



Certificate of Calibration No 111-17872

<i>Object</i>	Autocollimator Manufacturer: ZG Optique Model: AE-025 S/N: 190301
<i>Order</i>	Calibration of indicated angles.
<i>Applicant</i>	ZG Optique SA Fin-de-Praz 24 2024 St. Aubin
<i>Traceability</i>	The reported measurement values are traceable to national standards and thus to internationally supported realisations of the SI units.
<i>Date of calibration</i>	6 May 2019
<i>Marking</i>	Calibration label METAS 05.2019

CH-3003 Bern-Wabern, 9 May 2019

<i>For the Measurements</i>	Dr Rudolf Thalmann
<i>Approved by</i>	Dr Felix Meli, Head of Laboratory Laboratory for length, nano- and microtechnology



Mutual recognition

This certificate is consistent with Calibration and Measurement Capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures (CIPM). Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).

This document is only valid and reviewable in its electronic form.
Please observe the information given on www.metas.ch/ecert.

METAS

Lindenweg 50, 3003 Bern-Wabern, Switzerland, phone +41 58 387 01 11, www.metas.ch

Certificate of Calibration No 111-17872

Extent of calibration

Calibration of the indicated angles for azimuth and elevation (X- and Y-axis) within the specified range of $\pm 1200''$ / $\pm 900''$ and within a small range of $\pm 5''$.

Measurement procedure

The indications of the autocollimator were compared to a numerically controlled air bearing rotary table, equipped with a Heidenhain RON 905 angle measuring system, which is calibrated using an error separation technique.

A plane mirror with a diameter of 70 mm was used as reflector placed in the centre of the vertical rotation axis of the rotary table. The distance between the mirror and the autocollimator front end (tube) was 100 mm. The autocollimator axes were aligned vertically to the mirror plane using its own indication and the longitudinal rotation of the autocollimator was adjusted for a minimal signal change of the secondary angle indication.

The autocollimator readings were taken with the notebook computer delivered with the instrument, using the software GonioScanZG-3, Ver. 2.2 (2018). The readings were remote accessed through a TCP-client on the PORT=192.168.1.10:8803.

Measurement options: Distance 0.1 m, accumulation time 1 s.

During calibration, the configuration file C:\GonioScan 190301\GonioScanZG.dat last modified 03/05/2019 13:36 was active.

The ambient temperature during the measurements was $(20 \pm 0.2) ^\circ\text{C}$, the atmospheric pressure was within the interval (950 ± 6) hPa.

Measurement uncertainty

Deviation of reading: $U = 0.035'' + 3 \cdot 10^{-5} \cdot \alpha$, α : indicated angle

The reported uncertainty of measurement is stated as the combined standard uncertainty multiplied by a coverage factor $k = 2$. The measured value (y) and the associated expanded uncertainty (U) represent the interval $(y \pm U)$ which contains the value of the measured quantity with a probability of approximately 95%. The uncertainty was estimated following the guidelines of the ISO (GUM:1995).

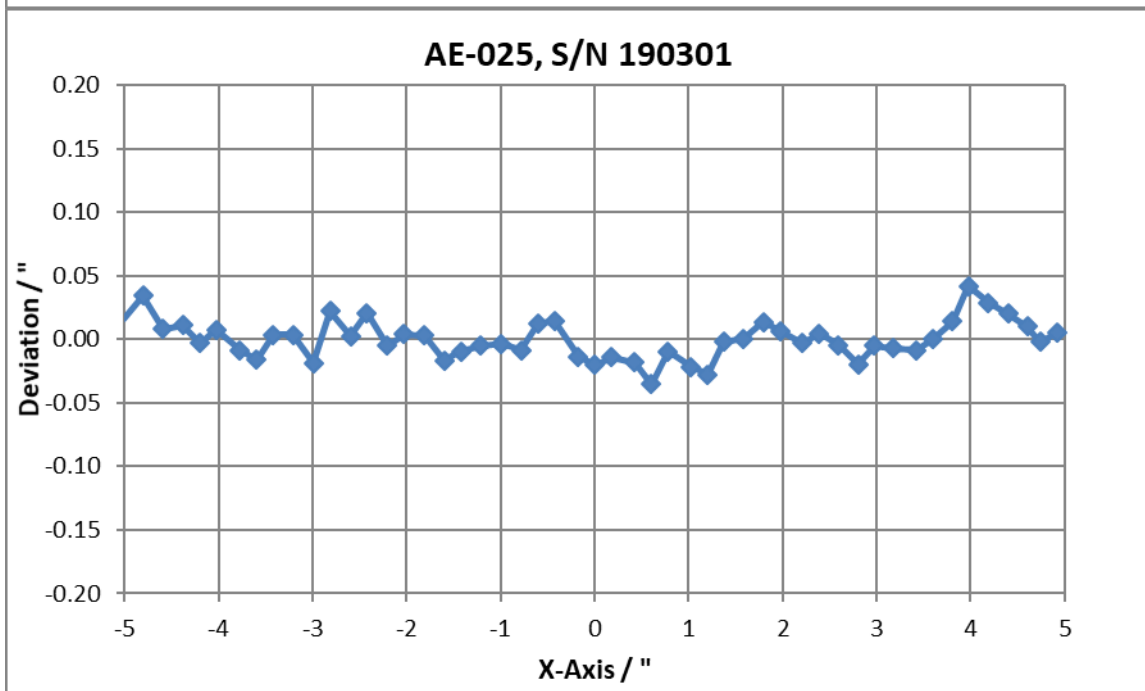
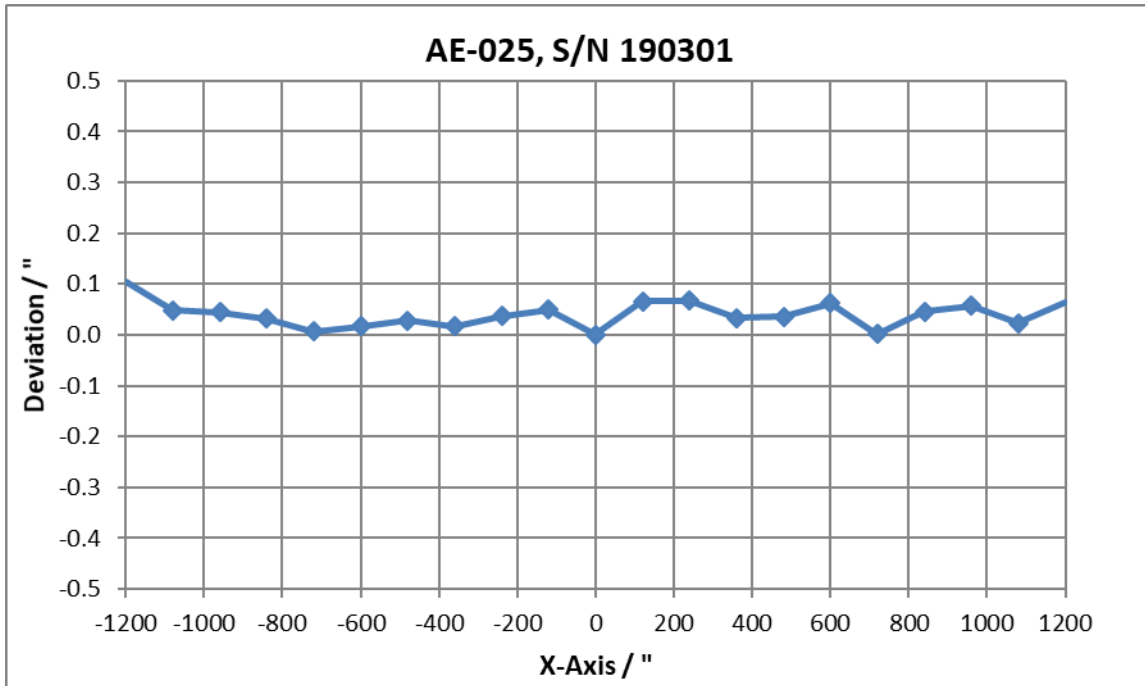
The measurement uncertainty contains contributions originating from the measurement standard, from the calibration method, from the environmental conditions and from the device under test. The long-term characteristic of the device is not included.

Certificate of Calibration No 111-17872

Measurement results

1. X-axis (Azimuth)

The indicated values are the average of 3 measurements.



Certificate of Calibration No 111-17872

2. Y-axis (Elevation)

The indicated values are the average of 3 measurements. For the calibration of the elevation angle, the autocollimator was rotated around its optical axis by 90°.

