HOFBAUER

OPTIK • MESS- UND PRÜFTECHNIK
VERTRIEB • BERATUNG • TRAINING

ELWIMAT ®

Electronic angle measuring machine

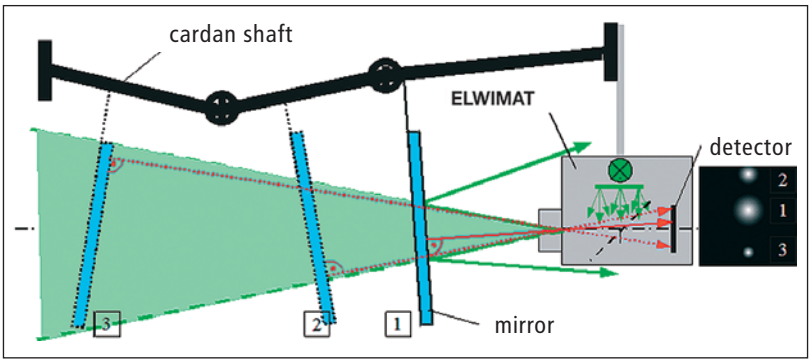
WiPoVi

Angle/position by means of vignetting

- Biaxial optical angle measuring with great measuring range >10°
  Working distance up to 30 m, reproducibility 0.0025°...0.000025° (< 0.1 wsec)
- Biaxial optoelectronic measuring of alignment Working distance up to 50 m, reproducibility (in dependency on distance) 0.2 ...50 μm
- Simultaneous detection of up to 6 degrees of freedom with special reflectors incl. roll angle and maesuring distance

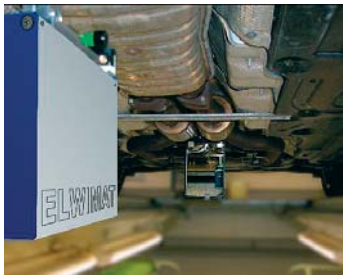
Vignetting as new measuring method

ELWIMAT® works according to the new, in-house development of the vignetted field diaphragm method. One of the measurement mirrors subject to the angle changes is illuminated by a special divergent beam of light. The bundle of rays are reflected on the mirror, whereby a part of the light re-enters the aperture of the sensor.
A bright point of light results here from the illuminated area shown vignetted on a position-sensitive detector.
The position shift y of this so-called V-SPOT is proportional to the angle change of the mirror α:



Angle measuring at the drive shaft and / or cardan shaft of a vehicle
Illustr.: Angle measurement sensor, measuring mirror and image at the detector

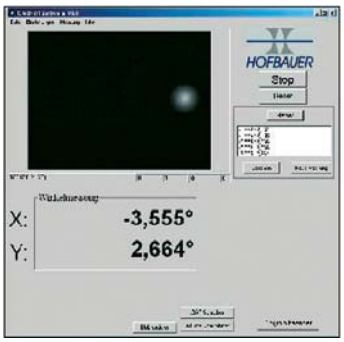
Measuring ranges are doubled



Illustr.: Calibration of the cardan shaft

Compared to conventional auto collimation telescopes, the measuring range under same optical parameters is doubled in the close-up range. In addition, it does not decrease with an increasing mirror distance s, but rather increases (see graphic ELWIMAT measuring ranges).
The measuring range in the distant field is independent of the limitation of the aperture of the lens. Only the mirror needs to be larger with an increasing angle and measurement distance.

Measuring data acquisition



Illustr.: Software surface with live image, display unit and table

The evaluation and data acquisition takes place automatically via CCD camera and analysis software on the computer. A modern USB interface is available as the interface.

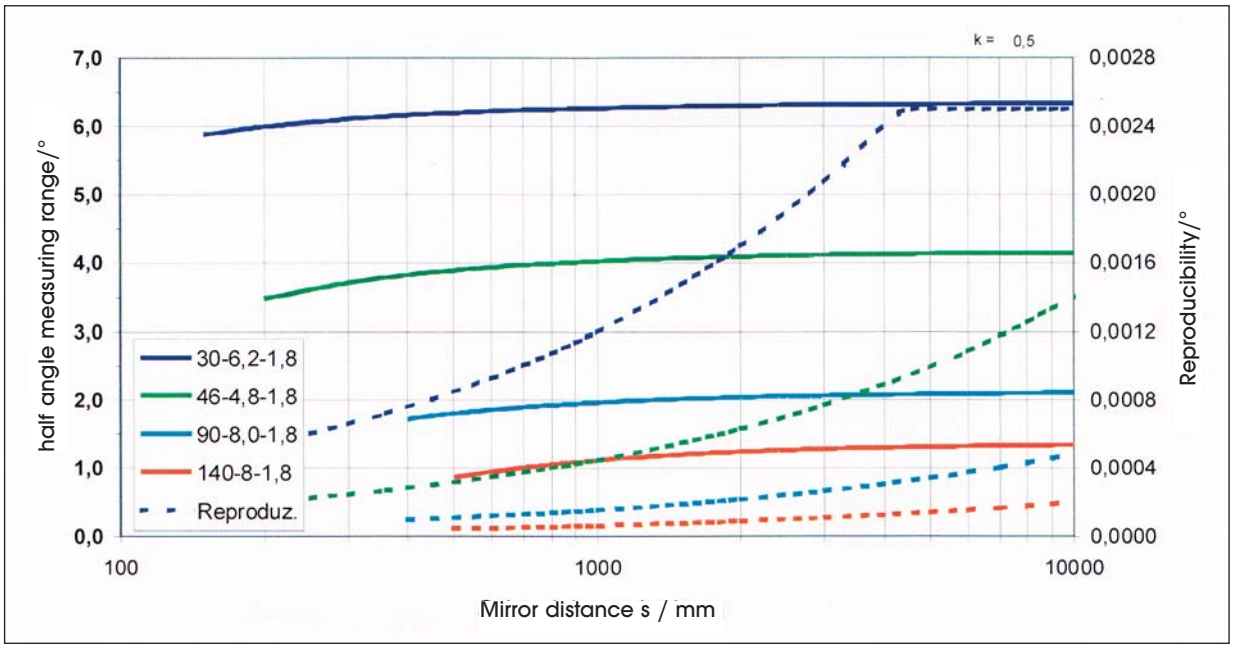
With the USB version, the power supply for the lighting and the camera takes place via the USB port. The measured value acquisition can also take place independent of the AC mains power Supply with a battery-powered notebook or touch PC. All measurements can be saved on touch-PC for later data evaluation.

Accessories

Quality front face mirror up to 300 x 200 mm^2, wide angle conversion lens, frame grabber for analogue camera version, WINDOWS software or a touch PC with RS 232, network and WiFi connection. Special reflector for multi beam reflection.

ELWIMAT®
Measurement range and reproducibility Angle measuring

Indications in focal length - F.No - camera format 1/1.8 inch



Illustr.: Measurement ranges and reproducibilities of the standard version in horizontal measuring direction (great extension of the sensor); in the vertical direction, the measuring range is one fifth (20%) smaller.

Technical data angle measuring

Designation	ELWIMAT 30-6.2-1.8	ELWIMAT 46-4.8-1.8	ELWIMAT 90-8.0-1.8	ELWIMAT 140-8.0-1.8
Capture range	± 6,3° x 5,0°	± 4,1° x 3,3°	± 2,1° x 1,6°	± 1,35° x 1,09°
Measuring range*	depending on measuring distance; s. graphic			
Accuracy (linearity)**	± 0,03°	± 0,015°	± 0,008°	± 0,006°
Reproducibility*** (depending on distance)	$< 5...25 \cdot 10^{-4}$° ≙ 1,8...9"	$< 2...14 \cdot 10^{-4}$° ≙ 0,7...5"	$< 1...5 \cdot 10^{-4}$° ≙ 0,36...1,8"	$< 4...20 \cdot 10^{-5}$° ≙ 0,15...0,7"
Weight	ca. 750 g			ca. 1000 g
Fixing	ITEM-aluminium profile or lens holder (Ø 40 f8)			
Data acquisition	Frame grabber or USB / WiFi / Touch PC / Windows			
Transfer of measuring data	RS232, LAN, WLAN			
Dimensions measure A	42 mm		82 mm	118 mm

* Greater measuring ranges, accuracies and resolutions on request

** Via overall measuring range i.e. via maximum angle α and maximum working distance s; higher accuracy / linearity at restricted working distance

*** See graphic

Industrial applications for ELWIMAT®

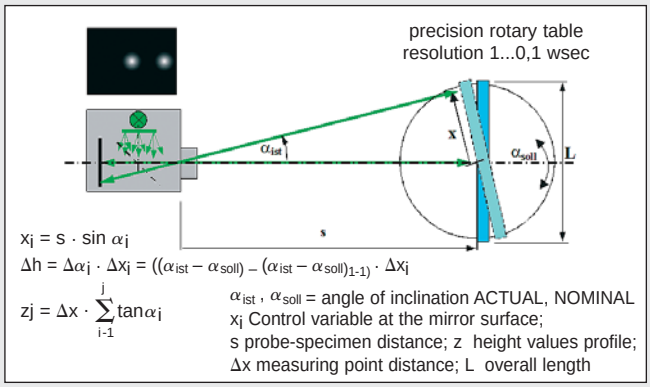
Mechanical engineering /plant construction

- Angle measuring in mechanical engineering and vehicle construction (Propeller shaft angle, camber and toe angle, parallelism, perpendicularity)
- Position measuring in mechanical engineering, vehicle and plant construction (monitoring of coupling misalignments at wind power plants)
- New procedures for turbine alignment
- 3-D measuring up to 6 freedom degrees in mechanical and plant engineering
- Geometric measuring of objects (e.g. straightness, flatness, positioning accuracy, alignment, etc. in up to 6 degrees of freedom)
- Roll angle measurement < 0,05 mm/m
- Parallelism measurement with 2 degrees of freedom

Optics

- Shape measurement of optical surfaces of big mirror substrates (spherical, aspherical and free forms)
- Assembly and adjustment of optomechanical construction groups
  (laser resonator and laser construction groups, microscopes, objectives
- Prism and wedge angle measuring

Measuring of the surface topography e.g. big plane mirror (straightness measuring according to the inclination method)



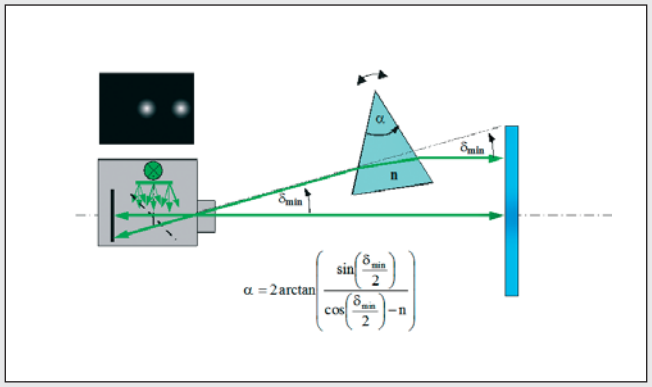
$x_i = s \cdot \sin \alpha_i$

$\Delta h = \Delta\alpha_i \cdot \Delta x_i = ((\alpha_{ist} - \alpha_{soll}) - (\alpha_{ist} - \alpha_{soll})_{1-1}) \cdot \Delta x_i$

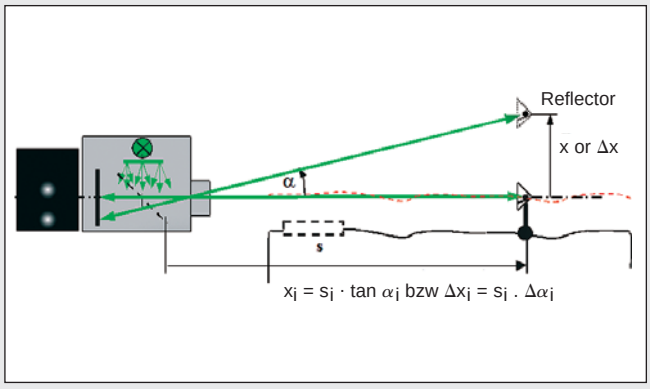
$z_j = \Delta x \cdot \sum_{i-1}^{j} \tan\alpha_i$

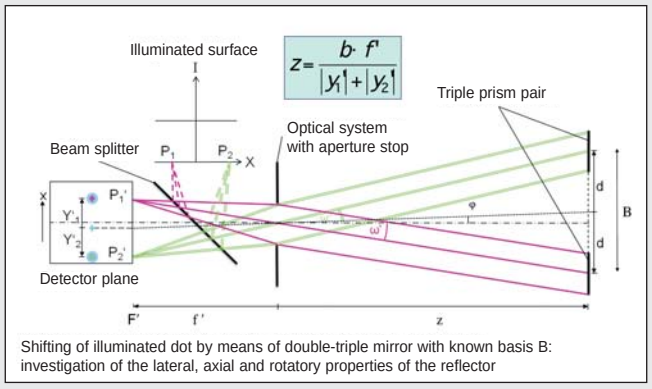
α_{ist} , α_{soll} = angle of inclination ACTUAL, NOMINAL
x_i Control variable at the mirror surface;
s probe-specimen distance; z height values profile;
Δx measuring point distance; L overall length

Prism and wedge angle measuring



Alignment measuring: Straightness measuring of construction parts, guideways and bearing shells





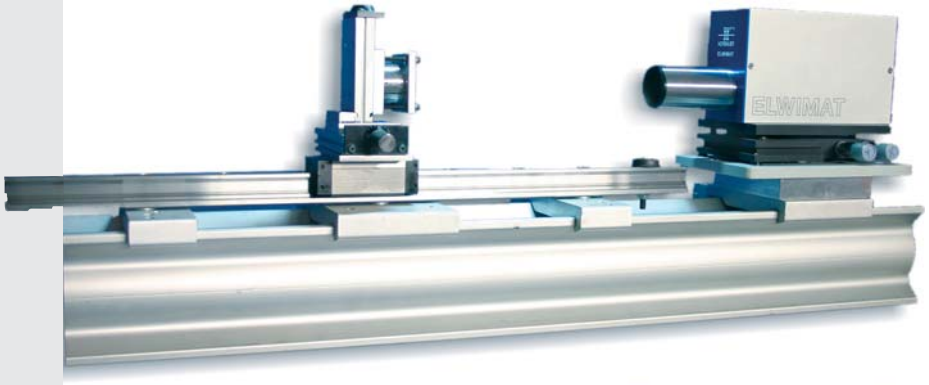
Shifting of illuminated dot by means of double-triple mirror with known basis B: investigation of the lateral, axial and rotatory properties of the reflector

Using reference point measurement (e.g. start and end point of the path), the straightness or height change of a slide relative to reference intervals is determined for given distances s_i. For the automatic distance determination s_i, a double reflector can be used with a calibrated base distance b.

Alignment measuring

One of the reflectors subject to the position change (x/y direction) is illuminated by a special divergent cone of light. The beam of rays from the light cone is partially reflected in the reflector itself and creates a bright point of light on a position-sensitive detector. The position shift of the so-called V-SPOT is proportional to the position change or height change of the reflector Δx/Δy.

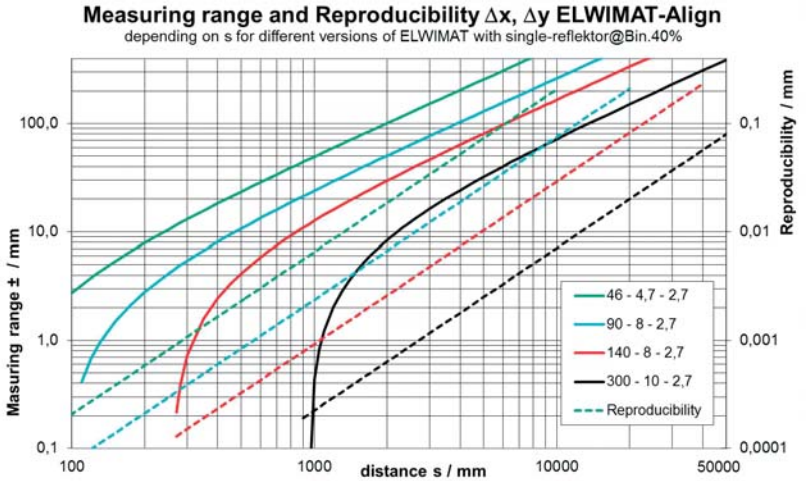
The reproducibility can be increased through a special double reflector. Using a certain algorithm, the distance and roll angle of the measurement reflector are automatically determined and displayed.



Increased mobility for field measuring

With small dimensions and a light weight (about 750 g), the battery-powered device can also be used as a mobile device.

Illustr.: Measuring ranges and reproducibilities at alignment measurement



Accessories

Mirror reflector, tripel reflector, double reflector and special reflector

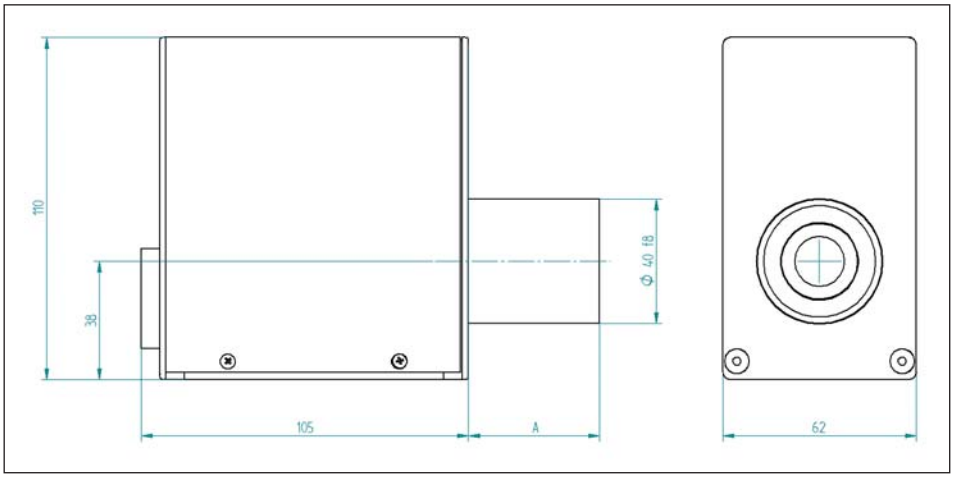
Technical data alignment measuring

Designation		with Single Reflector				Doublereflector
		ELWIMAT 46-4.8	ELWIMAT 90-8	ELWIMAT 140-8	ELWIMAT 300-11	ELWIMAT 46-4.8
Measuring distance / m		0,1 - 2	0,2 - 4	0,4 - 8	1 - 20	0,8 - 8
Measuring range ± / mm depending on distance		1 to 40	4 to 50	7 to 90	4 to 100	2 to 400
Resolution lateral (x/y)		0,1 µm	0,1 µm	0,1 µm	0,1 µm	0,1 µm
Reproducibility* / µm depending on distance		0,2 - 2	0,2 - 5	0,4 - 10	0,4 - 10	1 - 20
Accuracy alignment line		< 10 µm	< 15 µm	< 25 µm	< 40 µm	< 25 µm
Rel. deviation Δx/x		< (0,005 + Δs/s**) %				0,05 %
Measuring distance z	Capture	manual				automatical
	Resolution	---				0,01 mm
	Accuracy	---				0,001 - 0,1 %
Data acquisition		Frame grabber PCI bus card or USB/Windows evaluation software/touch PC				
Transfer of measuring data		RS232, LAN, WLAN				
Dimensions measure A		42 mm	82 mm	118 mm	274 mm	42 mm

* Information under laboratory conditions without additional environmental influences like oscillations, air turbulences, temperature fluctuations

** Δs/s = relative uncertainty of the manually specified or investigated measuring distance

Dimensions ELWIMAT in mm



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Dr. E. Hofbauer studied precision engineering before he received his doctorate in Ilmenau in the field of mechanical engineering. Since 1995, Dr. E. Hofbauer has been responsible for sales / consultation of optical measuring devices and is developing new methods of industrial application. He maintains a calibration laboratory for all types of optical parameters in Munich as well as in-house by customer. In cooperation with the University of Deggendorf and at the Technology Campus of Teisnach, where he developed and headed the measuring room as a part of a professorship for applied research in optical measurement technology from 2009 to 2012, new methods for certification of precision optics are developed. Education in optic seminars is also one other important part of the company strategie.