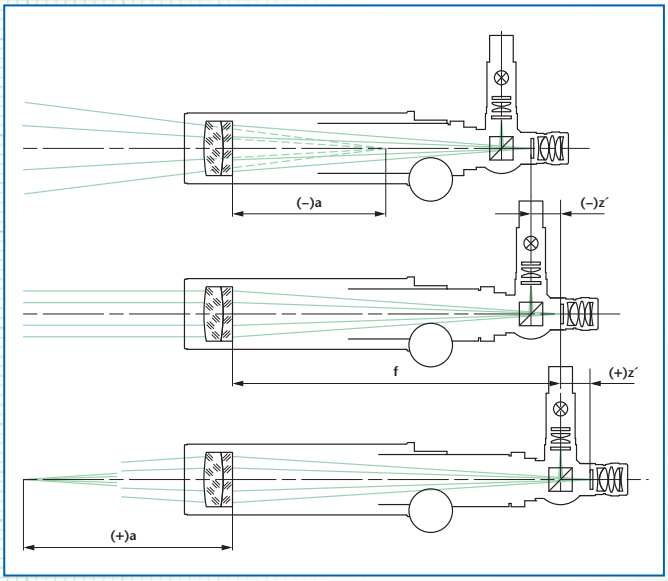
In contrast to eyepiece with f=14,7 mm eyepiece with f=10 mm gives a larger magnification but lesser FOV and eyepiece with f=25 mm gives a smaller magnification but larger FOV. In case a C-Mount–Camera adapter should be used, the eyepieces f=14,7 or f=25 mm has to be selected.

AUTOCOLLIMATORS

FOCUSABLE – STRAIGHT VIEWING

Description:

For a general description of the principle of functioning of focusable autocollimators see page 43.



Application areas:

- Measurement of angular tilt
- Qualitative testing of the imaging properties of optical elements and systems
- Measurement of large radii of curvature
- Infinity adjustment to other wavelengths

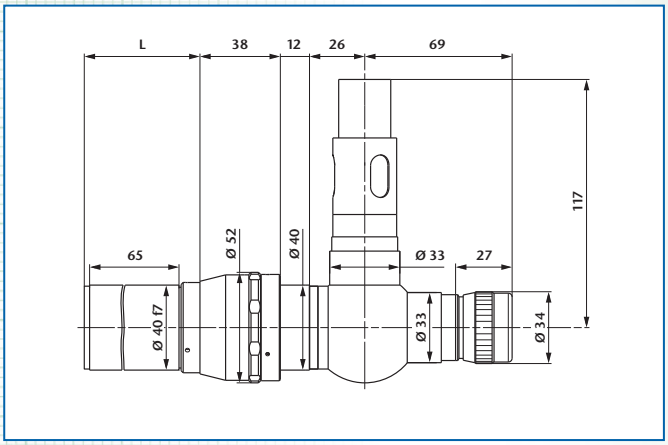
Notes on ordering:

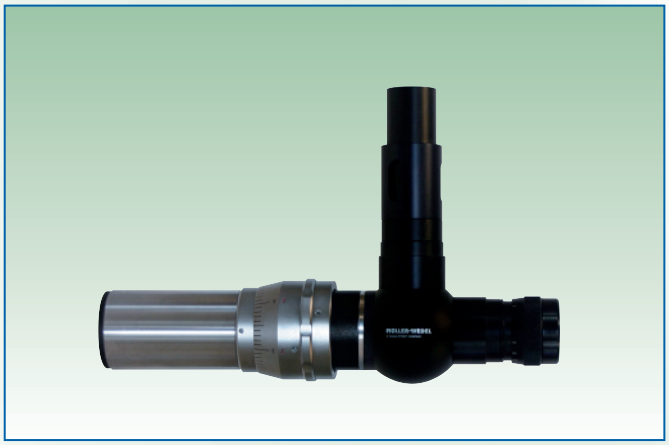
- Optionally, the autocollimators can be equipped with an eyepiece having 10 mm or 25 mm focal length.
- Two reticles, 6V/5W illumination w/cord, and eyepiece are included.
- The nomenclature of the adjustable autocollimators with straight viewing is as follows:

Example: AK G V 90/ 40/ 14,7 ±6

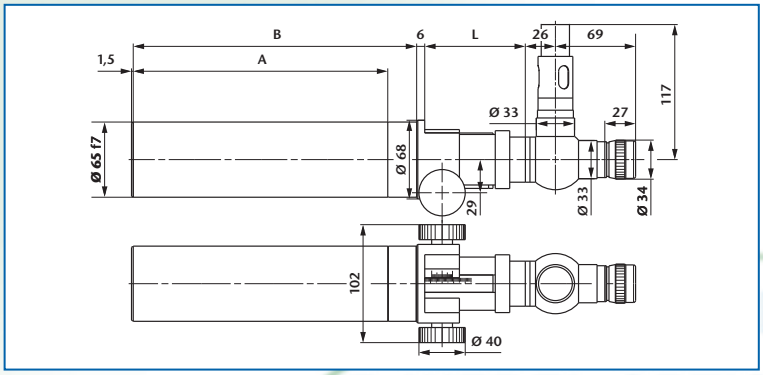
- AK – Autocollimator
- G – Straight viewing
- V – Variable
- 90/ – Focal length
- 40/ – Tube diameter
- 14,7 – Eyepiece focal length
- ±6 – Tube extension in mm

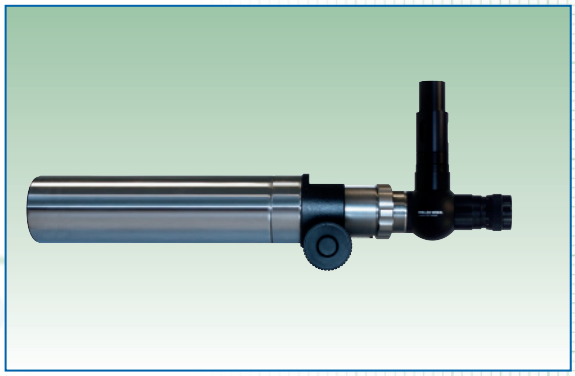
Impotant:
Please specify collimator reticle and eyepiece reticle (see page 82) as well as illumination (LED-, bulb- or cold light, see page 81) when ordering.



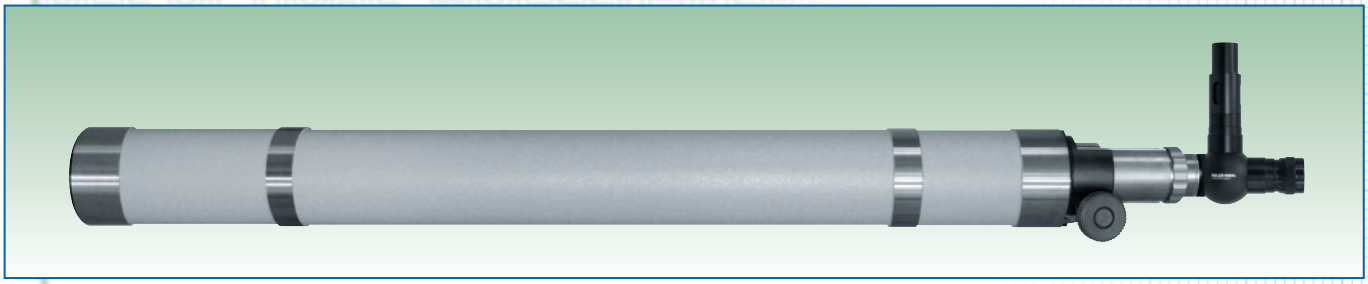


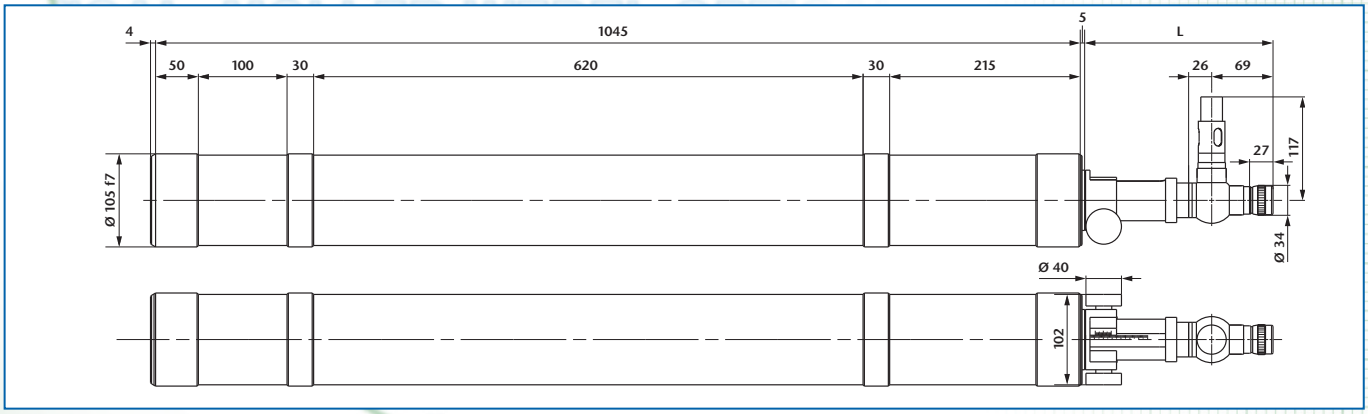
Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Distance range	L
229 501	AKGV 90/40/14,7/±6	90	16	±6	3,0°	–∞...–1,25 m 1,40 m...+∞	77±6
229 502	AKGV 90/40/14,7/+12	90	16	+12	3,0°	0,80 m...+∞	71^{+12}
229 503	AKGV 90/40/14,7/–12	90	16	–12	3,0°	–∞...–0,60 m	83_{-12}
229 504	AKGV 140/40/14,7/±6	140	28	±6	2,0°	–∞...–3,10 m 3,30 m...+∞	77±6
229 505	AKGV 140/40/14,7/+12	140	28	+12	2,0°	1,70 m...+∞	71^{+12}
229 506	AKGV 140/40/14,7/–12	140	28	–12	2,0°	–∞...–1,40 m	83_{-12}





Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Distance range	A	B	L
229 507	AKGV 300/65/14,7/±25	300	50	±25	1,0°	–∞...–3,4 m 3,8 m...+∞	220	245	87±25
229 508	AKGV 300/65/14,7/+50	300	50	+50	1,0°	2,1 m...+∞	220	270	62^{+50}
229 509	AKGV 300/65/14,7/–50	300	50	–50	1,0°	–∞...–1,5 m	220	220	112_{-50}
229 510	AKGV 500/65/14,7/±50	500	50	±50	0,5°	–∞...–4,5 m 5,4 m...+∞	310	360	112±50
229 511	AKGV 500/65/14,7/+100	500	50	+100	0,5°	3,0 m...+∞	310	410	62^{+100}
229 512	AKGV 500/65/14,7/–100	500	50	–100	0,5°	–∞...–1,5 m	310	310	162_{-100}





Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Distance range	L
229 516	AKGV 1100/105/14,7/±50	1100	78	±50	0,25°	–∞...–23,7 m 25,8 m...+∞	202±50
229 517	AKGV 1100/105/14,7/+100	1100	78	+100	0,25°	13,2 m...+∞	202^{+100}
229 518	AKGV 1100/105/14,7/–100	1100	78	–100	0,25°	–∞...–12,0 m	202_{-100}

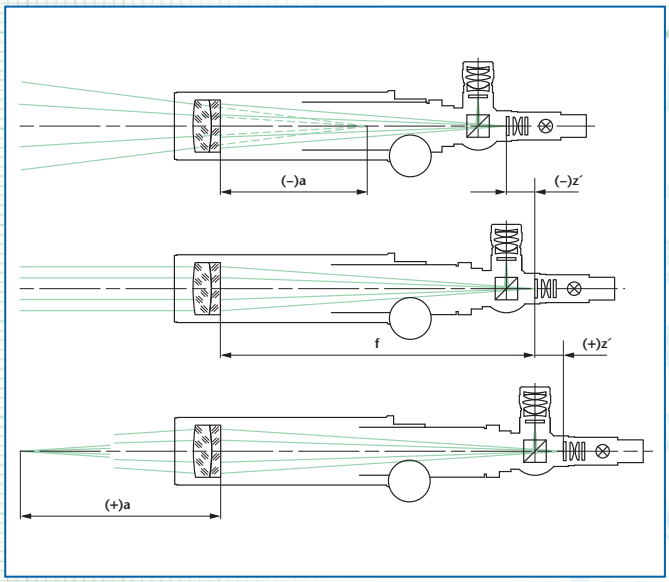
AUTOCOLLIMATORS

FOCUSABLE – 90°-VIEWING

Description:

For a general description of the principle of functioning of focusable autocollimators see page 43.

This autocollimator is equipped with right angle viewing (see page 46).



Application areas:

- Adjustment of optical and mechanical systems
- Qualitative testing of the imaging properties of optical elements and systems
- Measurement of large radii of curvature
- Infinity adjustment to other wavelengths

Notes on ordering:

- Optionally, the autocollimators can be equipped with an eyepiece having 10 mm or 25 mm focal length.
- Two reticles, 6V/5W illumination w/cord, and eyepiece are included.
- The nomenclature of the adjustable autocollimators with 90°-viewing is as follows:

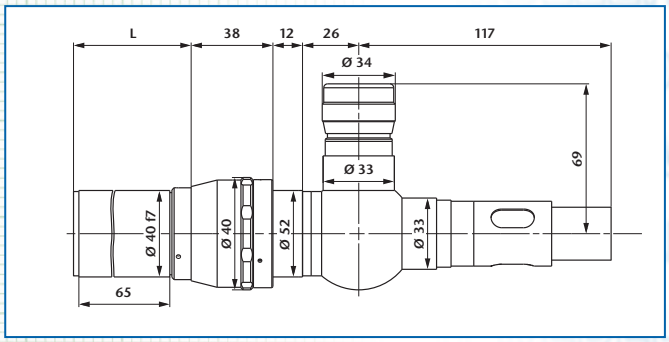
Example: AK | R | V | 90/ | 40/ | 14,7 | ±6

- AK – Autocollimator
- R – 90° viewing
- V – Variable
- 90/ – Focal length
- 40/ – Tube diameter
- 14,7 – Eyepiece focal length
- ±6 – Tube extension in mm

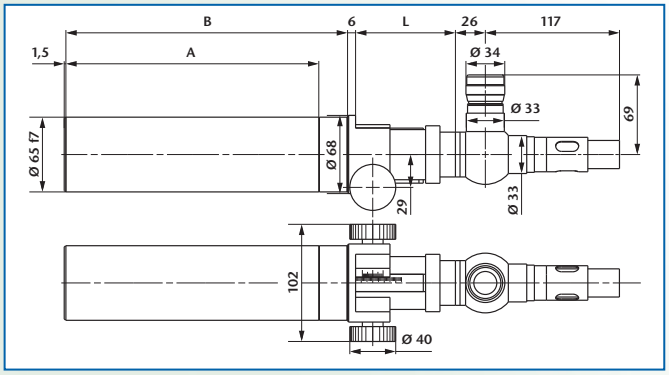
Important:

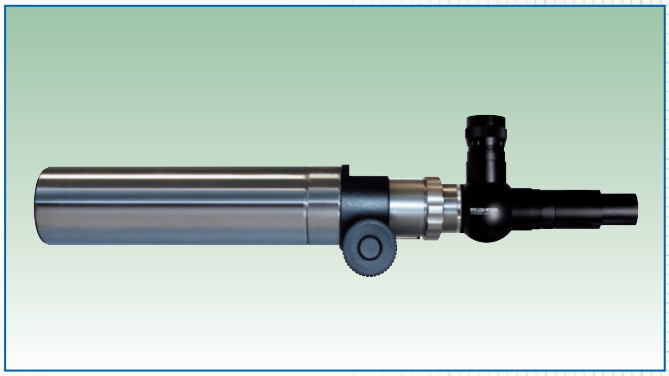
Please specify collimator reticle and eyepiece reticle (see page 82) as well as illumination (LED-, bulb- or cold light, see page 81) when ordering.

Please specify direction of use if reticles with lettering (e.g. coordinate division etc.) are used so that the lettering will be right-side-up.

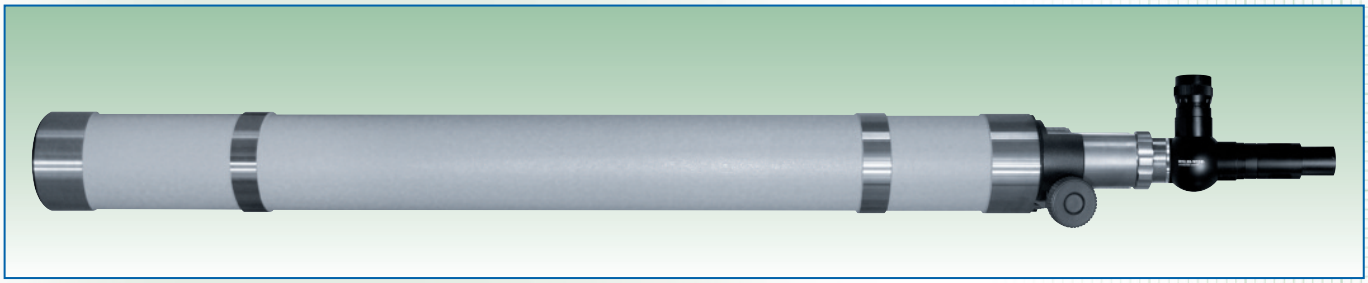


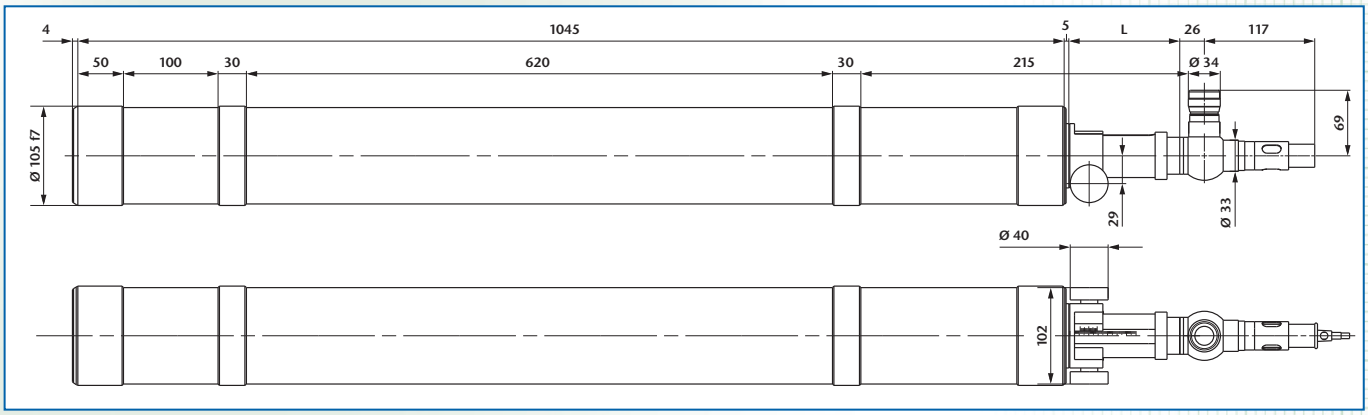
Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Distance range	L
229 701	AKRV 90/40/14,7/±6	90	16	±6	3,0°	–∞...–1,25 m 1,40 m...+∞	77±6
229 702	AKRV 90/40/14,7/+12	90	16	+12	3,0°	0,80 m...+∞	71^{+12}
229 703	AKRV 90/40/14,7/–12	90	16	–12	3,0°	–∞...–0,60 m	83_{-12}
229 704	AKRV 140/40/14,7/±6	140	28	±6	2,0°	–∞...–3,10 m 3,30 m...+∞	77±6
229 705	AKRV 140/40/14,7/+12	140	28	+12	2,0°	1,70 m...+∞	71^{+12}
229 706	AKRV 140/40/14,7/–12	140	28	–12	2,0°	–∞...–1,40 m	83_{-12}





Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Distance range	A	B	L
229 707	AKRV 300/65/14,7/±25	300	50	±25	1,0°	–∞...–3,4 m 3,8 m...+∞	220	245	87±25
229 708	AKRV 300/65/14,7/+50	300	50	+50	1,0°	2,1 m...+∞	220	270	62^{+50}
229 709	AKRV 300/65/14,7/–50	300	50	–50	1,0°	–∞...–1,5 m	220	220	112_{-50}
229 710	AKRV 500/65/14,7/±50	500	50	±50	0,5°	–∞...–4,5 m 5,4 m...+∞	310	360	112±50
229 711	AKRV 500/65/14,7/+100	500	50	+100	0,5°	3,0 m...+∞	310	410	62^{+100}
229 712	AKRV 500/65/14,7/–100	500	50	–100	0,5°	–∞...–1,5 m	310	310	162_{-100}





Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Distance range	L
229 716	AKRV 1100/105/14,7/±50	1100	78	±50	0,25°	–∞...–23,7 m 25,8 m...+∞	177±50
229 717	AKRV 1100/105/14,7/+100	1100	78	+100	0,25°	13,2 m...+∞	177^{+100}
229 718	AKRV 1100/105/14,7/–100	1100	78	–100	0,25°	–∞...–12,0 m	177_{-100}

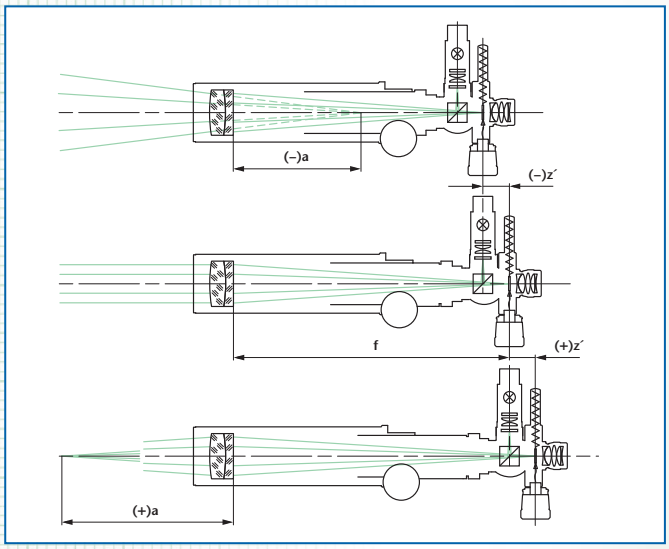
AUTOCOLLIMATORS

FOCUSABLE – STRAIGHT VIEWING WITH DOUBLE MICROMETER

Description:

For a general description of the principle of functioning of focusable autocollimators see page 43.

Additionally, micrometers allow the direct measurement of eyepiece reticle movement. The scale division (SD) of the micrometer drums is 5 µm.



Application areas:

- Measurement of angular tilt
- Qualitative testing of the imaging properties of optical elements and systems
- Measurement of large radii of curvature
- Infinity adjustment to other wavelengths
- Adjustment of optical and mechanical systems

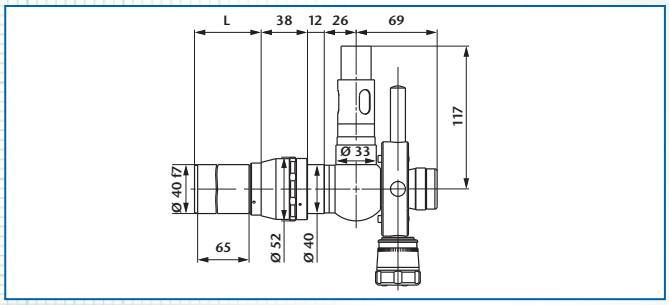
Notes on ordering:

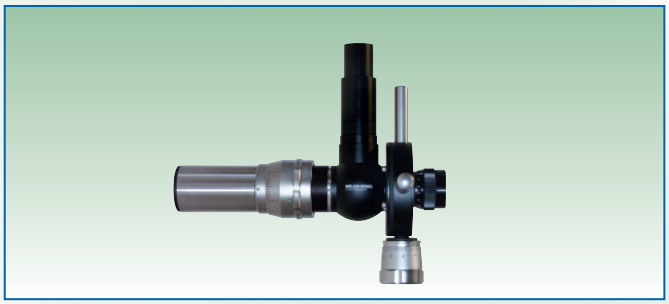
- Optionally, the autocollimators can be equipped with an eyepiece having 10 mm or 25 mm focal length.
- Two reticles, 6V/5W illumination w/cord, and eyepiece are included.
- The nomenclature of the adjustable autocollimators with straight viewing and with double micrometer is as follows:

Example: AK G V 90/ 40/ 14,7 ±6 MD

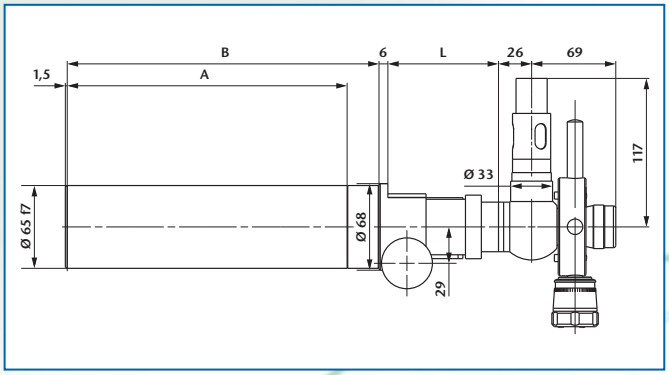
- AK – Autocollimator
- G – Straight viewing
- V – Variable
- 90/ – Focal length
- 40/ – Tube diameter
- 14,7 – Eyepiece focal length
- ±6 – Tube extension in mm
- MD – Double micrometer

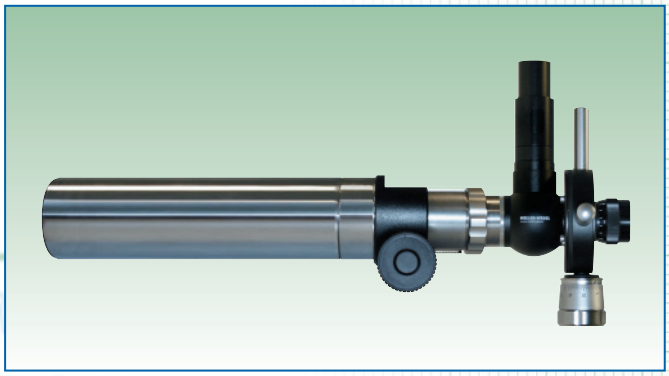
Important:
Please specify collimator reticle and eyepiece reticle (see page 82) as well as illumination (LED-, bulb- or cold light, see page 81) when ordering.



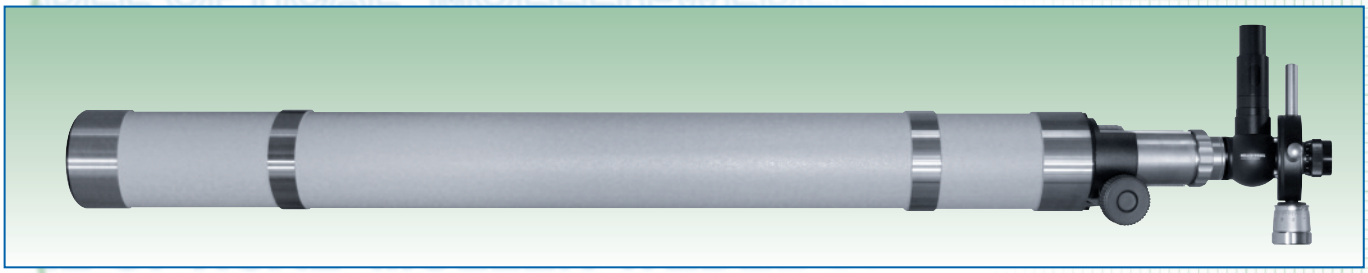


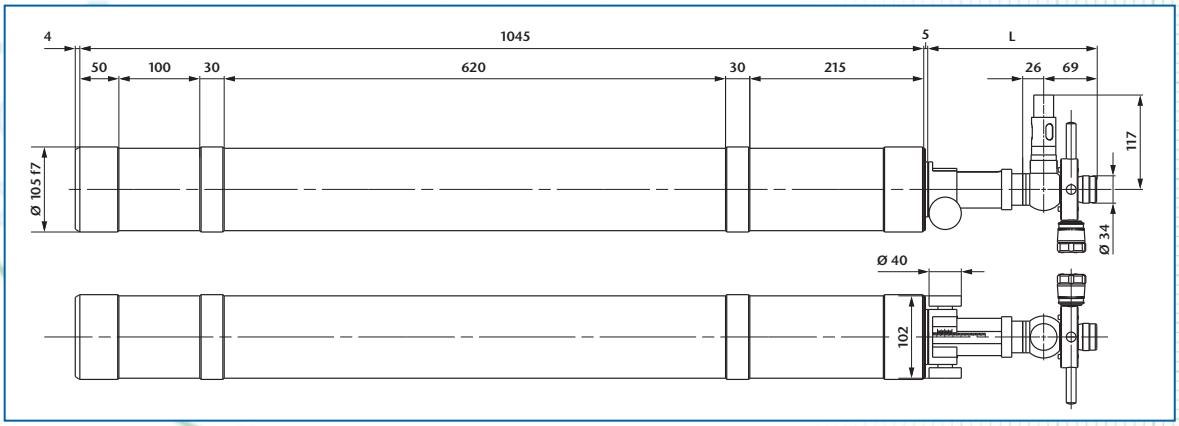
Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	SD	Distance range	L
229 631	AKGV 90/40/14,7/±6 MD	90	16	±6	3,0°	5,5″	–∞...–1,25 m 1,40 m...+∞	77±6
229 632	AKGV 90/40/14,7/+12 MD	90	16	+12	3,0°	5,5″	0,80 m...+∞	71^{+12}
229 633	AKGV 90/40/14,7/–12 MD	90	16	–12	3,0°	5,5″	–∞...–0,60 m	83_{-12}
229 634	AKGV 140/40/14,7/±6 MD	140	28	±6	2,0°	3,5″	–∞...–3,10 m 3,30 m...+∞	77±6
229 635	AKGV 140/40/14,7/+12 MD	140	28	+12	2,0°	3,5″	1,70 m...+∞	71^{+12}
229 636	AKGV 140/40/14,7/–12 MD	140	28	–12	2,0°	3,5″	–∞...–1,40 m	83_{-12}





Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	SD	Distance range	A	B	L
229 640	AKGV 300/65/14,7/±25 MD	300	50	±25	1,0°	2,0″	–∞...–3,4 m 3,8 m...+∞	220	245	220±25
229 638	AKGV 300/65/14,7/+50 MD	300	50	+50	1,0°	2,0″	2,1 m...+∞	220	270	195^{+50}
229 639	AKGV 300/65/14,7/–50 MD	300	50	–50	1,0°	2,0″	–∞...–1,5 m	220	220	245_{-50}
229 641	AKGV 500/65/14,7/±50 MD	500	50	±50	0,5°	1,0″	–∞...–4,5 m 5,4 m...+∞	310	360	245±50
229 644	AKGV 500/65/14,7/+100 MD	500	50	+100	0,5°	1,0″	3,0 m...+∞	310	410	195^{+100}
229 645	AKGV 500/65/14,7/–100 MD	500	50	–100	0,5°	1,0″	–∞...–1,5 m	310	310	295_{-100}





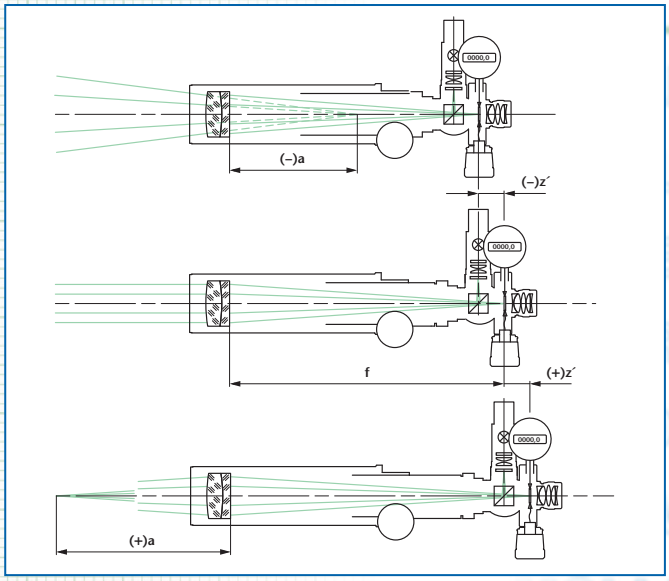
Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	SD	Distance range	L
229 642	AKGV 1100/105/14,7/±50 MD	1100	78	±50	0,25°	0,5″	–∞...–23,70 m 25,80 m...+∞	202±50
229 646	AKGV 1100/105/14,7/+100 MD	1100	78	+100	0,25°	0,5″	13,20 m...+∞	202^{+100}
229 643	AKGV 1100/105/14,7/–100 MD	1100	78	–100	0,25°	0,5″	–∞...–12,00 m	202_{-100}

AUTOCOLLIMATORS

FOCUSABLE – STRAIGHT VIEWING WITH DIGITAL DOUBLE

Description:

For a general description of the principle of functioning of focusable autocollimators see page 43.
In place of the micrometer drums above, optionally, programmable digital gauges allow direct reading of the tilting angle in arcsec or mrad.



Application areas:

- Measurement of angular tilt
- Adjustment of optical and mechanical systems
- Qualitative testing of the imaging properties of optical elements and systems
- Measurement of large radii of curvature
- Infinity adjustment to other wavelengths

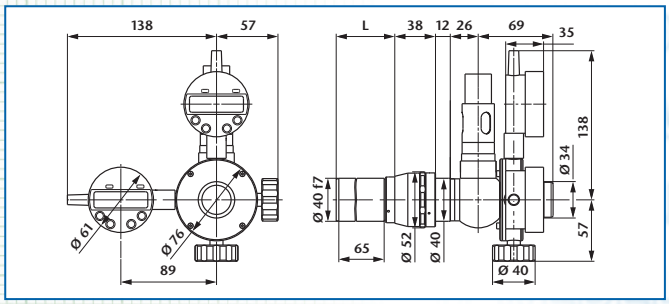
Notes on ordering:

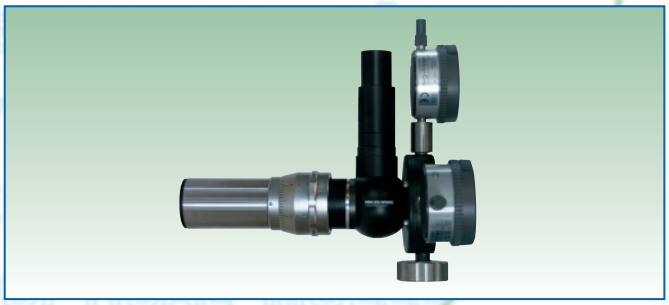
- Optionally, the autocollimators can be equipped with an eyepiece having 10 mm or 25 mm focal length.
- Two reticles, 6V/5W illumination w/cord, and eyepiece are included.
- Specify the unit of display of the digital gauges (mm, arcsec, milliradians).
- The nomenclature of the adjustable autocollimators with digital double micrometer is as follows:

Example: AK G V 90/ 40/ 14,7 ±6 MDD

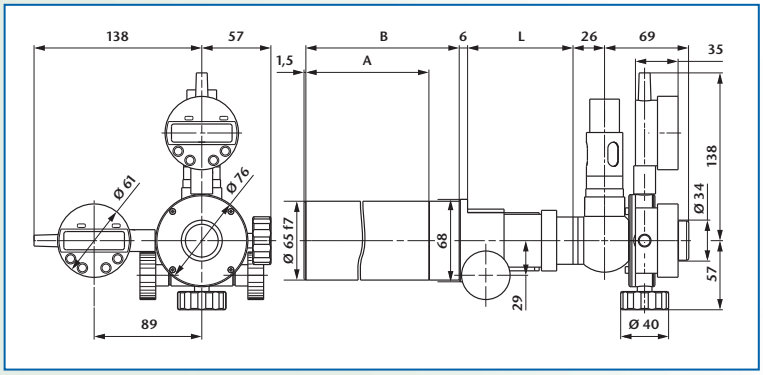
- AK – Autocollimator
- G – Straight viewing
- V – Variable
- 90/ – Focal length
- 40/ – Tube diameter
- 14,7 – Eyepiece focal length
- ±6 – Tube extension in mm
- MDD – Digital double micrometer

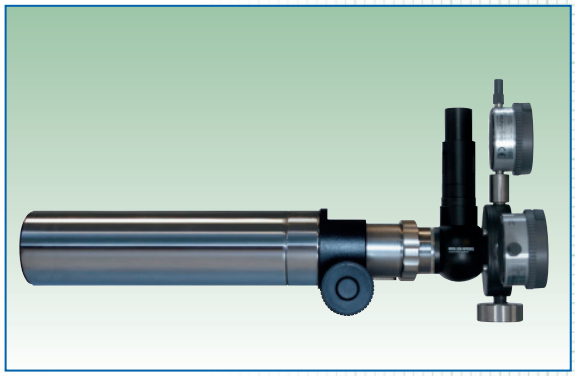
Important:
Please specify collimator reticle and eyepiece reticle (see page 82) as well as illumination (LED-, bulb- or cold light, see page 81) when ordering.



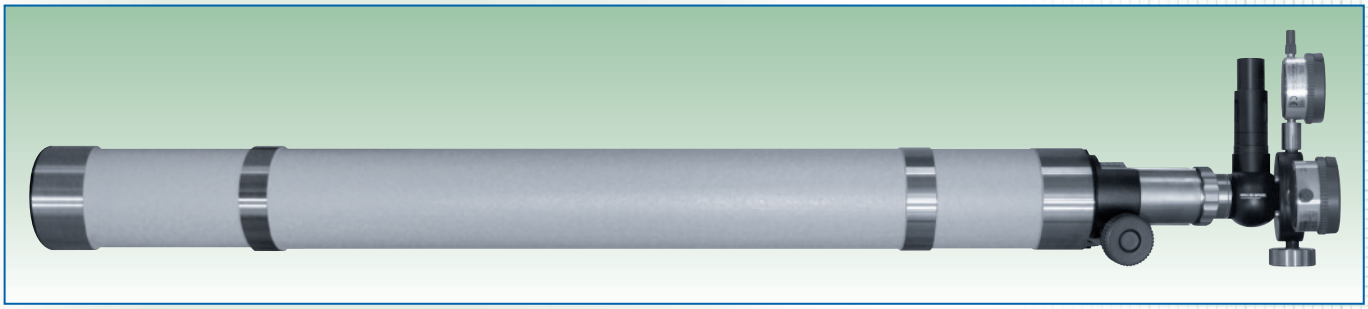


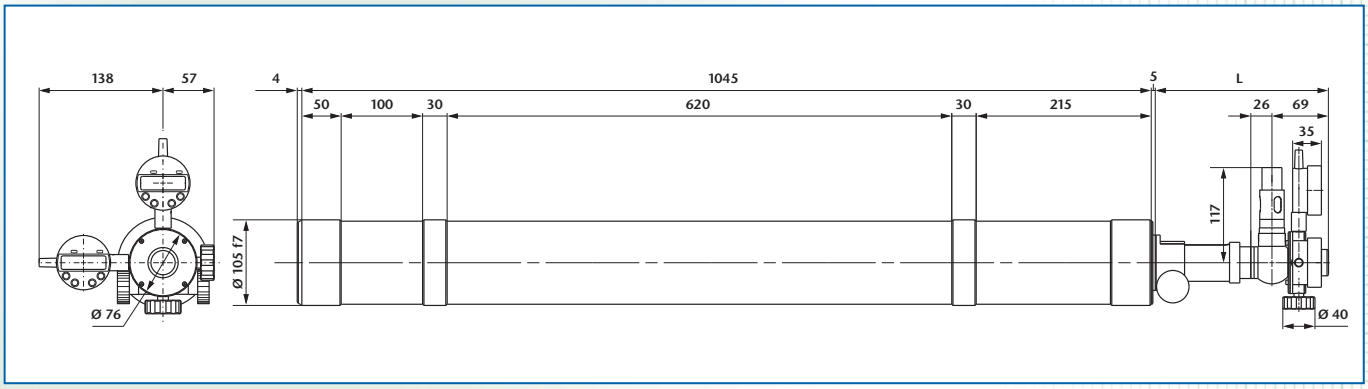
Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Resolution	Distance range	L
229 581	AKGV 90/40/14,7/±6 MDD	90	16	±6	3,0°	1,0″	–∞...–1,25 m 1,40 m...+∞	77±6
229 582	AKGV 90/40/14,7/+12 MDD	90	16	+12	3,0°	1,0″	0,80 m...+∞	71^{+12}
229 583	AKGV 90/40/14,7/–12 MDD	90	16	–12	3,0°	1,0″	–∞...–0,60 m	83_{-12}
229 584	AKGV 140/40/14,7/±6 MDD	140	28	±6	2,0°	1,0″	–∞...–3,10 m 3,30 m...+∞	77±6
229 585	AKGV 140/40/14,7/+12 MDD	140	28	–12	2,0°	1,0″	1,70 m...+∞	71_{-12}
229 586	AKGV 140/40/14,7/–12 MDD	140	28	–12	2,0°	1,0″	–∞...–1,40 m	83_{-12}





Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Resolution	Distance range	A	B	L
229 587	AKGV 300/65/14,7/±25 MDD	300	50	±25	1,0°	0,5 arcsec	–∞...–3,4 m 3,8 m...+∞	220	245	87±25
229 588	AKGV 300/65/14,7/+50 MDD	300	50	+50	1,0°	0,5 arcsec	2,1 m...+∞	220	270	62^{+50}
229 589	AKGV 300/65/14,7/–50 MDD	300	50	–50	1,0°	0,5 arcsec	–∞...–1,5 m	220	220	112_{-50}
229 590	AKGV 500/65/14,7/±50 MDD	500	50	±50	0,5°	0,2 arcsec	–∞...–4,5 m 5,4 m...+∞	310	360	112±50
229 591	AKGV 500/65/14,7/+100 MDD	500	50	+100	0,5°	0,2 arcsec	3,0 m...+∞	310	410	62^{+100}
229 592	AKGV 500/65/14,7/–100 MDD	500	50	–100	0,5°	0,2 arcsec	–∞...–1,5 m	310	310	162_{-100}





Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Resolution	Distance range	L
229 596	AKGV 1100/105/14,7/±50 MDD	1100	78	±50	0,5°	0,1 arcsec	–∞...–23,7 m 25,8 m...+∞	202±50
229 597	AKGV 1100/105/14,7/+100 MDD	1100	78	+100	0,5°	0,1 arcsec	13,2 m...+∞	202^{+100}
229 598	AKGV 1100/105/14,7/–100 MDD	1100	78	–100	0,5°	0,5 arcsec	–∞...–12,0 m	202_{-100}

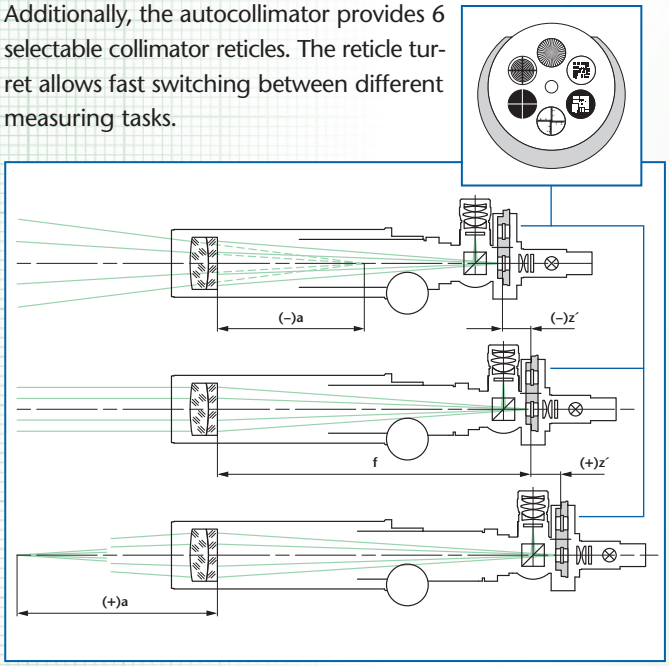
AUTOCOLLIMATORS

FOCUSABLE – 90°-VIEWING WITH RETICLE TURRET

Description:

For a general description of the principle of functioning of focusable autocollimators see page 43.

Additionally, the autocollimator provides 6 selectable collimator reticles. The reticle turret allows fast switching between different measuring tasks.



Application areas:

- Adjustment of optical and mechanical systems
- Qualitative testing of the imaging properties of optical elements and systems
- Measurement of large radii of curvature
- Infinity adjustment to other wavelengths

Notes on ordering:

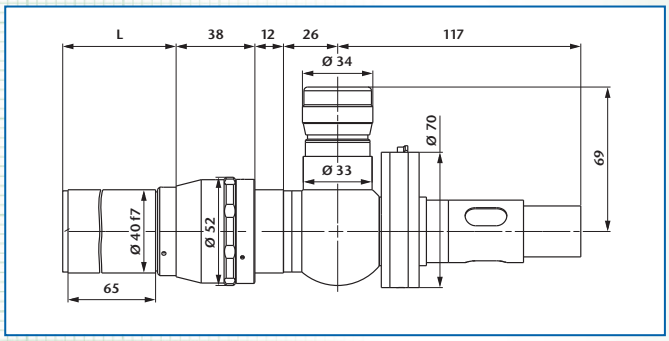
- Optionally, the autocollimators can be equipped with an eyepiece having 10 mm or 25 mm focal length.
- The reticles, 6V/5W illumination w/cord, and eyepiece are included.
- The nomenclature of the adjustable autocollimators with 90°-viewing and with reticle turret is as follows:

Example: AK R V 90/ 40/ 14,7 ±6 SW

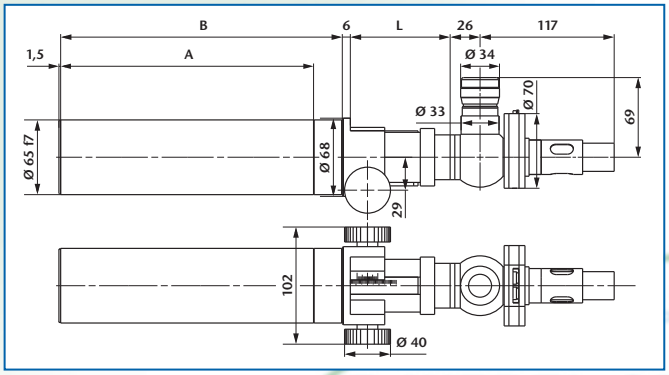
- AK – Autocollimator
- R – 90° viewing
- V – Variable
- 90/ – Focal length
- 40/ – Tube diameter
- 14,7 – Eyepiece focal length
- ±6 – Tube extension in mm
- SW – Reticle turret

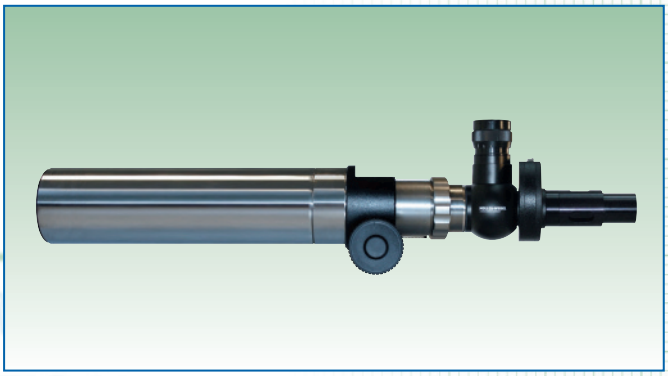
Important:

Please specify six collimator reticles and one eyepiece reticle (see page 82) as well as illumination (LED-, bulb- or cold light, see page 81) when ordering.
Please specify direction of use if reticles with lettering (e.g. coordinate division etc.) are used so that the lettering will be right-side-up.

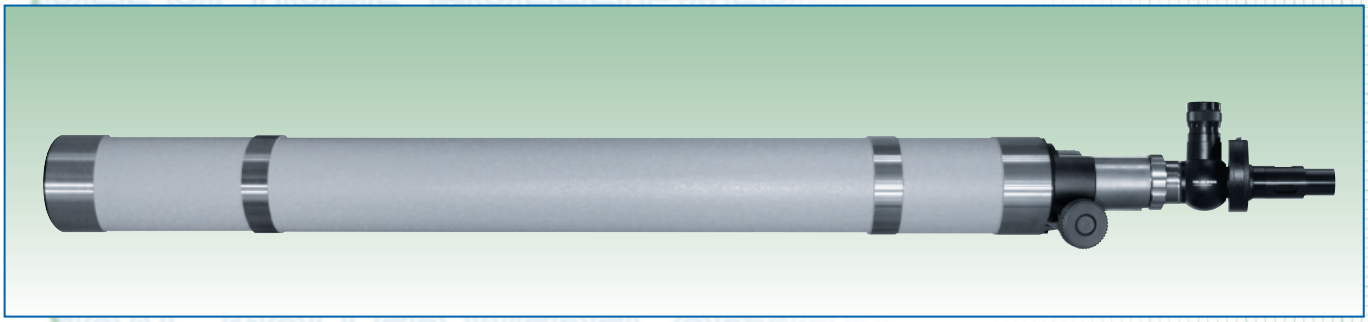


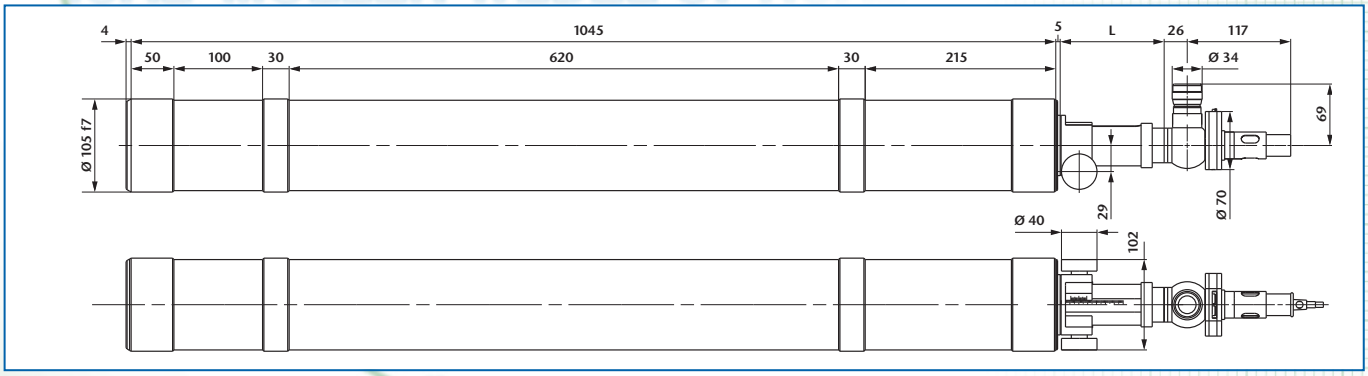
Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Distance range	L
229 781	AKRV 90/40/14,7/±6 SW	90	16	±6	3,0°	–∞...–1,25 m 1,40 m...+∞	77±6
229 782	AKRV 90/40/14,7/+12 SW	90	16	+12	3,0°	0,80 m...+∞	71^{+12}
229 783	AKRV 90/40/14,7/–12 SW	90	16	–12	3,0°	–∞...–0,60 m	83_{-12}
229 784	AKRV 140/40/14,7/±6 SW	140	28	±6	2,0°	–∞...–3,10 m 3,30 m...+∞	77±6
229 785	AKRV 140/40/14,7/+12 SW	140	28	+12	2,0°	1,70 m...+∞	71^{+12}
229 786	AKRV 140/40/14,7/–12 SW	140	28	–12	2,0°	–∞...–1,40 m	83_{-12}





Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Distance range	A	B	L
229 787	AKRV 300/65/14,7/±25 SW	300	50	±25	1,0°	–∞...–3,4 m 3,8 m...+∞	220	245	87±25
229 788	AKRV 300/65/14,7/+50 SW	300	50	+50	1,0°	2,1 m...+∞	220	270	62^{+50}
229 789	AKRV 300/65/14,7/–50 SW	300	50	–50	1,0°	–∞...–1,5 m	220	220	112_{-50}
229 790	AKRV 500/65/14,7/±50 SW	500	50	±50	0,5°	–∞...–4,5 m 5,4 m...+∞	310	360	112±50
229 791	AKRV 500/65/14,7/+100 SW	500	50	+100	0,5°	3,0 m...+∞	310	410	62^{+100}
229 792	AKRV 500/65/14,7/–100 SW	500	50	–100	0,5°	–∞...–1,5 m	310	310	162_{-100}





Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range	Distance range	L
229 796	AKRV 1100/105/14,7/±50 SW	1100	78	±50	0,5°	–∞...–23,7 m 25,8 m...+∞	202±50
229 797	AKRV 1100/105/14,7/+100 SW	1100	78	+100	0,5°	13,2 m...+∞	202^{+100}
229 798	AKRV 1100/105/14,7/–100 SW	1100	78	–100	0,5°	–∞...–12,0 m	202_{-100}

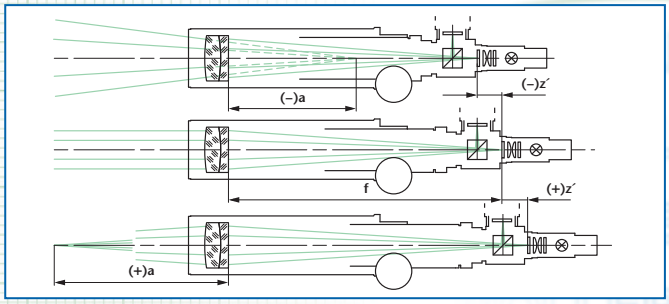
AUTOCOLLIMATORS

FOCUSABLE – WITH CCD-CAMERA MOUNT

Description:

For a general description of the principle of functioning of focusable autocollimators see page 43.

The eyepiece and the eyepiece reticle are replaced by a mount for a C-Mount-CCD-camera and the autocollimation image is directly imaged on the camera chip when it is mounted.



Application areas:

- Adjustment of optical and mechanical systems
- Qualitative testing of the imaging properties of optical elements and systems
- Measurement of large radii of curvature
- Infinity adjustment to other wavelengths

Notes on ordering:

- **The CCD-camera and computer hardware/software are NOT included.**
- As this type of autocollimator does not have an eyepiece reticle a direct measurement of the reticle displacement is impossible. Additional computer with software and frame grabber is needed.

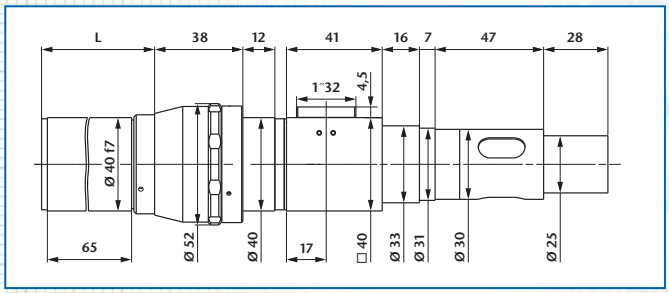
More notes on ordering:

- Collimator reticle and 6V/5W illumination w/cord are included.
- For angular measurement the autocollimator should be equipped with a negative crosshair reticle (see page 83). For testing of imaging quality use resolution target or Siemens Star (see page 87).
- The nomenclature of the adjustable autocollimators with CCD-camera mount is as follows:

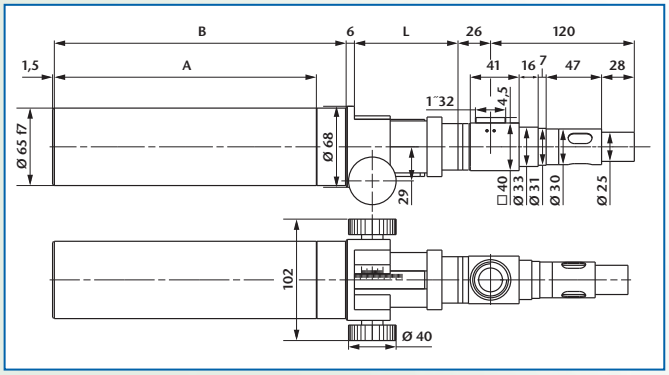
Example: AK | R | V | 90/ | 40/ | ±6 | CCD

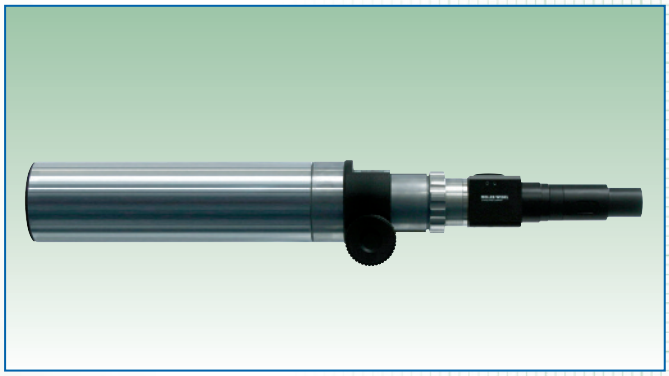
- AK – Autocollimator
- R – 90° viewing
- V – Variable
- 90/ – Focal length
- 40/ – Tube diameter
- ±6 – Tube extension in mm
- CCD – CCD-Camera mount

Impotant:
Please specify collimator reticle (see page 82) as well as illumination (LED-, bulb- or cold light, see page 81) when ordering.

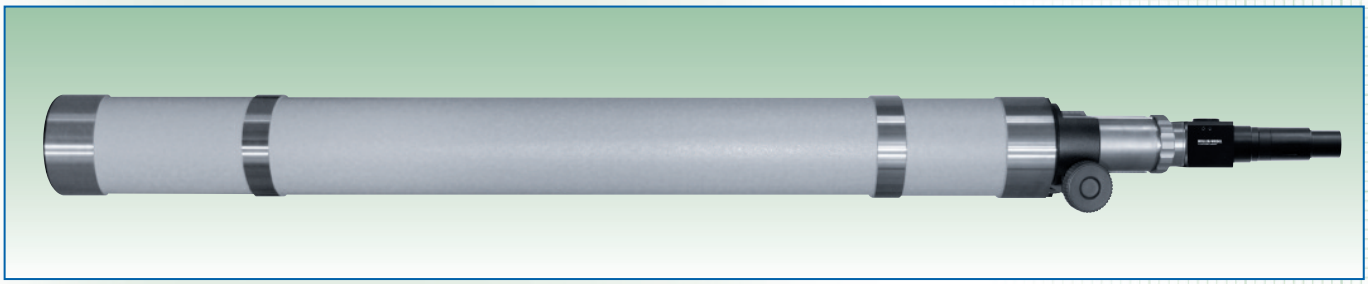


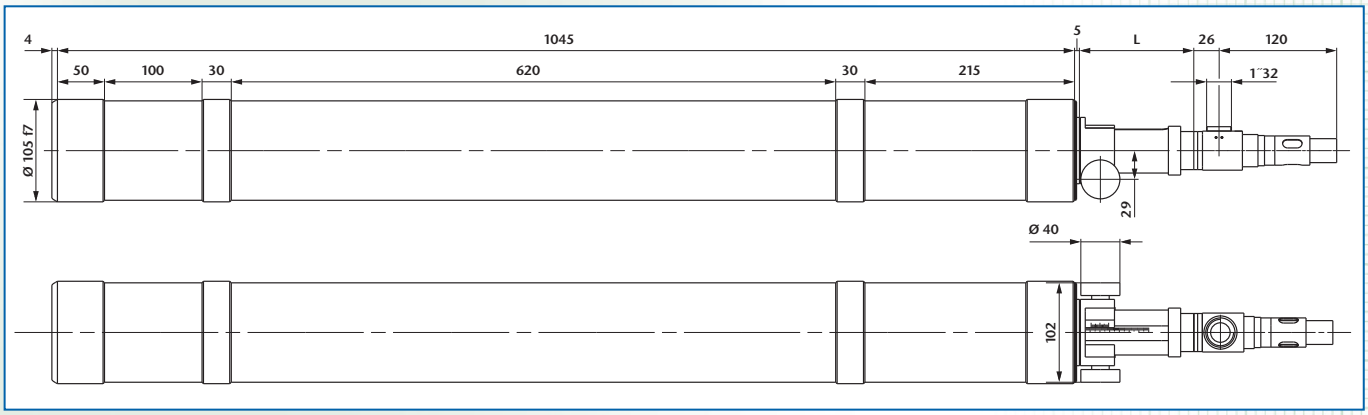
Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range*	Distance range	L
229 471	AKRV 90/40/±6 CCD	90	16	±6	x:2,50° y:1,80°	–∞...–1,25 m 1,40 m...+∞	77±6
229 472	AKRV 90/40/+12 CCD	90	16	+12	x:2,50° y:1,80°	0,80 m...+∞	71^{+12}
229 473	AKRV 90/40/–12 CCD	90	16	–12	x:2,50° y:1,80°	–∞...–0,60 m	83_{-12}
229 474	AKRV 140/40/±6 CCD	140	28	±6	x:1,60° y:1,20°	–∞...–3,10 m 3,30 m...+∞	77±6
229 475	AKRV 140/40/+12 CCD	140	28	+12	x:1,60° y:1,20°	1,70 m...+∞	71^{+12}
229 476	AKRV 140/40/–12 CCD	140	28	–12	x:1,60° y:1,20°	∞...–1,40 m	83_{-12}





Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range*	Distance range	A	B	L
229 477	AKRV 300/65/±25 CCD	300	50	±25	x:2,50° y:1,80°	–∞...–3,4 m 3,8 m...+∞	220	245	87±25
229 478	AKRV 300/65/+50 CCD	300	50	+50	x:2,50° y:1,80°	2,1 m...+∞	220	270	62^{+50}
229 479	AKRV 300/65/–50 CCD	300	50	–50	x:2,50° y:1,80°	–∞...–1,5 m	220	220	112_{-50}
229 480	AKRV 500/65/±50 CCD	500	50	±50	x:2,50° y:1,80°	–∞...–4,5 m 5,4 m...+∞	310	360	112±50
229 481	AKRV 500/65/+100 CCD	500	50	+100	x:2,50° y:1,80°	3,0 m...+∞	310	410	62^{+100}
229 482	AKRV 500/65/–100 CCD	500	50	–100	x:2,50° y:1,80°	–∞...–1,5 m	310	310	162_{-100}





Ord.-No.	Description	Focal length	Free aperture	Tube extension	Meas. range*	Distance range	L
229 486	AKRV 1100/105/±50 CCD	1100	78	±50	x:0,20° y:0,14°	–∞...–23,7 m 25,8 m...+∞	177±50
229 487	AKRV 1100/105/+100 CCD	1100	78	+100	x:0,20° y:0,14°	13,2 m...+∞	117^{+12}
229 488	AKRV 1100/105/–100 CCD	1100	78	–100	x:0,20° y:0,14°	–∞...–12,0 m	117_{-12}

* mit 2/3" CCD-Kamera