

Operation manual

Alignment Autocollimator

FAKG 300/40/14.7 MD



Version 11/2005

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1. General

An Alignment Autocollimator is an optical ruler with which objects can be aligned along a reference line (line of sight) with higher precision.

The MÖLLER-WEDEL OPTICAL Alignment Autocollimator establishes precise reference lines of sight. Its focusing range is from Zero to infinity.

The Autocollimator line of sight is the basic reference for all measurements and the exact location of it relative to the workpiece must be known with great accuracy.

When the Alignment Autocollimators are focussed on a target at a finite range, they not emitting parallel light beam (only at setting infinity the outgoing beam is parallel). The Alignment Autocollimator is then used as an Alignment Telescope and a lateral displacement of the targets Z can be measured. The effect of such a lateral displacement can be evaluated precisely when viewing through the eyepiece of the Alignment Autocollimator. In this case, both the center of the target and that of the Alignment Autocollimator reticle will appear at separate positions. If the center of the target and that of the crosshair reticle of the Alignment Autocollimator coincide, the target has no lateral displacement. (Fig. 1)

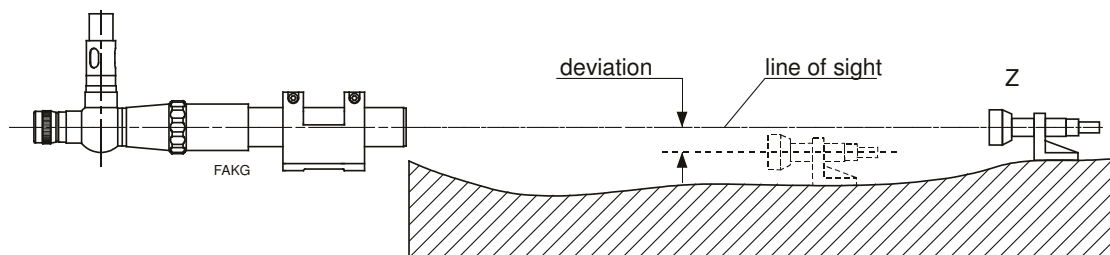


Fig. 1: Principle of use of an Alignment Autocollimator

With the aid of an Alignment Autocollimator it is possible to observe the lateral displacement of a target (in finite distance setting), as well as angular displacement (with infinite distance setting) (see Fig. 2).

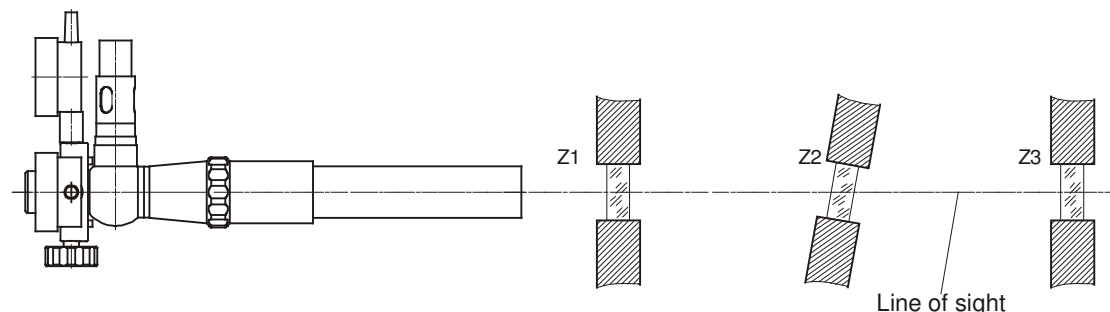


Fig. 2: Alignment of targets with the aid of an Alignment Autocollimator

2. UNPACKING AND CLEANING

The Alignment Autocollimator is a precision measurement instrument.

Unpack equipment carefully.

- ☞ No humidity, no shock stress!
- ☞ Keep clean the optical components such as lenses of the objective and of the eyepiece, and targets. Remove dust protection cap of the objective only for use of the equipment and attach after use.
- ☞ No finger prints!

For cleaning glass surfaces from dust best a blower or painting brush with soft and grease-free hairs. If the contamination is of rigid nature breathe to the glass surface to produce a thin liquid coating and wipe off using a piece of soft leather- do not use force!

or

Use a mixture of approx. 8 parts ether and one part alcohol and wipe off-but only after having removed dust beforehand.

When realizing damages when unpacking don't repair yourself otherwise our guarantee will expire. Contact our distributor or our factory.

☞ Important hint for the use in tropic regions

The equipment is not tested to be used permanently under tropical conditions.

In case the instruments are used under tropical conditions, after usage the instrument should be stored in rooms with a relative humidity not exceeding 75%.

3. PREPARATION FOR OPERATION

Temperature equalization

Even slight temperature differences in glass lead to stress which will reduce by annealing. For accurate measurements it is, therefore, recommended to store the Alignment Autocollimator one day beforehand in the measuring room.

If the temperature of the Autocollimator is below 15 °C, the image quality may be deteriorated. In this event the Autocollimator should be kept approx. 30 minutes with room temperature till the Autocollimator has adopted the required temperature through and through. The objective should have the same temperature inside and outside.

3.1 Setting into an fixture or holder

First of all, a suitable positioning for the Autocollimator should be chosen. The type of the positioner is determined by the measuring set-up. Unless prepared in anticipation by the user clamp fixtures are recommended.

- ☞ When using the clamp fixtures take care when tightening the clamping screws: Do not fasten the barrel clamp screws with excessive force to avoid strain being transmitted to the Autocollimator objective. This would lead to deterioration of the image quality.
- ☞ Important hint for fixing and rotating the Alignment Autocollimator
When rotating the Alignment Autocollimator in a fixture rotate the objective tube only, in no case the adapter sleeve with eyepiece (3.1 with 3.2) has to be used to rotate the Alignment Autocollimator to avoid that the adapter sleeve with the eyepiece will loosen (alignment of the Alignment Autocollimator will be lost)

3.2 Adjustment of eyepiece

The diopter setting of the eyepiece must be used to focus the eyepiece that the eyepiece reticle can be seen sharply.

4. Functional description of the instrument

Construction feature



Fig. 3: Basic components of Alignment Autocollimator FAKG 300/40/14,7
1 – alignment objective tube
2 – illumination adapter sleeve
3 – Adjustment knob for eyepiece reticle position
4 – digital gauge for measurement of reticle position
5 – Eyepiece $f=14,7$ mm

The Alignment Autocollimator FAKG 300/40/14,7 MD consists of an alignment objective tube (Fig. 3.1), and an autocollimation eyepiece with two digital gauges (Fig. 3.4), two adjustment knobs (Fig. 3.3), illumination adapter sleeve (Fig. 3.2) and an eyepiece (Fig. 3.5).



Important hint

Do not disconnect Rectangular sleeve from alignment objective tube!

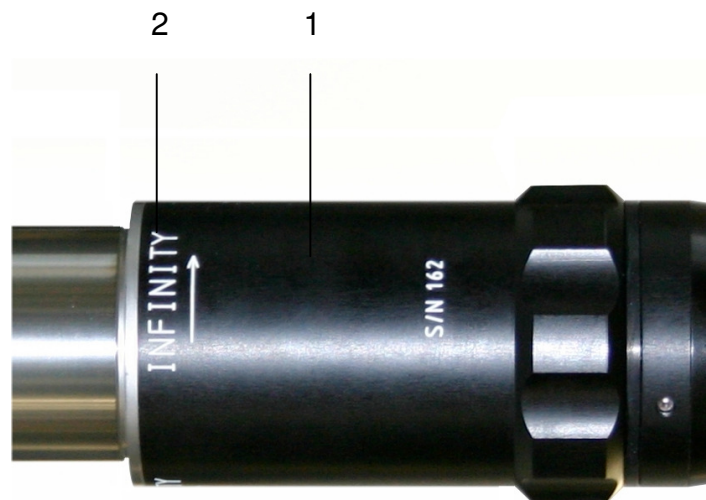


Figure 4: Focusing sleeve as part of the alignment objective tube
1 – Focusing sleeve
2 – marks indicating direction of rotation for focusing

The focus setting of the Alignment Autocollimator is carried out by using the focusing sleeve (4.1) of the objective tube. The marks (4.2) on the focusing sleeve indicates into which direction the knob must be rotate for focusing towards infinity distance. In order to turn the instrument to infinity, turn the focussing sleeve in infinity direction to the mechanical stop.

The line of sight runs parallel to the tube. This greatly facilitates the use of the Alignment Autocollimator for aligning boreholes, bearings etc., since with precise holding of the reference bearing the line of reference is already determined.

The robust construction with the stainless steel outside surface guarantee the maintenance of precision even in rough outside conditions.

As support for the Alignment Autocollimator different holders are available, well matched to the diameter of the Alignment Autocollimator.

Frequently the outer bearing or hole serves as reference for the measurement.

Master dimensions permit to easily place the Alignment Autocollimator in bores etc. by means of simple additional spacer rings to be placed in the corresponding aperture.

The Alignment Autocollimator FAKG 300/40/14,7 MD determines whether there is an alignment error and to some degree allow to determine the amount of error. The digital gauge can be used for measuring the deviation of the reticle position with respect to the optical axis ("ABS" measuring mode o the digital gauges) or an arbitrary reference position ("INC"-measuring mode of the digital gauges). After having measured the displacement in the reticle

plane the displacement in the reticle plane can be estimated by multiplication with the magnification between reticle and image plane (see sect. 5. on page 9). In autocollimation mode the tilting angle $\Delta\theta_x$ of the reflector can be calculated from the reticle displacement Δx with the following formula (y-direction similar):

$$\Delta\theta_x [\text{in } "] = \frac{\Delta x [\text{in mm}]}{2f [\text{in mm}]} \cdot 206265''$$

Here f is the focal length of the Alignment Autocollimator at infinity setting. (See calibration certificate for exact value.)

The details of use of the gauges can be gathered from the operation manual of the digital gauges delivered with the instrument.

☞ Important hints for the digital gauges:

Do not change the position of the absolute origin!

(sect. 5.3 of digital gauge users manual)

Do not rotate the digital gauges within the clamp neither loosen the clamps.

(Of course you may adjust the display unit angle as described in section 3.2 of the digital gauge users manual)

The proper zero setting of the digital gauges can be checked in autocollimation mode. For this purpose, a triple mirror or corner cube with small angular error ($\leq 2''$) is required. The instrument is adjusted to infinity and the corner cube is placed in front of the instrument. After switching on the illumination the collimator reticle image appears in the eyepiece at the absolute zero position. When measuring the position with the digital gauges in "ABS"-mode, it should coincide within $\pm 10\mu\text{m}$.

5. Technical data

Description	Data
Focusing range	0 m to infinity
Accuracy of line of sight	10 μm , denotes the deviation to a straight line measured in the image plane
Magnification of the reticle image at 0.5 m at 1 m at 2 m at 5 m at 10 m at 15 m at 20 m	Uncertainty of magnification is $\pm 5\%$ 5.9x 8.3x 13x 25x 43x 61x 79x
Field of View at 0.5 m at 1 m at 2 m at 5 m at 10 m at 15 m at 20 m at infinity	Tolerance $\pm 5\%$ 59 mm 83 mm 130 mm 250 mm 430 mm 610 mm 790 mm 1.95°
Objective focal length	85 mm (0m setting) to 290 mm (infinity setting)
Free aperture of objective	26 mm
Objective tube diameter	40f7
Objective tube material	Stainless steel
Focal length of eyepiece	14,7 mm
Image erection	laterally and vertically mirrored
Collimator reticle	single cross
Eyepiece reticle	double cross
Illumination	LED-type $\lambda=525\text{nm}$, 40nm FWHM
Overall Dimensions (LxWxH)	Approx. 330x55x84 mm
Weight	Approx. 2.6 kg

6. MAINTENANCE

If the instrument is treated carefully as it is usual with optical instruments the Alignment Autocollimator will not need maintenance.

Outer surfaces of objective and eyepiece may be contaminated in the course of the time. If so, clean as follows:

First remove particles from the dust from the surfaces using a blower. Wipe over with a dry piece of fine linen. If this fails, but only then, the surface should be cleaned with a mixture of approx. 8 parts by volume of ether and one part of alcohol.

☞ **Handle with care! The mixture is inflammable.**

The outer surface of the objective tube does not need maintenance.

7. Spare parts FAKG 300/40/14,7

<u>Ident -No.</u>	<u>Description</u>	<u>Quantity</u>
217 010	Eyepiece f=10 mm	1
217 015	Eyepiece f=14,7 mm	1
217 025	Eyepiece f=25 mm	1
135 101 02	Objective cover	1